

Note on the Occurrence of *VELATES SCHMIDELIANA*, Chemn. and *PROVELATES GRANDIS*, Sow sp., in the Tertiary Formation of India and Burma.
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While describing a number of fossils collected by me in the Upper Tertiary formation of Burma, near Minbu and Yenangyat, some further specimens which had been collected on the eastern slopes of the Atrakan Yoma, near the village of Napeh, about 40 miles west of Minbu, were presented by Mr. Way, Engineer in-Chief, Aeng Pass Railway, to the Geological Department. No particulars were given about the geological position of these fossils, but from my knowledge of the country I think that they come from strata older than those containing the marine fauna of Minbu and Yenangyat. The most characteristic and at the same time numerous among these fossils, was one kind that I recognized at once as belonging to the genus *Velates*, Mont. Now, considering the important position this genus holds in the Tertiary formation of Western India, where it is restricted to the Ranikot and Khirtar group, having its chief development in the latter,¹ I thought it advisable to compare the specimens from Burma with those from Western India, in order to establish the identity or to prove their difference. If identical, a most important fact would be established in regard to the correlation of the Tertiary strata of Burma and Western India. We know that *Velates schmideliana* does not reach beyond the Khirtar group in Sind; if therefore the species from Burma were identical with that from India, the important fact would be proved that the beds containing *Velates schmideliana* in Burma would be equivalent to the Ranikot or Khirtar group in Western India, most probably to the latter one, and therefore the whole series of the strata above that bed would represent the equivalents of the Nari, Gaj and Manchhar groups. Thus a most important step in the knowledge of the Tertiary formation of Burma would be gained—a fact which cannot be under-estimated, because the fossil here in question can be easily recognized in the field, and the geologist working in the remote jungly hills skirting the Arrakan Yoma would always have a guide to lead him, when the thickness of the jungle hides the closed sequence of the strata.

It was with this object in view that I took in hand the examination of the specimens from Burma, at the same time comparing the Indian *Velates schmideliana* with a typical specimen from Europe in order to make sure as to their identity. On taking up the subject I found almost at once that there exist in Western India two genera which at the first sight might easily be confused; the one is represented by a typical *Velates*; the other by the new genus *Provelates*, which resembles a cast of *Velates* so closely that I am perfectly certain that it has frequently been mistaken for it.

In fact the mistake begins almost immediately with the description of Tertiary fossils from India; in 1840 James de Carle Sowerby² mentions a fossil as *Neritina grandis* from Wagé-Ki-pudda, in Cutch, which he describes as follows: "Short, conical, smooth; spire concealed; aperture very large; base convex, its margin

¹ Distribution of the fossils described by Messrs d'Arch. and Haime, Memoirs, Geological Survey of India, Vol. XVII, 1880, page 205.

² Transactions of the Geological Society, 2nd ser., Vol. V, plate XXIV, fig. 9.

rounded. Diameter 3 inches; height $1\frac{1}{2}$ inch. This resembles *N. schmideliana*, but has a larger aperture in proportion and a less eccentric apex, it is also higher. The specimen is little more than a cast, and does not exhibit the edge of the inner lip, but still it shows the attachment of the ligament projecting from the lower surface, and that the aperture occupied more than half the base."

Now we have, in the Survey Museum, from Sind several specimens of a shell which are undoubtedly identical with *Neritina grandis*, as we shall presently see, but which are certainly different from *Velates schmideliana* with which they have been identified by Messrs. d'Archiac and Haime.¹ The specimens figured and described by them undoubtedly represent a true *Velates*, but this form is not identical with *Neritina grandis*, Sow., as the authors supposed.

Before going however into the details of the description of the Indian forms, it will be useful to recall the characters of the type *Velates schmideliana*, Chemn. sp., and then starting from this form to examine how the Indian types can be compared with it.

VELATES SCHMIDELIANA, Chemn. sp.

1786. *Nerit. schmideliana*, Chemn. Conch. Cab., Vol. 9, page 130, plate 114, figs. 975, 976.

1810. *Velates conoideus*, Denys de Montfort, Conchyl. Syst., Vol. II, page 354.

1853. *Nerita schmideliana*, D'Archiac and Haime, Desc. des. Anim. fossil. du groupe nummulitique de l'Inde, page 278, plate XXV, fig. 3, 3a, 4, 5, non. plate XXVII, fig. 1, 1b, 1c.

