VIDENSKAPSSELSKAPET I KRISTIANIA

RESULTATER
AV DE NORSKE STATSUNDERSTØTTEDE SPITSBERGENEKSPEDITIONER

BIND I

Nr. 2

J. P. J. RAVN:
ON THE MOLLUSCA OF THE TERTIARY OF SPITSBERGEN

UTGIT PAA
DEN NORSKE STATS BEKOSTNING
VED SPITSBERGENKOMITEEN

REDAKTØR: ADOLF HOEL

KRISTIANIA
I KOMMISSION HOS JACOB DYBWAD
1922

Nr. 2

ON THE MOLLUSCA
OF THE TERTIARY OF SPITSBERGEN
COLLECTED BY NORWEGIAN AND SWEDISH EXPEDITIONS

BY

J. P. J. RAVN

WITH 2 PLATES

CONTENTS.

I. Introduction.

Although Tertiary deposits are known from rather wide areas within the Arctic zone, yet deposits containing a marine Tertiary fauna seem to occur exceedingly rarely. Probably this fact is the principal cause of the uncertainty that is met with as regards the age of the Tertiary deposits of these countries, fossil plants being practically the only means by which the age of such deposits has been determined. It is well-known, that O. HEER, by his investigations, came to the conclusion that the widely extended Tertiary flora of the Arctic zone belongs to Miocene. Afterwards objections were raised to this view and it appeared probable that the flora was considerably older, and at present most of the authors seem to be inclined to refer it to the older Tertiary — to the Eocene or Paleocene. Of course, discoveries of marine deposits which contain a determinable fauna and are connected with plant-bearing deposits would greatly contribute to a definite decision on this point. It is true that deposits containing a marine Tertiary fauna have been known for a long time from Spitsbergen, but unfortunately the fossils found there were very badly preserved. A rather large amount of material was collected, especially during NATHORST and DE GEER's expedition in the year 1882. These marine fossils, from two different horizons, were examined by TH. FUCHS[1]. It is true that he did not succeed in referring any of them to its species, and often even the determination of the genus was uncertain, but from the composition of the fauna as a whole, he concluded that the fauna of both horizons might probably be regarded as Miocene, a conclusion that may be said to agree with HEER's determination of the age of the plant-bearing deposits. During later Swedish expeditions new material was collected, which also was examined by FUCHS, who invariably arrived at the same conclusion[2].

However, in late years, expeditions (especially Norwegian) have collected a considerable amount of material, and towards the end of

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1 TH. FUCHS: Ueber die während der schwedischen geologischen Expedition nach Spitzbergen im Jahre 1882 gesammelten Tertiärconchylien. — Bihang till Kgl. Svenska Vet.-Akad. Handlingar. Bd. 8, No. 15. Stockholm 1883.

2 See A. G. NATHORST: Beiträge zur Geologie der Bären-Insel, Spitzbergens und des König-Karl-Landes, p. 378 and 381. — Bull. of the Geol. Inst. of Upsala. Vol. X. Uppsala 1910.

the year 1914 Professor J. KIÆR of Christiania asked me whether I was willing to undertake the examination of this material, and when I had consented to do so the material was sent to me; and as it was desirable that the fossils collected during the Swedish expeditions should be examined at the same time, I applied for this purpose to Professor G. HOLM of Stockholm and Professor C. WIMAN of Uppsala; and I hereby express my cordial thanks to those gentlemen for their readiness in placing the material of the Academy of Sciences in Stockholm and of the Geological Museum of the Uppsala University at my disposal.

Unfortunately the material to hand is far from satisfactory; it consists almost exclusively of casts and moulds, but in some cases I succeeded in revealing impressions of the hinges of Lamellibranchia, so that a reliable determination as to the genus has been possible. However, another difficulty is often met with, the form frequently having been changed by the pressure to which the valves or the casts have been exposed; for which reason the determination of the species is often rather uncertain, and the conclusions are not always quite reliable. However, my conclusions as to the age of these deposits may be considered to be fairly well grounded, and as they differ considerably from those of FUCHS I think that the results should be published and not delayed on account of remote possibility of obtaining new and better material.

II. Stratigraphy.

A. HOEL, the Norwegian geologist, who personally collected a part of the material in question, has kindly communicated to me information concerning the situation of the different fossiliferous layers in the whole series. For the rest, I am not able to give fresh details as to the stratigraphical features and the sequence of the layers, but with regard to that, reference may be made to the detailed descriptions published by NATHORST (l. c. pp. 374—389) and DE GEER[1]. From these descriptions I shall only state that the stratigraphical features are rather obvious, and that the deposits over extensive areas lie nearly horizontally, so that the same series of layers can often be traced for a great distance. At any rate at Advent Bay, the substratum of the Tertiary consists of cretaceous layers, as was proved with certainty during the excursion to Spitsbergen of the International Congress of Geologists in 1910[2].

[1] GERARD DE GEER: On the Physiographical Evolution of Spitsbergen. — Geogr. Annaler 1919, H. 2, Stockholm.

[2] See E. STOLLEY: Über die Kreideformation und ihre Fossilien auf Spitzbergen. — Kgl. Svenska Vet.-Akad. Handlingar. Bd. 47, No. 11. Uppsala och Stockholm 1912.

According to NATHORST the series is as follows:

6. The uppermost series of sandstones (with coal and plants).
5. The series of "plattschiefrige" sandstones (with marine Mollusca).
4. The upper series of black schists (with pebbles of chert from the Permo-Carbonian).
3. The series of green sandstones (with traces of Vermes).
2. The lower series of dark schists.
1. The lowermost series of light sandstones (at the base, layers with coal and plants; marine Mollusca above).

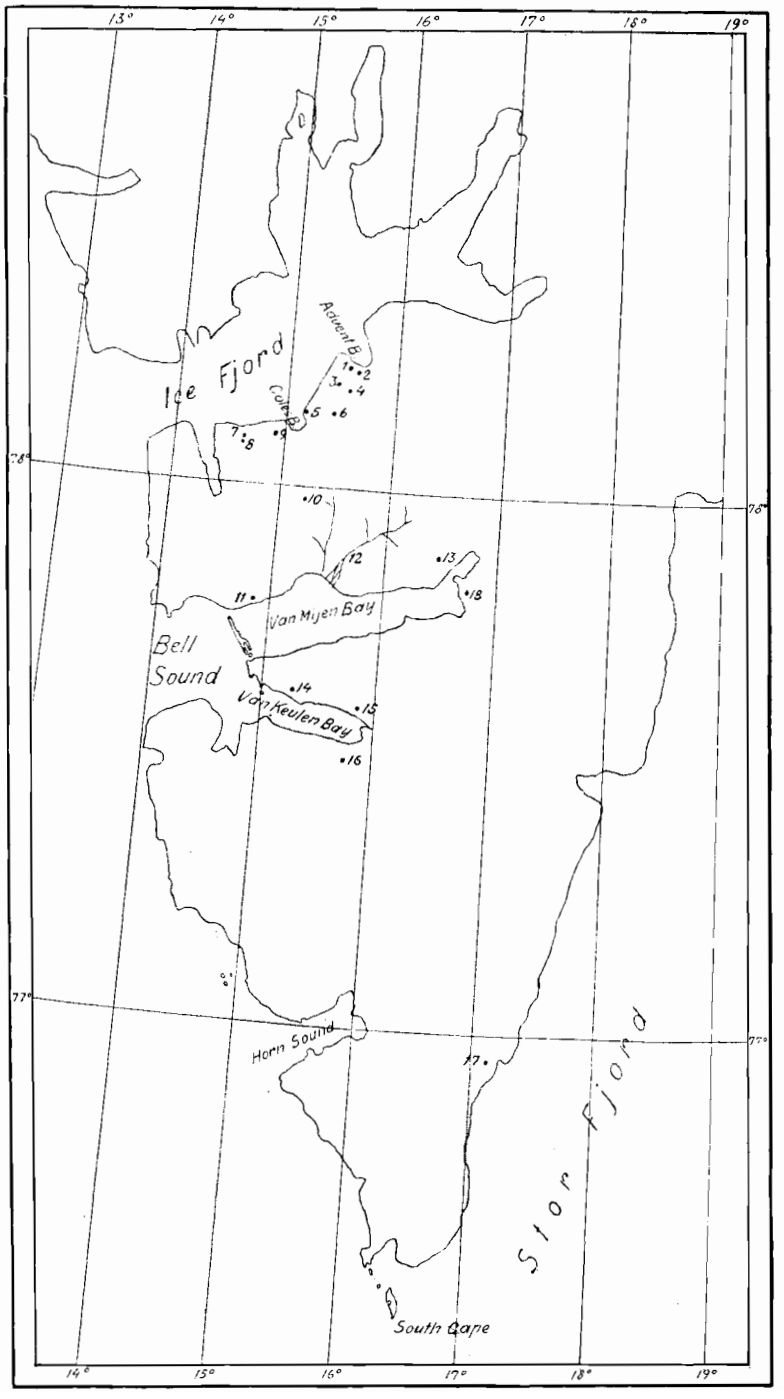
The thickness of the whole of the Tertiary series is estimated by NATHORST to be at least 1200 m. As to the conditions of sedimentation he writes (loc. cit. p. 383) as follows:

