CANADA

DEPARTMENT OF MINES AND TECHNICAL SURVEYS

GEOLOGICAL SURVEY OF CANADA
BULLETIN 41

FAUNA, AGE AND CORRELATION OF THE JURASSIC ROCKS OF PRINCE PATRICK ISLAND

By

Hans Frebold

EDMOND CLOUTIER, C.M.G., O.A., D.S.P.
QUEEN'S PRINTER AND CONTROLLER OF STATIONERY
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PREFACE

Information on the Jurassic of the Canadian Arctic was exceedingly scanty until the Jurassic beds of Prince Patrick Island were studied by E. T. Tozer in 1954. The fossils collected by him at that time have been studied by the author and are described and figured in this report.

The Jurassic faunas of Prince Patrick Island, which include several new species, are compared with faunas from other parts of the Arctic and with the northwest European standard section, and form the basis for the age determinations in this report. Much new information has thus been gained on the extent and nature of the northern Jurassic seas, and a new chapter added to the geological history of the Canadian Arctic.

GEORGE HANSON,
Director, Geological Survey of Canada

OTTAWA, OCTOBER 22, 1956

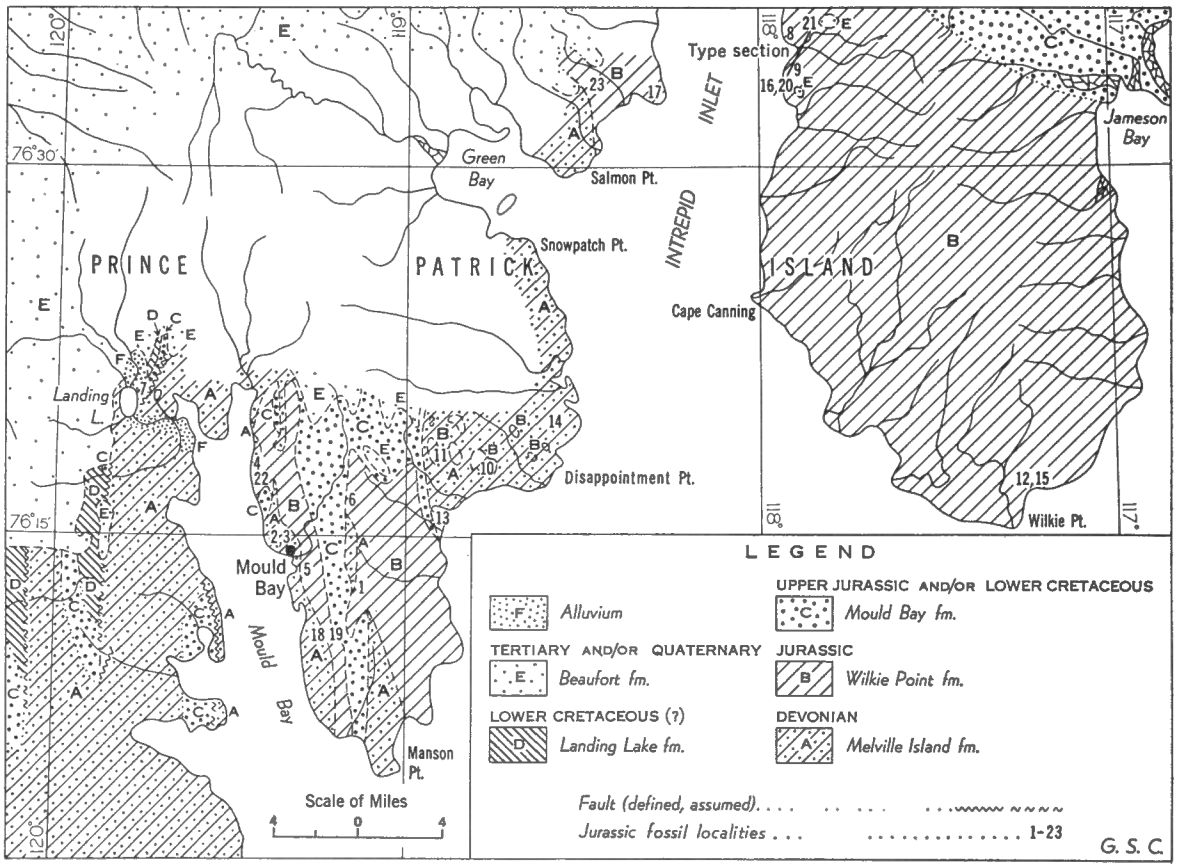

Figure 1. Jurassic localities in Prince Patrick Island. Geology after E. T. Tozer (1956). Numbers refer to fossil localities listed on pp. 17-21.

Figure 2. Map illustrating regions of marine deposition, shown by stipple pattern, in Western and Northern Canada during Jurassic time.

