GEOLOGICAL
SURVEY
OF
CANADA

DEPARTMENT OF MINES
AND TECHNICAL SURVEYS

BULLETIN 59

THE JURASSIC FAUNAS OF THE CANADIAN ARCTIC

LOWER JURASSIC AND LOWERMOST MIDDLE JURASSIC AMMONITES

Hans Frebold

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PREFACE

This report is based on fossil collections made over a vast area of the Canadian Arctic extending from Ellesmere Island in the north to the Aklavik region of the mainland. Detailed study of these ammonite faunas permits correlation of the associated Jurassic rocks and shows their faunal and stratigraphic relationships with the Arctic areas of East Greenland and Europe.

J. M. HARRISON,
Director, Geological Survey of Canada

OTTAWA, August 27, 1959

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Abstract

Lower Jurassic and lower Bajocian faunas are widely distributed in the Canadian Arctic, particularly in the Arctic Archipelago, where marine lower Sinemurian, Toarcian, and Bajocian are represented. In the Aklavik Range (northeastern Richardson Mountains, Arctic Coast region) lower and upper Sinemurian rocks are present; farther to the west lower Sinemurian, upper Pliensbachian, Toarcian and Bajocian are indicated. The index ammonites described in this paper are: lower Sinemurian-*Arietites* sensu lato gen. et sp. indet.; upper Sinemurian, zone of *Oxynoticeras oxynotum- O. oxynotum* (Quenstedt), *Gleviceras* ? sp. indet., *Arctoasteroceras jeletzkyi* n. gen., n. sp.; upper Sinemurian, probably zone of *Echioceras raricostatum-Echioceras* sensu lato sp. indet.; Pliensbachian- zone of *Amaltheus margaritatus- Amaltheus* sp.; Toarcian- *Dactylioceras commune* (Sowerby), *Catacoeloceras spinatum* (Frebold), *Catacoeloceras polare* (Frebold), *Harpoceras* cf. *exaratum* (Young and Bird), *Pseudolioceras* aff. *compactile* (Simpson), *Grammoceras* ? sp. indet.; Bajocian- *Leioceras opalinum* (Reinecke), *Pseudolioceras m'clintocki* (Haughton), *Pleydellia* ? sp. indet., *Erycites* cf. *howelli* (White).

Both in the Richardson Mountains and on the islands the sequence is very incomplete; the Hettangian and most of the Pliensbachian are apparently entirely absent, or, in the case of the Hettangian possibly represented by non-marine deposits locally. Faunal gaps occur in the Sinemurian and Toarcian. Compared with the northwest European standard section of the Lower Jurassic only six of the seventeen ammonite zones are found in the Canadian Arctic. Several transgressions and regressions took place in this area during the Early Jurassic and Bajocian. Close faunal and stratigraphic relationships with the Barents shelf and East Greenland are established. Zoogeographically most of the ammonites belong or are related to species of world-wide distribution.

Résumé

Les faunes du Jurassique inférieur et du Bajocien inférieur sont réparties un peu partout dans les régions arctiques du Canada, notamment dans l'archipel Arctique, où sont représentés des dépôts marins du Sinémurien inférieur, du Toarcien et du Bajocien. Dans la chaîne Aklavik (partie nord-est des monts Richardson, région littorale arctique), on relève la présence de roches du Sinémurien inférieur et du Sinémurien supérieur; celles qu'on trouve plus à l'ouest remontent au Sinémurien inférieur, au Pliensbachien supérieur, au Toarcien et au Bajocien. Les ammonites caractéristiques suivantes sont décrites dans l'étude: Sinémurien inférieur-*Arietites* sensu lato gen. et sp. indet.; Sinémurien supérieur, zone d'*Oxynoticeras oxynotum-O. oxynotum* (Quenstedt), *Gleviceras* ? sp. indet., *Arctoasteroceras jeletzkyi* n. gen., n. sp.; Sinémurien supérieur, probablement zone d'*Echioceras raricostatum-Echioceras* sensu lato sp. indet.; Pliensbachien, zone d'*Amaltheus margaritatus-Amaltheus* sp.; Toarcien-*Dactylioceras commune*

(Sowerby), *Catacoeloceras spinatum* (Frebold), *Catacoeloceras polare* (Frebold), *Harpoceras* cf. *exaratum* (Young et Bird), *Pseudolioceras* aff. *compactile* (Simpson), *Grammoceras* ? sp. indet.; Bajocien- *Leioceras opalinum* (Reinecke), *Pseudolioceras m'clintocki* (Haughton), *Pleydellia* ? sp. indet., *Erycites* cf. *howelli* (White).

La succession des couches est très incomplète, tant dans les monts Richardson que dans les îles; il semble que les étages Hettangien et la plupart du Pliensbachien ne soient pas du tout représentés, mais il se peut qu'il y ait ça et là, dans l'Hettangien, des dépôts d'origine non marine. Le Sinémurien et le Toarcien contiennent des lacunes fauniques. Dans l'Arctique canadien, on ne trouve que 6 des 17 zones d'ammonites qui sont ordinairement représentées dans la succession des couches du Jurassique inférieur du Nord-Ouest de l'Europe. L'Arctique canadien a été la scène de plusieurs transgressions et régressions marines au cours du Jurassique inférieur et du Bajocien. Il est certain que la faune et la stratigraphie se rattachent de près à celles de la plate-forme Barents et de l'Est du Groenland. Du point de vue zoogéographique, la plupart des ammonites en question appartiennent ou sont apparentées à des espèces réparties dans le monde entier.

INTRODUCTION

During the last 10 years, and particularly since 1954, many collections of Jurassic fossils have been made in various parts of the Canadian Arctic. Some of these fossils have already been described (Frebold, 1958a) and a brief summary was recently given (Frebold, 1958b). In this paper the index ammonites of the Lower Jurassic and the lower Bajocian of the Canadian Arctic islands and of the Richardson Mountains in the Arctic Coast region are described, the age and correlations of the beds concerned are outlined and the palæogeographic conditions are discussed. This study, to be followed by other reports on the index faunas of younger Jurassic beds, is based mainly on collections made by officers of the Geological Survey of Canada, i.e., R. Thorsteinsson and E. T. Tozer, who worked on the islands, and J. A. Jeletzky, who made studies in the Aklavik Range of the Arctic Coast region. Two smaller collections dealt with in this paper from the Rat River area, Richardson Mountains, were made by field parties of Shell Oil Company of Canada and British American Petroleum Company.

FOSSIL LOCALITIES

Lower Jurassic and Bajocian faunas have a wide distribution in the Canadian Arctic. Their occurrences and the faunal content at the various localities are summarized in this section. A more detailed description of the stratigraphy will be given in subsequent reports.

Owing to insufficient geographical names in these regions precise locality descriptions often cannot be given. The exact position of the fossil occurrences is therefore indicated on small maps (Figs. 2-8), and the location of the areas illustrated in these maps can be seen from the general index map (Fig. 1). The fossil localities described in this paper are in the Richardson Mountains, particularly in their northeastern part, the Aklavik Range and on Melville, Mackenzie King, Borden, Cameron, Cornwall, and Ellesmere islands. Occurrences of Lower Jurassic and Bajocian faunas on Prince Patrick and Axel Heiberg islands were described in a previous paper (Frebold, 1958a).

Richardson Mountains

Locality numbers correspond with those in Figure 2.

Locality 1 Near head of second northern tributary to Rat River, close to Yukon-Northwest Territories border. Collected by British American Petroleum Company. (GSC loc. 35968)
Arietites sensu lato gen. et sp. indet. Sinemurian.

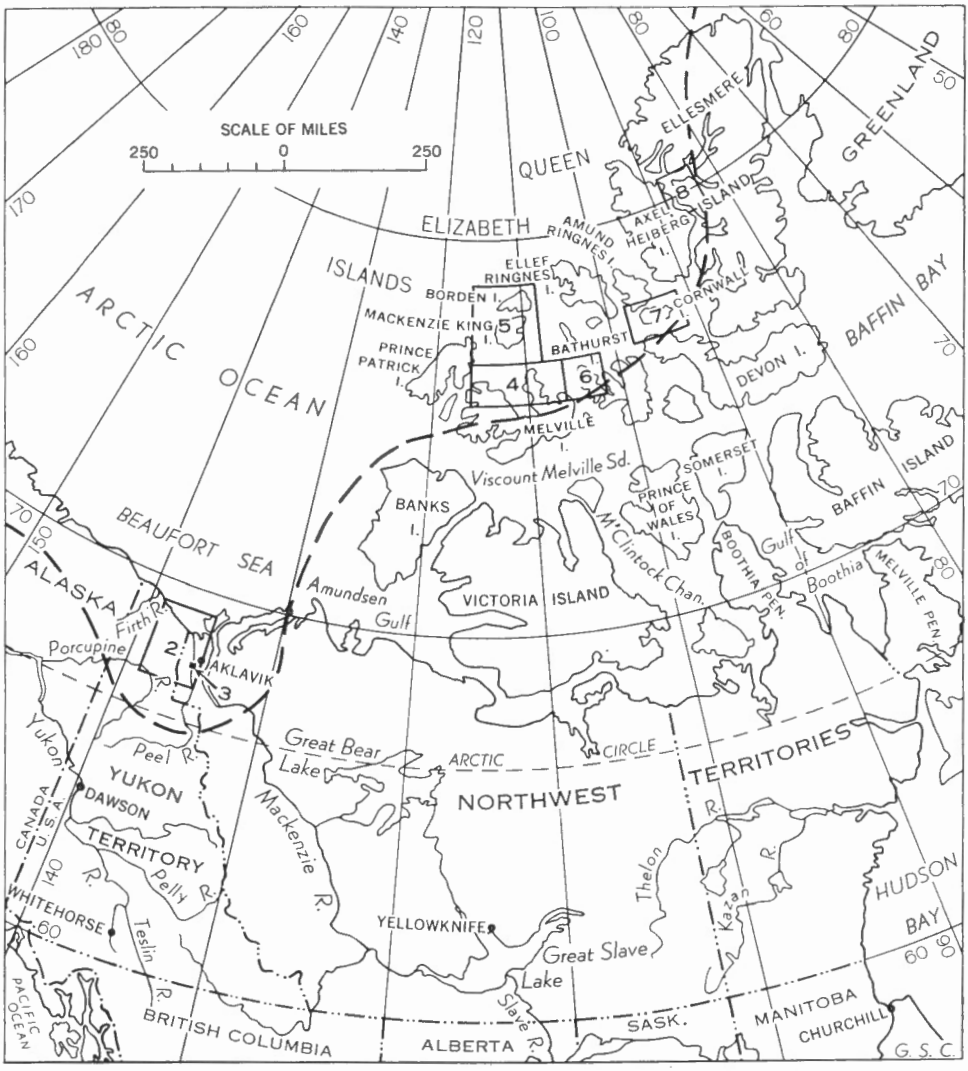

Figure 1. ***Index map showing position of areas illustrated in Figures 2 to 8. The broken line shows the assumed maximum extent of Lower Jurassic and Bajocian seas.***

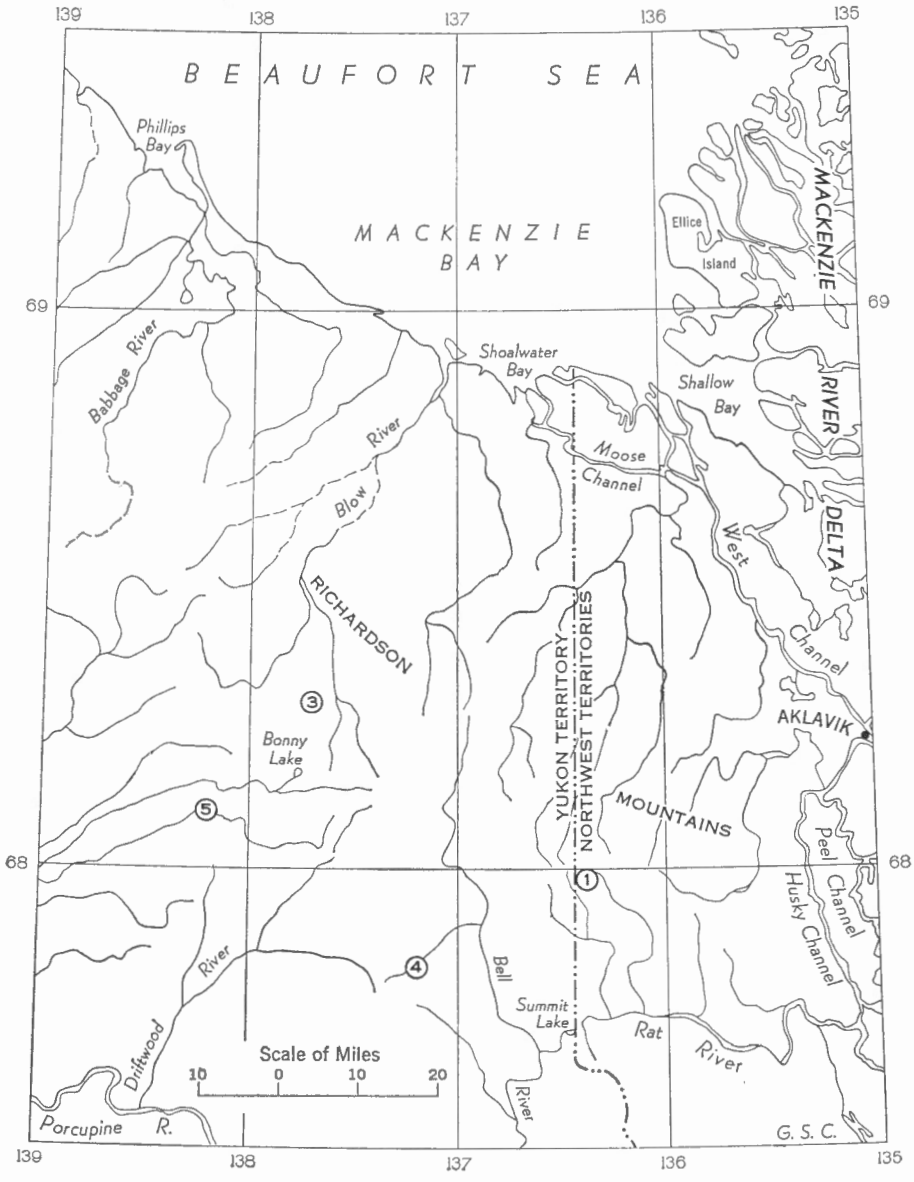

Figure 2. ***Lower Jurassic and lower Bajocian fossil localities in the Richardson Mountains. The exact position of fossil locality 2 could not be determined.***

77995-9—2

Locality 2 North of Rat River and east of Summit Lake. Collected by J. Talbot, Shell Oil Company of Canada. (GSC loc. 35969)
Pseudolioceras sp. indet. Toarcian or Bajocian.

Locality 3 On a small stream approximately 10 miles north of Bonny Lake. **(GSC loc. 39343)**
Amaltheus sp.[1] Upper Pliensbachian.

Locality 4 22 miles northwest of Summit Lake. (GSC loc. 39342)
Dactylioceras sp.[1], harpoceratid fragment. Toarcian.

Locality 5 About 12 miles west southwest of south end of Bonny Lake. (GSC loc. 38776)
Pseudolioceras sp., *Erycites howelli* (White)[1]. Lower Bajocian.

Aklavik Range (Northeastern Richardson Mountains)

Locality numbers correspond with those in Figure 3. *See* Plates XIII and XIV.

In the Aklavik Range, Lower Jurassic fossiliferous beds are exposed mainly in an area about 2 to 2½ miles south of Bug Lake and Bug Creek. Other fossil localities are in Bug Creek Canyon. Lower Jurassic strata in this area were discovered in 1955 by J. A. Jeletzky (1958a, b, and personal communication) who found two fossiliferous beds: the lower one, 14-18 feet thick and beginning 16-17 feet above the base of the Jurassic rocks, the upper one 8-10 feet thick and beginning about 35-40 feet above the top of the lower. Twenty-eight to twenty-nine feet above the upper fossil bed Jeletzky found a conglomerate that he considers to indicate a disconformity and a hiatus. About 20 feet above this conglomerate are beds with Bathonian ammonites. The thickness of the Lower Jurassic strata, which consist of marine sandstones and sandy siltstones and rest on Palæozoic rocks, is, according to Jeletzky, about 100-110 feet.

The Lower Jurassic faunas in this area consist mainly of ammonites, nautiloids, pelecypods and gastropods, of which the ammonites form the most important part. Some of the fossil localities are so close to one another that they could not be shown separately in the map (Fig. 3). Thus, localities 1, 2 and 6 comprise actually more than one locality each. The distribution of the faunas at the various localities is as follows:

Locality 1 comprises three fossil localities, of which two are in the lower and one in the upper fossil bed.
Upper fossil bed. (GSC loc. 25756)
Echioceras sensu lato sp. indet. Upper Sinemurian.
Lower fossil bed. (GSC loc. 25762, 25765)
Oxynoticeras oxynotum (Quenstedt), *Oxynoticeras* sp. indet., *Gleviceras* ? sp. indet., *Arctoasteroceras jeletzkyi* n. gen. et n. sp., nautiloids, gastropods, pelecypods. Upper Sinemurian.

[1] These fossils were collected while the paper was in the press. They will be described in another report.

