FALKLAND ISLANDS DEPENDENCIES SURVEY

SCIENTIFIC REPORTS

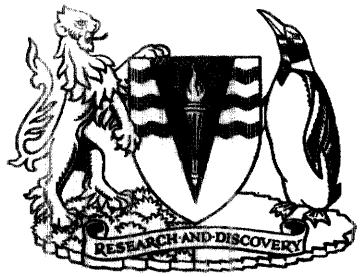
No. 21

UPPER JURASSIC AND CRETACEOUS AMMONITE FAUNAS OF ALEXANDER LAND AND GRAHAM LAND

By

M. K. HOWARTH, B.Sc. Ph.D.

Department of Palaeontology
British Museum (Natural History)



LONDON: PUBLISHED FOR THE COLONIAL OFFICE
BY HER MAJESTY'S STATIONERY OFFICE: 1958

UPPER JURASSIC AND CRETACEOUS AMMONITE FAUNAS OF ALEXANDER LAND AND GRAHAM LAND

By M. K. HOWARTH, B.Sc., Ph.D.

Department of Palaeontology
British Museum (Natural History)

(Manuscript received 2nd May, 1957)

ABSTRACT

Of thirty ammonites collected in Alexander Land, nine are comparable with the Lower Kimeridgian species *Perisphinctes (Orthosphinctes) transatlanticus* (Steinmann), while the remainder belong to the Aptian species *Sanmartinoceras patagonicum* Bonarelli, *Ancyloceras patagonicum* Stolley and *Silesites trajani* (Tietze).

Seventy ammonites collected from the James Ross Island group, north-east Graham Land, consist mainly of Kossmaticeratidae, notably *Maorites tuberculatus* sp. nov., and the Pachydiscid species *Eupachydiscus grossouvrei* (Kossmat). Although no stratigraphical information is available, by correlating with the same genera which have been collected bed by bed in western Madagascar, it can be shown that the whole of the Upper Cretaceous ammonite fauna known in West Antarctica (including that described in F.I.D.S. Scientific Report No. 3) is of Lower to Middle Campanian age.

CONTENTS

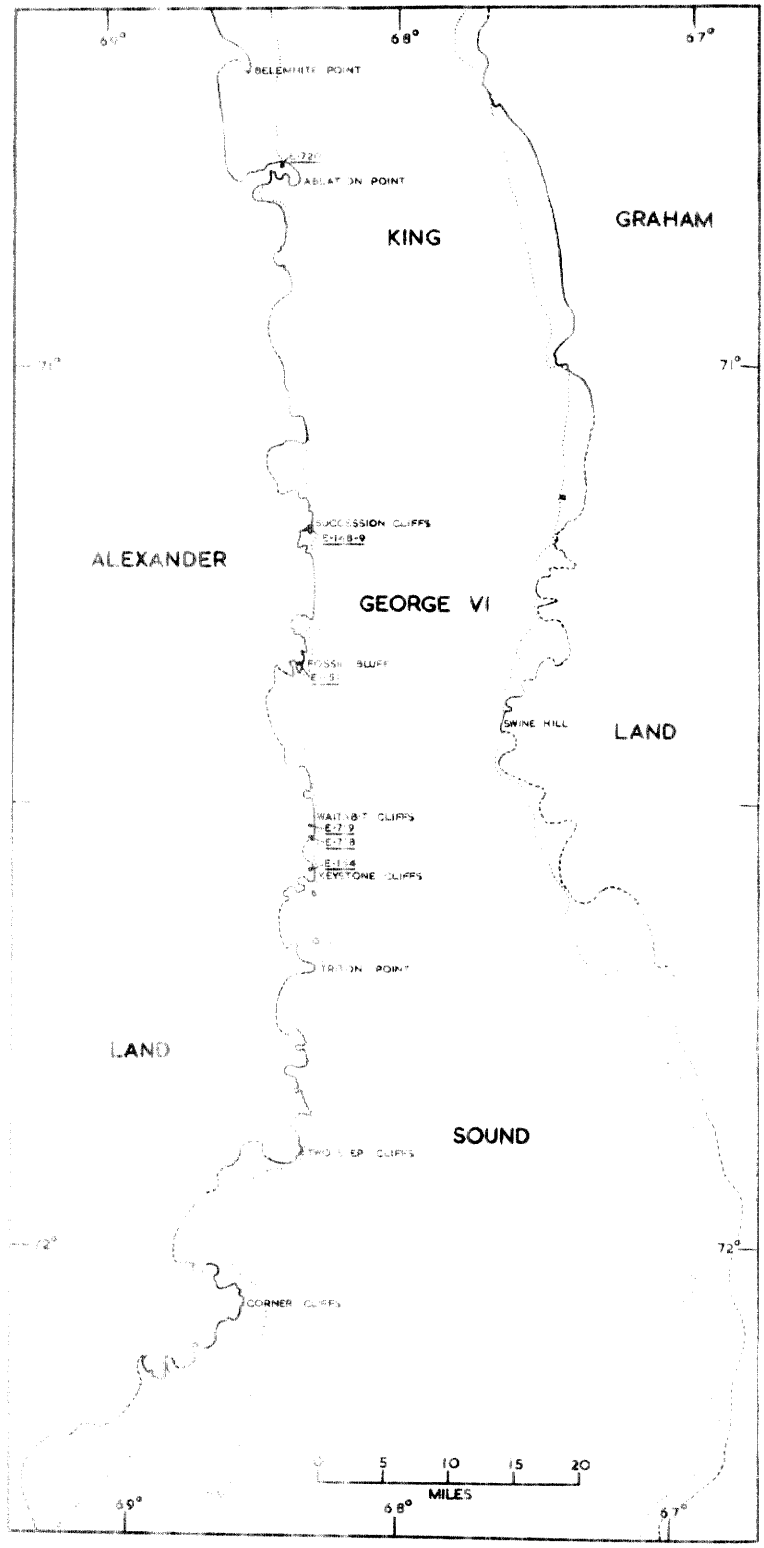


FIGURE 1
Sketch map of Alexander Land showing the positions of stations from which Upper Jurassic and Lower Cretaceous ammonites have been collected.

PART I. UPPER JURASSIC AND LOWER CRETACEOUS AMMONITES OF ALEXANDER LAND

INTRODUCTION

THIS report deals with part of the collection of fossils made by Dr. V. E. Fuchs and Dr. R. J. Adie in the eastern part of Alexander Land in 1948 and 1949. The Gastropoda, Lamellibranchia and Annelida in this collection have already been described by Dr. L. R. Cox in F.I.D.S. Scientific Report No. 4; his account also contains a sketch map of Alexander Land showing the localities of all the collecting stations (Cox, 1953, p. 2). Thirty ammonites were collected from eight localities, and amongst them are the first Aptian forms found in Antarctica and some Upper Jurassic forms hitherto known from this continent only by the single example from James Ross Island described by Spath (1953, p. 3; pl. 12, fig. 5). I am indebted to Mr. R. Casey and Dr. J. Callomon for several criticisms and suggestions.

A. LIST OF LOCALITIES AND SPECIES

FIG. 1 shows the respective positions of the collecting stations in Alexander Land.

E.148 Southern end of Succession Cliffs. Lat. 71°11.5′ S., long. 68°18.5′ W.
Ancyloceras cf. *patagonicum* Stolley (C.49044) *

E.149 Southern end of Succession Cliffs, half a mile north of E.148 (from the same beds as at E.148). Lat. 71°11.5′ S., long. 68°18.5′ W.
Ancyloceras patagonicum Stolley (C.49045–46, 49048).
Silesites cf. *trajani* (Tietze) (C.49047).

E.151 Southern end of Fossil Bluff, near the top of the sedimentary succession. Lat. 71°21′ S., long. 68°21′ W.
Phylloceras sp. indet. (C.49049).
? *Georgioceras* sp. indet. (C.49050).

E.154 North-east face of Keystone Cliffs. Lat. 71°34.5′ S., long. 68°18.5′ W.
? *Silesites* sp. indet. (C.49051).

E.718 Southern end of Waitabit Cliffs. Lat. 71°33′ S., long. 68°18.5′ W.
Ancyloceras cf. *patagonicum* Stolley (C.49052–54).

