With Compliments From
Dr. Lauge Koch

MEDDELELSER OM GRØNLAND
UDGIVNE AF
KOMMISSIONEN FOR VIDENSKABELIGE UNDERSØGELSER I GRØNLAND
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DE DANSKE EKSPEDITIONER TIL ØSTGRØNLAND 1947—53
UNDER LEDELSE AF LAUGE KOCH

UPPER CRETACEOUS FOSSILS FROM TRAILL AND GEOGRAPHICAL SOCIETY ØER, EAST GREENLAND

BY

DESMOND T. DONOVAN

WITH 4 FIGURES IN THE TEXT AND 3 PLATES

KØBENHAVN
C. A. REITZELS FORLAG
BIANCO LUNOS BOGTRYKKERI A/S
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I. INTRODUCTION

The present paper describes Upper Cretaceous fossils collected in the summer of 1952 in Geographical Society Ø, the islands in Vega Sund, and the northeastern part of Traill Ø. In addition, illustrations and further remarks are included for several species already recorded by the writer from Traill Ø (1953), in respect of which better material, or further information, is now to hand. As the writer's work has now covered a large part of the Upper Cretaceous area of Geographical Society and Traill Øer, the faunas which have been collected from this area, and from the neighbouring Hold with Hope, are listed and a few observations added.

The fossils described in this paper were collected on Dr. LAUGE KOCH's expeditions to East Greenland, principally that of 1952, and I am indebted to Dr. KOCH for the facilities to visit East Greenland and for his continued interest in the work. I was assisted in the field by several friends and students from Bristol University, whose help will receive more detailed acknowledgment in the stratigraphical account of Geographical Society Ø which is in preparation (to be published shortly as M. o. G. Bd. 103, Nr. 9). The laboratory work has been carried out in the Geology Department of Bristol University, and I wish to thank Mr. E.W. SEAVILL for taking the photographs of the specimens.

In determining the fossils I have had the benefit of help from several specialists whom I wish to thank. Mr. C. W. WRIGHT has suggested comparisons for the *Phylloceras* and *Lytoceras* from the Cenomanian which have saved much trouble. Dr. L. R. Cox has advised me on generic nomenclature of lamellibranchs, and Mr. R. CASEY kindly examined and commented on the hinge of one species. Mr. L. BAIRSTOW has examined a series of belemnites from one locality, and at his suggestion they were also submitted to Dr. J. A. JELETZKY who provided comments which are incorporated here.

II. STRATIGRAPHY

The stratigraphical subdivisions recently established for Traill Ø (DONOVAN, 1953) were confirmed in 1952 and were found to occur also in Geographical Society Ø. No new horizons were discovered in the Upper Cretaceous. For convenience of reference a table of formations is given here:

Stage			Rocks in Geographical Society Ø
Senonian	Maestrichtian		
	Campanian	Upper	Shales.
		Lower	
	Santonian	Upper	*Sphenoceramus* Beds. Shales and sandstones.
		Lower	
	Coniacian		
Turonian		Upper	*Inoceramus lamarcki* Beds. Shales and sandstones.
		Lower	
Cenomanian		Upper	
		Lower	Shales and sandstones with conglomerates near base.

The localities referred to will be found in the maps of the Geodetic Institute (sheets 72 Ö. 1 and 72 Ö. 2) and in the writer's stratigraphical publications (M. o. G. Bd. 111, Nr. 4, and Bd. 103, Nr. 9).

III. SYSTEMATIC PALAEONTOLOGY

Phylum MOLLUSCA.

Class *Cephalopoda.*

Order **AMMONOIDEA.**

Family **Phylloceratidae.**

Genus **Phylloceras** Suess, 1865.

Phylloceras cf. *velledae* (Michelin).

cf. 1834 *Ammonites Velledae* Michelin, pl. 35.
cf. 1841 *Ammonites Velledae* Michelin. D'ORBIGNY, p. 280, pl. 82, figs. 1—4.

Fragments of a *Phylloceras* from the Cenomanian (*varians* zone) of Geographical Society Ø bear the ornament characteristic of this and allied species, blunt ribs being separated by flat interspaces as in d'ORBIGNY's enlarged figure of the surface of the shell (1841, pl. 82, fig. 3). The material is insufficient for any attempt at specific attribution, although the fragments belonged to a fossil with approximately the shell-form of d'ORBIGNY's example rather than a more globose form such as the var. *inflata* described by COLLIGNON (1950, p. 35, pl. 4, figs. 16a,b) from the Albian of Madagascar. *P. velledae* belongs to a stock which persisted, with little change, throughout the greater part of the Cretaceous, and has been recorded from Europe, Africa and North America. The stratigraphical and geographical distribution of the species and its allies has been reviewed by BOULE, LEMOINE and THEVENIN (1906, p. 8), and more recently by COLLIGNON (1948) who includes *P. velledae* in the group of *P. tethys* (d'ORBIGNY) and gives a tabular summary of the Cretaceous species of this group (1948, p. 68).

According to some authors the species should be referred to the genus *Hypophylloceras*, set up by SALFELD in 1924 and made the type genus of a subfamily Hypophylloceratinae by SPATH (1927, pp. 37—38). According to SPATH the subfamily is distinguished by its "non-lituid internal saddles and obvious transitional characters to Desmoceratidae". The principal desmoceratid character is in the external suture-line, which in *Hypophylloceras* has the external and first lateral saddles about the same length, and a curved stem to the external saddle whereas in typical *Phylloceras* both saddles have straight stems and the first lateral

is longer than the external. WRIGHT (1952, p. 217, note 2) has rejected the subfamily Hypophylloceratinae, but further study might support the retention of *Hypophylloceras* as a genus or subgenus. The genus *Hyporbulites* Breistroffer (1947, p. 82), for *Phylloceras seresitense* Pervinquière from the Algerian Cenomanian, is probably synonymous with *Hypophylloceras*.

Geological horizon and locality: Cenomanian (*varians* zone) at the northern end of Tværdal[1]), Geographical Society Ø.

Family **Lytoceratidae.**

Genus **Lytoceras** Suess, 1865.

Lytoceras sp. nov. cf. *vicinum* H. Douvillé.

Pl. 2, fig. 8.

cf. 1916 *Lytoceras vicinum* H. Douvillé, p. 93, pl. 11, figs. 6a, b.

The impression of a lytoceratid ammonite was found in the *varians* zone of the Cenomanian. The cast taken from the impression (pl. 2, fig. 8) includes three whorls and has a diameter of about 4.8 cm, with an umbilicus about 30 % of the diameter. The whorl-section of the last whorl appears to have been compressed and cordate, with the whorl thickness not less than about 35 % of the diameter. The earlier whorls were probably more nearly circular in section. The ornament consists of fine, thread-like ribs, numbering about 40 on the last whorl, which are straight, with a slight forward inclination on the umbilical slope and whorl-side, and curve gently forward on the shoulder of the whorl. The venter is not preserved in the specimen so that the course of the ribs over it is not known. There is a constriction, which follows the same course as the ribs, at the end of the last whorl, and traces of another one quarter of a whorl earlier.

The ornament of the present species is compared with that of *Lytoceras vicinum* H. Douvillé, an Albian species known only from whorl fragments figured by DOUVILLÉ and by COLLIGNON (1950, pl. 5, fig. 2) from eastern Egypt and Madagascar respectively. In *L. vicinum* the overlap of the whorls is slight, and the umbilicus consequently wider than in the East Greenland species. The whorl section, however, is similar, changing with increase in size from circular to compressed with a narrow venter, and the ornament is also comparable, consisting of fine lines which pass radially across the whorl-side and curve forward,

[1]) This name is introduced for the large valley which crosses Geographical Society Ø from N.N.E. to S.S.W., and whose southern end is 16 km due west of Kap Mackenzie.

forming blunt chevrons over the venter. *L. vicinum* differs from the specimen under consideration in bearing periodic stronger ribs at intervals of 10 to 14 mm on the outer whorl, and in the absence of any constrictions.

The present form is regarded as specifically different from *L. vicinum* and from any other described species, but the material is inadequate to support the description of a new species.

COLLIGNON (*loc. cit.*) assigned DOUVILLÉ'S species to the subgenus *Thysanolytoceras* Buckman, but this attribution is not accepted by the present writer. The type of *Thysanolytoceras* is a Jurassic (Bajocian) species (*Amm. eudesianus* d'Orbigny) which differs little from the type species of *Lytoceras*, the Liassic *fimbriatum* (J. Sowerby). Whether or not *Thysanolytoceras* is accepted as a valid genus, there is no reason for using it for the Albian *L. vicinum*.

Geological horizon and locality: Cenomanian (*varians* zone) of the northern end of Tværdal, Geographical Society Ø.

Family **Gaudryceratidae.**

Genus **Gaudryceras** de Grossouvre, 1894.