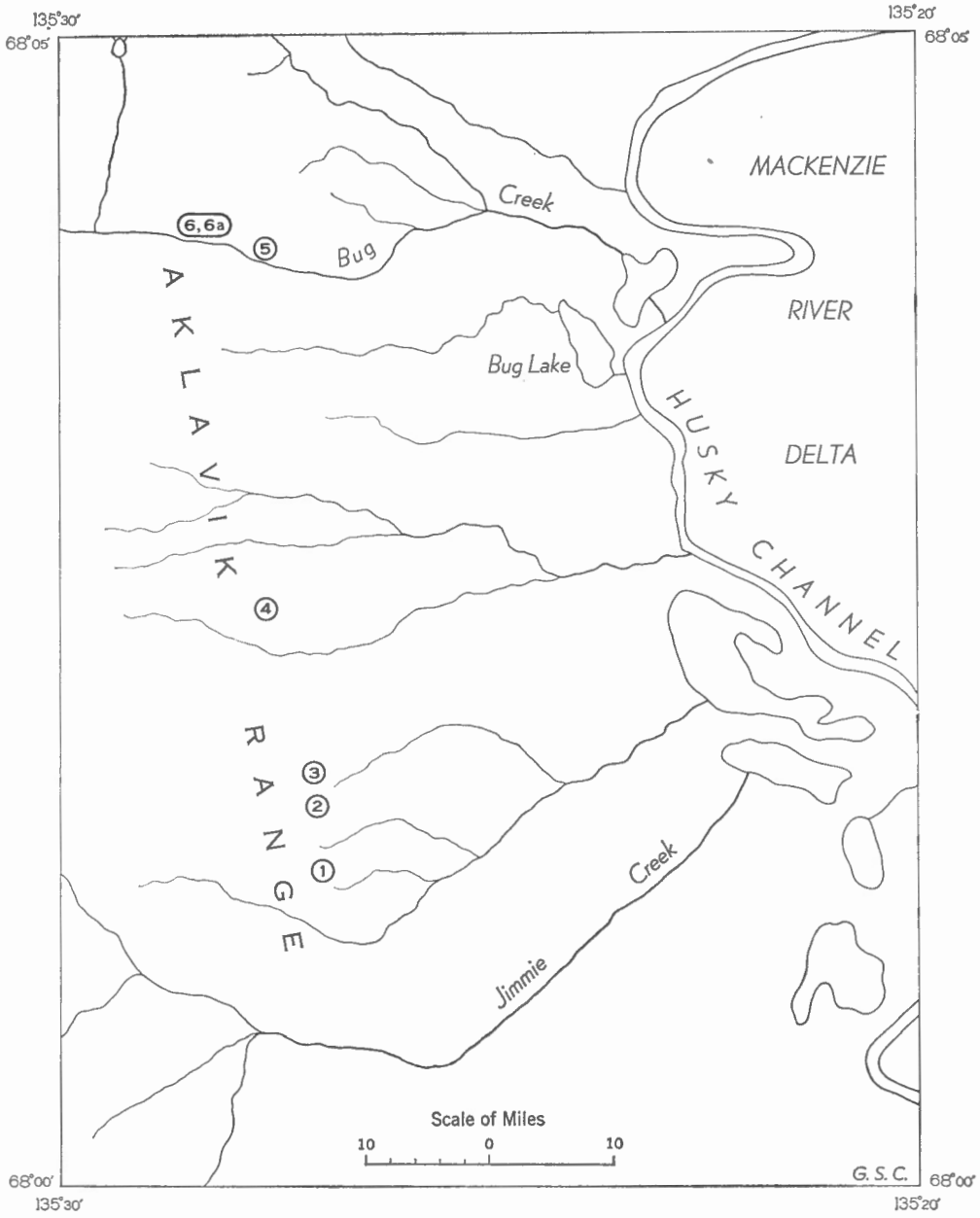

Figure 3. *Sinemurian fossil localities in Aklavik Range (northeastern Richardson Mountains).*

Locality 2 Lower fossil bed. (GSC loc. 26973, 26978)
Oxynoticeras oxynotum (Quenstedt), *Oxynoticeras* sp. indet., *Gleviceras* ? sp. indet., *Arctoasteroceras jeletzkyi* n. gen. et n. sp., nautiloids, gastropods, pelecypods. Upper Sinemurian.

Locality 3 Upper fossil bed. (GSC loc. 26974)
Echioceras sensu lato sp. indet. Upper Sinemurian.

Locality 4 Lower fossil bed. (GSC loc. 25763)
Arctoasteroceras jeletzkyi n. gen. et n. sp., gastropods, pelecypods. Upper Sinemurian.

Locality 5 Float, not in situ. Lower fossil bed. (GSC loc. 26975)
Arctoasteroceras jeletzkyi n. gen. et n. sp., gastropods, pelecypods. Upper Sinemurian.

Locality 6 Upper fossil bed. (GSC loc. 26976 (in situ), 26977 (float, not in situ)).
Echioceras sensu lato sp. indet. Upper Sinemurian.

Melville Island

Locality numbers correspond with those in Figure 4.

Locality 1 North side of Marie Bay, 11 miles west of its head. Within a few feet of the basal contact with the Triassic Björne formation. Collected by E. T. Tozer, 1958. (GSC loc. 35323)
Arietites sensu lato gen. et sp. indet. Sinemurian.

Locality 2 North shore of Marie Bay, 6 miles west of its head. Near base of the Jurassic strata. Collected by E. T. Tozer, 1958. (GSC loc. 35345)
Indeterminable small ammonites, *Pecten* sp., gastropods, wood. Possibly Sinemurian.

Locality 3 North side of Marie Bay, 60 feet above base of Wilkie Point formation exposures. Collected by R. Thorsteinsson, 1958. (GSC loc. 35314)
Leioceras opalinum (Reinecke), *Pseudolioceras* cf. *m'clintocki* (Haughton). Lower Bajocian.

Locality 4 Marie Heights, northwestern Butte. Collected by E. T. Tozer, 1958. (GSC loc. 37018)
Pseudolioceras m'clintocki (Haughton), *Oxytoma septentrionalis* (Haughton), *Pecten* sp. indet. Lower Bajocian.

Locality 5 Ten miles south of Depot Island on north coast. Collected by E. T. Tozer, 1958. (GSC loc. 35344)
Pseudolioceras cf. *m'clintocki* (Haughton). Lower Bajocian.

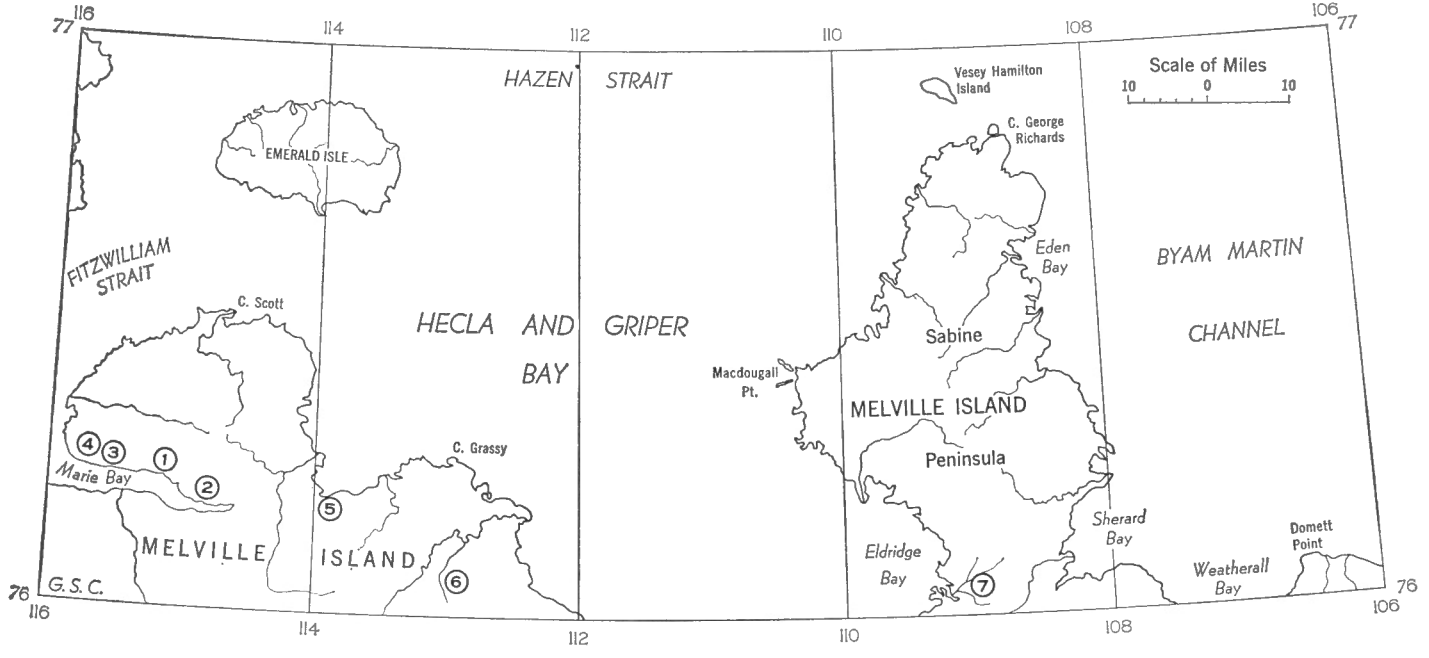

Figure 4. ***Lower Jurassic and lower Bajocian fossil localities in northern parts of Melville Island.***

Locality 6 East Kitson River, 12½ miles south of Cape Grassy, lower part of marine unit, about 100 feet above base. Collected by E. T. Tozer, 1958. (GSC loc. 37019)
Leioceras opalinum (Reinecke). Lower Bajocian.

Locality 7 Isthmus of Sabine Peninsula, eastern part of Melville Island. Collected by E. T. Tozer, 1958. (GSC loc. 37021)
Pseudolioceras sp. indet. Probably lower Bajocian.

All the outcrops of lower Bajocian strata on Melville Island are more or less disintegrated and no detailed information on their stratigraphy is available.

Mackenzie King Island

Locality numbers correspond with those in Figure 5. *See* Plate XV, figure 1.

Locality 1 About 9 miles east of the west coast. In talus, near base of a 78-foot-high ridge. Collected by R. Thorsteinsson and E. T. Tozer, 1958. (GSC loc. 35341)
Oxytoma jacksoni (Pompeckj), *Ostrea* sp. Lower Bajocian.

Locality 1a Same locality as locality 1. In talus, about 70 feet above occurrence of *Oxytoma jacksoni* (Pompeckj). Collected by R. Thorsteinsson and E. T. Tozer, 1958. (GSC loc. 35312, 35313)
Pseudolioceras m'clintocki (Haughton). Lower Bajocian.

Locality 1b Same locality as locality 1. Upper sandy ledge forming top of ridge. About 8 feet above talus collection of *P. m'clintocki* (Haughton). Collected by R. Thorsteinsson and E. T. Tozer, 1958. In situ. (GSC loc. 35315)
Pseudolioceras m'clintocki (Haughton). Lower Bajocian.

Borden Island

Locality numbers correspond with those in Figure 5.

Locality 1 Southern part of central Borden Island. Not in situ. Collected by E. T. Tozer, 1958. (GSC loc. 35322)
Arietites sensu lato gen. et sp. indet. Sinemurian.

Locality 2 Southern peninsula, on southern coast of Borden Island. About 100 feet stratigraphically above the base of Wilkie Point formation. Collected by R. Thorsteinsson, 1958. (GSC loc. 35342)
Harpoceras cf. *exaratum* (Young and Bird), *Dactylioceras commune* (Sowerby). Toarcian.

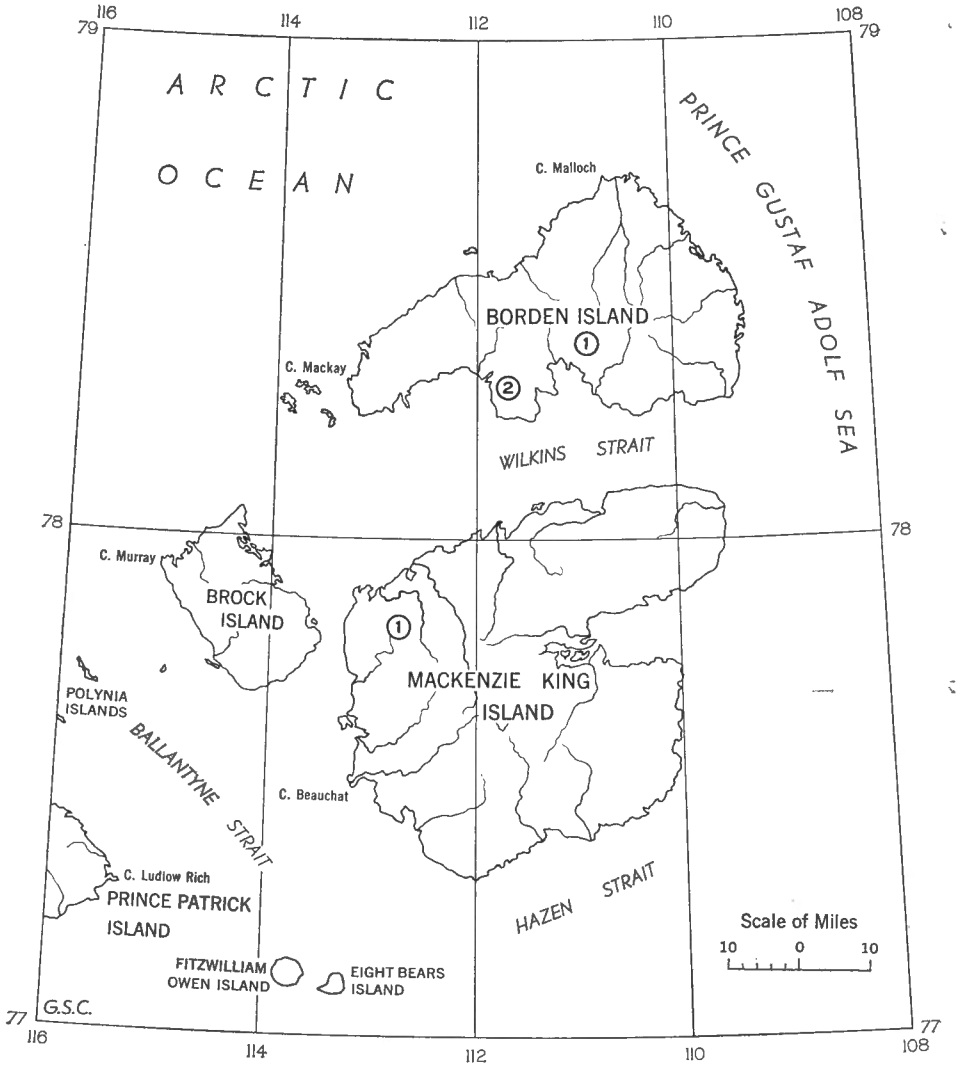

Figure 5. ***Lower Jurassic and lower Bajocian fossil localities on Mackenzie King and Borden Islands.***

Cameron Island

Locality number corresponds with that in Figure 6.

Locality 1 Two miles east of Success Point. Collected by E. T. Tozer, 1955. (GSC loc. 25861)
Pleydellia ? sp. indet., *Oxytoma jacksoni* (Pompeckj). Lower Bajocian.

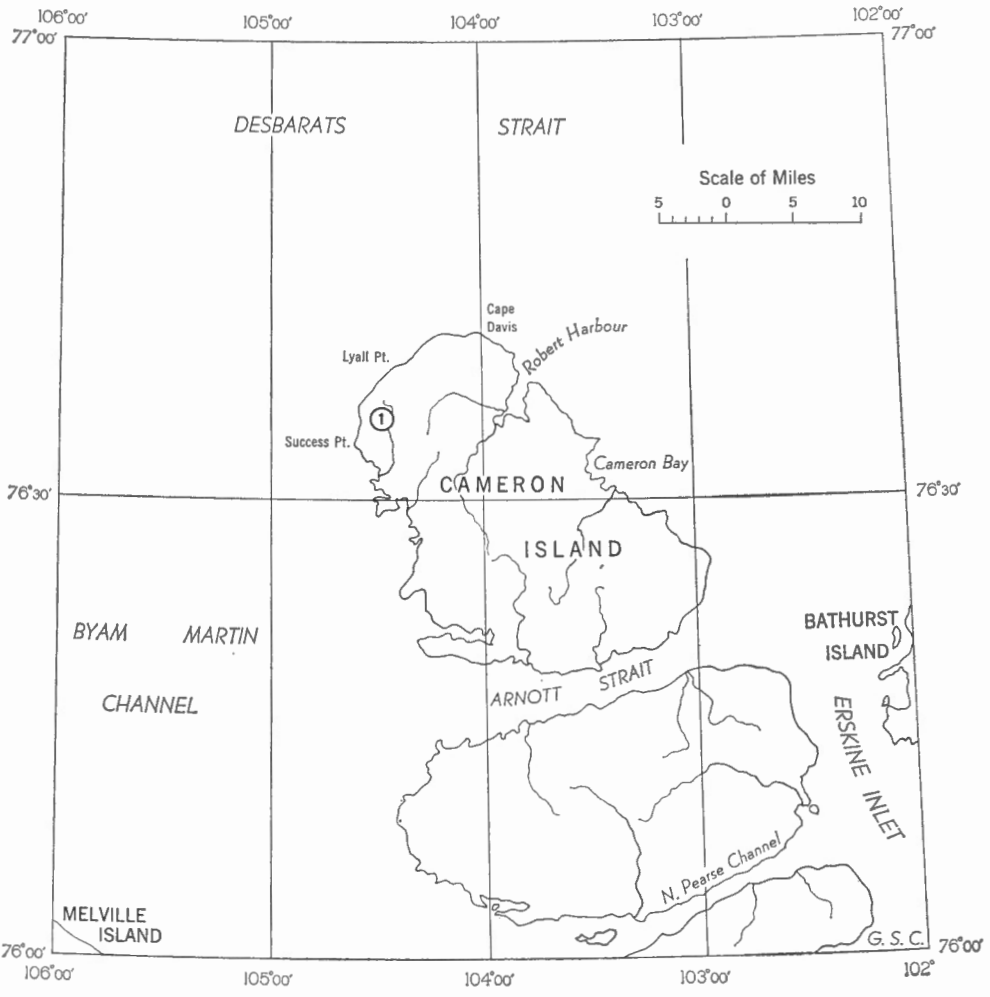

Figure 6. *Lower Bajocian fossil locality on Cameron Island.*

Cornwall Island

Locality number corresponds with that in Figure 7.

Locality 1 Along Jaeger River, in river bed, at different levels. Collected by H. R. Greiner, 1955. (GSC loc. 25981)
Dactylioceras commune (Sowerby), *Pseudolioceras* sp. indet., *Grammoceras* ? sp. indet. Toarcian.