As a list of synonyms is given by d'Archiac it is useless to repeat it here. The chief character of the shell consists in the feature that the last whorl expands suddenly and rapidly in such a way as to form an enormous body chamber, and by producing an enormous callosity on the spire, which partly envelopes the earlier whorls. The last whorl is therefore conical in shape, the apex of the cone being represented by the spire, the base by the aperture; its shape might perhaps be compared with a Phrygian cap. The surface of the last whorl is covered with fine irregular striæ of growth, which in the peripheral part run parallel to the circumference, that is to say, they form complete circles, while in the central part they form only semi-circles. The outline of the early shape is always more or less marked by a deep furrow, running obliquely from the centre towards the lower edge of the last whorl; the base of the last whorl is sub-orbicular, and formed by a broad and inflated callosity which is supported from inside by a strong septum; the aperture is semi-circular; the inner lip deeply denticulated, the outer lip sharp.

It is therefore clear that for the specific differences we must chiefly look to the shape of the last whorl; we have therefore to examine the Indian specimens whether they show any marked differences from the type specimens in that regard or not. The genus *Velates* has been found in the Indian Tertiaries at the following localities:—

1. Kharguzani hill near Laki (Sind), Khirtar group.
2. Two unknown localities in Sind.
3. Napeh in Upper Burma.

The best preserved specimens are those under No. 1, then follow those from Burma, while those under No. 2 are casts which in all probability belong to the genus *Velates*; the latter may be disposed of at once, not only because the exact

¹ D'Archiac and Haime, Desc. des. Anim. foss. du groupe nummulitique de l'Inde, page 278, plate XXV, fig. 3a, 4, 5, non. plate XXVII, fig. 1, b, .

locality and position where they were found are unknown, but also because as casts no fair idea can be formed as to their original shape. It remains therefore a question to be decided in the future whether they may perhaps represent a new species or not.

As regards the specimens from Khargurzani hill, they are tolerably well preserved, but none of them shows the base or the aperture sufficiently well; this is rather unfortunate, as it may be supposed that the character of the aperture differs in both species. For the present we must leave it to the future to decide this; but as regards the outer side of the last whorl, I cannot detect the slightest difference between the Indian and the French specimen; so unless some very distinguishing features would be brought to light as regards the feature of the aperture, we must consider the Indian form identical with *Velates schmideliana*, Chemn.

The specimens from Burma were apparently somewhat roughly handled and also exposed for a long time to weathering, but all the same I cannot discover any difference either in shape or surface sculpture of the last whorl. Neither does the aperture which can be fairly seen in some of the specimens exhibit any different characters. We must therefore consider that the Burma species is also identical with *Velates schmideliana*, Chemn.

However, in order to show that not only the external features agree, I have measured two specimens from France, five from Burma, and five from India, the dimensions of which are given in the subjoined table.

	Diameter of last whorl.	Length of last whorl.	Height of last whorl. ¹
French type specimens. {	75 mm.	90 mm.	56 mm.
	75	85	51
	62	?	39
Indian specimens . {	45	?	29
	56	65	38
	52	62	?
	49	60	?
	62	78	45
Burma specimens . {	51	68	41
	?	88	58
	83	?	59
	57	?	44

If we reduce these figures to a common denominator, we find that in the two French specimens the proportions are—

Diameter : Length : Height.

5 : 6 : 3·6

5 : 6 : 3·3

The proportions of the Indian specimens are as follows:—

5 : ? : 3·3

5 : ? : 3·3

5 : 6 : 3·3

5 : 6

5 : 6

And in the Burma specimens:—

5 : 6·5 : 4

5 : 7 : 4

? : 6·5 : 4

5 : ? : 4

5 : ? : 4

¹ This includes the visible part of the spire.

We see therefore that the French type and the Indian specimens agree very well as regards the proportions of the last whorl; the specimens from Burma seem however to differ a little, inasmuch as the last whorl is a little longer and a little higher. Now I do not want to lay too much weight on this fact, particularly as regards the height, because it will be seen from the above figures that it varies considerably even among specimens of the same locality; this might only be expected if we consider that the callosity of the base varies much in thickness; on the other hand, it would be of greater importance if the circumference of the last whorl as seen from above, would be elliptical instead of sub-orbicular as with the type *Velates schmideliana*; if we, however, examine *Velates schmideliana*, we find that at some time of its life the last whorl was also of elliptical circumference; now the largest specimen from Burma, which is unfortunately damaged, had apparently a sub-orbicular circumference, and unless it is proved by comparing numerous specimens of the various types that the Burma type differs materially in the shape of the last whorl from the others, we must consider it as identical with the Indian form and the French type specimen *Velates schmideliana*, Chemn.

