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MEMOIRS
OF
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BEING

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Ser. XIII.

SALT-RANGE FOSSILS.

Vol. II.

FOSSILS FROM THE CERATITE FORMATION.

By WILLIAM WAAGEN, Ph.D., F.G.S.,

Ober-Bergrath and Professor of Palaeontology at the University of Vienna.

Plates I—XL.

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SALT-RANGE FOSSILS.

VOL. II.

FOSSILS FROM THE CERATITE FORMATION.

PART I.

PISCES—AMMONOIDEA.

SALT-RANGE FOSSILS,

BY WILLIAM WAAGEN, PH.D.

Vol. II.

FOSSILS FROM THE CERATITE FORMATION.

INTRODUCTION.

In the Introduction to Vol. I of the present work it was proposed to devote a proper volume to the description of the fossil contents of the Ceratite beds.

Even then it was highly probable that the Ceratite beds were representative, in part or entirely, of the Trias of Europe, and this probability has been greatly strengthened by the publications on triassic strata in general that have appeared in the meantime. Still, however, it is not possible to say with certainty what parts of the Trias may be represented by the Ceratite formation of the Salt-Range. A discussion of this question will only be possible after the fossils shall have been described in detail.

Mr. Wynne was the first who separated this rock group from the underlying palæozoic series with which it had been united by Fleming and Theobald.

According to Mr. Wynne's indications the group forms indeed stratigraphically a member of the palæozoic series; and it is not on geological, but solely on palæontological grounds that it can be separated from the Productus-limestone group. As far as my own observations go, the stratigraphical conformity of the Ceratite beds with the next lower members of the palæozoic rock groups is everywhere obvious. Only on a very close examination one finds, off and on, a section which gives some indications that rather considerable physical changes in the conditions of the deposition of rocks must have taken place between the formation of the topmost beds of the Productus-limestone and the strata belonging to the Ceratite formation. At most places some unfossiliferous beds intervene, and sometimes even conglomerates are deposited at the base of the Ceratite group, which show that a certain amount of denudation must have taken place at the commencement of these latter beds.

As a natural consequence of the views held by Messrs. Theobald and Fleming, the fossils collected by them out of these beds were described as palæozoic species by Mons. de Koninck, while there was an intermixture of these with the truly palæozoic contents of the Productus-limestone. These fossils were described by Mons. de Koninck in the Quarterly Journal of the Geological Society of London for the year 1863, Vol. XIX.

There are chiefly only Cephalopoda which came out of the Ceratite formation; and for about ten of the species described by de Koninck there can be hardly any question as to their original geological position. There is chiefly only one species about which grave doubts exist, and this is *Sageceras (Ceratites) hauerianus*, Koninck, which has been mentioned by me already, Vol. I, p. 39. As no new specimen of this species has been found by me, and the original seems apparently to be lost, the question cannot be settled definitively at present. I shall not mention the species again in the text, though it is by no means denied that it may form part of the fauna of the Ceratite formation.

The remainder of the species described by de Koninck can be recognised without great difficulty and will be redescribed later on in the text.

As regards the subdivisions that can be made out within the Ceratite formation, we can distinguish two different orders.

There are, before all, three large subdivisions, which, on the whole, are very conspicuous and might, for a part at least, be recognised even by the casual observer. Below, there is a group of beds in which smooth Ceratites are by far predominating and in which other fossils are of comparatively rare occurrence. This group is generally of considerable thickness and of varying petrographical description.

Above this follows another group, characterised by richly ornamented forms of Ceratites, occurring in great numbers. At the side of these, countless bivalves are to be found, accumulated mostly in proper beds and forming distinctly bivalve limestones. In most cases, however, the shells are so firmly imbedded in the rock that it is impossible to detach them in a fit state for description.

The uppermost division of the Ceratite formation is made up for the greater part of massive dolomites, sometimes cavernous, and then rarely containing fossils, associated with some sandstones and some limestones, also with countless bivalves, on the top. Fossils are everywhere rare in this division, except in the topmost limestones, which, however, only very rarely allow of the fossils being detached. Thus, I shall have to describe only very few things out of this division. As regards the thickness of this group it is the thickest of all in the Tredian hills, amounting apparently locally up to several hundred feet. At other places its thickness is again much less considerable.

On the whole, we may say that the middle division is the least conspicuous one, never attaining a great thickness and very rarely comprising a great variety of rock, but mostly composed purely of limestones of rather insignificant thickness.

The three divisions can easily be subdivided further; but, before entering on

these details, it will perhaps be well to distinguish each of the divisions by a proper name.

The first of the divisions, which is the most conspicuous and has at the same time the greatest lateral extension, may best bear the name of Ceratite beds properly speaking. It comprises those strata which have furnished the greatest part of the species of Ceratites that have been described by de Koninck from the Salt-Range; while also Mr. Wynne had chiefly these beds in view when separating his Ceratite group from the Productus-limestone series.

The second division had not been known and distinguished before I came to the Salt-Range, and the fauna contained in these beds is an entirely new one. In order not to prejudice anything with regard to a possible parallelisation of these beds with some division of the European Trias, I give to it the name of "Bivalve limestones," as I had done already in my note-book, when on the ground.

The third division may be called the "Dolomite group," with reference to its prevailing rock.

a. CERATITE BEDS.

This division can be very conveniently subdivided into three groups, each of which contains a rich and characteristic fauna.

The lowest of these groups is composed of thinly-bedded very hard limestones of not very considerable thickness. I shall quote this group as "*Lower Ceratite limestones*."

Above these follow greenish-grey marls with many concretions and irregular beds of marl stone. Thin limestone beds, having a cone-in-cone structure, are also of frequent occurrence. I shall call these beds "*Ceratite marls*."

The next higher strata are composed mostly of yellow soft sandstones, which sometimes, however, also become calcareous, and then are of a more greyish colour. I shall introduce for these the name of "*Ceratite sandstones*."

Within the group some subdivisions may yet be distinguished: the lower sandstones, the *Stachella* (or *Bellerophon*) beds, and on the top the beds with *Flemingites* (*Ceratites*) *flemingi*.

With these latter deposits the Ceratite beds, properly speaking, come to a close.

b. BIVALVE LIMESTONES

Within this large group of rocks two subdivisions can be very conveniently distinguished.

The lower half of this group is mostly composed of very hard limestones, with intercalated marls of grey colour. Sometimes, but rarely, the limestones become yellow, and are then a little sandy. They are mostly crowded with richly sculptured ceratitoid cephalopoda, whilst the bivalves are of rarer occurrence.

Therefore I propose to designate these beds by the name of "*Upper ceratite limestones*."

The upper half of the Bivalve Limestone group is composed of yet harder limestones, which ring loudly under the hammer, but which have no such even bedding planes as is the case with the "*Lower ceratite limestones*." These beds are crowded with the remains of bivalves, whilst cephalopoda are of rather rare occurrence. At most localities it is impossible to extract the fossils out of this rock and only at some places, where the rock becomes somewhat softer, marly or sandy, has it furnished a number of specimens in a fit state for description.

The designation that ought to be given to this subdivision might perhaps best simply be styled "*Bivalve beds*."

It is not possible to distinguish any further subdivision within this group, as its vertical extension is very limited and the rocks very uniform in character.

c. DOLOMITE GROUP.

The prevailing rock of this group is a compact dolomite of a somewhat yellowish colour. In this rock fossils have not been found up to the present. At some very rare localities these dolomites become softer and somewhat brecciated and cavernous. At the same time this changes the colour into grey or reddish. In this variety of rock I detected some few internal castes of bivalves and gasteropoda. Besides the dolomites there are also some grey sandstones and greenish marls, but I am unable to assign a distinct level to them.

Only on the top of the whole group, just at the base of the variegated marls and sandstones, a bed of limestone can be distinguished, crowded with the remains of indistinct bivalves, and containing a single cephalopod of a quite peculiar shape.

These limestones may be distinguished as a proper subdivision, and can be quoted as "*Topmost limestones*."

According to all that has been said we arrive at the following classification of the Ceratite formation of the Salt-Range:—

Dolomite Group	.	{	Topmost limestones.
			Dolomitic beds.
Bivalve Limestones	.	{	Bivalve beds.
			Upper ceratite limestone.
Ceratite Beds	.	{	Ceratite sandstone
			Ceratite marls.
			Lower ceratite limestone.
		{	<i>Flemingites flemingi</i> beds.
			<i>Stachella (Bellerophon)</i> beds.
			Lower sandstone beds.

Among the fossils contained in all these strata the cephalopoda by far predominate; all the other organic remains occurring are insignificant in comparison with this class.

Among the species described by Mons. de Koninck in the Quarterly Journal of

the Geological Society, the following can be considered with tolerable certainty as coming out of the Ceratite formation:—

Acrodus, n.sp.
 „ *flemingianus*, Kon.
Saurichthys indicus, Kon.
Ceratites flemingianus, Kon.
 „ *murchisonianus*, Kon.
 „ *planulatus*, Kon.
 „ *lyellianus*, Kon.
 „ *latifimbriatus*, Kon.
 „ *buchianus*, Kon.
 „ *davidsonianus*, Kon.
 „ *lawrencianus*, Kon.
Goniatites (?) *gangeticus*, Kon.

Originally there were described altogether 44 species by Mons. de Koninck from the Salt-Range. Of these, 27 have been found to come out of the Palæozoic series, whilst not more than the above enumerated twelve species are attributable with certainty to the Ceratite formation, and there remain four more for which the horizon cannot be indicated with certainty. It is, however, highly probable that two of them—

Isastræa arachnoides, Kon.
Nerinea sp.

have been either collected in the variegated series, or have rolled down among the mesozoic species from yet higher strata.

One can say nearly with certainty that this has been the case with the two remaining species—

Nautilus burtini, Galeotti,
Macrocheilus depilis, Kon.

of which the latter appears to be probably the internal cast of some tertiary gastropod.

The triassic cephalopoda described by Mons. de Koninck have received, with the exception of one, the designation “Ceratites” on account of the ceratitic development of the sutural lines in all the species. Since, however, it has been shown that ceratitic lobes are not characteristic of a single genus only, but that they designate a certain state of development within the whole order of Ammonitoidea, and that very different ammonoid shells may exhibit at times, in certain rock systems, ceratitic lobes, such a designation cannot longer be accepted for the forms described by him; and it may be stated already here that only a single ceratite in a restricted sense is among the whole lot of de Koninck’s species.

The same is the case with *Goniatites gangeticus*, which is also a species that cannot remain longer under that heading.

A difficulty that arises in trying to identify de Koninck's figures with the natural specimens collected in the Salt-Range consists in the circumstance that he has evidently not taken the drawings of the sutural lines from the same specimens that are represented in the full figures: thus, a certain confusion is unavoidable, and it is to be regretted that some most eminent palæontologists have, at times, been led astray by this circumstance, which is most striking in *Gon. gangeticus* and *Ceratites flemingianus*.

An author that has made many most excellent remarks about the species described by Mons. de Koninck from the Salt-Range is Dr. v. Mojsisovics; and I shall barely be able to write a page of the following descriptions without recurring again and again to Mojsisovics' works.

With regard to the Salt-Range Cephalopoda especially, he attributed in his large work on the Mediterranean triassic province the following species to the genus *Meekoceras* :—

<i>Meekoceras planulatum</i> ,	Kon., sp.
„ <i>davidsonianum</i>	„ „
„ <i>buchianum</i>	„ „

whilst in his “Arctic Triassic Fauna” he transferred yet another species to the same genus :—

Meekoceras lawrencianum, Kon., sp.

Also, in his “Mediterranean Triassic Province” he considered *Goniatites gangeticus*, Kon., as probably belonging to his genus *Lecanites*.

Besides this distinct mention of certain species as belonging to other genera, we find also some passages in Mojsisovics' works, in which he speaks of the genera *Meekoceras* and *Xenodiscus* being diversedly represented in the triassic beds of the Salt-Range.

In this manner several forms occurring in the Salt-Range have already been determined definitively: as, however, Mons. de Koninck's figures are not quite absolutely reliable, there may, occasionally, still remain some doubt as to the systematic position of some of his species.

A most striking instance in this respect is exhibited by deKoninck's *Ceratites flemingianus*, in which the drawing of the sutural lines is absolutely fantastic, as will easily be detected in comparing my figures of the genus *Flemingites* with deKoninck's drawing.

And just this phantastic drawing has apparently induced Prof. Karpinsky to take notice of the mentioned species. In the “Mélanges Géologiques et Paléontologiques tirés du Bulletin de l'Académie Impériale de St. Pétersbourg,” Vol. I, p. 79, he represents *Ceratites flemingianus* as the descendant of the genus *Gastrioceras*, which itself again is brought into connection with *Glyhioceras*, Hyatt. He thinks that deKoninck's species is similar in all respects to *Gastrioceras* with the sole exception of the large lateral lobus, which is denticulated, whilst the same part is entire in *Gastrioceras*. My drawings, however, show that not only the first, but also the

second and third lobes (auxiliary lobes) are strongly denticulated. The affinity, therefore, of *Cerat. flemingianus* with *Gastrioceras* appears to be strongly questionable.

In the Records, Geological Survey of India, Vol. XIII, 1880, p. 94, Griesbach has published a paper, under the title: "Palæontological Notes on the lower Trias of the Himalaya," in which he also takes notice of some species of cephalopoda occurring in the Salt-Range. I shall leave it to the discussion of the geological results obtained from the description of the Triassic fossils to enter into detailed appreciation of the palæontological zones which the author introduced in this paper within the triassic beds of the Salt-Range. In this place I shall only note down the different determinations of species occurring in the Salt-Range, as followed out by Mr. Griesbach. He mentions:—

Ptychites lawrencianus, Kon., sp.

Norites planulatus, Kon., sp.

Ophiceras lyellianum, Kon., sp.

Xenodiscus gangeticus, Kon., sp.

„ *demissus*, Opp., sp.

I cannot enter now on the value of these determinations; they will be discussed in detail in the description of the respective species.

Last, not least, there must be mentioned Geheimrath Beyrich's classical work on the Cephalopoda of the Muschelkalk of the Alps. In this paper many remarks on Indian triassic Cephalopoda are contained, and chiefly the Himalayan species are discussed in detail. Also the Salt-Range forms are repeatedly mentioned, and I shall have occasion to refer in the proper place to those excellent remarks.

This is all that has come to my notice with regard to species from the triassic beds of the Salt-Range having been mentioned by later writers, and I can now proceed to give the specific descriptions.

VERTEBRATA.

Class : PISCES.

There are but few remains of fishes among the materials collected by myself and others in the Ceratite beds of the Salt-Range.

Already Mons. de Koninck had received some fish teeth from Dr. Fleming for description, and some of these specimens are contained in the collections of the Geological Society of London. It is not possible for me to give more accurate indications with regard to these things than those that have already been drawn up by Mons. de Koninck, as now-a-days no exact determinations of such teeth can be executed, except by microscopical sections, which of course cannot be prepared when only a single specimen of each species is available.

I therefore content myself with regard to Mons. de Koninck's species by reproducing his descriptions. The material collected by myself is very scanty, and barely sufficient to determine the genera with absolute certainty.

I must express here my most sincere thanks to Prof. Dames and Dr. Jaeckel, of Berlin, for their kind collaboration in trying to determine these few fish-remains; and chiefly Dr. Jaeckel has taken great pains to arrive at a safe determination of a little tooth of *Acrodus*, for which I shall introduce the name of *Acrodus jaeckeli*.

Sub-class: TELEOSTEI.

Order: PHYSOSTOMI.

Family: *HOLOPLEURIDÆ*.

Genus: SAURICHTHYS, Ag.

It is on the authority of de Koninck that I quote this genus as occurring in the Salt-Range. The characters of the specimens attributed by de Koninck to this genus are, however, not quite in accordance with what one is generally wont to attribute to *Saurichthys*, as the transversal section of the teeth of that genus is generally not compressed, but more or less circular. In other respects, on the contrary, the two teeth remind us strongly of *Saurichthys*; and as the determination of these things can hardly be definitively settled without having microscopical sections prepared, I accept his determination in a provisional way, until more extensive materials shall have been collected in the Salt-Range.

No other specimens have, up to the present, been detected belonging to the genus but the two that were at the disposal of Mons. de Koninck:—

1. SAURICHTHYS? INDICUS, Koninck: Pl. I, fig. 3 (enlarged two times), fig. 4 (enlarged six times).

1863. *Saurichthys indicus*, Kon.: Quart. Journ. Geol. Soc. Lond. Vol. XIX, p. 17, pl. VIII, figs. 6, 7.

1863. *Saurichthys indicus*, Kon.: Fossiles Paléoz. de l'Inde, p. 4, pl. VIII, figs. 6, 7.

Mons. de Koninck characterises his species in the following manner:—

“The teeth which I have attributed with some doubt to the genus *Saurichthys*, established by Mons. Agassiz, on account of their compressed form, are very small, very shining and of a brownish colour. Of the two specimens which have served for description, the one is 2, the other 6 millimetres in length. The latter is strongly striated at its base and resembles *Saur. Mougeoti*, Ag. It is somewhat less compressed than the other, whose surface is entirely smooth. Both specimens have a strongly pointed apex and cutting edges on both sides. The transversal section is sub-oval.”

I have nothing to add to this very accurate description, which, after a close inspection of the specimens contained in the Geological Society's collection, appears to be perfectly correct.

Locality and Geological Position.—The two specimens of this species were collected by Dr. Fleming at Varcha from a grey limestone.

It is impossible to say from what part of the Ceratite formation they may have come. On the other hand, it appears highly probable that they belong to the triassic fauna, and not to that of the Productus-limestone, though from the composition of the rock alone it is barely possible to tell, with absolute certainty, whether the one or the other is the case.

The specimens are preserved in the collection of the Geological Society of London.

Remarks.—It has been stated above that the position of this species in the genus *Saurichthys* is very doubtful, de Koninck having already pointed out the circumstance. The materials however, which are not at my disposal at this moment, but have been examined by me some years ago, are too limited to give a positive opinion on them.

Sub-class: GANOIDEI.

Order: LEPIDOSTEI.

Family: *SPHÆRODONTIDÆ*.

Genus: *COLOBODUS*, Ag.

The remains that can be attributed to this genus are extremely fragmentary, and I should not have ventured to decide the point as to the systematic position of these things had not Dr. Jaekel expressed, independently of myself, the opinion I had formerly, though with great doubts, also entertained, that they belonged to the genus *Colobodus*.

The remains represent a few scales, some small undeterminable fragments of the skeleton, and a single tooth.

The coarse sculpture of the bone fragments, and the bluntly conical shape of the tooth have induced me to attribute them to *Colobodus*. It must, however, be understood that the determination can by no means be considered as above every doubt. According to the manner, however, in which the remains that are at my disposal have been found to occur in the Salt-Range, there is much hope that a closer search may reveal even complete specimens.

1. *COLOBODUS DAMESEI*, Waagen, *n. sp.*, Pl. I, fig. 1 *a, b, c, e, k*. (The figures *a, b, c, e, k* are enlarged from fig. 1.)

All the remains existing of this species are disseminated on a single slab of limestone, intermingled with the remains of *Gyrolepis*. Not even two of the scales have retained their natural position, but all are strewn irregularly over the whole surface.

There are about six or seven scales which, with some probability, can be attributed to *Colobodus*. They are of very varying shapes, but mostly badly preserved or fragmentary. Only two of them show beyond every doubt their original shape, and have at the same time their external face distinctly exposed.

These are, like most of the others, of an obliquely rhombic shape, the one (fig. *c*) strongly elongate, the other (fig. *a*) much shorter and broader. Sometimes there is on one side a smooth margin, which has been covered by the following scale. The greatest part of the outer surface of the scales is covered by a dark-brown strongly shining enamel which shows strong diagonal folds, exhibiting irregular slight

lateral bends, which are often bifurcating and project very slightly above the margins of the scales. The coarseness of the sculpture and the high elevation of the folds are very characteristic, and strongly suggestive of the idea that these scales must have belonged to some species of *Colobodus*.

The same is the case with the small fragmentary skeleton bones which are exposed on the same limestone-slab. The worm-like, coarse, irregular elevations, which are also covered by a shining brown enamel, are in character exactly like the sculpture that is generally observed on parts of the skeleton of *Colobodus*.

The case is different with regard to the little tooth represented in fig. 1 *k*. The general shape of this tooth is very little in accordance with what one generally is wont to see determined as teeth of *Colobodus*, as these are, for the greater part, about hemispherical, with a little wart in the middle. As regards however this latter character, it is stated by Prof. Dames in his excellent treatise on the triassic *Ganoids*, that this wart very easily disappears by the usage of the teeth, which then appear nearly smooth. The hemispherical teeth are situated in the mouth of *Colobodus* on the palatine bones, whilst on the margins of the mandibles, according to Dames' indications and drawings, bluntly conical teeth appear, which are on the whole very rarely observable, but resemble in their outline very much the tooth represented in my figure. Such teeth are to be found drawn on Pl. IV of Dames' work, where the dentition of *Colobodus maximus*, Quenst., is delineated. The Indian tooth is smaller than any of those there represented, and evidently belongs to another species, but in the whole shape it is very similar.

Another circumstance which makes it highly probable that this tooth must be attributed to *Colobodus* and belongs to the same species, like the scales and fragments of skeleton bones described above, is this, that on this limestone-slab on which all these remains are exposed, only two forms are distinguishable, one *Gyrolepis* and one *Colobodus*. That the tooth here under consideration cannot belong to *Gyrolepis* is rather obvious, whilst, on the other hand, it is very similar to the mandible teeth of *Colobodus*.

The close juxtaposition of all these remains makes it highly probable that all that can be attributed to the genus *Colobodus* must belong to one and the same species of this genus.

The tooth measures 2 mm. in length and 1.5 mm. in breadth at the base. It is covered by a shining enamel on the top and appears to be much worn by usage. Of the wart on the top there is nothing visible. The lower part shows a very indistinct kind of vertical striation, which is by no means regular, as it is exhibited by the enlarged figure *k* on my Pl. I. This striation is probably only the result of a slight compression of the substance of the tooth.

Locality and Geological Position.—The limestone-slab on which all these remains are exposed was collected by myself not far from the village of Virgal in the lower ceratite limestone, just at the limit of the Ceratite marls.

Remarks.—The present species is easily distinguishable from all the species of *Colobodus* described from Europe by the coarse diagonal folding of the scales, which

folding is mostly transverse in the European species, and by the smaller size of the single tooth that has been found up to the present.

Order: HETEROCERCI.

Family: *PALÆONISCIDÆ*.

Genus: *GYROLEPIS*, Ag.

The remains belonging to this genus are very few, and their attribution to *Gyrolepis* is by no means certain.

There are some scales and a single tooth which I can attribute to this genus.

As these remains occur on the same slab of limestone on which the remains of *Colobodius* are exposed, there is some hope that a closer search on the spot may reveal also better determinable materials of this genus.

1. *GYROLEPIS*, *sp. indet.* Pl. I, fig. 1 *f, g, h, i*. (The figures *f, g, h, i* are enlarged from fig. 1.)

There are not more than three scales, of which, however, only one shows the external side, which I am inclined to attribute to the genus *Gyrolepis*. The scale which exhibits the external side is of a rhomboidal shape and covered by rather low diagonal folds, which often bifurcate and are on the whole rather irregular. The whole surface is covered by a shining brown enamel.

The other two scales, though exhibiting the internal face, are in their outline so very similar to the first one, that it appears highly probable they should belong to the same fish. The marks on fig. *h* are most probably only products of weathering. The longest diameters of the scales are 4^{mm}, 5^{mm} and 5·5^{mm} respectively.

Together with these scales there is on the same slab of limestone a little tooth preserved, which is, though very small (its length being not more than 1·75^{mm}), very slender and acutely pointed, and presents in this respect a strong contrast to the other tooth exposed on the same slab and which I have attributed to the genus *Colobodius*.

Its surface is covered by brown shining enamel, which appears to be perfectly smooth.

In its whole appearance this tooth shows much similarity to the teeth as figured by Prof. Dames in *Gyrolepis albertii*, Ag. On the whole, it seems, there cannot remain much doubt that this tooth also belongs to some species of *Gyrolepis*. Dr. Jaekel suggested to me that it perhaps should be attributed to *Saurichthys*. This is an opinion that on the whole deviates not very far from my own, if one considers that Martin has united the genus *Gyrolepis* altogether with *Saurichthys*. On account of the smallness of this tooth I am, however, rather inclined to follow the opinion expressed by Prof. Dames to me, and attribute it to *Gyrolepis*.

As now the scales and this tooth, which both have been recognised as most probably belonging to some *Gyrolepis* have been found in close juxtaposition, there is

a great probability that the two belong to one and the same species. The materials are, however, too scanty to give a proper name to these fragmentary parts.

Locality and Geological position.—The materials of this species have been detected in a slab of limestone, on which also the remains of *Colobodius* are preserved, which were collected by myself near Virgal in the Lower Ceratite limestone, just at the limit towards the Ceratite marls.

Remarks.—The present species is readily distinguishable from all the European species of the genus by the broad, flattened folds that are exhibited by the enamel of the scales. In this respect the Indian form seems to indicate a well-distinguishable species, which, however, cannot be exactly circumscribed, owing to the scantiness of the materials at hand.

In Europe the different species of *Gyrolepis* extend from lower Bunt-Sandstone to the topmost beds of the triassic formation. The geological position of the Indian species is probably very low down in the Bunter.

Sub-class : SELACHII.

Order : SQUALOIDEI.

Family : *CESTRACIONTIDÆ*.

Genus : *ACRODUS*, Ag.

This genus has most recently found an excellent describer in Dr. Jaekel, who has shown that it must be characterised chiefly by the internal microscopical structure of the teeth.

Outwardly the teeth can be recognised by the longitudinal median ridge that extends from one end to the other, by the transverse irregularly bifurcating wrinkles that originate at this ridge and the somewhat oblique position of the roof.

The genus, generally very easily determinable, is apparently not very rarely represented in the Salt-Range, as Dr. Fleming had detected several specimens that were afterwards described by Mons. de Koninck. However, strange to say, I myself have not found, in collecting in the field, a single specimen. Only afterwards in preparing the materials while chiselling out a large *Ceratite*, a specimen of a tooth of *Acrodus* was developed.

This presents quite a peculiar type and will be described under a proper specific designation. It is at the same time the only specimen of which the geological position is exactly known.

It cannot be made out from what particular bed Dr. Fleming's specimens may have come; there is, however, a very great probability that they came out of the Ceratite formation.

1. *ACRODUS FLEMINGIANUS*, Kon., Pl. I, fig. 2 (slightly enlarged).

1863. *Acrodus flemingianus*, Koninck : Quart. Journ. Geol. Soc. Lond., Vol. XIX, p. 17, Pl. VIII, fig. 5.

1863. *Acrodus flemingianus*, Koninck : Fossiles Paléoz. de l'Inde, p. 4, pl. VIII, fig. 5.

Mons. de Koninck describes the species in the following manner:—

“The general shape of the tooth is triangular, as seen from the front, and subelliptical from above. The enamel is very shining and of a dark-brown colour. It occupies about half the distance from back to front, and forms a pointed protuberance, the surface of which is wrinkled by a longitudinal striation, which striæ are slightly curved near the culminating point of the tooth. They are very strongly developed near the base and disappear nearly entirely on the ridge of the enamel. The root of the tooth is very much compressed, slightly curved at its base and rather porous.

“I have studied two specimens of this species. One of them has got 15^{mm} in breadth and 8^{mm} in length. The other has only 7^{mm} in breadth. Both specimens are contained in the collection of the Geological Society of London.”

This description is not very intelligible, and from the description alone it could barely be made out even if these specimens belonged to the genus *Acrodus*. A close inspection of the specimens contained in the Geological Society's collection, which I made some years ago, showed me that the larger of the two teeth, which forms the type of the species, belonged beyond doubt to *Acrodus*. It has a length of about 15^{mm}, is rather strongly elevated in the middle, and there extends from one end to the other a sharp crest, as is characteristic of the genus. The lateral parts of the crown, which shows a breadth of about 8^{mm}, are covered by fine wrinkles, which are most strongly developed on the rim that succeeds the root, and grow slowly fainter towards the crest.

Seen from above, the tooth resembles slightly *A. browni*, H. v. M. or *A. immarginatus*, H. v. M., as both ends are slightly compressed.

The root is not very high, and broadest in the middle. Its substance is rather porous, as has been stated by de Koninck.

This is all I can state from the notes on this tooth which I have made several years ago.

Locality and geological position.—The specimens described by Mons. de Koninck were collected in a limestone at Varcha, together with *Saurichthys* (?) *indicus*, mentioned above. It is most probable that this limestone is of triassic age, and belongs to the Ceratite formation.

Remarks.—The species has been compared by de Koninck to *Acrodus gaillardoti*, Ag., but it is stated by that author that it is distinct from Agassiz's species by the much more arched shape of its root: Dr. Jaekel, to whom I showed the drawing, expressed the opinion that it was in all respects, except in its size, very similar to *Acrodus minimus*, Plien., from the Upper Keuper of Wurtemberg, so much so that possibly the two might belong to one and the same species. Considering, however, the great distance of the localities at which the two have been found, the very considerable difference in size that exists between the two, and last of all the uncertainty as to the geological formation to which the Indian form ought to be attributed

I am inclined to let the Indian species stand under the name given to it by Mons. de Koninck.

2. *ACRODUS* *sp. indet.*

1863. *Acrodus*, n. sp., Koninck : Quarterly Journ. Geol. Soc. Lond., Vol. xix, p. 16.

1863. *Acrodus*, n. sp., Koninck : Fossiles Paléoz. de l'Inde, p. 5.

I am not in a position to give any more particulars regarding this species than what has been adduced already by Mons. de Koninck.

He says: "This species is very nearly related to *Acrodus lateralis*, Ag. It is smaller than *Acr. flemingianus*, and its shape is much more elliptic and less transverse at the base.

It was found in a limestone at Chidroo.

3. *ACRODUS* *JAECKELI*, Waagen, n. sp. Pl., I, fig. 5a., b.¹

A single tooth of this species is contained in the Salt-Range collection, and even this is not entire. Its characters are, however, so striking that it is most easily recognisable as a new species.

When the specimen had been drawn on Pl. I it was for the greater part yet covered up by the rock, and its characters could not fully be ascertained. Since that time I have developed it nearly entirely, and now the upper surface is perfectly uncovered.

The general shape of the tooth is extremely narrowly elongate, and it must have been three or four times as long as it is broad. There is, however, only part of its length preserved. Otherwise, the tooth is about as broad as it is high, the root not being visible.

There is no distinctly pointed elevation in the middle of the tooth, so that its height remains about the same for nearly its whole length.

Along the middle of the upper surface a high crest extends from one end to the other, from which the lateral parts of the crown slope down to the margins.

These lateral parts are covered by a very coarse wrinkling, which is the most characteristic thing of the whole tooth. It consists of single wrinkles, which generally do not bifurcate, and are highly elevated. Between larger wrinkles smaller ones are often intercalated. The most peculiar part of this wrinkling is situated just below the culminating point of the longitudinal crest, where the wrinkles diverge towards the two extremities of the tooth in a most particular manner.

The root appears either to be broken off or else it is covered up by the rock. The smallness of the specimen forbids the further developing of it.

With regard to a microscopical section that has kindly been prepared by Dr. Jaeckel, he writes as follows:—

"The section cuts through the height and breadth of the tooth and thus exhibits the characteristic

¹ I propose to give on one of the succeeding plates better, and more instructive, figures of this species than those on pl. I.

constitution of it in a vertical direction. The crown of the tooth is entirely represented, whilst the root on the specimen, as well as in the section, is wanting for the greatest part, only the uppermost portions, immediately following below the crown, are preserved. These parts suffice to recognise the large cavities which are characteristic in the structure of the roots of all Selachian teeth. From these cavities originate those large canals which have received the name of "Hauerian canals" whilst around them the substance of the tooth allows us only to recognise an indistinct confused mass of curving dentin-tubes.

"The large hauerian canals which contain the blood-vessels and nerves, and along their walls are charged with the odontoblasts, rise and ramify tree-like within the crown of the tooth in such a manner as to replace homologically the undivided pulpa, which in most kinds of teeth occupies the centre of the crown.

"From these large canals originate the extremely fine dentin-tubes which are the sheaths for the appendages of the odontoblasts. In the peripheral parts of the crown the large canals become divided in bundles of such dentin-tubes, the course of which is in general radial and approximately parallel to each other. In this manner a zone of dentin is formed, which covers, like a mantle, the median part of the crown in which the large canals are contained.

"The whole crown is at last lined by a covering that is produced by the action of the epithelium that is homologous to the enamel of the teeth of higher vertebrates, but is decidedly distinct from that substance by the circumstance that it does not separate into prismatic masses and is not sharply defined from the substance of the dentin, and that the dentin-tubes penetrate it for nearly its entire thickness. I have therefore distinguished this substance from the true enamel under the name of "Placoin-Schmelz." On the confines between dentin and enamel the dentin-tubes are mostly broken in their direction or show different other irregularities, wherewith a dark zone is produced which forms the limit between the two substances. The structure of this zone is yet to be analysed under higher magnifying powers.

"These characters can be seen in the figure which has been drawn about 40 times the natural size¹. The drawing of this tooth resembles thus perfectly the figures I have formerly (Die Selachier aus dem oberen Muschelkalk Thüringens: Abh. z. geol. spez. Karte v. Elsass-Lothringen. Strasburg 1889, Pl. VIII, figs. 1, 2, 3) given of the teeth of *Acrodus lateralis*, Ag. About the position of this tooth in the genus *Acrodus* there can thus not remain the slightest doubt. On the other hand, it is as certain that the present tooth belongs to a new species as it deviates considerably by its ribbings, as well as by its habitus and size, from all the species that have come to my notice up to the present.

"The preparation of the microscopical section was extremely difficult on account of the circumstance that only a very small fragment was at my disposal, and because the surrounding rock is much harder than the substance of the fossil."

The measurements of the specimen are as follows :—

Length of the crown as far as preserved	.	.	.	.	5 mm.
Height	.	.	.	.	1 "
Breadth	.	.	.	.	1 "

The entire length of the tooth has originally probably been 7 mm., so that a little less than one-third of the entire tooth has been broken off.

Locality and geological position.—The tooth that has served for description has been chiselled out from the rock adhering to a specimen of a *Flemingites* which I collected in the *Stachella* beds of the Ceratite sandstone of Chidru.

Remarks.—In its general shape this species reminds one of *Acrodus lateralis*, Ag. (*emend.* Jaekel), chiefly of those elongate varieties which have been subclassed under the name of *Acrodus gaillardoti* by Agassiz. The outline of the Indian species

¹ This figure also I propose to have reproduced on one of the later plates.

is, however, so much more elegant and its size so much less considerable that already in this respect a specific distinction appears unavoidable. To this comes yet the wrinkling, which is much more irregular and much finer in *Acrodus lateralis*.

In this latter respect the Indian species resembles somewhat *Acrodus keuperianus*, Mos. & Strickl., but it is of another shape and a different size.

MOLLUSCA.

Class : CEPHALOPODA.

Order : AMMONOIDEA.

Before entering on the special description of the forms of *Ceratites* occurring in the Salt-Range, it seems necessary to express my opinion as to the classification of the whole group which ought to be followed in the present work.

Since the publication of the first volume of this work, the whole aspect of the classification of the Cephalopoda has so radically changed that the whole class must be treated in an entirely different manner from the one prevailing some ten years ago.

The principle of descent has been introduced into the classification of these animals to a greater extent than in any other group, and the reason for this rests on the circumstance that the transmutations of forms within the single groups in the course of time can more easily be followed among these things than among other fossils; and for this reason it was also that among the Cephalopoda I first detected the developmental series, which were destined to form the base of a new classification of this class.

The principle of the introduction of the genetic connection of the single forms; or, in other words, the true relationships, as to classification, is certainly perfectly sound, but it must be used with great caution, or else one may be very easily led astray into wild phantasies.

Among the materials that I shall have to describe in the following pages, I shall be able to show the existence of a greater number of developmental series. These can be followed for three, four or even more species, through a tolerably large vertical extent of rock, but there the thread breaks, and there are not many instances where a developmental series can be distinctly followed, extending from one genus into another. To follow, however, the thing yet further is mostly absolutely impossible: the similarities attain such a conflicting nature that it becomes simply a matter of tact or taste in which way the broken threads should be again linked together. The case is yet less strongly beset with difficulties if one has to deal with more highly developed Ammonites of jurassic or cretaceous times, but among the palæozoic forms, where a complicated sculpture of the shell is almost entirely absent, it appears nearly hopeless ever to arrive at such an interpretation of the

true relationship that a common consent of all the writers on such subjects will be attained.

Certainly all the attempts that have been made in this respect up to the present are open to doubts of the most grave description, and as long as no minutely detailed monograph, *in which the threads are followed only as far as their continuation can be demonstrated in a really convincing manner*, brings more light with regard to the relations of the goniatitic forms to each other; a definitive classification of the Ammonoidea is absolutely impossible.

Up to the present, in such attempts, the purely hypothetical combinations and the undoubtedly observed facts have hardly ever been kept distinctly apart; so that all conclusions based on such foundations rest on absolutely unsafe ground.

Much has certainly been done during the last years with regard to the definitive classification of the Cephalopoda. The law of acceleration detected by Prof. Hyatt will yet do very good services, and Prof. Branco's investigations are of the greatest possible value; but we are yet very far from arriving at the bottom of the thing, and the classification of the Cephalopoda is nearly as great a riddle now as it ever was.

Ever since the description of fossils has been taken in hand, endeavours have been made to arrive at a classification of the Cephalopoda, which presented themselves in overwhelming numbers even to the casual observer. Now, one has at least penetrated so far into the matter that one knows with tolerable certainty that the Nautiloids are absolutely different from the Ammonoids, and that, if the two have sprung from the same root, they have followed entirely different lines of development.

To go further into subdivisions is barely possible, without leaving the safe ground. Formerly the Ammonoids have been further subdivided into *Goniatites*, *Ceratites* and *Ammonites*, and some of the recent systems have retained at least the first of these three divisions. Fischer, in his Manual of Conchology, under the name of *Retrosiphonata*, united them with the *Clymenidæ*, v. Suttner and Steinmann, under the name of *Goniatitidæ*. More recent observations, however, have shown that these groups can absolutely not be retained, as it is impossible to point out even only a single character which would be invariably in common to all the forms that must be united with the *Goniatitidæ*; or else forms that ought to be united with the *Goniatitidæ* on account of one character, must be absolutely removed from them on account of other characters, or on account of the close relationships they exhibit to quite other things.

Later on, one thought to find a character of overwhelming importance for the classification in the development of the first suture, a character that has been so wonderfully studied by Mr. Branco. It will be remembered that the singular development of the first suture in different groups of Ammonoids caused Mr. Branco to distinguish three subdivisions, which he called *Asellati*, *Latisellati* and *Angustisellati*, respectively. These subdivisions have been accepted by most authors of systematic works on the Ammonoids, for instance by Zittel, v. Suttner,

Steinmann, etc., and there are many reasons which make such a proceeding very seductive. One great drawback regarding these systematic groups consists, however, in the circumstance that it is in most cases absolutely impossible to observe just the very characters on which these groups are founded. For instance, in the Salt-Range Cephalopoda, just the innermost volutions are nearly always destroyed; and even if they are apparently present, the material is so precious that one cannot sacrifice many specimens in order to develop the first air chamber. This, however, would not be a circumstance which would absolutely forbid the use of such difficultly accessible characters as fundamentals of classification, if otherwise these characters could be shown to hold good in every case. But just this latter is apparently not the case. Director Karpinsky has shown that in such nearly related genera like *Medlicottia* and *Sageceras*, the one is probably latisellate, whilst the other is angustisellate; so that the former is to be placed into the *Latisellati*, the other among the *Angustisellati*, two groups of Ammonoids which ought to be widely apart.

Thus also the groups founded on the mode of development of the first suture can apparently not be used as great subdivisions of the Ammonoids. Oberberggrath v. Mojsisovics has in fact never accepted these subdivisions as proposed by Mr. Branco, but he sticks to his own classification, which consists in this that he distinguishes within the Ammonoidea two large subdivisions, for which he introduced the names of *Trachyostraca* and *Leiostraca*.

I must confess that I can well understand the reasons for his retaining, in spite of more recent discoveries, his own classification, as it is in no way worse than the others, and in many respects more practicable. It is questionable whether it is equally applicable to the entire variety of forms comprised in the Ammonoidea, but, with regard to the triassic faunæ, the groups of *Trachyostraca* and *Leiostraca*, as perfectly empirical ones, appear to be well selected. I myself shall use these terms in my descriptions, partly because I believe that approximately natural large divisions have been introduced by these groups, partly because, in a comparison of the Salt-Range triassic cephalopod fauna with that of other countries it will be very useful to have to deal with the same large groups, which have been applied in most of the works on triassic cephalopoda. The families that I shall have to create on the following pages can be distributed without great difficulty among Mojsisovics' groups. Nevertheless also, in this classification, one great drawback cannot be overlooked. This consists in the circumstance that the two mentioned large divisions of *Trachyostraca* and *Leiostraca* have never been properly characterised by Mojsisovics, and also I myself am not in a position to give such characteristics. The sculpture of the shell, which alone serves for this fundamental distinction, is a very variable thing, and there are in fact forms which must, in spite of a rather insignificant sculpture of the shell, be attributed to the *Trachyostraca* on account of their close relationship to other shells that form decidedly part of the mentioned group, and *vice versâ, mutatis mutandis*. But the great bulk of forms can always easily be distributed, and thus it seems to me that, by Mojsisovics' groups, elements of classification are furnished which must be taken hold of.

If thus for the triassic forms acceptable subdivisions have been found, the whole of the earlier and the later Ammonoids lack yet a proper classification, though the latter may perhaps in a general way be linked to the *Trachyostraca*. In this respect it may be possible to retain at least some smaller groups introduced in former systems which may present themselves as natural subdivisions.

The excellent classification of the Cephalopoda by v. Suttner and Steinmann gives some very useful hints in this respect. The distinction, in the first place, between *Goniatitidæ* and *Ammonitidæ* has been pointed out above by me as untenable. Natural divisions are most probably hidden under these groups, but we are for the moment perfectly unable to characterise and circumscribe them; and the peculiarities by which each of these groups can be readily recognised in all cases have to be detected. If we leave then aside these divisions, we turn to the next lower in order. These, however, have been applied by the learned authors to the *Ammonitidæ* exclusively. They distinguish there *Latisellati* and *Angustisellati*. We have seen above that also against these subdivisions grave objections exist. Also here the same circumstance prevails as in the distinction between *Goniatitidæ* and *Ammonitidæ*. There are certainly large natural groups of Ammonoids which can be classified according to the characters of the first suture. The *Ceratitidæ*, *Tropitidæ* and *Arcestidæ* are certainly all latisellate, whilst all the jurassic and cretaceous forms are angustisellate; but to distribute all the Ammonoids between the two groups will not do, first because among the *Goniatitic* forms there are many which are latisellate and blend most intimately together with the asellate ones, and second because in permian and triassic strata one finds most intimately connected forms of which one part is latisellate, whilst the other is angustisellate.

In future systems of classification, use will perhaps be made of those natural groups that are most probably represented by the *Asellati*, the *Latisellati*, and the *Angustisellati*; and proper subdivisions will be erected for the transitional groups: but for the moment our knowledge is much too limited to proceed in such a manner.

At the same time the circumstance must not be lost sight of that the groups thus formed are nothing but modes of appearance in time of the same stem, which in its development proceeds from the *Asellati* through the *Latisellati* to the *Angustisellati*; and it is doubtful whether much is gained, in comparison to the former distinction between *Goniatites*, *Ceratites*, and *Ammonites*, by the creation of such groups.

Such considerations show more clearly than anything how the whole question of the classification of the *Ammonoids* is yet absolutely in its infancy, so that we are not even able to penetrate so far into the subject as to recognise the principle according to which the subdivisions within the order should be separated.

Hyatt in his "Genesis of the *Arietidæ*," a most important publication in every respect, takes again another view of the matter, which, however, does not deviate very far from the distinctions that were already made by L. v. Buch among the *Ammonoids*; so that, after all, the groups distinguished by that eminent palæontologist

will perhaps finally prove to be the most practicable ones for a definitive classification of the *Ammonoids*. Hyatt says on page 7 of the mentioned publication: "The *Ammonoids*, therefore, according to our views, are not divisible into two grand divisions, but have six sub-orders: the *Goniatitinæ*, of the Silurian, Devonian, Carboniferous, Dyas and Trias; the *Clymeninæ*, of the Devonian; the *Arcestinæ*, of the Dyas and Trias; the *Ceratitinæ*, of the Dyas and Trias; the *Lytocratinæ*, of the Trias, Jura, and Cretaceous; and the *Ammonitinæ* of the Trias, Jura, and Cretaceous."

According to this classification probably all the *Ammonoids* occurring in the triassic beds of the Salt-Range would belong to the *ceratitinæ*, and thus the former genus *ceratites* would have been transformed simply into a sub-order. There is certainly a great amount of truth in such a classification, but at the same time also many of the objections I have brought forward against other classifications are applicable as well to this one. On the other hand, Hyatt's remarks on his classification are too short to bear out his deductions in detail. Perhaps I shall find yet occasion to return to this point in the concluding chapters after completing the description of the species.

If we now return to the classification as proposed by v. Suttner and Steinmann, we find, as the next lower stages of classification, the following five groups: *Trachyostraci*, *Leiostraci*, *Serratiformes*, *Linguatiformes*, and *Lanceolatiformes*. Of these groups, as has been remarked already above, the *Trachyostraci* and *Leiostraci*, in the restriction to part of the triassic forms as advocated by Steinmann, might be acceptable. The *Trachyostraci* comprise then about the same range of forms that has been subsumed by Hyatt under the name of *Ceratitinæ*. The *Leiostraci* contain only the single family *Arcestidæ*. The remainder of the groups may perhaps be well chosen, and the forms subsumed under them may really represent natural subdivisions, but the names I can absolutely not accept. The names imply the anticipation that the different groups thus formed have sprung in their development from different forms of goniatitic ancestors, which for the greater part have lived in devonian and for a smaller part in carboniferous times. To me it appears purely phantastic to link together forms of cephalopoda which have existed on the one hand in devonian, on the other in middle triassic or even in jurassic times. The separation of these forms in time is so enormous that even if the similarity appear to be as striking as possible, it can be only an apparent one; and the conclusions put on such similarities must necessarily be delusive.

The transitional faunæ during permian and oldest triassic times are yet by far too little known for us to follow the developmental series from one formation to the other; and even in cases in which the transition seems to be rather continuous, as in the one adduced by Director Karpinsky with regard to *Ibergiceras*, *Lecanites*, *Norites*, and *Medlicottia*, the single members of the developmental series are yet so far distant in time from each other that even in this case the possibility is not absolutely excluded, whether or not a concealed error might have crept in. I am sure that many men of science are not quite prepared to admit such a close relationship between *Medlicottia* and *Lecanites* as is demonstrated by Karpinsky's table. On

the other hand, the "*Ibergiceras-stage*" distinguished by Karpinsky is exhibited, as far as my experience goes, also by many *Ceratitidæ* and *Tropitidæ*.

If then the groups of *Serratiformes*, *Lingnatiformes*, and *Lanceolatiformes* cannot be accepted, there remain at last only the families, which appear as natural groups. These are very ably distinguished in v. Suttner's system, and also their arrangement is on the whole apparently a natural one. They appear, however, a little extensive to me, and it seems that the greater part of them might readily be subdivided into several sub-families, or else they might be transformed into divisions of a higher order, which again would contain smaller families. This, however, is a matter of taste, and not of very material importance.

So, we have arrived at that sort of subdivisions which, for the present alone, are of value according to my opinion,—the families. In the present state of our knowledge we can do nothing but arrange the single genera according to their affinities in smaller groups, which can bear the name of families. Even such a proceeding is yet open to many errors, and within the comparatively small variety of forms which occur in the triassic strata of the Salt-Range, I am in more than one case in grave doubt whether the families I shall have to create form really natural groups.

In recent publications on palæontological subjects, as a fundamental postulation of the treatment of such matters, the principle has been introduced that all the genera and all the families ought to be strictly monophyletic. This is a postulation which, according to my view, can never be fulfilled. The breaks in the succession of the single forms are in many, I may say in the majority of cases, so numerous and often so thorough that it is absolutely impossible to found a whole system on such fragmentary evidence. If any author tries strictly to adhere to such principles, he will always be forced to bridge over the breaks with his phantasy, which he can never completely fill up with observed facts. But then science would be at an end, and work produced under such auspices is no longer a strictly scientific treatise, but a phantastic hymn in the praise of theoretical anticipations.

Thus, in the definition of the genera and families which I shall have to treat of in the following pages, I shall always again return to the safe old way of characterising the groups as minutely as possible, and attribute all those forms to each respectively which show the characters essential for a group. At the same time, I shall not lose sight of the developmental connection as far as this can be made out with sufficient certainty. But in most cases there will remain yet so many doubts as to the real developmental connection of different forms or groups of forms that I cannot give expression to my view in such a style as to change all the systematic arrangement in favour of such supposed developmental relations. As such I cannot avoid accepting genera and families which are most probably polyphyletic. To arrive at purely monophyletic elements of classification is possible only in very exceptional cases.

I.—TRACHYOSTRACA.

Family: *CERATITIDÆ*, Mojs.

In former times the genus *Ceratites* was destined to contain all those *Ammonoidea* in which the lobes of the sutural lines were denticulated, whilst the saddles were entire. Though the same character is attributable also to those forms which are comprised in the present family, yet the family *Ceratitidæ* is far from being only a transformation of the former genus into a family.

It is the sculpture of the shell which before all is to be taken into consideration. This consists generally of thorns and tubercles mostly united together by simple or dichotome radiating ribs. The external or ventral side is more or less broad and smooth, so that most of the forms belonging to the family have got a squarish section of the whorls. Some aberrant species become nearly entirely smooth or show only broad radiating folds.

Another very important character consists in the length of the body-chamber, which occupies never more than one-half of the last whorl.

The sutural lines are generally very simple. The geologically oldest species have only one true lateral lobe and a small auxiliary lobe. Very soon, however, this latter shifts somewhat towards the ventral side, and is thus transformed into a second lateral lobe. The lobes are generally more or less distinctly denticulated, whilst the saddles are, with few exceptions, entire.

Mojsisovics distinguishes two sub-families within this family, of which only the first, the *Dinaritinæ*, is well represented in the Salt-Range. The second sub-family, the *Tyrolitinæ*, comprises a larger range of forms than the first, but in the Salt-Range there has only been found up to the present a single shell, which can be attributed, and this with some doubt, to this sub-family.

The *Dinaritinæ* are much more uniform in their development than the *Tyrolitinæ*. The geologically oldest forms possess only one true lateral lobe; whilst, later on, two lateral lobes are developed. Only a few auxiliary lobes are generally present, or else they run into a greater number of small denticulations, as in the genus *Prionites*, which will be described later on in the text.

Mojsisovics includes four genera in the sub-family, *viz.*—

Dinarites, Mojs.

Ceratites, Hau.

Klipsteinia, Mojs.

Arpadites, Mojs.

Of these only two, *Dinarites* and *Ceratites*, occur in the Salt-Range, whilst a new genus must be added from the triassic strata of that country which will bear the name of *Prionites*, W.

It is doubtful whether the sub-family *Dinaritinæ* ever attained an ammonitic development. There are no indications for this in the Salt-Range.

The sub-family *Tyrolitinae* exhibits on the contrary a by far more complicated variation of forms than occurs in the *Dinaritinae*. Also here exists in the geologically oldest shells, the genus *Tyrolites*, only a single lateral lobe, though two lateral lobes are developed very soon; while in the most recent genus, *Trachyceras*, the sutural lines have already assumed thoroughly ammonitic characters, though with a certain ceratitic habitus and little ramifications of the lobes.

Mojsisovics comprises the following four genera in the sub-family:—

Tyrolites, Mojs.
Balatonites, „
Badistites, „
Trachyceras, Gaube.

Of these only a single specimen of the genus *Balatonites* has been found in the Salt-Range, which cannot even be determined with absolute certainty.

Sub-family: DINARITINÆ.

Genus: *Dinarites*, Mojs.

It is very much to be regretted that Mojsisovics has not given any proper characteristic of his genus, as the developmental connection of the single forms is a very unsafe guide, and a thing that can absolutely not be made out with regard to the Salt-Range species.

The chief character which Mojsisovics apparently considers to be essential for his genus is a single true lateral lobe. There are forms in the Werfen beds of the Alps in which really only a single lobe is present on each side, which is hemmed in towards the umbilicus by a broad umbilical, and towards the siphonal side by an equally broad external saddle. In the Salt-Range, however, there is no form of *Dinarites* which would exhibit a similarly low stage of development. In all the Salt-Range species, where the sutures can be observed, there is a second lobe on the sides of the whorls present, the position of which is, however, such, below the line of involution of the preceding whorl, that it cannot be considered as a second lateral lobe, but only as an auxiliary one; so that there is also in these cases only a single lateral lobe observable.

The normal shape of the shell of *Dinarites* exhibits a moderately wide umbilicus, whorls that are generally higher than broad, with somewhat flattened lateral parts and with a broadly rounded external side. The sculpture consists of more or less numerous radial folds, which are often preceded on the inner volutions by little tubercles in the middle of the sides. The siphonal part is generally smooth.

This normal shape shows many variations, which, however, are generally not of such a nature as to entirely obscure the typical form. The umbilicus becomes sometimes larger, sometimes smaller. The whorls become more roundish in section or else more compressed. The sculpture becomes often nearly entirely obliterated.

In other cases the radial folds are transformed into contractions of the shell, and then continue also on the external or siphonal side, causing incisions or broad undulations to be formed there. It will perhaps be well, if more extensive materials will be at disposal, to consider whether these latter forms, such as *Dinarites succensis*, *taramellii*, etc., ought not better be considered as constituting a proper genus.

The most aberrant form within the genus is *Dinarites liccanus*, Hau., which has a sculpture consisting of two rows of strong thorns on each side of the whorls.

In the Salt-Range there are altogether not more than six species which I can attribute to the genus. Some among these have a strong resemblance to forms already described, others are more or less deviating. All of them belong to the *CircumPLICATI*, as distinguished by Mojsisovics.

One of the Indian species, for which I shall introduce the name of *Dinarites dimorphus*, W., bears a rather close resemblance to *Din. glacialis*, Mojs., from the mouth of the Olenek in North-East Siberia.

Another species, which I shall call *Dinarites coronatus*, W., again resembles a species of that arctic locality, *Dinarites volutus*, Mojs., but the resemblance is less close.

The remaining four species show a greater relationship to European forms, and it is the group of *Dinarites succensis*, Mojs., to which they can be compared.

The first two of these, *Dinarites patella*, W., and *Dinarites minutus*, W., are so closely related to *Dinarites succensis*, Mojs., that I can safely consider both as belonging to the same developmental series. The other two, *Dinarites sinuatus*, W., and *Dinarites evolutus*, W., belong to the same group of forms, but yet the similarity to the typical species, *Dinarites succensis*, is a distant one.

Of these six species, the first is from the upper ceratite limestone of Koofri, and the second out of the *Stachella* beds of the ceratite sandstone of Nanga. The third species belongs to the ceratite marls of Virgal, the fourth was found in the lower ceratite limestone of Koofri, the fifth in the bivalve beds of Chidroo, and the sixth comes from the same locality, but was there found in beds just below the upper ceratite limestone, that is to say, in the topmost beds (horizon of *Flemingites flemingi*) of the ceratite sandstone.

From a geological point of view the Salt-Range species must thus be arranged in the following manner from above downward:—

Bivalve beds:—*Dinarites sinuatus*, W.

Upper ceratite limestone:—*Dinarites dimorphus*, W.

Ceratite sandstone:—*Dinarites coronatus*, W. *Dinarites evolutus*, W.

Ceratite marls:—*Dinarites minutus*, W.

Lower ceratite limestone:—*Dinarites patella*, W.

There is no extensive developmental series distinguishable among the Salt-Range species. If we, however, wish to give expression to the general relation that

exists between species of other countries and those of the Salt-Range; we arrive at the following arrangement from a palæontological point of view:—

I.—DIVISION CIRCUMPLICATI:

(A) Species with Arctic Affinities:

a. Group of *DINARITES GLACIALIS*, Mojs.

1. *Dinarites dimorphus*, W.

b. Isolated species:

2. *Dinarites coronatus*, W.

(B) Species with European Affinities:

c. Group of *DINARITES CUCCENSIS*, Mojs.

3. *Dinarites patella*, W.

4. „ „ *minutus*, W.

d. Isolated species:

5. *Dinarites evolutus*, W.

6. „ „ *sinuatus*, W.

Species Nos. 3 and 4 are most likely in developmental connection.

The last two species are also somewhat more nearly related together, but I do not think that their similarity is sufficiently close, in order to consider them as forming a developmental series. On the other hand, their generic determination is rather doubtful.

I.—DIVISION CIRCUMPLICATI:

(A) Species exhibiting Arctic Affinities:

a. Group of *DINARITES GLACIALIS*, Mojs.

1. *DINARITES DIMORPHUS*, Waagen, n. sp., Pl. VII a, fig. 8, 8a, fig. 9, 9a; the latter two figures enlarged two times.

The specimens serving for description attain only very moderate dimensions. Nevertheless it is doubtful whether the species ever grows to a more considerable size, as the larger specimen has part of its body-chamber preserved, and the last sutural lines are very closely arranged.

The general shape of the species in adult specimens is thick disciform, with whorls that are about as thick as they are high. In adult specimens the sides of the whorls are very flatly arched, the bend being barely perceptible, and diverge somewhat towards the umbilicus, so that the greatest breadth of the whorls is situated a little above the umbilical edge. The umbilicus is surrounded by a rather high vertical wall which unites with the sides of the whorls nearly at right angles. The external part of the whorls is broadly flattened, forming rounded edges with the lateral parts.

Thus the transverse section of the whorls appears more or less trapezoidal.

The sculpture consists, in the full-grown stage, of very numerous fine radial folds, which commence at the umbilical edge, and extend in a nearly straight line over the lateral parts of the whorl, bending very slightly backwards near the external edge, just before they entirely disappear. None of them reaches the outer edge of the whorls.

The external part of the whorls is entirely smooth, without any sculpture. It was not here possible to observe any lines of growth by which one might decide whether they were not bent backward.

In the full-grown state, two lobes can be observed on each side of the whorl; of these however, according to the degree of involution, only one, the outer one, can be considered as a lateral lobe. The second lobe is hit by the line of involution a little outward of its bottom, so that its position is not entirely that of an auxiliary lobe, but still less that of a second lateral lobe. According to this position of the second lobe, we must consider the present species as having attained a rather high degree of development within the genus.

The external lobe is not visible, and all endeavours to trace it have failed. The external saddle is tolerably broad, and reaches not higher up than the other saddles: it is situated already for its greater part on the lateral side of the whorl. The lateral lobe is low, broadly rounded and without denticulations on the bottom; the lateral saddle of the same breadth, but much less high than the external one. Auxiliary lobe narrow, short, and slightly pointed. The auxiliary saddle forms a straight line extending down to the umbilical suture.

These are the conditions of the adult shell. In the young stage all the characters are very different.

The smallest stage that I have been able to observe has got a diameter of 4mm. At this size the whorls are much broader than high, with nearly angular sides, on the edge of which strong tubercles are placed. The external side is regularly arched, without the angular edges that appear later on. The lobes are very characteristic. They show in a most remarkable manner the "*Ibegiceras* stage," distinguished by Karpinsky in the Russian Permian species. There is a narrow, very deep, undivided external lobus present. The external saddles are narrow at their tops and widely open at the base, yet entirely situated on the external part of the shell. The lateral lobe is placed just at the edge between the tubercles which here ornament the shell. It reaches somewhat further down than the external lobe (a character which is erroneously represented in fig. 9a, where the lateral lobe is too short), and is very broad and well rounded. There is barely any indication of a second lobe on the lateral parts of the whorls.

Very remarkable also is the position of the siphon. It is rather far removed from the outer contour of the shell, and has a position about one-third way down between the external and internal sides of the whorls.

The whole sutural line has a considerable resemblance to the one of *Prolecanites*, with the sole difference that the lobes are broader and fewer in number.

I cannot say how long this development of the lobes is retained. The external shape changes at a diameter of about 12mm. The whorls then become squarish, with flattened lateral parts and a flatly rounded external side, but they are always still somewhat broader than high. The tubercles disappear slowly, beginning from a diameter of 9mm., and at 12mm. they are already entirely replaced by fine radial folds. The two obtuse edges hemming in the external part are developed only at the beginning of the body-chamber.

The dimensions of the larger of the two specimens at my disposal are as follows:—

	mm.
Diameter of the shell	24
" " " umbilicus	8
Height of the last whorl from the umbilical suture	9
" " " " from the preceding whorl	7.5
Thickness of the last whorl, about	7

Locality and Geological Position.—The two specimens of this species were found by myself at Kufsi in the Upper Ceratite limestone (bed No. 8 of the section in my note-book).

Remarks.—There are two species to which the present one is most nearly related: *Dinarites altus*, Mojs. and *Din. glacialis*, Mojs.

The similarity of *Din. dimorphus* to these two species is so striking that it need not be demonstrated by any words.

The Indian species differs from both by its flattened external part in the adult state, by a more strongly developed umbilical edge, and much broader lobes.

It is of much interest to find here in India a species most nearly related to forms that are among the most characteristic of the triassic beds on the shores of the Arctic Sea.

The development of the lobes needs perhaps some further remarks. The lobes are slightly denticulated in the Siberian species, whilst they are apparently rounded in the Indian shell. This is, however, probably really only an apparent character. In many of the *Ceratites* of the Salt-Range the denticulations of the lobes are so very fine and easily destroyable, that they are very easily lost by weathering. This has also very probably been the case in the present species. In fact, with a powerful lens a fine indistinct denticulation can be observed also in the Indian shell in some places, a proof that most probably originally denticulated lobes have been changed here by weathering into entire ones.

b. Isolated species.

2. DINARITES CORONATUS, Waagen, n. sp., Pl. VII, fig. 9a, b, 10 a, b.

It is a rather small species which I have designated with this name, and the generic designation is not above every doubt, but as the form of this shell is very

characteristic and easily recognisable, I thought it worth while to give a proper name to it.

The general shape of the species is thick patelliform, with inflated whorls which barely embrace each other, wherewith a very wide umbilicus is produced.

The whorls have a perfectly rounded transverse section, and there is neither an umbilical nor external edge developed. In young specimens the whorls are a little broader than they are high, whilst in a more adult stage they increase somewhat in height, and then this latter dimension becomes more considerable than the breadth, but the difference is not very strong.

In the young stage each whorl bears about five high thorn-like tubercles, which, as the shell increases more and more in size, become more and more elongated in a transverse or radial direction until, at a diameter of the shell of about 15mm., they are transformed into high, broad semiplicate folds. At the same time, the number is slightly augmented, and then seven such folds are recognizable on one whorl. The folds are always single, never dichotomous.

The external side remains always smooth, well rounded, and never shows any traces of folds.

The umbilicus is rather flat, not very deeply excavated, and not surrounded by an umbilical edge.

I regret to say that all endeavours to render the sutural lines visible on the specimens at my disposal have absolutely failed, and thus I am unable to give any details about this point. On account of this the generic determination must also remain doubtful. I have placed this form in the genus *Dinarites* on account of its general similarity to several species of this genus occurring in the triassic beds of Siberia.

The dimensions of the two otherwise excellently preserved specimens, No. 1 from Amb, No. 2 from Nanga, are as follows:—

	I.	II.
Diameter of the shell	22mm.	17mm.
" " " umbilicus	9mm.	7mm.
Height of the last whorl from the umbilical suture	9mm.	7mm.
" " " " " " " preceding whorl	8mm.	5.5mm.
Thickness of the last whorl	8mm.	8mm.

Locality and Geological Position.—There are altogether two specimens of this species preserved in the Salt-Range collection. I found both in the *Stachella* beds of the ceratite sandstone, one at Amb, the other at Nanga.

Remarks.—The present species exhibits a rather close similarity to all the species belonging to the group of *Dinarites simplicatus*, as described by Mojsisovics from the triassic beds of the mouth of the Olenek. From the great majority of these forms, however, the Indian species is distinguishable by its much broader external side. Only one of Mojsisovics' species shows a similar development in this respect, and this is *Dinarites volutus*, Mojs. The similarity of this form to our *Din. coronatus* is really a very striking one, the only difference consisting in the

circumstance that in the latter, in adult specimens, the radial folds are more straight and less numerous.

It is very annoying that in the Indian shells the sutural lines are not visible and that thus a really reliable comparison cannot be executed.

There is no other species to which the present one could be compared.

(B) Species with European Affinities.

c. Group of *DINARITES CUCCENSIS*, Mojs.

3. *DINARITES PATELLA*, Waagen, n. sp., Pl. XXII, fig. 2a, b.

The present shell is highly interesting on account of its close affinity to some species of the Alpine Muschelkalk.

The general shape of the shell is flat disciform, with whorls that are very much higher than broad and an umbilicus that is very small in young specimens and becomes larger in adult ones.

The whorls are very strongly compressed, and three times as high as they are broad, at least in specimens which are devoid of the body chamber. The lateral parts are flattened, only barely perceptibly arched, and the external side is very narrowly vaulted. The umbilicus is surrounded by a not very high, but quite vertical umbilical wall, which joins the lateral parts of the whorls in forming a very sharp edge.

The body-chamber deviates in its shape somewhat from the remainder of the shell, in so far as the transverse section of this part is only twice as high as it is broad. The lateral parts are much less flattened, but very perceptibly arched. The external side is much broader, often somewhat flattened, and then very indistinct external edges are developed. Another very striking character exhibited by the body-chamber consists in the circumstance that it deviates from the regular spiral, whereby the umbilicus gets suddenly much larger, and the height of the whorl much less considerable.

The sculpture of the shell is very characteristic and perfectly in accordance with what is exhibited by the other species belonging to the same group of forms. On the inner volutions the shell shows numerous contractions, or furrows, which are, though very shallow, still easily traceable. They form broad, roundish excavations which begin at the umbilical edge, extend, directed somewhat towards the front, over the lateral parts and reach, yet more strongly bent forward, the external side, which is crossed by them in a gentle curve. This crossing over the external side of these furrows causes a very slight undulation of this part of the shell. The sculpture described is that of the internal cast, the shell not being preserved.

Also, with regard to the sculpture, the body-chamber is differently developed. The broad furrows are here very closely arranged, so that the parts of the shell remaining between appear as narrow ribs, which originate at the umbilical edge

and extend, strongly bent forward, up to the middle of the lateral parts. Here they become rather indistinct, but seem to accept a somewhat falciform shape bending first backward, and in a gentle curve again towards the front. Near the external part they are replaced by sharp deep incisions, which cross over this part of the shell. There are three such incisions within the space of 10mm.

The aperture itself is not preserved in any of the specimens at my disposal.

The sutural lines are very simple, as far as can be observed, not denticulated. There is a very short external lobe, which is followed by a narrow external saddle. The only lateral lobe existing is broad and deep. The lateral saddle is rather narrow, and reaches a little less higher up than the external one. The auxiliary lobe is extremely small. On the whole, the chambered part of this shell is so very small, and the sutures so minute, that it is barely possible to observe their details.

The dimensions of a fragmentary specimen are as follow :—

	mm.
Diameter of the shell preserving part of the body-chamber, about	32
„ „ umbilicus	7
„ „ shell without body-chamber, about	16
„ „ umbilicus	3
Height of the last whorl from the umbilical suture	15.5
„ „ „ „ „ preceding whorl	11
„ „ preceding whorl from the umbilical suture	8
„ „ „ „ „ third whorl	5
Thickness of the last whorl	7
„ „ preceding whorl	3

Locality and Geological Position.—This is the geologically oldest species of *Dinarites* occurring in the Salt-Range. I collected three fragmentary specimens of it in the lowest beds of the Lower Ceratite limestone, to the west of the village of Khoora.

Remarks.—There is a group of forms, composed of three species, *Din. cuccensis*, Mojs., *Din. marionii*, Mojs., and *Din. taramellii*, Mojs., which are all very nearly related together, to which the present species seems to be most nearly related. Among the three mentioned shells it is chiefly the first which must be compared. From all three the Indian *Din. patella* differs by the small umbilicus and high compressed whorls which it possesses in its young state, and even if adult its umbilicus is still smaller than in the European species. Another distinguishing character that must be adduced consists in the sharp umbilical edge that is developed in *Din. patella*.

Otherwise, the similarity to *Din. cuccensis* is very striking; chiefly the body-chamber shows nearly identical characters. In *Din. cuccensis*, as well as in the Indian shell, the body-chamber becomes in many cases somewhat flattened on the external side, whilst in other varieties again this flattening is not so striking. The contractions of the shell, characteristic of both species, appear as narrow incisions on the external side in both cases. Only the sculpture on the lateral parts of the shell is slightly more strongly bent in the Indian than in the European shell.

From all this it appears that the two species are very closely related, and that *Dinarites patella* must most likely be considered as the ancestor of *Din. succensis*.

The developmental connection of the two species will appear yet more probable after the description of the following species shall have been completed, as this forms a truly connecting link between the two.

4. DINARITES MINUTUS, Waagen, n. sp., Pl. VIIa, fig. 1 (natural size), 1a, 1b, 1c (these latter figures enlarged), fig. 2 (natural size), 2a, 2b, 2c (enlarged).

Of this species the only specimens contained in the Salt-Range collection have no body-chamber preserved, so that only the shape of the inner volutions is known to me, but even these are very characteristic.

The general shape of the shell is patelliform, with moderately thick volution and a moderately wide umbilicus.

The transverse section of the whorls is helmet-shaped, as described by Prof. Hyatt, with a rather narrowly rounded external side and flatly vaulted lateral parts. The thickness of the whorls varies somewhat in comparison to their height. In quite young specimens the height of the whorls is equal to twice the thickness; at the same time the lateral parts are more flattened, and the whole whorl appears more compressed.

In larger specimens the thickness becomes, by and by, considerably more than half of the height. The lateral parts become more vaulted, and the whole whorl more inflated.

The umbilicus is also in this species surrounded by a vertical wall, which is however much less high than in the preceding species. An umbilical edge is also very distinctly developed.

The sculpture consists in contractions of the shell, which appear as shallow excavations that originate at the umbilical edge, extend over the lateral parts in bending towards the front, and cross in equal force over the external part. In some, chiefly larger, specimens they are more numerous and of more unequal strength than in others.

The sutures are only indistinctly visible in the quite young state. They consist then of a rather short and comparatively narrow external lobe, a comparatively deep and broad lateral lobe, and a very small auxiliary lobe, which is situated not very far from the umbilical edge. None of the lobes is denticulated.

The specimens at disposal are exclusively internal casts, none of them preserving a trace of the shell.

The dimensions of two specimens from the ceratite marls are as follow:—

	I.	II.
Diameter of the shell	6 mm.	11 mm.
„ „ umbilicus	1 mm.	3·5 mm.
Height of the last whorl from the umbilical suture .	3·5 mm.	5 mm.
„ „ „ „ „ „ preceding whorl .	2 mm.	4 mm.
Thickness of the last whorl	2 mm.	3·25 mm.

Locality and Geological Position.—The three specimens of this species were found by myself in the ceratite marls of Virgal.

Remarks.—The present species is in many respects a very interesting one: there remains but little doubt that it is the descendant of *Din. patella* described just before. The chief difference from that species consists in the circumstance that the umbilicus, which is very narrow in the young specimens of *Din. patella*, and becomes large only after the full-growing size has been attained, is in *Din. minutus*, already of considerable diameter in the young stage. This is a very fair example of the action of the law of acceleration, as pointed out by Prof. Hyatt. The thing goes, however, yet further. The two Indian species are in their geological position decidedly more ancient than the European species, which are most nearly related to them; as the Indian forms appear in beds, which most probably must be considered as the equivalents of the Bunter sandstone of Europe, whilst *Din. cuccensis* M., *Din. taramelii* M., etc., do not appear in Europe before the Muschelkalk. Thus, there is much probability that the European species are the descendants of the Indian ones. In the European forms the umbilicus is yet larger, and the incisions on the external side that are observable in *Din. patella* on the body-chamber only, have extended there apparently to the other volutions (Comp. Pl. V, fig. 7, Mojsisovics: Ceph. Med. Trias-Prov.) So also here the law of acceleration has been at work.

From *Din. cuccensis* our Indian *Din. minutus* can be readily distinguished by its smaller umbilicus and more involute whorls.

(d) Isolated species.

5. DINARITES EVOLUTUS, Waagen, n. sp., Pl. X, fig. 3a., b., c.

The general shape of this species is flatly disciform, with tolerably compressed whorls and a widely open umbilicus.

The transverse section of the whorls is rather compressed, with flattened sides, which only very slightly converge towards the broadly rounded external side.

There is neither a distinct umbilical edge present, nor a distinct umbilical wall. The lateral parts of the whorls bend inside in a narrow curve and attach themselves with a rounded outline to the preceding whorl.

The involution of the whorls is very small, a little more than one-third of the preceding whorl being covered up by the following one. In consequence of this the umbilicus becomes very wide and all the volutions are broadly exposed in it. On the whole it is rather flatly excavated, but the step of each whorl is well marked.

Not a trace of any suture is visible in the whole shell, and it has also been found impossible to expose them, as apparently not a trace of them has been preserved. The whole fossil gives the impression as if it were exhibiting part of the body-chamber, but as no trace of the sutures can be observed, it is impossible to attain any certainty in this respect. For this reason it also remains doubtful, whether the generic determination as *Dinarites* is correct.

The sculpture consists of rather faint, undivided radial ribs, which commence indistinctly near the umbilicus, and as they extend, become stronger and bend distinctly forward to the external side. Here the greater part of them disappear nearly entirely, only very faint traces of them crossing over the external side. Towards the end of the last volution these folds become stronger, smaller ones appear intercalated between the principal ones, and they extend without diminishing in strength over the external part of the shell, causing it to become undulating.

The inner volutions seem for the greater part to be entirely smooth.

The dimensions of the only specimen existing in the Salt-Range collection are as follow :—

	mm.
Diameter of the shell	46
" " " umbilicus	20
Height of the last whorl from the umbilicus	15.5
" " " " " " " preceding volution	13
Thickness of the last whorl	8.5

Locality and Geological Position.—I collected the single specimen of this species at Chidroo, in the topmost beds of the Ceratite sandstone, transitional to the Upper Ceratite limestone.

Remarks.—This species, if rightly determined as *Dinarites*, represents an intermediate form between *Din. cuccensis* and allied species, on the one hand ; and *Din. avisianus*, Mojs., on the other.

In common with *Dinarites taramelii*, Mojs., the present species has the flattened sides and the singular sculpture ; with *Din. avisianus*, on the contrary, there are the large umbilicus and the little involution of the whorls.

On the whole, however, the similarity of the Indian shell to the European shells just mentioned is a rather distant one.

Nevertheless, it is worthy of notice that the present species, with its decidedly younger geological position, bears also a certain resemblance to a much more recent European species.

6. DINARITES SINUATUS, Waagen, n. sp., Pl. X, fig. 4 a, b, c.

The general shape of this species is moderately thick disciform, with flatly rounded whorls and a large umbilicus.

The transverse section of the whorls is helmet-shaped, according to the designation as applied by Prof. Hyatt : that is to say, the lateral parts of the whorls are flatly vaulted and somewhat converging towards the external side. The latter is broadly arched. There is neither an umbilical wall present nor an umbilical edge, but the lateral parts bend with a narrow gentle curve down to the umbilical suture.

The whorls are very little embracing, so that two-thirds of the entire height of the whorls is exposed to view in the large umbilicus.

The sculpture consists of undivided strong broad radiating folds, which are perfectly rounded on their tops. They originate at the umbilicus and extend in a

nearly straight line, slightly directed towards the front over the lateral parts of the whorls. Near the external side, they bend in a gentle curve again more forward; and pass, in describing a rounded obtuse angle, over the external part of the shell. These folds appear to be less numerous and less strongly developed on the inner volutions than on the outer ones.

On the single specimen at my disposal, there is again not a trace of any sutural line observable; and it therefore must remain doubtful whether the outer volution belongs to the body-chamber or not. Also in this case the determination as *Dinarites* is by no means certain.

The measurements of this single fragmentary specimen are as follows:—

	mm.
Diameter of the shell, about	74
" " " umbilicus, about	32
Height of the last whorl from the umbilical suture	22
" " " " " " preceding whorl	17
Thickness of the last whorl	14

Locality and Geological Position.—The present species is one of the few forms of Cephalopoda that I have found in the Bivalve beds just below the dolomitic series. Though it is preserved only in a quite fragmentary condition, yet I thought it worth while to describe it, as it exhibits a very characteristic shape. The locality where it comes from is Chidroo.

Remarks.—In its general characters the present species exhibits a certain similarity to the one described just before under the name of *Din. evolutus*; only that the ornamentation of the shell is far more strongly developed in the present form. Like the preceding species, it reminds one also, to a certain extent, of the species allied to *Din. succensis*, Mojs., but the similarity is only a rather distant one. There exists also again a certain similarity to *Din. avisianus*, Mojs., but the radial folds are much more straight and not so swollen in the umbilical region.

On the whole, the present species deviates rather far from the types of *Dinarites* hitherto described, and even reminds one to a certain extent of some forms of *Sibirites* which will be described later on in the text.

Genus: CERATITES, de Haan (emend. Mojs.)

Through the excellent investigations of Dr. E. v. Mojsisovics, the definition of the genus has been thoroughly settled; and it is now by no means difficult to decide what forms ought to be considered as belonging to the genus.

The body-chamber is always short, occupying not more than one-half of the last whorl; the aperture apparently mostly somewhat contracted; the sutural line is nearly always composed of a tolerably short, bifid external lobe; and besides this there are always two lateral lobes: a small auxiliary lobe is also mostly present, but only rarely is there a greater number of auxiliary lobes.

There is a group of forms contained in the Salt-Range deposits, deviating with respect to the auxiliary lobes from every thing detected up to the present in other countries. In these forms the auxiliary lobes are very numerous, extremely

short and narrow, all of an equal size and forming a tolerably straight crenulated line extending from the second lateral saddle down to the umbilicus. These I shall separate generically from the genus *Ceratites* and unite under the name of *Prionites*, a genus that will be described in detail in the following pages.

The lobes, when normally developed, are crenulated on their tops, whilst the saddles are entire. The crenulations of the lobes have never been observed by me to descend laterally on the bodies of the lobes into the saddles. Only in Himalayan species sometimes does such a peculiarity occur.

Also a goniatic development of the sutural lines, as it often occurs in other groups of forms, often by atavism, has never been observed by me among the Salt-Range species.

The most ancient form that is attributed by Mojsisovics to this genus is *Ceratites plicatus*, W. sp., a fossil that was described by me in the first volume of the present work as a *Xenodiscus*. The reasons why such a change of name should be adopted are not stated in detail by the learned author, but it seems that a certain similarity to young specimens of *Cer. middendorfi*, Keys, guided him in such a proceeding. Though I cannot consider the similarity a striking one, yet I am not absolutely averse to the interpretation given by Mojsisovics to the fossil described by me if other characters did not make the case again very doubtful. It must not be forgotten that it is *only* the general similarity to other forms of *Ceratites*, chiefly the squarish transverse section of the whorls, on which such an association of the species with *Ceratites* is founded. On the other hand, there is the length of the body-chamber, which occupies nearly an entire whorl, which is apt to throw grave doubts on such an association. I shall later on return again to this point.

If such *Ceratites plicatus*, W., had to be considered as the most ancient species known up to the present, then already, at these remote times, the genus had attained typical Ceratite-lobes. The difference from more recent species consists only in the absence of one or more auxiliary lobes which are developed in the triassic forms. This is, however, not quite in accordance with what had formerly been maintained by Mojsisovics, who considered the genus *Ceratites* as taking its origin from *Dinarites*, which possesses only a single lateral lobe. Here now we have a *Ceratites* which is much more ancient than any *Dinarites* hitherto described, and which already possesses two lateral lobes.

The sculpture of the Ceratites is very variable, and such a number of different forms has been included by Mojsisovics in the genus, that one becomes doubtful whether the range of variation admitted in the genus is not drawn too far by him.

The typical shape exhibited by the forms belonging to Ceratites shows a moderately wide umbilicus and squarish whorls with a flattened external side. The variations observable are of two kinds, either affecting the shape of the whorls, or the sculpture. In the first case, the umbilicus becomes narrower, with the whorls high and compressed. In the second case, the whorls become ornamented

by simple or bifurcating straight transverse folds, which are, by and by, transformed into tubercles either at the umbilical margin, or at the edges of the flattened external side, or in the middle of the lateral parts at the points of bifurcation of the transverse folds.

To these normal shapes exhibited by Ceratite shells are yet added by Mojsisovics forms which develop a blunt keel on the external side, which may even be hemmed in on both sides by deep furrows; or again, other forms, in which the lateral sculpture becomes falciform: so that these shells may blend together with certain shapes occurring in the *Tropitidæ* or even the *Harpoceratidæ*.

In the Salt-Range no such forms occur, and so I may be excused for not giving a definite opinion on them.

The genus *Ceratites* is very richly represented in the different divisions of the Ceratite formation. It attains its greatest development, however, in the Upper Ceratite limestones, where I have detected not less than eight species. On the whole, there are ten species of *Ceratites* contained in the Ceratite formation of the Salt-Range. Of all the forms, however, described by Mons. de Koninck under that name, only a single one can remain standing in the genus, and this is *Cer. murchisonianus*, Kon.

There is, however, no very great variation of form among the Salt-Range ceratites.

Nevertheless, the different species can be distributed with ease among the different groups distinguished by v. Mojsisovics within the genus. To Mojsisovics's groups, however, yet one more must be added.

The first group which I am able to distinguish, I am inclined to call the "*Nodosi*": as it comprises the forms which are more or less richly sculptured in the mode of *Ceratites nodosus*; and thus contains the most typical shapes of *Ceratites*. The group has been distinguished already by Beyrich, but he gave to it a somewhat more extended sense. Mojsisovics has resolved the group into several more narrowly circumscribed ones: as, however, the species belonging to the group are very limited in number in the Salt-Range, I am not able to retain the narrower groups but recur to the old name of "*Nodosi*."

There are altogether three species belonging to this group. Two of them may be in a developmental connection. They are: *Ceratites normalis*, W., out of the lower beds of the Ceratite sandstone, and *Ceratites inflatus*, W., out of the Upper Ceratite limestone. The third species is an isolated one, and will bear the name of *Ceratites disculus*, W., occurring in the top beds of the Upper Ceratite limestone.

The second group comprises forms, which according to all their characters must be attributed to the *CircumPLICATI* of Mojsisovics.

Also in this group, the number of species is not very large. There are altogether four species, all isolated ones, and all coming from the Upper Ceratite limestone. They will bear the names: *Ceratites murchisonianus*, Kon., *Ceratites angularis*, W., *Ceratites dimorphus*, W., and *Ceratites sp. indet.*

The next group, to which an Indian species probably belongs, has been called the "*subrobusti*" by Mojsisovics. He characterises the group in the following manner. This group comprises typical *Ceratites* with fissilicate or intercalate ribs very strong umbilical thorns, and more or less distinctly developed marginal nodes. There is an auxiliary lobe developed above the umbilical suture.

There is a single form existing in the Salt-Range, which can be attributed to this group. It will bear the name of *Ceratites sagitta*, W., and is restricted to the Upper Ceratite limestone.

The last group finally, that can be distinguished, is the one that has been called "*Nudi*" by Mojsisovics. This group is characterised by its nearly entirely smooth whorls, and a generally tolerably wide umbilicus. The sculpture, if any occurs, consists of a few barely perceptible, not quite straight, but slightly curving radial folds.

To this group I am inclined to attribute two species of the Salt-Range. One of them, to which I shall give the name of *Cerat. wyneei*, W., was found by me in the topmost bed of the Ceratite sandstone, just below the Upper Ceratite limestone: the second will bear the name of *Ceratites patella*, W., and comes from the Upper Ceratite limestone.

Thus we arrive at the following classification of the different species of ceratites occurring in the Salt-Range:—

I.—NODOSI.

a. Group of CERATITES NORMALIS, W.

1. *Ceratites normalis*, W., n. sp.
2. „ *inflatus*, W., n. sp.

b. Isolated species.

3. *Ceratites disculus*, W., n. sp.

II.—CIRCUMPLICATI.

4. *Ceratites murchisonianus*, Kon.
5. „ ? *angularis*, W., n. sp.
6. „ *dimorphus*, W., n. sp.
7. „ *sp. indet.*

III.—SUBROBUSTI.

8. *Ceratites sagitta*, W., n. sp.

IV.—NUDI.

9. *Ceratites wyneei* W., n. sp.
10. „ *patella*, W., n. sp.

From a geological point of view, the distribution of the genus *Ceratites* in the Salt-Range is also very remarkable. A list of the species arranged in this manner gives the following result:—

I.—Upper Ceratite limestone:

Ceratites inflatus, W.

„ *disculus*, W.

„ *murchisonianus*, Kon.

„ *angularis*, W.

„ *dimorphus*, W.

„ *sagitta*, W.

„ *patella*, W.

II.—Top beds of the Ceratite sandstone:

Ceratites wynnei, W.

„ *sp. indet.*

III.—Lower region of the Ceratite sandstone:

Ceratites normalis, W.

We see that in the Salt-Range the genus is not represented below the Ceratite sandstone, and even in this rock group the genus is still rather rare, though typical species like *Ceratites normalis* occur.

As far as I can judge the matter at this moment, it seems to me that the Ceratite sandstone should be considered as forming the upper division of the Bunt Sandstone.

In Europe the genus *Ceratites* does not make its appearance before the Muschelkalk, and thus it seems that in India the genus has its first representants in earlier beds than in Europe.

I.—NODOSI.

a. Group of CERATITES NORMALIS, W.

1. CERATITES NORMALIS, Waagen, n. sp., Pl. VI, fig. 2 a, b, c, d.

The general shape of this species is thick disciform, with a rather wide umbilicus and squarish whorls.

The transverse section of the whorls is considerably higher than it is broad. The external side is flatly and broadly rounded, and joins the lateral parts in forming obtuse angles. The lateral parts are nearly flat, only very little vaulted, a little sloping outward; so that the transverse section of the whorls is slightly broader near the umbilicus than near the external part. The umbilicus is surrounded by a distinct high umbilical wall, which is, however, not quite vertical but slightly sloping. It joins the lateral parts in forming an obtuse angle which surrounds the umbilicus as a distinct umbilical edge.

Of the only specimen at my disposal, nothing but the body-chamber is present; whilst the inner volutions are preserved only as an indistinct impression on the rock.

The sculpture of the body-chamber consists of numerous small tubercles, which are situated at the external edge. There may have been about thirty of them on the body-chamber alone. They are in connection with nearly straight ribs, which originating, barely perceptibly, on the middle of the lateral parts are a little directed towards the front, and unite with the tubercles, causing these latter to assume an elongate shape. These ribs are much stronger towards the mouth of the shell than at the commencement of the body-chamber.

That part of the lateral sides surrounding the umbilicus is perfectly smooth.

The external part is represented in fig. 2 *b*. The tubercles which ornament the external edges of the whorls are here also distinctly visible. From these tubercles extend very faintly developed ribs, which cross over the external part from one tubercle to the other. They grow very faint in the middle, and are stronger near the tubercles. Their direction is only very little bent, nearly straight.

The body-chamber occupies about one-half of the last volution.

The species is very little involute. The indentation caused by the preceding whorl in the following one is not quite one-fourth of the entire height of the last volution. The umbilicus thus becomes comparatively very large.

The sutural line can be tolerably well observed at the commencement of the body-chamber. It is the last one that has existed on this specimen.

The external lobe is rather shallow, well divided in two branches, each of which is distinctly denticulated at the bottom. The external saddle is broad and reaches higher up than the siphonal incision between the two branches of the external lobe. The first lateral lobe is slightly narrower than the external saddle. It reaches considerably lower down than the external lobe and is distinctly denticulated at the bottom. The lateral saddle is as broad as the first lateral lobe and narrower than the external saddle. It reaches not higher up than the latter. The second lateral lobe is much shorter and narrower than the first one, but also distinctly denticulated on the bottom. There follows yet a broad auxiliary saddle and a small auxiliary lobe which is situated on the umbilical wall, but which is rather indistinctly preserved.

The measurements of the only specimen at my disposal are as follows, as far as they can be observed :—

	mm.
Diameter of the shell	70
„ „ „ umbilicus	21
Height of the last volution from the umbilical suture	27
„ „ „ „ „ „ preceding whorl	21
Thickness of the last volution	19

Locality and Geological Position.—The only specimen of this species existing in the Salt-Range collection was found at Nanga in the lower region of the Ceratite sandstone.

Remarks.—The present species has in its entire shape much similarity to certain forms occurring in the triassic strata of the Alps. It is, however, just a group of forms, to which the Indian species bears a similarity, which is by no means common, nor in any way characteristic. The majority of species of *Ceratites* occurring in the Alps possesses a narrow umbilicus and high compressed whorls; and there are only two forms among the *Nodosi* group, in which this is not the case, and these are *Cer. gosaviensis*, Mojs., and *Cer. superbus*, Mojs., which present a widely open umbilicus and rather depressed squarish whorls.

In these respects they remind me strongly of *Cer. normalis*, and the aspect from the external or siphonal side is also very similar. In *Cer. superbus* one observes the same little tubercles on both external edges, which are in connection with faint ribs that cross over the siphonal side of the shell. In *Cer. gosaviensis* these ribs disappear in the middle; and thus a kind of median elevation is formed, of which a very slight indication is to be found also in our species.

Otherwise the sculpture is, however, entirely dissimilar. The lateral parts of the shell are in the Indian species smooth from the umbilical edge up to the middle of the sides, where faint ribs commence; unless a tubercle is there formed. In the Alpine species just mentioned, a strong sculpture of ribs and tubercles commences already at the umbilical edge.

With regard to the sculpture, also some forms, occurring in the German Muschelkalk, may be compared, for instance *Cerat. enodis*, but here the tubercles on the external edge are much less numerous.

Another character that may well serve for comparison consists in the sutural line. In this respect the Indian shell is much more nearly related to the Alpine species than to those from the German Muschelkalk. In *Cerat. normalis*, as well as in the majority of Alpine species, there are two lateral and a small auxiliary lobe present, whilst in *Cer. enodis* apparently three lateral and two auxiliary lobes can be counted.

From all this it appears that the Indian form represents a well distinguishable species, which is tolerably nearly related to some Alpine shells, but bears at the same time also a certain resemblance to some species of the German Muschelkalk.

2. CERATITES INFLATUS, Waagen, n. sp., Pl. X, fig. 1 *a*, *b*, *c*.

Unfortunately, there is only a fragment of the body-chamber of this species preserved in the Salt-Range collection, though the shape of this fragment is so characteristic that it seems desirable to give a proper name to it and thus to fix this form.

The general shape of the species has evidently been thick disciform, with a not very narrow and not very deep umbilicus.

The transverse section of the whorls is higher than broad, with a broad, very flatly arched external side, which joins the lateral parts of the shell in forming an obtuse angle or external edge. The lateral parts of the shell are flatly but distinctly

The involution of the whorls is a little considerable, the indentation caused by the penultimate whorl in the last one amounting to a little less than one-third of the entire height of the latter.

The specimen serving for description is an internal cast without a trace of the shell-substance.

The measurements of the fragmentary specimen are about as follows :—

	mm.
Diameter of the shell, about	P103
" " umbilicus	P23
Height of the last whorl from the umbilical suture	45
" " " " preceding whorl	31
Thickness of the last "whorl".	30

The geological position of the specimen is not above every doubt, as Mr. Wynne's label is only signed "Trias." According to the condition of the rock, however, in which the specimen is contained, it appears highly probable that it has come from the Upper Ceratite limestone.

The first group of characters regarding the sculpture of the shell brings the present species so near *Cer. normalis*, W., that I have thought it convenient to consider the two as forming one developmental series, in which *Cer. normalis* must be considered as the ancestor of *Cer. inflatus*.

The second group of characters regarding the configuration of the umbilicus removes the two again from each other, and it must remain an open question whether, if more extensive materials were available, the two would not turn out to belong to two different developmental series.

I cannot solve the question now, and must await better information from better and more extensive materials.

The comparative narrowness of the umbilicus in the present species gives occasion to compare it with some other species of Europe, which could not be taken into consideration with regard to *Cer. normalis*.

There is chiefly *Cer. aviticus*, Mojs., which bears a certain resemblance, though this is only a distant one. The Indian species possesses much more inflated whorls and a yet fainter sculpture.

b. Isolated species.

3. CERATITES DISCULUS, Waagen, n. sp., Pl. XI, fig. 7 a, b.

This is a very interesting little species, and it is only to be regretted that the materials of it are so very scanty. There is only a single individual, and this even fragmentary, preserved in the Salt-Range collection.

The species is flatly disciform with a small umbilicus and compressed whorls.

The transverse section of the whorls is more or less trapezoidal with a flattened external part which is hemmed in on both sides by distinctly developed external edges. The lateral parts are perceptibly flattened in their external half, and slope strongly down to the external edges about from the middle of their extent. In the umbilical region, they are well vaulted and bend down to the umbilical suture in a gentle curve, reaching the preceding whorl under an acute angle. There is no distinct umbilical wall nor an umbilical edge present.

The sculpture of the outer volution consists in radial folds, which originate very indistinctly at the umbilical suture, and reach from there, without growing much stronger, up to about one-third of the entire height of the lateral parts. Here they bear an indistinct tubercle, and then alternately bifurcate or remain single.

In their extent from the lateral tubercles up to the external edges the ribs are much more strongly developed than in the umbilical region. They are a little directed towards the front and slightly curved. Each of them bears a rather strong tubercle at the external edge.

The inner volutions, as far as they are exposed to view within the umbilicus appear to be entirely smooth.

I regret to say that I have absolutely failed to make the sutural lines visible. I cannot exactly say whether this has been the case, the partitions of the air-chambers having been entirely destroyed by the process of fossilisation; or whether part of the outer volution belongs to the body-chamber. It seems, however, barely probable that the small fragmentary specimen at my disposal was already full grown.

The measurements are as follows :—

	mm.
Diameter of the shell	19
„ „ umbilicus	5.5
Height of the last whorl from the umbilical suture	9
„ „ „ „ „ preceding whorl	7
Thickness of the last whorl	5.5

Locality and Geological Position.—The only specimen of this species existing was found by me at Chidroo, in the topmost beds of the Upper Ceratite limestone.

Remarks.—The chief interest in connection with this species consists in the circumstance that it belongs to a group of forms which is most extensively developed in the Alps as well as in the Himalaya; whilst in the Salt-Range no other form, belonging to the same group, has been detected up to the present. It is the group of *Ceratites binodosus*, Hau., to which I allude.

Among European species it is before all *Ceratites binodosus* itself to which the present shell must be compared; and among the Himalayan ones it is *Ceratites thuillieri*, Opp.

From all the forms of the group the Indian species is different by the absence of an umbilical edge, the absence of thorns round the umbilicus, and much less numerous radial ribs. In these respects it is somewhat similar to *Cerat. luganensis*, Hau.

By the regular alternation of single and bipartite ribs, our *Cerat. disculus* chiefly resembles *Cerat. thuillieri*, Opp.; but the absence of umbilical tubercles and the very small number of radial ribs in the species make a distinction very easy.

II.—CIRCUMPLICATI.

4. CERATITES MURCHISONIANUS, Koninck, Pl. IV, fig. 1 a, b.

1863. *Ceratites murchisonianus*, Koninck, Quart. Journ. Geol. Soc. Lond., Vol. XIX, page 11, Pl. VIII, fig. 1,

1863. *Ceratites murchisonianus*, Koninck. Fossiles Paléozoïques de l'Inde. page 11, Pl. VIII, fig. 1.

The specimen of this species that has served Mons. de Koninck for description, was only a fragmentary one, and I myself am not in a much better position, as my specimen also is rather fragmentary, though it is somewhat more complete than that of M. de Koninck.

There is, however, an enormous difference in the size of both specimens, as the original specimen had a diameter of not less than 180mm. whilst the specimen that is at my own disposal is not more than 132mm. in diameter, so that de Koninck's original specimen must have possessed half to three-fourths of a volution more than the one under description.

Nevertheless, my specimen shows so much accordance in its general features with de Koninck's drawing that I think the two may be safely considered as belonging to one and the same species.

The general shape of the species is thick disciform, with whorls that are considerably higher than they are broad. The involution is very small, and the umbilicus of a moderate size.

The whorls increase somewhat in height during their growth. The inner volutions are not preserved in the specimen at my disposal, but at a diameter of the shell of about 82mm. the height of the last whorl is 35mm., whilst at a diameter of 132mm. height of the last volution is as much as 60mm.

The transverse section of the whorls is helmet-shaped, according to Prof. Hyatt's definition. The external part is narrow, rounded, but at the same time somewhat depressed; a character which is somewhat too little expressed in the front view, Pl. IV, f. 1 *b.*, whilst it is well represented in fig. 1 *a.* There is no distinct external edge formed by the junction of the external and lateral parts. The latter are flatly vaulted, and their greatest elevation is situated about the middle of the height of the whorls, shifted but slightly towards the umbilical side. From the highest elevation, which is however, only slightly prominent, the lateral parts descend gently towards the umbilical suture. There is not a trace of an umbilical edge, and the lateral part of the external whorl joins the preceding whorl at an acute angle.

The sculpture of the shell is very simple. It consists of straight radial folds, which are mostly simple and apparently more strongly expressed in the young than in the adult shell. In full-grown individuals, like the specimen described by M. de Koninck, the radial folds are resolved towards the end of the body-chamber, that is to say, towards the mouth of the shell, into a number of fine radial ribs.

In middle-sized specimens, like the one represented on Pl. IV, fig. 1, the sculpture appears characterised by the circumstance that these radial folds are very unequally distributed. The spaces between two folds are sometimes rather broad, sometimes moderately so; sometimes two of the folds are so closely approached to each other that it appears, as if one had to deal with a single fold, divided on the top by a furrow into two.

The folds originate a short distance above the umbilical suture and disappear again long before reaching the external part. The latter is perfectly smooth.

The sutural lines are only very indistinctly preserved in the specimen at my disposal. The siphonal lobe cannot be observed at all. The first lateral lobe is moderately broad and rather long. It is distinctly denticulated at its bottom. The second lateral lobe is as broad, but very much shorter, than the first one; also distinctly denticulated. An auxiliary lobe is present. It is considerably shorter than the second lateral lobe, and is situated well above the umbilical suture. The saddles are all entire and all on the same line, none of them reaching up higher.

The last third of the last volution of the figured specimen belongs to the body-chamber.

The measurements of the specimen are as follows :—

Diameter of the shell	.	.	.	.	.	.	.	.	.	.	mm.
" " " umbilicus	.	.	.	.	.	.	.	.	.	.	132
Height of the last volution from the umbilical suture	.	.	.	.	.	.	.	.	.	.	40
" " " " " " preceding whorl	.	.	.	.	.	.	.	.	.	.	59
Thickness of the last volution	.	.	.	.	.	.	.	.	.	.	49
	.	.	.	.	.	.	.	.	.	.	37

Locality and Geological Position.—It is not known from what particular bed the original of M. de Koninck may have come. The specimen under description was collected by me at Chidroo, in the Upper Ceratite limestone.

Remarks.—There are several species belonging to the *Circumplexi* group, with which the present shell can be compared ; and there are not only European but also Himalayan forms which show a certain resemblance.

There is before all *Ceratites erasmi*, Mojs., out of the lower Muschelkalk of the Alps, which shows a great affinity to the Indian shell. The general configuration of both species is nearly identical : only that, in the Indian form, the umbilicus is wider and the radial folds more numerous and less strong, characters which however, depend to a great measure upon the age of the shell. The external edges are very much stronger developed in *Ceratites erasmi* than in the Indian shell, and the sutural lines of both are entirely different. The entire shape of the lobes in *Cer. murchisonianus* is much clumsier, and the denticulations are entirely restricted to the bottom of the lobes. There is only one auxiliary lobe in the Indian shell whilst there are two in *Cer. erasmi*.

Ceratites wetsoni, Opp., from the Muschelkalk of the Himalaya, shows also a certain affinity, but the similarity is much less close, and the sculpture as well as the sutural lines differ rather far from our *Cer. murchisonianus*.

Still less nearly related, though showing also a certain similarity, are *Ceratites zezianus*, Mojs., from Alpine Noric beds, *Ceratites onustus*, Opp., and *Ceratites blanfordi*, Salter, from the Himalayan Muschelkalk. A closer comparison of these forms with *Cer. murchisonianus* is barely necessary.

5. CERATITES ANGULARIS, Waagen, n. sp., Pl. V., fig. 3.

This species is represented only by a small fragment of the body-chamber ; and it is barely sufficient to fix the species properly ; but the shape of this fragment is so peculiar that I thought it worth while giving a name to it, and thus avoid dragging it along in the literature under the designation of *sp. ind.*

The species must have been thick disciform, with large and deep umbilicus and depressed whorls.

The transverse section of the latter is somewhat trapezoidal, a little less high than it is broad. The external side is strongly depressed but slightly vaulted, hemmed in on both sides by distinct external edges. The lateral parts are flattened and distinctly sloping towards the external edges. Their greatest elevation is about one-

third of the entire height of the whorl distant from the umbilical suture. From this highest elevation the lateral parts slope down in a slightly curved plane to the umbilical suture.

The sculpture consists of strong tubercles situated on the highest lateral elevation of the whorls. There are four of these tubercles preserved on the fragment, but on the entire last whorl there must have been ten to thirteen of them. At these tubercles originate strong single straight ribs, which terminate at the outer edge with another but much fainter tubercle. The tubercles on both sides are joined together across the external part by a low, barely-perceptible, swelling of the shell, or rounded rib, which shows a very slight bend towards the front.

There is not a trace of the lobes, or any other characters visible.

The measurements are those of the figures.

Locality and Geological Position.—This fragment was collected by myself at Koofri, in the Upper Ceratite limestone.

Remarks.—The determination of this fragment is a very uncertain one, and must remain such as long as no better specimens, preserving their sutural lines, shall have been found.

I have placed the fragment in the genus *Ceratites*, on account of a general similarity exhibited by it to species belonging to that genus. The peculiarity of the present species consists chiefly in the circumstance that the tubercles situated on the outer edges of the whorl are of the same number as the principal tubercles on the lateral parts; so that the ribs originating at the latter remain always single, so far as can be observed.

In this respect the fragment reminds me even of certain *Nautiloids* occurring in upper palæozoic deposits.

As to species, the fragment recalls most strongly certain forms of *Ceratites*, *subrobustus*, described by Mojsisovics from the lower triassic deposits of the mouth of the Olenek in Northern Siberia.

6. CERATITES DIMORPHUS, Waagen., n. sp., Pl. XI, fig. 6 *a*, 6 *c*.

It is a very small species that I distinguish under this name.

The general shape is flatly disciform, with a rather small umbilicus and high compressed whorls.

The transverse section of the latter is trapezoidal, very much higher than broad with a flattened external and flattened lateral parts; none of these, however, is perfectly flat. The external part is but very little vaulted at the end of the last volution. At a diameter of the shell of less than 8mm., however, the external part is perfectly rounded and the flattening appears only after the shell has exceeded a diameter of 8mm. Then the external part is hemmed in on both sides by blunt external edges. The lateral parts are a little more distinctly vaulted than the external one, and the greatest transverse diameter of the whorls is situated in the lower third of

their height. An umbilical edge is not developed, but the lateral parts bend rather abruptly inside to the umbilical suture.

The sculpture of the shell is very different according to its age. In the young state, up to a diameter of 8mm., the lateral parts are covered by numerous fine radial folds, which do not bifurcate, originating very near the umbilical suture and disappearing at the external side, without crossing distinctly over that part of the shell.

In the later stages of growth, the fine radial folds are replaced by broad flat radial undulations, which are much less numerous. There are never any tubercles developed.

The external part remains always smooth.

The sutural lines are only very indistinctly visible. The siphonal lobe cannot be distinguished. The first lateral lobe is not very long but rather broad. The second lateral lobe is much shorter but nearly as broad as the first. Whether there is an auxiliary lobe present cannot be seen.

The measurements of the only existing specimen are as follows:—

	mm.
Diameter of the shell	15
„ „ umbilicus	3
Height of the last volution from the umbilical suture	7
„ „ „ „ preceding whorl	5.5
Thickness of the last volution	4

Locality and Geological Position.—The only specimen that has been found up to the present in the Salt-Range was collected by me at Chidroo, in the top-most beds of the Upper Ceratite limestone.

Remarks.—The inner volutions of the present species remind me rather strongly of *Ceratites varisci*, Mojs., from the Muschelkalk of the Alps. Like the European species, the Indian one possesses numerous fine radiating ribs which terminate not far from the external side without forming a tubercle—a character, which, however, also occurs only in young specimens of *Cerat. varisci*. The only difference in the young of both species consists in the umbilicus being wider and the volutions being thicker in the European species than in the Indian one.

Full-grown specimens in both species are, however, rather widely different from each other. In the Indian shell the *circumplectati* characters are more and more strongly developed as the individual grows larger, whilst the European form follows a quite different way of development. Its characters approach more and more the *Nodosi* group, so much so that towards the end of the body-chamber there appear tubercles along the outer edges of the whorls.

Thus, though the similarity between the two species may appear so close, yet a real relation between the two probably does not exist.

No other species has been described up to the present, which could be compared to *Ceratites dimorphus*.

7. CERATITES, *species indet.* Pl. XI, fig. 4 *a, b.*

A fragment of a body-chamber was collected by me in the highest beds of the Ceratite sandstone (horizon of *Flemingites flemingi*) at Virgal, which is unlike all the other species occurring in the Ceratite formation of the Salt-Range.

The species possessed a rather large umbilicus and laterally compressed whorls, which showed a flattened external side and gently curved lateral parts, without umbilical edge. The sculpture consisted in broad folds, which were strongest near the umbilical suture, growing gradually fainter as they approached the external side. They did not however stop there, but crossed in a barely perceptible manner over that part. The folds are directed strongly towards the front.

The mouth seems to have been somewhat contracted.

The materials of this species are too unsatisfactory and too badly preserved to allow of a proper name being given to it.

I thought this fragment, however, was worthy of some description, as all the different forms occurring in the Salt-Range ought to be marked, and because the geological position in which this species occurs is of special interest.

III.—SUBROBUSTI.

8. CERATITES SAGITTA, Waagen., n. sp., Pl. IV, fig. 3*a, b, c.*

I regret to say that it is again a very badly preserved specimen, which I have to describe under this name; but the general form of it is so peculiar that I cannot pass it in silence, and to quote all the different forms as *sp. ind.* is also of no use.

The general shape of the species is thick disciform, with inflated whorls and a tolerably wide umbilicus. The transverse section of the whorls is broadly helmet-shaped. The external side is rather narrowly rounded, not in the least flattened, and passes directly into the lateral parts, which strongly diverge in the direction of the umbilicus and are not much vaulted. A short distance above the umbilicus, at the lower fifth of the entire height of the whorl, they suddenly bend inside with a narrow curve to the umbilical suture and hit the preceding whorl nearly at right angles.

The sculpture consists of rather strong, elongated tubercles, which are situated near the umbilicus on the highest elevation of the lateral parts of the whorl. The fragment serving for description consists of the body-chamber only; and there are six of these tubercles on this part of the shell.

The tubercles are continued towards the external side as faint simple ribs, which are strongly directed towards the front and soon disappear on the upper half of the lateral part of the whorl.

The mouth of the body-chamber is indistinctly preserved in the specimen. The apertural margin appears to be quite simple and strongly bent inside, whereby the mouth becomes distinctly contracted. It is a little prolonged on the external side.

The sutural lines are not preserved in the specimen at my disposal.

The measurements are as follows :—

	mm.
Diameter of the shell	? 47
" " umbilicus	15
Height of the aperture from the umbilical suture	18
" " " " preceding whorl	? 14
Thickness at the aperture	17

Locality and Geological Position.—The fragmentary specimen thus described was collected by me at Chidroo, at the limit between the Ceratite sandstone and the Upper Ceratite limestone; it probably belongs to the latter.

Remarks.—It is to be regretted that no better preserved specimen of this species has been found, and it may be questioned whether it is quite prudent to notice also such fragmentary specimens. On the other hand, it cannot be denied that we can only obtain a clearer insight into the development of the triassic beds in the Salt-Range by giving as complete an account of the fossil contents of these beds as possible.

Now, the fossils that occur in the Upper Ceratite limestone are found for the greater part in a fragmentary condition; and a systematic search only could furnish more complete specimens. In Europe such a search is most easily instituted, and any man, with a little training, may be employed for collecting. The case is quite different in India: the enormous distances that have to be traversed there; the difficulty of travelling with a camp; the great expenses that are incurred in this mode of travelling; and last not least the necessity of sending a highly intelligent official, whose time might be employed on better work;—all these are absolute hindrances to a systematic search for fossils in out-of-the-way places.

So one must needs be contented with the materials that have been collected whilst the country was being surveyed; and if these materials are fragmentary, the result is to be regretted, but it cannot be helped. If in the special case of the Upper Ceratite limestone all those species ought to be ignored which are in a rather bad state of preservation, it would be impossible to give to the public even a tolerably adequate idea of the fauna contained in these beds; and as it happens, just the fauna of this subdivision is among the most interesting occurring in the Trias of the Salt-Range.

I hope therefore to meet with the approval of my colleagues if I describe also fragmentary specimens, as long as the characters of the species can be recognised from them.

The present species is so far interesting, since it shows a certain similarity to *Ceratites schrenki*, Mojs., on a very reduced scale. Also in this species the tubercles are restricted to the vicinity of the umbilicus; and from them start radial folds, which reach the external part of the shell, whilst they disappear sooner in the Indian shell. The tubercles are likewise much more numerous in our *Cerat. sagitta*.

Ceratites schrenki, Mojs., belongs to a group of forms, which has been distinguished under the name of "*Subrobusti*" by Mojsisovics. This group is very character-

Locality and Geological Position.—I collected this specimen at Chidroo, in the topmost beds of the Ceratite sandstone, just below the Upper Ceratite limestone.

Remarks.—The present species seems to be very nearly related to *Ceratites sturi*, Mojs., which has been described from Upper Noric beds of the Alps. The whorls of the Indian shell are slightly higher and more compressed, the umbilicus somewhat narrower than those of the Alpine species.

Still more nearly related appears to be *Dinarites mahomedanus*, Mojs., out of the Werfen beds of Glavaticevo in the Herzegovina. The shape of both species is absolutely the same, only the size of the European species is very much more considerable, and the sutural lines show the characters of the genus *Dinarites*.

It has been remarked in the description of the species, that the characters of the sutures in *Ceratites wynnei* come very near *Dinarites*, but that they are more in accordance with *Ceratites* than with the former genus. From all this it appears that our *Ceratites wynnei* might probably best be considered as an intermediate form between *Dinarites mahomedanus*, Mojs., and *Ceratites sturi*, Mojs. With such a supposition, the geological position of *Ceratites wynnei* would also be well in accordance, as one of the two European species is probably geologically older, the other decidedly younger, than the Indian shell. The enormous difference, however, in the geographical distribution forbids my expressing more positive opinion on the case.

10. CERATITES PATELLA, Waagen, n. sp., Pl. IV, fig. 2.

The general shape of this species is thick patelliform, with rounded whorls and a rather narrow umbilicus.

The transverse section of the whorls is helmet-shaped, with a not very broad, perfectly rounded external part. The greatest transverse diameter of the whorls is situated not far above the umbilicus, and from there the lateral parts slope towards the external side, with which they unite without forming any trace of an edge. From their greatest elevation the lateral parts bend rather quickly down to the umbilical suture, following an elegant curve, also without forming any trace of an umbilical edge, and hit the preceding whorl at about right angles. The umbilicus appears rather deep.

The surface of the shell is smooth for the greater part. Only at intervals low radial folds are observable, which are strongest on the highest elevation of the lateral parts, and extend to about the middle of the height of the whorl, then perfectly disappearing. The last of these folds is somewhat stronger and bifid.

There is not a trace of sutural lines on the whole shell, neither on the outer nor on the inner volutions. It is, however, probable that at least a part of the outer whorl belongs to the body-chamber.

The number of folds on the last whorl is about 7.

The dimensions of the only existing specimen of this species are as follows:—

Diameter of the shell	. . . . .	mm.
" " " umbilicus	. . . . .	63
Height of the last volution from the umbilical suture	. . . . .	16
" " " " " " preceding whorl	. . . . .	27
Thickness of the last volution	. . . . .	20

Locality and Geological Position.—This single specimen was found by me at Siran-ki-Dok, in the Upper Ceratite limestone.

Remarks.—The general shape of this shell makes it highly probable that it should be considered as belonging to the genus *Ceratites*, though not a trace of the sutural lines can be observed. The faintness and simplicity of the sculpture leave on the other hand not much doubt that this species should be placed in the *Nudi* group, if it is once considered as belonging to the genus *Ceratites*.

The *Nudi* comprise so few species that there is not much choice for a comparison. It is again *Ceratites sturi*, Mojs., which shows some resemblance, but in this species the umbilicus is very much larger and surrounded by a strong umbilical edge; at the same time the sculpture is fainter than in the Indian shell.

Comparison with *Cerat. wyneei*, described just before, is also necessary. For a short time I have thought that the two could perhaps be in a developmental connection, as the present species is geologically somewhat younger than *Cerat. wyneei*. On a closer comparison, however, the similarity is not so very striking, and it appears more probable that our *Cerat. patella* should be considered as an isolated species for the present. The umbilicus is narrower and the transverse section of the whorls more helmet-shaped than in *Cerat. wyneei*.

Genus: PRIONITES, Waagen, nov. gen.

For a long time I considered the species belonging to this genus only as forming a subdivision of the genus *Ceratites*; for in most characters they are well in accordance with that genus; but, after a lengthened consideration, the characters of the sutural line appeared still to deviate so far that I considered a generic distinction necessary.

The general shape of the shell can only be compared to that group of *Ceratites* comprised under the name of "*Circumplectati*" by Mojsisovics; while it is perfectly unlike those forms, which can be considered as the normal ones within the genus. The umbilicus is of moderate dimensions, the whorls more or less rectangular in section, with a distinctly flattened siphonal side hemmed in on both sides by distinct but not sharp external edges. There are never tubercles on these latter, whilst on the lateral parts strong tubercles are generally present.

The body-chamber of the shell comprises about half of the last whorl. The apertural margin is not preserved on any of the specimens known to me.

The most characteristic part of the shells belonging to the genus *Prionites* is the sutural line. It shows characters just the reverse of what can be observed in the

genus *Dinarites*. Like as in the latter genus, there are also here one external or siphonal and two lateral lobes present, but the position is a quite different one. The external lobe is entirely restricted to the flattened external side; and so is the greater part of the external saddle. The first lateral lobe is situated on the lateral part directly below the external edge, and the second lateral lobe is placed on or a little below the middle line of the lateral part. Thus, whilst in *Dinarites* the second lateral lobe is shifted so far inside towards the umbilicus, that it falls even within the line of involution and must thus be considered as an auxiliary lobe; in the genus *Prionites* it is placed far outside the line of involution, so that in many cases even the whole second lateral saddle is outside of that line. In a normal state of things in the case of such a situation of the second lateral lobe, a number of auxiliary lobes ought to follow filling up the space between the middle of the lateral parts and the umbilical suture; but nothing of the kind is to be observed in the genus *Prionites*.

The second lateral saddle is generally extremely low, and then follow a great number of small denticulations, which together form a quite straight line, without the slightest differentiation into auxiliary lobes. These denticulations are perfectly like the teeth of a saw, and therefore I have chosen the name of *Prionites* for this genus.

Another peculiarity of the genus consists in the circumstance that in some species only the first lateral lobe has denticulations at its bottom, and is thus ceratitic; whilst in the external lobe, as well as in the second lateral lobe, such denticulations are completely absent, whereby these two lobes appear thoroughly goniatitic. With regard to the external lobe, this is always the case.

From all this it appears that, though the forms belonging to this genus show in general a certain resemblance to certain species of *Ceratites*, still the sutural lines are so far deviating that a generic distinction from *Ceratites* seems to be necessary.

I cannot say in what developmental connection the genus *Prionites* may be to other genera of the family *Ceratitidæ*. It appears to me improbable that the genus may have taken its origin from *Ceratites* itself, as the sutural lines, in their partly goniatitic outline, exhibit such a low state of development that even the most ancient species of *Ceratites* have more complicated lobes than all the species of *Prionites*.

If we turn to *Dinarites* for a comparison, we find that the possibility of the genus *Prionites* having taken its origin from certain species of that genus cannot be excluded altogether, and thus *Prionites* would form, like *Ceratites*, a second branch springing from *Dinarites*. In reality, however, there are no positive indications for such a supposition.

The peculiarities of the sutural line of *Prionites* are partly repeated in several species already described. Two of such have been figured by M. de Koninck from the Salt-Range under the names of *Ceratites davidsonianus* and *Cer. buchianus*, in which forms, in the place of auxiliary lobes, there are also only denticulations. Nevertheless, these two species cannot be considered as forming part of the present

genus; because with regard to all the other characters, making abstract of the sutural line, they are perfectly deviating and in no connection whatever with *Ceratites*. On the contrary, they are near relations to *Meekoceras*, and will be treated of in the proper place.

Another species of M. de Koninck's which shows a certain resemblance with regard to the sutural line to the present genus, is *Ceratites flemingianus*. Here, however, it is (according to M. de Koninck's drawing, but not in nature) only the second lateral lobe which exhibits the same goniatitic development as occurs in some species of *Prionites*. It is a puzzle to me how M. de Koninck came to figure the sutural line of that species in the manner just described, as all the specimens of *Cer. flemingianus* at my disposal, and every one of the allied species show absolutely different sutural lines. There can thus be no question about the mentioned species being among the relations of *Prionites*.

Among non-Indian species a similar form has been described by Mojsisovics from the Olenek in Northern Siberia, under the name of *Meekoceras keyserlingi*. Also here the auxiliary lobes are replaced by a number of denticulations, which are, however, according to Mojsisovics's indications not all equal, but indistinctly arranged in two low auxiliary lobes. Thus the similarity seems to be only an apparent one, and the determination as *Meekoceras* to all appearances correct, as all the other characters are in accordance with that genus.

The genus *Prionites* is represented in the Salt-Range by five species, of which however only four can be determined with certainty.

The geologically oldest species, of which, however, the sutural lines are not, or barely, preserved, occurs in the lower beds of the Ceratite sandstone. It will bear the name of *Prionites arenarius*, W.

According to the general configuration of this species, it must be in close relation with another form which I found in the top beds of the Ceratite sandstone. This I shall call *Prionites trapezoidalis*.

These two species are probably in a developmental connection and will form the group of *Prionites arenarius*.

Another species, which is in less close connection with the two preceding, was found by me in the Upper Ceratite limestones. The name of this species will be *Prionites tuberculatus*.

The three species adduced up to this have one character in common, and this consists in the circumstance that the second lateral lobe is distinctly crenulated; whilst the other remaining two species have the same lobe thoroughly goniatitic. Therefore, two different sections can be distinguished within the genus. The first will be called the "*Crenulati*," comprising the first three species, whilst the second will bear the name of "*Lingnati*."

The section of the *Lingnati* comprises only two species, which were both collected by me in the Upper Ceratite limestone, and which will bear the names of *Prionites undatus* and *Prionites lingnatus*, respectively.

The species of *Prionites* can thus be arranged systematically in the following manner :—

SECTION I.—CRENULATI :

a. Group of PRIONITES ARENARIUS, W.

1. *Prionites arenarius*, W.
2. „ *trapezoidalis*, W.

b. Isolated species.

3. *Prionites tuberculatus*, W.

SECTION II.—LINGNATI :

a. Isolated species.

4. *Prionites undatus*, W.
5. „ *lingnatus*, W.

From a geological point of view the species have to be arranged in the following manner :—

Upper Ceratite Limestone.

Ceratite Sandstone.

Prionites tuberculatus, W.„ *undatus*, W.„ *lingnatus*, W.Upper : *Prionites trapezoidalis*, W.Lower : „ *arenarius*, W.

SECTION I.—CRENULATI :

a. Group of PRIONITES ARENARIUS, W.

1.—PRIONITES ARENARIUS, Waagen, n. sp., Pl. VI, fig. 6 a, b.

There is only a fragment of the body-chamber of this species preserved in the Salt-Range collection, and the determination of this fragment is not above every doubt. On the posterior end of this fragment, however, there are some impressions which might have been left by the crenulated part of the sutural line, and thus it is not alone the general configuration, which is very similar to that of *Prionites trapezoidalis*, which induces me to place it in the genus *Prionites*.

The general shape of the shell must have been flatly disciform, with a large and flat umbilicus and moderately thick whorls.