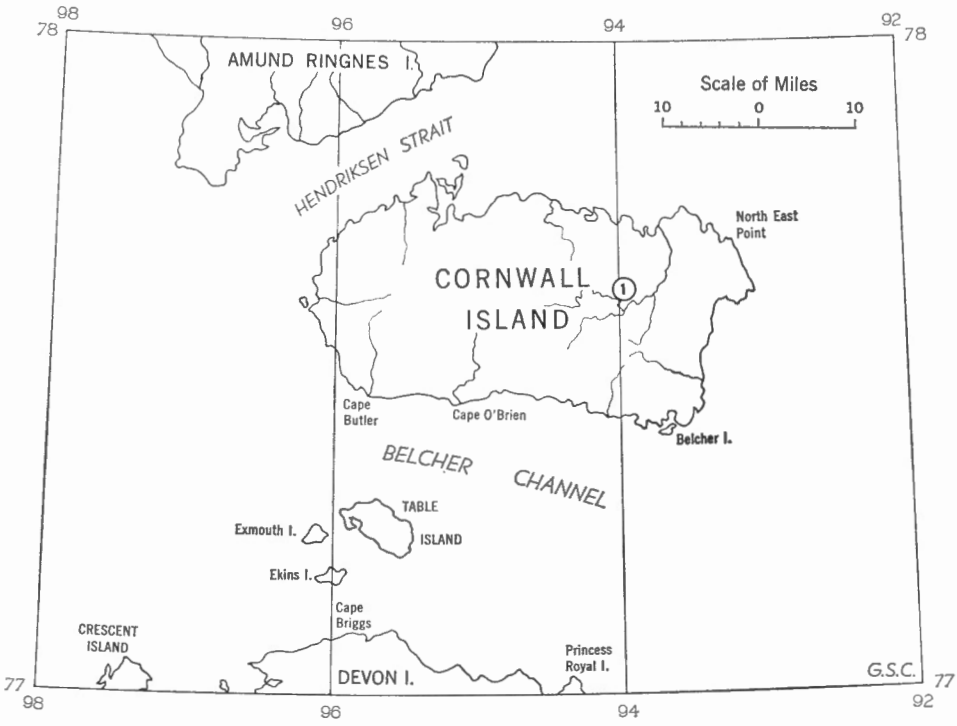

Figure 7. *Toarcian fossil locality on Cornwall Island.*

Ellesmere Island

Locality number corresponds with that in Figure 8.

Locality 1 Fosheim Peninsula, on east side of Black Top Ridge, east of Eureka weather station. Collected by E. T. Tozer, 1956. (GSC loc. 28780)
Catacoeloceras polare (Frebold), *Pseudolioceras* sp. indet., *Grammoceras* ? sp. indet. Toarcian.

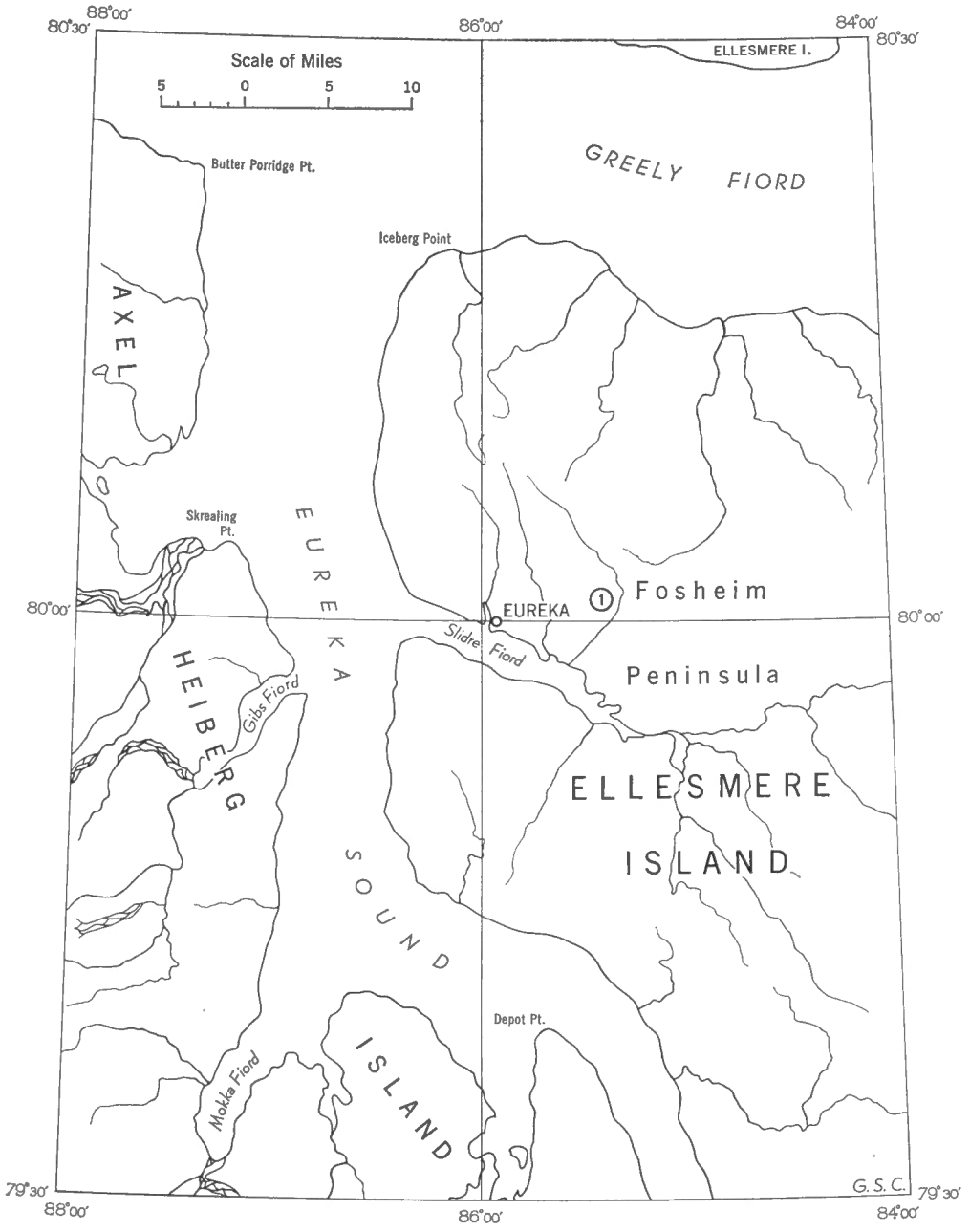

Figure 8. *Toarcian fossil locality on Fosheim Peninsula, Ellesmere Island.*

DESCRIPTION OF INDEX AMMONITES

Family ARIETITIDAE Hyatt, 1874
Subfamily ARIETITINAE Hyatt, 1874
Arietites sensu lato gen. et sp. indet.

Plate I, figures 1-3

Material. Four fragments, one from southern part of central Borden Island (GSC No. 14620), two from Melville Island, north side of Marie Bay, 11 miles from its head (GSC Nos. 14619, 14621), and one from the Richardson Mountains (GSC No. 14618).

Description. The Richardson Mountain specimen (Pl. I, fig. 1) is preserved mainly as a poor imprint. It is very evolute, and its whorls increase slowly in height. At a diameter of about 97 mm (the maximum diameter is slightly larger), the width of the umbilicus is about 57 mm and the height of the last whorl about 39 mm. The venter and suture line are not preserved, the ribs are undivided and slightly bent forward.

The measurements of the Melville Island specimen illustrated on Plate I, figure 2 are: diameter 74 mm, width of umbilicus 46 mm, height of the last whorl about 16 mm, thickness unknown. The straight, undivided ribs disappear towards the rounded venter, which has a keel with a shallow furrow on each side. The cross-section is not determinable as most of one side of the specimen is missing. The suture line is not preserved.

The other Melville Island specimen (not illustrated) has a slightly rounded venter, the keel has shallow furrows on each side. The cross-section seems to have been more or less quadrate. The flanks are entirely covered with rock material.

The small whorl fragment from the south-central part of Borden Island is 17 mm high and 18 mm wide; the venter is almost flat and the ventral keel has a shallow furrow on each side. The straight, undivided ribs are stronger than in the other specimens described here.

Remarks. The Richardson Mountains specimen and the two Melville Island specimens seem to be closely related to one another. The Borden Island fragment is distinguished by its stronger ribs. The generic position of all specimens is uncertain.

Subfamily ASTEROCERATINAE Spath, 1946
Arctoasteroceras n. gen.

Diagnosis. Moderately involute ammonites with oval cross-section, slightly arched to almost flat venter with or without keel. Ribs on flanks straight, slightly inclined forward, on venter very faint or not recognizable. Suture line very simple, often asymmetrical.

Remarks. This genus is similar to *Aegasteroceras* Spath in its outline and the low blunt keel. The suture line of both genera is also very similar, but the asymmetry so common in *Arctoasteroceras* has apparently not been observed in *Aegasteroceras*. *Aegasteroceras* is differentiated from *Arctoasteroceras* mainly by its much stronger ribs on the venter.

Occurrence. Aklavik area, Northwest Territories. Associated with *Oxynoticeras oxynotum* (Quenstedt); age: late Sinemurian, Oxynotum zone. The related genus *Aegasteroceras* Spath is slightly older (Obtusum zone).

The type species of *Arctoasteroceras* is *A. jeletzkyi* n. sp.

Arctoasteroceras jeletzkyi n. sp.

Plate II, figures 1-5; Plate III, figures 1-3

Material. Holotype: GSC No. 14623, Plate II, figures 1*a*, *b*. Paratypes: GSC Nos. 14624-14630, Plate II, figures 2-5, Plate III, figures 1-3. Other material: numerous specimens mostly fragmentary.

Diagnosis. Moderately involute, oval cross-section, moderately convex flanks. Venter slightly arched with low, blunt keel, or less narrow without keel. Larger specimens always without keel; no sulci. Straight ribs on lower two thirds of flanks, bent forward and very faint in upper part of flanks and on venter. Suture line moderately incised, asymmetrical or symmetrical. The species is named for the collector, J. A. Jeletzky, Geological Survey of Canada.

Holotype. (Pl. II, figs. 1*a*, *b*) Dimensions in millimetres:

Diameter	Width of umbilicus	Height of whorl	Thickness of whorl
62	20 (.32)	25 (.40)	—
46	14 (.30)	19 (.41)	15 (.33)

The holotype is moderately involute, has an oval cross-section, moderately convex flanks that grade into the slightly arched venter and the gentle umbilical slope. About one half of the preceding whorl is embraced. The ventral keel is very low and blunt, there are no sulci. The venter of the preceding whorl is somewhat sharper than that of the last. There are twenty-nine primaries on the last whorl, which in their lower two thirds are almost straight. Towards the umbilical edge these primaries are weaker and in their upper third they are bent forward and hardly recognizable. On the venter they are bent forward and extremely faint. In those parts of the umbilical slope where the shell is preserved, fine lines of growth are present.

The suture line is fairly simple and only very moderately incised. The ventral lobe lies on the right side of the venter, it is longer than the first lateral lobe. The second lateral is somewhat shorter than the first. There are two auxiliary lobes. The second lateral saddle is considerably higher than the first. The holotype is septate to the end of the last whorl.

Paratypes. The other specimens figured on Plates II and III illustrate the common deviations from the holotype which mainly concern the shape of the venter and the suture line. The fragment Plate II, figures 2*a, b* (GSC No. 14624) is distinguished from the holotype by a slightly higher cross-section, less convex flanks, a sharper venter and a symmetrically arranged suture line. The ventral keel is more clearly visible in the specimen (GSC No. 14630) illustrated on Plate III, figures 3*a, b*. The fragment (GSC No. 14625) illustrated on Plate II, figures 3*a, b,* has a more rounded venter, and the ventral keel is no longer recognizable. The ventral lobe in this specimen is on the left flank contrary to the holotype which has the ventral lobe on the right flank. The specimens (GSC Nos. 14627, 14629) illustrated on Plate II, figures 5*a, b* and Plate III, figures 2*a, b* are distinguished from the holotype and the other specimens described above by a flatter venter, entire absence of a ventral keel, and faint but more clearly discernible ribs on the venter. There are gradual transitions from these latidorsate forms to the ones with narrower venter. The fragment of a large unseptate whorl (GSC No. 14628) illustrated on Plate III, figures 1*a, b* probably belongs to a mature specimen. There is no ventral keel, the venter is broad. The ribs are divided in several fine branches which, in the upper part of the flanks and on the venter, are slightly bent forward. The same type of sculpture is present, though less clearly visible in the specimens illustrated on Plate II, figures 5*a, b* and on Plate III, figures 2*a, b*.

Remarks. General shape, suture line, and, to a certain degree, the sculpture of this new species resembles representatives of the genus *Aegasteroceras* Spath (1925, p. 265), such as *A. sagittarium* Blake (1876, Pl. VII, fig. 2) and *A. simile* Spath (1925, p. 265—*A. sagittarium* Wright, *non* Blake, Pl. LIIA, figs. 5, 6). However all these forms are easily distinguishable from *Arctoasteroceras jeletzkyi* by less numerous and stronger ribs, which, contrary to *A. jeletzkyi,* are also clearly developed on the venter.

Occurrence. Arctoasteroceras jeletzkyi is common in the Aklavik area, about 2 miles south of Bug Lake and Bug Creek. The species occurs associated with *Oxynoticeras oxynotum* (Quenstedt) and other oxynoticeratids.

Arctoasteroceras ? sp. indet.

Plate I, figures 4*a, b*

The whorl fragment (GSC No. 14622) illustrated, is distinguished from *Arctoasteroceras jeletzkyi* by a more rectangular cross-section with less convex flanks, a comparatively more prominent broad keel and the shallow sulci on both sides of the keel. The suture line is symmetrical and apparently identical with that of *A. jeletzkyi.* The generic position of this specimen is uncertain.

Occurrence. One specimen from Aklavik area, about 2 miles south of Bug Lake and Bug Creek, at locality 2, associated with *Arctoasteroceras jeletzkyi* and oxynoticeratids.

Family OXYNOTICERATIDAE Hyatt, 1875

Oxynoticeratidae are very common and usually associated with *Arctoasteroceras* in the Aklavik area. The localities are about 2 miles south of Bug Creek and Bug Lake. Many specimens are poorly preserved and identification, even at generic level, is impossible.

Genus *Oxynoticeras* Hyatt, 1875

Type species is *Ammonites oxynotus* Quenstedt, 1845, p. 98, Pl. 5, fig. 11.

Oxynoticeras oxynotum (Quenstedt)

Plate IV, figures 1-3

Holotype is *Ammonites oxynotus* Quenstedt, 1845, p. 99, Pl. 5, fig. 11.

Description. The specimen (GSC No. 14631) illustrated on Plate IV, figure 1, is the most completely preserved. The ribs are faint on the flanks, but more pronounced on the shoulder where they are bent sharply forward without crossing the sharp keel. Another fragmentary specimen (GSC No. 14633) illustrated on Plate IV, figure 3, is smaller. The ribs are very faint. Of the suture line, the first lateral lobe, the first lateral saddle and part of the ventral lobe are recognizable. The whorl fragment (GSC No. 14632) illustrated on Plate IV, figures 2*a, b,* apparently belongs to a living chamber. No ribs are visible. A preserved part of the preceding whorl shows some faint ribs and parts of the suture line, which is very little incised.

Remarks. The specimen illustrated on Plate IV, figure 1, agrees well with the holotype in the degree of involution, the shape of the ribs and the sharp keel. The other specimens here assigned to *O. oxynotum* (Quenstedt) are very similar to other specimens figured by Quenstedt (1884).

Occurrence. Aklavik area, about 2 miles south of Bug Lake and Bug Creek. Specimens Plate IV, figures 1, 2*a, b,* are from locality 1, specimen Plate IV, figure 3 is from locality 2. All specimens were associated with *Arctoasteroceras jeletzkyi.*

Oxynoticeras sp. indet.

Plate IV, figures 4, 5

Description. The fragment illustrated in Plate IV, figure 5 (GSC No. 14635) has flat flanks and a sharp keel; no ribs are preserved and the width of the umbilicus is not determinable. The suture line of the innermost preserved whorl shows part of the ventral lobe which is much deeper than the first lateral. At this stage the suture line is much less denticulated than that of the next younger whorl.

Another fragment (Pl. IV, fig. 4, GSC No. 14634) is very flat, has a sharp keel, and resembles the specimen illustrated in figure 5; the suture line, however, seems to be more denticulated. No sculpture is preserved.

The two specimens are too poorly preserved for specific identification.

Genus *Gleviceras* Buckman, 1918

Gleviceras ? sp. indet.

Plate IV, figures 6*a-c*

Description. The whorl fragment (Pl. IV, figs. 6*a-c,* GSC No. 14636) has moderately convex flanks which grade into the rather blunt-keeled venter. The transition to the umbilical wall is more abrupt. Some very faint ribs are preserved in the lower part of the right flank. The suture line is not clearly discernible, particularly the length of the first lateral in comparison to the ventral lobe could not be determined. Another whorl fragment not illustrated (GSC No. 14637) also has slightly convex flanks and a fairly blunt venter. Keel, umbilical wall, and ribs are not preserved. The suture line is poorly preserved but the first lateral seems to be about equal in length to the ventral lobe. The second lateral lobe is somewhat shorter than the first but much narrower.

Remarks. These fragments cannot be identified. The cross-section of the whorls, their fairly blunt venter and the abrupt umbilical wall preserved in one of the specimens indicate that they do not belong to the group of *Oxynoticeras oxynotum* (Quenstedt). In these regards they resemble *Gleviceras* but the imperfect preservation does not permit detailed comparisons.

Occurrence. Aklavik area, about 2 miles south of Bug Lake and Bug Creek, localities 1 and 2. Associated with *Arctoasteroceras jeletzkyi* and *Oxynoticeras oxynotum.*

Indeterminate Oxynoticeratids

Fragments of large oxynoticeratids were found at various localities, the largest one, at locality 1, has a whorl height of more than 135 mm. Some of these fragments have a cross-section similiar to that of *Oxynoticeras oxynotum* (Quenstedt), others have a less sharp venter. No ornament is visible. Two fragments show parts of the suture line. Identification of these fragments is not possible.

Family Echioceratidae Buckman, 1930

Echioceras sensu lato sp. indet.

Plate V, figures 1-3

Description. The specimen Plate V, figure 1 (GSC No. 14638) is somewhat compressed and distorted. The approximate dimensions in millimetres are: diameter 80, umbilical width 47, height of last whorl 16, thickness of last whorl

undeterminable. Apparently the thickness was greater than the height. The specimen is evolute, the whorls increase slowly in height, the venter is broad, the slope from the flanks to the umbilicus gentle. On the last whorl are about forty-nine undivided, usually equally spaced ribs that are bent forward and disappear at the ventral margin leaving the broad venter smooth. A distinct, though fairly low, ventral keel is present; no sulci. The ventral region is also illustrated on Plate V, figure 2 (GSC No. 14639) and figure 3 (GSC No. 14640).

In other specimens some of the ribs continue faintly on the venter. All specimens of this form are very unsatisfactorily preserved. No suture line could be studied.