The area of distribution of this remarkable species is therefore much wider than was supposed by d'Archiac: from France, it ranges through Italy, Egypt, Persia, Cutch, Sind, as far as Western Burma, or, roughly speaking, from 0° Long. to 94° Long; and as to our knowledge, *Velates schmideliana* is restricted to the same limited horizon in the early Tertiaries, we may say indeed, that at one time during the Tertiary era, *Velates schmideliana* was distributed over an area extending over at least one-quarter of the globe in length without however reaching beyond a certain northern latitude.

After having proved the identity of the Indian types of *Velates* with the well-known European species, it now remains to turn our attention to the *Velates*-like shell, that has been mistaken for *Velates* itself. As I have sketched the history of this form in the beginning of this paper it now remains to describe and fix the new genus.

Order: Prosobranchiata, Cuv.

Sub-order: Aspidobranchiata, Cuv.

Family: Neritidae, Gray.

Genus: *Provelates*, Noetling.

Spire invisible, perfectly involved by the last whorl, which is of a considerable size, and of sub-conical shape, separated on the upper side by a deep furrow which runs from the apex to the posterior end of the aperture, representing the suture; aperture, large semi-lunar, outer lip sharp, inner lip not perfectly known, but apparently callous and probably not denticulated; not quite covering a deep umbilicus. Shell thin, and covered with fine striæ of growth which become rather effaced on full grown specimens but which are very regular on young ones.

So far as known for the present this genus is restricted to the Khirtar group.

The only species known is *Provelates grandis*, Sow¹.

Mr. Blanford collected this species in the gorge of the Baran River (Sind), from where figures 6 and 7 came; figures 8 and 9 come from the hills east of Trok in Kohistan, where it was collected by Mr. Fedden. The younger specimens

¹ *Neritina grandis*, Sow., Transact. of the Geol. Soc., 2nd ser., vol. V, plate XXIV, fig. 9.

resemble very much an ordinary *Natica*, only that the suture becomes indistinct and as if it were covered with a second layer of shell substance. The largest specimen measures 54 mm. from the edge of the outer lip to the opposite side, while its height was not more than 26 mm.

Full grown specimens, particularly when they have partly lost the shell, resemble in appearance very much casts of *Velates schmideliana*, but they may always be distinguished by the large aperture which was not denticulated, and the traces of an umbilicus; if the casts which I have mentioned above really represent casts of *Velates schmideliana*, then the latter would be distinguished by having the last part of the last whorl partly separated from the former whorls and the traces of a denticulated inner lip. On both specimens there exists a sharp ridge at that place where in the *Provelates grandis* the limit of the callosity is marked on the earlier whorls, but inasmuch as there is a similar sharp ridge on the *inside* of the last whorl of *Velates schmideliana*, where it forms the continuation of the perpendicular septum on the lower part of the callosity, which naturally must leave the same mark on the cast, we are left as before in the dark regarding the identity of these casts. Of course the whole question could be decided at once if I could manufacture a cast of *Velates schmideliana*; but unfortunately my material does not allow this, so we shall have to wait until a favourable opportunity arrives for doing so.

EXPLANATION OF PLATES.

PLATE 1.

- Fig. 1. *Velates schmideliana*, Chemn. sp. Sables inférieures, Cuisse Lamotte, upper side.
 Fig. 1a. " " " " left side view.
 Fig. 1b. " " " " base.
 Fig. 1c. " " " " last whorl & spire.
 Fig. 2. *Velates schmideliana*, Chemn. sp. Khirtar Group, Kharguzani Hill (Sind), upper side.
 Fig. 2a. " " " " last whorl & spire.
 Fig. 2b. " " " " left side view.
 Fig. 3. *Velates schmideliana*, Chemn. sp. Khirtar Group, Napeh (Burma), left side view.
 Fig. 3a. " " " " upper side.
 Fig. 3b. " " " " base & aperture.

PLATE 2.