FAUNA, AGE AND CORRELATION OF THE JURASSIC ROCKS OF PRINCE PATRICK ISLAND

INTRODUCTION

The first Jurassic fossils to be found in the Canadian Arctic Archipelago were collected in Prince Patrick Island by M'Clintock's expedition in 1853 and were subsequently described in a paper by Haughton, 1858. During the course of the century that followed, no further systematic field investigations of the Jurassic deposits in the Canadian Arctic Archipelago were made. It remained for E. T. Tozer of the Geological Survey of Canada, who visited Prince Patrick Island in 1954, to demonstrate the significance of these Jurassic deposits. Tozer made a thorough study of the Jurassic outcrops and made extensive fossil collections. His field studies have been published in a preliminary paper (1956)[1] and his fossil material has been studied by the writer and is described in detail in the present paper. The results show that there are various Lower and Middle Jurassic beds on Prince Patrick Island containing interesting and, in part, hitherto unknown faunas.

The palæontological and stratigraphic results of this investigation have proved to be of value in elucidating the Jurassic deposits of other parts of the Canadian Arctic, which during the recent activities of the Geological Survey of Canada have yielded a number of interesting Jurassic faunas. Preliminary fossil identifications and stratigraphic conclusions based on these recent collections are incorporated in this paper, and have made possible a sketch of the Jurassic stratigraphy of the whole Archipelago and correlations with the Jurassic deposits in other parts of the Arctic. These Jurassic faunas recently collected in Canadian Arctic regions other than Prince Patrick Island will be described in detail in further papers.

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[1]Dates in parentheses are those of references cited at the end of this report.

DESCRIPTION OF FOSSILS

AMMONOIDEA

Dactylioceras commune (Sowerby) var. a

Plate I, figures 2, 4a-d, 5a, b, 6, 7a, b

cf. *Dactylioceras commune* (Dumortier) 1874, Pl. 26, figs. 1, 2.
cf. *Dactylioceras annulatum* (Dumortier) 1874, Pl. 26, figs. 3, 4.
Dactylioceras cf. *D. commune* Imlay 1955, Pl. 11, figs. 4-6.
Dactylioceras cf. *D. directum* Imlay 1955, Pl. 11, figs. 7-9, 14, (? 10, 11).
Dactylioceras cf. *commune* Frebold (*in* Tozer, 1956, p. 21).

The measurements in millimetres of the specimens figured are as follows:

	Diameter	*Umbilicus*	*Height*	*Thickness*
Pl. I, fig. 2	44	22(.50)	12(.272)[1]	11 (.25)
Pl. I, fig. 4a	about 45	24(.533)	11(.244)	11.5(.255)
Pl. I, fig. 4b	25	11.5(.460)	8(.320)	about 8.5(.340)
Pl. I, fig. 6	38	21(.552)	11(.289)	?
Pl. I, fig. 5	28	14(.500)	8(.285)	8(.285)

This very widely umbilicate form has slightly convex flanks and a fairly rounded venter; the cross-section of the larger specimens is rectangular, slightly higher than thick, but almost quadrate in specimen figured on Pl. I, figs. 4a, c, which forms the inner whorls of specimen figured on Pl. I, figs. 4a, d. A constriction is present at the anterior end of the last whorl of this specimen (*see* Pl. I, fig. 4a). On the inner whorl (Pl. I, fig. 4b) there are 39 straight, sharp and regularly bifurcating ribs. The secondary ribs are slightly protracted on the venter forming a very obtuse angle. At a diameter of 44 mm. the number of ribs has increased to 48 (Pl. I, figs. 2, 4a), they are somewhat forwardly inclined and even very slightly curved. Intercalation of single ribs towards the end of the last whorl may occur as in the specimens shown on Pl. I, figs. 2, 4a, 6.

A single larger whorl fragment (16 mm. high) probably belongs to the same species as the specimens described above. No change of the general shape and ribbing is indicated.

The suture line could only be observed in part on one of the specimens.

The forms described belong to the same species as Imlay's *Dactylioceras* cf. *D. directum* (1955, Pl. 11, figs. 7-9, 14). His *Dactylioceras* cf. *D. commune* (1955, Pl. 11, figs. 4-6) and *Dactylioceras* cf. *D. crassiusculum* are at least closely related. *D. directum* Buckman (1927, Pl. 654) differs from the forms described here by its more

[1]Figures in brackets are percentages of the diameter at which they were taken.

numerous and finer ribs. *Dactylioceras annulatum* (Sowerby) is related but has still more numerous ribs as is apparent from the figures of this species given by Dumortier (1874, Pl. 26, figs. 3, 4), Wright (1878-1886, Pl. 84, figs. 7, 8), Buckman (1927, Pl. 700), and others. The most closely related forms are certain varieties of *D. commune* (Sowerby) as for instance Dumortier's specimen (1874, Pl. 26, figs. 1, 2) which at the same diameter as the Prince Patrick Island forms, has about the same number and shape of ribs and a similar cross-section. The specimen of *D. commune* from Whitby, England, here figured in Pl. I, fig. 1, shows close relationships with some of the Prince Patrick Island specimens.