The transverse section of the latter is somewhat trapezoidal, with a broad flattened external part, hemmed in on both sides by indistinct external edges. The greatest transverse diameter of the whorls is situated about one-third of the entire height of the whorl above the umbilical suture. The whorls are comparatively rather thick, and the transverse diameter is as much as four-fifths of the height of the whorl. The lateral parts slope strongly from their greatest elevation towards the external edges and are quite flattened during this extent. Towards the umbilical suture they bend down in a gentle curve and hit the preceding whorl at an acute angle.

The fragment serving for description consists entirely of the body-chamber. There are three strong rounded tubercles on this part of the shell, which are situated on the most prominent space of the lateral parts. They are not prolonged into ribs in the direction of the external side. This latter is quite smooth.

The apertural margin is not preserved.

Nothing definite can be made out with regard to the sutural lines.

The dimensions, as far as they can be taken, are as follows :—

	mm.
Height of the aperture from the umbilical suture	34
" " " " " preceding whorl	23
Thickness of the aperture	28

The entire diameter of the specimen, when entire, may have been 96mm., while the width of the umbilicus may have measured 33mm. This is, however, nothing but conjecture.

Locality and Geological Position.—This fragmentary specimen was found by me in the lower beds of the Ceratite sandstone at Virgal.

Remarks.—Though there is nothing but a fragment of the body-chamber of this form, still this seems sufficient to fix the species. The remaining species of *Prionites* which I shall have to describe, show clearly that the sculpture of the shell does not change on the body-chamber, but is alike on all the volutions; and thus the fragment gives a fair idea of the appearance of the entire shell.

Of all the species hitherto described, only some of those which have been attributed by Mojsisovics to the "*Subrobusti*" group of the genus *Ceratites*—for instance, large specimens of *Ceratites middendorfi*, Keys., or *Cerat. schrenki*, Mojs.—show a distant similarity to the present species. The trapezoidal transverse section of the whorls, however, with its narrow external side, is a character by which the Indian shell can on a first glance be distinguished from the above quoted Siberian species.

The form that is most nearly related to the present species is *Prionites trapezoidalis*, W., which will be described next. Our *Prionites arenarius* is distinct from that species by lower and comparatively thicker whorls, a larger umbilicus and less frequent lateral tubercles, which are not prolonged into ribs.

On the whole, the two species are however so closely allied that I cannot but consider the two as forming one developmental series. Also, the occurrence of the two species in two succeeding divisions of the ceratite formation is in favour of such a supposition.

2. PRIONITES TRAPEZOIDALIS, Waagen n. sp., Pl. VI, fig. 1 a, b.

There is a well-preserved specimen of this species at my disposal, in which the greater part of the body-chamber and much of its original shell-covering is present.

The general shape of the species is flatly discoidal, with moderately thick whorls, and a rather narrow umbilicus.

The transverse section of the whorls is compressedly trapezoidal with a narrow but distinctly flattened external part. The external edges by which the lateral parts are united to the external one are not sharp but well expressed. The highest elevation of the lateral parts is situated in the lower third of the entire height of the whorl. From that place they slope, distinctly flattened, or even sometimes a little impressed, towards the external edges. In the direction of the umbilicus they bend in a gentle curve down to the umbilical suture. The preceding whorl is met at a very acute angle.

The sculpture of the shell consists of broad swellings, which are thickest on the highest elevation of the lateral parts, separated from each other by valleys of irregular breadth. From the swellings, there extend mostly very indistinct radial ribs in the direction of the external side; only sometimes one or the other of these ribs is more distinct. They disappear a good distance before reaching the external side.

On a great part of the specimen under description, the substance of the shell has been preserved, and its surface can be seen to have been covered by a great many very fine striæ of growth, which are but little bent, and indicate no prolongation of the external part towards the front.

The sutural lines only are rather imperfectly observable. The external lobe can barely be traced at all. It seems to have possessed two short undivided branches. The first lateral lobe is somewhat better visible. It is rather broad and not very long, apparently with three denticulations at its bottom. The external and first lateral saddles are of about equal height and perfectly undivided. The second lateral lobe is much narrower and shorter than the first one, with some three denticulations at its bottom. The second lateral saddle is very low and narrow: and after this follows a greater number of small denticulations, which cannot exactly be counted, all arranged in a straight line, down to the umbilical suture.

The measurements of the specimen are as follows:—

	mm.
Diameter of the shell	67
" " " umbilicus	20
Height of the last volution from the umbilical suture	28
" " " " " preceding whorl	19
Thickness of the last volution	20

Part of the last volution of this specimen belongs to the body-chamber.

Locality and Geological position.—The only specimen of this species preserved in the Salt-Range collection was found by me at Siranki-Dok in beds corresponding in their position to the upper division of the Ceratite sandstone, being decidedly lower than the Upper Ceratite limestone.

Remarks.—It has already been stated above that the species most nearly

related to the present one, is *Prionites arenarius*. It can be distinguished from the present *Prion. trapezoidalis* by its comparatively thicker whorls, larger umbilicus, and less frequent radial folds. A character that allows of an easy distinction and recognition of *Prion. trapezoidalis* consists in the rather narrow external side and the rather compressed whorls.

There can be little doubt that *Prionites trapezoidalis*, W., is the descendant of *Prionites arenarius*, W.

There is no other species with which the present one can be compared more particularly, except perhaps *Ceratites erasmi*, Mojs., from the Muschelkalk of the Alps. The external shape of both species is very similar, but their sutural lines are so very different, that here all comparison ends.

b. ISOLATED SPECIES.

3. PRIONITES TUBERCULATUS, Waagen, n. sp., Pl. V, fig. 2 a. b. c.

The general shape of this species is rather thick disciform, with a rather small umbilicus and strongly involute whorls.

The transverse section of the whorls differs according to the locality where it is found. In the spaces between the tubercles, with which the lateral parts are ornamented, the transverse section is strongly elongated, $1\frac{1}{2}$ times higher than it is broad. If, on the other hand, the section is situated in such a manner as to cut through a pair of lateral tubercles, the breadth is about equal to the height. The external side is broad and strongly flattened, and is united to the lateral parts by distinct but not sharp external edges. The lateral parts are highest where the tubercles are situated, which is on the lower third of the entire height of the whorl. From the height of the tubercles the lateral parts are sloping in both directions: at the same time they are flattened or a little impressed. They reach the umbilical suture at very acute angles. The umbilicus becomes thus quite flatly trochoid, and the umbilical sutures but little marked in it.

The sculpture consists, as has been remarked above, in very strong, isolated lateral tubercles, of which there are seven on the last volution. These tubercles cannot be seen on the inner whorls, as they are perfectly covered up by the succeeding volution. The tubercles are not in connection with any kind of ribs.

In the specimen figured on Pl. V, a little less than half of the last volution belongs to the body-chamber. The apertural margin is not preserved.

The sutural lines are very characteristic. The external lobe is short but very broad, with two pointed branches, without denticulations, and apparently without a median siphonal tubercle. Of the siphonal funnel, it cannot be decided whether it is directed towards the front, or backward; it is rather neutral in its development. The external saddle is not very broad and is undivided. The first lateral lobe is neither very broad nor very long, yet longer than the external one;

it bears at its bottom some four or five denticulations. The first lateral saddle is considerably broader than the external one, and reaches up about as high. The second lateral lobe is very short and narrow, and bears some three or four denticulations at its bottom. The second lateral saddle is shorter than the first one, rather narrow, and at its internal side its wall is very short. After this follow about nine small denticulations, which are perfectly undifferentiated, and form together a straight line, down to very near the umbilical suture, where at last a kind of little very shallow saddle is appended.

The dimensions of the specimen are as follows:—

	mm.
Diameter of the shell	70
" " " umbilicus	17
Height of the last volution from the umbilical suture	30
" " " " " " preceding whorl	18·5
Thickness of the last volution on the lateral tubercles	27
" " " " " between the lateral tubercles	20

Locality and Geological position.—The excellently preserved specimen, which has served for description, on which however only traces of the original shell are remaining, was found by me at Chidroo in the upper Ceratite limestone.

Remarks.—Though the present species, according to the development of its sutural lines, must be considered as belonging to the same section of the genus as the two preceding ones, yet it so far deviates in all its characters from the preceding two that it appears as a perfectly isolated form.

The configuration of the umbilicus, the characters of the sculpture, and a very different development of the sutural lines, make a distinction of the present species from *Prionites trapezoidalis*, W., very easy.

Of species which have already been described, there are none with which this can be more particularly compared.

II.—Section : LINGNATI.

a. ISOLATED SPECIES.

4. PRIONITES UNDATUS, Waagen, n. sp., Pl. V, fig. 1 a. b.

It is a large beautiful species which I describe under this name, and it is only to be regretted that the specimen that serves for description is so extremely brittle that the sutural lines could only be made visible very imperfectly, and that every touch breaks off more or less large pieces. The air-chambers are filled with crystalline calcspar, the single crystals of which are only very loosely attached to each other, and all endeavours to give more strength and steadiness to the whole have failed. Thus a great part of the specimen must gradually crumble away.

The general shape of the species is thick patelliform, with a small, rather flat umbilicus and not very involute whorls.

The transverse section of the latter is more or less trapezoidal, and considerably higher than it is broad. The external part is distinctly flattened, but somewhat more strongly arched than in the three preceding species. In consequence, the external edges, which are produced by the lateral parts joining the external one, show a yet more blunt development than in the preceding forms.

The highest elevation of the lateral parts is situated in the lower third of the entire height of the whorl. From these towards the external side, the lateral parts slope strongly, being at the same time somewhat impressed. Towards the umbilicus they descend in an equal declivity, being also somewhat impressed. The umbilical suture is quite flat, the lateral parts uniting with the preceding whorl in a nearly parallel direction.

The sculpture of the shell consists of a small number of broad and low tubercle-like undulations, of which six can be counted on the last volution. The valleys between are also not very deep, and are rather broad. There is no trace of any kind of ribs.

The shell surface is excellently preserved on a part of the last volution. It shows a great many very fine striæ of growth, which are but very little bent. At the umbilical suture they are strongly directed towards the front, then make a curve backward, are again a very little arched towards the front on that space of the lateral parts which shows the highest elevation, are bent a little backward in the low depression extending inside of the external edge, and bend again more strongly forward on the external part, thus indicating the existence of a short ventral prolongation on the apertural margin.

The last part of the last volution in the specimen under description belongs to the body-chamber.

Of the sutural lines but very little can be observed, as all is changed into one sparry matrix. Only one lobe can be seen quite clearly, and this is the second lateral one, which is here of special interest. It is situated on the outer declivity of the highest elevation of the lateral part, and shows an angular outline very similar to that exhibited by the second lateral lobe in *Prionites lingnatus*, W., which will be described next. The only difference consists in the circumstance, that the angle enclosed in the bottom of the lobe is less acute in *Prionites undatus* than in *Prionites lingnatus*.

The measurements of the specimen are as follows :—

	mm.
Diameter of the shell	132
„ „ „ umbilicus	35
Height of the last volution from the umbilical suture	59
„ „ „ „ „ preceding whorl	41
Thickness of the last volution	48

Locality and Geological position.—The only specimen of this species was collected by me at Chidroo in the Upper Ceratite limestone.

Remarks.—The present species is in many respects similar to the one described before under the name of *Prionites tuberculatus*, but the sculpture is already so far deviating, that a distinction is not difficult. To this must be added the quite different sutural line, in which the second lateral lobe is angular, whilst it is provided with three or four denticulations in *Prionites tuberculatus*. Thus it cannot be questioned, that *Prionites undatus* is a well distinguished species, which cannot be united with any other form.

Except *Prionites tuberculatus*, W., there is no other species with which the present one can be compared.

Much could perhaps be made of the question, whether *Prionites* should not be brought into connection with *Paralegocerus*, since the second lateral lobe, chiefly of the present species, has much similarity to the same lobe as developed in *Paralegocerus*. I do not, however, feel justified in entering into such discussions, as speculations on such things are of but very little use, so long as materials on which they can be founded are missing. There might exist a relationship between the two genera, but nobody can prove this to a certainty.

5. *PRIONITES LINGNATUS*, Waagen, n. sp., Pl. VI, fig. 3 a. b., fig. 4 a b., fig. 5.

The general shape of this species is thick patelliform, with rather depressed whorls, and a not very large funnel-shaped umbilicus.

The transverse section of the whorls is broadly trapezoidal, with a strongly flattened broad external part that is but very little arched, and is in consequence hemmed in on both sides by rather sharp external edges. The lateral parts are strongly prominent, and their greatest elevation is situated a little below the middle of the height of the whorl. From this point the lateral parts slope in both directions, less strongly towards the external side, where they are distinctly impressed, but very quickly towards the umbilical suture, settling in a nearly parallel direction on the preceding whorl, so that the umbilical suture appears barely excavated at all.

The sculpture consists of single not very strongly prominent tubercles. There are six to seven such tubercles on one volution, which are separated from each other by valleys which are broader than the tubercles. Valleys and tubercles are situated on the highest elevation of the lateral parts. There is not a trace of ribs in connection with the tubercles.

The sutural lines of this species are very characteristic. The external lobe is not very long but is deeply divided in two branches, which are angularly pointed. The external saddle is rather broad, perfectly undivided but not very high, reaching up no further than the insinuation between the two branches of the external lobe. The first lateral lobe is very long and narrow, with nearly parallel sides. It bears at its bottom three strong denticulations. The first lateral saddle is

very much broader than the preceding lobe, and then the external saddle reaches considerably higher up than the latter, and is broadly rounded, without any denticulations or incisions. The second lateral lobe is much shorter than the first one, very narrow, and angularly bent and strongly pointed at its bottom: perfectly goniatitic. The second lateral saddle is as broad as the first one but very much lower and somewhat depressed at its top. The internal wall is very short and is followed by a greater number (about six) of small equal denticulations, which are arranged in a straight radial line and extend down to near the umbilical suture. Just before the umbilical suture the denticulations cease, and are replaced by an entire curving line. There is no entire, full-grown specimen of this species at my disposal. The most completely preserved specimen shows the following dimensions:—

	mm.
Diameter of the shell	54
„ „ „ umbilicus	16
Height of the last volution from the umbilical suture	21
„ „ „ „ „ „ preceding whorl	16
Thickness of the last volution	19

Locality and Geological position.—There are three specimens of this species preserved in the Salt-Range collection, one complete one, and two fragmentary. All three were found by me at Koofri in the Upper Ceratite limestone.

Remarks.—The present species is most easily distinguishable from all the allied forms by its sutural line, which is quite peculiar. From all the species of the section “Crenulati” it is distinct by its goniatitic second lateral lobe; and from *Prionites undatus*, W., it can be distinguished also by the same lobe, which is very strongly pointed in the present species, whilst it is much broader and more pyramidal in *Prion. unadatus*.

Besides these characters of the sutural line, there are also differences in the general shape which distinguish the present species from those described above. The whorls are more depressed, the transverse section of them more angular, and the external side, broader and more strongly flattened than in the other species of the same genus.

Thus *Prionites lingnatus* appears as a well distinguishable and easily recognisable species.

Sub-Family: TYROLITINÆ.

Genus: BALATONITES, Mojs.

It is with grave doubts that I introduce this genus here, not because I am not certain of its validity, but because the specimen, which I consider as belonging to the genus, is rather badly preserved, and thus its determination is more or less uncertain.

According to Mojsisovics the genus *Balatonites* is characterised by its normal

number of lateral lobes, ceratitic development of the saddles, small tubercles on a continuous keel in the middle of the external side, tubercles along the external margin, and a short body-chamber.

All these characters, with the sole exception of the third one, can be distinctly observed to exist in the specimen from the Salt-Range. But just this third character is among the most important ones. Nevertheless I feel justified in quoting the specimen under the name of *Balatonites*, as the ribbing of the lateral parts is so peculiar and so much in accordance with that of other species of the genus, that it appears barely probable that this specimen should be considered as belonging to any other generic division.

Mojsisovics distinguishes three groups of forms within the genus:—

a.—Group of *BALATONITES GEMMATI*.

b.—Group of *BALATONITES ARIETIFORMES*.

c.—Group of *BALATONITES ACUTI*.

Of these, only the first one comes into consideration with regard to the species occurring in the Salt-Range.

This group is characterised by ribs, which, chiefly on the outer volutions, are tolerably regularly alternating, one shorter and fainter rib being intercalated between two longer and stronger ones, which originate at the umbilicus and extend to the external side. The stronger ribs bear tubercles, of which one spiral row, along the outer edge of the whorls, is present in all the species, whilst two other rows, one along the middle of the entire height of the whorls, and one on the umbilical edge, are of frequent, but not of general, occurrence. The same is the case with that row of tubercles extending along the middle line of the external side. It is present in most of the species, but in some others it becomes indistinct or is even entirely absent, and then the ribs extend with a slight bend towards the front uninterruptedly over the external side. The other two groups, the *arietiformes* and the *acuti*, are rather far deviating. The characters of sculpture are perfectly different, and it could even be questioned, whether these two should not better be considered as themselves composing different generic types.

For the present I need not enter upon this question.

The Indian species belongs beyond any doubt to the group of the *gemmati*, as all its characters are perfectly in accordance with the characters described just before. As far as can be seen on the rather badly preserved specimen, it is most nearly related to those species, in which the row of tubercles on the middle of the external side is nearly, or entirely obliterated.

According to Mojsisovics' indications, the genus *Balatonites* begins in the Werfen-beds of the Bunt-Sandstone and extends to the Noric beds in the Alps. Outside the Alps, it has representatives in the Muschelkalk of Central Europe.

The Indian species, for which I shall introduce the name of *Balatonites punjabiensis*, W., was found by me in glauconitic limestones which are on the horizon of the Upper Ceratite limestone, or a little lower.

From the triassic beds of the Himalaya, the genus *Balatonites* has up to the present not been mentioned.

a.—Group: BALATONITES GEMMATI.

1. BALATONITES PUNJABIENSIS, Waagen, n. sp., Pl. XXIV, fig. 5 *a. b. c.*

There is only a single fragmentary specimen of this species preserved in the Salt-Range collection. It consists of a few air-chambers and the entire body-chamber.

The species is of moderate size, flatly disciform in its general shape, with large umbilicus and compressed whorls.

The transverse section of the latter is high elliptical, with a rounded external side and somewhat flattened lateral parts. There is neither an umbilical nor external edge developed, and thus the whorls are everywhere perfectly rounded, without any angular outline.

The sculpture consists of radial ribs which are of very unequal strength, and also rather irregular in their arrangement. Stronger and fainter ribs can be distinguished, which on the whole alternate in a somewhat irregular manner.

The stronger ribs, of which there are about nine, on half a revolution, begin not far from the umbilical suture. Sometimes they are here a little swollen, and thus a kind of blunt tubercle is formed. But this is not the case in all these ribs, but only here and there. From their origin the ribs extend in a nearly straight direction, only slightly leaning forward over the lateral parts. In approaching the external side they become a little swollen, and bend distinctly forward. Distinct tubercles are but rarely developed, and if so, this sometimes takes place in quite a peculiar manner. There is a crest formed which takes a parabolical bend, in a way very much like that which can be observed in certain forms belonging to the genus *Perisphinctes*, for instance in *Perisph. curricosta*, Opp. From the tubercle, the ribs extend in equal force, always directed forward, on to about the middle of the external part. Here the specimen is too badly preserved in order to see whether the ribs make simply a curve towards the front, or whether there is a tubercle situated in the middle. Considering how few real tubercles exist on the whole shell, it appears improbable that in the middle of the external part, a regular row of tubercles should have been present, which were only to be found off and on.

The smaller ribs commence in about the middle of the lateral parts. Their situation is very irregular. Sometimes they are placed just in the middle, between two larger ribs and at other places so closely approach the larger ribs, that they

are nearly united with them, though they remain always perfectly distinguishable. They bear only very rarely a distinct tubercle.

Towards the apertural margin there is yet a fine striation intercalated between the larger and smaller ribs.

On the whole, the sculpture of this shell is so irregular in many respects, that it is barely possible to describe it thoroughly in all particulars.

The sutural line is not entirely visible. There is only a part of the first and the entire second lateral lobe distinctly traceable. The first lateral lobe is rather short but very broad. The outer and inner walls converge strongly towards the bottom of the lobe, which shows only a few rather indistinct denticulations. The first lateral saddle is entire, short, much broader at its base than at the top. The second lateral lobe is even much shorter than the first one, very broad; and the denticulations at its bottom barely visible. The second lateral saddle is very broad and very low, and reaches down to near the umbilical suture. Its internal wall ascends but little, and then the sutural line reaches the umbilical suture in a nearly horizontal direction, so that no distinct auxiliary lobe is formed.

The body-chamber comprises just half of the last volution.

The apertural margin is only very indistinctly preserved. It seems to have been nearly straight; with only a short, rounded ventral, or external prolongation.

The dimensions of the specimen are as follows:—

Diameter of the shell	(P) 52 mm.
„ „ umbilicus	20 „
Height of the last volution from the umbilical suture	19 „
„ „ „ „ „ preceding whorl	16 „
Thickness of the last volution	(P) 9 „

Locality and Geological position.—The specimen from which the above description has been taken was found in the Chitta-Wan near Ghari in a hard dark grey glauconitic limestone, which is either on the horizon of the Upper Ceratite limestone, or only very little lower.

Remarks.—There are two species with which the present one can be particularly compared, and these are *Balatonites golsensis*, Mojs., and *Balatonites ottonis*, Buch.

The first of these is in every respect similar, and even the irregularity of the sculpture, which is rather striking in *Bal. punjabiensis*, W., is to a certain extent repeated in *Bal. golsensis*. With regard to the external side a comparison is not possible, as this part is too indistinctly preserved in the Indian specimen. If it were not that our Indian species is much more elegant in its general appearance than the European shell mentioned, one would nearly be inclined to consider the two as identical.

Bal. golsensis, Mojs., was originally described from the Muschelkalk of the Alps.

The other species to which the present one can be compared is *Bal. ottois*, Buch., a species that has long been known from the Muschelkalk of Central Europe, and has later on also been found in the same beds in the Alps. Though in the general appearance of these shells a rather striking similarity to *Bal. punjabiensis* seems to exist, chiefly if the Alpine specimens are taken into consideration, yet on a closer examination it is found that a distinction between the two is very easy on account of the general absence of the lateral tubercles in the Indian species.

It thus becomes highly probable that *Bal. punjabiensis* is a well distinguishable species of the genus *Balatonites*. This is the first form of the sub-family *Tyrolitinae* that has with much probability been demonstrated to exist in India. It is true that the genus *Trachyceras* has long been quoted, and especially *Trachyceras aon*, as occurring in the Trias of the Himalaya. The determination, however, has been drawn into doubt, first by Stoliczka, later on by Beyrich.

So it appears by no means certain that the genus *Trachyceras*, and with it the sub-family *Tyrolitinae*, is represented in the Himalaya.

Now the determination of the present species, which, though not above every doubt, has much probability of its correctness, demonstrates the extension of the sub-family at least to the Salt-Range.

Family: *TROPITIDÆ*.

Our knowledge of this family is rather imperfect, and it is scarcely possible to deal with it in detail so long as Mojsisovics' great work on the Triassic Faunas of Hallstadt is not completed.

All that is known of this family consists of a short diagnosis drawn up in Mojsisovics' publications, from which it appears that the most important character of the shells belonging to this family consists in the length of the body-chamber, which comprises at least one volution, and is oftener even longer.

With regard to the sculpture of the shell characteristic of this family, it is very difficult to indicate any peculiarities in common with all the genera and species of the family. Generally the shell is richly sculptured, and provided with more or less numerous tubercles, which are either situated on the external, or internal margins, or else in the middle of the lateral parts of the whorls. In connection with these are radial ribs, which are either most strongly developed on the lateral parts of the whorls, very often stop at the external margin, or extend slightly on the external part, and disappear there in the middle; or else start from tubercles that are situated above the umbilical margin, and extend from there uninterruptedly over the external part.

In many cases, the external part is ornamented with a median keel, which is very strong and distinct in some forms, whilst it dwindles down to a mere thread in others. Sometimes the keel becomes double, and there is a furrow enclosed in the middle.

In most of the species the umbilicus is widely open, and the transverse section more or less squarish. In other cases the umbilicus is again narrower, and the transverse section of the whorls more or less semi-lunar.

A thing that often occurs is that the body-chamber deviates more or less from the original spiral, and becomes at the same time narrower towards the mouth.

These are the variations of the sculpture that occur in the forms described up to the present. There may be others in the Hallstadt beds, where the family shows its greatest development, but they have not been described up to date.

In the Salt-Range the family is largely represented, and the variety of forms is so great, that I have long been in doubt as to whether it would not be practicable to create some sub-families to receive different groups of forms. I have, however, found that it is very awkward to deal with the systematic arrangement of forms, of which so many more are known to exist in other countries, and which I trust will soon be described.

I therefore abstain from such an attempt in expectation of the early publication of Mojsisovics' large work on the Trias of Hallstadt.

Whilst the more recent forms belonging to the family have yet to be described, this is not the case with regard to the more ancient members. These have been treated in detail by Mojsisovics in his *Mediterranean Cephalopoda* as well as in his *Arctic Faunas*, and can serve for a comparison with the forms from the Salt-Range.

The family is generally considered to take its origin in the permo-carboniferous strata of Sicily, from which beds Gemmellaro has described his genus *Paraceltites*, and I think that there cannot remain much doubt that this genus must be included in the family. It shows a large umbilicus, compressed whorls, and not very strong radial ribs, which, on the external side, bend towards the front. The sutural line is not exactly known, but there are apparently two lateral lobes present, which show a perfectly goniatitic development. According to Prof. Gemmellaro's indications, the length of the body-chamber is somewhat in excess of one revolution. The apertural margin, though it has not been preserved in any of Gemmellaro's specimens, must have possessed a rounded, somewhat prominent ventral lobe, and a more or less straight lateral margin, as far as can be judged from the disposition of the sculpture of the shell.

The length of the body-chamber, the characters of the sculpture, and of the sutural line, combine almost to a certainty to place this genus in the family *Tropitidæ*.

If we look out now for more recent species, which exhibit similar characters, we find in the Permian formation the genus *Xenodiscus*, which at a first glance shows a very great similarity to *Paraceltites*. This is a result that has been very unexpected to me, I having committed the error of uniting the Salt-Range triassic forms with that genus—an opinion in which I now find I was entirely wrong. It gave me much trouble to detect this error; and it was only after I had studied all the Salt-Range triassic Cephalopoda in detail, that I found that all those forms which I had affiliated to *Xenodiscus* possessed quite a short body-chamber, which

never shows a greater length than $\frac{1}{2}$ of a volution, oftener even shorter, whilst in *Xenodiscus* it comprises 0.9 of one volution. This length of the body-chamber in *Xenodiscus* is a character on which but little stress has been laid up to this, but which is yet of very great importance. The species *Xenodiscus plicatus*, W., has been compared to *Ceratites* by Mojsisovics, but in treating above of that genus, I have remarked that on account of the length of the body-chamber, grave doubts must be entertained with regard to such a determination. In all the shells belonging to the family *Ceratitidæ* that have come to my notice, the length of the body-chamber is generally $\frac{1}{2}$ a volution; excepting (for instance, in *Trachyceras*) when it is as much as $\frac{2}{3}$, and in certain isolated cases, for instance, in some species of *Dinarites*, a length of $\frac{3}{4}$ of the last volution was found to be attained. Never has been observed in that family a length of the body-chamber comprising $\frac{9}{10}$ of the last volution; and forms in which such an extension is attained must be counted among those possessing a long body-chamber. At the same time it must be remarked that the species of *Celtites* and *Acrochordiceras*, occurring in the Salt-Range, show a body-chamber that comprises one volution or a little less, but never more.

To this must be added the characters of the sutural line. If we compare this part in *Paraceltites* we find that there exist two lateral lobes which are not very different in size, and that the second lateral lobe is distinctly above the line of involution of the preceding whorl: a kind of sutural lobe is also developed. Absolutely the same characters will be found in *Xenodiscus*, the lobes of the latter being distinct from those of *Paraceltites*, owing solely to the circumstance that they are crenulated on the bottom.

The *Ceratites obsoleti*, on the contrary, with which *Xenodiscus plicatus* has been placed by Mojsisovics, have an extremely small second lateral lobe, which is barely above the line of involution of the preceding whorl, and the sutural lobe is barely distinguishable. The length of the body-chamber in the forms of this group detected in the triassic beds of the Olenek in Siberia is most probably not more than half a volution. After all that has been said, I think I am justified in considering the genus *Xenodiscus* as forming part of the family *Tropitidæ*, and most nearly related to *Paraceltites*, replacing this genus in Upper Permian times.

The triassic species of the Salt-Range, which all possess a very short body-chamber, and are most nearly related to *Meekoceras*, as has most rightly been remarked by Mojsisovics, I shall separate from *Xenodiscus*, and shall introduce them under the name of *Gyronites*, distinguishing them at the same time from *Ophiceras*, Griesb., which might be a descendant from *Xenodiscus*, if the former should prove to possess a long body-chamber.

In the triassic beds of the Salt-Range, no descendant of *Xenodiscus* has been found up to the present. The genus *Celtites*, which contains the geologically oldest forms belonging to the family *Tropitidæ* in the Salt-Range, represents another branch, which is no doubt closely related, but nevertheless of another extraction.

The sculpture is on the whole very similar to that of *Xenodiscus plicatus*, but the sutural line is of a different character. The second lateral lobe is very small and of a rather uncertain position, sometimes above, sometimes partly below the line of involution of the preceding whorl. This shows that *Celtites*, like *Ceratites*, must also have taken its origin from a genus which had not yet developed a second lateral lobe. This genus is neither *Xenodiscus* nor *Paraceltites*, as in both a distinctly second lateral lobe is present.

With *Celtites* we have entered well into the confines of the family *Tropitidæ*, which can be traced in the Salt-Range as low as the Upper Bunt-Sandstone. From there the family can be followed without interruption to the topmost beds of the triassic formation.

In the Salt-Range the family is represented by the genera *Celtites*, Mojs., *Acrochordiceras*, Hyatt, *Stephanites*, Waagen, n. g., *Sibirites*, Mojs., *Goniodiscus*, Waagen, n. g., and *Pseudharpoceras*, Waagen, n. g.

All these genera belong to very different branches of the family, which cannot for the present however be traced in detail. All that can be said is that *Celtites* forms a division of its own within the family, judging from the forms that have been so far described. Another division is indicated by the genera *Acrochordiceras* and *Stephanites*. The genera *Sibirites* and *Goniodiscus* form again another division, and the genus *Pseudharpoceras* at last proves to belong to the same division, within the family in which also *Tropites* itself must be counted.

It is worthy of notice that the family *Tropitidæ* is rather largely represented in the triassic beds of the Salt-Range. If we consult the work on the Mediterranean Trias by Mojsisovics, we find that in that region there exist only two genera belonging to the *Tropitidæ*, *Acrochordiceras* and *Celtites*; and even in these there were among the enormous materials collected by Mojsisovics not more than 12 species. In Europe the chief development of the family takes place in the Upper Trias, not in the Mediterranean, but in the Juvavian Province as it is called by Mojsisovics.¹

In the Salt-Range, all the forms belonging to the family are probably of a lower and middle triassic age, as all of them are to be found in the Ceratite sandstone, or the Upper Ceratite limestone; and there is only a single exception to this rule. This is constituted by the genus *Pseudharpoceras*, which has been found in the topmost limestones.

Genus : CELTITES, Mojsisovics.

Mojsisovics describes the genus in the following manner :—

The whorls are very slowly increasing, very evolute, the umbilicus in consequence very large. The sculpture consists generally of simple straight ribs, which

¹ According to Mojsisovics' most recent publication (Sitzungsber. Kais. Acad., d. W. Wien., Vol. CI, Abth. I, October, 1892) the Juvavian Province has never existed except in phantasy. In reality the beds constituting that province are situated above the "Carnian", not below; and form a stage for themselves at the base of the "Rhætics," the "Juvavian stage." Is this view now correct? The development of the Trias in the Himalayan area will probably furnish the proofs in the one or other direction.

are interrupted on the external part. Only exceptionally, there occur, on large specimens, bifid ribs, but on the innermost volutions, such ribs are of frequent occurrence. The external part is more or less strongly vaulted, either quite smooth or with a thin thread-like keel in the middle, without furrows at its sides.

The position of the lobes is the normal one. The saddles are rounded without indentations, the lobes only slightly denticulated.

In the Alpine triassic deposits the genus commences in the Upper Muschelkalk and extends from there into the middle carnic beds.

In the Salt-Range the genus is rather largely represented. The determination of these fossils could be made sure of on account of the circumstance, that in several cases the greatest part of the body-chamber has been preserved, which shows, without doubt, that the apertural margin is yet present, to a length of nearly an entire volution.

With regard to the sutural lines the Indian species show, however, characters, which require a little emendation of Mojsisovics' diagnosis. There are several species, chiefly those that have been found in the Ceratite sandstone, which probably must be considered as being the equivalent of the upper division of the Bunter, in which the second lateral lobe is in its position not yet entirely above the line of involution of the preceding whorl, so that it cannot be strictly considered as a lateral lobe, but rather as an auxiliary one. By these species it is thus demonstrated that the arrangement of the lobes is not always the normal one in this genus, but that sometimes, chiefly in the geologically oldest species, the position of the second lateral lobe is uncertain.

With regard to the sculpture the Indian species are well in accordance with the characters indicated by Mojsisovics. It might only be remarked that the Indian forms all belong to that division of the genus in which a median keel on the external part is not developed.

There are a tolerably large number of forms belonging to this genus, preserved in the Salt-Range collection, but it is much to be regretted that in many cases the materials are very fragmentary.

There can be distinguished among the Salt-Range species two different groups. One of them possesses whorls that are more or less distinctly squarish in their transversal section, and another group, whose whorls are more or less oval or rounded. The first of these corresponds more or less to the group of *Celtites floriani* Mojs., the other to the group of *Celt. epolensis* Mojs. Both, however, cannot, I think, directly be united with the mentioned groups of Mojsisovics' species, but are only representative forms, repeating similar variations, in the Indian region.

The geologically oldest species of the genus occurring in the Salt-Range I shall designate under the name of *Celtites subrectangularis* W. It has been found by me in the lowest beds of the Ceratite sandstone at Virgal, but it is not restricted to these beds, but extends as well into the middle region of this division, where it has been detected in the society of some specimens of *Stachella* near Amb.

According to its general configuration, this shell belongs beyond doubt to that group of forms which are, to a certain extent, related to *Celt. floriani* Mojs. and

which are characterised by the squarish shape of the transverse section of their whorls.

To this species several others, that occur in more recent strata, can be linked, and thus a well developed and defined series is composed. Besides the peculiar transverse section of the whorls, all these shells are characterised by simple, strong yet straight ribs, which are often ornamented by little spines, either at the umbilical or at the external edge.

The next species that can be attributed to this series is a shell for which I shall introduce the name of *Celtites armatus*, W., and which occurs in the topmost beds of the Ceratite sandstone at Chidroo.

Next higher in the series follows *Celtites trapezoidalis*, W., which has been found by me at Chidroo in the lowest beds of the Upper Ceratite limestone.

The series is at last concluded by *Celtites multiplicatus* W., a species that occurs in the Upper Ceratite limestone at Koofri.

Besides these forms, that are most probably in a developmental connection with *Celt. subrectangularis*, W., there are, however, yet some others, which also possess a squarish section of the whorls, but which otherwise so far deviate, that they must be considered as isolated species. These are *Celtites dimorphus* W., and *Celtites sp. indet.*, which have both been found by me in the Upper Ceratite limestone, one at Virgal and the other at Chidroo.

It has been stated above, that there exists in the Salt-Range yet another group of forms belonging to the genus *Celtites*, which are characterised by a roundish or oval transversal section of the whorls, and which thus appear to be more or less nearly related to the group of *Celtites epolensis* Mojs. whorls. Besides, by the section these species are also characterised by simple ribs, which are not straight for their whole extent, but bend somewhat towards the front near the external margin of the whorls.

This group of forms appears to commence somewhat later in the series of triassic beds in the Salt-Range than the preceding one.

The geologically oldest species belonging to this group is *Celtites acuteplicatus*, W. It makes its first appearance in the middle region (the *Stachella* beds) of the Ceratite sandstone, and extends from there up into beds above the Upper Ceratite limestone.

This form is certainly most nearly related to *Celtites subrectangularis*, W. Its whorls are, chiefly in the young, rather inflated, and approach in the shape of their transverse section somewhat the mentioned species, but nevertheless I hesitate to accept a developmental connection between the two, as the character of the ribs is somewhat different in some respects.

Though I am thus not in a position to assert whether the second division may be a descendant from the first one, I must consider it at least as highly probable that a series of other forms has taken its origin from *Celtites acuteplicatus*, W.

There comes first *Celtites ovalis*, W., which occurs in the upper beds of the Upper Ceratite limestone, and then yet another *Celtites sp. ind.* which certainly

represents a distinct form but is only represented by a single fragmentary specimen.

To the forms that have been enumerated up to this, there must be added yet two more species, which most probably also belong to the genus *Celtites*, but which cannot be arranged under the subdivisions that have been distinguished up to the present; these are the isolated species *Celtites lævigatus*, W., from the Ceratite sandstone of the Chittawan, and *Celtites teres*, W., from the topmost beds of the Upper Ceratite limestones of Ghari.

Thus, we arrive at the following classification of the species of *Celtites* occurring in the triassic beds of the Salt-Range.

I. Division : QUADRANGULARES.

a. Group of *CELTITES SUBRECTANGULARIS*, W.

1. *Celtites subrectangularis*, W. (Lower Ceratite sandstone and *Stachella* beds).
2. „ *armatus*, W. (Upper Ceratite sandstone).
3. „ *trapezoidalis*, W. (Upper Ceratite limestone, lower beds).
4. „ *multiplicatus*, W. (Upper Ceratite limestone).

b. Isolated species.

5. *Celtites dimorphus*, W. (Upper Ceratite limestone).
6. „ *sp. indet.* (Upper Ceratite limestone).

II. Division : OVALES.

c. Group of *CELTITES ACUTEPLICATUS*, W.

7. *Celtites acuteplicatus*, W. (*Stachella* beds up to Upper Ceratite limestone, top beds, (? Bivalve limestones).
8. „ *ovalis*, W. (Upper Ceratite limestone).
9. „ *sp. ind.* (Upper Ceratite limestone).

d. Isolated species.

10. *Celtites lævigatus*, W. (Ceratite sandstone).
11. „ *teres*, W. (Upper Ceratite limestone).

If we consider these eleven species from a geological point of view, we find that not more than four of them occur in the Ceratite sandstone, of which three are restricted exclusively to that rock-group, whilst the fourth extends from there up to the Upper Ceratite limestone, and perhaps even up to the bivalve beds.

The remaining seven species are all peculiar to the Upper Ceratite limestone.

If we compare this distribution with that exhibited by the species occurring in the Mediterranean province of the Alpine Trias, we find that there is there no species which could be attributed to the Bunter, whilst by far the greatest number of species occurs in the upper half of the Muschelkalk, the zone of *Ceratites trinodosus*. Only two of all the known forms extend into yet higher strata.

This geological distribution is tolerably well in accordance with what we can observe in the Salt-Range. We have already been able to conclude with some certainty from the species that have been described up to this, that the Upper Ceratite limestone must be approximately on the same level with the Muschelkalk in Europe. Thus we have also in India the greatest development of the genus *Celtites* at the age of the Muschelkalk, whilst only a single form extends perhaps up yet into higher strata. But whilst in Europe the genus makes its first appearance in the Muschelkalk, in the Salt-Range there are four species which have been found in lower strata, and thus we see that here the genus is already well represented at the age of the Bunter of Europe.

I. QUADRANGULARES.

a. Group of *CELTITES SUBRECTANGULARIS*, W.

1. *CELTITES SUBRECTANGULARIS*, Waagen, n. sp., Pl. VII, fig. 3*a*, *b*, fig. 6*a*, *b*, *c*.

This is a tolerably small species with squarish whorls and a rather widely open umbilicus.

In all the specimens at my disposal only the body-chamber, which comprises about one whorl, is well preserved, whilst the inner volutions are always compressed so that the shape of the sutural lines cannot be observed. All the specimens represent only internal casts and there is not a trace of the shell-covering observable.

The transverse section of the whorls is approximately rectangular, with rounded-off corners, rather considerably higher than it is broad. The lateral parts are flatly vaulted, the same is the case in the external part. The greatest transverse diameter of the whorls is situated a little below the middle of the lateral parts, and from there these latter slope as well towards the external side as towards the umbilicus.

The large umbilicus is surrounded by a rather high and approximately vertical umbilical wall, which joins the lateral parts in forming an obtuse, but distinct umbilical edge.

The sculpture of the shell consists in simple straight radial ribs which originate at a little barely perceptible swelling just above the umbilical edge, extend from there in a quite straight perfectly radial direction over the lateral parts, and terminate at the external margin, forming there very often again a kind of slight tubercle. The ribs are rounded on their tops, without any edges.

In exceptional cases a shorter intercalated rib appears near the external margin between the other regularly radial ribs.

As the specimens which serve for description are to a great extent deteriorated by weathering it is difficult to count how many ribs may have existed on an average on each volution. As far as can be made out, it seems that there were present between 13 and 16 ribs on the last volution of the two most completely preserved specimens, of which the first is 30mm. and the second 35mm., in diameter.

On weathered specimens the external side appears almost entirely smooth. On well preserved specimens, however, the ribs also continue over the external part of the shell. They are, however, always very weak, and present only low rounded undulations. They extend transversely over the siphonal or external part of the shell and connect each single rib of one lateral part with the corresponding rib of the other side.

There is no trace of any median keel observable as is the case with many European species of the genus.

Of the sutural lines only very rude traces are preserved, and it appears impossible to describe from such the characters of the sutures in an approximately satisfactory manner. There seems, however, only a single principal lateral lobe present.

The measurements of two specimens, the one from the Lower Ceratite sandstone of Virgal, and the Middle Ceratite sandstone (*Stachella* beds) of Amb, are as follows:—

	I.	II.
Diameter of the shell	35 mm.	29.5 mm.
" " umbilicus	13 "	10 "
Height of the last volution from the umbilical suture .	12.5 "	10 "
" " " " " preceding whorl .	10 "	8 "
Thickness of the last volution	11 "	9.5 "

The greatest part of the last volution of the two measured specimens belongs decidedly to the body-chamber, but it cannot exactly be stated where the chambered part of the shell commences.

Locality and Geological position.—There are chiefly the two figured specimens which can with certainty be attributed to the present species. Some fragments that are preserved in the Salt-Range collection might also yet belong to it but they are too badly preserved, to allow of an exact determination.

Of the well-preserved specimens, one was collected by me at Virgal in the lower division of the Ceratite sandstone. This is the geologically most ancient specimen of the genus that has been detected up to the present time in the Salt-Range. The second specimen was also found by myself in the middle division of the Ceratite sandstone, the *Stachella* beds, at Amb. From this it appears that the species is not restricted exclusively to a single subdivision, but ranges from the lower to the middle division of the Ceratite sandstone.

Remarks.—Among the species of the genus *Celtites* that have been described up to the present there exists a whole group of forms, the group of *Celtites floriani* Mojs., which can be compared to the form here distinguished. The whole group is characterised by single, rather straight, radial lateral ribs, inflated whorls, and a generally very faint median keel on the siphonal side. This latter character is decidedly absent in the Indian species, but otherwise *Celtites michaelis* Mojs. shows by its squarish transverse section of the whorls, much similarity.

Considering, however, the absence of any trace of a keel in the Indian shell, and the difference in age between the two species, it is but barely probable that the two

are near relations. It might perhaps be that the Indian *Celtites subrectangularis* may turn out to be the ancestor of all the group of *Celtites floriani*, but for the present there is no proof whatever for such a supposition.

So much however is above doubt, that *Celtites subrectangularis* is well distinguishable from all the species of the genus hitherto described.

2. *CELTITES ARMATUS*, Waagen, n. sp., Pl. VII, fig. 1 *a, b, c*, fig. 7 *a, b, c*.

This is a well-sized species, with strongly depressed whorls and a widely open umbilicus.

There are two specimens of this species preserved in the Salt-Range collection, both internal casts, without a trace of the shell preserved. One of the specimens has the greatest part of its body-chamber preserved, which shows, as far as it is present, near to one volution. The other is apparently composed of air-chambers, but the sutural lines are very indistinctly observable.

The transverse section of the whorls of this species is depressed and trapezoidal, and much broader than it is high. The lateral parts are distinctly flattened, and somewhat sloping towards the external side, so that the greatest transverse diameter of the whorls is situated not far above the umbilicus. From their highest elevation the lateral parts bend down in a gentle curve to the umbilical suture, without forming a distinct umbilical edge or umbilical wall.

The external side is very strongly depressed, and only very slightly vaulted, joining the lateral parts in forming an obtuse angle.

The sculpture consists of single straight ribs, which commence above the umbilical declivity and extend in a quite straight radial direction to the external edge. The ribs are strong and narrow, but not sharp on their tops. At the point where the ribs commence, and where they terminate at the outer edge, little spines are situated, which are less conspicuous in the young than in full-grown specimens.

This sculpture is, on the whole, very regular, and only in very exceptional cases does it occur, that one fainter rib is intercalated between two stronger ones.

The external side is nearly entirely smooth, and only under favourable circumstances, in catching the light under an oblique angle, is one able to observe, that slight rib-like undulations extend across this part of the shell from the little spines situated along the external edge on one side of the whorl to those on the other side.

On the whole, the sculpture of the shell of this species is not dissimilar to that observable in *Aegoceras armatum*, Sow. of the Middle Trias of England.

On the specimens at my disposal the sculpture seems to remain of about the same pattern in young specimens as in adult ones, and on the specimen that has preserved nearly its entire body-chamber, in the length of near to one volution, there is no trace of a change of the sculpture towards that part most nearly approached to the mouth in comparison to that at its commencement and on the chambered part of the shell.

The sutures are only preserved in very rude traces in one of the specimens, and it appears impossible to describe them in any way.

The measurements of the two specimens, from the topmost division of the Ceratite sandstone at Chidroo, are as follow :—

	I.	II.
	mm.	mm.
Diameter of the shell	45	27·5
„ of the umbilicus	20	10·5
Height of the last volution from the umbilical suture	14·5	9·5
„ „ „ from the preceding whorl	11·5	8
Thickness of the last volution	16	11

Specimen No I has preserved nearly its entire body-chamber.

Locality and Geological Position.—The two specimens of this species preserved in the Salt-Range collection were found by me in the topmost division of the Ceratite sandstone at Chidroo.

Remarks.—The present species is, though very closely related to the preceding one, yet easily distinguishable by its much more inflated whorls and robust sculpture.

The present *Celtites armatus* recalls to a certain extent again the different forms belonging to the group of *Celtites floriani*, Mojs., mentioned in the description of the preceding species, but again from all of them it is distinct by the absence of a median keel on the external side. Otherwise, none of the European triassic species can be compared more in detail with the Indian shell under description.

As *Celtites subrectangularis*, W., and *Celtites armatus*, W., occur in strata immediately succeeding each other, and both are in general appearance most conspicuously similar, it appears highly probable that the two might be in a developmental connection. No definite direction in variation can however be made out, as the species that follows next differs quite as much from *Celtites subrectangularis* as the present one.

3. CELTITES TRAPEZOIDALIS, Waagen, n. sp., Pl. XXI, fig. 3a, b, c.

It is a very elegant, little shell which I have to describe under this name.

The general shape is not very thickly disciform with a wide umbilicus, it is rather flat, and the whorls are broadest on the external side.

The species is represented in the Salt-Range collection by a single specimen which is of rather small dimensions, and most probably only represents the young of a much larger shell. The general shape, however, so distinctly deviates from the other species of the genus, and is so characteristic, that it can safely be considered as belonging to a distinct species. It consists of an internal cast only, and there is no trace of the shell left on it, otherwise its preservation is most excellent.

The transverse section of the whorls is trapezoidal, and considerably higher than it is broad. The most conspicuous part is the external side, which at the same time represents the greatest transversal diameter of the whorls. It is strongly flattened, only very slightly vaulted, and joins the lateral parts of the shell under a narrow, somewhat acute angle, which, however, forms no distinct edge, but is narrowly rounded off. The lateral parts of the shell are perfectly flattened, and not at all

vaulted. They are slightly sloping towards the umbilical side, so that the transverse section of the whorls appears distinctly tapering in this direction. Near the umbilicus the lateral parts bend inside in a short narrow curve, to meet the umbilical suture; but there exists no umbilical edge, or distinct umbilical wall. The elevation of the lateral parts above the umbilical suture is but very small, so that the umbilicus itself appears rather shallow.

The involution of the whorls is extremely small, and the indentation caused by the penultimate whorl into the last one is not more than half a millimetre.

The sculpture of the whorls is very elegant, but is restricted exclusively to the lateral parts. It consists of rather numerous, straight radial folds, which commence faintly a little above the umbilical suture, are strongest in the middle of the lateral parts, and disappear again towards the rounded-off external edge, without forming the slightest trace of any tubercle. There are 18 to 19 of these folds on the last volution. The innermost volutions, up to a diameter of the shell of 2mm., appear to be smooth.

The external side is perfectly smooth, without any trace of folds or undulations.

The sutural lines are very well preserved on different parts of the specimen, but on account of the smallness of the individual, all kinds of denticulations are yet absent, and thus the sutural lines appear absolutely goniatitic. There is only a single distinct large lateral lobe present, which is considerably deeper than the external lobe. A second very small lobe, which is situated near the umbilicus, on the lateral part of the shell, cannot without a certain restriction be determined as a second lateral lobe, as the line of involution of the preceding whorl hits this lobe only a very little inside its deepest excavation.

This position of the second lateral lobe is of great interest if taken into consideration with regard to the geological position held by the present species. We will see that the next higher species in the geological sequence shows a sutural line in which the two lateral lobes occupy a perfectly normal position; whilst here, in the geologically older species, this position is not a normal one, and the second lateral lobe occupies a place which is intermediate between that of a normal lateral and that of an auxiliary lobe. The observation would be of yet higher value, if we were able to assert that in the preceding two species, occurring in the ceratite sandstone, the position of the second lobe was entirely that of an auxiliary one, but the sutures are so badly preserved in these two species that such an assertion is impossible.

We shall see that in the group of *Celtites ovalis*, W., the case is different, and that the forms occurring in the Ceratite sandstone show the normal position of the lateral lobes.

The measurements of the only existing specimen of this species are as follows:—

	mm.
Diameter of the shell	19
„ „ umbilicus	7
Height of the last volution from the umbilical suture	6.75
„ „ „ from the preceding whorl	6
Thickness of the last volution	5.5

Locality and Geological position.—The specimen that has served here for description was collected by me at Chidroo in the very lowest beds of the Upper Ceratite limestone, just above the Ceratite sandstone.

Remarks.—The present species appears to be most nearly related to *Celtites armatus*, described before. The difference between the two consists, however, in the transverse section of the whorls, which is higher than the breadth of *Celtites trapezoidalis*, whilst the contrary is the case in *Celtites armatus*. Besides this, the greatest transverse diameter of the whorls is situated in the former species at the external edges, whilst it is not far removed from the umbilical suture in the latter. The sculpture is also somewhat different in both forms. Thus the two can easily be distinguished.

With regard to the shape of the transverse section of the whorls, a comparison with *Celtites subrectangularis*, W., is necessary, from which it will be seen that the difference in the position of the greatest transverse diameter of the whorls is very striking, and that in this case also a distinction is very easy.

Among European species *Celtites fortis*, Mojs., bears most resemblance to the present form, inasmuch as there the whorls are also somewhat broader near their outer edge than in the umbilical region. In the European shell, however, the whorls are lower and more depressed than in our Indian species, and there exists a rather distinct keel in the middle of the external side, which is decidedly absent in *Celtites trapezoidalis*. Thus the Indian shell represents beyond doubt a different species, though it may be in a certain respect analogous to the European *Celtites fortis*.

4. CELTITES MULTIPLICATUS, Waagen, n. sp., Pl. VII, fig. 2 *a*, *b*, *c*.

This species is rather thickly disciform, with a moderately wide and rather deeply excavated umbilicus, and with whorls which appear slightly trapezoidal in their transverse section.

There is only one well preserved specimen of this species in the Salt-Range collection: there are some fragments which perhaps belong to it, but these are too badly preserved to allow of determination.

The specimen that serves for description is an internal cast, on which, part of the body-chamber has been preserved. The innermost volutions have been destroyed by weathering. The sutural lines are not very distinctly visible.

The transverse section of the whorls is indistinctly trapezoidal, with rounded-off corners and slightly vaulted sides. The lateral parts of the shell are but very flatly arched, and their highest elevation is situated not far above the umbilical wall. From there they slope very distinctly towards the external edges, and are slightly depressed in the direction of the umbilical wall. This latter part is very fully developed, and forms a vertical wall surrounding the umbilicus. The umbilical edge is distinctly rounded off, not sharp, but nevertheless perceptible. On the external side, the lateral unites with the external part of the shell, in forming

broadly rounded-off external edges. The external part is comparatively narrow and only very flatly arched.

The sculpture consists of numerous straight radial ribs, which commence at the umbilical edge, in forming a small and barely perceptible tubercle. From there they extend in a perfectly straight radial direction over the lateral parts of the shell. They are not very high, but still distinct, and are separated from each other by broad rounded valleys. At the external edges distinct little tubercles are formed by all the ribs, which disappear almost entirely or extend only in very faint traces on to the external part, which is in consequence nearly smooth.

I counted on the last volution twenty-two such ribs.

Another character, which much contributes to the characteristic appearance of the present species, consists in the involution of its whorls, which is more considerable than in any of the species of the genus hitherto described.

The sutural lines can be tolerably well distinguished. They appear however to be very simple. The external lobe is short, broad at its anterior part, and narrow at its bottom, not branched nor denticulated, with a little indentation in the middle. The external saddle is entire, and broadly rounded. The first lateral lobe is broad and deep, with nearly parallel walls and some denticulations at its bottom. The lateral saddle is again entire, rounded, somewhat narrower than the external one, and reaching not further up than the latter. The second lateral lobe is well above the line of involution of the preceding whorl, and thus the disposition of the lobes appears as the normal one. The lobe itself is very small and pointed, without denticulations. After this lobe follows a little auxiliary saddle, which reaches down to the umbilical edge. I have not observed any auxiliary lobe present on the umbilical wall.

The dimensions of the specimen are as follows :—

	mm.
Diameter of the shell	34
" " umbilicus	12
Height of the last volution from the umbilical suture	14
" " " " from the preceding whorl	10
Thickness of the last volution	10.5

Locality and Geological position.—The species was collected by me at a single locality (Koofri), where I found a well determinable specimen and some bad fragments. These things occurred there in beds, which I considered as belonging to about the middle region of the upper Ceratite limestone.

This species is thus the most recent one among those forms that compose the group of *Celtites subrectangularis*, W.

Remarks.—The present species is again rather closely related to *Celtites armatus*, W., described above. The distinction is however very perceptible as in *Celtites multiplicatus*, the radial folds are much more numerous, and the whorls more strongly compressed and involute.

From *Celtites trapezoidalis*, W., the present species can be distinguished by the transverse section of the whorls, which are broadest at the external edges in *Celtites*

trapezoidalis, whilst in *Celtites multiplicatus* the greatest breadth is situated not far above the umbilicus.

Of European species, again, the group of *Celtites floriani* must be compared, but the absence of a median external keel distinguishes again the Indian shell from all the European forms.

b. Isolated species.

5. *CELTITES DIMORPHUS*, Waagen, n. sp., Pl. VII, fig. 5, a, b, c.

The general shape of the shell is rather thickly disciform, with a moderately wide and rather shallow umbilicus.

The only specimen existing of this species is not quite complete, but is sufficiently well preserved to allow of an exact description. It consists of an internal cast only, but the sutures are nevertheless not preserved, and can, therefore, not be described. The greatest part of the specimen seems to consist of the body-chamber, but as the sutural lines are not preserved, it is difficult to state where this part commences. The aperture is not preserved.

The transverse section of the whorls is near to rectangular, and only very slightly trapezoidal in shape, being a little narrower at the external, than at the umbilical side. The lateral parts are very flatly vaulted. Their greatest elevation is situated not far above the umbilicus. From there they slope slightly towards the external edges, whilst in the direction of the umbilicus they bend down in a well-rounded curve to the umbilical suture, without forming a distinct umbilical wall or edge. The external side is rather broad, and very slightly vaulted; it joins the lateral parts in forming an obtusely rounded-off external edge.

The involution of the whorls is very moderate.

The sculpture of the whorls is quite distinct in the different parts of the shell. On the inner volutions, that is, probably on the chambered part of the shell, the lateral parts of the whorls are ornamented by very few thick broad folds, of which there are about six on one volution. These folds commence quite imperceptibly a little above the umbilicus, are a little swollen in the middle, somewhat in the manner of tubercles, and terminate quite faintly on the external edges. They are quite straight, and extend in an absolutely radial direction.

Whether they are transformed on the innermost volutions directly, into tubercles, or spines, as is not improbable, cannot be observed, as these innermost volutions are not preserved on the specimen under description.

On the outer volution the sculpture is quite a different one. It consists here of numerous straight radial ribs, which grow by-and-by fainter the nearer they approach the aperture. The exact number cannot be counted, as part of the last volution is broken away. These ribs are not altogether radial, but lean a little towards the front. They commence not far above the umbilicus, with barely perceptible little tubercles, extend then straight over the lateral parts of the whorl, and terminate at the outer edge again forming barely perceptible tubercles. From here they extend as rather distinct rounded folds across the external part

of the whorl, connecting the corresponding tubercles of both sides with each other. These transverse folds on the external side are most distinct towards the anterior end of the last volution.

On the inner volutions the external side appears to be smooth.

The sutural line cannot be observed.

The dimensions of the only existing specimen are as follows:—

Diameter of the shell	36 mm
" " umbilicus	14 "
Height of the last volution from the umbilical suture	12 "
" " " " from the preceding whorl	10 "
Thickness of the last volution	11 "

Locality and Geological Position.—The specimen serving for description was collected by me at Koofri in the middle beds of the Upper Ceratite limestone, together with *Celtites multiplicatus* previously described.

Remarks : The present species is easily distinguishable from all the other forms of the same genus by the difference of form that is exhibited by the inner and outer volutions. Even fragments are easily recognised, as the sculpture of the different parts is always characteristic.

The outer volution is somewhat similar to *Celtites subrectangularis*, W., but the ribs are fainter and somewhat more numerous in the present species.

The inner volutions cannot be compared to any other species except to the following one:—

6. CELTITES, SPEC. INDET., Pl. VII, fig. 4, *a*, *b*.

During my excursions in the Salt-Range, I found at Chidroo, in the Upper Ceratite limestone, the impression of the umbilical region of an ammonite, which evidently had belonged to a shell, probably most nearly related to the preceding species, and thus may with some certainty be determined as belonging to the genus *Celtites*.

The specimen is figured 4*a* of Pl. VII, whilst in fig. 4*b*, an ozokerite impression of the same specimen is represented.

One sees that the fragment belonged to an ammonoid shell, which possessed a widely open umbilicus, and probably not very involute whorls. The umbilicus was surrounded by an umbilical wall, which was not very distinctly limited off from the lateral parts of the whorls, as no distinct umbilical edge was developed.

The whorls were ornamented by a strong radial sculpture, which however differs in certain parts of the shell. The inner volutions were provided with thick, prominent, rounded tubercles, of which there were about four to five on one volution. After a diameter of the umbilicus of about 15mm. is attained, these tubercles are changed into thick rounded radial folds, which continue for about half to three-quarters of a volution, on which space ten such folds can be counted. Then, again, a change is effected, and radial ribs are developed, which are similar to those that occur in the other species of *Celtites*, previously described in this work.

By the difference in sculpture on the several parts of the shell, this fragment resembles most *Celtites dimorphus*, W. It cannot, however, be united with that species on account of the much more robust sculpture that is exhibited by that fragment.

Thus it appears highly probable that by this fragment yet one further species of *Celtites* is indicated, but the materials are too fragmentary to give a proper name to it.

II—Division: OVALIS.

c. Group of CELTITES ACUTEPLICATUS, W.

e. CELTITES ACUTEPLICATUS, Waagen, n. sp., Pl. VII, fig. 5 (right figure), 5c, figs. 6, 7.

This species occurs in tolerable numbers in certain beds, but it is nearly always in a fragmentary condition.

The general shape of the shell is flatly disciform with a wide umbilicus, rather compressed, having little embracing whorls.

There are only internal casts of this species at my disposal, which are all in a fragmentary condition. Some of the fragments show part of the body chamber, whilst others are entirely composed of air-chambers. How long the body chamber may have been, cannot be gauged on any of them.

The transverse section of the whorls is tolerably compressedly oval, considerably higher than it is broad, and well rounded everywhere. The greatest transverse diameter is situated a little below the middle of the lateral parts, where these latter are slightly flattened. From there the lateral parts extend in a gentle curve towards the umbilical suture, without forming any kind of an umbilical wall or edge. Towards the external side the curve is quite equal and gentle, so that not a trace of any external edge can be distinguished. The external side is also very equal, rather highly arched, and joins the lateral parts in quite an imperceptible manner.

The sculpture consists of tolerably numerous, single, nearly straight ribs, which are not quite radial, and lean a little forward. They commence at a very short distance above the umbilicus, bend a little, and become high and sharp, with broad valleys between. During their extension over the lateral parts of the whorls they remain quite straight and of equal strength. In approaching, however, the external part, they become somewhat broader and flatter, and bend at the same time slightly forward. They then quickly disappear, without reaching the external part, which is quite smooth and without a trace of any folding.

There are about 25 radial folds on one volution.

The sutural lines are almost completely visible on a small fragment from the Upper Ceratite limestone at Chidroo. The external lobe is apparently not very deep, but it cannot be completely observed. The external saddle is comparatively narrow, entire, without any indentation: it does not reach very high up. The first lateral lobe is deep but not very broad. In the specimen at my disposal no denticulations can be observed at its bottom, but this is probably due to faulty preser-

vation, as the surface of the specimen is slightly attacked by weathering, and these denticulations are in most of the Salt-Range *Ceratites* easily lost, if the preservation is not excellent. The lateral saddle is broad and flat, also entire, without indentations. The second lateral lobe is very low, rather pointed at its bottom, and very broad at its upper extremity. It is not denticulated. Its position above the line of involution of the preceding whorl is above all doubt, though this line approaches it closely. The only existing auxiliary saddle is very low and broad: it reaches down to the umbilical suture.

The dimensions of the present species can only be very approximately taken, as no entire specimen is at my disposal. The most complete specimen from Koofri is preserved partly only by an impression on the rock; and from this specimen alone measurements can be drawn; these must, however, be taken for what they are worth. The measurements are as follows:—

Diameter of the shell	. . . . .	P28 mm.
" " " umbilicus	. . . . .	P12 "
Height of the last volution from the umbilical suture	. . . . .	8.5 "
" " " " " from the preceding whorl	. . . . .	7 "
Thickness of the last volution	. . . . .	7 "

It must be remarked that the inner volutions possess a much more depressed transverse section than the outer ones. In the specimen the measurements of which have been given, the preceding whorl of the one indicated last shows a height, from the umbilical suture, of 5.25^{mm.}; whilst its thickness is 5^{mm.}; that is to say, the inner volutions are much more inflated than the outer ones.

Locality and Geological Position.—Several specimens, all fragmentary, were found by me whilst in the Salt-Range. The geologically oldest of these were collected at Virgal in the Ceratite sandstone in a position which I considered as corresponding to about the *Stachella* beds, or a little lower. Another fragment I found at Chidroo in the typical Upper Ceratite limestones. I detected several more fragments at Koofri, in limestone beds which were a little above the typical Upper Ceratite limestones, and which I am inclined to consider as about intermediate between these and the Bivalve limestones; belonging, however, rather to the lower than to the upper group.

The species thus attains a range from the Ceratite sandstone up to the base of the Bivalve limestones.

Remarks.—The general appearance of the present form is much like some species belonging to the genus *Arietites* or *Schlotheimia*, but the smoothness of the external side distinguishes the Indian shell readily from all those jurassic genera.

Within the genus *Celtites* previously described there are also forms which more or less closely resemble the present species; *Celtites epolensis*, Mojs., taking first place. The general configuration of the shell and the characters of the ribs are nearly identical, but the ribs are much less numerous in the Indian than in the European species.

Among the Indian forms all the species belonging to the division of the *Quadrangulares* are more or less similar, and among these again the *Celtites multi-*

plicatus, W., shows the greatest affinity. The distinction, however, between the species here under consideration and the shell in question is very easy, as the characters of the ribs, and of the transverse section of the whorls, are quite different in both forms.

A still further very remarkable similarity exists between our *Celt. acuteplicatus* and some shells which have been described by Mojsisovics from Siberia, and for which the group of the "*Ceratites obsoleti*" has been created by that author. The species have been called by him *Ceratites multiplicatus*, *Cer. hyperbores*, *Cer. fissiplicatus*, and *Cer. discretus*. The external similarity appears on a first glance rather close, as the sutural lines are nearly identical, but one soon detects that the ribs are straighter and more sharply defined in the Indian shell than in the Siberian species, and that the existence of a short body-chamber in the latter forbids a closer comparison with species of *Celtites*. Nevertheless, I must allow that of the Indian species also, no specimen has been found in which the length of the body-chamber could have been stated without any doubt. But the great length of some fragments of body-chambers which I have found admit of my concluding with some probability that the entire chamber must have possessed a length of near to one revolution. On account of such observations I have transferred the Indian shell into the genus *Celtites*, representing rather close affinities to the European *Celtites epolensis*, whilst I have separated it from the *Ceratites obsoleti*.

There are in fact, in the Salt-Range triassic beds, shells which have in their general configuration much similarity to *Celtites acuteplicatus* and its allies, but which are most certainly provided with a short body-chamber. These I had formerly united with my genus *Xenodiscus*, and they are most nearly related to the *Ceratites obsoleti*. Nevertheless, I did not unite them with the genus *Ceratites*, but must consider them as belonging to a new genus "*Gyronites*," which is most nearly related to *Meekoceras* and belongs to the "Sub-order" (as one may call it) of the *Leiostraca*. I should think that it would be more correct to consider the above-mentioned Siberian species of *Ceratites* rather as belonging also to my new genus, or else to the genus *Ophiceras* of Griesbach, which is also most nearly related to *Meekoceras*.

8. *CELTITES OVALIS*, Waagen, n. sp., Pl. VII α , fig. 5 (left figure), fig. 5a, 5b.

The general shape of this species is compressedly disciform, with a moderately narrow umbilicus and not many embracing whorls.

The materials of this species contained in the Salt-Range collection are rather scanty, and there is no complete specimen of it known to me. There are mostly fragments of body-chambers, all internal casts, and one specimen, which is preserved partly as an impression on the rock and partly as an internal cast. This latter specimen is the most complete.

The transverse section of the whorls is compressedly oval, and everywhere well rounded. The lateral parts are quite flatly vaulted, and their greatest elevation is situated about the middle of the height of the whorls. From there they descend in an equal gentle curve to the umbilical suture without forming an umbilical edge

or any trace of an umbilical wall. The external part is narrowly and equally rounded, and joins the lateral parts without the formation of any trace of an external edge.

The sculpture consists of simple broad folds, which do not extend in a strictly radial direction but lean a little backwards. They commence not far above the umbilical suture, bend distinctly backward, describing a gentle curve, with the concave side directed towards the front, and disappear not far from the external side, without showing any swelling or node. These ribs are highest about the middle of the sides of the whorls. They are all of equal strength and distributed at regular slowly increasing distances as the shell increases in size. It is not known to me whether the inner volutions are ornamented with the same sculpture, as the impression these parts of the shell have left on the rock appears to be rather smooth, but as this impression is much weathered there might be thus a mistake about this character.

The external part of the whorls is perfectly smooth and rather narrowly rounded.

The body-chamber appears to have occupied just one volution. It is, however, not possible to give a positive opinion on this matter, as the sutural lines are so badly preserved that one cannot be quite certain where the last one has been situated.

Thus, it is also not possible to furnish a description of the characters of the sutural lines.

The apertural margin has not been preserved.

The measurements of a specimen from the Upper Ceratite limestone of Koofri are:—

Diameter of the shell	. . . . .	35	mm.
" " " umbilicus	. . . . .	13	"
Height of the last volution from the umbilical suture	. . . . .	12.5	"
" " " " " from the preceding whorl	. . . . .	10.5	"
Thickness of the last volution	. . . . .	28	"

Locality and Geological Position.—The few, mostly fragmentary, specimens of this species, of which only one is in a somewhat good condition of preservation, were all found in the upper region of the Upper Ceratite limestone at Koofri.

Remarks.—The present species shows a certain resemblance to the preceding one; nevertheless, a distinction between the two is very easy. In the form under description the umbilicus is narrower and the whorls higher and more strongly embracing; the ribs on the whorls are not so straight and less numerous, and they disappear at a certain distance from the external side of the whorl, so that the smooth space on the latter is broader in this species than in *Celt. acuteplicatus*. If thus a distinction between the two is not difficult, it is evident that both are so nearly related to each other, that it will not be wrong to suppose a developmental connection between the two.

Like all the group of forms to which the present species belongs, this one also shows a certain distant similarity to *Celt. epolensis*, Mojs., but the European species has more volutions and more numerous ribs, so that nobody will be induced to mistake the one for the other.

9. *CELTITES*, *spec. indet.*, Pl. VIIa, fig. 11, 11a.

I did not venture to introduce a new name for the fragment figured on Pl. VII a, fig. 11, as the material is too scanty to fix the form definitely.

In general outward appearance, this form is very similar to *Celtites acuteplicatus*, as described above. The umbilicus is rather large, the whorls but little embracing. Their transverse section is rather broad, not much narrower than it is high and everywhere well rounded. The whorls are provided on their sides with single exceptionally high and sharp ribs, which are rather far distant from each other, and between which, only in a single instance, a shorter one is intercalated towards the external side. The ribs are not quite straight but slightly bent, with the concave side directed backward.

The external side is perfectly smooth.

The fragment consists entirely of part of the body-chamber, and therefore nothing can be observed with regard to the sutural lines.

It has already been remarked that the present form appears to be most nearly related to *Celt. acuteplicatus*, W., described before. The rather striking differences that nevertheless are present, consist in the strong prominence and sharpness of the ribs, which appear to be at the same time less numerous, and in the greater inflation of the whorls. So it seems to me that the specimen represented in fig. 11 cannot be directly united with *Celt. acuteplicatus*, but most probably represents yet another species of *Celtites*, occurring in the Upper Ceratite limestone.

The specimen was found in the highest layers of the Upper Ceratite limestone at Keofri.

ISOLATED SPECIES.

10. *CELTITES LÆVIGATUS*, Waagen, n. sp., Pl. VIIa, fig. 3.

The materials of this species are rather unsatisfactory, and I should not have ventured to describe it under a proper specific designation, were it not that its geological position in the Ceratite sandstone gives this form a special interest.

The general shape is flatly disciform, with a rather wide umbilicus and laterally compressed whorls that are but very little embracing.

The transverse section of the whorls is roundedly oval, with equally vaulted lateral parts. The greatest transverse diameter of the whorls is situated about the middle of their height. From there the lateral parts bend in a gentle curve down to the umbilical suture without the formation of an umbilical edge or an umbilical wall. Similarly, they join the external part of the shell in a perfectly gentle and regularly rounded curve.

The external part of the whorls is perfectly smooth, and not very broadly rounded.

The sculpture of the shell is very simple, and so little prominent that on a first glance the shell appears to be almost smooth. In fact, the inner volutions, up to a diameter of the shell of about 15^{mm}. are devoid of any sculpture; and, only after this size is exceeded, does the sculpture begin to appear. It consists of very low

and faint, rather broad, somewhat falciform folds or ribs, which begin at a little distance above the umbilical suture, are most distinct for a short distance on the middle of the sides, and disappear again towards the external side of the whorls in bending a little forward. Between these folds there are fine thread-like wrinkles which have the same shape and direction as the folds, but which are of rather unequal distribution.

The sutural lines are distinctly visible on some parts of the specimen. The external lobe is short and not very broad, without denticulations at its bottom. The next following external saddle is entire, broadly rounded, and rather low. The most conspicuous part of all in the sutural line is the first lateral lobe. It is rather broad and deep, reaching down much more deeply than the external lobe. At its bottom there seem to be some slight denticulations, but the state of weathering of the specimen does not allow of making quite sure of this character. Both sides of this lobe are nearly parallel, but only slightly converging towards the bottom. The first lateral saddle is not quite as broad as the external one, and does not reach higher up than the latter. It is also entire and broadly rounded. The second lateral lobe is distinctly above the line of involution of the preceding whorl. It is very short, its sides strongly converging. At its bottom this lobe is very narrowly rounded, nearly pointed, without any distinct denticulations. The next following saddle reaches up again to the same height as the other saddles. It is entire and quite flatly rounded.

It is followed yet again by a quite minute auxiliary lobe, which is partly concealed in the umbilical suture.

The body-chamber of the animal has not been preserved in the specimen under description.

The measurements of this specimen are as follows:—

Diameter of the shell	.	.	.	.	.	.	.	.	.	.	mm.
" " umbilicus	.	.	.	.	.	.	.	.	.	.	33
Height of the last volution from the umbilical suture	.	.	.	.	.	.	.	.	.	.	14
" " " " preceding whorl	.	.	.	.	.	.	.	.	.	.	11
Thickness of the last volution	.	.	.	.	.	.	.	.	.	.	10

Locality and Geological Position.—The only specimen of this species in the Salt-Range collection was found rather low down in the Ceratite Sandstone of the Chitta-Wan, near Ghari.

Remarks.—The generic determination of the present form is rather doubtful as the body-chamber is not preserved, and thus it cannot be determined whether the length of that part of the shell had one volution or not. The reason why I attribute this shell to the genus *Celtites* is on account of its general resemblance to the forms, previously described in this work. The characters by which this species can be distinguished from those described before, consist in the smoothness of the shell, on which no distinct radial ribs exist, but only low rounded folds, between which a fine radial striation can be observed. This peculiarity distinguishes the present species not only from the Indian shells, but also from the European forms, that have been attributed up to the present, to the genus *Celtites*.

11. *CELTITES TERES*, Waagen, n. sp., Pl VIIa, fig. 4. 4a. 4b.

It is with diffidence that I introduce the present form in the genus *Celtites*, as its general shape deviates considerably from that exhibited by the majority of shells which have up to the present been attributed to the genus.

The general shape of the shell is flatly disciform, reproducing rather the shape of a coiled string. The umbilicus is large and flat, and the whorls numerous and but little embracing. The transverse section of the whorls is near to circular, but very little higher than it is broad. The lateral parts of the whorls are well vaulted, their greatest elevation being situated about in the middle of their height. They bend in a gentle curve down to the umbilical suture without forming an umbilical edge or umbilical wall. The suture itself is nevertheless strongly impressed, on account of the considerable protrusion of the lateral parts of the preceding whorl. The external part of the whorls is broadly rounded, uniting with the lateral parts in a gentle curve, where all distinct demarcation of these parts is obliterated.

The sculpture of the shell is rather different according to age. In the young state the shell appears to be nearly smooth, with very indistinct broad low folds, which originate at the umbilical suture, are strongly bent towards the aperture and disappear near the external part of the whorl. Between these folds, off and on, at irregular distances contractions of the shell are disseminated, which in all respects are similar to furrows between the folds, only that they are much deeper and continued over the external part of the shell. On the body-chamber, which is, however, only partly preserved, so that it is not possible to say whether it occupied fully one volution or not, but which to all appearances has been rather long, the sculpture changes considerably. The radial folds become very narrow and rather sharp, and are present in great numbers. They are strongest near the umbilicus, become fainter on the middle of the lateral parts, and disappear entirely before reaching the external part. They bend strongly towards the aperture. These folds are always simple, never divided. There are generally one or two fainter folds intercalated between two strong ones.

The aperture of the body chamber has not been preserved.

On the inner volutions of this specimen the sutural lines can be seen in some places, but the external lobe is covered up everywhere by the succeeding volution. The most conspicuous part of this sutural line is an enormous first lateral lobe which by its excessive breadth occupies nearly all the space on the lateral part. It is not very deep, is perfectly rounded and not denticulated at its bottom, though this latter character may partly be caused by a bad preservation, as the surface of the shell on this part is somewhat deteriorated by weathering. The first lateral lobe is followed by a very short and narrowly rounded first lateral saddle, and after this follows again a very short and narrow second lateral lobe. This is, however, distinctly above the line of involution of the preceding whorl. From there, a low saddle extends down to the umbilical suture.

The measurements of this specimen cannot well be taken, as the outer volution

is rather imperfect, and it is of no use giving measurements of a specimen in such a fragmentary condition.

Locality and Geological Position.—The only specimen of this species in the Salt-Range collection was found in the vicinity of Ghari in very hard rusty limestone, apparently partly dolomitic, that holds a position very high up in the ceratite formation. It might probably be considered as an equivalent of the upper ceratite limestone of other localities further to the east.

Remarks.—The present species resembles in its general appearance certain forms belonging to the genus *Lytoceras*, and if found in middle jurassic strata one would not hesitate to attribute it to that genus if the length of the body-chamber, and the characters of the sutural lines were not known. But the peculiarities of these last-mentioned parts of the shell would under any circumstances prevent the present species from being connected with *Lytoceras*. Above all, the length of the body-chamber, which to all appearances has taken up one or very nearly one revolution is a thing that never occurs in *Lytoceras* or any allied genus. The sutural line is, however, so strange in its development that I know of no other form of an ammonitic shell possessing a similar one.

Thus *Celt. teres* appears as a very strange form, which I attribute to the genus *Celtites*, simply on account of the length of its body-chamber and of the peculiarity of its sculpture, which consists of ribs that are always undivided as in *Celtites*.

As regards specific similarities, our present form shows only a distant similarity to *Celtites epolensis*, Mojs., but its ribs are much finer.

Genus: ACROCHORDICERAS, Hyatt.

The present genus must be counted among the rarest of those occurring in triassic strata. Therefore the number of species, that have been attributed to it up to the present is very limited and does not exceed five or six, to which I am now able to add about an equal number. It is very much to be regretted that, on account of the rareness of these forms in the Salt-Range also, most of these are only represented by fragments or single specimens.

The original characteristic of this genus given by Hyatt, in the fourth volume of the reports on the Geological Exploration of the 40th Parallel is at present completely useless, and one must rely solely on the figures given by Meek. But even these are of a very unsatisfactory quality, as there exists no front view of any of the specimens, and had not Nöetling shortly after given somewhat more instructive figures of another species, it would have been hardly possible to fix the genus. The genus can indeed only be considered to have been truly established after Mojsisovics had given, in his *Cephalopoda of the Mediterranean Triassic Province*, a proper diagnosis. Later on, von Hauer, in his description of the *Muschelkalk Fauna of Han Bulog near Serajevo*, adds some more species to the present genus.

Mojsisovics' diagnosis runs as follows: "With regard to the external characters

of *Acrochordiceras*, this genus is provided with a strong sculpture, consisting of ribs, which are continuously developed on the lateral parts, as well as on the periphery. They commence not far from the umbilicus, and are alternately stronger and weaker. On the lateral parts of the shell most of them are divided, and at the points of division, in the adult shell, strong thorns are developed.

“The body-chamber comprises invariably more than one volution.”

The sutural line is but very imperfectly known. Mojsisovics has been able to observe it in young specimens, and only Nöetling (not to speak of Hauer's recent drawing) has given the figure of the sutural line of an adult shell. This is characterised by an enormously broad first lateral lobe, and a second lateral lobe, that is barely above the line of involution of the preceding whorl. With regard to this latter character, I shall be able to add some new observation from the Indian materials. Otherwise, the Indian materials are not apt to augment our knowledge of the genus *Acrochordiceras* very considerably, as they are too fragmentary and show hardly any sutural lines.

In the Salt-Range the genus is represented by six different forms, five of which are decidedly new, whilst one seems in its general configuration very nearly related to *Acrochordiceras damesi*, Nöetling. The geologically most ancient species that has been found in the Salt-Range comes from the Ceratite Sandstone, at the limit between the *Stachella* beds and the upper division of the group. I shall introduce for this form the name of *Acroch. atavum*, W. Its most striking character consists in its nearly quite smooth body-chamber. All the remaining five species are from the upper Ceratite limestone. They will be called: *Acrochord. dimidiatum*, W., *Acrochord. distractum*, W., *Acrochord. coronatum*, W., *Acrochord. cf. damesi*, Nöetl., and *Acrochord. compressum*, W. If we try to find out some more intimate relations between some of these forms we find that we may well distinguish two different groups. The first of these is characterised by a comparatively wide umbilicus and weak sculpture. The *Acr. atavum* is the first species that must be attributed to this group: next comes *Acr. dimidiatum*: both form apparently a well-characterised developmental series, which in so far is somewhat strange, as the more ancient species has the body-chamber nearly smooth, whilst the geologically younger one has this part of the shell provided with a distinct sculpture, when, according to Hyatt's "Law of Acceleration," the reverse ought be the case.

The other group is made up of species which show a more or less close resemblance to *Acrochord. damesi*, Nöetl. Three of the above enumerated species belong to this group. There can be no question, however, of a developmental connection of these forms, as they all occur in about the same horizon.

There remains yet a single species which cannot be attributed to either of the above-mentioned groups, and thus must be considered as an isolated species.

We thus arrive at the following grouping of the species of *Acrochordiceras*:—

a. Group of *ACROCHORDICERAS ATAVUM*, W.

- 1 *Acrochordiceras atavum*, W. (Ceratite sandstone, Upper region).
- 2 „ *dimidiatum*, W. (Upper ceratite limestone).

b. Group of *ACROCHORDICERAS DAMESEI*, Nöetl.

- 3 *Acrochordiceras distractum*, W. (Upper ceratite limestone).
 4 „ *coronatum*, W. („ „ „).
 5 „ *cf. damesi*, Nöetl. („ „ „).

c. ISOLATED SPECIES.

- 6 *Acrochordiceras compressum*, W. (Upper ceratite limestone).

a. Group of *ACROCHORDICERAS ATAVUM*, W.1. *ACROCHORDICERAS ATAVUM*, Waagen, n. sp. Pl. III, fig. 3 *a. b.*

Though the present species is represented in the Salt-Range collection only by a single fragmentary specimen, yet the configuration of this fragment is so strange and its geological position so extraordinary, that to describe and give it a proper name seems unavoidable. The fragment is barely sufficient to determine the genus with any possible certainty, as of the body-chamber only one-half of a volution is preserved: thus, it cannot be stated, whether originally the body-chamber took up one entire volution; but the sculpture that exists on the proximal-end of this body-chamber is so characteristically that of *Acrochordiceras*, that the determination of the genus may still be considered as most probably correct.

The general form of the shell is thickly disciform, with a comparatively wide umbilicus and rounded whorls. The transverse section of the whorls is a rounded oval, but very little higher than it is broad. The lateral parts are flatly rounded, the greatest elevation being situated in the lower third of the height of the whorl. From there the lateral parts slope gently towards the umbilical suture without forming an umbilical edge or distinct umbilical wall. The umbilical suture is reached at an acute angle. The external part of the whorls is broadly rounded and unites imperceptibly with the lateral parts.

The sculpture of the shell is rather different on different parts. On the commencement of the body-chamber, and most probably also on the inner volutions, which are, however, not preserved, the sculpture consists of radial ribs, which commence at a small distance above the umbilical suture, and extend up to the middle of the sides, leaning at the same time strongly forward. At the middle of the sides they are raised into strong, compressed tubercles, which are elongated in the direction of the rib. From these tubercles start two or three low, broadly rounded ribs, the connection of which with the tubercles is, however, rather indistinct. They extend uninterruptedly over the external part of the shell down to the tubercles of the other side, and are highest and most strongly expressed on this external part, but even here they are not very strongly prominent.

At the beginning of the body-chamber, starting from the last sutural line, there are yet four of these elongated lateral tubercles. After this the sculpture suddenly stops. There comes a lengthened nearly smooth space, in which only two faint traces of lateral ribs can be discerned, and then comes again one of these elongated rib-like lateral tubercles, which is however broader and more rounded than those on the commencement of the body-chamber. The further extension of the body-chamber

is broken away, and thus it cannot be stated how the sculpture may not change towards the mouth of the shell. The external part of the shell becomes quite smooth, after the regular lateral tubercles have disappeared.

Of the sutural line of this species but very little is preserved. Of the first lateral lobe only traces are visible. The first lateral saddle does not reach very high up, is rather narrowly rounded, and entire. After this comes a broad, not very deep, auxiliary lobe, which occupies nearly the entire space between the first lateral saddle and the umbilical suture. This lobe is entire, without any denticulations. A very small sutural saddle is just half-way above the umbilical suture.

The dimensions of the only existing specimen are as follows:—

Diameter of the shell	. . . . .	81 mm.
„ of the umbilicus	. . . . .	31 „
Height of the last volution from the umbilical suture	. . . . .	29 „
„ „ „ „ from the preceding whorl	. . . . .	? 22 „
Thickness of the last volution	. . . . .	27 „

The last half of the last volution belongs to the body-chamber; it is, however, evident that this part of the shell is not complete, as no trace of an apertural margin is distinguishable.

Locality and Geological Position.—The specimen, which represents only one-half of the entire shell, was collected in the Ceratite Sandstone of Virgal at the limit between the middle and upper divisions of that group.

Remarks.—The species thus described as *Acrochord. atavum*, W., is remarkable in several respects. To all appearance it is the most ancient species of the genus that has been found up to the present; and just on account of this circumstance it is highly interesting to state that it forms the root of two different series of forms that are more richly developed in more recent strata.

In the description I have stated that the shell exhibits at different stages of growth different types of sculpture. On the inner volutions, probably, up to the commencement of the body-chamber, which latter part only is preserved in our specimen, the sculpture is that of a typical *Acrochordiceras*, consisting of tuberculated lateral folds and more numerous rounded ribs, crossing over the external part. This sculpture is now further developed in the species, that appear in a later period, at the age of the Muschelkalk, in very different parts of the globe, also in the Salt-Range, and which forms constitute what is generally styled *Acrochordiceras*. Later on, however, the sculpture of the species under consideration changes entirely. The whorl becomes quite smooth, and only at certain distances the lateral tubercles remain, which have originally ornamented the lateral folds. This sculpture is also more strongly developed in other forms that appear later on, at the age of the Upper Ceratite limestone, in the Salt-Range. The entire configuration of these shells however, appeared to me sufficiently deviating to consider them as constituting a proper genus for themselves, for which I shall introduce the name of *Stephanites*. Thus *Acrochord. atavum* appears to be the starting-point of two different series of development of *Acrochordiceras* proper on the one hand, and *Stephanites* on the other.

Besides these developmental connections existing between the present species and other forms, the sutural line of *Acr. atavum* also deserves some notice. It is true there is nothing of this sutural line exactly known except the second lateral lobe, or perhaps auxiliary lobe as it also may be styled. But this is just the most interesting part. This broadly rounded, not denticulated, but entirely goniatic lobe, is just divided in two by the line of involution of the preceding whorl. This lobe is thus here neither a true lateral nor a true auxiliary lobe. Mojsisovics states the same character in the species of *Acrochordiceras* occurring in the Alpine Muschelkalk, only that the lobes in their entire development are more thoroughly Ceratitic. The case is different with *Acrochord. damesi*, which, according to Nöetling's drawing, exhibits the same position of the second lobe, like the other species of *Acrochordiceras*, up to a very short distance before the commencement of the body-chamber; but in the last few sutural lines a true second lateral lobe, as well as a small auxiliary lobe, are developed.

Specifically, the present species is easily distinguishable from all the species of *Acrochordiceras* hitherto described.

2. *ACROCHORDICERAS DIMIDIATUM*, Waagen, n. sp., Pl. III, fig. 3 a. b.

This species is known to me only in a fragmentary condition, being thus merely represented by a portion of a body-chamber. In this specimen the external part is not regularly rounded, but is slightly keeled, though, to all appearance, this character is only brought about by a lateral compression which the specimen has undergone in the process of fossilisation.

The general shape of the species is thickly disciform, with rather thick rounded whorls, and a tolerably wide umbilicus. The transverse section of the whorls is very little broader than it is high. The lateral parts are not very strongly protruding, their strongest elevation being situated a little below the middle of the height of the whorls. From there they bend down in a well expressed curve to the umbilical suture, without forming a distinct umbilical wall or edge. The external part shows an ogival curve, with an indistinct keel in the middle. As I, however, consider this only an accidental feature, it seems probable that originally the external part was broadly rounded without any trace of a keel.

The sculpture of the shell is very characteristic. Not far above the umbilical suture originate strong radial ribs, which lean slightly forward and become highly elevated on the middle of the sides, forming there a kind of not very prominent, elongated tubercle. Of such tubercles there may have been about fourteen or fifteen on one volution. They are not all of the same strength; after several of the stronger sort, a weaker one is intercalated. Outside of the tubercles each of these radial ribs is divided in two broadly rounded low folds, which pass uninterruptedly over the external part of the shell. At certain intervals a third fold is intercalated between the other ones.

The characteristic feature of the sculpture of this shell in comparison with other species of the genus *Acrochordiceras* consists in the circumstance, to which also the name alludes, that the lateral tubercles, which are in connection with the radial ribs,

are placed nearly strictly in the middle of the summit of the whorl, whilst in all the other species, with the sole exception of *Acr. atavum*, they are placed nearer the umbilical suture. The sculpture just described is not, like that in *Acrochord. atavum*, restricted to the inner volutions and the commencement of the body-chamber, but covers to all appearances the entire shell up to its mouth.

The sutural line cannot be observed in the specimen here described.

The measurements of the specimen as far as they can be taken appear to be as follows:—

Diameter of the shell	.	.	.	.	.	.	.	.	.	78 mm.
" of the umbilicus	.	.	.	.	.	.	.	.	.	26 "
Height of the last volution from the umbilical suture	.	.	.	.	.	.	.	.	.	30 "
" " " " from the preceding whorl	.	.	.	.	.	.	.	.	.	? 23 "
Thickness of the last volution	.	.	.	.	.	.	.	.	.	31 "

Locality and Geological Position.—The specimen was collected in the Upper Ceratite limestone at Siranki-Dok.

Remarks.—The present species appears by the characters of its sculpture to be rather closely related to *Acrochordiceras atavum*, *W.*, described before, and chiefly to that state of the species that is represented by the inner volutions up to the commencement of the body-chamber. This sculpture is chiefly remarkable for the circumstance that the lateral thorns, which are so very characteristic of the genus, are but feebly developed in the two mentioned species, and appear rather as elongated swellings of the radial ribs, than as individualised thorns. On account of this circumstance it appears to me not improbable that the two forms might be in a developmental connection, though in that case it appears strange that in *Acr. atavum* the last part of the body-chamber should become smooth, whilst in the geologically more recent *Acr. dimidiatum* not a trace of this character appears. As a general rule, one would expect to find just this character more strongly developed in the more recent species, a fact that in reality takes place in the genus *Stephanites* to be next described. I cannot tell how it now comes about that just within the genus *Acrochordiceras* a certain degree of a retrograde development seems to take place, so that in the present species the sculpture again extends apparently up to the end of the body-chamber. The present species can easily be distinguished from *Acr. atavum*, by the more regular sculpture and from the forms belonging to the group of *Acr. damesi* by the elongated, and not very strongly developed lateral tubercles.

b. Group of ACROCHORDICERAS DAMESEI, Nöetl.

3. ACROCHORDICERAS DISTRACTUM, Waagen, n. sp., Pl. III, fig. 4, a. b. c.

This is a somewhat fragmentary specimen, of which however the greater part is preserved, and it seems to consist of the body-chamber.

The general shape of the specimen is very strongly inflated, with a comparatively narrow and very deep umbilicus and very thick whorls. The transverse section of the whorls is approximately transversely rhomboidal, with very strongly projecting lateral parts, to which character the name alludes; although it appears, however, very different, according as it is taken on the lateral tubercles or

between them. In the latter case it is transversely oval and not very much broader than it is high. The lateral parts are then broadly rounded, bending with a gentle curve down to the umbilical suture, without forming an umbilical edge or distinct umbilical wall. The preceding whorl is, however, met at nearly a right angle, and in this respect the representation in fig. 4 c. is not quite correct. The external part is broadly rounded, and rather depressed, and joins the lateral part without any distinct demarcation.

The sculpture of the shell is extremely strong and prominent. Somewhat below the middle of the lateral parts there are thick rounded tubercles or thorns, which change the whole transverse section of the whorls to a rhomboid. Of these tubercles there may have been about eight on one volution. There are barely any ribs discernible which would extend from them down to the umbilical suture, but, on the other hand, there originate from each of them two broad low rounded folds, which extend right across the external part down to the corresponding tubercle on the other side of the whorl. Between these folds that are in connection with the tubercles, other single free ones are intercalated.

The sculpture just described seems however not to extend to the innermost volutions, as the latter, up to a diameter of the shell of about 15 mm., seems to have been quite smooth. I am, however, not quite sure on that point, as these inner volutions are rather badly preserved, and it cannot be decided whether the suture on these parts has not perhaps been destroyed by weathering.

No traces of sutural lines are any where visible, the last volution of the specimen is excellently preserved and altogether an internal cast, on which only in the vicinity of the umbilical suture some remnants of the shell have been preserved, thus leading to the belief that the last volution belongs entirely to the body-chamber. That no traces of the sutural lines can be seen on the inner volutions may be due to their bad preservation. Thus I am unable to say anything about the character of the sutural lines of this species.

The measurements of the specimen are as follows :—

Diameter of the shell	.	.	.	.	.	.	.	.	.	53 mm.
„ of the umbilicus	.	.	.	.	.	.	.	.	.	16 „
Height of the last volution from the umbilical suture	.	.	.	.	.	.	.	.	.	23.5 „
„ „ „ „ from the preceding whorl	.	.	.	.	.	.	.	.	.	18 „
Thickness of the last volution on the tubercles	.	.	.	.	.	.	.	.	.	34 „
„ „ „ „ between the tubercles	.	.	.	.	.	.	.	.	.	28 „

It has been stated above that this is an internal cast without any traces of the shell on the tubercles or elsewhere.

Locality and Geological Position.—The only well preserved specimen was found by me at Siranki-Dok in the Upper Ceratite limestone. Some other poor fragments, that might also belong to the present species, come from the same bed and locality.

Remarks.—The present species belongs, according to the general configuration of the shell, to that group of forms which includes those species on which the genus *Acrochordiceras* has been founded. The most striking character of these forms, in contrast with those that have been described by me before, consists in the lateral thorns which are not elongated and are situated not quite in the middle of the sides,

but are more approximated to the umbilical suture. With regard to these characters, the present species resembles *Acrochord. hyatti*, Meek, as well as *Acrochord. damesi*, Nöetl. From the former species the present one may be distinguished, as far as can be judged from the very unsatisfactory drawings, by the tubercles that are yet more closely approached by the umbilical suture and by the ribs that cross over the external part, which are much more numerous in the American shell than in the Indian one. Similar characters distinguish it also from *Acrochordiceras damesi*, Nöetl.;—only that in our species there start very regularly from each lateral tubercle two external folds, and there is only a single intermediate one between two pairs, whilst in the European species there are always three folds starting from each tubercle, and the intermediate ones are distributed very irregularly: often there are none at all and sometimes there are two.

Thus, the present species seems to be well distinguishable from those described in other countries.

4. *ACROCHORDICERAS CORONATUM*, Waagen, n. sp., Pl. III, fig. 5 *a. b. c.*

This form is represented in the Salt-Range collection by only a rather small fragment which is so very characteristic that most certainly a proper species is represented by it; and thus I do not hesitate to give a proper name to it.

The general form of the entire shell must have been very thickly disciform, with a deep and wide umbilicus, in which quite a number of whorls must have been visible. As, however, only a fragment of one whorl exists, nothing definite can be said of the general form of this shell.

The transverse section of the whorl is on the whole transversely oval, and considerably broader than it is high. The lateral parts of the shell are rather narrowly rounded, descending to the umbilical suture in a steep declivity, but not forming a vertical wall or umbilical edge. The external part is broadly rounded, somewhat depressed, and not distinctly marked off from the lateral parts. The impression left by the preceding whorl is broad, not much protruding and flatly arched.

The sculpture consists of very strong lateral tubercles, which are rather closely set, and of which there may have been about twelve on one volution. From these tubercles descend very slight, barely perceptible, undulations, replacing the radial ribs of other species, in the direction of the umbilical suture, without, however, reaching the latter. The tubercles are placed not entirely in the middle of the sides, but shifted somewhat downward in the direction of the umbilical suture. This position of the tubercles is not well represented in the lateral view, fig. 5b, whilst it is better visible in the view of the external part (5a) or in the transverse section (5c). Towards the external side of the shell each of the tubercles is in connection with three narrow, rather sharp ribs, which cross without interruption from one side to the other, uniting on the other side again with the corresponding tubercle. Between the succeeding groups of three ribs there is mostly a single free rib intercalated.

The fragment collected is evidently part of a body-chamber, as no trace of the sutural lines can be detected. Of the shell-substance only small fragments remain. On most places, chiefly on the thorns, all traces of the shell have disappeared.

The measurements of the specimen are as follows:—

Diameter of the shell (may have been about)	. . . . .	55 mm.
" of the umbilicus (may have been about)	. . . . .	23 "
Height of the last volution from the umbilical suture	. . . . .	14 "
" " " " from the preceding whorl	. . . . .	12 "
Thickness of the last volution between the lateral thorns	. . . . .	12 "
" " " " " on the lateral thorns	. . . . .	15 "

Locality and Geological Position.—The specimen was found by Mr. Wynne on the road between Swas and Budikheyl. The bed from which it came is not exactly known, but according to the characters of the rocks in which it was preserved, it appears most probable that it was originally included in the Upper Ceratite limestone.

Remarks.—The present species is easily distinguished from all the forms that have up to this been attributed to the genus. The strongly depressed transverse section of the whorls, the narrow lateral parts and the small involution are characters that have been observed in no other species and make the distinction of the present one very easy. Only the characters of the ribbing are similar to those occurring in *Acrochordiceras damesi*, and from these it is evident that the present form belongs to the same group, in which also this European species must be counted.

5. *ACROCHORDICERAS* cf. *DAMESI*, Nöetl., Pl. IV, fig. 5 a. b.

1880. *Ammonites (Acrochordiceras) damesi*:—Nöetling: Die Entwicklung der Trias in Niederschlesien: Zeitsch d. Deutsch. Geolog. Ges., Vol. XXXII, 1880, p. 334, Pl. XV., fig. 1, 1a, 1b.

1882. *Acrochordiceras damesi*:—(Nöetl.) Mojsisovics: Die Cephalopoden der Mediterranen Trias-Provinz: Abh. K. K. Geolog. Reichsanst., Vol. X, p. 140. Footnote.

It is very much to be regretted that the form that I introduce under the above name is represented in the Salt-Range collection by only such a very small fragment that it seems impossible to decide with certainty whether this Indian shell can be considered as really identical with the European species. To all appearance, however, it is identical.

The fragment comes from a much smaller specimen than the original of Dr. Nöetling, and as the innermost volutions of Nöetling's specimen have been destroyed, a comparison becomes so much more difficult. Another drawback in regard to a comparison with the European specimen consists in the circumstance that this has undergone a very strong compression and deformation, and that the original shape of the transverse section of the whorls is not quite certain.

On the whole, it seems not improbable that the inner volutions of *Acrochord. damesi* may have been of the shape exhibited by the Indian fragment.

The fragment consists of part of one volution, on which only traces of the shell are preserved. There is no sutural line visible on it. The transverse section is compressedly oval, and considerably higher than it is broad. The involution of the shell has been pretty considerable, as the preceding whorl causes a rather deep indentation. The lateral parts are flatly arched and descend in a flat curve to the umbilical suture. The external part is broadly vaulted and rather highly projecting; it unites with the lateral parts without proper demarcation.

The sculpture consists of strong lateral thorns, which are shifted very far towards the umbilical suture, their distance from that part being just one-third of the

entire height of the whorl. There are hardly any traces of ribs extending from them down to the umbilical suture. Towards the external part of the shell there start from each of these thorns three broad rounded ribs, which cross without interruption over the external part to the corresponding thorn on the other side. Between these groups of three ribs there is sometimes a single rib intercalated, which is not connected with any thorn.

In all these characters the Indian fragment is well in accordance with the figure of *Acrochordiceras damesi*, as drawn by Nöetling; only that the transverse section is somewhat doubtful. It must, however, be remarked that in this respect Nöetling's figure seems to be not quite correct. In the lateral view the innermost lateral thorn that is yet preserved shows a position just one-third of the entire height of the volution distant from the umbilical suture, a position that is absolutely in accordance with that observed in the Indian fragment. The distance of the horn in Nöetling's drawing is in the lateral view 16^{mm}. from the peripheral outline. In the front view on the same plate, however, it is only 13^{mm}., and thus it is evident that here the curve of the external part is represented much too flat. Thus, the external part must also in the German specimen be much more strongly protruding, and in this respect be more in accordance with the Indian fragment than appears to be the case from the drawing. Thus I come to the conclusion that most probably the Indian fragment is identifiable with Nöetling's species.

The measurements of the Indian specimen are as follows:—

Diameter of the shell (may have been about)	. . . . .	40 mm.
" " umbilicus (may have been about)	. . . . .	10 "
Height of the last volution from the umbilical suture	. . . . .	16 "
" " " " " from the preceding whorl	. . . . .	11 "
Thickness of the last volution between the lateral thorns	. . . . .	14 "
" " " " " on the lateral thorns	. . . . .	17 "

Locality and Geological Position.—The fragment was collected by me at Siranki-Dok in the Upper Ceratite limestone.

Remarks.—*Acrochordiceras damesi* has recently been figured by Hauer, also from the Mediterranean Muschelkalk of Han Bulog, near Serajevo. It appears, however, doubtful whether the figured specimen really belongs to Nöetling's species. The tubercles seem to be more closely approached to the umbilical suture than is the case in the genuine form. The identification of the present specimen, with a species from the European Muschelkalk, though not above every doubt, is of very great importance. Among all the lot of *Cephalopoda* that I have had occasion to describe up to the present, this is the only one that could be brought in close connection with a European form; and it is very remarkable that it is no alpine species with which it can be identified, but one from the Central European Muschelkalk. An affinity of the Salt-Range triassic deposits to those of Central Europe is also indicated by the exclusive development of *ceratitic* forms of *Ammonites* and the complete absence of the genus *Ptychites* in both these geographical regions.

c. ISOLATED SPECIES.

6. *ACROCHORDICERAS COMPRESSUM*, Waagen, n. sp., Pl. IV, fig. 4a. b. c.

The materials of this species also are very fragmentary, and had the fragment I

shall describe belonged to a genus of less importance, I would have passed it over in silence. But the genus *Acrochordiceras* is of such geological value and its species are so rare, whilst at the same time each fragment of the shell belonging to this genus is so very characteristic in its configuration that the geological importance of these forms, and the facility with which species can be characterised even from small fragments of the shell, have led me to describe incomplete specimens also as proper species.

The present specimen consists of half a volution, all internal cast, without a trace of the shell. It represents the first half of the body-chamber of a specimen of rather moderate dimensions.

The general shape of the shell must have been rather flatly disciform with compressed whorls, a rounded external side and a small umbilicus.

The transverse section of the whorls is compressedly oval and very much higher than it is broad. The indentation for the reception of the preceding whorl is somewhat less than one-third of the entire height of the whorl. The lateral parts of the shell are very flatly curved but descend rather abruptly to the umbilical suture, without, however, forming an umbilical edge or a distinctly umbilical wall. The external part is rather narrowly rounded, highly protruding and uniting with the lateral parts without proper demarcation.

The sculpture of the shell is not very strongly marked, and in this respect deviates considerably from the rest of the genus. It consists of low lateral tubercles which are situated nearer the umbilical suture than the peripheral part. Their distance from the umbilical suture is about two-fifths of the entire height of the volution. No ribs extend from those tubercles to the umbilical suture, but in the direction of the peripheral part there proceed two low, often barely, perceptible folds towards the external part of the shell, crossing uninterruptedly over that part, and uniting on the other side with the corresponding tubercles. Sometimes a single rib appears to be intercalated between these pairs, in no way connected with any tubercle.

Of the last septum, some traces can be observed on the proximal end of the fragment, showing that the fragment represents part of the body-chamber. These traces, however, are not sufficient to follow the sutural line and to describe its details.

The measurements of the specimen are as follows:—

Diameter of the shell	. . . . .	31 mm.
„ of the umbilicus	. . . . .	7 „
Height of the last volution from the umbilical suture	. . . . .	14 „
„ „ „ „ from the preceding whorl	. . . . .	10 „
Thickness of the last volution between the lateral tubercles	. . . . .	9.5 „
„ „ „ „ on the lateral tubercles	. . . . .	11 „

Locality and Geological Position.—The specimen was found by me at Chidroo in the topmost beds of the Upper Ceratite Limestones, just at the base of the Bivalve Limestones.

Remarks.—By the compressed shape of its whorls this species deviates from the remainder of the species belonging to the genus. I have therefore considered it as an isolated form, though in the general character of its sculpture it reminds one

somewhat of the group of *Acrochordiceras damesi*, Nöetl., but this sculpture is so very weak in this species, that in some parts it becomes barely perceptible, I have on these grounds separated it from the rest. On the whole, this species is an easily distinguishable form.

Genus: STEPHANITES, Waagen, n. gen.

As stated already in the description of *Acrochordiceras atavum*, W., this species most probably is the starting-point of a new genus of ammonoid shells, for which I introduce the name of *Stephanites*. The genus is, beyond doubt, closely related to *Acrochordiceras*, and it is chiefly only the different mode of sculpture which distinguishes it from Hyatt's genus.

The shells belonging to this genus are very strongly inflated with only few whorls. On the lateral parts there are very strong tubercles or thorns which are in no connection with any ribs. Otherwise, the shell is entirely smooth. The external part is smooth and broadly rounded. The body-chamber occupies in its length somewhat more than one volution, for, though it is not preserved in any of the specimens at my disposal up to its very mouth, it exhibits there already one volution in length. The shape of the aperture is not known to me.

The development of the sutural line is very different in the two species that I attribute to the genus. In one the second lateral lobe is very distinctly above the line of involution of the preceding whorl, and can thus unhesitatingly be styled a true lateral lobe; in the other, on the contrary, this lobe is distinctly below the line of involution, and can thus only be considered as an auxiliary lobe. It is very remarkable that both these species are out of the same bed, though from different localities.

The characters of the sutural line existing in this genus are only indicated by the peculiarity that the saddles are always broadly rounded and entire, and that the lobes are but little denticulated at the bottom, and that one large lateral lobe is always present. Thus, the sutural line appears absolutely ceratitic in its development.

Adverting to all that has been said on the subject, we find that the chief characters of the genus consist in a ceratitic development of the sutural line, in the existence of a body-chamber that exceeds one volution in length, and in the sculpture, that is composed solely of, sometimes enormous, lateral thorns without any other ornamentation.

In general appearance the present genus reminds one very strongly of the genus *Aspidoceras*, Zittel, of the upper jurassic rocks; so much so that, if the sutural line and the length of the body-chamber were not known in the Salt-Range specimens, it would be impossible to distinguish them from Zittel's genus.

The real affinity, however, of the genus points to *Acrochordiceras*, Hyatt, with which genus our *Stephanites* stands most probably in a developmental connection. The geologically oldest species of the genus *Acrochordiceras*, which, according to my view, must be placed at the limit between middle and upper Bunt-Sandstein, and which I have introduced above under the name of *Acr. atavum*, W., shows in so far mixed characters, since the second lateral lobe also indicates the position of an

auxiliary lobe, and is in its shape very low (goniatitic) in development, while the shell becomes smooth, with single lateral knobs, towards the mouth. Both these characters have changed in the same sense in *Stephanites*. The second lobe has become ceratitic and is in its position sometimes above the line of involution, a true second lateral lobe; and the smoothness of the shell, with its lateral knobs, has extended to the inner volutions, and the ribs on the external part, which existed on the inner volutions of *Acr. atavum*, have disappeared entirely. These changes seem to me sufficiently important to distinguish the shells on which they have been observed as a proper genus.

The genus *Stephanites* is represented in the Salt-Range collection by two species, which I shall call—

Stephanites superbis, W., and

Stephanites corona, W.

Both were collected by me in the Upper Ceratite Limestone.

1. *STEPHANITES SUPERBUS*, Waagen, n. gen. et sp., Pl. II, figs. a. b. c.

A beautifully preserved specimen serves for description. It consists of an internal cast on which no trace of the shell remains. The last half of the last volution belongs to the body-chamber, the remainder is covered by sutural lines, which are, however, for the greater part rather indistinct, the siphonal lobe in particular is nowhere traceable.

The general shape of the species is very thickly disciform with a rather narrow umbilicus and very inflated whorls. The umbilicus is very deep and funnel-shaped.

The transverse section of the whorls is somewhat rhomboidal, with two upper longer and two lower shorter sides. The lateral parts are very narrowly rounded, and strongly elevated in the middle. Towards the umbilicus they pass into a sloping plane, which to a certain extent forms a sloping umbilical wall, which is, however, not limited off from the lateral parts by an umbilical edge.

The external part is very broadly rounded, and not very strongly protruding. It unites with the lateral parts without any proper demarcation.

The sculpture consists of enormous lateral tubercles, which are quite rounded and very prominent on the greater part of the shell, but which become elongated, and less strongly elevated on the distal end of the body-chamber. There are ten to twelve of such tubercles on one volution. These tubercles are in no connection with any ribs, and on all other parts the shell is perfectly smooth. The external part of the shell chiefly is perfectly smooth without the slightest undulations or any indications of transverse folds. The distribution of the tubercles is very regular and only in a single instance, on the fourth tubercle from the commencement of the body-chamber, is there so far an irregularity, as this tubercle is divided into two, of which the proximal is lower, and the distal higher. The situation of the tubercles is not exactly on the middle of the lateral parts, being shifted somewhat downwards in the direction of the umbilical suture. This applies, however, chiefly to the body-chamber, where the external part is more strongly protruding than on the chambered parts. On the latter parts, the external side of the shell is less strongly prominent and the tubercles are found approximately on the middle of the lateral parts.

The sutural lines are fairly visible on the specimen that serves for description, only that the external or siphonal lobe is nowhere distinctly traceable. The most striking character of this sutural line is the external saddle, which is entire, broadly rounded and reaching up ever so much higher than all the rest of the sutural line. It is followed by a broad and rather deep first lateral lobe. The lateral walls of it are nearly parallel and entire. At the bottom this lobe is provided with some seven dentations, of which the middle ones are strong and well expressed. This lobe is situated entirely outside the lateral tubercles. The lateral saddle is very broad and much shorter than the external one. It is entire, broadly rounded with diverging sides, and situated just beneath the lateral tubercles. The second lateral lobe is again entirely above the involution of the preceding whorl, which passes a short distance inside the lateral tubercles. It is much shorter and narrower than the first lateral lobe, has got entire, converging sides, and on its bottom some five well expressed denticulations. It is followed towards the umbilicus by a broadly rounded and entire saddle, which is again shorter than the lateral one. The sutural line reaches with this the umbilical suture, without forming a distinct auxiliary lobe.

The measurements of the specimen are as follows :—

Diameter of the shell	133 mm.
„ of the umbilicus at the umbilical suture	46 „
Height of the last volution from the umbilical suture	55 „
„ „ „ „ from the preceding whorl	45 „
Thickness of the last volution on the lateral thorns	74 „
„ „ „ „ between the lateral thorns	62 „

Locality and Geological Position.—The specimen that has served for description was collected by me at Chidroo in the Upper Ceratite limestones.

Remarks.—The present species can only be compared to some jurassic forms belonging to the genus *Aspidoceras*, and there has not been, so far as I am aware, any triassic species described up to the present which would bear any similarity to our *Stephanites superbus*.

Among the species of *Aspidoceras*, it is chiefly *Aspidoceras ponderosum* described by me from the jurassic deposits of Kachh which bears a general resemblance, but this resemblance is only a distant one, and on a closer examination one would easily see that the inner volutions of the jurassic form have got two rows of tubercles which, not to speak of the essential differences of the sutural lines, is in itself a sufficiently distinctive character.

Among the triassic species the present one can only be compared to the shells belonging to the genus *Acrochordiceras*, and among these again chiefly to *Acrochord. atavum*, W. As has been pointed out in the description of that species, there is only the last part of the body-chamber which has no other sculpture except the lateral spines, but the transverse section of this part is so entirely different from that of *Steph. superbus* that nobody is likely to mistake one form for the other.

2. STEPHANITES CORONA, Waagen, n. gen. et sp., Pl. III, fig. 1, a. b.

The specimen for which I introduce the above name consists of an internal cast of the body-chamber of a moderately-sized individual. The last sutural line is

only partly visible. The inner volutions have all been destroyed. The specimen has suffered slightly from compression, so that it appears more strongly involute towards the mouth than it is in reality.

The general shape of the species is thickly disciform, with inflated whorls and a not very wide, moderately deep funnel-shaped umbilicus.

The transverse section of the whorls is irregularly circular, about as broad as it is high. The lateral parts of the shell are flatly and very regularly vaulted, bending down to the umbilical suture in a very regular curve, without forming either a distinct umbilical wall or umbilical edge. The external part is rather strongly prominent, broadly vaulted and uniting with the lateral parts without any distinct demarcation.

The sculpture of the shell is very simple. It consists of thick, rounded lateral tubercles, of which there are nine to ten on one volution. They are in no connection with any ribs, and therefore all the remainder of the shell appears perfectly smooth. These tubercles are situated at a distance of about one-third of the entire height of the volution from the umbilical suture. There is not, as in the preceding species, a change of form of these tubercles towards the mouth of the shell but all are of the same description, a character that may, however, have also been brought about by the circumstance that the present shell is probably not full-grown.

Of the sutural line (the last one before the commencement of the body-chamber) but very little can be seen on the specimen; just the lobes, properly speaking, are covered up by the end of the succeeding volution, and only the saddles are well visible.

The shape of the external lobe cannot be made out at all. The external saddle is broadly rounded, entire and not very deep, reaching the least high of all the saddles. The first lateral lobe is rather broad at its commencement, its sides converging towards the bottom. Whether it is denticulated there or not cannot be observed, but most probably it is. The lateral saddle is not very broad, but well-rounded, entire and reaching somewhat higher up than the external one. The lobe next following towards the umbilicus is distinctly below the line of involution of the preceding whorl, and cannot thus be styled a second lateral lobe, but may be counted as an auxiliary one. It is not much narrower than the lateral lobe, and has got at its commencement nearly parallel sides. It cannot be said how long it has been or whether there were denticulations at its bottom, as just this part has been destroyed. After this lobe there follows again a saddle, of which, however, only one-half is above the umbilical suture. This saddle is entire and well-rounded, reaching somewhat higher up than the lateral saddle.

The dimensions of the specimen are as follows:—

Diameter of the shell	.	.	.	.	.	.	.	.	.	76 mm.
" " umbilicus	.	.	.	.	.	.	.	.	.	P 23 "
Height of the last volution from the umbilical suture	.	.	.	.	.	.	.	.	.	? 32 "
" " " " from the preceding whorl	.	.	.	.	.	.	.	.	.	25 "
Thickness of the last volution on the lateral tubercles	.	.	.	.	.	.	.	.	.	33 "
" " " " between the lateral tubercles	.	.	.	.	.	.	.	.	.	30 "

The dimensions preceded by a query are somewhat uncertain on account of a slight deformation the specimen has undergone in the process of fossilization.

Locality and Geological Position.—The only specimen of this species was found by me in the Upper Ceratite Limestone at Siranki-Dok.

Remarks.—The present species is rather closely related to the preceding one, but there are some characters which, according to my view, make it necessary to separate the two forms. There is first of all the transverse section of the whorls, which is nearly circular and about as high as it is broad. In *Steph. superbus*, on the contrary, the breadth is far more considerable than the height, and this character is still more strongly developed on the inner than on the outer volutions. The entire shape of the transverse section of the whorls is also in both species entirely different.

A second character on which great stress must be laid, consists in the development of the sutural line. In *Steph. corona* the external saddle is the shortest; in *Steph. superbus* it is the longest. In the latter species a second lateral lobe is distinctly developed; in the former species, on the contrary, the same lobe is yet in the position of an auxiliary lobe: the sutural saddle is entirely above the umbilical suture in *Steph. superbus*, whilst only one-half of it is visible in *Steph. corona*, etc.

Thus, I think, I am perfectly justified in considering the present species as well distinguishable from the preceding one.

Genus SIBIRITES, Mojsisovics.

This genus was introduced in the year 1886 by Mojsisovics in his memoir on the "Arctic triassic faunas" and published in the "*Mémoires de l'Académie Impériale des Sciences de St. Pétersbourg*, VIIe série, Tome, XXXIII, No. 6.

The description given by Mojsisovics runs as follows:—"Shell small, consisting of moderately involving volutions. The type, *Sibir. pretiosus*, shows clearly that the genus possessed a long body-chamber that occupied the whole of the last volution. The sculpture of the shell consists of numerous, strong, straight lateral ribs, which are mostly divided in two on the external margin. The divided ribs, which are considerably narrower and weaker than the lateral ones, cross over the external part of the shell. In the geologically older species they form an angle that is directed with its apex towards the front: in the geologically younger forms out of the Hallstadt limestones, on the contrary, they pass straight from one side to the other. In some geologically younger species, which then in their general appearance, have much similarity to *Cæloceras pettos*, there are thorns or tubercles at the points of division of the ribs." "The sutural line is very simple with entire saddles and two slightly denticulated lateral lobes. Auxiliary lobes are absent though the whorls are not evolute."

To this diagnosis I have but little to add according to the materials from the Salt-Range. Before all it must be stated that Mojsisovics' observation as to the angular ribs on the external part of the geologically older forms of the genus holds good also for most of the Salt-Range species, and only few of them deviate from this rule.

The body-chamber is very long, and in several species the sutural line cannot be observed, because the last of these is covered up by the end of the body-chamber

In most of the Salt-Range species the last half of the body chamber becomes quite smooth and every kind of sculpture disappears. There are, however, also others in which the body-chamber is sculptured. In most respects the sculpture of the Salt-Range species resemble the genus *Ægoceras* of the Lias of Europe, and chiefly *Æg. capricornum* or *Ægoplanicosta*. In this respect there exists a certain difference between the majority of the species of *Sibirites* occurring in India and in Siberia. In the latter country their general appearance is more in accordance with the genus *Schlotheimia*, and in India there is only a single species which shows similar characters.

Another character that must be mentioned as peculiar in the Indian shells is in regard to the sutural line. Mojsisovics says that there are always two lateral lobes present, but this is not the case with all the Indian species. In some of the species the second lobe is not entirely above the line of involution of the preceding whorl, so that this lobe is just cut in two by the line mentioned. Thus, it cannot be styled either a true auxiliary, or yet a true lateral lobe. A circumstance that also must be mentioned consists in the peculiarity that in many of the Indian species the sutural line appears entirely *goniatitic*, whilst in others again it is perfectly *ceratitic*. Keyserling, who was considered a very acute observer, has remarked in describing his *Ceratites eichwaldi*, that in this species the denticulations of the lobes were so strongly fugitive that they became very easily obliterated. It is not improbable that in those Indian specimens that exhibit *goniatitic* sutural lines, if better preserved, denticulations of the lobes would also appear. Just this fugitive condition of the denticulations indicates, however, as well a state of transition between the *goniatitic* and the *ammonitic* development, as the position of the second lateral lobe above or below the line of involution of the preceding whorl.

In no Indian form are true auxiliary lobes developed, and this is again quite in accordance with Mojsisovics' indications.

It is very remarkable that the Indian species of *Sibirites* are all restricted to the same geological division, though within this the single species may hold peculiar positions, as some forms have been found by me more numerous in the upper, and others again chiefly in the lower part of the division; but as yet my observations have been too limited in this direction to make any positive indications. Thus, I am only able to assert to a certainty that all the species of *Sibirites* that have come to my notice in the Salt-Range are from the Upper Ceratite Limestone.

The number of species that are here heaped together in this single division is very remarkable, and I am able to describe not less than eleven distinct ones. These can be very conveniently divided in two large groups or sections, which, however, are not fundamentally different from each other, as there exist transitional forms in several directions. The forms that belong to the first section have a sculpture in which the ribs that pass over the external side are more or less strongly bent forward, where they form either a curve towards the front, or else they bend so strongly as to appear more or less angular, and then often as furrows in the middle. These latter forms show then some similarity to the genus *Schlotheimia* of the Lias formation, and *Sibir. eichwaldi*, Keys., sp., exhibits the most extreme develop-

ment in this direction. I shall introduce for this section the name of the "*Curvicostati*." Another section is characterised by ribs that pass straight over the external part. This latter part is mostly angular in these forms, and there are sometimes little spines or thorns developed on both external angles. This section is only little developed in the Salt-Range, and there are only three species present there. For this section I shall introduce the name of "*Rectecostati*."