Remarks. Species of the genus *Echioceras* Bayle are distinguished from this form by more widely spaced ribs. Other genera of the Echioceratidae are distinguished by the presence of ventral furrows (*Paltechioceras* Buckman) or by a sharper venter (*Leptechioceras* Buckman) and feeble to faint ribs (*Leptechioceras* Buckman, *Tmaegophioceras* Spath).

Occurrence. The figured specimens are from the Aklavik area, south side of Bug Creek Canyon (locality 6). This form occurs 35 to 40 feet above *Oxynoticeras oxynotum* and *Arctoasteroceras jeletzkyi.*

Family DACTYLIOCERATIDAE Hyatt, 1867

Genus ***Dactylioceras*** Hyatt, 1867

Dactylioceras commune (Sowerby)

Plate V, figures 4-6

Holotype is *Ammonites communis* Sowerby, 1815, p. 10, Pl. 107, figs. 2, 3.

Remarks. Dactylioceras commune (Sowerby) was recently described from Prince Patrick Island (Frebold, 1958a, p. 2, Pl. I, figs. 1, 2, 4-7, *non* 3). Specimens collected on the southern peninsula of Borden Island (GSC Nos. 14641, 14642) illustrated on Plate V, figures 4, 5, and in the mid-eastern part of Cornwall Island (GSC No. 14643) illustrated in Plate V, figure 6, agree well with the Prince Patrick Island specimens. The Borden Island specimens were associated with *Harpoceras* cf. *exaratum* (Young and Bird).

Genus *Catacoeloceras* Buckman, 1923

Catacoeloceras polare (Frebold)

Plate V, figures 7*a, b,* 8

Coeloceras polare Frebold, 1929, p. 258, Pl. 2, figs. 11-13.
Coeloceras polare Frebold, 1930, p. 61, Pl. 22, fig. 4.

Lectotype. The specimen described by Frebold, 1929, p. 258, Pl. 2, figs. 12, 12*a.*

Description. The specimen (GSC No. 14644) illustrated on Plate V, figures 7*a, b,* has the following dimensions: diameter 28 mm, width of umbilicus 15 mm, height of whorl 8 mm, thickness of whorl 7 mm. The venter is almost flat. The straight and fairly strong ribs are at the ventral margin divided into two branches that cross the venter where they are slightly bent forward. Commonly every second primary rib has a tubercle at the point of division. The larger whorl fragment (GSC No. 14645) illustrated on Plate V, figure 8, has more secondary ribs and some intercalated, undivided primary ribs.

Remarks. The specimens agree very well with the Spitzbergen specimens of this species. *Catacoeloceras spinatum* (Frebold) described from Prince Patrick and Axel Heiberg islands (Frebold, 1958a, p. 3, pl. 2, figs. 1-4) is distinguished by finer ribs and longer spines.

Occurrence. East of Black Top Ridge, Fosheim Peninsula, Ellesmere Island, associated with *Grammoceras* n. sp. ? and *Pseudolioceras* sp. indet.

Superfamily HILDOCERATACEAE Hyatt, 1867

Family HILDOCERATIDAE Hyatt, 1867

Subfamily HARPOCERATINAE Neumayr, 1869

Genus *Harpoceras* Waagen, 1869

Harpoceras cf. *exaratum* (Young and Bird)

Plate V, figure 9

Harpoceras cf. *exaratum* (Young and Bird) Imlay 1955, p. 88, Pl. 11, figs. 12, 13, 15.

Description. The small specimen illustrated on Plate V, figure 9 (GSC No. 14646), is a rubber cast made of an imprint. The measurable dimensions in millimetres are: diameter 20, width of umbilicus 5, height of last whorl 10. The flanks are slightly convex, they grade into the narrow venter that has a high keel. The umbilical wall of the last whorl is steep and almost perpendicular, it joins the flank in an abrupt rounded edge that becomes sharper near the end of the whorl. The flanks are covered with fine falcoid ribs.

Remarks. The specimen is very similar to the small specimen from Prince Patrick Island, figured by Imlay (1955, Pl. 11, fig. 13). It is also similar, though much smaller than *H.* cf. *exaratum* (Young and Bird) Donovan (1954, p. 46) described by Wright (1878-86, Pl. 62, figs. 1-3) as *H. exaratum* (Young and Bird).

Occurrence. Wilkie Point formation, associated with *Dactylioceras commune,* 100 feet stratigraphically above base of formation, south coast of Borden Island.

Genus *Pseudolioceras* Buckman, 1889

Pseudolioceras m'clintocki (Haughton)

Plate VIII, figures 1-9; Plate IX, figures 2-4

Ammonites m'clintocki Haughton 1858, p. 244, Pl. 9, figs. 2-4.
Harpoceras m'clintocki Neumayr 1885, p. 85, Pl. 1, figs. 5-8.
Ludwigella ? cf. *L. rudis* (Buckman) Imlay 1955, p. 75, Pl. 11, figs. 1-3.
"Harpoceras" aff. *m'clintocki* Frebold (partim) *in* Tozer, 1956, pp. 20, 21, 22.
Ludwigia m'clintocki Frebold 1958*a*, p. 7, Pl. 5, figs. 3a, b, 4a, b.

Holotype. Ammonites m'clintocki Haughton 1858, p. 244, pl. 9, figs. 2-4.

Description. Previous descriptions of this species were based on fragments, none of them showing the complete ammonite or a sufficiently preserved suture line. Haughton's drawing of the lateral view of the holotype is unfortunately not reliable. The umbilicus is probably too wide and the height of the last whorl is greater in its middle part than at its end. The dimensions of the holotype given by Haughton (loc. cit.) can therefore not be regarded as accurate.

The abundant and well-preserved specimens recently collected permit a full redescription of this species. The dimensions in millimetres of three specimens are:

	Diameter	Width of umbilicus	Height of whorl	Thickness of whorl
GSC No. 14652, Plate VIII, figure 1	58	8 (.14)	32 (.55)	—
GSC No. 14654, Plate VIII, figure 3	46	8 (.17)	24 (.50)	11 (.24)
GSC No. 14663, Plate IX, figure 3	33	6 (.18)	17 (.50)	10 (.30)

The species is involute and narrow umbilicate. Small specimens have a comparatively wider umbilicus than the larger ones. The flanks are laterally compressed, very slightly convex, and converge gradually towards the venter. A high hollow keel is present but no ventral sulci. Specimens with whorl heights of almost 14 mm or more have a steep, almost perpendicular umbilical wall. The height of this wall increases with the height of the whorls and the umbilicus becomes deep. The umbilical wall forms with the flanks almost a right angle, the umbilical edge is first blunt but becomes sharp in larger specimens. In specimens with whorl heights less than 14 mm the flanks grade gently to the umbilicus. The ribs are straight and inclined forward in the lower half of the flanks, in their upper half they are stronger and bend backward. In the marginal zone of the venter they swing forward again and fade out. In many specimens this forward swing is not recognizable. Some specimens have fewer and stronger ribs, others have more numerous and finer ribs and the two extremes might have been considered as different species if there were not transitional specimens. The suture line (*see* Pl. VIII, fig. 3*a*) is well denticulated, the ventral lobe is about equal in length to the first lateral, in some cases it is slightly shorter. The second lateral lobe is about half the size of the first. There are five or more auxiliary lobes, depending on the size of the specimen. Both lateral lobes are fairly slender and three-pointed. The first lateral saddle is broad and deeply subdivided by an accessory lobe which is equal in length and

almost equal in shape to the second lateral lobe. The second lateral saddle is equal in width to the first lateral lobe and somewhat narrower than the internal half of the first lateral saddle. The suture lines follow one another very closely.

Remarks. Unfortunately Haughton's and Neumayr's types could not be traced, but the figures given by these authors clearly establish identity with the specimens here described and with the Prince Patrick Island fragments described by the author (Frebold, 1958a, p. 7, Pl. 5, figs. 3*a, b*). The new material however also includes forms with finer ribs which were apparently not present in the original material.

The generic position of this species was formerly uncertain. The author (Frebold, 1958a) assigned the Prince Patrick Island fragments to *Ludwigia* Buckman, and Imlay (1955, p. 75, Pl. 11, figs. 1-3) placed other fragments very similar to *m'clintocki* into *Ludwigella* ?. Complete specimens are now available and show that the species belongs to *Pseudolioceras* Buckman. *P. m'clintocki* is closely related to the lower Bajocian *P. beyrichi* (Schloenbach) (*see* Schloenbach, 1865, Pl. 27, figs. 4, 5) which has similar suture line and rib pattern. The specific identity can not be established because adequate comparative material is not available. *P. whiteavesi* White (White, 1889, p. 69, Pl. 13, figs. 1-5) from the Alaskan lower Bajocian is also related but this species has a narrow umbilical ridge not observed in *P. m'clintocki.* Toarcian species of this genus, including the type species *P. compactile* (Simpson), (*see* Buckman, 1911, Pl. 41A, figs. 1, 2; Pl. 41B, figs. 1, 2), *P. gradatum* Buckman (*see* Buckman, 1888, Pl. 20, figs. 5, 6) in contrast with *P. m'clintocki* and the lower Bajocian species mentioned above have flat areas on both sides of the ventral keel.

Occurrence. The specimens described here were found in the Wilkie Point formation on Mackenzie King Island, about 9 miles east of its west coast (*see* Pl. XV, fig. 1). A part of the collection was made in situ in a sandy bed that forms the top of a ridge. More specimens were collected in talus 8 feet below the outcrop. The local association on Prince Patrick Island of *P. m'clintocki* with *Leioceras opalinum* was established in a previous paper (Frebold, 1958a, p. 23).

Pseudolioceras cf. *m'clintocki* (Haughton)

Plate IX, figure 1; Plate X, figure 1; Plate XI, figures 1-3; Plate XII, figure 1

Description. Most of the comparatively large specimens described here as *P.* cf. *m'clintocki* (Haughton) are weathered and, to a certain degree, laterally compressed by secondary pressure. They are very involute, narrow umbilicate, disc-like, with a narrow, almost sharp venter that has a high keel. The cross-section of the larger whorls (*see* Pl. XI, fig. 1*b,* and Pl. XII, fig. 1) is lanceolate. The flanks join the steep, almost perpendicular wall in a sharp edge. The ribs are faint, particularly in the lower part of the whorl, or entirely missing. On some specimens it can be seen that the absence of ribs is caused, at least in part, by weathering. The

large specimen (GSC No. 14667) illustrated on Plate X, figure 1, appears to be smooth, but there are other specimens (for example, GSC No. 14661 illustrated in fig. 1, Pl. IX) with faint ribs preserved. In some cases it could be observed that large specimens with smooth or almost smooth outer whorls have inner whorls with ribs like those of *P. m'clintocki*.

The suture line is strongly denticulated, the ventral lobe is of about equal length to the first lateral, the second lateral of about equal length to the deep accessory lobe that subdivides the wide first lateral saddle, the number of auxiliary lobes depending on the size of the specimen. The largest specimen has a diameter of 175 mm. As the entire living chamber is missing, the specimen must have been still larger.

Remarks. These large specimens are similar to *P. m'clintocki* in general outline, ribs and suture line, and probably belong to this species.

Occurrence. Most of the specimens were found in the Wilkie Point formation on Mackenzie King Island, about 9 miles east of its west coast, associated with *P. m'clintocki* (Haughton). One whorl fragment was found on the north side of Marie Bay, Melville Island, associated with *Leioceras opalinum* (Reinecke).

Pseudolioceras sp. indet. A

Description. Some poorly-preserved specimens or imprints of an undeterminable species of *Pseudolioceras* have flat zones on both sides of the ventral keel. These forms are similar to certain Toarcian species as, for example, *P. pumilum* Buckman (Buckman, 1888, Pl. 20, figs. 5, 6). One specimen is from the mid-eastern part of Cornwall Island, others are from Strandfjord, Axel Heiberg Island, where they are associated with *P.* aff. *compactile* (Simpson), and *Catacoeloceras spinatum* (Frebold).

Pseudolioceras sp. indet. B

Plate V, figure 10

Description. Small fragments with a maximum whorl height of 7 mm. The flanks are slightly convex with gentle transition to the narrow venter which has a fairly high keel. The transition of the flanks to the umbilicus is more abrupt. The ribs are inclined forward on the lower half of the flanks, they swing backward in the upper part and forward again in the transitional zone of venter and flanks. The lower half of the ribs is weaker than the upper. These specifically indeterminable fragments are similar to young specimens of *Pseudolioceras*.

Occurrence. North of Rat River and east of Summit Lake, Richardson Mountains.

Subfamily GRAMMOCERATINAE Buckman, 1904

Genus *Grammoceras* Hyatt, 1867

Grammoceras ? sp. indet.

Plate XII, figures 5-7

Grammoceras cf. *saemanni* (Dumortier) Frebold, 1929, p. 263, Pl. 2, figs. 6, 7.

Description. Several fragments and imprints from Cornwall and Ellesmere islands show complete agreement with *Grammoceras* cf. *saemanni* (Dumortier) described by the author (loc. cit.). This form is moderately involute, smaller specimens have a high-oval, larger specimens a more rectangular cross-section. The flanks are first moderately convex, in larger specimens almost parallel to one another. The transition to the venter and umbilical slope is first gradational, larger specimens develop rounded ventral and umbilical edges. The keel is moderately high, in larger specimens it is bordered on each side by flat, comparatively wide zones. The ribs are undivided, in the lower half of the flanks they are weaker than in the upper half and inclined forward. In the upper part of the flanks they swing backward forming an obtuse angle; in the marginal zone between flanks and venter they bend forward again. There are no ribs on the venter. No suture line is visible.

Remarks. The specimens from the Canadian Arctic are clearly identical with those described by the author from Spitzbergen as *G. saemanni* (Dumortier). The new material shows that they can be distinguished from *G. saemanni* (Dumortier) and such other related species as *G. bingmanni* (Denckmann), *G. striatulum* (Sowerby), and *G. toarcense* (d'Orbigny) by a narrower umbilicus, and less numerous ribs which are usually more sharply bent.

These falcoid ribs are not characteristic of the genus *Grammoceras* and the generic assignment of the form described here may need further review should better preserved material become available. The specimens belong to a species that may be characteristic of certain Toarcian deposits in the Arctic. Unfortunately the unsatisfactory state of preservation does not warrant precise identification.

Occurrence. Jaeger River, Cornwall Island, and on east side of Black Top Ridge, east of Eureka weather station on Fosheim Peninsula, Ellesmere Island. At this locality *Grammoceras* ? sp. indet. is associated with *Catacoeloceras polare* (Frebold) and *Pseudolioceras* sp. indet.

Genus *Pleydellia* Buckman, 1899

Pleydellia ? sp. indet.

Plate IX, figures 5, 6; Plate XII, figures 2-4

Description. The specimens described here as *Pleydellia* ? sp. indet. all came from the same piece of rock. They are moderately involute, their flanks are slightly convex with rounded gradual transition into the narrow venter which has a fairly low keel. Young specimens as GSC Nos. 14665, 14666 (*see* Pl. IX, figs. 5 and 6)

have no umbilical wall and the flanks descend very gently to the umbilical region. An umbilical wall first becomes noticeable when the specimens attain the size of those illustrated on Plate XII, figures 3 and 4, and is more clearly developed at the end of the whorl of the larger specimen (GSC No. 14671) illustrated on Plate XII, figures 2*a, b*. The flanks are more rounded in younger specimens like those illustrated on Plate IX, figures 5 and 6, than at later stages of growth. The cross-section is higher than wide, more or less oval in young specimens, but with more flattened flanks at later stages of growth.

The ribs are slightly falcoid, and usually weaker in the lower half of the flanks than in the upper, some are bundled near the umbilicus, others are divided at about the half height of the flanks. Some secondaries are intercalated. There are specimens with very fine and others with stronger ribs. The number of ribs is also subject to variation.

The suture line of the specimen illustrated on Plate XII, figures 2*a, b,* is not deeply incised. The ventral lobe is much shorter than the first lateral and the second lateral is considerably smaller than the first. The broad first lateral saddle is subdivided into two halves of which the inner one is larger than the outer. The second lateral saddle is narrower than the first. No other elements of the suture line could be seen.

Remarks. The fragmentary preservation of the larger specimens does not allow detailed comparisons with any known species, and the assignment of these forms to the genus *Pleydellia* is tentative. The specimen illustrated on Plate XII, figures 2*a, b,* is somewhat similar to certain variations of *P. aalensis* (Zieten) (*see* Benecke, 1905, figs. 4, 5, 6, Pl. 47) but the suture line of this and related species is distinguished by a deeper denticulation of the first lateral lobe.

Associated with the specimens described here are some large specimens. The dimensions in millimetres of the best preserved one (GSC No. 14677 not illustrated) are: diameter 176, width of umbilicus 54 (.30), height of last whorl 84 (.48), thickness of last whorl about 51 (.29). At the end of the last whorl the cross-section is lancet-shaped with its greatest width near the umbilical edge. The venter is fairly sharp. There is a high, steep, and almost vertical umbilical wall in the anterior part of the last whorl which gradually loses height towards the posterior part. Secondary compression of this part of the ammonite may have contributed to this decrease in height. The umbilical edge is rounded. In the posterior part of the last whorl a fairly high and sharp keel is present and the flanks do not seem to grade into the roof-like ventral region, but seem to be separated from it by an edge. These conditions may, however, have been accentuated by secondary compression.

No sculpture is visible, ribs seem to have been entirely absent. As parts of suture lines are recognizable to the end of the last whorl, most of the living chamber is missing and the specimen must have been still larger. Identification of these large, poorly preserved specimens is not possible. They may possibly be large specimens of *Pleydellia* ? sp. indet. described above.

Occurrence. Jaeger formation, Cameron Island, 2 miles east of Success Point. Associated with *Oxytoma jacksoni* (Pompeckj).

Family GRAPHOCERATIDAE Buckman, 1905

Subfamily LEIOCERATINAE Spath, 1936

Genus *Leioceras* Hyatt, 1867

Leioceras opalinum (Reinecke)

Plate VI, figures 1-4; Plate VII, figure 1

Leioceras opalinum Frebold 1958a, p. 6, Pl. 4, figs. 1-6; Pl. 5, figs. 1, 2. For more detailed synonymy *see* Frebold (loc. cit.).

Holotype. Nautilus opalinus Reinecke, 1818, p. 55, Pl. 1, figs. 1, 2.