E.719 Central part of Waitabit Cliffs (from the same beds as at E.718). Lat. 71°32′ S., long. 68°18.5′ W.
Sanmartinoceras patagonicum Bonarelli (C.49055–59).

E.720 Northern face of Ablation Point. Lat. 70°47′ S., long. 68°24.5′ W.
Perisphinctes (*Orthosphinctes*) cf. *transatlanticus* (Steinmann) (C.49035–43).

B. THE UPPER JURASSIC FAUNA

AT station E.720 nine fragmentary specimens of *Perisphinctes* (*Orthosphinctes*) cf. *transatlanticus* (Steinmann) were found. The two best-preserved specimens (Plate I, figs. 1–2) greatly resemble Steinmann's species (1881, p. 279; pl. 13, fig. 1), which occurs in the Lower Kimeridgian zone of *Streblites tenuilobatus* at Caracoles near the frontiers of Bolivia, Argentina and Chile (for correlation see Arkell, 1956, p. 583). Widely spaced, deep constrictions can be seen on both specimens, and these are characteristic of *Orthosphinctes* rather than the very closely related subgenus *Dichotomoceras*; both subgenera occur in the Upper Oxfordian and Lower Kimeridgian.

* All the specimens described in this report have been deposited in the collections of the British Museum (Nat. Hist.). The numbers given in brackets throughout the text are the registered catalogue numbers of the British Museum (Nat. Hist.).

Several lamellibranchs found at this locality are undoubtedly of Aptian age, but the section is complicated by a series of thrusts, so that Cox's conclusion (1953, p. 5) that both Aptian and Jurassic rocks are present can be confirmed. The most accurate date that can be given to the Jurassic rocks is **Bimammatum to Tenuilobatus Zones of the Upper Oxfordian–Lower Kimeridgian.**

C. THE LOWER CRETACEOUS FAUNA

Of eighteen ammonites collected from five localities those of greatest interest are six specimens of the Upper Aptian genus *Sanmartinoceras* which are described fully below. All the remainder are fragmentary and poorly preserved, consisting of an indeterminate *Phylloceras*, a fragment with small tubercules and ribbing bundled at the umbilical edge (Plate I, fig. 3) which probably belongs to the South Georgian Upper Aptian genus *Georgioceras* Wilckens (1947, p. 21), eight fragments of *Ancyloceras patagonicum* Stolley and two *Silesites*. The best *Ancyloceras patagonicum* is figured in Plate I, fig. 4, and, although perhaps a little more densely ribbed, it compares well with Stolley's holotype (1912, pl. 1, fig. 3) which came from the Aptian of the San Martin Lake area of Patagonia. The ? *Silesites* sp. indet. from station E.154 is a 15 mm. diameter crushed nucleus, but the specimen from station E.149 is larger and better preserved and is figured in Plate I, fig. 5. The best specific match is with *Silesites trajani* (Tietze, 1872, p. 140; pl. 9, fig. 1) which is from the Aptian of Swinitza, at the western end of the Transylvanian Alps; other species of *Silesites* occur in the Barremian (Upper Neocomian). Thus the whole of the Lower Cretaceous fauna can be dated as **Aptian**, and the *Sanmartinoceras* part as **Upper Aptian.**

D. SPECIFIC DESCRIPTIONS

Family Oppeliidae Bonarelli, 1894

Subfamily Aconeceratinae Spath, 1923

The morphology, systematic position and distribution of this subfamily have recently been reviewed by Casey (1954, pp. 267–9). In view of the striking resemblance of the Aconeceratinae to the Oppeliidae and the presence of acknowledged survivors of the latter family in the Valanginian and Hauterivian it is now held that this Hauterivian to Middle Albian subfamily should be included in the Oppeliidae. Of the five Aconeceratinid genera, *Protaconeceras* Casey, 1954, *Aconeceras* Hyatt, 1903, *Gyaloceras* Whitehouse, 1927, and *Falciferella* Casey, 1954, have smooth tests ornamented by striae or very feeble ribs only. Ribbed forms are referred to *Sanmartinoceras* s.s. Bonarelli, 1921, and its subgenus *Theganeceras* Whitehouse, 1926; the latter differs from *Sanmartinoceras* s.s. in being a little more closely ribbed, and it is known from seven German specimens figured by Koenen (1902) and one English specimen described by Casey (1954). Although there are only twenty described or figured specimens (including the six described here) of *Sanmartinoceras* s.s. these have a very wide distribution in Australia, Alexander Land, South Georgia, Patagonia, Greenland and ? Britain.

Genus *Sanmartinoceras* Bonarelli, 1921

Type species: *S. patagonicum* Bonarelli

The following species have been described:

1. *S. fontinale* (Hudleston, 1890, p. 241; pl. 9, fig. 1).
2. *S. groenlandicum* Rosenkrantz, 1934, p. 20; pl. 4, fig. 3; pl. 5, figs. 1–5.
3. *S. olene* (Tenison-Woods, 1883, p. 150; pl. 7, fig. 8; pl. 8, fig. 1). Neotype figured Whitehouse, 1927, pl. 17, fig. 6.
4. *S. patagonicum* Bonarelli, 1921, p. 27; pl. 5, figs. 3–5.

(a) *S. fontinale* and *S. olene* are two closely related forms in the Upper Aptian of Queensland and South Australia. Eight specimens are known. Because of the large difference in size of the two type specimens

direct comparison is not possible, but it is doubtful whether the two are specifically distinct. Both differ from *S. patagonicum* in that the ribbing commences at 20 mm. diameter and the ventral half of each rib is curved forwards more strongly (see Whitehouse, 1927, pp. 115–18).

(b) *S. patagonicum* is known from three specimens from the San Martin Lake area of Patagonia, where they are associated with the Aptian ammonite *Ancyloceras patagonicum* Stolley. Although the ornament details of the San Martin specimens are not so well preserved as in the Alexander Land examples described below, the latter do not differ in any way from Bonarelli's figures of *S. patagonicum* and therefore they are referred to that species. A fragmentary specimen from the Upper Aptian of South Georgia has been described and compared with this species by Wilckens (1947, p. 28; pl. 3, fig. 6).

(c) *S. groenlandicum* is represented by a single specimen in the Upper Aptian of East Greenland. This differs from *S. patagonicum* in that it is ribbed from an earlier stage (22 mm. diameter), and from *S. fontinale* and *S. olene* in the greater backward projection of the ventral parts of its ribs.

(d) The two species "*Oppelia*" *haugi* Sarasin (1893, p. 156; pls. 4–6, fig. 11), described from one specimen from the Aptian of France, and "*Ammonites*" *trautscholdi* Sinzow (1870, p. 118; holotype figured Trautschold, 1865, p. 22; pl. 3, fig. 17), described from one specimen from the Aptian at Simbirsk, Russia, have been referred to *Sanmartinoceras* by several authors. But they show neither the high serrated keel nor ribs differentiated into strong backwardly projected ventral halves and dorsal striae which are characteristic of *Sanmartinoceras*. Their sickle-shaped striae and low smooth keels are typical of *Aconeceras* in which genus both are best included.

Sanmartinoceras patagonicum Bonarelli

Plate I, figs. 6–10.

Sanmartinoceras patagonicum Bonarelli, 1921, p. 27; pl. 5, figs. 3–5.
Sanmartinoceras cf. *patagonicum* Bonarelli, Wilckens, 1947, p. 28; pl. 3, fig. 6.
Sanmartinoceras patagonicum Bonarelli and Nágera, Spath, 1953, p. 3.

Description: The six Alexander Land specimens are all external moulds with details of the ornament well preserved in places, but no suture-lines are visible.

The shell is involute, the best preserved specimen (Plate I, fig. 9) having the following dimensions: Diameter 60 mm., whorl height 29 mm. (0.48), umbilical width 10 mm. (0.17).

Early whorls are smooth with growth line striae only. Ribs commence in four of the specimens at 42, 40, 35 and approximately 35 mm. diameter respectively; the fifth is not yet ribbed at its maximum diameter of 31 mm. and the sixth is a nucleus only.