Mojsisovics has already made some indications with regard to the subdivision of the genus in these two sections, but he considers the difference as depending upon the geological age of the species, so that the *Curvicostati* should be restricted to lower geological positions than the *Rectecostati*. To a certain extent his views in this respect are also confirmed by my observations in the Salt-Range, as the greatest number of species occurring there belong to the first section, and the presence there of some of the *Rectecostati* appears rather as an exception than as a rule. In Europe all the species belonging to the genus have to be counted to the *Rectecostati*, and they are all out of the Juvavian stage of the Upper Trias, as has most recently been defined by Mojsisovics.

Considering the species of *Sibirites* found in the Salt-Range from this point of view, one must say that the occurrence of some of the *Rectecostati* in the Upper Ceratite Limestone gives a rather recent aspect to the cephalopod fauna of that stage.

As regards the single species of the genus that I shall have to describe, several groups can be distinguished, all of which are very well characterised. Among the forms belonging to the first section there can be distinguished before all a group that I shall introduce under the name of *Sibirites kingianus*, W. This group is characterised by a rather broadly rounded external part, and to all appearances *goniatitic* sutural line; the body-chamber becomes smooth towards its end. To this group belong four species which I shall introduce under the respective names of, *Sib. kingianus*, W., *Sib. chidruensis*, W., *Sib. dictotomus*, W., and *Sib. inæquicostatus*, W.

A second group will bear the name of group of *Sibirites ceratitoides*, W. There are only two species that belong to this group. They are characterised by a narrowly rounded external part, and ribs that are but very little curved, and distinctly *ceratitic* sutural lines. I shall call the species: *Sib. ceratitoides*, W., and *Sib. discoides*, W., respectively.

A third group that can be distinguished comprises among the Salt-Range forms only a single species. This is, however, very nearly related to *Sibir. eichwaldi*, Keys. Thus I shall call this the *Sibirites eichwaldi* group, it is characterised by an angular external part and ribs that are very strongly bent forward, forming an angle that is directed with its apex towards the front. The Salt-Range species will bear the name of *Sib. angulosus*, W.

To these three groups must at last be added an isolated species, which I shall describe under the name of *Sib. parvumbilicatus*, W. It is distinct from all the rest by its narrow umbilicus.

Among the section of the *Rectecostati* only a single group can be distinguished,

for which I shall introduce the name of group of *Sib. ibex*, W. This group is characterised by high, compressed whorls, an angular external part and a very strong sculpture. Two species can be attributed to it which will be described under the names of *Sib. ibex*, W., and *Sib. hircinus*, W. A third species, which also decidedly belongs to the section of the *Rectecostati*, cannot be brought into any closer connection with any other form. I must therefore consider it as an isolated species, and shall introduce the name of *Sib. tenuistriatus*, W., for it.

Thus we arrive at the following classification of the species of *Sibirites* :—

A.—Section CURVICOSTATI.

I. Group of *SIBIRITES KINGIANUS*, W.

1. *Sibirites kingianus*, Waagen, n. sp.
2. „ *chidruensis*, Waagen, n. sp.
3. „ *dichotomus*, Waagen, n. sp.
4. „ *inaequicostatus*, Waagen, n. sp.

II. Group of *SIBIRITES CERATITOIDES*, W.

5. *Sibirites ceratitoides*, Waagen, n. sp.
6. „ *discoides*, Waagen, n. sp.

III. Group of *SIBIRITES EICHWALDI*, Keys.

7. *Sibirites angulcsus*, Waagen, n. sp.

IV. ISOLATED SPECIES.

8. *Sibirites parvumbilicatus*, Waagen, n. sp.

B.—Section RECTECOSTATI.

V. Group of *SIBIRITES IBEX*, W.

9. *Sibirites ibex*, Waagen, n. sp.
10. „ *hircinus*, Waagen, n. sp.

VI. ISOLATED SPECIES.

11. *Sibirites tenuistriatus*, Waagen, n. sp.

Before leaving the general discussion of the present genus I must refer to the juvenile state of the forms that occur in the Salt-Range. It is a fact that is worthy of notice that in the juvenile state the angularity of the external part is of very general occurrence, so that in this condition nearly all the Salt-Range species can be compared to *Sibir. eichwaldi*. Later on, this character disappears entirely in the groups of *Sib. kingianus*, *Sib. ceratitoides*, and in the isolated species *Sib. parvumbilicatus*. From this peculiarity it would appear probable that *Sibir. eichwaldi* represents the original shape, and that the Indian species are derived forms, which have their root in the Siberian species. But then it would appear also probable that the Indian species are more recent in their geological age than *Sibir. eichwaldi*.

A.—Section CURVICOSTATI.

I. Group of SIBIRITES KINGIANUS, W.

1. SIBIRITES KINGIANUS, Waagen, n. sp., Pl. VIII, fig. 1, *a. b. c.*; fig. 2 *a. b. c.*

Several specimens of this species have been collected by myself, and thus their juvenile as well as their full-grown states have become known to me. All the specimens, however, are provided with their shells, and thus the sutural lines cannot be observed, all being transformed into one sparry mass. This peculiarity is annoying for the reason that it becomes thus impossible to observe with certainty how long the body-chamber may have been.

The general shape of the shell is rather thickly disciform, with a comparatively small and not very deep umbilicus and rounded volutions.

The transverse section of the whorls is elongately oval, and considerably higher than it is broad. The lateral parts of the shell are rather flattened but very slightly vaulted. In the direction of the umbilicus they are only slightly tapering, until a short distance before the umbilicus they suddenly bend down to form a distinct umbilical wall, which is, however, not limited off from the lateral parts by a distinct edge. The external part of the shell is not very broadly rounded, and unites with the lateral parts without any proper demarcation.

In the young shell, that is represented in fig. 2, the transverse section of the whorls is somewhat squarish, a little broader in comparison to the height than in the full-grown form. Besides this, the external part is flattened, and marked off from the lateral parts by distinct edges.

The sculpture is very different in particular stages of growth.

In the young state, as represented in fig. 2, smaller specimens not being known to me, the sculpture consists of very unequal, somewhat falciform ribs, which take their origin just above the umbilical wall. From there they extend over the lateral parts of the whorl, leaning distinctly over in the direction of the front and making a curvature somewhat like an S, bending first forward, then backward and near the external margin again forward. There may have been about eight to ten strong ribs on one volution. Between these some three or four weaker ones are intercalated, showing the same curve. Sometimes one or the other of them appears dichotomous, the point of union being a little below the middle of the lateral part. On the external part of the shell the ribs appear more equal in strength. They cross uninterruptedly over this part, bending strongly forward, forming thus distinctly an obtuse rounded-off angle, directed with its apex towards the front.

In the adult shell the sculpture becomes somewhat different. The ribs are then all of equal strength, mostly arranged in pairs, each pair uniting a short distance before reaching the umbilical wall. Their curvature is less strong than in young specimens. On the whole, however, they are always a little falciform. On the external part of the shell they are broad and rounded, somewhat more strongly developed than on the remainder of the shell, and crossing over that part all in equal strength. Their curvature towards the front is very distinct.

Towards the last part of the body-chamber the sculpture is again changed.

The ribs become then rapidly weaker, and at last the shell appears entirely smooth. None of the specimens have the mouth of the shell preserved, and I am thus unable to say what the configuration of that part may have been.

The sutural line cannot be observed on any of the specimens at my disposal.

The measurements of two specimens from the Upper Ceratite Limestone of Chidroo are as follow :—

	I.	II.
Diameter of the shell	48 mm.	19 mm.
„ of the umbilicus	14 „	5 „
Height of the last volution from the umbilical suture	20 „	8.5 „
„ „ „ „ from the preceding whorl	16 „	6.5 „
Thickness of the last volution	15 „	7 „

Locality and Geological Position.—Several specimens of this species, mostly fragments, have been collected by me. They were all found at the same locality, at Chidroo, in a section which traverses the whole Trias. The bed in which this species, together with the one following, occurs, is a system of grey nodular marls of 50 feet in thickness, in which fossils are found in great numbers in certain beds. The species of *Sibirites* are chiefly restricted to a layer that is very high up in the series, not far from the sandstones that form at this locality the base of the “*Bivalve limestones*.”

Remarks.—The full-grown shape of this species cannot be compared to any other than jurassic species, and among these the genus *Ægoceras* of the middle Lias shows most similarity, so that, if the present species had been found in liassic strata, it would have been described unhesitatingly as a form more or less nearly allied to *Æg. capricornum*, provided that, as in the specimens that served for description, the sutural lines would not have been visible.

The present species can, however, unhesitatingly be accepted as something different from *Ægoceras*, on the one hand, because it comes from beds that are beyond doubt very different in age from the Lias of Europe, and, on the other, because in the next allied forms the sutural lines can be observed, and they demonstrate that the sutural line also in this form has been most probably *goniatitic*.

Of the other forms none can be compared more closely with the present species. Only the young shell has got a certain resemblance to *Sibirites eichwaldi*, Keys, though also here a distinction is easy. The angular shape of the external part occurs, it is true, in both forms, but it is more strongly expressed in the Siberian than in the Indian species. Besides, there are the ribs in *Sib. eichwaldi*, interrupted in the middle of the external side, whilst this is not the case in *Sib. kingianus*, and thus the latter appears as a characteristic and well-distinguishable species.

2. *SIBIRITES CHIDRUENSIS*, Waagen, n. sp., Pl. VIII, fig. 3, *a. b. c.* ; fig. 4, *a. b. c.*

The present species is represented in the Salt-Range collection by several specimens, some of which are in excellent preservation. In one of the specimens it can be observed that the greatest part of the last volution belongs to the body-chamber. The young and the adult of the present species are not so much different in shape and sculpture as has been observed in the case of the preceding species.

The general shape of the shell is rather thickly disciform, with a comparatively narrow umbilicus and somewhat inflated volutions, wherewith the umbilicus appears more or less funnel-shaped.

The section of the whorls is more or less oval, the transverse diameter being a little shorter than the vertical one. The lateral parts are somewhat flattened, and only very slightly vaulted. In the direction of the umbilicus they bend down in a narrow curve to the umbilical suture, without, however, forming a very distinct umbilical wall; an umbilical edge being completely absent. The external part is broadly rounded, and unites with the lateral parts without any proper demarcation. In the young state the whorls are somewhat broader than in the adult, and here the transverse diameter of the whorls is very nearly equal to the vertical one. In the young also the external part is rounded, and not angular.

The sculpture is, on the whole, very similar to that of the preceding species, but even here the characters differ between the young and adult shells. In the young the sculpture consists of rather equal but very little bending nearly straight ribs, which are leaning very little forward. They originate at the umbilical wall and extend, mostly undivided, over the lateral parts. As they approach the external part, the majority of them are divided in two, and they then stretch uninterruptedly over the external part, describing a distinct curve towards the front.

As the individuals augment in size, the point of division of the ribs shifts more and more in the direction of the umbilicus, and in adult specimens the ribs are mostly simple up to the middle of the sides, and then divided in two. The ribs become stronger as they approach the external part and are strongest on that part. At the same time, however, inequality prevails, some of them being stronger, some less so. Towards the end of the body-chamber the ribs become weaker and weaker, and at last the shell gets quite smooth. The apertural margin has not been preserved in any of the specimens.

The sutural line is visible only on one of the smaller fragments figured in fig. 3, Pl. VIII. The external lobe is rather short, divided in the middle by a rather deep median tubercle for the passage of the siphon. The external saddle is very narrow and short, and rounded without any indentations. The first lateral lobe is excessively broad and deep, with converging sides and broadly rounded at its bottom, without the slightest denticulations as far as can be observed. The lateral saddle is again very narrow and short, not reaching higher up than the external one. The second lobe is very shallow, barely half as deep as the first lateral, with very strongly converging sides, very narrowly rounded at its bottom, and almost coming to a point. There are also in this lobe no denticulations observable. The position of this lobe is not entirely above the line of involution of the preceding whorl, and thus it cannot well be considered as a true lateral lobe. After this again there comes apparently a broad saddle, but here the sutural line becomes indistinct, and it cannot be made out with certainty whether a minute auxiliary lobe exists above the umbilical suture. The most peculiar feature of this sutural line is the enormously broad first lateral lobe, which is of an extraordinary shape, and only comparable to the lateral lobe of some *goniatites*.

The measurements of two specimens of this species from Chidroo, the one with partly preserved body-chamber, and the other consisting only of inner volutions are as follows :—

	I.	II.
Diameter of the shell	42 mm.	21 mm.
" of the umbilicus	11 "	5 "
Height of the last volution from the umbilical suture	18 "	9 "
" " " " from the preceding whorl	13 "	6 "
Thickness of the last volution	14 "	8 "

Locality and Geological Position.—This is apparently the most common species of the genus occurring in the Salt-Range. During the short time at my disposal for collecting fossils in the Upper Ceratite Limestones at Chidroo, I found two excellently preserved full-grown specimens and several fragments of smaller ones. The species evidently occurs there in great numbers. The bed in which it has been found here is the same in which the preceding species was also met with.

Remarks.—The present species is closely related to the preceding one, but it is nevertheless not difficult to distinguish the two. In our *Sib. chidruensis* the whorls are much more inflated and the umbilicus much smaller than in *Sib. kingianus*; the ribbing also is different in both species. In the former the point of division of the ribs is about the middle of the lateral parts of the shell, and the ribs themselves slightly irregular in thickness, whilst in the latter species the ribs are divided near the umbilical wall, and are very regular in the later stages of growth. A glance at the plates will show how very different the two species are in their younger stages of growth.

Among the Siberian species of *Sibirites* there are none which can be compared more nearly with the present one.

3. *SIBIRITES DICHOTOMUS*, Waagen, n. sp., Pl. VIII., fig. 5, *a. b.*; fig. 6, *a. b.*; fig. 9, *a. b. c. d.*

It is again a much rarer species that I have to describe under the above name.

The general shape of the shell is somewhat thickly disciform, with a not very wide umbilicus and slightly compressed whorls, which are but little embracing.

The transverse section of the whorls is somewhat rectangular and about one-third higher than it is broad. The lateral parts of the whorls are considerably flattened, and only slightly vaulted. Towards the umbilicus they bend suddenly down, forming a distinct but not very high umbilical wall, which is separated from the lateral parts by a not very distinct, rounded umbilical edge. The external part is also flattened to a certain extent, but very little rounded. It unites with the lateral parts in forming very obtusely rounded edges.

The sculpture is again somewhat different in particular stages of growth. In the young the radial ribs, of which the sculpture is composed and which lean distinctly forward, differ greatly in size, some being very prominent, others less so. The dichotomy of these ribs, which is so characteristic in the adult forms, is not yet well expressed, as only some of the ribs are as yet dichotomous. The whorls are low and rather thick with an oval transverse section. As the shell grows larger, a state of development represented in figure 9, the whorls become higher and more compressed, but yet exhibiting a more or less oval transverse section, as the external

part is not yet distinctly flattened. The vertical umbilical wall, however, and the umbilical edge, are well developed. At this size the sculpture exhibits the transition of the young to the adult stage. The ribs become more and more equal in strength, and the dichotomy of them is more and more regular in occurrence.

In the adult stage at last, as represented in figure 6, the ribs are nearly all of equal strength, and most of them are divided in two at the margin, where the external and lateral parts meet. There is, however, some irregularity in this respect. Some of the ribs remain single from their origin at the umbilical edge up to the external part. In other cases short ribs are intercalated, which are for the greater part restricted to the external part of the shell, and reach only a short stretch down in the lateral parts. On the external part of the shell all the ribs make a strong bend towards the front, forming a distinct curve in this direction.

On the whole, the mode of sculpture as developed on the present species is suggestive of certain *Ammonites* belonging to the genus *Perisphinctes* occurring in middle or upper jurassic strata. This similarity is however quite external; and one will easily be convinced of this by a glance at the sutural lines which are clearly visible on two of the specimens. Before, however, entering on the descriptions of the sutural lines, I must remark that the three specimens of this species that are at my disposal are entirely composed of air chambers, and it is therefore not known to me whether the sculpture of the shell may not have changed again on the body-chamber, or whether the shell becomes entirely smooth, as has been observed on other Indian species of the genus.

Wherever the sutural line can be observed, it appears to be perfectly goniatitic and nowhere are denticulations of the lobes visible. I am, however, not prepared to assert that this is the original state, and in the face of the observation made by Count Keyserling on Siberian specimens of his *Ceratites eichwaldi*, that the denticulations are very easily destroyed on these forms, as could also be the case with Indian species. If excellently preserved specimens were found, the existence of some denticulations could perhaps be traced.

I can, however, at all events describe the general features of the sutural lines as they presented themselves to my observation. The external lobe is rather broad, but not very long, and is divided in the middle by a rather strongly developed median tubercle below which the siphon passes. The external saddle is well rounded, entire and not very broad. The first lateral lobe is, however, exceedingly broad but not very deep, reaching distinctly lower down than the external one. It has converging lateral walls and is entirely rounded at its bottom, without any observable denticulations. The lateral saddle is broad, slightly broader than the external one, reaching up also a little higher. It is slightly depressed at its summit and without indentations. The second lobe is situated close above the line of involution of the preceding whorl and is thus a true second lateral lobe, and it is a little shorter than the first lateral lobe, very narrow, with converging sides and so narrowly rounded at its apex that it appears almost pointed. After this follows a flatly rounded, low and rather broad saddle that reaches down to the umbilical edge. Whether there is yet a small auxiliary lobe situated on the umbilical wall cannot be observed.

The measurements of the three figured specimens are as follows :—

	I	II	III
Diameter of the shell	36 mm.	20 mm.	13 mm.
„ of the umbilicus	10 „	6 „	4 „
Height of the last volution from the umbilical suture	15.5 „	9 „	5.5 „
„ „ „ from the preceding whorl	12 „	7 „	4 „
Thickness of the last volution	10.5 „	6 „	5 „

Locality and Geological Position.—The three specimens of this species known to me were found in the Upper Ceratite Limestone at Chidroo, together with the two species previously described under the names of *Sib. kingianus*, W., and *Sib. chidruensis* W.

Remarks.—The present species can very easily be distinguished from similar forms occurring in the same bed by the vertical wall and more or less distinct edge that surrounds the umbilicus. This character holds good for full grown and middle-sized specimens, whilst the characteristic sculpture, consisting of ribs that become dichotomous near the external margin, is well developed only in the adult shell. With regard to its thickness and to the size of the umbilicus the present species shows some variation, and the depressed shape of the external part also is not well expressed in one of the specimens. Nevertheless I think the three specimens figured can well be considered as belonging to one and the same species, that can always be distinguished from all the other forms of *Sibirites* that have been described up to the present.

Among the Siberian species there is one that can be compared more particularly with the present one, and this is *Sib. pretiosus*, Mojs. This form has also regular dichotomous ribs, but the sculpture is very much stronger and the ribs are interrupted in the middle of the external part, a character that is entirely absent in our *Sib. dichotomus*. *Sib. pretiosus* has also a much larger umbilicus.

4. *SIBIRITES INÆQUICOSTATUS*, Waagen, n. sp., Pl. VIII., fig. 7, *a. b.*; fig. 8, *a. b.*

The general form of the shell of this species is thickly disciform, with moderately compressed whorls which are rather embracing, and a not very wide umbilicus.

The transverse section of the whorls in the full-grown state is rather compressedly oval, the thickness being about as much as two-thirds of the height. The lateral parts are considerably flattened, their curvature being barely perceptible. In the direction of the umbilicus they bend gently down to the umbilical suture, without forming a vertical umbilical wall or a distinct umbilical edge. The external part is broadly rounded, not flattened, and uniting with the lateral parts without proper demarcation. The greatest transverse diameter of the whorls is situated a little below the middle of the lateral parts. In the specimens that I consider in the young state of the present species, the transverse section of the whorls is squarish, and the external part very broad and strongly depressed.

The sculpture of the shell is very characteristic, and there is in this respect not much difference between the young and the full-grown specimens. It consists of radial, somewhat falciform ribs, which are of very unequal strength. They

begin very faintly not far above the umbilical suture, bend a little towards the front, then back again, and grow slowly stronger until near the external margin; they are directed again strongly towards the front, reaching at the same time their greatest elevation on the external part of the shell, where they form a distinct curve towards the front. These ribs are apparently less numerous in the young than in the adult stage. In the young specimen represented in fig. 7, there may have been originally about 36 ribs on one volution, of which there were about 12 very strong and prominent, whilst the rest were much weaker; so that, as a rule, there were two ribs of the weaker sort intercalated between two strong ones. The same difference in the size of the ribs as in the young shell exists in the adult one. Here also there are about 12 strong ribs developed on one volution, but the intercalated weaker ribs are much more numerous, and one counts generally three to four such intercalated between two of the stronger sort. In this species also the ribs are sometimes bifid not far above the umbilical suture, but this does not occur regularly, only off and on.

The sculpture changes on the body-chamber of the adult specimens. Here the weak ribs disappear nearly entirely and the shell becomes smooth. The stronger ribs are yet preserved for a certain distance, but become much weaker, and it is probable that towards the mouth of the shell, which is not preserved in any of the specimens at my disposal, the surface of the shell will have become quite smooth.

The sutural line has not been preserved on any of the specimens, and I am thus not able to give any particulars regarding this part.

The measurements of two specimens are as follows:—

	I.	II.
Diameter of the shell	39 mm.	16 mm.
„ of the umbilicus	10 „	5 „
Height of the last volution from the umbilical suture	17 „	7 „
„ „ „ „ from the preceding whorl	13 „	5 „
Thickness of the last volution	11.5 „	6.5 „

Locality and Geological Position.—This species was also found by me in the Upper Ceratite Limestone of Chidroo, in the same bed as those previously described. Of this species adult specimens are very rare, whilst fragments of smaller ones, which I am inclined also to attribute to it, are not rare. Several such species have been collected by me, whilst of adult specimens only the figured one was found.

Remarks.—The distinctive character by which this species can easily be recognised is the inequality of its ribs, which is retained also in the adult stage.

The species that I had occasion to describe previously, possess in the young state also mostly unequal ribs; but this character is comparatively soon lost, and in the adult state the ribs are all of nearly the same strength.

The young stages of these forms can be distinguished from similarly-sized specimens of the present species by the inequality of the ribs, which is much more strongly developed in our *Sib. inæquicostatus* than in the other Salt-Range species.

To the Siberian species of *Sibirites* none can be compared more particularly than the present form.

II. Group of SIBIRITES CERATITOIDES, W.

5. SIBIRITES CERATITOIDES, Waagen, n. sp., Pl. VIII., fig. 10, *a. b. c.*

The general shape of the species is rather flatly disciform, with a tolerably small umbilicus and compressed whorls, the involution of which makes up two-sevenths of their entire height.

The transverse section of the whorls is compressedly oval, the thickness being somewhat in excess of one-half of the entire height of the whorl. The lateral parts are, however, distinctly vaulted and not flattened. In the direction of the umbilicus they bend gently down to the umbilical suture, without forming a vertical umbilical wall or a distinct umbilical edge. The external part is rather narrowly rounded, uniting with the lateral parts without proper demarcation.

The sculpture of the shell consists of numerous radial ribs, which are somewhat falciform and mostly dichotomous on or below the middle of the sides. They commence very faintly near the umbilical suture, are then bent a little backward and turn, in becoming more and more strongly expressed, again towards the front reaching thus the external part. On this latter part of the shell they are almost imperceptibly bent towards the front. The furrows between the ribs are very unequal in depth, some are deep, others again faint. The ribs are arranged mostly in pairs, each of them springing from a common root—that is to say, each taking its origin in a single rib that becomes dichotomous on or a little below the middle of the lateral parts of the shell. Some of the ribs remain, however, single for their whole extent, and these are generally a little stronger than the rest.

The sutural lines are clearly visible on the specimen described. The external lobe is rather short but tolerably broad. It is divided in the middle by a median tubercle, which is not very large. The external saddle is broad, well-rounded, entire, and reaching up much higher than the other saddles. The first lateral lobe is neither very broad, nor very deep. Its external wall is strongly sloping, the internal one nearly vertical. At the bottom this lobe is distinctly denticulated, bearing some four denticulations which are arranged in a curve. The lateral saddle is about as broad as the external one. It is also well rounded and entire, but not reaching up as high as the external one. The second lobe is very short and very broad in comparison to its length. Its sides are strongly converging, and at its bottom there are very distinct denticulations, about four in number. The situation of this lobe is distinctly above the line of involution of the preceding whorl, and it must thus be considered as a true second lateral lobe. After this comes a broad shallow saddle, that is also entire, reaching down to the umbilical suture.

The measurements of the figured specimen are as follows :—

Diameter of the shell	32 mm.
„ of the umbilicus	8 „
Height of the last volution from the umbilical suture	15 „
„ „ „ „ from the preceding whorl	12 „
Thickness of the last volution	9 „

Locality and Geological Position.—There is only a single specimen of this species preserved in the Salt-Range collection. This was found by me at Chidroo, in the upper ceratite limestone, with the species already described.

Remarks.—The form here under description deviates greatly from those species previously described. In the lateral view, the shell bears a certain similarity to some species belonging to the genus *Schlotheimia*; it chiefly reminds one of *Schlotheimia charmassei*, but in turning it round and looking on the external part it will be seen that the furrow, characteristic for the genus *Schlotheimia*, is absent, and thus the similarity is only an apparent one.

From all the species of *Sibirites* described in the foregoing pages, the present one can easily be distinguished by its more compressed shell and ribs, which are only very slightly curved towards the front on the external part. Another distinctive character is furnished by the sutural lines, which are very distinctly ceratitic, which is not the case in the other species.

Among the forms described by Mojsisovics from Siberia, there are some which on a first glance seem to be somewhat similar to our *Sib. ceratitoides*; but here also, on a comparison of the external part with the genus *Schlotheimia*, the median furrow will be found wanting, and thus all further comparison ceases.

6. *SIBIRITES DISCOIDES*, Waagen, n. sp., Pl. VIII., fig. 11, *a. b. c.*

The general shape of this species is flatly disciform, with compressed whorls, a rounded external side and a narrow, flat umbilicus, that occupies about one-fifth of the diameter of the shell. The involution is very small. The indentation caused by the penultimate whorl into the last one occupies only a little less than one-fifth of the entire height of the latter.

The transverse section of the whorls is compressedly oval with a narrowly rounded external side. The lateral parts are very flatly rounded, the greatest transverse diameter being situated a little below the middle of the height of the whorl. In the direction of the umbilicus the lateral parts bend gently down to the umbilical suture without forming a distinct umbilical wall or umbilical edge. The external part is, as mentioned above, very narrowly rounded, but yet not approaching in shape a rounded-off edge. It unites with the lateral parts without proper demarcation.

The sculpture of the shell is very simple. It consists of somewhat falciform radial folds, which are very faint on the lateral parts of the shell and become strong only on the external part, where they cause a distinct undulation of the shell. They are mostly single, and undivided, but can be distinguished only with difficulty for their greater part. On the external side they appear as broad rounded undulations which are bent very slightly towards the front.

The sutural lines can be seen tolerably well on the specimen serving for description. The external lobe is broad and very shallow, with a rather large siphonal tubercle in the middle. The sides of the lobes are strongly converging towards its bottom. The external saddle does not reach very high up, it is broadly and flatly rounded and entire, without any indentations. The first lateral lobe is not very deep and rather narrow. At its bottom it possesses about four very small and rather indistinct denticulations. Its sides are very strongly sloping. The lateral saddle is very broad, reaching up about as high as the external one. It is flatly rounded and entire. The second lateral lobe is distinctly above the line of involu-

tion of the preceding whorl. Its outer or upper wall is very strongly sloping, while its inner or lower one is not. This lobe is short and very narrow. It has denticulations at its bottom, which are, however, so indistinct that they cannot be exactly counted. After this lobe follows a low flat saddle that is also entire and reaches down to the umbilical suture. The specimen is made up entirely of air-chambers, and thus it cannot be stated how the sculpture may have changed with the commencement of the body-chamber. The more and more augmenting faintness of sculpture as the specimen grows larger renders it very probable that the body-chamber was quite smooth.

The measurements of the only existing specimen are as follows :—

Diameter of the shell	23.5 mm.
„ of the umbilicus	5 „
Height of the last volution from the umbilical suture	12 „
„ „ „ from the preceding whorl	10 „
Thickness of the last volution	7 „

Locality and Geological Position.—There is only a single fragmentary specimen of this species preserved in the Salt-Range collection, found by myself in the upper region of the Upper Ceratite Limestone at Chidroo, together with the other species of the same genus previously described by me.

Remarks.—The present species is most nearly related to the preceding one; the two can, however, easily be distinguished by their sculpture, which consists chiefly of broad undulations on the external part in our present *Sib. discoides*, whilst it is made up of numerous narrow ribs in *Sib. ceratitoides*.

With regard to the sutural lines, both species are very similar, and it is for this reason that I consider both as belonging to one and the same group of forms.

The resemblance of the present species to the other forms is very small, and it is, therefore, unnecessary to point out their distinguishing characters.

III. Group of SIBIRITES EICHWALDI, Keys.

7. SIBIRITES ANGULOSUS, Waagen, n. sp., Pl. VIII., fig. 12, *a. b. c.*; fig. 13, *a. b.*

This is a highly interesting species, but I regret to say the materials are rather scanty, consisting only of some fragmentary specimens, on which the sutural lines cannot be made out.

The general shape of the species is somewhat compressedly disciform with tolerably high angular whorls and rather large shallow umbilicus, which comprises a little less than one-third of the entire diameter of the shell.

The transverse section of the whorls is somewhat trapezoidal, with an angular external part and flattened sides. The lateral parts are but very little vaulted, and never quite flat. The greatest transverse diameter of the whorls is just two-thirds of the entire height of the whorl distant from the external part. Towards the umbilicus the lateral parts bend gently down to the umbilical suture, without forming a distinct umbilical wall or umbilical edge. Towards the external part they are slowly tapering.

The external part is quite flat and not very broad. It joins the lateral parts in forming very distinct external edges. In its middle there is an indistinct shallow depression.

The involution of the whorls is very small, the indentation caused by the penultimate whorl into the last one taking up not more than one-fifth of the entire height of the last volution.

The sculpture consists of numerous radial ribs, which are only very slightly falciform. In the young state the ribs are very unequal in strength, and there are generally two fainter ribs intercalated between two stronger ones. The ribs are all single, not dichotomous. They commence directly above the umbilical suture, and extend in nearly a straight direction, bending only very slightly towards the front about the middle of the lateral parts of the whorls. On the external edges they are suddenly strongly deflected towards the front, and form in the middle of the external part a distinct angle, being at the same time somewhat depressed, by which a kind of furrow is formed. In the full-grown shell the inequality of the ribs is less distinctly developed, and the angularity in the middle of the external part is also sometimes less distinct. It must also be remarked that in the young shell as well as in the adult one the stronger ribs project often most strongly just on the external edge, where they are deflected towards the front, thus forming a kind of very small indistinct tubercle.

The sutural lines cannot be observed on any of the specimens at my disposal.

The measurements of two specimens are as follows:—

	II.	II.
Diameter of the shell	25 mm.	14 mm.
" " umbilicus	9 "	5 "
Height of the last volution from the umbilical suture	11 "	7 "
" " from the preceding whorl	8 "	5 "
Thickness of the last volution	6.5 "	5 "

Locality and Geological Position.—There are several specimens of this species preserved in the Salt-Range collection, but they are all only fragmentary. Among them there is only a single fragment, the one represented, Pl. VIII, fig. 12, which shows somewhat larger dimensions, and furnishes the proof that the angular section of the whorls is not only present in the young state. All the rest—some three or four—are fragments of small specimens. All these fragments were collected by me at Chidroo in the Upper Ceratite Limestone, together with the other species of *Sibirites* described on the foregoing pages.

Remarks.—The most remarkable feature of the present species consists in the circumstance that it shows a rather striking similarity to *Sibirites eichwaldi* of Siberia. This similarity is chiefly brought about by the angular shape of the whorls—a character that is not absent in other Indian species, but which is there restricted to the young state only, whilst it soon disappears as the shell augments in size. In our *Sib. angulosus*, on the contrary, the angularity of the external part of the whorls is a persistent character, and thus the full-grown shell can only be compared to *Sib. eichwaldi*, Keys.

If we pass in review the figures given by Mojsisovics of that species, we stop first of all at fig. 8, which form shows the most striking resemblance to our present

species. I am not certain whether fig. 8 should not better be considered as something different from the typical *Sib. eichwaldi*, as its compressed volutions, which are very high in comparison to their thickness, are not well in accordance with the remainder of the specimens represented on the same plate, and as its sculpture is also of a somewhat different pattern. On the whole, this figure shows the greatest resemblance to young specimens of *Ægoceras jamesoni*, Sow., as they occur in Northern Germany, where they have been distinguished under the name of *Æg. bronni*. To this figure our *Sib. angulosus* must first be compared. The umbilicus is a little larger in the Indian shell, the ribs are of unequal strength, and their angularity in the middle of the external part is less strikingly developed. Though these differences now are certainly sufficient to establish a specific difference between the Indian and the Siberian shells, yet, notwithstanding them, the typical similarity of the two is very striking, and it appears most probable that the two will be in a more close connection than simple similarity. I am inclined to pronounce the opinion that there might exist a developmental connection between the two, and that *Sib. eichwaldi* will turn out to be the more ancient member; but in such cases one must not forget that this is merely a personal opinion in support of which no proofs exist. It is to be very much regretted that in many similar cases the subjectivism of such opinions is quite overlooked, and that afterwards such things are treated as indisputable facts.

From other species of the genus that have been described on the foregoing pages, the present one can easily be distinguished by the angular whorls retained by it in more advanced stages of growth; by the ribs, that show an angular bend in the middle of the external part; and by the flattening of these ribs just on the mentioned place, whereby a kind of median furrow on the external part of the whorls is formed. From a geological and geographical point of view it is very interesting and of the utmost importance to find in India a shell which shows so much similarity to a Siberian form that one is inclined to consider the two as belonging to the same developmental series.

IV. ISOLATED SPECIES.

8. *SIBIRITES PARVUMBILICATUS*, Waagen, n. sp., Pl. IX, fig. 5, *a. b. c.*;
fig. 6, *a. b.*

• The materials of this species are not very extensive, but nevertheless sufficient to enable me to describe the species accurately.

There are two specimens both coming from the same bed and locality. I think the two belong to one and the same species, though their general configuration is somewhat different. The smaller one represents, I think, the young state. It chiefly differs from the other specimen by a flattened external part, whilst the same part of the shell in the larger specimen is perfectly rounded. We have seen from the description of several of the preceding species that in the young state there existed a flattened space in the middle of the external part hemmed in on both sides by distinct external edges, but that this character disappears as the species grows larger, so that the full-grown shape exhibits a perfectly rounded external

side. The same peculiarity, it seems to me, also prevailed in the present species, and I therefore think I am correct in considering the two specimens as belonging to the same species.

The general shape of the shell is rather thickly disciform, with more or less compressed whorls and an umbilicus, which in the young state is very small [a little less than $\frac{1}{8}$ th of the entire diameter], whilst it becomes larger as the growth of the shell progresses, and is at least not more than $\frac{1}{5}$ th of the diameter of the shell in full-grown specimens. The involution decreases at the same rate as the umbilicus augments in size.

The transverse section of the whorls differs somewhat in the young and adult states. In the young specimen it is rather trapezoidal, with somewhat flattened lateral parts and a depressed external side. The greatest transverse diameter is situated at the upper limit of the lower third of the entire height of the volution. From there the lateral parts descend in a nearly flat declivity to the external edges, whilst towards the umbilicus they suddenly bend down to the umbilical suture, without, however, forming a distinct umbilical wall or umbilical edge. The external part is distinctly flattened, and hemmed in on both sides by distinct external edges. In the adult specimen the transverse section of the whorls is somewhat different. The greatest transverse diameter of the whorls is situated here a little below the middle of the entire height of the whorl, and the involution is not so considerable. Whilst in the young the involution is a little more than one-third of the entire height of the volution, it takes up in the adult not quite one-fourth of that height. The general shape of the transverse section is oval, the external part being not very perceptibly flattened, or even entirely rounded. The lateral parts are not very strong, but are very equally vaulted. Towards the umbilicus they bend gently down and reach the umbilical suture nearly at right angles. On the external side they are not properly demarcated from the external part, and the external edges, which are so distinctly developed in the young specimen, disappear by-and-by, until towards the commencement of the body-chamber the external part becomes perfectly rounded.

The sculpture of the shell is not very different in the young and the adult forms. It consists always of radial ribs, which are slightly falciform and lean somewhat over in the direction of the front. Some of these ribs are stronger, some fainter, and in the young shell there are generally two smaller ribs intercalated between two stronger ones. In the adult shell, on the contrary, there is, towards the commencement of the body-chamber, generally only one fainter rib intercalated between two stronger ones. The change from one to the other state can be well observed on the specimen represented in fig. 5. On the external part all the ribs are uninterruptedly passing from one side to the other, whilst they are at the same time but very little bent forward. On the distal part of the body-chamber all kind of sculpture disappears, and the shell becomes perfectly smooth.

The measurements of the full-grown specimen cannot all be given, as the last volution is preserved only in a small fragment. When entire, the specimen must have had a diameter of at least 68 mm., whilst the umbilicus exhibited a diameter of about 15 mm.

So far as the measurements can be taken on the two existing specimens, they are as follows:—

	I.	II.
Diameter of the shell	42 mm.	23 mm.
" " umbilicus	9 "	4 "
Height of the last volution from the umbilical suture	20 "	12 "
" " " " " preceding whorl	15 "	7.5 "
Thickness of the last volution	13 "	8.5 "

Locality and Geological Position.—The two specimens under description were found by me at Siran-ki-Dok in the Upper Ceratite Limestone, together with many other species, such as *Acrochordiceras dimidiatum*, W., *A. distractum*, W., etc.

Remarks.—The present species is easily distinguished from other forms of the same genus by the very small umbilicus, which does not again occur in any of the shells that have been described by me on the foregoing species. To the Siberian species also none can be compared in more detail, and thus the present form appears really an isolated one, which by the curvature of its ribs on the external part of the shell can without doubt be attributed to the *Curvicostati*, but which otherwise cannot be compared in particular to any other species. With this form the *Curvicostati* group comes to a close.

SECTION II: RECTECOSTATI.

V. Group of SIBIRITES IBEX, W.

9. SIBIRITES IBEX, Waagen n. sp. Pl. IX, fig. 3a, b, c.

There is only a single fragment of a body-chamber of an ammonitic shell that enables me to distinguish the present species. Though this material is extremely limited and scanty, yet I venture to introduce a proper name for this form, as its general configuration is so striking that beyond all doubt by this fragment is indicated the existence of a proper species, which can easily be distinguished from all similar forms.

The general shape of the shell is flatly disciform with a flattened angular external part and a moderately narrow umbilicus, the involution of the whorls being about as much as one-third of their entire height.

The transverse section of the whorls is nearly rectangular, the transverse diameter in the umbilical region not exceeding in size to any great extent that near the external margin. The lateral parts of the whorls are only very flatly vaulted. The greatest transverse diameter of the whorls is situated in the lower third of their entire height. From there the lateral parts are very slowly tapering in the direction of the umbilicus, until the umbilical margin is reached, when the shell suddenly bends down to form a vertical umbilical wall. The umbilical edge is however, not sharp, and is rather indistinctly defined. In the direction of the external margin the lateral parts form a very slightly vaulted slope. The external

part of the shell is quite flat and rather broad, hemmed in on both sides by distinct external edges, in which the external and the lateral parts join.

The sculpture of the shell is very characteristic. It consists of not numerous strong radial ribs, which commence at a short distance from the umbilical margin and extend, showing only a barely perceptible falciform bend to the external edge, where they are most strongly developed. Alternately these ribs are somewhat longer; that is to say, half their number extend further towards the umbilicus than the other half. There may have been altogether about 20 such ribs on one volution. On the fragment serving for description there are 10 of them preserved. On the external part these ribs cross as high and strong elevations in a perfectly straight direction from one side to the other, uniting with the corresponding rib on the other side of the shell.

The sutural line is rather indistinctly preserved on one end of the fragment. It can be seen that the external lobe has been very short and broad. The external saddle is just hit in its middle by the external edge. The first lateral lobe is broad with sloping sides; it is longer than the external lobe. There seem to have existed some denticulations at its bottom. The lateral saddle is narrowly rounded, entire, not reaching further up than the external one. The second lateral lobe is also narrow very much shorter than the first lateral with sloping sides. It cannot be seen whether there were any denticulations existing. Its position is very close above the line of involution of the preceding whorl. After this there follows yet a small and narrow second lateral saddle, and on the vertical umbilical wall a minute auxiliary lobe, already half concealed in the umbilical suture. The sutural line just described is the last one before the commencement of the body-chamber. The dimensions of the specimen are as follows:—

Diameter of the shell	.	.	.	.	.	.	.	.	.	31 mm.
" " " umbilicus	.	.	.	.	.	.	.	.	.	7 "
Height of the last volution from the umbilical suture	.	.	.	.	.	.	.	.	.	14 "
" " " " from the preceding whorl	.	.	.	.	.	.	.	.	.	9.5 "
Thickness of the last volution	.	.	.	.	.	.	.	.	.	8 "

Locality and Geological Position.—The only fragment of this species was collected by me at Chidroo in the Upper Ceratite limestone together with the other species of *Sibirites* described on the foregoing pages.

Remarks.—There is no species of *Sibirites* which could be compared more particularly with the present one. Among the true *Ammonites* there is the *Amalthes ibex*, Orb. which shows much similarity, but a close comparison is also here impossible. It is, however, always a fact worthy of notice that such very similar forms are developed at different times in the progress of evolution of the Ammonite tribe, that shells which evidently represent very different states in the progress of development of the whole stem, yet externally show such a striking similarity. After all that has been said up to the present with regard to similarities which the different species of *Sibirites* that have been described on the preceding pages exhibit to different forms of *Ammonites*, we see that *Sibirites* must be considered as a truly collective type. It shows similarities to the ammonitic genera *Schlo-*

theimia, *Ægoceras* and *Amaltheus*; and I should not be surprised if one day *Sibirites* would turn out to contain the ancestors of several of the jurassic ammonite genera.

10. *SIBIRITES HIRCINUS*, Waagen, n. sp. Pl. IX, fig. 4 *a*, *b*.

The general shape of this species is flatly disciform with angular whorls, which are flattened on the external part with a moderately narrow umbilicus.

The transverse section of the whorls is very compressed, narrowly rectangular, the indentation caused by the preceding whorls being a little more than one-fourth of the entire height of the whorls. The lateral parts of the whorls are nearly quite flat, barely vaulted at all. In the direction of the umbilicus they bend only little before reaching the umbilicus, when they are suddenly deflected to form a not very high but nearly vertical umbilical wall. The umbilical edge is, however, not very sharply expressed. In the direction towards the external part of the shell, the lateral parts are only very slightly tapering, and at last they are hemmed in by distinct external edges, in which the rather broadly flattened external part joins the lateral ones. The latter form for a certain extent nearly parallel planes, so that the greatest transverse diameter of the whorls is situated within a zone that extends between the first and the last quarters of the entire height of the volution.

The sculpture of the shell is very characteristic. It consists of radial ribs showing a slight falciform bend, which are of very unequal strength. The stronger sort begins at a short distance above the umbilical edge as thin thread-like ribs, which are slightly directed towards the front. In the middle of the sides they begin to become stronger, making a very feeble curve that turns the convex side towards the front. As they approach the external edge they become more and more swollen, turning at the same time strongly towards the front, and are highest on that edge, forming thus a kind of very elongated tubercle. From there they pass in about equal strength as high ridges on to the flattened external part which is crossed by them in a straight line. There may have been about twenty of these ribs on one volution. The finer ribs are intercalated between the stronger ones. There are two to four of these finer ribs between two of the stronger sort. The former commence at the same distance above the umbilical edge like the other ones, but from the beginning they are somewhat finer, and as they progress towards the external part they do not increase in any perceptible manner in height. Their curvature is like that of the stronger ribs, and on the external part they pass as fine, straight, elevated threads from one side to the other.

The sutural lines are not visible on the single specimen that serves for description, and thus I am unable to tell whether this specimen also has preserved its body-chamber or not.

The measurements of the specimen are as follows:—

Diameter of the shell	31 mm.
„ „ umbilicus	7.5 „
Height of the last volution from the umbilical suture	15 „
„ „ „ „ „ „ preceding whorl	11 „
Thickness of the last volution	7 „

Locality and Geological Position.—There is only a single specimen of this species preserved in the Salt-Range collection, and this is even not entire, as about half of its last volution and all the inner whorls have become so deteriorated by weathering that their sculpture cannot be seen. The entire specimen is filled up by white calcspar, and on the external side a part of the shell is preserved. This specimen was found by me in the Chittawan near Gharsi in the Upper Ceratite Limestone together with the form that will be described next.

Remarks.—The present species is of a very characteristic and most striking general appearance, and it is not easy to be mistaken for any other form. It is apparently most nearly related to *Sib. ibex* described before; and at a first glance the two seem to be similar. On a close examination, however, one finds that *Sib. hircinus* has a larger umbilicus, and more strongly flattened sides. As regards its sculpture it is observable that the strong ribs are narrower than the ribs of *Sib. ibex*, and that nearly all of them reach down to near the umbilical margin, which is not the case in the species just mentioned. The intercalated finer ribs are also entirely absent in *Sib. ibex*. It cannot thus be doubted that the two shells belong to different species. There is, however, yet another form to which *Sib. hircinus* must be compared, and this is *Sib. angulosus*, W. The similarity of the latter to the form under description consists in the character of the sculpture, in which also stronger ribs, which are slightly swollen near the external margin, are disseminated between finer ones. *Sib. angulosus*, however, has got an umbilicus which is yet larger than that of *Sib. hircinus*; and on the external part all the ribs make a distinct bend towards the front, and are a little depressed in the middle, where a kind of median furrow is formed in the middle of the external part. This difference is striking, and according to it the two species *Sib. hircinus* and *Sib. angulosus* must not only be kept separate specifically, but must also be placed in different divisions of the genus.

Among the Siberian and the European species of the genus, as far as they are known to me, there is none to which the present form can be compared more particularly.

VI. ISOLATED SPECIES.

II. SIBIRITES TENUISTRIATUS, Waagen, n. sp., Pl. IX, fig. 1 a. b. c. d.; fig. 2 a. b. c.

Only fragments of this species are known to me, and the full figure drawn in fig. 2 is only an ideal representation of what this shell may have been when complete.

The fragments of this form found by me in the Upper Ceratite Limestone of the Chittawan, pointed to a shell of very peculiar features, and in order to arrive at a clearer idea of its general characters I executed the drawing represented on Pl. IX, fig. 2, and which I have had lithographed in order to give also to the reader occasion to judge how far I have succeeded in my restoration.

There are altogether three fragments of this species for description. It would perhaps have been better to have ignored them altogether, but the form interested

me so much that I could not abstain from studying it in detail and giving a description of it.

The fragments consist of a piece of an inner volution, a fragment of the shell in the half-grown state, and a part of the external side of the full-sized shell. All three fragments were extracted from one and the same small piece of rock, but I cannot state for certain whether all belonged to one and the same specimen, the large fragment was probably part of a separate shell. I shall describe each fragment separately.

The inner volution is much compressed, of a rather flatly disciform shape, with a very narrow umbilicus. The transverse section of the whorls is trapezoidal, the greatest diameter being at the umbilical edge. The umbilical wall is not quite vertical, and not very high; it is limited above by a sharp umbilical edge. From there the lateral parts of the shell slope regularly, forming only a barely perceptible curve, towards the external edge, which is again very sharp and distinct. The external part is flattened, not very broad and hemmed in on both sides by the very sharp external edges.

The sculpture of this specimen consists of numerous sharp undivided ribs, that originate at the umbilical edge and extend, in making a rather distinct falciform curve to the external part which is crossed by them in a straight line. The inequality in strength of these ribs, that occurs in all the other allied forms, is only very little expressed in this one, but traces of it can also here be detected without difficulty. On the whole, this shape is very characteristic and easy of recognition.

In the half-grown shell, the sculpture becomes fainter and the ribs much more numerous. Between 6-8 of these very fine ribs there is one rib intercalated which is slightly stronger, and becomes most prominent at the external edge. Only these stronger ribs extend in the direction of the umbilical edge, and reach nearly down to it; the fainter ones, on the contrary, disappear on the middle of the lateral parts.

As the shell becomes in time full grown, the ribbing on the lateral parts disappears more and more, and only in the vicinity of the external edges a very fine striation appears that is obliquely directed towards the front. From distance to distance a somewhat stronger rib is intercalated, which swells into a little tubercle or spine just at the external edge. At this size, the external part of the shell is no longer quite even, but slightly and very flatly vaulted. All the striation crosses in a straight line over this part of the shell, and the stronger ribs that are in connection with the tubercles are also more strongly marked here.

The only doubtful point remaining with regard to the general configuration of the full-grown form is the size of the umbilicus. It is probable that it becomes comparatively somewhat larger than in the juvenile state but I cannot tell this for certain. In fig. 2a the size of the umbilicus is purely conjectural.

The sutural line cannot be seen on any of the fragments, and I am thus not able to say anything about it or the measurements, which cannot be taken on account of the smallness of the fragments.

Locality and Geological Position.—The three fragments of this species were collected by me in the Chitta-Wan in a piece of rock from a bed of the Upper

Ceratite Limestone. The same piece also contained the fragments of *Sib. tenuistriatus* and specimen of *Sib. hircinus* described before.

Remarks.—The present species seems at a first glance rather closely related to *Sib. hircinus*, W., especially if one compares fig. 2c with the figure of the mentioned species (fig. 4 b.) on the same plate. This similarity is, however, only an artificial one, as the artist in drawing the ideal figure 2c evidently took the figure that was just below as a pattern, and thus caused the likeness. If the other figures are compared, the similarity is only a distant one.

There are still many doubtful points connected with this interesting species, and it would have been much more satisfactory had better specimens been obtainable in order that more could have been learnt about them. The point I consider most doubtful is the generic position of the present form. Though the sculpture and general configuration of the young shell show many points of affinity to other forms of *Sibirites*, yet the full-grown shell differs so from the general pattern, chiefly in the development of little spines along the external margin, that I am not sure whether in this case it can be classed as *Sibirites*. This difference shows itself again in the typical species of the genus following, and it does not therefore appear wrong to place this form under the genus *Goniodiscus* in preference to that of *Sibirites*. As, however, the distinguishing character of *Goniodiscus* consists in the sutural line, which part is not known in *Sib. tenuistriatus* I am not able to arrive at any safe determination about this form and have therefore left it in the genus *Sibirites*.

Genus GONIODISCUS, Waagen, n. gen.

This form is evidently very nearly related to *Sibirites*, and it is chiefly owing to the difference in the sutural line that I am able to distinguish the new genus. As there is only a single species attributable to this genus, I cannot indicate the range of variation the shells belonging to it may undergo with regard to their general configuration and sculpture.

The shells that I consider belonging to *Goniodiscus* are rather thickly disciform in their general shape, with a flattened external part, that is hemmed in by sharp external edges on both sides and a rather small but deep umbilicus.

The sculpture is a very feeble one, if at all present. It consists of a fine radial striation, which is made up of numerous fine falciform striæ, some of which are somewhat stronger than the rest. These stronger striæ or ribs are in connection with little tubercles that are disseminated at equal distances on the external edges of the shell.

The most important character of the genus consists in the sutural line, which shows much typical similarity to that of the genus *Pronorites* as described by Mojsisovics, or *Manticoceras* as distinguished by Hyatt.

The external or siphonal lobe is tripartite as in *Pronorites* with two longer lateral, and a shorter median finger. The lateral branches have two denticulations each. The first lateral lobe is very long with strong denticulations at its bottom. The second lateral lobe is broad and very distinctly developed also strongly denticu-

lated. After this there is again a very broad auxiliary lobe above the umbilical suture, which possesses many irregular denticulations. The saddles are all entire.

The sutural line is a very peculiar one, and apt to raise many questions as to a classification of the Ammonoidea in general. A tripartite external lobe is exhibited only by very few forms of the whole sub-class, such as *Pronorites*, Mojs., or *Triainoceras*, Hy. Another type is represented by *Manticoceras*, Hy., and it is just this type to which first of all the sutural line of the present genus must be compared. It is a well-known fact that with regard to *Manticoceras* the opinions of Palæontologists differ greatly as to what is to be considered the siphonal in this genus, and what the first lateral lobe. Hyatt, in his "Genera of Fossil Cephalopoda" where he has used this name, considers Hall's *Goniatites simulator* as type of his genus. In the description of this species, in the Palæontology of New York, Vol. V, Hall is not very positive as to the designation of the single lobe of the sutural line, and has called the external of the two lobes that appear on the lateral parts of the shell the "ventro-lateral" lobe. In *Goniatites pattersoni*, Hall, the most nearly related form to all appearances, he on the contrary, designates the external of the two lobes as the lateral lobe, and the little lobe on the periphery as the ventral or siphonal lobe. Hyatt seems to accept this view.

If we turn to the European species belonging to the genus *Manticoceras*, we find that Sandberger inclines to the opinion adopted also by Hall, viz., that the very small lobe on the middle of the external part of the shell should be considered as the ventral lobe, whilst the two lateral branches ought to be taken as the first lateral lobe.

Zittel's view of the matter is, however, quite different. He considers the entire tripartite arrangement of lobes in the external region of the shell of *Manticoceras* as a tripartite ventral lobe, the only lateral lobe existing would in this case be shifted entirely towards the umbilicus. There is much to be said in favour of such an opinion, and I too have termed the three little lobes on the external part of *Goniodiscus* as ventral or external lobes. The arrangement in *Goniodiscus* is again very similar to that of *Manticoceras*, except that the whole has attained a ceratitic development and the median prominence as well as the lateral branches have each got two terminating denticulations.

Though the external lobes thus show the greatest typical similarity to the corresponding part of *Manticoceras*, yet the remaining part of that line cannot be compared to that genus.

In regard to the other characters the genus may better be compared to *Pronorites* or *Triainoceras*. Both these genera have also a tripartite ventral lobe, but the lateral branches of this lobe are so small that no doubts have ever been entertained about the designation of this lobe. The three divisions are on the same line, and appear in fact only as terminal denticulations of a deep ventral lobe. There follow at least two distinct lateral lobes on the lateral parts of the shell of the genera mentioned. In *Pronorites* the first lateral lobe is bipartite, in *Triainoceras* it is simple. Thus *Goniodiscus* bears greater similarity to the latter genus.

I shall, however, not carry these comparisons further. It seems useless to go further into details, because all these forms are so far distant in time from *Gonio-*

discus that nobody will be in a position to assert positively, whether the affinity between these forms is only an apparent one, or exists in reality.

From all these considerations it appears clear that the sutural line of *Goniodiscus* is a very peculiar one, which can well be considered as distinguishing it from other allied genera by a proper generic designation.

As regards sculpture, *Goniodiscus* appears so very closely allied to *Sibirites* that a perfect transition from *Goniodiscus* to *Sibirites* seems clear, so much so that in the use of the last species of *Sibirites* described by me I was very much in doubt whether I should place it in *Sibirites* or transfer it to *Goniodiscus*. The circumstance that the sutural line in this form was not known to me caused me to place it under the former genus.

Although the sculpture is so very much alike in both genera I cannot assert positively that the two are closely connected, as the length of the body-chamber is not known to me.

If *Goniodiscus* should prove to possess a long body-chamber like *Sibirites*, then the relationship of the two genera would be obvious, but so long as this circumstance is not known, the affinity founded solely on similarity of sculpture cannot be considered as established. Even its position in the *Trachyostraca* is open to question, because a sutural line, on which the external lobe is developed in such a manner that parts of it resemble an adventive lobe, is a thing that appears very extraordinary during this latter division of the *Ammonoids*.

The single species known to me of this genus was found in the Upper Ceratite Limestone, and will bear the name of *Goniodiscus typus*, W.

1. GONIODISCUS TYPUS—Waagen. n. gen. et sp., Pl. IX, fig. 7, 8a. b. c, 9, 10.

This species seems to have attained very considerable dimensions, judging by the fragments at my disposal, though the description of the species must be given from some well preserved, though smaller-sized specimens. Most of them are internal casts, and only a single fragment has preserved its shell. All of them are chambered throughout; thus, the sculpture and extent of the body-chamber are quite unknown to me.

The general configuration of the species is flatly disciform with compressed whorls, a flattened external part and a comparatively small and deep umbilicus. The whorls are very embracing, and there is about one-third of the entire height of the whorls occupied by the indentation caused by the preceding whorl. In the younger specimens, however, the involution is stronger than in the more adult ones, and thus also the umbilicus appears comparatively narrower in smaller than in larger specimens.

The transverse section of the whorls is somewhat sagittate, the apex being cut off by the rather broadly flattened external side. The lateral parts are distinctly obliquely flattened, the greater transverse diameter of the whorls being situated in the lower third of their entire height. From there the lateral parts form a sloping plane in the direction of the very sharp external edges. Towards the umbilicus

the lateral parts are perfectly rounded and bend down to the umbilical suture in a gentle curve, without forming an umbilical edge or distinct umbilical wall. The external part of the whorls is tolerably broad, strongly flattened not very perceptibly vaulted and hemmed in on both sides by sharp external edges.

The sculpture of the shell is a very weak one, and internal casts appear to be almost entirely smooth. Only when exceptionally well preserved can the sculpture be detected. In our figure 8 a. b. c. such a specimen is represented, and one can see there that the sculpture consists of little spines situated along the external edges of the shell, and of which there may have been about thirty on one volution. Sometimes a barely perceptible ridge seems to extend across the flattened external side from one spine to the other.

If the shell is preserved there are very fine thread-like ribs in connection with these spines, which then appear rather as swellings of these ribs. The latter are somewhat falciform, and can be traced close to the umbilicus. Between these ribs there are numerous very fine striæ of growth, which run for their whole extent parallel with the ribs. Whether this sculpture is preserved in large specimens or if it disappeared altogether, as the shell attained larger dimensions, is not known to me, as all the specimens at my disposal showing any great diameter are not sufficiently well preserved to have retained traces of this weak sculpture, even if they had originally been present.

On the whole, the shell attained rather considerable dimensions, and the fragment from which the sutural line, represented in fig. 9 was taken, shows whorls that were above 30 mm. in height.

The sutural line, as already demonstrated, is very peculiar in the genus. The external or siphonal lobe is very broad and short, and has three subdivisions. The median one is the narrowest and shortest. It is wedge-shaped and terminates in two points. The two lateral parts are much more prominent and broader. They are also tapering towards their bottom, and terminate there in two sharp points or denticulations. The external saddle is not very broad and very short and does not reach up higher than the two little angular saddles dividing the external lobe into three parts. It is entire, without any indentations.

The first lateral lobe is very long and not very broad. It reaches down about twice as far as the external lobe. It is slightly contracting, the sides tapering towards the bottom, where about six sharp denticulations are observable. The first lateral saddle reaches slightly further up than the external one, but is otherwise of the same pattern, and without any indentations. The second lateral lobe is slightly broader, but much shorter than the first lateral one. It is also contracting towards its bottom, and has there six denticulations. The second lateral saddle is much broader than the other saddles, is slightly flattened on the top and reaches up about as far as the external one. It is also entire and its inner wall is somewhat overhanging. After this there follows an auxiliary lobe, which is about twice as broad as both the lateral lobes. It is closely denticulated, having about eight to ten denticulations and reaches down to the umbilical suture.

The dimensions of two of the specimens at my disposal, both chambered up to the end, are as follows:—

	I.	II.
Diameter of the shell	44 mm.	33 mm.
„ of the umbilicus	9.5 „	6 „
Height of the last volution from the umbilical suture	21 „	16 „
„ „ „ „ from the preceding whorl	14 „	10 „
Thickness of the last volution . . . . .	...	9 „

Locality and Geological Position.—There are altogether four specimens of this species in the Salt-Range collection, all of which were found by me in the Upper Ceratite Limestone of Chidroo, which has furnished also so many other interesting forms, for instance, the many species of *Sibirites* described on the foregoing pages. These latter shells, as well as the specimens of *Goniodiscus*, were detected in the same bed.

Remarks.—The affinities exhibited by *Goniodiscus* to *Manticoceras* have been expounded by me in the description of the genus. In its general outward appearance the shell of *Goniodiscus* shows a certain similarity to *Norites gondola*, Mojs., out of the Muschelkalk of the Alps. This similarity is, however, only an apparent one, as the sutural lines of both forms are perfectly different.

Genus PSEUDHARPOCERAS, Waagen, n. gen.

I am obliged to create this new genus for the reception of a single species, which in its general configuration resembles very much the typical *Tropites*, but which still in certain important characters deviates so far from that type that it cannot be classed under the same generic designation. It cannot be denied that it is somewhat awkward to treat of a genus more or less nearly related to *Tropites*, as up to the present but very little is known of *Tropites* itself, chiefly because the range of variation of the forms admitted in the genus are, and will remain, unknown to the public at large so long as Mojsisovics' work on the Triassic beds of Hallstadt is not published. I nevertheless venture to distinguish the present genus, as the difference between it and the typical *Tropites* is too obvious to be overlooked.

In outward appearance the shell of *Pseudharpoceras* reminds one at first glance of *Tropites*. The shell shows a large umbilicus, compressed whorls, and on the external side a strong keel, hemmed in on both sides by deep furrows. The sculpture consists of radial ribs, which are strongly expressed only in the peripheral region, and have on the whole a somewhat falciform shape. Some of them are in connection with tubercles, that are not numerously disseminated along the umbilical margin.

The most important and distinctive character consists in the sutural line, which possesses, besides the external, only one lateral lobe. Whether any denticulations existed on the bottom of this lobe cannot be stated with certainty, as the sutural line is somewhat deteriorated by weathering. It is, however, highly probable that such a denticulation was present. On the umbilical suture the line descends again a little, but no distinct auxiliary lobe is traceable.

Such a sutural line, with only a single lobe on each lateral part of the shell, has not up to the present been reported to occur in any form of *Tropites*. It appears in a similar manner in *Tyrolites*, but combined with a very short body-chamber.

In the specimen at my disposal, about three quarters of the last volution belongs to the body-chamber, and evidently much of it is broken off; so that the body-chamber must have occupied in this shell at least one volution.

Thus it is evident that notwithstanding the similarity of the sutural line to *Tyrolites*, this form belongs to the family *Tropitidae*, and by the characters of the sculpture of the shell it must be placed in the immediate vicinity of *Tropites* itself. That a shell possessing such a sutural line must be separated from *Tropites*, though its outward appearance may be very much like that of the mentioned genus is obvious, and thus I venture to introduce for it the name of *Pseudharpoceras*.

I have chosen this name to indicate the great similarity this form possesses to certain species of the genus *Harpoceras* chiefly occurring in the Kelloway-Group of the Jurassic formation. I need only refer for example to *Harpoceras punctatum* Scahl. or *H. brighti*, Pratt, which are extremely like our *Pseudharpoceras*. These forms, however, do not possess either furrows on the sides of the external keel, or such a long body-chamber, or a similar sutural external line; so that the general similarity of the sculpture is only delusive. Other species, some of which have been described by Buckmann under the generic names of *Ludwigia*, etc., may be more like our *Pseudharpoceras*, in their general appearance, though they all possess a short body-chamber and more complicated sutural lines. Thus *Pseudharpoceras* appears to represent a generic type easily distinguishable from all other forms.

There is only a single species of this genus among the materials at my disposal.

1. PSEUDHARPOCERAS SPINIGER (Verchère, Ms.) n. gen. et sp., Pl. XXI, fig. 1 a.
b. c.

This is a species of moderate size apparently, as the specimen at my disposal is only of moderate dimensions, but I cannot say whether it may not have grown very large. As an indication of the possibility that the shell may have increased very considerably, I may mention the circumstance that the sutural lines are situated exceptionally far from each other. On the interior whorls of this shell, the last one being nearly all occupied by the body-chamber, there are not more than six or seven sutural lines on one volution.

The general shape of the shell is flatly disciform, with a large umbilicus and somewhat compressed whorls, which are slightly contracted towards the aperture, so that the thickness does not increase after the commencement of the body-chamber.

The transverse section of the whorls is elongately oval, being very considerably higher than it is broad. The indentation caused by the preceding whorl, the last one, is just one-sixth of the entire height of the transverse section. The lateral

parts are considerably flattened, showing only a very slight curve for the greater part of their extent. The greatest transverse diameter is situated in the lower third of the entire height of the whorls. Towards the umbilicus the lateral parts bend down in a gentle curve to the umbilical suture, without forming a distinct umbilical edge, but yet constituting a well-marked umbilical wall. In the direction of the external side they bend rather abruptly over in a narrow curve to meet the external part of the shell. The latter shows a strong and rather narrow curve, with a high keel in the middle, that is hemmed in on both sides by deep furrows. There is no trace observable of the keel having been separated from the remainder of the shell by a separate shelly lamina.

The sculpture of the shell is very characteristic and resembles strongly certain forms of *Harpoceras*, or even yet more strongly certain forms of *Hammatoceras*. Quite near to the umbilicus, just where the umbilical wall joins the lateral parts of the shell there are rather strong tubercles, which, when the shell was complete which is not the case in the specimen serving for description, most probably carried strong thorns or spines. From these spines there start generally two somewhat falciform ribs, which in the beginning are very weak, but grow stronger as they approach the external part of the shell. Here they turn somewhat towards the front, and stop short at the furrows accompanying the median keel. Between these pairs of ribs that are in connection with the tubercles there are others, mostly three in number, intercalated, which commence faintly on the middle of the sides, are not connected with any tubercles, but are otherwise of the same description as the rest. None of the ribs divide any more near the external part, but all remain simple.

The sutural line is rather badly displayed on the specimen under description though its preservation is sufficient to show the following characters. The external lobe is short and very broad, with two short points and a small siphonal tubercle. The external saddle is also very low and broad, very widely open at its base, and tapering towards the apex, without any trace of indentations. The lateral lobe is comparatively narrow, and also very short; its sides are converging towards the bottom. There seem to be some slight indications of denticulations at this place. After the lateral lobe, there comes a very broad and low saddle reaching down to the umbilical suture, without being interrupted by any indentation. Though this sutural line has apparently been much deteriorated by weathering, yet it seems improbable that this has taken place to such an extent as to destroy the second lateral lobe altogether, since the sculpture of the shell is perfectly well preserved at the same place where the sutural lines are visible. Thus we are justified in concluding that only a single lateral lobe has existed in this shell. The peculiar circumstance of the sutural lines being well separated from each other has already been mentioned.

About five-sixths of the last volution of this specimen belongs to the body-chamber. The whorl contracts from the beginning of the body-chamber to the aperture in so far as it does not increase any more in thickness. It must therefore also slightly deviate from the regular spiral, but this deviation is so small that it cannot be easily observed in a lateral view of the shell. The specimen consists of

an internal cast without a trace of the shell. The measurements of the specimen are as follows:—

Diameter of the shell	37 mm.
„ of the umbilicus	14 „
Height of the last volution from the umbilical suture	14 „
„ „ „ „ preceding whorl	12 „
Thickness of the last volution	8 „

Locality and Geological Position.—The only form of the species existing in the Salt-Range collection was found by Dr. Verchere in the Sheik-Budin area at Paniala Black Hill. According to the label attached to the specimen it was contained in a yellow limestone placed at the base of the variegated (Jura-Rhætic) series at the limit to the Ceratite formation. Thus there can be no doubt that the specimen belongs to the fauna of the topmost yellow limestones which I have observed at other localities to follow above the Dolomite group, just at the base of the plant-bearing rhætic-jurassic beds.

Remarks.—Dr. Verchere recognised the species as new, and he marked “*Goniatites spinigera*, Verchere,” on the label. I have retained this name; but the genus had to be described as also new to science. It is gratifying for me to be able to make use here of one of Verchere’s names, and thus to mark once more his great labours in working out the Geology of the Punjab and Kashmir. After all that I could state in my tours in those countries, he appears to have been a very fair observer; but all his endeavours were again and again overruled by his theoretical hobbies of which he could not rid himself, and to which he adapted all his observations.

As regards the affinities of the species, the different species of the genus *Tropites* must above all be taken into consideration. By the characters of the sculpture, as well as by the circumstance that the body-chamber slightly contracts towards the aperture, the present species reminds one strongly of *Tropites subbullatus* and its allies; but as the different species have not been properly distinguished up to the present, it is difficult to single out certain special forms and give the differences from them. From all of these, however, the present form can be distinguished by the sutural line, which is nearly goniatitic and possesses only a single lateral lobe.

I have stated already that *Hammatoceras* also has an external appearance much like the shell here under consideration, but even here the sutural line is a complete obstacle to any identification.

II. LEIOSTRACA.

It is evident that, with the description of the forms that will now have to be treated in detail, we enter upon a field of work which is perfectly different from that cultivated up to this by me in the consideration of the *Trachyostraca*.

The *Leiostraca* comprise very numerous forms of *Ammonoids*, which seem to be developed in a quite exceptional manner in the Triassic deposits of the Salt-Range, and which appear, at a first glance, most intimately linked together by a similar external appearance and similar sutural lines, but which on a closer examination

probably represent very different things. The distinction is, however, much more difficult here than in other groups of Ammonoids; and from all that I can guess it seems to me that the materials at my disposal are far too limited to guide one out of the labyrinth of these forms, which are all alike and all again different from each other. One must needs make distinctions, but the groups thus formed possess such indifferent characters and are so vaguely limited off from others, that one feels most keenly how unsafe is the ground on which one stands.

One thing, however, is certain, that those groups of the *Leiostraca* which in Europe are most characteristic of the triassic strata and are there most numerous represented, the *Arcestitidæ*, the *Cladiscitidæ*, and the true *Pinacoceratidæ*, with their distinctly adventive elements in the sutural line, are completely absent in the Salt-Range. Instead of these there are other groups, which, partly in enormous numbers, furnish the representatives of the *Leiostraca* in that country, and I cannot but think that this peculiarity must depend on geographical causes. The European triassic faunas are to all appearances the descendants (at least for a part) of those permian Cephalopod faunas that have been described by Gemmellaro from Sicily or by myself from the Productus Limestone. The *Arcestitidæ* and the *Pinacoceratidæ* in a restricted sense, and of the *Trachyostraca* the *Tropitidæ* have most probably their roots in these faunas. In the Salt-Range, on the contrary, quite different forms predominate, of which we do not know as yet the permian ancestors. These latter must have existed in permian times in a geographical region that is not yet known to us. Thus it comes that the greater part of the *Leiostraca* from the Salt-Range are perfectly strange, to us, and that only some forms that appear as varieties in European strata can be generically identified.

According to the views, at which I have arrived only after a very lengthened consideration, I think five families can be distinguished among the *Leiostraca* occurring in the Salt-Range. I must confess that I am here at variance with Mojsisovics' views, but this is more apparently the case than in reality. Mojsisovics himself has already several times pointed out that his families, the *Arcestitidæ* and the *Pinacoceratidæ*, were groups of so large an extent that they would have to be broken up in the future into a number of subdivisions. He, however, was of opinion that only sub-families ought to be established, whilst the families ought to be retained. On this point, however, I cannot concur with him, as the number of forms comprised, for instance, in the family *Pinacoceratidæ* is so varied, where the different types deviate so far from each other, that it seems not adequate to distinguish them simply as sub-families. We may, I think, hit the mark more directly if we promote the families of Mojsisovics to the rank of sub-orders, and distinguish within these a number of families. Thus we have two sub-orders within the *Leiostraca*.

I. Sub-order: ARCESTITIDÆ.

II. „ PINACOCERATIDÆ.

Having thus arrived at two sub-orders, we have then to change Mojsisovics' sub-families into families, but even proceeding thus we do not yet arrive at such divisions

as are suitable for the description of the materials contained in the Salt-Range collection. Mojsisovics introduces in his fundamental work on the Cephalopoda of the Mediterranean Province as sub-families in his family *Pinacoceratidæ* the following: I., *Pinacoceratinæ*; II., *Lytoceratinæ*; and III. *Ptychitinæ*. In the first of these five genera are placed,—viz., *Beneckia*, *Longobardites*, *Sageceras*, *Megaphyllites*, and *Pinacoceras*. Among these the genus *Megaphyllites* appears as a stranger, and has been removed already by Zittel and Steinmann to the *Phylloceratidæ*. I concur perfectly with them in this respect, and must also consider this genus as the starting-point of the family *Phylloceratidæ*.

The remainder of the genera, as placed together by Mojsisovics, form apparently a well-defined natural group, which only has to be transformed into a real family, and to which yet some more genera like *Medlicottia*, W., *Propinacoceras*, Gemm., and *Lecanites*, Gemm., must be added, to entitle it to a general acceptance. In the Salt-Range the family is but sparingly represented, and there is only a single genus which can be attributed to it, as will be demonstrated in the sequence.

The second sub-family, as distinguished by Mojsisovics, has been called by him *Lytoceratinæ*. He places only three genera in this sub-family,—viz., *Lecanites*, *Norites*, and *Monophyllites*. These genera have been distributed very differently by different authors,—as, for instance, Zittel has placed *Lecanites* in the *Lytoceratidæ*, *Norites* in the *Pinacoceratidæ*, and *Monophyllites* in the *Phylloceratidæ*. With regard to this latter genus, I rather concur with Mojsisovics, and am inclined to consider *Monophyllites* as the starting-point of the family *Lytoceratidæ* a view that is shared also by Steinmann, though he places the genus itself yet in the *Phylloceratidæ*.

With regard to the other two genera mentioned above, I must confess that I cannot let them stand in the sub-family *Lytoceratinæ*, or, as one perhaps should better say, in the family *Lytoceratidæ*. As far as my opinion goes, I cannot detect any distinct affinity or even similarity between those two genera and *Monophyllites*, or *Lytoceras*. They are decidedly something different, but they can, it seems to me, be as little united with the *Pinoceratidæ* as is advocated by Zittel at least for (*Norites*) as with *Lytoceras*. The two genera, however, nearly as they appear to be related to each other on a first glance, still seem to differ rather widely in their systematic affinities. *Norites* approaches rather closely to the *Pinacoceratidæ* proper, as in all the forms related to that genus a tendency is observable to produce, adventitious lobes, whilst in *Lecanites* such a propensity cannot be detected; but, on the contrary, this genus is so intimately connected with *Gyronites* and by means of this genus with *Meekoceras*, that I must consider for this latter genus a position in the *Meekoceratidæ* as the most correct one. *Norites*, on the other hand, furnishes the type for a proper family, which has been sketched out already by Karpinsky. Mojsisovics traces the origin of the two mentioned genera from some devonian *Goniatites*, which he calls *Pronorites* and *Prolecanites*, respectively. Whether he be right in doing so I cannot judge, as I have no materials for observations in this respect. Mojsisovics has, however, apparently considered these two last mentioned genera as rather nearly related to each other; and Hyatt places

also the two in his family *Prolecanitidæ*. How the two goniatitic genera may be related to each other is another question; but as to the triassic forms I must consider them as belonging to different families.

Thus there remains only the genus *Norites* as a type of a proper family, which has, however, nothing to do with *Lytoceras*, as has been advocated by Mojsisovics; but which must be considered as standing quite isolated, forming for itself a family. Karpinsky has already advocated the recognition of a sub-family *Noritinæ*, in which he places the genera *Pronorites*, *Parapronorites*, and *Norites*. It seems to me necessary to transform this sub-family into a family under the name of *Noritidæ*, and to place in this family three new genera occurring in the Salt-Range. One of these has been described in this work by mistake already among the *Trachyostraca* under the name of *Goniodiscus*, W., in the sequence of *Sibirites*. After a repeated reconsideration of all the facts, I am, however, now inclined to place it in the family *Noritidæ*, and consider this position as the more correct one.

Finally, the third sub-family that has been accepted by Mojsisovics is that of the *Ptychitinæ*. Not less than seven genera have been distinguished within this sub-family, viz.—*Nannites*, *Meekoceras*, *Hungarites*, *Carnites*, *Gymnites*, *Sturia*, and *Ptychites*. I cannot judge of the greater part of these genera, as among all the lot only *Meekoceras* is represented in the Salt-Range. Zittel promotes the sub-family to the rank of a family, but accepts it otherwise in the same extension that Mojsisovics had given to it. He adds, however, the genus *Xenodiscus*, W., to it. I have demonstrated before, in the discussion of the family *Tropitidæ* of the *Trachyostraca*, that this genus most probably must be transferred to the mentioned family.

There are two genera among the family *Ptychitidæ* which can serve as prototypes for all the forms occurring in the Salt-Range, more or less allied to the family; these are *Ptychites* and *Meekoceras*. The forms that can be affiliated to the one, and those that appear more or less nearly related to the other genus, form two well-distinguishable groups; and as several genera must be placed in each, I think it convenient also in this case to distinguish two families—the *Ptychitidæ* and the *Meekoceratidæ*.

We arrive thus at the following classification of the *Leiostraca* occurring in the Salt-Range:—

Sub—Order: PINACOCERATIDÆ,

I. Family: *LYTOCERATIDÆ*.

II. „ *PINACOCERATIDÆ*,

III. „ *NORITIDÆ*.

IV. „ *PTYCHITIDÆ*,

V. „ *MEEKOCERATIDÆ*.

It remains now to describe and characterise these families in detail.

Before, however, entering on the special descriptions, there remain yet some remarks to be made regarding the mode of proceeding in this respect. In the *Trachyostraca*, where the shells are already easily distinguishable by their different

ornamentations, the chief points of distinction of the genera and species must always be taken from the characters of the sculpture in the first place. The case is quite different in the *Leiostraca*, where one has to deal always with smooth shells, in which only sometimes low radial folds are developed. There the distinctions become very difficult, and there is many a failure to be recorded before one gets hold of characters which make a thorough distinction at all possible. For the forms occurring in the Salt-Range, the configuration of the auxiliary and that of the external lobe must be regarded as such characters. The augmentation of the auxiliary lobes, as the single forms extend into more and more recent deposits of the triassic beds, is very characteristic; the same is the configuration of these lobes in different developmental series; also for the distinction of genera their configuration can be made very useful.

The external lobe augments its indentations in a very strange and characteristic manner, and so furnishes very appreciable characters for the distinction of the single forms.

The general configuration of the shells is on the whole much less important.

Before all, there is the inflation of the whorls, which is, strange to say, of systematic value: then come the dimensions of the umbilicus, but the angular bends of the shell, that occur very often on both sides of the external part, and that for instance are also characteristic for the shell of *Norites gondola*, are of very subordinate systematic value and can only be used for specific distinctions. A similar observation has, as far as I remember, already been made by Mojsisovics.

This is all that can be said with regard to a systematic treatment of the *Leiostraca*, and I can now proceed with the specific descriptions.

Sub-Order : PINACOCERATIDÆ.

I. Family : *LYTOCERATIDÆ*.

It is not possible for me to state with any degree of certainty whether this family be really represented in the Salt-Range, and thus I may well be excused for the brevity of my remarks on it.

The most ancient genus of those belonging to this family is *Monophyllites*, Mojs. This has its first representatives already in the lower Muschelkalk of the Alps and in Spitzbergen, where it occurs at about the same horizon. It is not known up to the present from what palæozoic form this genus may have originated, but it appears almost certain that it is on the other hand the ancestor of the true genus *Lytoceras*, Suess, which is represented in such great numbers in the jurassic strata, chiefly within the limits of the Alpine jurassic province. In cretaceous times, other genera seem to succeed; but apparently there is yet much to be elucidated before one can be certain in this respect. *Costidiscus*, Neum., ought to be one of these forms, existing during the Neocomian formation, but the real relation of these forms to other genera must yet be worked out in detail. Yet more strongly is this the case as regard the genera *Hamites*, *Ptychoceras*, *Baculites*, *Turritiles*, *Heteroceras*, etc., which are also all affiliated to *Lytoceras*, and which most probably

are in some connection with that genus; but how this connection has been brought about in reality is still rather doubtful, and must be worked out in the future.

At present, only the genus *Monophyllites* takes up our interest, this being perhaps the only one that may be represented in the Salt-Range. The materials are, however, so unsatisfactory, that it is impossible to pronounce a positive opinion on them.

Genus MONOPHYLLITES : Mojsisovics.

This genus comprises some of the most characteristic and most frequent species of Ammonites contained in the triassic strata of the Alps.

The general characters of the genus are easily traceable. The shell is always flatly disciform, with a very wide mostly shallow umbilicus and whorls that are but very little embracing. The sculpture is always very insignificant, consisting in some cases of numerous sharp radial striæ, which are somewhat falciform; in other cases the shell is quite smooth. Varices or contractions of the shell occur sometimes. The transverse section of the whorls is mostly somewhat laterally compressed, but, exceptionally also, sometimes nearly circular.

The sutural lines distinguish this genus most characteristically from the otherwise very similar genus *Lytoceras*. Whilst the latter genus always possesses only two lateral lobes, without any auxiliary ones, there are generally one or two auxiliary lobes present in *Monophyllites*. Also the terminations of the saddles, to which the name ought to allude, are highly characteristic. They are so largely phylloid, without any secondary indentations, that they appear almost ceratitic.

Among the materials that have been collected in the Salt-Range there are two fragments of an ammonitic shell, which I am inclined to attribute to the genus *Monophyllites*. As, however, the sutural line is not visible, the fragments consisting of parts of the body-chamber, an exact determination appears impossible.

1. MONOPHYLLITES, *Sp. indet.*, Pl. VII a, fig. 12, 12 a. b.; fig. 13, 13 a.

The two fragments which I have to describe under this heading come from rather large specimens which must have possessed a diameter of about 85 to 90mm.

The general shape of the shell must have been disciform with a tolerably large, and moderately deep umbilicus. The whorls were smooth, rather inflated and barely embracing, nearly only touching each other.

The transverse section of the whorls is nearly circular, just as broad as it is high. The lateral parts are very slightly flattened, and bend gently in a regular curve down to the umbilical suture. The external part is broadly and regularly vaulted. The indentation of the preceding whorl into the last one takes up about one-sixth of the entire height of the whorl.

The sculpture of the surface of the fragments is very faint. It consists of faint undulations which take their origin a little above the umbilical suture, and extend in a slight curve, directed a little towards the front, across the lateral parts of the shell. On the external part they make also a slight bend towards the front. In the rear of each of these undulations there is a shallow furrow, indicating

the former existence of varices, which were probably stronger and less numerous on the inner volutions of the shell than on those fragments of the body-chamber which are alone accessible to our observation. On this latter part of the shell, these varices have been numerous, and there are three to four of them visible on each of the fragments. On the spaces between the varices, there is visible on the lateral parts of the shell a fine radial striation, which is, however, very indistinct in most places. On the external part only traces of the varices are present.

The chambered part of the shell is absent in both specimens, and thus nothing can be observed of the sutural line.

Locality and Geological Position.—Both fragments were found together at the same locality, in the Chitta Wan, where they were contained in the Upper Ceratite Limestone.

Remarks.—It will appear from the above description that the general outline of these fragments shows much similarity to other forms of the genus *Megaphyllites*; and this circumstance also induced me to describe them under that heading. Whether I have been right in doing so is impossible to assert positively, as the sutural line of this form is not known. I did not, however, think it convenient to pass these fragments entirely in silence, as their occurrence in the Upper Ceratite Limestone is always of some interest.

II. Family : *PINACOCERATIDÆ*.

It is barely possible to make any more use of this name, as everybody who treats of fossil cephalopoda has accepted it, and yet everybody gives another meaning to it. The reason for this discrepancy has evidently originated in the circumstance that Mojsisovics has originally given to his family *Pinacoceratidæ* such an enormous latitude that it was impossible to retain the group in the original sense. The name is, however, so very appropriate, the genus *Pinacoceras* being so exceedingly characteristic, that I myself also feel compelled to use the name, though my views with regard to the range of forms that ought to be included in the family are again different from all the rest.

As type of the family the genus *Pinacoceras* must always be accepted, or else the name would be no longer appropriate. According to this view, we must consider such forms as possess a laterally compressed shell, and distinctly adventive elements in their sutural lines, as belonging to the family. This view is, however, not shared by other men of science, except perhaps by Steinmann and Suttner.

Mojsisovics also includes in his sub-family *Pinacoceratinæ* forms with rather inflated shells and without distinct adventive lobes like *Megaphyllites*; whilst, on the other hand, he unites compressed shells with a very distinct adventive lobe partly in the genus *Meekoceras*, or he considers them at least as a distinct genus belonging to the sub-family *Ptychitinæ*.

Zittel purifies the family at least of the genus *Megaphyllites*; but again refers *Norites*, which has no adventive lobe, to the *Pinacoceratidæ*.

According to my view, the occurrence of a distinct adventive lobe in the sutural line of an Ammonite is such an important character that it must overrule many

others. For instance, *Ceratites hedenstræmi*, Keys., which possesses a very distinct adventive lobe, has been referred by Mojsisovics to the genus *Meekoceras*. Now, there is no country in the world which possesses such numbers of species of *Meekoceras* as the Salt-Range; but among all this enormous amount of forms not a single one is present which shows quite distinctly adventive elements in its sutural line.

I should think, therefore, that the formation of a separate adventive lobe requires such a peculiar mode of development of the sutural line, that it seems primarily improbable that in very intimately connected forms, as one must suppose that different species of one and the same genus are, the one should possess an adventive lobe, the other not. Thus I come to the conclusion that *Ceratites hedenstræmi* and its ally *Ceratites furcatus*, Oeberg, cannot belong to *Meekoceras*, but that it forms a proper genus, for which I introduce the name of *Hedenstræmia*, W., n. gen.

But if we compare the sutural line of *Hedenstræmia* with that of *Longobardites*, we find scarcely any other difference than that the auxiliary lobes show a somewhat other character. On the other hand, the general configuration of the shell of *Hedenstræmia furcata*, Oeb., exhibits such a striking resemblance to *Carnites*—a peculiarity that seems to have already struck Mojsisovics in describing the species—that I must also consider *Carnites* as belonging to the same group of forms.

With regard to *Carnites*, Mojsisovics has been induced to compare this genus with *Hungarites*, because in the quite juvenile state of *Carnites* no adventive lobe exists, or is only developed after the shell has attained a diameter of about 15mm. We do not know, however, at what age *Longobardites* or *Beneckeia* may develop the corresponding part of their sutural line, and all that may be deduced from this peculiarity of *Carnites* is, that we may conclude that the goniatitic ancestor of these forms may have been a species that possessed no adventive lobes. The sutural line of the full-grown state of *Carnites* is so typically that of a member of the family *Pinacoceratidæ* that I cannot but consider the genus as forming part of that family.

After all that I have now written I think I am justified in extending the family *Pinacoceratidæ* to all those forms having a laterally compressed shell and distinctly separated adventive elements in their sutural line; excluding all the other forms in which these characters are not met with.

The number of genera which under such circumstances I am able to attribute to the family is rather extended, and several groups or sub-families may be distinguished among them.

A genus which is most generally accepted as belonging to the *Pinacoceratidæ* is *Medlicottia*, W. It has the adventive elements of its sutural line arranged in a longitudinal manner. At the side of *Medlicottia* appear in the permian deposits of Sicily two other genera: *Propinacoceras*, Gemm., and *Sicanites*, Gemm., in which the adventive elements already show a radial arrangement. The terminations of the lobes in all these genera are bifid, and the same is the case in *Sageceras*, Mojs., which appears in Middle and Upper Triassic beds of the Alpine region. I therefore am of opinion that *Sageceras* stands in a closer connection with the above men-

tioned three permian genera than with the rest of the shells belonging to the *Pinacoceratidæ*, and thus I venture to propose a sub-family designation for those forms, notwithstanding the enormous break that exists in every respect between *Sageceras* and *Propinacoceras*. The sub-family name will perhaps best be *Medlicottiinæ*. The name has been used already by Karpinsky, but he excludes *Sageceras* altogether, and supposes for that genus a quite different systematic position.

Another genus which has been advocated as the presumptive ancestor of all the *Pinacoceratidæ* by Suttner and Steinmann is *Beloceras*, Hyatt. Notwithstanding the circumstance that this latter genus occurs already in strata of Upper Devonian age, yet the general configuration of the shell and the arrangement of the sutural line is so strikingly similar to *Pinacoceras* proper that the two must be brought into closer connection. Whether the one be really the ancestor of the other I cannot decide, as all connecting links are missing, and the break in time between the two is quite inconceivably large. Nevertheless, I think the similarity should not be lost sight of; and to mark this also in the system, I unite the two in one sub-family, for which I introduce the name of *Beloceratinæ*. The characters of this sub-family consist chiefly in the existence of numerous adventive and auxiliary lobes and in the principal lateral lobes and saddles being pointed, not bifid.

Another series has been singled out already by Mojsisovics. It is restricted to the Muschelkalk and consists of two genera: viz., *Beneckeia*, Mojs., and *Longobardites*, Mojs. It is doubtful whether the characters of these two genera are sufficiently different from those exhibited by the genera of the next following series to warrant their distinction as a proper sub-family. As they are, however, probably of another extraction than the genera of the following series, I give a proper sub-family designation to them, and call this sub-family *Beneckeinæ*. As characters of this group it may be adduced that there is only one adventive lobe present, and that the shells have always a sharply cutting external side.

The last group is composed of three genera, two of which are new. These are: *Hedenstræmia*, W., *Clypites*, W., and *Carnites*, Mojs. Between *Hedenstræmia* and *Carnites* there is again a great break, not so much in shape and development as in time, and I cannot vouch for their standing in a developmental connection. I include these three genera under the sub-family name of *Hedenstræmiinæ*. These genera are characterised by a shell that is in general very similar to that of the *Medlicottiinæ*, with two edges along the external part, and by the existence of only a single adventive lobe, which is perhaps developed only in later stages of growth. The terminations of the lobes are not bifid.

We arrive thus at the following arrangement of the genera belonging to the family *Pinacoceratidæ*:—

I.—Sub-Family: MEDLICOTTIINÆ

1. Genus *Medlicottia*, W. Permo-carboniferous to Permian.
2. „ *Propinacoceras*, Gemm. Permian.
3. „ *Sicanites*, Gemm. Permian.
4. „ *Sageceras*, Mojs. Middle and Upper Trias.

II.—Sub-Family : BELOCERATINÆ.

5. Genus *Beloceras*, Hyatt. Upper Devonian.
6. „ *Pinacoceras*, Mojs. Middle and Upper Trias.

III.—Sub-Family : BENECKEINÆ.

7. Genus *Beneckeia*, Mojs. Muschelkalk.
8. „ *Longobardites*, Mojs. „

IV.—Sub-Family : HEDENSTRÆMIINÆ.

9. Genus *Hedenstræmia*, W., n. g., ? Bunter.
10. „ *Clypites*, W., n. g. Lower Trias.
11. „ *Carnites*, Mojs. Upper Trias.

Of all these genera only the genus *Clypites* is represented in the Salt-Range.

Sub-Family : HEDENSTRÆMIINÆ.

Genus CLYPITES, Waagen n. gen.

The specimens belonging to this genus have been taken by me to belong to *Sageceras*, so long as the sutural lines had not yet been made visible in detail, because the general shape of these shells is strikingly similar to that of those belonging to the mentioned genus.

The sutural lines, however, proved to be more like those of *Longobardites*, and in the face of such conflicting evidence there remained nothing but to make a new genus out of these things.

The general shape of the shell is laterally strongly compressed, without any or with only a very small umbilicus. The external part of the shell is narrow and very distinctly flattened, hemmed in on both sides by sharp edges. The surface is perfectly smooth, showing only sometimes very faint falciform striæ of growth.

The most characteristic part is the sutural line. The external or siphonal lobe is very broad, but very short, with short angular branches, which appear like secondary denticulations of the adventive lobe which immediately follows. The latter is distinctly developed, longer than the external but shorter than the first lateral lobe, which is the most prominent and most important one of the whole sutural line. The second lateral lobe is not always quite distinctly developed, but sometimes blends together with the very irregular auxiliary lobes that yet follow. The principal lobes are all denticulated, the saddles entire.

The genus seems to be most nearly related to my genus *Hedenstræmia*, that I have created above. According to Mojsisovics' indications, the adult forms of that genus possessed an angular external side of the whorls, not a sharply cutting one as has been drawn by Keyserling. Also in the young state of *Hedenstræmia furcata* the angles are present. Thus in general shape the two genera are rather similar;

the chief difference, however, consists in the sutural lines. The external lobe is much more distinctly individualised in *Hedenstræmia* than in *Clypites*, and separated from the adventive lobe by a broad rounded adventive saddle, which part is narrow or even angular in *Clypites*. The same difference also exists between *Clypites* and *Longobardites*, whilst otherwise the sutural lines are not so very dissimilar. To this difference there is in *Longobardites* yet another one added, that the external side of the shell is sharp and provided with a high keel.

With *Sageceras*, *Clypites* shares nothing but the external shape.

The genus *Clypites* is the least typical one among all the *Pinacoceratidæ*, as its adventive lobe is but very little detached from the siphonal one. If we consider the mode in which the adventive lobes have been developed in general, as has been demonstrated by Mojsisovics with regard to *Sageceras*, and also as it appears most clearly from the development of *Carnites*, we must come to the conclusion that *Clypites* most probably belongs to one of the most recent branches of the *Pinacoceratidæ*, in which the adventive elements in the sutural line are just in process of development, and that this is the very reason why the adventive lobe is yet so intimately connected with the siphonal one.

The genus is represented in the Salt-Range by three species, all which were found in one and the same bed, in the Ceratite Marls.

1. CLYPITES TYPICUS, Waagen, n. gen. et sp.: Pl. XXI, fig. 7 *a. b.*

The general shape of this little shell is flatly disciform, without any umbilicus, and with a flattened external part, that is hemmed in on both sides by sharp and distinct edges.

The transverse section of the whorls is strongly sagittate, and the indentation caused by the preceding whorl into the succeeding one is exactly two-fifths of the entire height of the latter. The lateral parts of the whorls are very flatly vaulted, the greatest transverse diameter being situated just one-fourth of the entire height of the whorl above the centre of the shell. From there the lateral parts slope very slowly in the direction of the siphonal side, whilst they curve somewhat more quickly inside in the direction of the centre. The siphonal side of the shell is narrow but perfectly flat; it unites with the lateral parts in forming sharp edges but no keels.

The specimen has the greatest part of its shell preserved, and therefore the umbilicus appears entirely closed. In its stead there is a not very thick columella, which is, however, not prominent.

The most characteristic part of this species is its sutural line. The external lobe is very low but very broad, divided by a not very high siphonal tubercle in two lateral branches. In the middle of this tubercle there is a small prominence, which is not closed, but remains open for the passage of the siphon. At its sides there are the two short, pointed, not denticulated, lateral branches, one on each side, which are about parallel to each other, and are situated already on the lateral parts of the shell. After these branches follows a narrow but perfectly rounded adventive saddle,

which is, however, rather low, and does not reach higher up than the little saddles at the sides of the median tubercle. The adventive lobe, that now follows, reaches not much lower down than the lateral branches of the external lobe. It is narrow and terminates at its bottom with two denticulations. Its sides are not quite parallel, but slightly sloping towards the bottom. The external or second adventive saddle reaches much higher up than the first one. It is also much broader and broadly rounded at its upper termination.

The first lateral lobe is very broad but very short, reaching only very little lower down than the adventive lobe. It possesses four denticulations at its bottom, which are all about equally strong and stand on about the same line. The first lateral saddle is about as broad but not so prominent as the external one. It is also broadly rounded on its upper extremity. The second lateral lobe is slightly narrower and also somewhat shorter than the first one. It is provided at its bottom also with four denticulations, which are, however, very minute, but also all on the same line. The second lateral saddle is again as broad, and reaching up as highly up as the first one; it is also broadly rounded at its top. After this there follows a number of small irregular lobes, which can be considered as auxiliary. First there is a large conical one, without denticulations, then comes a little twin-lobe, with two denticulations; and at last two small pointed prominences. The saddles are all entire and of varying, slowly diminishing breadth.

The measurements of the figured specimen are as follows:—

Diameter of the shell	. . . . .	38 mm.
Height of the last volution from the centre	. . . . .	23
" " " " preceding whorl	. . . . .	13.5
Thickness of the last volution	. . . . .	9
Breadth of the external part	. . . . .	2

Locality and Geological Position.—Only one complete specimen and fragments of another were found by myself. These were contained in white limestone bands intercalated between the Ceratite Marls at Nanga.

Remarks.—The present species can be compared in detail with only very few forms. In general outline it reminds one most vividly of certain forms of *Meekoceras*, but the absence of any umbilicus is a character that I have not observed to occur in any species of that genus. But even if similar forms should occur among *Meekoceras*, the peculiar sutural line of the present species would always make a distinction easy.

2. CLYPITES KINGIANUS, Waagen, n. gen. et sp.: Pl. XXI, fig. 8 *a. b.*; Pl. XXII, fig. 3.

In its general outline the present species is very similar to the preceding one.

The shell is also flatly disciform, without any umbilicus and with a flattened bi-angular external part. But the mode of increase seems to be different in this species, as the increase of height of the whorls is excessively large, as large as in *Sageceras*, so that the indentation caused by the penultimate whorl into the

last one occupies not more than one quarter of the entire height of the latter.

The transverse section of the whorls is distinctly sagittate, very strongly compressed and very high. The lateral parts are not quite flat, but very flatly vaulted. Their greatest elevation is a little outside of the first third of the entire height of the whorl; from there they taper somewhat more quickly in the direction of the umbilicus, and very slowly towards the siphonal side. The latter is distinctly flattened and unites with the lateral parts in forming sharp edges, but no keels. The umbilicus is again quite closed and replaced by a central shelly columella.

The most characteristic part of the species is the sutural line. On the whole it is similar to that of the preceding species, but there are several differences. The external lobe is again very short and very broad. In the middle there is the siphonal tubercle, divided in the middle by a prominence that remains open for the passage of the siphon. Thus each half of the siphonal tubercle forms a little saddle on each side of the prominence. At last follow the lateral branches. They are short and simple, pointed at the bottom. They are separated from the large adventive lobe by a narrow rounded saddle that reaches not higher up than the median part of the siphonal lobe. The adventive lobe is broad and extending much further back than the siphonal lobe with its branches. It bears three to four denticulations at its bottom. Its sides are nearly parallel. The second adventive saddle, or external saddle as it also may be styled, is broad, perfectly rounded, and reaching up as high as the median part of the external lobe. The first lateral lobe is the largest of all. It is not very broad, with sides slightly converging towards its bottom. It reaches further back than all the other lobes, and bears at its bottom strong dentations, of which the middle one is more prominent than the others. The first lateral saddle is comparatively narrowly rounded at its top; it is also not quite straight, but a little crooked, and reaches higher up than all the other saddles.

The second lateral lobe is not distinct, but blends together with the auxiliary series. What may be taken to be this lobe bears two strong dentations and is followed towards the umbilicus by a short, and not very broad, saddle, that is again followed on the other side by a broad, irregular, auxiliary lobe, that has two small and one large but shorter dentation. After this there are yet two saddles and two small lobes. The whole sutural line hangs a little down towards the umbilicus, forming a kind of very shallow sutural lobe.

The dimensions of the only specimen found up to the present, though it is not quite complete, are as follows:—

Diameter of the shell, about	. . . . .	61 mm.
Height of the last volution from the centre	. . . . .	36 "
" " preceding whorl	. . . . .	28 "
Thickness of the last volution	. . . . .	13 "
Breadth of the external part	. . . . .	3 "

Locality and Geological Position.—The specimen was collected by myself at Virgal in the Ceratite Marls.

Remarks.—The present species is very nearly related to the preceding one, and

on a first glance one should be inclined to consider the two as identical; on a closer examination, however, one finds that there are differences which forbid such identification.

Before all, there exists in the present *Clypites kingianus* another mode of increase of the whorls; so that in this respect it resembles *Sageceras* more than *Clyp. typicus*. Other differences are found in the development of the sutural lines. In *Clyp. kingianus* the adventive lobe is broad, the first lateral lobe extends more backwards than all the others, the first lateral saddle reaching much higher up than the rest. The second lateral lobe is not distinctly separated from the auxiliary series, and the latter hangs down a little, forming a kind of a shallow sutural lobe. Of all these characters just the contrary is the case in *Clyp. typicus*. The adventive lobe is narrow, the first lateral lobe is broad but short and finely denticulated, the first lateral saddle reaches no higher up than the rest, the second lateral lobe is very distinctly developed, and the auxiliary series does not hang down. Thus there can be no doubt that the two forms must represent different species.

Of other species there is none which can be compared more in detail.

3. CLYPITES EVOLVENS, Waagen, n. gen. et sp., Pl. XXII, fig. 2 a. b. c.

This is again a very rare species, of which only one specimen exists in the Salt-Range collection.

The general shape of the species is flatly disciform, but there is the difference that it possesses an umbilicus, which is not the case in the two previously described forms of the same genus. It is true I cannot tell whether the umbilicus was present in all stages of growth, as the specimen is an internal cast, whilst the shell is preserved in *Clyp. typicus* and *Clyp. kingianus*; and in the inner volutions of the present species the umbilicus is so narrow that it might well once have been filled up by a shelly column. In the full-grown state of the present species, however, a well-developed umbilicus must have been present, had the shell been preserved.

The transverse section of the last whorl is somewhat different in different places. Before the body-chamber commences the transverse section is strongly compressed, very similar to that of the preceding species, with the sole difference that a small umbilicus exists. The greatest transverse diameter is situated about in the middle of the height of the whorl, and makes up just one-half of that height. From there the lateral parts taper about equally in the direction of the siphonal side as well as in the direction of the umbilicus. The latter is very narrow and surrounded by a not very high vertical umbilical wall. The siphonal side is flattened but rather narrow, hemmed in on both sides by sharp edges. The involution in the chambered part of the shell makes up about two-fifths of the height of the exterior whorl. On this chambered part there is also a rather distinct sculpture present, which consists of low, broad undulations, which originate near the umbilicus, and extend in a radial direction, with a slight falciform bend, to near the siphonal side. They are most distinct on the exterior half of the lateral parts.

The body-chamber commences at a diameter of the shell of 52mm. The

length of this part is just one-half a volution. With the commencement of the body-chamber the umbilicus begins to become large, the suture deviates from the regular spiral and reaches the aperture, forming a rather flat parabolical curve. Of the apertural margin there is only a very small piece preserved. At the point where the suture leaves the regular spiral the umbilical wall becomes oblique, but the margin which marks off this wall from the lateral part remains distinct. Towards the apertural margin, there appears a broad furrow on this oblique umbilical wall. The shape of the apertural margin itself cannot be made out. All these features are not quite correctly represented on Pl. XXII, fig. 2 a, where the umbilicus appears much too narrow towards the apertural margin.

The sculpture on the body-chamber becomes much fainter and finer: it consists of fine somewhat falciform ribs, which are rather numerous.

The sutural line of this species is very characteristic. Also here the drawing is not quite correct in some details. The external lobe is not very broad, with a rather shallow siphonal tubercle in the middle. It shows on both sides of the siphonal tube two strong dentations, of which the second bears mostly two denticulations on its bottom. The first adventive saddle is narrow and low, but more distinctly developed than is represented in the drawing. The adventive lobe is somewhat broader than in the drawing, and bears mostly three denticulations at its bottom. The second adventive or external saddle is rather narrow, well rounded at its extremity, reaching very high up, as high or even a little higher than the first lateral saddle.

The first lateral lobe is very broad, extending a little further backward than the adventive lobe. Its sides are diverging towards the front, and its bottom is finely denticulated, bearing some six denticulations, which are not all on the same level. The first lateral saddle is somewhat broader at its base than the external saddle, but soon contracts, bends somewhat over in the direction of the umbilicus, and is rather narrowly and obliquely rounded on its summit. The second lateral lobe is very distinct. It is very broad and considerably shorter than the first lateral lobe. Its sides are nearly parallel and its bottom bears also some six fine denticulations, which are not all on the same level. The second lateral saddle is short but very broad. Its sides are parallel and its top distinctly flattened. After this there yet follow some eight more denticulations or small auxiliary lobes, which are rather irregular.

The dimensions of the specimen are as follows:—

Entire diameter of the shell	. . . . .	79 mm.
Diameter at the beginning of the body-chamber	. . . . .	52 „
„ of the umbilicus	. . . . .	11 „
„ „ before the commencement of the body-chamber	. . . . .	3 „
Height of the last whorl at the mouth from the umbilical suture	. . . . .	39 „
„ „ „ „ preceding volution	. . . . .	27 „
Height of the last whorl at the commencement of the body-chamber—		
<i>a.</i> from the umbilical suture	. . . . .	29 „
<i>b.</i> from the preceding whorl	. . . . .	18 „
Thickness of the last volution at the apertural margin	. . . . .	17 „
„ „ „ „ commencement of the body-chamber	. . . . .	13 „

Locality and Geological Position.—The specimen was collected by myself at Virgal in the Ceratite Marls.

Remarks.—The present species seems to be very nearly related to the two preceding ones; there are, however, characters which make a distinction most easy. Before all, there are such distinctive characters observable already in the external shape of the shell. The existence of a small but distinct umbilicus, which increases in size as soon as the body-chamber commences, and the presence of a low but distinct sculpture on the lateral parts of the shell, are very distinctive. Other differences exist in the sutural line. If we compare this line with that of *Clyp. typicus* we find that in the mentioned species the external lobe is more simple, the adventive lobe more distinctly detached, the first lateral lobe broader and shorter, the first lateral saddle reaching less high up, and that at last the auxiliary series is perfectly different. The difference from the sutural line of *Clypites kingianus* is yet more considerable. In this respect only the second lateral lobe need be compared, which is blended together with the auxiliary series in *Clyp. kingianus*, whilst it is distinctly developed and easily recognisable in *Clyp. evolvens*.

Thus it appears that the latter species represents a well-characterised and easily-recognisable form.

3. Family: *NORITIDÆ*.

Already Karpinsky has proposed to distinguish a sub-family *Noritinæ*, which he places on a line with two other sub-families, which he calls *Medlicottiinæ* and *Lecanitinæ*, respectively. In the *Noritinæ* he places three genera: *Pronorites*, *Parapronorites*, and *Norites*, and considers the bifid lobes as the most striking character of the sub-family.

Though I am not in accordance with Karpinsky, in considering the bifid lateral lobes as the most important character, but rather the persistent tripartite external lobe also in the full-grown shells, yet it seems necessary to me to retain the subdivision, but at the same time to transform it into a true family, as the forms belonging to it deviate so much from all the others that it does not seem advisable to place them with any other together in another family. The most ancient form that has been brought into connection with *Norites* by Mojsisovics is the genus *Pronorites*, Mojs. This latter genus is characterised by a tri-cuspidate external lobe and by a first lateral lobe that is bifid in most cases. The first of these characters now seems to be the most essential one by which the family can be distinguished, as it is repeated in a more or less strong degree in all the succeeding genera.

The genus approaching in time most closely to *Pronorites* is *Parapronorites*, Gemm. In the species belonging to this genus the external lobe is also tri-cuspidate, but the first lateral lobe, though in its general character also yet bifid, possesses mostly many denticulations, whilst the second and some further lobes have also become bifid. After this genus there is a great break in the series, as *Parapronorites* occurs in Sicily and in the Artinsk-Sandstone; and the next following genus *Norites*, is restricted to the Muschelkalk of the Alps.

But though *Parapronorites* approaches in time more closely to *Norites* than *Pronorites*, which is mostly of a carboniferous distribution, yet in its shape *Norites* is more closely related to *Pronorites* than to *Parapronorites*. Most men of science will be inclined to attribute this strange fact to the circumstance that from *Pronorites* probably two lines of development may take their origin; one of which leads to *Parapronorites*, the other to *Norites*. It cannot be denied that this view may possibly be correct, but it can as little be denied that though the developmental connection between *Pronorites* and *Parapronorites* may be near to certain, yet there exists no proof whatever that *Norites* is a descendant of *Pronorites*, as both genera are very far distant in time from each other, while connecting links have not been detected up to the present. Nevertheless, the similarity in the sutural lines of *Pronorites* and *Norites* is so striking that for the present we shall not take heed of the enormous gap, but unite, as does Mojsisovics, the two genera as more or less nearly related. We are here in a similar situation with regard to *Beloceras* and *Pinacoceras*, which we also have brought into connection notwithstanding the enormous gap in time between the two.

In the Salt-Range now, two new genera have been detected which are related to the same forms, but which nevertheless do not fill up the gap existing between *Norites* and *Pronorites*. For the first of these I shall introduce the name of *Ambites*, W. This genus is characterised by thoroughly goniatitic sutural lines, in which the external lobe is the most characteristic part. It is distinctly tripartite, as in *Pronorites*, but only the median part is pointed, whilst the lateral branches are broadly rounded. The first lateral lobe is not bifid but entire.

I was long in doubt what affinities I should attribute to this very strange form, as *Lecanites* and *Paraprolecanites* seemed to have an equal claim on this affinity with *Pronorites*; but at last I decided in favour of the latter, as, before all, the shell here under consideration seemed to possess too great an involution of the whorls to be compared with the very widely umbilicated forms of *Prolecanites* and *Lecanites*; and then I was unable to detect among all the species of *Lecanites* that came under my observation a tripartite external lobe. This character seems to be entirely restricted to the family of the *Noritidæ*, and seems not to occur again except in some *Goniatites*, the affinities of which among the more recent Ammonites have not yet been worked out. The absence of any subdivision in the first lateral lobe seemed to me not of such fundamental importance as to forbid the affiliation of the genus *Norites*; at least in such a manner as to place both in the same family.

The second genus existing in the Salt-Range is of quite another description. The sutural line is here strongly ceratitic, the indentations of the lobes reaching far up towards the tops of the saddles. The latter are somewhat club-shaped or phylloid. The most strange feature of the whole sutural line consists in the circumstance that it is barely possible to decide what is to be considered as the first lateral lobe, and whether there existed an adventive lobe or not. There is a rather large median prominence in the middle of the siphonal lobe, at both sides of which there are again equally large fingers, which three dentations together might perhaps form a tripartite siphonal lobe. But this lobe would then be extremely short, not

dissimilar to the siphonal lobe of *Ptychites gibbus*, Ben., which is, however, bipartite, not tripartite. After this the sutural line descends strongly without the intervention of a large saddle, to form a very characteristic bipartite lobe, which in its general configuration is similar to the bipartite first lateral lobe of *Norites*. The next following lobe in the Indian shell is larger than the bipartite one, and occupies the place of a first lateral lobe. One sees from these few indications what difficulties there are to be overcome in the interpretation of this sutural line, but on the whole the general characters of this form can only be compared to *Norites* and its allies, on account of the tripartite condition of the external and the bipartite character of the first lobe after this, whether the latter be called an adventive or a lateral lobe.

I shall introduce for this undoubtedly new genus the name of *Paranorites*,

On page 126 of the present work I have described the genus *Goniodiscus*, and have affiliated it on account of its outward appearance to *Sibirites*, notwithstanding its very strangely developed sutural line. After repeated consideration of the case, I find now that the outward appearance is probably deceptive in this case, and that greater stress is to be laid on the development of the sutural line, in which a very distinctly tripartite external lobe is the most characteristic part. According to this, the genus ought to be placed in the family *Noritidæ*, and I really think this to be the proper position for this genus; so that the family is represented in the Salt-Range by three genera, viz.:

AMBITES, W.

PARANORITES, W.

GONIODISCUS, W.

A shell has already been described by Mojsisovics that probably also belongs to *Goniodiscus*, under the name of *Xenodiscus dentosus*, from the lower Trias of the Olenek in Siberia. The tripartite external lobe is, however, here less strongly developed than in the Indian shell. It seems unnecessary to describe here the genus *Goniodiscus* over again.

If we consider the geological arrangement of the genera that have been mentioned as belonging to the family *Noritidæ*, we find the following facts. In carboniferous and lowest permian times, the genus *Pronorites* is to be found. *Parapronorites* is exclusively permian. The genus *Ambites* is restricted to the Ceratite Marls, one of the lowest divisions of the lower Trias, whilst *Paranorites* occurs also in the lower Trias, but in its topmost divisions. Lastly, *Norites* is characteristic of the Muschelkalk, as is also probably *Goniodiscus*.

In this succession in time there is not a trace to be detected of a development in any certain direction. Each genus stands by itself and forms a member of a broken chain in which the connecting links are missing, and even this chain must have been made up of several wires. All these genera have, however, a few characters in common: these are compressed whorls, a shell that bears a narrow or only moderately wide umbilicus, and a distinctly tripartite external lobe. Otherwise, there seems to be a certain tendency to form indistinctly adventive lobes, and to make the lateral lobes bipartite by the formation of a large incision in the middle.

1. Genus, *AMBITES*, Waagen, n. gen.

Not more than three species in the Salt-Range collection can be attributed to this genus. These shells have a rather narrow umbilicus, compressed whorls, and goniatitic sutures.

The general form of the shell is therefore disciform, with a biangular external part. The shell is, however, not quite smooth, but bears a distinct, though not very prominent, sculpture, which is chiefly distinctly developed on the body-chamber. This sculpture consists of falciform broad undulations, which are crossed by a few faint concentric ridges. The diameter of the umbilicus increases somewhat more rapidly than the diameter of the shell, so that larger specimens have a comparatively wider umbilicus than smaller ones. The body-chamber seems to have occupied about one-half of a volution. On one of the specimens the apertural margin seems to have been preserved, but its exact outline is rather indistinct. The external part of the shell is somewhat more strongly projecting than the umbilical region. On the lateral parts the apertural margin projects a little in the middle, and is then slightly cut out in the direction of the umbilicus, whilst it is nearly straight towards the external part. On this latter the apertural margin is not distinctly preserved, but to all appearance it has been cut off straightly. Also the lines of growth, which are extremely fine, are apparently straight on this part, and not making a curve backward as in *Goniatites*.

It has been stated above that the sutural lines are perfectly goniatitic. There are two distinct lateral lobes present, whilst the auxiliary series is transformed into a straight line. The external lobe is broad and tripartite; the median part is pointed, whilst the two lateral parts are broadly rounded. These are the characters of the genus.

The affinities are, however, manifold. There is, before all, the genus *Triainoceras* of Hyatt, which by its sutural line is apparently related to the present genus. The affinity, is, however, only an apparent one. The transverse section of the whorls of *Triainoceras* is nearly circular, not compressed; and in the tripartite external lobe also there exist fundamental differences, inasmuch as in the devonian genus the median part is largest and strongly prominent, whilst the lateral parts are narrow and much smaller—just the contrary of what exists in our *Ambites*. With regard to the external lobe, there exists a much closer resemblance between the latter genus and the sutural line of an unknown form that has been figured by Sandberger on Pl. IX of his "Versteinerungen des Rheinischen Schichtensystems in Nassau" under the name of *Goniatites mixolobus*, Phill. But also here, the lateral parts of the external lobe are pointed and not rounded as is the case in *Ambites*. The same is the case in the genus *Paraprolecanites* which was created by Karpinsky for some unknown species. It has also a tricuspidate external lobe, in which all three parts are pointed.

On account of these discrepancies I have long considered the forms for which I have now introduced the name of *Ambites* as belonging to the genus *Lecanites*; but after I found that the latter genus is largely represented in the Salt-Range and

never shows a trace of a median prominence in the middle of the external lobe, I have at last been compelled to separate these forms under a proper generic designation.

The general form of these shells most closely resembles *Norites*, as the umbilicus is also rather narrow and the whorls compressed. The chief difference consists in the lateral lobes, which are not bifid as in *Norites*, in *Pronorites*, and in *Parapronorites*; but as the tripartite external lobe holds good also in the present forms, I cannot but consider them as related in some way or other to *Norites*, which relation I tried to express in placing them all in one and the same family, for which I have introduced the name of *Noritidæ*.

The species of *Ambites* occurring in the Salt-Range are restricted to the lower divisions of the Ceratite formation. Two of them—*Ambites discus*, W., and *Ambites magnumbilicatus*, W.—occur in the Ceratite Marls; the third species, *Ambites rupestris*, W., has been found up to the present only in the lowest beds of the Lower Ceratite Limestone.

1. *AMBITES DISCUS*, Waagen; n. gen. et sp.: Pl. XXI, fig. 4 *a. b.*;
fig. 5, *a. b. c.*

The general shape of the species is flatly disciform, with a moderately wide umbilicus and a flattened external part hemmed in on both sides by sharp angular bends of the shell. The involution is somewhat variable, as the umbilicus widens as the shell progresses in size. In a specimen of about 40 mm. diameter, the indentation caused by the preceding whorl into the last one takes up two-sevenths of the entire height of the latter. In a specimen of about 65 mm. in diameter, on the contrary, this indentation is not more than two-eighths of the height of the last volution.

The transverse section of the whorls is laterally compressed, considerably higher than it is broad. The greatest transverse diameter is situated just in the middle of the height of the whorls. From there the lateral parts slope in a gentle curve in the direction of the umbilicus; then suddenly bend down just before reaching the umbilical suture, thus forming a low but distinct umbilical wall, that is, however, not hemmed in above by an umbilical edge. In the direction of the siphonal side the curve is about equal to that near the umbilicus; so that the lateral parts are about equally vaulted for all their extent on the one side until they touch the umbilical wall on the other, when they unite with the flattened external part forming a sharp external edge.

The sculpture of the shell is low but distinct. It is more strongly expressed on internal casts than if the shell is preserved. It consists of falciform radial ribs which are arranged in pairs, so that two of them are always united to form a broad undulation, which is separated from the next one by a low broad valley. Each undulation bears on the top a little furrow, which separates it in two radial ribs. These undulations commence a little distance above the umbilical wall, are most strongly expressed on the middle of the sides, and disappear more or less towards the external edge. Only on one fragment are they somewhat more strongly developed

in that region, and cause there a slight crenulation of that edge. Also, the external part is not quite smooth, but bears very low undulations which are in connection with those on the lateral parts. On internal casts two spiral prominences can be observed, which are not far distant from each other, are situated a little above the medium part of the shell, and have between them an insignificant spiral excavation, which, however, does not reach up to the mouth of the shell. The radial sculpture crosses indiscriminately over it. This excavation corresponds evidently to a thickening of the shell-substance that has probably been produced by the successive insertion of the shell-muscles. In a fragment of the body-chamber that reaches to near the mouth of the shell, the interior of the two spiral ridges stops off shorter than the exterior one. Where the former ceases there is a distinct roundish impression that reaches down to the margin of the umbilical wall. Perhaps an interpretation of this impression as that of the shell-muscle would be more correct, but then the spiral ridges would have to be considered as the impression of the *annulus*.

The sutural line is extremely simple. The external lobe is very broad and rather short. It is distinctly divided in three parts, of which the median one is the shortest, is sharply pointed, and limited on both sides by sharp angular incisions. The lateral parts reach much further down and are broadly rounded, not dissimilar to an adventitious lobe. The external saddle that now follows is very narrow, perfectly rounded on the top and reaching barely higher up than the median part of the external lobe. The first lateral lobe is very broad, with sides that somewhat converge towards its bottom. It reaches much lower down than the external lobe. Its bottom is broadly rounded. The first lateral saddle is somewhat broader than the external one, with very strongly converging sides. Its top is perfectly but narrowly rounded. In its height it stands equal to the external saddle. The second lateral lobe is very considerably shorter and narrower than the first lateral, but it is broader than the first lateral saddle. Its sides are also converging and its bottom broadly rounded. The second lateral saddle is very small, and after it there follows yet a kind of little lobe, after which the sutural line goes straight down to the umbilical suture.

The measurements of two specimens are as follows:—

	I.	II.
Entire diameter of the shell	42 mm.	65 mm.
Diameter of the umbilicus	8 "	17 "
Height of the last volution from the umbilical suture	20 "	28 "
" " " " preceding whorl	15 "	22 "
Thickness of the last volution	9 "	12 "

The smaller specimen consists of the anterior half of the last volution of the body-chamber; and at its end there are traces of the apertural margin. In the larger specimen the body-chamber is only just commencing. In both specimens, only fragments of the shell are preserved on the side represented in the figure.

Locality and Geological Position.—Of this species, but two entire specimens and some fragments are preserved; they were collected by myself at Amb in the Ceratite Marls.

Remarks.—The present species cannot be compared in detail with any other form, all its specific characters being perfectly peculiar.

2. *AMBITES MAGNUMBILICATUS*, Waagen, n. gen. et sp. : Pl. XXI, fig. 6, *a. b. c.*

The present species is very similar to the preceding one and can only be distinguished with difficulty. Nevertheless I thought it convenient to separate it under a distinct name, as these forms are of such importance when compared with the different forms of *Goniatites*, that even the slightest deviations in form must be noted.

The general shape of the shell is flatly disciform, as with the preceding species, but the umbilicus is, in specimens of equal diameter, much wider in the present form. The involution of the shell is thus also much less considerable. At the mouth of the shell, which is partly preserved, the indentation caused by the preceding whorl is not more than one quarter of the height of that mouth, whilst in a specimen of about the same diameter as the preceding species it makes up near to one-third of that height.