Dactylioceras commune (Sowerby) var. b

Plate I, figures 3a, b

The measurements in millimetres of this specimen are as follows:

Diameter	*Umbilicus*	*Height*	*Thickness*
42	20(.476)	12(.285)	8(.195)

The form is widely umbilicate, the flanks are almost flat, the venter narrow and slightly arched, the cross-section high rectangular. There are 39 straight mostly bifurcated ribs on the flanks; the secondary ribs cross the venter somewhat inclined forwards and without interruption. The poorly visible suture line has a tripartite first lateral lobe on the middle of the flank. It has the same length as the external lobe. As far as can be seen the suture line agrees well with that of other representatives of *Dactylioceras*.

This variety is distinguished from *Dactylioceras commune* var. a by its narrow venter, higher cross-section, stronger and less numerous ribs. The single specimen designated as *D. commune* var. b may have been flattened to some extent by secondary compression. This might account in part for some of the differences as compared with *D. commune* var. a.

Coeloceras spinatum n. sp.

Plate II, figures 1a-e, 2, 3, 4a, b

Coeloceras n. sp. Frebold 1956 (*in* Tozer, 1956, p. 21).

Faunas with abundant Coeloceratids have been found in Prince Patrick Island at two localities, i.e., east of Landing Lake and east of Mould Bay weather station. They have also been found on Axel Heiberg Island at Strand Fiord. At the last two named localities the form described here is associated with *Pseudolioceras* aff. *compactile* (Simpson) and *Coeloceras* aff. *desplacei* (d'Orbigny), whereas in the collections made at the first mentioned locality *C.* aff. *desplacei* (d'Orbigny) is missing.

The measurements in millimetres of some of the figured specimens are as follows:

	Diameter	*Umbilicus*	*Height*	*Thickness*
Plate II, figs. 4a, b	16	6.5(.406)	5.0(.312)	?
Plate II, figs. 1a-e	(inner 31 whorls)	15.5(.500)	11.0(.387)	18(.581)
Plate II, figs. 1a-e	(last 55 whorl)	29.5(.536)	16(.390)	22(.400)

This very evolute form has a cross-section (*see* Pl. II, fig. 1e) considerably thicker than high with slightly arched venter. The small specimen figured on Pl. II, figs. 4a, b has 34 straight, fairly sharp ribs on the last whorl. Most of them bifurcate but some are tripartite. At some of the points of division spines are developed. Long spines are preserved on the preceding whorl. The fine secondary ribs cross the venter without interruption or weakening.

The long spines are clearly seen on the rubber cast (Pl. II, fig. 1a) of the imprint left by the specimen figured in figs. 1b-e. The last whorl of this specimen has 58 primary ribs; some of these are united to one another by a spine at the point of division. The same type of sculpture is present in the still larger whorl fragment (Pl. II, fig. 2), which is 17.0 mm. high and 24.5 mm. thick.

The suture line (*see* Pl. II, fig. 3) is similar to that of other representatives of the genus *Coeloceras*.

This form is related to some other spinose Coeloceratids as for instance *Coeloceras* (*Spinicoeloceras*) *spicatum* S. Buckman (1927, Pl. 777), from which it is distinguished mainly by its higher and sharper ribs, and to *Coeloceras polare* Frebold (1929b, pp. 258, 259, Pl. 2, figs. 11-13; and 1930, p. 61, Pl. 22, fig. 4) which has stronger ribs.

Coeloceras aff. *desplacei* (d'Orbigny)

Plate II, figure 5; Plate III, figures 1, 2a, b

Incomplete specimens of another *Coeloceras* have been found both on Prince Patrick and Axel Heiberg Islands, where they are associated with *Pseudolioceras* aff. *compactile* (Simpson) and *Coeloceras spinatum* n. sp.

The specimen shown on Plate III, figs. 1, 2a, b has a whorl height of 10 mm. and a thickness of 12 mm. Most of the straight primary ribs bifurcate at the external border with some of the bifurcation points showing remains of spines. The secondaries cross the slightly arched venter somewhat inclined forward and without any interruption or weakening. The larger whorl fragment Plate II, fig. 5 (whorl height 15 mm., whorl thickness about 18 mm.) has about 23 primary and 35 secondary ribs. Most of the primaries bifurcate, others remain undivided. Some of the primaries are united with one another in a spine. This general type of ribbing is similar to that of *Coeloceras*

as spinatum n. sp., however, *Coeloceras spinatum* has much finer ribs and a much wider cross-section.

The incomplete preservation of the form under discussion prohibits detailed comparisons, but *Coeloceras desplacei* (d'Orbigny) (d'Orbigny, 1842, pp. 334-336, Pl. 107; Dumortier, 1874, pp. 102, 103, Pl. 27, fig. 4) shows close relationship both in the general shape and the type of ribbing. Better material of the Arctic form is required before any direct identification can be made.

Pseudolioceras aff. *compactile* (Simpson)

Plate III, figures 3, 4, 5a-c, 6

"Harpoceras" aff. *m'clintocki* Frebold, (partim) (*in* Tozer 1956, pp. 20, 21, 22), non *Harpoceras m'clintocki Haughton* 1858, non *Harpoceras m'clintocki* Neumayr (1885).