The ornament is divided into two parts bounded by a shallow spiral groove which runs along the mid-line of the side of the whorl. Dorsal to the groove the test is covered with fine striae, no larger than the growth line striae of earlier whorls, which curve gently forwards from the umbilicus to the mid-line. At the groove the striae turn sharply backwards through approximately 90° and continue backwards across the ventral half of the whorl with a slight curve concave towards the front. Just before reaching the venter the striae curve strongly forwards and pass on to the sides of the keel tangentially. Between the spiral groove and the venter large ribs or undulations are superimposed on the striae, following the same line. Both ribs and sulci between are rounded, and the maximum width of each rib occurs just before it turns slightly towards the front, joins the venter and dies out. The high keel has striae on its sides and a finely serrated top. At the mouth border a lappet is developed along the line of the spiral groove, but in none of the specimens is a rostrum preserved.

Remarks: The lappets and serrations of the keel cannot be seen on the more poorly preserved originals of *S. patagonicum* from Patagonia, but in all visible characters the Patagonian and Antarctic specimens do not differ. These two characters together with a long rostrum are well developed in the single Greenland specimen of *S. groenlandicum*. The line followed by the striae (see Plate I, fig. 9b) is of a similar shape to that in *S. groenlandicum* (Rosenkrantz, 1934, pl. 5, fig. 5) and by comparing these with the shape of the striae in *S. fontinale* and *S. olene* (Rosenkrantz, 1934, pl. 5, figs. 7–9) it will be seen that in both the latter species the angle at the spiral groove is considerably less than a right angle, and that the ventral halves are curved more evenly towards the front.

Although no suture-lines are visible the mode of preservation suggests that the last suture-line occurs at approximately the end of the smooth whorls, and the ribs are therefore a feature of the adult body chamber only. The keel is serrated at all stages of growth.

Locality: Station E.719: central part of Waitabit Cliffs. Lat. 71°32′ S., long. 68°18.5′ W., Alexander Land. Upper Aptian.

REFERENCES

ARKELL, W. J. 1956. *Jurassic Geology of the World*, 806 pp. Oliver & Boyd, Edinburgh and London.

BONARELLI, G. 1921. *In* Bonarelli, G. *and* J. J. Nágera: Observaciones geologicas en las inmediaciones del Lago San Martín (Territorio de Santa Cruz). *Minist. Agric., Direcc. Gen. Minas, Buenos Aires*, Bol. No. 27 (Ser. B, Geol.), 39 pp., 5 pls.

CASEY, R. 1954. *Falciferella*, a new genus of Gault Ammonites, with a review of the family Aconeceratidae in the British Cretaceous. *Proc. Geol. Ass., Lond.*, **65**, 262–77.

COX, L. R. 1953. Lower Cretaceous Gastropoda, Lamellibranchia and Annelida from Alexander I Land (Falkland Islands Dependencies). *Falkland Islands Dependencies Survey Scientific Reports*, No. 4, 14 pp., 2 pls.

HUDLESTON, W. H. 1890. Further Notes on Some Mollusca from South Australia. *Geol. Mag.*, (3) **7**, 241–6.

KOENEN, A. von. 1902. Die Ammonitiden des Norddeutschen Neocom. *Abh. preuss. geol. Landesanst.* (N.F.) **24**, 451 pp., 55 pls.

ROSENKRANTZ, A. 1934. *In* Bøgvad, R. *and* A. Rosenkrantz: Beiträge zur Kenntnis der unteren Kreide Ostgrönlands. *Medd. Grønland*, **93** (1), 17–28.

SARASIN, C. 1893. Étude sur les *Oppelia* du groupe du *nisus* et les *Sonneratia* du groupe du *bicurvatus* et du *raresulcatus*. *Bull. Soc. géol. Fr.*, (3) **21**, 149–64, pls. 4–6.

SINZOW, I. 1870. Geologischer Abriss des Saratovschen Gouvernements. *Ver. Russ.-Kais. Min. Ges. St.-Petersburg* (now *Mém. Soc. russe Miner.*), (2) **5**, 105–22 (in Russian).

SPATH, L. F. 1953. The Upper Cretaceous Cephalopod Fauna of Graham Land. *Falkland Islands Dependencies Survey Scientific Reports*, No. 3, 60 pp., 13 pls.

STEINMANN, G. 1881. Zur Kenntnis der Jura- und Kreideformation von Caracoles (Bolivia). *Neues Jb. Miner. Mh.*, Abt. B, 1, 239–301.

STOLLEY, E. 1912. Über einige Cephalopoden aus der unteren Kreide Patagoniens. *Ark. Zool.*, **7** (23), 18 pp., 1 pl.

TENISON-WOODS, J. E. 1883. On some Mesozoic Fossils from the Palmer River, Queensland. *J. roy. Soc. N.S.W.*, **16**, 147–54, pls., 7–9.

TIETZE, E. 1872. Geologische und paläontologische Mittheilungen aus dem südlichen Theil des Banater Gebirgsstockes. *Jb. geol. Reichsanst. (Bundesanst.), Wien*, **22**, 35–142.

TRAUTSCHOLD, H. 1865. Der Inoceramen-Thon von Ssimbirsk. *Bull. Soc. Nat. Moscou*, **38**, 1–24, pls. 1–3.

WHITEHOUSE, F. W. 1927. Additions to the Cretaceous Ammonite Fauna of Eastern Australia. Part I (Simbirskitidae, Aconeceratidae and Parahoplitidae). *Mem. Qd Mus.*, **9** (1), 109–20, pls. 16–17.

WILCKENS, O. 1947. Paläontologische und geologische Ergebnisse der Reise von Kohl-Larsen (1928–29) nach Süd-Georgien. *Abh. senckenb. naturf. Ges.*, **474**, 66 pp., 9 pls.

PART II. UPPER CRETACEOUS AMMONITES OF NORTH-EAST GRAHAM LAND

INTRODUCTION

THIS report deals with part of two collections from north-east Graham Land made in recent years by members of the Falkland Islands Dependencies Survey; the first was made by Mr. R. Stoneley in 1952, and the second by Mr. A. J. Standring in 1953–4. Both collections contain several forms that were not represented in the fauna described by the late Dr. L. F. Spath in F.I.D.S. Scientific Report No. 3. Thus there are