Gaudryceras sp. indet.

Pl. 2, fig. 3.

An impression found in Traill Ø in 1950, but not previously recorded, is now attributed to this genus. The shell is ornamented by fine ribs, of variable spacing, with the characteristic gaudryceratid curve, and by periodic thicker ribs accompanying constrictions, about 25° apart. The shell appears to have been quite evolute, with the umbilicus a little less than 45 % of the diameter.

The fossil was found in association with poorly preserved *Inoceramí* which are probably *I. crippsi*, indicating a Cenomanian age, but the identification is not certain and the occurrence may belong to a higher horizon in the Upper Cretaceous.

Family **Scaphitidae.**

Genus **Scaphites** Parkinson, 1811.

Scaphites greenlandicus Donovan.

Pl. 2, figs. 4, 5, text-fig. 1.

1872 *Scaphites roemeri* d'Orbigny. SCHLÜTER, p. 89, pl. 27, fig. 4.
1883 *Scaphites* sp. de Loriol, p. 206.
1897 *Scaphites roemeri* d'Orbigny. MADSEN, p. 49, plate, figs. 1, 2a, b, 3a, b.
1918 *Scaphites nicolletii* Morton. RAVN, p. 363, pl. 9, figs. 1, 2.
1953 *Scaphites greenlandicus* Donovan, p. 121.

Additional examples of this species were found in 1952 at a locality three or four kilometres east of the summit of Laplace Bjerg on Geographical Society Ø, and enable the writer's recent observations to be supplemented. The new specimens are all crushed, but the form and ornament of the body-chamber are well-shown. The apertural margin is slightly curved and makes an angle a little greater than a right angle

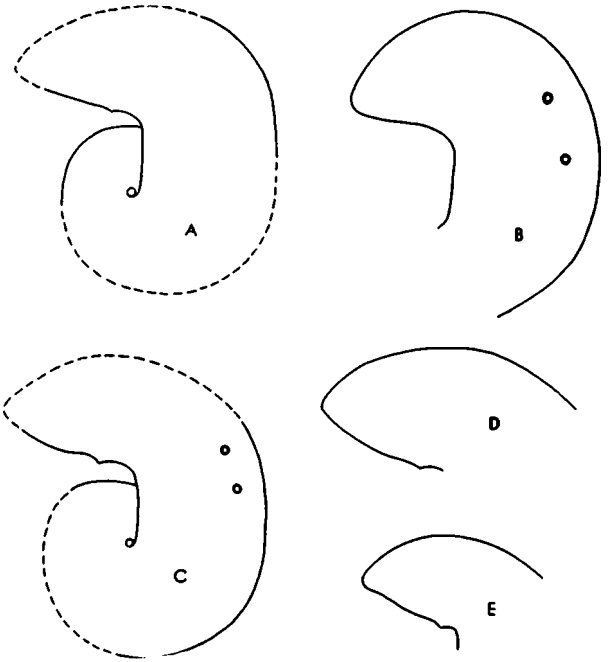


Fig. 1. Outline side views of various specimens of *Scaphites greenlandicus*, to illustrate form of the body-chamber and aperture. All one-half natural size. *A*, paratype, from Niaqornat, West Greenland, after RAVN, 1918, pl. 9, fig. 1. *B*, from Haldem, Westphalia, after SCHLÜTER, 1872, pl. 27, fig. 4. *C*—*E*, from locality 4 km east of Laplace Bjerg, Geographical Society Ø, East Greenland.

with the straight section of the body-chamber, so that the latter is not hook-shaped as in some species of *Scaphites*. Text-figure 1 shows the outline of the body-chamber and aperture in individuals from West Greenland, East Greenland and Germany, and illustrates the close agreement in this character of the specimens from different sources. The ornament of the species has already been described and is further exemplified by the new material, an example of which is here figured (pl. 2, fig. 5). One specimen (pl. 2, fig. 4) differs from the usual form of the species in having six tubercles on the shoulder of the whorl on the anterior part of the body-chamber. The writer has stated (1953, p. 122) that the maximum number of tubercles in the species is two, and the

rest of the new material conforms with this definition. In the absence of more specimens it is difficult to say whether the diagnosis of the species should be emended or whether the form with six tubercles is to be regarded as a distinct variety. As it is also larger in size than typical individuals the latter course is provisionally adopted.

The North American specimen figured by MEEK (1876, pl. 34, figs. 4a, b), referred to *S. greenlandicus* with a query when the species was originally described, is now definitely excluded, though it may be closely related. MEEK's specimen is smaller and has coarser ornament than *S. greenlandicus*. MOBERG's body-chamber fragment (1885, pl. 3, figs. 9a, b), previously referred to *S. greenlandicus*, has at least three tubercles and a nearly flat venter (which may or may not be exaggerated by the preservation) and is better removed from the synonymy of the typical form of the species.

Geological horizon and locality: Upper Campanian of Maanedal, Traill Ø and the Laplace Bjerg area, Geographical Society Ø.

Family **Schloenbachiidae.**

Genus **Schloenbachia** Neumayr, 1875.

Schloenbachia aff. *subplana* (Mantell).

1822 *Ammonites varians* var. *subplana* Mantell, p. 116, pl. 21, fig. 2.
1853 *Ammonites varians* var. *sub-plana* Mantell. SHARPE, p. 23, pl. 8, figs. 10a—c.
1951 *Schloenbachia subplana* (Mantell). WRIGHT and WRIGHT, p. 23.

Two crushed specimens agree with this species in having closely-spaced peripheral tubercles, but the preservation does not permit comparison of the other characters.

Geological horizon and locality: Cenomanian (*varians* zone) of Borgøen. Probably represented at same horizon near Bjørnedal, Traill Ø.

Schloenbachia subtuberculata (Sharpe).

Pl. 1, figs. 3a, b, 4, 8.

1853 *Ammonites varians* var. *subtuberculata* Sharpe, p. 22, pl. 8, figs. 5a—c, 6a, b.
1951 *Schloenbachia subtuberculata* (Sharpe). WRIGHT and WRIGHT, p. 22.
1953 *Schloenbachia subtuberculata* (Sharpe). DONOVAN, p. 119.

About half a dozen uncrushed specimens from Geographical Society Ø, two of which are here figured (pl. 1, figs. 3a, b, 4) agree well with the lectotype of this species in shell-form and in the spacing of the umbilical and peripheral tubercles. The ribbing in several of the specimens is more regular than on the type, and one or two examples approach a figure of the species in d'ORBIGNY (1841, pl. 92, figs. 3, 4) in this character.

The ornament in many species of *Schloenbachia* was subject to a good deal of individual variation, and there is no need for an unduly rigid interpretation of the species. The ribs, which in contrast to the condition in *S. subvarians* are not joined to the peripheral tubercles, tend to be more numerous than these tubercles. On the inner whorls there may be half as many ribs again as tubercles, but with growth the numbers become more nearly equal, as in SHARPE's syntypes. The ornament on the earlier whorls of the syntypes, the originals of which are lost, is not known.

A fragment of the body-chamber of a large specimen (pl. 1, fig. 8), which must have been at least 10 cm. in diameter, bears ornament similar to that of examples of *S. subtuberculata* with diameters of 5 to 6 cm. The whorl-section is only partially preserved but appears to be comparable to that of *S. subtuberculata*, although the umbilicus must have been larger. The specimen is provisionally assigned to the species, but no extensive series of this species, which might enable the characters at larger sizes to be established, appears to have been figured.

Geological horizon and localities: Cenomanian (*varians* zone) of southern Traill Ø and the northern part of Tværdal, Geographical Society Ø.

Schloenbachia subvarians Spath.

Pl. 1, figs. 1a, b, 2a, b, 6, 7a, b, text-fig. 2.

1853 *Ammonites varians* var. *intermedia* Mantell. SHARPE, p. 23, pl. 8, figs. 7a, b.
1926 *Schloenbachia subvarians* Spath, p. 81.
1951 *Schloenbachia subvarians* Spath. WRIGHT and WRIGHT, p. 22.
1953 *Schloenbachia subvarians* Spath. DONOVAN, p. 119.