"Die Kohlenflöze an der Basis des untersten Sandsteins deuten auf limnische Verhältnisse, bald darauf aber kündigen die marinen Muscheln Einbruch des Meeres an. Diese Muscheln müssen aber in seichtem Wasser gelebt haben, und auch die Reihen 2—5, die sämtlich als marin aufzufassen sind, sind als Litoralalbildungen zu betrachten, obschon die beiden Schieferserien wohl etwas tiefere Verhältnisse als die Sandsteinserien ankündigen. Die oberste Sandsteinreihe mit Pflanzen und Kohlenflözen ist endlich ein Zeugnis, dass ein Rückgang des Meeres wieder eingetreten ist."

Later on in the same work (p. 384) NATHORST states that in the "Fågelcañon" at Coles Bay WIMAN and B. HÖGBOM found a plant-bearing layer at a level of 290 m.; he is of opinion that this layer probably belongs to the series of green sandstones. Presumably, this indicates a lacustrine or estuarine horizon, although sometimes remains of a terrestrial flora can be found, together with marine fossils, in what are therefore undoubtedly marine layers.

The whole material at my disposal comes from that part of Spitsbergen which is situated south of the Ice Fjord. There Tertiary deposits occur over a very extensive and almost continuous area. I have seen no Mollusca from the localities of smaller area north of the Ice Fjord. However, during ISACHSEN'S expedition in 1909 HOEL found marine fossils on the east coast of the Prince Charles Foreland, but unfortunately that material has been lost during transport.

As it appears from the list of fauna (see p. 10—11), fossils seem to be found in three different horizons, belonging respectively to the first, the third and the fifth divisions of NATHORST'S series. In the oldest of these divisions the Molluscan fauna is almost entirely marine, whilst that of the middle division is mainly estuarine. From the uppermost division only a scarce fauna is known, containing both marine and estuarine species. Therefore it is uncertain whether the deposits of that series are marine or estuarine. In the following I shall briefly



1. Flower Valley. — 2. Longyear Valley, Mine no. 1. — 3. Mt. Nordenskiöld. — 4. Mt. Hierta. — 5. East of Coles Bay. — 6. Tält Mtn. — 7. Mt. 397.4, the north-western slope. — 8. Mt. 397.4, the western slope. — 9. Mt. Vesuv, the western slope of the plateau. — 10. Mt. Nobel. — 11. Coal Mtn. — 12. Conway's Valley. — 13. Mt. Liljewalch. — 14. Mt. Fyrkanten. — 15. Mt. Brongniart. — 16. Mt. Basilika. — 17. Mt. Hedgehog. — 18. Mt. Torell.

mention the different localities from which determinable Mollusca are known, arranging them in NATHORST'S series. The situation of the localities is shown in the map.

a. First Series.

The Molluscan fauna of this series is almost entirely marine. As a typical locality the East of Coles Bay may be mentioned. For the situation of this locality reference can be made to a section described and figured by NATHORST (loc. cit. p. 376, fig. 71). All the fossils from this locality were collected during NATHORST and DE GEER'S expedition in 1882.

Longyear Valley, Advent Bay. Only a single cast of an indeterminable species of *Lucina* was found here. It was collected by HOLMSEN in 1909 and comes from Mine No 1 on the east side of the valley, at a height of about 230 m. above the level of the sea, nearly at the same place in the series as the preceding locality.

Flower Valley, nearly in the middle of the south-west coast of Advent Bay. Here in 1919 A. HOEL collected several fossils, among which were two species also known from the locality East of Coles Bay.

Coal Mtn., on the north side of Van Mijen Bay. Here fossils were collected by HOLMSEN in 1909 near the layer of coal on the south slope of the mountain. According to information given by HOEL this locality belongs to the lower part of NATHORST'S first division. Only a single fossil was determinable.

The south coast of Van Mijen Bay, probably Mt. Torell. Here in the plantbearing horizon B. HÖGBOM in 1911 collected two species of *Cyrena*. According to information given by HOEL that locality belongs to the first series.

Mt. Fyrkanten, Van Keulen Bay. In 1914 H. L. NORBERG collected here a species that is known from both the first and the third series. Two other species, found during NATHORST'S expedition in 1898, were found in boulders. One of these species is not quite certainly determinable; the other species, *Meretrix orbicularis* EDW. *sp.?*, occurs in localities of the first series.

Mt. Basilika, Van Keulen Bay. The only species known from this locality was collected during NATHORST'S expedition in 1898; it is also known from Coal Mtn.

Mt. Hedgehog, Stor Fjord. As to this locality the same is true as has been said above about Mt. Basilika.

b. Third series.

Until the year 1914 fossil Mollusca were known almost only from NATHORST'S first and fifth series, but during the Norwegian expedition in 1914 HOEL succeeded in finding numerous specimens of *Cyrena* in

a layer of sandstone belonging to the upper part of the third series. This discovery is of very great importance, these fossils being in a state of preservation superior to that of the fossil Mollusca previously known from the Tertiary of Spitsbergen.

The Molluscan fauna of the third series is entirely estuarine, but with a few specimens of marine species. The estuarine fauna is represented by several species of *Cyrena* which, at least in some localities, seem to occur in abundance. I do not know what is the relation between this horizon and the plant-bearing layer in Fågelcañon, discovered by WIMAN and HÖGBOM and mentioned above (p. 5). The marine fossils of the third series occur more often scattered, and they may be supposed to come from layers which lie a little below or above the estuarine deposits. Thus at Mt. Nobel a marine species was found in a layer which, according to HOEL, probably belongs to the upper part of the third series.

As the most typical locality of the third series, the north-western slope of Mt. 397.4 may be mentioned. Rather abundant material, belonging to 5 species of *Cyrena*, was collected by the Norwegian expedition in 1914; some of these species were found in great number.

The western slope of Mt. 397.4. During the Norwegian expedition in 1914 one single marine species besides an estuarine one was found here. According to HOEL, this locality belongs to the third series.

The western slope of the plateau of Mt. Vesuv. The material from here was also collected by the Norwegian expedition in 1914. The two species of *Solenocurtus* found here indicate a marine horizon of the same age as the first series, while three species of *Cyrena* are known from the third series. According to HOEL, the locality belongs to the third series. It may be assumed that both marine species come from layers a little older than those containing the species of *Cyrena*.

Mt. Nobel, Van Mijen Bay. At the base of this mountain HOLMSEN found in 1909 a single specimen of *Meretrix? sp.* According to HOEL the specimen was probably collected in the upper part of the third series.

Mt. Liljewalch, at the north side of the inner end of Van Mijen Bay. Here a specimen of *Cf. Solenotellina brevisinuata* was collected by B. HÖGBOM in 1911; it may indicate the occurrence of the third series, especially of its upper part.

c. Fifth series.

As indicated by the occurrence of a species of *Solenocurtus*, at least a part of this series seems to be marine. Unfortunately, the fossils from it are rather scarce and in a bad state of preservation.

Mt. Nordenskiöld, S. W. of Advent Bay. The only determinable specimen from this place consists of two valves of *Cyrena augustidens* belonging to the same individual. It was gathered by the Swedish expedition in 1909. This species is also known from the third series, but, according to HOEL, the locality belongs to the fifth series. Further, in 1907 a fossil was found here by B. HÖGBOM. FUCHS, who examined it, compared it with a *Venus* (see NATHORST, loc. cit. p. 381); it is, however, quite indeterminable.