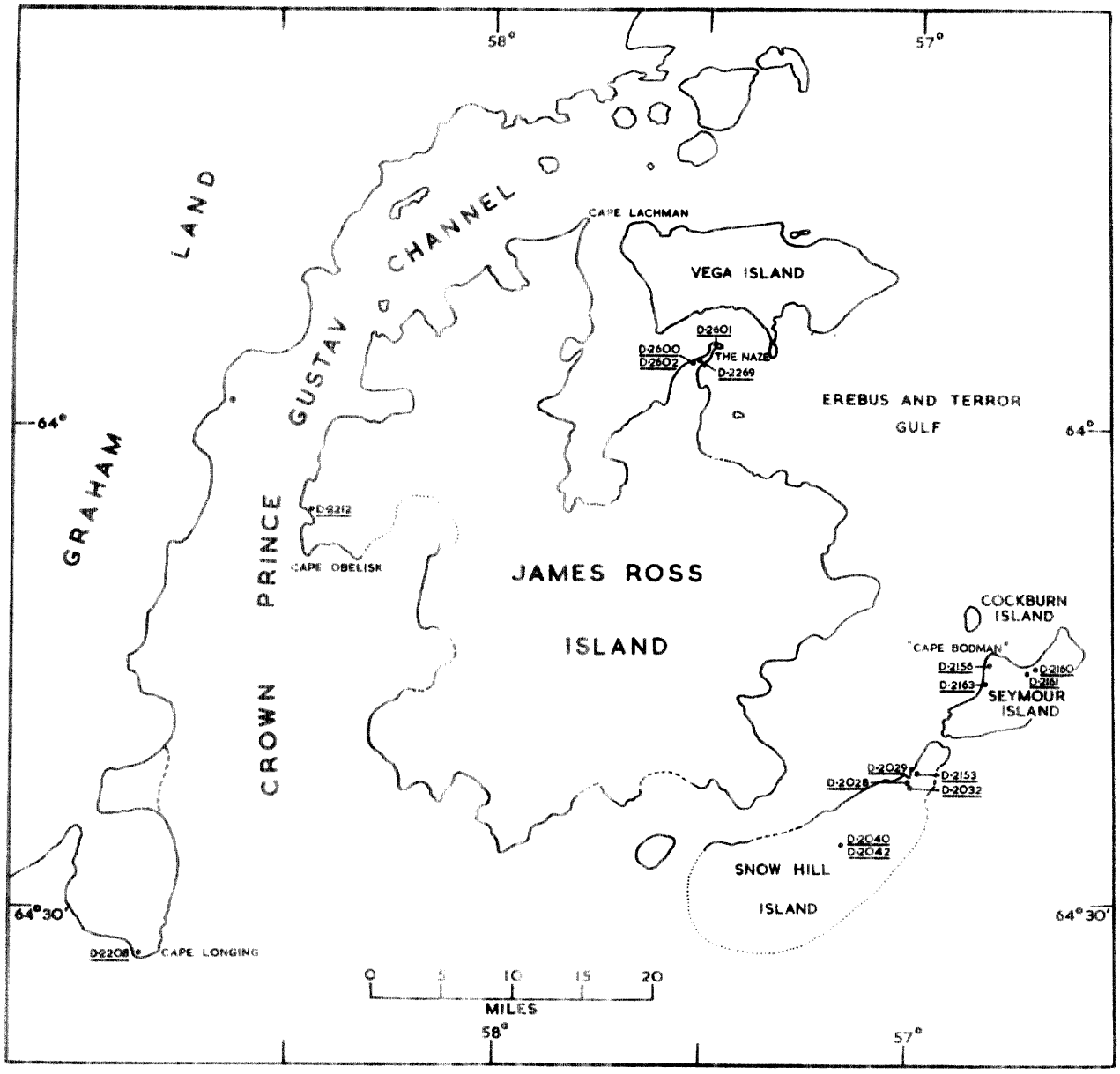


FIGURE 2

Sketch map of north-east Graham Land and James Ross Island showing the positions of stations from which Upper Cretaceous ammonites have been collected.

many examples of a new species of *Maorites* and some of the finest *Jacobites* yet found in Antarctica, as well as the usual multitude of *Gunnarites*. There are also the first recognizable inflated Pachydiscids of the genus *Eupachydiscus* to be found in Antarctica and a very well preserved example of the Tetragonitid subgenus *Saghalinites*. Stratigraphical information concerning the James Ross Island group ammonites, on the absence of which recent workers like Collignon and Matsumoto have commented, is unfortunately not yet available. However, recent accurate collecting in Madagascar has enabled the Antarctic assemblages to be dated more precisely by means of both their Kossmaticeratidae and Pachydiscidae. A new map showing all the ammonite localities of James Ross Island and the neighbouring islands is given in Fig. 2. I am indebted to Mr. C. W. Wright for several criticisms and suggestions.

A. LIST OF LOCALITIES AND SPECIES

Snow Hill Island

D.2028 Nodules in sandstone; shoulder of valley immediately south-west of Nordenskjöld's hut (300 ft. a.s.l.). Lat. 64°22′ S., long. 57°00′ W.
Gunnarites antarcticus (Weller) (C.49104–16).
Jacobites anderssoni (Kilian and Reboul) (C.49090–94).

D.2029 Foot of low cliff about half a mile north-east of Nordenskjöld's hut; same beds as D.2028. Lat. 64°21.6′ S., long. 56°59.5′ W.
Gunnarites antarcticus (Weller) (C.49117–20).

D.2032 Prominent crag 100 ft. above D.2028. Lat. 64°22′ S., long. 57°00′ W.
Gunnarites antarcticus (Weller) (C.49121).

D.2040 Foot of easternmost of larger buttresses. "Middle Nunatak". Lat. 64°27′ S., long. 57°10′ W.
Tetragonites (*Saghalinites*) *cala* (Forbes) (C.49063).
Gunnarites antarcticus (Weller) (C.49122).

D.2042 Lowest point on western half of "Middle Nunatak". Lat. 64°27′ S., long. 57°10′ W.
Gunnarites antarcticus (Weller) (C.49123–25).

D.2153 Valley about half a mile north-east of Nordenskjöld's hut. Lat. 64°22′ S., long. 56°59′ W.
Gunnarites antarcticus (Weller) (C.49095–101).
Jacobites crofti Spath (C.49088).
J. anderssoni (Kilian and Reboul) (C.49089).

Seymour Island

D.2156 Clays with nodules; low knoll on south side of valley 0.8 miles south of "Cape Bodman". Lat. 64°15′ S., long. 56°48′ W.
Maorites tuberculatus sp. nov. (C.49067)

D.2160 South-west corner of flat area at west end of Cross Valley. Lat. 64°15.3′ S., long. 56°42.5′ W.
Grossouvrites gemmatus (Huppé) (C.49086), not *in situ*.

D.2161 0.4 miles south-west of D.2160 on south-west slopes of Cross Valley. Lat. 64°15.6′ S., long. 56°43′W.
Grossouvrites gemmatus (Huppé) (C.49087).

D.2163 Small hillock 100 yds. inland from coast, 2.2 miles south-south-west of "Cape Bodman". Lat. 64°16.4′ S., long. 56°49′ W.
Maorites tuberculatus sp. nov. (C.49068–84).

Graham Land Mainland

D.2208 Grey calcareous sandstones; rock pavement above highest part of the cliffs at Cape Longing. Lat. 64°33′ S., long. 58°51′ W.
Tetragonites cf. *epigonus* (Kossmat) (C.49061).

James Ross Island

D.2212 Sandstones; south-eastern slope of cliffs about 3 miles north-north-east of Cape Obelisk. Lat. 64°5.5′ S., long. 58°26′ W.
Tetragonites (*Saghalinites*) cf. *cala* (Forbes) (C.49062).
Desmophyllites sp. indet. (C.49065).

D.2269 East-north-east side of Fortress Hill, south-western part of The Naze. Lat. 63°56′ S., long. 57°31′ W.
Eupachydiscus grossouvrei (Kossmat) (C.49126–27).

D.2600 Northern slopes of Fortress Hill, south-western part of The Naze. Lat. 63°56′ S., long. 57°31.4′ W.
Gunnarites antarcticus (Weller) (C.49102).
Diplomoceras lambi Spath (C.49130).

D.2601 North-west slopes of Comb Ridge, northern part of The Naze. Lat. 63°55′ S., long. 57°28.5′ W.
Gunnarites antarcticus (Weller) (C.49103).

D.2602 Northern slopes of Fortress Hill, south-western part of The Naze. Same locality as D.2600. Lat. 63°56′ S., long. 57°31.4′ W.
Diplomoceras lambi Spath (C.49128–29).

B. SPECIFIC DESCRIPTIONS

1. Family Tetragonitidae Hyatt, 1900

This family ranges from the Aptian to the top of the Maestrichtian and many of the species and genera have long ranges. *Tetragonites*, which ranges from the base of the Albian to the Middle Campanian, is the most typical Tetragonitid genus, with a subquadrilateral whorl section, a large whorl breadth and with whorls about one half involute; its type species is the Albian form *T. timotheanum* (Pictet) (see Spath, 1923, p. 26; text-fig. 6). The Turonian-Coniacian species *T. epigonum* (Kossmat) was made the type of the new genus *Epigoniceras* Spath, 1925, although it shows no morphological differences of generic value from *T. timotheanum*. Wright and Matsumoto (1954, p. 110) have recently pointed out that the only difference between *T. timotheanum* and *T. epigonum* is that the latter has recurved suspensive (adventitious) lobes. Examination of all the Albian—Cenomanian and Turonian—Campanian *Tetragonites* and "*Epigoniceras*" in the British Museum (Natural History) and a review of all the published figures of the suture-lines of these species reveals, however, that recurved, straight and even "upcurved" suspensive lobes are found throughout the stratigraphical range. In fact the angle between the suspensive lobes and the rest of the suture-line shows considerable variation. Thus "*Epigoniceras*" is unnecessary, for even on a stratigraphical basis it complicates rather than clarifies a relatively simple and long ranging group of ammonites. Highly inflated and involute forms have been split off as the genus *Pseudophyllites*, and evolute, slender-whorled forms as the subgenus *Saghalinites*.

Genus *Tetragonites* Kossmat, 1895

Type species: *Ammonites timotheanus* Pictet, 1847
(= *Epigoniceras* Spath, 1925, subjective synonym)
Tetragonites cf. *epigonus* (Kossmat)

Plate I, figs. 12 a, b.