- Fig. 1. *Velates schmideliana*, Chemn. sp. Khirtar Group, Napeh (Burma), left side view.
 Fig. 1a. " " " " upper side.
 Fig. 2. " " " " upper side.
 Fig. 2a. " " " " left side view.
 Fig. 3. *Provelates grandis*, Sow. sp. Khirtar Group (Gorge of Baran river), upper side.
 Fig. 3a. " " " " left side view.
 Fig. 3b. " " " " base.
 Fig. 4. *Provelates grandis*, Sow. sp. Khirtar Group, Gorge of Baran river, upper side.
 Fig. 4a. " " " " left side view.
 Fig. 4b. " " " " base.
 Fig. 5. *Provelates grandis*, Sow. sp. Khirtar Group, Truk (Kohistan) upper side.
 Fig. 6. " " " " upper side.
 Fig. 6a. " " " " sculpture enlarged.
 Fig. 7. *Velates schmideliana*, Chemn. sp. (?) cast, Khirtar group (?) Sind, upper side.
 Fig. 7a. " " " " lower side.

D^r Noetling.

Records, Vol. XXVII Pt. 3. Pl. I.

fig. 1.



fig. 1 a.

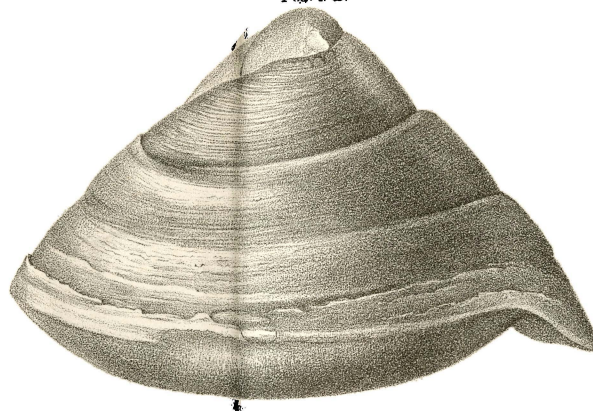


fig. 1 b.

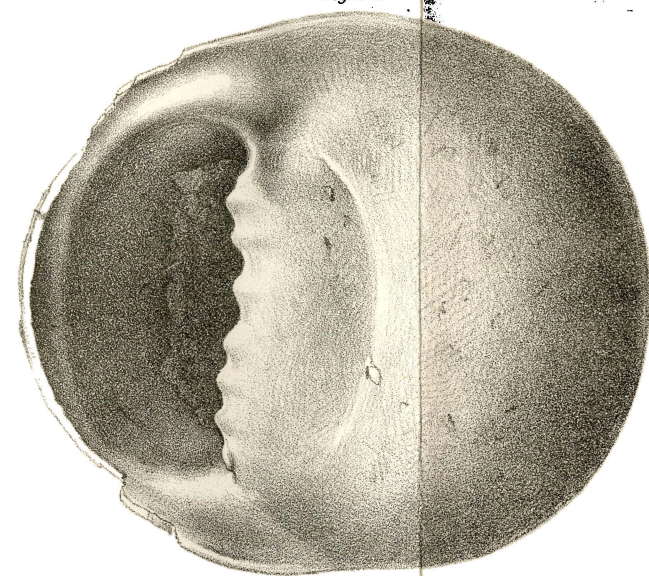


fig. 2.

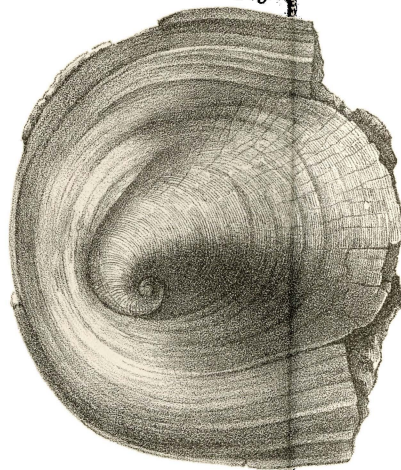


fig. 2 a.