The transverse section of the whorls is compressed, considerably higher than it is broad. The greatest transverse diameter of the whorls is situated somewhat lower down than in the preceding species, being about one-third of the entire height above the umbilical suture. The lateral parts slope from there in a very flat curve towards the external edge, whilst in the direction of the umbilicus this curve is much stronger; but here already, after a very short distance, the umbilical edge is reached, which is not very sharp, but much more strongly expressed than is represented in the figures. The umbilical wall is much higher than in the preceding species and distinctly sloping.

The sculpture of the shell is exactly like that of the preceding species. It consists also of low falciform radial undulations which bear a furrow on their top, so that each is made up of two radial ribs. The spiral impression is also present, and comes to light when the shell of the body-chamber is removed. It is, however, broader in this species than in *Amb. discus*.

The mouth of the shell is preserved nearly for its entire length. It is most deeply cut out in the region of the umbilical edge, turns then forward, and is slightly protracted on the middle of the sides; but the most prominent region is the siphonal part. On the whole, this mouth is most similar to that of some forms of *Harpoceras*, only that the siphonal part is not pointed but, as far as can be observed, straightly cut off.

The length of the body-chamber is exactly one-half of the last volution.

The sutural line is thoroughly goniatitic. The external lobe is very broad and tripartite. The median pointed part is on the same level as the lateral rounded branches. The external saddle is narrow and reaches much higher up than the median part of the external lobe. The first lateral lobe extends much lower down than the external one. It is broadly rounded and has somewhat sloping sides. The first lateral saddle is much broader than in *Amb. discus*. It reaches also somewhat higher up than in that species, and exceeds in this respect the external saddle. The

second lateral lobe is much shorter than the first lateral, is rather narrowly rounded, and has very strongly sloping sides. The second lateral saddle is very low and very broad; much broader than in the preceding species. After this there follows yet an indistinct small lobe which passes gradually into a straight line that reaches down to the umbilical suture.

The dimensions of the specimen are as follows :—

Diameter of the shell	. . . . .	44 mm.
" " umbilicus	. . . . .	11.5 "
Height of the last volution from the umbilical suture	. . . . .	20 "
" " " preceding whorl	. . . . .	15 "
Thickness of the last volution	. . . . .	9 "

Locality and Geological Position.—The only example of this species in the Salt-Range collection was found by myself at Amb in the Ceratite Marls, together with the specimens of the preceding species.

Remarks.—The differences of the present species from *Amb. discus* have been notified already in the description of the species. They consist chiefly in the larger umbilicus, the less involute whorls, the higher umbilical wall, and the existence of an umbilical edge. Also in the sutural line there exist some differences, chiefly in the external lobe and the lateral saddles.

With other species, the present one need not be compared.

3. *AMBITES RUPESTRIS*, Waagen, n. gen. et sp.: Pl. VII *a*, fig. 10, 10 *a*.

Only a single specimen of this species is contained in the Salt-Range collection, and this even is not so excellently preserved as the specimens of the two preceding species. The rock in which it is contained is, however, so little favourable to an excellent preservation of the fossil, that one must needs be contented with even such a specimen as may give a clue to the constitution of the fauna contained in this particular bed. The specimen cannot be detached from the adhering rock. It is composed of air-chambers for its entire extent, and in some places the shell is preserved.

The general form of the shell is flatly disciform, with compressed whorls and a not very wide umbilicus. The involution is moderate, and the indentation caused by the penultimate whorl into the last one makes up about two-fifths of the entire height of the latter.

The transverse section of the whorls is somewhat trapezoidal, much higher than it is broad. The lateral parts are very flatly and equally vaulted. The greatest transverse diameter is situated a little outside of the middle of the lateral parts. From there the latter slope somewhat more quickly in the direction of the external side than in the direction of the umbilicus. This latter is surrounded by a distinct and rather high umbilical wall, which is, however, not quite vertical but somewhat sloping. It unites with the lateral parts to form a not very distinct umbilical edge. The external part is not very broad and perfectly flattened. It is hemmed in on both sides by sharp angles.

As far as can be judged from the specimen, the shell seems to be quite smooth and devoid of any distinct sculpture. Only in some places it appears as if very faint traces of radial sculpture had existed; one cannot, however, be certain of the circumstance.

The most characteristic part of the whole shell is the sutural line, which is excellently preserved. The external lobe is short, very broad and tripartite, as in the two preceding species. The median part is small, pointed on the bottom and limited on both sides by little angular incisions. The lateral parts are broadly rounded and about on the same level as the median part, in the same manner as is represented on Pl. XXI, fig. 6 c. of *Amb. magnumbilicatus*. The external saddle does not reach very high up; it is narrowly rounded on its top and its external side is strongly sloping. The first lateral lobe is very long, reaching down much further than the external one. It is very narrowly rounded at its bottom and its sides are nearly parallel. The first lateral saddle is broad, much broader and reaches much higher up than the external one. It has also nearly parallel sides, and its top is very broadly rounded. The second lateral lobe, which is apparently yet partly outside of the line of involution, is very low and broad, perfectly rounded on its bottom, with a strongly sloping inner side, and merging into a broad and low saddle that extends down to the umbilical suture.

The dimensions of the specimen, as far as can be taken, seem to be as follows :—

Diameter of the shell	.	.	.	.	.	.	.	.	.	.	.	44 mm.
" " umbilicus	.	.	.	.	.	.	.	.	.	.	.	11 "
Height of the last volution from the umbilical suture	.	.	.	.	.	.	.	.	.	.	.	21 "
" " " " preceding whorl	.	.	.	.	.	.	.	.	.	.	.	P 14 "
Thickness of the last volution	.	.	.	.	.	.	.	.	.	.	.	P 11 "

Locality and Geological Position.—The only specimen of this species was found by me west of Khoora in the lowest beds of the Lower Ceratite Limestone. These beds are filled with thousands of fossils, chiefly Ammonite shells, but nothing can be extracted; only what is exposed by weathering on the surface of the limestone slabs being fit for description.

Remarks.—I have placed this species in the genus *Ambites* on account of the configuration of the external lobe, which is exactly like that of *Amb. magnumbilicatus*, W. The species otherwise deviates considerably. The two species previously described have a distinct second lateral lobe, whilst in the present form the position of this lobe is somewhat doubtful, as it seems to be only partly above the line of involution. Another point of discrepancy consists in the long and narrow first lateral lobe, which is in its shape perfectly different from the same lobe of *Amb. discus* and *Amb. magnumbilicatus*. Thus there cannot be the slightest doubt that *Amb. rupestris* is a species quite different from those previously described; though another question also arises as to whether it should not be considered as the ancestor of the other two. According to its geological position it ought to be so, as the lowest beds of the Lower Ceratite Limestone are considerably lower in position than the Ceratite Marls; and also according to the development of the second lateral lobe. In the one and the other forms, a developmental con-

nection between the two would not be absolutely improbable, but I do not dare to express a definite opinion in this respect. In these aggravatingly indifferent forms, as are all the Leiostraca of the Salt-Range, one can never be too cautious in drawing conclusions; and I rather abstain from propagating opinions with regard to which I myself cannot arrive at any conviction.

Genus PARANORITES, Waagen, n. gen.

It is only a single species for which I must create this new genus, and therefore it is very difficult to distinguish between specific and generic characters.

That which I consider as essential for the genus is the sutural line. This is one of the strongest features recognisable; and a most strange part again is the external lobe, which consists of three parts, of which the lateral are very strongly individualised, whilst the median one nearly disappears. This median part is made up of three simple, rather long and nearly parallel fingers, of which again the median one is the broadest and longest. These three fingers may perhaps represent all the external lobe, and what follows next may be adventitious lobes; but then this external lobe would be extremely short, even shorter than in *Ptychites gibbus*, Ben., as it has been figured by Mojsisovics. The thing on which the greatest systematic value must be placed is the median prominence, which has also caused me to place this genus in the family *Noritidae*. The lobe following next is large and intimately united with the tripartite median part. It extends rather low, and bears at its bottom a distinct secondary saddle which divides the lobe in two branches in exactly the same way as the first lateral lobe is divided in the genus *Norites*. The question now arises, is this lobe to be considered as an equivalent of the first lateral lobe of *Norites*, or is it rather to be taken as an adventitious lobe; or, again, only as the lateral branch of the extremely broad external lobe? The absolute isolation in which the present form stands with regard to a developmental connection with other species or genera forbids a definite solution of this question, and I can only point out the peculiarity, without attempting any explanation. After this lobe there follows a narrow but high saddle, and after this the largest lobe, which may perhaps best be styled the first lateral. Besides this there is yet a second lateral lobe, and, in the umbilical region, a number of auxiliary dentations. All the lobes are strongly ceratitic.

Among European genera of Ammonites, there are only very few which can be compared with the present genus. Among these, *Norites* is to be primarily mentioned; though even in this case the similarity is only a distant one. The sutural line has already been compared in the description to that genus; and we have seen that, though some points of similarity exist, yet on the whole the points of discrepancy are predominating. Among other forms, there is only a single one which can at all be compared, with regard to its sutural line, to the present genus, and this is *Meekoceras maturum*, Mojs. It is much to be regretted that the median part of the external lobe of this species is not known, so that it could be decided whether a median part with three fingers ever existed or not. The lateral branch is

indistinctly bipartite, much more so than in our *Paranorites*. The bipartition recurs again in the second lateral, and the first auxiliary lobes. Otherwise the shell of *Meekoceras maturum* is much more narrowly umbilicated than our *Pronorites*, but a radial falciform sculpture is again present in both.

There cannot be any question of a generic identity between the two, though a certain relation may in fact exist. The forms that have been described by Mojsisovics in his "Mediterranean Province" under the generic designation of *Meekoceras* seem to me only partly to belong to that genus; in fact I am inclined to accept the single *Meekoceras caprilense* as generically identical with what I shall have to describe under that name, whilst all the rest show other affinities, chiefly to *Proptychites*, that I shall have to treat of next. Also to our *Paranorites* a certain relation may exist, though probably a more remote one, as the median prominence in the external lobe does not exist either in *Proptychites* or in *Meekoceras*; a character that removes the genus *Paranorites* among the forms more or less allied to *Norites*, and consequently I have placed the former genus in the family *Noritidæ*.

PARANORITES AMBIENSIS, Waagen, n. gen. et sp. : Pl. XXII, fig. 1, *a. b. c. d.*

An excellently preserved specimen serves for the definition of this species. The greater part consists of an internal cast showing its sutures beautifully. Though the specimen possesses a rather considerable diameter, yet it is entirely made up of air-chambers, no part of the body-chamber being preserved. In some places remnants of the shell have been preserved, and these show the exceptional thickness of one millimetre. The surface of this shell is, however, very badly preserved, as it is all covered with firmly adhering grains of sand that obscure all the finer sculpture.

The general shape is flatly disciform, with a tolerably wide umbilicus and compressed whorls. Where the shell is preserved, the external side of the whorls appears flattened and obtusely biangular; on the internal cast, however, this part is nearly perfectly rounded.

The transverse section of the whorls is compressed, very considerably higher than it is broad. The greatest transverse diameter is situated not far above the umbilicus, from which it is removed about one-sixth of the entire height of the shell. The umbilicus is surrounded by a rather high vertical umbilical wall which is, near the umbilical suture, even turned a little inside. It unites with the lateral parts of the shell to form a barely perceptible obtuse umbilical edge. The lateral parts are very flatly and evenly vaulted. From the umbilical wall, the curvature ascends rather quickly to the highest point of elevation, which is, as has been stated, not far off. From there it slopes very slowly and equally down to the external part, with which it unites in forming a broadly rounded obtuse edge, where the shell is preserved, though it is barely at all perceptible on the internal cast. The external part presents itself also differently according as the shell is present or not. In the former case the external part appears distinctly flattened, in the latter it is nearly perfectly rounded.

The sculpture is very low and indistinct, but in its configuration it is perfectly that of *Harpoceras*. It consists of low falciform undulations, which are sometimes bifid on the middle of the sides and sometimes single. The external part is devoid of sculpture.

The sutural line has already been partly described in the definition of the genus; still some details must be made known. I regret to say that the drawing of this line on Pl. XXII, fig. 10, does not exactly represent all these details; chiefly the three fingers in the middle of the external lobe are not quite correctly represented. The median one is correct; it is rather long and perfectly conical. The little saddles separating it from the lateral fingers are also correctly represented; but these latter are too short, as they are in reality considerably longer than the median. The little saddle following next, in reality reaches higher up than appears from the drawing. With these exceptions the drawing is tolerably correct. The bipartite lobe is strongly but finely denticulated on both its branches, and on the side towards the external saddle the denticulation reaches rather high up. The external saddle is narrow and somewhat club-shaped or phylloid. It is also very high, extending much higher than the median part of the external lobe, and its top is perfectly rounded. The first lateral lobe is broad and long; a little longer than the bipartite lobe. It is also a little club-shaped and bears at its lower termination a great number of fine denticulations which show a pyramidal arrangement. The first lateral saddle is broader than the lobe, slightly club-shaped, reaching higher up than the external saddle and somewhat obliquely rounded at its top. The second lateral lobe is much shorter and narrower than the first, with many denticulations at its bottom which form together a little arch. The second lateral saddle is broad, short and obliquely depressed at its top. After this there follow seven larger dentations, which only indistinctly form auxiliary lobes. Some of them bear yet subordinate denticulations.

The measurements of the specimen are as follows:—

Diameter of the shell	. . . . .	102 mm.
" umbilicus	. . . . .	27 "
Height of the last volution from the umbilical suture	. . . . .	45 "
" " " preceding whorl	. . . . .	36 "
Thickness of the last volution	. . . . .	22 "

Locality and Geological Position.—The only individual of this species was found by me at Amb in the *Stachella* beds of the Ceratite Sandstone.

Remarks.—No species have been described up to the present with which the present one can be compared in any detail. As regards generic affinities or differences, these have been discussed already in the description of the genus.

4. FAMILY: *PTYCHITIDÆ*.

As stated in the introduction to the *Leiostraca*, Mojsisovics has already distinguished a sub-family under the name of *Ptychitinæ*. This sub family comprises seven genera, of which one, *Carnites*, has been removed by me to the family *Pinacoceratidæ*. Of some others—viz., *Nannites* and *Hungarites*—I

cannot judge as there are no materials of these at my disposal; and thus there remain only the genera *Meekoceras*, *Gymnites*, *Sturia*, and *Ptychites*, which require to be treated in detail.

The genus *Meekoceras*, which is one of the first genera enumerated by Mojsisovics in his sub-family, has troubled me considerably. Mojsisovics was certainly right in uniting this genus with *Ptychites* in the same sub-family, if one considers the extent which he has given to his genus; but just this circumstance makes me doubtful, whether all these different things belong to one and the same genus. There can be no doubt about *Meekoceras caprilense*, which is most decidedly a *Meekoceras*; but already *Meekoceras cadoricum* is doubtful. It shows a very great resemblance to my genus *Proptychites*, whilst it deviates very considerably from *Meekoceras caprilense* on the one hand, and on the other as widely from *Meekoceras reuttense* and all its allies. It thus seems to me highly probable that three different groups of forms have been mixed up by Mojsisovics in the genus *Meekoceras*, of which the majority may be related to *Ptychites*, and must be placed in the *Ptychitidæ*; whilst the smaller part, with *Meekoceras caprilense*, must remain in the genus *Meekoceras*, which is, according to the materials contained in the Salt-Range collection, to be removed from the *Ptychitidæ* and forms the prototype of a proper family.

I have already stated that *Meekoceras cadoricum*, Mojs., is very similar to my *Proptychites*, and I consider it as highly probable that this species really belongs to my genus; but *Meekoceras reuttense*, Beyr., certainly does not belong to it, and it will form with its allies probably a separate genus, for which a new name will have to be introduced. I propose for this genus the name of *Beyrichites*, in commemoration of Beyrich's classical paper "Über einige Cephalopoden aus dem Muschelkalk der Alpen," in which for the first time one of the Cephalopod faunas of the older triassic deposits of the Alps was made known. *Beyrichites reuttensis*, Beyr., *Bey. kanikofi*, Opp., and *Beyr. maturus*, Mojs., sp., would have to be considered as some of the prototypes of this genus.

Thus we see that *Meekoceras*, which always has compressed whorls and a narrow external side, must be eliminated from the *Ptychitidæ*, whilst some of the forms counted with *Meekoceras* by Mojsisovics in reality belong to *Proptychites*, and may thus remain in that family.

So we have recognised already one genus as belonging to the family, and this is *Proptychites*. To this genus the genus *Ptychites* is very nearly related, on the one hand, on the other the genus *Beyrichites*.

That the genus *Sturia* is very nearly allied to *Ptychites* has never been questioned by anybody.

Another group of forms is indicated by the genus *Gymnites*, Mojsisovics. On a first glance this genus seems to be very far deviating, but on a closer examination one finds that in reality there exists a certain affinity to *Ptychites*, and that Mojsisovics was perfectly right in putting both into the same family. The sutural line of both is on the whole not dissimilar, and on the last volutions of *Gymnites* similar plications appear, as they do in most species of *Ptychites*.

As my genus *Xenodiscus* has been considered the ancestor of *Gymnites* by Mojsisovics; as to which after all he may be correct at least with regard to *Xenod. carbonarius*, W., still this species cannot retain the generic name *Xenodiscus*. On a previous page of this volume, in the introduction to the family *Tropitidæ*, I have shown that the first species mentioned by me in the genus, and for which the generic name must be applied in the first case, is probably a thing that does not belong to the *Leiostraca* at all, but must rather be transferred to the *Trachyostraca*. Already Mojsisovics had done so in his arctic triassic faunas, but he had placed my *Xenodiscus plicatus* in the genus *Ceratites*, which is decidedly erroneous. On account of the length of the body-chamber, the genus can only be placed in the family *Tropitidæ*; and thus I have considered it as an intermediate form between *Paraceltites*, Gemmellaro, and *Celtites*, Mojs. The case is, however, different with regard to the second species, the *Xenodiscus carbonarius*, W. This seems to be in fact very nearly related to *Gymnites*, as in both these forms the inner volutions are perfectly smooth, whilst the last volution is provided with a more or less strong sculpture; and in both the body chamber attains a length of near to one volution. But if this second species is really so far different from *Xenod. plicatus* as to belong to a quite different division in the system of the Ammonoids, then most certainly it must receive also a different generic designation, and I introduce for this *Xenod. carbonarius*, the generic name of *Xenaspis*, W., n. gen. The typical species of this genus has been found in the upper Permian beds of the Salt-Range, and it appears very doubtful to me whether the genus extends yet to the triassic formation. Certainly, if there should occur in the lower Trias, transitional forms between *Xenaspis* and *Gymnites*, they ought to exhibit a more complicated sutural line than exists in the former genus.

As a form analogous in certain respects to *Gymnites* as well as to *Sturia*, I consider my genus *Flemingites*. It has a large umbilicus, and its sculpture, commencing only after the shell has attained considerable dimensions, is very similar to that of the full-grown *Gymnites palmai*, Mojs. At the same time, it possesses a spiral striation such as exists in *Sturia*, and thus I am inclined to consider the genus *Flemingites* as a representant of the *Sturia* type within the *Gymnites* group.

Perhaps *Ophiceras*, Griesb., might also belong to the *Ptychitidæ*; and it seems to be most nearly related to *Xenaspis* on account of the system of sculpture, which is also restricted to the last volutions. I cannot, however, be quite certain on this point, and shall refer to it later on in the text.

If we now consider all the genera that have been mentioned, and try to deduce from them a general diagnosis of the family, we find that there are not many points in which all these forms agree. The most constant character is the mode of sculpture, which in most genera appears only after the shell has attained a certain size. It then consists of low radial folds or undulations which only very exceptionally correspond with tubercles that appear towards the mouth of the shell either on the lateral parts or on the margins of the external part. Sometimes the folds become falciform, in other cases the shell also remains quite smooth. There are generally two lateral lobes present, and the external lobe is always shorter than the first lateral; in the same way the external saddle nearly always reaches a lesser height than the

first lateral saddle. The auxiliary series is very differently developed according to the geological age of the different forms.

The length of the body-chamber seems to take up about three quarters of the last volution.

A character that is also peculiar is the frequent occurrence of a concentric striation on the forms belonging to this family. I know of no other family of Ammonoid shells, except the *Cladiscitidæ* of the Sub-order Arcestoidea, in which this character is met with so frequently.

The genera belonging to this family can be distributed easily in two sub-families according to the size of the umbilicus. The first sub-family, for which the name *Proptychitinæ* may be introduced, because the name *Ptychitinæ* cannot be accepted on account of its having been used by Mojsisovics in quite a different sense, would be characterised by a narrow umbilicus and more or less inflated whorls; whilst the second sub-family, which can have the name of *Gymnitinæ*, possesses a large umbilicus and more or less (but very moderately) compressed whorls.

We thus arrive at the following classification of the family *Ptychitidæ* :—

1. Sub-family : PROPTYCHITINÆ.

1. Genus, *Proptychites*, Waagen, n. gen. (Bunter to Muschelkalk.)
2. „ *Beyrichites*, Waagen, n. gen. (Muschelkalk to Carnian stage.)
3. „ *Ptychites*, Mojs. (Muschelkalk to Noric stage.)
4. „ *Sturia*, Mojs. (Muschelkalk to Noric stage.)

2. Sub-family : GYMNITINÆ.

5. Genus, *Xenaspis*, Waagen, n. gen. (*Xenodiscus*, W., *pars.*) (Permian.)
6. „ *Flemingites*, Waagen, n. gen. (Bunter to Muschelkalk.)
7. „ *Gymnites*, Mojsisovics (Muschelkalk to Carnian stage.)

Of all these genera only two, *Proptychites* and *Flemingites*, occur in the Salt-Range, being rather richly represented.

Sub-family : PROPTYCHITINÆ.

Genus : PROPTYCHITES, Waagen, n. gen.

1880. *Ptychites (lawrencianus)*, Kon., Griesbach : Records, Geol. Surv. India, Vol. XIII, p. 102.

1892. *Proptychites*, Waagen : Records, Geol. Surv. India, Vol. XXV, p. 183.

1892. *Proptychites*, Waagen : Jahrb. k. k. Geolog. Reichsanst., Vol. 42, p. 379.

Already Mr. Griesbach has well recognised the general similarity of the shells that I unite under the name of *Proptychites* with the genus *Ptychites* of Mojsisovics; but he has gone too far in uniting the two in the same genus. At

the time when he wrote his paper for the Records, it is true, one did not distinguish so sharply the different forms of the triassic Ammonoids, so that the mistake was much less grave then than it would be now; but, under present circumstances, it would be absolutely wrong not to make a generic distinction between the two groups.

The genus *Proptychites* can always be easily recognised by the general configuration of the shell and the sutural line.

The general form of the shell is always thickly lenticular, with a narrow umbilicus and a very broadly rounded external side. The shell is generally perfectly smooth, and only in more recent forms is it that radial folds are developed, which become, in the last representatives of the genus, more or less falciform.

In the sutural line, the genus is characterised by a very short external lobe, which is divided in the middle by a very large median tubercle, which might be considered as a siphonal saddle by itself. The external saddle is narrow, and, with a single exception, considerably shorter than the first lateral saddle. Very remarkable is the change the sutural line undergoes in different developmental groups as one proceeds from geologically older to more recent species. The geologically most ancient shells possess no distinct auxiliary lobes, and the lateral branches of the external lobe are provided with few and little individualised dentations; whilst the same parts become much more complicated and distinctly developed in more recent forms.

The genus is very largely represented in the Salt-Range, but does not extend beyond the Ceratite Sandstone. The numerous species that occur can be grouped in different ways. First of all it seems to me the smooth forms can be separated from the folded ones, so that the first may be united under the term *Nudi*, whilst the latter may receive the designation *Plicosi*. Within these two primary divisions a number of developmental series may be established.

If we first turn to the division *Nudi* we can distinguish the following developmental series.

The first group of forms is inaugurated by a species for which I shall introduce the name of *Proptychites oldhamianus*, W. This form was found by Dr. T. Oldham in the Lower Ceratite Limestone of Namal. It is characterised by inflated whorls and a thoroughly ceratitic sutural line in which the auxiliary series is barely indicated by a few dentations. This is followed at the base of the Ceratite Marls by the typical *Proptychites lawrencianus*, Kon., which already has a complicated auxiliary series in which an indistinct first auxiliary lobe can be made out with difficulty. At last there has been found by myself in the same section in the upper region of the Ceratite Marls the *Proptychites latifimbriatus*, Kon., which has not only one but even two distinct auxiliary lobes. All these forms resemble *Propt. oldhamianus* by their narrow umbilicus and thoroughly ceratitic sutural lines.

Probably from the same species, *Propt. oldhamianus*, rises another developmental series, of which the most ancient representative was found by me at the base of the Ceratite Marls; but which differs from the preceding one in the circumstance that the sutural line in these forms is ammonoid,—that is to say, that the denticulations of the lobes reach very nearly up to the tops of the saddles, whilst in the

second lateral saddle even the top shows yet some denticulations. In other respects the forms belonging to this developmental series are very similar to the respective forms of the first series. For the geologically most ancient species, I introduce the name of *Proptychites ammonoides*, W., n. sp. After this follows, in the middle region of the Ceratite Marls, a species for which I introduce the name of *Proptychites magnumbilicatus*, W., n. sp., and which is distinct from the one preceding by a larger umbilicus, more strongly prominent and dentated lateral branches of the external lobe, and a differently developed auxiliary series. With this species the present series comes to an end.

A third developmental series is characterised by narrower, somewhat compressed whorls and more or less flattened sides. The most ancient species belonging to this series comes again from the Lower Ceratite Limestone and has received the name of *Proptychites discoides*, W., n. sp. Next follows, at the base of the Ceratite Marls, a species for which I introduce the name of *Proptychites khoorensis*, W., n. sp. The whorls are somewhat thicker, the auxiliary series very numerously denticulated. The last species of this series receives the name of *Proptychites trilobatus*, W., n. sp., and is characterised by the most strongly compressed whorls and a distinct well-separated first auxiliary lobe.

All these species belong to the division *Nudi*. Within this division there must yet be added one isolated species for which I introduce the name of *Proptychites aberrans*, W., n. sp. It occurs in the upper division of the Ceratite Sandstone.

The division of the *Plicosi* is much less numerously represented in the Salt-Range. Within this division only one developmental series, consisting of two species, can be distinguished. The geologically oldest form is a species for which the name of *Proptychites undatus*, W., n. sp., seems the most appropriate. It comes from the upper region of the Ceratite Marls. The next following form was found in the *Stachella* beds of the Ceratite Sandstone, and will bear the name of *Proptychites plicatus*, W., n. sp. It has a more strongly developed sculpture and a different sutural line. To these two forms there must yet be added an isolated species, which I shall call *Proptychites obliqueplicatus*, W., n. sp., and which occurs also in the *Stachella* beds. There might, perhaps, exist a certain affinity between this species and *Propt. khoorensis*, W., but more extensive and better materials are required to judge on the case.

Thus we arrive at the following grouping of the species of *Proptychites* occurring in the Salt-Range :—

I. Section : *NUDI*.

a. Group of *Proptychites oldhamianus*, W.

1. *Proptychites oldhamianus*, W., n. sp. Lower Ceratite Limestone.
2. „ *lawrencianus*, Kon., sp. Base of Ceratite Marls.
3. „ *latifimbriatus*, Kon., sp. Ceratite Marls, upper region.

b. Group of *Proptychites ammonoides*, W.

4. *Proptychites ammonoides*, W., n. sp. Base of Ceratite Marls.
5. „ *magnumbilicatus*, W., n. sp. Ceratite Marls, upper region.

- c. Group of *Proptychites discoides*, W.,
 - 6. *Proptychites discoides*, W., n. sp. Lower Ceratite Limestone.
 - 7. „ *khoorensis*, W., n. sp. Base of Ceratite Marls.
 - 8. „ *trilobatus*, W., n. sp. Ceratite Marls, upper region.
- d. Isolated species.
 - 9. *Proptychites aberrans*, W., n. sp. Ceratite Sandstone, upper region (*Flemingites* beds).

II. Section : PLICOSI.

- e. Group of *Proptychites undatus*, W.
 - 10. *Proptychites undatus*, W., n. sp. Ceratite Marls.
 - 11. „ *plicatus*, W., n. sp. Ceratite Sandstone (*Stachella* beds).
- f. Isolated species.
 - 12. *Proptychites obliqueplicatus*, W., n. sp. Ceratite Sandstone (*Stachella* beds).

To these Salt-Range species there is to be added probably only a single European form, which has been described by Mojsisovics under the name of *Meekoceras cadoricum*, Mojs. This form has many points of resemblance to different species of our genus *Proptychites*. Before all, the general shape of the shell is identical; then the radial sculpture consisting of somewhat falciform folds; and, at last, the sutural line in which the external lobe is very broad and very short, are exactly alike in most *Proptychites*: the saddles are somewhat club-shaped as in *Propt. obliqueplicatus*; and the second lateral saddle is most characteristically depressed, exactly as in *Propt. ammonoides* and some other species. Thus I think that this form ought to be designated *Proptychites cadoricus*, Mojs., sp. It would then at the same time be the most recent species of the genus which has been found up to the present, as it occurs in the Muschelkalk of the Alps; whilst the Salt-Range species do not reach higher up than the upper limit of the Bunt Sandstein.

The genus *Proptychites* must be compared on the one hand with *Ptychites* and *Beyrichites*, and on the other with *Meekoceras*.

Among the great number of species of *Ptychites* occurring in the Muschelkalk of most countries, the group of the *Ptychites flexuosi* bears the most striking similarity to the genus here under consideration. This similarity finds expression chiefly in the similar transverse section of the whorls which, is nearly identical in both; but in all other respects a distinction is also in this case most easy.

Proptychites never attains a thoroughly ammonitic sutural line; and even in the most recent species, *Propt. cadoricus*, Mojs. the saddles bear only such minute indentations that even in the drawing they are unrepresented. Now, though transitional species probably exist between *Proptychites* and *Ptychites*, still any such have not been found up to the present, and up to this time the distinction by the sutural line alone holds perfectly good. If such transitional forms be ultimately found, it will be left to the tact or taste of the observer of the day as to the genus to which he will attribute them.

With regard to *Beyrichites*, which name has just been created by myself, the distinction is somewhat more difficult. Some of the species that will fall within the scope of the genus (like *Bey. proximus*, Opp.) still have a perfectly ceratitic sutural line, whilst others, that are, however, more typical, show a sutural line that is very similar to that of *Ptychites*. In this case, it is chiefly the different systems of sculpture that afford excellent points of distinction. The sculpture of *Proptychites*, as far as any such exists, is exactly like that of *Ptychites*; whilst the sculpture of *Beyrichites* is strongly falciform, the exterior half of it however, being more strongly expressed.

Finally, the genus *Meekoceras* only remains for comparison, because Mojsisovics has placed the typical species of the genus *Propt. lawrencianus*, Kon., in the former genus. Otherwise the similarity is not a very striking one. The general appearance of the shell of *Meekoceras* is very much different from that of *proptychites*, as the whorls of the former genus are always compressed with a narrow siphonal side, that is either provided with two projecting angles or is narrowly rounded; but even in the latter case only very rarely does it happen that at least slight traces of angular bends are observable. Further, the development of *Meekoceras* is a quite different one. It has been demonstrated above that *Proptychites* acquires, as a rule, one or even two distinct auxiliary lobes already in the upper region of the Ceratite Marls, whilst in *Meekoceras*, in much more recent strata, the auxiliary series is generally not yet distinctly differentiated. Thus *Proptychites* is also most certainly different from *Meekoceras*. A group of forms that also shows much similarity to *Proptychites* is the group of *Ceratites polaris*, Mojs., as described by Mojsisovics from the triassic beds of Spitzbergen. I can, however, only point out this similarity without being able to enter further into this question.

I. Section : NUDI.

a. Group of PROPTYCHITES OLDHAMIANUS, W.

1. PROPTYCHITES OLDHAMIANUS, Waagen, n. gen. et sp.: Pl. XIX, fig. 3, a. b. c.

It is a rather rare species that I have to describe under this name, there being only a single specimen on which it is founded.

The specimen represents an internal cast, which is tolerably well preserved and is chambered for the greater part of its extent, retaining only a small fragment of the body-chamber.

The general outline is more or less lenticular, with a not very broad external side and somewhat flattened lateral parts. The umbilicus is very narrow, surrounded by a distinct vertical umbilical wall. The involution is moderate. The indentation caused by the penultimate whorl into the last one occupies not quite one-third of the entire height of the latter.

The transverse section of the whorls shows in its outline the figure that has been called "helmet-shaped" by Hyatt. The greatest transverse diameter of the whorls is situated a very little distance above the umbilical edge, and from there

the lateral parts taper only very little in the direction of the umbilicus. In the opposite direction, however, towards the external side, they slope very strongly and evenly, showing barely any arch, and forming more or less sloping planes. The external side is rather narrowly rounded, and unites with the lateral parts without forming any edges. The very high and vertical umbilical wall unites with the lateral parts of the shell to form an indistinct umbilical edge.

The surface of the internal cast is perfectly smooth, without any trace of a sculpture.

The sutural line, represented in fig. 3 *c*, is very simple. The external lobe is very broad, with a very high and round median prominence resembling a siphonal saddle. The lateral branches are short and not very broad, with about three dentations at the bottom. The external saddle does not extend higher up than the median prominence in the external lobe. It is tolerably broadly rounded and entire. The first lateral lobe is not very broad but rather long. It reaches much lower down than the external lobe, has nearly parallel sides, and bears about four dentations at its bottom. The first lateral saddle is very broad, broader than all the others, rounded, entire, and reaching somewhat less highly up than the external saddle. The second lateral lobe is broader and much shorter than the first. It bears also some four dentations which are all on the same level. The second lateral saddle is broad, low and depressed on its top. The auxiliary series that now follows, consists of some dentations which are all on the same level and reach as low down as the first lateral lobe.

The measurements of the specimen are as follows:—

Diameter of the shell	. . . . .	62 mm.
" " umbilicus	. . . . .	8 "
Height of the last volution from the umbilical suture	. . . . .	33 "
" " " " " preceding whorl	. . . . .	22 "
Thickness of the last volution	. . . . .	20 "

Locality and Geological Position.—The only typical specimen of this species existing was found by Dr. Thomas Oldham on the road from Namal to Moosakheyl, in the deep gorge that is here cut through the entire range. According to the rock in which it is contained, this specimen came beyond doubt from the Lower Ceratite Limestone. Another specimen which most probably belongs to this species, but in which the sutural line cannot exactly be made out, and which in consequence cannot be determined with absolute certainty, was found by Mr. Wynne at Khoora, also in the Lower Ceratite Limestone.

Remarks.—Among the species that have been described up to the present there is only *Proptychites lawrencianus*, Kon., that can be compared with the shell here under consideration. Both forms are, however, easily distinguishable. M. de Koninek's species is much more strongly inflated and its external side is much more broadly rounded than on *Propt. oldhamianus*. At the same time, the latter species has a much more simple sutural line. Even in specimens of an equal size, as has been figured, Pl. XVII, fig. 2 *a*, 3 *b*; the auxiliary series is much more complicated in *Propt. lawrencianus*, and the first lateral and the external lobes possess more numerous and stronger dentations.

2. PROPTYCHITES LAWRENCIANUS, de Koninck, sp.: Pl. XVIII, fig. 1 *a. b.*;
Pl. XVII, fig. 2 *a. 3 b.*

1863. *Ceratites lawrencianus*, de Koninck, Quart. Journ. Geol. Soc. Lond., Vol. XIX, p. 14, Pl. VI, fig. 3.
1863. *Ceratites lawrencianus*, de Koninck, Mémoire sur les fossiles paléozoïques recueillis dans l'Inde par le Dr. Fleming, p. 8 Pl. VI, fig. 3.
1886. *Meekoceras lawrencianum*, (Kon.) Mojsisovics: Arctische Trias-Faunen, page 79.
1892. *Proptychites lawrencianus*, (Kon. sp.) Waagen: Rec. Geol. Surv. Ind., Vol. XXV, page 183.
1892. *Proptychites lawrencianus*, (Kon. sp.) Waagen: Jahrb. k. k. Geol. Reichsanst., Vol. XLII, page 379.

This is one of the most frequently occurring species of the triassic deposits in the Salt-Range.

Its general shape is thickly lenticular, with a narrow umbilicus and a broadly rounded external part. The involution of the whorls is not very considerable, the indentation caused by the penultimate whorl into the last one being a little less than one-third of the entire height of the latter. The umbilicus is surrounded by a vertical wall, which is less distinctly developed in the young than in adult specimens.

The transverse section of the whorls is broadly oval, with vaulted lateral parts. The greatest transverse diameter of the shell is situated a short distance below the middle of the height. From there the lateral parts slope but little in the direction of the umbilicus, but in the direction of the external side they show a very equal curve and unite with the very broadly rounded external part without any proper demarcation.

In large specimens, there appears sometimes a slight spiral impression on both sides just below the external part. The umbilical wall surrounding the umbilicus is nearly vertical and very high in adult specimens, and unites with the lateral parts, forming a not very distinct umbilical edge. In young specimens, on the contrary, this wall is less high, somewhat sloping, and the umbilical edge is perfectly rounded off. Only internal casts of this species are at my disposal; but on these not a trace of any sculpture exists.

The sutural line is very characteristic and is very well represented in M. de Koninck's figure. The external lobe is very broad and short, and is deeply divided in two parts by a very strong median prominence. The lateral branches have some four or five dentations at their bottom, which form together a distinct arch. The external saddle is also short, and rather narrowly rounded at its top. The first lateral lobe is very long, by far the longest of all the lobes, and extends very far beyond the external lobe. Its sides are slightly converging towards the bottom, where it is provided with five to seven rather coarse dentations, which form together a rather oblique arch, the dentations reaching on the external side of the lobe much higher up than on the internal. The first lateral saddle is the broadest of all and extends somewhat higher up towards the mouth of the shell than the external saddle. It is very obliquely rounded at its top, its highest point being shifted quite toward the internal or umbilical side. The second lateral lobe is considerably broader but much shorter than the first lateral. It bears generally five dentations at its bottom,

which together form a flattened arch. Its sides are strongly converging towards the bottom. The second lateral saddle is very broad and very short, much receding in comparison to the first lateral saddle; it is broadly rounded at its top. The auxiliary series, that follows after this, is somewhat variable according to age and individual. In young specimens there are observable first two larger dentations, one broad and one narrow; and after these a number of such of smaller size, which are all on about the same level. In full-grown specimens, the first broad dentation has been transformed into a kind of very indistinct auxiliary lobe that bears some four or five denticulations, forming together a barely prominent arch. The second large dentation has grown much larger, but shows no secondary dentation; and after this there follow, as in the young, an uncertain number of smaller dentations, which are all on about the same level.

The measurements of two specimens, one young and one adult, both without body-chamber, are as follows :—

	I.	II.
Diameter of the shell	57 mm.	114 mm.
„ „ umbilicus	7 „	19 „
Height of the last volution from the umbilical suture	30 „	59 „
„ „ „ preceding whole	22 „	38 „
Thickness of the last volution	17 „	41 „

Locality and Geological Position.—This species has been found at many localities by all those men of science that have visited the Salt-Range. M.de Koninck does not indicate specially where the original of his species was found, but all the specimens that were collected by Dr. T. Oldham, Mr. Wynne or myself came from the Ceratite Marls. According to my observations, the accurate geological position of this species is at the base of the Ceratite Marls, just above the Lower Ceratite Limestone, where it occurs often in great numbers. In the upper region of the Ceratite Marls, it is already replaced by the next following species: *Proptychites latefimbriatus*, Kon., sp.

The specimens here under consideration are from the following localities :—Mountains east of Katwahee (1 sp.), Chitta-Wan near Ghari (3 sp.), Koofri (layer 12 of section—1 sp.), west of Khoora (1 sp.).

Remarks.—This species is most nearly related to *Propt. oldhamianus*, W., as it has been described on the foregoing pages. The chief differences from that species consist in a different transverse section of the whorls and in the sutural line, in which chiefly the auxiliary series is much more strongly differentiated than is the case in the geologically older *Propt. oldhamianus*.

The general outline of *Proptychites lawrencianus*, Kon., very strongly recalls the general shape of the shell of different forms of *Ptychites*; and it appears most probable that just this species furnishes the starting-point of different groups or forms that can be distinguished within the genus *Ptychites*. It is very much to be regretted that these geologically older series of *Proptychites*, like that of *Propt. oldhamianus* or *Propt. ammonoides*, stop already in the upper region of the Ceratite Marls, and thus really transitional forms of *Proptychites* are absent. The forms of *Proptychites* occurring in the Ceratite sandstone belong to quite an

aberrant series, and we cannot expect to find among these the real ancestors of *Ptychites*; though in their geological position they approach much more closely to the ancient forms of that genus.

3. PROPTYCHITES LATIFIMBRIATUS, de Kon. sp.: Pl. XVII., fig. 2 *a. b. c.*

1863. *Ceratites latifimbriatus*, de Koninck : Quart. Journ. Geol. Soc. Lond., Vol. XIX., p. 13 ;
pl. VII., fig. 2.

1863. *Ceratites latifimbriatus*, de Koninck : Mémoire sur les fossiles paléozoïques recueillis dans
l'Inde par le Dr. Fleming, p. 9, pl. VII., fig. 2.

This is a much rarer species than the preceding one, only a single specimen having been collected by me: an internal cast which is for the greater part of its extent much weathered, only a small space of it being perfectly well preserved. On this space, the artist has represented a radial striation, which is, however, probably artificial and not a character of the shell.

The general outline is more or less lenticular, with not very strongly inflated whorls. The umbilicus is narrow and deep, surrounded by a vertical umbilical wall. The involution of the whorls is not very considerable; the indentation caused by the penultimate whorl into the last one making up just one-third of the entire height of the latter.

The transverse section of the whorls is oval, well rounded, and much higher than it is broad. The greatest transverse diameter of the whorls is situated a little below the middle of the entire height of the whorls. From there the shell slopes but very little in the direction of the umbilicus, whilst in the direction of the siphonal side it bends down in a gentle curve to meet the broadly-rounded external side, which unites with the lateral parts of the shell without any proper demarcation. The umbilical wall meets the lateral parts of the shell, forming a very indistinct rounded umbilical edge.

The surface of the shell was originally probably perfectly smooth, without any sculpture. The radial striation, indicated in the drawing, is not so regular as it is represented, and has, as has been remarked above, probably been brought about by accident. The specimen is entirely composed of air-chambers, no trace of the body-chamber being preserved.

The sutural line is very characteristic. The external lobe is very broad, with a large prominence, a kind of siphonal saddle, in the middle. The lateral branches are very strongly indented, the dentations reaching up to near the top of the median prominence. At the bottom of these lateral parts of the external lobe the dentation becomes so strong that it approaches even to a branching of this lobe. The external saddle is very narrow and short. It is rounded and entire at its top. The first lateral lobe is broad and long, reaching furthest down of all the lobes. It is very strongly dentated at its bottom, its sides are nearly parallel for their greater extent, and the dentations reach up about half-way, becoming smaller and smaller. The first lateral saddle is not very broad, and is obliquely rounded towards its top. It extends somewhat higher up than the external saddle. The second lateral lobe is as broad as the first one, but much shorter. Its dentations are

not so very large, but very numerous, forming together an oblique arch. The dentations reach also rather high up at its sides. The second lateral saddle is broad, somewhat club-shaped, and much shorter than the first one. It is characteristically flattened at its top. The first auxiliary lobe is large and well developed; it is somewhat club-shaped,—that is to say, broader at its bottom than at its commencement. The first auxiliary saddle is of the same pattern as the second lateral, also broad and flattened at its top, but much shorter. The second auxiliary lobe is also still distinct, bearing some dentations at its bottom. After this there seem yet to follow some dentations; but one cannot well distinguish them.

The measurements of the specimen are as follows:—

Diameter of the shell	. . . . .	92 mm.
„ „ umbilicus	. . . . .	14 „
Height of the last volution from the umbilical suture	. . . . .	47 „
„ „ „ „ preceding whorl	. . . . .	32 „
Thickness of the last volution	. . . . .	28 „

Locality and Geological Position.—The only individual of this species existing in the Salt-Range collection was found by myself west of Khoora in the upper region of the Ceratite Marls, in the same section in which at the base of these marls *Proptychites lawrencianus*, Kon. sp., was collected. M. de Koninck's indications as to the locality where the original of his species was found, “dans le calcaire à *Productus de Varcha*,” must be erroneous, as the ceratite formation does not occur near Varcha. The specimen must rather have come from the Namal-gorge, which is not far off, and where Dr. Oldham also collected several *Ceratites*.

Remarks.—I have identified this species with *Ceratites latifimbriatus* of M. de Koninck, though my figure and his are not absolutely identical; but as all figures of the Salt-Range fossils represented in de Koninck's Mémoires are more or less schematic, one cannot consider a slight discrepancy as of material importance.

The present species is, as has already been remarked by M. de Koninck, most nearly related to *Propt. lawrencianus*. The differences between the two consist in the less strongly inflated shell and more complicated sutural lines of the present species. The strong dentation of the external lobe and the distinct development of a first and second auxiliary lobe in the present *Propt. latifimbriatus* are characters which are very striking and make a distinction most easy.

b. Group of PROPTYCHITES AMMONOIDES, Waagen.

4. PROPTYCHITES AMMONOIDES, Waagen n. gen. et. sp.: Pl. XVII., fig. 1 *a. b. c.*;
Pl. XIX., fig. 2 *a. b.*

The general outline of this shell is much like that of *Propt. lawrencianus*, Kon., with the sole difference that the present species possesses a faint radial sculpture, which is not the case in the shell described by de Koninck.

The shell is in general thickly lenticular, with rather inflated whorls, a broadly rounded external side and a narrow umbilicus. The involution of the shell is not very considerable, the indentation caused by the penultimate whorl into the last one being a little less than two-fifths of the entire height of the latter.

The transverse section of the whorls is roundedly oval, much higher than it is broad. The greatest transverse diameter of the whorls is situated just below the middle of the lateral parts. These latter are very equally rounded for all their extent, but their curve is less sloping in the direction of the umbilicus than towards the siphonal side: they unite with this lateral part, which is broadly rounded, without any proper demarcation. The umbilicus is surrounded by a not very high vertical umbilical wall, which is limited above by an umbilical edge, which is very indistinct in young and more distinctly developed in full-grown specimens.

The sculpture of the internal casts, which are alone at my disposal, consists of very low and faint radial undulations, which commencing at the umbilical edge, are strongest on the middle of the lateral parts, and disappear as they approach the siphonal side. They are somewhat falciform in their bend, and remain always single, and are never bifurcating.

The sutural line is very characteristic, but a little variable in different specimens. The external lobe is very broad, but also very short. The prominence in the middle, forming a kind of siphonal saddle, is very low. The dentations of the lateral branches of this external lobe are very strong and numerous, and reach up to near the passage of the siphon in the median part. On the other side, they extend to near the top of the external saddle. There are altogether about 8-10 of these dentations, which are arranged in a prominent arch. The external saddle is low and rather narrow. It is entire at its top. The first lateral lobe is very long, much longer than the external, and broad. Its sides are strongly converging. There are about six strong dentations on the bottom of this lobe, and several others reach high up at its sides. The latter dentations are more numerous on the siphonal than on the umbilical side of the lobe. The first lateral saddle is not very broad and is obliquely rounded towards its top. It reaches higher up, and is at the same time broader than the external saddle. The top of this first lateral saddle is also entire. The second lateral lobe is nearly as broad but very much shorter than the first lateral. It bears very numerous dentations, which together form an elliptic curve, and reach up to very near its commencement. The second lateral saddle is broad, very short and strongly flattened at its top, so as to appear nearly angular. It is not entire, but bears two indentations in the middle. The auxiliary lobe is sometimes more, sometimes less distinctly separated from the remainder of the auxiliary series. It is broad and short, and bears five or six dentations at its bottom. The little saddle that follows next is sometimes broader, sometimes narrower; and after this there come a number of irregular dentations which cannot be described in detail. All the auxiliary series is exposed on the lateral parts of the shell, and only some small dentations are situated on the umbilical wall.

The measurements of the larger of the two specimens preserved in the Salt-Range collection are as follows:—

Diameter of the shell	. . . . .	155 mm.
" " " umbilicus	. . . . .	26 "
Height of the last volution from the umbilical suture	. . . . .	77 "
" " " " " " preceding whorl	. . . . .	47 "
Thickness of the last volution	. . . . .	43 "

The specimen, of which the measurements have been given, possesses the commencement of the body-chamber, but is apparently not yet full grown.

Locality and Geological Position.—There are altogether two specimens of this species. Both are fragmentary. The larger of these fragments was found by myself west of Khoora at the base of the Ceratite Marls, together with *Propt. lawrencianus*, Kon. sp. The second specimen was collected by Mr. Wynne, north of Katwahee. It most certainly comes also from the Ceratite Marls, but the exact geological position of this specimen is not known.

Remarks.—The present species is most nearly related to *Proptychites lawrencianus*, Kon., but can easily be distinguished from that shell by its sculpture and by the sutural line. The most characteristic part of the latter is the second lateral saddle with its two indentations.

Propt. ammonoides has probably also taken its origin from *Propt. oldhamianus*, but it is, in comparison with *Propt. lawrencianus*, a premature form, as its first auxiliary lobe is already nearly fully developed, the same lobe being still very indistinct in *P. lawrencianus*, which occurs in the same bed. This is perhaps also the reason why the next following species, *Propt. magnumbilicatus*, shows to a certain degree a retrograde development in this respect.

5. PROPTYCHITES MAGNUMBILICATUS, Waagen, n. gen. et sp.: Pl. XIX., fig. 1 *a. b. c.*

It is only a fragment of a very large individual on which I must found this species.

The general outline is thickly disciform, with moderately inflated whorls and a large umbilicus. The involution of the whorls is not very large, the indentation caused by the penultimate whorl in the last one taking up not more than two-sevenths of the entire height of the latter.

The transverse section of the whorls is well rounded everywhere, on the whole oval in shape, considerably higher than it is broad. The greatest transverse diameter of the whorls is situated a little below the middle of their entire height. The lateral parts of the shell are very equally vaulted, sloping but very little in the direction of the umbilicus, whilst they show a much stronger bend in the direction of the siphonal side. This latter is broadly rounded and unites with the lateral parts without proper demarcation. The umbilicus is surrounded by a not quite vertical wall which joins the lateral parts without forming a distinct umbilical edge.

The shell of this species possesses no trace of any sculpture.

The sutural line is most characteristic. The external lobe is very broad but not very deep. It possesses in the middle a high but not very broad median prominence or siphonal saddle. The lateral branches bear enormous dentations at their bottom, of which there are, however, not more than three, which sometimes bear at their sides little secondary denticulations. At the side of the external lobe which faces the external saddle the dentations reach up to the top of this saddle. The external saddle reaches somewhat higher up than the median siphonal prominence of the external lobe. It is moderately narrow and distinctly flattened at its top. The

first lateral lobe is very long and very broad, and its sides are slightly converging towards its bottom. This lobe has a great number of dentations which are largest at its bottom and smaller at the lateral walls, on which latter they reach up to near its base. All the dentations together form an oblique arch. The first lateral saddle is narrow, narrower at its top than the other principal saddles, and reaches higher up than the rest. The top is narrowly rounded and bears an indentation on each of its sides. The second lateral lobe is not larger than the external lobe and much narrower than the first lateral. It also has converging sides, and bears many dentations, which are obliquely arranged. The largest is at the termination of the wall facing the umbilical side of the lobe, and from there towards the first lateral saddle they diminish gradually in size, whilst at the same time they reach up at this side to near the top of the mentioned saddle. The second lateral saddle is less high than the first, but strongly and equally flattened on its top. Its sides are nearly parallel, and there are two distinct indentations on its under termination. The auxiliary series is much reduced on account of the small space that remains, because the large umbilicus of the shell causes the whorls to be much less high in their transverse section than is the case with other species. The first auxiliary lobe can still be easily distinguished, and it bears four dentations at its bottom, of which the one that lies next to the umbilical side is the most prominent. Towards the umbilicus, this auxiliary lobe is followed very closely by a large single dentation that appears also in *Propt. ammonoides*, but is here more distinctly separated from its neighbour. On the umbilical wall, not far from the umbilical suture, there follows yet a very small second auxiliary lobe.

The measurements of the specimen may probably have been the following:—

Diameter of the shell, probably	145	mm.
" " umbilicus, probably	43	"
Height of the last volution from the umbilical suture	64	"
" " " " preceding whorl	46	"
Thickness of the last volution	41	"

The fragment serving for description is entirely composed of air-chambers.

Locality and Geological Position.—This single fragment was found by myself in the Chitta-Wan near Ghari, in the upper region of the Ceratite Marls.

Remarks.—The present species is in all respects most nearly related to the previously described *Propt. ammonoides*, W., but is distinct from that form by its sutural line as well as by its large umbilicus. In the former respect the differences consist chiefly in the more frequent indentations of the lateral walls of the saddles, in the large principal dentations of all the lobes, and in the auxiliary series, in which, notwithstanding its general reduction, a second auxiliary lobe has been developed. By its large umbilicus the present species can be easily distinguished from all the other forms of the genus *Proptychites*.

c. Group of PROPTYCHITES DISCOIDES, W.

6. PROPTYCHITES DISCOIDES, Waagen, n. gen. et sp.: Pl. XX., fig. 1 *a. b. c. d.*,
fig. 2 *a. b.*

The present species is represented by one fragmentary specimen and one external

impression in the rock, from which a gutta-percha cast could be taken; and thus the species appears to be one of the more rare shells.

The general shape is more or less discoidal, with a rather narrowly rounded external side and a narrow umbilicus. The involution of the shell is not very large; the indentation caused by the penultimate whorl in the last one occupying a little less than one-third of the entire height of the latter.

The transverse section of the whorls is narrow, very much higher than it is broad, with nearly parallel sides. The lateral parts are strongly flattened, barely vaulted at all; and it is difficult to find out where the greatest transverse diameter is situated. On a closer examination one finds that its position is just at the upper limit of the lower third of the entire height of the whorl. From there the lateral parts taper but very little in the direction of the umbilicus, whilst in the opposite direction their sloping is somewhat more considerable. The external part is rather narrowly and very equally rounded, and unites with the lateral parts without any distinct demarcation. The umbilicus is surrounded by a tolerably high vertical wall, which unites with the lateral parts in forming a distinct umbilical edge. In the smaller of the two specimens one can observe that the umbilicus is rather deep and funnel-shaped, and there are about four volutions exposed in it.

The shell is perfectly smooth, without any trace of sculpture in the smaller specimen. In the larger one, some very faint, barely perceptible radial folds are observable, which are, however, only somewhat more distinctly visible in the vicinity of the umbilicus.

The sutural line is very characteristic. The external lobe is very broad and rather long. It is divided by a deep median prominence in two lateral parts which are developed in a manner like the other lobes. They are rather broad and long, provided with parallel sides, and bear exclusively at their bottom a number of dentations (about five) which form together a low arch. The external saddle is rather narrow, with about parallel sides, and reaching considerably higher up than the median prominence of the external lobe. It is well rounded at its top. The first lateral lobe is very broad, much broader than the lateral branch of the external lobe, and reaches also somewhat lower down than this latter. Its sides are also about parallel, without any dentations, which are exclusively restricted to the bottom of the lobe. There are also here about five of these dentations, which are all on the same level. The first lateral saddle is rather narrow, narrower than the lobe, but broader than the external saddle. It has nearly parallel sides, reaches up as high as the external saddle, and is well rounded at its top. The second lateral lobe is just as broad as the preceding saddle. It is slightly shorter than the first lateral lobe, has again parallel sides and bears some dentations at its bottom. Four of these are on the same level, the fifth is shifted somewhat up towards the second lateral saddle. This latter is as broad as the first lateral saddle and reaches as high up. It is, however, not quite regularly rounded on its top, but somewhat flattened. The auxiliary series stands on a level half as low down as the other lobes. It is composed of a row of irregular dentations which are all on the same level.

The measurements of the two specimens are as follows :—

	I.	II.
Diameter of the shell	39 mm.	73 mm.
" " " umbilicus	7 "	12 "
Height of the last volution from the umbilical suture	21 "	38 "
" " " " preceding whorl.	15 "	26 "
Thickness of the last volution	95 "	16 "

Locality and Geological Position.—The larger of the two specimens was found by me at Virgal in the Lower Ceratite Limestone. The smaller specimen, which, though merely an impression on the rock, is very well preserved; it was collected by Mr. Wynne in the vicinity of Katwahee, and according to the rock in which it is preserved, has evidently also come from the Lower Ceratite Limestone.

Remarks.—As regards the mode and degree of development, the present species is most nearly related to *Propt. oldhamianus*, W. The sutural line of both species shows absolutely the same type, and the differences are only very small. In this respect, it must, however, not be overlooked that both these species come from one and the same geological horizon, and thus the typical similarity of their sutural lines was to be expected. Nevertheless, also here differences exist which show clearly that one has to deal with different species. The external saddle is much broader, the first and second lateral saddles are much lower in *Propt. oldhamianus* than in *Propt. discoides*, and then, there is the transverse section of the whorls, which is perfectly different in the two shells.

On the other hand, *Propt. discoides* is the starting-point of a quite different series of forms, which all possess compressed whorls, whilst the whorls of the descendants of *Propt. oldhamianus* are always strongly inflated.

PROPTYCHITES KHOORENSIS, Waagen, n. gen. et sp.: Pl. XX., fig. 4 a. b. c.

This is a species which, occurring together with *Proptychites lawrencianus*, Kon., is rather difficult of differentiation from that form, though it is at the same time much rarer than de Koninck's species; being only represented in the Salt-Range collection by a single specimen. The general shape is rather thickly disciform, with a broadly rounded external side and a very narrow umbilicus. The involution of the shell is very small; the indentation caused by the penultimate whorl into the last one only occupying a little more than one quarter of the entire height of the latter.

The transverse section of the whorls is very elongately oval, very much higher than it is broad. The greatest transverse diameter is situated within the lower third of the entire height of the whorl. The lateral parts are not so strongly flattened as in the preceding species, but they are distinctly, though only very flatly, vaulted. Their greatest elevation falls together with the greatest transverse diameter of the whorl. From there the shell tapers but very little in the direction of the umbilicus, and somewhat more strongly so in the direction of the external side. This latter is perfectly and broadly rounded, and unites with the lateral parts without proper demarcation. The umbilicus is surrounded by a distinct vertical umbilical wall, which joins the lateral parts to form a distinct umbilical edge.

The shell is perfectly smooth, without any trace of sculpture.

The sutural line is very similar to that of *Propt. lawrencianus*. The external lobe is not very long but very broad, divided in the middle by a deep median prominence or siphonal saddle. The lateral parts or branches are very strongly individualised, appearing as distinct lobes by themselves. They are very broad, with nearly parallel sides, and are provided at their bottom with at least six fine dentations, which form together a very flat, barely perceptible, arch. The external saddle is narrow and reaches distinctly higher up than the median prominence of the external lobe. It possesses parallel sides and is regularly rounded at its top. The first lateral lobe is slightly narrower than the lateral part of the external lobe, but reaches very considerably lower down. It has about parallel sides, is very slightly club-shaped, and bears at its bottom five dentations, of which the median one is more prominent. The first lateral saddle is barely perceptibly more prominent than the external one. It is very slightly club-shaped or phylloid and obliquely rounded at its top. The second lateral lobe is somewhat shorter than the first lateral, yet always longer than the external lobe. It has parallel sides and bears four dentations at its bottom, which are all at the same level. The second lateral saddle is not very short, but reaches much less highly up than the other saddles. It is about as broad as the external saddle, has again nearly parallel sides, and is broadly and equally rounded at its top. The auxiliary series is on a level with the bottom of the other lobes. There is an auxiliary lobe which bears about six to eight dentations indistinctly recognisable.

The measurements of the specimen are as follows :—

Diameter of the shell	. . . . .	68 mm.
" " umbilicus	. . . . .	8.5 "
Height of the last volution from the umbilical suture	. . . . .	36 "
" " " preceding whorl	. . . . .	27.5 "
Thickness of the last volution	. . . . .	18 "

Locality and Geological Position.—This single specimen was found by me to the west of Khoora, in the lowest beds of the Ceratite Marls, just above the upper limit of the Lower Ceratite Limestone, together with numerous specimens of *Proptychites lawrencianus*.

Remarks.—As has been stated already in the introductory remarks to the description of the present species, this shell is very nearly related to *Propt. lawrencianus*, with which it occurs in the same bed. It can be distinguished, however, from that form by the general shape of its shell, which is much less inflated, or, on the contrary, rather compressed. Other differences exist in the sutural line, in which the lateral branches of the external lobe are much more strongly individualised; the saddles are much longer and possess all parallel sides, and the second lateral lobe is much narrower and of equal breadth for all its extent; all features of which the contrary is to be observed in de Koninck's species.

Another form to which the present species must be compared is *Propt. discoides*, W., described above. In comparison with this shell the present one has more inflated whorls, of which the lateral parts are more distinctly vaulted and the

umbilicus is much narrower. In the sutural line one can observe that the lateral branches of the external lobe are much broader; that the second lateral saddle is much shorter; and that the auxiliary series is much more complicated.

8. *PROPTYCHITES TRILOBATUS*, Waagen, n. gen. et sp.: Pl. XX., fig. 3 *a. b. c.*

It is again a very rare shell that I have to describe under this name.

The general shape is rather flatly disciform, with a narrowly-rounded external part, strongly compressed whorls, and a very small umbilicus. The involution of the shell is somewhat more considerable than in the preceding species. The indentation caused by the penultimate whorl into the last one occupies a little less than one-third of the entire height of the last volution.

The transverse section of the whorls is very much higher than it is broad, with nearly parallel flattened sides and a regularly vaulted external part. The greatest transverse diameter of the whorls is situated about in the middle of the lateral parts—a circumstance that can, however, only be found out after very careful measuring, as on a first glance the lateral parts of the shell appear perfectly flat for a larger extent. In the direction of the umbilicus they taper but very little before reaching the indistinct rounded umbilical edge. In the direction of the external part, on the contrary, they appear slightly sloping for a somewhat larger extent. The external part is comparatively broadly rounded and unites with the lateral parts of the shell without proper demarcation. The umbilicus is surrounded by a vertical umbilical wall, which unites with the lateral parts, forming an indistinct rounded umbilical edge.

The shell is perfectly smooth, without any trace of sculpture.

The sutural line is highly characteristic. The external lobe is very broad, but the lateral branches are not individualised as in the preceding species; and the median prominence is not developed as a separate siphonal saddle. The lateral branches are provided with many dentations which reach in the middle up to near the passage of the siphon, whilst the lateral wall facing the external saddle remains undivided. The external saddle reaches somewhat higher up than the median prominence of the external lobe. It is very narrow, and has sides which converge towards its top, which latter is entire and very narrowly rounded. The first lateral lobe is extremely broad and somewhat longer than the external lobe. It bears five large dentations at its bottom which form a line that obliquely ascends towards the limit of the first lateral saddle. This saddle is much shorter than the external one, possesses strongly converging sides, and is very narrowly and somewhat obliquely rounded at its top. The second lateral lobe is as broad as the first one, but considerably shorter. It shows some eight little dentations at its bottom, which form together a low arch. The second lateral saddle reaches up as highly as the first one. It is somewhat more broadly rounded and slightly club-shaped or phylloid. The first auxiliary lobe is very distinctly developed, considerably shorter and narrower than the second lateral, bearing some six denticulations at its bottom. At its umbilical side it is very closely approached by a large dentation,

after which a somewhat broader saddle follows. There appear yet some more dentations before the umbilical suture is reached.

The measurements of the specimen are as follows:—

Diameter of the shell	.	.	.	.	.	.	.	.	.	74 mm.
" " umbilicus	.	.	.	.	.	.	.	.	.	8 "
Height of the last volution from the umbilical suture	.	.	.	.	.	.	.	.	.	41 "
" " " preceding whorl	.	.	.	.	.	.	.	.	.	29 "
Thickness of the last volution	.	.	.	.	.	.	.	.	.	15 "

Locality and Geological Position.—The only specimen preserved was found by me in the Chitta-Wan, from the upper region of the Ceratite Marls.

Remarks.—The present species is most nearly related to the preceding one, from which it can, however, readily be distinguished by its more compressed shape and the distinct development of an auxiliary lobe. By this latter character the species approaches more or less to *Propt. latifimbriatus*, Kon., which form was found in the same geological horizon as the species here under description. Nevertheless the two can be distinguished most easily: *Propt. latifimbriatus* is much more inflated and its sutural line much more strongly denticulated than in our present *Propt. trilobatus*; and besides this there is a second auxiliary lobe present in the former species, whilst it is absent in the latter.

d. ISOLATED SPECIES.

9. PROPTYCHITES ABERRANS, Waagen, n. gen. et sp.: Pl. X., fig. 2 a. b. c. d.

This is a small but very strongly inflated shell, with broadly oval whorls and a tolerably large umbilicus, in which many whorls are exposed. Its involution is considerable. The indentation produced by the penultimate whorl into the last one occupies just one-third of the entire height of the latter, only one quarter of the height of the penultimate whorl remaining exposed within the umbilicus.

The transverse section of the whorls is broadly oval, somewhat higher than it is broad. The lateral parts are considerably vaulted for their whole extent, the greatest transverse diameter being situated just in their middle. From there, the lateral parts slope about equally in both directions, and the shell reaches the umbilical suture without forming a distinct umbilical edge or an umbilical wall. Towards the siphonal side the lateral parts unite with the broadly rounded external part also without any proper demarcation.

The shell is perfectly smooth, without a trace of any kind of sculpture.

The sutural line is very remarkable. The external lobe is very short and very narrow. The median prominence is rounded and very small, and the lateral branches are simply pointed. The external saddle is very broad, broader than all the other saddles, and also reaching higher up than the rest. It is without any indentations and very broadly rounded at its upper extremity. The first lateral lobe is the longest of all. It is somewhat narrower at its upper extremity than at its lower. On its bottom, it bears about seven very fine but very long dentations, which together form a strongly prominent arch. The first lateral

saddle is considerably lower and somewhat narrower than the external one. It is slightly contracted at its base and broadly rounded at its top. The second lateral lobe is much shorter and but very little narrower than the first lateral. It is also somewhat broader at its bottom than at its upper extremity. There are five long and narrow dentations at its bottom, which form together a strongly prominent arch. The top of the second lateral saddle is on the same level as that of the first; otherwise the saddle is much shorter. It is broadly rounded at its top. After this there follow yet two distinct little auxiliary lobes.

The measurements of the somewhat fragmentary specimen are as follows:—

Diameter of the shell about	.	.	.	.	.	.	.	34 mm.
" " umbilicus	.	.	.	.	.	.	.	7 "
Height of the last volution from the umbilical suture	.	.	.	.	.	.	.	17 "
" " " " preceding whorl	.	.	.	.	.	.	.	12 "
Thickness of the last volution	.	.	.	.	.	.	.	12 "

Locality and Geological Position.—This is the most recent species of the genus occurring in the Salt-Range, represented by but a single individual which was found by me in the upper division of the Ceratite Sandstone, together with *Flemingites flemingi*, Kon., in a section near Koofri (bed No. 9 of my note-book).

Remarks.—As this species deviates widely in the characters of its sutural line as well as in the absence of an umbilical wall from the other forms described up to the present in this genus, it might be questioned whether it is rightly placed. I have deliberated much on the case, but could not find a better position for this little shell. If we consider this form as a member of the genus *Proptychites*, its possessing two distinct auxiliary lobes fits well into the general scheme, because one must expect a shell occurring in such comparatively recent beds to have a sutural line in which the auxiliary series is well merged in distinct auxiliary lobes.

As to species, the present one cannot be compared with any other form more in particular.

II.—Section PLICOSI.

e. Group of PROPTYCHITES UNDATUS, W.

10. PROPTYCHITES UNDATUS, Waagen, n. gen. et sp.: Pl. XXIV., fig. 4 a. b.

The materials of this species are extremely limited, as there exists only a single fragmentary specimen; but this is so fairly well preserved that one can make out all the characters of the species without difficulty.

The general shape is thickly disciform, with compressedly rounded whorls and a tolerably large umbilicus. The lateral parts are provided with radial folds. The involution of the shell is rather small; the indentation produced by the penultimate whorl into the last one occupying not more than one-fifth of the entire height of the latter.

The transverse section of the whorls is elongately oval, much higher than it is broad. The lateral parts are well vaulted, and the greatest transverse diameter is situated in the lower third of the entire height. From there the lateral parts slope but very little in the direction of the umbilicus; but much more so in the

direction of the siphonal side. This latter is narrowly rounded and unites with the lateral parts without proper demarcation. The umbilicus is surrounded by an indistinct umbilical wall, which unites with the lateral parts in a well-rounded curve without forming a distinct umbilical edge.

The sculpture of the shell is on the whole rather faint. It consists of low radial folds, which commence above the umbilical wall and are strongly directed forward. They remain always single and are but very little bent, while they disappear again before reaching the external part. Within the umbilicus there are about twelve of these folds visible on one volution. The folds are stronger where the shell is preserved, and appear fainter on the internal cast.

The sutural line is of the same type as with other species of the genus. The external lobe is not very broad, with a moderately deep prominence or siphonal saddle in the middle. The lateral branches are narrow, not very distinctly individualised and bear some three dentations on their bottom. The external saddle is rather broad with parallel sides, reaching considerably higher up than the median prominence of the external saddle. Its top is regularly rounded. The first lateral lobe is somewhat longer than the external one, rather broad with parallel sides and having some five or six dentations at its bottom, which form together a low arch. The first lateral saddle extends higher up than the external one; it is also broader than the latter, has again parallel sides, and is not very regularly rounded at its top. The second lateral lobe is much shorter than the first but nearly equally broad. Its sides are about parallel, and on its bottom there are some five fine dentations which form together a regular arch. The second lateral saddle is as broad as the first but much shorter. Its sides are parallel and the top somewhat flattened. After this, follows again a small but distinct auxiliary lobe the dentations of which are not well preserved. From there the sutural line descends in a nearly straight line to the umbilical suture.

The measurements of the figured specimen are as follows :—

Diameter of the shell about	.	.	.	.	.	.	.	.	51 mm.
" of the umbilicus	.	.	.	.	.	.	.	.	13 "
Height of the last volution from the umbilical suture	.	.	.	.	.	.	.	.	24 "
" " " from the preceding whorl	.	.	.	.	.	.	.	.	18 "
Thickness of the last volution	.	.	.	.	.	.	.	.	13 "

The specimen has its shell partly preserved, as is represented in the drawing.

Locality and Geological Position.—The sole form of this species was found by me at Nunga in the Ceratite Marls, but its exact horizon within that series is not known to me.

Remarks.—The present species must be compared in the first place to *Propt. ammonoides* W., described on one of the foregoing pages. This latter species possesses also a slight radial sculpture and is thus very similar to the present form. The differences between the two species consist, however, in the much more compressed whorls and the much simpler sutural line of the species here under consideration. Also, *Propt. lawrencianus* might be compared, as it shows at the same size a sutural line which is not quite dissimilar. But the distinction is also here

11. PROPTYCHITES PLICATUS, Waagen n. gen. et. sp.: Pl. XXIV, fig.: 3 *a. b.*

The general shape is disciform, with a narrowly rounded external side and a moderately wide umbilicus. The involution of the shell is not very considerable and the indentation caused by the penultimate whorl into the last one occupies only about one quarter of the entire height of the latter.

The sculpture consists of not very numerous strong radial folds which are always single, showing a slightly falciform bend somewhat directed towards the front. On the last volution, eight such folds can be counted. The siphonal side remains always perfectly smooth.

The measurements of the specimen are as follows :—

Diameter of the shell	26 mm.
„ of the umbilicus	7 „
Height of the last volution from the umbilical suture	12 „
„ „ „ from the preceding whorl	9 „
Thickness of the last volution	8.5 „

Locality and Geological Position.—I found but a single individual of this species in the Ceratite Sandstone, specially in the Stachella beds of this group, in the vicinity of Amb.

Remarks.—The species is most nearly related to the one described before under the name of *Propt. undatus*, W. It is distinguishable from that species by the transverse section of the whorls, which is quite different in the two shells. The sculpture also is much stronger in the present species than in *Propt. undatus*. The sutural line which ought to be much more complicated in the more recent species, does not hold good in this case, but shows about the same state of development in both forms.

The next younger species in a geological sense is *Propt. cadoricus*, Mojs., sp. which is, however, a European shell. In its general form it is very similar to the two previously described species, but it possesses a much narrower umbilicus, and in its sutural line it shows two auxiliary lobes, as it ought to do according to its geological position.

f. ISOLATED SPECIES.

12. PROPTYCHITES OBLIQUEPLICATUS, Waagen n. gen. et. sp.: Pl. XVII, fig. 3 a, 2 b.

The specimen on which I must found this species is only partly well preserved; that is to say, only the outer half of the whorls, as far as the involution has reached the surface of the whorls, is not deteriorated by weathering; but the part that has been exposed in the umbilicus is quite weather-worn and indistinct. The outer volution has now been broken away, and thus a specimen has been obtained which can well serve for a description.

The general shape is thickly disciform, with a tolerably large umbilicus and a rather narrowly rounded external side. The involution of the shell is not very large: the indentation produced by the penultimate whorl into the last one occupies somewhat less than one-third of the entire height of the latter.

The transverse section of the whorls is somewhat in the shape of an arrow's head, the point of which has been rounded off. The lateral parts are flatly but very equally vaulted. The greatest transverse diameter of the whorls is situated very low down, about the height of the antisiphonal lobe. From there towards the closely approached umbilicus, the shell tapers only very little; but, in the opposite direction towards the external part, the shell descends in a very equal curve, and unites with the narrowly rounded external part without proper demarcation. Sometimes it looks as if the external part was somewhat flattened, with obtuse edges developed on both sides. The umbilicus is apparently surrounded by a vertical umbilical wall.

Of the sculpture, only the external half can be distinguished. On the middle of the sides, thick folds appear, of which there are nine on the last volution. These folds probably originate at an umbilical edge and extend in a somewhat radial direction up to the middle of the sides; but the interior half of the lateral parts is so badly weather-worn that nothing can be distinguished. On the middle of the lateral parts the folds seem to become deflected, and then are strongly directed backward.

At the same time, each fold has a depression on its top, which grows broader towards the peripheral part and divides each of the folds in two indistinct branches. Towards the periphery of the shell all the folds grow gradually weaker and disappear entirely before reaching the siphonal side which latter always remains perfectly smooth. To what a considerable height these folds attain on the middle of the lateral parts can be most distinctly made out in the front view, which is represented in Pl. XVII, fig. 2b.

The sutural line is only partly known to me. The external lobe is not very broad, nor very long. Its median prominence is narrow and not rounded on the top. The lateral branches are as broad as the first lateral lobe. They are strongly dentated at their bottom and the dentations form together a strongly prominent arch. The external saddle is narrow and strongly club-shaped. It is entire and narrowly rounded on its top. The first lateral lobe is very long, much longer than the external one, and very narrow, considerably more so at its base than at its bottom. The latter is provided with some six dentations which together form a very strongly prominent arch. The first lateral saddle is rather broad, much broader than the external one and also broader than the first lateral lobe. It reaches also slightly higher up than the external saddle and is somewhat obliquely arched at its top. On the whole it is also club shaped. The second lateral lobe is very much smaller than the first and even slightly shorter than the external one. It bears some five dentations at its bottom, which together form a small arch, and is broader there than at its base. The second lateral saddle is only partly preserved, and it can only be stated that it is shorter than the first one. All the rest of the sutural line cannot be distinguished.

The measurements of the only existing specimen are as follows :—

Diameter of the shell	. . . . .	57 mm.
„ of the umbilicus	. . . . .	11 „
Height of the last volution from the umbilical suture	. . . . .	28 „
„ „ from the preceding whorl	. . . . .	21 „
Thickness of the last volution	. . . . .	17 „

Locality and Geological Position.—The specimen was collected by me at Koofri in the middle region of the Ceratite-Sandstone, the *Stachella*-beds (bed No. 10 of the section in my note-book).

Remarks.—I was for some time in doubt as to whether I should not attribute this species to the genus *Beyrichites*, and even now I am not quite certain if such a position would not be the more appropriate one ; but it would require specimens of a somewhat more complete preservation, to decide the question definitively. As it is, it seemed to me, that the folds which are strongly expressed on the external half of the lateral parts of the whorls of this species will have most probably extended down to near the umbilicus ; and then the affinity of this form to the *Ptychites flexuosi* of Mojsisovics would be more close than to *Beyrichites*.

As to species, the present shell cannot be compared to any form that has been described up to the present, as the division of each rib into two towards the external side is not repeated in any other similar shell.

Sub-Family: *GYMNITINÆ*.

Genus: *FLEMINGITES*, Waagen n. gen.

1892. *Flemingites*, Waagen: Rec. Geol. Sur. India, Vol. XXV, part 4, page 184.

1892. *Flemingites*, Waagen: Jahrb. k. k. Geolog. Reichsanst., Vol. 42, part 2, page 380.

This genus contains the most conspicuous and strangest Ammonites existing in the triassic deposits of the Salt-Range; and the figure given by M. de Koninck of a species belonging to it has given rise to many discussions as to what systematic position this remarkable shell could possibly hold. It is much to be regretted that the figure of this shell, as drawn by de Koninck, seems to be entirely erroneous, since all the specimens collected by me deviate in the most essential character—the sutural line—from de Koninck's drawing. It is represented in the Salt-Range by not less than seven species, and the materials, on which the description must be based, are on the whole quite satisfactory. The only point in the organisation of these shells which remains doubtful is the configuration of the apertural margin, which latter is not preserved in any of the specimens at my disposal.

The characters of the genus are as follows. All the species have a discoidal shell, with a large umbilicus in the middle. The transverse section of the whorls is mostly compressed, being considerably higher than it is broad. Sometimes the two dimensions are nearly equal, but there is no case known to me in which the thickness exceeds the height. The involution of the whorls is always very small, the result being a very large and flat umbilicus.

The whorls are generally provided with a sculpture, which often becomes very marked, and which led me, in the beginning, to consider these shells as belonging to the *Trachyostraca*. But even in the most strongly sculptured species the inner volutions are perfectly smooth; and as in another form this character prevails up to a very considerable diameter, and then only very faint ribs are developed, I decided on placing these shells among the *Leiostraca*. I shall, however, have to adduce yet other reasons in favour of such an opinion.

The sculpture always consists of single radial folds varying in intensity on the different parts of the volutions. They are never dichotomous, and never extend to the external part of the shell. These folds are always crossed by a fine concentric striation, which is of the same character as that occurring in the genus *Sturia*, Mojs., of the sub-family *Ptychitinæ*. This striation is sometimes more marked, sometimes less so, but this depends to a great extent on the mode of preservation. It is, however, not exclusively restricted to the exterior surface of the shell, but appears also on internal casts.

The sutural line is characteristic. The external lobe is very broad and shows a certain tendency to develop adventitious elements, as may be observed in the sutural lines of *Flemingites glaber*, W., Pl. XI, fig. 2d., of *Flemingites compressus*, W., and *Fl. trilobatus*, W., represented on Pl. XVI, fig. 1 c and 2 b. This character is again one of those which cause me to place these shells among the *Leiostraca*. The two lateral lobes are always well developed. The interior of these is represented in

de Koninck's drawing as simply pointed,—a circumstance which attracted the attention of all former observers; but I regret to say that this drawing is probably erroneous, inasmuch as all the specimens that have come under my notice have the second lateral lobe provided with at least two denticulations, though as a rule, there are many more. The auxiliary series is very differently developed in different species. Sometimes there is not a trace of an auxiliary lobe, the second lateral saddle reaching down directly to the umbilical suture. In other cases the sutural line descends again after forming the second lateral saddle, and there are some irregular denticulations intercalated between the latter and the umbilical suture. In some few instances at least, a distinct auxiliary lobe is formed, which is again followed by a distinct auxiliary saddle.

These variations in the development of the sutural line are not so strictly distributed in different species, according to their respective geological age, in the present genus, as is the case, for instance, in the genus *Proptychites*; but here also we may state that, as a general rule, the more recent the single species, the more complicated is the sutural line.

The length of the body-chamber in the present genus cannot be observed with absolute certainty, as in none of the specimens at my disposal has the apertural margin been distinctly preserved; but to all appearances, in some of the larger specimens the apertural margin cannot have been very far off; and from this it appears probable that the body-chamber was not very long, and probably did not exceed one-half of a volution.

It has been stated above that the genus is represented in the Salt-Range by no less than seven species, all of which occur in the Ceratite Sandstone; the smaller species, in the middle region, the so-called Stachella beds, the larger ones, in the upper region, the *Flemingites* beds, as I have styled them.

Several groups of forms can be distinguished according to their affinities, but I cannot state positively whether they correspond also to an evolutionary series, as the exact beds in which each single form may occur, are not known to me. The most primitive form, which shows but little sculpture and has the lateral branches of the external lobe almost entirely transformed into adventitious lobes, is a shell for which I introduce the name of *Flem. glaber*, W., and which I detected in the Stachella beds. It stands rather isolated among the other species, and thus I am obliged to treat it as an isolated form. The first group of forms that can be unquestionably distinguished must be considered as corresponding to an evolutionary series. It commences in the *Stachella* beds with a small species, for which I introduce the name of *Flem. nanus*, W. This latter has no distinct auxiliary lobe, whilst in the species next following in the Upper Ceratite Sandstone (the *Flemingites* beds) this lobe is very distinctly developed. This latter species will receive the name of *Flem. trilobatus*, W. In the Salt-Range this series comes to a close here, but in other countries it appears that it extends still higher.

The next two groups which I am able to distinguish are simply groups of forms showing a close connection with each other, but in which an evolutionary succession cannot be proved. These are: First, the group of *Flemingites rotula*, W., in

which this species is united with another shell for which I introduce the name of *Flem. radiatus*, W., both of which occur in the *Stachella* beds, and are characterised by compressed whorls and numerous radial ribs. Secondly, the group of *Flem. flemingianus*, Kon. sp., with which a shell called by me *Flem. compressus*, W., is most closely allied. Both these forms are very large and strongly sculptured.

We thus arrive at the following classification of the shells belonging to this genus, of which, however, *Flem. flemingianus* must always be considered the type.

a. ISOLATED SPECIES.

1. *Flemingites glaber*, W. n. sp. *Stachella* beds.

b. Group of FLEMINGITES NANUS, W.

2. *Flemingites nanus*, W. n. sp. *Stachella* beds.
3. „ *trilobatus*, W. n. sp. Upper Ceratite Sandstone.

c. Group of FLEMINGITES ROTULA, W.

4. *Flemingites rotula*, W. n. sp. *Stachella* beds.
5. „ *radiatus*, W. n. sp. „ „

d. Group of FLEMINGITES FLEMINGIANUS, de Kon. sp.

6. *Flemingites flemingianus*, de Koninck sp. Upper Ceratite Sandstone.
7. „ *compressus*, W. n. sp. Upper Ceratite Sandstone.

If we wish to compare the present genus with forms occurring in other countries, we can lay hold of several characters. The most important among which appear to be the spiral striation of these shells, their large umbilicus, and their sutural line. The first two characters we find repeated in the genus *Gastrioceras*, which was most numerous during permo-carboniferous and permian times. In this genus, however, the sutural line is still perfectly goniatic, and there is only a single lateral lobe present. The sculpture consists of knobs or short radial ribs on the lateral parts of the shell. It appears not at all impossible that *Gastrioceras* might be the ancestor of *Flemingites*; but there are no proofs whatever for such a supposition, and thus a decision on this question is absolutely impossible. On the other hand, some shells have been described out of the Muschelkalk of Sarajewo by Hofrath von Hauer which show a very great similarity to our *Flemingites*. Von Hauer has introduced for them the names of *Ceratites striatus* and *Ceratites crasseplicatus*. It cannot be denied that these forms show a great similarity to certain genera belonging to the *Trachyostraca*, chiefly to Hauer's genus

Proteusites, a group of forms that appears to be most nearly related to *Acrochordiceras*, or to the new genus that has been described by me in the present volume under the name of *Stephanites*. The distinction of the two above-quoted species from these two genera can, however, be decided by the observation of the length of the body-chamber, which occupies one volution in *Proteusites* and *Stephanites*, whilst it is only half as long in *Ceratites striatus* and *Cer. crasseplicatus*. In this respect these two forms would be in accordance with *Ceratites*, and so far von Hauer's determination would be correct; but the spiral striation occurring in both these shells, the absence of any thorns or spines on the surface of their whorls, and the general similarity to my *Flemingites*, make another generic position for them probable.

The similarity is chiefly striking if we compare our *Flemingites trilobatus* with Hauer's species. The involution is somewhat greater, the umbilicus in consequence somewhat narrower, the whorls more inflated and somewhat more deeply depressed; but the general characters of the shell and of the sculpture are absolutely identical. Yet more striking is the similarity, if we compare the sutural lines. The saddles are all constricted at the base and broadly rounded at the apex. The lobes are identical in their shape, with some very remarkable exceptions. The external lobes have lost their adventitious elements; and instead of one, there are two auxiliary lobes in von Hauer's species; all changes which one must expect to take place in the more recent members of the same evolutionary series. Now, my *Flemingites trilobatus* was found by me in the topmost division of the Bunt-Sandstein, whereas von Hauer's species occur at some horizon in the Muschelkalk. Thus it appears that *Ceratites striatus* and *C. crasseplicatus* do not only belong to the genus *Flemingites*, but must probably be attributed to an evolutionary series that takes its origin in *Flem. nanus* in the middle beds of the Bunt-Sandstein of the Salt-Range; proceeds then to *Flem. trilobatus*, W., in the topmost beds of the Bunter; has then emigrated to Europe and produced there during the time of the Muschelkalk the species *Flem. crasseplicatus*, Hauer, sp.; to terminate at last with *Flem. striatus*, Hauer sp., in which already the saddles are provided with indentations all round, thus assuming an ammonitic development of the sutural line. It thus appears very strange that the genus, which is so well represented during the time of the Bunter in the Salt-Range, should suddenly stop in the topmost beds of that formation and ascend here no higher in strata, to which I am inclined to attribute a Muschelkalk age.

a. ISOLATED SPECIES.

1. FLEMINGITES GLABER, Waagen n. gen. et. sp., Pl. XI, fig. 2 a, b, c, d.

There is only a single individual of this species in the Salt-Range collection, nor is it quite complete, the shell being only partially preserved, but it is otherwise in very good condition. The specimen is entirely composed of air chambers.

The general shape is flatly discoidal, with a wide umbilicus which is quite flat.

The whorls are compressed and perfectly oval in their transverse section, a little less than twice as high as they are broad.

The lateral parts of the whorls are very flatly, but equally arched. The greatest transverse diameter is situated a little below the middle of the entire height of the whorls. From thence the lateral parts slope with a gentle bend, about equally in the direction of the external part as well as in the direction of the umbilicus. Before reaching the umbilical suture, however, they rather suddenly bend down to form a very indistinct, rounded umbilical wall, which is not bounded off from the remainder of the lateral parts by an umbilical edge.

The external part is rather narrowly rounded, not flattened. It is always perfectly smooth and devoid of any sculpture in its median part at least. It is only very indistinctly marked off from the lateral parts of the whorls.

The sculpture of the shell is two-fold,—one is a radial, the other a spiral, sculpture. The radial sculpture commences only after the shell has attained a diameter of more than 30 mm. Up to this diameter the shell is perfectly smooth, with the exception of the concentric striation, which has appeared already at an earlier age. The radial sculpture then consists of low and very broad folds, broader even than the intervals between. In the beginning, these folds are covered by a fine radial striation made up probably of stronger striæ of growth, which are not perfectly straight, but show a very slight falciform bend. Further on, the striation disappears, the folds are smooth on their tops and lean slightly over towards the front. As the body-chamber of the specimen under description is not preserved, it cannot be stated whether the sculpture has been changed on that part of the shell or not.

The concentric spiral striation is not equally distributed all over the shell, but it appears stronger in some parts and fades away in others. I cannot say with certainty at what diameter it first makes its appearance. Certainly, on the inner volutions of the specimen under description nothing of it can be seen, though the surface of the shell is tolerably well preserved. The specimen has attained a diameter of nearly 30 mm, when traces of the spiral striation can first be made out. It consists then of fine parallel striæ which cover the outer half of the volution as it is exposed within the umbilicus, whilst the interior half, down to the umbilical suture, remains smooth. On the last volution of the specimen under description the striation is most distinctly developed, notwithstanding the circumstance that the greatest part of this is an internal cast, whilst only small remnants of the shell have been preserved on part of the external side and near the umbilical suture. The striation commences on this last volution on the lateral parts of the shell at a distance of about one-third of the entire height of the volution above the umbilical suture; but here it is still extremely faint and barely perceptible. The striæ only become distinctly developed half way up between the umbilical suture and the external part. After this there follow about ten to eleven striæ at equal distances and of about equal strength. Under the lens they appear as low parallel ridges. In the middle of the external part there remains a smooth zone with a breadth of about 2 or 3 mm. On the fragments of shell which remain on this specimen, the spiral striation appears to be of a somewhat different character. The parallel striæ

The sutural line is very remarkable in this species. It is known to me all round, being visible even on the internal part of the volution. The external lobe is very strangely developed, and its exact extent is very uncertain. Just in the middle of the external part there is a small lobe, under which the siphon passes. The former is pointed on each side, and is then followed by a very small saddle. Now, is this structure to be considered as the external lobe, or as a simple indentation of the median tubercle? After the small saddle, which is narrowly but perfectly rounded, there follows a broad and not very deep lobe, which may either be considered as an adventitious lobe or as the lateral branch of the external lobe strongly individualised. This lobe is broader than it is deep. It bears five denticulations at its base, of which the median one is most prominent. All the denticulations together form an equally rounded arch. The saddle which follows next must be considered either as an adventitious or as the external saddle. According to analogies with other species, the latter probably is the case. It is short, broad, and very equally rounded, without any indentations. The lobe which follows next is certainly the first lateral lobe. It is deep, considerably deeper than broad, and reaches much further down than the preceding lobe. It has perfectly parallel sides. At its base there are eight to ten denticulations, which form together a strongly prominent ogival arch. The first lateral saddle is extremely broad and obliquely rounded. It reaches distinctly higher up than the external one. The second lateral lobe is much shorter and narrower than the first one. It reaches not quite so far down as the adventitious (?) lobe. It has parallel sides and bears many denticulations at its base, which are arranged in an obliquely descending curve. The second lateral saddle is less oblique than the first and reaches also less high up, but nevertheless higher than the external saddle. It is broadly rounded at its top, and very slightly contracted at its base.

The internal part of the sutural line is very simple. The umbilical suture itself cuts through a small saddle, after which a broad internal lobe follows, which possesses some four strong denticulations at its base. This lobe is short, much broader than it is deep. The next following internal saddle is rather narrow, well-rounded, and reaches about as high up as the first lateral saddle. The anti-siphonal lobe is narrow and very long. It is slightly contracted below, and bears four strong denticulations on its base, of which the two median ones are longest.

The measurements of the figured specimen are as follows :—

Diameter of the shell	. . . . .	80 mm.
„ of the umbilicus	. . . . .	32 „
Height of the last volution from the umbilical suture	. . . . .	28 „
„ „ „ from the preceding whorl	. . . . .	24 „
Thickness of the last volution	. . . . .	15 „

As has been stated above, this specimen is entirely composed of air-chambers.

Locality and Geological Position.—The only existing specimen of this species I found at Chidroo in the Stachella beds of the Ceratite Sandstone.

Remarks.—This species appears to me to be the most primitive one of the genus, and therefore I have ranged it in the first place. The smoothness of its shell, the poor development of the radial folds, and the smooth zone in the middle of the external part, which causes this latter to assume a somewhat bi-angular appearance, are all characters which testify to a rather primitive development. To these must be added the characters of the external line, in which no distinct auxiliary lobe is developed while the lateral branches of the external lobe are transformed into a true adventitious lobe.

Such characters could never be united in a member of the Trachyostraca, and therefore I have placed the genus in the vicinity of *Ptychites* as a member of the sub-family *Gymnitinæ*, corresponding to a certain extent to the genus *Sturia* in the sub-family *Ptychitinæ*. Nevertheless, I must confess that the last members of the genus in the Muschelkalk of Sarajevo have lost nearly all the characters of the *Leiostraca*, and can barely be recognised as members of the mentioned sub-order if it were not for their striking affinity with the more ancient species of the genus.

The species here under consideration reminds me, as regards the inequality of its concentric striæ, very much of some species of *Gastrioceras*, such as *Gast. zitteli*, Gemm., or *Gast. suessii*, Harp.

b. GROUP OF FLEMINGITES NANUS, W.

2.—FLEMINGITES NANUS, Waagen n. gen. et. sp., Pl. VII., fig. 8 a, b.

It is but a fragmentary specimen, on which parts of the shell are preserved, which serves for the description of this species.

The general shape of the shell is flatly discoidal with moderately inflated whorls and a wide, flat umbilicus. The involution is very small, the overlap of the last whorl over the preceding one not amounting to more than one-sixth of the former.

The transverse section of the whorls is somewhat rectangular, considerably higher than it is broad. The greatest transverse diameter occurs at exactly half the height of the whorls. The lateral parts are rather flattened, not much vaulted: from their highest point of elevation they slope in a quite equal, slight curve in the direction of the umbilicus as well as in the direction of the external part. The latter is also somewhat flattened, only slightly vaulted. It unites with the lateral parts in forming obtusely rounded-off angles. The umbilicus is surrounded by a sloping umbilical wall, which unites with the lateral parts of the whorls, forming a distinct but not very sharp umbilical edge.

The sculpture of the shell consists of low, straight radial folds, which are rather distantly placed from each other. There may have been about eight of such folds on

one volution. The folds of succeeding whorls do not correspond with each other. The intervals between the folds are smoothed and of very unequal extent. The folds disappear in approaching the external angle.

The concentric striation, characteristic of the genus, is very slightly developed in this species. It is on the whole very fine and low, and is chiefly restricted to the external part of the shell, where it appears already on the inner volution. On the last volution it extends down to the lateral parts of the shell, but disappears also here on the middle part of the latter. This striation can only be seen on those parts of the specimen where the shell is preserved. On the internal cast nothing of it can be detected.

The sutural line of this species is clearly traceable on certain parts of the specimen, and exhibits the following characters. The external lobe is very broad, deeply divided in the middle by the median tubercle. This shows in the middle, again, a small lobe under which the siphon passes. It is pointed, simple and very narrow, limited on both sides by very narrow but not quite angular saddles. The lateral branches of the external lobe which now follow are not very deep, but developed somewhat in the manner of an adventitious lobe, though not so distinctly as in the preceding species. Their sides are convergent towards the base, which is provided with some four denticulations which form an obliquely ascending curve in the direction of the external saddle. This latter is broad, with parallel sides, reaching not much higher up than the median tubercles of the external lobe. Its top is entire and well rounded. The first lateral lobe is broader than the external saddle, and very considerably longer than the external lobe. It possesses parallel sides, reaches very far down, and bears at its bottom a great number of fine denticulations, which form together a strongly prominent arch. The first lateral saddle is about as broad as the preceding lobe. It reaches slightly higher up than the external saddle. It is very slightly contracted at its base and broadly rounded at its top. The second lateral lobe is much shorter and narrower than the first one, yet it reaches somewhat lower down than the external lobe. It is somewhat club-shaped, its base being somewhat broader than its upper extremity. On the former there are some five denticulations, which form together a strongly prominent arch. The second lateral saddle is very small and narrow, broader at its top than at its base. It extends less high up than the external saddle, and is well rounded at its top. The auxiliary series which now follows reaches at first as low down as the external lobe, but only the first denticulation is so strongly prominent; the further ones are arranged in a very oblique, strongly ascending line, which extends to the umbilical suture.

The measurements of the specimen are as follows:—

Diameter of the shell	(may have been about)	.	.	.	.	.	41 mm.
" of the umbilicus (	" " )	.	.	.	.	.	16 "
Height of the last volution from the umbilical suture		.	.	.	.	.	15 "
" " from the preceding whorl		.	.	.	.	.	13 "
Thickness of the last volution		.	.	.	.	.	11 "

Locality and Geological Position.—The only form of this species existing in

the Salt-Range collection was found by me in the Stachella-beds of the Ceratite Sandstone at Amb.

Remarks.—The species is very easily distinguishable from the shell previously described under the name of *Flem. glaber*, W. It needs only a comparison of the figures to appreciate the differences. More nearly related to the present species must have been the young of *Flem. radiatus*, W., and *Flem. flemingianus*, Kon., which will be described presently. Especially the first of the two species is very similar, but still it can be distinguished by more numerous radial folds, more compressed whorls, and a different rate of increase. These two latter characters hold good also with regard to *Flem. rotula*, W. *Flem. flemingianus*, Kon., possesses whorls which increase much more rapidly in their height, and which also differ in the characters of their concentric striation.

3. FLEMINGITES TRILOBATUS, Waagen n. gen. et. sp. Pl. XVI. fig. 2, 2 a. b.

It is again a fragmentary specimen, composed of air-chambers and with only partly preserved shell which must serve for the description of this species.

The general shape of the shell is flatly discoidal, with a not very wide umbilicus and somewhat compressed, squarish whorls. The involution of the shell is not very great, the overlap of the last whorl over the preceding one amounting to not more than one-sixth of the entire height of the former.

The transverse section of the whorls is somewhat trapezoidal with flattened sides and very considerably higher than it is broad. The greatest transverse diameter of the whorls is situated within the lower third of the entire height. The lateral parts are very distinctly flattened for their greater extent, as has been stated above. From their point of highest elevation they slope in a very regular curve down to the umbilical suture without forming an umbilical edge or a distinct umbilical wall. In the opposite direction, towards the external side, they form a slowly sloping declivity until a short distance before the siphonal side of the whorl is reached, and then bend in a rather narrow curve down to meet the external part of the shell. This latter shows a flat but very equal curve and unites with the lateral parts without proper demarcation.

The sculpture of the shell consists of radial folds of very unequal strength. On the inner volutions there is generally one weaker fold intercalated between two stronger ones, whilst on the last whorl the folds are more equal in their strength. The folds are all nearly quite straight and are never divided. Towards the distal extremity of the last whorl the animal must have received some injury, as is demonstrated by an irregularity in one of the folds on the side of the specimen which has not been represented in the figure. After this injury the three fine ribs have been formed which are shown on the extremity of the last whorl in the drawing. The external part shows no sculpture except the spiral striæ.

The spiral striation is very distinctly developed on certain places of this shell. This is, however, only the case where the substance of the shell has been preserved, whilst on the internal cast the spiral striation can be seen only with difficulty

This striation is most strongly developed on the external half of the lateral parts of the whorls. It is much weaker on the external part of the shell, and disappears slowly from the middle of the lateral parts towards the umbilicus. The striæ are not all of the same strength, but as the shell augments in size new ones are intercalated which are in the beginning weaker than the rest, and only slowly attain the same strength as the other striæ.

The sutural line is very characteristic. The external lobe is enormously broad, divided in the middle by a not very broad nor very prominent siphonal tubercle. It is slit open in the middle for the passage of the siphon, which latter has its funnel directed backwards. The lateral branches of the external lobe are separated into two distinct parts by a secondary saddle, and it is a matter of doubt whether the inner denticulations might not better be considered as constituting the external lobe, whilst those directed towards the lateral faces of the shell should be taken as an adventitious lobe. Then the external lobe would bear on the bottom of each lateral branch only two denticulations, whilst of the adventitious lobes each would bear four such. But the secondary saddle which separates the external lobe from the adventitious one is very small comparatively, and thus I have preferred to take the whole as a unity and consider it as constituting the external lobe.

The external saddle is comparatively large and reaches considerably higher up than the median siphonal tubercle of the external lobe. It is slightly contracted at its base and broadly rounded at its top, thus appearing more or less phylloid. It is entirely without indentations. The first lateral lobe is not much longer than the external one. It is broader at its bottom than at its commencement, and is provided with many denticulations which reach rather far up along its lateral outlines. There are about ten of these denticulations, of which the median ones are very long. They all form together an arch, which resembles the arches occurring in Arabian architecture.

The first lateral saddle reaches up only a little higher than the external one and is also broader than the latter. It is again narrowed at its base and broadly rounded at its top, somewhat phylloid in its appearance, and is entirely without indentations. The second lateral lobe is not only shorter than the first one, but also shorter than the external lobe. It bears also about eight denticulations at its base, which reach very high up laterally, and of which again the median ones are the largest. The second lateral saddle is much smaller than the two preceding ones, strongly narrowed at its base and slightly depressed, but at the same time broadly rounded at its top, without indentations. After this follows a distinct auxiliary lobe, which is much shorter but only little narrower than the second lateral. It bears four strong denticulations on its bottom, which are arranged in about a straight line. In its direction this lobe is obliquely placed with regard to the other lobes, and beginning from this lobe the sutural line hangs down a little, forming a kind of very shallow sutural lobe, as it is developed in many more recent genera of Ammonites. The next following distinct auxiliary saddle is not entirely above the umbilical suture.

The measurements of the figured specimen are as follows :—

Diameter of the shell (may have been about)	. . . . .	116 mm.
„ of the umbilicus ( „ „ „ „ )	. . . . .	39 „
Height of the last volution from the umbilical suture	. . . . .	46 „
„ „ „ „ from the preceding whorl	. . . . .	38 „
Thickness of the last volution	. . . . .	26 „

Locality and Geological Position.—This single form of the species was found by me on the road from Varcha to Oochali. It is contained in a yellowish-grey sandy calcareous rock, and its geological position can be defined as the upper region of the Ceratite Sandstone, because not far above the bed in which this specimen was contained, the Upper Ceratite Limestone made its appearance. The section was, however, at this place neither very distinct nor very clear.

Remarks.—Of the species hitherto described in this work, only *Fleming. nanus*, W., can be compared more in detail with the present form. The differences of the two shells consist in the circumstance that the former species has a larger umbilicus, whorls that are much thicker in comparison to their height, and a sutural line in which the saddles are less strongly phylloid. The lateral branches of the external lobe are not bifid, and the auxiliary lobe is less distinctly defined.

Of other species, the two shells which have been described by von Hauer under the names of *Ceratites crasseplicatus*, H., and *Cer. striatus*, H., must be considered. It has been stated above, in the description of the genus, that these two shells most probably belong to the genus *Flemingites*. The first of the two species is different from the shell under description by its very weak spiral striation, by its thicker and less high whorls, all characters in which it resembles *Flem. nanus* more than *Flem. trilobatus*. The sutural line, however, is much more in accordance with that of the latter species, only the external lobe is deviating as well as the auxiliary series, in which two auxiliary lobes are developed in the shell from the Muschelkalk, whilst there is only one in our *Flem. trilobatus*. In *Cer. striatus*, H., the sutural line is perfectly ammonitic.

C. GROUP OF FLEMINGITES ROTULA, W.

4. FLEMINGITES ROTULA, Waagen n. gen. et. sp. Pl. XI. fig. 3 a, b.

It is only a single rather small but very well preserved specimen, from which this species has to be described.

The general shape of the shell is flatly discoidal, with compressed whorls and a rather large and flat umbilicus. The involution is very small and the overlap of the last whorl over the preceding one amounts to not more than one-sixth of the entire height of the former.

The transverse section of the whorl is somewhat elongate-rectangular, with slightly arched sides. The external part is distinctly flattened. The greatest transverse diameter is situated somewhat below the middle of the entire height of the whorls. From thence the lateral parts slope with a very slight curve towards

the external part of the shell, with which they unite at an obtuse angle. In the direction of the umbilicus the lateral parts appear nearly parallel, showing only a very slight curve. The umbilicus is surrounded by a sloping umbilical wall, which unites with the lateral parts forming an indistinct umbilical edge. The external part is smooth and flattened, hemmed in on both sides by obtuse edges.

The sculpture of the shell consists in simple radial folds, of which there are on an average about twelve on one volution. They are not all of the same strength, but mostly alternately stronger and weaker. They originate at the umbilical edge, are strongest on the middle of the sides and disappear again before reaching the external part.

The spiral striæ, characteristic of the genus, are very fine and very numerous, about equally distributed all over the surface of the whorls.

The sutural line is very characteristic and most important for the distinction of the species. The external lobe is rather indistinctly preserved: it seems to have been very broad and very short with small lateral branches and a moderately large siphonal tubercle in the middle. The external saddle is broad and reaches very high up; it is the broadest one of all the saddles, its sides are slightly convergent towards the top, which is broadly and equally rounded. The first lateral lobe is also very broad, with sides which converge towards the bottom. It extends much further down than the external lobe and bears some five fine denticulations at its base, which form together a distinct arch. The first lateral saddle is somewhat shorter and narrower than the external one. It possesses also convergent sides and is narrowly rounded at its top. The second lateral lobe is comparatively broad but much shorter than the first one. It possesses also a number of fine denticulations at its base which form together also a distinct arch. The second lateral saddle is very short and very broad, and extends on the inner volutions down to the umbilical suture; towards the end of the specimen, which is entirely composed of air-chambers, there are, at the umbilical edge, instead of an auxiliary lobe, two fine denticulations intercalated above the umbilical suture. A true auxiliary lobe is, however, never developed.

The measurements of the specimen serving for description are as follows:—

Diameter of the shell	43 mm.
„ of the umbilicus	15 „
Height of the last volution from the umbilical suture	18 „
„ „ „ from the preceding whorl	15 „
Thickness of the last volution	9 „

Locality and Geological Position.—The only representative of this species was found by me at Nanga in the middle region of the Ceratite Sandstone, the so-called Stachella-beds.

Remarks.—The present species appears to be rather closely related to *Flemingites glaber*, W., described by me on the foregoing pages. The existence of a strong radial sculpture however in the present species makes a distinction easy. Also *Flem. nanus*, W., is very similar, but its whorls are much thicker and more strongly depressed. From the form which will be described next under the name of *Flem.*

radiatus, the present one is distinct by the absence of any decided auxiliary lobe and the less frequent radial folds.

5. *FLEMINGITES RADIATUS*, Waagen n. gen. et sp. Pl. XI, fig. 1 a, b, c.

The materials from which this species must be described consist of two excellently preserved specimens, the larger of which is an internal cast, whilst in the smaller one most of the shell is preserved. Both specimens show part of the body chamber.

The general shape of the shell is flatly discoidal, with compressed whorls and a tolerably wide umbilicus. The involution of the shell is very small, though larger than in the preceding species, inasmuch as the overlap of the last whorl over the preceding one amounts to a little less than one-fourth of the entire height of the former.

The transverse section of the whorls is nearly rectangular with rounded-off corners, very much higher than it is broad. The lateral parts of the whorls are nearly quite flat, barely perceptibly arched; and it thus becomes difficult to state where the greatest transverse diameter occurs, as to a great extent the two sides are perfectly parallel to each other. The umbilicus is surrounded by a sloping but narrow umbilical wall, which is bounded above by a rounded umbilical edge. This passes gradually into the lateral parts of the whorl, which are slightly arched for a short distance and then become quite flat. This lasts for a distance equal to one-third of the entire height of the whorl, and then the lateral parts slope with a very slight curve down to the external part of the shell. This latter shows a flat curve and unites with the lateral parts in forming very obtuse external edges.

The sculpture of the shell consists of numerous radial folds, which become fainter as the specimen grows larger. These folds are always simple, never divided, and commence just above the umbilical wall, and extend quite straight over the lateral parts of the whorls, reaching up to the external edge, where they disappear again. On the inner volutions, these folds are less numerous than on the outer ones. On the former, one can count about twelve on one volution, whilst on the latter, there are eighteen to twenty-two within the same space.

The spiral striation is very fine and very close, about equally distributed over the whole surface of the shell all round the single whorl. But it is more distinctly developed on the outer than on the inner volutions. This character may be, however, only an apparent one, as the surface of the shell is rather rough on account of the circumstance that all the specimens are contained in a sandstone, and the grains are very firmly adherent. Thus the striation may have been obliterated on the inner volutions, where it must have been naturally much finer and more easily destroyed. On the internal cast the spiral striation appears much weaker, but also quite distinct.

The sutural line is very distinctly preserved in both specimens. The external lobe is broad and not very long. It is divided in the middle by a moderately deep and broad siphonal tubercle, which bears in the middle of its top a distinct pointed indentation, a character which has been preserved only in the second specimen,

which is not figured. The lateral branches of the external lobe have convergent sides and bear some five denticulations on their base, the external saddle is short, broad and well rounded. All the saddles are somewhat contracted at their base, thus appearing very slightly phylloid. The first lateral lobe is not very broad, but is long with nearly parallel sides. It bears five or more denticulations on its base, which together form a distinct arch. The first lateral saddle is somewhat broader than the external one and reaches also somewhat higher up. It is broadly and regularly rounded at its top. The second lateral lobe is much shorter and narrower than the first one, possesses also parallel sides and bears between five and eight denticulations on its base which form together a low arch. The second lateral saddle is considerably shorter and narrower than the first one, and is regularly rounded at its top. After this there follows a very distinct auxiliary lobe which is as deep and broad as the second lateral, and shows four denticulations on its base, which form an obliquely ascending arch. The small auxiliary saddle which is also present is not entirely above the umbilical suture. It is much lower than the second lateral saddle.

The measurements of the two specimens are as follows :—

	I.	II.
Diameter of the shell	83 mm.	72 mm.
„ of the umbilicus	29 „	26 „
Height of the last volution from the umbilical suture . . .	32 „	29 „
„ „ „ from the preceding whorl . . .	25 „	23 „
Thickness of the last volution	15 „	12 „

Both these specimens show part of the body-chamber, and in the one figured on Pl. XI. fig. 1, the last sutural line has been drawn, so that it appears that the last half of the last volution belongs to it. At the same time it is evident that this specimen was full-grown, as the last three sutural lines are more closely arranged than the preceding ones. This latter specimen is at the same time mostly an internal cast.

Locality and Geological Position.—The two specimens were found by me at Nanga in the middle region of the Ceratite Sandstone together with numerous specimens of *Stachella*. It was in this locality that I first distinguished these beds as *Stachella*-beds.

Remarks.—The present species is closely related to the preceding one, and this so much so, that I was much in doubt whether I should not unite these two forms together. Only after I had been able to develop in both forms sutural lines of identical sizes, was I convinced that two different species were represented by these shells. In *Flemingites rotula*, W., there is never a distinct auxiliary lobe present, but there are in its place two little denticulations developed, which are on the same level as the top of the second lateral saddle, and after which the sutural line descends nearly straight to the umbilical suture: in *Flem. radiatus*, W., on the contrary there exists a very distinct auxiliary lobe already, at an earlier stage of development of the shell than has just been described in *Fl. rotula*, and after this there is also a distinct auxiliary saddle visible above the umbilical suture. Other

points of difference are, that *Flem. rotula* possesses a comparatively smaller umbilicus and less numerous radial folds. Thus it is evident that the two forms represent different species.

Another form which is somewhat similar, is *Flem. nanus*, W. The whorls are, however, much thicker in this species and the mode of increase quite different. Also the sutural line differs inasmuch as the auxiliary lobe is, though present, yet only developed at the side adjoining the second lateral saddle; but fades together with the remainder of the auxiliary series in the direction of the umbilicus, so that it does not appear as a distinctly separated lobe. Thus a separation of *Flem. radialis* from this form is also very easy.

d. GROUP OF FLEMINGITES FLEMINGIANUS, de Kon.

6. FLEMINGITES FLEMINGIANUS, de Koninck sp. Pl. XII. XIII. XIV.

- 1863 *Ceratites flemingianus*, Koninck : Quar Journ. Geol. Soc. Lond. Vol. XIX. p. 10, pl. VII. fig. 1.
 1863 *Ceratites flemingianus*, Koninck : Fossiles paleozoïques de l'Inde p. 12, pl. VII. fig. 1.
 1892 *Flemingites flemingianus* (Kon. sp.), Waagen Rec. Geol. Surv. India, Vol. XXV. page 184.
 1892 *Flemingites flemingianus* (Kon. sp.), Waagen : Jahrb. k. k. Geol. Reichsanst., Vol. XLII, page 380.

This is a shell of very considerable dimensions which in its general outlines reminds one much of full-grown specimens of *Gymnites palmai*, Mojs., with the difference that the inner volutions are not quite smooth but are provided with low radial folds, and the sutural line is thoroughly ceratitic.

The general shape of the shell is discoidal with a wide umbilicus and rather inflated whorls. The involution is not considerable and the overlap of the last whorl over the preceding one amounts to a little less than one quarter of the entire height of the former.

The transverse section of the whorls is not quite identical in shape in different places, and the chambered part of the shell possesses more compressed whorls than the body-chamber of the full-grown specimen. In the former case the height of the whorls is equal to $1\frac{1}{3}$ times their thickness, whilst in the latter case the same dimension is only as much as $1\frac{1}{2}$ times the thickness. On the whole the transverse section of the whorls is oval, well rounded everywhere. The greatest transverse diameter is situated two-fifths of the entire height of the whorl above the umbilical suture. From their highest point of elevation the lateral parts slope fairly equally in the direction of the umbilicus as well as in the direction of the external part, forming in both directions very gentle curves. The umbilical suture is reached, without any distinct umbilical wall being formed, whilst the external part, which is more broadly rounded on the more inflated outer volutions than on the compressed inner ones, unites with the lateral parts without any proper demarcation.

The sculpture is very different in different parts of the shell. The inner volutions, up to a diameter of the shell of about 130 mm., are provided on their lateral parts with single low and rounded radial folds, which are mostly alternately weaker and stronger. The latter commence very near the umbilical suture, are strongest

about the middle of the lateral parts of the whorls, and disappear before reaching the external side. The weaker folds begin near the middle of the lateral parts and disappear also before reaching the external side. As the shell grows larger, the sculpture begins to change. The radial folds become narrower, but at the same time more strongly marked. They are no longer quite straight but very slightly falciform. In their strength they vary again very much, and are also very unequally distanced; sometimes twin folds are formed, in which one such fold is immediately followed by another. In this way a great irregularity is produced, which is yet further augmented by the circumstance that many of them are restricted to the umbilical region, and disappear before reaching the middle of the lateral parts. The strongest of these folds do not stop when they approach the external part of the shell but, becoming much lower and broader, cross over it as slight, flat undulations.

This state lasts until the ultimate sutural lines are produced. With the beginning of the body-chamber the sculpture again becomes more regular. First some twin folds are produced which are replaced later on by single, very marked radial folds, which become so high on the middle of the lateral parts as to form almost tubercles. Between and on these folds, small ribs are formed which begin a little below the middle of the height of the lateral parts and extend from there in an approximately straight direction across the external part, being interrupted in the middle of the latter by a distinct furrow, which exists, however, only on the internal cast, while it is absent on specimens provided with their shell. The external part of the shell is thus not smooth as in other species of the genus, but shows broad low folds crossing over it on the inner volutions, while it possesses a fine transverse ribbing on the body-chamber.

The spiral striation is very strongly developed on the outer surface of the shell, whilst it is much weaker on the internal casts, often barely traceable in the latter case. It consists of little parallel ribs which appear like threads on the surface of the shell. It appears most strongly developed on the lateral parts of the whorls, while it is much weaker on their external part.

The sutural line is somewhat variable in this species, nevertheless it is highly improbable, that it could ever show the outline represented in M. de Koninck's drawing. I cannot guess what was the reason for this drawing, which is most unnatural and extraordinary in every respect. Among all the forms of Ammonites occurring in the Salt Range there is none which would show on the first lateral lobe a similar lateral denticulation which would disappear again towards the base of the lobe; and the form of the second lateral lobe is repeated only in one species of my genus *Prionites*, as has been demonstrated on a former page.

On several of the specimens at my disposal the sutural line is clearly traceable, and shows in all cases the following characters. The external lobe is very broad, but not very deep. It is divided in the middle by a strong siphonal tubercle which causes the formation of two distinct lateral branches. These are again subdivided by a small secondary saddle into two halves, each of which bears some larger denticulations and of which the one adjoining the external saddle has somewhat the

appearance of an adventitious lobe. The external saddle reaches very high up, as high or even higher than the first lateral saddle. Its sides are not quite parallel and it is rather narrow and well but equally rounded at its top. The first lateral lobe is broad, its sides converge slightly towards its base and it reaches down a little lower than the external lobe. There are some four or six strong denticulations at its bottom which form together a low arch. The first lateral saddle is very broad at its base and rather narrow at its top, where it is quite regularly rounded. It is mostly shorter than the external saddle. The second lateral lobe is somewhat shorter than the first one, and its sides converge strongly towards its base, where it bears mostly four, but sometimes also only two, in other cases again six denticulations. The smaller the number is, the larger are the denticulations. The second lateral saddle is again broad at its base and rather narrow at its top, where it is well and equally rounded. After this there follows an indistinct one-sided auxiliary lobe which bears some four or five strong denticulations, which reach down to the umbilical suture.

The measurements of two of the most complete specimens are as follows :—

	I.	II.
Diameter of the shell	253 mm.	188 mm.
" of the umbilicus	122 "	77 "
Height of the last volution from the umbilical suture	75 "	63 "
" " " " from the preceding whorl (?)	59 "	50 "
Thickness of the last volution	64 "	47 "

In the specimen No. 1 the greater part of its body-chamber is apparently preserved; it is at the same time an internal cast only; whilst specimen No. 2 has retained its shell on its outer volution, and is made up for its greatest part of air-chambers.

Locality and Geological Position.—The largest and best preserved specimens of this species were collected by me at Chidroo in the upper region of the Ceratite Sandstone. As this same form was afterwards found at other localities in the same geological position, I introduced the name of Flemingites beds for these strata. The species was found partly by Mr. Wynne, partly by myself at the following localities: Chidroo (2 specimens), Varcha (one specimen), Koofri section, bed No. 9 (one fragment). It is not known where M. de Koninck's original specimen came from. He only says that it was contained in a brownish sandstone.

Remarks.—The identification of my specimens with M. de Koninck's figures and description has given me great trouble, and even now I am not quite certain whether my determination is quite correct. M. de Koninck's original having been lost, it will always remain doubtful whether his drawing may not after all be correct, and then my specimens would beyond doubt be different not only specifically, but even generically, from his.

In the face of these doubts also other circumstances, not only the questionable correctness of the drawing, must be taken into consideration. If one compares de Koninck's figure with the drawing given by me on Pl. XIV, it must be confessed that the similarity is a most striking one. Both specimens do not represent full-grown shells, but are specimens of a middle size, in their dimensions almost

absolutely identical. Thus an identification can be justified notwithstanding the different sutural line and the deviating transverse section of the whorl. The drawing of this section, as given by de Koninck, is also absolutely impossible in any Ammonite; the mode of involution and the umbilical region being most unnatural. So I have at last decided to refer the specimens figured by me on Plates XII, XIII and XIV to de Koninck's species.

Of the other species of the genus, described by me on the foregoing pages, hardly any can be compared in greater detail with the present one. *Flemingites nanus*, W., is the only form which might at all be taken into consideration, but a comparison is very difficult, as no small specimen of *Flem. flemingianus* is known to me. It cannot positively be asserted, but it seems probable, that the young of the species here under consideration did not possess such a squarish transverse section as is exhibited by *Flem. nanus*, and the auxiliary series of the sutural line is quite differently developed in the latter shell.

Though in such a manner the specific identity is most improbable, yet *Flemingites nanus* might almost as well have been the ancestor of *Flem. flemingianus* as it has been taken by me to be of *Flem. trilobatus*, W.

7. FLEMINGITES COMPRESSUS, Waagen n. gen. et. sp. Pl. XV., Pl. XVI, fig. 1 a, b, c.

The present species probably grew still larger than the preceding one. The fragments described belong to forms not yet full-grown, though their diameter was as large as that of the specimen represented on Pl. XII.

The general outline of the shell is flatly discoidal, with a moderately wide umbilicus and compressed whorls. The involution is somewhat less considerable than in the preceding species, and the overlap of the last whorl over the preceding one amounts only to $\frac{1}{6}$ of the entire height of the former.

The transverse section of the whorls is very regularly oval, considerably higher than it is broad. The greatest transverse diameter is situated a little below the middle of the entire height of the whorl. From thence the lateral parts slope for a certain distance, but very little in the direction of the umbilicus, until a short distance before reaching that region they bend in a regular curve rather quickly down to meet the umbilical suture, without, however, forming a distinct umbilical wall nor an umbilical edge. In the direction of the external part of the shell the slope of the lateral parts is more distinct. At the same time they form a slight but very regular curve and unite with the external part without distinct demarcation. The external part of the shell is broadly and regularly rounded.

The sculpture of the shell varies in different parts. On the chambered portion of the shell the sculpture consists of low radial folds, which vary in prominence somewhat irregularly, and even their distances are not always the same. There may have been about eight to ten of the stronger kind on one circuit. These folds are almost straight, and of nearly equal height. They commence a short distance above the umbilical suture and disappear before reaching the external part.