Lytoceras (*Tetragonites*) *epigonum* Kossmat, 1895, p. 135; pl. 17, figs. 4–5.
Lytoceras (*Tetragonites*) *epigonum* Kossmat, Kilian and Reboul, 1909, p. 14.

A single specimen from the mainland of Graham Land may be compared with Kossmat's species. Its preservation is rather poor and it has been crushed obliquely, so that exact determination is not possible. Parts of the last suture-line are just visible at the beginning of the three-quarters of a whorl of body chamber, and the oblique constrictions, quadrilateral whorl section and moderate inflation and involution are characters typical of *Tetragonites*. The type specimens of *T. epigonus* are from the Trichinopoly Beds of Turonian or Coniacian age in southern India. Other closely similar forms are known from the Santonian and Campanian of Madagascar, South Africa, New Zealand and Japan (see Collignon, 1956, pp. 98–99), and therefore it is not possible to give an accurate date to this single Antarctic example.

Locality: Station D.2208; Cape Longing, mainland of Graham Land. Lat. 64°33′ S., long. 58°51′ W. (C.49061). Kilian and Reboul (1909, p. 14) recorded it as rare on Snow Hill Island, but no examples were figured.

Subgenus *Saghalinites* Wright and Matsumoto, 1954

Type species: *Ammonites cala* Forbes, 1846

Tetragonites (*Saghalinites*) *cala* (Forbes)

Plate I, figs. 11a, b.

Ammonites cala Forbes, 1846, p. 104; pl. 8, fig. 4.
Lytoceras (*Tetragonites*) *cala* (Forbes), Kossmat, 1895, p. 136; pl. 17, fig. 12.
Saghalinites cala (Forbes), Spath, 1953, p. 9.

Three Antarctic examples of this species are now known: a very well preserved specimen (? adult) from Snow Hill Island, which is complete to the mouth border and indistinguishable from both Forbes's holotype (1846) and the paratype figured by Kossmat (1895); an obliquely crushed specimen from north of Cape Obelisk, James Ross Island, which may be compared with this species; and the 12 mm. diameter juvenile described by Spath (1953, p. 9) from Humps Islet. The Snow Hill Island example (Plate I, fig. 11) has the following dimensions: maximum diameter 52.5 mm.; at 49.6 mm. diameter, whorl height 16.1 mm., umbilical width 23.3 mm., whorl breadth (thickness) 19.9 mm.; the curved oblique constrictions are seen very well but unfortunately no suture-lines are visible.

The type specimens of *S. cala* came from the Valudayur Beds of Campanian or Maestrichtian age in southern India, while the Snow Hill Island example was associated with typical *Gunnarites antarcticus* and is therefore of Lower Campanian age.

Localities: Station D.2040; Snow Hill Island (C.49063); associated with *Gunnarites antarcticus*.
Station D.2212; cliffs about 3 miles north-north-east of Cape Obelisk, James Ross Island (C.49062).

2. Family Desmoceratidae Zittel, 1895

Genus *Desmophyllites* Spath, 1929

Desmophyllites sp. indet.

Plate I, figs. 13a, b.

The poorly preserved fragment figured in Plate I, fig. 13, consists of two-thirds of a whorl of body chamber with the last suture-line and the flared mouth border just visible. The constrictions are approximately radial, but following a slightly sigmoidal curve they are bordered by a ridge in front of their dorsal halves and a ridge behind the forwardly projected ventral halves which is particularly well developed on the venter.

The nearest specific match is with *Desmophyllites pyrenaicum* (Grossouvre, 1894, p. 168; pl. 25, fig. 2; *non* pl. 37, fig. 9) from the Santonian of France, which has the same degree of involution and whorl

inflation. Most other forms, including the type species *D. larteti* (Seunes) (holotype figured Grossouvre, 1894, pl. 34, fig. 2), are more involute and more compressed than this Antarctic fragment.

Desmophyllites seems to have a considerable vertical range, and as well-preserved specimens are required for exact identification the present fragment is of little use for determination of the age of this Antarctic sedimentary succession.

Locality: Station D.2212; cliffs about 3 miles north-north-east of Cape Obelisk, James Ross Island (C.49065).

3. Family Kossmaticeratidae, Spath, 1922

Knowledge of this family has recently been revolutionised by the publication of monographs by Collignon (1955*b*) and Matsumoto (1955*a*). Collignon's magnificent work on the ammonites of the Menabe district has, for the first time, enabled some genera of this family to be put on a sound stratigraphical basis. By correlating against the zonal scheme determined mainly from ammonites of the subfamily Texanitinae collected from the same beds (Collignon, 1948, pp. 105–6), it can be shown that the genus *Maorites*, which is found in beds 4 and 5 at Berere, Menabe (Collignon, 1955*b*, p. 48), comes from the middle part of the Lower Campanian; i.e. the zone of *Diplacmoceras bidorsatum* (for correlation of the Berere beds see Hourcq, 1950, pp. 64–76). This is the only Kossmaticeratid genus found in both Madagascar and north-east Graham Land.

Genus *Maorites* Marshall, 1926

Type species: *Kossmaticeras tenuicostatum* Marshall, 1917

Maorites tuberculatus sp. nov.

Plate II, figs. 1–3.

Diagnosis: *Maorites* with pronounced tubercles at the umbilical edge at diameters of up to 45–50 mm. Ribs fine, arising in bunches from the tubercles, following a slight backward curve across the side of the whorl, then sweeping well forwards to cross the venter. Some bifurcation occurs at the point where the ribs sweep forwards. Whorls overlap the whole of the ribbing on the next inner whorl leaving the tubercles alone exposed. Constrictions deep, following the same line as the ribs which they do not interrupt; there are six to nine per whorl at 50–75 mm. diameter.

Dimensions (in mm.):	Diameter	Whorl height	Whorl breadth	Umbilical width
C.49073. Holotype (Plate II, fig. 1)	85	38.6	27.1	25.0
C.49083. Topotype (Plate II, fig. 3)	82	37.7	24.7	23.1
C.49077. Topotype (Plate II, fig. 2)	45.5	19.7	—	15.0

Remarks: Although there are sixteen specific names available for *Maorites* (for lists see Collignon, 1955*b*, pp. 43–4, and Matsumoto, 1955*a*, pp. 141–2), these Seymour Island examples are distinct from any other known form by reason of their sharp umbilical tubercles, which are in some cases elongated into spines. The degree of involution is just sufficient for whorls to cover the whole of the ribbing of the next inner whorl leaving the tubercles alone exposed, so that the ornament in the umbilicus appears as a spiral row of tubercles. The tubercles begin to diminish in size at 45 mm. diameter, but they are still present on the adult body chamber as sharp raised portions of the ribs at the umbilical edge. The largest complete adult has a mouth border at 155 mm. diameter, which is immediately preceded by a constriction bordered by thick raised portions of the shell.

By its large tubercles this species may be readily distinguished from *M. seymourianus* (Kilian and Reboul, 1909, pl. 19, fig. 1 (lectotype, here designated)) and from *M. densicostatus* (Kilian and Reboul, 1909, pl. 18, fig. 1 (lectotype, here designated)) which also occur at the same locality on Seymour Island; another difference is the forward curve of the ribs of *M. tuberculatus*, while those of *M. seymourianus* pass radially across the venter. The other Antarctic *Maorites*, *M. pseudobhavani* Spath, 1953, from James Ross Island, also has smaller tubercles and is generally more evolute and less compressed than *M. tuberculatus*. The New Zealand, Madagascan, South African and south Indian species of *Maorites* all differ in having smaller tubercles, and thus *M. tuberculatus* is the most coarsely tuberculate species known. The genus *Natalites* Collignon, 1954, consists of more evolute and more coarsely ribbed forms, and *Karapadites* Collignon, 1954, has smooth whorl sides in the juvenile.

Locality: Stations D.2156 and D.2163; Seymour Island, south of "Cape Bodman" (C.49067–84); associated with *Grossouvrites gemmatus* (Huppé).

Genus *Grossouvrites* Kilian and Reboul, 1909

Grossouvrites gemmatus (Huppé)

Plate II, figs. 4a, b.