Mt. Hierta, Advent Bay. During NATHORST and DE GEER'S expedition in 1882 some Mollusca were found here in layers belonging to the fifth series. They were examined by FUCHS, who (pp. 7 and 8) speaks of them as "*Cytherea (Callista) sp.*" and "*Psammobia sp.*" FUCHS (see NATHORST loc. cit. p. 381) also compares a specimen found in 1907 by B. HÖGBOM with a *Psammobia*, but it is also quite indeterminable. Moreover, the Swedish expedition in 1909 found here, in a grey sandstone from the base of the plant-bearing layer, a single specimen of a mussel, which I shall describe under the name of *Cf. Solenotellina brevisinuata*. This species is also known from two localities of the third series.

Tält Mtn. From this locality only one specimen of a new species of *Solenocurtus* is known. It was collected by G. NORDENSKIÖLD in 1890. According to NATHORST it is the fifth series which occurs here.

Mt. Brongniart, Van Keulen Bay. Here NATHORST'S expedition in 1898 collected some fossils enclosed in boulders. From the occurrence of two species of *Cyrena*, it may be supposed that at least some of these boulders have come from the third series, although, according to HOEL, Mt. Brongniart is composed of the uppermost part of the Tertiary.

As mentioned above, FUCHS by his investigation of the older material came to the conclusion that the Tertiary fauna of Spitsbergen probably is referable to the Miocene. This conclusion agrees entirely with HEER'S determination of the age of the plant-bearing deposits. However, FUCHS did not hide the fact that the conclusion was highly uncertain, which is correct. As his list of the fauna shows, he has not been able to refer any fossil to its species, and also his determinations of the genus are in most cases quite tentative, except when the form, as in the species of *Solenocurtus,* is so characteristic that it alone

List of

	1[1] Longyear Valley, Mine No. 1	1 Flower Valley	1 East of Coles Bay	1 Coal Mtn.	1 Van Mijen Bay, the south coast	1 Mt. Fyrkanten
1. *Pecten corneus* SOW. *sp.* ?	—	+	—	—	—	—
2. *Lucina sp.*	+	—	—	—	—	—
3. *Cyrena (Corbicula) angustidens* MELL.	—	—	—	—	—	—
4. — (—) *altissima n. sp.*	—	—	—	—	?	?[2]
5. — (—) *sp.*	—	—	—	—	—	—
6. — (—) *cuneiformis* FÉR. ?	—	—	—	—	—	—
7. — (—) *Hoeli n. sp.*	—	—	—	—	+	—
8. — *(Donacopsis) acutangularis* DESH. ?	—	—	—	—	—	—
9. *Cyprina sp.*	—	—	—	—	—	—
10. *Meretrix (Dosiniopsis) orbicularis* EDW. *sp.* ?	—	—	—	+	—	+[2]
11. — *pyriformis n. sp.*	—	—	+	—	—	—
12. — *(Callista) Nathorsti n. sp.*	—	+	+	—	—	—
13. — *sp.* ?	—	—	—	—	—	—
14. *Cf. Solenotellina brevisinuata* COSSM.	—	—	—	—	—	—
15. *Solenocurtus (Macha) Nordenskiöldi n. sp.*	—	—	—	—	—	—
16. — *n. sp.*	—	—	+	—	—	—
17. — *(Novaculina) spitsbergensis n. sp.*	—	—	+	—	—	+
18. — *(Tagalus?) sp.*	—	—	+	—	—	—

[1] The numbers in this place indicate the situation of the localities in NATHORST'S series.

suffices for the determination, because in no case has he succeeded in discovering the hinge, the construction of which is of so great systematic importance. I was therefore obliged to put aside as quite indeterminable a great many of the fossils examined by FUCHS, but in some cases I succeeded in making a preparation which gave a more or less thorough insight into the construction of the hinge. By that means I obtained a firmer basis than FUCHS for the determination of the genera. By this means I was guided to conclusions which sometimes differed highly from those of FUCHS.

And then the new material collected during the last years; even if it cannot be said to be quite satisfactory, yet it is often far better than the older material and is, on the whole, rather serviceable. Yet, as we shall now see, it does not suffice for the exact determination of the age. Also the fact that some of the best-preserved specimens appear to belong to new species unknown from other districts renders it highly difficult to make a comparison with deposits from other places, the age of which has already been determined. The occurrence of so great a number of new species may be explained by the circumstance

the Fauna.

1	1	3	3	3	3?	3	5	5 or 6	5	5?	Paleocene			Eocene		
Mt. Basilika	Mt. Hedgehog	Mt. Vesuv, the western slope	Mt. 397.4, the north-western slope	Mt. 397.4, the western slope	Mt. Nobel	Mt. Liljewalch	Mt. Nordenskiöld	Mt. Hierta	Tält Mtn.	Mt. Brongniart	Lower	Middle	Upper	Lower	Middle	Upper
—	—	—	—	—	—	—	—	—	—	—	—	—	—	(+)	(+)	(+)
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	+	+	—	—	—	+	—	—	—	—	+	?	—	-	- -
—	—	+	+	—	—	—	-	—	—	+2	—	-	—	—	-	-
—	—	—	—	—	—	—	—	—	—	+2	—	—	—	—	—	—
—	—	—	+	—	—	—	—	—	—	—	- - -	—	(+)	—	—	—
—	—	+	+	+	—	—	—	—	—	—	—	—	- -	—	—	—
—	—	—	+	—	-	—	-	—	—	—	—	(+)	—	-	—	—
—	—	—	—	—	—	—	-	—	—	+2	—	—	—	—	—	—
+	+	—	—	—	—	—	-	—	—	—	—	(+)	(+)	(+)	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	+	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	+	—	+	—	+	—	—	—	—	—	(+)	—	-
—	—	—	—	—	—	-	—	—	+	—	—	—	—	—	—	—
—	—	+	—	—	—	—	—	—	—	?2	—	—	—	—	-	—
-	—	+	—	—	—	—	—	—	-	-	—	—	—	—	—	-
—	—	—	—	—	—	—	—	-	—	-	-	—	—	—	-	-

2 Found in loose-lying stones.

that the fauna here mentioned lived in regions which lie so far towards the North and so far away from the other countries with a marine Tertiary fauna.

It is consequently difficult to attain a sure determination of the age on the basis of the present material. The most reliable result seems to me to be obtained by considering the fauna of NATHORST'S third series. In this series 5 species of *Cyrena* are found. One of these, *C. angustidens*, occurs in great numbers. In the Paris Basin it is found in the Middle Paleocene and in south England perhaps also in the Upper Paleocene (the Woolwich and Reading Beds). Two other species, *C. cuneiformis* and *C. acutangularis*, whose occurrence in Spitsbergen has not yet been established with certainty, are known from the Upper and the Middle Paleocene of western Europe respectively. The fourth species, *C. Hoeli n. sp.* seems nearly related to western European species from the Upper Paleocene. Finally, the fifth species, *C. altissima n. sp.* is quite different from all others known to me. Altogether, the species of *Cyrena* seem to indicate to a marked degree that the deposits here met with are of Middle-paleocene or perhaps

Upper-paleocene age. To some extent the marine species found in this series seem to be contradictory to this conclusion, as they appear to indicate the Eocene age of the deposits in question; but the determination of these species is less certain, and therefore so much importance cannot be attached to them as to the species of *Cyrena*. Perhaps we might be inclined to suppose that the marine species come from a horizon a little higher than that in which the estuarine species were found; but as some of these occur also in the first series, such a supposition is not quite justifiable.

Of course, from the position of the deposits, it is evident that the first series with its almost exclusively marine fauna is older than the third series. However, with regard to the marine fauna of the former series, like that of the third series, it seems to indicate the Eocene more than the Paleocene. So the *Pecten corneus?*, *Lucina sp.*, *Meretrix Nathorsti* and *Solenocurtus n. sp.* seem to indicate an Eocene age, while *Meretrix orbicularis?* indicates the Paleocene as much as the Eocene. But here it must be remembered that the species mentioned above partly are new species and partly are such as have not been referred with certainty to species already known. So the possibility of the first series also being paleocene is by no means excluded.