On the body-chamber the sculpture is different. First, at the commencement of the body-chamber, the radial folds are augmented in number, and become at the same time much narrower. They commence here directly at the umbilical suture, and are strongly bent forward towards the mouth of the shell. In the middle of the lateral parts they are slightly bent, showing a convexity towards the front, and concavities above and below. Most of these folds extend on to the external part of the shell and cross over it, forming low broad undulations.

Further towards the mouth of the shell the stronger folds become again less numerous, but in the intervals between them, numerous falciform ribs are intercalated and extend also to the folds themselves in a somewhat irregular manner. These ribs also begin immediately at the umbilical suture and extend to near the external part, but do not cross over it, as far as may be observed on the fragments at my disposal.

A better preserved fragment of this species shows that these falciform ribs become more and more numerous and more strongly developed as they approach the mouth. The strong ribs, however, characteristic of the preceding species, seem to be absent in this one.

The spiral striation is excellently distinguishable on one of the fragments which serve for description, as it retains the greatest part of its shell. On internal casts the striation is always indistinct. It begins on the innermost volutions, but is there somewhat more closely arranged than is represented on the drawing on Pl. XV. On these inner volutions it is very fine, barely perceptible with the naked eye. As the specimens grow larger the striation becomes coarser and coarser, and on the largest fragment that is at my disposal the spiral striation has become as coarse as the falciform radial ribs, so that a regular reticulation of square meshes is formed. Even on the internal cast this reticulation is perceptible.

There is no specimen in which the mouth of the shell has been preserved.

The sutural line of this species does not differ much from that of the preceding one. The external lobe is also broad and bifid, but the denticulations on the base of the lobe are more varied and complicated. Each lateral branch is divided by a phylloid, secondary saddle into two equal parts, each of which shows several denticulations. The external saddle is high, but not very broad. It is strongly phylloid, and much broader at its apex than at its base. The former is broadly and regularly rounded. The first lateral lobe is broad and long, reaching lower down than the external lobe. It possesses nearly parallel sides and bears some seven denticulations at its base, which are arranged in a distinct arch. The first lateral saddle is broader than the external one and reaches also somewhat higher up. It has parallel sides and is somewhat obliquely rounded at its top. The second lateral lobe is but little narrower than the first lateral, but much shorter, even slightly shorter than the external lobe. It shows also parallel sides and bears four denticulations on its base which are all on the same line. The second lateral saddle is much narrower and shorter than the first one. Its sides are parallel but the inner one much shorter than the external, its top regularly rounded. The auxiliary series forms together one broad auxiliary lobe,

which possesses four large denticulations all on the same level, and reaches down to the umbilical suture. The measurements of the figured specimen are as follow:—

Diameter of the shell	(may have been about)	.	.	.	.	.	222 mm.
"	of the umbilicus ( " " " " )	.	.	.	.	.	89 "
Height of the last volution	from the umbilical suture	.	.	.	.	.	76 "
"	" " " " from the preceding whorl	.	.	.	.	.	63 "
Thickness of the last volution		.	.	.	.	.	45 "

Locality and Geological Position.—There are only two fragmentary specimens in the Salt-Range collection. One of them represents about half of an entire specimen, the other is smaller, but is a fragment of a still larger specimen. Both were found by myself in the section at Koofri (bed No. 9) in a soft brown sandstone, which forms the upper division of the Ceratite Sandstone and contains also specimens of *Flem. flemingianus*.

Remarks.—This species is closely related to *Flem. flemingianus* described above, and I was some time in doubt whether I should not better consider this form as identical with Koninck's species than the preceding one. Even now I am not perfectly certain about it, but on the whole, Koninck's figure seemed to me so absolutely similar to medium-sized specimens of the preceding species that I decided the question as I have done here.

Flem. compressus differs from *Flem. flemingianus*, Kon., chiefly in that the transverse section of the whorls is considerably narrower in comparison to their height, and that the umbilicus is comparatively narrower. Another difference consists probably in the absence of those strong radial ribs, which are so conspicuous in *Flem. flemingianus*. The larger fragment of the species, though apparently belonging to a specimen that must have attained at least the diameter of *Flem. flemingianus* as represented on Pl. XII., shows no trace of such ribs, and thus it appears most probable that they were never developed.

5. Family: MEEKOCERATIDÆ.

This is the last family of ammonoid forms which I have to describe from the triassic deposits of the Salt-Range. At the same time however, it is the one which contains the largest number of forms amongst all the families which I have treated of in the present volume. Up to now only very few forms were known, which showed any similarity to the genus *Meekoceras* as it had been described by Hyatt, and thus nobody has found it requisite to distinguish these forms as constituting a proper family, and one or two genera seemed perfectly sufficient to fit these few shells into. The genera which were recognised to be most closely related to each other were *Meekoceras*, Hand., and *Xenodiscus*, W., but in this very rudimentary attempt to classify these shells an error had crept in, which, as all errors generally are, was followed by a number of further mistakes. It must be confessed, that it seems barely possible with the few facts that were at disposal then, to recognise the truth, and I myself was guilty of commencing these errors. When creating the genus *Xenodiscus* I united under

that name three different things, among them some forms from the triassic beds of the Salt-Range, which had been figured by Koninck, and this was wrong, and was the starting point of all the following mistakes. Now after having studied the forms in detail, I know that the genus *Xenodiscus* is not only not identical with what has been united with it by me, but that on the other hand in the triassic beds of the Salt-Range the genus is even completely absent.

The principle was sound; *Meekoceras* is in fact very closely related to these forms, which occur in the Salt-Range and which had been united by me with *Xenodiscus*, but it has nothing to do with *Xenodiscus* proper nor with *Xenaspis* as it had been distinguished by me in the introduction to the *Gymnitinae*. The latter group of forms had been rightly affiliated by Mojsisovics to *Gymnites*, but it has but little affinity with *Meekoceras* or any other similar genus.

Another unexpected fact which came to light whilst studying the fossils from the Salt-Range in detail is the very close relation which was found to exist between the forms from the Salt-Range, which I had included with *Xenodiscus* and for which I have recently introduced the name of *Gyronites*, and the genus *Lecanites*, Mojsisovics. The relation is an extremely close one, so much so, that it appears often quite arbitrary whether a certain shell should be placed in one or the other genus.

The differences between *Xenaspis* and *Gyronites* consist above all in the length of the body-chamber, which in the former genus is about one volution, whilst in the latter genus, as in all the *Meekoceratidæ*, it is not longer than a half volution. The shell of *Xenaspis* is smooth until the commencement of the body-chamber, where a radial sculpture is formed. This character is in accordance with *Gymnites*, where the sculpture is also developed in later stages of growth only. In *Gyronites*, on the contrary, if any sculpture exists, it already commences on the inner whorls. The typical species of *Xenodiscus* which makes an exception in this respect, has been removed to the genus *Ceratites* by Mojsisovics. In the introduction to the family *Tropitidæ* I have remarked, that if it could not be united with the *Leiostraca* at all it would be better to place it among the *Tropitidæ* on account of its long body-chamber, and I am inclined to consider that the genus *Xenodiscus* forms an intermediate link between *Paraceltites* and *Celtites*.

Lastly, it must be remarked, that *Xenodiscus* and *Xenaspis* show even in permian times a thoroughly ceratitic development of their sutural lines, whilst *Gyronites* begins only in the trias to develop a ceratitic suture.

In his "Arctic Triassic Fauna" Mojsisovics states that the sole difference between *Xenodiscus* (*Xenaspis* properly speaking) and *Meekoceras* consists in the circumstance that the former possesses a larger umbilicus than the latter. This is correct so far as *Gyronites* is concerned, but *Xenaspis*, in probably being the ancestor of *Gymnites*, has quite different affinities, and cannot be compared to *Meekoceras*.

It appeared the more perplexing, when it was found, that there existed such

a close affinity between *Gyronites* and *Lecanites*. This latter genus had been considered by Mojsisovics as the starting point of the *Lytoceratidæ*; but instead of finding this genus developing itself in the direction of *Lytoceras*, we observe that it is contented to acquire a ceratitic suture of the same type as it possessed formerly with a goniatitic development and thus to produce the genus, and that its pedigree disappears after this, and cannot be followed further on. I do not wish to insist by this, that it is absolutely impossible that there may exist some connection between *Lytoceras* and *Lecanites*, but the probability of such a supposition is not very great and proofs are absolutely wanting.

We thus see that we had to deal formerly with two genera, which, on account of their decided relationship, must be placed in the family *Meekoceratidæ*; these are *Meekoceras*, Hyatt, and *Lecanites*, Mojs. To these must now be added the genus *Gyronites*, as has been shown above. The number of forms belonging to this family and occurring in the Salt-Range is, however, far too large and varied to be conveniently divided into three genera, and it is necessary to establish a number of further generic groups. The characters which are common to all these forms are ceratitic or goniatitic sutures which, so far as I can ascertain, never attain an ammonitic development; compressed whorls, which condition a disciform shape of the shell, and lastly a body-chamber, which seldom exceeds more than half a whorl in length. The sculpture, if there is any, consists invariably only of single radial ribs, which never become bifid but are sometimes slightly falciform. The external side never bears a sharp keel in the middle, but it is sometimes very narrowly rounded. Generally it appears to be either gently rounded or provided with two edges, thus assuming a biangular outline. The sculpture hardly ever crosses the external part of the shell. The apertural margin is mostly simple, with almost straight lateral parts and a not very prominent ventral lobe. In exceptional cases the lateral parts are cut out deeply with a somewhat biangular outline much in the manner of *Ptychites ensomus* or *Ptych. acutus* as figured by Mojsisovics.

If we cast a superficial glance at the numerous forms belonging to the family and occurring in the triassic deposits of the Salt-Range, we may observe two leading characters, which divide them. These are, first, the comparative largeness of the umbilicus, and second, the different development of the sutural lines. The characters will furnish a fair basis for the grouping of the forms. The sculpture of the shell, on the contrary, is of very inferior value for the comparison, and can only be used for specific distinctions moreover, as most of these forms are perfectly smooth, and the existence of a sculpture must be considered an exception.

Commencing with those forms, which possess a rather narrow umbilicus, we find that first of all two groups can be distinguished among them, according to the development of their sutural line; one group which possesses goniatitic lobes and a second group in which a ceratitic development of the sutures prevails. In the first group there are to be distinguished two genera, for which I introduce the names *Kymatites*, W., and *Parakymatites*, W., respectively. Each can be distin-

guished from the other by the different development of the external lobe and by the auxiliary series which is very different in the two genera. These genera are closely related to *Lecanites*, Mojs., but differ from it by a perfectly deviating development of the external lobe and the small umbilicus.

The two genera proposed are nearer related to each other than to any of the remaining forms of the family, and thus can be considered conveniently as forming a sub-family for themselves for which I shall introduce the name of *Kymatitinæ*.

The second group, which possesses ceratitic sutures, can also be divided into several genera, according to the different development of the auxiliary series in the various forms. For the first genus I shall introduce the name *Aspidites*, W. Its auxiliary series in the sutural line is composed of many coarse and unequally sized denticulations, which are arranged in a completely irregular manner, but never form regular auxiliary lobes. This genus contains not less than seven species which are all restricted to the middle and upper region of the Ceratite Sandstone. For the second genus I introduce the name of *Kingites*, W. There are only a few (not more than three) forms which belong to this generic group. It is characterised by an auxiliary series in the sutural line which is composed of a varying number of unequally-sized denticulations, which are all on the same level. Generally they are grouped in such a manner as to form one or two indistinct auxiliary lobes. This mode of development of the auxiliary series has been excellently described already by Mojsisovics in his *Meekoceras Keyserlingi*, and in fact this species appears to be very nearly related to the Salt-Range forms, and most probably forms also part of the genus *Kingites*. In the Salt-range the genus occurs in the Ceratite Marls and the lower region of the Ceratite Sandstone.

These two genera, viz., *Aspidites* and *Kingites*, are so closely related that I was much in doubt whether I should not consider them simply stages of development of one and the same group of forms. Even now I am not quite certain, whether this is not really the case, but in these smooth shells, where the sutural lines are the sole means by which to compare the different forms, I have absolutely failed to find out any trustworthy proofs for such a conclusion. Thus, after much deliberation I have decided to describe the different forms as several genera, not heeding the possibility of some species of the one genus being the direct ancestors of other forms included in the next genus. These genera are thus most probably polyphyletic, but we possess no means of following the different generic series in detail. This again affords one of the most striking cases which proves how the vigorous demand for monophyletic divisions in the palæontological system is purely utopian.

These two genera, which are so closely related to each other as has been demonstrated, form together another sub-family for which I introduce the name of *Aspiditinæ*.

Besides the discoid forms which possess narrow umbilici, and the sub-divisions which have just been enumerated, there can be made out another group of forms, in which the umbilici are of varying sizes, sometimes larger, sometimes

wider, whilst the sutural lines are very characteristic. The genus *Meekoceras*, Hyatt, furnishes the type of this group. The auxiliary series in the sutural line of these forms is much more simple than we have found it to be in the *Aspiditinae*. Either it forms a simple arch, thus simulating a large and very broad auxiliary lobe, as is the case in *Meekoceras*, Hyatt, or else there is one, or sometimes two distinct auxiliary lobes developed, and these forms I distinguish as the new genus *Koninckites*.

The genus *Meekoceras* commences in the lower Ceratite Limestone, but is very rare there, and extends up to the Upper Ceratite Limestone, where it is again rare, but furnishes very large species. Its chief development is in the Ceratite Marls and the Ceratite Sandstone. For the genus *Koninckites* one might suspect, on account of its distinctly developed auxiliary lobes, a more recent geological position than for *Meekoceras*, but just the contrary is the case. It is represented already by three species in the Lower Ceratite Limestone and has its last representative, a single species, in the upper region of the Ceratite Sandstone.

These two genera form together again a well defined and easily recognisable Sub-family, for which I introduce the name of *Meekoceratinae*.

Lastly, there remain the forms with large umbilicus to be considered in detail. The first genus which falls within this sub-division is the genus *Lecanites*, Mojsisovics, the position of which in the family *Meekoceratidae* has been treated of already in the foregoing pages. It possesses thoroughly goniatitic sutural lines and its chief representative in the Salt-Range is *Goniatites Gangeticus*, Koninck. The genus commences in the Lower Ceratite Limestone and extends from there through all the triassic strata up to the Bivalve Limestones, and furnishes there two of the few representatives of the *Ammonoidae*. This genus is most intimately connected with my genus *Gyronites*, of which I have treated also above. The latter extends also through all the beds of the Trias of the Salt-Range.

To these two genera a third must be added, for which I introduce the name of *Prionolobus*, W. It is distinct from the other two by a sutural line in which the auxiliary series is composed of a number of fine denticulations which are all on the same level and form together a straight line.

The last-mentioned three genera, viz., *Lecanites*, *Gyronites* and *Prionolobus* form together again a sub-family for which I introduce the name of *Gyronitinae*, because the name of *Lecanitinae* or *Lecanitidae* has been used already several times in a different sense, and thus might cause confusion.

In conclusion, we arrive at the following classification of the forms belonging to the family *Meekoceratidae* :—

- a. Sub-family : KYMATITINÆ.
 - 1. Genus *Kymatites*, W.
 - 2. „ *Parakymatites*, W.
- b. Sub-family : ASPIDITINÆ.
 - 3. Genus *Aspidites*, W.
 - 4. „ *Kingites*, W.

c. Sub-family : MEEKOCERATINÆ.

5. Genus *Meekoceras*, Hyatt.6. „ *Koninckites*, W.

d. Sub-family : GYRONITINÆ.

7. Genus *Lecanites*, Mojsisovics.8. „ *Gyronites*, W.9. „ *Prionolobus*, W.

Before proceeding to describe the single forms, it appears necessary to say a few words about the genus *Ophiceras*, which has been proposed by Griesbach to embrace certain forms, which occur in the Buntsandstein of the Himálayas. At first glance one might be inclined to consider Griesbach's genus as something very similar to *Gyronites*, but on closer examination one soon finds that Griesbach has united two different things in his genus. The typical species, *Ophiceras tibeticum*, Griesb., is decidedly very different from the two other species, *Oph. Himálayanum*, Griesb., and *Oph. medium*, Griesb. The first of these three forms, which has been designated by Griesbach himself as the typical species of his genus, is a very strange one. In its general configuration it is not dissimilar to *Xenaspis*, W., as described above. Its inner volutions are perfectly smooth, until the shell has attained considerable dimensions, then large, knob-like folds, few in number, are developed and at last these are replaced by numerous somewhat falciform plications. Though this system of sculpture is similar to that of *Xenaspis*, yet the cross-section of the whorls is different: it is not rectangular but lanceolate. The sutural line is very strange. It possesses a rather distinct adventitious lobe, which is absent in all similar genera, except perhaps *Hedenstræmia*, W., but there the adventitious lobe is yet more distinctly developed. The name *Ophiceras* must be applied to this form, and thus the position of the genus depends on the affinities of this species. On the whole the most close relation seems to exist to the *Gymnitinæ*, and I would not hesitate to proclaim the genus *Ophiceras* as the descendant of *Xenaspis*, did not the characters of the sutural line cause me again to doubt. Thus I abstain from deciding the question definitively, and remark only thus much, that the genus *Ophiceras*, as I have defined it, is decidedly different from all the genera contained in the *Meekoceratidæ*, and must most probably be removed from that family, and may better be placed in that of the *Ptychitidæ*.

The case is different with the other two species of the genus: viz., *Oph. Himálayanum* and *Oph. medium*. These belong most probably to one and the same genus, and resemble my *Gyronites* closely, but differ in every respect from *Ophiceras (tibeticum)* as has been shown by the above description. The system of sculpture is quite different, and in the sutural line every trace of an adventitious lobe is absent. In all these respects the two species are in accordance with *Gyronites*, with the sole exception of the external lobe, which has been drawn tri-cuspidate by Griesbach, a peculiarity which never occurs in *Gyronites*. It seems, however, probable to me that the drawing is erroneous or at least exaggerated in this respect,

and that the two species belong in reality to my genus *Gyronites*. However this may be, the two forms cannot belong to the genus *Ophiceras*, but must be placed in some other genus.¹

With this I can leave the general description of the family *Meekoceratidæ*. In the general system there would follow after this the family *Hungaritidæ* with the genera *Otoceras*, Griesbach, and *Hungarites*, Mojsisovics, but these are not represented in the Salt-Range, and thus I have no occasion to enter more especially upon the discussion of this latter family.

Sub-family : *KYMATITINÆ*.

Genus KYMATITES, Waagen n. gen.

The species belonging to this genus are but few, and their range of variation is very limited.

The surface of the shell is always perfectly smooth, without any trace of a sculpture. The umbilicus is rather narrow, the whorls compressed with a rounded external side, or with two indistinct angles, so that the median part of the external side appears slightly flattened. The length of the body-chamber and the margin of the aperture is not known to me.

The most striking characters of the genus are expressed in the sutural line. It is either perfectly goniatitic or only the first lateral lobe shows some barely perceptible and very irregular denticulations, whilst the other lobes remain always entire. The most important parts of the sutural line are the external lobe and the auxiliary series. The former is very broad and possesses a deep siphonal tubercle in the middle, which is bounded on both sides by the lateral branches of the lobe which are not very deep and are perfectly rounded, having somewhat the appearance of an adventitious lobe. The auxiliary series consists only of a slight bend, which reaches down to the umbilical suture.

There are only two species of this genus known to me, which most probably are in a developmental relation to each other. The geologically more ancient form has been found by Dr. Verchère in the triassic beds of Sheikh-Budin. Judging from the rock in which this specimen is contained, it must have been collected in the Lower Ceratite Limestone, and I introduce for it the name of *Kymat. typus*, W. The second species has been found by myself in the Chitta-Wan in beds which correspond about to the lower region of the Ceratite Sandstone. I give to it the name of *Kymat. posterus*, W., and it must most probably be considered as the descendant of the first species. With regard to the affinities of the genus, there is only the genus *Lecanites*, Mojs., which can be compared to the present forms. They differ from *Lecanites*, however, in the quite different development of the external lobe,

¹ At the time when this was written, Dr. Waagen could have examined the type specimens of *Ophiceras* if he had wished to do so, as the entire Himalayan collection was, and is still, in Vienna, where it will be described, — Dir., Geol. Surv., Ind.

and in the narrow umbilicus, the former possessing broad lateral branches, resembling adventitious lobes in the genus under description, whilst the same lobe is narrow, with small pointed lateral branches, in *Lecanites*.

A genus which might also be compared is *Ambites*, W., as described in the preceding pages. But here the distinction is easy; as in the genus just mentioned the external lobe is tripartite, whilst in *Kymatites* it is interrupted in the middle.

So far as is known up to the present, the genus *Kymatites* is entirely restricted to the Salt-Range.

1. KYMATITES TYPUS, Waagen n. gen. et. sp. Pl. XXVII. fig. 1 a. b. c.

The general shape of the shell is flatly discoidal with compressed whorls and a somewhat flattened external side. The umbilicus is narrow and not very deep. The involution of the shell is considerable and the overlap of the last whorl over the preceding one amounts to a little less than two-fifths of the entire height of the former. The transverse section of the whorls is an elongated oval, very much higher than it is broad. The lateral parts of the shell are flatly vaulted, and the greatest transverse diameter is situated just at the upper limit of the lower third of the entire height of the whorl. From there the lateral parts slope with a flat but well-rounded curve very equally towards the umbilical suture, and reach it without forming a trace of an umbilical wall or an umbilical edge. In the direction of the external part of the shell the bend of the lateral parts is much less considerable. The slope is distinct but the curve very small, so that the surface appears almost flat. The external part of the shell is distinctly flattened and joins the lateral parts in forming rounded-off external edges. The shell is perfectly smooth without a trace of any sculpture. Neither the margin of the aperture nor any part of the body-chamber is preserved in the specimen under description.

The sutural line is extremely simple, perfectly goniatitic. The external lobe is extremely broad, rather deeply cut out in the middle by a large siphonal tubercle. The lateral branches are well rounded at their base; the side adjoining the siphon is decidedly sloping, the other one ascending almost vertically. The external saddle is narrow, reaches high up, is well rounded at its top, with nearly parallel sides. The first lateral lobe extends much further down than the external one. It is broad, well rounded at its base and possesses almost parallel sides. The first lateral saddle is about as broad as the preceding lobe. It reaches as high up as the external saddle and its sides are slightly convergent towards its top, which is broadly and equally rounded. The second lateral lobe, which is distinctly above the line of involution, is much shorter and narrower than the first one. Its base is narrowly rounded, and its sides convergent. After this there follows the auxiliary series, consisting of a very broad, low, flattened saddle followed by a broad lobe, which reaches as low down as the second lateral lobe and extends to the umbilical suture.

The measurements of the specimen under description are as follow :—

Diameter of the shell	54 mm.
„ of the umbilicus	8 „
Height of the last volution from the umbilical suture	29 „
„ „ „ „ from the preceding whorl	19 „
Thickness of the last volution	13 „

Locality and Geological Position.—The only specimen of this species existing in the Salt-Range collection comes from the triassic strata of Sheikh-Budin, and judging from the rock in which it is contained, it has been collected in the Lower Ceratite Limestone. The specimen was brought to Calcutta by Mr. Wynne, but I do not know whether he found it himself or whether it has formed part of Dr. Verchère's collection.

Remarks.—In its general outline the present species can be compared with quite a number of other shells, but as soon as one takes the sutural line into consideration the present species appears as a perfectly isolated form, which shows only some similarity with the next following species.

2. KYMATITES POSTERUS, Waagen n. gen. et. sp. Pl. XXVI, fig. 3 a, b, c.

The general shape of the shell is very much like that of the preceding species. The shell is more or less lenticular in its general outline with compressed whorls and a moderately narrow umbilicus. The involution is not very considerable, and the indentation of the penultimate whorl into the last one is only a little less than one-third of the entire height of the latter.

The cross section of the whorls is a compressed oval, very much higher than it is broad. The lateral parts of the shell are only flatly vaulted, the greatest transverse diameter being situated slightly above the lower third of the entire height of the whorls. From there the lateral parts taper in about an equal degree towards the umbilicus as well as towards the external part. In the former direction they bend very gently down to the umbilical suture without forming a distinct umbilical wall nor an umbilical edge. The external part of the shell appears scarcely perceptibly flattened, and it is joined by the lateral parts in forming extremely indistinct external edges.

The shell is perfectly smooth without a trace of any sculpture, neither on the shell itself nor on the internal cast. The specimen under description is composed entirely of air-chambers.

The sutural line is very characteristic, though not so perfectly goniatitic as in the preceding species. The external lobe is broad, but very short. The median denticulation or siphonal tubercle reaches very high up, even slightly higher than the external saddle. It is at the same time very broad, and thus the lateral branches of the external lobe are far removed from each other and look like small adventitious lobes. They are short, narrow and perfectly rounded at their base. The side adjoining the siphonal tubercle is sloping, the other one vertical. The external saddle is broad, somewhat obliquely rounded on its top and possesses

unequal sides. The one adjoining the external lobe is short, the other one very long and sloping. The first lateral lobe is narrow and very deep. Its sides are somewhat convergent towards the base, on which two or three very small and irregular denticulations can be made out. The first lateral saddle is much broader than the preceding lobe and does not reach as high up as the external saddle. It is flatly and obliquely rounded on its top, ascending slightly in the direction of the umbilicus. Its sides are oblique. The second lateral lobe is very short, but as broad as the first lateral. It is perfectly rounded at the base. The auxiliary series, which now follows, is composed of a very low and broad saddle, which might perhaps be taken as second lateral saddle, and which passes without demarcation into a low and broad lobe, which reaches down to the umbilical suture.

The measurements of the specimen which serves for description are as follow :—

Diameter of the shell	50 mm.
„ of the umbilicus	9 „
Height of the last volution from the umbilical suture	26 „
„ „ „ „ from the preceding whorl.	18 „
Thickness of the last volution	11 „

Locality and Geological Position.—The only specimen of this species was found by myself in the Chitta-Wan, in beds corresponding in age to the lower region of the Ceratite Sandstone.

Remarks.—This species is very closely related to the preceding one. In the general shape there are, it is true, but very little differences, and there can be adduced as such only the facts that the external part of the shell is less distinctly flattened, the external edges much more indistinct and the umbilicus slightly larger in the species under consideration. The chief points of difference, however, must be looked for in the sutural line. It is scarcely necessary again to describe these differences, which are obvious, when comparing the drawings of the sutural lines of the two species. A very remarkable and rare fact is, that the first lateral lobe bears some denticulations at its base in this species, whilst the other lobes are devoid of such. This is a fact which cannot be observed very often.

It seems probable to me, that the two species of this genus stand in a developmental relation to each other, but then a link in the Ceratite Marls is missing.

Genus: PARAKYMATITES, Waagen n. gen.

It is a single species only on which I found this new generic designation. In its general configuration it appears most closely related to *Kymatites*, but the sutural line shows so many points of difference, that though a position of this form in the sub-family *Kymatitinae* is beyond every doubt, yet it cannot be advocated to unite it with the genus *Kymatites*, but an absolutely new generic designation must be introduced for it.

The general shape of the specimen is discoidal with a narrow umbilicus. The shell is smooth, without any trace of a sculpture. In the sutural line the external

lobe and the auxiliary series are the most characteristic parts. The former is very broad, divided in the middle by a not very large siphonal tubercle. The lateral branches of this lobe are broad and biangular at the base, the two angles being united by a concave line. The auxiliary series consists of three auxiliary lobes separated from each other by distinct rounded auxiliary saddles. These characters of the sutural line are so peculiar and contrast so strongly with those of the sutural line of *Kymatites* that a generic distinction appears to be absolutely necessary.

The only species which belongs to this genus has been found in the Stachella-beds, the middle region of the Ceratite Sandstone.

It is in every respect an entirely isolated form.

1. *PARAKYMATITES DISCOIDES*, Waagen n. gen. et. sp. Pl. XXXVI., fig. 3. a. b. c.

The specimen under description is contained in a hard brown grit, in which the preservation is not very good, as the sand grains adhere firmly to the fossil, and its surface thus appears coarse and uneven. Nevertheless the essential characters of the species can be made out quite satisfactorily. The specimen consists of an internal cast, entirely composed of air-chambers, on which here and there traces of the shell still remain.

The general shape of the specimen is discoidal with compressed whorls and a very narrow umbilicus. The involution is inconsiderable and the overlap of the last whorl over the preceding one amounts to a little more than one-third of the entire height of the former. The transverse section of the whorls is sagittate, very much higher than it is broad. The sides are distinctly flattened and slope considerably towards the external part of the shell. The largest transverse diameter of the whorls is situated within the lower fourth of their entire height. From this highest point of elevation the sides extend almost parallel, and slope very little towards the direction of the umbilicus, then they rather suddenly bend down to the latter, thus forming a rather distinctly sloping and slightly tumid umbilical wall, which is, however, not bounded by a distinct umbilical edge. In the direction of the external part of the shell the sides are almost flat, barely arched at all, and thus this part of the shell forms a sloping plane. The external part of the whorls is distinctly flattened and joins the sides in forming sharp external margins.

The surface of the shell is perfectly smooth, without a trace of any sculpture.

The sutural line is very peculiar, and of very great importance in this genus. The external lobe is extremely broad but not very deep. Only the median siphonal tubercle is situated on the external part of the shell, whilst the lateral branches are altogether shifted to the sides of the volution. These lateral branches are very broad, and are cut off obliquely, with an angular prominence on each side. The internal angle, situated nearest to the siphuncle, is placed on the external margin of the whorl. The second angle, adjoining the external saddle, is situated entirely on the side of the specimen, and forms the deepest point of the external lobes. The two angles are connected by a slightly concave line. The external

saddle is neither very high nor broad. It is strongly contracted at its base, and somewhat obliquely rounded on its top. The first lateral lobe is somewhat longer than the external one. It is tolerably broad and its sides are slightly convergent towards the base. The latter is well rounded without any trace of denticulations. The first lateral saddle is very broad and reaches somewhat higher up than the external one. Its sides are distinctly sloping; its top somewhat obliquely and flatly rounded. The second lateral lobe is much shorter than the first. Its sides are strongly convergent towards the base, which is narrowly rounded, without any trace of denticulations. The second lateral saddle is broad and shallow with strongly sloping sides. It is much shorter than the first one, and broadly and equally rounded on its top.

The auxiliary series which now follows consists of three little auxiliary lobes, which become gradually smaller. They all have sides which strongly converge towards the base, which is narrowly rounded, without denticulations. Between them are small auxiliary saddles, which are of much the same shape as the lobes, but are reversed. After the last auxiliary lobe a straight line runs down to the umbilical suture.

The dimensions of the specimen are as follow :—

Diameter of the shell	47	mm.
„ of the umbilicus	4	„
Height of the last volution from the umbilical suture	26	„
„ „ from the preceding whorl	17	„
Thickness of the last volution	11	„

Locality and Geological Position.—The only specimen of this species was found by myself in the Stachella-beds, of the middle division of the Ceratite Sandstone at Chidroo.

Remarks.—This form stands quite isolated among all the Ammonoids which have been found up to the present in the Salt-Range. According to the perfectly goniatitic development of its sutures it must before all be compared to *Kymatites*, but the differences which exist here with regard to the external lobe and the auxiliary series have been pointed out already in the discussion of the genus. With regard to the general shape of the specimen the genus *Clypites* as described above might be compared, but here also the sutural line is quite different, so that a detailed comparison becomes impossible. Among the more ancient forms of *Goniatites* the genus *Beloceras*, Hyatt, shows a certain similarity in its general appearance, but here also the numerous adventitious elements in the sutural line forbid a closer comparison.

Sub-family : *ASPIDITINÆ*.

Genus : *ASPIDITES*, Waagen n. gen.

This is a genus which attains very considerable dimensions, and whose general appearance is most conspicuous.

I was a long time very much in doubt what to do with these forms, as they seemed

so intimately related to other genera, that a separation appeared very difficult, whilst on the other hand their striking appearance demanded a separate designation. After much deliberation I arrived at last at the fact, that certain characters in the sutural line are so peculiar to these forms, that I was able to distinguish them as a proper genus.

The general shape of these forms is discoidal, generally of considerable dimensions. The umbilicus is very variable in size, sometimes very narrow, in other cases of a moderate width, never, however, very large. The whorls are always compressed, mostly with a flattened external part which is hemmed in on both sides by sub-angular margins, but in some cases this part is also well and regularly rounded. The sculpture, if any, consists only of low radial folds, which show mostly a somewhat falciform bend. The body-chamber seems to have occupied about one half of a volution, and does not differ in its sculpture from the rest of the shell. Mostly, however, it deviates more or less from the regular spiral, sometimes even so much so, that they attain a somewhat scaphitic appearance. The margin of the aperture has not been preserved in any of the specimens of species belonging to this genus, but in some cases it may be observed, that the shell in approaching it is strongly contracted just above the umbilical wall, so that a deep spiral depression has been formed. In the sutural line again, great stress must be laid on the development of the external or siphonal lobe and of the auxiliary series. The sutural line never appears goniatitic in this genus, but is always most distinctly ceratitic. The external lobe is always very broad, divided by a large siphonal tubercle into two well-individualised lateral branches. These are always strongly denticulated, but the crenulations are never arranged in such a manner as to let any part of the lateral branch appear as an indistinct adventitious lobe, but each lateral branch forms a unit which cannot conveniently be subdivided.

The auxiliary series consists of a more or less considerable number of irregular crenulations, which are very different in size, and are sometimes arranged to form irregular and indistinct auxiliary lobes which are separated from each other by quite as irregular auxiliary saddles. On the whole three different types of development of the auxiliary series can be distinguished within this genus.

In the first type, for which I wish to introduce the name of the *Polymeri*, there follows after the second lateral saddle a very broad first auxiliary lobe which bears at least four strong denticulations, often even more, which are of unequal size and variously arranged. After this first broad auxiliary lobe there comes a varying number of larger and smaller denticulations, all separated from each other by indiscriminately larger and smaller saddles.

The second type, for which I use the name of *Dimeri*, has its first auxiliary lobe very regularly divided by a secondary saddle into two symmetrical branches, each of which bears two denticulations. The first auxiliary saddle is well developed, and after this there follow only a few more irregular denticulations down to the umbilical suture.

Finally there is a type, for which I introduce the name of the *Allomeri*, in

which no regular arrangement can be made out. The auxiliary lobes, if such can at all be distinguished, are small and irregular, the saddles all subdivided.

If we neglect the peculiarities of the single subdivisions for the present, we find that the genus is characterised by an auxiliary series in the sutural line, in which a great number of denticulations are united, which are all of very unequal size and very irregularly arranged. Mostly a first, very broad auxiliary lobe is formed, but further there cannot be made out any regularity in the arrangement. The genus is rather largely represented in the Salt Range, but strange to say, all of them are united in one and the same division of the Trias, and this is the Ceratite Sandstone, and even within this stage there are five out of seven species found together in the middle region, the *Stachella* beds, whilst probably only two occur in the upper region, the *Flemingites* beds.

As has been stated, altogether there can be distinguished seven species within this genus, which may be distributed among the different types in the following manner:—

I. POLYMERI.

1. *Aspidites superbus*, W., Flemingites beds (?).
2. „ *arenosus*, W., Stachella beds.
3. „ *magnumbilicatus*, W., Stachella beds.

II. DIMERI.

4. *Aspidites evolvens*, W., Flemingites beds.
5. „ *Kingianus*, W., Stachella beds.

III. ALLOMERI.

6. *Aspidites dentosus*, W., Stachella beds.
7. „ *discus*, W., „ „

The genus under description is very closely related to *Meekoceras*, Hyatt, but before entering into a closer comparison I must first state what I consider the typical form of that genus to be. Generally one considers as type of a genus that species which has been described as the first one under that generic name, and thus *Meekoceras applanatum* ought to be considered as the typical species in this case. I think, however, that an exception from the rule should be established here, inasmuch as the species first mentioned by Hyatt in the description of the genus should be taken to represent the type of the genus, as it appears from the text that most probably Hyatt himself has considered the most involute form as the typical one, and in this case *Meekoceras gracilitatis* would be this form. This agrees at the same time with the general view which has been established by Mojsisovics in the matter, as he also is of opinion, that forms with narrow umbilici and compressed whorls ought to be considered as constituting the genus *Meekoceras*.

The sutural line of *Meekoceras gracilitatis* has been well figured, and it appears from this, that in this form, as well as in *Meekoceras Mushbachanum*, the

auxiliary series consists only of a few denticulations, which form together a very indistinct auxiliary lobe, which is followed in some cases by the commencement of an umbilical saddle. If we now define the genus *Meekoceras* in such a manner, it is obvious that *Aspidites* as described here, is different from Hyatt's genus, as in the former the auxiliary series is of a perfectly different and much more complicated composition.

Another genus to which the genus *Aspidites* must be compared is the one that has been described on one of the foregoing pages under the name of *Clypites*, W. In this case it is chiefly the external lobe, on the structure of which a distinction must be founded. In *Aspidites*, as has just been stated, no part of the external lobe is so much separated from the rest or so differently developed, that it could be considered as a rudimentary adventitious lobe: in *Clypites*, on the contrary, such an adventitious lobe exists, though in a somewhat rudimentary state. In the general shape of the shell there is also a difference to be recorded, inasmuch as *Clypites* possesses either no umbilicus whatever, or only a very small one, whilst (in comparison with this) *Aspidites* shows a large umbilicus.

The distinction of all the genera of the *Meekoceratidæ* is a rather difficult one, and there always remain forms, the position of which remains somewhat doubtful, but it is not worse in these cases than it is in other groups of Molluscs. Those who had to describe *Gastropods* will have felt the difficulty in the distinction of the genera and families, but notwithstanding this difficulty, everybody considers these genera as sound; the same is the case with the *Meekoceratidæ* and the *Leiostraca* at large. Though the limits of the different genera and families may be somewhat difficult to trace, still the distinctions must be made, if we wish to arrive at a right understanding of the relations which may exist among these shells.

I Group: POLYMERI.

1. ASPIDITES SUPERBUS, Waagen n. gen. et. sp. Pl. XXIII, Pl. XXIV, fig. 1 a, b.

This is the most characteristic species of the genus which has been found up to the present.

Its general form is largely discoidal with compressed whorls and small umbilicus. The involution is considerable and the overlap of the last whorl over the preceding one occupies $\frac{2}{3}$ of the entire height of the former.

The transverse section of the whorls is lancet-shaped with a flattened external part; its height is very much larger than its breadth. The greatest transverse diameter of the whorls is situated towards the upper limit of the interior third of the entire height. The sides of the shell are but very little arched and from their highest point of elevation they slope but very little in the direction of the umbilicus, until at a short distance before reaching that part, they rather suddenly bend down to the umbilical suture, without, however, forming a distinct umbilical wall nor an umbilical margin. In the direction of the external part, the slope of the lateral parts is somewhat more considerable, but the curve is still flatter.

The external part of the shell is flatly rounded, and at its junction with the side forms subangular external edges.

The shell seems to have been perfectly smooth without any trace of a sculpture. The shell-surface is not known to me, as the specimen under description is an internal cast, all made up of air-chambers. The specimen, which has a diameter of about 240 mm. is a full-grown one, as the last sutural lines are much more closely arranged than the rest. The body-chamber has, however, been entirely broken away. The spiral remains regular up to the very end of the specimen.

The sutural line is most beautifully preserved. The external lobe is very broad, divided into two lateral branches by a broad but not very deep median siphonal tubercle. On the side adjoining this tubercle the lateral branches are provided with four very large denticulations, whilst on the side adjoining the external saddle some smaller denticulations are situated. The external saddle is narrow and reaches very high up. It is somewhat contracted at its base and thus appears phylloid, and is somewhat obliquely rounded at its top. The first lateral lobe is very broad and deep, reaching somewhat lower down than the external one. It is also narrower at its upper part than at its base. The latter bears some ten very strong crenulations which are arranged in a distinct arch. The first lateral saddle is very oblique with a sloping side adjoining the first lateral, and a vertical side adjoining the second lateral lobe. It reaches somewhat higher up than the external saddle and its top is narrowly rounded. The second lateral lobe is again broader at its base than at its beginning. It is but little narrower, although much shorter than the first lateral. At its base it bears some eight strong denticulations, which are arranged in a very strongly prominent arch. The second lateral saddle is more regularly developed than the two preceding ones. It is much narrower and shorter than the first lateral, possesses nearly parallel sides and has its top only slightly obliquely rounded. The auxiliary series at the same time is very complicated and very characteristic. It commences after the second lateral saddle with a very broad, but also very short auxiliary lobe, which bears first a group of four denticulations, which together form again a kind of sub-lobe. After this follow two very large denticulations like little lobes, and then the first auxiliary saddle. This latter is narrow, short and obliquely flattened on the top. The small narrow lobe which now follows bears two denticulations, then comes a conical saddle narrowly rounded on the top and then a pointed lobe. A broad flattened saddle which now follows, together with the next following bipartite lobe, and a part of an umbilical saddle which is still above the umbilical suture, hang down a little, so as to form together a large sutural lobe.

The measurements of the figured specimen are as follows:—

Diameter of the shell	. . . . .	235 mm.
„ of the umbilicus	. . . . .	9 „
Height of the last volution from the umbilical suture	. . . . .	140 „
„ „ „ „ from the preceding whorl	. . . . .	88 „
Thickness of the last volution	. . . . .	57 „

Locality and Geological Position.—The only specimen of this species which exists, had been found by Mr. Wynne, and its exact geological position is there-

fore not known to me. From its preservation it seems most probable, that it was originally contained in the upper division of the Ceratite sandstone in the same bed in which the large specimens of *Flemingites* occur. The label belonging to this specimen has been lost somehow, and thus also its locality is doubtful. The number which is marked on the specimen points, however, to Chidroo as the locality from which it has come.

Remarks.—The present species shows much similarity to the different forms of *Clypites* which have been described in this work. The chief differences between these forms, among which chiefly *Clypites typicus* and *Clyp. Kingianus* must be compared, consist in the different development of the external lobe. In these two species the lateral branches of that lobe are developed in the manner of adventitious lobes, which is not the case in *Asp. superbus*, and for this reason it seemed necessary not only to make a specific, but even a generic distinction between these forms. *Clypites evolvens* is a much smaller shell, which is full-grown at a diameter of about 80mm., whilst *Asp. superbus* attains a diameter at least three times as great.

Of other forms none could be compared in particular to the present species.

2. ASPIDITES ARENOSUS, Waagen n. gen. et. sp. Pl. XXVI, fig. 1 a, b, c.

It is a fragment of a moderate-sized specimen, consisting of an internal cast and composed of air-chambers.

Its general shape is discoidal with a moderately wide umbilicus. The involution of the shell is not very considerable, and the overlap of the last whorl over the preceding one amounts to just one-third of the entire height of the former.

The transverse section of the whorls is a narrow oval, much higher than it is broad. The sides of the shell are but very little inflated, the greatest transverse diameter of the whorls being situated just at the upper limit of the lower third of their entire height. From there the sides slope gently, without being much curved, in the direction of the umbilicus, until by a rather sudden bend, they are deflected to meet the umbilical suture. An indistinct umbilical wall is thus formed, but is not hemmed in by an umbilical margin. In the direction of the external side, the sides are more suddenly sloping and are at the same time distinctly curved. The external part is somewhat flattened and joins the sides in forming indistinct external edges.

There exists no sculpture whatever on this shell.

The sutural line is distinctly preserved. The external lobe is broad, divided into two branches by a not very deep siphonal tubercle. These branches are provided all round with little denticulations. The external saddle is narrow and somewhat phylloid, well and equally rounded on its top. The first lateral lobe is broad and somewhat longer than the external one. It bears some six small denticulations at its base, which are arranged in a flat arch. The first lateral saddle is extremely broad and reaches somewhat higher up than the external one. It is slightly obliquely rounded on its top. The second lateral lobe is much narrower and shorter

than the first lateral and bears some five or six little denticulations along its base which form together a strongly prominent arch. The second lateral saddle is again much shorter and narrower than the first one. It is regularly rounded on its top. The auxiliary series, which now follows, is composed first of a very broad and short auxiliary lobe, which bears four strong equal denticulations. Then comes an indistinct little saddle, then three small denticulations and lastly three saddles of about equal size, separated from each other by two strong denticulations.

The measurements of the specimen may have been as follow :—

Diameter of the shell	(P) 77 mm.
„ of the umbilicus	10 „
Height of the last volution from the umbilical suture	39 „
„ „ „ „ from the preceding whorl	26 „
Thickness of the last volution	15 „

Locality and Geological Position.—The fragmentary and only existing specimen of this species was found by myself at Chidroo in the Stachella-beds, the middle region of the Ceratite sandstone.

Remarks.—The present species does not seem to be very closely related either to the preceding species nor to the forms belonging to the genus *Clypites*. Its relations are with the species which will be described next, and I shall indicate the differences in discussing that form.

3. ASPIDITES MAGNUMBILICATUS, Waagen n. gen. et. sp. Pl. XXVI, fig. 5 a, b, c.

The specimen available for description is entirely composed of air-chambers, and its shell-substance is partially preserved. This latter shows a faint falciform sculpture, whilst the internal cast is entirely smooth.

Its general shape is discoidal, with a rather large umbilicus, which seems to have become still larger on the last volution which has been broken away in the specimen, as the traces of the umbilical suture can still be followed for a certain distance. The involution is comparatively very small, as the overlap of the last whorl over the penultimate one occupies only very little more than a quarter of the entire height of the last volution.

The transverse section of the whorls is a compressed oval, considerably higher than it is broad. The sides of the shell are well and regularly arched, and unite with the external part, which is also perfectly rounded, without any proper demarcation. The largest transverse diameter of the whorls is situated just at the upper limits of the lower third of the entire height of the whorl. From there the sides slope down in a gentle curve towards the umbilicus, which is surrounded by a very sharp umbilical margin. The umbilical wall which follows is overhanging, being bent strongly inwards. In the direction of the external side of the shell, the sides slope distinctly in a flat curve.

As has been stated above, the external side of the shell-substance on the lateral faces of the whorls shows a faint falciform sculpture. This consists of broad low falciform folds which are separated from each other by faint narrow furrows.

The folds commence at the umbilical edge and are broadest near the external part of the shell. On the whole they appear somewhat like bundles of stronger striae of growth. The external side is perfectly smooth even where the shell substance is preserved. The internal cast is always entirely smooth.

The sutural line is not very different from that of the preceding species, only in the auxiliary series more considerable differences may be observed. The external lobe is extremely broad, divided into two lateral branches by a not very deep siphonal tubercle. Each lateral branch bears at its base some five denticulations, of which the two adjoining the external saddle are the largest. The external saddle is neither very broad nor very deep. It is somewhat phylloid in its shape and slightly obliquely rounded on its top. The first lateral lobe is slightly longer than the external one but not very broad. It bears seven denticulations at its base, which form together a strongly prominent arch, and of which the middle one is strongest. The first lateral saddle is much broader, and reaches only a little higher up than the external one. It possesses parallel sides and is obliquely rounded on its top. The second lateral lobe is narrower and very much shorter than the first. It has nearly parallel sides and bears six little denticulations on its base, which form together a distinct slightly oblique arch. The second lateral saddle is very broad but very short, and is distinctly flattened on its top. The first auxiliary lobe is nearly as broad as the preceding saddle. It bears four denticulations of which the last one is very large. After this lobe there follows yet a small flattened auxiliary saddle, then a strong denticulation and then again a small saddle which reaches down to the umbilical suture.

The measurements of the figured specimen are as follow :—

Diameter of the shell	78 mm.
„ of the umbilicus	19 „
Height of the last volution from the umbilical edge	36.5 „
„ „ „ „ from the umbilical suture	35 „
„ „ „ „ from the preceding whorl	26 „
Thickness of the last volution	18 „

Locality and Geological Position.—The only specimen of this species has been found by myself in the Stachella-beds, the middle region of the Ceratite Sandstone, at Chidroo.

Remarks.—The species appears to be most closely related to *Asp. arenosus* described just before. From the commencement I wished very much to unite the two under one and the same name, because the number of species described in this work increases in so alarming a manner, but nevertheless I found it impossible to proceed with the combining of these two forms, because the differences are too considerable.

First the general form: The external side is perfectly rounded and the external edges are missing; the umbilicus is much wider, surrounded by an overhanging umbilical wall and a very sharp umbilical edge, all characters which are present in the species here considered, whilst just the contrary is the case in *Asp. arenosus*. In the sutural line the second lateral saddle is entirely different in

both species, and so is the auxiliary series, so that it appears impossible to consider these two forms as belonging to one and the same species. *Asp. magnumbilicatus* on account of its large umbilicus shows also much affinity to the genus *Koninkites*, W., which will be described in the Sub-family *Meekoceratinae*. The first auxiliary lobe is however too broad and too irregularly crenulated to allow of this species being placed in that genus, but it must be considered as a true *Aspidites*.

II. Group DIMERI.

4. *ASPIDITES EVOLVENS*, Waagen n. gen. et. sp. Pl. XXV, fig. 1 a, b.

It is again only a single fragmentary specimen on which this species has been founded, but this fragment is so characteristic that it most certainly indicates the existence of a distinct species.

The general shape of the shell is discoidal with a moderately wide umbilicus, as long as the shell is not yet full-grown, but becomes suddenly much larger as soon as the body-chamber commences. The involution is different if we consider either the inner whorls or the last one including the body-chamber. On the inner whorls the involution is very considerable and the overlap of the outer whorls over the inner ones consists of a little less than half of the entire height of the former, whilst the last whorl, not far from the mouth of the shell, overlaps not quite one-third of its own height.

The tranverse section of the whorls is on the inner volutions, before the body-chamber commences, elongate-oval, with a flattened external part, much higher than it is broad. The sides are flatly but distinctly arched, and the largest transverse diameter is situated at about the middle of the height of the whorl. From there the lateral parts taper but very little in the direction of the umbilicus, and though they are tumid, the bend is barely perceptible. The umbilicus is deep and comparatively narrow, surrounded by a high, vertical umbilical wall, which joins the sides in forming a sharp umbilical margin. In the direction of the external side, the sides of the shell taper somewhat more strongly, but form also only a very flat curve. The external part is very flatly arched and joins the lateral parts of the shell in forming sub-angular margins.

Where the body-chamber commences, near the aperture of the shell, the transverse section is somewhat different from the outline which has just been described. Here the lateral parts are more strongly arched, because beginning from their highest elevation they slope also here quickly in the direction of the umbilicus, where the shell is distinctly contracted. The umbilicus comparatively has become very wide, and the vertical wall, which surrounds it, lower. The umbilical margin remains sharp, and there is formed just above it a broad flat spiral impression, which, as it seems, disappears again at the margin of the aperture. I cannot be quite certain, but I have the impression that for a short distance this margin has been preserved. It consists of a narrow rim, behind which a flat furrow follows.

Its outline, however, cannot be followed, as the space, where it can be recognised is too small.

According to this observation the length of the body-chamber would take up scarcely half a volution, so that the evolution of the shell or the widening of the umbilicus would commence by half a whorl earlier than the body-chamber begins.

The shell shows no kind of sculpture whatever.

The sutural line is not known to me along its whole extent, as the external and the first lateral lobes are not preserved in the specimen which serves for description. The first lateral saddle is broadly and somewhat obliquely rounded. The second lateral lobe is not very long and its sides are very strongly convergent towards the bottom, which bears some four tolerably strong denticulations, which are all on about the same level. The second lateral saddle reaches somewhat higher up than the first one, is as broad as the latter and very obliquely rounded on its top. The first auxiliary lobe is a twin-lobe, consisting of two equal parts. The whole lobe is broad, with nearly parallel sides. Each of its sub-divisions, which are separated from each other by a narrow secondary saddle, which is very narrowly rounded at its top, bears two strong denticulations on its base. The first auxiliary saddle is somewhat narrower than the second lateral, but reaches at the same time somewhat higher up. It is broadly and equally rounded at its top. After this there follows a small lobe with two strong denticulations, and further on some more of them situated on the vertical umbilical wall, but rather indistinctly preserved on the specimen described.

The internal sutural line, which is indistinctly preserved on part of the specimen, apparently possessed a long narrow anti-siphonal lobe, which bears two denticulations at its base, as far as this can be made out. After this comes a narrow saddle and then a broad lobe, which possesses three strong and equal denticulations, which are all on the same level. Further down towards the umbilical suture, the sutural line becomes so indistinct that nothing definite can be made out.

The dimensions of this fragmentary specimen may have been as follows :—

Diameter of the shell	(?) 164 mm.
„ of the umbilicus from the aperture	34 „
„ „ „ from the preceding whorl	16 „
Height of the last volution from the umbilical suture	77 „
„ „ „ from the preceding whorl	50 „
„ of the penultimate volution from the umbilical suture	42 „
„ „ „ „ from the preceding whorl	23 „
Thickness of the last volution at the apertural margin	36 „
„ of the penultimate volution	20 „

Locality and Geological Position.—The specimen which serves for description, is the only one of this species known and was found by myself at Nanga in a light grey very micaceous sandstone, filled with fragments of shells. Among these fragments adhering to the specimen there is also one of *Flemingites flemingianus*, Kon., and from this it is evident that the specimen came from the upper region of the Ceratite Sandstone, the Flemingites beds.

Remarks.—The species here described seems to be closely related to *Aspidites superbus*, W., described above. The chief points of difference consist in the umbilicus, which becomes very wide towards the aperture, and in the sutural line, in which the first auxiliary lobe is very regularly doubly bipartite in the present species, whilst it is divided into many irregular denticulations in *Asp. superbus*.

There is no other form to which the present species might be compared in detail.

5. *ASPIDITES KINGIANUS*, Waagen n. gen. et. sp. Pl. XXXII, fig. 1.

Pl. XXXIII, fig. 1 a, b.

I introduce this name for a very large and conspicuous species. Its general shape is discoidal with a tolerably large umbilicus and flattened whorls which bear low, broad radial undulations. The involution is inconsiderable, and the overlap of the last whorl over the preceding one, amounts to just one-third of the entire height of the former.

The transverse section of the whorls is somewhat sagittate in its general outline, though the external part is somewhat flattened. The sides of the shell are tumid to a certain extent only, whilst they are flattened or even slightly compressed at other places. The largest transverse diameter of the whorls is situated within the lower third of their entire height. From the highest point of elevation the sides slope in a gentle curve towards the umbilicus. The latter is surrounded by a distinct sloping umbilical wall, which becomes higher and more distinct as the specimen grows larger. It unites with the sides of the shell in forming an indistinct umbilical margin on the last volution, whilst on the inner volutions such an edge is not formed. In the direction of the external side of the shell the lateral parts slope also for a distance in forming a slight curve, but after this follows a zone which is either quite flat or even very slightly impressed. At a short distance before reaching the external side they are again arched, and they unite with the flattened external part in forming barely perceptible external edges.

The surface of the specimen, which represents an internal cast entirely composed of air-chambers, is not quite smooth, but bears a certain number of very low, flat radial undulations which are most distinctly expressed on the most prominent parts of the lateral sides of the whorls. There may have been about 15 of them on one volution. The external part is always perfectly smooth.

The sutural line is in most parts of the specimen somewhat deteriorated by weathering, but at other places again it is excellently preserved. The external lobe is very broad, with a very deep median siphonal tubercle, so that the lobe is divided into two well-marked lateral branches. Each of the latter is provided with many strong denticulations, of which those on the siphonal side of the branch, four in number, are very long, whilst two more, situated on the lateral sides, are much smaller. The external saddle is narrow, reaching somewhat higher up than the siphonal tubercle in the external lobe. It is somewhat contracted at its base, and appears thus more or less phylloid, being well and equally rounded on its top. The first lateral lobe is not much longer than the external one, and

slightly broader at its base than at its commencement. It bears mostly six strong denticulations on the base, which form together a strongly prominent arch. The first lateral saddle reaches very much higher up than the external one,—it is the most prominent one of all the saddles. It is also somewhat phylloid and slightly obliquely rounded on the top. The second lateral lobe is as broad, but much shorter than the first. It is also broader at its base than at its commencement, and bears also some six denticulations on the former, which are arranged in a somewhat oblique arch. The second lateral saddle is phylloid in its shape, very broad and very short. It is broadly but equally rounded on its top. The first auxiliary lobe is very broad, divided by a narrow secondary saddle into two somewhat unequal branches. The first of these branches bears generally three, the second only two strong denticulations. The first auxiliary saddle is rather narrow and short, with sloping sides. After this there follow four strong denticulations, which are all on the same level.

The measurements of the figured specimen are as follows:—

Diameter of the shell	. . . . .	185 mm.
„ of the umbilicus	. . . . .	37 „
Height of the last volution from the umbilical suture	. . . . .	93 „
„ „ „ from the preceding whorl	. . . . .	62 „
Thickness of the last volution	. . . . .	52 „

Locality and Geological Position.—The figured specimen, the only one of this species existing in the Salt-Range collection, has been found by myself at Virgal in the middle region of the Ceratite Sandstone, the Stachella-beds.

Remarks.—The present species appears to be most closely related to the one described above under the name of *Aspidites evolvens*, W., and it might be even the case that the two may stand in a developmental connection together, as the present form is older, geologically speaking, than the other, but in these smooth shells, where striking characters are absolutely wanting, it is impossible to assert whether such a developmental connection has existed in reality.

The differences between this and *Asp. evolvens*, consist in the much larger size the present species has attained and in the umbilicus, which is from the commencement much larger in the present form and possesses a sloping umbilical wall, whilst it is very small in the young shell in *Asp. evolvens*, and is surrounded by a perfectly vertical umbilical wall. Also the auxiliary series of the sutural line is different in both shells, not to speak of the radial undulations which exist in *Asp. Kingianus*.

Another shell which shows a certain resemblance is *Asp. superbus*, W., but here the great difference in the width of the umbilicus makes a distinction very easy.

III. Group: ALLOMERI.

6. ASPIDITES DENTOSUS, Waagen n. gen. et, sp. Pl. XXXIII, fig. 2 a. b. c.

We possess only a fragment of this species, and for a time I was inclined to ignore this form altogether; but as its specific characters can be made out, I could not neglect to describe it.

The general form of the shell must have been discoidal, with a moderately wide umbilicus and compressed whorls. The involution is not very considerable and the overlap of the last whorl over the preceding one amounts to one-third of the entire height of the former.

The transverse section of the whorls is elongate-oval with a flattened external side. The lateral parts are about equally arched for their greatest extent. The greatest transverse diameter is situated at the upper limit of the lower third of the entire height of the whorl. From there the lateral parts slope distinctly, forming a gentle curve, in the direction of the umbilicus until they bend rather suddenly down to meet the umbilical suture in about a vertical direction. Though a kind of umbilical wall is thus formed, yet this passes without any proper demarcation into the sides of the whorls. In the direction of the siphonal side the lateral parts form a long sloping gentle curve, and eventually meeting the flattened external part of the shell form indistinct external margins.

As far as can be seen from the fragment, the lateral faces of the whorls were provided with low, straight radial undulations.

The sutural line is most excellently preserved on this fragment. The external lobe is comparatively not very broad, divided in the middle by a deep but rather narrow siphonal tubercle, whereby the lobe becomes divided into two distinct lateral branches. Each of these bears one strong denticulation on the declivity adjoining the siphon and three smaller ones at its base. The external saddle is narrow, extending much higher up than the siphonal tubercle in the external lobe. It possesses nearly parallel sides, and is equally rounded on its top. The first lateral lobe is much longer than the external one. It is somewhat broader at its commencement than at its base, where it bears five denticulations, of which the median one is the largest, and which are all nearly on the same level. The first lateral saddle is very broad and reaches hardly so high as the external one. It possesses sloping sides, and is obliquely rounded on its top. The second lateral lobe is much shorter than the first one, and at the same time also narrower. It has nearly parallel sides, and along its base bears four to five denticulations, which are on very different levels. The second lateral saddle is broad and short, and is flatly rounded on its top. The auxiliary series is composed of many very irregular denticulations, which are all on about the same level, and form together one shallow and extremely broad auxiliary lobe. The denticulations composing this auxiliary series are of very unequal size.

The fragment on which this species has been founded is too small to give the measurements with any accuracy, and the diameter of the shell and of the umbilicus can be indicated only approximately. Thus the measurements may have been:—

Diameter of the shell	(?) 105 mm.
" of the umbilicus	(?) 21 "
Height of the last volution from the umbilical suture	52 "
" " " " from the preceding whorl.	35 "
Thickness of the last volution	24 "

Locality and Geological Position.—I collected this fragment at Koofri in the section which I measured there. It was contained in the bed, which I marked No. 10, and which forms part of the middle region of the Ceratite Sandstone, and has furnished many of the characteristic fossils of the Stachella beds.

Remarks.—I have been somewhat doubtful whether I ought not to place this form into the genus *Meekoceras* instead of *Aspidites*, as its characters show many points of affinity with the former genus. Chiefly the auxiliary series, which forms all one auxiliary lobe, is to a certain extent like that occurring in *Meekoceras*, but there are some differences which caused me to take another view of the matter. The auxiliary series in *Meekoceras* is never so extended and never composed of such unequal denticulations as is the case in the present species, and so I have at last decided to place this form into the genus *Aspidites*.

On account of the very different development of the auxiliary series in the present species, it seems unnecessary to compare this form in detail with others of the same genus, as its specific difference is obvious.

7. *ASPIDITES DISCUS*, Waagen n. gen. et. sp. Pl. XXV, fig. 2 a. b. c.

The single specimen which serves for description represents the interior volutions of a large shell, of which the outer whorls have been destroyed. The latter have, however, left on the inner whorls the distinct traces of their internal sutural lines, so that it has been possible to trace them perfectly safely.

The general outline of the shell is discoidal, with a very small umbilicus and strongly compressed whorls. The involution is moderate and the overlap of the outer whorl over the preceding one amounts to rather more than one-third of the entire height of the former.

The transverse section of the whorls is sagittate, very much higher than it is broad. The lateral parts are flatly arched, and their greatest elevation is situated at the upper limit of the lower third of the entire height of the whorl. From there the lateral parts slope in a distinct curve in the direction of the umbilicus and bend then rather abruptly down to meet the umbilical suture, without, however, forming a distinct umbilical wall, nor an umbilical edge. In the direction of the siphonal side the lateral parts are so flatly arched that the curve is barely perceptible. The external side is distinctly flattened, and unites with the lateral parts to form a sub-angular external margin.

The shell is perfectly smooth, without any sculpture.

The sutural line was disclosed by grinding down the surface which was still covered with remains of the internal shell of the exterior volution. The external lobe is broad and very short. It is divided into small lateral branches by a shallow median siphonal tubercle. Each branch is provided at its base with three little denticulations. The external saddle is low and narrow, with sloping sides and is narrowly and obliquely rounded at its top. The first lateral lobe is somewhat longer than the external, its base is obliquely descending in the direction of the umbilicus, and provided with four or five small denticulations.

The first lateral saddle is very broad and reaches very much further up than the external one. Its external side is very long and strongly sloping, whilst its internal one is very short and vertical. The top is broadly but obliquely rounded. The second lateral lobe is about as broad but very much shorter than the first lateral. Its sides are approximately parallel, and its base is about on a level with the top of the external saddle. It is provided with four or five very unequal denticulations. The second lateral saddle is about as high as the first one, again with very unequal sides, the inner one being much shorter, and it is rather broadly rounded on its top. The auxiliary series is very complicated; it comprises at least three indistinct little lobes, separated by saddles, each of which bears a strong denticulation in the middle, to which there are some strong denticulations added above the umbilical suture.

The internal sutural line of the broken-off outer whorl which is still preserved on this specimen shows a very long and narrow anti-siphonal lobe, which terminates in two strong denticulations. The first internal lateral lobe is separated from it by a high and tolerably broad saddle which is well rounded on the top. The lobe itself bears three denticulations, of which one is very large, whilst the other two, situated on the side turned towards the anti-siphonal lobe, are smaller. The saddle which now follows is much narrower and shorter than the first one, but is also well rounded on the top. The second internal lateral lobe terminates in two long and unequal denticulations. After this there follow yet two pyramidal simple lobes, which become gradually smaller, then again one with three small denticulations, and at last the very small sutural lobe.

The entire internal sutural line possesses a somewhat goniatic appearance.

The measurements of the figured specimen are as follows:—

Diameter of the shell	60 mm.
„ of the umbilicus	„
Height of the last volution from the umbilical suture	34 „
„ „ from the preceding whorl	21 „
Thickness of the last volution	14 „

Locality and Geological Position.—The only specimen of this species was found by myself at Nanga, in the middle region of the Ceratite Sandstone, the Stachella beds.

Remarks.—The present species appears to be most nearly related to *Asp. superbus*, W., described already. The general shape of both shells is indeed very similar, and if the sutural line of the one had not been known, there is but little doubt that the two would have been united in one and the same species. If, however, one compares the two sutural lines, one soon will find that the auxiliary series in both species is absolutely different. Whilst there are three auxiliary lobes, which are very similar to each other in the present species, there is only one very broad auxiliary lobe and some denticulations in *Asp. superbus*, and according to all observations I have made with regard to these forms, bearing ceratitic sutural lines, it seems to me impossible to unite forms with such different characters in the sutural lines in one and the same species.

There is no other form to which the present species might be compared in greater detail.

Genus : KINGITES, Waagen n. gen.

1886 *Meekoceras* (Hyatt) Mojsisovics :—Arctische Triasfaunen, page 81—83 (non Hyatt).

This genus is on the whole very similar to *Meekoceras*, and it cannot be wondered at, that Mojsisovics, with the very limited materials which he possessed of these forms, has united them with Hyatt's genus. In describing such a large number of similar shells, as we possess from the Salt-Range, it is soon evident that generic distinctions must be made to rescue the whole from chaotic confusion.

The general outline of these shells is always discoidal with very small umbilici. The external part is nearly always rounded, and there is a single species known to me, in which it is flattened as in most species of the preceding genera. The shell is smooth without any sculpture; only, if the surface of the shell is well preserved, there appears a very fine somewhat falciform radial striation composed of very closely arranged striæ of growth, which are sometimes heaped together in bundles, which latter can also be recognised on the internal cast.

The length of the body-chamber appears to have been about one half of a volution or somewhat more, but there is no specimen known to me in which the apertural margin was perfectly preserved. In one of the specimens described by Mojsisovics the body-chamber becomes strongly inflated in the peripheral region, but generally, it appears, the body-chamber does not deviate much in its general appearance from the remainder of the shell.

The sutural line is most characteristic. It consists of a varying number of denticulations, which are generally of the same size, and only in large specimens very small denticulations are intercalated at certain places. All the larger denticulations are on much the same level, and would, properly speaking, form no auxiliary lobes, did not the arrangement of them point to auxiliary lobes. There is generally a conspicuous group of three or four denticulations which marks the first auxiliary lobe. The saddle which follows after them is generally made up of a smooth almost straight line, and only in very large specimens there appear also in this saddle some very small denticulations. After this again there follows a group of several larger denticulations which define the second auxiliary lobe, but this is already indistinct.

On the whole a tendency to reduce the number of denticulations in the auxiliary series may be observed in this genus, and I shall have to describe forms, in which the first auxiliary lobe consists of a single denticulation only, and in the most recent species, this denticulation has shifted already so far towards the umbilical suture, that it appears almost as a small sutural lobe, whilst all the space above has been occupied by the very broad second lateral saddle.

The genus is, so far as is known up to the present, of an entirely lower triassic origin, and we are acquainted with five species which belong to it. Two of these have been described by Mojsisovics under the generic designation of *Meekoceras*

from the lower triassic strata of the Olenek in Siberia: they are, *Kingites Keyserlingianus*, Mojs. sp., and *K. rotundatus*, Mojs. sp., whilst three others occur in the lower trias of the Salt-Range.

The Indian forms may be divided into two groups, according to the configuration of their external parts. The first group, which I call the "*Rotundati*," possess a perfectly rounded external side. To this group, to which the Siberian species also belong, two of the Indian species may be ascribed, which were both found in the Ceratite Marls, and which will bear the names of *Kingites lens*, W., and *K. declivis*, W., respectively. The other group, for which I introduce the name of "*Biangulares*," is intended to comprise those forms, in which the external part of the shell is distinctly flattened, and hemmed in on both sides by distinct external edges. Among the Indian species there is only one form which can be placed in this group, and this will bear the name of *K. minutus*, W.

Thus we arrive at the following arrangement of the species of *Kingites* which occur in the Salt-Range:—

I. Section : ROTUNDATI.

1. *Kingites lens*, Waagen n. gen. et. sp. (Ceratite Marls).
2. „ *declivis*, Waagen n. gen. et. sp. („)

II. Section : BIANGULARES.

3. *Kingites minutus*, Waagen n. gen. et. sp. (Ceratite Sandstone, lower region).

Though these forms occur also partly in succeeding strata, I am unable to make out any evolutionary connection between them.

From all that has been said with regard to this genus, it appears evident that it is very closely related to the genus *Meekoceras*, Hyatt. I have stated already in the discussion of the genus *Aspidites*, W., that I consider *M. gracilitatis* and *M. Mushbachanum* as the typical species of the genus *Meekoceras*, and also the considerations which have led me to do so, so I need not again enter into that question. The sutural line of the latter of these two species is more typical than that of *M. gracilitatis*, which, to judge from the drawing, is somewhat indistinct near the umbilical region. From the sutural lines, it appears that the auxiliary series in these forms constitutes only one very broad auxiliary lobe, which reaches down to within a short distance of the umbilical suture, and is composed of a larger number of denticulations, which are all of about the same size, and are mostly arranged in a broad arch, rarely standing all on the same level. The auxiliary saddles are almost entirely suppressed and this latter character constitutes the chief point of difference from the present genus, in which the saddles are better developed than the lobes. Though this difference seems to be of very minor importance at first sight, yet on examining the figures, one will soon find that it greatly influences the general appearance of the shells, and that the genus *Kingites* is thus not at all difficult to recognise.

In its general configuration the genus *Aspidites* is not dissimilar to the present genus, and demands therefore a more accurate comparison. In this case also it is the different development of the auxiliary series in the sutural line which makes a distinction easy. *Aspidites* possesses a very broad and strongly developed first auxiliary lobe, and after this follow many smaller denticulations and saddles, which are also more or less to be considered as distinct members of the series, whilst in the genus *Kingites* the first auxiliary lobe consists only of three or four denticulations, which are on the same level, and after this there follows a large saddle, sometimes with several insignificant denticulations.

The genus *Kingites* may be the descendant of *Kymatites*, as in the typical development of the sutural lines of both genera many points of similarity can be made out, but it is impossible to say with any certainty, whether in reality an evolutionary connection exists between these forms.

I. Section : ROTUNDATI.

1. KINGITES LENS, Waagen n. gen. et. sp. Pl. XXVI, fig. 4 a, b, c, d.

The species is founded on an excellently preserved specimen with part of the shell adherent.

The general shape is distinctly lenticular with a narrowly rounded external part and a very small umbilicus. The involution is considerable, and the overlap of the last whorl over the preceding one amounts to about three-fifths of the entire height of the former.

The transverse section of the whorls is elongate-oval, well rounded everywhere, and considerably higher than it is broad. The lateral parts are very equally and gently arched, the greatest transverse diameter being situated very little below the middle of the entire height of the whorl. The lateral parts slope very gently towards the umbilicus until they arrive in the immediate vicinity of the latter, when they bend rather suddenly inwards, thus forming a kind of rounded umbilical wall without a trace of any umbilical edge at its upper limit.

The umbilicus is deep, very narrow and funnel-shaped. Towards the apertural margin it seems to widen a little, but this is merely due to the circumstance that the shell is here somewhat broken and not quite complete.

In the direction of the siphonal side the slope of the lateral part is much more distinct, though the curve is here also very inconsiderable. The external part of the shell is perfectly, and rather narrowly rounded and passes gradually into the lateral parts.

The shell is perfectly smooth, but on its surface may be seen very fine, falciform striæ of growth.

The sutural line is well preserved. The external lobe is very broad and short, bearing in the middle a rather deep siphonal tubercle which divides the former into two distinct lateral branches, which are, however, not very strongly individualised. They bear one denticulation on the siphonal declivity, two below, and one at

the margin of the external saddle. This latter does not reach up very high, possesses parallel sides and is broadly and equally rounded above. The first lateral lobe is much longer than the external lobe, has parallel sides, and bears below denticulations of a first and second order. The first lateral saddle is broader and reaches higher up than the external one. It is broadly and symmetrically rounded above. The second lateral lobe extends about as low down as the external one. It is much narrower than the first lateral lobe and also possesses parallel sides. It bears four denticulations below, which are arranged in an oblique arch. The second lateral saddle is quite as broad as the first, but very much shorter. It is distinctly flattened above. The first auxiliary lobe is very broad and short, composed of three strong denticulations which are barely below the level of the top of the preceding saddle. After this there follows again a very broad and flat saddle, and then a single denticulation, which represents a second auxiliary lobe.

The measurements of the figured specimen are as follows :—

Diameter of the shell	. . . . .	57 mm.
„ of the umbilicus	. . . . .	4 „
Height of the last volution from the umbilical suture	. . . . .	37 „
„ „ „ from the preceding whorl	. . . . .	20 „
Thickness of the last volution	. . . . .	14 „

Locality and Geological Position.—The single specimen of this species was found by myself at Virgal, in the Ceratite Marls.

Remarks.—The present species is most closely related to *Kingites* (*Meekoceras*) *Keyserlingi*, Mojs. sp., from the banks of the Olenek river in Siberia. In this form, however, the umbilicus is still smaller and the external part of the shell is more narrowly rounded. This species possesses also a faint radial sculpture which is absent in the Indian form. The greatest difference exists, however, in the sutural line, which, though generically identical, is in other respects very different. This finds expression chiefly in the shape of the lateral lobes, which possess strongly convergent sides in the Siberian form, whilst they are parallel in the species under consideration. There is no other species with which the present one could be compared in greater detail.

2. KINGITES DECLIVIS, Waagen n. gen. et sp. Pl. XXVI, fig. 2 a, b, c, d.

Of this species we possess an excellently preserved internal cast, entirely composed of air-chambers.

The general shape is again lenticular, with a small umbilicus, compressed whorls and a rounded external part. The involution is inconsiderable: the overlap of the last whorl over the preceding one amounts to just one-third of the entire height of the form.

The transverse section of the whorls is elongate-oval, very much higher than broad. The lateral parts are flatly arched, the greatest transverse diameter being situated at the upper limit of the lower third of the entire height of the whorl. From there the lateral parts descend in a sloping curve towards the umbilicus until

they reach the umbilical suture, where they suddenly bend inwards to form an indistinct, rounded, narrow umbilical wall. In the direction of the external side the lateral parts appear flattened, barely curved at all, but distinctly sloping. The external part of the species is very narrowly rounded, and passes into the lateral parts quite gradually.

The internal cast under description is perfectly smooth, without a trace of sculpture.

The sutural lines are excellently preserved. The external lobe is very broad and short, divided in the middle by a deep siphonal tubercle, thus forming two distinct lateral branches, which are somewhat oblique and possess three small denticulations below, all on about the same level. The external saddle is very narrow, and reaches up much higher than the siphonal tubercle. Its sides contract very slightly towards its base, in consequence of which the saddle appears slightly phylloid. It is equally and narrowly rounded above. The first lateral lobe is narrow but very long. It extends much further down than the external one, possesses almost parallel sides, and shows only very indistinct denticulations, which form a strongly prominent arch. The first lateral saddle is broader than the external one and reaches also somewhat higher up. Its sides are parallel and it is evenly rounded above. The second lateral lobe is much shorter and at the same time much broader than the first lateral. Its sides are slightly sloping and, below, are five very distinct denticulations, which are all on about the same level. The second lateral saddle is very broad and short. It is obliquely flattened above; on the umbilical side it is followed by a small denticulation which represents an auxiliary lobe, after which comes an oblique and flat saddle which reaches down to the umbilical suture. The two last-mentioned saddles together with the small auxiliary lobe hang down distinctly, and form a kind of large sutural lobe which extends lower down than the first lateral lobe. The tops of all the saddles, beginning at the siphonal tubercle, describe together an arch, the culminating point of which is represented by the top of the first lateral saddle.

The measurements of the figured specimens are as follow :—

Diameter of the shell	32 mm.
„ of the umbilicus	3 „
Height of the last volution from the umbilical suture	18 „
„ „ „ „ from the preceding whorl	12.5 „
Thickness of the last volution	8 „

Locality and Geological Position.—Ceratite Marls.

Remarks.—This species should be compared with the previously described *Kingites lens*. Both possess similar outlines, with the single difference that the greatest transverse diameter of the shell is situated lower down, the lateral parts of the whorls are more flattened on their external half, and the external side of the shell is more narrowly rounded in *K. declivis*. The chief differences, however, are exhibited by the sutural lines. A character which is of very great importance consists in the circumstance that the first lateral lobe is barely at all denticulated in the latter

species, whilst the presence of a deep sutural lobe forms a character of great importance. Both these peculiarities are not developed in *K. lens*, and thus it appears most probable to me that they represent different species.

A thing which has very much puzzled me is the question whether *K. declivis* might not be, perhaps, the young of *K. lens*, as the difference in size of the two specimens is rather considerable. If, however, we take the height of the last volution of the first species and project it on the last volution of the second, we find that the distance of the sutural lines, as they have been drawn by me in the two species is not more than half a volution in reality, and it appears most improbable that the characters of the sutural line of *K. declivis* should have been so thoroughly transformed within the distance of half a volution, as to attain the characters of that of *K. lens*.

Thus it appears much more probable that the two forms belong to different species than that they represent stages of growth of one and the same species.

I look upon *K. declivis* therefore as a well characterised species.

II. Section : BIANGULARES.

3. *KINGITES MINUTUS*, Waagen n. gen. et. sp. Pl. XXXVI, fig. 6 a, b, fig. 7 a, b.

This species is lenticular in general shape, as are the two preceding forms, but the external part of the shell is distinctly flattened and bordered on both sides by sharp edges. The umbilicus is comparatively large for a species of this genus, and the involution is not considerable. The overlap of the last whorl over the preceding one occupies just one-third of the entire height of the former.

The transverse section of the whorls is more or less lanceolate, the point being cut off by the flattened external side. The lateral parts are distinctly flattened on their external half, whilst they are strongly arched in the umbilical region. The largest transverse diameter of the whorls is situated at the upper limit of the inner third of their entire height. Thence the lateral parts descend in a well-rounded curve to the umbilicus, without forming a distinct umbilical wall. Towards the siphonal side the lateral parts are flattened, as stated above, but nevertheless they show at the same time a very slight curve. The external part is quite flat, rather narrow and bounded by distinct external edges.

One of the specimens shows on the surface slight traces of somewhat falciform radial ribs, whilst the other specimen is quite smooth.

The sutural line is well shown on one of the specimens. The external lobe is very broad and short, divided into two lateral branches by a not very high, rounded siphonal tubercle. Each of the lateral branches is provided with three small denticulations below. The external saddle is broad and low. Its sides slope, and it is broadly and evenly rounded above. The first lateral lobe is not longer than the external one, much broader at its commencement than below, where some four small denticulations may be observed. The first lateral saddle is broader than the external one, but does not reach higher up. It is somewhat depressed

above and somewhat obliquely rounded. The second lateral lobe is shorter and narrower than the first, also provided with sides, which converge towards its base, where three small denticulations may be observed. The second lateral saddle is much shorter than the first, and is extremely broad, forming a flat arch. After this there follows a stronger denticulation, which represents an auxiliary lobe, already very near to the umbilical suture, and of the next following saddle there is only a slight indication visible above that suture. The sutural line does not hang down to form a sutural lobe as in the preceding species.

The measurements of the better preserved of the two specimens are as follows:—

Diameter of the shell	25 mm.
„ of the umbilicus	5 „
Height of the last volution from the umbilical suture	12 „
„ „ „ „ from the preceding whorl	8 „
Thickness of the last volution	7 „

Locality and Geological Position.—Only two specimens of this species have been found, of which the smaller fragmentary one represents part of the body chamber only, whilst the larger, almost entire specimen is entirely composed of septa. Both were found at Virgal in the lower division of the Ceratite Sandstone.

Remarks.—This species is very closely related to the preceding one, but may be distinguished from it by its flattened external sides and the much larger umbilicus; the sutural lines also are entirely different, as there is no sutural lobe developed in this species, whilst there is one in *K. declivis*.

Though *K. declivis* and *K. minutus* occur in succeeding geological positions, it is very doubtful whether the two stand in an evolutionary relation, as the general outlines of these forms deviate too much.

Sub-Family: *MEEKOCERATINÆ*.

Genus *MEEKOCERAS*, Hyatt.

1879. *Meekoceras*, Hyatt (pars) in C. A. White: Fossils of the Jura-Trias of South-Eastern Idaho, Bull U. S. Geol. Surv. of the Territories, Vol. V, p. 111.

1880. *Meekoceras*, Hyatt (pars) in White: Contributions to Palæontology No. 5, page 112.

1882. *Meekoceras*, Hyatt, Mojsisovics: Cephalopoden der Mediterranen Trias-Provinz, page 213 (pars: *M. caprilense* M.)

This genus is one of those which besides *Sibirites* and *Proptychites* contains the greatest number of species amongst all genera occurring in the Salt-Range, and yet I have removed from it a great many forms, which up to this would have been quite unhesitatingly united with it.

It is quite true that Hyatt's diagnosis is quite insufficient for the definition of the genus, yet if one adheres rigorously to the characters exhibited by the figures in White's "Contributions to Palæontology," it is always possible to find out what is meant by the name.

I have stated already in the discussion of the genus *Aspidites* that I consider

Meekoceras gracilitatis as the typical species of the genus. The text of Hyatt's diagnosis up to the paragraph where the above species is mentioned, runs as follows :—

“ These species, so far as they go, are unlike the *Ceratites* of any foreign locality, but have more resemblance to the Muschelkalk than to the St. Cassian or Hallstadt faunas. They possess in common one characteristic which separates every species from the typical forms of European *Ceratites*. There are but three lateral cells and two lateral lobes besides the finer auxiliary lobes and cells. This occurs in the most involute species “ C ” (*M. gracilitatis*) as well as in the least involute.”

This passage has induced me to consider this very species to be the typical one. If we try to find out the essential characters of this form, and construct from them the characters of the genus, we arrive at the following results. In the course of description of the Ceratite fauna of the Salt-Range I have repeatedly had occasion to demonstrate, that the most important characters for the distinction of genera and other large groups of these forms are to be found in the development of the auxiliary series, and thus it is, before all, to this part that our attention must be directed.

In *M. gracilitatis* the auxiliary series forms a single broad, low auxiliary lobe, which is very flat in this one species, but which is followed by a small auxiliary saddle, which appears only partly above the umbilical suture. The same characters, with specific differences only, we find repeated in *M. Mushbachanum*. Here the auxiliary lobe is again very broad, but much deeper and provided with more numerous and stronger denticulations. It also is followed by an auxiliary saddle which about reaches to the umbilical suture.

Another type is represented by the evolute *M. applanatum*. In this species, the auxiliary series seems to be altogether absent, and the second lateral saddle reaches down to the umbilical suture. Thus it is evident that the latter species cannot be left standing in the same genus with the two others.

This is perfectly in accordance with what has been stated first by Mojsisovics and which was afterwards generally accepted,—that *M. applanatum* represents a genus different from that to which *M. gracilitatis* and *M. Mushbachanum* belong. The name *Meekoceras* must, however, be retained for the two latter species because *M. gracilitatis* must be looked upon as the type of the genus. *M. applanatum* belongs most probably to my genus *Gyronites*, but this is a question which will be treated of in a subsequent part of the text.

We are now in a position to enumerate the peculiarities of the genus *Meekoceras* as follows: The shell is always flatly discoidal, sometimes with a small, sometimes with a somewhat larger, umbilicus. The external side is generally provided with two external edges, but it is often evenly rounded. The majority of species are smooth, but when a sculpture occurs it consists of single radial folds, which are never divided, but are sometimes straight, sometimes slightly falciform, and always restricted to the lateral parts of the shell. There is no species known to me in which tubercles of any kind are developed.

The most characteristic part of the shell is the sutural line. The external lobe

is always divided into two lateral branches by a more or less deep siphonal tubercle. A median prominence in this tubercle, such as has been drawn by Dr. White in the American species, is absent in the Salt-Range forms. There are always two lateral lobes well distinguishable. The auxiliary series invariably constitutes a single, very broad auxiliary lobe, which is either semi-circular below or flattened, forming an almost straight line. In some exceptional cases this lobe appears goniatic, without denticulations. Generally it is provided with numerous, more or less marked denticulations, which are either all of the same size or else somewhat unequal, but never so much so as to sub-divide this large auxiliary lobe into several secondary ones. After this broad auxiliary lobe there follows generally a small auxiliary saddle which is in some cases entirely above the umbilical suture, in others only partly so.

The length of the body-chamber of this genus seems to have occupied about one-half a volution or slightly more. I am not quite certain, however, with regard to this character, as none of the specimens at my disposal show apertural margins, and I must judge only from very closely related forms.

According to this diagnosis I must restrict the range of the genus *Meekoceras* very considerably, as compared with the views expressed by Dr. v. Mojsisovics. According to what has just been stated, of all the forms quoted by Mojsisovics only the single species *M. caprilense* can be left standing in that genus. All the rest of the species enumerated by him in his "Mediterranen Provinz" must be transferred to other genera. I have already stated in the description of the genus *Proptychites*, that *M. cadoricum* most probably belongs to that genus, whilst for the others I have created the new generic designation *Beyrichites*, W. These forms, according to my opinion, do not even belong to the *Meekoceratidæ*, but to the *Ptychitidæ*. More to the point, it appears to me, are the determinations by Mojsisovics of *Meekoceras* in his "Arctic Triassic Fauna," because these shells belong really to the family *Meekoceratidæ*, with the sole exception, perhaps, of *M. affine*, which might be also a *Proptychites*. Two of these I have been obliged to transfer to the genus *Kingites*, whilst the third, *M. sibiricum*, belongs to the genus *Koninckites*, which will be next described.

The number of species of *Meekoceras* which occur in the Salt-Range is very considerable, there being altogether no less than ten species present, which may be distributed among quite a number of groups and sub-divisions. As in the genus *Kingites*, so also here we can distinguish forms with a rounded external side and some, in which this part of the shell is biangular. The first section I comprise under the name "*Rotundati*," whilst the second may be comprised under the designation "*Biangulares*."

In the first of these sections a group of forms can be made out which bears a great resemblance to the American *Meekoceras Mushbachanum*, White, and will bear therefore the name of this species. There are two species which can be placed into this group. The first of these will receive the name of *Meekoceras falcatum*, W. It is distinct from the American shell chiefly by its larger umbilicus. The Salt-Range form occurs in the middle region of the Ceratite Sandstone, the

Stachella-beds. The second species which belongs to this group I shall call *Meekoceras fulguratum*. This species is founded only on a fragment of a large form, but it is all the more interesting, because it comes from the Upper Ceratite Limestone. There is some probability that it is the successor of *M. falcatum*, but it is impossible to assert this positively. The whole group is remarkable on account of the comparatively strongly developed sculpture, which is common to these forms.

For the second group I propose the name of *Meekoceras euomphalum*, Keyserling sp. This form was included by Mojsisovics in the genus *Meekoceras* in 1882, but was afterwards removed by the same author to the genus *Xenodiscus*. The former position was, however, the more correct, and it requires only an inspection of the auxiliary series of the sutural line, as represented in Mojsisovics' drawing, to be convinced of this fact. A species which is very closely related to this Siberian form occurs in the Salt-Range. It had been united by Koninck with his *Ceratites planulatus*, but it differs entirely from the typical form of this species. I propose to introduce for it the name of *M. Koninckianum*. It occurs in the Ceratite Marls.

The *Biangulares* are more numerous represented in the triassic beds of the Salt-Range than are the *Rotundati*.

Amongst them must be mentioned first the group of *Meekoceras varians*. It is composed of two members, *M. varians*, W., occurring in the Lower Productus Limestone, and *M. pulchrum*, W., of the Ceratite Marls. Probably they stand in some evolutionary relation to each other, but I cannot positively assert this. The group is characterised by its perfectly smooth shells and an auxiliary series of the sutural line, which possesses a broad auxiliary lobe, the denticulations of which are arranged in a straight line. It is on the whole somewhat transitional between the "*Rotundati*" and the *Biangulares*, as the external edges are absent in the young and are developed only in later stages of growth.

The next group is composed of three forms, two of which occur in the middle region of the Ceratite Sandstone and the last in the Upper Ceratite Limestone. The group takes its name from the species *Meekoceras magnumbilicatum*. This, as well as the next species, *M. rota*, occurs in the Stachella-beds, whilst the group is represented in the Upper Ceratite Limestone by *M. tardum*, W. The whole group is composed of forms in which the auxiliary series of the sutural line forms a broad auxiliary lobe, in which the denticulations are arranged in a strongly prominent arch. Only the shell of *M. rota* bears a radial sculpture whilst that of the other two species is smooth.

The next group comprises a single species only, which appears to be more or less closely related to *Meekoceras gracilitatis*, White, and I therefore choose the name of this American species as the heading of the group. The Indian species belonging to this group is *M. planulatum*, Kon. sp. Both forms possess a very flat and broad auxiliary lobe; the American form with a few indistinct denticulations, the Indian without any such. *M. planulatum* occurs in the Stachella-beds of the Salt-Range.

The last species is an isolated one, which I name *Meekoceras radiosum*, W., and occurs in the lower region of the Ceratite Sandstone. The auxiliary series of its sutural line forms to a certain extent a transitional link with the next following genus *Koninckites*, which will be treated of further on. The similarity consists in the circumstance that in the auxiliary series the denticulations are not all equidistant, but three of them are closer together, thus forming a kind of indistinct first auxiliary lobe, a character which is fully developed in the genus *Koninckites*.

We thus arrive at the following systematic arrangement of the species belonging to the genus *Meekoceras* occurring in the triassic beds of the Salt Range :—

I.—Section : ROTUNDATI.

a. Group of MEEKOCERAS MUSHBACHANUM, White.

1. *Meekoceras falcatum*, W., Stachella-beds.
2. „ *fulguratum*, W., Upper Ceratite Limestone.

b. Group of MEEKOCERAS EUOMPHALUM, Keys.

3. *Meekoceras Koninckianum*, W., Ceratite Marls.

II.—Section : BIANGULARES.

c. Group of MEEKOCERAS VARIANS, W.

4. *Meekoceras varians*, W., Lower Ceratite Limestone.
5. „ *pulchrum*, W., Ceratite Marls.

d. Group of MEEKOCERAS MAGNUMBILICATUM, W.

6. *Meekoceras magnumbilocatum*, W., Stachella-beds.
7. „ *rota*, W., Stachella-beds.
8. „ *tardum*, W., Upper Ceratite Limestone.

e. Group of MEEKOCERAS GRACILITATIS, White.

9. *Meekoceras planulatum*, Kon. sp., Stachella-beds.

f. Isolated species.

10. *Meekoceras radiosum*, W., Ceratite Sandstone (Lower region).

With regard to the geological distribution of the species belonging to this genus, we find that they range through the greater part of the divisions of the

Trias formation of the Salt-Range, but that their chief development takes place in the Ceratite Sandstone, which might be considered as equivalent to the upper division of the Bunter Sandstein of Europe, in which not less than five species have been found. It commences with a single species in the Lower Ceratite Limestones, is represented by two species in the Ceratite Marls, and after having attained its greatest development in the Ceratite Sandstone, it ascends into the Upper Ceratite Limestone, where two gigantic species have been found. These latter subdivisions may correspond to the Muschelkalk of Europe.

The genus *Meekoceras* is closely related to several other genera. First, there is the genus *Aspidites*, which requires a more detailed discussion. To begin with, it must first be observed, that in all these forms the general shape furnishes no characters which could be used in the diagnosis of the genera, but that we have to turn for this purpose to the study of the sutural lines. So also in this case, where the sutural lines, especially so far as they belong to the auxiliary series, are of first importance. In *Aspidites* the auxiliary series of the sutural line commences with a very broad and rather deep auxiliary lobe, which is separated from the rest of the auxiliary series by a distinct saddle, whilst after this saddle there follow a number of irregular denticulations. The auxiliary lobe shows at its base denticulations of very unequal size and distribution. Even from this description it appears conclusive that the auxiliary series is quite different from that of *Meekoceras*, in which all the denticulations composing the auxiliary series form only one auxiliary lobe, which reaches down to near the umbilical suture, and is followed by a single small saddle which is either entirely, or only partially, above the sutural line.

Still more striking is the difference between *Meekoceras* and *Kingites*. In the latter genus, as has already been stated in the description of the genus, the saddles in the auxiliary series predominate over the lobes, and thus its auxiliary series becomes so thoroughly different from that of *Meekoceras*, that a comparison is barely possible.

The next genus is closely related to *Meekoceras* and I describe it under the name of *Koninckites*. I have already mentioned in the introduction to the family *Meekoceratidæ* that *Koninckites* possesses a more highly developed sutural line than *Meekoceras*, and one might therefore assume *Koninckites* to be more recent than *Meekoceras*, but the contrary is the case. The higher development of the sutural line again finds its expression in the auxiliary series. *Koninckites* has its auxiliary series divided into distinct lobes and saddles, the first auxiliary lobe being always well shown. It is small and narrow, not broad with many denticulations as in *Aspidites*, but is provided with three almost equal denticulations. Beyond this, in many species there follows a second and even third distinct auxiliary lobe.

The character of the auxiliary series enables us to distinguish the genus *Koninckites* easily from *Meekoceras*. All the genera which belong to the subfamily *Gyronitinae* possess larger umbilici than *Meekoceras* and are by this character alone easily distinguished. The differences in the sutural lines will be treated of when describing those genera.

Section ROTUNDATI.

a. GROUP OF MEEKOCERAS MUSHBACHANUM, White.

1. MEEKOCERAS FALCATUM, Waagen n. sp. Pl. XXXVI, fig. 4 a, b, c.

We have before us a well preserved specimen which not only retains the greater part of its shell, but also part of its body-chamber.

The general shape of the species is discoidal, with compressed, rounded whorls and a comparatively large umbilicus. The involution of the shell is nevertheless considerable, and the last whorl overlaps the penultimate one to the extent of rather more than two-fifths of the entire height of the former.

The cross section of the whorls is a perfect oval, considerably higher than it is broad. The lateral parts are but very slightly arched, and they appear almost flat to the eye; it is only on measurement that the degree of inflation is perceptible. The greatest transverse diameter is situated near the upper limit of the inner fourth of the entire height of the whorl. Thence the lateral parts curve rather rapidly down to an obtuse umbilical edge which forms the upper limit of a high sloping umbilical wall. In the direction of the siphonal side of the shell, the lateral parts form a very gentle and barely perceptible curve. The external part is rather narrowly rounded, and passes into the lateral parts without any definite demarcation.

The sculpture on this form is rather marked and very characteristic. The innermost volutions up to a diameter of about 5^{mm} are smooth, after which broad radial folds appear, and cover the sides of the shell. They commence just at the umbilical edge, are most marked near the middle of the sides, and disappear again before reaching the siphonal side of the shell. Their shape is somewhat falciform; being first turned slightly towards the front, then leaning back and again turning gently towards the front immediately before disappearing in the neighbourhood of the siphonal part. There are about 20 to 22 of these folds on one whorl, and twice on each volution may be seen an insignificant irregularity in their distribution, two of them being situated close together. This sculpture is retained up to the commencement of the body-chamber; on the latter the number of the folds is greatly increased, but they become at the same time much less marked. The length of the body-chamber cannot be ascertained exactly, as only less than half a volution of it is preserved.

The external part is always perfectly smooth.

The sutural line is very simple. The external lobe is very broad, with a rather flat siphonal tubercle in the centre, so that the lateral branches of it appear only indifferently developed. They possess some three or four denticulations on the side adjoining the siphonal tubercle. The external saddle is not very broad, but is somewhat phylloid in shape, the base being slightly narrower than the apex, which is broadly and equally rounded. It reaches very much higher up than the siphonal tubercle in the middle of the external lobe. The first lateral lobe is much longer than the external one. It possesses approximately parallel sides and bears about five small denticulations on its base, which form together a highly

prominent arch. The first lateral saddle extends rather higher up than the external one and is also much broader. Its sides are somewhat sloping and its top obliquely, but barely perceptibly rounded. The second lateral lobe is much narrower and shorter than the first. Its sides are convergent towards the base, where some four or five small denticulations may be observed, forming together a very prominent arch. The second lateral saddle is as broad but much lower than the first one. It is flattened above, and forms a distinctly depressed arch. The auxiliary series forms a broad, rounded lobe which bears some three or four denticulations on its base, and is followed by a saddle which is only partly above the umbilical suture.

The measurements of the only existing specimen of this species are as follows:—

Diameter of the shell	. . . . .	66 mm.
„ of the umbilicus	. . . . .	22 „
Height of the last volution from the umbilical suture	. . . . .	26 „
„ „ „ „ from the preceding whorl	. . . . .	17 „
Thickness of the last volution	. . . . .	14 „

The diameter of the shell when entire was probably 70^{mm}, but the end of the body-chamber being broken, it is impossible to take correct measurements.

Locality and Geological Position.—We possess only a single specimen of this species, which I found at Amb, in the middle region of the Ceratite Sandstone,—the Stachella-beds.

Remarks.—This species appears to be so closely related to the American species *Meekoceras Mushbachanum*, White, that I doubted for a considerable time whether I ought not to consider them as identical, thus admitting that the American form also occurs in the triassic deposits of the Salt-Range, but I have finally decided to make a new species of the Indian specimen.

The differences consist in the following characters: The umbilicus is considerably larger, the sculpture more marked, and in the sutural line the lateral branches of the external lobe are less strongly individualised in the Indian, than in the American form. Otherwise the similarity is most striking, but I think the differences are sufficient to separate the two as distinct species.

There is no other species with which it could advantageously be compared.

2. MEEKOCERAS FULGURATUM, Waagen n. sp., Pl. XXX, fig. 2 a, b, c.

This species is founded on a fragment of the internal cast of a very large individual, the general shape of which must have been discoidal, with large umbilicus and compressed whorls. The involution is very small and the overlap of the last whorl over the penultimate one amounts to not more than one-eighth of the entire height of the former. It is, however, probable that the inner were more decidedly involute than the outer whorls, as in many similar forms the umbilicus becomes comparatively larger in accordance with the growth of the shell.

The cross section of the whorls is an elongated oval, very much higher than it is broad. The sides of the shell are inflated throughout. The greatest transverse

diameter of the whorls is situated at the upper limit of the lower third of their entire height. From this point the sides slope in a somewhat oblique curve towards the umbilical suture, being more sharply bent in the vicinity of the umbilicus than on the sides of the shell. But neither a distinct umbilical wall nor yet an umbilical edge, is present. In the direction of the siphonal side the bend is also distinct, nevertheless it forms only a rather flat sloping arch. The external part of the shell is rather narrowly rounded and passes gradually into the lateral parts.

The sculpture of the shell consists of broad radial undulations, of which there are three within 80^{mm}. of the external whorl, which indicates a diameter of about 140^{mm}, and thus there may have been some 10 or 11 of these folds on the entire surface of the last volution.

The sutural line is very well preserved and coarsely denticulated. The external lobe is not very broad and is divided in the centre by a rather high siphonal tubercle into two distinct lateral branches, each bearing at its base four marked denticulations, of which the two central ones are very prominent. The external saddle is somewhat phylloid, its base being narrower than its apex. It extends a little higher up than the siphonal tubercle and is obliquely rounded, being somewhat flattened on the side nearest the siphuncle. The first lateral lobe is considerably longer than the external one and is broader at its base than at its commencement. Its sides are somewhat concave and on its base there are nine very strongly marked denticulations, some of which are secondary; they form together a very strongly prominent arch. The first lateral saddle is scarcely broader and reaches only very little higher up than the external one. It is again somewhat phylloid in shape and its top is also somewhat obliquely rounded. The second lateral lobe is narrower, but not much shorter than the first. It is also somewhat broader at its base than at its commencement, and its sides are again concave. It bears about eight very marked denticulations at its base, some of which are also secondary; collectively they form a very prominent arch. The second lateral saddle is much shorter and narrower than the first. It is also slightly and obliquely rounded above. The auxiliary series consists of three enormous denticulations, forming together an obliquely descending lobe, after which follows a small saddle reaching down to the umbilical suture.

The dimensions of the specimen may have been as follows:—

Diameter of the shell, about	(?) 141 mm.
„ „ „ umbilicus, about	(?) 54 „
Height of the last volution from the umbilical suture	53 „
„ „ „ „ from the preceding whorl	47 „
Thickness of the last volution	31 „

Locality and Geological Position.—I found this fragment at Siranki-Dok in the Upper Ceratite Limestone.

Remarks.—The geological position in which this species occurs, seemed to me of such interest, that I have considered it expedient to describe even this fragment. I doubted, for some time, whether it ought not to be included in the genus

Ceratites, to which the denticulations of the lobes seemed to point, but on account of the very strange development of the auxiliary series, which I have never seen in any *Ceratites*, where distinct auxiliary lobes may always be observed,—I have decided to place this species in the genus *Meekoceras*.

It seems to be most closely related to the species which has been described above under the name of *M. falcatum*, and if one were to enlarge the latter to about twice its diameter, it would closely resemble the species here described. It is, however, very doubtful if *M. falcatum* ever attained such dimensions. Other, and striking differences exist between the two shells. The radial plications are much less frequent in *M. fulguratum*, the umbilical wall and umbilical edge have completely disappeared, and the sutural line is entirely different.

On the whole, however, it is probable that *M. falcatum* is the ancestor of *M. fulguratum*, as they occur in succeeding geological horizons.

b. GROUP OF MEEKOCERAS EUOMPHALUM, Keyserling sp.

3. MEEKOCERAS KONINCKIANUM, Waagen n. sp. Pl. XXVI, fig. 6 a, b, c, d.

1863. *Ceratites planulatus*, Koninck: (pars) Quart. Journ. Geol. Soc. Lond., Vol. XIX, pag. 12, Pl. V, fig. 1, c, d, e. (non 1 a, b, c.)

1863. *Ceratites planulatus*, Koninck: (pars) Foss. paléoz. de l'Inde pag. 10, Pl. V, fig. 1 c, d, e. (non fig. 1 a, b, c.)

This species is founded on a single, but well preserved internal cast.

In general shape it is rather broadly discoidal with a moderately wide umbilicus and whorls not much compressed. The involution is not considerable, and the overlap of the last whorl over the penultimate occupies only little more than one-fourth of the entire height of the former.

The transverse section of the whorls is a perfect oval, much higher than it is broad. The umbilicus is surrounded by an arched umbilical wall, which, however, does not show a distinct umbilical edge, where it passes into the sides of the shell. The greatest transverse diameter of the whorls is situated at the upper limit of the lower third of their entire height. The sides are flatly but very evenly arched. From their highest point of elevation they slope only very slightly towards the umbilicus till they meet the rounded umbilical wall, whilst in the direction of the umbilicus the slope is much more considerable. The external part of the shell is narrowly, but perfectly rounded and passes gradually into the lateral parts.

The shell is perfectly smooth for the greater part of its extent, only on the last part of the outer volution a few very faint falciform folds being visible on the lateral parts.

The sutural line is very simple. The external lobe is very broad, being divided into two distinct lateral branches by a deep siphonal tubercle, bearing in the centre a slight indentation. Of the lateral branches each is provided at its base with three very unequal denticulations. The external saddle is very narrow with parallel sides. It reaches very high up and is perfectly and equally rounded above. The first lateral lobe is not very broad, but deep, and extends much lower down than

the external lobe. It possesses parallel sides, and there are about six denticulations at its base, arranged in a low arch. The first lateral saddle is as broad as the preceding lobe. It reaches slightly higher up than the external saddle, has parallel sides and is broadly and equally rounded above. The second lateral lobe is slightly narrower and much shorter than the first. It also bears six denticulations at its base, which together form a not very prominent arch. The second lateral saddle is very low and indistinct, and is flatly and broadly rounded above. The auxiliary series consists of a broad and short lobe, which bears no denticulations but is broadly rounded at its base and is followed by a low saddle which reaches down to the umbilical suture.

The dimensions of the figured specimen are as follows :—

Diameter of the shell	. . . . .	45 mm.
„ of the umbilicus	. . . . .	10 „
Height of the last volution from the umbilical suture	. . . . .	21 „
„ „ „ from the preceding whorl	. . . . .	16 „
Thickness of the last volution	. . . . .	12 „

Locality and Geological Position.—The only specimen of this species, which exists in the Salt-Range collection, I found myself at Virgal in the Ceratite Marls.

Remarks.—This species had been united by Koninck with his *Ceratites planulatus*, because he was of opinion that the inner volutions of that form had a rounded external side, whilst the outer volutions had become biangular. This is true, so far as the innermost volutions are concerned, but if the external margins do not yet exist in a specimen of the size of diameter exhibited by the one described by Koninck or by my own, they would hardly be developed later on, and thus this form without external margins most certainly differs from *Ceratites planulatus*, which also in specimens smaller than that figured by Koninck exhibits distinct external margins.

Another question is, whether the specimen which I have figured on Pl. XXVI is in reality identical with the one which has been reproduced by Koninck on his Pl. V, fig. 1 c, d, e. According to the drawing, Koninck's species appears to possess flatter whorls, a larger umbilicus, and less deep lobes, but I regret to say that M. de Koninck's figures are too indifferent to enable me to identify any of them with the specimens collected by me in the Salt-Range, with any degree of certainty. As it is, it appears exceedingly improbable that Koninck's specimens belong one and all to species which are not represented amongst my material, and I must therefore accept the other conclusion, that the drawings are too bad to recognise specific characters in them. The similarity between Koninck's and my own specimen consists in the general shape of the shell and the goniatitic development of the auxiliary series of the sutural line.

A species to which this one seems to be very closely related is *Meekoceras euomphalum*, Keyserling sp., from the lower triassic deposits of the Olenek in Siberia. The original figures given by Keyserling in "Middendorf's Reise" are not very good and would render a comparison rather difficult, but the figure

of this species given by Mojsisovics in his "Arctische Trias" needs only a cursory glance to show its obvious similarity to those reproduced in this work. The whorls are comparatively speaking a little higher in the Indian species than in the Siberian one, while, as regards the sutural line, the lateral lobes are broader, and the auxiliary series is provided with denticulations in the latter, whereas, in *Meekoceras Koninckianum*, the most striking character of the sutural line consists in the circumstance that the auxiliary series shows a goniatitic development. Thus I think that, though the similarity of both shells is very great, yet the two must be considered as belonging to different species. The Indian form should be geologically older than the Siberian one.

II. Section: BIANGULARES.

c. GROUP OF MEEKOCERAS VARIANS, W.

4. MEEKOCERAS VARIANS, Waagen n. sp. Pl. XXIX, fig. 2 a, b. 3 a, b, c.
4. 5 a, b.

There are a number of specimens in the Salt-Range collection, mostly fragmentary, which may be considered as belonging to this species.

The largest of them show almost the entire body-chamber with the greater part of its shell, whilst the smaller fragments are mostly internal casts, showing sutural lines only.

The general shape of the species is arched and discoidal, with a moderately narrow umbilicus, and a biangular external side, but it varies considerably, according to the age of the specimens. In quite young ones, up to a diameter of shell of about 15^{mm}, the umbilicus is comparatively very large, the whorls rather inflated, with an oval transverse section, the lateral portions of the whorls being equally rounded all over. The external part is perfectly rounded, without any external margins. The involution is inconsiderable and the overlap of the last whorl over the preceding one amounts to not more than one-fifth of the entire height of the former. On the innermost volutions up to a diameter of the shell of about 7 or 8^{mm}, the whorls possess a rather characteristic sculpture, which consists of numerous contractions of the shell, which are strongly inclined towards the front, but are otherwise almost straight. They are equally strongly marked on the lateral parts of the whorls as well as on the external part. The shell surface between these contractions resembles broad rounded folds.

As the shell grows larger, up to a diameter of 15^{mm}, the whorls become higher and are more compressed. The lateral parts become flatter and the contractions of the shell less deep and more distant from each other. At the same time they assume a falciform outline and, especially on the external part of the shell, they form a strongly protracted lip, much in the manner of *Phylloceras ultramontanum*, Zitt. Each contraction is made up of two parts: in front there is a furrow, which is chiefly deeply cut in on the external part, and this is followed behind by a rounded fold which is also most strongly developed on the external part. In this stage of growth

the species possesses a most striking resemblance to certain forms of *Phylloceras*. This similarity is, however, soon lost again. In later stages of growth, the umbilicus again becomes comparatively narrower, and the shape of the shell is then more or less lenticular. In specimens of 20^{mm}. diameter, the contractions of the shell have already entirely disappeared, and in their place a very faint radial sculpture is developed, which is composed of barely perceptible falciform folds, but this also is soon lost again, the shell becoming perfectly smooth. The umbilicus is surrounded by an almost vertical umbilical wall, which unites with the lateral parts of the whorls to form a tolerably sharp umbilical edge. The external part of the shell becomes gradually flatter, and at a diameter of the shell of about 30^{mm}., the external angles by which the external part is hemmed in on both sides, begin to make their appearance and finally the ultimate shape of the shell is attained. The diameter of the umbilicus has again become comparatively larger and the whorls comparatively more inflated. The involution is not considerable; the overlap of the last whorl over the preceding one amounting to about one-third of the entire height of the former.

The transverse section of the whorls is ovally rounded, much higher than it is broad; its greatest transverse diameter is situated a little below the middle of the height of the volution. From there the lateral parts slope but slightly towards the umbilicus, and their curve is insignificant in that direction. The umbilicus is surrounded by a very distinct umbilical wall, which is not quite vertical, and unites with the lateral parts to form an obtuse umbilical margin. The lateral portions slope much more decidedly towards the external side and are at the same time very distinctly, but flatly curved. The external part is flattened until the commencement of the body-chamber, when the external margins, which hitherto have marked the limit between the external and the lateral parts, become indistinct.

The largest specimen of this species in the Salt-Range collection shows apparently the greater part of its body-chamber, but it is impossible to state exactly where it commences, as the whole specimen is filled with a sparry matrix, and all trace of the sutural lines has disappeared.

The greater part of this specimen is perfectly smooth, but towards the end of the last volution some sculpture is visible. It consists of scarcely perceptible, broad radial undulations, between and on which are seen thin thread-like costæ which commence on the umbilical edge and extend in an almost straight radial direction towards the external part of the shell, which, however, is never reached. The striæ or costæ are quite irregular in length.

Some traces of the "epidermides"¹ is seen on the penultimate whorl in front of the aperture; it consists of fine, short, irregular striæ, running transversely over the flattened external side, and most marked on the external margins.

The sutural line is well preserved on some of the fragments. The external lobe is broad but not very long. It is divided by a rather narrow, but deep angular median tubercle, into two distinct lateral branches, which are placed on the lateral parts of the shell. Each of these bears three principal denticulations

¹ Black shelly deposit,—*Epidermides* of Barrande.—EDIT.

below, of which the central one is the most prominent. In some cases there are also two additional denticulations intercalated between the bottom of these lateral branches and the siphuncle. The external saddle is very narrow, slightly phylloid, and does not reach much higher than the median siphonal prominence of the external lobe. The first lateral lobe is much longer than the external one, and broader at its base than at its commencement. It bears some four to six, or even eight, denticulations at its base, forming together a very prominent arch. The first lateral saddle is much broader than the external saddle and reaches higher up. It is more or less distinctly obliquely rounded above. The second lateral lobe is either exactly as broad, or even slightly broader than the first, but is at the same time much shorter. It bears at least six denticulations on its base, which form together a strongly prominent arch. The second lateral saddle is as broad as the first, but does not reach so high up, and its top is on about the same level as that of the external saddle. It is, as a rule, regularly rounded, sometimes slightly flattened above. The auxiliary series consists first of a broad and low lobe, which bears some six denticulations of various sizes, but which are all on the same level, and extend to the inside of the umbilical margin; then follows a very small saddle, and then once more a small denticulation just above the umbilical suture.

The dimensions of the largest specimen of this species are as follows :—

Diameter of the shell	. . . . .	97 mm.
„ of the umbilicus	. . . . .	21 „
Height of the last volution from the umbilical suture	. . . . .	45 „
„ „ „ „ from the preceding whorl	. . . . .	31 „
Thickness of the last volution	. . . . .	24 „

Locality and Geological Position.—We possess altogether seven specimens which, though mostly very fragmentary, may all be recognised as belonging to this species. They were collected by myself west of Khoora, in the lowest beds of the lower Ceratite Limestone.

Remarks.—The present form may easily be distinguished from the other species of this genus by having external margins. I regret to say that in the figure 2 b, of Pl. XXIX, this character is scarcely sufficiently shown.

Meekoceras caprilense, Mojs., might be compared with the species under description, but it possesses a narrower umbilicus, and the external margins, besides being much sharper, are developed at much earlier stages of growth.

5. *MEEKOCERAS PULCHRUM*, Waagen n. sp. Pl. XXIX, fig. 1 a, b, c; Pl. XXVII, fig. 2 a, b, c, d, fig. 3 a, b, c.

This species is represented in the Salt-Range collection by three well preserved specimens, all of which I have figured.

There is but very little doubt that it is the descendant of *M. varians*, as it also shows, though in a less degree, similar variations in its different stages of growth. I am not acquainted with its first stages of growth, as the smallest specimen which

has come under my observation has a diameter of 37^{mm}. The general shape of the shell is distinctly lenticular, with a rather small umbilicus, compressed whorls and an external part of the shell, which does not show any traces of external margins. The umbilicus is surrounded by a steeply sloping umbilical wall, which, in uniting with the sides of the whorls, forms a distinct umbilical margin. At this stage of growth the shell is already provided with a radial sculpture, which, however, can only be observed partially. This sculpture is absolutely similar to that of the full-grown specimens of *M. varians*. It consists also of barely perceptible, slightly falciform, radial undulations on and between which nearly straight, thread-like costæ may be seen, which are better visible on the surface of the shell, than on the internal cast. In the figure on Pl. XXVII, fig. 2 a, this sculpture is not quite correctly represented as it shows only radial undulations, which are somewhat too closely arranged.

As the shell grows larger, the umbilicus begins to widen, and the umbilical wall becomes more and more vertical. At a diameter of about 40^{mm}, the external margins begin to appear and remain very distinct, even in the largest specimens examined by me.

The full-grown state of the shell is represented in fig. 1 on Pl. XXIX. Its general outlines are also more or less lenticular, with a rather large umbilicus, compressed whorls, and a distinctly flattened external side, which is defined on both sides by external margins. The involution of the shell is inconsiderable and the overlap of the last whorl over the preceding one amounts to about one-third of the entire height of the former.

The transverse section of the whorls is more or less oval, much higher than it is broad, with rounded sides and a flattened external part. The greatest transverse diameter is situated within the lower third of the entire height of the whorl. From thence the lateral parts slope but very little in the direction of the umbilicus, and, in uniting with the almost vertical umbilical wall, form obtuse umbilical margins. In the direction of the siphonal side the slope is much more considerable, and the lateral parts descend with a gentle curve to the external margin. The external part of the whorl is very distinctly flattened.

The sculpture of the shell consists of well-defined radial undulations, which have a barely perceptible falciform bend, are most marked in the middle of the lateral parts and disappear again before reaching the external margin. Filiform costæ are wanting in this species, but it must be remembered that the specimen under description is an internal cast only.

The sutural line is very well preserved in the young, as well as in the adult specimen, and it may be observed that it does not vary in the different stages of growth. The external lobe is broad, divided into two lateral branches by a rather shallow but somewhat broad, angular siphonal tubercle or saddle. Each branch bears many denticulations along its base, and these, in adult specimens, come close up to the siphuncle. The external saddle is distinctly phylloid in outline, not very broad, but reaches higher up than all the other saddles. It is narrow, rounded

and somewhat oblique above. The first lateral lobe extends much lower down than the external one. It is somewhat broader at the base than near its commencement. There are four to eight denticulations along its base, which form together a strongly prominent, but slightly oblique arch. The first lateral saddle does not reach so high as the external one. It is very broad and possesses almost parallel sides. At its top it is broadly rounded. The second lateral lobe is not quite so broad and much shorter than the first. Its sides are nearly parallel and it bears four to six denticulations along its base, which form together a distinct arch. The second lateral saddle is very characteristic. It is very short and broad, strongly depressed above so as to become almost biangular. The auxiliary series is composed first of a broad, low lobe, which bears some six denticulations along its base, which form together a low arch; then comes a small saddle, and after it, in adult specimens, follow one or two denticulations on the umbilical wall, till the umbilical suture is reached, but these latter cannot be made out distinctly.

The dimensions of two specimens, a young and an adult one, both composed of septa, are as follows:—

	I.	II.
Diameter of the shell	37 mm.	103 mm.
„ of the umbilicus	8 „	27 „
Height of the last volution from the umbilical suture . . .	19 „	48 „
„ „ „ „ from the preceding whorl . . .	12 „	32 „
Thickness of the last volution	9 „	25 „

Locality and Geological Position.—The three specimens of this species were found by myself in the Ceratite Marls of the Chitta-Wan near Ghari.

Remarks.—As I have already stated above, I am inclined to consider this species as most probably a descendant of *M. varians*. It cannot be wondered at, therefore, that they are very closely allied.

The points of distinction between this and the preceding species are the following. The sculpture is stronger and shows a definite character at much earlier stages of growth in this than in the preceding species. The umbilicus is larger in the full-grown specimen, and the external part is more distinctly flattened. In the sutural line, the external saddle is broader and reaches up higher in the last than in the preceding species, and the second lateral saddle is very distinctly flattened, which is not the case in *M. varians*.

Thus, the two forms, though they are very closely related, show decided differences.

d. GROUP OF MEEKOCERAS MAGNUMBILICATUM, W.

6. MEEKOCERAS MAGNUMBILICATUM, Waagen, n. sp. Pl. XXXIII, fig. 3 a, b.

Of this species I possess only a single fragmentary specimen, which is entirely made up of septa, but has some portions of its shell adhering to it.

The general shape is flatly discoidal with strongly compressed whorls and large umbilicus. The involution is most inconsiderable, and the overlap of the last

whorl over the preceding one amounts to about one-fourth of the entire height of the former.

The transverse section of the whorls is more or less lanceolate with only slightly arched sides and a flattened external side. The greatest transverse diameter is situated at the upper limit of the lower third of the height of the whorls. From there the sides slope but very little in the direction of the umbilicus and join the very distinct, high, and vertical wall, which surrounds the umbilicus, forming an obtuse umbilical margin. In the direction of the siphonal side the slope is much more considerable, the curve being at the same time very flat. The external part of the shell is distinctly flattened, and in uniting with the sides forms distinct, obtuse external margins.

The last volution of the shell is quite smooth; the inner ones, however, exhibit a faint radial sculpture which consists of low undulations of the shell, best seen near the middle of the sides of the shell.

The sutural line is distinctly traceable on the last volution of this specimen. The external lobe is very broad, divided by a shallow, but extremely broad siphonal prominence into two lateral branches, most of which are situated on the sides of the whorl. The deepest point of these lateral branches is situated near the external saddle, and from thence they ascend slowly towards the siphuncle, being provided with a great number of small denticulations. The external saddle is comparatively broad, with almost parallel sides, and ascends considerably higher than the siphonal tubercle near the middle of the external lobe. Above, it is broadly and regularly rounded. The first lateral lobe is just as broad as the preceding saddle, but reaches down much lower than the external one. Its sides are slightly inflated, and there are some eight very small denticulations on its base, which form together a very strongly prominent arch. The first lateral saddle is much broader than the preceding lobe and does not extend as high up as the external saddle. Its sides are nearly parallel, but somewhat curved. Above, it is rather obliquely rounded. The second lateral lobe is much narrower and shorter than the first. Its sides are also nearly parallel and slightly curved. Along the base are five or six denticulations which form together an arch. The second lateral saddle is narrower and very much shorter than the first. It is flatly and obliquely rounded above, but turns in the opposite direction to the first lateral saddle. The auxiliary series which now follows, forms a very broad auxiliary lobe which reaches down to the umbilical suture. It is situated below all the other lobes, and is provided with numerous denticulations, eight to ten in number, which are all of much the same size. They form together a very broad oblique arch.

The dimensions of the figured specimen are as follows:—

Diameter of the shell, about	79 mm.
„ of the umbilicus	21 „
Height of the last volution from the umbilical suture	33 „
„ „ „ „ from the preceding whorl	25 „
Thickness of the last volution	17 „

Locality and Geological Position.—This species is founded on a fragment, which amounts to about half the original specimen. I obtained it at Chidroo in the middle region of the Ceratite Sandstone, the Stachella-beds.

Remarks.—This species may be readily distinguished from all the forms which have been described in the foregoing pages; its most characteristic feature is again the auxiliary series. The only form to which it bears a closer resemblance is *M. Mushbachanum*, White, which possesses also a large umbilicus and an auxiliary series of a similar nature. In our species the whorls are much more compressed, quite smooth and provided on the external part with two obtuse, but still distinct margins. The same characters distinguish this species also from other similar forms, as, for instance, *M. falcatum*, W., etc.