Ammonites gemmatus Huppé, 1854, p. 35; pl. 1, fig. 3.
Kossmaticeras (Grossouvrites) gemmatum (Huppé), Kilian and Reboul, 1909, p. 38; pl. 17, figs. 1–3.
Grossouvrites gemmatus (Huppé), Spath, 1953, p. 29; pl. 5, fig. 1.

Well-preserved inner whorls in the present collection (Plate II, fig. 4) supplement the large body chamber figured and described by Spath (1953); the test is very thin and well preserved, ornamented by low, straight ribs which pass radially across the venter. Small tubercles are developed on the umbilical edge. Adult body chambers such as those figured by Spath (1953) show considerable uncoiling and reduction in whorl height towards the aperture. The involute and thick whorls and characteristic ornament distinguish this genus from other Kossmaticeratidae.

All the Antarctic specimens, including those figured by Kilian and Reboul (1909), are from a locality south-east of "Cape Bodman" on Seymour Island. Outside Antarctica the only other specimens of this species are Huppé's holotype and two further examples figured by Steinmann (1895, p. 68; pl. 6, figs. 1–2) from the Quiriquina Beds at Conception Bay, Chile, and two examples from South Island, New Zealand. One of the latter has been figured by Trechmann (1917, p. 338; pl. 21, fig. 6) and the other is in the British Museum (Nat. Hist.) (C.48086). A second species of *Grossouvrites*, *G. denticulatus*, occurs at Kaipara, North Island, New Zealand, and two specimens have been figured by Marshall (1926, p. 189; pl. 25, fig. 3; pl. 38, figs. 5–6; and 1927, p. 357, pls. 36–37).

Locality: Stations D.2160 and D.2161; about 3 miles south-east of "Cape Bodman", Seymour Island (C.49086–87); associated with *Maorites tuberculatus*.

Genus *Jacobites* Kilian and Reboul, 1909

Jacobites anderssoni (Kilian and Reboul)

Plate II, figs. 5–6; Plate III, fig. 1.

Kossmaticeras (Jacobites) anderssoni Kilian and Reboul, 1909, p. 35; pl. 7, figs. 1–5; pl. 8, figs. 3 & 5; pl. 12, figs. 1–2; pl. 16, fig. 3.

Seventeen examples of this species are now known from Kilian and Reboul's figures and from specimens in the present collection. All come from the area around Nordenskjöld's winter station on Snow Hill Island. Details of the ribs and tubercles show considerable variation in this species, no two examples being

alike; therefore, a specimen with average characters, the original of Kilian and Reboul, 1909, pl. 7, fig. 1, is here designated lectotype. Nevertheless, all the specimens show the same general sequence of changes in rib-density and tubercle strength during growth and this can now be described.

The earliest whorls are densely ribbed, with oblique constrictions and irregular small tubercles on the umbilical edge. At this stage whorls are not distinguishable from inner whorls of *Maorites densicostatus* (Kilian and Reboul) or *M. seymourianus* (Kilian and Reboul). At a diameter varying from 37 to 45 mm. coarse ribbing appears abruptly and remains until 72 to 85 mm. diameter. Between these sizes the ribs are particularly variable in density and strength; one specimen has only three ribs in a quarter of a whorl, but the usual density is nine to ten per half whorl. At the commencement of the coarse ribbing tubercles appear alternately on the ventro-lateral edges and the mid-ventral line, and in most specimens they are elongated into long spines. The irregular umbilical tubercles remain and there are occasional constrictions. The coarse ribbing is usually terminated by an oblique constriction at 72–85 mm. diameter. Ribbing of greater density follows, but the spines remain unchanged, and this ornament passes on to the adult body chamber. On the largest known specimen (Plate III, fig. 1), which has the last suture-line and one third of a whorl of (? adult) body chamber, the ribs become rather more widely spaced again towards the end; this example would have been at least 200 mm. diameter when complete.

Locality: Stations D.2028 and D.2153; Snow Hill Island (C.49089–94); associated with *Gunnarites antarcticus*.

Jacobites crofti Spath

Plate III, figs. 2a, b.

Jacobites crofti Spath, 1953, p. 27; pl. 4, figs. 2–3.

Spath's holotype is wholly septate at its maximum diameter (65 mm.), but the specimen now figured is an 85 mm. diameter complete adult with a smooth band bordering the aperture on the unfigured side. The body chamber occupies half a whorl and the last septum is at a diameter of about 60 mm. It is somewhat crushed obliquely so that almost all the trituberculate venter can be seen from the figured side. Towards the end of the body chamber the tubercles disappear and the whorl height decreases; these together with the smooth band bordering the aperture are characters typical of an adult. Small tubercles are irregularly developed at the umbilical edge.

This species differs from *J. anderssoni* in its closer ribbing at diameters of more than 45 mm.

Locality: Station D.2153; Snow Hill Island (C.49088); associated with *Gunnarites antarcticus*.

Genus *Gunnarites* Kilian and Reboul, 1909

Gunnarites antarcticus (Weller)

This species has been exhaustively described by Spath (1953). The present collection contains twenty-nine examples from Snow Hill Island (C.49095–101, 49104–25) and two from the northern slopes of Fortress Hill and the north-west slopes of Comb Ridge, The Naze, James Ross Island (C.49102–03).

4. Family Pachydiscidae Spath, 1922

As in the case of the Kossmaticeratidae, our knowledge of the Pachydiscidae has been greatly enhanced by Collignon's recent description (1955*a*) of a rich fauna collected bed by bed in the Menabe district of western Madagascar. The Japanese Pachydiscidae have recently been revised by Matsumoto (1947, 1951 and 1955*b*). The forms common to both north-east Graham Land and Madagascar are *Pachydiscus*

gollevillensis (d'Orbigny) described and figured by Kilian and Reboul (1909, p. 43; pl. 19, fig. 3; pl. 20), and *Eupachydiscus grossouvrei* (Kossmat) described below. Both these species and several closely related ones are found in the Lower and Middle Campanian at various localities in western Madagascar (see Hourcq, 1950, pp. 64–89, and Collignon, 1955*a*). The only other Pachydiscidae from north-east Graham Land are the indeterminate fragment figured by Kilian and Reboul (1909, pl. 6, fig. 2) and *Hoepenites* aff. *amarus* (Paulke) figured by Spath (1953, p. 39; pl. 10, fig. 7).* *Hoepenites* is of Campanian age in Madagascar.

Genus *Eupachydiscus* Spath, 1922

Eupachydiscus grossouvrei (Kossmat)

Plate III, figs. 3a, b; Plate IV, figs. 1–2; Plate V.

Ammonites ootacodensis Stoliczka, 1865, pl. 57 (*non* pl. 54, figs. 3–4; *non.* pl. 56).
Pachydiscus grossouvrei Kossmat, 1898, p. 166 (nom. nov. for Stoliczka, 1865, pl. 57).
Pachydiscus grossouvrei Kossmat, Basse, 1931, p. 26; pl. 2, figs. 16–17.
Eupachydiscus grossouvrei (Kossmat), Collignon, 1955*a*, p. 40; pl. 7, fig. 2; pl. 28, fig. 1.

The two large specimens figured here, from The Naze, James Ross Island, agree closely with Stoliczka's original figure (1865, pl. 57) which was renamed by Kossmat in 1898, and whose interpretation has recently been discussed in detail by Collignon (1955*a*, pp. 40–2). Both are still septate at their maximum diameters (about 220 mm.), so that the body chambers must have reached very large sizes. The outer whorl of the larger specimen (Plate IV, fig. 1; Plate V) is an internal mould with no test retained and consequently the ribbing appears somewhat weaker than on Stoliczka's original which is complete with most of its test. Inner whorls (Plate IV, figs. 2a, b), with the test preserved, show the curved ribs and small umbilical tubercles characteristic of this species; they have the following dimensions (in mm.):

	Diameter	Whorl height	Whorl breadth	Umbilical width
C.49126. Plate IV, fig. 2	113	54	51	25
C.49127. Plate III, fig. 3	91	42.5	44	22.5

These are very close to the proportions of Collignon's Madagascan specimens (1955*a*, p. 41), but the dimensions of Stoliczka's original are not known. The suture-line is highly complex and is similar to that of the type species of *Eupachydiscus*, *E. isculensis* (Redtenbacher).