From the fifth series only a very few determinable specimens are known. The species, which I have named *Solenocurtus Nordenskiöldi*, seems to be nearly related to the recent *S. strigilatus*. Two other species *(Cyrena angustidens* and *Cf. Solenotellina brevisinuata)* indicate the Paleocene or, perhaps, the Eocene. The fossils from Mt. Brongniart were found in boulders, which probably originate from another place, where the third series is met with. It is of course impossible to determine with certainty the age of the deposits on such a basis. However, there is scarcely reason for supposing that the fifth series is of much younger age than the third, as the enormous Tertiary deposits of Spitsbergen were probably laid down in an amazingly short time.

So it follows from these investigations that it is very probable, if not absolutely certain, that at all events the older part of the Tertiary of Spitsbergen (including NATHORT's third series) was deposited towards the end of the Paleocene epoch, and as mentioned above it may be supposed that the other part of the whole series is but little younger. This result differs rather considerably from that obtained by FUCHS. However, the mere discovery of the *Cyrena*-fauna of the third series may be said to shake our confidence in FUCHS' result. For while in the older Eogene of Western Europe a great many species of the genus *Cyrena* occur and it is still abundantly represented in the Oligocene, yet only a very few species remain in the Miocene epoch, and a little after the beginning of the Quaternary period the genus disappears

entirely from these countries. Such being the case in Western Europe it would be very strange if, so late as in the Miocene epoch, the genus were represented by no less than 5 species in a country so far towards the North as Spitsbergen.

As mentioned above it might appear that the marine species found in the Tertiary of Spitsbergen indicate a slightly younger age, because they exhibit a connection with the Eocene of Western Europe. This resemblance, however, exists presumably only in appearance and may possibly be due to the incompleteness of the available material. In this connection I must emphasize the fact that the Tertiary fauna known from Kap Dalton in East-Greenland, and referred by me to the Eocene, has not one species in common with the Tertiary of Spitsbergen, although it also contains in addition to entirely marine species at least one estuarine species, viz. *Cyrena Gravesii*.[1] It is possible that if the transuralian Tertiary should one day be thoroughly examined it would be found to be related to the Tertiary of Spitsbergen.

In conclusion I shall briefly mention that the oldest Tertiary flora of Spitsbergen, examined by HEER, is found in the lowermost layers immediately beneath those in which the marine fauna of the first series was collected. If this fauna be Paleocene, HEER'S reference of the flora to the Miocene cannot, of course, be right. In such a case, this flora cannot be younger than the Paleocene and it may be nearly comtemporary with the well-known floras of Gelinden and Sézanne. However, according to the older investigations, the flora of Spitsbergen does not present any resemblance to these floras; whether this fact is due to differences of climate or to other reasons, I am not prepared to say. It is to be hoped that renewed investigations on the Tertiary flora of Spitsbergen may elucidate this question.

III. Description of the Fossils.

1. Pecten corneus Sow.?

Pl. 1, fig. 3.

1818. *Pecten corneus* SOWERBY, Mineral Conch., III, p. I, Pl. 204.
1843. „ „ „ , NYST, Coq. et Polyp. foss. de Belgique, p. 23, Pl. 23, fig. 1.
1861. „ „ „ , WOOD, Eocene Bivalves, I, p. 39, Pl. 9, fig. 7.
1893. „ „ „ , v. KOENEN, Nordd. Unter-Oligocän, V, p. 1020, Pl. 67, figs. 1—3.

From the Tertiary of Spitsbergen the genus *Pecten* is only known by a single, very imperfect specimen which consists of the impression of the inner surface of a valve, probably a left one. Its form is highly

[1] J. P. J. RAVN: The Tertiary Fauna at Kap Dalton in East-Greenland. — Meddel. om Grønland. Vol. 29. Copenhagen 1903.

changed by pressure, but its outline seems to have been rather circular. The surface appears to have been smooth, or at any rate with only very slight radial ornamentation, the cast also being completely smooth at the margin. In the middle the valve was moderately convex and distinctly flattened towards both the lateral margins. Both the ears were short and they appear slightly produced dorsally. Only the impression of the anterior (?) ear is fairly complete; it had an obtuse, rounded outer angle. Immediately inside the hinge-margin a ridge was found on the inner surface of the valve; this list increased in height and in width towards the margins and terminated very abruptly. Similar ridges proceeded from both sides of the ligament-pit and passed obliquely downwards almost following the boundary between the ears and the valve itself. These lists also terminated very abruptly.

Measurements cannot be given owing to the alteration of form; the height, however, was probably a little greater than the length.

It is of course, scarcely possible to refer to its species a specimen as imperfect as the one in question. But the resemblance to *Pecten corneus* is very evident. The only noteworthy difference seems to be that the anterior (?) ear appears to be somewhat more rectangular than is the case in *P. corneus*.

P. corneus is known from the whole Eocene of England, from the Eocene and Lower Oligocene of Belgium and from the Lower Oligocene of Germany.

Distribution. Flower Valley (1 spec.; A. HOEL coll. in 1919).

Under the name *Pecten demissus* BEAN LINDSTRÖM[1] mentions a smooth *Pecten* from both sides of Advent Bay and also from the coast between Advent Bay and Coles Bay. Under the same name, LUNDGREN[2] also describes and figures a single valve from a fallen stone from the east coast of Advent Bay. As we now know that the supposed Jurassic deposits on the west coast of Advent Bay must be referred to the Lower Cretaceous, there is reason for supposing that the determination of at any rate some of these specimens was not correct, the species perhaps being a Tertiary one. At my request Professor G. HOLM kindly sent me the material for examination. Unfortunately it was in a bad state of preservation, but yet it seems to be just possible that most of the specimens might be referred to *P. orbicularis* SOW., a species which has a very wide vertical distribution in the Cretaceous. *P. corneus*, on the other hand, did not seem to be represented in this material.

[1] G. LINDSTRÖM: Om Trias- och Juraförsteninger från Spetsbergen, p. 14. — Kgl. Svenska Vet.-Akad. Handlingar. Bd. 6, No. 6. Stockholm 1866.

[2] B. LUNDGREN: Bemerkungen über die von der schwedischen Expedition nach Spitzbergen 1882 gesammelten Jura- und Trias-Fossilien, p. 16, Pl. 2, fig. 12. — Bihang till Kgl. Svenska Vet.-Akad. Handlingar. Bd. 8, No. 12. Stockholm 1883.

2. Lucina sp.

Perhaps a large *Lucina*, judging from its outline and size, may be *L. argus* MELLEV., but a reliable determination as to its species is not possible.

Distribution. Longyear Valley, Mine No 1. (1 spec.; G. HOLMSEN coll. in 1909).

3. Cyrena (Corbicula) angustidens Mellev.

Pl. I, figs. 5—7.

1857—1858. *Cyrena intermedia* MELLEV.; DESHAYES, Animaux sans vertèbres, I, p. 514, Pl. 38, figs. 19 and 20.
– *Cyrena angustidens* MELLEV.; DESHAYES, ibidem, p. 515, Pl. 37, figs. 1 and 2.
1871. *Cyrena (Loxoptychodon) intermedia* DESH.; SANDBERGER, Land- und Süsswasser-Conch., p. 163, Pl. 10, fig. 3.
1886. „ *angustidens* MELLEV.; COSSMANN, Coquilles foss. de l'éocène de Paris, p. 136.

Some specimens of a *Cyrena* seem to be referable to this rather variable species.

Valve oval, very oblique and inequilateral, rather compressed, with a rounded carina extending from the umbo to the posterior part of the ventral margin. Anterior and posterior margins strongly convex, the ventral margin less curved. Umbo pointed, but only slightly prominent. Ornamentation consists of some usually fine lines of growth. Unfortunately the hinge was only partially available far examination. As far as could be seen, it was a hinge typical of *Corbicula*.

Height 13 mm., length 19 mm.