From the forms belonging to the group of *M. varians*, the present one is distinguished by its larger umbilicus and an auxiliary series, which forms a very broad rounded auxiliary lobe, descending lower than all the rest.

7. *MEEKOCERAS ROTA*, Waagen, n. sp. Pl. XXVII, fig. 6 a, b, c, d.
fig. 7 a, b, c.

We possess only a few small, but well-ornamented specimens of this species, and I am unable to say how large this shell may have been. Probably it was smooth when old, but this is merely conjectural.

As it is, the general shape of the specimens at my disposal is more or less lenticular, with a rather narrow umbilicus, compressed whorls and a flattened external side. The whorls increase rather rapidly in height, but the involution is not very considerable. The overlap of the last whorl over the preceding one amounts to about one-third of the entire height of the former.

The transverse section of the whorls is to a certain extent sagittate. The greatest transverse diameter is situated at the upper limit of the lower third of the height of the whorl. From this highest point of elevation the lateral part of the whorls bend gently down to the umbilical suture, without forming a distinct umbilical wall, yet reaching that suture almost at right angles. In the direction of the siphonal side the lateral parts are flat, barely curved at all, but having at the same time a decided slope. The external part is distinctly flattened, and in uniting with the lateral parts of the whorls, forms well-marked external margins.

The ornamentation of the shell is very characteristic. It consists of single, strong radial folds with a falciform bend. These ribs or folds are more pronounced in the larger than in the smaller of the two specimens which I have before me. On the larger specimen there are seven such ribs on the last volution; they commence close to the margin of the umbilicus, are most marked near the middle of the sides, and after bending towards the front, disappear before reaching the external margins.

The sutural line is distinct only on the larger specimens; that of the smaller specimen is erroneously represented in the drawing.

The most striking feature of the sutural line of this species is the phylloid development of all the saddles. The external lobe is very broad, and divided into two lateral branches by a shallow siphonal prominence. Each of these branches, nearly the whole of which are situated on the sides of the whorl, is provided with many denticulations, extending to within a short distance of the siphuncle. The external saddle is not very broad, distinctly phylloid, and well rounded above. The first lateral lobe is very broad and short, and reaches down only very little lower than the external one. It bears eight to ten denticulations on its base, which form together a broad and prominent arch. The first lateral saddle is much narrower than the preceding lobe, though broader than the external saddle. It is also distinctly phylloid and rounded above. It does not reach up so high as the external saddle. The second lateral lobe is also exceptionally broad and short, though narrower and shorter than the first. It bears about six denticulations on its base, which form together a very strongly prominent arch. The second lateral saddle is very short and narrow, not quite so distinctly phylloid as the others. It is also regularly rounded above. The auxiliary series which follows next forms one very broad auxiliary lobe extending to the umbilical suture. It bears a great many denticulations on its base, forming together a strongly prominent, broad arch, which reaches down as low as or even a little lower than all the other lobes.

The dimensions of the larger of the two specimens are as follows:—

Diameter of the shell	. . . . .	33 mm.
„ of the umbilicus	. . . . .	8 „
Height of the last volution from the umbilical suture	. . . . .	16 „
„ „ „ „ from the preceding whorl	. . . . .	11 „
Thickness of the last volution	. . . . .	9 „

Locality and Geological Position.—One specimen (type) from Nanga, another (smaller) from Amb; both from the Stachella beds and found by myself.

Remarks.—The characters of the sutural line of this species prove it to be a near relation of *M. magnumbilicatum*, but it differs from the latter, in that the saddles of its sutural line are all phylloid. The shell is also ornamented in *M. rota*, whereas it is almost smooth in *M. magnumbilicatum*.

Possibly both are descendants of *Meekoceras Mushbachanum*, with external margins developed.

8. MEEKOCERAS TARDUM, Waagen, n. sp. Pl. XXXI, fig. 1.

I introduce this name for a very small fragment of a large individual. However, as it comes from the Upper Ceratite Limestone, its occurrence in this geological horizon is of so much interest, that I did not hesitate to name it.

The shell was very large, with compressed whorls and a wide umbilicus. Whether the external part of the shell was bi-angular or rounded cannot be seen, as this part of the shell is broken. It appears probable to me that external

margins were present, and I have therefore ventured to place this species into this section of the genus *Meekoceras*. The umbilicus is surrounded by a high, but not very distinct umbilical wall, which joins the lateral parts of the whorl without forming any kind of an umbilical margin. The very large umbilicus, and the smoothness of the shell, together with some similarity of the sutural line, have induced me to place this species so close to *M. magnumbilicatum*.

The sutural line is only partially preserved in this fragment. The first lateral lobe is narrow, but very deep. Its sides are concave, and along its base there are some ten strong denticulations, which form together a narrow and very prominent arch. The first lateral saddle is not very broad, somewhat phylloid and obliquely rounded above. The second lateral lobe is much shorter and considerably narrower than the first. Its sides are also somewhat concave, and on its base there are some five large denticulations which form together a distinct arch. The second lateral saddle is broad and short, and flatly rounded above. The auxiliary series consists of many denticulations, some of which have secondary incisions. They form together a comparatively deep and broad auxiliary lobe, which is followed by a narrow, but high saddle, after which the sutural line descends again to form a narrow sutural lobe, of which only half is seen above the umbilical suture.

It is not possible to give measurements, owing to the fragmentary character of the specimen.

Locality and Geological Position.—Upper Ceratite Limestone, Koofri.

Remarks.—It is very closely related to *M. magnumbilicatum* with which it has many characters in common. It differs from that form, however, inasmuch as its auxiliary series is much more complicated.

e. GROUP OF MEEKOCERAS GRACILITATIS, White.

9. MEEKOCERAS PLANULATUM, Kon. sp. Pl. XXIV, fig. 2 a, b, c ; Pl. XXXIX, fig. 2 a, b ; Pl. XL, fig. 1.

1863. *Ceratites planulatus*, Koninck : Quart. Journ. Geol. Soc. Lond., Vol. XIX, page 12, Pl. V, fig. 1, 1a, 1b (non fig. 1, c, d, e.)

1863. *Ceratites planulatus*, Koninck : Foss. paléoz. de l'Inde, page 10, Pl. V, fig. 1, 1a, 1b (non fig. 1, c, d, e.)

Of this species we possess only a single incomplete specimen which does not even show the sutural line ; I have decided therefore to reproduce also Koninck's original figure on Pl. XXXIX.

The general shape of the shell is flatly discoidal with compressed whorls and a moderately narrow umbilicus. The involution is inconsiderable, and the amount of the overlap of the last whorl over the preceding one, amounts to one-third of the height of the former.

The transverse section of the whorls is somewhat sagittate, with a distinctly flattened external part. They are strongly compressed, very much higher than they are broad. The lateral parts are very flatly arched, the greatest transverse

diameter being situated within the lower third of the height. From this highest point of elevation the lateral parts slope but very little, showing, however, at the same time a distinct curve in the direction of the umbilicus. This latter is surrounded by a rather high, but not very distinct, arched umbilical wall, which, in uniting with the lateral parts, forms obtuse, indistinct umbilical margins. The sides descend rapidly towards the external side and are distinctly flattened, and their curve in this direction is barely perceptible; near the junction they form distinct external margins.

The shell bears a faint radial sculpture, which consists of low, barely perceptible undulations, turned more or less backwards, showing a slightly falciform curve. The external part of the shell is always quite smooth.

The characters of the sutural line are only known to me through Koninck's drawing. The external lobe seems to have been very broad, with a deep, angular, siphonal tubercle in the middle, by which the lobe is divided into two distinct lateral branches, each of which bears several denticulations along its base. The external saddle seems to reach up considerably higher than the siphonal tubercle, but also higher than the first lateral saddle; there is, however, no certainty in this latter respect, as Koninck's drawings vary with regard to this character as well as with regard to the breadth of this saddle, which appears sometimes broader, sometimes narrower than the first lateral. The same is the case with regard to the other elements of the sutural line, and thus there is no use in entering into a detailed description based on Koninck's drawings only. This, however, deserves special notice, that there is an auxiliary series, which forms a single shallow lobe, without denticulations, followed by a similarly shallow saddle, which is only partly above the umbilical suture.

To supplement the measurements of the only, and broken, specimen at my disposal, I give here those of Koninck's specimens from his own descriptions. The dimensions will then be as follows:—

	I.	II.
Diameter of the shell	48 mm.	85 mm.
„ of the umbilicus	9 „	18 „
Height of the last volution from the umbilical suture	23 „	40 „
„ „ „ „ from the preceding whorl	16 „	(?) „
Thickness of the last volution	10.5 „	19 „
„ of the external part	3 „	4 „

M. de Koninck's specimen retained the greater part of the body-chamber, which formed about half a volution.

Locality and Geological Position.—One specimen from Koofri; Stachella-beds. Locality of *de Koninck's* specimen not known.

Remarks.—The only species which seems to be closely related to this one, is *M. gracilitatis*, White, which in general shape and character of the shell, as well as of the sutural line, is almost identical with it, and the differences which exist are rather irrelevant ones only. Such is the sculpture, which is better expressed in *M. gracilitatis*, and in which the single folds are distinctly leaning over towards the front, whilst the reverse takes place in *M. planulatum*. In the sutural line, the

auxiliary series is without any denticulations in the latter species, whilst a few indistinct ones exist in *M. gracilitatis*. Though these differences appear sufficient to separate the two forms as distinct species, yet the similarity between the two forms is so great, that one cannot but think that the two, notwithstanding the enormous geographical distance, are evolutionally connected, and I have considered it convenient to give expression to this view by placing the two in one and the same series.

The species is much less closely related to *M. Koninckianum*. M. de Koninck placed both forms into the same species, because he thought that the young of *M. planulatum* possessed no external margins, but a cursory glance at my figure, Pl. XXIV, fig. 2 c, will prove the contrary to have been the case. *M. Koninckianum* is, as has been stated in the description of that species, a relation of *M. euomphalum*, Keys., whilst *M. planulatum* must be brought into connection with *M. gracilitatis*.

f. ISOLATED SPECIES.

10. MEEKOCERAS RADIOSUM, Waagen, n. sp. Pl. XXXVI, fig. 2 a, b, c, d.

This species is founded on a well preserved specimen, which is mostly composed of septa with portions of the shell still adherent.

Its general shape is moderately thick and discoidal, with a very small umbilicus and a flattened external side. The involution of the shell is inconsiderable and the overlap of the last whorl over the preceding one amounts to somewhat less than one-third of the entire height of the former.

The transverse section of the whorls is more or less elongate-oval, much higher than it is broad, with moderately inflated lateral, and flattened external parts. The greatest transverse diameter is situated above the inner third of the height of the whorl. From their highest points of elevation the lateral parts slope barely perceptibly, with a very slight curve, towards the umbilicus. This latter is surrounded by a distinctly sloping umbilical wall which, in uniting with the lateral parts, forms a well defined but not very sharp umbilical edge. The lateral parts slope towards the external part somewhat rapidly but without much convexity. Near the junction with the flattened external part they form sharp margins.

The sculpture is slight but distinct. It consists of very numerous, fine radiating folds or lines which on the inner volutions, are most marked in the vicinity of the umbilicus, whilst on the last whorl they are most pronounced near the middle of the sides. They are of an imperfect falciform character, but disappear before reaching the external edge. The external part is smooth.

The external lobe is very broad, divided in the middle by a siphonal prominence, which is rounded above. Through it the lobe is divided into two distinct lateral branches, which are generally situated on the lateral parts of the shell, but are nevertheless nearly parallel to each other. They bear a great number of

small denticulations at their base, which show a somewhat pyramidal arrangement. The external saddle is narrow and not very high, but reaches higher than the median prominence in the siphonal lobe. It possesses parallel sides and is regular and rounded above. The first lateral lobe is very long and narrow; its sides converge towards the base, with some five denticulations. The first lateral saddle is distinctly oblique, not much broader and only slightly higher than the external one. It is narrowly and somewhat obliquely rounded above. The second lateral lobe is much shorter and broader than the first. Sides converge towards the base with some four large denticulations. Second lateral saddle very low and as broad as the first; rounded above. The auxiliary series forms a very broad auxiliary lobe which reaches down to the umbilical suture; it begins to be subdivided by an indistinct grouping of its denticulations. This auxiliary series resembles that of *Aspidites* to a certain extent.

The dimensions of the figured specimen are as follows:—

Diameter of the shell	. . . . .	54 mm.
„ of the umbilicus	. . . . .	6 „
Height of the last volution from the umbilical suture	. . . . .	29 „
„ „ „ „ from the preceding whorl	. . . . .	10 „
Thickness of the last volution	. . . . .	13 „

Locality and Geological Position.—Chitta-Wan in the lower beds of the Ceratite Sandstone.

Remarks.—The generic position of this species is not quite certain. I have already mentioned that this species resembles somewhat the genus *Aspidites* in the character of its sutural line, but the sub-division of the auxiliary lobe is so very indistinct, that I decided to place the species in the genus *Meekoceras*.

It is desirable to note, that *M. radiosum* is geologically older than all the species of *Aspidites* described on the foregoing pages, and which are distributed in the middle and upper regions of the Ceratite Sandstone, and we are thus entitled to suppose that it may be their ancestor.

Genus : KONINCKITES, Waagen, n. gen.

The last genus which belongs to the sub-family *Meekoceratinae* differs but little from the typical genus *Meekoceras*, and it is only owing to the different development of the sutural line that I have determined to place some forms into a new genus.

This form is flatly discoidal with a moderately large umbilicus. The sculpture is always poorly developed, and if there is any, it is composed of faint radial folds, which show a slight falciform bend. The external part is invariably quite smooth, sometimes hemmed in on both sides by external margins, sometimes well rounded. In the preceding genera it was generally possible to distinguish two different sections amongst the various forms, conformably with the different develop.

ment of the external part. This, however, is not the case in this genus, as there are several forms in which external edges are present in the young, whilst they are absent in the adult specimen.

The most characteristic feature of this genus is the sutural line. The external, the first and second lateral lobe are similar to those in the other genera, with the sole exception, that in one species a goniatic development of the external lobe occurs. The most characteristic feature here also, is the auxiliary series. It commences always with a distinct first auxiliary lobe which is normally developed in width and in the mode of denticulation. This is followed by a normal first auxiliary saddle, which is succeeded in larger (rarely in smaller) species, by a second distinct auxiliary lobe. In most species this latter is absent, and the first auxiliary saddle is usually succeeded by a number of more or less irregular denticulations, which reach down to the umbilical suture. Thus the leading feature of the species of this genus is the existence of an auxiliary lobe which follows the second lateral saddle, and which is neither of excessive breadth nor shows very irregular denticulations, and which is separated from the rest of the auxiliary series by a distinct auxiliary saddle.

A great many species may be referred to this genus and they may be arranged into several groups, but they do not form large sections. The groups may partly represent stages of evolution.

There is first a group of which *Koninckites vetustus*, W., is the representative. It is characterised by a shallow umbilicus and whorls rounded all over. This species is the earliest form of the genus and occurs in the Lower Ceratite Limestone; in the Ceratite Marls above, *K. ovalis* occurs, which is closely related to the former.

The second group is represented by *Koninckites impressus*, W., which is distinguished by strongly developed external margins on all the whorls, even in specimens of very large diameter. It is the earliest species of this group and occurs also in the Lower Ceratite Limestone. In the Ceratite Marls above, occurs *K. Vercherei*, W., founded on a single specimen collected by Dr. Verchère. Another species, *K. gigas*, W., a somewhat doubtful species, was found in the Ceratite Sandstone.

There is a third group represented by *Koninckites volutus*, W., which in early stages possesses external margins, which later on become rounded. It is found in the Ceratite Marls. In the lower part of the Ceratite Sandstone occurs another species which was known to M. de Koninck, and which he called *K. (Ceratites) Lyellianus*.

Lastly, there remain several species, which appear isolated. One of them occurs in the Lower Ceratite Limestone, and was described by M. de Koninck. It is a strange form, which in its general appearance somewhat resembles *Aspidites*, but possesses an auxiliary sutural series which deviates very much from that generally met with in this. M. de Koninck has called this species *K. (Ceratites) Davidsonianus*.—*K. radiatus*, W., is the most recent species of the whole genus, and it also exhibits quite isolated characters, and cannot be united with any of the

above species. It occurs in the Stachella-beds of the Ceratite Sandstone. The genus *Koninckites* may therefore be grouped as follows :—

I. Group of *KONINCKITES VETUSTUS*, W.

1. *Koninckites vetustus*, W.: Lower Ceratite Limestone.
2. „ *ovalis*, W.: Ceratite Marls.

II. Group of *KONINCKITES IMPRESSUS*, W.

3. *Koninckites impressus*, W.: Lower Ceratite Limestone.
4. „ *Vercherei*, W.: Ceratite Marls.
5. „ *gigas*, W., Ceratite Sandstone.

III. Group of *KONINCKITES VOLUTUS*, W.

6. *Koninckites volutus*, W.: Ceratite Marls.
7. „ *Lyellianus*, Kon. sp.: Lower region of Ceratite Sandstone.

IV. ISOLATED SPECIES.

8. *Koninckites Davidsonianus*, Kon. sp.: Lower Ceratite Limestone.
9. „ *radiatus*, W.: Ceratite Sandstone, Stachella-beds.

The genus, we see, is entirely restricted to the lower divisions of the Trias in the Salt-Range, and occurs there only in beds, which seem to be approximately equivalent to the Bunter Sandstein of Europe. Within this group of rocks the distribution of each species is a very equal one. There are three species present in the Lower Ceratite Limestone, the same number exists in the Ceratite Marls, and three have been found in the Ceratite Sandstone. Thus the distribution appears to be quite different from that of the genus *Meekoceras*.

The relations of *Koninckites* to other genera are not very complicated; it is most closely related to *Aspidites*. Both genera have a distinct first auxiliary lobe in common, but in *Aspidites* this is very broad and irregular, sub-divided in different ways, whilst in *Koninckites* it is narrow, regular, and mostly provided with three equal denticulations. In the latter genus a distinct second auxiliary lobe often succeeds, which is never the case in *Aspidites*.

Another genus, which is very closely related, is *Meekoceras*, and the limits between the two genera can often be drawn with difficulty only, because in some cases the single broad auxiliary lobe which is characteristic of *Meekoceras* becomes sometimes indistinctly sub-divided and then it is doubtful to which genus the form should be relegated. The relations of the special form to other species must be taken into consideration also, and the question be solved in this way. But generally there cannot be much doubt about the generic position of a species, and every form, in which a distinct first auxiliary lobe can be made out must be placed into the genus *Koninckites*, whilst all such forms, in which the auxiliary series is not differentiated, must be considered as belonging to the genus *Meekoceras*.

Up to the present, only very few forms of *Koninckites* have been described, and I know of only a single one which might be attributed to this genus, namely, *Meekoceras sibiricum*, Mojs., which was found in the lower triassic deposits of the Olenek in Siberia.

I. GROUP OF KONINCKITES VETUSTUS, W.

1. KONINCKITES VETUSTUS, Waagen n. gen. et. sp. Pl. XXVII, fig. 4 a, b, c, d, fig. 5 a, b, c.

The general shape of the shell is more or less lenticular, with flatly oval whorls and a moderately narrow and shallow umbilicus. The involution of the shell is not very considerable, and the last whorl overlaps the penultimate one to the extent of rather less than one-third of the entire height of the former.

The transverse section of the whorls is oval, very much higher than broad. The greatest transverse diameter is situated within the lower third of the entire height of the whorls. The lateral parts are flat, but not regularly convex.

From the most inflated point, the sides slope in a distinct curve to the umbilical suture without forming any trace of an umbilical wall or edge, and meeting the suture at an acute angle. Towards the external side, the shell is almost flat, whilst the former is well rounded, and passes into the lateral parts without special demarcation.

The species bears a very faint radial sculpture, which on the internal cast is barely perceptible and consists of single radial folds, which commence not far from the umbilical suture, but become more distinct on the external half of the lateral parts. In fig. 5 a, b, on Pl. XXVII. a fragment of the body-chamber of a large individual, with shell preserved, has been figured, in which the sculpture is more strongly developed. It is apparent that this sculpture consists chiefly of an accumulation of striae of growth. They cross over the external part where they are sharply bent towards the front. The folds, however, generally die out without reaching the external part.

The sutural line is very characteristic. The external lobe is very broad and short. It possesses a shallow siphonal tubercle or saddle in the middle, which is, however, almost as broad as the whole lobe. The lateral branches, which are thus formed, possess a more or less pyramidal shape, and are provided with rather marked denticulations along the whole extent of their lower extremity. The external saddle is broad but very short, and slightly phylloid in its shape. It is somewhat flatly rounded on its top. The first lateral lobe does not reach down so low as the external one. It is narrower at its upper extremity than at its base, where some six denticulations are to be observed, which together form a very flat arch. The first lateral saddle is oblique and reaches much higher than the external one, and is also somewhat broader. It is very obliquely rounded at its top. The second lateral lobe is as broad but very much shorter than the first one, being placed obliquely towards the latter. It bears six to eight denticulations along its base, which together form a flat arch. The second lateral saddle is narrower and shorter than the first one,

and is regularly rounded on the top. The first auxiliary lobe is narrow and short, but distinct. It bears three denticulations along its base. It is followed by a small saddle and three larger irregular denticulations, which are all on the same level and reach down to the umbilical suture.

The dimensions of the smaller of the two figured specimens are as follows:—

Diameter of the shell	54 mm.
„ of the umbilicus	10 „
Height of the last volution from the umbilical suture	26 „
„ „ „ „ from the preceding whorl	18 „
Thickness of the last volution	13 „

Locality and Geological Position.—Lower Ceratite Limestone, Chidroo, two specimens, Coll. Waagen.

Remarks.—The present species exhibits a certain external similarity to several species of the genus *Meekoceras*, as for instance young specimens of *M. pulchrum*, W., which have been figured on the same plate with this species. If the sutural line is not visible a distinction is impossible, owing to the outward similarity of these forms.

Among the species belonging to the genus *Koninckites* there is only the next following one, which is very closely related, as will be seen below:—

2. KONINCKITES OVALIS, Waagen n. gen. et. sp. Pl. XXVIII, fig. 3 a, b, c., fig. 4 a, b.

The present species is in all respects strikingly similar to the preceding one, and its distinction is by no means easy.

The general shape of the shell is again more or less lenticular; the involution is more considerable than in the last described species, and consequently the shallow umbilicus is also larger and the whorls overlap each other to the extent of half their height.

The transverse section of the whorls is a compressed oval, very much higher than broad. The lateral parts are flatly convex, and the greatest transverse diameter of the shell is situated very low down, just above the inner fourth of the entire height of the whorl. From their highest points of elevation the lateral parts slope in a gentle curve down to the umbilical suture, without forming any trace of an umbilical wall, and reach that suture at a very acute angle. In the direction of the siphonal side the lateral parts show a very flat but distinct curve, and pass gradually into the well-rounded external part of the shell.

In full-grown specimens the last whorl becomes slightly more inflated towards the aperture, the external part being then broadly rounded.

The shell possesses a slight radial sculpture which is always better shown on the body-chamber. This sculpture consists of radial folds, which are set well apart and lean over towards the aperture, showing a distinct falciform character. Between them there are numerous fine radial and parallel plications. The sculpture disappears more or less towards the aperture, being replaced by very numerous striæ of growth.

The mouth of the shell is preserved in one of the fragments. It is very simple in outline, possesses a broadly rounded ventral prominence and is deeply incised at a short distance above the umbilical suture.

The sutural line possesses few remarkable features. The external lobe is very broad and short, divided by a shallow angular, median prominence into two lateral branches, which are provided with a number of denticulations along their base. The external saddle is narrow and short, with parallel sides, and is well rounded on the top. The first lateral lobe is rather long and broad, with parallel sides, and bears six denticulations, which form a prominent arch. The first lateral saddle is much longer and broader than the external one. It has parallel sides and is symmetrically rounded on the top. The second lateral lobe is much narrower, but only a little shorter than the first. It has some four denticulations, which form a prominent arch. The second lateral saddle is as broad as the first, but very much shorter. It has sloping sides and is rather flatly convex on the top. The first auxiliary lobe is very small, and has indistinct denticulations. It is followed by a small saddle, a small lobe and again a low saddle, which is, however, only partly above the umbilical suture.

The dimensions of the smaller one of the two figured specimens, which still retains a portion of its body-chamber, are as follows:—

Diameter of the shell	60 mm.
„ of the umbilicus	13 „
Height of the last volution from the umbilical suture	29 „
„ „ „ „ from the preceding whorl	16 „
Thickness of the last volution	13 „

Locality and Geological Position.—Ceratite Marls, Virgal, three specimens, Coll. Waagen.

Remarks.—This species is most intimately connected with the one last described and it appears most probable that they are descended from each other.

In general shape they are very similar, the differences consisting only in the circumstance that the umbilicus is larger in this species, the external part broader and more rounded, and that the sculpture is more strongly expressed; at the same time, the sutural line is more regular in this, than in the preceding species.

These differences seem to be sufficient to distinguish the two as different species, particularly as the last described species occurs in younger strata than the preceding one.

II. GROUP OF KONINCKITES IMPRESSUS, W.

3. KONINCKITES IMPRESSUS, Waagen n. gen. et. sp. Pl. XXXV, fig. 6 a, b.

This species is flatly discoidal, with compressed whorls and a rather wide umbilicus. The involution is very small, and the last whorl overlaps the preceding one to the extent of about one quarter of the entire height of the former.

The transverse section of the whorls is more or less lanceolate with a flattened external side. The lateral parts are very flatly convex and the largest transverse diameter is situated somewhat below the middle of the entire height of the whorl.

From this point the sides slope in a flat curve towards the umbilicus. The latter is surrounded by a very narrow, but distinct umbilical wall, which forms an umbilical edge near the junction with the lateral parts. Above this edge is seen a shallow depression which surrounds the umbilicus and which forms the principal specific character. The lateral parts slope towards the siphonal side in the same manner as towards the umbilicus, and their curve is equally flat. The external part is quite flattened and, near the junction with the lateral parts, forms a very sharp external edge, below which a slight depression is observable, which runs close to the external edge, on the lateral parts.

The shell is without sculpture, properly speaking. Only here and there faint falciform striæ of growth may be observed, which on the inner volutions are grouped together.

The sutural lines may be traced over the entire surface of the specimen. The external lobe is very broad, of medium depth and perfectly goniatitic. It is divided by a short rounded siphonal tubercle or saddle into two lateral branches, which are already situated on the lateral parts. They are sharply pointed, not denticulated. The external saddle is long with convergent sides rather narrowly rounded above. The first lateral lobe is rather longer than the external one. It is broader at its commencement than below and exhibits some four denticulations, which form a very prominent arch. The first lateral saddle is much broader, but slightly longer than the external one. It has also somewhat convergent sides, but is much more broadly rounded above than the external saddle. The second lateral lobe is much narrower and shorter than the first. It possesses some four denticulations along its base, which form a distinct arch. The second lateral saddle is very short and almost as broad as the first. It is distinctly flattened above. After this a distinct first auxiliary lobe with three denticulations may be observed, after which follow some undulations before the umbilical suture is reached. These latter ascend obliquely and form a kind of sutural saddle.

The dimensions of the single specimen extant are as follows:—

Diameter of the shell	.	.	.	.	.	.	.	.	.	48 mm.
„ of the umbilicus	.	.	.	.	.	.	.	.	.	12 „
Height of the last volution from the umbilical suture	.	.	.	.	.	.	.	.	.	22 „
„ „ „ „ from the preceding whorl	.	.	.	.	.	.	.	.	.	16 „
Thickness of the last volution	.	.	.	.	.	.	.	.	.	9 „

Locality and Geological Position.—Virgal, Lower Ceratite Limestone, one specimen.

Remarks.—This species is most remarkable on account of the goniatitic development of its external lobe. Even its position in the genus *Koninckites* might be questioned, because this character is of very frequent occurrence in the genus *Gyronites*, whilst in *Koninckites*, it is the only form which exhibits this peculiarity. Nevertheless I have left this species in the latter genus, because the development of the auxiliary series is typically that of *Koninckites*, and it would not well fit in with *Gyronites* or any other allied genera.

On the other hand, its relation to *K. Vercherei*, described below, is so close, that I must assume that they are evolutionally connected with each other.

Specifically *K. impressus* appears to be similar to several of the previously described forms, but on closer examination one soon finds that this similarity is an apparent or external one only, and that in reality no affinity exists between this species and other forms.

4. KONINCKITES VERCHEREI, Waagen n. gen. et sp. Pl. XXX,
fig. 1 a, b, c, d.

This is a large and very remarkable species, and is fortunately in an excellent state of preservation.

In general shape it is flatly discoidal with compressed whorls and an umbilicus which is rather narrow at first, but rapidly increases as the shell becomes larger. The involution of the shell is very inconsiderable, and the last whorl overlaps the preceding one to the extent of rather less than one-fourth of the entire height of the former.

The transverse section of the whorls is somewhat in the form of a blunt arrow-head. The lateral parts are very flatly convex, the greatest width being situated a little beyond the inner third of the entire height of the whorl. From this point the lateral parts slope very gently towards the umbilicus. The latter is surrounded by a comparatively high vertical, almost overhanging umbilical wall, which near the junction with the lateral parts forms a distinct umbilical edge. The sides slope towards the siphonal side more abruptly, but at the same time are only slightly convex. The external part of the shell is distinctly flattened, and near the junction with the lateral parts forms sharp external edges.

The shell is quite smooth, at least on the chambered part, which is the only portion of the shell which is known; the body-chamber is not preserved.

The sutural line is clearly visible on the greater part of the specimen. The external lobe is very broad, and rather long. It is divided into two lateral branches by a not very deep angular siphonal prominence. This lobe is denticulated from the margin of the external saddle to the siphuncle in the middle, and forms altogether an obliquely ascending line. The external saddle is broad, with parallel sides, and well rounded above. The first lateral lobe is somewhat longer than the external one. It possesses parallel sides and shows some four large denticulations below, which are arranged in an almost straight line. The first lateral saddle is much broader than the external one, but does not reach up much higher. It is very broadly and regularly rounded above. The second lateral lobe is very much smaller than the first, with some four denticulations below which form a low arch. The second lateral saddle is narrower than the first and is much shorter. It is distinctly flattened above. The first auxiliary lobe is very distinct, and also smaller than the second. It is followed by a small saddle and by two large denticulations which ascend obliquely, as in the preceding species, thus forming a kind of sutural saddle.

The specimen must have been of very considerable dimensions, but of the last volution only a fragment has been preserved, which suffices to show how enormously the umbilicus increased in size as the specimen attained larger dimensions. But even this fragment consists of air-chambers only, and there is no trace of body-chamber preserved. Exact measurements can only be taken of the inner volutions, which are as follows:—

Diameter of the shell	74 mm.
„ of the umbilicus	17 „
Height of the last volution from the umbilical suture	33 „
„ „ „ from the preceding whorl	25 „
Thickness of the last volution	16 „

Locality and Geological Position.—Kotela in the Trans-Indus Range (Rotta Roh of Verchère); Ceratite Marls most probably; one specimen found by Dr. Verchère.

Remarks.—Dr. Verchère identified this specimen with *Ceratites semipartitus*, Buch. Although a certain similarity between his specimen and von Buch's species cannot be denied, still this identification is quite erroneous, as in our species every trace of sculpture is absent.

The only species with which it might be compared is *K. impressus*. The general outline of both shells is perfectly identical, and the only fundamental difference rests in the external lobe, which is goniatic in the latter form, whilst it is ceratitic in the species under description. Other differences, as, for instance, the absence of depressions on the sides,—above the umbilical suture and below the external edge,—are of minor importance. They only demonstrate the fact that we have to deal with two different species, whilst their general similarity makes it highly probable that the two stand in some evolutionary relation to each other.

5. KONINCKITES GIGAS, Waagen n. gen. et. sp. Pl. XXXI,
fig. 2 a, b, c.

This species is founded on a small fragment of a specimen of very large size, but proper specific characters may be made out from it.

This species must have been large and discoidal with tolerably inflated whorls and wide umbilicus. The involution is very considerable and the overlap amounts to not much less than half the height of the last whorl.

The transverse section of the whorls possesses more or less the shape of a blunted arrow-head. The lateral parts are rather inflated, and the greatest transverse diameter is situated above the inner third of the height of the whorl. From this point the lateral parts bend in a curve to the umbilical suture, rather flat at first and more abrupt near the umbilicus; but there is neither a distinct umbilical wall nor trace of an umbilical edge to be seen. Towards the siphonal side the lateral parts are more flatly convex, and form near the junction with the somewhat flattened external part rather obtuse external margins. These margins are retained up to the very largest dimensions of the shell, and this forms one of the most striking characters of this species as compared with similar forms.

The fragment shows traces of radial sculpture, consisting of low, broad undulations, of which there may be seen about three on this fragment. They are most strongly developed on and below the middle of the lateral parts, whilst the exterior half of the whorl is almost entirely smooth.

The sutural line is somewhat obliterated by weathering, but it is sufficiently well preserved to be described in detail, and not only the exterior but also the interior part of this line may be traced.

The external lobe is very broad and tolerably deep. It is divided into two lateral branches by a moderately high siphonal tubercle. Each of the branches possesses five denticulations which form two groups,—one in the vicinity of the siphonal tubercle with two denticulations, and another adjoining the external saddle with three denticulations, but they are on different levels. The external saddle is neither very broad nor high. It has parallel sides and is well and symmetrically rounded above. The first lateral lobe is broad and deep. It is slightly contracted in the middle of its length and has some eight to ten denticulations below, which together form a strongly prominent arch. The first lateral saddle is broader than any of the other saddles and reaches also much higher up. Its sides are nearly parallel and it is obliquely rounded above. The second lateral lobe is not much narrower, but considerably shorter than the first. Its sides converge slightly downwards, and it possesses on its base some six or seven denticulations which form together a prominent arch. The second lateral saddle is narrower and much shorter than the first. It is skew-shaped in outline with the inner side vertical, and obliquely rounded above. The first auxiliary lobe is as broad as the second lateral, but much shorter. Its sides are parallel. It has four or five very large denticulations, which together form a flat arch. The first auxiliary saddle is narrower and much shorter than the second lateral. Sides parallel, symmetrically rounded above. The second auxiliary lobe, which is still very distinct, is much narrower and shorter than the first; has four denticulations on very unequal levels. The second auxiliary saddle very narrow, reaching higher up than the first. Narrow, symmetrically rounded above. Followed by some irregular denticulations which form together a small sutural lobe. Inside the umbilical suture are a number of variously sized denticulations, which are, however, not grouped into distinct and separate lobes and saddles. They are on very different levels, and are very difficult to describe in detail, but they are best seen in the drawing. The antisiphonal lobe is very long and narrow, and reaches down as far as does the first lateral, and terminates distinctly in two large points. On both sides of it there are interior saddles which reach up nearly as high as the external saddle. They are not very broad and are symmetrically rounded above.

The dimensions of the specimen are as follows:—

Diameter of the shell	(may have been about)	.	.	.	.	.	240 mm.
" of the umbilicus	( " " " " )	.	.	.	.	.	90 "
Height of the last volution from the umbilical suture	.	.	.	.	.	.	93 "
" " " " from the preceding whorl	.	.	.	.	.	.	57 "
Thickness of the last volution	.	.	.	.	.	.	53 "

The fragment is made up entirely of air-chambers, and as the septa are well apart from each other, we may assume that the specimen was not full-grown. Another fact, which is worthy of notice, is the unsymmetrical development of this fragment, a character which has not been shown in the drawing. One of the lateral parts is 5^{mm} narrower than the other, and thus it happens that on one side the disposition of the lobes is quite different from that on the other. The second auxiliary lobe has no denticulations on one side, whilst it is provided with four of them on the other. Also the second lateral lobe is shifted further down on the one than on the other side. The external lobe is, however, quite symmetrical.

Locality and Geological Position.—The species has been founded on a single fragment, which was obtained by Mr. Wynne at Choa. The rock in which the specimen is preserved leaves no doubt that it has come from the Ceratite Sandstone. Other specimens from the same locality point to the probability that it is the lower division of the Ceratite Sandstone which is exposed at that locality, and thus it seems most probable, that also this species forms part of the fauna contained in the lower part of this sub-division.

Remarks.—The position of this species in the group of *K. impressus* is not quite above doubt, and further proofs are required before the question can be decided definitely. If we compare this species with the one which preceeds it in the next older deposits, namely, *K. Vercherei*, we find that the differences are rather considerable. Although this species must also have attained very considerable dimensions, still the general shape of the shell is much more slender than that of *K. gigas*. The sutural line also differs, inasmuch as in *K. impressus* and *K. Vercherei* the last denticulations of the auxiliary series form a kind of sutural saddle, whilst in the former species no such saddle exists; although it must be admitted that the second auxiliary saddle reaches rather higher up than the first, thus affording a slight indication that also in this species the sutural saddle is foreshadowed.

Considering these differences, I felt doubtful whether *K. gigas* might not be a descendant of *K. Vercherei*, or whether it be of other ancestry. But there can be no doubt that this species is quite distinct from those described before.

Another form with which it might perhaps be compared, is *Aspidites Kingianus*, which is also a shell of considerable dimensions. The umbilicus appears, however, to be much larger in *Koninckites gigas*; the first auxiliary lobe is indistinctly bifid, and the remainder of the auxiliary series is quite different to that of the first named species.

III.—GROUP OF KONINCKITES VOLUTUS, W.

6. KONINCKITES VOLUTUS, Waagen n. gen. et. sp. Pl. XXVIII, fig. 1, fig. 2 a, b.

This is a very large species, on the whole not dissimilar to the preceding form, but it loses the external edges of the shell with age, which is not the case in *Koninckites gigas*.

It is largely discoid, with rather compressed whorls and a tolerably wide umbi-

licus. The involution of the shell is inconsiderable and the overlap of the last whorl over the preceding one amounts to about one-fourth of the entire height of the former.

The transverse section of the whorls varies somewhat in specimens of different age. In the young, up to a diameter of shell of about 70^{mm}, it is more or less lanceolate, with a flattened external side, whilst in larger specimens it becomes a very elongated oval with a rather narrow, rounded external part. The lateral parts of the whorls are very flatly arched, and the largest transverse diameter is shifted very far down in the direction of the umbilicus, so that it is situated at the upper limit of the inner fourth of the entire height of the whorls. From this highest point of elevation the lateral parts slope barely at all in the direction of the umbilicus. This latter is surrounded by a distinct, almost vertical, but considerably inflated, umbilical wall which passes into the lateral parts gradually, the umbilical edge being perfectly rounded. The lateral parts slope considerably, towards the siphonal side of the shell, but are at the same time only very slightly inflated. In young specimens distinct external edges are present, whilst in adult individuals the regularly rounded external part passes gradually into the lateral parts.

The sutural line can only be made out on the smaller of the two specimens which serve for description. The external lobe is broad and tolerably long. It is divided into two distinct lateral branches by a low siphonal tubercle or saddle. Each of the branches bears some four denticulations below. The external saddle is not very high, but is slightly phylloid, and regularly rounded above. The first lateral lobe is very much deeper than the external one. It is narrower at its commencement than at the base, where some eight denticulations may be counted, which form together a very strongly prominent arch. The first lateral saddle is also somewhat phylloid and is about as high as the external one, but it is slightly broader and regularly rounded above. The second lateral lobe is not quite so broad as the first, and is much shorter. It bears also some six denticulations below, which form a strongly prominent but oblique arch. The second lateral saddle is very small, but regularly rounded above. The first auxiliary lobe is not very distinct, owing to the fact that the next following saddle is so very small. Nevertheless it can be made out. It bears three distinct denticulations below. After this follow some four larger denticulations, all on about the same level, before reaching the umbilical suture.

In the larger specimen the sutural lines are very indistinct, but one can make out that they are very closely arranged. We may therefore conclude that this specimen is fully-grown but without the body-chamber.

The measurements of the two specimens, which can only be given accurately in the case of the smaller, as the last volution in the larger specimen is too much crushed, are as follows:—

	I.	II.
Diameter of the shell	55 mm.	(?) 201 mm.
„ of the umbilicus	17 „	(?) 60 „
Height of the last volution from the umbilical suture . . .	24 „	79 „
„ „ „ „ from the preceding whorl . . .	18 „	61 „
Thickness of the last volution	13 „	?

Locality and Geological Position.—The smaller specimen was found in the Ceratite Marls on the road from Vurcha to Oochali, and the larger one in the upper region of the Ceratite Marls at Amb.

Remarks.—This species is evidently most closely related to *Koninckites gigas*. The most striking difference between these two forms has already been mentioned; it consists in the circumstance, that the external edges are retained even in the full-grown individuals of *K. gigas* whilst in *K. volutus* they exist only in the young specimens. The umbilicus also is comparatively much larger in *K. gigas*, and the rate of involution is very much greater in the former than in the present shell.

7. KONINCKITES LYELLIANUS, Koninck sp. Pl. XXX, fig. 3 a, b, c.

1863. *Ceratites Lyellianus*, Koninck : Quart. Journ. Geol. Soc. Lond., Vol. XIX, page 12, pl. VI, fig. 1.

1863. *Ceratites Lyellianus*, Koninek : Fossiles Paléozoïques de l'Inde, page 10, pl. VI, fig. 1.

The general shape of this species is discoidal, with an umbilicus which increases in size as the shell increases in diameter, and with rather inflated whorls. The involution of the shell is very small and the overlap of the last whorl over the preceding one occupies scarcely one-fifth of the entire height of the former.

The transverse section of the whorls is elongate-oval, well-rounded everywhere. The lateral parts are flatly arched, whilst the greatest diameter of the shell is situated very low down, at the upper limit of the lower or inner fourth of the entire height of the whorl. From this highest point of elevation the lateral parts slope, but only slightly, towards the umbilicus. This latter is surrounded by a high and distinct umbilical wall, which is very strongly inflated, which, near the umbilical suture, even bends slightly inwards. The lateral parts pass gradually into the umbilical wall. They slope strongly towards the siphonal side of the shell, which is rather narrowly rounded.

The shell is perfectly smooth.

The sutural line is imperfectly known, being preserved only down to the first auxiliary lobe, whilst the remainder of the auxiliary series is invisible. Also in M. de Koninck's drawing this part of the sutural line is very indistinctly represented. As far as known the sutural line shows the following characters: the external lobe is broad but not very long. It is divided into two lateral branches by a short siphonal tubercle or saddle, and at the posterior extremity of these branches, is provided with irregular denticulations, of which there are about five on each branch. The external saddle is rather narrow and not very long. It possesses almost parallel sides and is symmetrically rounded above. The first lateral lobe is rather broad and long, reaching down lower than the external one. It possesses parallel sides and bears some six rather irregular denticulations, which form together a not very strongly prominent arch. The first lateral saddle is very broad and reaches up somewhat higher than the external one. It is very oblique in outline, and rather narrowly rounded

above. The second lateral lobe is very much narrower and shorter than the first one. Its sides are not quite parallel; it has five denticulations, which form together a flat, somewhat oblique arch. The second lateral saddle is broad and very short. It has parallel sides and is quite flattened above. At the same time, it is set somewhat obliquely and appears to have a tendency to assist in the formation of a sutural lobe. The same is apparently the case with all the auxiliary series, of which, however, only the first auxiliary lobe is known to me.

In his description of this species M. de Koninck mentions the presence of three lateral lobes, but my specimen shows most clearly that the lobe which follows after the second lateral saddle is already within the line of involution, and that thus this lobe can only be considered to be an auxiliary one. This lobe is short and very broad. Its sides are almost parallel and there are four large denticulations at the base which are arranged on the same level. After this lobe may be observed the commencement of a small saddle, but this is already indistinct. At another part of the specimen it seems that after the first auxiliary saddle there follow a larger denticulation, a distinct saddle, and then some smaller denticulations, which reach down to the umbilical suture.

Our specimen is smaller than Mons. de Koninck's type-specimen. That author estimates the probable diameter of his specimen at 120^{mm}, but according to my reconstruction of the figure it must have been 129^{mm}. The diameter of the umbilicus he gives as 40^{mm}, which seems to be correct. The measurements of our specimen are as follows:—

Diameter of the shell	91 mm.
„ of the umbilicus	24 „
Height of the last volution from the umbilical suture	41 „
„ „ „ „ „ from the preceding whorl	33 „
Thickness of the last volution	23 „

Locality and Geological Position.—Collected by Mr. Wynne at Choa in beds which most probably correspond to the lower region of the Ceratite sandstone.

Koninck does not indicate any special locality for his specimen.

Remarks.—This species may be most easily identified amongst all those described by M. de Koninck, on account of two characters which he indicates: a rounded external side and three distinct lobes on each of the lateral sides.

Among all the extensive material at my disposal, there was only a single, and this even not very well-preserved, specimen, which showed these characters combined, and thus I could not fail to identify it with Koninck's species.

The species is most closely related to *K. gigas*, and for some time I considered these two as forming one species, but after having found that the latter species always possesses external edges, even in its last stage of growth, whilst in *K. Lyellianus* they were absent even in moderate-sized specimens, I was obliged to distinguish them specifically.

I have now placed this form nearer to *K. volutus*, W., because this species also loses its external edges in later stages of growth. It is distinct from that species inasmuch as it is more involute and has its first auxiliary lobe much more distinctly developed.

IV.—ISOLATED SPECIES.

8. KONINCKITES DAVIDSONIANUS, Koninck sp. Pl. XXXIII, fig. 4 a, b, c, d.

1863. *Ceratites Davidsonianus*, Koninck : Quart. Journ. Geol. Soc. Lond., Vol. XIX, page 13, pl. VI, fig. 2.

1863. *Ceratites Davidsonianus*, Koninck : Fossiles Paléoz. de l'Inde, page 10, pl. VI, fig. 2.

I am not quite certain whether I have identified this species correctly, as M. de Koninck's figure is so unsatisfactory that it is barely possible to recognise the form from it.

In general shape it is flatly discoidal, with a narrow umbilicus and flattened whorls. The involution is moderate and the overlap of the last whorl over the preceding one occupies just one-third of the entire height of the former.

The transverse section of the whorls is elongate-oval with a flat external side. The lateral parts are evenly arched, and the greatest transverse diameter is situated very near the middle of the entire height of the whorls. From this highest point of elevation the sides slope very regularly and with a slight curve towards the umbilicus. This latter is surrounded by a distinct but very narrow umbilical wall, which, near the junction with the lateral parts, forms a sub-angular umbilical edge. The lateral parts slope towards the siphonal side in the same manner and their curve is equally flat. The external part is distinctly, but not quite, flat. Near the junction with the lateral parts they form distinct, but not sharp external edges.

What sculpture there is, is chiefly developed on the body-chamber, whilst the chambered part of the shell seems to be quite smooth. It consists of low, broad, radial folds, which are most strongly marked on and above the middle of the lateral parts, but disappear at a considerable distance below the external edges. It cannot be stated whether this sculpture is retained in an identical manner up to the very mouth of the shell, as in the specimen under description only a part of the body-chamber is preserved.

The external part remains always smooth. The sutural line is well seen on the specimen. The external lobe is extremely broad but very short. It is divided by a deep angular siphonal tubercle into two distinct lateral branches, which are situated partly on the external, partly on the lateral faces of the shell. They are provided with some four denticulations, which are arranged in an obliquely ascending line. The external saddle is very short, reaching no higher up than the siphonal tubercle in the external lobe. It possesses parallel sides, is not very broad and is symmetrically rounded above. The first lateral lobe is very long and tolerably broad. It has parallel sides and bears some six denticulations, which form together a not quite regular, but very strongly prominent arch. The first lateral saddle is broad, but reaches up barely higher than the external one. It possesses almost parallel sides, is somewhat flattened above, and at the same time distinctly obliquely, but flatly rounded. The second lateral lobe is very short and rather broad. Its sides converge somewhat towards the bottom, where it bears some five or six small denticulations, which form together a narrow but very

strongly prominent arch. The second lateral saddle is as broad as the first, but very short. Its top is flattened and appears almost biangular. The auxiliary series commences with a small first auxiliary lobe which is much shorter and narrower than the second lateral one, and bears three very distinct denticulations below. After this follows a small narrow saddle, and after this again three large equal denticulations, separated from each other by rather broad saddles. All these are on the same line.

The species does not seem to have attained large dimensions, and the specimen under description appears to have been full grown. Rather less than half of the last volution belongs to the body-chamber. The dimensions are as follows:—

Diameter of the shell	. . . . .	61 mm.
„ of the umbilicus	. . . . .	8 „
Height of the last volution from the umbilical suture	. . . . .	32 „
„ „ „ „ from the preceding whorl	. . . . .	21 „
Thickness of the last volution	. . . . .	14 „

Locality and Geological Position.—Chidroo in the Lower Ceratite Limestone; a single specimen found by myself. It is not known from what bed or locality M. de Koninck's specimen was derived.

Remarks.—This species is a very remarkable one, as it stands about midway between the genera *Koninckites* and *Aspidites*, and as all the species of the latter genus occur in more recent strata only, it is not improbable that our species is the ancestor of the genus *Aspidites*. I have, nevertheless, described it as a *Koninckites*, because the first auxiliary lobe, which is very broad in *Aspidites*, is very small in this case and provided with only three denticulations. The similarity with *Aspidites* consists chiefly in the development of the members of the auxiliary series, which with their numerous denticulations show many relations to the same parts of this genus.

K. Davidsonianus is very easily distinguishable from all the other species belonging to the genus *Koninckites* by its umbilicus, which is smaller than in any other form.

M. de Koninck's drawing is most unsatisfactory, as are all the plates contained in that paper. The small auxiliary lobe is not shown, though probably present in the specimen. I can understand this, as even my own artist, who is very experienced in such matters, had overlooked this lobe at first. The absence of this character in de Koninck's figure does not, therefore, prevent me identifying our specimen with that author's species, all other points being tolerably in accord.

9. KONINCKITES RADIATUS, Waagen n. gen. et sp. Pl. XXXII., fig. 2 a, b, c.

It is a strange fragment which I describe under this name; it represents evidently only the inner volutions of a large form, the full-grown state of which I am not acquainted with.

The general shape is flatly discoidal, with compressed whorls and a moderately

wide umbilicus. The involution is very inconsiderable and the overlap of the last whorl over the preceding one does not even occupy quite one-fourth of the entire height of the former.

The transverse section of the whorls is very much higher than broad, with very slightly inflated lateral parts. The greatest transverse diameter is situated at the upper limit of the inner fourth of the entire height of the whorl. From this highest point of elevation the lateral parts slope scarcely at all towards the umbilicus, and are at the same time very strongly flattened, so as to show barely any curve. The umbilicus is surrounded by a high vertical wall, which in joining the lateral parts forms an indistinct rounded umbilical edge. The lateral parts slope very distinctly towards the siphonal part and show at first a very flat curve, which, however, increases its bend as the external part is approached. This latter is very distinctly and rather narrowly rounded and passes gradually into the lateral parts.

The sculpture of the shell consists of rather marked, but not very numerous, broad radial folds, which commence as slight swellings at the umbilical edge, extend to about the middle of the lateral parts, where they make a slight curve backward, and disappear again a considerable distance within the external part of the whorls. The external part remains always quite smooth.

There are about ten or eleven such folds on one circuit.

The sutural line is distinctly visible on the specimen under description, and is very peculiar in its characters. The external lobe is rather long and, comparatively, not very broad. It is divided by a rather short median siphonal tubercle into two rather indistinct lateral branches. The whole space between is provided with denticulations of which one is placed just in the centre, so that the siphuncle passes beneath it. This character is, however, very fugitive and disappears, if the surface is only very slightly weathered. On the bottom of each lateral branch there are three denticulations, and a fourth is placed higher up, in the direction of the external saddle. This latter is long and narrow, and distinctly phylloid in shape. It is symmetrically and rather broadly rounded above. The first lateral lobe is the broadest and longest of all. It is narrower above than below where it has some nine to ten denticulations, which form together a very strongly prominent arch. The first lateral saddle is broader and longer than the external one. It is also slightly phylloid in shape, and rather broadly, but not quite symmetrically rounded above. The second lateral lobe is shorter and narrower than the first one. It is broader below than above, and has some seven denticulations which form together a flat pointed arch. Two of the denticulations are pushed far up, nearly to the middle of the height of the lateral parts of this lobe. The second lateral saddle is very much shorter and narrower than the first one. It is very strongly phylloid in shape, but rather narrowly rounded above. The first auxiliary lobe is very distinct, short, and comparatively broad, and very much broader below than above. It exhibits four large denticulations, which form together a very flat and oblique arch. The saddle which now follows is distinctly phylloid in shape, but very short and narrow.

After this there comes a single large denticulation, and near the umbilical suture, a small sutural lobe with two denticulations.

The dimensions of the only specimen of this species which is known to me are as follows:—

Diameter of the shell	.	.	.	.	.	.	.	.	.	49 mm.
„ of the umbilicus	.	.	.	.	.	.	.	.	.	14 „
Height of the last volution from the umbilical suture	.	.	.	.	.	.	.	.	.	21 „
„ „ „ „ from the preceding whorl	.	.	.	.	.	.	.	.	.	16 „
Thickness of the last volution	.	.	.	.	.	.	.	.	.	13 „

Locality and Geological Position.—The only specimen of this species was found by me at Amb in the middle region of the Ceratite-Sandstone, in the so-called Stachella-beds.

Remarks.—The present species is perfectly isolated, both as regards its geological position and its general configuration.

It is the most recent form belonging to the genus *Koninckites* which has come under my notice, and is apparently not connected with any other forms found in more ancient strata.

The sculpture of this species is also very peculiar, and is entirely restricted to this form only, which makes a distinction from other species easy at first sight. To this must be added the peculiarity of the sutural line, in which all the saddles are phylloid, a character that does not recur in such a degree in any other species.

Sub-family : GYRONITINÆ.

Genus : LECANITES, Mojsisovics.

The genus *Lecanites* was created by Mojsisovics in 1882 in his “Cephalopoden der Mediterranen Trias-Provinz,” and it had then already been recognised by him that the genus was also represented in the triassic beds of the Salt-Range.

The genus is characterised by a large umbilicus, and whorls, which only very slightly overlap each other. The shell is mostly quite smooth, and only in some forms a rather indistinct, never very prominent, radial sculpture is developed. The most characteristic feature of these forms consists in the sutural line, which is always perfectly goniatitic, and which is distinct from the sutural line of *Prolecanites* chiefly owing to the existence of a more or less large siphonal tubercle or saddle, by which the external lobe is divided into two lateral branches.

The length of the body-chamber does not seem to amount to more than one half of a volution, but the shape of the apertural margin is imperfectly known to me. It seems to have been somewhat falciform with a rather large, rounded external prominence.

Dr. v. Mojsisovics considered the genus to be the probable ancestor of the *Lytoceratidæ*, and if one looks only at the external shape, especially that of the

figure represented on Pl. XXXIX, fig. 4, where a distinct contraction of the shell is exhibited, one can understand how this author came to such a conclusion. The sutural line, however, does not furnish the slightest indication for supposing an affinity in that direction. The most ancient forms of *Monophyllites* which are known to us up to the present have distinctly phylloid saddles, while the lobes are of quite a different pattern. I do not wish to say, that I consider it as absolutely impossible that *Lecanites* and *Monophyllites* could be related, but we must await further proof before we can accept *Lecanites* as the ancestor of *Monophyllites*.

The genus *Lecanites* is well represented in the triassic beds of the Salt-range, and ranges throughout the middle beds, being absent only in the uppermost strata.

In spite of their indifferent preservation, we can distinguish several groups of forms, probably representing several stages of evolution.

I. *Lecanites gangeticus*, Kon. sp., is the representative of a group of smooth forms possessing perfectly rounded external parts. In the trias of the Salt-range, two species belonging to this group are found: the more ancient of the two, *L. gangeticus*, Kon., occurs in the Lower Ceratite Limestone, while the second, *L. planorbis*, W., is much more recent. Several links between these two forms must be wanting. The upper triassic species of Europe, *L. glaucus*, Must., is probably the most recent of this group.

II. *L. Psilogyrus*, W., is the type of a group of forms which is characterized by compressed whorls and distinctly flattened, biangular external sides. The species of greatest geological age in this group (the type) occurs in the lowest beds of the Lower Ceratite Limestone and has been found in this position in more than one locality. Another species, *Lecanites undatus*, W., occurs in the upper region of the Lower Ceratite Limestone.

III. *L. ophioneus*, W., represents a group, amongst which occur the oldest forms of the genus; the whorls show a distinct radial sculpture, and the external part shows in some specimens a flattened, biangular but rather indistinct zone, whilst in other cases (chiefly in adult specimens), it is perfectly rounded. The whorls are rather inflated, with a somewhat depressed transverse section. The group commences with *L. ophioneus*, W., which occurs in the upper region of the Ceratite Sandstone. The other species, *L. convolutus*, W., was found in the Upper Ceratite Limestone, and the group terminates with *L. laqueus*, W., in the Bivalve beds.

It is possible, but by no means certain, that this group may also be descended from *L. gangeticus*, Kon. sp.

IV. Lastly, an isolated species occurs in the Lower Ceratite Limestone. This form has inflated whorls and a biangular crest on the external part.

The classification of the species belonging to the genus *Lecanites* is therefore as follows:—

I. Group of *LECANITES GANGETICUS*, Kon. sp.

1. *Lecanites gangeticus*, Kon. sp.: Lower Ceratite Limestone.
2. „ *planorbis*, W.: Bivalve layers.

II. Group of *LECANITES PSILOGYRUS*, W.3. *Lecanites psilogyrus*, W. : Lower Ceratite Limestone, lowest beds.4. „ *undatus*, W. : Lower Ceratite Limestone, upper beds.III. Group of *LECANITES OPHIONEUS*, W.5. *Lecanites ophioneus*, W. : Ceratite Sandstone, upper region.6. „ *convolutus*, W. : Upper Ceratite Limestone.7. „ *laqueus*, W. : Bivalve layers.

IV. ISOLATED SPECIES.

8. *Lecanites impressus*, W. : Lower Ceratite Limestone.

It is apparent from the foregoing that the genus is chiefly represented in the Lower Ceratite Limestone, in which we know of the occurrence of four species. In the two following divisions, the genus is represented by only one species in each division, while in the Bivalve beds, two species occur.

In Europe only a single species belonging to this genus has been found, and this occurs in beds of the lowest division of the Upper Trias, corresponding probably with the Lower Trias of the Salt-range.

I. GROUP OF *LECANITES GANGETICUS*, Kon. sp.1. *LECANITES GANGETICUS*, Koninck sp. : Pl. XXXIX, fig. 4 a, b, c.1863. *Goniatites gangeticus*, Koninck : Quart. Journ. Geol. Soc. Lond., Vol. XIX, page 14, pl. V, fig. 2.1863. *Goniatites gangeticus*, Koninck : Foss. paléozoïques de l'Inde, page 7, pl. V, fig. 2.1882. *Lecanites gangeticus* (Kon. sp.) Mojsisovics : Cephalop. d. Mediterranen Trias—Provinz, page 200.

None of my specimens correspond entirely either with Koninck's figure or description. I believe, however, that these figures are incorrect. I have ventured to identify the specimen represented on Pl. XXXIX, fig. 4, with M. de Koninck's species.

The specimen from which I describe this species, is in general shape more or less thickly discoid, with large umbilicus and perfectly rounded whorls. The involution is inconsiderable, and the overlap of the last whorl over the preceding one occupies about one-sixth of the height of the former.

The transverse section of the whorls is an oval, with somewhat flattened sides. The greatest transverse diameter of the whorls occurs slightly above the upper limit of the lower third of their height. From this point the lateral parts descend in a very flat curve towards the umbilicus, where they are suddenly bent inwards to meet the umbilical suture, thus forming a kind of indistinct umbilical wall. The sides slope more decidedly towards the siphonal side. The external part is broadly rounded and passes gradually into the lateral parts.

Shell perfectly smooth, with the exception of a somewhat sigmoidal contraction.

The sutural line is very characteristic. The external lobe is moderately deep and rather broad. It is divided in the centre by a siphonal tubercle, or saddle, into

two separate branches, which are sharply pointed below. The external saddle reaches considerably higher up than the siphonal tubercle. It is broader at the base than above, where it is symmetrically rounded. The first lateral lobe is deeper than the external lobe, is of conical shape, and much broader at its commencement than at its base. It is narrowly rounded below and shows no trace of denticulations. The first lateral saddle is very broad and much higher than the external one. Its sides are strongly convergent towards the top, which is rounded. The second lateral lobe is of much the same breadth, but is considerably shorter than the first. Its sides converge rapidly towards its base, where it is rather more broadly rounded than the first lateral lobe; it shows no denticulations. The second lateral saddle is small and short, somewhat flattened above. It is followed by a small and indistinct auxiliary lobe and a low saddle which reaches down to the umbilical suture.

The specimen consists of septa only.

The measurements of the specimen are as follow :

Diameter of the shell	42 mm.
" of the umbilicus	17 "
Height of the last volution from the umbilical suture	15 "
" " " " " from the preceding whorl	12 "
Thickness of the last volution	10 "

Locality and Geological Position.—The single specimen of this species was found by Dr. Warth near Vurcha, but its exact locality is not known. Judging from the rock, it can only have been derived from the Lower Ceratite Limestone.

It is also unknown from which locality or bed M. de Koninck's specimen was obtained.

Remarks.—Our specimen agrees fairly well with M. de Koninck's figure and description, but there are some differences which point to the possibility that the latter specimen may have come from a more recent bed than the one described here.

Koninck's figure shows a specimen with more compressed and higher whorls, and with somewhat smaller umbilicus. In all these characters it approaches *L. planorbis*, W., which will be described next in order. It may have been a transitional form between *L. Gangeticus*, from the Lower Ceratite Limestone, and *L. planorbis*, from the Bivalve beds.

Both de Koninck's specimen and mine resemble *L. glaucus*, Must. sp. 1, but the latter possesses more compressed whorls and shorter lobes than the Salt-range form.

In this respect the following form is much more nearly related to Count Munster's species than this one.

2. LECANITES PLANORBIS, Waagen n. sp. Pl. XXXIX, fig. 3 a, b, c.

As the name implies, this species has compressed whorls and a tolerably large umbilicus. The involution is small, and the overlap of the last whorl over the preceding one occupies not more than one-eighth of the entire height of the former.

The cross section of the whorls is oval, their height being about twice their breadth. The lateral parts of the shell are very slightly inflated, and the greatest transverse diameter of the whorls occurs a little below the middle of their height.

From this point they slope gently down to the umbilical suture. The curve being very slight throughout, there is no umbilical wall. The sides slope also very gently towards, and pass gradually into, the siphonal part, which is narrow and rounded.

This shell seems to have been quite smooth; only in a few places barely perceptible traces of very faint radial undulations may be seen.

The body-chamber is almost entire, but the apertural margin is broken. The length of the former is exactly half a volution; the latter seems to have been falci-form with a projecting rounded tongue on the external side.

The sutural line is very well preserved. The external lobe is very short and broad, and is divided into two branches by a siphonal tubercle or saddle, which reaches close up to the commencement of the lobe; these branches are conical in shape, being narrow and rounded below. The external saddle is only very slightly higher than the siphonal tubercle. It is not very broad, with sides converging towards its apex, which is narrow and somewhat obliquely rounded. First lateral lobe very broad, and rather short. Sides markedly converging towards the base, which is broad and evenly rounded, without trace of denticulations. First lateral saddle slightly broader than the external one and barely higher. Sides markedly converging towards the top, which is somewhat flatly rounded. Second lateral lobe very much narrower and shorter than the first. Its external wall slopes, while the internal wall is nearly vertical. It is narrow but regularly rounded below. There is no distinct second lateral saddle developed, but the sutural line runs from the upper end of the second lateral lobe in an almost straight line to the umbilical suture.

The specimen is an internal cast without any trace of the shell. Its dimensions are as follows:—

Diameter of the shell	53 mm.
„ of the umbilicus	18 „
Height of the last volution from the umbilical suture	20 „
„ „ „ „ „ from the preceding whorl	17 „
Thickness of the last volution	9 „

Locality and Geological Position.—I found this single specimen at Chitroo in a light yellow, soft sandstone, which forms part of the Bivalve beds of the Ceratite formation.

Remarks.—This species may be easily distinguished from the preceding form and also from *L. Gangeticus*, as figured by de Koninck, by its more compressed whorls.

It is more difficult to distinguish our species from *L. glaucus*, Must. sp., which occurs in the Upper Trias of Europe. They are very much alike, the only points of difference being that the latter species is less involute, with correspondingly smaller umbilicus, while the sutural line possesses a distinct second lateral saddle and even a small auxiliary lobe, which are absent in our form. They also differ greatly in size. *L. planorbis* is probably the more ancient of the two forms, and *L. glaucus* should therefore be looked upon as the most recent member of the genus *Lecanites*.

II. GROUP OF LECANITES PSILOGYRUS, W.

3. LECANITES PSILOGYRUS, Waagen n. sp. Pl. XXXIX, fig. 5 a, b, c, d.

This species seems to be common in the lower deposits of the Lower Ceratite Limestone. It can only be distinguished with great difficulty from *Gyronites frequens*, which occurs in the same geological horizon, and it requires very close observation and well preserved specimens to distinguish its characters.

It is discoidal, with large umbilicus. Involution very small, and overlap of the last whorl over the preceding one not more than one-ninth of the height of the former.

The cross section of the whorls is an elongated ellipse with a flat external side. The lateral parts are only slightly arched, and the greatest transverse diameter of the whorls occurs at the upper limit of the lower third of their height. From this point the sides slope gently towards the umbilicus, on approaching which they rather suddenly bend down to the umbilical suture, forming thus an undefined rounded umbilical wall without an umbilical edge. The lateral parts slope towards the siphonal side somewhat more suddenly, but are only slightly arched. The external side is flattened, and passes gradually into the lateral parts without forming sharp external edges.

The surface is perfectly smooth. The sutural line is very simple and well preserved. The external lobe is very short and broad, and is divided into two lateral branches by a broad siphonal tubercle or saddle. These branches are sharply pointed, and are already situated on the lateral parts of the specimen. The external saddle is broad, short, and evenly rounded above. The first lateral lobe is very deep, and broad at its commencement; it has convergent sides and is narrowly rounded below, but without a trace of denticulations. The first lateral saddle reaches up very little higher than the external one, and is also somewhat broader with steeply sloping sides, and evenly rounded above. The second lateral lobe is also very short and narrow. It possesses convergent sides and is rounded below without being denticulated. The second lateral saddle is only slightly indicated as a shallow undulation, after which the sutural line descends in a straight line down to the umbilical suture.

The specimen is made up of septa only.

The dimensions of the specimen are as follows:—

Diameter of the shell	. . . . .	42	mm.
„ of the umbilicus	. . . . .	16	„
Height of the last volution from the umbilical suture	. . . . .	15.5	„
„ „ „ „ from the preceding whorl	. . . . .	13.57	„
Thickness of the last volution	. . . . .	8	„

Locality and Geological Position.—Khoora; in the lowest beds of the Lower Ceratite Limestone together with *Gyronites frequens*. Number of specimens, 4.

Remarks.—It may be distinguished from other species of *Lecanites* without much difficulty by the flatness of its external side.

It is more difficult to distinguish it from *Gyronites frequens*, with which it is

identical in general shape; the difference consists only in the sutural lines. In our specimen the lobes are entire, whilst in *Gyronites frequens* they are provided with denticulations. For this distinction however well preserved specimens are required.

4. *LECANITES UNDATUS*, Waagen n. sp. Pl. XXXVIII, fig. 1 a, b, c.
fig. 2 a, b, c.

This species is discoidal with compressed whorls and large umbilicus. The involution is very slight, though greater than in the species last described. The overlap of the last whorl over the preceding one amounts to about one-fourth of the height of the former.

The cross section of the whorls is more or less lanceolate, with a flat external part. The lateral parts of the shell are arched, and the largest transverse diameter is situated slightly below the middle of the height of the whorls. From this point the lateral parts slope in a gentle and regular curve towards the umbilicus, and bending down almost at right angles to the umbilical suture, form an indistinct, rounded umbilical wall. They also slope gently towards the siphonal side, which is distinctly flattened; the junction is marked by sharp external edges.

The shell is perfectly smooth up to a diameter of about 25mm., after which is developed sculpture, consisting of broad radial undulations, which are absolutely straight. There are about 15 such folds on one circuit, showing first just above the umbilical margin, and dying out again on, or a little beyond, the middle of the lateral parts. They are present both on the body-chamber and on the inner whorls of the specimen.

As neither of the specimens shows an entire body-chamber, we are unable to describe the apertural margin.

The sutures are well preserved in both specimens. The external lobe is short and broad, divided into two lateral branches by a low rounded siphonal tubercle or saddle, which is so broad that the branches have been pushed on to the lateral parts; they are not very deep, but are sharply pointed below. The external saddle is short and not very broad, but it is considerably higher than the siphonal tubercle; it is evenly rounded above. The first lateral lobe is very deep but not broad; it is much lower than the external lobe, and its sides converge slightly towards the base. It is usually narrowly rounded below, without trace of denticulations, but in some instances the sutural lines look as if a very fine and irregular incipient denticulation were present. The first lateral saddle is the most prominent part of the whole sutural line. It reaches very much higher up than the external saddle, and is broader than the first lateral lobe. It is broadly, and somewhat obliquely, rounded above. The second lateral lobe is very short and narrow. It is not so deep as the external lobe, possesses somewhat convergent sides, and is narrowly rounded below; it has not the slightest trace of denticulations. The second lateral saddle is very low, but stands on a somewhat higher level than the external saddle. It is followed by a broad, shallow, irregular and small lobe, which reaches down to the umbilical suture.

The dimensions of the more complete of the two specimens are as follows:—

Diameter of the shell	.	.	.	.	.	.	.	.	.	52 mm.
" of the umbilicus	.	.	.	.	.	.	.	.	.	18 "
Height of the last volution from the umbilical suture	.	.	.	.	.	.	.	.	.	19 "
" " " " from the preceding whorl	.	.	.	.	.	.	.	.	.	15 "
Thickness of the last volution	.	.	.	.	.	.	.	.	.	10 "

Locality and Geological Position.—In the hills east of Katwahee (one complete specimen) and at Kafir Kote (one fragmentary specimen), both in the Lower Ceratite Limestone.

Remarks.—This species demonstrates the intimate connection between the genera *Lecanites* and *Gyronites*; only the first lateral lobe exhibits sometimes a fine denticulation, which never occurs on the second lateral lobe. I believe therefore that I am justified in assuming that the genus *Gyronites* marks a stage in the further development of the genus *Lecanites*.

III. GROUP OF LECANITES OPHIONEUS, W.

5. LECANITES OPHIONEUS, Waagen n. sp. Pl. XXXVIII, fig. 12 a, b.

This species is a very characteristic one, and is represented by a well preserved specimen.

In general shape it is more or less discoidal, with rather inflated whorls and large umbilicus. The involution of the shell is very slight and the overlap of the last whorl over the preceding one amounts to about one-sixth of the height of the former.

The cross section of the whorls is oval, considerably higher than broad. The lateral parts are evenly arched and the greatest transverse diameter is situated not much below the middle of the height of the whorl. From this point the lateral parts slope in a barely perceptible curve towards the umbilicus, and shortly before reaching the latter, they bend down more suddenly to the umbilical suture. The umbilical wall, if it may be so called, is not well defined from the lateral parts. The sides form a more marked curve towards the siphonal side, into which they pass gradually; the external side is broadly and evenly rounded.

The ornamentation of the shell is faint but characteristic. It consists of numerous radial ribs, which are almost quite straight. They begin a short distance from the umbilical suture and extend close to the external part of the shell, without, however, crossing it at any point. They are not all equally marked, but frequently less distinct ribs are intercalated. This irregularity is chiefly developed on the last volution, part of which belongs to the body-chamber, whilst on the inner whorls the ribbing is much more regular. The innermost volutions, up to a diameter of the shell of about 8^{mm}, are quite smooth. So long as the ribbing is regular there are about 17 such on one circuit. After this the number is uncertain.

The sutural line is well preserved on this specimen. The external lobe is broad and short and divided in the middle by a rounded but not very high siphonal tubercle, thus forming two lateral branches. These latter are shallow, not very

broad and not pointed below, but narrowly rounded, and without denticulations. The external saddle is narrow, and not much higher than the siphonal tubercle. It is rather narrowly, but evenly rounded above. The first lateral lobe is considerably deeper than the external lobe. It is very broad at its commencement and much narrower below, where it is broadly and evenly rounded, without a trace of denticulations. The first lateral saddle is about as broad as the preceding lobe, and is only very little higher than the external saddle. It is broadly and evenly rounded above. The second lateral lobe is less deep and narrower than the first one. Its sides converge downwards, where it is narrowly and evenly rounded. The second lateral saddle is only slightly indicated; it is very small. After this the sutural line descends somewhat, and passes down in a straight line to the umbilical suture.

The dimensions of the figured specimen are as follows:—

Diameter of the shell	. . . . .	48 mm.
„ of the umbilicus	. . . . .	19 „
Height of the last volution from the umbilical suture	. . . . .	17 „
„ „ from the preceding whorl	. . . . .	14 „
Thickness of the last volution	. . . . .	11 „

Locality and Geological Position.—Chidroo; in beds which correspond most probably with the upper region of the Ceratite Sandstone, as developed at other localities. Number of specimens, one.

Remarks.—The group of forms, to which the present species belongs, is a very remarkable one, as its generic position may be questioned in several ways. The perfectly goniatitic sutural line and the tendency to form external edges on the whorls, which show more clearly on the two following species than in this one, make a close relation to *Lecanites* and *Gyronites* most probable, whilst in general form and sculpture of the shell it is almost identical with the forms which Mojsisovics has comprised under his “*Ceratites obsoleti*” for which group he has quite recently created the name of *Danubites*.

The *Ceratites obsoleti* appear to me to be a rather unfortunate group. At first my genus *Xenodiscus*, and afterwards the group of *Celtites Floriani*, Mojs., were placed in it. Of *Xenodiscus* I have shown that, if the typical species of this genus has to be transferred to the *Trachyostraca*, which may probably be correct, it shows much more affinity to *Celtites* than to *Ceratites*, and that *Xenodiscus* most likely will have to be considered the descendant of *Paraceltites*, Gemm. With regard to the group of *Celtites Floriani*, I can only state that all the forms which occur in the Salt-range, and which are more or less closely related to *Celtites Floriani*, possess a body-chamber of at least one volution in length, and that thus there can be no question of uniting them with the genus *Ceratites*.

The group of the *Ceratites obsoleti* would therefore have to be restricted to the species which Mojsisovics described in his “*Arktische Triasfaunen*,” but it must be confessed that these show a striking similarity to certain forms of *Lecanites* and *Gyronites* in which the external edges are not developed. It needs only a comparison of *Ceratites multiplicatus*, M., with our *Lecanites ophioneus* to be convinced of the extreme similarity. The sculpture is similarly irregular in both forms, but is

6. **LECANITES CONVOLUTUS**, Waagen n. sp. Pl. XXXVII, fig. 10 a, b, c.

The cross section of the whorls is oval, with a flattened external side. The lateral parts are arched, and the largest transverse diameter of the whorls is situated only a short distance below the middle of their height. From this point they slope gently towards the umbilicus; the curve increases slightly in the immediate vicinity of the umbilical suture. The curve towards the siphonal side is similar; the external part of the shell is distinctly flattened, but nevertheless the external margins which are formed, are barely perceptible. And it is probable that in larger specimens no margins remain.

The sutural line is well preserved. The external lobe is not broad, but very short. An angular siphonal tubercle or saddle divides it into two short lateral branches which end in a sharp point below on the obtuse external edge of the whorl. The external saddle is narrow and short, and reaches up very little higher than the siphonal tubercle ; it is evenly rounded above. The first lateral lobe is broad, but not very deep. Sides slightly convergent downwards ; below, narrowly and evenly rounded. The first lateral saddle is much broader than the preceding lobe. It reaches only a little higher up than the external saddle, and is broadly and evenly rounded above. The second lateral lobe is very small, with convergent sides, and is narrowly rounded below. The second lateral saddle is already indistinct. It is very short and broadly rounded above. After this the sutural line descends again and disappears below the umbilical suture.

Diameter of the shell	. . . . .	23 mm.
„ of the umbilicus	. . . . .	10 „
Height of the last volution from the umbilical suture	. . . . .	8 „
„ „ „ „ from the preceding whorl	. . . . .	6.5 „
Thickness of the last volution	. . . . .	5 „

Locality and Geological Position.—Chidroo; Upper Ceratite Limestone. A single specimen.

Remarks.—This species is very closely related to the preceding one, but may be distinguished by its radial folds, which are less numerous and more restricted to the umbilical region; and as this specimen was found in younger strata, it is most probable that it forms a different link in the same chain of evolution.

It appears unnecessary to compare it with the *Ceratites obsoleti*, as the external edges make a distinction easy.

7. *LECANITES LAQUEUS*, Waagen n. sp. Pl. XXXVIII, fig. 9 a, b, 10.

This species seems to have attained rather large dimensions and is probably the largest form belonging to the genus *Lecanites*.

We possess several specimens of this species, but their preservation is for the greater part rather unsatisfactory. All of them are internal casts, composed of septa only, and they are mostly crushed. In general outline they are discoidal, with compressed whorls and large umbilicus. The involution is not considerable and the overlap of the last whorl over the preceding one amounts to exactly one-fifth of the height of the former.

The cross section of the whorls is oval, with a somewhat narrow external side. The lateral parts are flatly arched, and the greatest transverse diameter is situated within the lower third of the height of the volution, that is to say, not far above the umbilicus. From that point they bend rather rapidly down to the umbilical suture. On the other hand, the lateral parts slope gradually, and with a flat curve, towards the siphonal side. The external part is very slightly flattened, or rather, is narrowly rounded, and passes into the sides, forming very obtuse and indistinct external edges. This is still the case in specimens with a diameter of 40 to 50 mm. In still larger specimens not a trace of the flattening or of the edges remains.

The ornamentation consists of low radial ribs, which become less distinct and more irregular, the larger the specimens grow, and it is not improbable that full-grown specimens are quite smooth. The radial folds are well marked from near the umbilicus up to the middle of the lateral parts. They then become fainter and disappear before reaching the outer margin of the shell. The folds are almost quite straight; but on approaching the outer margin sometimes appear to have a tendency to bend slightly forward.

The sutural line is not well preserved. The external lobe is short and very broad, and divided into two lateral branches by a broad and low siphonal tubercle. The branches do not seem to have been sharply pointed below, but rather narrowly rounded. The external saddle is of moderate breadth, low and evenly rounded above. The first lateral lobe is considerably deeper than the external lobe. Its sides converge downwards, and it is rather narrowly and regularly rounded below. I have not been able to detect any denticulation on this lobe in any of the specimens. The first lateral saddle is the broadest of all the members of this sutural line. It is at the same time very little higher than the external saddle, only it is depressed and

flattened above, and on the whole broadly rounded. The second lateral lobe is very small, with convergent sides, narrowly rounded below, and without trace of denticulation so far as can be seen. The second lateral saddle is very small and low, sides sloping and slightly depressed above. After this there follows a faint indication of a small lobe, after which the sutural line continues with a barely perceptible depression in an almost straight line to the umbilical suture.

The dimensions of the only tolerably complete specimen are as follows:—

Diameter of the shell	. . . . .	45 mm.
„ of the umbilicus	. . . . .	19 „
Height of the last volution from the umbilical suture	. . . . .	16 „
„ „ „ „ from the preceding whorl	. . . . .	13 „
Thickness of the last volution	. . . . .	9.5 „

The largest fragment of this species may have belonged to a specimen of about 65 to 70 mm. diameter; it is also composed of septa only.

Locality and Geological Position.—Chidroo; in a yellow calcareous sandstone much weathered, above the Upper Ceratite Limestone, beyond doubt part of the group of the Bivalve beds. Fragments of five specimens, of which only one is tolerably well preserved.

Remarks.—This species is very closely related to *L. ophioneus* described above, and may be chiefly distinguished from it by a difference in the cross section of the whorls, of which the largest transverse diameter occurs quite close to the umbilicus, and also by a slight flattening of the external part, which characteristic is maintained in this species up to a diameter at which this feature has altogether disappeared in *L. ophioneus*. In this respect this species resembles more closely *L. convolutus*, but differs from it in all other respects. In cross section, this species somewhat resembles *Ceratites fissiplicatus*, Mojs., but the latter shows finer radial sculpture with ribs distinctly curved, and the lobes in the sutural line are provided with a fine denticulation. The similarity seems therefore to be an external one only.

Ceratites hyperboreas, Mojs., which possesses perfectly goniatitic lobes, also shows a certain resemblance to *L. laqueus*, but its whorls are thicker and more depressed.

IV. ISOLATED SPECIES.

8. *LECANITES IMPRESSUS*, Waagen n. sp. Pl. XXXVII, fig. 7 a, b, 8 a, b.

Its general shape is broadly discoidal, with a rather large umbilicus, and somewhat inflated whorls. The involution of the shell is inconsiderable, and the overlap of the last whorl over the preceding one amounts to one-fourth of the height of the latter.

The cross section of the whorls is somewhat lanceolate, with a flattened external side. The lateral parts are well arched and the greatest transverse diameter of the whorls is situated at the upper limit of the lower third of their height. From

this point the lateral parts slope very gently towards the umbilicus, but a short distance before reaching its immediate vicinity, they rather suddenly bend down to meet the umbilical suture. In this manner a very high and distinct umbilical wall is formed, which passes, however, into the lateral parts without forming an umbilical edge. The lateral parts slope considerably towards the siphonal side, forming a low but distinct arch. Before reaching the external edge the curve flattens rapidly and the shell even bends outwards a little, thus forming a shallow depression which runs all along the external edges, on the lateral parts. The external part is quite flattened and bordered on both sides by sharp external edges, which have a slight lateral projection. The shell is quite smooth.

The sutural line is rather badly preserved on both specimens, which are much weathered. But it seems to be extremely simple. The external lobe is not seen, but it appears to have been very short and broad, with broad lateral branches which were rounded below, and which are already situated on the lateral parts. The external saddle is very broad and short, with steeply sloping sides, and evenly rounded above. The first lateral lobe is very broad, and reaches apparently somewhat lower down than the external one. Its sides converge rapidly downwards to its base, which is broadly rounded without trace of denticulations so far as can be seen. The first lateral saddle is about as broad as the external one, but is perhaps a little higher, and is broadly and regularly rounded above. The second lateral lobe is much narrower than the first, but is quite as deep. Its sides converge, and it is narrowly rounded below, without a trace of denticulations. This is followed by a low wavy line, which corresponds to a second lateral saddle, and a rounded depression, which reaches down to the umbilical suture.

Both specimens consist of septa only.

The dimensions of the two specimens under description are as follow :—

	I.	II.
Diameter of the shell	60 mm.	50 mm.
„ of the umbilicus	20 „	18 „
Height of the last volution from the umbilical suture	25 „	20 „
„ „ „ „ from the preceding whorl	19 „	15 „
Thickness of the last volution	15 „	12 „

In these measurements the thickness of the last volution is conjectural, as both specimens are firmly embedded in the matrix, which makes direct measurement impossible.

Locality and Geological Position.—Hills east of Kutna in the Lower Ceratite Limestone; number of specimens, 2.

Remarks.—This species seems to be closely related to *L. psilogyrus*, W., above described, and both occur in about the same geological horizon. The latter species, however, is much thinner and much less involute, not to speak of the distinct spiral impressions which run along the external edges of *L. impressus*.

I think, therefore, that the two species may be easily distinguished, notwithstanding that both possess quite smooth shells.

Genus GYRONITES, Waagen n. gen.

1879. *Xenodiscus*, Waagen (pars) : This work Vol. I, page 33.

1892. *Gyronites*, Waagen : Rec. Geol. Surv. Ind., Vol. XXV, page 183.

1892. *Gyronites*, Waagen : Jahrb. W. W. Geol. Reichsanst., Vol. XLII, page 379.

I have already on several occasions referred to this genus, which I unfortunately misunderstood, thus causing much confusion. Only after making these fossils my special study was I able to correct my error; while Mojsisovics and others who followed me fell into the same mistakes. I must admit, however, that it was Mojsisovics who was the first to discover that several different forms had been included in my genus *Xenodiscus*, and that at least the first species, *X. plicatus*, must be removed from it and transferred to the *Trachyostraca*. He was also the first to recognise that at least part of the Siberian species which he had placed into my genus *Xenodiscus*, were really closely related to *Meekoceras*, but nevertheless this learned author included several forms erroneously in my genus.

From what has been said in this work with reference to my genus *Xenodiscus*, it appears that the following distinction should be made among the species which were formerly placed in it by myself:—

1. *XENODISCUS*, W., the first and typical species *X. plicatus*, W., belongs to the family *Tropitidæ*, of the sub-order *Trachyostraca*. It forms an intermediate link between the genus *Paraceltites* Gemmellaro, of the lower Permian, and the genus *Celtites*, Mojs., of the lower and middle Trias.

2. *XENASPIS*, W. n. gen. The second species referred by me to the genus *Xenodiscus*, *X. carbonarius*, W., belongs to the sub-order *Leiostraca*, and forms the type of a new genus for which I have introduced the above name in this work. It must be placed into the family *Ptychitidæ*, sub-family *Gymnitinæ*, and is the representative of the genus *Gymnites* in Permian times. The affinity which exists between the two genera had already been recognized by Mojsisovics. The most striking characteristic which it possesses in common with *Gymnites* is that it attains a well-developed radial sculpture only in the full-grown state. Whether this genus is represented in triassic beds remains very doubtful up to the present. It appears more probable that a form intermediate between *Xenaspis* and *Gymnites* will be found in beds corresponding in age to the Bunter Sandstein of Europe.

3. *Gyronites*, W. n. gen. This name will comprise all triassic forms which I had formerly included in the genus *Xenodiscus*. They appear to possess quite different relationships to the two preceding genera, and are most nearly related to *Meekoceras* which had already been recognized by Mojsisovics, or, still more closely, to *Lecanites*, as will be shown presently.

After having shown that the forms, which I formerly included under *Xenodiscus* must now be distributed among not less than three genera, each of which belongs to a quite different group of Ammonoids, I may proceed to give a special description of the last-named of these three genera.

The forms which belong to the genus *Gyronites* are generally of a moderate size, though some of them seem to attain to larger dimensions. The whorls are,

laterally, always more or less compressed, and the umbilicus large. The sculpture of the shell is never very marked, but is confined to simple, almost straight radial folds, whilst in the greatest number of cases, the shell remains quite smooth. The body-chamber seems to have attained the length of one-half of a volution or very slightly more, but the shape of the apertural margin is not exactly known.

The sutural line is very simple. The external lobe is broad, divided into two lateral branches by a large siphonal tubercle or saddle, which is only very exceptionally indented in the centre by a small fold. The lateral branches are mostly goniatic, without denticulations. There are always two lateral lobes present, generally both denticulated, whilst the second lateral lobe is very seldom without denticulations. The auxiliary series does not form distinct auxiliary lobes. It is either provided with small denticulations or is quite goniatic. If denticulations are present, they do not form straight lines as in the genus *Prionolobus*.

The genus *Gyronites* is so very closely related to the genus *Lecanites*, Mojs., that in reality the distinction becomes perfectly arbitrary. It has just been stated that in most species of the first of the two genera the external lobe is goniatic, as regards its lateral branches, as also is the auxiliary series. To these must be added in some cases, the second lateral lobe, and there remains only the first lateral lobe which always bears denticulations, which, however, may easily be overlooked. On glancing at the figures of *G. frequens* represented on Pl. XXXVII, it will be apparent that only the enlarged figures of the sutural lines show these denticulations, which are too small to be represented in the drawings of natural size. Hence we see that the transitions from *Lecanites* to *Gyronites* are very gradual, and it is only because it seems to me rather awkward to include, in one and the same genus, forms with goniatic, and others with perfectly ceratitic sutural lines, that I feel obliged to create a new generic designation for the latter.

Another genus which is also very closely allied to *Gyronites* is *Meekoceras*. The shells belonging to this latter genus have, as a rule, a considerably smaller umbilicus, and where this is the case, a distinction is not very difficult, but in dealing with forms of *Meekoceras* with large umbilici, the distinction is not easy. In such cases, only the condition of the sutural lines can furnish characters for diagnosis. In *Gyronites* the goniatic characters predominate, so that the denticulations which give to the lobes their ceratitic aspect, may very easily be overlooked. The lateral branches of the external lobe, if they are not entirely angular, bear at the extremity adjoining the external saddle, two, or at most, three small denticulations, whilst in similar forms of *Meekoceras* the entire distal end of the external lobe is set with more or less large denticulations. In all the other lobes of *Gyronites* the denticulations are always so small as to be barely visible to the naked eye, and only in certain exceptional cases of weathering do they become larger and well marked; in *Meekoceras*, on the contrary, the denticulations, chiefly on the auxiliary series, are large and easily visible. Though these characters seem to be of small importance in the description, yet for the observation of the specimens, they appear to be sufficiently trustworthy, and in combination with the general characters of the shell give a very characteristic appearance to all the species belonging to the genus *Gyronites*.

Already in the introduction to the family *Meekoceratidæ* I have alluded in detail to the similarity which exists between certain forms of the genus *Ophiceras*, Griesb., and my genus *Gyronites*. I have there shown that the typical species of *Ophiceras*, namely, *O. tibeticum*, differs widely from *Gyronites*, and should most probably form part of the sub-family *Gymnitinæ*, whereas the other two species, *O. himalayanum* and *medium*, might perhaps belong to the genus now under consideration. I cannot, however, assert this positively. The external lobe of the last of the two mentioned species was drawn by Griesbach with a small indentation in the centre of the siphonal tubercle, a character which does not occur thus in *Gyronites*, but if anything like it occurs, it is developed as drawn by me in *Gyronites arenosus*. Besides this *O. medium* possesses also a body-chamber which is somewhat in excess of the length generally occurring in *Gyronites*. So there remains only *O. himalayanum* which might perhaps form part of my genus, but as none of the species which occur in the Salt-range are identical with that form, I cannot decide the question.

If we wish to inquire whether forms belonging to the genus *Gyronites* have been described already on previous occasions, we must before all turn to Mojsisovics' work on the Arctic Trias. The author refers several forms to my genus *Xenodiscus*. Most of the species figured in this work possess a tripartite external lobe, and on that account alone are doubtful. Only two of them, fig. 7, *Xenodiscus euomphalus*, and fig. 11, a variety of *Xenodiscus Schmidtii*, show a simply bipartite external lobe. The first I placed into the genus *Meekoceras* on account of the great development of the auxiliary series of its sutural line, and the second will have to be removed to my genus *Gyronites*, and appears to be most closely allied to *G. evolvens* which occurs in the Ceratite Marls of the Salt-Range. I am obliged to re-name this Siberian form, *Gyronites Mojsisovicsi*, W., because the other species which were included by Mojsisovics under the name of *Xenodiscus Schmidtii* will have to be distinguished from fig. 11.

I must also mention that I placed *X. dentosus*, Mojs., into my genus *Goniodiscus*, and that *X. Schmidtii*, excluding fig. 11, bears generally a marked resemblance to that form, whilst *X. Karpinokü* most strikingly recalls *Ophiceras* (?) *himalayanum* or *medium* of Griesbach, whilst it has no resemblance to any of my species of *Gyronites*, which occur in the Trias of the Salt-range.

Dr. C. A. White describes and figures species of *Gyronites* in his note "on the triassic fossils of South-Eastern Idaho." He unites them with the genus *Meekoceras* under the specific designation of *M. aplanatum*, White. He evidently includes under this name two species, which are described in White's "Contributions to Palæontology," Pl. 31, fig. 1, a, b and d, and fig. 1, c, respectively. For the first of the two, the specific name "*aplanatum*" must be retained, whilst the second will have to be re-named.

With regard to the first of these two species, I am doubtful whether it really belongs to *Gyronites*, as the sculpture which suddenly appears on the last third of the last volution, seems to point to the possibility of its belonging after all to the genus *Xenaspis*. Only a comparison with the original and a study of a larger number of

specimens from those localities will decide the question. The second species, however, is beyond all doubt a *Gyronites*, and I determine it as *G. Whiteanus*, W.

The genus is rather largely represented in the Salt-range, and we possess at present no less than nine species from that locality. These may be divided into three sections, according to the general outline of their volutions; the first I call "*Biangulares*," on account of the biangular condition of the external part of their whorls; the second I comprise under the designation of "*Semirotundati*," because only the interior whorls are provided with external edges, whilst the outer volutions become rounded, and lastly, there is the section of the "*Rotundati*," the whorls of which are perfectly rounded.

In the first section (*Biangulares*) I distinguished first a group of forms, which if "*Meekoceras*" *aplanatum* is really a *Gyronites*, would have to take its name from this species; but as the systematic position of *M. aplanatum* is uncertain, I prefer to choose for it the name of the first species contained in it, and shall call it the group of *Gyronites frequens*. This group contains two species, of which the first, *G. frequens*, W., occurs in great numbers in the lowest beds of the Lower Ceratite Limestone, whilst the second, *G. superior*, W., was found in the upper beds of the same formation,—just at the boundary of the Ceratite Marls. The forms belonging to this group are characterized by compressed, biangular, smooth whorls, a wide umbilicus and a distinct auxiliary series in the sutural line.

The next group belongs to *Gyronites Mojsisovicsi*, W. It is characterized by species with rather small umbilici in their earlier stages, which however widen considerably later on. The whorls are smooth and compressed. *G. Mojsisovicsi*, a species from Siberia, does not occur in the Salt-range, but is there represented by *G. evolvens*, W., which occurs in the Ceratite-Marls.

Finally, this section closes with an isolated species *G. Nangaensis*, W., in which the auxiliary series is altogether absent, and which is therefore quite distinct from all the others. It occurs in the lowest beds of the lower Ceratite Limestone.

The second section (*Semi-rotundati*) contains only one group of forms, represented by *G. plicatus*, W., which is well characterized by its radial folds. To this group may probably belong *G. Whiteanus*, W., from South-Eastern Idaho. The following species belong to this group: *G. plicatus*, W., from the Lower Ceratite Limestone; *G. rotula*, W., from the Upper Ceratite Limestone; and *G. radians*, W., from the same horizon.

The third section (*Rotundati*), contains only two isolated species, both from the Ceratite Sandstone; they are *G. arenosus*, W., and *G. vermiformis*, W.

We thus arrive at the following classification of the species belonging to the genus *Gyronites*:

I. Section BIANGULARES.

a. Group of GYRONITES FREQUENS, W.

1. *G. frequens*, W., Lower Ceratite Limestone, lowest beds.
2. *G. superior*, W. ditto ditto, highest beds.

b. Group of *G. MOJSISOVICSI*, W.3. *G. evolvens*, W., Ceratite-Marls.

c. ISOLATED SPECIES.

4. *G. Nangaensis*, W., Lower Ceratite Limestone, lowest beds.

II. Section SEMI-ROTUNDATI.

d. Group of *G. PLICOSUS*, W.5. *G. plicatus*, W., Lower Ceratite Limestone.6. *G. rotula*, W., Ceratite Sandstone, upper region.7. *G. radiatus*, W., ditto, ditto.

III. Section ROTUNDATI.

e. ISOLATED SPECIES.

8. *G. arenosus*, W., Ceratite Sandstone.9. *G. vermiformis*, W., ditto.

We find therefore, with regard to the geological distribution of the genus, that of the nine species known to us, four occur in the Lower Ceratite Limestone, four in the Ceratite Sandstone, and one in the Ceratite-Marls. It would appear that the genus is entirely restricted to the lower part of the Ceratite formation, and that it does not ascend to the middle division. This distribution contrasts remarkably with that of the preceding genus, which is not only found in the Upper Ceratite Limestones, but occurs also in the Bivalve layers. Out of India we know of only two representatives of this genus; the first, *G. Mojsisovicsi*, W., occurs in the black limestones at the mouths of the Olenek in Siberia, which Mojsisovics considers to be homotaxial with the Bunter Sandstein of Central Europe; the second, *G. Whiteanus*, W., forms part of the small fauna, which was discovered in the triassic sandstone of South-Eastern Idaho, the exact geological horizon of which has not yet been settled, but which may possibly be of Bunt-Sandstein age.

It is most probable, therefore, that the beds in which the Salt-range species of *Gyronites* occur, are also referable to the same period.

I. Section BIANGULARES.

A. GROUP OF *GYRONITES FREQUENS*, W.1. *GYRONITES FREQUENS*, Waagen n. gen. et. sp. Pl. XXXVIII, fig. 1 a, b; 2 a, b.

This species, which is of moderate dimensions, forms entire layers of shells in the lower division of the Lower Ceratite Limestone.

Its general shape is discoidal, with compressed whorls, and large umbilicus. The involution is small, and the overlap of the last whorl over the preceding one amounts to between one-fourth and one sixth of the height of the former.

The cross section of the whorls is a more or less compressed ellipse, the external part being always distinctly flattened. The lateral parts are always well arched, and the greatest transverse diameter occurs at a short distance below the middle of the height of the whorls. From this point the lateral parts slope gently and evenly towards the umbilicus. An umbilical wall is therefore wanting, although the umbilicus is not flat, but is considerably depressed. The lateral parts slope somewhat more suddenly towards the siphonal side, though the curve is not greater. The external part of the shell is narrow and distinctly flattened, forming a flat zone, which is bordered by very distinct, and sharp external edges.

All the specimens which we possess of this species are casts only, and show no kind of sculpture.

The sutural lines are clearly shown and very characteristic. The external lobe is broad and short, divided into two lateral branches by a low, broad siphonal tubercle, which is generally flat above. The lateral branches are generally situated on the external edges, but are sometimes pushed over and on to the lateral parts. They are very short and narrow, and rounded below, but provided with denticulations. The external saddle is very low, rather broad, and evenly rounded above. The first lateral lobe is deep and comparatively narrow. Its sides are nearly parallel or only slightly convergent downwards; the base is provided with some six small denticulations which might easily pass unnoticed, but which become more distinct when weathered. These denticulations form a prominent arch. The first lateral saddle is broad and much higher than the external one. It is well and evenly rounded above. The second lateral lobe is very small, much shorter and narrower than the first one, and provided at the base with some four or five denticulations, which are, if possible, even still smaller than those of the first lateral lobe. They also form a prominent arch. The second lateral saddle is low, but comparatively broad, its sides are sloping, and it is broadly and evenly rounded above. The auxiliary series consists of only one broad and shallow lobe, which exhibits some very small, barely visible denticulations below, and reaches down to the umbilical suture.

The largest specimen of this species has a diameter of 65 mm. No. I has the largest umbilicus and the least compressed whorls, No. III has the smallest umbilicus and the most strongly compressed whorls, whilst No. II is intermediate: their dimensions are as follows:—

Diameter of the shell	50 mm.	42 mm.	36 mm.
„ of the umbilicus	20 „	16 „	11 „
Height of the last volution from the umbilical suture	17 „	15 „	13 „
„ „ „ „ „ from the preceding whorl	13 „	12 „	10.5 „
Thickness of the last volution	10 „	8 „	6 „

Locality and Geological Position.—The detached specimens, figured on Pl. XXXVII, were found at Khoora. They are most frequently found in the lowest beds of the Lower Ceratite Limestone, and in many cases some of the limestone banks are almost exclusively made up of shells of this species. There are, however, only a few localities where specimens of it can be detached from the rock, and thus it happens that the form is comparatively sparingly represented in the Salt-range col-

lection. The frequent occurrence of the species is evident from the fragment of rock, represented on Pl. XL, fig. 4, on which no less than six specimens and fragments of such can be distinguished, besides two other *Ammonites*, which cannot be determined. The other side of the specimen is crowded with a large number of fragments of the same species.

Remarks.—This species is very closely related to *Lecanites psilogyrus*, W., which has been described on one of the foregoing pages. In fact the sole difference between the two shells lies in the sutural line, which in the one case is perfectly goniatitic, whilst in the other it tends to become slightly ceratitic. I will admit that transitions may exist between the two forms, and most probably such must have existed, but nevertheless I believe that they should be distinguished. *L. psilogyrus* is evidently a survivor of some form which was common in a geologically older stratum, but is now exceedingly rare in the Lower Ceratite Limestone, whilst *Gyronites frequens* is the rising form, which indicates a new order of things setting in with the commencement of the deposition of the Lower Ceratite Limestone. I have kept the two species distinct for this reason.

2. GYRONITES SUPERIOR, Waagen n. gen. et. sp. Pl. XXXVII, fig. 6 a, b.

Its general shape is discoidal, with a moderately wide umbilicus. The involution of the shell is very slight, and the overlap of the last over the preceding whorl amounts to about one-sixth of the height of the former.

The cross section of the whorls is lanceolate, with a comparatively broad and flat external side. The lateral parts are flatly arched, and the largest transverse diameter occurs a short distance above the upper limit of the inner third of the height of the whorls. From this point the lateral parts slope with a gentle curve towards the umbilicus, and when close to it, bend suddenly down, and form a more or less indistinct umbilical wall. The lateral parts slope in a similar curve towards the siphonal side. Just before reaching the external edges, they form a slight impression in the same manner as seen in *Lecanites impressus*, W. The external part is comparatively broad and quite flattened. The external edges by which it is bounded on each side are very sharp and form a distinct rim, which projects above the lateral parts. The shell is quite smooth.

The sutural line is very characteristic. The external lobe is deep and broad, divided by a rather high siphonal tubercle into two branches, which are already situated on the lateral parts of the whorl. Each of these bears along its base some three or four small denticulations. The external saddle is narrow, but reaches to a considerable height. Its sides are nearly parallel, and it is evenly rounded above. The first lateral lobe is very deep and rather narrow. It has parallel sides and possesses some six denticulations below, forming a low arch. The first lateral saddle is as narrow as the external saddle, but is higher. It is, as a rule, evenly rounded above, but has a tendency to become oblique. The second lateral lobe is rather narrower and much shorter than the first. Its sides are also parallel, and there are also some six very narrow but rather long denticulations, forming a well-

rounded arch. The second lateral saddle is much narrower than the first, but about the same height. It is narrowly and somewhat obliquely rounded above. After this follows a narrow lobe which appears goniatitic in the specimen under consideration; then the sutural line ascends again and disappears under the umbilical suture.

The measurements of the figured specimen are as follows:—

Diameter of the shell	. . . . .	52 mm.
„ of the umbilicus	. . . . .	17 „
Height of the last volution from the umbilical suture	. . . . .	20 „
„ „ „ „ from the preceding whorl.	. . . . .	17 „
Thickness of the last volution	. . . . .	9 „

Locality and Geological Position.—West of Khoora; uppermost beds of the Lower Ceratite Limestone near the boundary of the Ceratite-Marls. A single specimen.

Remarks.—This species is very closely related to the preceding one, and I was for some time in doubt as to whether I ought not to unite the two under the same specific designation. But I have come to the conclusion that their deviation is much too great to justify such a classification. *G. superior* has a considerably narrower umbilicus, its whorls are much more strongly compressed, and the involution of the whorls is much less than even in the most extreme case of *G. frequens*, W., which has been reproduced on the same plate, in fig. 4. From a comparison of the figures, as well as of the measurements given in the text, the points of difference between these two forms become at once apparent. To these may be added the difference of the sutural lines, which, as a rule, are much more markedly denticulated in *G. superior*, which shows also a denticulated external lobe.

It appears to me most probable that *G. superior* is the direct descendant of *G. frequens*.

B. GROUP OF GYRONITES MOJSISOVICSI, Waagen.¹

3. GYRONITES EVOLVENS, Waagen n. gen. et. sp. Pl. XXXV, fig. 7 a, b, c, d.

This is a very interesting form owing to its close affinity to a species obtained from the Trias of the Olenek in Siberia. Its general shape is discoidal, with a shallow umbilicus, which is rather narrow at first, but increases in size with the growth of the shell. The lateral parts show a very faint radial sculpture, whilst the external part is considerably flattened. The rate of involution does not change much with the widening of the umbilicus, but the overlap of the last whorl over the preceding one amounts generally to a little less than one-fourth of its height.

The cross section of the whorls is oval with a flattened external side. The lateral parts are very evenly arched and the greatest transverse diameter occurs at a short distance below the middle of the height of the whorls. From this point the

¹ See *ante*: Introduction to the genus *Gyronites*.

lateral parts slope in a very even curve towards the umbilical suture, which they meet at an acute angle. There is no trace of an umbilical wall. The slope is rather more considerable towards the siphonal side, but the curvature is less. The external side forms a flat zone, which is bounded on both sides by sharp and distinct external edges.

The shell is not quite smooth, but there are very faint, slightly falciform, radial folds, which appear to have been formed by the combination of somewhat more strongly developed striae of growth. These folds are so faint that it is difficult to count them, but there may have been about 18 on one circuit.

The sutural lines are well preserved; the external lobe is very broad, divided in the middle by a siphonal tubercle or saddle into two lateral branches, which on one side are situated almost entirely on the lateral parts of the whorls. These branches are narrow and bear two or three denticulations below. The external saddle is comparatively broad, with sloping sides. It is broadly and evenly rounded above. The first lateral lobe is considerably deeper than the external lobe, but is not very broad. Its sides converge rapidly downwards, and along the base, which forms a distinct arch, are some four or five denticulations. The first lateral saddle is broader than the external one, and of much the same height. It is very broadly, and at times rather obliquely, rounded above. The second lateral lobe is much shorter and narrower than the first. Its sides converge towards the base which is provided with three to five denticulations. The second lateral saddle is very small, but evenly rounded above. Beyond this the sutural line forms a small indistinct lobe which bears some obscure denticulations, after which it descends rapidly to the umbilical suture.

In this specimen, the sutural line is not quite symmetrically developed, and the siphuncle is shifted slightly to one side, so that one branch of the external lobe is placed altogether on the lateral part of the shell, whilst the other coincides with the external edge. In consequence of this, the lobes and saddles are narrower on one side than on the other, but this feature is of no material importance, as it occurs frequently in all groups of Ammonites.

The diameter of the entire specimen may have been 65mm., with a corresponding diameter of the umbilicus of 21mm., but as the last half of the outer whorl is broken away, some traces of it only remaining, exact measurements can only be taken of the inner volutions. They are as follows.—

Diameter of the shell	. . . . .	46 mm.
„ of the umbilicus.	. . . . .	13 „
Height of the last volution from the umbilical suture	. . . . .	20 „
„ „ „ „ „ from the preceding whorl	. . . . .	15 „
Thickness of the last volution	. . . . .	10 „

Locality and Geological Position.—Locality doubtful, but this single specimen probably came from Khoora: there is little doubt that it is derived from the Ceratite-Marls.

Remarks.—This species deviates rather widely from the other species of *Gyro-*
nites of the Salt-Range, but it seems to be closely related to a form from Siberia, for

which I have introduced the name of *Gyronites Mojsisovicsi*, W. Mojsisovics¹ united this form with his *Xenodiscus Schmidtii*, but I consider it most decidedly different from that species. The points of similarity with *G. evolvens* consist chiefly in its general appearance, the increase of the relative size of the umbilicus as the shell grows larger, and the great similarity which exists between the sutural lines of both species. The points of difference consist in the more strongly compressed and relatively higher whorls, with a much narrower external side in the Indian species.

Whether the similarity between these two forms indicates a real relationship, I cannot decide.

c. ISOLATED SPECIES.

4. GYRONITES NANGAENSIS, Waagen n. gen. et. sp. Pl. XXXVII, fig. 5 a, b, c.

This is a very strange form in which the auxiliary series of the sutural line is altogether absent, two lateral lobes, however, being present. Its general shape is discoidal, with large umbilicus and compressed whorls. The involution is very slight and the overlap of the last whorl over the preceding one amounts to less than one-sixth of its entire height.

The cross section of the whorls is more or less oval, with a flattened external side. The lateral parts are but little inflated, and the greatest transverse diameter occurs at the upper limit of the lower third of the height of the whorls. From this point the lateral parts slope towards the umbilicus, at first very gently, but later on, they bend rather suddenly down to meet the umbilical suture, almost at right angles, thus forming a rather distinct, sloping umbilical wall, which, however, is not bounded by an umbilical edge. The slope of the lateral parts towards the siphonal side is more decided, but they are less flatly curved. The external part is distinctly flattened and tolerably broad, and bounded on both sides by sharp external edges.

The sculpture of the shell is distinct and very simple. There are numerous almost straight radiating folds which cover the lateral parts of the whorl. These folds attain their greatest development on the upper margin of the umbilical wall, grow fainter as they proceed, then make a scarcely perceptible falciform bend and finally disappear before reaching the external edge. There may have been about fifty of such folds on one circuit. The inner whorls are not sufficiently well preserved to indicate the existence of sculpture.

The external lobe is broad and rather deep. It is divided into two lateral branches by a rather shallow, median siphonal tubercle or saddle, which is well rounded above. The lateral branches extend to the sides of the whorl and are sharply pointed below. The external saddle is narrow and not very high. It has nearly parallel sides and is not quite evenly rounded above. The first lateral lobe is very deep and narrow, and somewhat club-shaped in its general outline. There

¹ Arktische Triasfaunen, Pl. XI, fig. 11a, b, c.

are very numerous serrations on its lower part which, however, are not entirely restricted to the base, but extend also a short distance up the sides of the lobe. The first lateral saddle is very broad, and is much higher than the external one. It is broadly, but not quite evenly rounded above. The second lateral lobe is rather broader than the first, but very much shallower. Its sides are nearly parallel, and there are some six denticulations at its base, which form together a prominent arch. The second lateral saddle is only a little lower than the first. It is obliquely rounded above and extends down to the umbilical suture, so that no traces of auxiliary elements can be distinguished in this sutural line. The involution of the shell is, however, so small, and the second lateral saddle so broad, that the second lateral lobe is entirely above the line of involution.

The dimensions of the only existing specimen of this species are as follows:—

Diameter of the shell	. . . . .	49 mm.
„ of the umbilicus	. . . . .	21 „
Height of the last volution from the umbilical suture	. . . . .	16 „
„ „ „ „ from the preceding whorl	. . . . .	14 „
Thickness of the last volution	. . . . .	9 „

Locality and Geological Position.—Nanga; in the lowest beds of the Lower Ceratite Limestone.

Remarks.—In general shape this species is very similar to *G. frequens*, W., but it can be distinguished at once from that form by its sculpture, which is very characteristic, though not very prominent. A comparison of the sutural lines shows that still more decided differences exist; while, owing to the absence of auxiliary elements in this species, it is easily distinguishable from all other species of *Gyronites*. In that respect it agrees with only a single species, *viz.*, the typical form of *Meekoceras aplanatum*, White. I have already stated that I am not quite certain as to whether this form ought not to be included in the genus *Gyronites*, and with regard to its general appearance, there is no question of comparing our species with the form described by Dr. White; nevertheless, it is worth noting that the two forms have at least this one character in common, *viz.*, the sutural lines of both are devoid of an auxiliary series.

II. Section: SEMI-ROTUNDATI.

D. GROUP OF GYRONITES PLICOSUS, W.

5. GYRONITES PLICOSUS, Waagen n. gen. et. sp. Pl. XXXVIII, fig. 11 a, b.

In general shape, this form again is more or less discoidal, with large umbilicus and rather compressed whorls. The involution is very small and the overlap of the last whorl over the preceding one amounts to not more than one-fifth of the height of the former.

The cross section of the whorls is elongate-oval, being much higher than it is broad. The lateral parts are only very slightly arched, the greatest transverse

diameter occurring at the upper limit of the lower fourth of the height of the whorl. From this point the lateral parts slope towards the umbilicus, barely perceptibly at first, but afterwards taking a sudden bend, they reach the umbilical suture, where they are almost at right angles to the preceding whorl. In this manner a very distinct umbilical wall is formed, which, however, is not bounded above by a distinct umbilical edge. The lateral parts slope considerably towards the siphonal side, but at the same time are only very slightly curved. The external part is broadly and evenly rounded, and passes into the lateral parts gradually; it is, however, probable that in young specimens external edges were present, as is the case in the two following species.

The sculpture of the shell is very characteristic. It consists of single radiating folds, which are generally very marked in the vicinity of the umbilicus. They commence as very high, distinct folds just at the margin of the umbilical wall, but remain so only for a short distance. Near the middle of the whorls they are already much fainter, and on the outer third they disappear again without reaching the external part. The folds are always quite straight, without any distinct bend. There are 18 of them on one circuit. The external part of the shell is invariably quite smooth.

The sutural line is only partially preserved. The external lobe is short and not very broad, divided into two lateral branches by a short, rounded siphonal tubercle or saddle; the branches are, however, very indistinctly visible, and in most places entirely destroyed. The external saddle is narrow and short, with sides slightly converging towards the top, which is narrowly and evenly rounded. The first lateral lobe is very small and narrow, with sloping sides and some four very small denticulations below, which are, however, only visible under a lens. The denticulations form a narrow but prominent arch. The first lateral saddle is enormously broad and very low. Its sides are sloping and it is broadly, but quite evenly, rounded above. The second lateral lobe is extremely short and narrow. Its sides converge downwards where on examination with the lens they show some very minute denticulations. The second lateral saddle is still narrower than the preceding lobe and very much shorter than the first. It is narrowly rounded above. After this follows a curved, slightly foliaceous line, which represents the auxiliary series and extends down to the umbilical suture.

The last half of the last volution belongs to the body-chamber.

The dimensions of this specimen are as follows :—

Diameter of the shell	.	.	.	.	.	.	.	.	.	.	34 mm.
„ of the umbilicus	.	.	.	.	.	.	.	.	.	.	15 „
Height of the last volution from the umbilical suture	.	.	.	.	.	.	.	.	.	.	11 „
„ „ „ „ from the preceding whorl	.	.	.	.	.	.	.	.	.	.	9 „
Thickness of the last volution	.	.	.	.	.	.	.	.	.	(?)	7 „

This latter measurement is only approximate as the specimen is firmly embedded in the rock.

Locality and Geological Position.—I found this single specimen together with many individuals of *G. frequens* in the lowest beds of the Lower Ceratite Limestone at Khoora.

Remarks.—This form is very characteristic owing to its high and sharp folds, and there is no other species of this genus hitherto described by me to which it could be compared in particular. In other genera, however, forms have been described which show a certain similarity to our species, and among them may be mentioned particularly *Ophiceras Himalayanum* Griesb. I have already several times mentioned that Griesbach's species might possibly belong to my genus *Gyronites*, but I am not in a position to express a positive opinion on the subject. I shall again abstain from doing so, and restrict myself to the simple statement that *O. Himalayanum* and my *G. plicatus* most certainly constitute different species. The system of sculpture of *Ophiceras* is quite different from that prevailing in *Gyronites*. My species has quite straight radial ribs, whilst they are more or less falciform in Griesbach's specimen. The latter loses its sculpture altogether at the commencement of the body-chamber, and only later on, single tubercles appear, whereas on *G. plicatus*, the sculpture becomes stronger with the commencement of the body-chamber, and does not change its character further on. There is therefore no doubt that these two are at least different species.

Another form which may be compared with the above is *Ceratites multiplicatus*, Mojs., from Siberia. The general appearance of this shell, more particularly the cross section of the whorls, is very similar to *G. plicatus*. The almost straight radial ribs are, however, more numerous and less strongly developed in the umbilical region, in the Siberian species than in the Indian form. Here also similarity exists, but not identity.

6. GYRONITES ROTULA, Waagen, n. gen. et sp. Pl. XXXVIII.

fig. 3 a, b, 4 a, b, 5 a, b.

The general shape of this small species is flatly discoidal, with very large umbilicus and compressed whorls, the external side of which is distinctly flattened in young specimens, though it becomes perfectly rounded in older ones. The involution is very small, and the overlap of the last whorl over the preceding one amounts to not more than one-fifth of the height of the former.

The cross section of the whorls is perfectly elliptical in adult specimens, which already have a rounded external part, whilst in young specimens, where a flattened external part is present, the ellipse is interrupted on that side. The greatest transverse diameter occurs at a short distance below the centre of the vertical axis of the cross-section. The lateral parts slope from this point in a comparatively equal curve in both directions. Towards the umbilicus the curve is at first very flat, but afterwards bends more rapidly and meets the umbilical suture always at an acute angle, and a distinct umbilical wall is therefore wanting. The lateral parts curve distinctly towards the siphonal side in adult specimens, whilst in young

ones they appear somewhat more flattened, but at the same time more distinctly sloping. The external part is perfectly rounded in the adult shell and joins the lateral parts without proper demarcation, whilst in the young, it is distinctly flattened, and forms on each side, near its junction with the lateral part, a sharp external edge. The latter become more obtuse in middle-sized specimens and finally disappear entirely.

The sculpture of the shell is very distinct. It consists of radial folds—not very numerous, but very slightly falciform. They begin at a short distance above the umbilical suture, are most marked below the middle of the lateral parts and disappear again on the outer third of the entire height of the whorl. There are between ten and twenty of these folds on one circuit. The exterior is always quite smooth.

The sutural lines are distinctly visible on the specimens under description. The external lobe is short and broad, with a shallow median siphonal saddle with a broadly rounded top. The lateral branches of the external lobe, thus formed, are very shallow, narrowly rounded below and perfectly goniatic. The external saddle is very low and broad. Its sides are sloping, and its top rather obliquely rounded. The first lateral lobe is short and narrower than the external saddle. Its sides converge downwards; there are numerous denticulations, forming together a prominent arch. The denticulations are so small that they can be seen only with the lens. The first lateral saddle is again very broad, but is only very slightly higher than the external one. It has sloping sides and is very broadly rounded, often somewhat flattened above. The second lateral lobe is still smaller and narrower than the first. If it is well preserved, it is possible to observe by means of a lens a number of denticulations at its base forming a well-rounded arch. The second lateral saddle is very low and is not broad. After this the sutural line descends and forms a short, broad, and rounded auxiliary lobe which reaches down to the umbilical suture; it shows some very small serrations below.

The dimensions of three specimens are as follows :—

	I	II	II
Diameter of the shell	35 mm.	26 mm.	19 mm.
„ of the umbilicus	16 „	11 „	7 „
Height of the last volution from the umbilical suture .	10 „	9 „	7 „
„ „ „ from the preceding whorl .	8 „	7.5 „	6 „
Thickness of the last volution	7 „	5.5 „	4 „

Locality and Geological Position.—Of this species, four specimens were found in the Chitta-Wan, in beds corresponding in age to the lower division of the Ceratite Sandstone.

Remarks.—This species may easily be distinguished from the preceding one by the character of its ribs, which are slightly falciform, whilst in *G. plicatus* they are quite straight. Another species to which this form must be compared is *Ophiceras Himalayanum*, Griesb. This species is still more closely related to the form under consideration than to the previous one. The chief difference consists in the size of the umbilicus, which is considerably larger in

G. rotula than in *Ophiceras Himalayanum*. It is also very doubtful whether Griesbach's species possessed in earlier stages of growth the external edges, which are seen in the Salt-Range form.

Another, and very similar form, is that figured by Dr. C. A. White in his "Contributions to Palæontology," Pl. 31, fig. 1 c., which he names *Meekoceras applanatum*, but which in reality represents a different species. I propose therefore to rename this form *Gyronites Whiteanus*, W., and have alluded to it under this name in the introductory notes to this genus. It agrees almost in every respect with *G. rotula*, except in the dimensions of the umbilicus, which is much larger in the American than in the Indian species. Owing to this difference I am unable to unite these two forms under one specific designation, as I felt much inclined to do at first.

7. *GYRONITES RADIANS*, Waagen. n. gen. et sp. Pl. XXXVIII.
fig. 6 a, b, 7 a, b, 8 a, b.

This species is very similar to the preceding one, but possesses better developed ceratitic lobes and a more sharply defined radial sculpture.

Its general outline is more or less discoidal, with large umbilicus and broadly rounded external part. The involution is very small and the overlap of the last whorl over the preceding one amounts to not more than one-sixth of the height of the former.

The cross section of the whorls is perfectly oval, the lateral parts being only slightly arched. The largest transverse diameter of the whorls occurs at a short distance below the centre of the vertical axis of the cross section. From this point the lateral parts slope scarcely at all towards the umbilicus, till on nearing the umbilical suture they bend down rather rapidly and meet that suture, thus forming a sloping and indistinct, but rather high umbilical wall. They slope more decidedly towards the siphonal side, and are at the same time distinctly curved. The external part is broadly rounded and gradually passes into the sides of the whorls.

The external part is very indistinctly flattened in young specimens, and shows very obtuse external edges.

The sculpture is very characteristic. It consists of numerous radial folds, which are very sharp on the top, with sloping sides and broad rounded depressions between. There are about 28 of them on one circuit, but it must be noted that they are not absolutely equi-distant, and at some places are more closely arranged than at others. The ribs appear first above the umbilical wall, are most marked a little below the middle of the sides and disappear again before reaching the external part. They are slightly falciform. These species are apparently often subject to diseases, which cause irregularities in the sculpture. Thus the ribs either fail to become quite radial in their position and are then irregularly spaced, or else the outer half of the rib disappears entirely, as is the case in the specimen represented in fig. 7. The exterior is invariably quite smooth.