The three Madagascan specimens figured by Basse (1931) and Collignon (1955*a*) are indistinguishable from these Antarctic examples, and the horizon of Collignon's specimens is known to be the lower part of the Middle Campanian.

The similar species *E. haradai* (Jimbo, 1894, p. 29; pl. 2, fig. 2; pl. 3, fig. 1, including *P. teshioensis* Jimbo which is conspecific) from Hokkaido, northern Japan, is of Lower Campanian age (see Matsumoto, 1951, p. 25; and 1955*a*, table on page 158).

Locality: Station D.2269; The Naze, James Ross Island (C.49126–27).

* *Patagiosites* Spath, 1953, p. 38 (type species: *Ammonites patagiosus* Schlüter, 1867, p. 22; pl. 4, fig. 4) is best regarded as a synonym of *Hoepenites* Collignon, 1952, p. 9 (type species: *Pachydiscus patagonicus* Paulke, 1906, p. 232; pl. 19, fig. 1). The two type species, *Hoepenites patagiosus* from north Germany and *H. patagonicus* from Patagonia, are very closely related and probably congeneric.

C. AGE OF THE FAUNA

ALL the forms in the fauna described above are in agreement with Spath's main conclusion that the assemblages so far found in north-east Graham Land are of more or less the same age (Spath, 1953, p. 53). Spath gave this age as Upper Campanian, but Collignon's recent work in Madagascar (1955*a* and 1955*b*) has shown that a more accurate correlation for at least part of the fauna is with the zone of *Diplacmoceras bidorsatum* of the Lower Campanian (see Collignon, 1954, p. 62, and the standard for Cretaceous zones in Grossouvre, 1901, p. 801, and table XXXV). Of the Kossmaticeratidae, *Maorites* is the most accurately dated genus, being confined to the Bidorsatum Zone in Madagascar; the other genera are either unknown outside Antarctica or are not placed in a good stratigraphical sequence. The Pachydiscidae give a similar age, though perhaps a little younger, for *Eupachydiscus grossouvrei* is found mainly in the Middle Campanian of Madagascar. Of the Tetragonitidae, *Tetragonites epigonus* and similar species range from the Turonian to the Campanian at various localities; *T.* (*Saghalinites*) *cala* is of Campanian to Maestrichtian age in southern India. The fragment of *Desmophyllites* cannot be accurately dated. By the associations of species in the same beds at several of the localities, the long ranging forms can be dated by means of those species whose ages are more accurately known. Thus it can be shown that all the assemblages from the James Ross Island group are of approximately the same age, and this spans, at the most, **the Lower and Middle Campanian.**

REFERENCES

BASSE, E. 1931. Monographie paléontologique du Crétacé de la Province de Maintirano, Madagascar. *Ann. géol. Serv. Min Madagascar, Mém. hors série*, 86 pp., 13 pls.

COLLIGNON, M. 1948. Ammonites néocrétacées du Menabe (Madagascar). I. Les Texanitidae. *Ann. géol. Serv. Min. Madagascar*, Fasc. 13, 1–63, pls. 1–14; Fasc. 14, 64–117, pls. 15–32.

———. 1952. *See* Collignon, 1955*a*.

———. 1954. Essai de nomenclature stratigraphique des terrains sédimentaires de Madagascar. *Travaux du bureau géologique, Madagascar*, **63**, 67 pp.

———. 1955*a*. Ammonites néocrétacées du Menabe (Madagascar). II. Les Pachydiscidae. *Ann. géol. Serv. Min. Madagascar*, Fasc. 21, 98 pp., 28 pls. Also published in 1952 in: *Travaux du bureau géologique, Madagascar*, **41**, 114 pp., 33 pls.

———. 1955*b*. Ammonites néocrétacées du Menabe (Madagascar). III. Les Kossmaticeratidae. *Ann. géol. Serv. Min. Madagascar*, Fasc. 22, 54 pp., 12 pls. Also published in 1954 in: *Travaux du bureau géologique, Madagascar*, **62**, 59 pp., 12 pls.

———. 1956. Ammonites néocrétacées du Menabe (Madagascar). IV. Les Phylloceratidae; V. Les Gaudryceratidae; VI. Les Tetragonitidae. *Ann. géol. Serv. Min. Madagascar*, Fasc. 23, 106 pp., 11 pls.

FORBES, E. 1846. Report on the Fossil Invertebrata from Southern India, collected by Mr. Kaye and Mr. Cunliffe. *Trans. Geol. Soc. London*, (2) **7**, 97–174, pls. 7–19.

GROSSOUVRE, A. De. 1894. Recherches sur la craie supérieure. II. Paléontologie. Les Ammonites de la craie supérieure. *Mém. Carte géol. dét. France*, 264 pp., 39 pls.

———. 1901. Recherches sur la craie supérieure. I. Stratigraphie générale. Avec une monographie du genre *Micraster* par J. Lambert. *Mém. Carte géol. dét. France*, 1013 pp.

HOURCQ, V. 1950. Les Terrains sédimentaires de la Région de Morondava. *Ann. géol. Serv. Min. Madagascar*, Fasc. 20, 109 pp., 1 pl.

HUPPÉ, L. H. 1854. *In* Gay: Fauna Chilena, *Hist. fis. y polit. de Chile. Zool.*, **8**, 7–54, pls. 1–2.

JIMBO, K. 1894. Beiträge zur Kenntniss der Fauna der Kreideformation von Hokkaido. *Paläont. Abh.*, (N.F.) 2, 149–94.

KILIAN, W. and P. REBOUL. 1909. Les Céphalopodes Néocrétacés des îles Seymour et Snow-Hill. *Wiss. Ergebn. schwed. Südpolarexped.*, 1901–03, Bd. 3, Lief. 6, 75 pp., 20 pls.

KOSSMAT, F. 1895–98. Untersuchungen über die südindische Kreideformation. *Beitr. Paläont. Geol. Öst.-Ung.*, **9**, 97–203, pls. 15–25; **11**, 1–46 and 89–152, pls. 1–8 and 14–19.

MARSHALL, P. 1926. The Upper Cretaceous Ammonites of New Zealand. *Trans. Proc. N.Z. Inst.*, **56**, 129–210, pls. 19–47.

———. 1927. A Kaipara Ammonite. *Trans. Proc. N.Z. Inst.*, **58**, 357–8, pls. 36–7.

MATSUMOTO T. 1947. A Note on the Japanese Pachydiscinae. *Sci. Reports Geol. Dept., Fac. Sci., Kyūshū Univ.*, **2** (1), 34–46 (in Japanese).

———. 1951. A Note on the Pachydiscinae, a Cretaceous Ammonite-group. *Trans. Proc. Palaeont. Soc. Japan*, (N.S.) **1**, 19–26.

———. 1955*a*. Family Kossmaticeratidae from Hokkaido and Saghalien (Studies on the Cretaceous ammonites from Hokkaido and Saghalien—VI). *Jap. J. Geol. Geogr.*, **26**, 115–64, pls. 8–10.

———. 1955*b*. The bituberculate Pachydiscids from Hokkaido and Saghalien (Studies on the Cretaceous ammonites from Hokkaido and Saghalien—VIII). *Mem. Fac. Sci. Kyūsyū Univ.*, Ser. D, Geology, **5** (3), 153–84, pls. 31–7.

PAULKE, W. 1906. Die Cephalopoden der oberen Kreide Südpatagoniens. *Ber. naturf. Ges. Freiburg i. B.*, **15**, 167–244, pls. 10–19.

SCHLÜTER, C. 1867. *Beiträge zur Kenntnis der jüngsten Ammoneen Norddeutschlands*. Bonn. 36 pp., 6 pls.

SPATH, L. F. 1923. A Monograph of the Ammonoidea of the Gault. Part I. *Palaeontogr. Soc.* [*Monogr.*], 1–72, pls. 1–4.

———. 1953. The Upper Cretaceous Cephalopod Fauna of Graham Land. *Falkland Islands Dependencies Survey Scientific Reports*, No. 3, 60 pp., 13 pls.

STEINMANN, G. 1895. Die Cephalopoden der Quiriquina-Schichten. *Neues Jb. Miner., Mh., Abt. B.*, **10**, 64–94, pls. 4–6.