The identification of this species from East Greenland, previously based on indifferent material, has now been confirmed by the discovery of good uncrushed specimens in Geographical Society Ø. The species is represented by about a dozen examples of various sizes, including a number of isolated body-chambers. The body-chamber was about half a whorl in length. The larger specimens, c. 6.0 cm diameter, show the slight opening out of the umbilicus which is indicated in SHARPE's figure of the type. The proportions correspond fairly closely to those of the type, and SPATH's var. *aperta*, with umbilicus 36—38 % of the diameter, has not been found in Greenland. The ornament also agrees well with the typical form of the species, there being between 28 and 30 ribs on the outer part of the whorl-side. The ventral ends of the ribs normally bear the tubercles which lie on the ventro-lateral angle, but sometimes the ribs become out of step with the tubercles and end between them, the tubercles then being isolated from the ribs. This condition is shown at the end of the last whorl of the type, and occurs sporadically at various diameters in the Greenland material. The rib

frequency is fairly constant throughout the material examined, and the closer ribbed var. *densicostata* Spath does not occur. A few individuals have more widely spaced ornament than usual, and one, here illustrated (pl. 1, figs. 1a, b), has only 23 ventro-lateral tubercles at a diameter of 5.3 cm. The same specimen also has more robust ornament than the typical *S. subvarians* and may be regarded as a stage in the transition to *S. subtuberculata*. Specimens with thicker whorls than normal (about 35 % of the diameter instead of 25—30 %), and with slightly irregular ornament illustrate another aspect of the same trend.

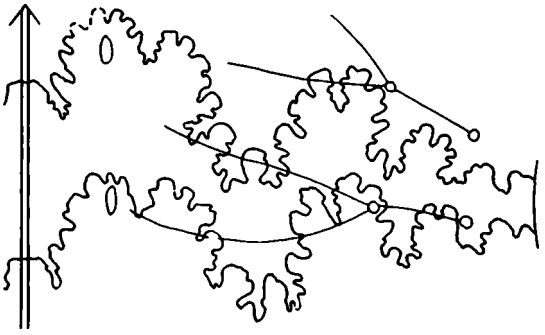


Fig. 2. Two successive external suture-lines of an example of *Schloenbachia subvarians* from Geographical Society Ø, East Greenland, at a diameter of approximately 3.5 cm. × 3. The positions of ribs and tubercles are indicated.

Two typical Greenland examples are figured here (Pl. 1, figs. 6, 7a, b) to illustrate the close correspondence with European material. Part of the external suture-line of another specimen is shown in text-figure 2.

Two body-chamber fragments, one of which is figured (pl. 1, figs. 2a, b), belonged to individuals about 10 cm in diameter, and are difficult to identify on account of their large size. The figured example bears fairly typical *S. subvarians* ornament on one side, with the ribs joined to the peripheral tubercles; on the side figured the ornament is less regular. The whorl-section was less compressed than in the type, and the umbilicus larger, but this may have been a result of the opening out of the umbilicus which is already beginning, in the type of the species and the Greenland specimens referred to above, at about 6 cm diameter. On the second fragment, which is very short, the ornament is also of *subvarians* style, but the whorl-section is even more quadrate than in the other large example, the whorl-thickness being about 90 % of the whorl-height. These fragments are provisionally attached to the present species but it is not possible to determine them satisfactorily without a series of more complete specimens to illustrate the relationship of the small to the large forms.

Geological horizon and locality: Cenomanian (*varians* zone) of the northern part of Tværdal, Geographical Society Ø. Same horizon of southern Traill Ø.

Schloenbachia cf. *varians* (J. Sowerby).

Pl. 2, figs. 2a, b.

1817 *Ammonites varians* J. Sowerby, p. 169, pl. 176, upper central figure only.
1853 *Ammonites Coupei* Brongniart. SHARPE, p. 23, pl. 8, figs. 2a, b.
1938 *Schloenbachia varians* (J. Sowerby). SPATH, pp. 543—44.
1951 *Schloenbachia varians* (J. Sowerby). WRIGHT and WRIGHT, p. 22.

A body-chamber fragment is closer to this than to other described species, but differs from the typical *S. varians* in having a wider umbilicus and more regular ribbing. The ornament is rather like that of *S. subtuberculata*, but the thicker, more inflated whorl-section and the wider venter, as well as the larger umbilicus, are points of difference from that species.

Geological horizon and locality: One fragment from the Cenomanian (*varians* zone) of the northern part of Tværdal, Geographical Society Ø.

Schloenbachia varians var. *tetrammata* (J. de C. Sowerby).

Pl. 2, figs. 1a, b.

1828 *Ammonites tetrammata* J. de C. Sowerby, p. 166, pl. 587, fig. 2.
1853 *Ammonites Coupei* var. *tuberculata* Mantell. SHARPE, p. 24, pl. 9, figs. 1a, b.
1951 *Schloenbachia varians* var. *tetrammata* (J. de C. Sowerby). WRIGHT and WRIGHT, p. 22.

The example referred to this variety differs from the typical form of the species, exemplified by SHARPE's figures (1853, pl. 8, figs. 2a, b), in having more prominent and more distant tubercles, and corresponds with the var. *tetrammata*. The ribs on the outer part of the whorl-side are reduced to a row of tubercles whose presence, in addition to the other three rows, suggested the varietal name.

The variability of *S. varians* has been commented on by numerous authors and J. DE C. SOWERBY's species was reduced to the status of a variety of *S. varians* by SPATH (1938, p. 545).

Geological horizon and locality: One example from the Cenomanian (*varians* zone) of the northern part of Tværdal, Geographical Society Ø.

Schloenbachia sp.

Pl. 1, fig. 5.

Three small examples of *Schloenbachia* have the shell-form of *S. subvarians* but different ornament. The spacing of the peripheral tubercles is about the same as in *S. subvarians* but the ribs are more numerous,

13 or 14 to every 10 tubercles, and are not regularly joined to the tubercles. There are about half as many pairs of umbilical tubercles as there are peripheral tubercles. The ornament has a general resemblance to that of a form from Bochum, Westphalia, figured by SCHLÜTER (1871, pl. 4, figs. 3, 4) except that SCHLÜTER's figure has only one row of umbilical tubercles, a condition anomalous for the genus which may be due to careless drawing.

Geological horizon and locality: Cenomanian (*varians* zone) of the northern part of Tværdal, Geographical Society Ø.

Family **Collignoniceratidae.**

Genus **Collignoniceras** Breistroffer, 1947.

?*Collignoniceras* sp. indet.

The small fragment in question is not large enough for positive identification, but since *Collignoniceras* has already been recorded from East Greenland by SPATH (1946, p. 11, as *Prionotropis*) the attribution is not improbable. *Prionocyclus* is indistinguishable from *Collignoniceras* at small sizes, but identification with the already recorded genus seems preferable.

Geological horizon and locality: Turonian, west of Laplace Bjerg, Geographical Society Ø.

Order **BELEMNOIDEA.**

Family **Belemnitellidae.**

Genus **Actinocamax** Miller, 1826.

?*Actinocamax verus* Miller.

?1826 *Actinocamax verus* Miller, p. 64, pl. 9, fig. 17.

A single apical fragment from the same locality as the *Belemnitella* sp. indet. described below has been recognised by Dr. JELETZKY as belonging to a different species from the remainder of the fragments. It appears to belong to *A. verus* Miller or *A. verus* var. *fragilis* Archangelsky. The guard of *A. verus* and its allies is so distinctive that the identification is fairly confident despite the inadequacy of the material. For discussion of the age of the assemblage which yielded this species see below under *Belemnitella* sp. indet.

Genus **Belemnitella** d'Orbigny, 1840.

?*Belemnitella* sp. indet.

A series of fragments collected from a single locality in the northern part of Tværdal, Geographical Society Ø, constitute the only uncrushed

belemnite remains which have so far been found in the Upper Cretaceous of East Greenland. All but one (*Actinocamax verus* described above) may belong to the same species. Unfortunately the possibilities of identification are limited by the fact that only apical fragments of the guard were recovered, and the alveolus is unknown. No other fossils were found in association except a single fragment of *Inoceramus* sp., so that there is no independent evidence as to the age of the assemblage.

The fragments have been examined by Mr. L. BAIRSTOW, who first suggested the identification with *Belemnitella*, and, at his instigation, by Dr. J. A. JELETZKY who kindly provided further comments. The following is an extract from Dr. JELETZKY's observations:

"The total lack of alveolar part of the guard in all of your specimens makes it impossible to distinguish positively between *Actinocamax s. str.* and *Belemnitella*-like offsprings of the former genus. However, I feel that the guards in question are those of *Belemnitella s. str.* rather than of any *Actinocamax* species that I am familiar with. *Belemnella* is, in my opinion, ruled out by the character of the dorso-lateral, double vascular imprints, and *Gonioteuthis* by the total lack of any granulation and by extremely strong flattening of the guards in dorso-ventral direction. This flattening and the very weak development of all vascular imprints suggest tentatively that the ?*Belemnitella* sp. indet. in question belong to early, primitive *Belemnitella* forms around *B. propinqua* (Mob.) or *B.* ex gr. *mirabilis* Arch. (an undescribed species). All these primitive forms are of Santonian age and are, at least in the present state of our knowledge, known only from the Russian and Scandinavian boreal Upper Cretaceous localities."