Description. The small whorl fragment (GSC No. 14650) illustrated on Plate VI, figure 3, has the lanceolate cross-section, the sharp venter and very fine undivided falcoid lines on the flanks as have the specimens of *L. opalinum* described from Prince Patrick Island. Another fragment (GSC No. 14649) illustrated on Plate VI, figure 2, has the inner whorls preserved. At this stage of growth the flanks grade into the gentle umbilical slope, the sharp umbilical edge, characteristic of this species, is not yet developed. The large specimen (GSC No. 14651) illustrated on Plate VII, figure 1, has a secondarily compressed umbilical region and the umbilical edge is, therefore, not well preserved. The suture lines of the specimens illustrated on Plate VI, figures 1*a, b,* and Plate VII, figure 1, agree well with that of *L. opalinum* (Reinecke). The ventral lobe is a little shorter than the first lateral, which in turn is considerably larger than the second lateral lobe. The first lateral saddle is wide and subdivided into two parts, of which the inner one is wider and higher than the outer one. The second lateral saddle is much narrower than the first. There are some auxiliary lobes.

Occurrence. North side of Marie Bay, Melville Island, 60 feet above the base of the Wilkie Point formation exposures.

AGE DETERMINATIONS

The age and correlation of most of the faunas described in this paper have been discussed previously (Frebold, 1958a, b). As part of the Lower Jurassic and Bajocian ammonites of the Canadian Arctic are identical with, or closely related to, well-known European species, it is easy to refer most of them to northwest European stages, and even zones. However, it is obvious that the Lower Jurassic sequence of the Canadian Arctic is very incomplete as compared with the European.

Hettangian

At present no marine strata that can be assigned to the Hettangian stage is indicated in any part of the Canadian Arctic. Ammonites belonging to this stage such as *Psiloceras* and *Schlotheimia* are well known in parts of British Columbia (*see* Frebold, 1951b) and Yukon but have not been found in the Canadian Arctic. Some of the non-marine beds developed on some of the islands below the marine Toarcian may include deposits of Hettangian age. They have yielded plants of 'Rhaeto-Liassic' aspect.

Sinemurian

The oldest marine Lower Jurassic faunas hitherto found in the Canadian Arctic are probably the indeterminable ammonites described here as *Arietites* sensu lato sp. indet. from the Rat River area (Richardson Mountains), Borden and Melville islands. They may belong to different species and are tentatively placed in the lower Sinemurian zones of *Arietites bucklandi* or *Arnioceras semicostatum*. On Borden and Melville islands the beds concerned are more or less concealed and no details are known about the occurrence of the one specimen of *Arietites* sensu lato sp. indet. from the Richardson Mountains. Some indeterminable small ammonites found on Melville Island close to the lower contact of the Jurassic strata and an indistinctive pelecypod fauna found close to the Jurassic-Triassic boundary on Ellesmere Island may belong to the Sinemurian but this cannot be proved on the basis of the available material.

The fauna characterized by the index ammonites *Oxynoticeras oxynotum* (Quenstedt), *Gleviceras* ? sp. indet., and *Arctoasteroceras jeletzkyi* n. gen. et n. sp. is known only from the Aklavik range, in the area near Bug Creek and Bug Lake. As this fauna contains the European zone fossil *Oxynoticeras oxynotum* it is assigned to this upper Sinemurian zone.

Above this zone, in the same area, echioceratids described here as *Echioceras* sensu lato sp. indet. occur. The beds concerned are here tentatively assigned to the European zone of *Echioceras raricostatum,* which is the uppermost Sinemurian zone. Unfortunately the poor preservation of the ammonites concerned does not warrant detailed comparison with European species of this zone.

Pliensbachian

No Pliensbachian ammonites older or younger than the *Amaltheus margaritatus* zone have yet been found in the Canadian Arctic, and this zone is known to be present only at one locality in the Richardson Mountains. It is probable that the Pliensbachian is missing in most areas. This can actually be demonstrated on Prince Patrick Island, where the Toarcian forms the base of the Jurassic.

Toarcian

Two Toarcian zones in the Lower Jurassic sequence of Prince Patrick Island were recognized recently (Frebold, 1958a, pp. 21-23, 32). The lower zone is that of *Hildoceras bifrons* of the lower Toarcian, indicated by abundant specimens of *Dactylioceras commune* (Sowerby) which is very frequent particularly in the lower part of this zone in northwestern Europe. *Hildoceras bifrons* itself has not yet been found in the Canadian Arctic.

Imlay (1955, Pl. 11, figs. 12, 13, 15) figured fragments of an ammonite, from Prince Patrick Island, under the name *Harpoceras* cf. *exaratum* (Young and Bird). This form was apparently associated with *Dactylioceras commune*. A small specimen that is very similar to Imlay's form is here described under the same name. It was found on Borden Island in the bed with *D. commune*. In England *H. exaratum* (Young and Bird) belongs to the lower part of Arkell's zone of *Harpoceras falcifer* that is older than the zone of *Hildoceras bifrons* to which *D. commune* belongs. *D. commune* and *H. exaratum* should therefore not normally be associated with each other. However, as the Canadian Arctic form could not be identified directly with *H. exaratum* (Young and Bird) it is possible that it belongs to a different species. In this case there would be no discrepancy with the European zonal succession.

The upper zone is characterized by *Pseudolioceras* aff. *compactile* (Simpson), *Catacoeloceras spinatum* (Frebold), *Catacoeloceras polare* (Frebold) and *Grammoceras* n. sp. ?. These forms are related to species of the northwest European subzone of *Grammoceras striatulum* which forms part of the *Lytoceras jurense* zone of the upper Toarcian.

Index ammonites of this zone were found on Prince Patrick, Cornwall, Axel Heiberg, and Ellesmere islands, but may actually have a wider distribution.

The presence of Toarcian beds in the Arctic coast region was recently suggested by the author (Frebold, 1958b, p. 30). This assumption is based on a small collection made by J. Talbot, Shell Oil Company of Canada, at a locality north of Rat River and east of Summit Lake, close to the Yukon-Northwest Territories border and about 35 miles southwest of the Sinemurian localities near Bug Lake and Bug Creek. The fragments of small ammonites contained in this collection are similar to small specimens of *Pseudolioceras* from the Arctic islands but are not specifically determinable. The associated belemnite and pelecypod fragments are not diagnostic. The possibility that the beds concerned may be of early Bajocian age cannot be ruled out.

Another small collection from a locality 22 miles northwest of Summit Lake (GSC loc. 39342) contains *Dactylioceras* sp. and a harpoceratid fragment. *Dactylioceras* establishes the presence of Toarcian in this area.

In the Bug Lake and Bug Creek area of the Aklavik Range neither Toarcian or lower Bajocian beds seem to be present.

Lower Bajocian

The lower part of the Bajocian is represented on Prince Patrick, Melville, Mackenzie King, Cameron, and Axel Heiberg islands. Unfortunately many outcrops are poor and disintegrated and the succession of the faunas is not clear. There are three index fossils, i.e., *Leioceras opalinum* (Reinecke), *Pseudolioceras m'clintocki* (Haughton), and *Oxytoma jacksoni* (Pompeckj). *Leioceras opalinum* (Reinecke) was found on Prince Patrick and Melville islands. In northwest Europe this species is the zone fossil of the opalinum zone that forms the lowermost part of the Bajocian and the Middle Jurassic. The presence of this zone in the Canadian Arctic is thus clearly indicated. In Melville Island a form described here as *Pseudolioceras* cf. *m'clintocki* (Haughton) was found associated with *L. opalinum* but at other localities the two species do not occur in the same bed. For example, on Mackenzie King Island, where numerous well-preserved specimens of *Pseudolioceras m'clintocki* were found, no *Leioceras opalinum* was collected. This indicates that there may be some stratigraphic overlap between the two species. *Oxytoma jacksoni* (Pompeckj) is now known from Prince Patrick, Mackenzie King and Axel Heiberg islands. In Prince Patrick Island it was found associated with *P. m'clintocki* in the type section of the Wilkie Point formation on the east side of Intrepid Inlet. On Mackenzie King Island it occurs about 70 feet below the same ammonite whereas on Cameron Island it is associated with ammonites described here as *Pleydellia* ? sp. indet., which cannot be used for direct age determination. The precise mutual stratigraphical relationship of *Leioceras opalinum, Pseudolioceras m'clintocki,* and *Oxytoma jacksoni* are not absolutely clear, they are here tentatively placed in one zone, i.e., that of *Leioceras opalinum.*

At one locality (GSC loc. 38776) in the Richardson Mountains the presence of lower Bajocian is indicated by *Erycites* cf. *howelli* (White) and *Pseudolioceras* sp.

THE GAPS IN THE SEQUENCE

Two different kinds of gaps are present in the Lower Jurassic and Bajocian sequence of the Canadian Arctic. They are gaps recognizable in the entire region and gaps of only local occurrence.

Stages or parts of stages missing in the entire region or possibly replaced by non-marine beds (*see* Table I) are the whole Hettangian, part of the Sinemurian, most of the Pliensbachian, and parts of the Toarcian, particularly the zone of *Dactylioceras tenuicostatum.* About six of the seventeen Lower Jurassic zones of northwest Europe are more or less well indicated in the Canadian Arctic, i.e., one of the two lower Sinemurian zones (*Arietites bucklandi* or *Arnioceras semicostatum*), the upper Sinemurian zones of *Oxynoticeras oxynotum, Echioceras raricostatum,* the *Amaltheus* zone of the Pliensbachian, the lower Toarcian zone of *Hildoceras bifrons* and part of the upper Toarcian *Lytoceras jurense* zone.

Stages or parts of stages present in some parts of the region and missing in others are: the Sinemurian, present in part on some of the islands and in the Richardson Mountains, is entirely absent in Prince Patrick Island, where the Toarcian lies directly on Devonian or locally on Triassic (Tozer, 1956 and personal communication). The Sinemurian may also be absent on other islands where it has not been recorded, but as beds of this age may be concealed, or simply not found, no certain opinion can be offered. In the Bug Lake and Bug Creek area of the Aklavik Range the two upper Sinemurian zones are present; they rest on the Palæozoic. The lower Sinemurian zone with *Arietites* sensu lato sp. indet., which is established about 35 miles to the southeast, is absent. The upper Sinemurian *Oxynoticeras* and *Echioceras* zones of the Bug Creek and Bug Lake area have not been found in other parts of the Canadian Arctic and it seems reasonable to believe that on most of the islands they are actually absent. The Toarcian and lower Bajocian zones so widespread on the Arctic islands are not indicated in the Aklavik Range and are probably absent. Farther to the west, however, both Toarcian and lower Bajocian are present.

CORRELATION WITH OTHER ARCTIC REGIONS

Correlation of the Toarcian and lower Bajocian beds of the Canadian Arctic with northern Alaska, the Barents shelf and East Greenland has been discussed in a previous paper (Frebold, 1958a). These relationships are summarized in Table I. Correlations of Jurassic rocks older than Toarcian are discussed in the following.

Marine beds of Hettangian age are unknown in the Canadian Arctic. They are also unknown in the Barents shelf and in East Greenland but they may be locally represented in the Arctic Coastal Plain of northern Alaska (Imlay, 1955, p. 81 and chart 1). From the same area Imlay (1955, p. 81 and chart 1) mentions beds with *'Arietites'* cf. *'A' bucklandi* (Sowerby), which are probably equivalent in age to the lower Sinemurian beds in the Rat River area, on Borden and Melville islands, in which *Arietites* sensu lato sp. indet. was found. Marine equivalents of these beds are unknown in the Barents shelf area and East Greenland. Marine upper Sinemurian beds with *Oxynoticeras oxynotum* (Quenstedt), other oxynoticeratids, *Arctoasteroceras jeletzkyi* n. sp., nautiloids, pelecypods, and gastropods found in the Bug Creek and Bug Lake area, are unknown in northern Alaska, the Barents shelf area and East Greenland and seem to be absent also on the Canadian Arctic islands. Part of the Pliensbachian that appears to be entirely absent on the Arctic islands is represented in northern Alaska and at one locality in the Richardson Mountains by various species of the zone of *Amaltheus margaritatus*. Marine beds of this age are also known from the mouth of the Lena in northern Siberia (Pavlow, 1914, p. 63). Marine beds of early Pliensbachian age are known from East Greenland where *Uptonia jamesoni* and *Beaniceras* were found (*see* Rosenkrantz, 1934, pp. 110-115).

	EUROPEAN STAGES (Arkell 1956)	NORTHWEST EUROPE STANDARD ZONES (Arkell 1956)	RICHARDSON MOUNTAINS	AKLAVIK RANGE (Northeastern Richardson Mts.)	PRINCE PATRICK ISLAND	MELVILLE ISLAND	MACKENZIE KING & BORDEN ISLANDS	CAMERON ISLAND	CORNWALL ISLAND	AXEL HEIBERG ISLAND	ELLESMERE ISLAND	NORTHERN ALASKA after Imlay, 1955	BARENTS SHELF	EAST GREENLAND after Rosenkrantz, 1934
L. MIDDLE JURASSIC	L. Bajocian	*Leioceras opalinum*	*Erycites* cf. *howelli*, *Pseudolioceras*	Absent	W.P. *Leioceras opalinum*, *Pseudolioceras m'clintocki*, *Oxytoma jacksoni*	W.P. *Leioceras opalinum*, *Pseudolioceras m'clintocki*	W.P. *Pseudolioceras m'clintocki*, *Oxytoma jacksoni* Ⓜ	J.F. *Pleydellia* ? sp. indet., *Oxytoma jacksoni*				*Pseudolioceras* cf. *whiteavesi*	*Oxytoma jacksoni*	*Pseudolioceras beyrichi*
LOWER JURASSIC	Toarcian	*Lytoceras jurense*			WILKIE PT. FM. *Pseudolioceras* aff. *compactile*, *Catacoeloceras spinatum*	Not identified	WILKIE PT. FM.	Not identified	*Grammoceras* n. sp. ?	S.F. *Pseudolioceras* cf. *compactile* *Catacoeloceras spinatum*	*Grammoceras* n. sp. ?, *Pseudolioceras* sp. indet. *Cat. polare*	*Pseudolioceras* cf. *lythense*	*Pseudolioceras* cf. *compactile*, *Catacoeloceras polare*	*Pseudolioceras compactile*
		Hildoceras bifrons	*Dactylioceras* sp.		*Dactylioceras commune*		*Dactylioceras commune* Ⓑ		*Dactylioceras commune*, *Pseudolioceras* sp. indet.			*Dactylioceras* spp. (coarsely ribbed)		*Dactylioceras groenlandicum*
		Harpoceras falcifer			Absent		Not identified	Not identified	Not identified	Not identified	Not identified			
		Dactylioceras tenuicostatum										*Dactylioceras* spp. (finely ribbed)		
	Pliensbachian	*Pleuroceras spinatum*												
		Amaltheus margaritatus	*Amaltheus* sp.									*Amaltheus* spp.		No index fossils
		Prodactylioceras davoei	Not identified											
		Tragophylloceras ibex												*Beaniceras* sp., *Lytoceras fimbriatum*
		Uptonia jamesoni												*Uptonia jamesoni*
	Sinemurian	*Echioceras raricostatum*		*Echioceras* s. l. sp. indet.	Absent							Not identified	Absent	Not indicated
		Oxynoticeras oxynotum		*Arctoasteroceras jeletzkyi*										
		Asteroceras obtusum		Absent										
		Euasteroceras turneri												
		Arnioceras semicostatum	*Arietites* s. l. gen. et sp. indet.			*Arietites* s. l. gen. et sp. indet.	*Arietites* s. l. gen. et sp. indet. Ⓑ							
		Arietites bucklandi										*"A."* cf. *"A." bucklandi*		
	Hettangian	*Schlotheimia angulata*				Not identified	Not identified	Non marine beds with coal seams and "Rhaeto-Liassic" plants may belong in part to this interval				?		Non marine beds with Hettangian flora
		Psiloceras planorbis												

ABBREVIATIONS
W.P.– Wilkie Point formation; J.F. – Jaeger formation; S.F. – Savik formation
Ⓜ–Mackenzie King Island; Ⓑ–Borden Island

G. S. C.

Table 1. Correlation chart of the Lower Jurassic and lowermost Bajocian sequence in the Canadian Arctic and other Arctic regions

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GENERAL PALAEOGEOGRAPHIC CONCLUSIONS

The Canadian Arctic region is considered a border zone of the Jurassic Arctic Ocean. From this ocean came various transgressions flooding parts of the Arctic islands and parts of the Arctic coast.

Transgressions are now known to have occurred during the early Sinemurian (in parts of the Arctic coast region and in some of the islands), late Sinemurian (part of the coast region), late Pliensbachian (part of the coast region), Toarcian (most of the Queen Elizabeth islands and part of the coast region) and early Bajocian (in some of the islands and part of the coast region). Most of these transgressions were followed or preceded by times of regressions.

The absence of whole stages or parts of them in the entire Canadian Arctic is explained by total regressions of the sea. Considering the duration of the Early Jurassic and early Bajocian (rough estimate is 8 to 10 millions of years) a repeated coming and going of the sea is what should be expected and what actually took place in these times in other regions of the world. This leads to the assumption that the whole Canadian Arctic was not covered by the sea during the Hettangian, part of the Sinemurian, most of the Pliensbachian, part of the Toarcian. As no orogenic movements are known to have taken place in these times, epeirogenetic uplifts affecting the whole area are seen as the cause of these regressions.

The local gaps are explained by the special position of the areas concerned. Thus, the absence of the lower Sinemurian, Pliensbachian, Toarcian and lower Bajocian zones in the Aklavik Range can be explained by an assumed proximity of the eastern coast-line (*see* palæogeographic map, Fig. 1). The absence of the whole Sinemurian (in addition to the Hettangian and Pliensbachian) on Prince Patrick Island can hardly be explained by the nearness of the coast-line, particularly after the discovery of Sinemurian beds on Melville Island, which was closer to the land than Prince Patrick Island. It is, therefore, reasonable to suggest that this region was an island during most of the Early Jurassic time that was not flooded before the Toarcian.

The palæogeographic map (Fig. 1) is largely the same as part of the map figured in previous papers (Frebold, 1957, 1958a, b). The southern coast-line of Melville Island has, however, been moved slightly to the south.

Zoogeographically the Lower Jurassic and Bajocian ammonite faunas belong to genera and species that are closely related to, or identical with, those of other parts of the world.

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PLATES I to XV

PLATE I

(All figures natural size)

Figure 1. *Arietites* sensu lato gen. et sp. indet. (Page 13.) Lateral view. Lower Sinemurian. Richardson Mountains, near head of second northern tributary to Rat River. GSC No. 14618.

Figure 2. *Arietites* sensu lato gen. et sp. indet. (Page 13.) Lateral view. Lower Sinemurian. Melville Island, north side of Marie Bay, 11 miles west of its head. GSC No. 14619.