STOLICZKA, F. 1865. The Fossil Cephalopoda of the Cretaceous Rocks of Southern India. Vol. 3, Ammonitidae. *Palaeont. indica*, 216 pp., 93 pls.

TRECHMANN, C. T. 1917. Cretaceous Mollusca from New Zealand. *Geol. Mag.* (6) **4**, 294–305 and 337–42, pls. 19–21.

WRIGHT, C. W. and T. MATSUMOTO. 1954. Some Doubtful Cretaceous Ammonite Genera from Japan and Saghalien. *Mem. Fac. Sci. Kyūsyū Univ.*, Ser. D, Geology, **4**, 107–34.

Printed in Great Britain under the authority of Her Majesty's Stationery Office by Benham and Company Limited, Colchester
Wt. P9637 H27 1066 7/57

PLATE I

(All figures are natural size)

Figs. 1–2 *Perisphinctes* (*Orthosphinctes*) cf. *transatlanticus* (Steinmann) (C.49036, C.49041). Station E.720.

Fig. 3 ? *Georgioceras* sp. indet. (C.49050). Station E.151.

Fig. 4 *Ancyloceras patagonicum* Stolley (C.49046). Station E.149.

Fig. 5 *Silesites* cf. *trajani* (Tietze) (C.49047). Station E.149.

Figs. 6–8; 9a, b; 10 *Sanmartinoceras patagonicum* Bonarelli. Station E.719. 6–7 (C.49056, C.49057) show portions of the serrated keel; 8 (C.49056) shows a well developed lappet; 9a (C.49055) is an adult with almost half a whorl of body chamber, and 9b is a trace of one of the striae; 10 (C.49058) is a large specimen in which the smooth stage persists to 42 mm. diameter.

Figs. 11a, b *Tetragonites* (*Saghalinites*) *cala* (Forbes) (C.49063). Station D.2040.

Figs. 12a, b *Tetragonites* cf. *epigonus* (Kossmat) (C.49061). Station D.2208.

Figs. 13a, b *Desmophyllites* sp. indet. (C.49065). Station D.2212.

1

3

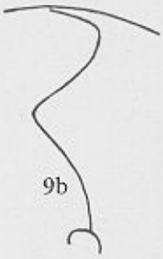
4

2

6

7

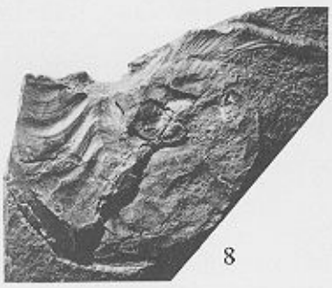
5



9b

9a

10



8

12b

11a

11b

12a

13a

13b

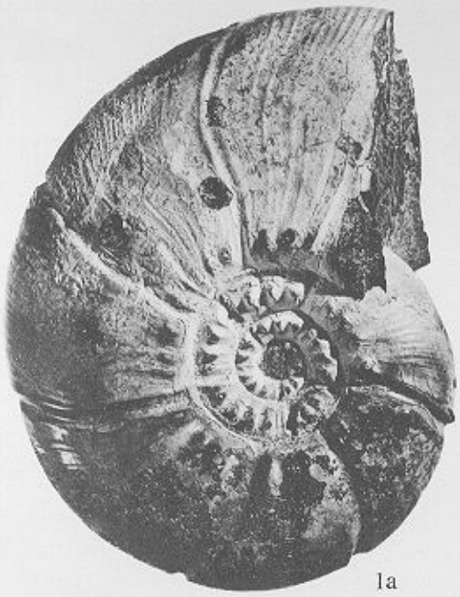
PLATE II

(All figures are natural size)

Figs. 1a, b; 2a, b; 3a, b *Maorites tuberculatus* sp. nov. Station D.2163. 1 (C.49073) holotype; 2–3 (C.49077, C.49083) topotypes.

Figs. 4a, b *Grossouvrites gemmatus* (Huppé) (C.49087). Station D.2161.

Figs. 5; 6a, b *Jacobites anderssoni* (Kilian and Reboul). 5 (C.49089) Station D.2153; 6a, b (C.49091) Station D.2028.



1a

1b

2a

2b

3a

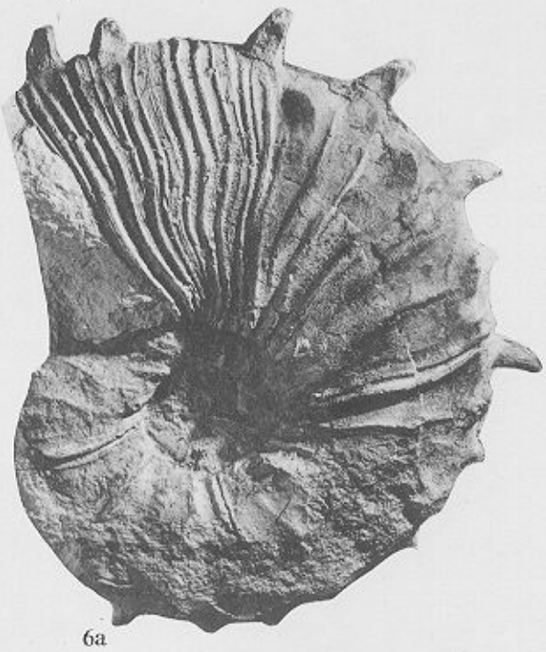
3b

4b

4a

5

6b



6a

PLATE III

(All figures are natural size)

Figs. 1a, b *Jacobites anderssoni* (Kilian and Reboul) (C.49094). Station D.2028.

Figs. 2a, b *Jacobites crofti* Spath (C.49088). Station D.2153.

Figs. 3a, b *Eupachydiscus grossouvrei* (Kossmat) (C.49127). Station D.2269. Inner whorls of specimen figured in Plate IV, fig. 1, and Plate V.


1a
2b
1b
3b
3a
2a

PLATE V

(Natural size)

Eupachydiscus grossouvrei (Kossmat) (C.49127). Station D.2269. For ventral view see Plate IV, fig. 1; the inner whorls are figured in Plate III, figs. 3a, b.

PLATE IV

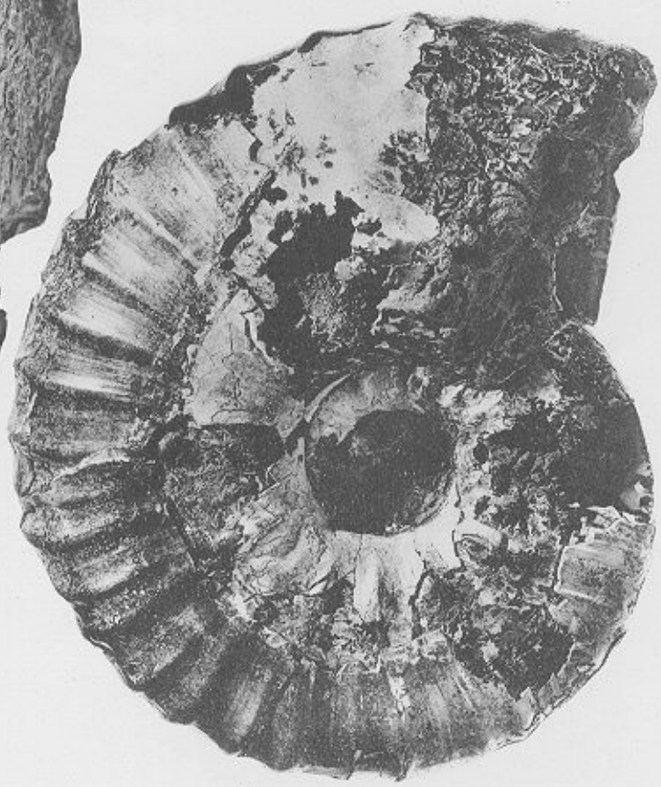
(All figures are natural size)

Fig. 1 *Eupachydiscus grossouvrei* (Kossmat) (C.49127). Station D.2269. Ventral view of specimen figured in Plate V.

Figs. 2a, b *Eupachydiscus grossouvrei* (Kossmat) (C.49126). Station D.2269.

1

2b



2a