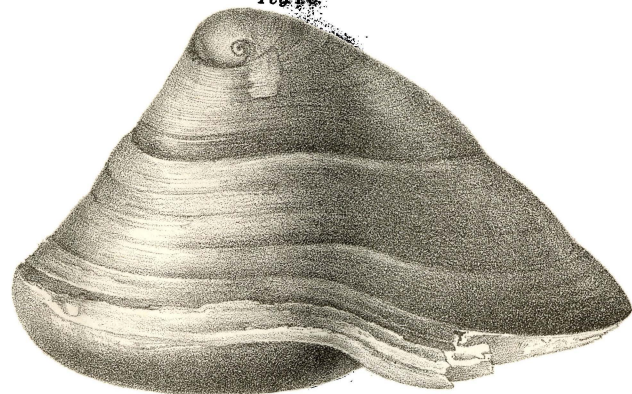


fig. 2 a.

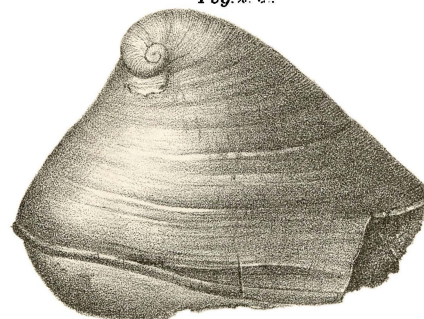


fig. 2. b.

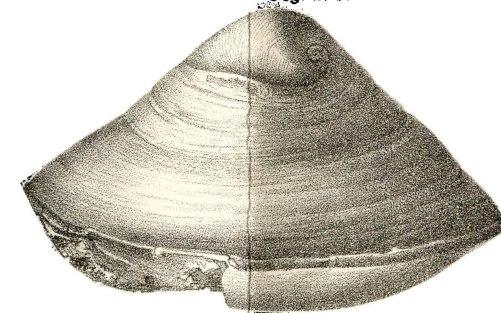


fig. 3.

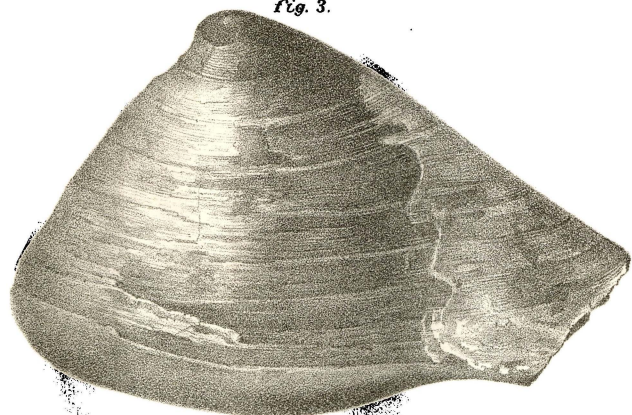


fig. 3 a.

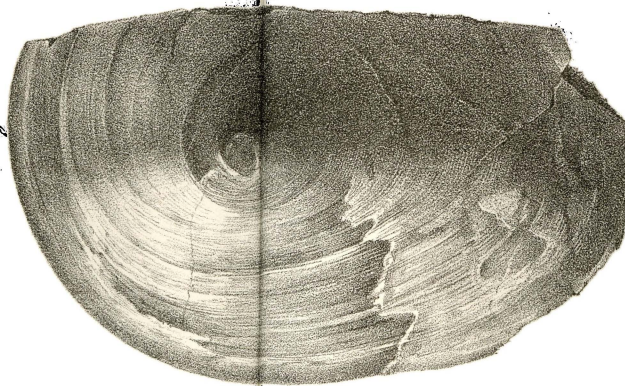
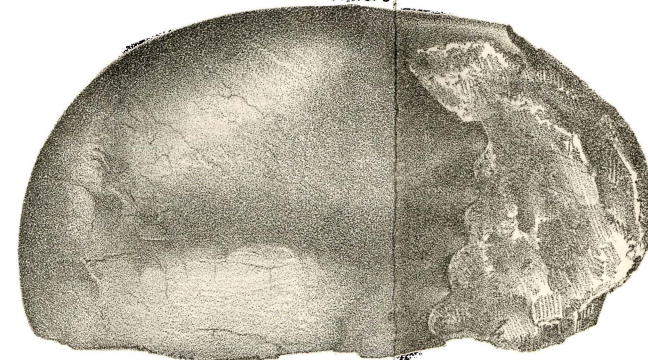


fig. 3. b.



D. Noelling.

Records, Vol: XXVII. Pt. 3. Pl. II.

fig. 1.