Geological horizon: The age of the beds which yielded the two species of belemnites described above is not closely determinable, but is unlikely to fall outside the range Upper Coniacian to Lower Campanian, judging from the known occurrence in northern Eurasia of the species of *Belemnitella*, mentioned above, which appear to be closest to the present material, and of *Actinocamax verus* and allied species. Dr. JELETZKY suggests that the age is likely to be uppermost Coniacian or Santonian, but he stresses the slender nature of the evidence. Taking into account the formations already known in the neighbourhood, it is likely that the rocks which yielded the assemblage belong to the *Sphenoceramus* Beds, which are of Upper Santonian or Lower Campanian age (DONOVAN, 1953, p. 95). At least, the probable age of the belemnites is consistent with their belonging to this formation, and it is not necessary to postulate the existence of a horizon additional to those already recognised from the area.

Class *Lamellibranchia.*

Family **Nuculanidae.**

Genus **Nuculana** Link, 1807.

Nuculana? *panda* (Nilsson).

Pl. 3, figs. 12 a, b.

1827 *Nucula panda* Nilsson, p. 16, pl. 10, fig. 4.
1935 *Leda panda* (Nilsson). Hägg, p. 18, pl. 2, figs. 15—18.

Two specimens from the Upper Campanian agree with this species, except that the hinge-line is slightly straighter in the Greenland material. One example, an external mould, shows fine concentric ornament on the shell, similar to that which appears to be present in Hägg's figure 17. The second example, figured here, is an imperfect internal mould, with a relatively rounded posterior end, which corresponds with the form exemplified by Hägg's figures 16 and 18.

Two further examples, with a more strongly curved ventral margin comparable to Hägg's figure 15, are probably also to be referred to the species. In both, however, the hinge-line anterior to the umbo is slightly convex dorsally, instead of straight or concave as in all the individuals figured by Hägg.

The species figured as *Nuculana bisulcata* (Meek and Hayden) by Meek (1876, p. 104, pl. 15, figs. 4a, b) shows little, if any, significant difference from Nilsson's species, but the figured material is hardly adequate to support a definite pronouncement as to synonymy. De Loriol (1883, p. 208) and Ravn (1918, p. 345) recorded a species from Atâ, on Nûgssuaq peninsula, West Greenland, which they identified as *N. bisulcata* but Ravn's figure (*op. cit.* pl. 7, fig. 17) does not permit the identification to be unreservedly confirmed. It is clear, however, that very similar, if not identical, forms lived in Sweden, East and West Greenland, and the Central United States in Upper Senonian times. Neither Nilsson's nor Hägg's figures, nor the present material, show the hinge-line and adjacent structures well enough to render the generic placing of the species beyond doubt. Meek stated (1876, p. 105) that he had not seen the hinge of *N. bisulcata.*

The Swedish record of the species is from the upper part of the "Middle Senonian" of Hägg, and is probably of Lower Campanian age. The East Greenland specimens are from Upper Campanian beds, and the North American *Nuculana bisulcata* must be from about the same horizon.

Geological horizon and locality: Upper Campanian, eastern flank of Laplace Bjerg, Geographical Society Ø.

Nuculana? sp. indet. I.

Text-fig. 3.

A slightly damaged internal mould of a strongly convex right valve from the *varians* zone would have been about 2.6 cm long when complete, with a thickness of the single valve (measured on the mould) of 0.65 cm. The outline of the shell is shown in text-figure 3. The adductor scars are visible, but the pallial line cannot be traced. The taxodont hinge

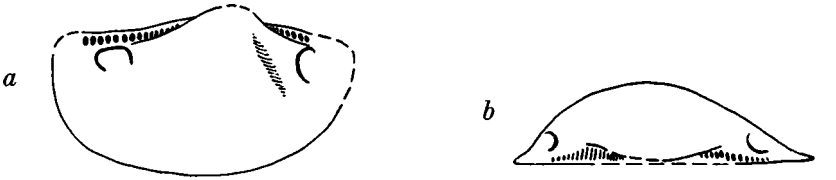


Fig. 3. Right-hand side (a) and ventral (b) views of *Nuculana?* sp. indet. I from the Cenomanian (*varians* zone) of the northern part of Tværdal, Geographical Society Ø. One and a half times natural size.

must originally have possessed at least 35 teeth, but the central part of the hinge-line cannot be clearly made out, and the generic position therefore remains in doubt.

Geological horizon and locality: Cenomanian (*varians* zone) of the northern part of Tværdal, Geographical Society Ø.

Nuculana? sp. indet. II.

A single internal mould from the *varians* zone has an oval shell outline and a taxodont hinge. The shell appears to have been more compressed than in the last species. The reference to *Nuculana* is provisional.

Geological horizon and locality: Cenomanian (*varians* zone) of Borgøen.

Family **Pteriidae.**

Genus **Oxytoma** Meek, 1865.

Oxytoma pectinata (J. de C. Sowerby).

Pl. 3, fig. 11.

1836 *Avicula pectinata* J. de C. Sowerby, p. 338, pl. 14, fig. 3.
1905 *Pteria (Oxytoma) pectinata* (Sowerby). WOODS, p. 59, pl. 8, figs. 8a, b, 9, 10a, b, 11—13, 14a, b.

The species, not previously found in East Greenland, is represented by four imperfect left valves from the Cenomanian (*varians* zone) of the northern part of Geographical Society Ø. According to WOODS the species ranges from the Aptian to the Cenomanian in England.

Family **Isognomonidae.**

Genus **Inoceramus** Wm. Smith, 1816.

Inoceramus (Inoceramus) crippsi Mantell.

Pl. 3, fig. 1.

1822 *Inoceramus Cripsii* Mantell, p. 133, pl. 27, fig. 11.
1911 *Inoceramus Crippsi* Mantell. Woods, p. 273, pl. 48, figs. 2, 3, text-figs. 33—35.

The material attributed to this species collected in 1952 was crushed and adds nothing to the records already published by the writer from Geographical Society and Traill Øer (Donovan, 1949, p. 9; 1953, p. 94). A typical left valve from Geographical Society Ø is figured here. The spacing of the concentric ribs is variable between different individuals and sometimes on different parts of the same specimen.

Geological horizon and locality: Cenomanian, common throughout Geographical Society and Traill Øer.

Inoceramus (Inoceramus) lamarcki Parkinson.

1819 *Inoceramus Lamarckii* Parkinson, p. 55, pl. 1, fig. 3.
1912 *Inoceramus Lamarcki* Parkinson. Woods, p. 307, pl. 52, figs. 4—6, pl. 53, figs. 1—7, text-figs. 63—85.

The species is represented only by fragments, some of them much damaged, which bear ornament similar to that of *I. lamarcki* var. *cuvieri* (J. Sow.). A large piece, representing the postero-ventral portion of a right valve, is very similar to an example of that variety figured by Woods (1912, text-figure 82). As far as can be judged from the few fragments which are suitable for comparison, the material corresponds closely with British examples of the species.

Geological horizon and locality: *Inoceramus lamarcki* Beds, Upper Turonian and ?Lower Senonian, Geographical Society and Traill Øer.

Inoceramus (Inoceramus) pictus J. de C. Sowerby.

Pl. 3, figs. 5, 6.

1829 *Inoceramus pictus* J. de C. Sowerby, p. 215, pl. 604, fig. 1.
1911 *Inoceramus pictus* Sowerby. Woods, p. 279, pl. 49, fig. 5, 6, text-fig. 36.

The species is represented by fragmentary, crushed material only, which displays ornament and, so far as can be made out, shell-outline corresponding to that of *I. pictus* as figured by Woods. The surface of the shell in some examples shows undulations similar to those present on the type of the species (Woods, 1911, text-fig. 36).

At the one exposure where *I. pictus* was found it was associated with a single fragment of a fairly typical *I. crippsi*. The age is without

doubt Cenomanian, and the species has in Britain a similar range to that of *I. crippsi.*

Geological horizon and locality: Cenomanian, near Kap MacClintock, Geographical Society Ø.

Inoceramus (Inoceramus) tenuis Mantell.

1822 *Inoceramus tenuis* Mantell, p. 132.
1911 *Inoceramus tenuis* Mantell. WOODS, p. 271, pl. 48, fig. 1, text-figs. 31, 32.

Two crushed and incomplete specimens correspond with this species in ornament and are provisionally assigned to it. They resemble the form exemplified by the type (WOODS, 1911, text-figs. 31, 32), from the Chalk Marl (basal *varians* zone) rather than the more nearly circular form from the Red Limestone (Upper Albian) figured in WOOD's plate 48, fig. 1.

Geological horizon and locality: Albian of Kap Palander, Traill Ø.

Subgenus *Sphenoceramus* Böhm, 1915.

Inoceramus (Sphenoceramus) patootensis de Loriol

Pl. 3, figs. 7, 8.