Figures 3a, b. *Arietites* sensu lato gen. et sp. indet. (Page 13.) 3a, lateral view; 3b, venter. Lower Sinemurian. Southern part of central Borden Island. GSC No. 14620.

Figures 4a, b. *Arctoasteroceras* ? sp. indet. (Page 15.) 4a, lateral view; 4b, ventral view. Upper Sinemurian, Oxynotum zone. Aklavik Range, about 2 miles south of Bug Lake and Bug Creek, locality 2. GSC No. 14622.

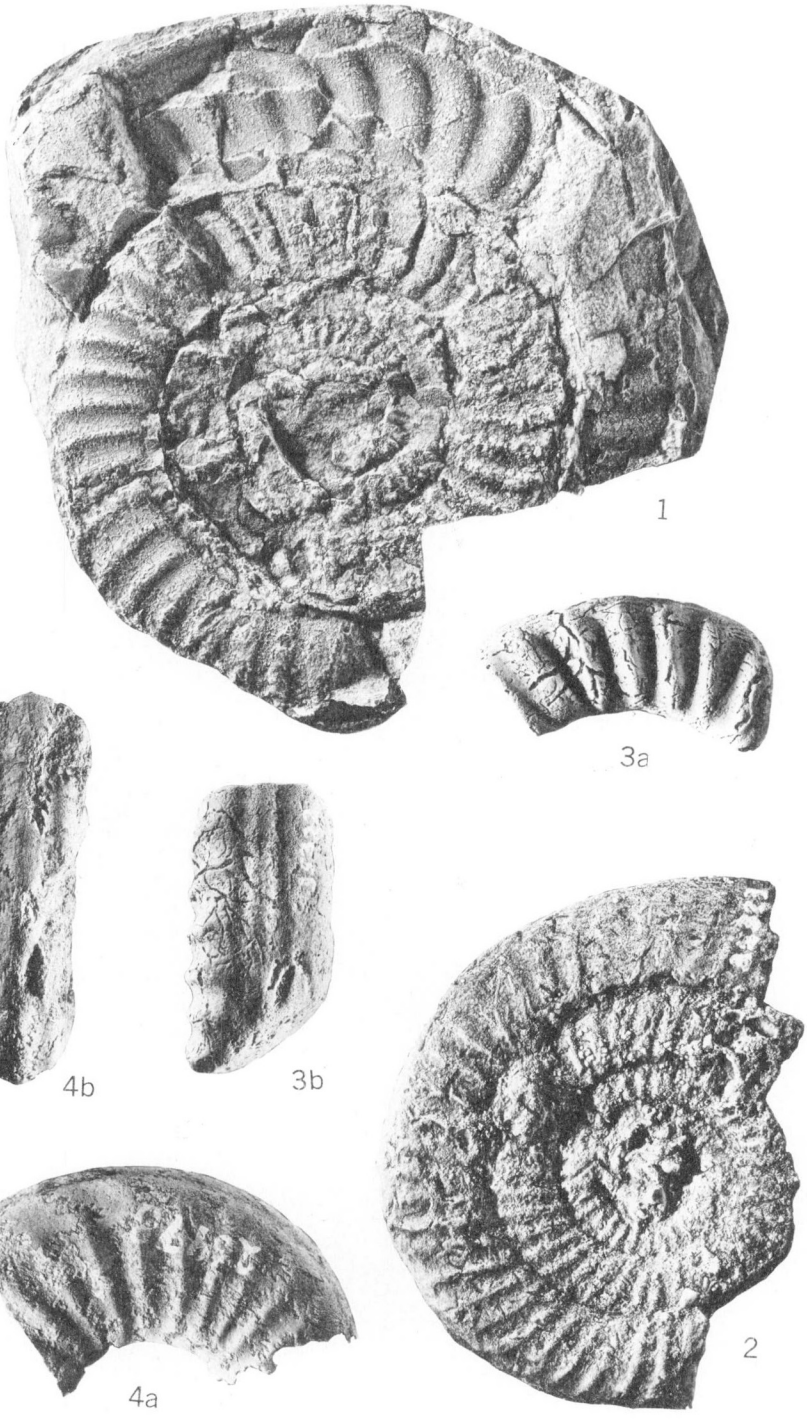

1
3a
4b
3b
2
4a

PLATE II

(All figures natural size)

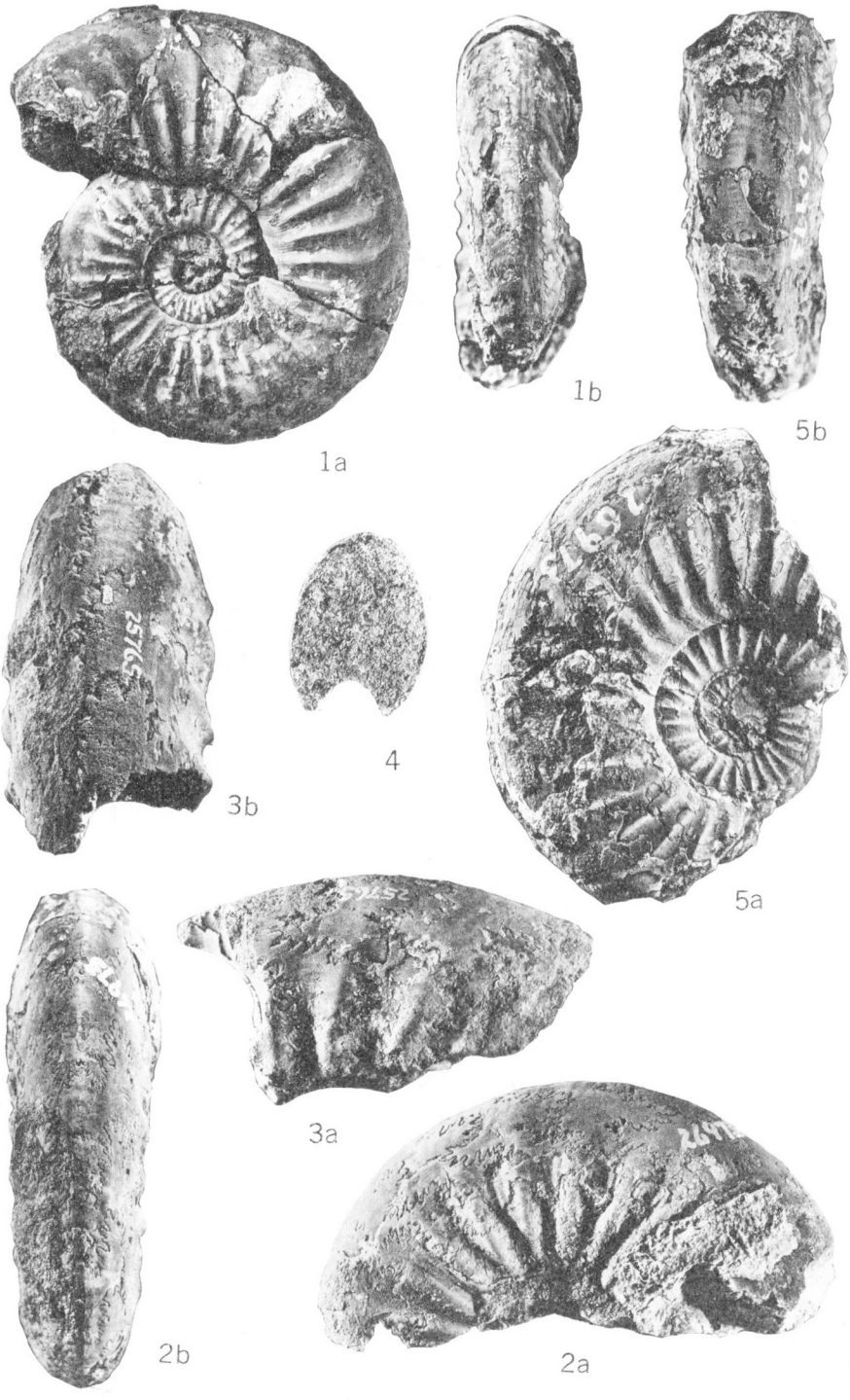
Figures 1a, b. *Arctoasteroceras jeletzkyi* n. gen. et n. sp. (Page 14.) 1a, lateral view; 1b, ventral view. Upper Sinemurian, Oxynotum zone. Aklavik Range, about 2 miles south of Bug Lake and Bug Creek, locality 1. Holotype, GSC No. 14623.

Figures 2a, b. *Arctoasteroceras jeletzkyi* n. gen. et n. sp. (Page 14.) 2a, lateral view; 2b, ventral view. Upper Sinemurian, Oxynotum zone. Aklavik Range, about 2 miles south of Bug Lake and Bug Creek, locality 2. Paratype, GSC No. 14624.

Figures 3a, b. *Arctoasteroceras jeletzkyi* n. gen. et n. sp. (Page 14.) 3a, lateral view; 3b, ventral view with part of suture line. Same stratigraphic position and locality as figure 1. Paratype, GSC No. 14625.

Figure 4. *Arctoasteroceras jeletzkyi* n. gen. et n. sp. (Page 14.) Cross-section. Same stratigraphic position and locality as figure 1. Paratype, GSC No. 14626.

Figures 5a, b. *Arctoasteroceras jeletzkyi* n. gen. et n. sp. (Page 14.) 5a, lateral view; 5b, ventral view. Same stratigraphic position and locality as figure 2. Paratype, GSC No. 14627.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2b
2a

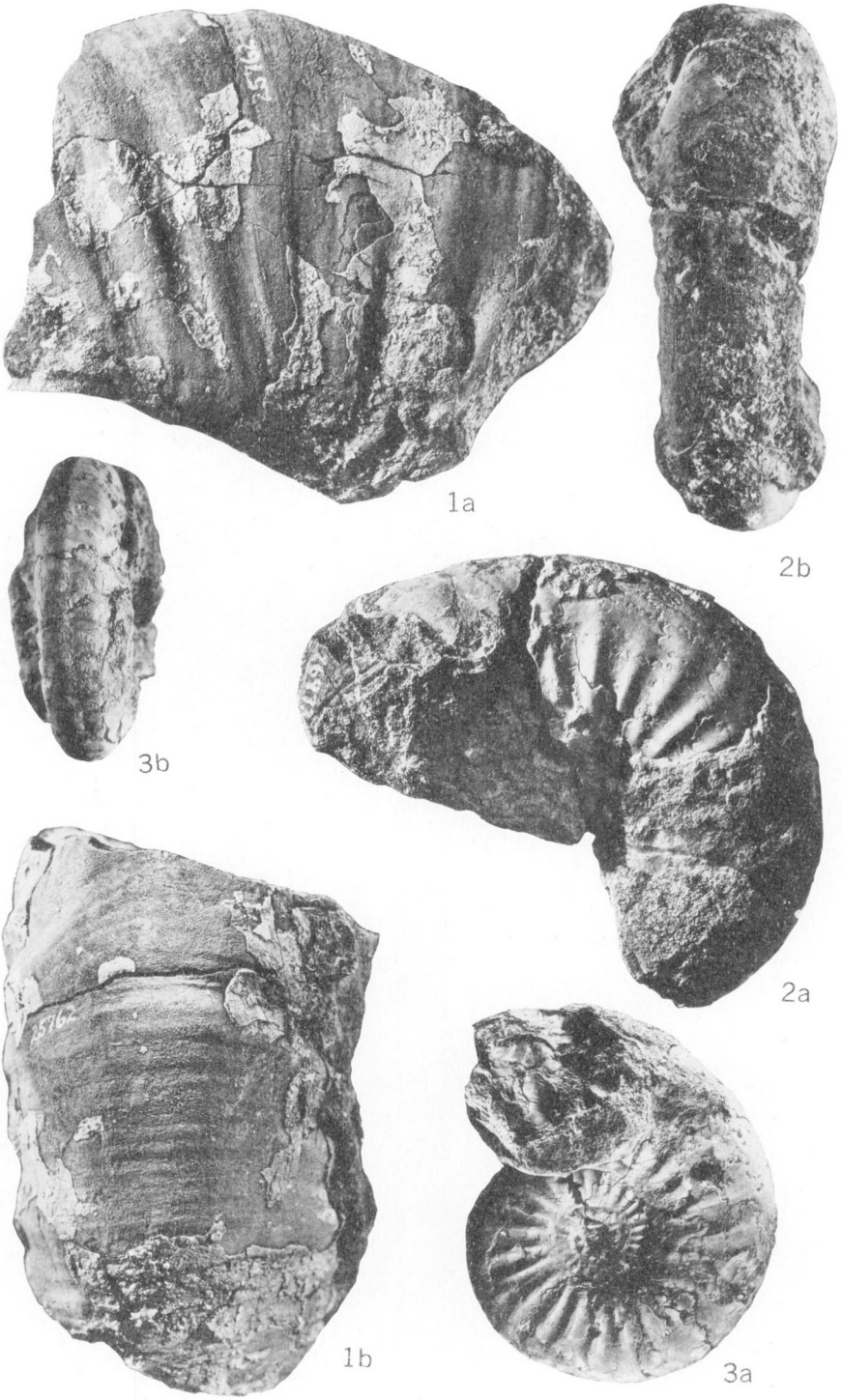
PLATE III

(All figures natural size)

Figures 1a, b. *Arctoasteroceras jeletzkyi* n. gen. et n. sp. (Page 14.) 1a, lateral view; 1b, ventral view. Upper Sinemurian, Oxynotum zone. About 2 miles south of Bug Lake and Bug Creek, locality 1. Paratype, GSC No. 14628.

Figures 2a, b. *Arctoasteroceras jeletzkyi* n. gen. et n. sp. (Page 14.) 2a, lateral view; 2b, venter. Upper Sinemurian, Oxynotum zone. About 2 miles south of Bug Lake and Bug Creek, locality 2. Paratype, GSC No. 14629.

Figures 3a, b. *Arctoasteroceras jeletzkyi* n. gen. et n. sp. (Page 14.) 3a, lateral view; 3b, ventral view. Same stratigraphic position and locality as figure 2. Paratype, GSC No. 14630.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2a
1b
3a

PLATE IV

(All figures natural size)

Figure 1. *Oxynoticeras oxynotum* (Quenstedt). (Page 16.) Ventral view. Upper Sinemurian, Oxynotum zone. Aklavik Range, about 2 miles south of Bug Lake and Bug Creek, locality 1. Hypotype, GSC No. 14631.

Figures 2a, b. *Oxynoticeras oxynotum* (Quenstedt). (Page 16.) 2a, lateral view; 2b, ventral view. Same stratigraphic position and locality as figure 1. Hypotype, GSC No. 14632.

Figure 3. *Oxynoticeras oxynotum* (Quenstedt). (Page 16.) Lateral view. Aklavik Range, about 2 miles south of Bug Lake and Bug Creek, locality 2. Hypotype, GSC No. 14633.

Figure 4. *Oxynoticeras* sp. indet. (Page 16.) Ventral view of whorl fragment. Same stratigraphic position and locality as figure 3. GSC No. 14634.

Figure 5. *Oxynoticeras* sp. indet. (Page 16.) Ventral view of fragmentary larger specimen. Same stratigraphic position and locality as figure 1. GSC No. 14635.

Figures 6a-c. *Gleviceras* ? sp. indet. (Page 17.) 6a, lateral view; 6b, cross-section; 6c, ventral view. Same stratigraphic position and locality as figure 3. GSC No. 14636.

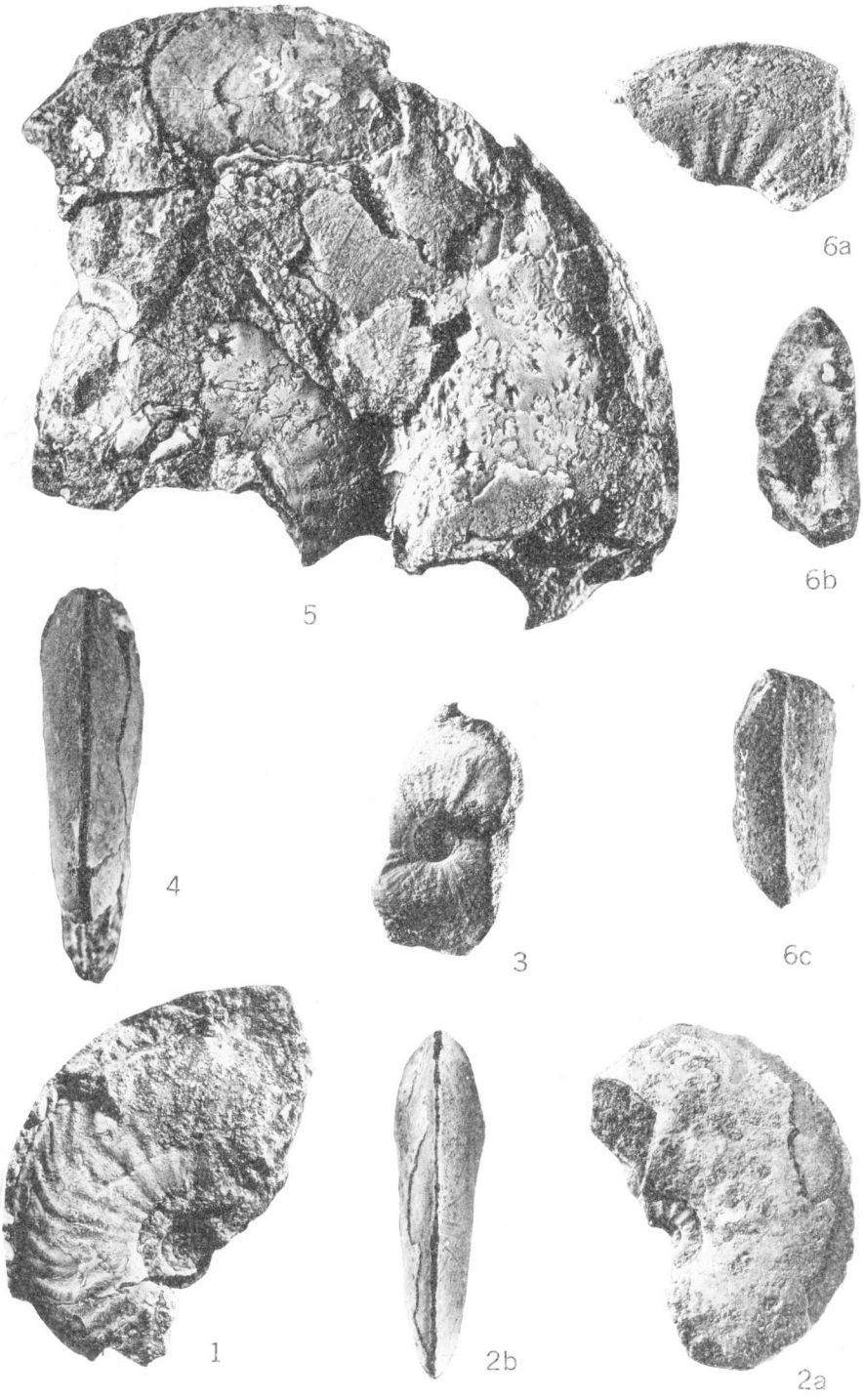
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PLATE V

(All figures natural size)

Figure 1. *Echioceras* sensu lato sp. indet. (Page 17.) Lateral view. Upper Sinemurian, Raricostatum zone. Aklavik Range south side of Bug Creek Canyon, locality 6. GSC No. 14638.