The sutural line is well preserved on the specimens under description. Two of them, the largest and the smallest, consist of septa only, whilst in the specimen represented in fig. 7 the last third of the last volution belongs to the body-chamber. The external lobe is very short, and is not broad. It is divided by a shallow angular siphonal saddle into two small branches, which bear two or more very minute denticulations below. The external saddle is narrow but not very high. It has almost parallel sides, and is narrowly and evenly rounded above. The first lateral lobe is not much deeper than the external one and is also rather narrow. Its sides converge very slightly downwards; at the base I observed some five or six denticulations, which may be seen with the naked eye, and which form a prominent arch. The first lateral saddle is very broad and considerably higher than the external one. It has sloping sides, and is broadly, and somewhat obliquely rounded above. The second lateral lobe is very much smaller than the first. Its sides converge rapidly towards the base, where some three or four denticulations are seen, together forming a well-rounded arch. The second lateral saddle is already indistinct. It is very low and rather broadly rounded. After this the sutural line descends somewhat and describes a shallow curve, on which some three or four denticulations are seen.

The dimensions of two specimens are as follows:—

	II.	II.
Diameter of the shell	40 mm.	33 mm.
" of the umbilicus	18 "	16 "
Height of the last volution from the umbilical suture	13 "	10.5 "
" " " from the preceding whorl	11 "	9 "
Thickness of the last volution	10 "	17 "

Locality and Geological Position.—Chitta-Wan near Ghari; in beds corresponding in age to the lower part of the Ceratite Sandstone, and accompanied by the preceding species. Three specimens in all.

Remarks.—This species is very closely related to the preceding one, but may be distinguished from it by its more numerous and more sharply defined radial folds which are characteristic both of this species and of *Ophiceras Himalayanum*.

There still remains, however, another series of forms, to which the present species might be compared, *viz.*, the group of *Ceratites obsoleti* of Mojsisovics, to which I have already referred. It seems to me very probable that the four species, with the exception possibly of *Ceratites multiplicatus*, Mojs., figured by Mojsisovics on Pl. IX of his "Arktische Trias" may belong to my genus *Gyronites*; in which case *Ceratites hyperboreas*, Mojs., should be compared with *G. radians*, to which it is very similar. I am really at a loss to distinguish these two forms, yet hardly dare unite the two under one name. The sole points of difference which can be urged consist in the ribs being slightly more falciform and the external side perhaps a little more narrowly rounded in the Siberian than in the Indian species.

III. Section : ROTUNDATI.

e. ISOLATED SPECIES.

8. *GYRONITES ARENOSUS*, Waagen, n. gen. et sp. Pl. XXXVII., fig., 9 a, b, c.

Of this we possess only a very small fragment of an internal cast, but even this is of very great interest by reason of its great affinity to one of the *Ceratites obsoleti* of Siberia.

Its general outline is also flatly discoidal, with compressed whorls and large umbilicus. The involution is very small, and the overlap of the last whorl over the preceding one amounts to not more than one-fifth of the entire height of the former.

The cross section of the whorls is a rounded trapezoid, considerably higher than broad. The lateral parts are distinctly flattened and slope considerably, so that the greatest transverse diameter occurs as low down as the upper limit of the inner fourth of the height of the whorl. From this point the lateral parts slope in a rather sudden curve towards the umbilical suture, without forming a distinct umbilical wall. The lateral parts slope also towards the siphonal side, but are barely curved at all until a short distance before reaching the external part, when they become more curved, and pass into the external part gradually; the latter is broadly rounded.

The sculpture of the shell is only partially preserved. On the lateral parts of the outer volution are a number of radial folds showing a distinct falciform bend but not equally well seen throughout their whole extent. They appear at a considerable distance above the umbilical suture, attain their maximum development on the outer half of the whorl, and disappear again before reaching the other side.

These radial folds for the most part pass into fine radial striae, which cover the whole surface of the specimen. The inner volution is too badly preserved to observe whether it was quite smooth or whether this appearance was brought about by weathering. The exterior is perfectly smooth.

The sutural line is tolerably well preserved. The external lobe is very broad and short, and the manner in which the siphuncle passes it is very remarkable, and corresponds with Mojsisovics' description of some Siberian *Ammonites*, inasmuch as it is evident that the animal possessed a siphonal funnel which was not only directed forwards, but also turned backwards. The siphonal tubercle or saddle is neither very broad nor high, but divides the whole lobe into two distinct lateral branches, which are very narrowly rounded below, and appear sometimes to have borne very small denticulations. The external saddle is short and rather narrow, and well rounded above. The first lateral lobe is much deeper than the external one. Its sides converge downwards, with some five or six rather marked denticulations along the base, forming a prominent arch and reaching a short way up the lateral faces of the lobe. The first lateral saddle is very broad and is distinctly higher than the external one. Its sides slope and its top is broadly and rather obli-

quely rounded. The second lateral lobe is as broad as the first, but very much shallower. Its sides converge downwards; five distinct denticulations form a prominent arch. The second lateral saddle is very short and narrow, and well rounded above. After this follow an indistinct auxiliary series, forming apparently one lobe, on which some serrations can be made out.

The dimensions of the specimen may have been as follows :—

Diameter of the shell, probably	. . . . .	47	mm.
" of the umbilicus, probably	. . . . .	20	"
Height of the last volution from the umbilical suture	. . . . .	15	"
" " " " from the preceding whorl	. . . . .	12	"
Thickness of the last volution	. . . . .	8.5	"

Locality and Geological Position.—Chitta-Wan near Ghari; in beds which most probably correspond to the lower division of the Ceratite Sandstone; a single fragment.

Remarks.—This species is quite isolated among the other Salt-Range forms of this genus, but it is all the more similar to a form which Mojsisovics described from Siberia under the name of *Ceratites fissiplicatus*, M. I will not insist on the desirability of placing this species into the genus *Gyronites*, but I only state that great similarity exists. Still a specific identification is not possible, as the Indian form is less involute and has a much larger umbilicus.

9. GYRONITES VERMIFORMIS, Waagen, n. gen. et sp. Pl. XXXIX, fig. 1 a, b, c, d.

I introduce this name for a very indifferent species, but the specimen is very perfectly preserved, and deserves a specific designation.

Its general outline is flatly discoidal, with compressed whorls which are well rounded all over, and a large umbilicus. The involution of the shell is very small and the overlap of the last whorl over the preceding one amounts to no more than one-fifth of the entire height of the former.

The cross-section of the whorls is elongate-oval, much higher than broad. The greatest transverse diameter of the whorls is situated immediately below the centre of the vertical axis of the cross-section. From this point the lateral parts slope, at first very slightly, towards the umbilicus, but a short distance before reaching the latter they bend down in a gentle curve and meet the umbilical suture at an acute angle. The lateral parts slope somewhat more rapidly towards the siphonal side but at the same time are only very slightly curved. The external part is not very broadly, but evenly rounded, and joins the lateral parts without clear demarcation.

There is no trace of sculpture visible. The shell itself is indifferently preserved, and its surface is rough and much weathered, so that a more delicate sculpture would not be seen. The internal cast is also smooth. I was able to trace the sutural line on parts of the specimen. The external lobe is not very broad, but rather deep. It is divided by a very short, rounded siphonal tubercle or saddle, into two short lateral branches, which are sharply pointed below. The external saddle is narrow and not very high. Its sides slope slightly and its top is somewhat obliquely rounded.

The first lateral lobe is broad and deep with almost parallel sides ; at the base are about six very small denticulations, which are only distinctly visible with a lens. They form a well-rounded arch. The first lateral saddle is broad but only very little higher than the external one. Its sides are almost parallel and it is broadly and evenly rounded above. The second lateral lobe is very small and short. The side directed towards the umbilicus is very short, but the sides are almost parallel. On the base of this lobe are some four or five very small denticulations, which can only be distinguished with a lens. They form a low arch. The second lateral saddle cannot be made out, as the sutural line runs almost straight down from the second lateral lobe to the umbilical suture. The dimensions of the specimen are as follows :—

Diameter of the shell	58 mm.
„ of the umbilicus	22 „
Height of the last volution from the umbilical suture	21 „
„ „ „ „ from the preceding whorl	17 „
Thickness of the last volution	12 „

Locality and Geological Position.—Chidroo ; in beds corresponding in age to the lower region of the Ceratite Sandstone ; a single specimen.

Remarks.—This species is in general appearance very peculiar, and cannot be compared with any of the species of *Gyronites* hitherto described. This perfectly smooth form is only comparable to a species, which must be attributed to the genus *Prionolobus*, which exhibits similar general characters, but in which the sutural line is entirely different. Also *Lecanites planorbis*, W., described previously, might be compared, but besides having an entirely different sutural line, this species differs also from the form under description by having much more compressed whorls.

Genus PRIONOLOBUS, Waagen, n. gen.

Under this generic designation I unite a series of forms, having a discoidal shell with compressed whorls and a large umbilicus, while their auxiliary series is composed of a number of small denticulations, as in the genus *Prionites*, which I described among the family *Ceratitidæ*.

The characters of this genus are very simple and very similar to those of *Gyronites* and *Lecanites*, the chief points of difference being found in the sutural line.

In general appearance the species of this genus are always discoidal on account of their slightly inflated whorls and, as a rule, large umbilicus. The external part of the whorls is mostly flattened, as in the two preceding genera, and frequently forms distinct external edges near its junction with the lateral parts. But there are also some forms with perfectly rounded external parts.

The species belonging to this genus possess, as a rule, a perfectly smooth shell, and when sculpture exists, it consists of simple radial folds, which only in a single

case are transformed into small elongated tubercles. The external part is always quite smooth. The sutural line forms the most characteristic feature of these species. There are two characters in this sutural line which readily distinguish the species belonging to this genus, *viz.*, the external lobe and the auxiliary series. The former is always divided into two lateral branches by a siphonal saddle which, as a rule, is deep and angular. Each of these branches has some three or four denticulations below, and is thus not goniatitic, as in most species of the preceding genus. The auxiliary series consists of one single lobe only, which shows on its base a number of small denticulations arranged in a straight line extending to the umbilical suture.

The species belonging to the genus *Prionolobus* are tolerably numerous, but are restricted to the lower half of the Ceratite formation. The largest number, seven out of ten species, occurs in the Lower Ceratite Limestone. In the Ceratite Marls only two species were found, whilst only one form occurs in the upper region of the Ceratite Sandstone.

The ten species of this genus may be conveniently divided into several groups. First, it is possible, as in the preceding genera, to distinguish several sections, according to the different configuration of their external parts. The first of these sections, for which I use the name of '*Biangulares*' comprises those forms which have a flattened exterior with angular external edges. Among these, several groups of forms may be distinguished. First, there is a group with smooth shells, in which the umbilicus is comparatively narrow. The most ancient species of this group is *P. atavus*, W., which occurs in the Lower Ceratite Limestone. The following species, *P. rotundatus*, W., forms part of the fauna of the Ceratite Marls. The last species of this group, *P. sequens*, W., occurs in the upper division of the Ceratite Sandstone.

The second group of the first section is characterised by radial folds, which appear on the lateral parts of the shells, and by a very large umbilicus. All occur in the Lower Ceratite Limestone, but are arranged in an ascending order within this group of beds. In the lowest beds occurs *P. compressus*, W., which is the type of this group. It has flattened, steeply sloping sides. The next species, *P. plicatus*, W., occurs in the middle region of the Lower Ceratite Limestone. Its lateral parts are more inflated and their slope is less considerable. *P. ovalis*, W., was found in the uppermost beds of the Lower Ceratite Limestone, and possesses highly arched lateral parts, which slope scarcely at all.

To these forms must be added two isolated species, *P. plicatilis*, W., of the Lower Ceratite Limestone, and *P. undatus*, W., of the Ceratite Marls.

Another section of this genus is formed by the "*Rotundati*," which have a perfectly rounded exterior. There are only a few forms in this section which cannot be included in any of the groups, and must consequently be considered isolated species. One of these is *P. Buchiannus*, Kon. sp., which is characterised by well-marked radial folds, and occurs in the Lower Ceratite Limestone; and the second is *P. ophioneus*, W., which occurs in the same bed, but has a perfectly smooth shell.

We may thus classify the species of the genus *Prionolobus* as follows :—

I. Section : BIANGULARES.

a. Group of *PRIONOLOBUS ATAVUS*, W.

1. *P. atavus*, W. Lower Ceratite Limestone.
2. „ *rotundatus*, W. Ceratite Marls.
3. „ *sequens*, W. Ceratite Sandstone, upper region.

b. Group of *PRIONOLOBUS COMPRESSUS*, W.

4. *P. compressus*, W. Lower Ceratite Limestone, lower region.
5. „ *plicatus*, W. „ „ „ middle region.
6. „ *ovalis*, W. „ „ „ highest beds.

c. ISOLATED SPECIES.

7. *Prionolobus plicatilis*, W. Lower Ceratite Limestone.
8. „ *undatus*, W. Ceratite Marls.

II. Section : ROTUNDATI.

d. ISOLATED SPECIES.

9. *Prionolobus Buchianus*, Kon. sp. Lower Ceratite Limestone.
10. „ *ophioneus*, W. „ „ „

With regard to general appearance, the species of this genus seem to be most closely related to the two preceding genera, and if the sutural line be not exactly known, it is scarcely possible to distinguish between the three genera. Thus it is evident that the sutural line is the most important feature of these forms. The genus *Lecanites* possesses no trace of denticulations on its lobes, and its sutural line is thus quite goniatic. In *Gyronites* the external lobe is generally goniatic, whereas all the others are provided with more or less numerous denticulations, so that the sutural line on the whole possesses a ceratitic character; the auxiliary series is variable, partly goniatic, partly provided with irregular denticulations. The genus *Prionolobus*, lastly, has a purely ceratitic sutural line. The external lobe is always provided with more or less numerous denticulations, while the auxiliary series consists of one very broad and short lobe, which has a number of denticulations, all of the same size, and forming together a straight line.

Although *Prionolobus* is the highest as regards the development of its sutural line, yet it is not so in geological position. Whilst the genus *Lecanites* extends up to the beds above the Upper Ceratite Limestone, beds which most probably correspond with the upper region of the Muschelkalk of Europe, the genus *Prionolobus* extends no further than the Ceratite Sandstone. In this respect it is of some interest to observe the manner of distribution of the last-named genus in the triassic strata of the Salt-Range; as has been stated above, seven species occur in the Lower Ceratite Limestone, two in the Ceratite Marls, and one in the Ceratite Sandstone, from which it appears that, so far as we are able to say at present, the genus disappears in beds which probably correspond more or less with the upper region of the Bunt-Sandstein of Europe.

a. Group of PRIONOLOBUS ATAVUS, W.

Its general shape is discoidal, with compressed whorls and umbilicus of rather variable width. The involution of the shell is very small and the overlap of the last whorl over the preceding one amounts generally to very little more than one-fifth of the height of the former.

From this point the lateral parts slope evenly towards the umbilicus, forming at the same time a very flat curve, till a short distance before reaching the umbilical suture, they bend down rather rapidly, thus forming a very indistinct umbilical wall. The lateral parts slope somewhat more considerably towards the siphonal side and are at the same time less distinctly curved. The external part always forms a distinctly flattened zone which is bounded by not very sharp external edges.

The sutural line is characteristic. The external lobe is not very distinct in any of my specimens. It is neither very deep nor broad and is divided in the centre by a moderately high siphonal saddle. The lateral branches which are thus formed seem to possess some two or three denticulations below. The external saddle is very small, barely higher than the siphonal one. It is very narrow, and is evenly rounded above. The first lateral lobe is rather broad and shallow. It descends very little lower than the external one, has slightly convergent sides, and possesses some four or five denticulations, which form together a tolerably regular arch. The first lateral saddle is much higher than the external one. Its outer side is steeply sloping, the inner one less so. Its top is somewhat obliquely rounded. The second lateral lobe is as broad, but very much shallower than the first. Its sides converge very slightly downwards, and it has some five well-marked denticulations which form together a prominent arch. The second lateral saddle is broad, low, and flattened above. The auxiliary lobe is very shallow, but extremely broad. It has some six denticulations, which are arranged in a straight line.

[illegible]

Locality and Geological Position.—This species is not rare in the Lower Ceratite Limestone of the Salt-Range, though it is met with less frequently than *Gyronites frequens*. On the rock specimen from Khoora represented on Pl. XL, fig. 4, there are two very badly preserved specimens which most probably belong to the species under description. The type specimen I collected at Virgal in the Lower Ceratite Limestone and the specimen represented on Pl. XXXV, fig. 4, was found at Kafir-Kote (Trans-Indus) in the same horizon.

Remarks.—This species, when the sutural lines are not distinctly visible, might easily be mistaken for *Gyronites frequens*. However, the umbilicus of our species is invariably smaller than that of *G. frequens*. In the latter the diameter of the umbilicus is always considerably more than one-third of the diameter of the entire form, whilst in *P. atavus*, it is always very considerably less than one-third of the entire diameter. If the sutural line is visible, the two can readily be distinguished. In the auxiliary series, the denticulations of the single auxiliary lobe are arranged in a straight line in *P. atavus*, whereas in *G. frequens* it forms a curved line, with a distinct separate lobe. The external lobe too is denticulated in the former, while in the latter it is goniatic.

This species may be readily distinguished from others of the genus *Prionolobus*, by the fact that among the shells with a biangular outer side and smooth whorls, ours has the largest umbilicus.

2. *PRIONOLOBUS ROTUNDATUS*, Waagen, n. gen. et sp. Pl. XXXIV. fig. 1 a, b. c; fig. 2 a, b; fig. 3 a, b.

This species is one of the most characteristic forms of the Ceratite Marls, and is in some localities rather common in these beds.

Its general shape is also discoidal, with a small, very shallow umbilicus and compressed whorls. The involution of the shell is very considerable, and the overlap of the last whorl over the preceding one amounts to between one-third and two-fifths of the height of the former.

The cross-section of the whorls is elongate-oval, with a flattened outer side and very flatly arched lateral parts. The younger the shell, the further in does the greatest transverse diameter of the whorls occur. In small specimens, up to a diameter of about 40 mm., it is situated at the upper limit of the inner third of the height of the whorl, while in large specimens, which have not yet developed the final body-chamber, this greatest transverse diameter occurs somewhat below the centre of the vertical axis of the cross-section, and in specimens in which the final apertural margin has been preserved, it is found to occur exactly in the centre, equi-distant from the outer edge and from the umbilical suture. The lateral parts are flatly and very evenly arched. From their highest point of elevation they curve evenly down to the umbilical suture, and it is most remarkable that barely any trace of an umbilical wall is found, the lateral parts meeting the preceding whorl at a very acute angle. They form, however, a very flat and even curve towards the siphonal side the slope being scarcely greater than in the opposite

direction. The external part is distinctly flattened but near the junction with the lateral parts forms only very obtuse external edges.

The shell is quite smooth.

The sutural line is very characteristic, and exhibits the peculiarities of the genus in a most striking manner. The external lobe is short and broad, divided by a high angular siphonal saddle into two distinct lateral branches, which are situated on the lateral parts of the specimen. These branches are oblique, and bear on their base some four denticulations, forming together a small arch. The external saddle extends barely higher than the siphonal one. It is distinctly phylloid in shape, that is to say, broader at the top than at the base. Above, it is quite evenly rounded. The first lateral lobe descends considerably lower down than the external lobe. It is at the same time rather broad and has nearly parallel sides. Its base is very oblique, the outer side of the lobe being much shorter than the inner. There are some six or eight denticulations at the base, which form together a very oblique arch. The first lateral saddle reaches considerably higher than the external one. It is much less phylloid and has almost parallel sides. Above, it forms a broad, oblique arch. The second lateral lobe is shallower than the first, but of much the same breadth, and has some five denticulations, which form together an obliquely descending arch. The second lateral saddle is almost as broad, but very much lower than the first. Its sides slope somewhat and it is distinctly flattened above. The whole auxiliary series forms one very broad lobe, which reaches down to the second lateral lobe. It is finely serrated below, showing some six or eight small denticulations, all arranged in a straight line, which runs down to the umbilical suture, above which there is no trace of any large saddle.

The dimensions of three specimens are as stated below; the largest still retains the body-chamber entire, with the exception of the apertural margin, which, however, in the second is well-preserved whilst the smallest specimen is entirely composed of septa only.

	I.	II.	III.
Diameter of the shell	70 mm.	57 mm.	40 mm.
„ of the umbilicus	16 „	12 „	7 „
Height of the last whorl from the umbilical suture .	32 „	26 „	19 „
„ „ „ „ from the preceding whorl .	21 „	16 „	13 „
Thickness of the last whorl	16 „	13 „	10 „

The specimen (1) of which the measurements are given, is the largest known to me. It is not absolutely certain where its body-chamber begins, nor is its apertural margin preserved. The latter, however, is seen in the next specimen (2); which shows a broad, and very prominent, perfectly rounded ventral lobe, followed below by a rather deep biangular outline. At the umbilical suture there is a small shelly prominence. On the whole, this apertural margin is not dissimilar to that figured by Mojsisovics of *Ptychites ensomus*, Beyr.

The measurements of specimen (3) show that the inner whorls are rather dissimilar to those of the full-grown specimen. Up to a diameter of 5 millimetres, the shell possesses whorls which are laterally but only very slightly compressed, so that their transverse section appears almost round, and this effect is intensified owing

to the fact that the outer side also is perfectly rounded. When the specimen attains a diameter of 8mm., the external edges begin to appear and the umbilicus becomes comparatively smaller and smaller, till the diameter reaches 40mm., when the final shape is attained.

Locality and Geological Position.—Virgal, in the Ceratite Marls. Rare at other localities. Ten specimens.

Remarks.—The most characteristic feature of the present species is the shallow umbilicus, which is not surrounded by an umbilical wall. It is very difficult to indicate this in the drawing; fig. 1 gives the best impression of this character though even here it is not so striking as in the original specimens. This character distinguishes this species from the preceding, *P. atavus*, W., as well as from the following species, *P. sequens*.

There are also some differences in the sutural lines, but they are of minor importance.

3. PRIONOLOBUS SEQUENS, Waagen, n. gen. et sp. Pl. XXXIV, fig. 5 a, b, c.

This species is very similar to the preceding one. It has, however, a larger and more deeply sunk umbilicus, and seems to have attained a very much larger size.

Its general outline is flatly discoidal, with a moderately wide umbilicus, compressed whorls and a flattened outer side. The involution is rather pronounced, and the overlap of the last whorl over the preceding one amounts to considerably more than one-third of the height of the former.

The cross-section of the whorls is elongate-oval, with a flattened external side. The lateral parts form a low but very even arch. The greatest transverse diameter of the whorls occurs at a point situated at rather less than half their height above their base. From this point the lateral parts slope in a gentle curve towards the umbilicus, but at a short distance from it they descend more rapidly, still however meeting the umbilical suture at an acute angle, thus forming a very indistinct umbilical wall.

The lateral parts slope rather more towards the siphonal side, but with a still flatter curve. The external part is always distinctly flattened, and bounded by rather blunt, but distinct external edges.

The shell is quite smooth.

The sutural line is not very characteristic and strongly resembles that of the preceding species. On the whole, the lobes seem rather narrower, while the finely serrated part, representing the auxiliary series, seems to be more pronounced in this species.

The external lobe is rather short and not very broad. It is divided by a high angular siphonal saddle into two lateral branches, which are well individualised, and show some five small denticulations along their base. The external saddle is not much higher than the siphonal. It is distinctly phylloid in shape, being considerably contracted at its base. The first lateral lobe extends further down than

the external lobe. It is not very broad, its sides are slightly concave, and along its base are some six denticulations forming a low arch. The first lateral saddle is broad, higher than the external saddle, and skew-shaped. At the top it is rather narrowly and obliquely rounded. The second lateral lobe is shorter than the first, and even shorter than the external lobes. It is narrow, and bears along its base some five denticulations which form a low arch. The second lateral saddle is about as broad as the first, but is not quite so high, and remains at about the same level as the external saddle. It is sometimes distinctly flattened above. The auxiliary lobe is very broad, and increases very rapidly in breadth as the shell grows larger, while the denticulations show a corresponding increase in number, and are arranged in a straight line. The early sutural lines of the whorl show six denticulations on this lobe, whilst on the last sutural line, which is preserved on this specimen, ten such denticulations may be counted in this auxiliary lobe. I detected no trace of any auxiliary saddle.

The measurements of the single existing specimen of this species are as follows :—

Diameter of the shell	59 mm.
„ of the umbilicus	16 „
Height of the last volution from the umbilical suture	28 „
„ „ „ „ from the preceding whorl	17 „
Thickness of the volution, about	13 „

The specimen consists of septa only ; and as it is crushed, its thickness cannot be measured correctly.

Locality and Geological Position.—Virgal, in the upper part of the Ceratite Sandstone, in beds containing *Flemingites Flemingi* and *Aspidites superbus*.

Number of specimens—One.

Remarks.—This species is very closely related to the two previous forms. It may be distinguished from *P. atavus*, W., by a somewhat narrower umbilicus, comparatively higher whorls and a much more markedly developed auxiliary series. It differs from *P. rotundatus*, W., in its larger and shallower umbilicus, which is surrounded by an indistinct umbilical wall.

A character, which distinguishes this species from the two preceding ones, is its size ; this must have been very considerable, as the internal cast which serves as type specimen, is covered up to its very end with sutural lines, the last of which are not more closely arranged than the first, a character which points to the probability that the commencement of the body-chamber is still very distant. The size of this species would therefore be about twice as great as that of the two preceding forms.

b. GROUP of PRIONOLOBUS COMPRESSUS, Waagen.

4. PRIONOLOBUS COMPRESSUS, Waagen n. gen. et sp. Pl. XXXV, fig. 3, a, b, c.

The general outline of this species is also flatly discoidal, with strongly compressed whorls, large umbilicus and flattened external side. The involution of

the shell is very small, and the overlap of the last whorl over the preceding one amounts to a little less than one-fourth of the height of the former.

The cross-section of the whorls is of the form of a sharply pointed arch, with the external portion cut off. The largest transverse diameter is situated very low down, at the upper limit of the inner fourth of the height of the whorl. From this point the lateral parts slope scarcely at all towards the umbilicus, which is surrounded by a distinct, high, almost vertical wall, provided with a distinct umbilical edge. The lateral parts slope very strongly towards the siphonal side, but are at the same time only very slightly arched. The external part is distinctly flattened and provided with sharp external edges.

The sculpture is very characteristic. In the early stages, up to a diameter of about 20 to 25mm. its surface is entirely smooth. Then radial folds begin to appear, which become more and more marked as the shell increases in size. These folds are always single. They are most marked on the umbilical edge, extend in a straight, almost radial direction, with a very slight backward bend, to a point situated just beyond the middle of the lateral parts, and then disappear, leaving the outer half of the whorl quite smooth. There may have been about 15 of these folds on one circuit. With the commencement of the body-chamber, the sculpture changes again; the high knob-like folds are transformed into weak radial striæ, which show a very slight falciform bend. The external part is perfectly smooth.

The sutural line is tolerably characteristic on account of the height of the first lateral saddle. The external lobe is neither very broad nor deep, and is divided in the middle, by a rounded siphonal saddle, into two lateral branches, situated partly on the sides of the shell. They each possess some three denticulations along their base. The external saddle is broad and symmetrical, well rounded above. The first lateral lobe is as broad as the preceding saddle, but extends very much lower down than the external lobe. Its sides converge slightly towards the base where it bears some five small denticulations, forming a low arch. The first lateral saddle is extremely broad and much higher than the external saddle. It has slightly sloping sides, and is obliquely rounded above. The second lateral lobe is much shorter and narrower than the first, and does not extend so far down even as the external lobe. Its sides converge and it possesses some three or four denticulations at its base which together form a low arch. The second lateral saddle is flattened above, broad and very low. The single auxiliary lobe is very short but broad; it bears some five denticulations at the bottom, which are arranged in a straight line.

The measurements are—

Diameter of the shell	51 mm.
„ of the umbilicus	20 „
Height of the last volution from the umbilical suture	18 „
„ „ „ „ from the preceding whorl	14 „
Thickness of the last volution	9 „

Locality and Geological Position.—Nanga, in the lowest beds of the Lower Ceratite Limestone; a single specimen.

Remarks.—This species is not difficult to recognize. Its cross section is very characteristic, and corresponds only with forms possessing entirely different sutural lines. Among such *Gyronites Nangaensis*, W., may be quoted, but in this case, even if the sutural lines were invisible, the sculpture of the shell would make a distinction easy, as there are about 50 radial folds on one circuit in this species, whilst there are only about 15 on *P. compressus*, W.

5. PRIONOLOBUS PLICATUS, Waagen, n. gen. et. sp. Pl. XXXV, fig. 2 a, b, c.

The general outline of this species is also flatly discoidal, with large umbilicus, compressed whorls and a flattened external side. The involution of the shell is inconsiderable, and the overlap of the last whorl over the preceding one amounts to just one-fifth of the height of the former.

The cross-section of the whorls is an elongated oval, with a flattened external part, being very much higher than broad. The largest transverse diameter of the whorls is situated a little above the upper limit of the inner third of the height of the whorl. From this point, the lateral parts slope scarcely at all towards the umbilicus, and are at the same time but very slightly arched. The umbilicus is surrounded by a distinct and inclined umbilical wall, with a distinct, but blunt umbilical edge. The slope of the lateral parts towards the siphonal side is much more considerable, and the sides are at the same time distinctly arched. There are distinct, but nevertheless rather obtuse external edges.

Sculpture appears only after the diameter has attained about 25^{mm.}, the inner whorls being entirely smooth. After this, single radial folds are developed; these are very low and faint at first, but become more marked as the specimens increase in size. These folds are invariably single. They begin at the umbilical edge, take a slight bend forwards, are most marked about the middle of the lateral parts, and disappear again long before reaching the external edge, along which extends a smooth zone, occupying about one-third of the height of the whorl.

The specimen under description has only part of its body-chamber preserved, so that it is not clear whether the sculpture changes again nearer the mouth of the shell.

The sutural line is well seen. The external lobe is broad but very shallow. It is divided in the middle by a deep siphonal saddle into two distinct lateral branches, situated just on the external edges, and each of which possesses three small denticulations below. The external saddle is broad but very low. It is slightly phylloid in shape, is only very little higher than the siphonal saddle, and is well and evenly rounded above. The first lateral lobe is neither very broad nor deep. Its sides are almost parallel, and there are some four or five small denticulations below which form together a not very prominent arch. The first lateral saddle is the broadest member of the whole sutural line, but is only slightly higher than the external saddle. Its sides have a distinct slope, and it is somewhat obliquely rounded above. The second lateral lobe is very small, and much shorter and narrower than

the first. It has steeply sloping sides and has some four very small denticulations on its base. The second lateral saddle is broad, but very short. Its sides slope and it is distinctly flattened above. After this follows the auxiliary series, forming a single short, but broad lobe which reaches down to the umbilical suture. It bears along its base some six or seven small denticulations all of the same size, arranged in a straight radial line.

The dimensions of the figured specimen are :—

Diameter of the shell	. . . . .	59 mm.
„ of the umbilicus	. . . . .	21 „
Height of the last volution from the umbilical suture	. . . . .	22 „
„ „ „ „ from the preceding whorl	. . . . .	18 „
Thickness of the last volution	. . . . .	11 „

Locality and Geological Position.—Khoora; in the middle region of the Lower Ceratite Limestone; a single specimen.

Remarks.—This species is most closely related to the preceding one, and it is evident that both belong to one and the same evolutionary series. The differences of the two forms are, however, clear enough. There is first the general outline of the shell which shows marked differences. The whorls are much less compressed, the umbilical wall having a steeper slope in this than in the preceding species. The sculpture in *P. compressus* is most pronounced in the vicinity of the umbilical wall, whilst it is equally well marked all over, in the form under description. In all these respects our species is decidedly intermediate between the geologically older *P. compressus*, and the next following *P. ovalis*.

6. PRIONOLOBUS OVALIS, Waagen, n. gen. et. sp. Pl. XXXV, fig. 1 a, b, c.

The general outline of the species is flatly discoidal, with very large umbilicus and compressed whorls. The involution of the shell is very small, and the overlap of the last whorl over the preceding one amounts to but little more than one-fifth of the height of the former.

The cross-section of the whorls is an elongated ellipse with a slightly flattened sides. The greatest transverse diameter occurs at the upper limit of the inner third of the height of the whorl. From this point the lateral parts slope but little towards the umbilicus. The umbilicus is surrounded by a rather indistinct wall, and there is a very obtuse, rather rounded umbilical edge. The lateral parts slope rather distinctly towards the siphonal side, and are at the same time well curved. The external part is indistinctly flattened, with very obtuse outer edges.

The sculpture is very simple and is restricted to a certain portion of its length only. The innermost volutions, up to a total diameter of about 20mm., are perfectly smooth. After this, radial folds begin to appear; they are well apart from each other, are always simple, and bend slightly forwards. They begin at the indistinct, rounded umbilical edge, where they are most marked. Thence they extend to near the middle of the lateral parts, where they disappear, leaving the outer half

of the whorl entirely smooth. These folds continue, however, only for about one volution, on which are seen about sixteen to eighteen of them, after which the shell becomes smooth again. The greater part of this smooth portion belongs to the body-chamber.

The sutural lines are tolerably distinct. The external lobe is very shallow and broad. It is divided into two distinct lateral branches by a rather low, but broad siphonal saddle. Each of the lateral branches bears three distinct denticulations below. The external saddle is short, not very broad and slightly phylloid in shape. Its top is quite symmetrically rounded. The first lateral lobe is very narrow and extends but little below the external lobe. Its sides converge slightly towards its base on which some four or five distinct denticulations are arranged in a very low arch. The first lateral saddle is the largest member of the sutural line. It is extremely broad, and is higher than all the other saddles. Its sides converge slightly toward its apex, which is somewhat obliquely rounded and at the same time depressed in shape. The second lateral lobe is very much shallower and narrower than the first. Its sides converge slightly towards its base, which is provided with four very small denticulations, all on the same level. The second lateral saddle is tolerably broad but very low, and distinctly flattened above. After this follow about six small denticulations, which are equal in size and arranged on the same level. They represent together the auxiliary series.

The dimensions of the single specimen in existence are as follows :—

Diameter of the shell	. . . . .	62 mm.
„ of the umbilicus	. . . . .	27 „
Height of the last volution from the umbilical suture	. . . . .	20.5 „
„ „ „ „ from the preceding whorl	. . . . .	17 „
Thickness of the last volution	. . . . .	11.5 „

The latter portion of the last whorl belongs to the body-chamber.

Locality and Geological Position.—West of Khoora, in the uppermost beds of the Lower Ceratite Limestone; a single specimen.

Remarks.—The present species forms the last link in the evolutionary series in which I have placed it. We have seen that the tendency of the forms within this series is gradually to transform the cross section of the whorls into a perfect oval; this is attained in the greatest perfection by this last species. The umbilical edge, most strongly developed in *P. compressus* and already much reduced in *P. plicatus*, has altogether disappeared in this species. The same is the case, though in a lesser degree, with regard to the external edges, of which only faint traces may be observed in *P. ovalis*. These characters serve as points of distinction between our last form and the two preceding ones; there are, however, other features which are no less striking. They find expression chiefly in the sculpture. The latter, which is well-marked in *P. compressus*, where it is chiefly restricted to the vicinity of the umbilical margin, becomes fainter in *P. plicatus*, is least pronounced in *P. ovalis*, so that in this respect also we can distinguish between the three species. But on the whole they are very similar to each other and belong evidently to one and the same evolutionary series.

c. ISOLATED SPECIES.

7. PRIONOLOBUS PLICATILIS, Waagen, n. gen. et sp.; Pl. XXXVI, fig. 1 a, b, c.

This species has been founded on a fragmentary specimen only, but the shape, no less than the sculpture, of this form, is so characteristic that I cannot abstain from giving it a specific name. In general outline it is flatly discoidal, with large umbilicus and compressed whorls. The involution of the shell is very small, and the overlap of the last whorl over the preceding one amounts only to about one seventh of the entire height of the former.

The cross section of the whorls is a compressed oval, with a flattened external side. The greatest transverse diameter is situated at the upper limit of the inner fourth of the height of the whorl. From that point, the lateral parts slope very gently towards the umbilicus, being at the same time but very little inflated. The umbilicus is surrounded by a high and slightly arched umbilical wall; there is no trace of an umbilical edge. The lateral parts slope much more decidedly towards the siphonal side, and are at the same time much flatter. The external part of the whorls is flattened and rather narrow, with distinct external edges.

The sculpture is very characteristic; it consists of very numerous, fine radial folds, which are very irregularly developed and are most pronounced on the highest parts of the sides of the whorls. They are almost quite straight and disappear again about the middle of the lateral parts.

The sutural line is well preserved. The siphonal lobe is neither very deep nor broad, and is situated entirely on the flattened external part of the shell. It is divided in the centre into two short branches by a rather low angular siphonal saddle, each of which bears at its base two small denticulations. The external saddle is broad, but rather low. It is evenly rounded above, and is higher than the siphonal saddle. The first lateral lobe is much narrower than the adjoining saddles. Its sides tend to converge downwards; there are four small denticulations, arranged in a rather prominent arch. This lobe is only a little longer than the siphonal one. The first lateral saddle is, comparatively speaking, very large. It is much higher than the external saddle, is slightly oblique in shape, and somewhat narrowly rounded above. The second lateral lobe is as broad as the first but not nearly so deep. Its base is on much the same level as the siphonal lobe. Its sides slope distinctly and it has some three small denticulations, which are arranged almost on the same level. The second lateral saddle is very small and much lower than the first. After this come three denticulations, on the same level, representing together the auxiliary series.

The specimen is entirely composed of septa which are very closely arranged.

The dimensions of the specimen are :—

Diameter of the shell	37 mm.
„ of the umbilicus	14 „
Height of the last volution from the umbilical suture	14 „
„ „ „ from the preceding whorl	11.5 „
Thickness of the last volution	7.5 „

Locality and Geological Position.—Sheik-Budin, apparently from the Lower Ceratite Limestone; a single specimen.

Remarks.—This species is quite isolated among all the other forms of the genus occurring in the Salt-Range, and cannot be compared to any other in detail.

8. *PRIONOLOBUS UNDATUS*, Waagen, n. gen. et sp.; Pl. XXXVI, fig. 5 a, b.

This species has been founded on a single fragmentary specimen, which, however, is of considerable interest, as it is the only form of *Prionolobus* occurring in the Ceratite Marls, and it is the more interesting, in that it shows no relationship whatever to any of the other species, but is a representative of a separate group.

Its general shape is flatly discoidal, with compressed whorls and a small umbilicus. The rate of involution cannot be observed, as the anterior half of the shell is quite crushed; but it must have been considerable.

The cross section of the whorls is a compressed oval, with a distinctly flattened external part. The largest transverse diameter of the whorls occurs just at the umbilical edge, which is very sharp and distinct. The umbilical wall thus formed is vertical and rather high. The lateral parts slope very distinctly towards the siphonal side, but are not very highly arched. The outer side is rather narrow and flat, and has sharp external edges. Where the shell substance is well preserved, as is the case on parts of the specimen, one may observe a slightly marked line along the middle of the flattened external part which forms a kind of median keel or crest. Not the slightest trace of this keel is shown on the internal cast.

The sculpture is very remarkable. It consists of distinctly falciform ribs, which are of a very peculiar description. They spring from the umbilical edge, and extend thence up to about the middle of the lateral parts. Here they are most marked and perhaps slightly thickened. From this point the ribs bend towards the front, but are at the same time so faint, that they could not well be shown in the drawing. Each rib is divided into two, above the thickened part, the branches being separated from each other by a very shallow depression. These features are so feeble that they can only be seen when in certain positions with regard to the light.

The sutural line is only partially preserved. The siphonal lobe is broken away in most places, but seems to have been so broad, that its lateral branches were entirely situated on the lateral parts. The external saddle is very narrow, evenly rounded above, with nearly parallel sides. It is not high. The first lateral lobe is as broad as the external saddle. It is not very deep, and has parallel sides and some three or four denticulations, which are all on the same level.

The first lateral saddle is very much broader than the preceding lobe. It is much higher than the external saddle and is somewhat oblique. The second lateral lobe is very much shorter than the first but of much the same breadth. It has some three denticulations below, which are on the same level. The second lateral saddle is narrower than the first but broader than the external saddle, with

which it is on much the same level. Of the auxiliary series only three denticulations, on the same line and above the umbilical edge, are visible; beyond this nothing can be distinguished.

The specimen, so far as it is preserved, represents only the body-chamber with part of its last sutural line. The shell is preserved on the greater portion of the specimen, but the apertural margin is broken away.

The dimensions of this specimen are :—

Diameter of the shell	29 mm.
„ of the umbilicus	6 „
Height of the last volution from the umbilical suture	15 „
„ „ „ „ from the preceding whorl	?
Thickness of the last volution	8 „

Locality and Geological Position.—Virgal, in the Ceratite Marls; a single fragment.

Remarks.—I am not quite sure whether I am right in including this species in the genus *Prionolobus*, as its configuration is not quite typical of the genus, and it might very well be taken for that of *Meekoceras*. The sutural line, however, so far as it is visible, points, rather to *Prionolobus*, but it must not be forgotten that this line is only partially preserved, and that if better specimens were available, it might turn out to be that of *Meekoceras*.

II. Section : ROTUNDATI.

d. ISOLATED SPECIES.

9. PRIONOLOBUS BUCHIANUS, Koninck sp. ; Pl. XXXV, fig. 5 a, b, c.

1863. *Ceratites Buchianus*, Koninck : Quart. Journ. Geolog. Soc. Lond., Vol. XIX, page 13, Pl. VI, fig. 4.

1863. *Ceratites Buchianus*, Koninck : Fossiles Paléozoïques de l'Inde, page 9, Pl. VI, fig. 4.

As in previous cases, it is extremely difficult to decide what species is really referred to under this name, as M. de Koninck's drawings are so imperfect that it is scarcely possible to recognise the species from them. All that it is possible to infer from this drawing is, that it must refer to a species with a large umbilicus, distinct radial sculpture, and a sutural line which evidently points to the genus *Prionolobus*. As these characters are combined in the specimen which I am about to describe, I have ventured to affix M. de Koninck's name to this form.

Its general shape is flatly discoidal, with tolerably compressed whorls and a large umbilicus. The greatest transverse diameter of the whorls is situated a little below the centre of the vertical axis of the cross-section of the whorls. From this point the lateral parts slope scarcely at all towards the umbilicus and are also barely perceptibly arched. The umbilicus is surrounded by a high, sloping umbilical wall, and an obtuse umbilical edge. The lateral parts slope distinctly towards the siphonal side and are at the same time rather inflated. The external part is almost quite regularly rounded, being perhaps very slightly depressed or flattened. At all

events it passes gradually into the lateral parts, external edges being decidedly absent.

The sculpture is very characteristic, and the inner volutions differ in this respect from the outer ones. In Mons. de Koninck's specimen the inner volutions are not preserved at all, and thus a very strict comparison is not possible. Nor does my specimen show more than part of these inner volutions, which up to a diameter of shell of about 30 mm., bear only single knob-like folds, which are most marked on the umbilical edge and extend slightly towards the middle of the lateral parts of the whorls, without, however, reaching so far. There are about ten such knobs on one circuit. On the last volution the sculpture is transformed into more numerous radial folds, which are also most marked on the umbilical edge, whence they extend in an almost radial direction to within a short distance of the external part of the shell, at the same time becoming fainter. There may have been about 20 to 26 of these folds on one circuit, in all probability becoming fainter as the age of the shell increased, the body-chamber being probably quite smooth. One specimen, however, is entirely composed of septa.

The sutural line is tolerably well preserved, the external lobe being very broad and shallow, and divided in the centre by a very broad and low siphonal tubercle, into two oblique lateral branches, each of which bears on its base three small denticulations. The external saddle is also very broad and low, and barely higher than the siphonal saddle. It is evenly, but very flatly rounded above. The first lateral lobe is deep and very narrow. It reaches much further down than the siphonal lobe, has nearly parallel sides, and bears some five small denticulations below, arranged in a very prominent arch. The first lateral saddle is slightly narrower than the external saddle, but is much higher. It is somewhat obliquely rounded above. The second lateral lobe is much shorter and narrower than the first. It is not even as deep as the external lobe. Its sides converge distinctly towards its base, on which there are some three denticulations, all on the same level. The second lateral saddle is very much lower and narrower than the first; nevertheless its apex extends somewhat higher than that of the external saddle. The auxiliary series, composed of about four denticulations, which are all on the same level, is altogether situated on the umbilical wall.

The dimensions of the figured specimen are:—

Diameter of the shell	. . . . .	41 mm.
„ of the umbilicus	. . . . .	17 „
Height of the last whorl from the umbilical suture	. . . . .	14 „
„ „ „ from the preceding volution	. . . . .	11 „
Thickness of the last whorl	. . . . .	9 „

Locality and Geological Position.—West of Khoora, in the lower region of the Lower Ceratite Limestone; a single specimen.

Remarks.—Among all the species of *Prionolobus* hitherto described, the only forms with which the present species can be compared are those included in the group of *P. compressus*. It may however be distinguished from them by the absence of external edges and the peculiar sculpture of the inner volutions, which has not

been observed on any other species of the genus. Some species of *Lecanites* and *Gyronites* resemble the form under consideration, but in these cases the differences of the sutural line make a distinction easy.

10. *PRIONOLOBUS OPHIONEUS*, Waagen, n. gen. et sp.; Pl. XXXIV, fig. 6 a, b.

In general shape this shell is also flatly discoidal, with somewhat inflated whorls and a large umbilicus. The involution is not considerable, and the overlap of the last whorl over the preceding one amounts to a little less than one third of the entire height of the former.

The cross section of the whorls is perfectly oval, with a well-rounded external side. The greatest transverse diameter of the whorls occurs just at half the height of the whorl. From this point the lateral parts descend with a very even curve towards the umbilicus, as well as towards the siphonal side. In the umbilical region the bend of the lateral parts is so regular, that no distinct umbilical wall is formed. The siphonal part is rather broadly and evenly rounded and passes gradually into the lateral parts. The specimen is perfectly smooth.

The sutural line is fairly well preserved. The external lobe is broad, but not very deep, and divided in the middle, by a siphonal saddle, into two lateral branches which are rounded below, and are apparently without denticulations. The external saddle is not very broad nor high. It is evenly rounded above. The first lateral lobe extends considerably lower down than the external lobe and is at the same time rather broad. The sides converge only very slightly downwards, and there are some six very small denticulations at the base, which form together a very prominent arch. The first lateral saddle is of approximately the same breadth as the preceding lobe, but extends considerably higher up than the external saddle. Its sides are nearly parallel, and its apex is broadly and evenly rounded. The second lateral lobe is somewhat shorter and narrower than the first. It is on the whole slightly club-shaped and has on its base some four denticulations arranged in an arch. The second lateral saddle is very low and narrow, and evenly rounded above. The auxiliary series is composed of some six small denticulations, all of equal size and arranged in a straight line.

The measurements of the figured specimen are :—

Diameter of the shell	. . . . .	55 mm.
„ of the umbilicus	. . . . .	20 „
Height of the last volution from the umbilical suture	. . . . .	19 „
„ „ „ from the preceding whorl	. . . . .	14 „
Thickness of the last volution	. . . . .	12 „

Locality and Geological Position.—Khoora, in the Lower Ceratite Limestone ; a single specimen.

Remarks.—The present species occupies a very isolated position among all the other forms of the genus, and there is none with which it could be compared in detail. On the other hand, there exists much similarity to forms belonging to other genera, as, for example, to *Gyronites vermiformis*. The general outline of

both shells is very similar, although *G. vermiformis* is much more compressed than *P. ophioneus* ; the fundamental difference between them lies however in the sutural lines, and the entirely different horizons in which these forms are respectively found.

Another species which shows some similarity is *Lecanites gangeticus*, Kon., but the umbilicus and the sutural lines are quite different.

PLATE I.

- Fig. 1. Limestone slab from the *Lower Ceratite Limestone* near the junction with the *Ceratite Marls* at *Virgal*, containing the following:—
 Fig. *a, b, c, e, k*: *COLOBODUS DAMESI*, Waagen, n. sp., p. ; *a, c*, scales from the external side; *b, e*, skeleton bones; *k*, mandible tooth; all enlarged.
 Fig. *f, g, h, i*: *GYROLEPIS*, SP. INDET., p. ; *f, h*, scales from the external side; *g*, scale from the internal side; *i*, tooth; all enlarged.
 Fig. *d*, scale of a *GANOID*, internal side, genus and species not determinable, enlarged figure.
- Fig. 2. *ACRODUS FLEMINGIANUS*, Koninck, p. .
 Copy of Mons. de Koninck's figure: Quart. Journ. Geol. Soc., Vol. XIX.
- Figs. 3 and 4. *SAURICHTHYS* (?) *INDICUS*, Koninck, p. .
 Copies of Mons. de Koninck's figures in the Quart. Journ., Vol. XIX.
- Fig. 5. *ACRODUS JAECKELI*, Waagen, n. sp., p. .
 Lateral view of a fragment of a tooth from the *Stachella*-beds of the *Ceratite Sandstone* of *Chidroo*; 5 *a*, natural-size; 5 *b*, the same enlarged. (For better figures of this tooth see Pl. XL of this work.)

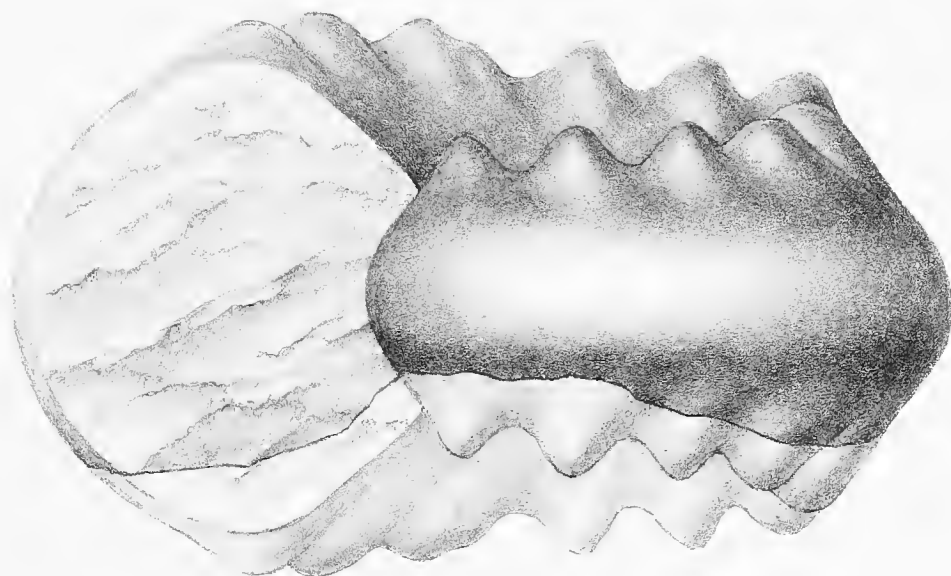


PLATE II.

1. STEPHANITES SUPERBUS, Waagen, n. gen. et. sp., p. .

All figures natural size ; 1, *a*, side-view ; 1, *b*, front-view ; 1, *c*, sutural line as far as preserved.

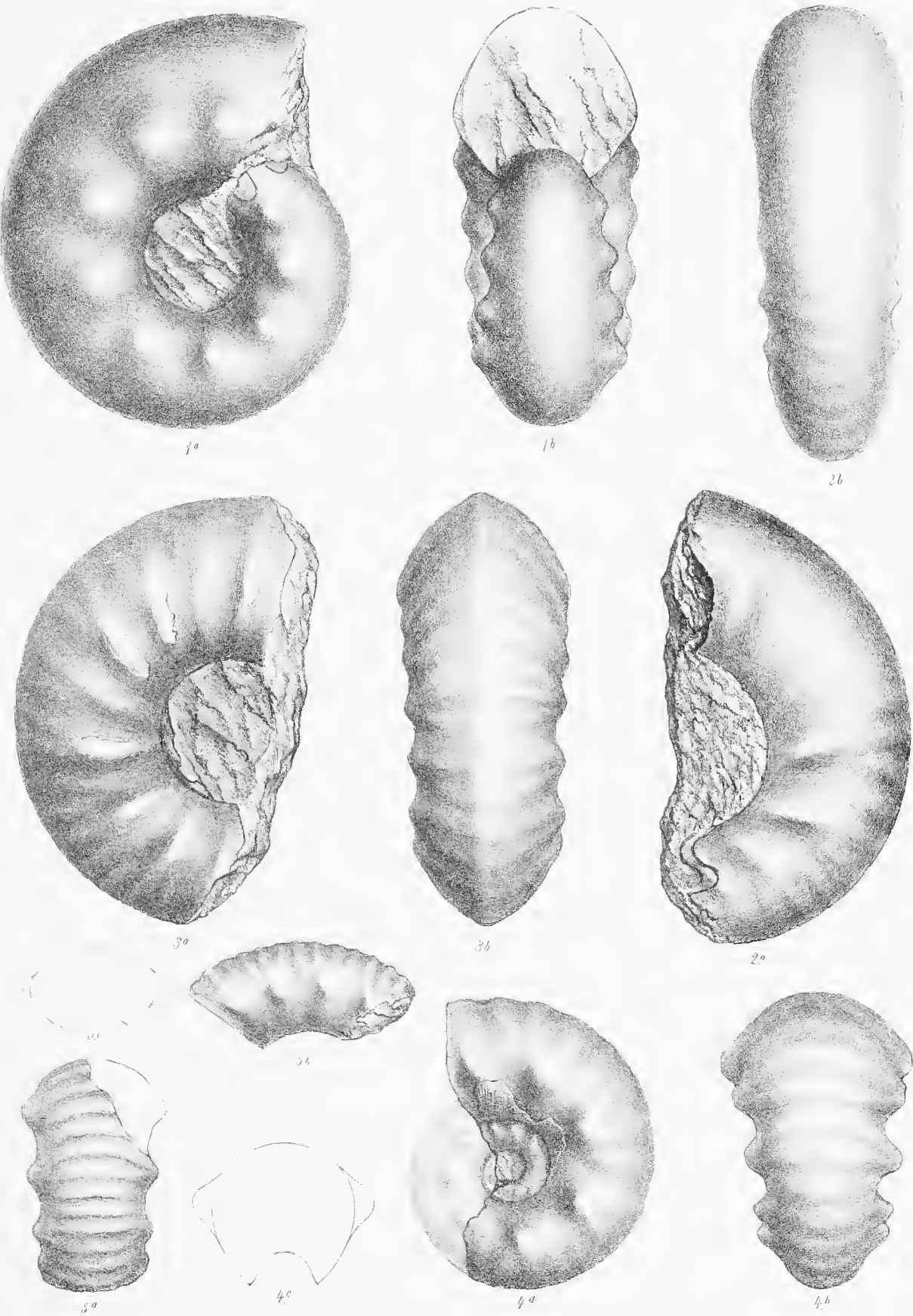
From the *Upper Ceratite Limestone* of *Chidroo*.



Joh Haupt p. na

PLATE III.

- Fig. 1. STEPHANITES CORONA, Waagen, n. gen. et. sp., p. .
From the *Upper Ceratite Limestone* of *Siran-ki-Dok* ; 1, *a*, lateral view ; 1, *b*, front-view.
- Fig. 2. ACROCHORDICERAS ATAVUM, Waagen, n. sp. p. .
From the *Lower division* of the *Ceratite Sandstone* (below *Stachella*-beds) of *Virgal* ;
2, *a*, lateral view ; 2, *b*, back-view.
- Fig. 3. ACROCHORDICERAS DIMIDIATUM, Waagen, n. sp., p. .
From the *Upper Ceratite Limestone* of *Siran-ki-Dok* ; 3, *a*, lateral view ; 3, *b*, back-view.
- Fig. 4. ACROCHORDICERAS DISTRACTUM, Waagen, n. sp., p. .
From the *Upper Ceratite Limestone* of *Siran-ki-Dok* ; 4, *a*, lateral view ; 4, *b*, back-view ; 4, *c*, cross section of the last whorl.
- Fig. 5. ACROCHORDICERAS CORONATUM, Waagen, n. sp., p. .
Fragmentary specimen from the *Upper Ceratite Limestone*, on the road between *Swas* and *Budikheyl* ; 5, *a*, back-view ; 5, *b*, lateral view ; 5, *c*, cross section.



A. von der Hagen

Joh. Hauptmann

PLATE IV.

- Fig. 1. CERATITES MURCHISONIANUS, Koninck, p. .
Specimen with part of the body-chamber preserved, from the *Upper Ceratite Limestone* of *Chidroo*; 1, *a*, lateral view; 1, *b*, front-view.
- Fig. 2. CERATITES PATELLA, Waagen, n. sp., p. .
Specimen without shell or traces of sutural lines, from the *Upper Ceratite Limestone* of *Siran-ki-Dok*; 2, *a*, lateral view; 2, *b*, back-view.
- Fig. 3. CERATITES SAGITTA, Waagen, n. sp., p. .
Fragment without sutural lines, from the lower limit of the *Upper Ceratite Limestone* of *Chidroo*; 3, *a*, lateral view; 3, *b*, back-view; 3, *c*, cross section.
- Fig. 4. ACROCHORDICERAS COMPRESSUM, Waagen, n. sp., p. .
Fragment from the upper region of the *Upper Ceratite Limestone* of *Chidroo*; 4, *a*, lateral view; 4, *b*, back-view; 4, *c*, cross section.
- Fig. 5. ACROCHORDICERAS cf. DAMESI, Noetling, p. .
Fragment from the *Upper Ceratite Limestone* of *Siran-ki-Dok*; 5, *a*, lateral view; 5, *b*, cross section.

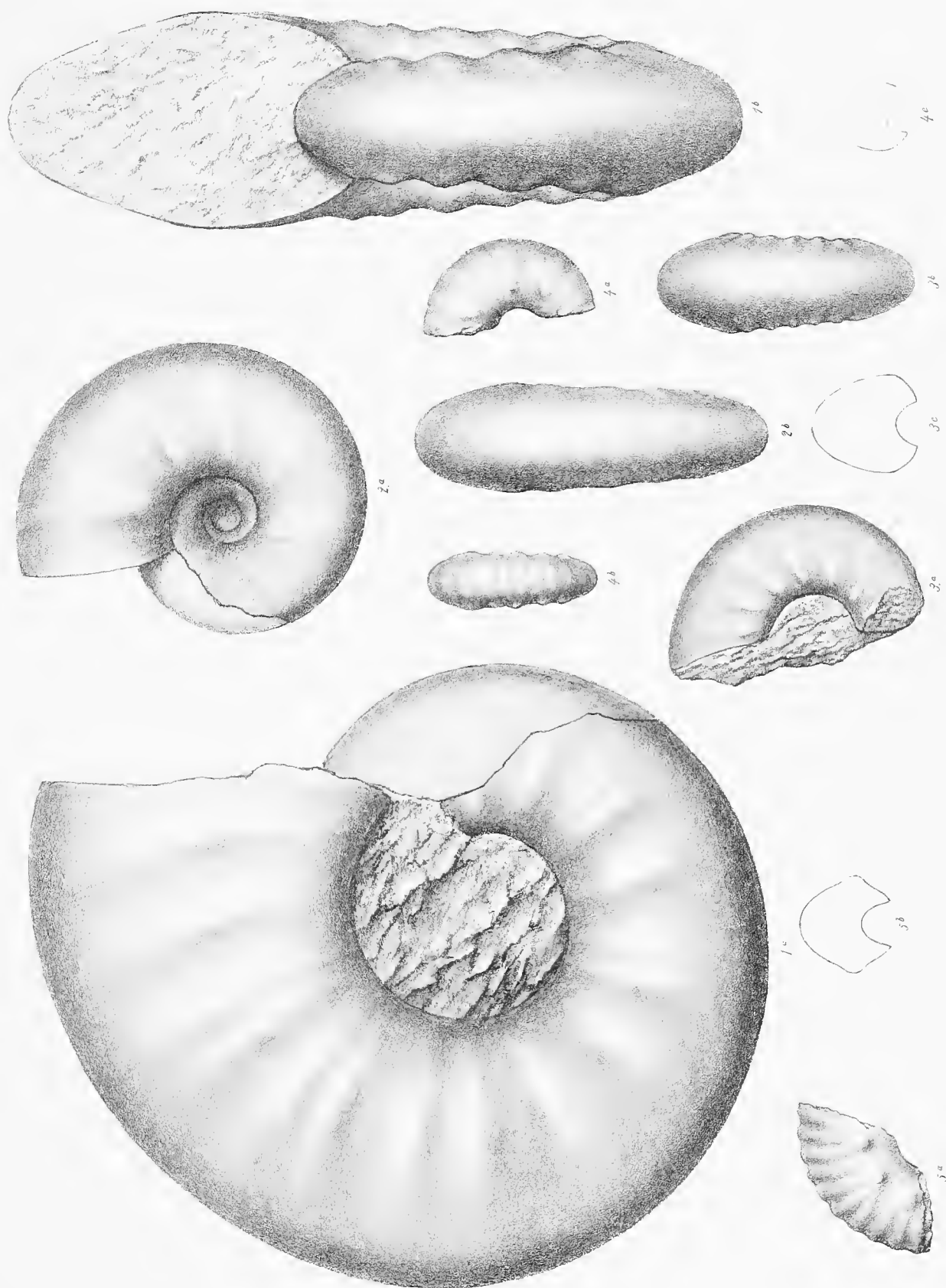
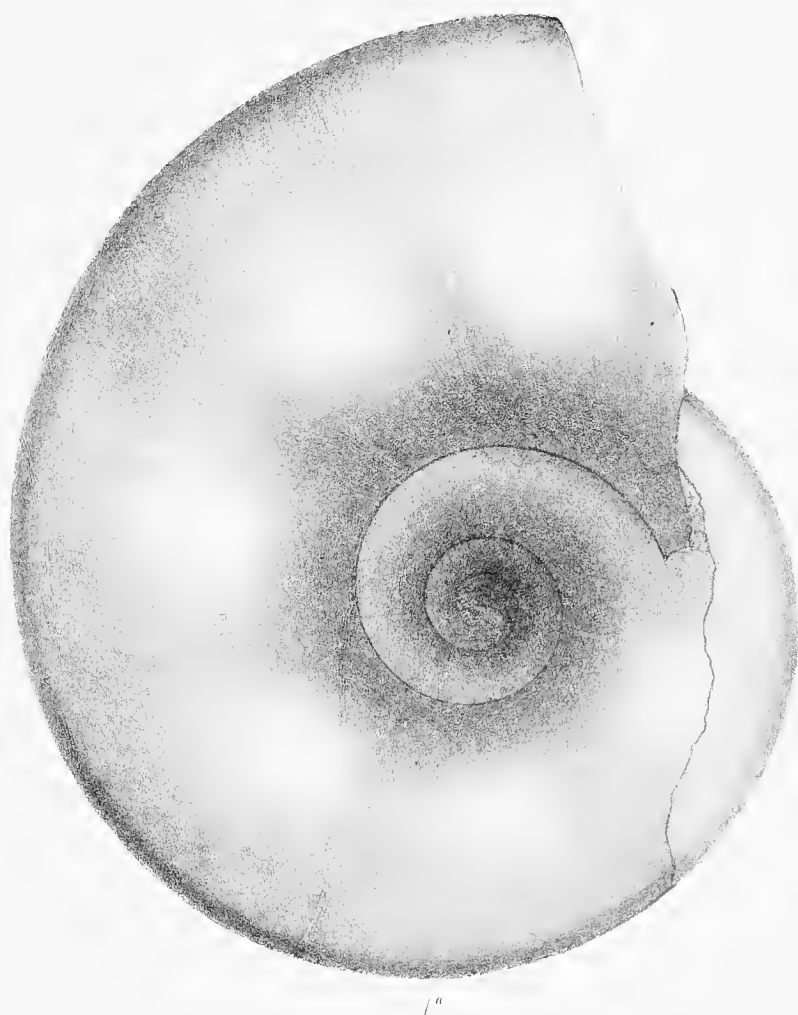
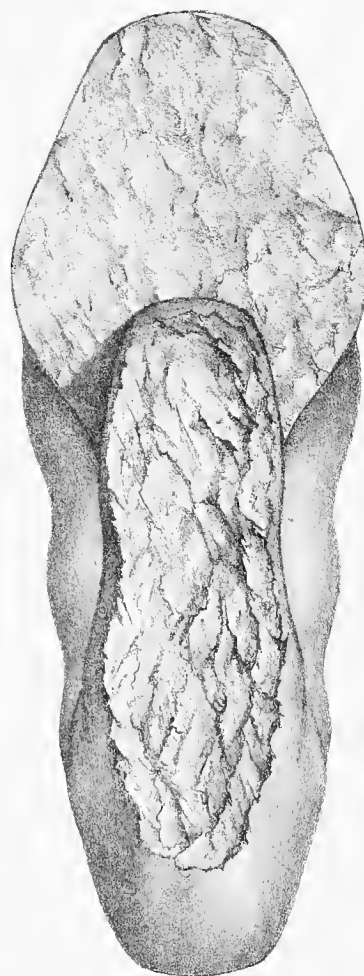


PLATE V.

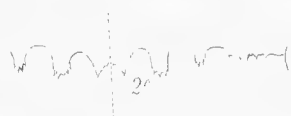
- Fig. 1. PRIONITES UNDATUS, Waagen, n. gen. et sp., p. .
Specimen with shell partly preserved, all converted into a sparry matrix, from the
Upper Ceratite Limestone of *Chidroo*; 1, *a*, lateral view; 1, *b*, front-view.
- Fig. 2. PRIONITES TUBERCULATUS, Waagen, n. gen. et. sp., p. .
Specimen without shell, and with only partially preserved body-chamber, from the
Upper Ceratite Limestone of *Chidroo*; 2, *a*, lateral view; 2, *b*, front-view
2, *c*, sutural line.
- Fig. 3. CERATITES (?) ANGULARIS, Waagen, n. sp., p. .
Fragment of the body-chamber of a middle-sized specimen, without shell, from
the *Upper Ceratite Limestone* of *Koofri*; 3, *a*, back-view; 3, *b*, lateral view
3, *c*, cross section.



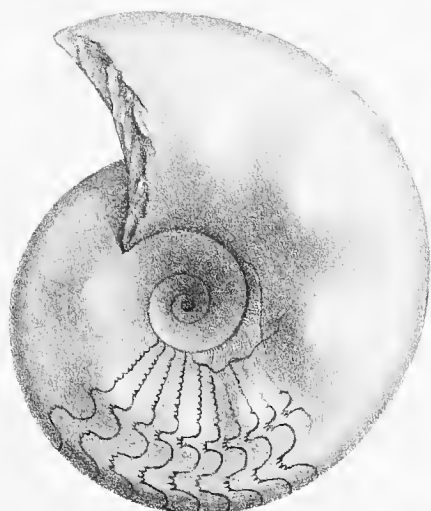
1^a



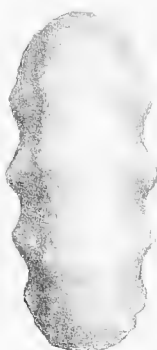
1^b



2^a



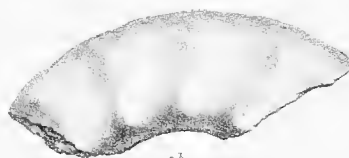
2^a



3^a



3^c



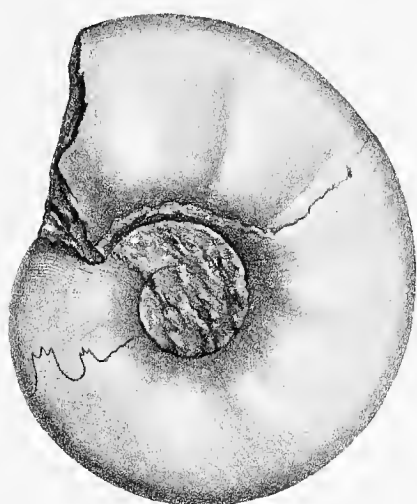
3^b



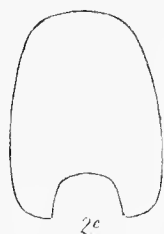
2^b

PLATE VI.

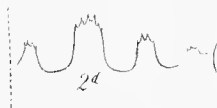
- Fig. 1. PRIONITES TRAPEZOIDALIS, Waagen, n. gen. et. sp., p. .
Specimen with partly preserved body-chamber, and fragments of shell, from the
topmost beds of the *Ceratite Sandstone* of *Siran-ki-Dok*; 1, *a*, lateral view; 1, *b*,
front-view.
- Fig. 2. CERATITES NORMALIS, Waagen, n. sp., p. .
Fragment, showing the end of septa and the largest part of the body-chamber,
from the *lower region* of the *Ceratite Sandstone* of *Nanga*; 2, *a*, lateral view;
2, *b*, back-view; 2, *c*, cross section of the last whorl; 2, *d*, sutural line (upside
down).
- Figs. 3, 4, 5. PRIONITES LINGUATUS, Waagen, n. gen. et sp., p. .
From the *Upper Ceratite Limestone* of *Koofri*; fig. 3. *a*, lateral view of a middle-
sized specimen; 3, *b*, back-view of the same specimen; fig. 4, *a*, fragment,
showing the sutural lines; 4, *b*, sutural line of this specimen; fig. 5, cross
section of the largest fragment.
- Fig. 6. PRIONITES ARENARIUS, Waagen, n. gen. et sp., p. .
Fragment, representing part of the body-chamber, from the *lower region* of the
Ceratite Sandstone of *Virgal*; 6, *a*, lateral view; 6, *b*, cross section.



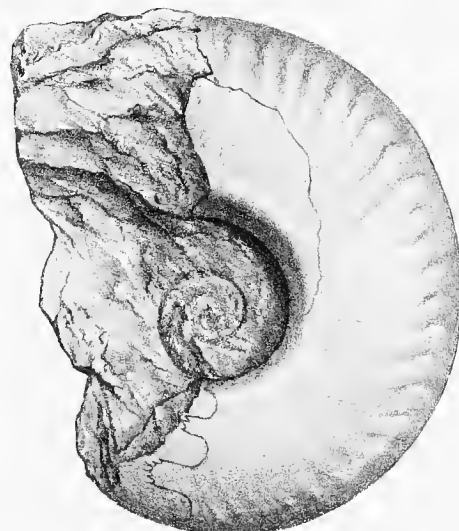
1^c



2^c



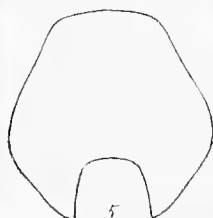
2^d



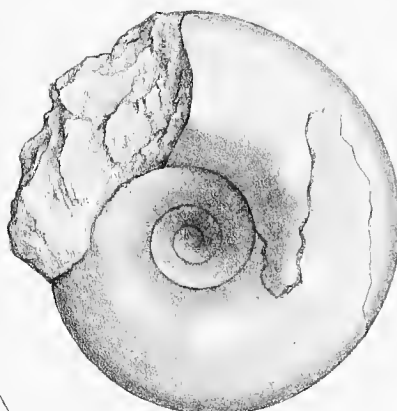
2^a



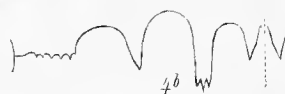
1^b



5



3^a



4^b



2^b



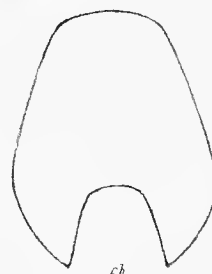
6^a



3^b



4^a



6^b

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PLATE VII.

- Fig. 1. *CELTITES ARMATUS*, Waagen, n. sp., p. .
Specimen without shell, with only part of the body-chamber preserved, from the *topmost beds* of the *Ceratite Sandstone* of *Chidroo*; 1, *a*, lateral view; 1, *b*, back-view; 1, *c*, cross section of the last whorl. (See also fig. 7.)
- Fig. 2. *CELTITES MULTIPLICATUS*, Waagen, n. sp., p. .
Specimen without shell, with a small portion of the body-chamber preserved, from the *Upper Ceratite Limestone* of *Koofri*; 2, *a*, lateral view; 2, *b*, front-view; 2, *c*, sutural line (upside down).
- Fig. 3. *CELTITES SUBRECTANGULARIS*, Waagen, n. sp., p. .
Specimen without shell, somewhat weathered, and without sutural lines, from the *lower region* of the *Ceratite Sandstone* of *Virgal*; 3, *a*, lateral view; 3, *b*, front-view. (See also fig. 6.)
- Fig. 4. *CELTITES SPECIES INDETERM.*, p. .
Impression, and gutta-percha cast of the same, from the *Upper Ceratite Limestone* of *Chidroo*.
- Fig. 5. *CELTITES DIMORPHUS*, Waagen, n. sp., p. .
Specimen with body-chamber, and without sutural lines, from the *Upper Ceratite Limestone* of *Koofri*; 5, *a*, lateral view; 5, *b*, back-view; 5, *c*, front-view.
- Fig. 6. *CELTITES SUBRECTANGULARIS*, Waagen, n. sp., p.
Small specimen without sutural lines, from the *Stachella*-beds of the *Ceratite Sandstone* of *Amb*, somewhat better preserved than fig. 3; 6, *a*, lateral view; 6, *b*, back-view; 6, *c*, front-view. (See also fig. 3.)
- Fig. 7. *CELTITES ARMATUS*, Waagen, n. sp., p. .
Small specimen without sutural lines, from the *upper region* of the *Ceratite Sandstone* of *Chidroo*; 7, *a*, lateral view; 7, *b*, back-view; 7, *c*, front-view.
- Fig. 8. *FLEMINGITES NANUS*, Waagen, n. gen. et sp., p. .
Fragment from the *Stachella*-beds of the *Ceratite Sandstone* of *Amb*; 8, *a*, lateral view; 8, *b*, front-view.
- Figs. 9 and 10. *DINARITES CORONATUS*, Waagen, n. sp., p. .
Two specimens without sutural lines from the *Stachella*-beds of the *Ceratite Sandstone*. Fig. 9, from *Amb*: 9, *a*, lateral view; 9, *b*, front-view. Fig. 10, from *Nanga*; 10, *a*, lateral view; 10, *b*, front-view.

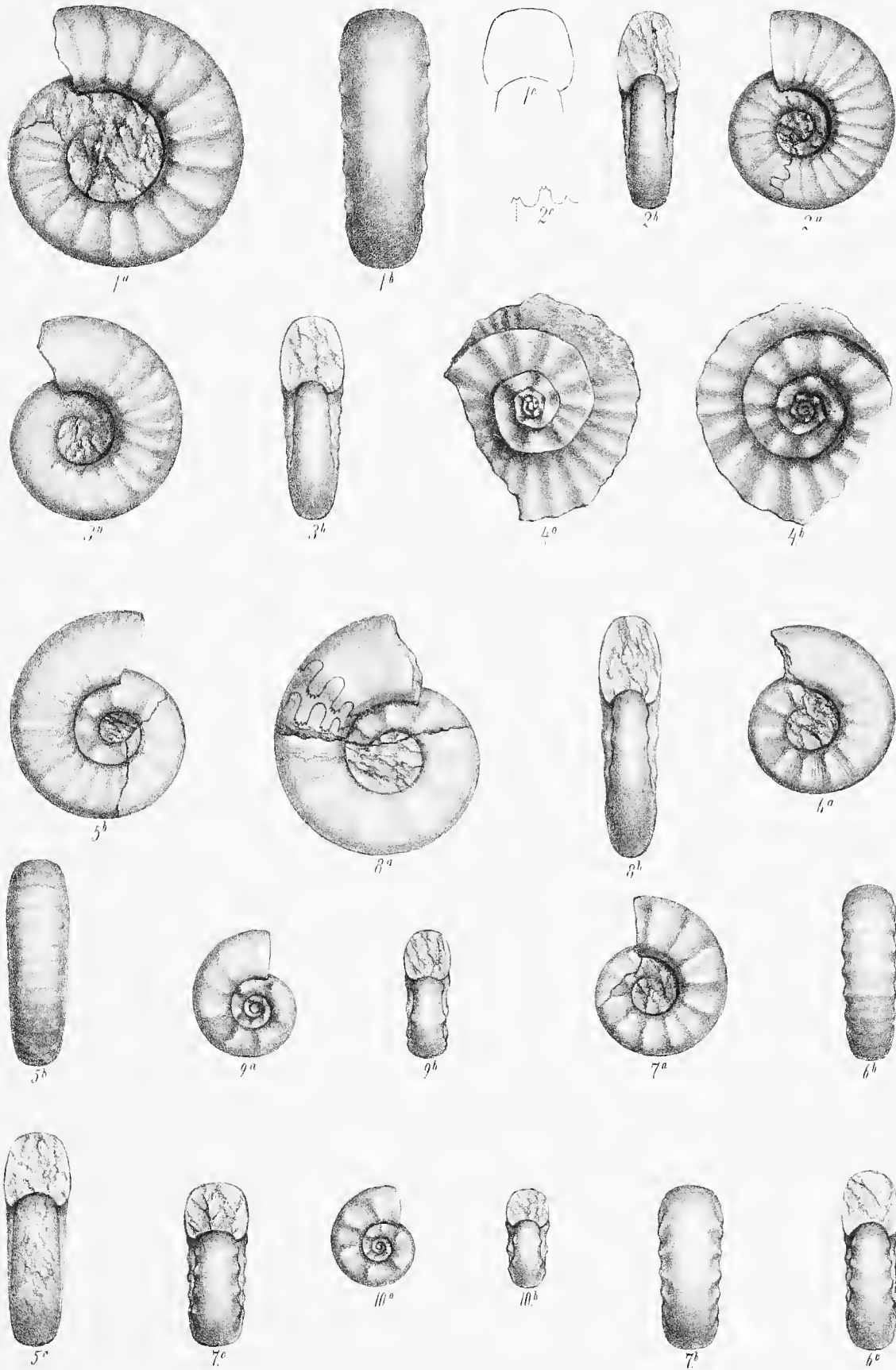


PLATE VII A.

- Figs. 1 and 2. *DINARITES MINUTUS*, Waagen, n. sp., p. .
 Two small specimens, internal casts, all composed of septa, from the *Ceratite*, *Marls of Virgal*. Fig. 1, lateral view, natural size; 1, *a*, the same enlarged; 1, *b*, front-view; 1, *c*, back-view; the latter two also enlarged. Fig. 2, second specimen, lateral view, natural size; 2, *a*, the same enlarged; 2, *b*, back-view; 2, *c*, front-view, also enlarged.
- Fig. 3. *CELTITES LÆVIGATUS*, Waagen, n. sp., p. .
 Fragment without shell, from the *lower region* of the *Ceratite Sandstone* of the *Chitta-Wan* near Ghari, lateral view.
- Fig. 4. *CELTITES TERES*, Waagen, n. sp., p. .
 Fragment, probably belonging to the *Upper Ceratite Limestone* of the vicinity of *Ghari*; 4, lateral view; 4, *a*, lateral view from the other side; 4, *b*, cross section.
- Fig. 5. Small slab of limestone from the higher beds of the *Upper Ceratite Limestone* of *Koofri*, containing two species of *Celtites*; the specimen on the left, represents *CELTITES OVALIS*, Waagen, n. sp., that on the right, *CELTITES ACUTEPLICATUS*, Waagen, n. sp.
- Fig. 5a. *CELTITES OVALIS*, Waagen, n. sp., p. .
 Fragment from the *Upper Ceratite Limestone* of *Koofri*; 5, *a*, lateral view; 5, *b*, cross section of the last whorl, at the distal end (same specimen as represented by fig. 5).
- Figs. 6 and 7. *CELTITES ACUTEPLICATUS*, Waagen, n. sp., p. .
 Two fragments from different localities. Fig. 6, from the *Upper Ceratite Limestone* of *Chidroo*. Fig. 7, two fragments from the *middle region* of the *Ceratite Sandstone* of *Virgal* (see also fig. 5, figure on the right side, and 5, *c*, for this species).
- Figs. 8 and 9. *DINARITES DIMORPHUS*, Waagen, n. sp., p. .
 Two specimens from the *highest beds* of the *Upper Ceratite Limestone* of *Koofri*. Fig. 8, specimen with part of body-chamber preserved; 8, lateral view, natural size; 8, *a*, cross section of the last whorl at the distal end. Fig. 9, small specimen showing only the inner whorls well preserved; 9, lateral view enlarged twice; 9, *a*, front-view, upside down, also twice enlarged.
- Fig. 10. *AMBITES RUPESTRIS*, Waagen, n. gen. et sp., p. .
 From the *Lower Ceratite Limestone* of *Khoora*; 10, lateral view; 10, *a*, cross section.
- Fig. 11. *CELTITES*, SPECIES INDET., p. .
 Fragment from the *topmost beds* of the *Upper Ceratite Limestone* of *Koofri*; 11, lateral view; 11, *a*, cross section.
- Figs. 12 & 13. *MONOPHYLLITES* (?) SPECIES INDET., p. .
 Fragments of two different specimens from the *Upper Ceratite Limestone* of the *Chitta-Wan*. 12, lateral view; 12, *a*, back view; 12, *b*, cross section; 13, other specimen, lateral view; 13, *a*, back-view.

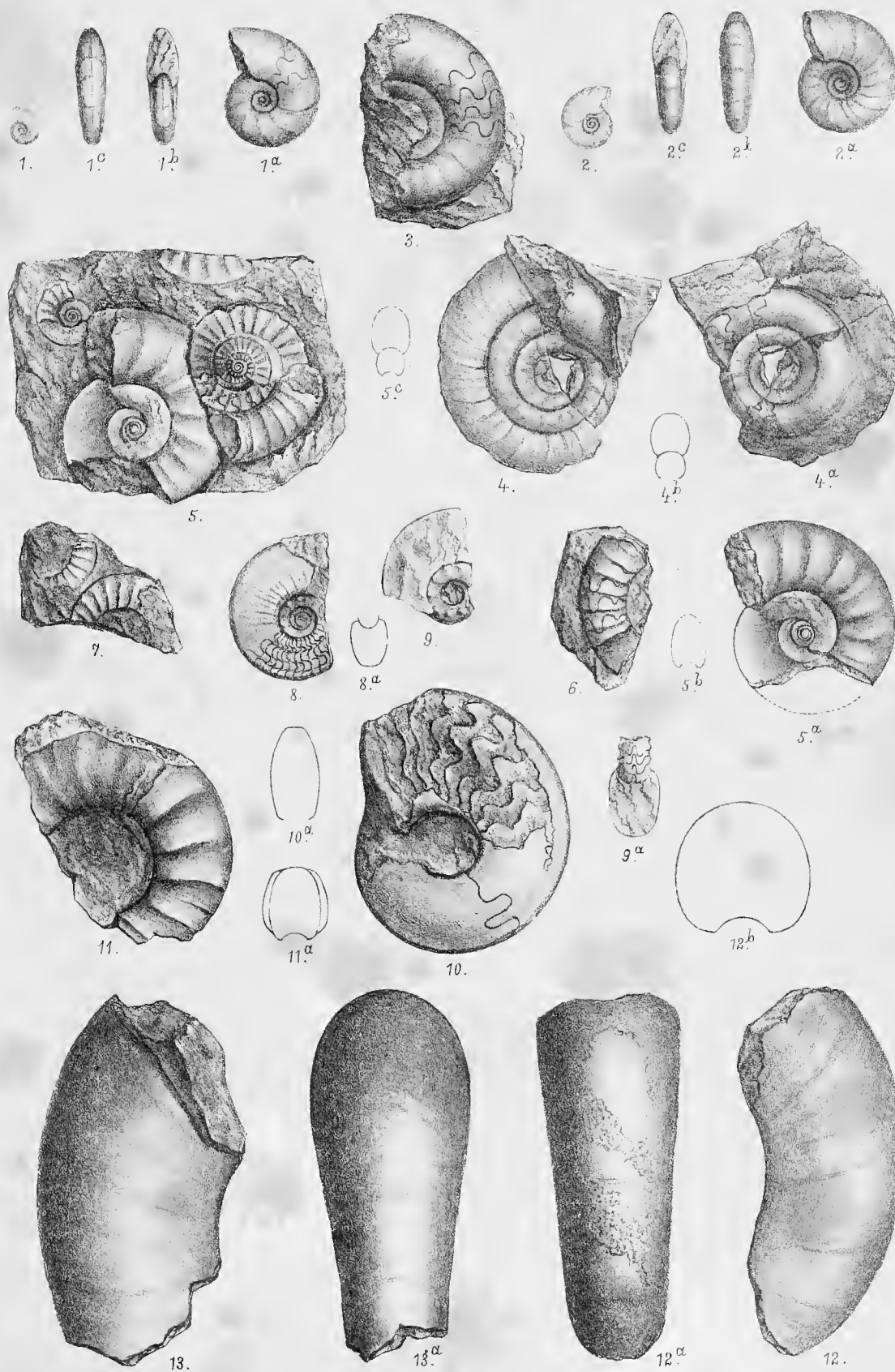


PLATE VIII.

Figs. 1 and 2. *SIBIRITES KINGIANUS*, Waagen, n. sp., p. .

Two specimens from the *Upper Ceratite Limestone of Chidroo*. Fig. 1, full-grown specimen with partly preserved body-chamber; 1, *a*, lateral view; 1, *b*, front-view; 1, *c*, back-view. Fig. 2, small specimen, partially preserved; 2, *a*, lateral view; 2, *b*, back-view; 2, *c*, cross section.

Figs. 3 and 4. *SIBIRITES CHIDRUENSIS*, Waagen, n. sp., p. .

Two specimens from the same bed and locality as the preceding; fig. 3, small specimen, partially preserved only, exhibiting its sutural line; 3, *a*, lateral view; 3, *b*, back-view; 3, *c*, sutural line, the saddles below. Fig. 4, specimen with partly preserved body-chamber; 4, *a*, lateral view; 4, *b*, front-view; 4, *c*, back-view.

Figs. 5, 6, & 9. *SIBIRITES DICHOTOMUS*, Waagen, n. sp., p. .

Three specimens from the *Upper Ceratite Limestone of Chidroo*. Fig. 5, small specimen; 5, *a*, lateral view; 5, *b*, back-view. Fig. 6, larger specimen, entirely composed of septa; 6, *a*, lateral view; 6, *b*, front-view. Fig. 9, middle-sized specimen, exhibiting its sutural lines; 9, *a*, lateral view; 9, *b*, front-view; 9, *c*, back-view; 9, *d*, sutural line, the saddles below.

Figs. 7 & 8. *SIBIRITES INAEQUICOSTATUS*, Waagen, n. sp., p. .

Two specimens from the *Upper Ceratite Limestone of Chidroo*. Fig. 7, small specimen; 7, *a*, lateral view; 7, *b*, back-view. Fig. 8, specimen with partially preserved body-chamber; 8, *a*, lateral view; 8, *b*, front-view.

Fig. 10. *SIBIRITES CERATITOIDES*, Waagen, n. sp., p. .

Fragment from the *Upper Ceratite Limestone of Chidroo*. All composed of septa only, partly showing sutural lines; 10, *a*, lateral view; 10, *b*, cross section; 10, *c*, back-view.

Fig. 11. *SIBIRITES DISCOIDES*, Waagen, n. sp., p. .

Fragment from the same bed and locality as the preceding; 11, *a*, lateral view; 11, *b*, back-view; 11, *c*, cross section.

Figs. 12 & 13. *SIBIRITES ANGULOSUS*, Waagen, n. sp., p. .

Two specimens from the *Upper Ceratite Limestone of Chidroo*. Fig. 12, fragment of larger specimen without sutural lines; 12, *a*, lateral view; 12, *b*, back-view; 12, *c*, cross section. Fig. 13, small specimen; 13, *a*, lateral view; 13, *b*, back-view.

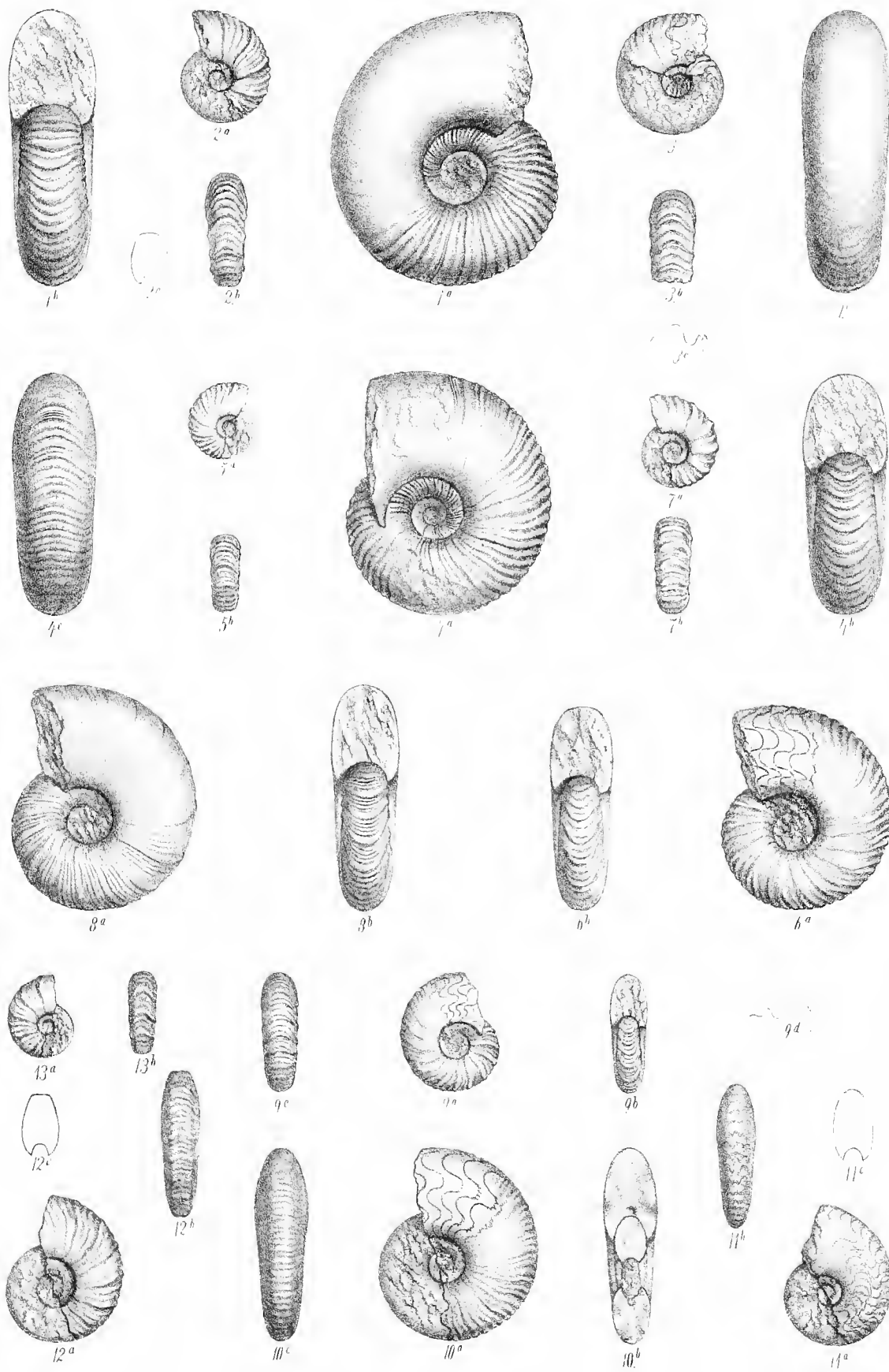


PLATE IX.

Figs. 1 & 2. *SIBIRITES TENUISTRIATUS*, Waagen, n. sp., p. .

Fig. 1, three fragments from the *Upper Ceratite Limestone* of the *Chitta-Wan* near *Ghari*; 1, *a*, fragment of the shell of a middle-sized specimen, lateral view; 1, *b*, external part of a large specimen, back-view; 1, *c, d*, small fragment, lateral view and back-view. Fig. 2, ideal figure, constructed from fragments.

Fig. 3. *SIBIRITES IBEX*, Waagen, n. sp., p. .

Fragment with the last sutural line and part of the body-chamber, from the *Upper Ceratite Limestone* of *Chidroo*; 3, *a*, lateral view; 3, *b*, back-view; 3, *c*, cross section.

Fig. 4. *SIBIRITES HIRCINUS*, Waagen, n. sp., p. .

Fragment from the *Upper Ceratite Limestone* of the *Chitta-Wan* near *Ghari*; 4, *a*, lateral view; 4, *b*, back-view.

Figs. 5 & 6. *SIBIRITES PARVUMBILICATUS*, Waagen, n. sp., p. .

Two specimens from the *Upper Ceratite Limestone* of *Siran-ki-Dok*. Fig. 5, large specimen with part of body-chamber; 5, *a*, lateral view; 5, *b*, back-view. Fig. 6, smaller specimen without sutural lines; 6, *a*, lateral view; 6, *b*, back-view.

Figs. 7 to 10. *GONIODISCUS TYPUS*, Waagen, n. gen. et sp., p. .

Four specimens from the *Upper Ceratite Limestone* of *Chidroo*. Fig. 7, large specimen, composed of septa only, not very well preserved, lateral view. Fig. 8, internal cast of a middle-sized specimen somewhat broken; 8, *a*, lateral view; 8, *b*, back-view; 8, *c*, front-view. Fig. 9, sutural line of a large fragment. Fig. 10, lateral view of a fragment with shell preserved. (This genus belongs probably to the family *Noritidæ*—see p. .)

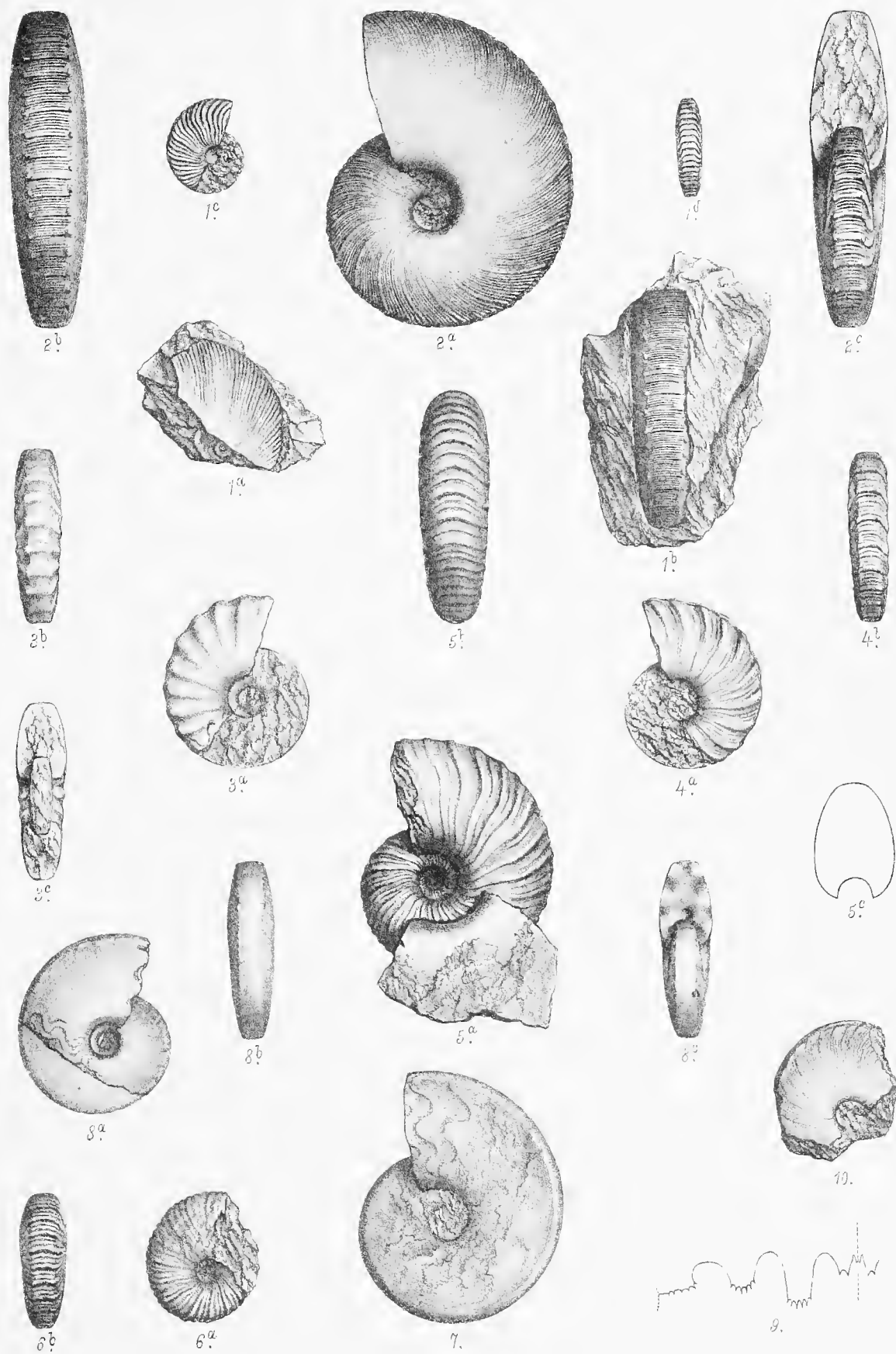
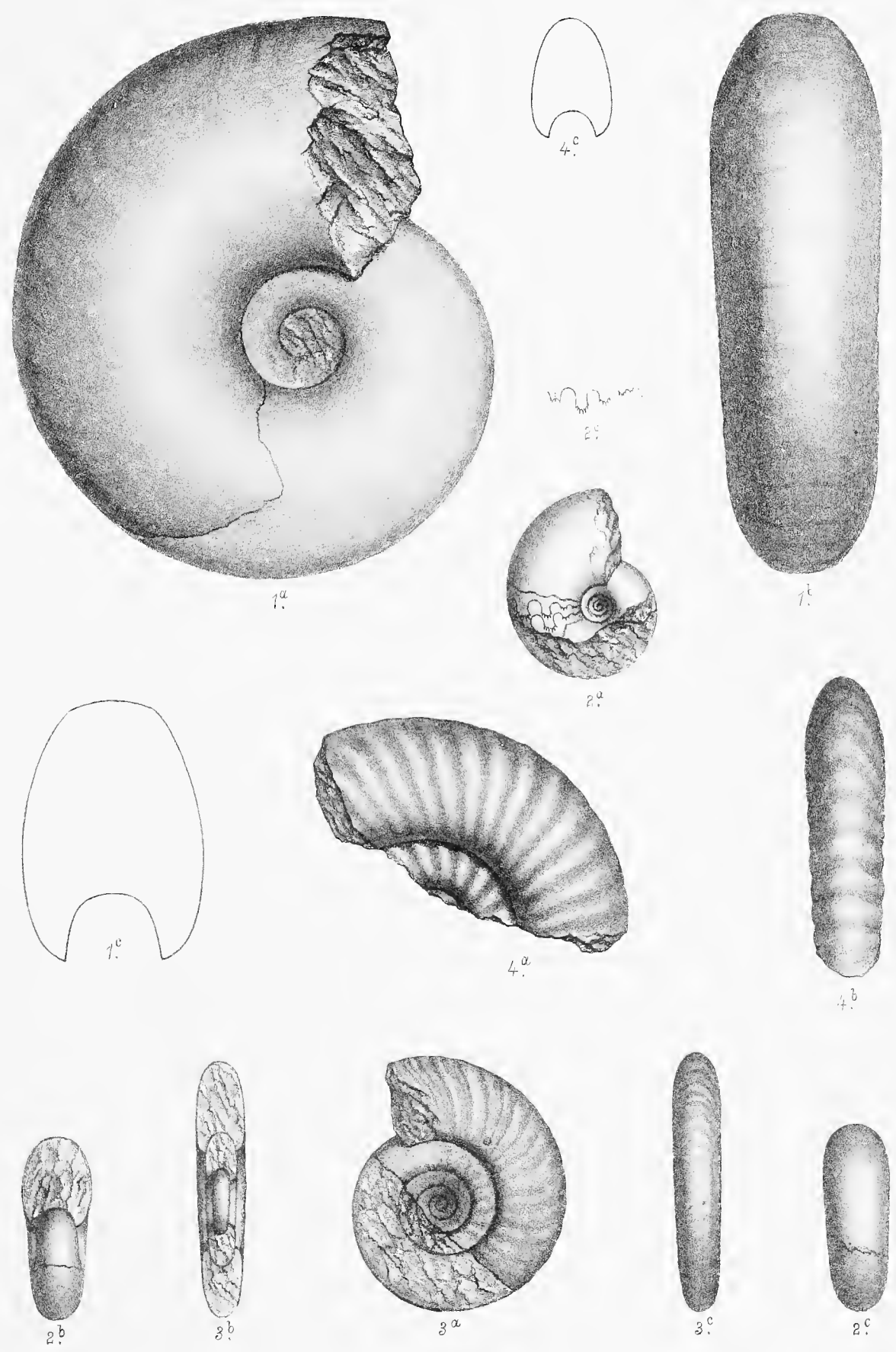


PLATE X.

- Fig. 1. CERATITES INFLATUS, Waagen, n. sp., p. .
 Fragment of a large specimen, showing only the body-chamber, and without trace of shell, from the *Upper Ceratite Limestone* (?) of the *Bukh ravine*; 1, *a*, lateral view; 1, *b*, back-view; 1, *c*, cross section.
- Fig. 2. PROPTYCHITES ABEREANS, Waagen, n. gen. et sp., p. .
 Small, somewhat fragmentary specimen from the *upper region* of the *Ceratite Sandstone* of *Koofri*; 2, *a*, lateral view; 2, *b*, front-view; 2, *c*, back-view; 2, *d*, sutural line.
- Fig. 3. DINARITES EVOLUTUS, Waagen, n. sp., p. .
 Fragment from *Chidroo*, near the junction between the *Ceratite Sandstone* and *Upper Ceratite Limestone*; 3, *a*, lateral view; 3, *b*, cross section; 3, *c*, back-view.
- Fig. 4. DINARITES SINNATUS, Waagen, n. sp., p. .
 Fragment of a large specimen from the *Bivalve layers* of *Chidroo*; 4, *a*, lateral view; 4, *b*, back-view.



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PLATE XI.

- Fig. 1. FLEMINGITES RADIATUS, Waagen, n. gen. et sp., p. .
Specimen with part of body-chamber and remnants of shell, from the middle region (*Stachella-beds*) of the *Ceratite Sandstone* of *Nanga*; 1, *a*, lateral view; 1, *b*, front-view; 1, *c*, sutural line.
- Fig. 2. FLEMINGITES GLABER, Waagen, n. gen. et sp., p. .
Fragment composed of septa only and part of its shell, from the middle region (*Stachella-beds*) of the *Ceratite Sandstone* of *Chidroo*; 2, *a*, lateral view; 2, *b*, back-view; 2, *c*, front-view and cross section; 2, *d*, sutural line.
- Fig. 3. FLEMINGITES ROTULA, Waagen, n. gen. et sp., p. .
Specimen with part of body-chamber from the middle region (*Stachella-beds*) of the *Ceratite Sandstone* of *Nanga*; 3, *a*, lateral view; 3, *b*, front-view.
- Fig. 4. CERATITES SP. INDET., p. .
Fragment of body-chamber of a rather large specimen from the *upper region* of the *Ceratite Sandstone* of *Virgal*; 4, *a*, lateral view; 4, *b*, cross section.
- Fig. 5. CERATITES WYNNEI, Waagen, n. sp., p. .
Small specimen with body-chamber, from the *upper region* of the *Ceratite Sandstone* of *Chidroo*; 5, *a*, lateral view; 5, *b*, front-view.
- Fig. 6. CERATITES DIMORPHUS, Waagen, n. sp., p. .
From the *upper region* of the *Upper Ceratite Limestone* of *Chidroo*, septa only; 6, *a*, lateral view; 6, *b*, front-view; 6, *c*, back-view.
- Fig. 7. CERATITES DISCULUS, Waagen, n. sp., p. .
Fragment from the *upper region* of the *Upper Ceratite Limestone* of *Chidroo*; 7, *a*, lateral view; 7, *b*, cross section.

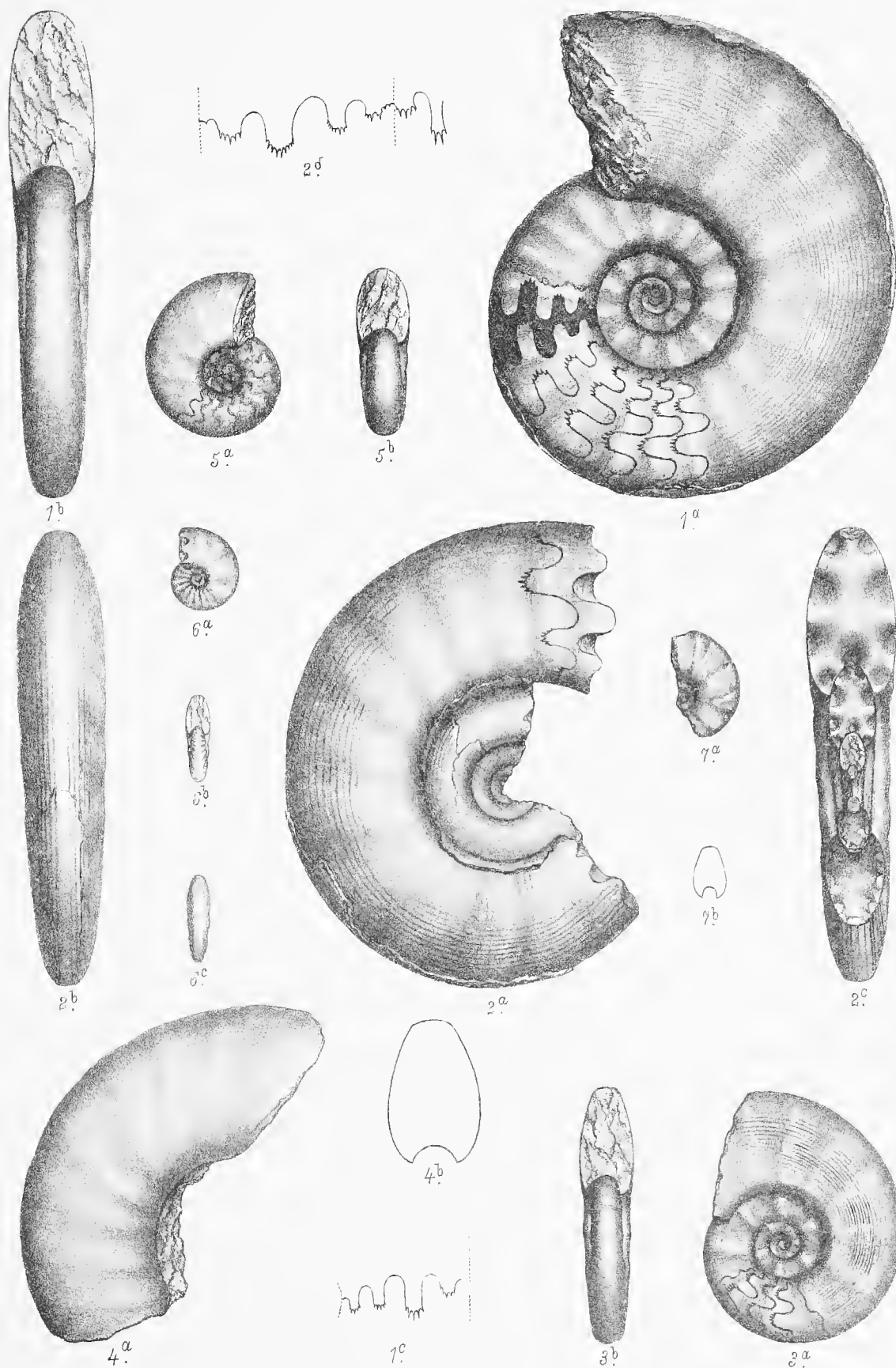


PLATE XII.

- Fig. 1. FLEMINGITES FLEMINGIANUS, Koninek, sp., p .
Specimen with partially preserved body-chamber, from the *upper region* of the
Ceratite Sandstone of *Chidroo*, lateral view.

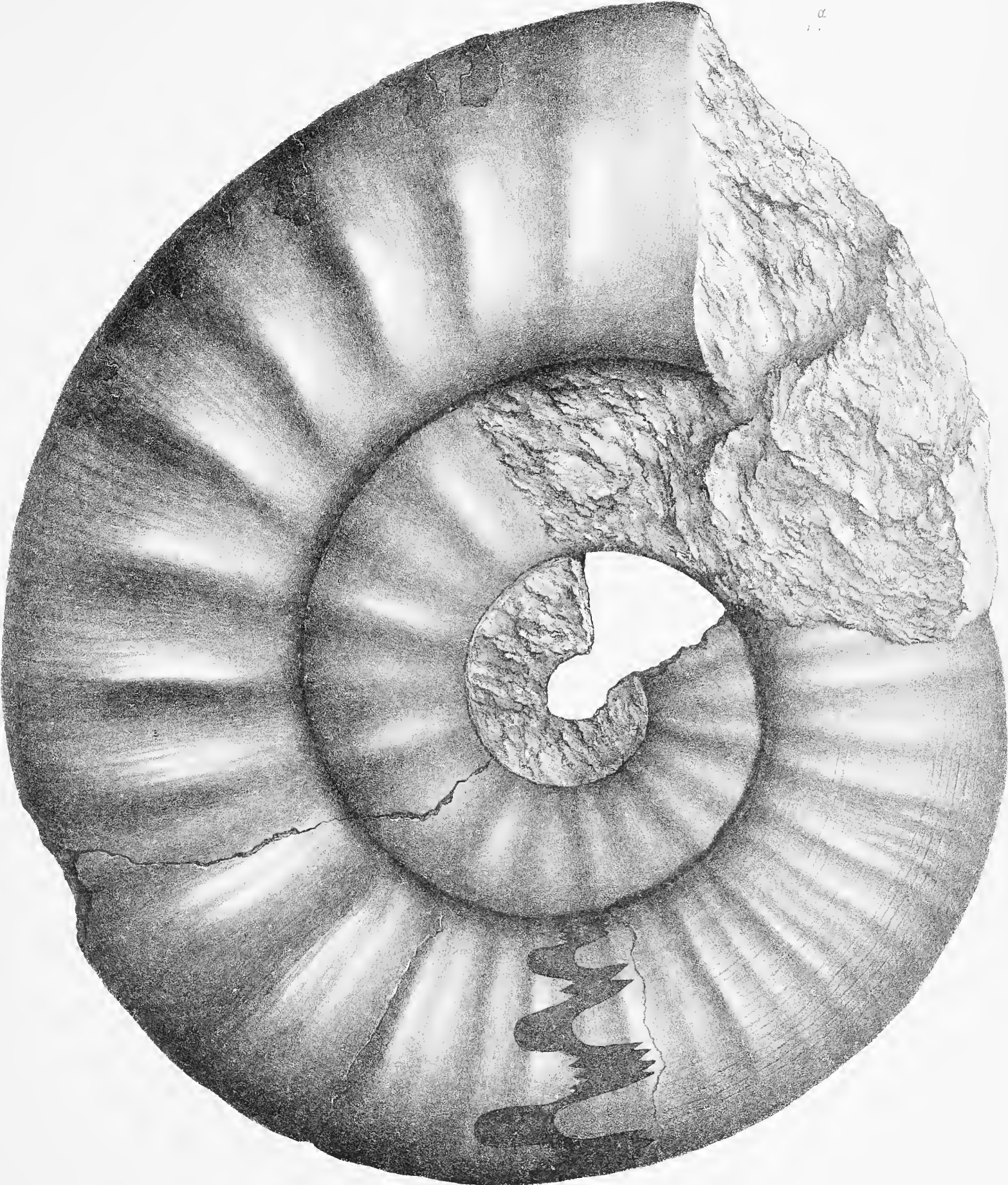


PLATE XIII.

1. FLEMINGITES FLEMINGIANUS, Koninck, sp. n. .

The same specimen as represented on Pl. XII; 1, *b*, front-view; 1, *c*, back-view.

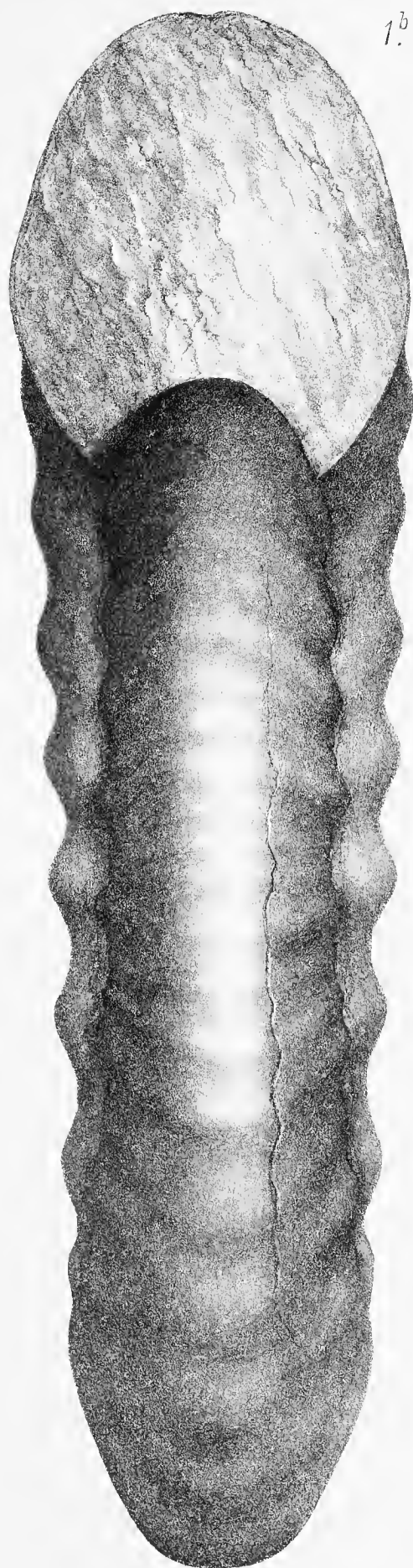


PLATE XIV.

- Fig. I. FLEMINGITES FLEMINGIANUS, Koninck, sp., p. .
Specimen with partly preserved shell, not entirely full grown, from the *upper region*
of the *Ceratite Sandstone* of *Chidroo*; 1, *a*, lateral view; 1, *b*, cross section.

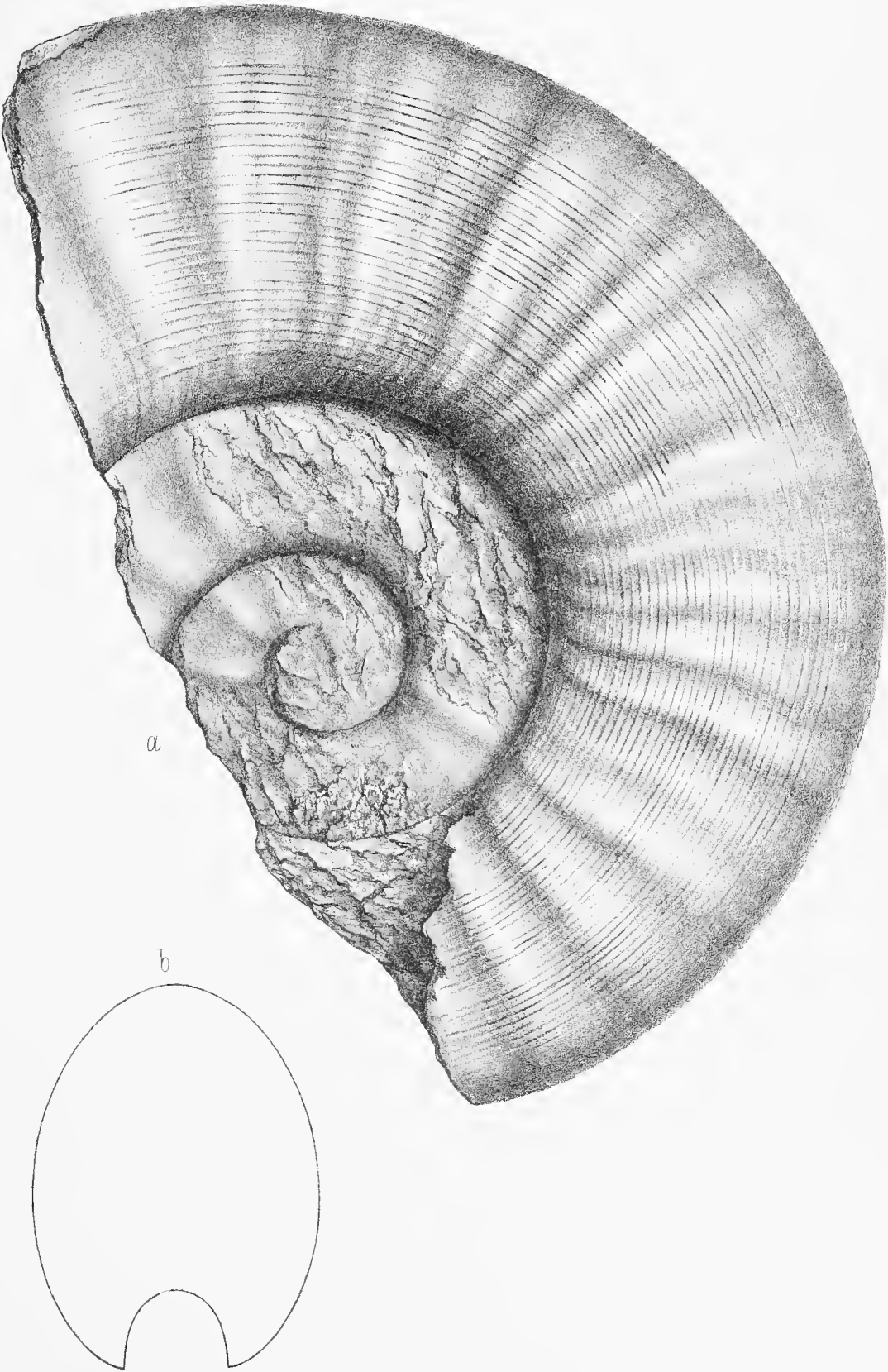


PLATE XV.

1. FLEMINGITES COMPRESSUS, Waagen, n. gen. et sp., p. .
Fragment with part of body-chamber and remains of shell, from the *upper region*
of the *Ceratite Sandstone* of the section at *Koofri*, lateral view.

4.

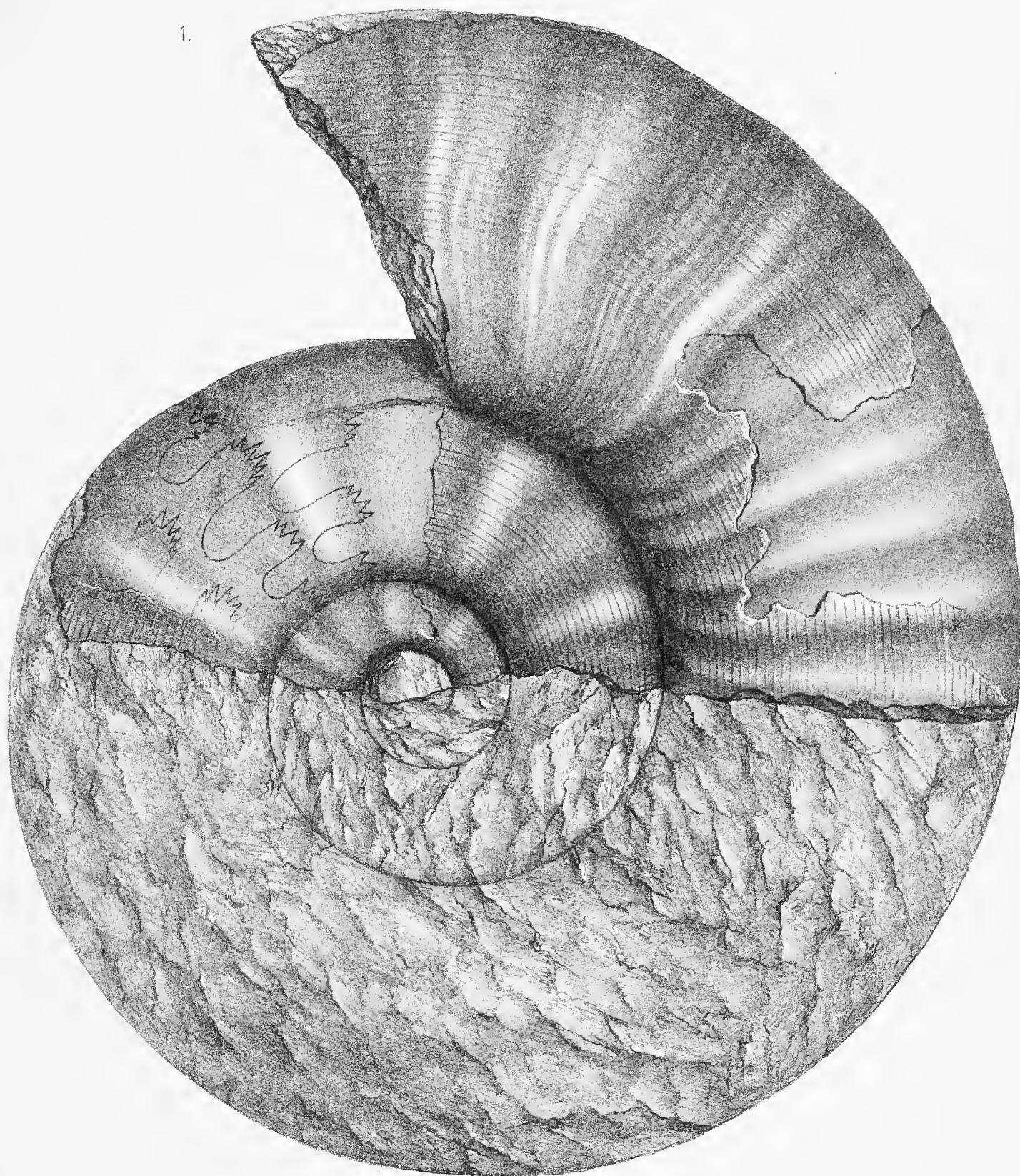


PLATE XVI.