1883 *Inoceramus patootensis* de Loriol, p. 211.
1918 *Inoceramus patootensis* de Loriol. RAVN, p. 337, pl. 5, fig. 1, pl. 6, figs. 1, 2.
1953 *Inoceramus (Sphenoceramus) patootensis* de Loriol. DONOVAN, p. 95.

An island in the Scott Keltie group, in Vega Sund, and a mountain west of Freycinet Bjerg, Geographical Society Ø, have yielded typical fragments of this species, already recorded by the writer from the neighbouring north coast of Traill Ø. The fragments which are identifiable represent individuals similar to the one shown in RAVN's plate 5, fig. 1, with regular concentric ribbing and slight radial ornament. Typical fragments are now figured for comparison with the material from West Greenland and elsewhere.

Inoceramus subquadratus Schlüter (1887, p. 43), from the Lower Senonian of Texas, was not figured by its author, but a probable type was depicted by ADKINS (1928, pl. 34, fig. 6). On the basis of this illustration the species cannot be separated from *I. patootensis.* SCHLÜTER remarked that he had examples of the species both from Texas and Westphalia. A shell figured by the same author as *I. lobatus* (Schlüter, 1877, pl. 38, fig. 1, *non* Münster) is doubtfully distinct from *I. patootensis.* It is difficult, however, to give a satisfactory synonymy on account of the inadequacy of the figures of many "species" of *Sphenoceramus.*

The reservations previously expressed by the writer (1953, p. 95) with regard to the stratigraphical value of the Greenland species of *Sphenoceramus* still apply. It is doubtful whether a more extensive

investigation of the species would enable precise conclusions to be reached, on account of the unsatisfactory nature of the material from both Greenland and from Europe and North America.

Geological horizon and locality: *Sphenoceramus* Beds, Upper Santonian or Lower Campanian, Scott Kelties Øer and Geographical Society Ø.

Inoceramus (Sphenoceramus) sp. indet.

Pieces of large individuals of *Sphenoceramus* which cannot be specifically identified were found at several places in Vega Sund and Geographical Society Ø. They possibly belong to the species already recorded from the area, *I. (S.) patootensis* and *I. (S.) steenstrupi*, but neither figured examples of these species nor the material at hand allows fragments of large shells, in which the umbonal portion is missing, to be identified with species founded on small specimens. The fragments show a strong development of the radial ornament, and present an appearance like that of *I. digitatus* J. de C. Sowerby (see Woods, 1912, p. 337, text-fig. 95) and the similar *I. subcardissoides* Schlüter (1877, p. 271, pl. 37). Both these 'species' were founded on fragments of large shells and may represent merely the ornament developed on other species of *Sphenoceramus* when the shell reaches a large size.

Geological horizon and locality: *Sphenoceramus* Beds, Upper Santonian or Lower Campanian, Scott Kelties Øer and Geographical Society Ø.

Family **Amusiidae.**

Genus **Variamussium** Sacco, 1897.

Variamussium ignoratum (Ravn).

Pl. 2, figs. 6, 7, text-fig. 4.

1918 *Pecten (Amussium) ignoratus* Ravn, p. 342, pl. 7, figs. 13a, b, 14.
1949 *Variamussium* sp. Donovan, p. 10, text-fig. 7.
1953 *Variamussium ignoratus* (Ravn). Donovan, p. 96.

A further example of this long-ranging species, briefly discussed recently by the writer, has been found in the *varians* zone of Borgøen. Some remarks may be added to the description already given.

The interpretation of the East Greenland material is rendered difficult by imperfect preservation. The shell appears to have been very thin. The fine radial ribs on the outer surface of the left valve are hollow, so that this radial ornament appears also on the internal mould of the valve. This is shown by the left valve figured in Plate 2, figure 7, and in text-figure 4. The fine radial ribs are sometimes at a slight angle to the stout, widely spaced internal ribs of the left valve, as shown in text-figure 4. The anterior ear of the left valve, which is larger than the

posterior, is covered by faint radial ornament. No ornament is visible on the posterior ear of any of the East Greenland specimens.

The right valve has fine concentric ribs, two or three to the millimetre, which appear as fine concentric grooves on the inner surface. The concentric ribs are shown in text-figure 4, which also shows the widely-spaced internal ribs which appear to be marked on the outer surface of the valve, although this may be an effect of preservation. The anterior ear of the right valve bears faint radial and concentric striations. The posterior ear is not known from East Greenland material.

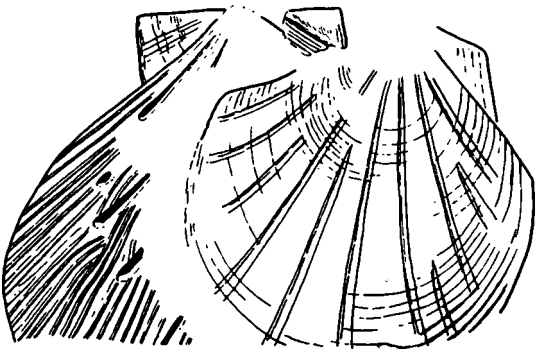


Fig. 4. *Variamussium ignoratum* (Ravn). Drawing, × 5, of an example from Bjørnedal, Traill Ø, age uncertain. The specimen is seen from the left-hand side, the valves having become displaced. The left valve, preserved as an internal mould, is on the left side of the figure and has been largely destroyed, but the ears are seen (the posterior one slightly displaced) and the anterior part of the mould shows the impressions of the fine radial ornament and of the strong internal ribs. The right valve is preserved as an external mould and shows the fine concentric ornament and traces of the radial internal ribs. The anterior ear only of this valve is preserved. Areas where the detail is obscure are left blank in the drawing.

The internal ribs show considerable variation in both valves. They never reach right to the umbo, but the distance from it at which they start varies from about 0.5 to 3 or 4 mm. In some individuals they extend to the margin of the shell, but in others may terminate as far as 3.5 mm from it (*e. g.* pl. 2, fig. 6). Occasional ribs are intercalated in the series at varying distances from the umbo, so that the total number present depends upon the size of the individual shell. The greatest number counted in the East Greenland material is 13, including intercalations, as in both the valves here figured. RAVN states that in the type material of *V. ignoratus* the number varies between 8 and 11, but in view of the variability and the tendency to increase by intercalation the writer does not feel justified in setting up a new variety or species on the basis of the limited material available.

The age of RAVN's material is unknown; there is no published evidence for Cretaceous rocks earlier than Coniacian in West Greenland.

A species with similar shell form and internal ribbing has recently been described as *Chlamys (Propeamussium) squamula* (Lamarck) var. *groenlandica* Hassan from the Paleogene of Kap Brewster, south of Scoresby Sund (HASSAN, 1953, p. 26, pl. B, fig. 11). It differs from the present species in having fine concentric ornament on the outer surface of the left valve. ROSENKRANZ has briefly recorded *Propeamussium* from the Palaeocene/Danian of West Greenland, but a specific identification is not given (ROSENKRANTZ, 1951, p. 156).

Geological horizon and locality: Cenomanian (*varians* zone) of Traill Ø and Borgøen. Albian of Geographical Society Ø.

Family **Lucinidae.**

Genus **Lucina** Bruguière, 1797, *s. l.*

"*Lucina*" *laminosa* (Reuss).

Pl. 3, figs. 2—4.

1844 *Venus laminosa* Reuss, p. 198.
1953 *Lucina laminosa* (Reuss). DONOVAN, p. 97.

For remarks on the synonymy of this species see DONOVAN 1953, pp. 97—98. The species and its synonyms, referred to *Venus* by REUSS, have been ascribed to the genus *Lucina* by subsequent workers. An examination of the hinge displayed by internal moulds from East Greenland does not confirm this attribution. Mr. R. CASEY, who has kindly examined the material, has pointed out that while the dentition definitely places the form in the Lucinidae, its characters are not those of *Lucina* itself. The species cannot be confidently placed in any known lucinoid genus and as the material does not permit a comprehensive study it is here recorded as "*Lucina*" with the qualification that it does not belong to that genus in the strict interpretation.

Geological horizon and locality: The species is the most abundant bivalve in the Upper Campanian beds of Traill and Geographical Society Øer.

"*Lucina*" *tenera* (J. de C. Sowerby).

Pl. 3, figs. 9, 10.

1836 *Venus? tenera* J. de C. Sowerby, p. 335, pl. 11, fig. 7.
1875 *Lucina tenera* (Sowerby). JUKES-BROWNE, p. 300, pl. 15, figs. 10—12.
1907 *Lucina tenera* (Sowerby). WOODS, p. 154, pl. 24, figs. 10—14.
1953 *Lucina* sp. indet. DONOVAN, p. 98.