Incompletely preserved specimens resembling some representatives of the genus *Pseudolioceras* have been found at various localities on Prince Patrick Island and Axel Heiberg Island. At some of the localities they are associated with *Coeloceras spinatum* n. sp. and *C.* aff. *desplacei* (d'Orbigny).

The specimens here assigned to the genus *Pseudolioceras* have a fairly low keel bordered on either side by a flattened zone. The inner whorls are almost entirely concealed by the last one. The narrow umbilicus has steep, almost perpendicular walls. The ribs are falciform, their lower part is thinner than their upper part. The large specimen (Pl. III, fig. 6) shows only the upper broad part of them clearly. The ribs disappear before they have reached the keel. No suture line could be observed.

In my preliminary report on the Jurassic fossils collected by Tozer on Prince Patrick Island (*see* Tozer, 1956, pp. 20, 21, 22) I have mentioned these forms as *"Harpoceras"* aff. *m'clintocki* Haughton. Haughton's picture of this species (Haughton, 1858, Pl. IX, figs. 2, 3, 4, pp. 244, 245) shows, indeed, some similarities both in general shape and type of ribbing, however, Haughton's and Neumayr's (1885, Pl. 1, figs. 5-8) figures show a forward bending of the ribs near the keel which is absent in these forms. The true *"Harpoceras" m'clintocki* Haughton is represented in other collections from Prince Patrick Island and is described below.

The forms described here from Prince Patrick Island and Axel Heiberg Island show close similarities with representatives of the group of *Pseudolioceras compactile* described by me from the Upper Lias of Spitsbergen (Frebold 1929b, pp. 260-262, Pl. 2, figs. 1-5). Thus, the small Prince Patrick Island specimen (Pl. III, fig. 3), in which the lower part of the ribs is not recognizable, may be compared with the Spitsbergen form (Frebold, 1929b, Pl. 2, figs. 5, 5a, p. 262) described as *Pseudolioceras* cf. *württenbergeri* Denckmann, whereas the large Axel Heiberg Island specimen (Pl. III, fig. 6) seems to be close to the Spitsbergen form described by me (Frebold, 1930, Pl. 6, figs. 1, 2) as *Pseudolioceras pumilum* Buckman. Unfortunately the

umbilical region of the Axel Heiberg Island specimen was not preserved and the identity with *P. pumilum* is doubtful. Relationships of the Canadian Arctic forms to representatives of this genus from the East Greenland Upper Lias, figured by Rosenkrantz (1934, Pl. 6, figs. 1-3, Pl. 7, fig. 3) and to some of the Alaskan *Pseudolioceras* described and figured by Imlay (1955, p. 89, figs. 15, 16, 17, 18, 20, 21) undoubtedly exist but the unsatisfactory state of preservation of many of the specimens prohibits accurate comparisons and identifications.

Leioceras opalinum (Reinecke)

Plate IV, figures 1, 2, 3, 4a, b, 5a-c, 6; Plate V, figures 1, 2

Nautilus opalinus Reinecke, 1818, p. 55, Pl. 1, figs. 1, 2.
Ammonites opalinus Quenstedt, 1886, p. 492, Pl. 55, figs. 1, 10, 12, 18, 22.
Lioceras opalinum S. Buckman, 1887, p. 35, Pl. 13, figs. 1, 8-10.
Harpoceras opalinum Benecke, 1905, pp. 403-411, Pl. 53, figs. 1-6.
Ludwigia opalina Dorn, 1935, pp. 65, 66, Pl. 24, fig. 3, Pl. 26, fig. 2, Pl. 28, fig. 1, text—fig. Pl. 6, figs. 4-7.
Ludwigia (*Lioceras*) *opalina* Frebold (*in* Tozer 1956, pp. 20, 21, 22).

Many fragments and some good imprints of complete specimens of this species were collected 1 mile east of Point Wilkie on Prince Patrick Island where they are associated with *Ludwigia m'clintocki* (Haughton), and some pelecypods. There are both small and large specimens. The species has also been found on the east and west sides of Intrepid Inlet.

The measurements in millimetres of the specimen figured in Pl. IV, fig. 2 are as follows:

Diameter	*Umbilicus*	*Height*	*Thickness*
40	6(.150)	21(.525)	?

The general shape of this form is characterized by a fairly narrow umbilicus, slightly convex flanks which grade into the sharp keeled venter. The umbilical wall slopes obliquely to the umbilicus, it is separated from the flanks by a sharp edge. In many specimens the umbilical wall is broken off, a fact, which when overlooked, may lead to misidentifications. There are no ribs but only fine falciform, parallel, apparently undivided lines. The lines of both flanks join each other on the keel in an acute angle.

Only parts of the moderately incised suture line were seen. Plate IV, fig. 4a, shows the first and second lateral lobes.