Figure 2. *Echioceras* sensu lato sp. indet. (Page 17.) Ventral view. Same stratigraphic position and locality as figure 1. GSC No. 14639.

Figure 3. *Echioceras* sensu lato sp. indet. (Page 17.) Ventral view. Same stratigraphic position and locality as figure 1. GSC No. 14640.

Figure 4. *Dactylioceras commune* (Sowerby). (Page 18.) Rubber cast, lateral view. Wilkie Point formation, Toarcian. Borden Island, southern peninsula, locality 2. 100 feet stratigraphically above base of Wilkie Point formation. Hypotype, GSC No. 14641.

Figure 5. *Dactylioceras commune* (Sowerby). (Page 18.) Rubber cast, lateral view. Same stratigraphic position and locality as figure 4. Hypotype, GSC No. 14642.

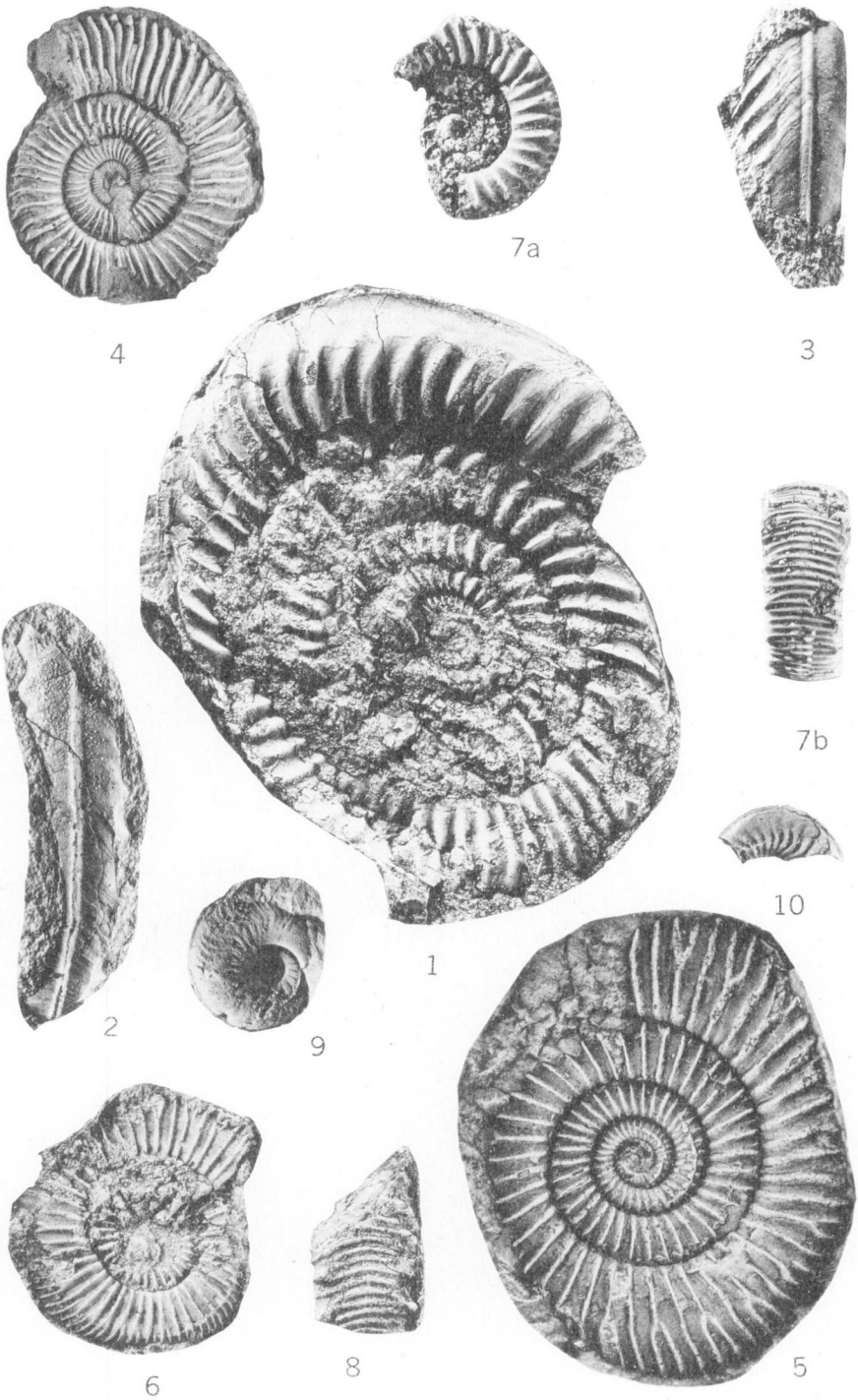
Figure 6. *Dactylioceras commune* (Sowerby). (Page 18.) Rubber cast, lateral view. Jaeger formation, Toarcian. Cornwall Island, mid-eastern part, on Jaeger River. Not in situ. Hypotype, GSC No. 14643.

Figures 7a, b. *Catacoeloceras polare* (Frebold). (Page 18.) 7a, lateral view; 7b, ventral view. Toarcian. Ellesmere Island, Fosheim Peninsula, east of Eureka weather station. Hypotype, GSC No. 14644.

Figure 8. *Catacoeloceras polare* (Frebold). (Page 18.) Ventral view. Same stratigraphic position and locality as figure 7. Hypotype, GSC No. 14645.

Figure 9. *Harpoceras* cf. *exaratum* (Young and Bird). (Page 19.) Rubber cast, lateral view. Same stratigraphic position and locality as figure 4. GSC No. 14646.

Figure 10. *Pseudolioceras* sp. indet. B. (Page 22.) Lateral view. Toarcian or Bajocian. Richardson Mountains, north of Rat River and east of Summit Lake. GSC No. 14647.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8
5

PLATE VI

(All figures natural size)

Figures 1a, b. *Leioceras opalinum* (Reinecke). (Page 25.) 1a, lateral view; 1b, ventral view. Wilkie Point formation, lower Bajocian. Melville Island, north side of Marie Bay, 60 feet above base of Wilkie Point formation exposures. Hypotype, GSC No. 14648.

Figure 2. *Leioceras opalinum* (Reinecke). (Page 25.) Lateral view. Same stratigraphic position and locality as figure 1. Hypotype, GSC No. 14649.

Figure 3. *Leioceras opalinum* (Reinecke). (Page 25.) Lateral view. Same stratigraphic position and locality as figure 1. Hypotype, GSC No. 14650.

Figure 4. *Leioceras opalinum* (Reinecke). (Page 25.) Ventral view and cross-section of specimen illustrated on Plate VII, figure 1. Same stratigraphic position and locality as figure 1. Hypotype, GSC No. 14651.

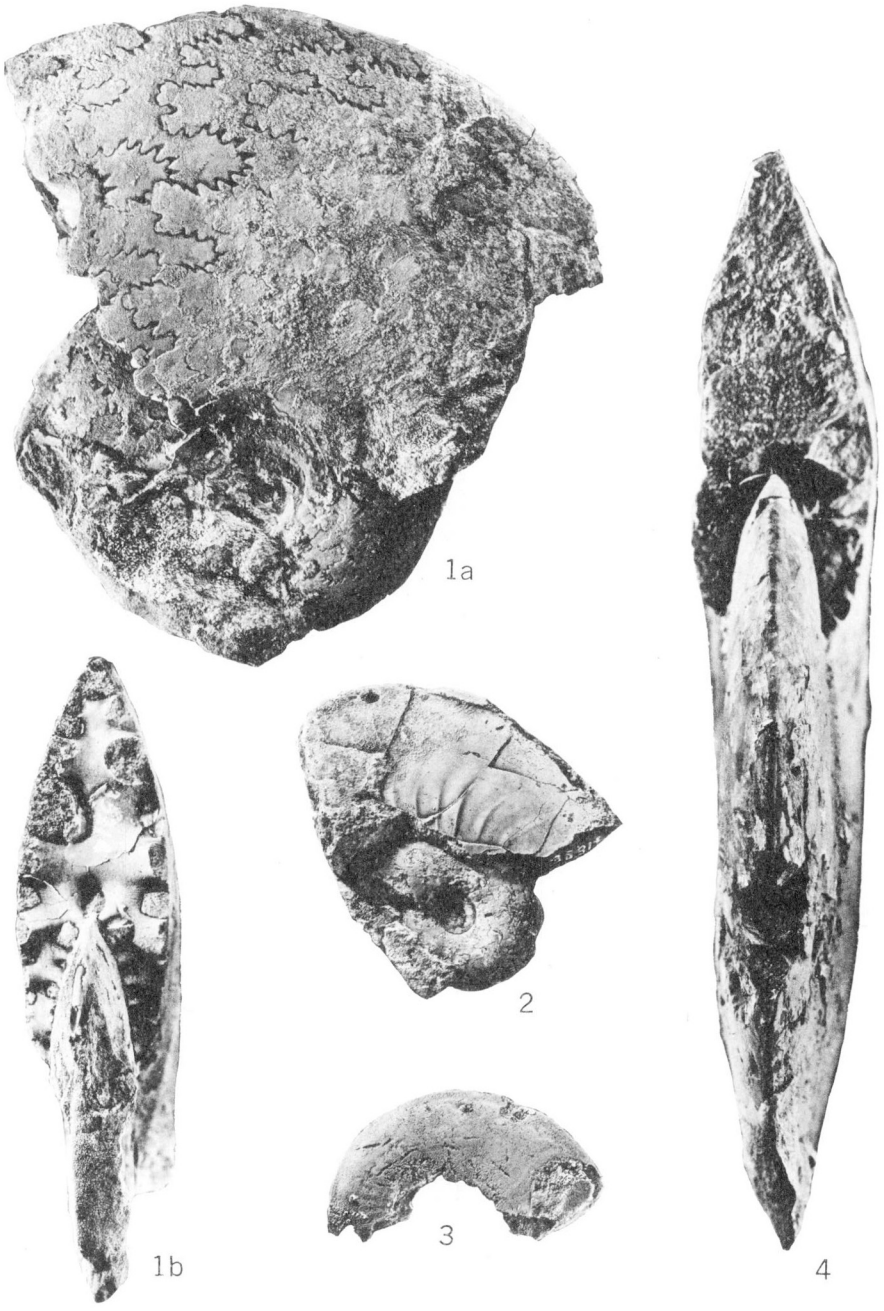

1a
1b
2
3
4

Plate VII

(Figure natural size)

Figure 1. *Leioceras opalinum* (Reinecke). (Page 25.) Same specimen as Plate VI, figure 4. Lateral view. Wilkie Point formation, lower Bajocian. Melville Island, north side of Marie Bay, 60 feet above base of Wilkie Point formation exposures. Hypotype, GSC No. 14651.

1

PLATE VIII

(All figures natural size)

Figure 1. *Pseudolioceras m'clintocki* (Haughton). (Page 20.) Lateral view. Wilkie Point formation, lower Bajocian. Mackenzie King Island, about 9 miles east of the west coast, about 70 feet above horizon with *Oxytoma jacksoni* (Pompeckj). Hypotype, GSC No. 14652.

Figure 2. *Pseudolioceras m'clintocki* (Haughton). (Page 20.) Lateral view. Same stratigraphic position and locality as figure 1. Hypotype, GSC No. 14653.

Figures 3a, b. *Pseudolioceras m'clintocki* (Haughton). (Page 20.) 3a, lateral view; 3b, ventral view. Same stratigraphic position and locality as figure 1. Hypotype, GSC No. 14654.

Figures 4a, b. *Pseudolioceras m'clintocki* (Haughton). (Page 20.) 4a, lateral view; 4b. ventral view. Same stratigraphic position and locality as figure 1. Hypotype, GSC No. 14655.

Figure 5. *Pseudolioceras m'clintocki* (Haughton). (Page 20.) Lateral view. Same stratigraphic position and locality as figure 1. Hypotype, GSC No. 14656.

Figure 6. *Pseudolioceras m'clintocki* (Haughton). (Page 20.) Lateral view. Same stratigraphic position and locality as figure 1. Hypotype, GSC No. 14657.

Figure 7. *Pseudolioceras m'clintocki* (Haughton). (Page 20.) Lateral view. Same stratigraphic position and locality as figure 1. Hypotype, GSC No. 14658.

Figures 8a, b. *Pseudolioceras m'clintocki* (Haughton). (Page 20.) 8a, lateral view; 8b, ventral view. Same stratigraphic position and locality as figure 1. Hypotype, No. 14659.

Figure 9. *Pseudolioceras m'clintocki* (Haughton). (Page 20.) Lateral view. Same stratigraphic position and locality as figure 1. Hypotype, GSC No. 14660.

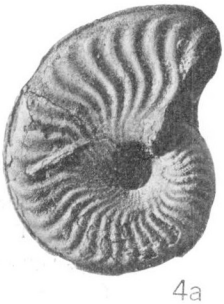
1

4b

2

3a

3b



4a

5

8b

6

7

9

8a

Plate IX

(All figures natural size)

Figure 1. *Pseudolioceras* cf. *m'clintocki* (Haughton). (Page 21.) Same specimen as Plate XII, figure 1. Lateral view. Wilkie Point formation, lower Bajocian. Mackenzie King Island, about 9 miles east of west coast, about 70 feet above horizon with *Oxytoma jacksoni* (Pompeckj). GSC No. 14661.

Figure 2. *Pseudolioceras m'clintocki* (Haughton). (Page 20.) Lateral view. Same stratigraphic position and locality as figure 1. Hypotype, GSC No. 14662.

Figure 3. *Pseudolioceras m'clintocki* (Haughton). (Page 20.) Lateral view. Same stratigraphic position and locality as figure 1. Hypotype, GSC No. 14663.

Figure 4. *Pseudolioceras m'clintocki* (Haughton). (Page 20.) Lateral view. Same stratigraphic position and locality as figure 1. Hypotype, GSC No. 14664.

Figures 5a, b. *Pleydellia* ? sp. indet. (Page 23.) 5a, lateral view; 5b, ventral view. Jaeger formation, lower Bajocian. Cameron Island, 2 miles east of Success Point. GSC No. 14665.

Figures 6a, b. *Pleydellia* ? sp. indet. (Page 23.) 6a, lateral view; 6b, ventral view. Same stratigraphic position and locality as figure 5. GSC No. 14666.