The material from Traill Ø recorded recently by the writer as *Lucina* sp. indet. has now been supplemented by several further examples

from beds of the same age (*varians* zone) on Borgøen, the largest of the Brochs Øer in Foster Bugt, and the species is now definitely identified with *L. tenera*. The largest example is 1.8 cm long, larger than any of the English specimens figured by JUKES-BROWNE or by WOODS. A small and a medium-sized example are figured here. The species is found in the Albian of Britain, the highest occurrence being in the Upper Greensand of uppermost Albian age.

Geological horizon and locality: Cenomanian (*varians* zone) of Borgøen and southern Traill Ø.

Class *Scaphopoda*.

Family **Dentaliidae**.

Genus **Dentalium** Linnaeus, 1758, *s. l.*

Dentalium sp. indet.

A single scaphopod was found in the Upper Campanian beds on Geographical Society Ø. It is 2.9 cm long, slightly curved, and increases in diameter from approximately 0.5 mm to 3 mm. The surface of the shell is smooth.

Four species of *Dentalium* were recorded from West Greenland by RAVN (1918, pp. 354—356), two of which bear some resemblance to the present example. *D. pauperculum* Meek and Hayden is a small smooth species, the type of which was figured by MEEK (1876, pl. 18, fig. 14). The form recorded by RAVN as *D. (Laevidentalium)* sp. is larger and corresponds approximately with the East Greenland specimen in dimensions. Neither of these species is figured by RAVN from West Greenland material.

IV. NOTES ON THE FAUNAS

Cenomanian.

The full list of species recovered from the Cenomanian of Traill and Geographical Society Øer is now as follows:

Schloenbachia aff. *subplana* (Mantell)
S. subtuberculata (Sharpe)
S. subvarians Spath
S. cf. *varians* (J. Sowerby)
S. varians var. *tetrammata* (J. de C. Sowerby)
Schloenbachia spp.
Indeterminate baculitid
Mesogaudryceras cf. *leptonema* (Sharpe)
Phylloceras cf. *velledae* (Michelin)
Lytoceras sp. nov. cf. *vicinum* (H. Douvillé)
Inoceramus crippsi Mantell
I. pictus J. de C. Sowerby
"*Lucina*" *tenera* (J. de C. Sowerby)
Nucula pectinata J. Sowerby var. *cretae* Gardner
Nuculana? spp. indet.
Oxytoma pectinata (J. de C. Sowerby)
Variamussium ignoratum (Ravn)
"*Natica*" sp. indet.
"*Turbo*" sp. indet.

The commonest species in the Cenomanian, namely *Inoceramus crippsi* and various species of *Schloenbachia*, are identical with forms found in the Chalk of the British Isles and neighbouring countries, and this fact, together with the absence of *Schloenbachia* in North America, gives the Cenomanian fauna a European emphasis which is lacking in the later Cretaceous faunas of East Greenland. At present East Greenland seems to be the westernmost place where *Schloenbachia* occurs. It seems doubtful whether *Inoceramus crippsi* occurs in North America; species have been described (*I. comancheanus* Cragin and *I. bellevuensis* Reeside) which are allied to it and to *I. anglicus*, perhaps more closely, as far as ornament is concerned, to the latter species (Reeside, 1923).

The ammonite recorded as *Phylloceras* cf. *velledae* belongs to a group which had a wide distribution in the old and new worlds, so that

its presence in East Greenland is not surprising. The new species of *Lytoceras* found, on the contrary, does not agree with any well-known group, the nearest form which can be found for comparison being from the Albian of Africa.

The remaining species, so far as they can be determined specifically, have been attributed, with one exception, to European forms, but none of them are fully known from the material available and the attributions to familiar species are a matter of convenience. The exception is the species identified as *Variamussium ignoratum* (Ravn) whose presence in the fauna is a puzzle. It has not been recorded from the Cenomanian elsewhere, and is known only from the Upper Cretaceous (?Senonian) of West Greenland. Other possibly related species are much earlier or later, judging from published records.

The presence of the European ammonite *Schloenbachia* enables the age of the Cenomanian fauna in Traill and Geographical Society Øer to be determined more closely than for most of the Mesozoic faunas. The common species found in East Greenland, namely *S. subtuberculata* and *S. subvarians*, characterise the Lower Cenomanian or *varians* zone of Great Britain. *S. varians* itself is less common than the other species mentioned in both countries. An attempt has been made by SPATH (1926a, pp. 424—426) to provide a more detailed subdivision of the Cenomanian, but this is difficult of practical application, at least on the basis of *Schloenbachia* species. Mr. C. W. WRIGHT has suggested that the East Greenland fauna is likely to belong to the lower to middle part of the Lower Cenomanian.

Turonian.

The complete list of fossils known from the Turonian of East Greenland is:

Collignoniceras cf. *woolgari* (Mantell-Meek)
Scaphites sp. cf. *geinitzi* d'Orbigny
S. aff. *lamberti* (de Grossouvre)
S. aff. *morrowi* Jeletzky
Inoceramus lamarcki Parkinson
Lucina sp. indet.
Nucula whitfieldi Weller

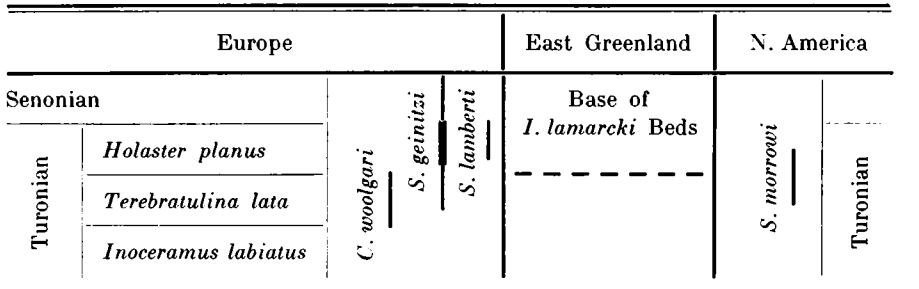
The ammonites belong to genera which were common to both the old and the new worlds at this time. *Collignoniceras woolgari* is a European species, recognized by MEEK from the United States, and SPATH, who recorded this species (1946, p. 11), referred his fragment to the American representative of the species. *Scaphites geinitzi* and *S. lamberti* are European species which both have close relations, if not identical representatives, in North America. SPATH (*loc. cit.*), in recording the latter species

and *Collignoniceras* cf. *woolgari*, remarked that "both species are known from localities in Canada and the U. S. A.", but SPATH's material, like the writer's, was poorly preserved, and it would be unwise to stress the American rather than the European affinities of these forms. *Scaphites morrowi* is a more convincing North American element, being known only from the United States.

Inoceramus lamarcki is a well-known European Turonian fossil, but very similar shells occur in North America, and there is little difference between, for instance, *I. undabundus* Meek and Hayden, as figured by MEEK (1876, pl. 3, fig. 2), and the var. *cuvieri* of PARKINSON's species. SCHLÜTER, in his paper on *Inoceramus* (1877), records *I. undabundus* as occurring in North Germany, and also notes the synonymy of the North American *I. umbonatus* Meek and Hayden with *I. involutus* J. de C. SOWERBY, a species of the same group as *I. lamarcki*. Although there are doubtless important points of difference as well as of similarity between the European and North American *Inocerami*, the relationship of the faunas, which is undoubtedly close, has been obscured by the different names under which American examples of European species have usually been recorded.

Nucula whitfieldi is known from New Jersey, in the south-eastern United States, where it occurs at a higher horizon (Senonian) than in East Greenland.

The age of the Turonian fauna can only be approximately determined. As regards correlation with European stratigraphy, *Collignoniceras woolgari* is recorded from the *Terebratulina lata* zone of Great Britain (WRIGHT and WRIGHT, 1951, p. 30); *Scaphites geinitzi* is common in the *Holaster planus* zone, but occurs rarely in the preceding *T. lata* zone and extends up into the Senonian; the Greenland form, in any case, is not identified positively with the European species. *Scaphites lamberti* is said by SPATH (1946, p. 11) to belong to the middle part of the Upper Turonian. In North America, *Scaphites morrowi* is closely related to *S. carlilensis* and occurs with it in the Blue Hill Shale of Kansas. The range of *S. carlilensis* is given by COBBAN and REESIDE (1952, tables 10a, b) as the third quarter of the Turonian stage.



The evidence is very slender but fairly consistent, and suggests a date at about the middle of the Turonian for the basal beds of the *Inoceramus lamarcki* Beds in the Rold Bjerge, Traill Ø, which carry *Scaphites* sp. cf. *geinitzi* and *S.* aff. *morrowi*. In Europe, *I. lamarcki* continues into the Lower Senonian, but its upper limit in East Greenland is unknown.

Upper Santonian — Lower Campanian.