The available specimens vary considerably in form which is due — at any rate to some extent — to the unequal pressure to which they have been exposed; even two valves forming a pair may often differ entirely in outline. The carina varies considerably in prominence and in some cases is very indistinct. The main point in which these differ from the French specimens seems to be that the anterior part of the hinge-margin is, as a rule, somewhat more convex. Most of the specimens in question agree best with DESHAYES' figures of *C. angustidens*; a few agree more closely with the same author's figures of *C. intermedia*, and a single specimen seems to be referable to *C. difficilis* DESH., a species which COSSMANN is inclined to consider as only a variety of *C. angustidens*. The specimen from Mt. Nordenskiöld mentioned by NATHORST (loc. cit. p. 381) and compared by FUCHS with a *Venus*, belongs quite certainly to this species. In the posterior part of the right valve, two long, lateral teeth can be seen, and in the left valve one lateral tooth.

The hinge being but imperfectly known the determination is perhaps not quite reliable still the fact that in Spitsbergen varieties are found similar to those in the Paris Basin, indicates that in Spitsbergen also we have to do with *C. angustidens*.

Distribution. Mt. Nordenskiöld (a pair of valves; B. HÖGBOM coll. in 1909). Mt. Vesuv, the western slope of the plateau (several spec.; A. HOEL coll. in 1914). Mt. 397.4, the north-western slope (numerous spec.; A. HOEL coll. in 1914).

According to DESHAYES the species occurs in the Middle Paleocene (Sables inférieurs). SANDBERGER reports it also from the Upper Paleocene (Woolwich and Reading Beds), but in NEWTON's List of the British Oligocene and Eocene Mollusca the species is not mentioned; perhaps it is concealed under one of EDWARDS' many MS-names.

4. Cyrena (Corbicula) altissima n. sp.

Pl. I, figs. 1 and 2.

Shell rather slightly convex, oblique, oval. Height usually a little greater than length. Umbones far in front of the middle of the valves. Hinge-margin highly curved; anterior margin more convex than the posterior; ventral margin semi-circular. Hinge-plate broad. In the left valve three divergent cardinal teeth, of which the anterior is the strongest, the posterior the faintest; in the right valve also three cardinal teeth, the anterior being rather short, the posterior long and strong. The lateral teeth as usually in the species of *Corbicula*; the anterior lateral ones rather short and the posterior ones very long. In the cast a broad and flat furrow passes from the hinge-region towards the ventral margin which, however, it does not reach, the furrow decreasing gradually. The furrow is not equally distinct in all casts; it even seems to be absent in some cases. Corresponding with it a carina must have been found on the inner surface of the valve. The outer surface shows rather faint lines of growth only.

Height 24 mm., length 21 mm. Another specimen measured 26 and 25 mm. respectively.

The species here described is especially characterized by its great height, by its outline and by the radial carina, which is found on the inner surface of most of the valves.

In a loose-lying block of sandstone from Mt. Brongniart two pairs of valves were found. One especially of these specimens is unusually large, being 37 mm. high and 35 mm. long. Also it is elongated anteriorly and not posteriorly; however, this difference may be due to the pressure to which the valve was exposed.

In another loose-lying block of sandstone from Mt. Fyrkanten, a somewhat incomplete impression of the outer surface of a valve was

found. Perhaps it may be referred to this species, but it is not quite determinable. This is also the case as regards an impression from the plant-bearing horizon of the south coast of Van Mijen Bay, where also a badly preserved pair of valves was found, possibly referable to the species in question.

Distribution. Mt. Vesuv, the western slope of the plateau (2 single valves and 2 pairs of valves; A. HOEL coll. in 1914). Mt. 397.4, the north-western slope (6 single valves and 8 pairs of valves; A. HOEL coll. in 1914). Mt. Brongniart (2 pairs of valves, from a loose-lying block of stone; A. G. NATHORST coll. in 1898). Mt. Fyrkanten (1 spec. ?, from a loose-lying block of stone; A. G. NATHORST coll. in 1898). The south coast of Van Mijen Bay, probably Mt. Torell, in the plant-bearing horizon (1 or 2 spec. ? B. HÖGBOM coll. in 1911).

5. Cyrena (Corbicula) sp.

Pl. I, fig. 9.

During NATHORST'S expedition in 1898 some Lamellibranchia were found on Mt. Brongniart. The shells were most frequently preserved, but were always transformed into coarse-grained calcite. Some of them were almost completely flattened. By careful preparation with hydrochloric acid I succeeded in making visible the hinge of one specimen, and then it appeared to be a hinge typical of *Corbicula*. A reliable determination of the species is scarcely possible on account of the alteration of form. Perhaps one would be inclined to refer these specimens to *C. angustidens*, but their outline appears to be considerably less inequilateral. They show a great similarity to the species from the Woolwich Beds at Dulwich, mentioned and figured by WOOD[1] under the name *C. trigona* DESH., a species that COSSMANN[2] regards as young specimens of *C. cuneiformis*. COSSMANN, however, feels doubtful whether WOOD is right in referring the English specimens to *C. trigona*, and as WOOD himself says that his figure is not quite accurate, it is impossible to assert the identity of the form from Spitsbergen with that of WOOD. An almost perfectly preserved valve is 12.5 mm. high and 13.5 mm. long.

Distribution. Mt. Brongniart, from a loose-lying block of stone (7 spec.; A. G. NATHORST coll. in 1898).

[1] S. WOOD: Eocene Bivalves. Suppl., p. 8, Pl. A, fig. 9.

[2] M. COSSMANN: Coquilles foss. de l'éocène de Paris, I, p. 133.

6. Cyrena (Corbicula) cuneiformis Fér.?

Pl. I, fig. 4.

1817. *Cyclas cuneiformis* SOWERBY, Mineral Conch., II, p. 140, Pl. 162, figs 2 and 3.
1825. *Cyrena* „ FÉR.; DESHAYES, Coquilles foss., I, p. 122, Pl. 19, figs. 1, 2, 20 and 21.
1858. „ „ „ „ , Animaux sans vertèbres, p. 513.
— „ *Deshayesi* HÉB.; „ , ibidem, p. 516, Pl. 37, figs. 19—21.
1872. „ *(Loxoptychodon) cuneiformis* FÉR ; SANDBERGER, Land- und Süsswasser-Conch., p. 181, Pl. 8, fig. 6.
1877. „ *cuneiformis* SOW.; WOOD, Eocene Bivalves. Suppl., p. 5, Pl. A, fig. 3.
1886. „ *(Corbicula) cuneiformis* FÉR.: COSSMANN, Coquilles foss. de l'éocène de Paris, p. 133.

An impression of the outer surface of a pair of valves shows a great resemblance to this species.

Shell oblong, very inequilateral, subtriangular, rather compressed. Umbones somewhat in front of the middle of the valves, slightly prominent. Anterior margin short, truncated, rather slightly convex; ventral margin slightly curved. Posterior part of the valve produced downwards, with a rounded carina tapering towards the ventral margin. Ornamentation consists of concentric lines of growth.

As regards the form, the present specimen seems to agree very well with valves of this species from Barton, but the hinge being invisible, the determination is not quite reliable.

A cast of a right valve highly resembles DESHAYES' figures of *C. Deshayesi* and perhaps it also may be referred to *C. cuneiformis*, which is known from the lignites in the Paris Basin and from the Woolwich Beds of England.

Distribution. Mt. 397.4, the north-western slope (a pair of valves and a single valve; A. HOEL coll. in 1914).

7. Cyrena (Corbicula) Hoeli n. sp.

Pl. 2, fig. 4.

Some fairly well-preserved specimens of a *Cyrena* of a characteristic form I was not able to refer to any species previously described.

Shell solid, oval, slightly produced posteriorly, moderately convex, rather inequilateral. The hinge agrees closely with that typical of *Corbicula*. Surface with numerous stronger and fainter concentric lines of growth. The impressions do not show that the lateral teeth have been cross-striated, but that is probably due to the coarse-grained nature of the sandstone in which the impressions were found.

Height 24 mm., length 34 mm.

The form of the specimens is somewhat variable which is probably due to pressure. Some less complete valves were somewhat larger than the specimens figured.

This species is probably allied to the large form of *C. tellinella* FÉR., mentioned and figured by DESHAYES,[1] but it is less elongated and probably more convex than that species, also the ventral margin is more curved. As regards the form, it also resembles *C. Dulwichiensis* RICKM., particularly a specimen figured by WOOD,[2] but the umbones seem to be less prominent, and the valve is shorter and has the ventral margin more curved.