The Prince Patrick Island specimens agree very well in every respect with *Leioceras opalinum* (Reinecke), as redefined by Dorn (1935, pp. 65, 66), however, his inclusion of the genus *Leioceras* in *Ludwigia* previously accepted by me (Frebold *in* Tozer, 1956, pp. 20, 21, 22) is not followed here.

Ludwigia m'clintocki (Haughton)

Plate V, figures 3a, b, 4a, b

Harpoceras m'clintocki Haughton 1858, p. 244, Pl. 9, figs. 2-4.
Harpoceras m'clintocki Neumayr 1885, p. 85, Pl. 1, figs. 5-8.
"Harpoceras" aff. *m'clintocki* Frebold (partim) (*in* Tozer 1956, pp. 20, 21, 22).

From the bed with *Leioceras opalinum* 1 mile east of Point Wilkie, Prince Patrick Island, Tozer collected a number of fairly well preserved fragments of another Harpoceratid which is identical with *Harpoceras m'clintocki* Haughton. Haughton's type material (redescribed and refigured by Neumayr, loc. cit.) was also collected at Point Wilkie, apparently at the same locality and from the same bed as Tozer's.

The unsatisfactory preservation of Haughton's material has for a long time prevented the clarification of its stratigraphic position. Now after having been found associated with *Leioceras opalinum* its stratigraphic position is established as Lower Bajocian, zone of *Leioceras opalinum.*

The best preserved specimen collected by Tozer is figured on Pl. V, figs. 4a, b. It has very slightly convex flanks and a lancet-like cross-section, a fairly steep umbilical wall, and a sharp umbilical edge. The fairly high keel lies between two flattened zones which are entirely absent in the above described *Leioceras opalinum.* The falciform ribs consist of a lower, very fine, almost unrecognizable part which is directed forward and a thicker upper part, first bent backward and then, in the uppermost part of the flank, swinging forward again.

Only the general outline of the moderately incised suture line, which seems to be similar to that of *Leioceras opalinum,* could be studied (Pl. V, fig. 3a). The external and first lateral lobes are about equal in length. The external saddle is much broader than the lateral saddle. The second lateral lobe is about half the size of the first. There are three or more umbonal lobes.

In most of the specimens collected by Tozer, and in all of Haughton's and Neumayr's specimens the umbilical wall and edge are broken off in an almost imperceptible manner. Neumayr (loc. cit., p. 85) overlooked this fact and thought the form had a smooth umbilical slope without edge. Specimens with broken off umbilical wall and edge collected by Tozer show a perfect agreement with Neumayr's figures of *"Harpoceras" m'clintocki.* Haughton (loc. cit., p. 244) mentioned close resemblance of his species with *A. concavus* Sowerby of the lower Oolite. Neumayr also (loc. cit., p. 85) recognized a certain similarity in the type of ribbing, but having overlooked the incompleteness of the umbilical region in Haughton's specimens he says that Haughton's species is distinguished from *concavus* Sow. mainly by absence of a sharp umbilical edge and the umbilical wall. The proof that *m'clintocki* Haughton actually has these characteristics makes this species again closer to *Ludwigia concava* Sow. and related forms; there are, however, still other distinctions between the two species,

as for instance the width of the umbilicus, which is larger in *m'clintocki* than in *concava.*

Cranocephalites vulgaris Spath

Plate VII, figures 1a-c, 2; Plate VIII, figures 1a-c

Cranocephalites vulgaris Spath, 1932, pp. 20-22, Pl. 1, figs. 2-4; Pl. 2, figs. 1, 4; Pl. 3, fig. 5; Pl. 4, figs. 1, 3; Pl. 5, figs. 1a, b; Pl. 8, figs. 1a, b; Pl. 10, figs. 3a, b.

Arctocephalites (*Cranocephalites*) *vulgaris* Donovan, 1953, p. 84, Pl. 16, figs. 4a, b.

Arctocephalites (*Cranocephalites*) cf. *vulgaris* Frebold (*in* Tozer, 1956, pp. 21, 22, 23).

Arctocephalites (*Cranocephalites*) cf. *vulgaris,* var. *robusta* Frebold (*in* Tozer, 1956, p. 21).

The measurements in millimetres are as follows:

	Diameter	*Umbilicus*	*Height*	*Thickness*
Pl. VII, figs. 1a-c	85	18(.21)	36(.42)	40(.47)
Pl. VIII, figs. 1a-c	68	15(.22)	29(.43)	34(.50)

About three-quarters of the last whorl of the specimen figured on Pl. VII, figs. 1a-c belong to the body-chamber which is contracted, so that the umbilicus opens out. The venter of this last whorl is slightly rounded, almost flattened and almost smooth. The transition of the flanks into the steep umbilical wall is rounded. There are about 17 strong, forwardly inclined primaries and about 42 secondaries on the flanks. Some of the primaries are tripartite, others bipartite. The point of division is somewhat below the half height of the flank. Some of the secondaries do not join the primary rib. The secondaries are alternating on the venter, i.e., a posterior secondary of one flank joins or is opposite to the anterior secondary of the corresponding primary on the other flank. The suture line of this specimen is very similar to that figured by Spath (loc. cit., Pl. 3, fig. 5). This specimen agrees very well with Donovan's *Arctocephalites* (*Cranocephalites*) *vulgaris* (Donovan, 1953, p. 84, Pl. 16, figs. 4a, b) and with Spath's *Cranocephalites vulgaris* var. *robusta* (Spath, 1932, pp. 20-22, Pl. 2, figs. 1a, b).