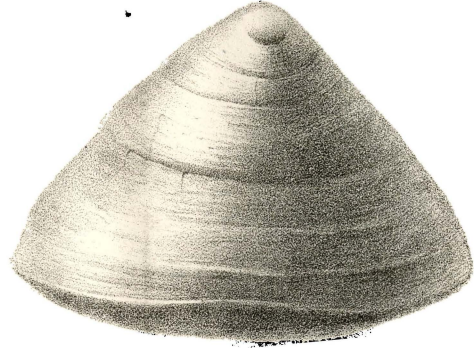


fig. 1 a.

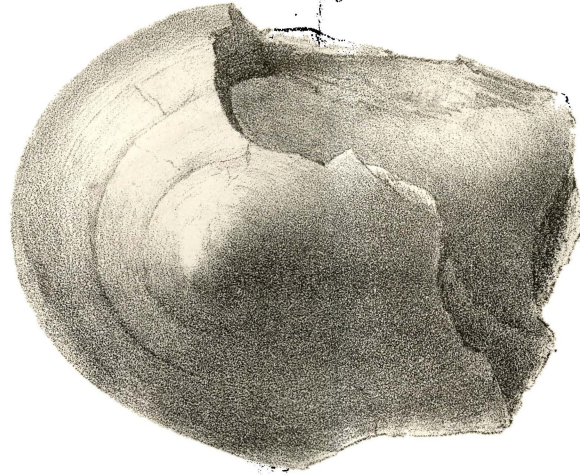


fig. 2.

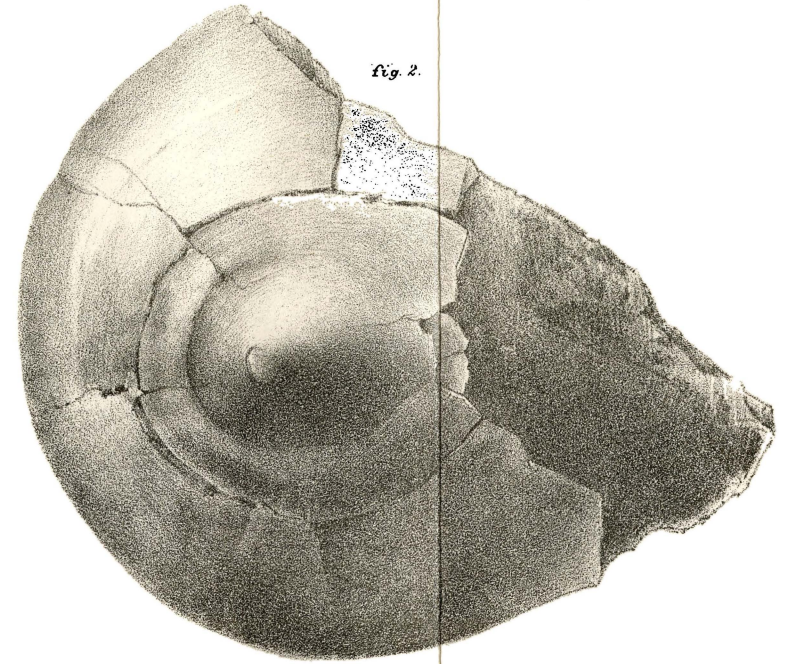


fig. 3.



fig. 3 a.

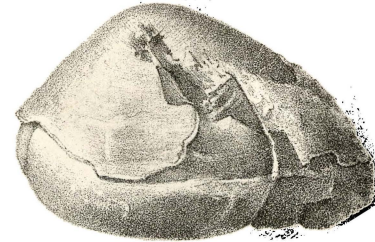


fig. 3 b.



fig. 4.



fig. 4 a.



fig. 4 b.

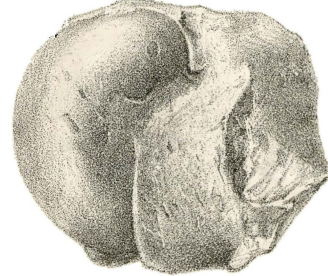


fig. 5.



fig. 6.



fig. 6 a.



fig. 7.

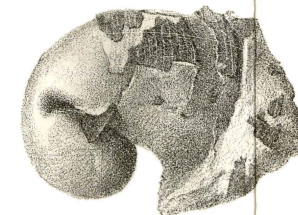


fig. 7 a.