- Fig. 1. FLEMINGITES COMPRESSUS, Waagen, n. gen. et sp., p. .
The same specimen as represented on Pl. XV; 1, *a*, back-view; 1, *b*, cross section
(drawing inaccurate—see the dimensions in the text); 1, *c*, sutural line.
- Fig. 2. FLEMINGITES TRILOBATUS, Waagen, n. gen. et sp., p. .
Fragment from the *upper region* of the *Ceratite Sandstone*, on the road from *Vurcha*
to *Oochali*; 2, lateral view; 2, *a*, cross section; 2, *b*, sutural line.

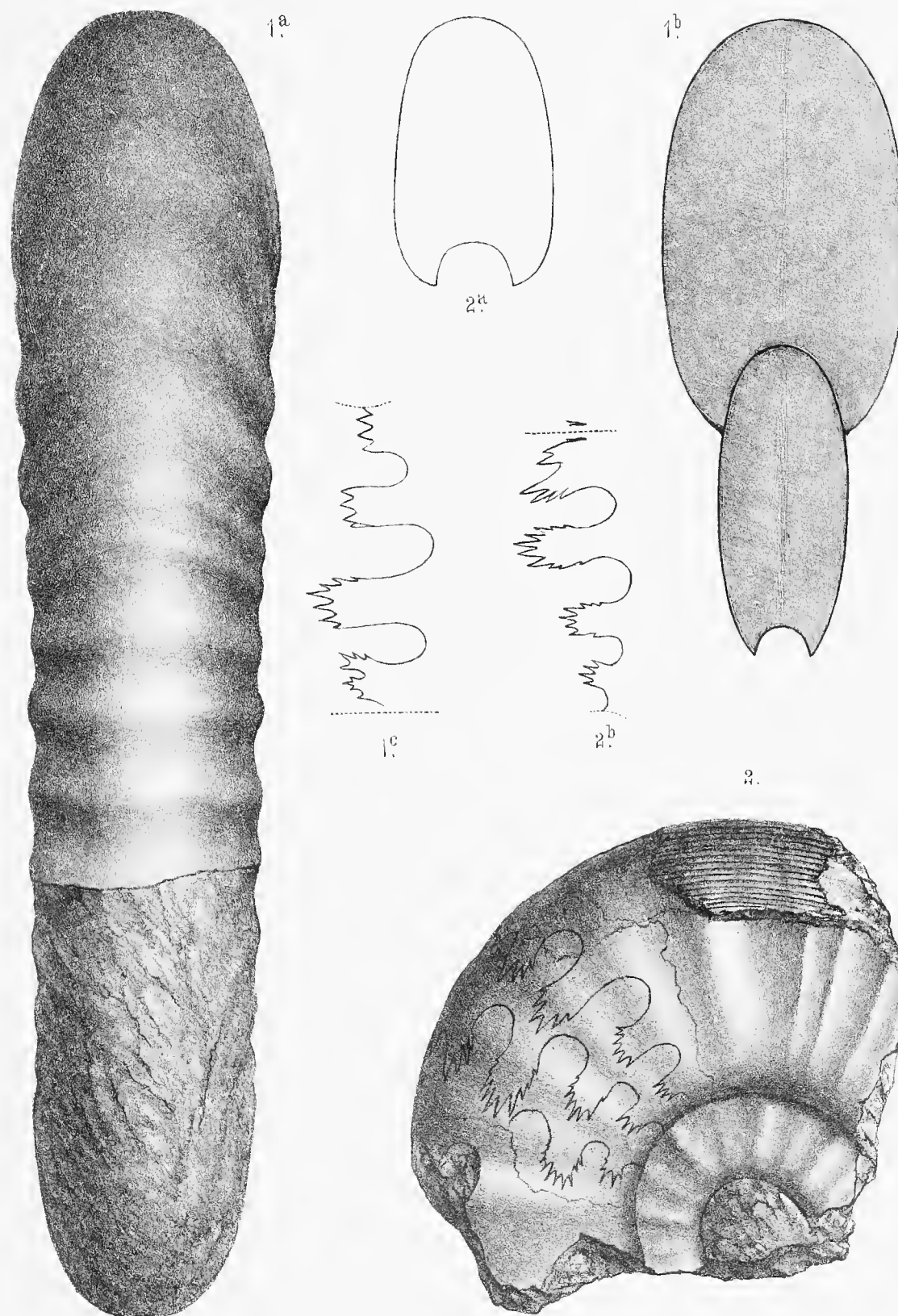
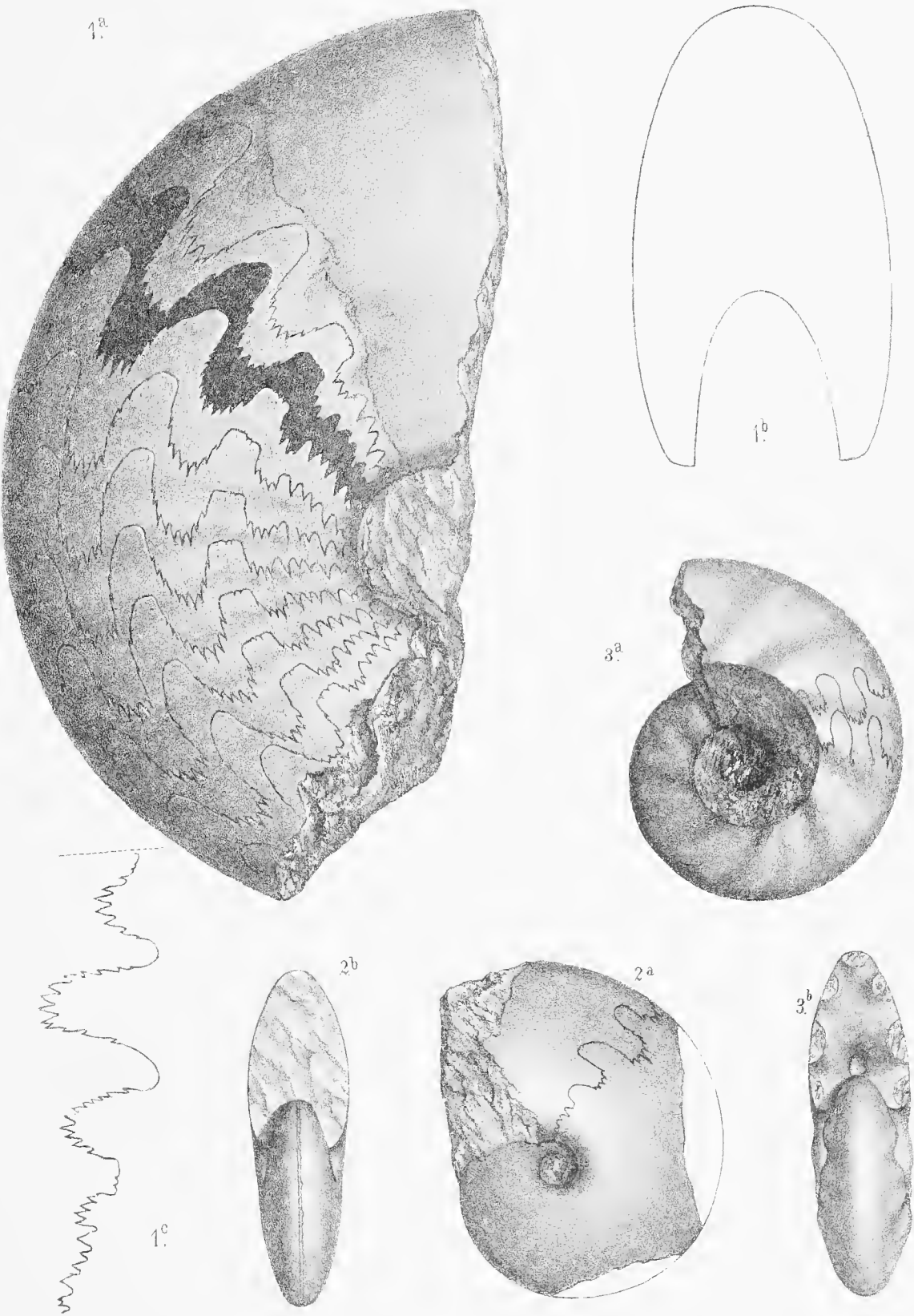


PLATE XVII.

- Fig. 1. PROPTYCHITES AMMONOIDES, Waagen, n. gen. et sp., p. .
Fragment with part of body-chamber, from the base of the *Ceratite Marls, west of Khoora*; 1, *a*, lateral view; 1, *b*, cross section; 1, *c*, sutural line. (See also Plate XIX, fig. 2.)
- Figs. 2*a*, 3*b*. PROPTYCHITES LAWRENCIANUS, Koninck, sp., p. .
Small specimen, partly broken, from the base of the *Ceratite Marls* of the *Chitta Wan*; 2, *a*, lateral view; 3, *b*, front-view. (See also Plate XVIII, fig. 1.)
- Figs. 3*a*, 2*b*. PROPTYCHITES OBLIQUEPLICATUS, Waagen, n. gen. et sp., p. .
Small specimen, weathered, from the middle region of the *Ceratite Sandstone* (*Stachella-beds*) of *Koofri*; 3, *a*, lateral view; 2, *b*, front-view.

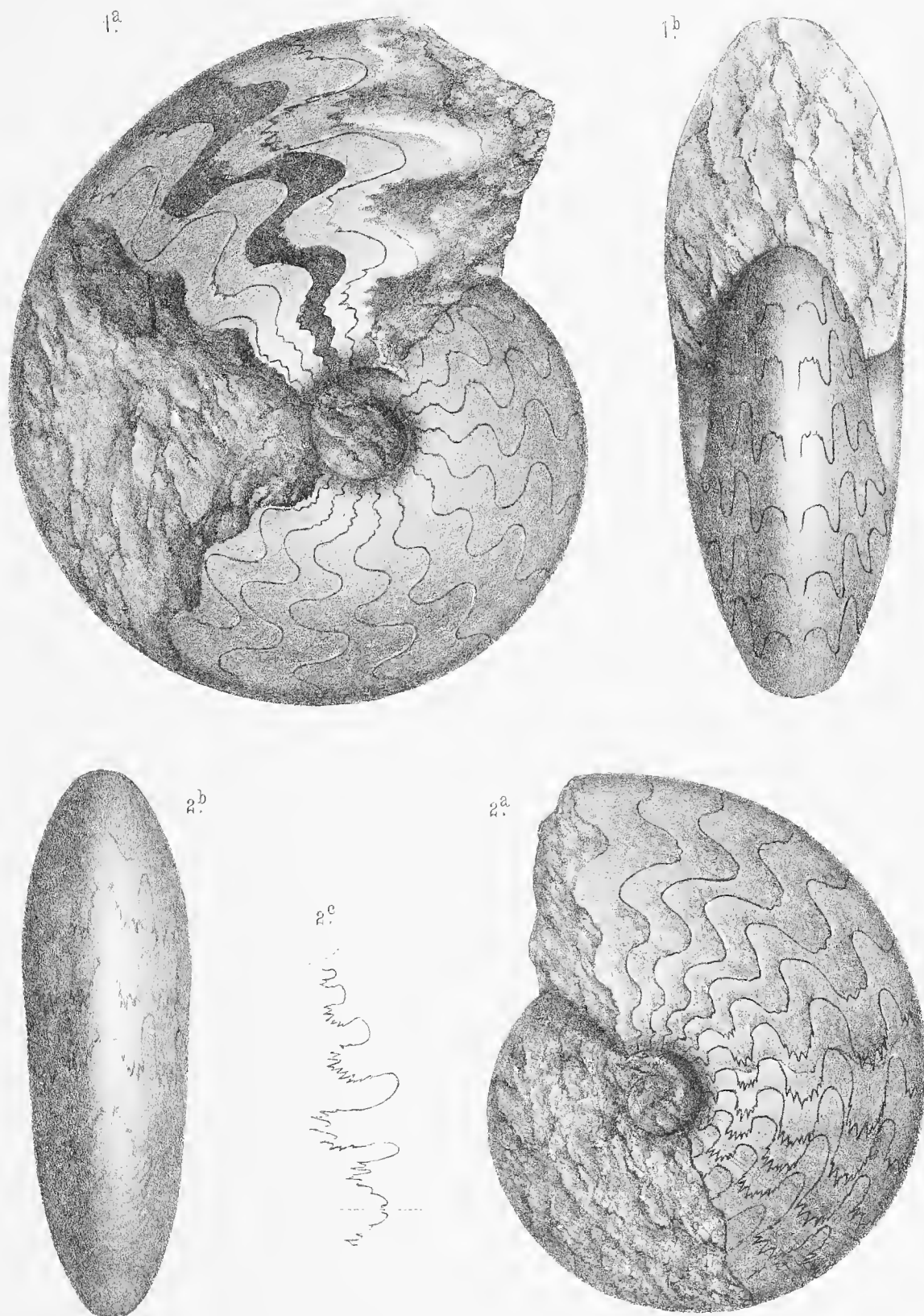


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PLATE XVIII.

- Fig. 1. PROPTYCHITES LAWRENCIANUS, Koninck, sp., p. .
Middle-sized specimen without shell, entirely composed of septa, from the base of the
Ceratite Marls, West of Khoora ; 1, *a*, lateral view ; 1, *b*, front-view. (See also
Plate XVII, fig. 2*a*, 3*b*.)
- Fig. 2. PROPTYCHITES LATIFIMBRIATUS, Koninck, sp., p. .
Medium-sized specimen, rather weathered, composed of septa only, from the *upper*
region of the *Ceratite Marls, west of Khoora* ; 2, *a*, lateral view ; 2, *b*, back-view ;
2, *c*, sutural line.



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PLATE XIX.

- Fig. 1. PROPTYCHITES MAGNUMBILICATUS, Waagen, n. gen. et sp., p. .
Fragment without shell, composed of septa only, from the upper region of the
Ceratite Marls of the *Chitta-Wan* near Ghari; 1, *a*, lateral view; 1, *b*, cross
section; 1, *c*, sutural line.
- Fig. 2. PROPTYCHITES AMMONOIDES, Waagen, n. gen. et sp., p. .
Fragment without shell, composed of septa only, from the lower region of the
Ceratite Marls of the hills *north of Katwahee*; 2, *a*, lateral view; 2, *b*, cross
section. (See also Plate XVII, fig. 1.)
- Fig. 3. PROPTYCHITES OLDHAMIANUS, Waagen, n. gen. et sp., p. .
Specimen with partly preserved body-chamber, from the *Lower Ceratite Lime-*
stones on the road from *Namal* to *Moosakheyl*; 3, *a*, lateral view; 3, *b*, front-
view; 3, *c*, sutural line.

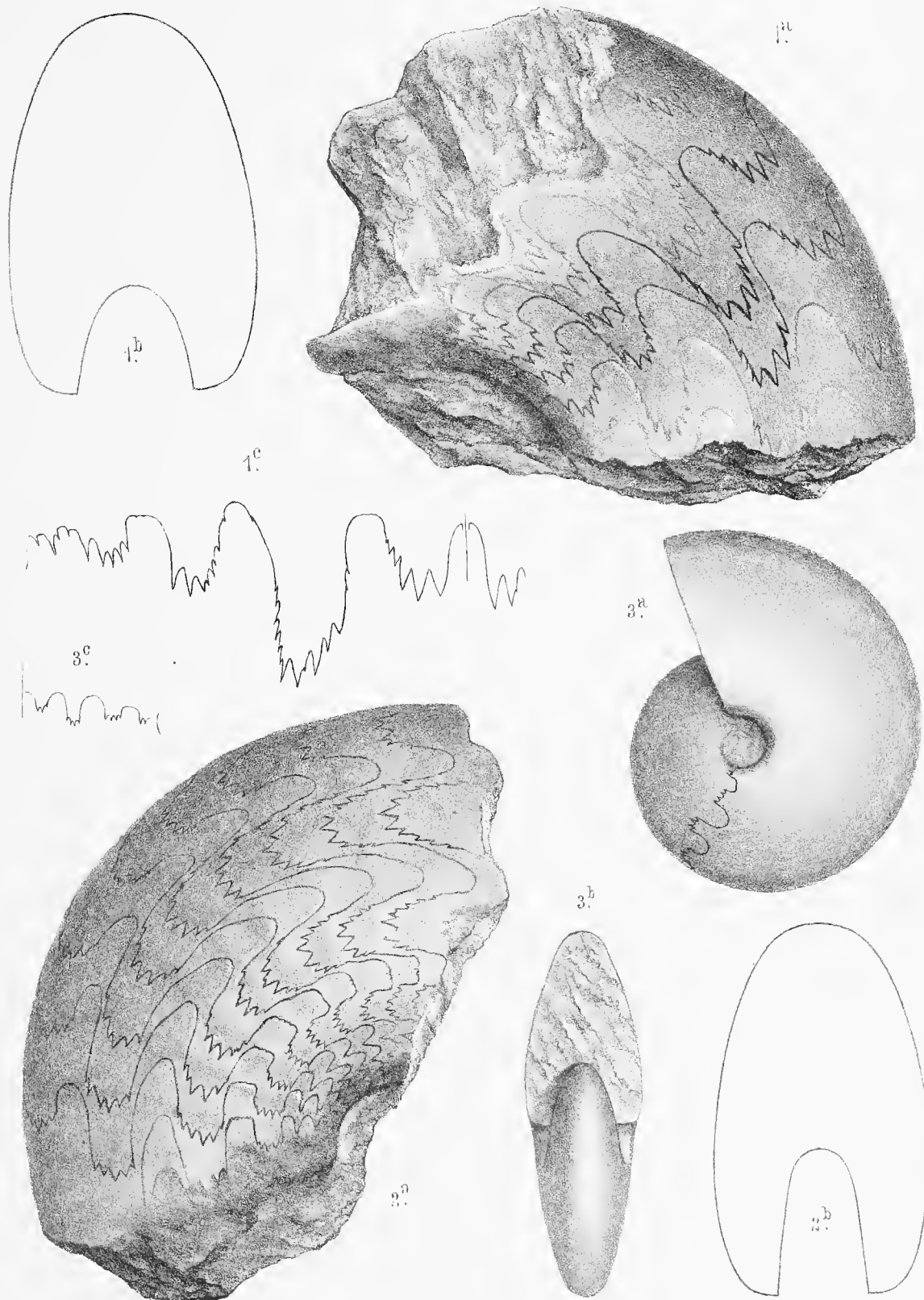
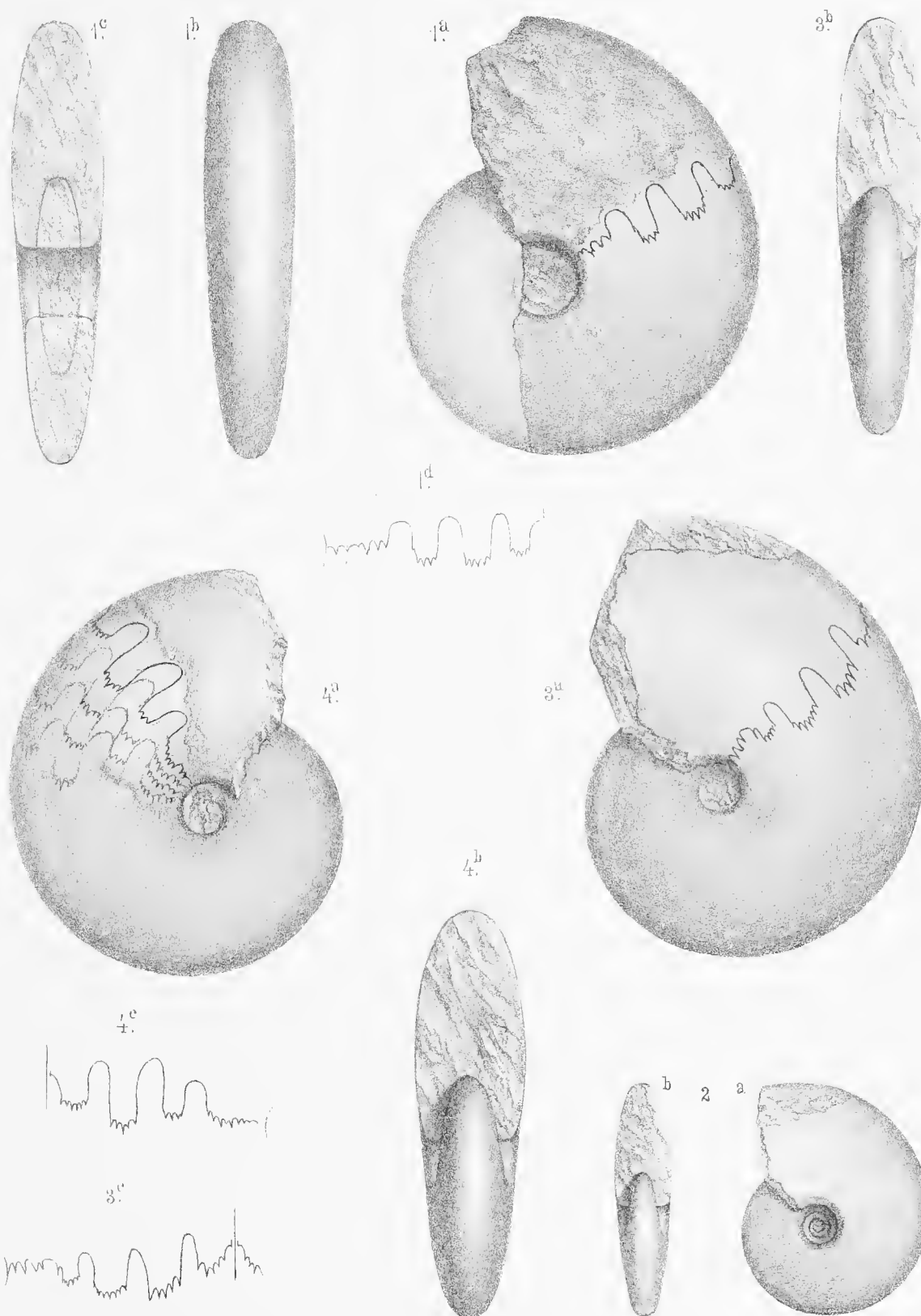


PLATE XX.

- Fig. 1. PROPTYCHITES DISCOIDES, Waagen, n. gen. et sp., p. .
 Fragment from *Lower Ceratite Limestone* of *Virgal*; 1, *a*, lateral view; 1, *b*,
 back-view; 1, *c*, cross section; 1, *d*, sutural line.
- Fig. 2. PROPTYCHITES DISCOIDES, Waagen, n. gen. et sp., p. .
 Gutta-percha cast of an impression of a small specimen from the *Lower Ceratite*
Limestone of the vicinity of *Katwahee*; 2, *a*, lateral view; 2, *b*, front-view.
- Fig. 3. PROPTYCHITES TRILOBATUS, Waagen, n. gen. et sp., p. .
 Specimen from the *upper region* of the *Ceratite Marls* of the *Chitta-Wan* near
Ghari; 3, *a*, lateral view; 3, *b*, front-view; 3, *c*, sutural line.
- Fig. 4. PROPTYCHITES KHOORENSIS, Waagen, n. gen. et sp., p. .
 Specimen with the commencement of the body-chamber, from the *base* of the *Ceratite*
Marls, west of *Khoora*; 4, *a*, lateral view; 4, *b*, front-view; 4, *c*, sutural
 line.



A. Swoboda del et lith.

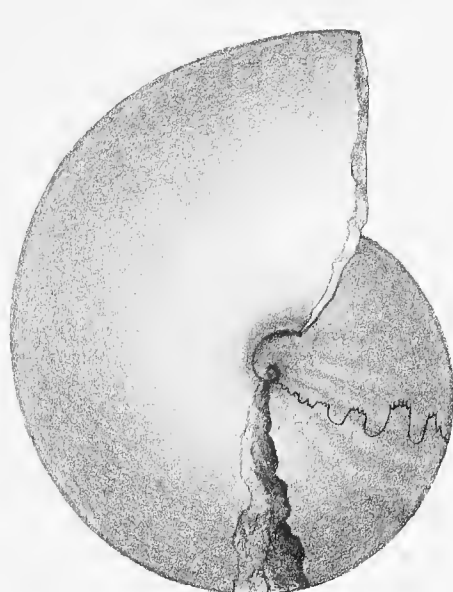
Joh Hampi prima

PLATE XXI.

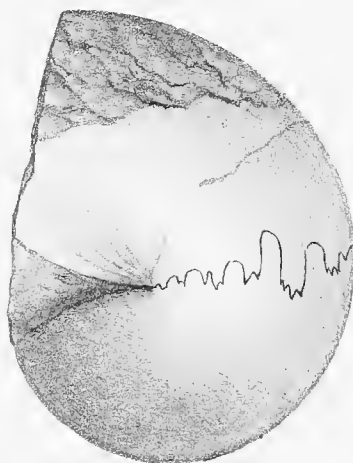
- Fig. 1. *PSEUDHARPOCERAS SPINIGER*, Verchère, sp. Ms. n. gen. et sp., p. .
Specimen with part of body-chamber from the *topmost limestones* of the Ceratite formation, Trans-Indus continuation of the Salt-Range, *Paniala Black Hill*; 1, *a*, lateral view of the one side; 1, *b*, the same, other side; 1, *c*, front-view.
- Fig. 2. *DINARITES PATELLA*, Waagen, n. sp., p. .
Specimen with part of body-chamber from the *lowest beds* of the *Lower Ceratite Limestone* of west of *Khoora*; 2, *a*, lateral view; 2, *b*, front-view and cross section.
- Fig. 3. *CELTITES TRAPEZOIDALIS*, Waagen, n. sp., p. .
Small specimen, without shell, composed of septa only, from the passage beds between the *Ceratite Sandstone* and *Upper Ceratite Limestone* of *Chidroo*; 3, *a*, lateral view; 3, *b*, front-view; 3, *c*, back-view.
- Figs. 4 and 5. *AMBITES DISCUS*, Waagen, n. gen. et sp., p. .
Two specimens from the *Ceratite Marls* of *Amb*. Fig. 4, larger specimen somewhat fragmentary and not quite symmetrically developed, with part of body-chamber; 4, *a*, lateral view; 4, *b*, front-view. Fig. 5, smaller specimen, with the largest part of body-chamber up to the apertural margin, almost all internal cast; 5, *a*, lateral view; 5, *b*, front-view; 5, *c*, some of the sutures, upside down, the saddles below.
- Fig. 6. *AMBITES MAGNUMBILICATUS*, Waagen, n. gen. et sp., p. .
Specimen without shell, but entire body-chamber, from the *Ceratite Marls* of *Amb*; 6, *a*, lateral view; 6, *b*, front-view; 6, *c*, some sutural lines, upside down, the saddles below.
- Fig. 7. *CLYPITES TYPICUS*, Waagen, n. gen. et sp., p. .
Small specimen, entirely composed of septa, from the *Ceratite Marls* at *Nanga*; 7, *a*, lateral view; 7, *b*, front-view.
- Fig. 8. *CLYPITES KINGIANUS*, Waagen, n. gen. et sp., p. .
Middle-sized specimen without body-chamber, from the *Ceratite Marls* of *Virgal*; 8, *a*, lateral view; 8, *b*, sutural line. (For further figures of this specimen see Pl. XXII, fig. 3, and Pl. XL, fig. 2.)

PLATE XXII.

- Fig. 1. *PARANORITES AMBIENSIS*, Waagen, n. gen. et sp., p. .
 Specimen composed of septa and small fragments of shell only, from the middle region of the *Ceratite Sandstone* (*Stachella*-beds) of *Amb*; 1, *a*, lateral view; 1, *b* front-view; 1, *c*, back-view; 1, *d*, two sutural lines.
- Fig. 2. *CLYPITES EVOLVENS*, Waagen, n. gen. et sp., p. .
 Specimen with entire body-chamber and part of the apertural margin, from the *Ceratite Marls* of *Virgal*; 2, *a*, lateral view; 2, *b*, front-view; 2, *c*, two sutural lines.
- Fig. 3. *CLYPITES KINGIANUS*, Waagen, n. gen. et sp., p. .
 Specimen from the *Ceratite Marls* of *Virgal*; lateral view. (See also Pl. XXI, fig. 8, and Pl. XL, fig. 2.)



2^a



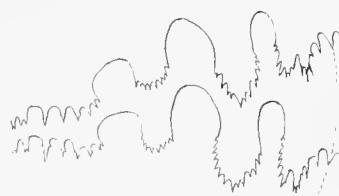
3.



2^b



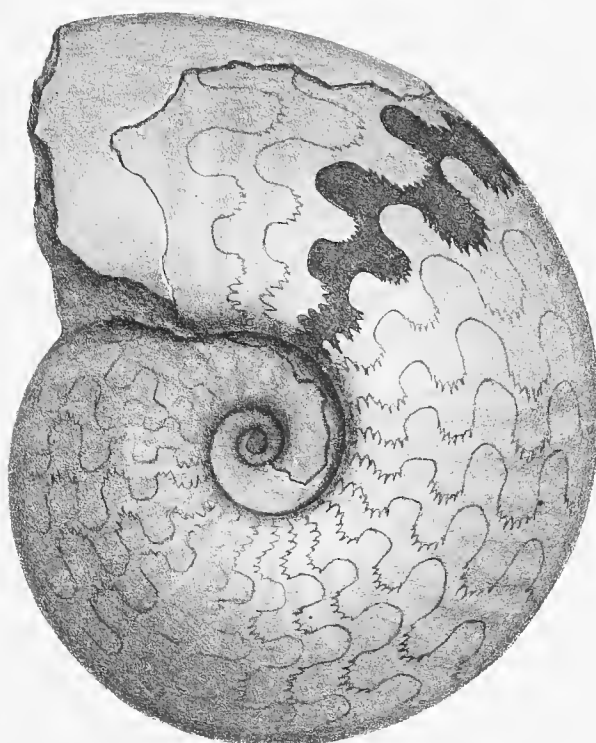
2^c



1^d



1^c



1^a

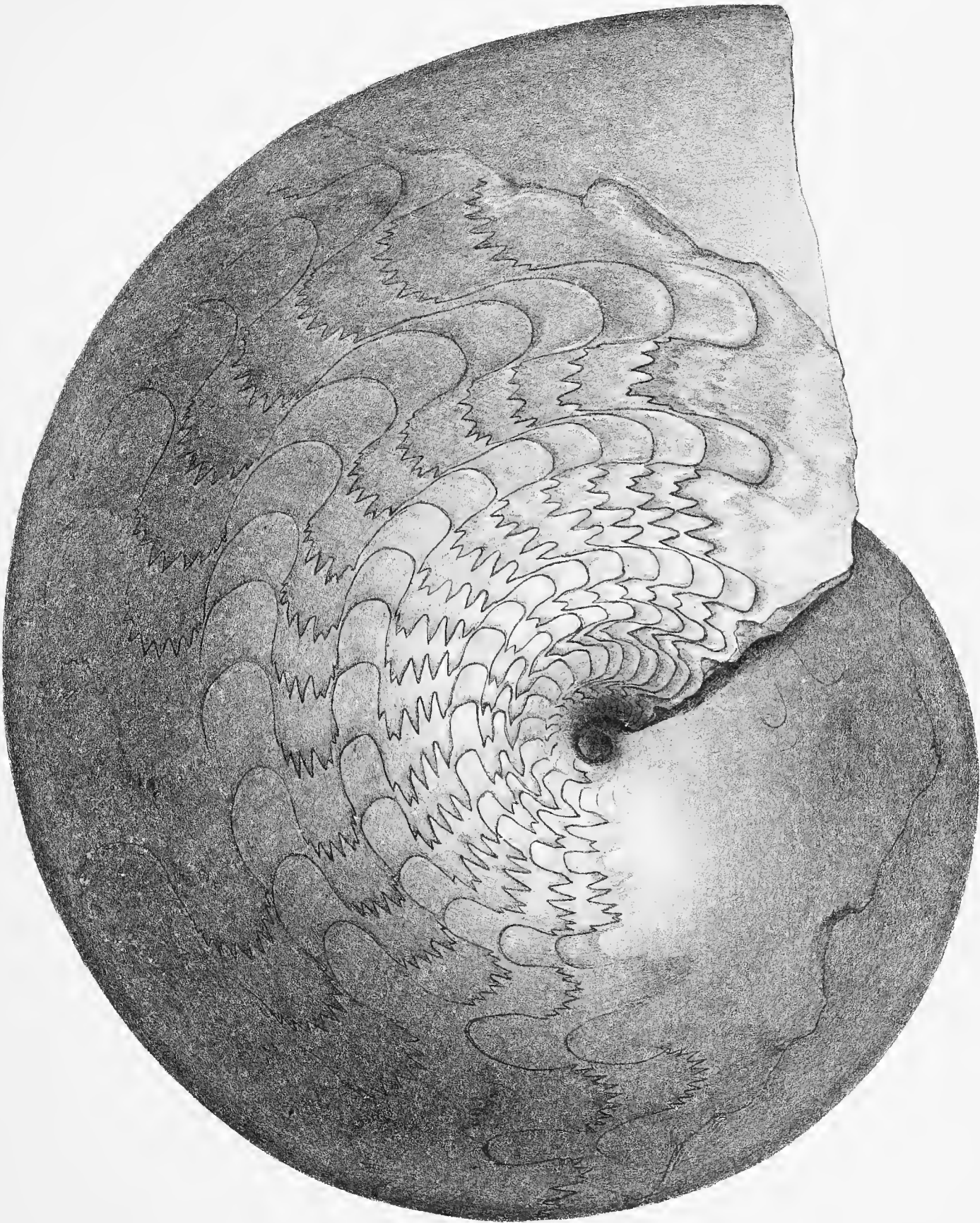


1^b

PLATE XXIII.

1. ASPIDITES SUPERBUS, Waagen, n. gen. et sp., p. .

Specimen without shell, entirely composed of septa, probably from the *upper region*
of the *Ceratite Sandstone* (*Flemingites* beds) of *Chidroo*; lateral view.



A Swoboda del et lith.

John Hargraves

PLATE XXIV.

- Fig. 1. *ASPIDITES SUPERBUS*, Waaget, n. gen. et sp., p. .
Same specimen as represented on Pl. XXIII ; 1, *a*, front-view ; 1, *b*, sutural line.
- Fig. 2. *MEEKOCERUS PLANULATUM*, Koninck, sp., p. .
Fragment without sutural lines, from the middle region of the *Ceratite Sandstone* (*Stachella*-beds) of *Koofri* ; 2, *a*, lateral view ; 2, *b*, front-view ; 2, *c*, back-view and cross section. (See also for this species: Pl. XXXIX, fig. 2 *a*, *b*, and Pl. XL, fig. 1.)
- Fig. 3. *PROPTYCHITES PLICATUS*, Waagen, n. gen. et sp., p. .
Small specimen without shell, composed of septa only, from the middle region of the *Ceratite Sandstone* (*Stachella*-beds) of *Amb* ; 3, *a*, lateral view ; 3, *b*, front-view.
- Fig. 4. *PROPTYCHITES UNDATUS*, Waagen, n. gen. et sp., p. .
Fragment from the *Ceratite Marls* of *Nanga* ; 4, *a*, lateral view ; 4, *b*, front-view.
- Fig. 5. *PSALATONITES PUNJABIENSIS*, Waagen, n. sp., p. .
Fragment without shell from the *Upper Ceratite Limestone* of the *Chitta-Wan* near *Ghari* ; 5, *a*, lateral view ; 5, *b*, back-view ; 5, *c*, cross section.

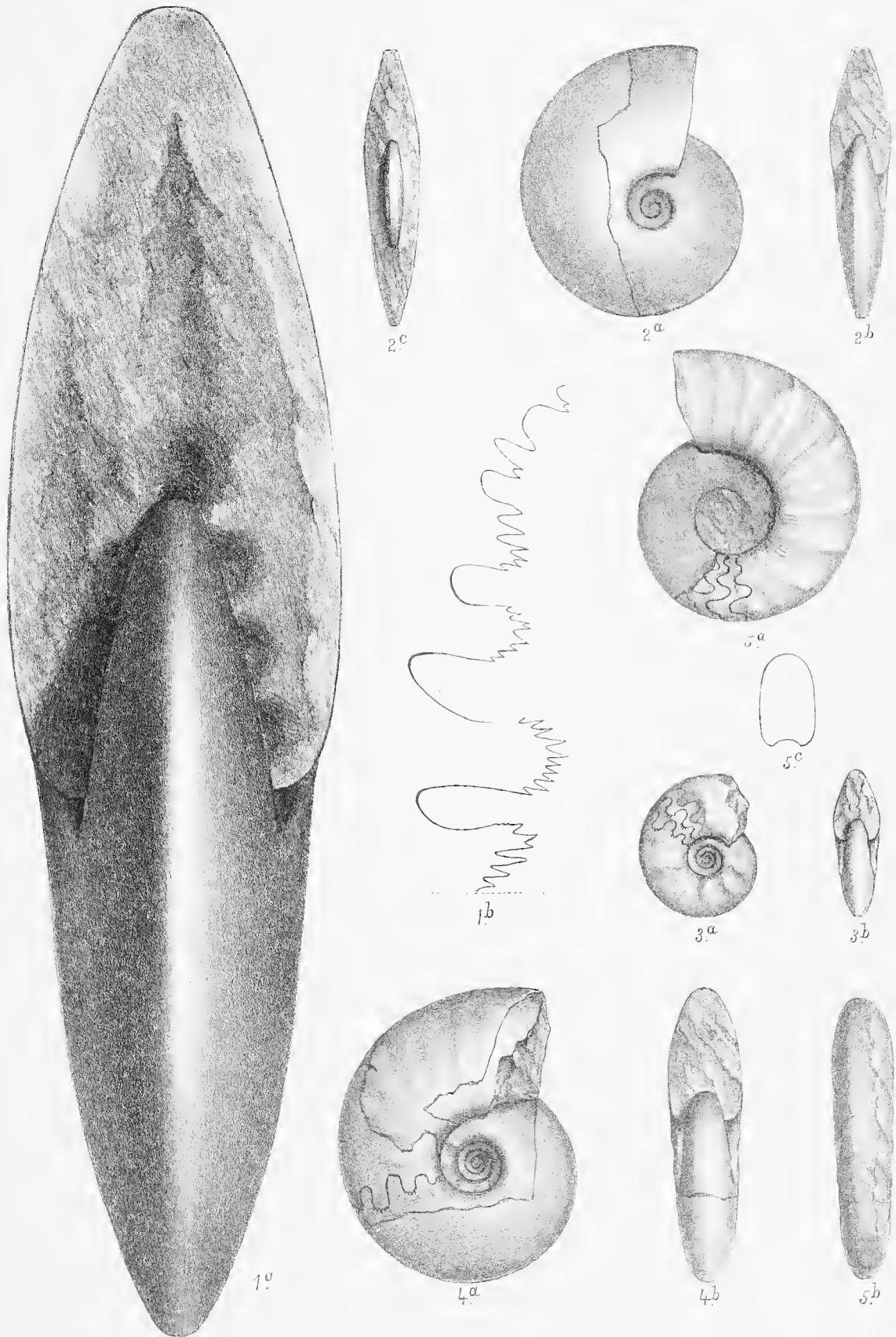
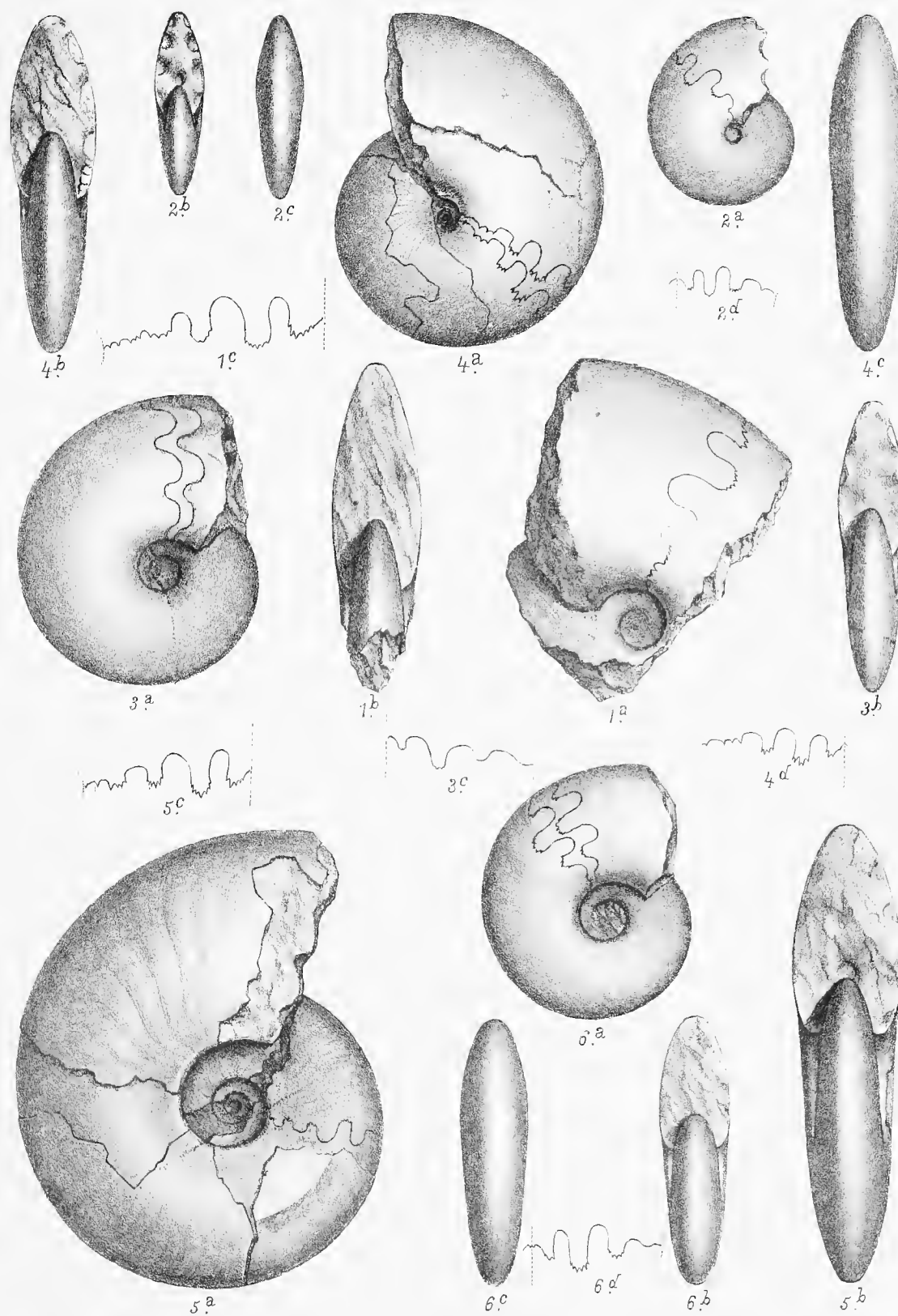


PLATE XXV.

- Fig. 1. ASPIDITES EVOLVENS, Waagen, n. gen. et sp., p. .
Broken specimen, partly restored, with part of body-chamber, and one of the sutural lines preserved, from the *upper region* of the *Ceratite Sandstone* of *Nanga*; 1, *a*, lateral view; 1, *b*, front-view, much restored.
- Fig. 2. ASPIDITES DISCUS, Waagen, n. gen. et sp., p. .
Specimen, entirely composed of septa, bearing on its surface the impression of the internal sutural line of the succeeding whorl, and showing on its last volution, where the shell is removed, its own external sutural line; from the *middle region* of the *Ceratite Sandstone* (*Stachella*-beds) of *Nanga*; 2, *a*, lateral view showing the external sutural line (siphonal lobe on the periphery); 2, *b*, back-view; 2, *c*, internal sutural line, with the doubly pointed antisiphonal lobe above.

PLATE XXVI.

- Fig. 1. ASPIDITES ARENOSUS, Waagen, n. gen. et sp., p. .
 Fragment without shell from the middle region of the *Ceratite Sandstone* (*Stachella-*
beds) of *Chidroo*; 1, *a*, lateral view; 1, *b*, front-view; 1, *c*, sutural line.
- Fig. 2. KINGITES DECLIVIS, Waagen, n. gen. et sp., p. .
 Small specimen, composed of septa, without shell, from the *Ceratite Marls* of
Virgal; 2, *a*, lateral view; 2, *b*, front-view; 2, *c*, back-view; 2, *d*, sutural line.
- Fig. 3. KYMATITES POSTERUS, Waagen, n. gen. et sp., p. .
 Specimen without shell, all composed of septa, from the *lower region* of the *Ceratite*
Sandstones of the *Chitta-Wan*; 3, *a*, lateral view; 3, *b*, front-view; 3, *c*, sutural
 line.
- Fig. 4. KINGITES LENS, Waagen, n. gen. et sp., p. .
 Specimen with shell partially preserved, from the *Ceratite Marls* of *Virgal*; 4, *a*,
 lateral view; 4, *b*, front-view; 4, *c*, back-view; 4, *d*, sutural line.
- Fig. 5. ASPIDITES MAGUMBILICATUS, Waagen, n. gen. et sp., p. .
 Specimen with greater part of its shell, from the middle region of the *Ceratite*
Sandstone (*Stachella-beds*) of *Chidroo*; 5, *a*, lateral view; 5, *b*, front-view; 5, *c*,
 sutural line.
- Fig. 6. MEEKOCERAS KONINCKIANUM, Waagen, n. sp., p. .
 Specimen, composed of septa only, from the *Ceratite Marls* of *Virgal*; 6, *a*, lateral
 view; 6, *b*, front-view; 6, *c*, back-view; 6, *d*, sutural line.

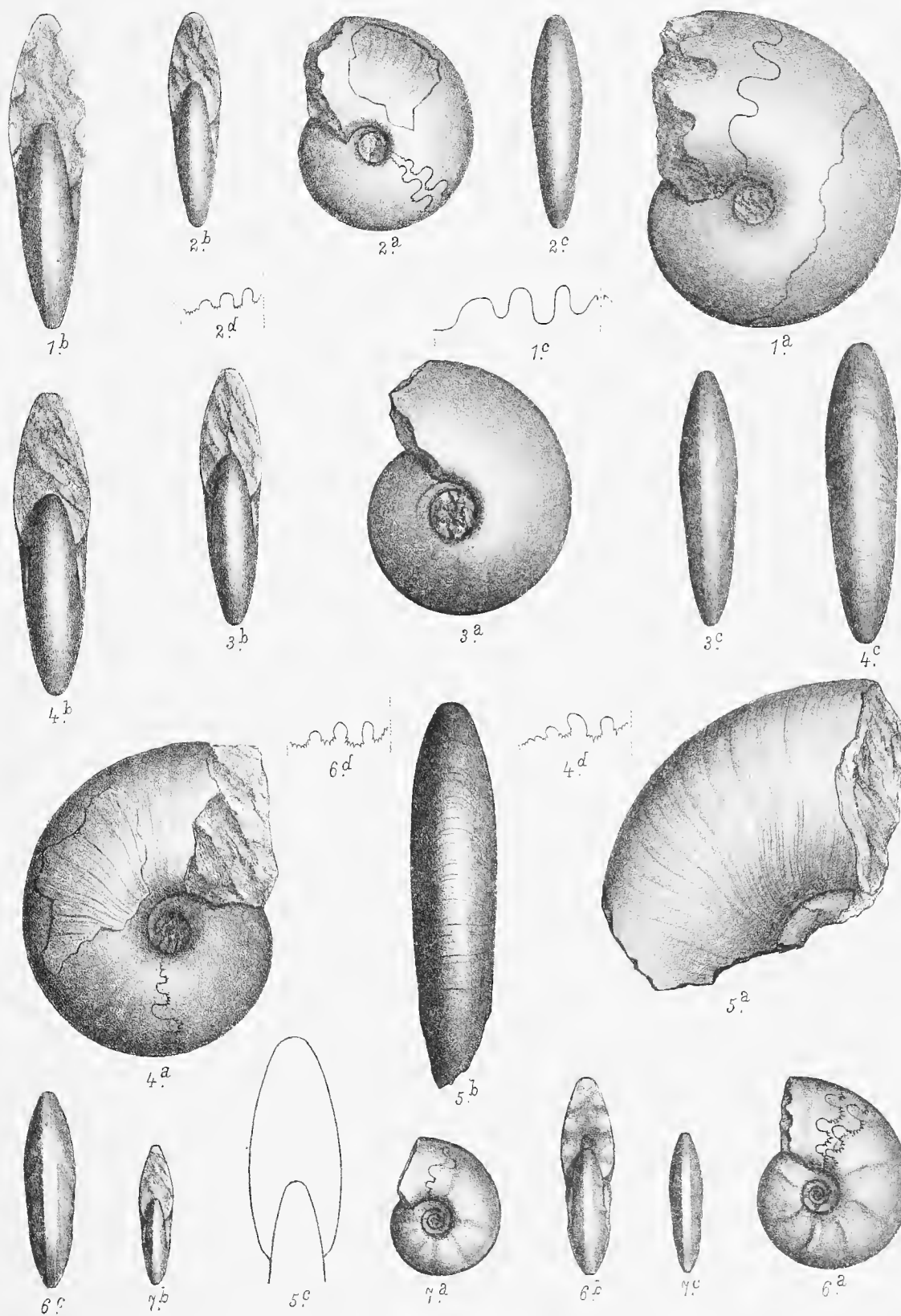


A. Svoboda del. et lith.

John Haupt print.

PLATE XXVII.

- Fig. 1. **KYMATITES TYPUS**, Waagen, n. gen. et sp., p. .
Somewhat fragmentary specimen, composed of septa only, from the *Lower Ceratite Limestone* of *Sheikh Budin*; 1, *a*, lateral view; 1, *b*, front-view; 1, *c*, sutural line.
- Figs. 2 and 3. **MEKOCERAS PULCHRUM**, Waagen, n. sp., p. .
Two specimens from the *Ceratite Marls* of the *Chitta-Wan*. Fig. 2, specimen composed of septa, with part of shell; 2, *a*, lateral view; 2, *b*, front-view; 2, *c*, back-view; 2, *d*, sutural line. Fig. 3, specimen with badly-preserved shell, somewhat deviating from the regular spiral; 3, *a*, lateral view; 3, *b*, front-view; 3, *c*, back-view. (See also for this species Pl. XXIX, fig. 1.)
- Figs. 4 and 5. **KONINCKITES VETUSTUS**, Waagen, n. gen. et sp., p. .
From the *Lower Ceratite Limestone* of *Chidroo*. Fig. 4, specimen composed for the greater part of septa only, with part of its shell; 4, *a*, lateral view; 4, *b*, front-view; 4, *c*, back-view; 4, *d*, sutural line. Fig. 5, fragment of body-chamber of a full-grown specimen, with shell, but without apertural margin; 5, *a*, lateral view; 5, *b*, back-view; 5, *c*, cross section.
- Figs. 6 and 7. **MEKOCERAS ROTA**, Waagen, n. sp., p. .
Fig. 6, larger specimen, internal cast, all composed of septa, from the middle region of the *Ceratite Sandstone* (*Stachella*-beds) of *Nanga*; 6, *a*, lateral view; 6, *b*, front-view; 6, *c*, back-view. Fig. 7, smaller specimen from the same bed as the preceding, but from *Amb*; 7, *a*, lateral view, the sutural line very badly preserved and thus erroneously drawn; 7, *b*, front-view; 7, *c*, back-view.

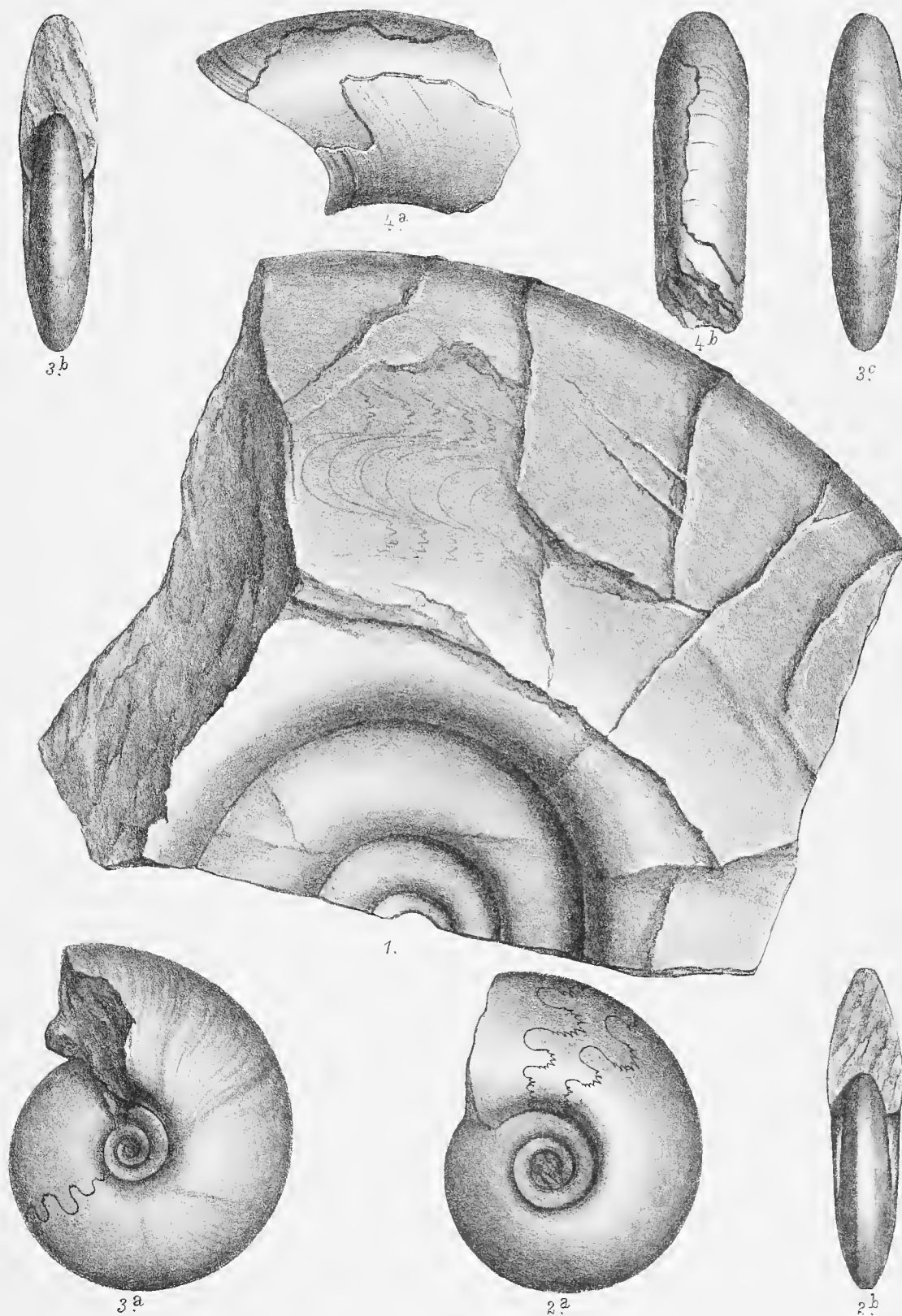


A. Swoboda del et lith

Joh Haupt prunt

PLATE XXVIII.

- Fig. 1. KONINCKITES VOLUTUS, Waagen, n. gen. et sp., p. .
Compressed, fragmentary specimen, composed of septa only, from the *uppermost-beds*
of the *Ceratite Marls* of *Amb* ; lateral view.
- Fig. 2. KONINCKITES VOLUTUS, Waagen, n. gen. et sp., p.
Small specimen, composed of septa only and without shell, from the *Ceratite Marls*
on the road from *Vurcha* to *Oochali* ; 2, *a*, lateral view ; 2, *b*, front-view.
- Figs. 3 and 4. KONINCKITES OVALIS, Waagen, n. gen. et sp., p.
Two specimens from the *Ceratite Marls* of *Virgal*. Fig. 3, nearly full-grown specimen
with part of body-chamber ; 3, *a*, lateral view ; 3, *b*, front-view ; 3, *c*, back-view.
Fig. 4, fragment of body-chamber showing the apertural margin and part of the
shell covering ; 4, *a*, lateral view ; 4, *b*, back-view.

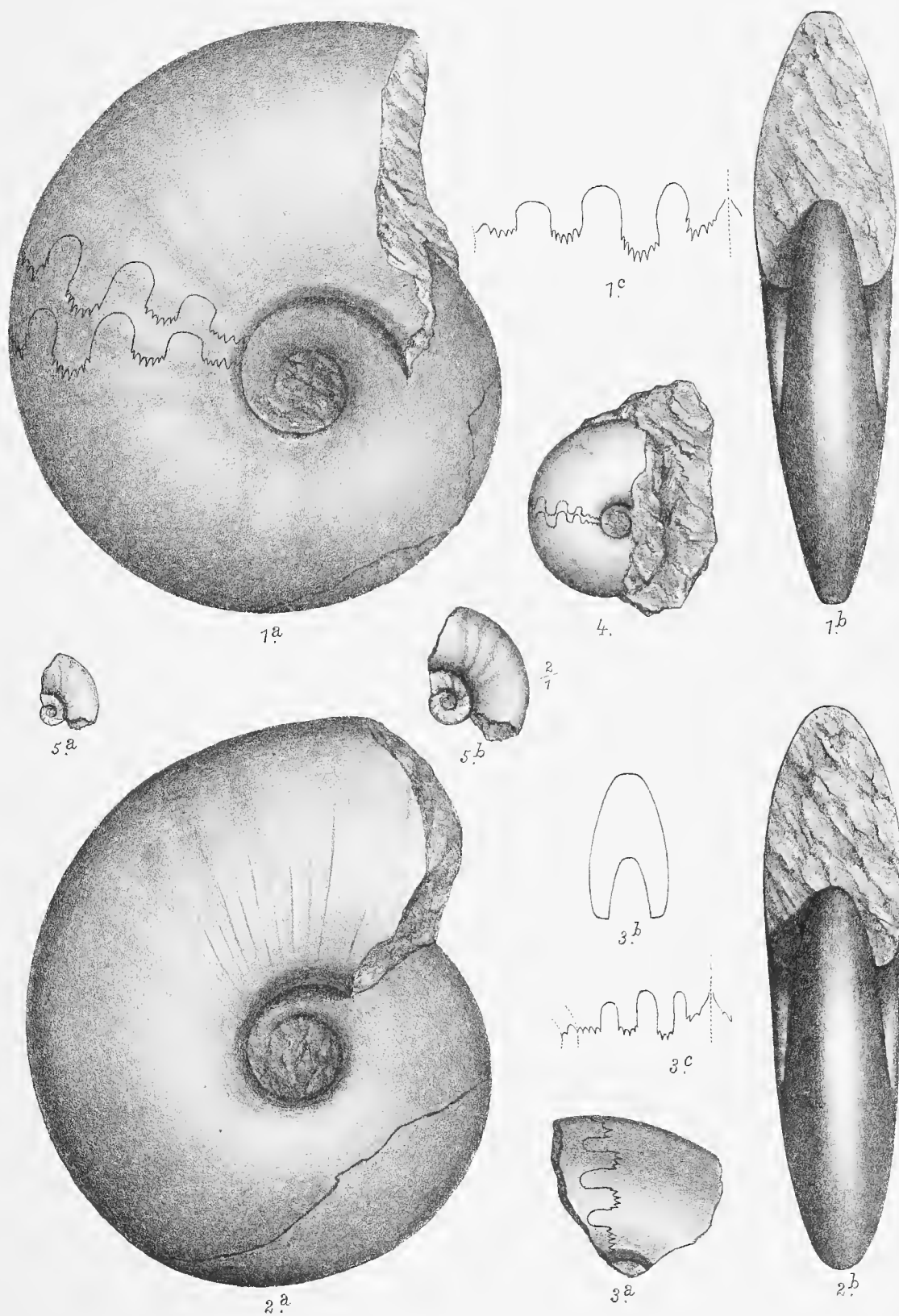


A. Swoboda del et lith.

Joh Haupt print.

PLATE XXIX.

- Fig. 1. MEEKOCERAS PULCHRUM, Waagen, n. sp., p. .
Specimen without shell, showing the commencement of the body-chamber, from the *Ceratite Marls* of the *Chitta-Wan*; 1, *a*, lateral view; 1, *b*, front-view; 1, *c*, sutural line. (See for this species also Pl. XXVII, figs. 2, 3.)
- Figs. 2—5. MEEKOCERAS VARIANS, Waagen, n. sp., p. .
Different specimens from the *Lower Ceratite Limestone* of *west* of *Khoora*. Fig. 2, specimen with shell preserved and body-chamber nearly entire; 2, *a*, lateral view; 2, *b*, front-view (the external edges are not well shown in this figure). Fig. 3, fragment of a medium-sized individual, showing the sutural lines; 3, *a*, lateral view; 3, *b*, cross section; 3, *c*, sutural line. Fig. 4, small specimen without shell, lateral view. Fig. 5, innermost whorls, taken out of a large individual, lateral view; 5, *a*, natural size; 5, *b*, the same, enlarged twice.

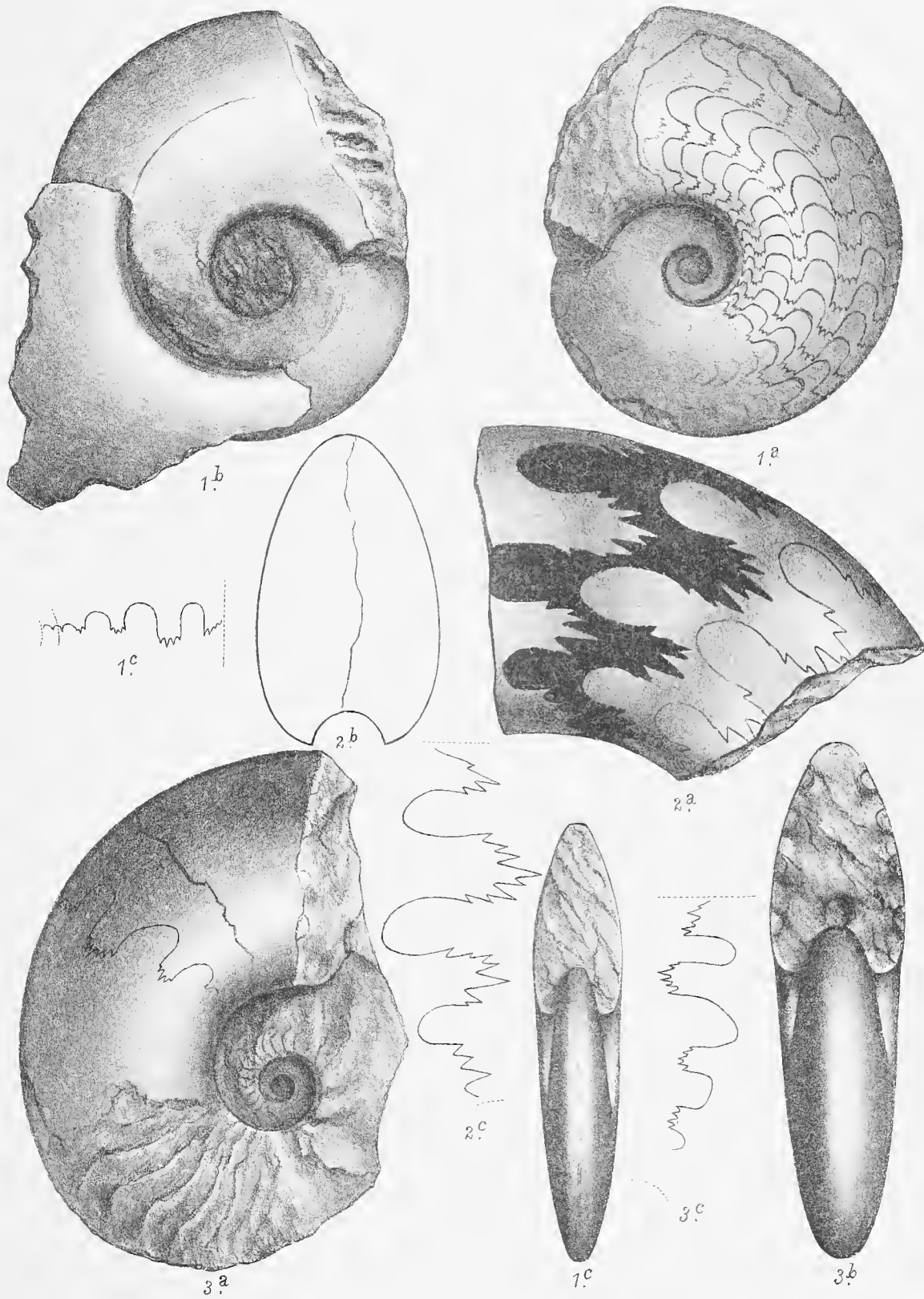


A. Svoboda del et lih

John Hauptmann

PLATE XXX.

- Fig. 1. KONINCKITES VERCHEREI, Waagen, n. gen. et sp., p. .
Specimen from Dr. Verchere's collection, from *Kotela*, probably out of the *Ceratite Marls*; 1, *a*, lateral view of one side of the specimen, without shell; 1, *b*, lateral view of the other side, with shell; 1, *c*, front-view; 1, *d*, sutural line.
- Fig. 2. MEEKOCERAS FULGURATUM, Waagen, n. sp., p. .
Fragment from the *Upper Ceratite Limestone* of *Siran-ki-Dok*; 2, *a*, lateral view; 2, *b*, cross section; 2, *c*, sutural line.
- Fig. 3. KONINCKITES LYELLIANUS, Koninck, sp., p. .
Much weathered specimen, from the *lower region* of the *Ceratite Sandstone* of the hills near *Choa*; 3, *a*, lateral view, the sutural line only very indistinctly preserved; 3, *b*, front-view, restored; 3, *c*, sutural line on the other side of the specimen, only partially preserved.



A. Swoboda del et lith

Ed. Hauptmann

PLATE XXXI.

- Fig. 1. MEEKOCERAS TARDUM, Waagen, n. sp., p. .
Fragment with part of shell from the *Upper Ceratite Limestone* of *Koofri*; lateral view.
- Fig. 2. KONINCKITES GIGAS, Waagen, n. gen. et sp., p. .
Fragment of internal cast, much weathered, from the *Ceratite Sandstone* (lower region?) of the hills near *Choa*; 2, *a*, lateral view; 2, *b*, cross section (drawn much more symmetrically than it occurs in nature); 2, *c*, sutural line showing also the anti-siphonal lobe.

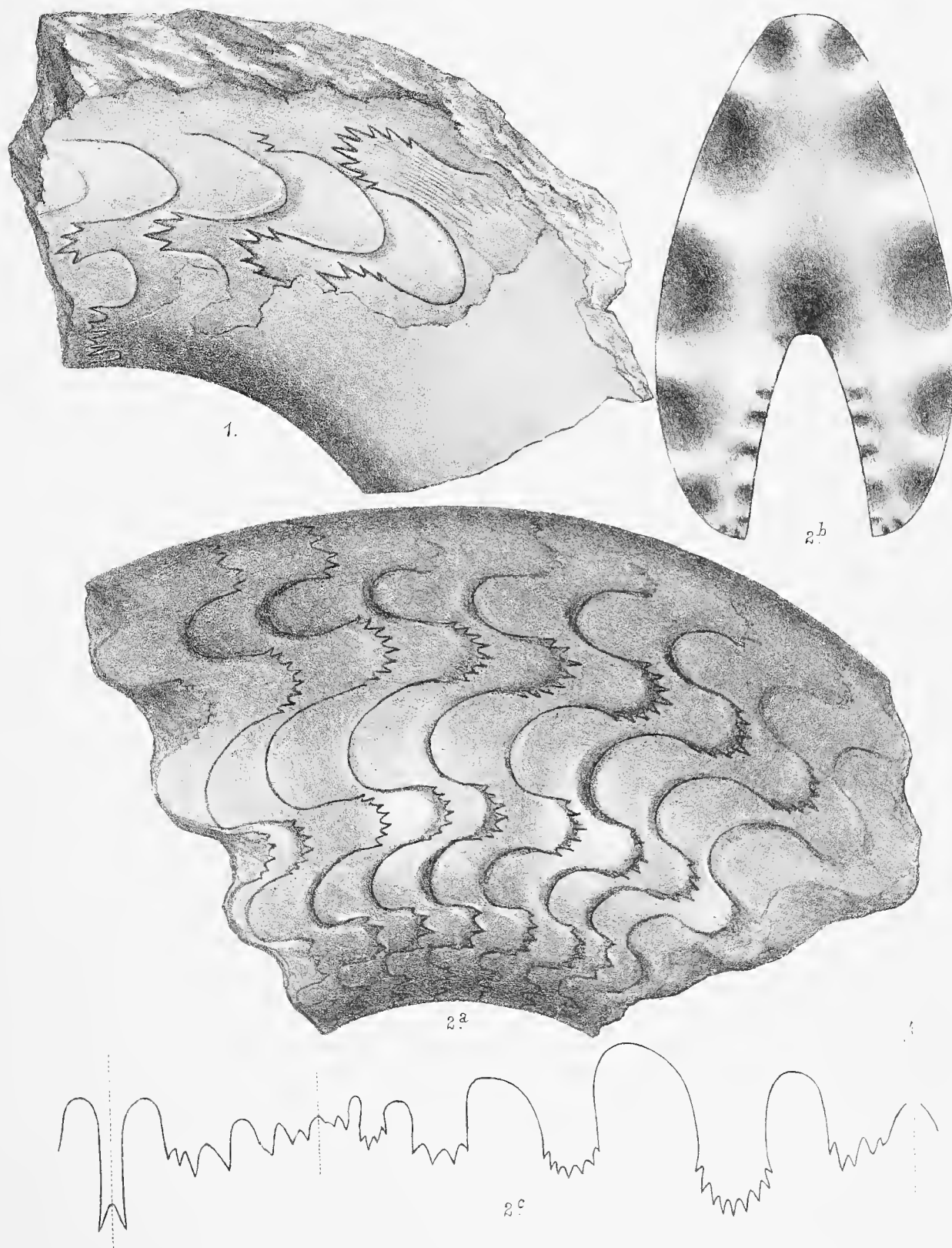


PLATE XXXII.

- Fig. 1. ASPIDITES KINGIANUS, Waagen, n. gen. et sp., p. .
Specimen without shell from the middle region of the *Ceratite Sandstone* (*Stachella-*
beds) of *Virgal*, lateral view.
- Fig. 2. KONINCKITES RADIATUS, Waagen, n. gen. et sp., p. .
Specimen with part of shell, from the middle region of the *Ceratite Sandstone*
(*Stachella-beds*) of *Amb*; 2, *a*, lateral view; 2, *b*, front-view; 2, *c*, sutural line,
enlarged.

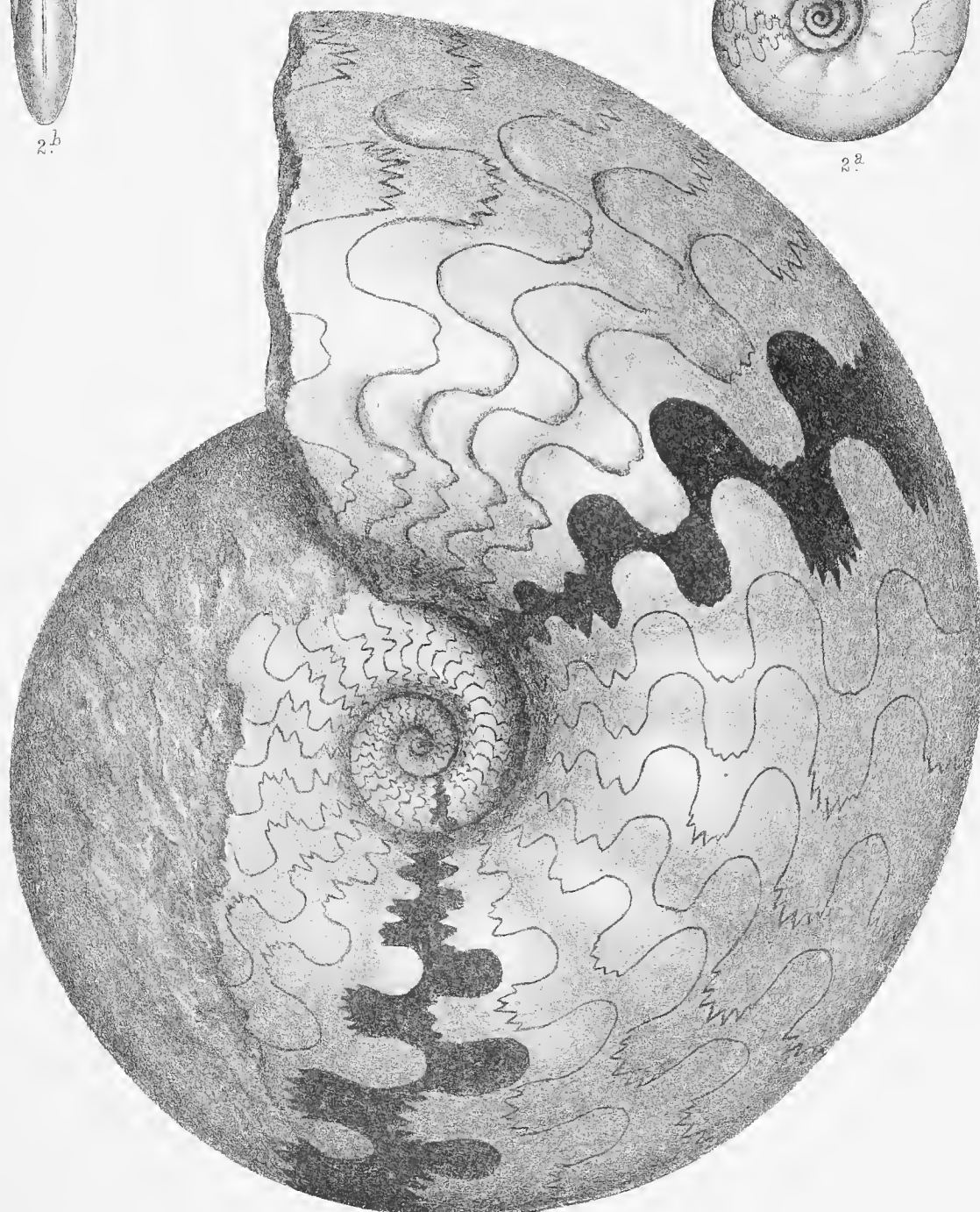
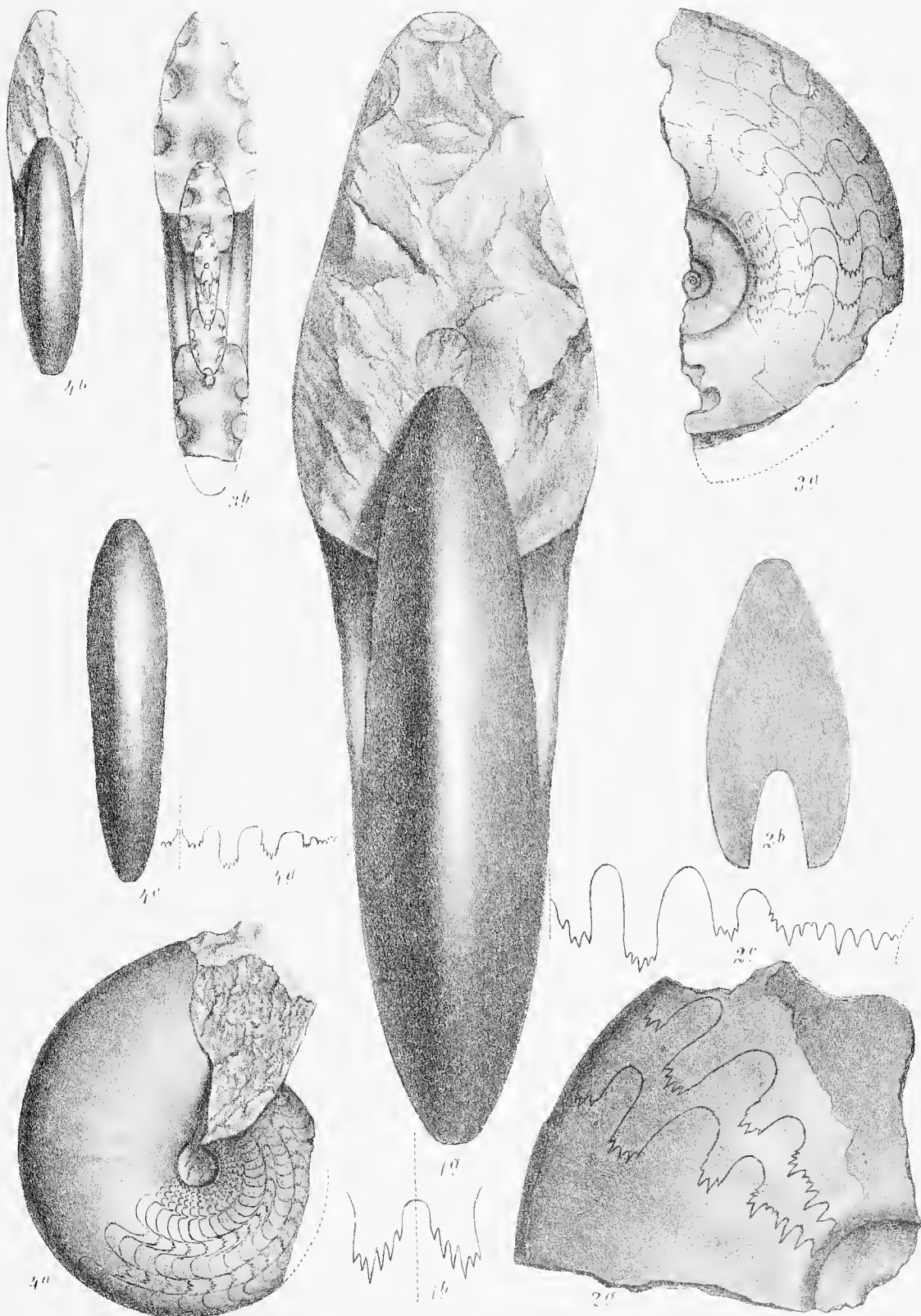


PLATE XXXIII.

- Fig. 1. *ASPIDITES KINGIANUS*, Waagen, n. gen. et sp., p. .
 Same specimen as represented on Pl. XXXII, fig. 1; 1, *a*, front-view; 1, *b*, external or siphonal lobe.
- Fig. 2. *ASPIDITES DENTOSUS*, Waagen, n. gen. et sp., p. .
 Fragment, showing the sutural lines, from the middle region of the *Ceratite Sandstone (Stachella-beds)* of *Koofri*; 2, *a*, lateral view; 2, *b*, cross section; 2, *c*, sutural line.
- Fig. 3. *MEEKOCERAS MAGNUMBILICATUM*, Waagen, n. sp., p. .
 Fragment from the middle region of the *Ceratite Sandstone (Stachella-beds)* of *Chidroo*; 3, *a*, lateral view; 3, *b*, cross section.
- Fig. 4. *KONINCKITES DAVIDSONIANUS*, Koninck, sp., p. .
 Specimen without shell, but with body-chamber, from the *Lower Ceratite Limestone* of *Chidroo*; 4, *a*, lateral view (the sutural lines are not quite correctly drawn—see fig. 4, *d*); 4, *b*, front-view; 4, *c*, back-view; 4, *d*, sutural line.

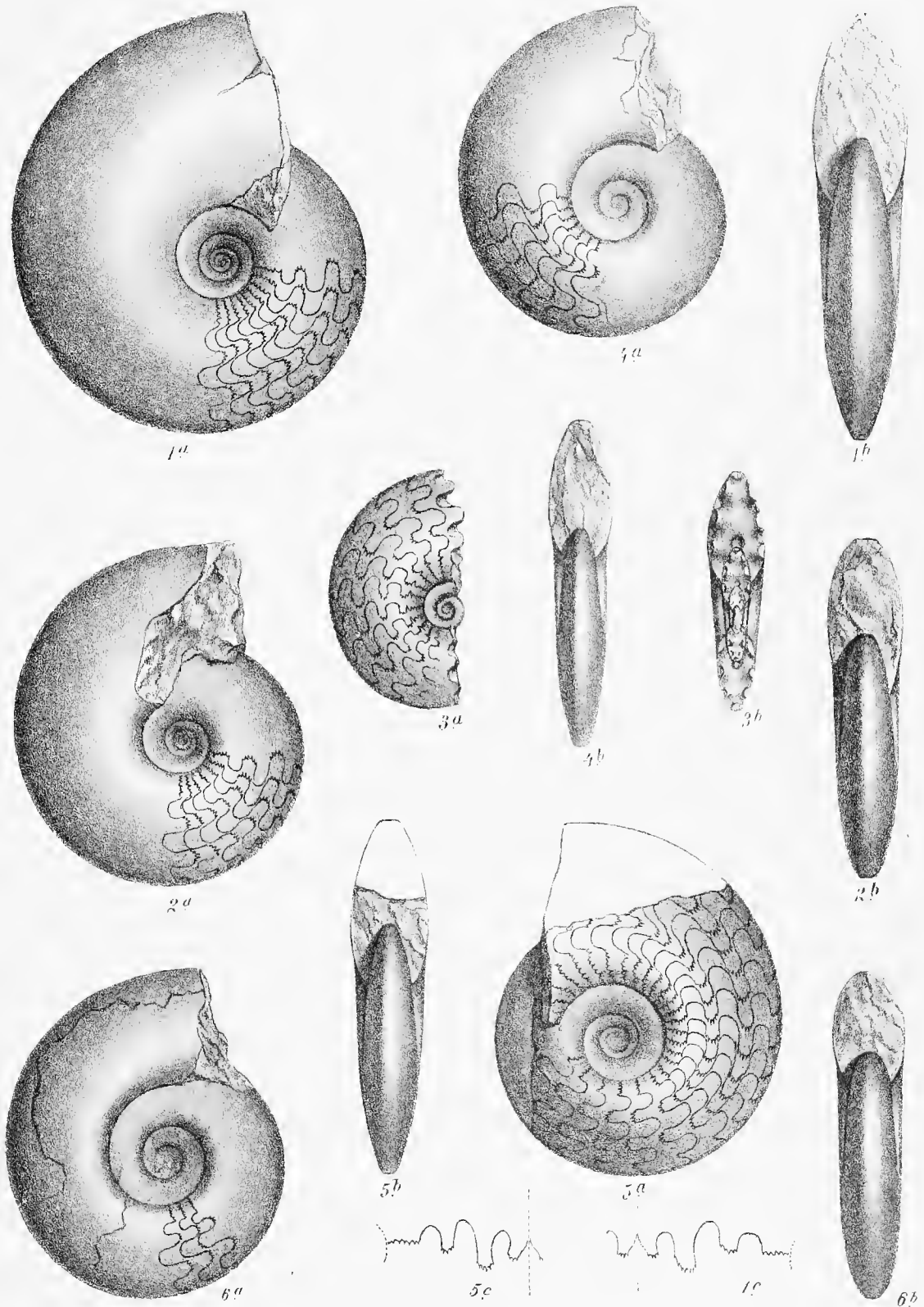


A. Swoboda del. et lith.

Th. Bannwarth print.

PLATE XXXIV.

- Figs.** 1—3. *PRIONOLOBUS ROTUNDATUS*, Waagen, n. gen. et sp., p. .
 Three different specimens from the *Ceratite Marls* of *Virgal*. Fig. 1, large specimen with the greater part of body-chamber, all internal cast without trace of shell; 1, *a*, lateral view; 1, *b*, front-view; 1, *c*, sutural line. Fig. 2, specimen with entire body-chamber and apertural margin, without trace of shell substance; 2, *a*, lateral view; 2, *b*, front-view. Fig. 3, small fragmentary specimen with somewhat abnormal sutural lines; 3, *a*, lateral view; 3, *b*, cross section.
- Fig.** 4. *PRIONOLOBUS ATAVUS*, Waagen, n. gen. et sp., p. .
 Specimen with traces of shell and part of body-chamber, from the *Lower Ceratite Limestone* of *Virgal*; 4, *a*, lateral view; 4, *b*, front-view. (See also Pl. XXXV, fig. 4.)
- Fig.** 5. *PRIONOLOBUS SEQUENS*, Waagen, n. gen. et sp., p. .
 Specimen without shell composed of septa only, from the *upper region* of the *Ceratite Sandstone* (*Flemingites* beds) of *Virgal*; 5, *a*, lateral view; 5, *b*, front-view; 5, *c*, sutural line.
- Fig.** 6. *PRIONOLOBUS OPHIONEUS*, Waagen, n. gen. et sp., p. .
 Specimen with partially preserved shell, and portion of body-chamber, from the *Lower Ceratite Limestone* of *Khoora*; 6, *a*, lateral view; 6, *b*, front-view.

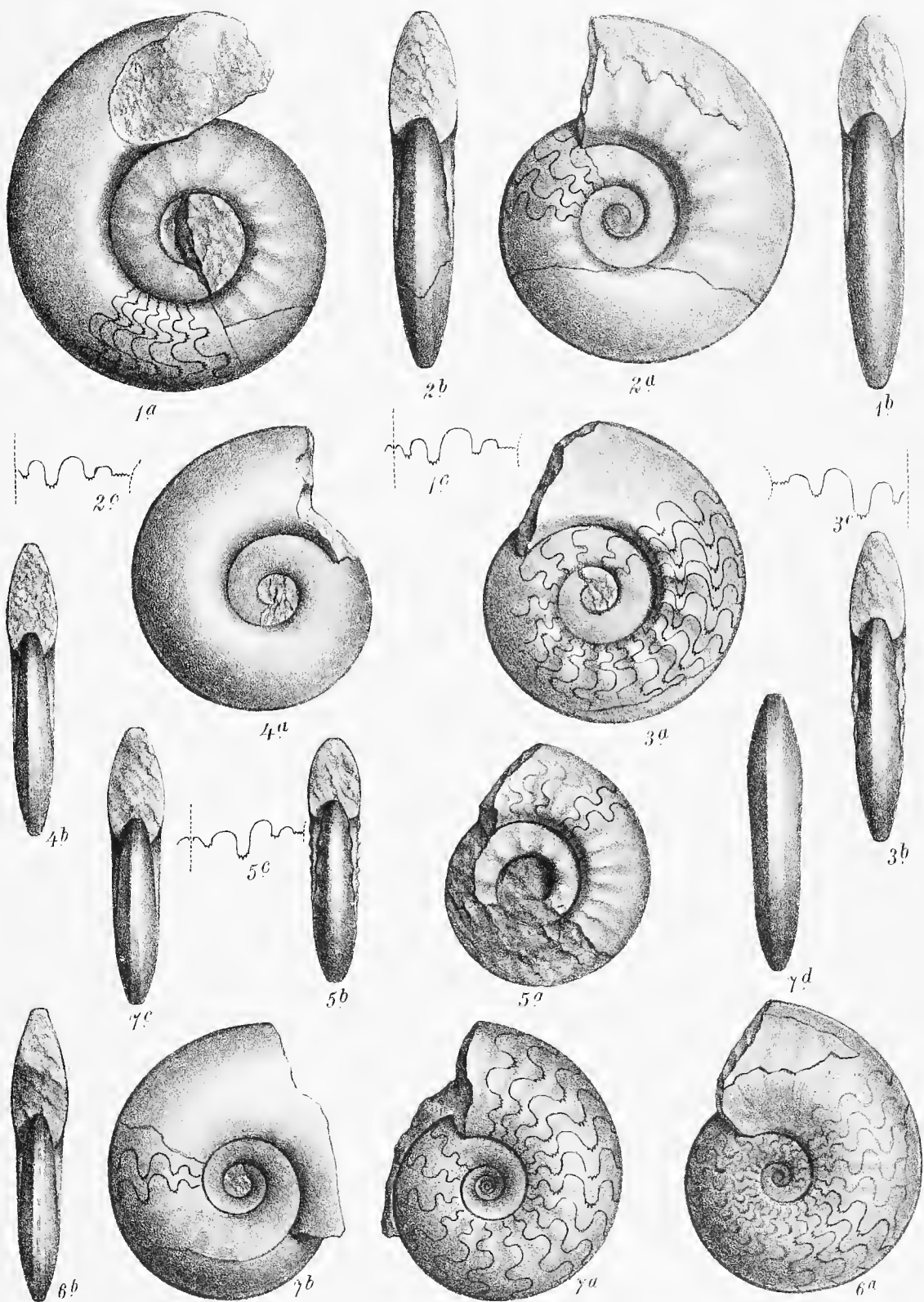


A. Swoboda del. et lith.

Th Bannwarth print.

PLATE XXXV.

- Fig. 1. PRIONOLOBUS OVALIS, Waagen, n. gen. et sp., p. .
Specimen without shell, but with part of body-chamber, from the *highest beds* of the *Lower Ceratite Limestone* of west of *Khoora* ; 1, *a*, lateral view ; 1, *b*, front-views ; 1, *c*, sutural line.
- Fig. 2. PRIONOLOBUS PLICATUS, Waagen, n. gen. et sp., p. .
Specimen somewhat broken, mostly internal cast, from the *middle region* of the *Lower Ceratite Limestone* of *Khoora* ; 2, *a*, lateral view ; 2, *b*, front-view ; 2, *c*, sutural line.
- Fig. 3. PRIONOLOBUS COMPRESSUS, Waagen, n. gen. et sp., p. .
Specimen without shell, but with commencement of the body-chamber, from the *lowest beds* of the *Lower Ceratite Limestone* of *Nanga* ; 3, *a*, lateral view ; 3, *b*, front-view ; 3, *c*, sutural line.
- Fig. 4. PRIONOLOBUS ATAVUS, Waagen, n. gen. et sp., p. .
Specimen, probably internal cast, but showing only faint traces of sutural lines, from the *Lower Ceratite Limestone* of *Kafir Kote* ; 4, *a*, lateral view ; 4, *b*, front-view. (See for this species also Pl. XXXIV, fig. 4.)
- Fig. 5. PRIONOLOBUS BUCHIANUS, Koninck, sp., p. .
Fragment, composed of septa only, from the *Lower Ceratite Limestone* (*lower region*), west of *Khoora* ; 5, *a*, lateral view ; 5, *b*, front-view ; 5, *c*, sutural line, somewhat enlarged.
- Fig. 6. KONINCKITES IMPRESSUS, Waagen, n. gen. et sp., p. .
Specimen all entirely composed of septa, from the *Lower Ceratite Limestone* of *Virgal* ; 6, *a*, lateral view ; 6, *b*, front-view.
- Fig. 7. GYRONITES EVOLVENS, Waagen, n. gen. et sp., p. .
Specimen with part of its shell and commencement of the body-chamber, from the *Ceratite Marls*, probably from *Khoora* ; 7, *a*, lateral view ; 7, *b*, lateral view, other side ; 7, *c*, front-view ; 7, *d*, back-view.

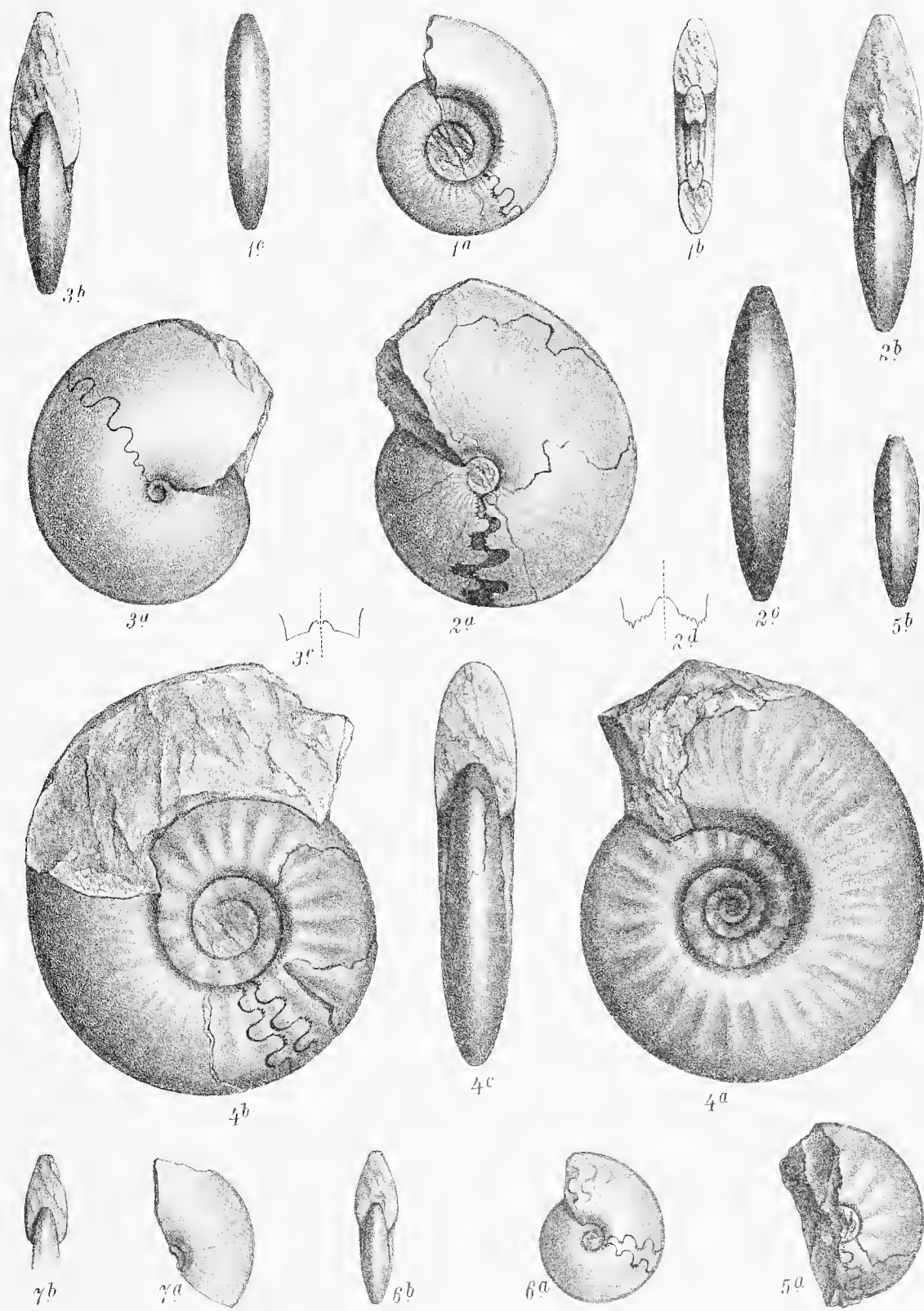


A. Swoboda del. et lith.

Th Bannwarth print

PLATE XXXVI.

- Fig. 1. PRIONOLOBUS PLICATILIS, Waagen, n. gen. et sp., p. .
 Fragment from the *Lower Ceratite Limestone* of *Sheikh-Budin* ; 1, *a*, lateral view, partly restored ; 1, *b*, cross section ; 1, *c*, back-view.
- Fig. 2. MEEKOCERAS RADIOSUM, Waagen, n. sp., p. .
 Specimen with partially preserved shell from the *lower region* of the *Ceratite Sandstone* of the *Chitta-Wan* ; 2, *a*, lateral view ; 2, *b*, front-view ; 2, *c*, back-view ; 2, *d*, siphonal lobe, enlarged.
- Fig. 3. PARAKYMATITES DISCOIDES, Waagen, n. gen. et sp., p. .
 From the middle region of the *Ceratite Sandstone* (*Stachella*-beds) of *Chidroo* ; 3, *a*, lateral view ; 3, *b*, front-view.
- Fig. 4. MEEKOCERAS FALCATUM, Waagen, n. sp., p. .
 Specimen with shell, showing the commencement of the body-chamber, from the middle region of the *Ceratite Sandstone* (*Stachella*-beds) of *Amb* ; 4, *a*, lateral view ; 4, *b*, lateral view, other side ; 4, *c*, front-view.
- Fig. 5. PRIONOLOBUS UNDATUS, Waagen, n. gen. et sp., p. .
 Fragment with partially preserved shell, from the *Ceratite Marls* of *Virgal* ; 5, *a*, lateral view ; 5, *b*, back-view.
- Figs. 6 and 7. KINGITES MINUTUS, Waagen, n. gen. et sp., p. .
 Two specimens from the *lower region* of the *Ceratite Sandstone* of *Virgal*. Fig. 6, small specimen without shell, composed of septa only ; 6, *a*, lateral view ; 6, *b*, front-view. Fig. 7, fragment of body-chamber of a somewhat larger specimen ; 7, *a*, lateral view ; 7, *b*, cross section.

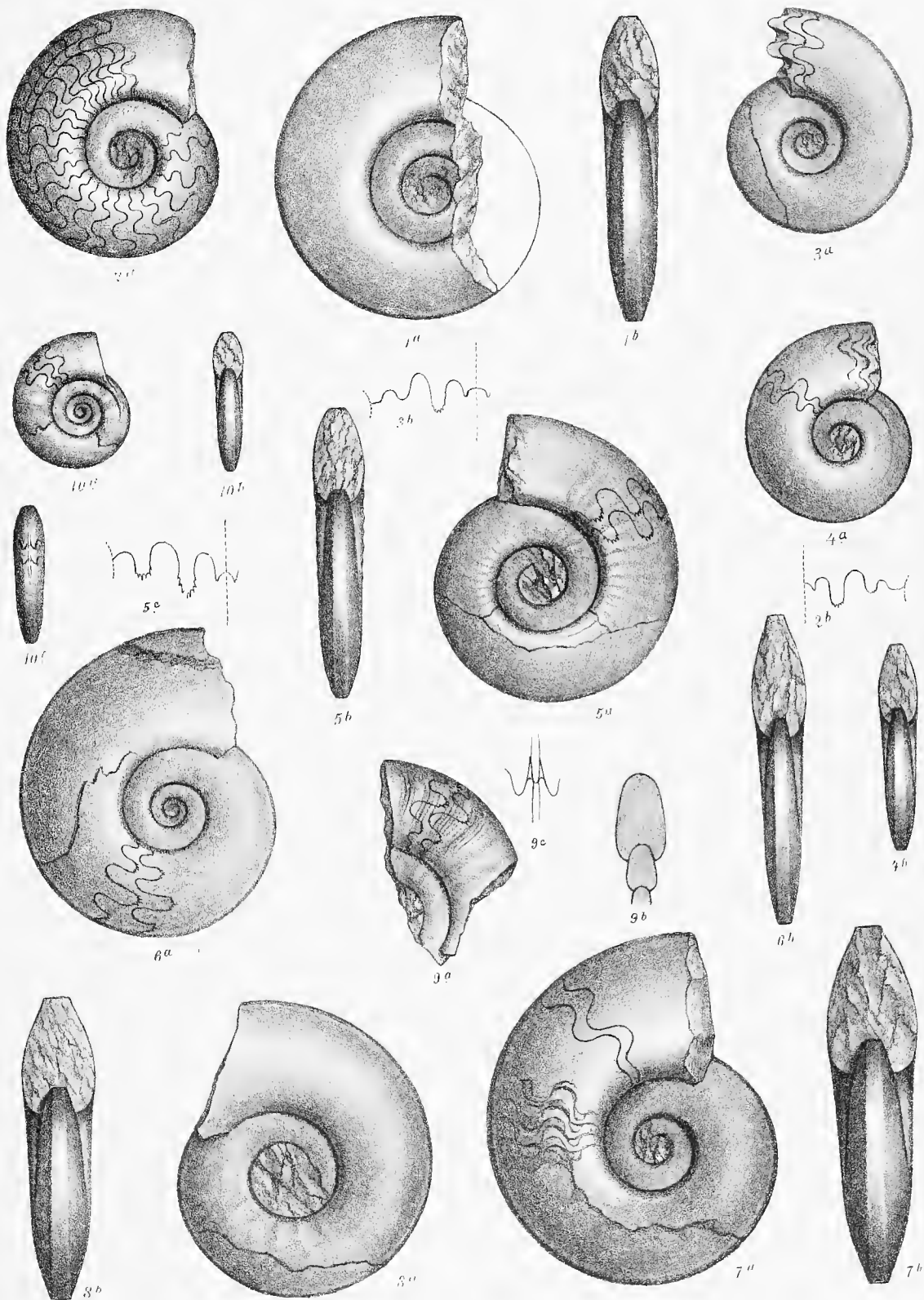


A. Swoboda del. et lith.

Th. Bannwarth print.

PLATE XXXVII.

- Figs. 1—4. *GYRONITES FREQUENS*, Waagen, n. gen. et sp., p. .
 Different specimens from the *lower beds* of the *Lower Ceratite Limestone* of *Khoora*.
 Fig. 1, one of the largest specimens found, with almost entire body-chamber ; internal cast, but showing only traces of sutural lines ; 1, *a*, lateral view ; 1, *b*, front-view, restored. Fig. 2, specimen without shell, showing the sutural lines and commencement of the body-chamber ; 2, *a*, lateral view ; 2, *b*, sutural line. Fig. 3, specimen without shell ; 3, *a*, lateral view ; 3, *b*, sutural line. Fig. 4, small specimen, composed of septa only ; 4, *a*, lateral view ; 4, *b*, front-view.
- Fig. 5. *GYRONITES NANGAENSIS*, Waagen, n. gen. et sp., p. .
 Somewhat fragmentary specimen without shell from the *lowest beds* of the *Lower Ceratite Limestone* of *Nanga* ; 5, *a*, lateral view ; 5, *b*, front-view ; 5, *c*, sutural line.
- Fig. 6. *GYRONITES SUPERIOR*, Waagen, n. gen. et sp., p. .
 Specimen without shell from the *uppermost-beds* of the *Lower Ceratite Limestone*, west of *Khoora* ; 6, *a*, lateral view ; 6, *b*, front-view.
- Figs. 7—8. *LECANITES IMPRESSUS*, Waagen, n. sp., p. .
 Two specimens from the *Lower Ceratite Limestone* of the hills east of *Katwahee*.
 Fig. 7, middle-sized specimen without shell, showing sutural lines distinctly ; 7, *a*, lateral view ; 7, *b*, front-view. Fig. 8, smaller specimen without shell, with indistinct traces only of sutural lines ; 8, *a*, lateral view ; 8, *b*, front-view.
- Fig. 9. *GYRONITES ARENOSUS*, Waagen, n. gen. et sp., p. .
 Fragment from the *lower region* of the *Ceratite Sandstone* of the *Chitta-Wan* ; 9, *a*, lateral view ; 9, *b*, cross section ; 9, *c*, passage of the siphuncle through the siphonal lobe, enlarged.

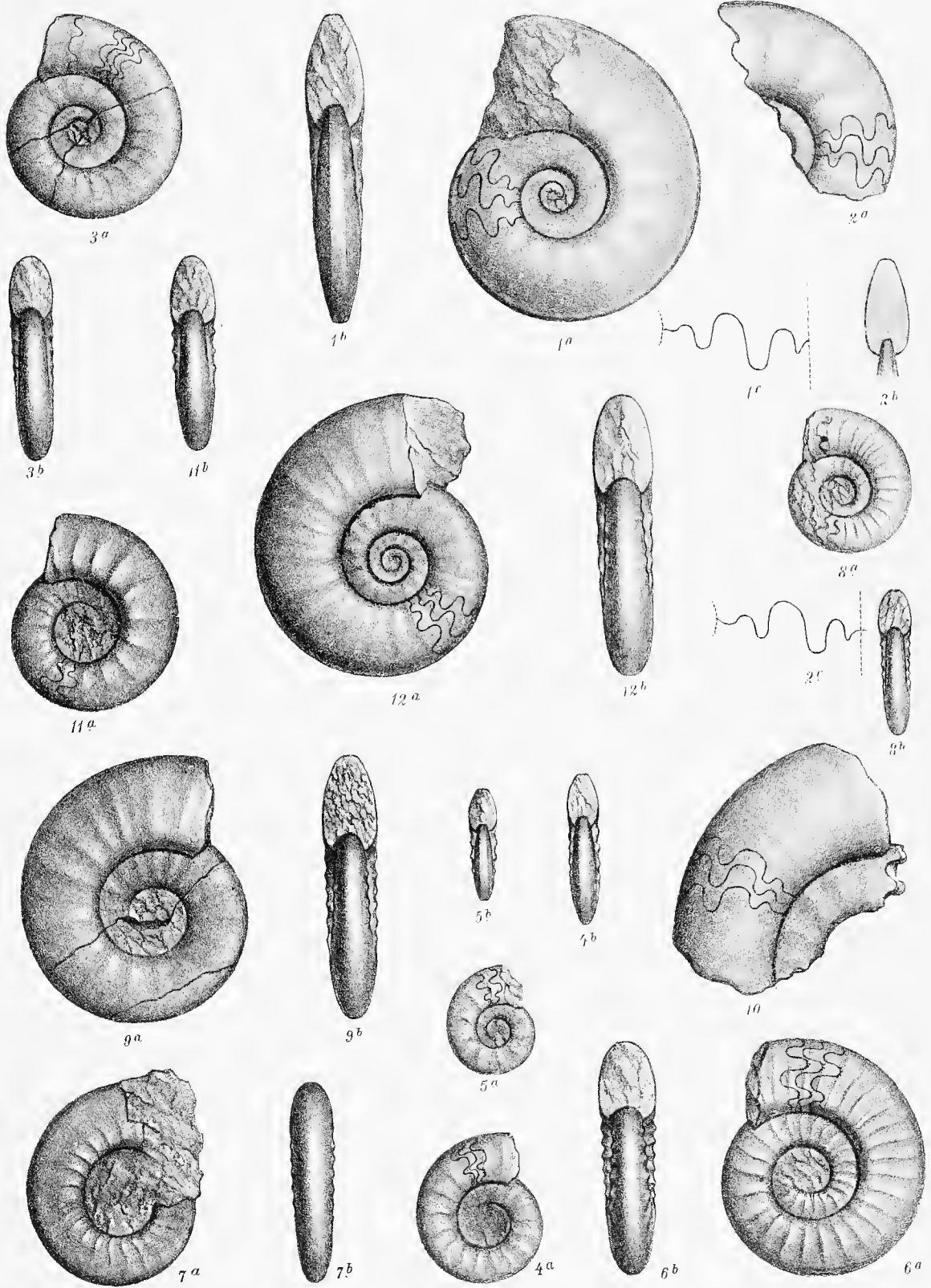


A. Swoboda del. et. lith.

Th. Bannwarth print.

PLATE XXXVIII.

- Fig. 1. *LECANITES UNDATUS*, Waagen, n. sp., p. .
 Specimen without shell from the *Lower Ceratite Limestone* of the hills East of *Katwahee*; 1, *a*, lateral view; 1, *b*, front-view; 1, *c*, sutural line, enlarged.
- Fig. 2. *LECANITES UNDATUS*, Waagen, n. sp., p. .
 Fragment from the *Lower Ceratite Limestone* of *Kafir-Kote*; 2, *a*, lateral view; 2, *b*, cross section; 2, *c*, sutural line, enlarged.
- Figs. 3—5. *GYRONITES ROTULA*, Waagen, n. gen. et sp., p. .
 Three different specimens from the *lower region* of the *Ceratite Sandstone* of the *Chitta-Wan* near *Ghari*. Fig. 3, largest specimen found without shell; 3, *a*, lateral view; 3, *b*, front-view. Fig. 4, smaller specimen, also without shell; 4, *a*, lateral view; 4, *b*, front-view. Fig. 5, smallest specimen known; 5, *a*, lateral view; 5, *b*, front-view.
- Figs. 6—8. *GYRONITES RADIANS*, Waagen, n. gen. et sp., p. .
 Three specimens from the *lower region* of the *Ceratite Sandstone* of the *Chitta-Wan*. Fig. 6, largest specimen known, entirely composed of septa; 6, *a*, lateral view; 6, *b*, front-view. Fig. 7, specimen showing only traces of sutural lines, the last third of the last volution belonging to the body-chamber; 7, *a*, lateral view; 7, *b*, back-view. Fig. 8, small specimen composed of septa only; 8, *a*, lateral view; 8, *b*, front-view.
- Figs. 9 & 10. *LECANITES LAQUEUS*, Waagen, n. sp., p. .
 Two specimens, rather badly preserved, from the *Bivalve-layers* of *Chidroo*. Fig. 9, medium-sized specimen, apparently only composed of septa; 9, *a*, lateral view; 9, *b*, front-view. Fig. 10, fragment of a larger specimen, showing sutural lines distinctly, lateral view.
- Fig. 11. *GYRONITES FLICOSUS*, Waagen, n. gen. et sp., p. .
 Specimen mostly composed of septa, the last half of the last volution belonging to the body-chamber; from the *lowest beds* of the *Lower Ceratite Limestone* of *Khoora*; 11, *a*, lateral view; 11, *b*, front-view.
- Fig. 12. *LECANITES OPHIONEUS*, Waagen, n. sp., p. .
 Specimen with part of body-chamber; from the *upper region* of the *Ceratite Sandstone* of *Chidroo*; 12, *a*, lateral view; 12, *b*, front-view.

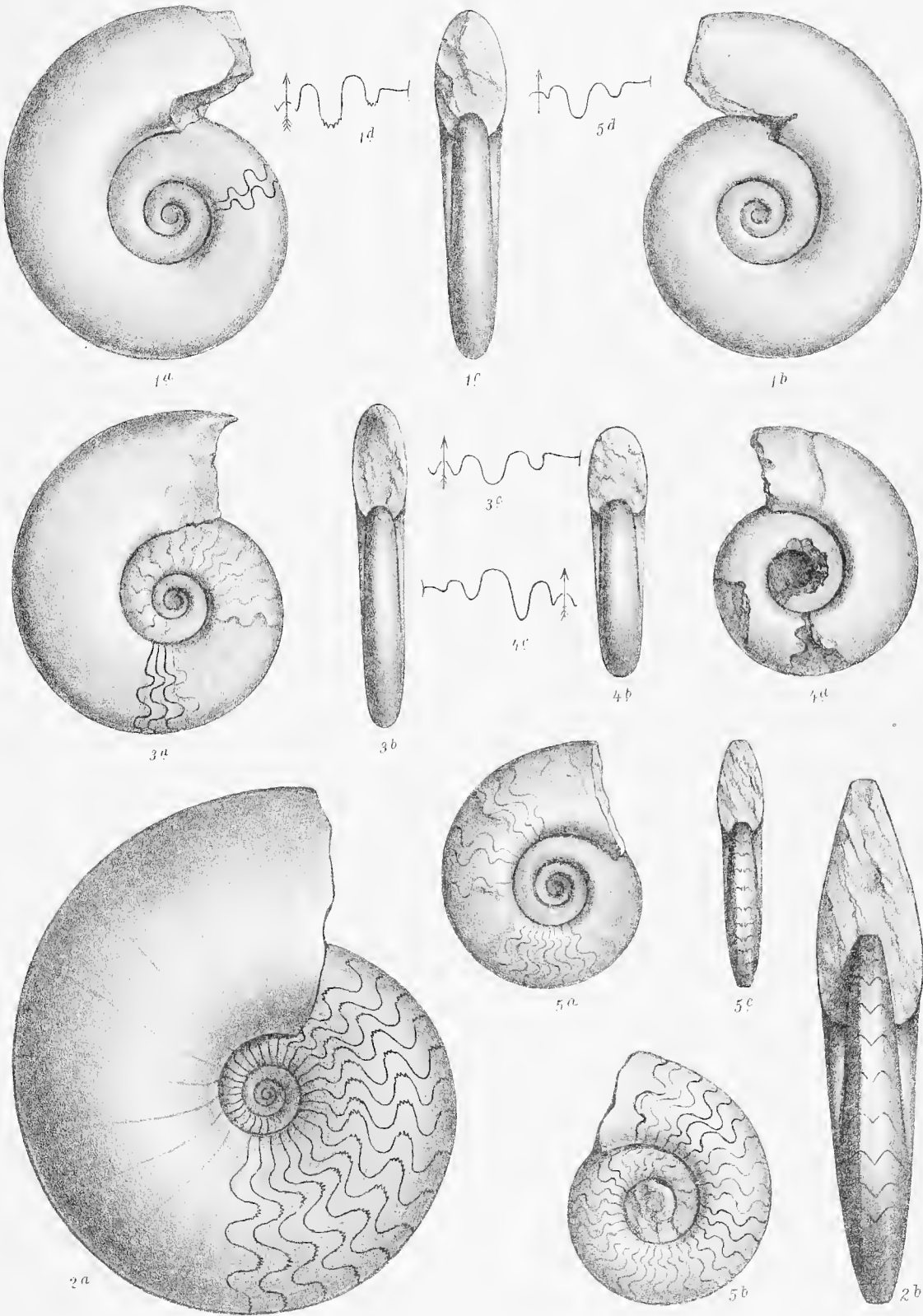


A. Swoboda del. et. lith.

Th. Bannwarth print.

PLATE XXXIX.

- Fig. 1. *GYRONITES VERMIFORMIS*, Waagen, n. gen. et sp., p. .
Specimen with badly preserved shell, from the *lower region* of the *Ceratite Sandstone* of *Chidroo*; 1, *a*, lateral view; 1, *b*, lateral view, other side; 1, *c*, front-view; 1, *d*, sutural line, somewhat enlarged.
- Fig. 2. *MEEKOCERAS PLANULATUM*, Koninck, sp., p. .
Copy of Mons. de Koninck's original figure in the Quarterly Journal, Geol. Soc., Vol. XIX, Plate V, fig. 1; 2, *a*, lateral view, 2, *b*, front-view. (See also for this species Pl. XXIV, fig. 2, and Pl. XL, fig. 1.)
- Fig. 3. *LECANITES PLANORBIS*, Waagen, n. sp., p. .
Specimen with body-chamber, but without shell, from the *Bivalve-layers* of *Chidroo*; 3, *a*, lateral view; 3, *b*, front-view; 3, *c*, sutural line, somewhat enlarged.
- Fig. 4. *LECANITES GANGETICUS*, Koninck, sp., p. .
Specimen without shell, composed of septa only, from the *Lower Ceratite Limestone* near *Vurcha*; 4, *a*, lateral view; 4, *b*, front-view; 4, *c*, sutural line, somewhat enlarged.
- Fig. 5. *LECANITES PSILOGYRUS*, Waagen, n. sp., p. .
Specimen without shell, entirely composed of septa, from the *lowest beds* of the *Lower Ceratite Limestone* of *Khoora*; 5, *a*, lateral view; 5, *b*, lateral view, other side; 5, *c*, front-view; 5, *d*, sutural line, somewhat enlarged.

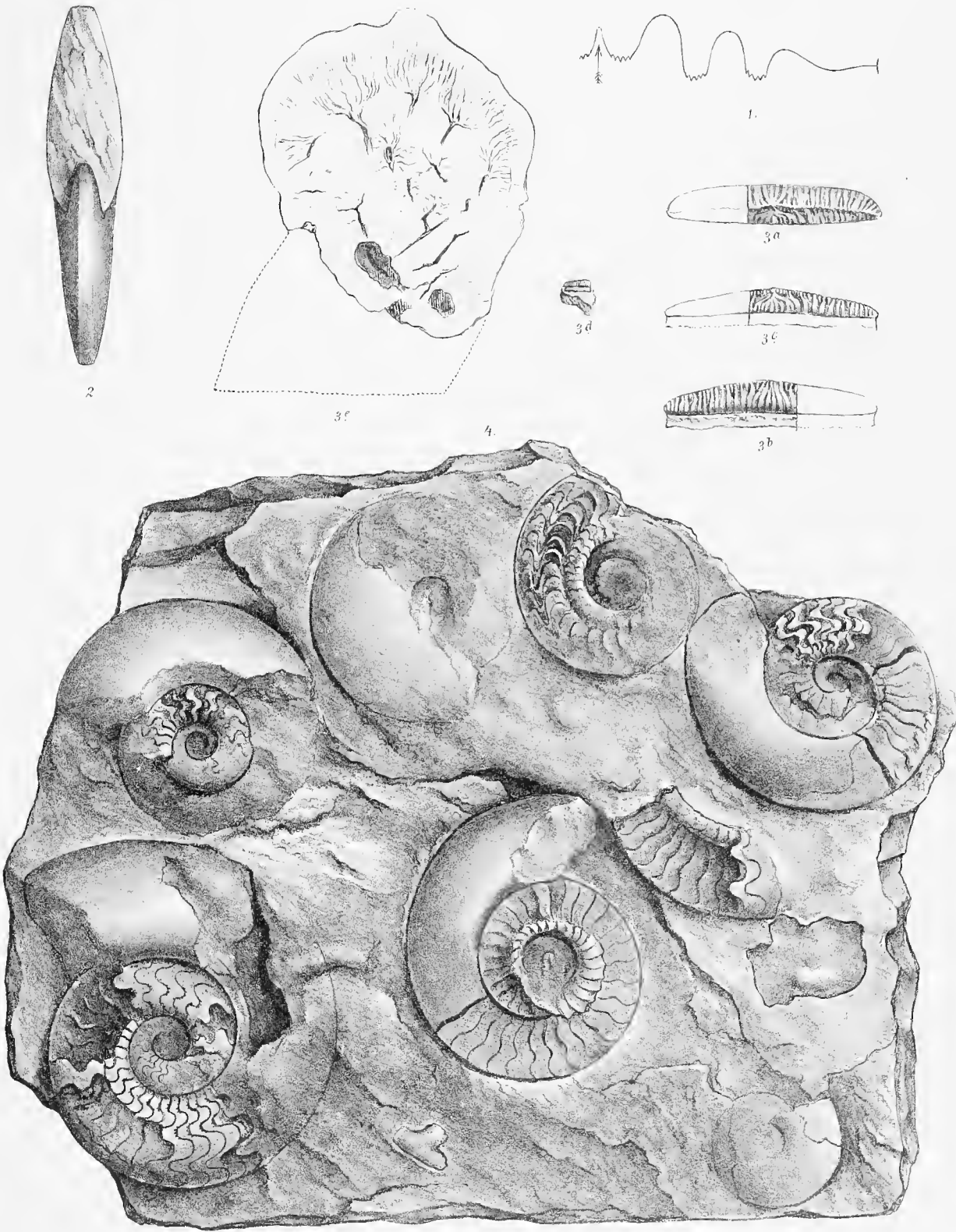


A. Swoboda del. et. lith.

Th. Bannwarth print.

PLATE XL.

- Fig. 1. *MEEKOCERAS PLANULATUM*, Koninck, sp., p. .
Sutural line copied from Mons. de Koninck's drawing in the Quarterly Journal, Geological Society, Vol. XIX, Pl. V.
- Fig. 2. *CLYPITES KINGIANUS*, Waagen, n. gen. et sp., p. .
Front-view of the specimen represented on Pl. XXXI, fig. 8.
- Fig. 3. *ACRODUS JAECKELI*, Waagen, n. sp., p. .
Specimen from the middle region of the *Ceratite Sandstone* (*Stachella*-beds) of *Chidroo*; 3, *a*, view from above; 3, *b*, view from one side, 3, *c*, view from the opposite side; these three figures much enlarged; 3, *d*, lateral view, natural size; 3, *e*, microscopic cross section, taken from a drawing made by Dr. Jaekel of Berlin.
- Fig. 4. *GYRONITES FREQUENS*, Waagen, n. gen. et sp., p. .
Slab of limestone from the *Lower Ceratite Limestone* of *Khoora*, showing on one side six somewhat fragmentary specimens, and two other indeterminable *Ammonites*, whilst the rock itself is crowded throughout with the same species. (See for this species also Pl. XXXVII, figs. 1—4.)



A. Swoboda del. et. lith.

Th. Bannwarth print.