Distribution. Mt. Vesuv, the western slope of the plateau (1 or 3 valves; A. HOEL coll. in 1914). Mt. 397.4, the north-western slope (6 or 7 pairs of valves and 2 single valves; A. HOEL coll. in 1914). Mt. 397.4, the western slope (one pair of valves; A. HOEL coll. in 1914). Van Mijen Bay, the south coast, probably Mt. Torell, in the plant-bearing horizon (1 or 2 pairs of valves; B. HÖGBOM coll. in 1911).

8. Cyrena (Donacopsis) acutangularis Desh. ?

Pl. I, fig. 11.

1857—1858. *Cyrena acutangularis* DESHAYES, Animaux sans vertèbres, I, p. 517, Pl. 38, figs. 17 and 18.

1872. *Cyrena (Donacopsis) acutangularis* DESH., SANDBERGER, Land- und Süsswasser-Conch. p. 164, Pl. 10, fig. 5.

1886. „ („) „ „ , COSSMANN, Coquilles foss. de l'éocène de Paris, p. 139.

A small, rather compressed, triangular valve which closely resembles *C. acutangularis*, but as the hinge is unknown and the outline is not visible to its full extent, the determination is not quite reliable. The shell seems to have been thin; the lines of growth show that the valve was rather iniquilateral, but hardly so much as in the specimen figured by SANDBERGER. As in that specimen, the margin behind the umbo is very slightly concave; the ventral margin is rather slightly convex.

C. acutangularis is known from the Sables inférieurs of the Paris Basin.

Distribution. Mt. 397,4, the north-western slope (1 valve; A. HOEL coll. in 1914).

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[1] DESHAYES: Animaux sans vertèbres, p. 507, Pl. 38, figs. 3 and 4.

[2] S. WOOD: Eocene Bivalves. Suppl., Pl. A, fig. 14 c.

9. Cyprina sp.

In a loose-lying block of stone a large cast was found, the shell of which was partly preserved. I succeeded in preparing the hinge. The hinge-plate was broad. In the left valve there were three cardinal teeth, the anterior of which was parallel to the hinge-margin and behind that tooth there was a deep socket. The middle tooth was strong and triangular; it was separated from the posterior, elongated tooth by a large, triangular socket. It was consequently a typical *Cyprina*-hinge, and this also appears to be the case with the hinge of the right valve; the latter is, however, but imperfectly known. The shell was rather thick; only concentric lines of growth could be seen.

Height 38 mm., length 49 mm.

It is scarcely possible to determine the species of this specimen; it seems to be unusually elongated. In that feature it differs from a specimen of *C. Morrisii* SOW. from the Thanet Sands at Herne Bay which I examined; it appears to be closely allied to that species.

Distribution. Mt. Brongniart, in a loose-lying block of stone (1 spec.; A. G. NATHORST coll. in 1898).

10. Meretrix (Dosiniopsis) orbicularis Edw. sp.?

Pl. I, fig. 10.

1852. *Cytherea orbicularis* EDW.; MORRIS, Fossil Shells, p. 265, Pl. 16, fig. 5.
1857—1858. „ „ „ ; DESHAYES, Animaux sans vertèbres, I, p. 475, Pl. 29, figs. 11—14.
1886. *Dosiniopsis* „ „ ; COSSMANN, Coquilles foss. de l'éocène de Paris, p. 126.

Perhaps some casts may be referred to this species. They are rather compressed and nearly circular, and in form they agree with MORRIS and DESHAYES' figures. Unfortunately all the impressions of the hinge are more or less incomplete; they do not appear to agree entirely with that of *M. orbicularis*, at least not with that figured by DESHAYES. However, impressions of the hinge of two right valves indicate distinctly the presence of the depression which corresponds with the horizontal, anterior tooth of the left valve. So at least the generic determination can be considered as reliable.

Two casts from Mt. Hedgehog are very incomplete; one of them is of an unusually elongated form, but this may be due to pressure.

M. orbicularis is known from the Sables inférieurs and from the Thanet Sands, Woolwich Beds and London Clay.

Distribution. Coal Mtn. (3 pairs and 2 single valves; G. HOLMSEN coll. in 1909). Mt. Fyrkanten, in a loose-lying block of stone (2 pairs of valves; A. G. NATHORST coll. in 1898). Mt. Basilika (one pair of valves; A. G. NATHORST coll. in 1898). Mt. Hedgehog (one pair of valves and one single valve; A. G. NATHORST coll. in 1898).

11. Meretrix pyriformis n. sp.

Pl. II, fig. 3.

1883. *Terebratula sp.* ?, FUCHS, Tertiärconch. aus Spitzbergen, p. 8.

The casts collected East of Coles Bay during NATHORST's expedition in 1882 can be referred to several different types, which appear to vary considerably, perhaps in part according to the pressure to which they were exposed. With regard to two casts belonging to one of these types FUCHS remarks as follows: "Zwei Steinkerne zeigen so vollständig die äussere Gestalt einer grossen Terebratel, aus der Gruppe d. *T. ampulla*, dass sie immerhin dieser Gattung angehören können, obgleich sonst Terebrateln in derartigen Ablagerungen nicht vorzukommen pflegen. — Auch ist es auffallend, dass in beiden Fällen nur der Steinkern der Schnabelklappe vorhanden ist, während doch sonst bei Terebrateln beide Schalen zusammen zu bleiben pflegen." It is therefore only with great doubt that FUCHS has referred these casts to the genus *Terebratula*, and since I have now succeeded in preparing the impression of the hinge in one of the specimens it really proves to be not a *Terebratula*, but a heterodont Pelecypod that is represented here. Although by no means all the details of the structure could be seen, yet I have given a name to the species for practical purposes.

Shell large, rather inflated, pear-shaped, most frequently somewhat oblique. Umbones prominent, somewhat curved forwards. The margin in front of the hinge concave, behind the hinge slightly convex, the remaining margin evenly curved. Surface of the shell with concentric lines of growth. Only the hinge of the left valve is fairly well-known. As far as can be seen, in front there is a horizontal tooth; behind that are three diverging cardinal teeth, of which especially the first and the second are very narrow.

Two of the most entire casts measure 60 mm. in height, while the length of the one is 48 mm. and of the other 52 mm. Some of the specimens were somewhat larger (measuring as much as 75 mm. in height) which is the case with the only specimen found in Flower Valley.

This species differs from the preceding in being higher and more inflated.

Distribution. Flower Valley (2 casts; A. HOEL coll. in 1919). East of Coles Bay (10 casts; A. G. NATHORST coll. in 1882).

12. Meretrix (Callista) Nathorsti n. sp.

Pl. II, fig. 7.

Among the casts collected East of Coles Bay there are some specimens of an extraordinary form. I have succeeded in preparing the impression of the hinge of a right valve, and thus it appears that these casts represent a species of *Meretrix*.

Shell rather large, elongated and very inequilateral, roundly triangular, moderately convex. Umbones far in front of the middle of the valves, in some cases at the middle of the anterior half of the valve, strongly curved forwards. The margin in front of the umbones somewhat concave, behind the umbones slightly convex and forming a long, shallow curve, as does also the ventral margin. Anterior and posterior margins abruptly rounded. Surface probably ornamented with stronger and fainter concentric lines of growth. The hinge of the right valve showing in the front a horizontal tooth and behind this three strong cardinal teeth, the anterior and the middle only slightly divergent.

Height 40 mm., length 65 mm.

The examples in question are somewhat different with regard to the obliquity of the valves and the proportion of the height to the length. This variability may, however, be due in part to pressure in different directions. All the specimens from Flower Valley are somewhat larger than those from the locality East of Coles Bay. As regards the form, the species appears to be closely allied to some species from the Paris Basin, for instance *M. laevigata* LAM., but as a rule the species from Spitsbergen is higher and more pointed both in front and behind; also it is considerably larger.

Distribution. Flower Valley (5 spec.; A. HOEL coll. in 1919). East of Coles Bay (10 spec.; A. G. NATHORST coll. in 1882).

13. Meretrix sp.?

Pl. I, fig. 8.

A cast showing the sculpture of the surface of the shell was unfortunately not quite complete. Perhaps it belongs to a species of *Meretrix*. The shell was oval, nearly equilateral and rather strongly inflated. Ornamentation consists of numerous faint, regular, concentric ribs.