In Traill and Geographical Society Øer the *Sphenoceramus* Beds yield the following species:

Inoceramus (Sphenoceramus) patootensis de Loriol
I. (S.) steenstrupi de Loriol
I. (Inoceramus) ?lamarcki Parkinson
Oxytoma tenuicostata (Römer)
Linuparus dülmensis (Geinitz)

The Knudshoved Beds of Hold with Hope carry (FREBOLD, 1934):

Inoceramus (Sphenoceramus) geltingi Frebold
I. (S.) teicherti Frebold
Oxytoma tenuicostata (Römer)
Pteria(?) aff. *pectinoides* Ravn

The dating of both these faunas, depending as it does on lamellibranchs, is not exact, and while the Knudshoved Beds fall within the same age range as the *Sphenoceramus* Beds the occurrence of a single species in both formations can hardly be taken to prove contemporaneity. *Sphenoceramus patootensis* and *S. steenstrupi* are widely distributed species which occur also in north-west Europe and West Greenland, and have close relations, at least, in western Canada (see DONOVAN, 1953, p. 95). FREBOLD points out that his two new species of *Sphenoceramus* are of the same group as *I. (S.) cardissoides* Goldfüss, and mentions other allied species. In view of the inadequacy of the East Greenland material studied by FREBOLD and by the writer, detailed comparisons are impossible. The subgenus *Sphenoceramus* had a wide distribution in the old and new worlds, and a considerable stratigraphical range in the Senonian. A large number of species have been named and the study of the group is made more difficult by the variability of individuals and the fact that large specimens are often incomplete.

Oxytoma tenuicostata occurs in Europe and West Greenland, but has not been recognized from North America. *Linuparus dülmensis* had, in the writer's view, a wide distribution both in Europe and America (DONOVAN, 1953, p. 125).

The two species of belemnite recently found in Geographical Society Ø, recorded here as *?Belemnitella* sp. indet. and *?Actinocamax verus* Miller, are likely to be of Upper Coniacian or Santonian age, but do not help with the dating of the other Upper Cretaceous faunas since they were associated only with a fragment of *Inoceramus* resembling *I. inconstans* or *I. lamarcki*, and cannot be definitely assigned to any of the known formations.

Inoceramus (Sphenoceramus) patootensis, *I. (S.) steenstrupi* and *Oxytoma tenuicostata* (recorded as *O. nebrascana*) occur at Pâtût, in West Greenland (RAVN, 1918, and ROSENKRANTZ, 1942, p. 41). Recently ROSENKRANTZ has recorded also baculitids and scaphitids from these Upper Santonian-Lower Campanian beds of West Greenland (1951, p. 156) but details have not yet been published. Until identifications of these fossils are known none of the formations with *Sphenoceramus*, in West or East Greenland, can be dated more closely than Upper Santonian or Lower Campanian.

Upper Campanian.

The total fauna known from the Upper Campanian of East Greenland (Traill and Geographical Society Øer) is as follows:

Scaphites greenlandicus Donovan
S. greenlandicus var.?
S. quadrangularis Meek & Hayden
Dentalium sp. indet.
"*Lucina*" *laminosa* (Reuss)
Nucula cancellata Meek and Hayden
Nuculana? panda (Nilsson)
?*Tellina steenstrupi* de Loriol.
3 lamellibranch spp. indet.

The fauna is not extensive enough for significant comparisons to be made with other areas. That the species named above do not represent the total number living in Upper Campanian times is shown by the recovery of three species of unidentifiable lamellibranchs, but so far conditions do not seem to be promising for the completion of the faunal list, for the known occurrences of beds of this age are all in screes and no exposures of the fossiliferous strata have been found. A few areas in Geographical Society Ø have not yet been examined, but conditions there suggest that even if further localities were discovered they might well be equally disappointing.

Scaphites greenlandicus occurs also in West Greenland, and identical or closely similar forms in north-west Europe. It has not been figured

from America, but allied species certainly occur there. *S. quadrangularis* is, however, a species described from Dakota and Montana in the northern United States which has not been recorded from West Greenland.

Comparison of the remaining fauna with West Greenland is not profitable on account of the fact that the exact stratigraphical positions of the majority of the fifty-odd species recognized by RAVN (1918) are unknown. A mere inspection of his table (*op. cit.* pp. 328—29) shows that more than one horizon is represented. ROSENKRANTZ (1942, p. 39) declared that a large part of the fauna described by RAVN as Cretaceous is in reality Palaeocene, and in 1951 (p. 156) he gave a list of the Upper Cretaceous and Palaeocene horizons recognized from West Greenland. Here the only fossil listed under "Upper Campanian" is "*Acanthoscaphites roemeri*" (= *Scaphites greenlandicus* of the present writer); ROSENKRANTZ had remarked in 1942 (p. 41) that this fauna had a "purely European character", but he does not say whether this statement was based only on the *Scaphites*, or on associated fossils as well. As far as the East Greenland assemblage is concerned, it would be unwise to stress the European more than the North American elements, and the difference between the Upper Senonian faunas of the two continents may not be so great as appears from a casual examination of lists of species, as there seems to have been a tendency to propose new trivial names for American forms without an exhaustive check for possible identity with European species.

Scaphites quadrangularis[1]) occurs in the Upper Campanian of North America (COBBAN and REESIDE, 1952, chart 10b). Specimens believed to represent *S. greenlandicus*, and certainly its near relation *S. roemeri*, are found in the Upper Campanian of Europe. The age of the East Greenland fauna is therefore well established.

General Remarks.

All the fossil assemblages from the Upper Cretaceous of East Greenland are poor in species. The lists given here are undoubtedly incomplete, and further collecting would probably add a few more species, but even so the total would not be impressive. For the greater part of their thicknesses the Upper Cretaceous formations are completely barren, and when fossiliferous horizons occur they seldom carry more than one or two species in any abundance. The small number of species known,

[1]) This species was previously recorded by the writer (1953, p. 124) in the form in which it was originally published, namely *Scaphites nodosus* Owen var. *quadrangularis* Meek and Hayden. The writer now follows more recent American practice in regarding MEEK and HAYDEN's variety as a distinct species.

coupled with the generally defective preservation of the material, do not permit extensive remarks on the affinities of the faunas. European and American species are about equally represented, so that the area is intermediate between the two continents, rather than closely allied to either, in its faunal characters. Comparison with faunas from the Old and New Worlds is also made more difficult by the fact that in many cases new species seem to have been named without full investigation of the possibility of their being already known on the other side of the Atlantic, and many similarities between European and American faunas are, in fact, obscured by the different nomenclature.

ALPHABETICAL INDEX OF SPECIES

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Færdig fra trykkeriet den 29. maj 1954.

PLATES

Plate 1.

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Figs. 1a, b, 2a, b. *Schloenbachia* aff. *subvarians* Spath. Cenomanian, *varians* zone, northern end of Tværdal, Geographical Society Ø 11

Figs. 3a, b. *Schloenbachia subtuberculata* (Sharpe). Same horizon and locality as figs. 1 and 2 9

Fig. 4. *Schloenbachia* aff. *subtuberculata* (Sharpe). Same horizon and locality as figs. 1 and 2 9

Fig. 5. *Schloenbachia* sp. Same horizon and locality as figs. 1 and 2 12

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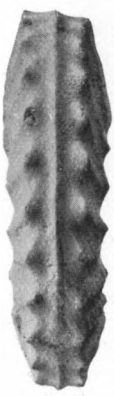
Fig. 8. *Schloenbachia subtuberculata* (?) (Sharpe). Same horizon and locality as figs. 1 and 2 10

All the figures on this plate are natural size.



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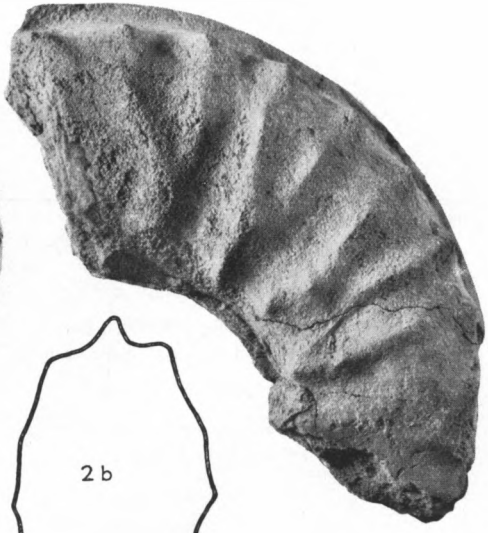

2a

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3a

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7a

7b

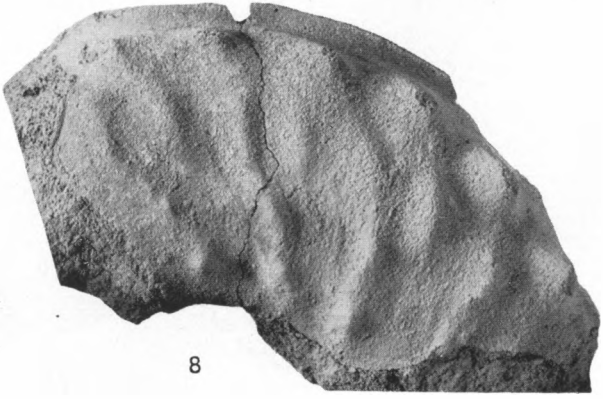

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Plate 2.