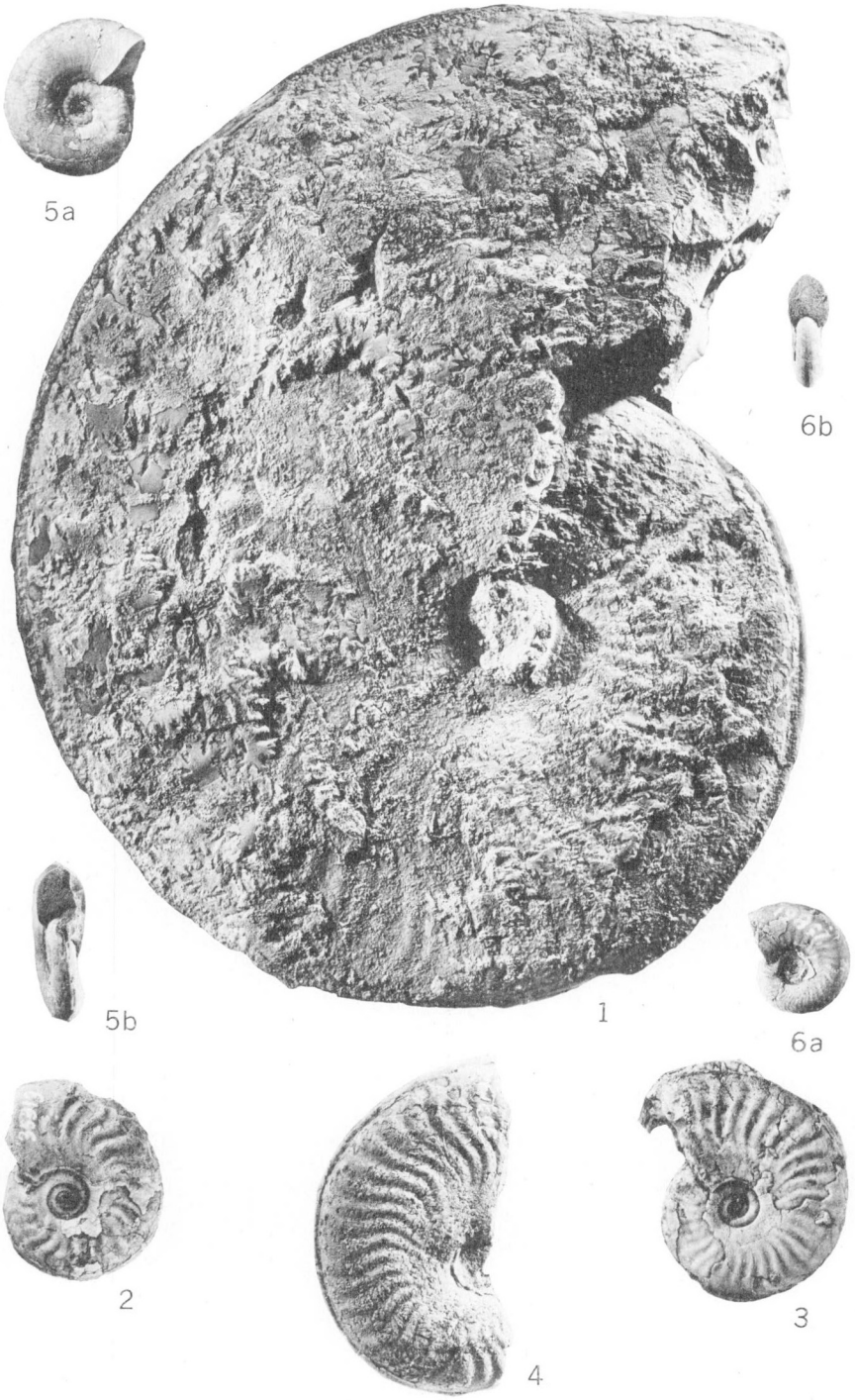
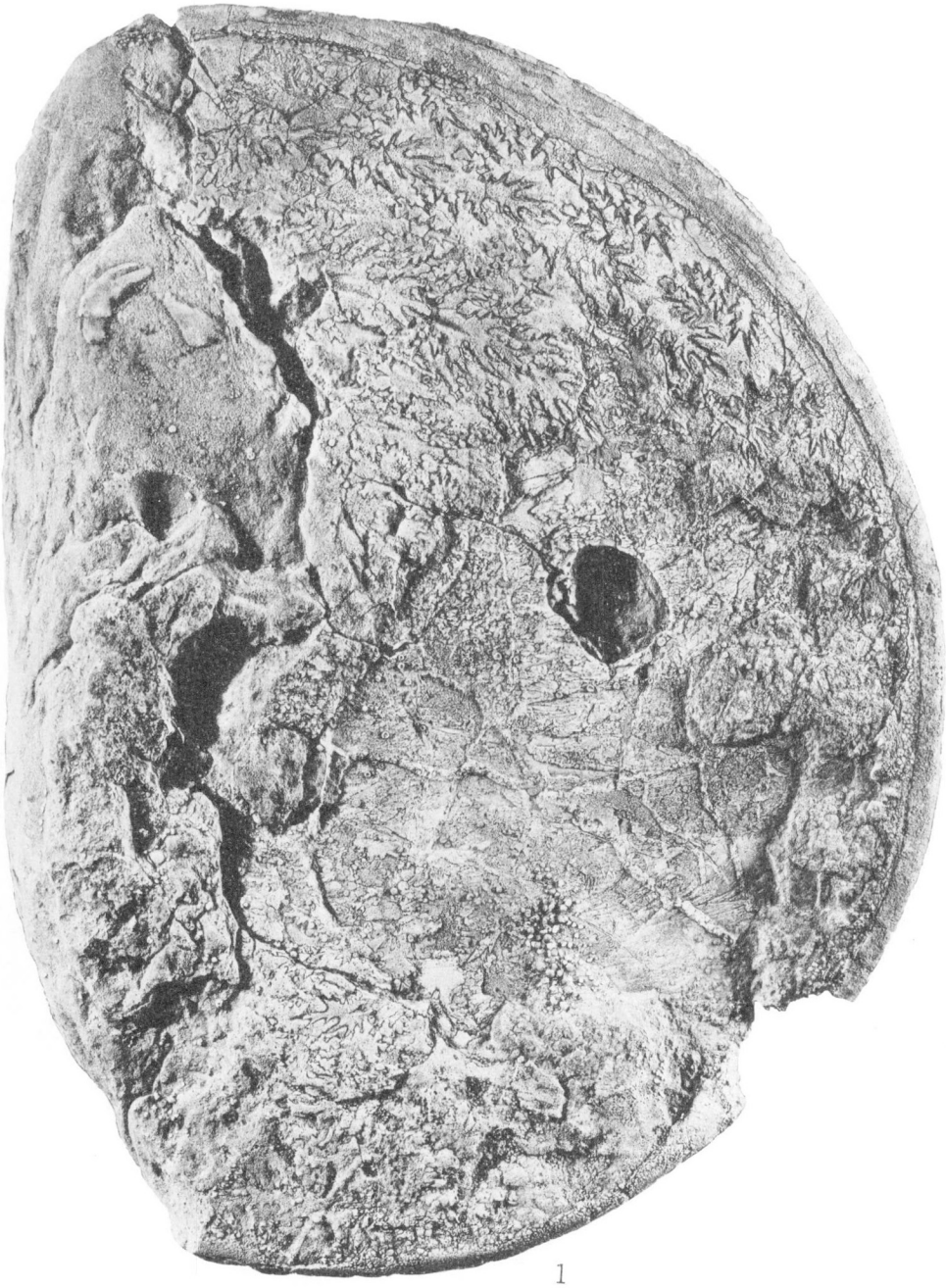

5a
6b
5b
1
6a
2
4
3

PLATE X

(Figure natural size)

Figure 1. *Pseudolioceras* cf. *m'clintocki* (Haughton). (Page 21.) Lateral view. Wilkie Point formation, lower Bajocian. Mackenzie King Island, about 9 miles east of the west coast, about 70 feet above horizon with *Oxytoma jacksoni* (Pompeckj). GSC No. 14667.



1

PLATE XI

(All figures natural size)

Figures 1a, b. *Pseudolioceras* cf. *m'clintocki* (Haughton). (Page 21.) 1a, lateral view; 1b, cross-section. Wilkie Point formation, lower Bajocian. Melville Island north side of Marie Bay, 60 feet above Wilkie Point formation exposures. GSC No. 14668.

Figure 2. *Pseudolioceras* cf. *m'clintocki* (Haughton). (Page 21.) Lateral view. Wilkie Point formation, lower Bajocian. Melville Island, north side of Marie Bay. GSC No. 14669.

Figure 3. *Pseudolioceras* cf. *m'clintocki* (Haughton). (Page 21.) Lateral view. Wilkie Point formation, lower Bajocian. Mackenzie King Island, about 9 miles east of the west coast, about 70 feet above horizon with *Oxytoma jacksoni* (Pompeckj). GSC No. 14670.

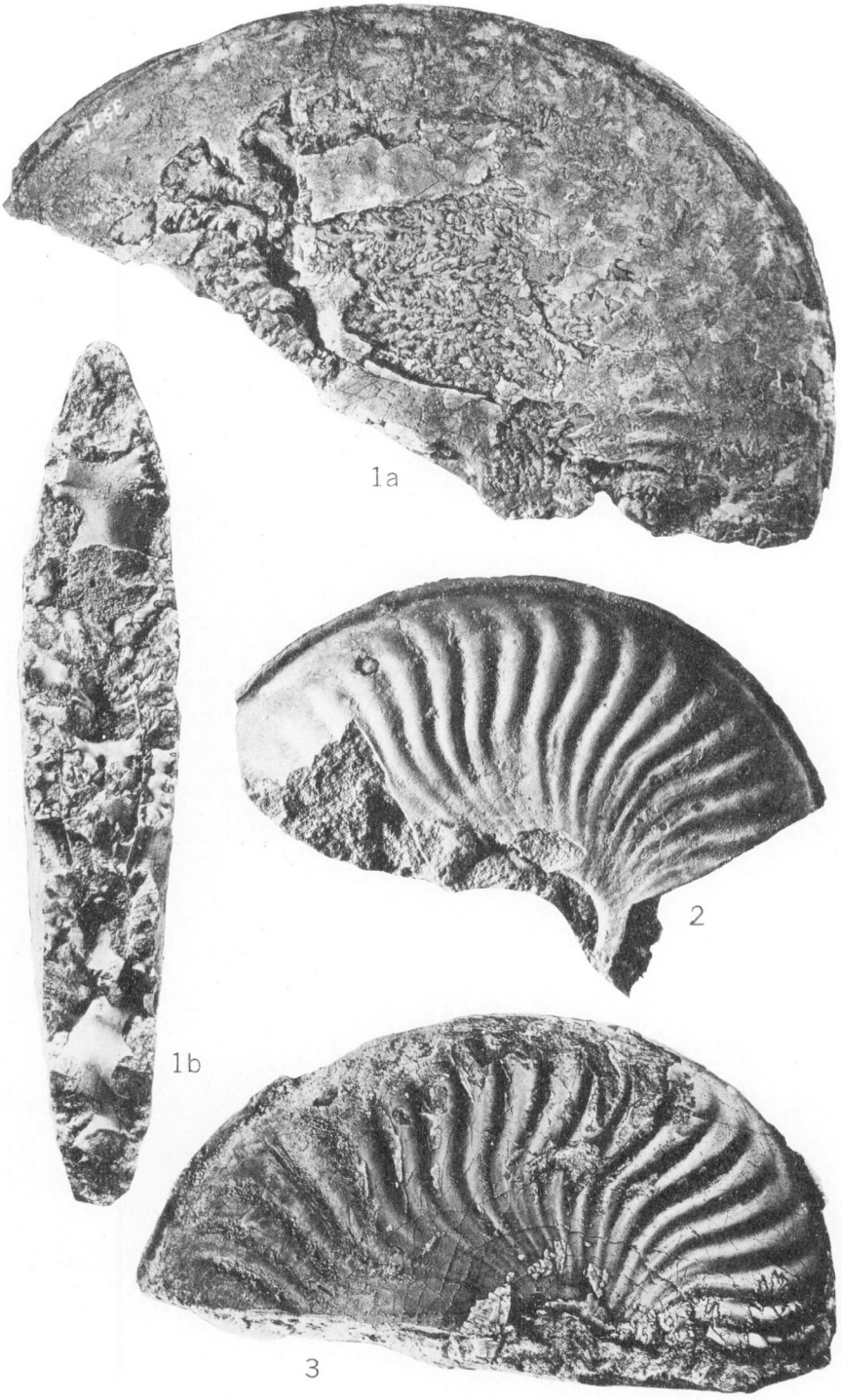

1a
1b
2
3

Plate XII

(All figures natural size)

Figure 1. *Pseudolioceras* cf. *m'clintocki* (Haughton). (Page 21.) Ventral view and cross-section of specimen illustrated on Plate IX, figure 1. Wilkie Point formation, lower Bajocian. Mackenzie King Island, about 9 miles east of the west coast, about 70 feet above horizon with *Oxytoma jacksoni* (Pompeckj). GSC No. 14661.

Figures 2a, b. *Pleydellia* ? sp. indet. (Page 23.) 2a, lateral view; 2b, ventral view and cross-section. Jaeger formation, lower Bajocian. Cameron Island, 2 miles east of Success Point. GSC No. 14671.

Figure 3. *Pleydellia* ? sp. indet. (Page 23.) Lateral view. Same stratigraphic position and locality as figure 2. GSC No. 14672.

Figure 4. *Pleydellia* ? sp. indet. (Page 23.) Lateral view. Same stratigraphic position and locality as figure 2. GSC No. 14673.

Figures 5a, b. *Grammoceras* ? sp. indet. (Page 23.) 5a, lateral view; 5b, ventral view. Toarcian. Ellesmere Island, Fosheim Peninsula, east side of Black Top Ridge, east of Eureka weather station. GSC No. 14674.

Figure 6. *Grammoceras* ? sp. indet. (Page 23.) Ventral view. Same stratigraphic position and locality as figure 5. GSC No. 14675.

Figure 7. *Grammoceras* ? sp. indet. (Page 23.) Ventral view. Same stratigraphic position and locality as figure 5. GSC No. 14676.

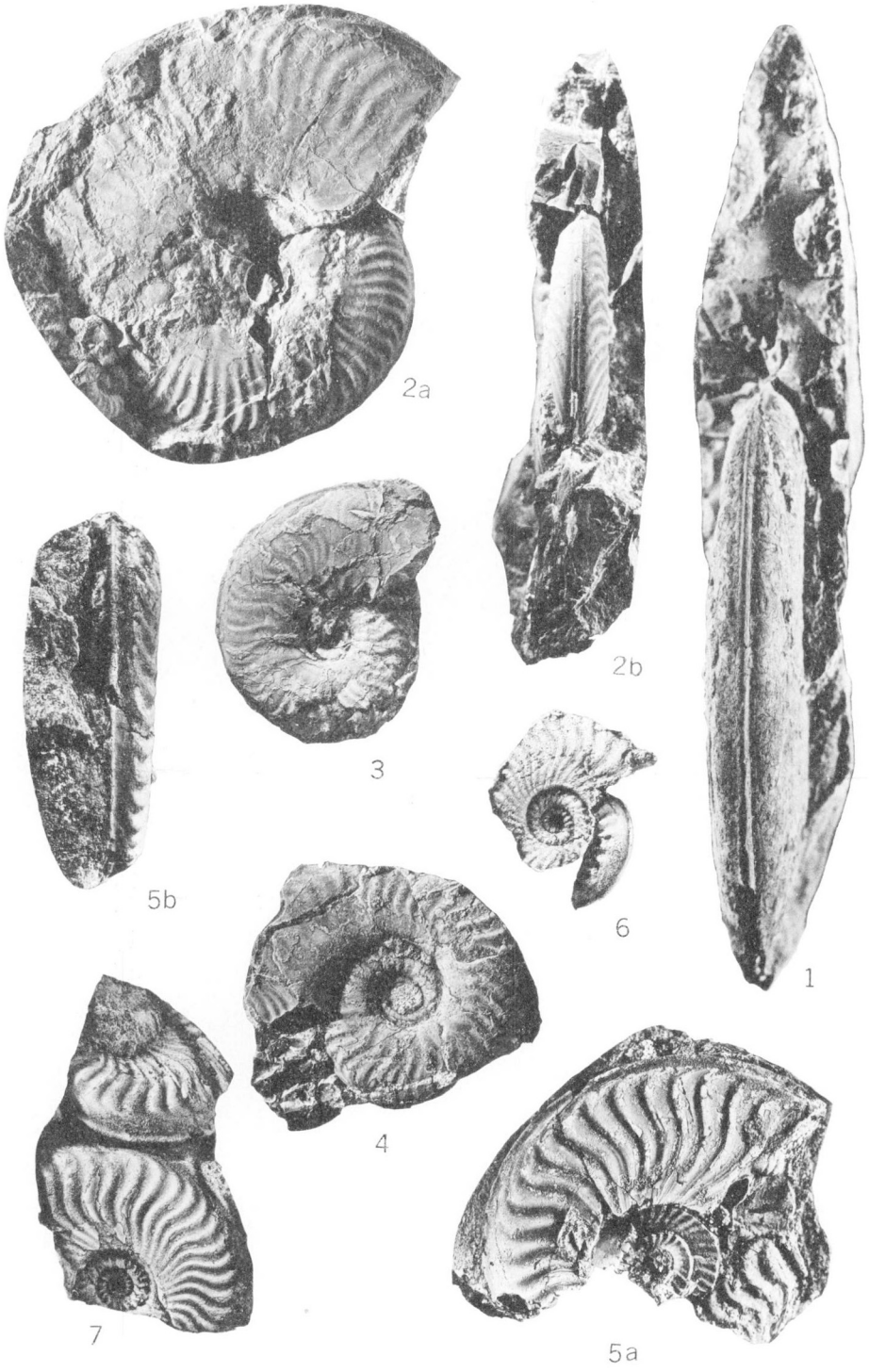
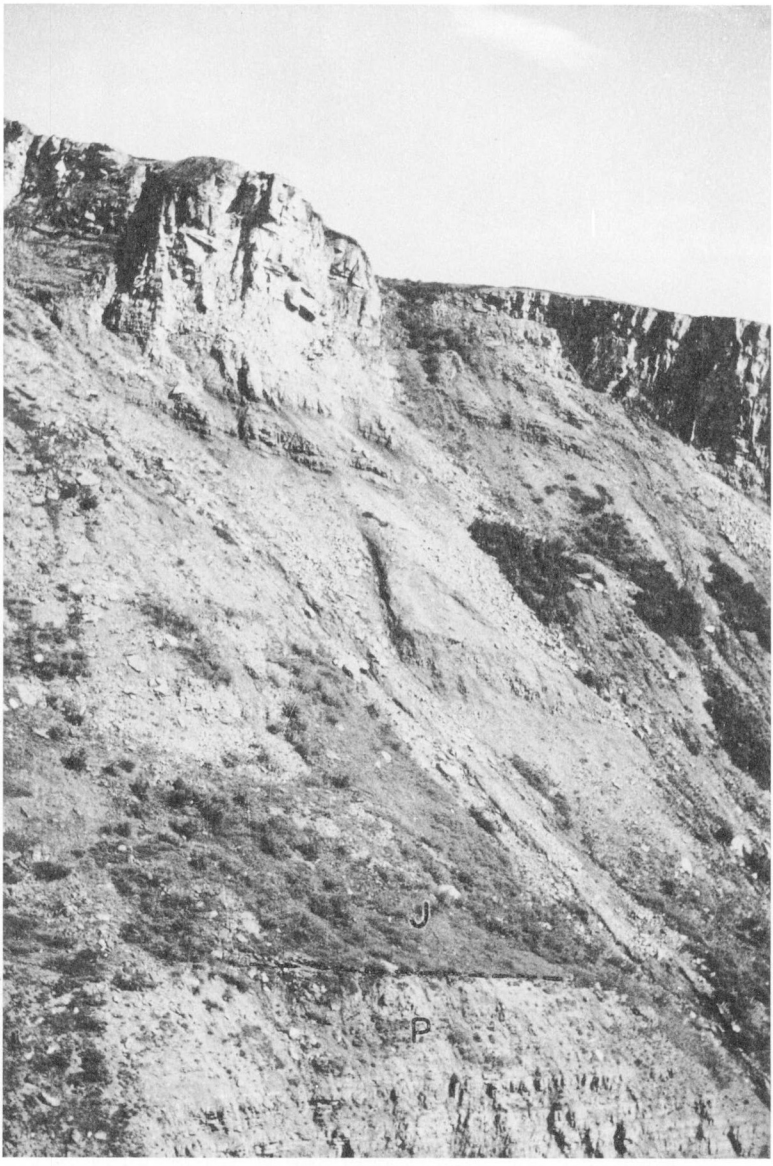

2a
2b
1
3
5b
6
4
7
5a

PLATE XIII

Figure 1. North wall of Bug Creek Canyon, Aklavik Range. Permian (P)-Jurassic (J) contact. Jeletzky photo. (*See* pp. 4-6.)



1

PLATE XIV

Figure 1. Locality 1. Two miles south of Bug Creek and Bug Lake. P—Permian and ? Carboniferous; SO—Sinemurian, bed with *Oxynoticeras* and *Arctoasteroceras;* SE—Sinemurian, bed with *Echioceras;* MJ—Middle Jurassic, C—uppermost Jurassic and Lower Cretaceous, - - - thrust fault. Jeletzky photo. (*See* p. 4.)

1

PLATE XV

Figure 1. Bajocian strata on Mackenzie King Island, at locality 1. Thorsteinsson photo. (*See* p. 8.)


Pseudolioceras m'clintocki - in situ
Pseudolioceras m'clintocki - abundant in talus
Oxytoma bed

1

PLATE XV