The Prince Patrick Island whorl fragment (Pl. VIII, figs. 1a-c) which belongs entirely to the body-chamber has a more rounded venter than the bigger specimen (Pl. VII, figs. 1a-c), the type of ribbing, however, is the same as also is the smoothness of the periphery. A wide constriction is present at the end of the whorl and the umbilicus opens out in this part of the shell. The rubber cast made of the imprint of the preceding whorl shows a well-rounded venter which is crossed by the ribs transversely without interruption or weakening. The ribs are also in this stage tripartite and bipartite. *Cranocephalites vulgaris* Spath (1932, Pl. I, figs. 3a, b) which is of about the same stage of development is very similar.

The specimen represented by the rubber cast (Pl. VII, fig. 2) already has a more flattened venter with a weakening of the ribs in the peripheral region appearing.

Cranocephalites vulgaris Spath is a common form in the *Cranocephalites* beds of East Greenland.

Arctocephalites ? sp. indet. 1

Plate VII, figure 3

This unsatisfactorily preserved specimen is distinguished from *Cranocephalites vulgaris* Spath by its more globose form, narrower umbilicus, finer and more numerous ribs. The suture line is too poorly preserved for any comparison to be made and it is difficult to decide whether this specimen belongs to *Arctocephalites* or *Cranocephalites*. This specimen was found at the same locality as *Cranocephalites vulgaris* Spath.

Arctocephalites ? sp. indet. 2

Plate VIII, figures 2a, b, 3a-c

The two whorl fragments figured differ from both *Cranocephalites vulgaris* Spath and *Arctocephalites* ? sp. indet. 1 by their elliptical cross-section and narrower venter. The ribs, which are forwardly inclined, are divided into two or three branches that disappear almost entirely before reaching the periphery, thus rendering the central part of the venter fairly smooth. Equal stages of growth of certain representatives of *Arctocephalites*, as *A. ellipticus* Spath have a similar cross-section and a similar type of ribbing but are distinguished from the Prince Patrick Island form by a narrower umbilicus.

It is questionable whether these Prince Patrick Island specimens belong to *Arctocephalites* or to *Cranocephalites*.

Genus *Arkelloceras* n. gen.[1]

Medium-sized (diameter up to 111 mm.) fairly evolute ammonites, whorls thicker than high. Young specimens with fairly strong, sharp ribs, on venter forming elongated tubercle-like thickenings that border a flat almost smooth peripheral zone. In this young stage fine lines connect alternating ribs of both sides on the venter forming a zigzag pattern. At medium stages of growth venter is rounded, smooth zone reduced in size, and alternation of ribs on both sides of peripheral zone very clear. Later stages of growth, alternation irregular, mature specimens with smooth venter. This genus is clearly distinguished from *Cranocephalites* by its kosmoceratid-like inner whorls, whose ventral region resembles that of certain species of the Upper Bajocian genus *Garantia*. In most species of *Garantia* the ventral furrow, usually bordered on both sides by row of tubercles, is retained in all stages of growth contrary to *Arkelloceras*. Furthermore, *Garantia* has nodes on the flanks which are absent in *Arkelloceras*.

Type-species: *Arkelloceras tozeri* n. sp.[2]

Representatives of this new genus were collected by E. T. Tozer

[1]The genus is named for Dr. W. J. Arkell, Cambridge.
[2]The type-species is named for Dr. E. T. Tozer, Geological Survey of Canada.

(*see* Tozer, 1956, p. 19) on the east side of Intrepid Inlet, 10 miles north of Cape Canning, Prince Patrick Island. The base of the 70-foot thick sandstone and sand with dusky red, fossiliferous, hard bands and phosphatic nodules in which these ammonites occur, is in the Intrepid Inlet section (*see* Tozer, 1956, pp. 19, 20) 45 feet above the *Leioceras opalinum* bed. Many of the specimens were collected from talus immediately below the ammonite bed which also yielded specimens of *Inoceramus lucifer* Eichwald and *Inoceramus* sp.

The stratigraphic position of the *Arkelloceras* bed in relation to the *Cranocephalites* bed is unknown.

Arkelloceras tozeri n. sp.

Plate IX, figures 1a-d, 2a, b, 3a, b; Plate X, figures 1a-c, 2a, b; Plate XI, figures 1a-c, 2a, b

Ammonites n. gen. and n. sp. Frebold (partim), (*in* Tozer, 1956, pp. 19, 22).