The figures are natural size except where otherwise stated.

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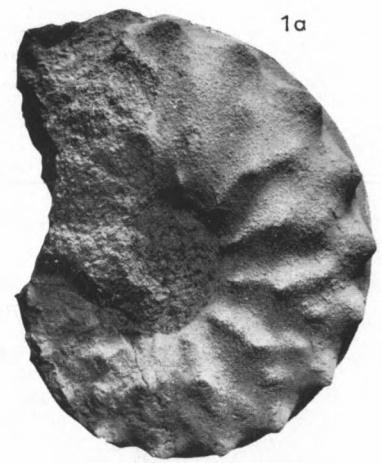

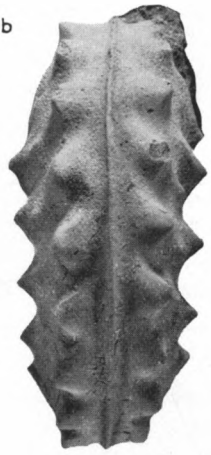

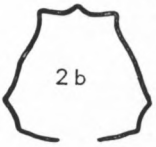

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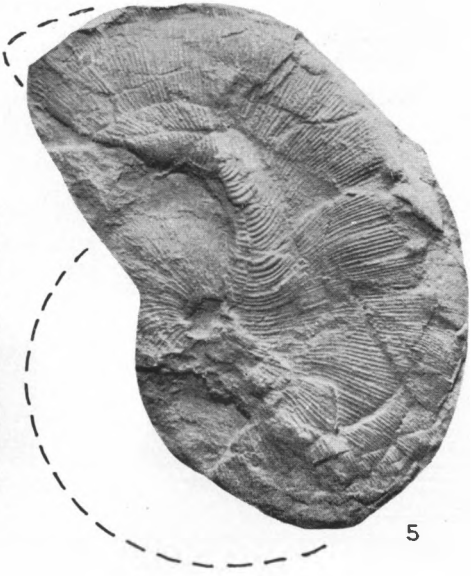

Plate 3.

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Fig. 1. *Inoceramus (Inoceramus) crippsi* Mantell. Left valve. Cenomanian, south coast of Geographical Society Ø, 4 km E.N.E. of Kap Hovgaard 17

Fig. 2. "*Lucina*" *laminosa* (Reuss). Impression from external mould of left valve, × 1.5. Upper Campanian, locality 58, Maanedal, Traill Ø 21

Fig. 3. "*Lucina*" *laminosa* (Reuss). Right valve, ×1.5. Upper Campanian, eastern flank of Laplace Bjerg, Geographical Society Ø 21

Fig. 4. "*Lucina*" *laminosa* (Reuss). Impression from external mould of right valve, × 3. Same horizon and locality as fig. 2 21

Fig. 5. *Inoceramus (Inoceramus) pictus* J. de C. Sowerby. Part of a crushed ?left valve. Cenomanian near Kap MacClintock, Geographical Society Ø 17

Fig. 6. *Inoceramus (Inoceramus) pictus* J. de C. Sowerby. Fragment of umbonal part of valve. Same horizon and locality as fig. 5 17

Fig. 7. *Inoceramus (Sphenoceramus) patootensis* de Loriol. Impression from external mould of part of right valve. Upper Santonian or Lower Campanian, southern end of the island in Vega Sund 5.5 km west of Kap Hovgaard 18

Fig. 8. *Inoceramus (Sphenoceramus) patootensis* de Loriol. Impression from external mould of left valve. Upper Santonian or Lower Campanian, from the eastern side, below the summit, of the peak 6 km due west of Freycinet Bjerg .. 18

Fig. 9. "*Lucina*" *tenera* (J. de C. Sowerby). Right valve, ×1.5. Cenomanian, *varians* zone, locality 2, near Bjørnedal, Traill Ø 21

Fig. 10. "*Lucina*" *tenera* (J. de C. Sowerby). Right valve, ×1.5. Cenomanian, *varians* zone, Borgøen 21

Fig. 11. *Oxytoma pectinata* (J. de C. Sowerby). Left valve. The outer, ornamented layer of the shell is missing from the specimen. Cenomanian, *varians* zone, northern end of Tværdal, Geographical Society Ø..... 16

Figs. 12a, b. *Nuculana? panda* (Nilsson). Internal mould of left valve. Fig. 12a. Natural size, fig. 12b, × 3. Upper Campanian, eastern flank of Laplace Bjerg, Geographical Society Ø 15

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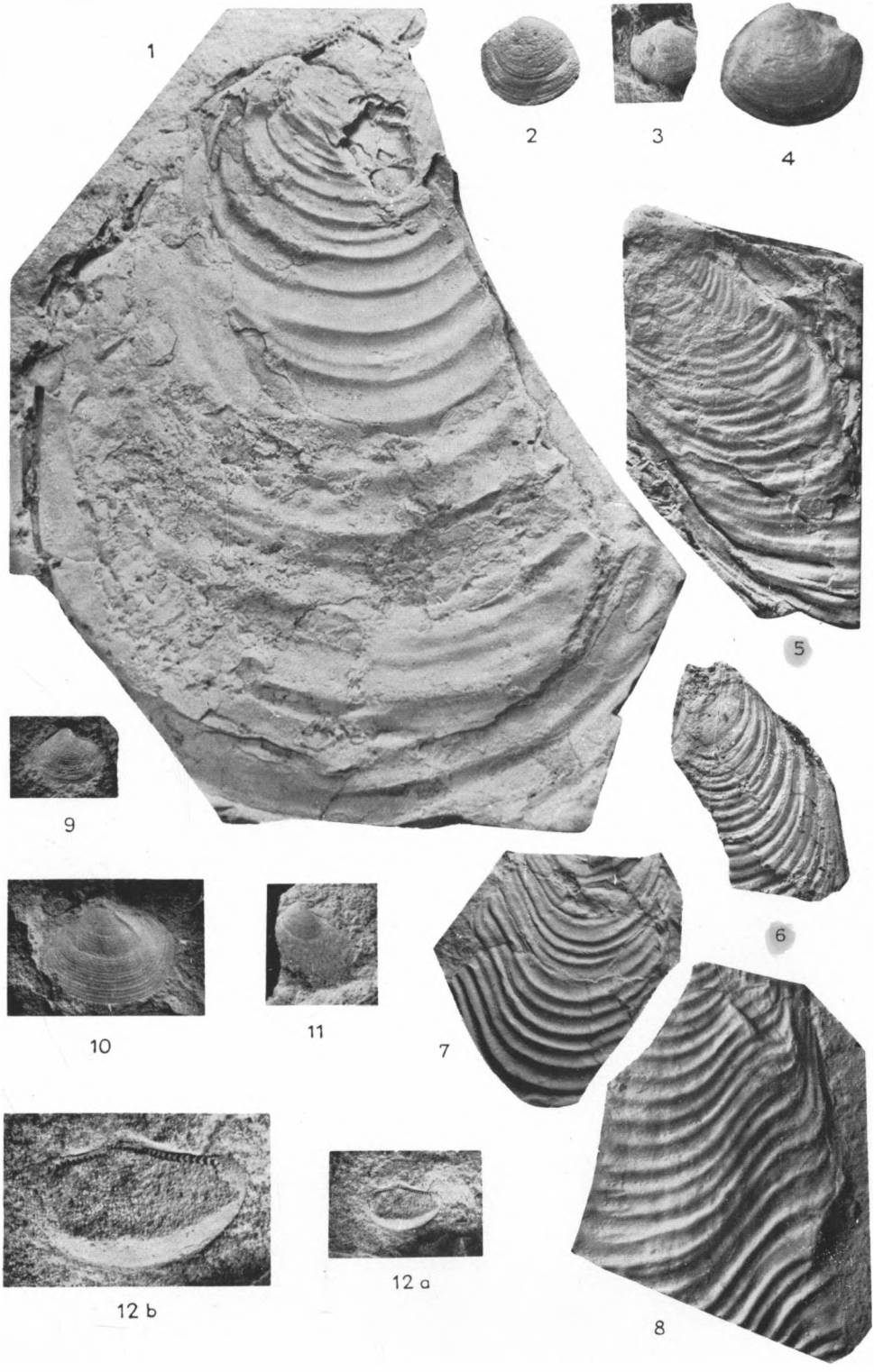
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