Height 18 mm., length 27 mm.

No trace of the hinge being visible a reliable determination as to the genus is impossible. The valve is more equilateral than is usually the case in species of *Meretrix*. In that, however, it closely agrees

with *M. delicatula* DESH., of which species it is highly reminiscent. According to COSSMANN[1] *M. delicatula* is identical with *M. striatula* DESH.

Distribution. Mt. Nobel (1 spec.; G. HOLMSEN coll. in 1909).

14. Cf. Solenotellina brevisinuata Cossm.

Pl. II, fig. 6.

1886. *Soletellina brevisinuata* COSSMANN, Coquilles foss. de l'éocène de Paris, p. 90. Pl. 5, figs. 12—14.

Some casts showing the sculpture of the surface of the shell appear to agree in form rather closely with species of *Solenotellina* described from the Paris Basin, particularly with *S. brevisinuata* COSSM.

Shell much elongated, oval, but slightly convex, gaping at both extremities. Anterior extremity a little narrower than the posterior. Umbones somewhat behind the middle of the valves, slightly prominent. Anterior and posterior margins evenly rounded. Nymphae not distinct, but they appear to have been short and thick. Ornamentation consists of stronger and fainter concentric lines of growth.

One of the specimens in question is 9.5 mm. high and 23 mm. long; the dimensions of another specimen are 8 and 20 mm. respectively, and of a third specimen 6 and 15 mm.

These specimens show the closest agreement with COSSMANN'S fig. 12, but the posterior extremity is a little narrower and the ventral margin straighter. The internal characters (hinge, adductor scars and pallial line) not being able to be examined, a reliable determination is impossible, and even the determination of the genus is not quite indubitable.

S. brevisinuata is reported by COSSMANN from the Calcaire grossier.

Distribution. Mt. Hierta (1 spec.; B. HÖGBOM coll. in 1909). Mt. 397.4, the western slope (1 spec.; A. HOEL coll. in 1914). Mt. Liljewalch (1 spec.; B. HÖGBOM coll. in 1911).

15. Solenocurtus (Macha) Nordenskjöldi n. sp.

Pl. II, fig. 5.

1910. *Psammosolen (Macha) sp.* FUCHS in NATHORST: Geol. der Bären-Insel, Spitzbergens etc., p. 381.

I agree with FUCHS in considering the Pelecypod mentioned by NATHORST, as a species of *Solenocurtus (Macha).* It was found by G. NORDENSKIÖLD in 1890 on Tält Mt. It is a particularly well-

[1] M. COSSMANN, l. c. 1886, p. 130.

preserved impression of the outer surface of the whole right valve and of the greater part of the left valve.

Shell long, evenly convex, but yet somewhat compressed at the extremities, gaping a little anteriorly and somewhat more posteriorly. Umbones somewhat in front of the middle of the valves. Hinge and ventral margins straight, nearly parallel one to the other; anterior margin evenly curved passing rather abruptly into the hinge-margin; posterior margin strongly curved below, less curved upwards and forming with the hinge-margin a rather obtuse, rounded angle. Anterior and posterior margins passing evenly into the ventral margin. Ornamentation consists of rather strong lines of growth at irregular intervals. Besides this there are, especially in the middle part of the valves, fine, irregular, radial lines. The presence of the oblique stripes, found in many species of *Solenocurtus*, is not demonstrable with certainty in the specimen described here.

Height 20 mm., length 42 mm.

As was pointed out by FUCHS before, this species closely resembles the recent *S. strigilatus* L. *sp.* It is, however, somewhat higher in proportion and the anterior margin is a little more, and the posterior margin somewhat less, curved.

Distribution. Tält Mt. (1 spec.; G. NORDENSKIÖLD coll. in 1890).

16. Solenocurtus n. sp.

Pl. II, fig. 1.

1883. *Psammosolen (Macha) sp.;* FUCHS, Tertiärconchylien aus Spitzbergen, p. 7.
1910. „ „ „ „ in NATHORST, Geol. der Bären-Insel, Spitzbergens etc., p. 377.
? 1897. *Psammobia? n. sp.* KARPINSKY, Versant oriental de l'Oural, p. 13.

Like FUCHS I refer the impression of two pairs of valves to the genus *Solenocurtus*. They were found East of Coles Bay and in a loose-lying block of stone at Mt. Brongniart respectively and show the inner surface of the valves. Moreover, an impression of the outer surface of another pair of valves was found on Mt. Vesuv. In form they differ from the preceding species, but show a rather great resemblance to *S. Deshayesi* DES MOUL. From that they differ in being somewhat higher and less convex, but that is, perhaps, due to pressure; moreover, both the anterior and the posterior margins are less acute and more evenly rounded; also the umbones appear to be nearer to the middle of the valves. In that respect and also in others they agree better with the *Psammobia? n. sp.* reported from the Transuralian Tertiary by A. KARPINSKY,[1] a species hitherto not described, which I

[1] A. KARPINSKY: Versant oriental de l'Oural, d'Ourjom à Ékathérinebourg, p. 13. — Guides des excursions du VII Congrès géol. internat. St. Pétersbourg 1897.

know only from some unpublished figures which KARPINSKY kindly sent me. The similarity to that species is so great that their identity is highly probable. The example from Mt. Brongniart is proportionally a little longer than the other specimens and belongs perhaps to another species.

The impression best-preserved (from Mt. Brongniart) is 40 mm. long and 16 mm. high.

Distribution. East of Coles Bay (1 spec.; A. G. NATHORST coll. in 1882). Mt. Vesuv, on the western slope of the plateau (1 spec.; A. HOEL coll. in 1914). Mt. Brongniart, in a loose-lying block of stone (1 spec.; A. G. NATHORST coll. in 1898).

17. Solenocurtus (Novaculina?) spitsbergensis n. sp.

Pl. II, fig. 2.

1883. *Siliquaria sp.*, FUCHS, Tertiärconch. aus Spitzbergen, p. 7.

Several impresssions and casts, some of which have parts of the shell preserved as pseudomorphs, were referred by FUCHS to *Siliquaria*, a sub-genus of *Solenocurtus*. However, they appear to me to show a greater agreement with the sub-genus *Novaculina*, but the material to hand does not allow a very reliable decision of the question.

Shell thick, oval, much elongated, somewhat inequilateral, rather strongly convex, rounded at the extremities. Nearly at the middle of the ventral margin there is a very slight sinuosity, corresponding with a more or less distinct depression which extends from the umbo to the ventral margin. Ornamentation consists of somewhat irregular, concentric folds especially distinct at the extremities of the valve. Moreover, in a few valves there are seen traces of rather regular wrinkles passing somewhat obliquely to the concentric folds. — No traces of the structure of the hinge-margin are seen. A single cast found with 3—4 specimens of the species here described, but perhaps not belonging to it, shows indications of a slight pallial sinus of nearly the same form and depth as in *S. gangeticus*.

An impression of a pair of valves found on the western slope of the plateau of Mt. Vesuv shows comparatively few, strong, concentric folds, but otherwise it seems to agree well with the specimens described above.

For comparison I have had specimens of *S. (N.) gangeticus* BENS. which agree rather well with the present species, but their hinge-margin appears to be more curved, and their surface shows more regular folds. This species also shows the wrinkles mentioned above, which however seem to be somewhat more irregular.

A cast from Mt. Fyrkanten also seems to belong to this species. Here also the impression of the hinge-margin is seen; the umbo was rather prominent, almost as in *S. gangeticus*.

Possibly the form mentioned by FUCHS (loc. cit. p. 7) collected at Mt. Hierta may be referred to the above species. Yet this does not appear to be very probable, because that form is higher, and its hinge-margin more strongly curved.

Distribution. East of Coles Bay (14 valves; A. G. NATHORST coll. in 1882). Mt. Vesuv, on the western slope of the plateau (1 pair of valves; A. HOEL coll. in 1914). Mt. Fyrkanten (1 pair of valves; H. L. NORBERG coll. in 1914).

18. Solenocurtus (Tagalus?) sp.

1883. *Pharella sp.*; FUCHS, Tertiärconch. aus Spitzbergen, p. 7.