The measurements in millimetres of the figured specimens are as follows:

	Diameter	*Umbilicus*	*Height*	*Thickness*
Pl. IX, fig. 1a (holotype)	111	38(.342)	44(.396)	48(.432)
Pl. IX, fig. 1b (inner whorls of holotype)	23	9(.39)	9(.39)	13(.565)
Pl. X, figs. 1a-c	100	36(.36)	40(.40)	53(.53)
Pl. XI, fig. 1a	80	28(.350)	32(.40)	36(.45)
Pl. XI, fig. 1c	48	?	?	23(.48)
Pl. X, fig. 2b	40	?	17(.425)	22(.55)
Pl. IX, figs. 2a, b	32	11(.344)	12(.375)	18(.562)
Pl. IX, fig. 3a	18	—	—	—

The two youngest specimens in this collection (Pl. IX, figs. 1b, c, 3a), of which figures 1b, c are the inner whorls of the holotype (Pl. IX, figs. 1a-d) have well-rounded flanks which grade into an entirely flat venter. The umbilicus is fairly wide with rounded walls. Some of the straight ribs bifurcate on the middle of the flanks, others are undivided. The ribs are stronger in the upper half of the flanks than in their lower part, reaching their greatest strength in the zone bordering the flat and almost smooth region of the venter, where they form tubercle-like elongated thickenings. The ribs of both sides are not opposite to one another and very fine lines which can be seen clearly under the microscope cross the flat, almost smooth venter connecting alternating ribs on opposite sides. Thus a very fine zigzag line is present on the venter of the small specimen (Plate IX, figs. 3a, b).

The cross-section of this stage is thicker than high.

The stage represented by the rubber cast (Pl. X, fig. 2a) still shows a flattened ventral zone which, however, is less smooth than that of the smaller specimens. The ribs that cross this zone are less weak, and the zigzag pattern is not recognizable. Most of the ribs are bipartite at this stage, some single ribs are intercalated.

The next whorl of this specimen (Pl. X, fig. 2b) has a rounded

venter with a narrow, almost smooth zone. Alternating position of the ribs on the venter is still recognizable. This alternation is also very clear in the somewhat smaller specimen (rubber cast) figured in Pl. IX, figs. 2a, b. This specimen has a fairly deep umbilicus, which is characteristic of this and later stages.

The penultimate whorl (plaster cast) of the specimen figured on Pl. XI, figs. 1a-c has a well-rounded venter with clear alternation of the ribs which are about equally strong in the upper part of the flanks and on the venter. The smooth zone on the venter is reduced to a line (Pl. XI, fig. 1c).

The cross-section of the outer whorl (Pl. XI, fig. 1b) of the same specimen is somewhat thicker than high, with well-rounded venter, which, however, towards the end of the whorl is becoming slightly flattened. Ribs are present over the whole whorl in the lower part of the flanks, but in the upper part and on the venter they are very weak and disappear towards the end of the whorl.

The specimen shown on Pl. X, figs. 1a-c and Pl. XI, figs, 2a, b consists of a large outer whorl (diameter 100 mm.) that belongs entirely to the body-chamber and the imprint of part of the inner whorls, from which a rubber cast was made (Pl. X, fig. 1c). This shows the deep umbilicus. The umbilicus of the outer whorl opens out slightly towards the end. Weak ribs on both flanks and venter are present only in the first quarter of the whorl, on the remaining part only the fairly thick umbonal ribs persist. The cross-section is considerably thicker than high, the venter is slightly arched. The poorly preserved suture line (Pl. XI, fig. 2a) at the beginning of the last whorl shows fairly narrow lobes. The external and first lateral lobes are apparently of equal length, the second lateral is much shorter. The external and lateral saddles are of about equal width, umbonal-lobes are not preserved.

The holotype (Pl. IX, figs. 1a-d) with its diameter of 111 mm. is the largest specimen in the collection. It was selected as the holotype because some of the ontogenetic stages characteristic of this species are preserved in this specimen. The inner whorls of this specimen (Pl. IX, figs. 1b, c) are described above. Only the beginning of the next whorl is still present but it is too poorly preserved for study. The venter of the remaining part, however, is preserved as an imprint (Pl. IX, fig. 1d) which shows the alternating arrangement of the ribs. The preserved part of the last whorl that belongs to the body-chamber has ribs only in the lower part of the flanks. The last suture line at the beginning of the body-chamber is preserved as a fragment.

Medium-sized specimens of *Arkelloceras tozeri* show an alternation of ribs similar to that of *Cranocephalites vulgaris* described above.

Arkelloceras mclearni n. sp.[1]

Plate XII, figures 1a-c, 2a-g, 3a-c; Plate XIII, figures 1a-d, 2a-c, 3a, b

Ammonites n. gen. and n. sp. Frebold (partim), (*in* Tozer, 1956, pp. 19, 22).

[1]The species is named for Dr. F. H. McLearn, Ottawa.