The impression of the inner surface of a pair of valves was referred by FUCHS to the genus *Pharella*. FUCHS remarks that it resembles *P. javanica* LAM. and *P. subovata* CUV. from the Indian seas. — The impression is in a bad state of preservation, the pallial line and the hinge being invisible. It seems to me that it agrees more closely with some species of *Tagalus*, especially with *S. (T.) Dombei* REEVE; like that species it also has a broad hinge-margin behind the umbones. However, it differs in being comparatively higher and in having a pointed anterior extremity.

Distribution. East of Coles Bay (1 pair of valves; A. G. NATHORST coll. in 1882).

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Plate I.

Figs. 1 and 2. *Cyrena (Corbicula) altissima n. sp.* The north-western slope of Mt. 397.4.
- 3. *Pecten corneus* SOW. ? Flower Valley.
- 4. *Cyrena (Corbicula) cuneiformis* FÉR. ? The north-western slope of Mt. 397.4.
- 5 and 6. *Cyrena (Corbicula) angustidens* MELL. The north-western slope of Mt. 397.4.
- 7. *Cyrena (Corbicula) angustidens* MELL. Mt. Nordenskiöld.
- 8. *Meretrix sp.* ? Mt. Nobel.
- 9. *Cyrena (Corbicula) sp.* Mt. Brongniart.
- 10. *Meretrix (Dosiniopsis) orbicularis* EDW. *sp.* ? Two connected valves. Mt. Fyrkanten.
- 11. *Cyrena (Donacopsis) acutangularis* DESH. ? × 2. The north-western slope of Mt. 397.4.

The figures are of the natural size, except where otherwise stated.

In the Palæontological Museum of the University of Christiania are preserved the specimens figured in Nos. 1–6, 8 and 11.

In the Zoo-palæontological Dpt. of Vetenskapsakademien in Stockholm: Nos. 9. and 10.

In the Geological Museum of the University of Uppsala: No. 7.

Plate II.

Figs. 1. *Solenocurtus n. sp.* The western slope of Mt. Vesuv.
- 2. *Solenocurtus (Novaculina?) spitsbergensis n. sp.* The western slope of Mt. Vesuv
- 3. *Meretrix pyriformis n. sp.* East of Coles Bay.
- 4. *Cyrena (Corbicula) Hoeli n. sp.* The north-western slope of Mt. 397.4.
- 5. *Solenocurtus (Macha) Nordenskiöldi n. sp.* Mt. Nordenskiöld.
- 6. *Cf. Solenotellina brevisinuata* COSSM. Mt. Liljewalch.
- 7. *Meretrix (Callista) Nathorsti n. sp.* East of Coles Bay.

All the figures are of the natural size.

In the Palæontological Museum of the University of Christiania are preserved the specimens figured in Nos. 1, 2 and 4.

In the Zoo-palæontological Dpt. of Vetenskapsakademien in Stockholm: Nos. 3, 5 and 7.

In the Geological Museum of the University of Uppsala: No. 6.

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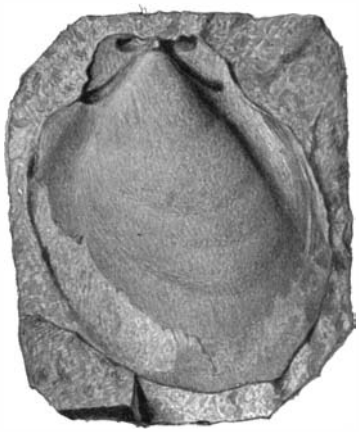

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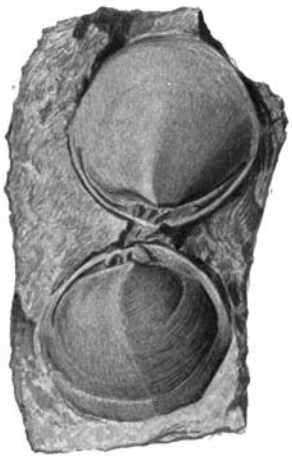

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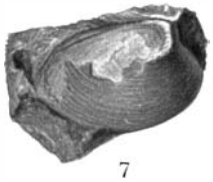

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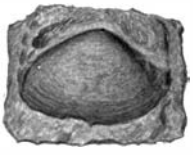

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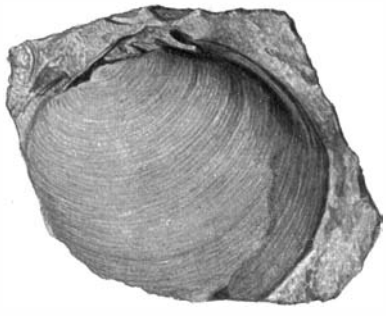

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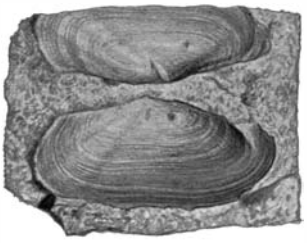

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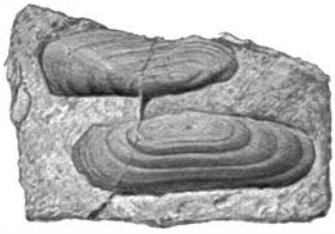

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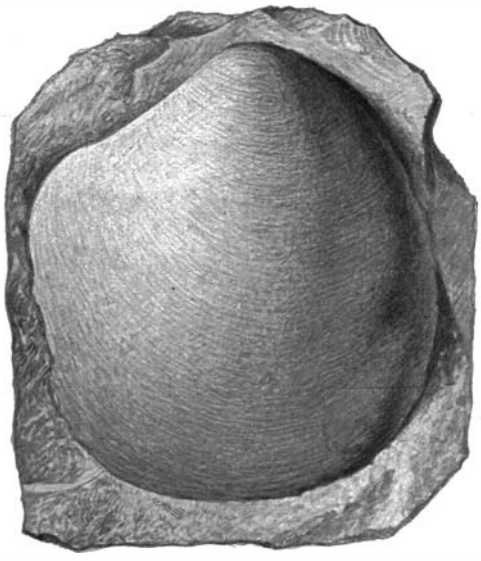

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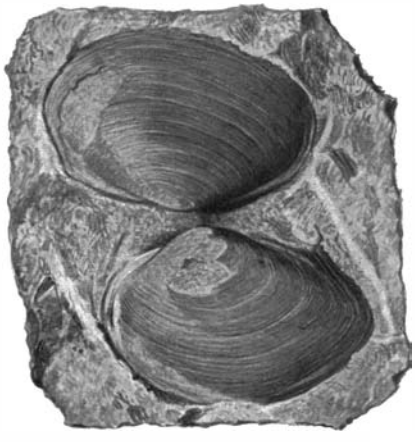

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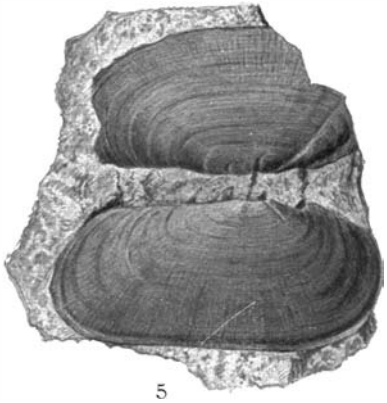

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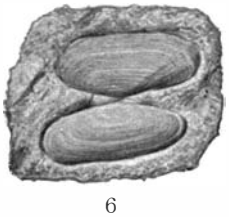

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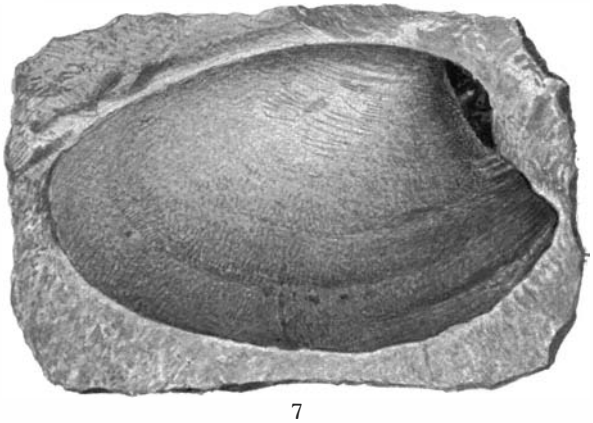

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