The measurements in millimetres are as follows:

	Diameter	*Umbilicus*	*Height*	*Thickness*
Pl. XII, figs. 1a-c (holotype)	52	23(.44)	17(.327)	18(.346)
Pl. XII, figs. 3a, b	20	7(.35)	7(.35)	7(.35)

This species does not reach the size of *Arkelloceras tozeri*. The nature of the sculpture shows that both species are closely related, but *A. mclearni* is clearly distinguished from *A. tozeri* by a wider and shallower umbilicus, by relatively thinner whorls, and, generally by stronger ribs. These differences seem to be constant, judging from the relatively large number of specimens available for study.

The last whorl of the small specimen (Pl. XII, figs. 2a-c) is as high as thick. In later stages of the ontogenetic development the cross-section is thicker than high (*see* Pl. XII, fig. 1b, and Pl. XIII, fig. 3b). The type of ribbing of young forms of this species (*see* Pl. XII, figs. 2d-g, which illustrate the inner whorls of specimen figs. 2a-c, and Pl. XII, figs. 3a, b) is generally the same as in the small specimens of *A. tozeri*, i.e. the primaries bifurcate at about the middle of the flank and only a few ribs are undivided. The point of bifurcation is in some cases slightly thickened. The secondaries do not cross the venter, leaving an almost smooth zone as is present in *A. tozeri*. The preceding whorl (rubber cast) (Pl. XIII, fig. 2c) of the whorl fragment Pl. XIII, figs. 2a, c and the venter of the inner whorl of the holotype (Pl. XII, fig. 1c) still show the flattened, almost smooth peripheral zone of the venter bordered by fairly sharp alternating ribs.

In later stages of the ontogenetic development the central part of the venter remains somewhat flattened, but the smooth peripheral zone, typical of the younger specimens is merely indicated by a slight weakening of the ribs (*see* ventral views on Plates XII and XIII).

Only part of the suture line could be studied. On the inner side of the whorl fragment (Pl. XIII, fig. 3b) the external and first lateral lobes of the preceding whorl are preserved. E and L′ lobes are of equal length, L′ is tripartite.

PELECYPODA

Nucula? sp. indet. aff. *N. axiniformis* Phillips

Several poorly preserved Nuculids, comparable with *Nucula axiniformis* Phillips (1835, Pl. XI, fig. 13) occur in phosphatic nodules and associated with *Pseudolioceras* aff. *compactile* (Simpson), *Pleuromya* sp. aff. *simplex* Warren, and *Oxytoma* sp. on the east side of Intrepid Inlet, 12 miles north of Cape Canning.

Cucullaea sp.

Plate II, figure 6; Plate III, figures 7,8

In phosphatic nodules east of Mould Bay weather station a small *Cucullaea* is very common. The moulds show close resemblance with those of both *Cucullaea* cf. *goldfussi* Borissjak (non Roemer) (Boriss-

jak, 1905, p. 56, Pl. 3, figs. 16a, b) and *C.* cf. *oblonga* Borissjak (non Goldfuss) (Borissjak, loc. cit. pp. 56, 57, Pl. 3, figs. 17a, b) from the Bajocian of the Donetz Jurassic of the U.S.S.R. An imprint apparently belonging to this form (Pl. III, fig. 7) shows part of the shell sculpture which consists of very fine radial and concentric lines. As the sculpture of the two Russian forms mentioned above is unknown, no further comparisons can be made. *Cucullaea goldfussi* Roemer (1836, Pl. 6, figs. 18a, b), whose teeth seem to be different from those of *C.* cf. *goldfussi* Borissjak and those of the Prince Patrick Island form, is clearly distinguished from the latter by the absence of radial elements in the sculpture. Radiating lines are present in *C. oblonga* Goldfuss (1826-33, p. 148, Pl. 123, figs. 9a, b) but this Oxfordian species has a much more elongated shape than the Prince Patrick Island and Russian forms.

Cucullaea sp. was found in Prince Patrick Island associated with *Coeloceras spinatum* n. sp., *Pseudolioceras* aff. *compactile* (Simpson), *Pleuromya* aff. *simplex* Warren, *Oxytoma* sp., and *Protocardia striatula* (Phillips).

Protocardia striatula (Phillips)
Plate III, figures 11, 12

Cardium striatulum Phillips, 1835, p. 128, Pl. 11, fig. 7.
Cardium striatulum Quenstedt, 1858, p. 328, Pl. 44, figs. 18, 19.
Protocardia striatula Benecke, 1905, pp. 228-231, Pl. 17, figs. 1-6.

All Prince Patrick Island specimens agree very well with Phillips', Quenstedt's and Benecke's figures of this species, but they are smaller. The species was found on the east side of Intrepid Inlet, 12 miles north of Cape Canning in phosphatic nodules and associated with *Pseudolioceras* aff. *compactile* Simpson, *Belemnites* sp., and *Pleuromya* aff. *simplex* Warren. On the east side of Mould Bay weather station the species occurs in phosphatic nodules with *Coeloceras spinatum* n. sp., *Cucullaea* sp., and *Pleuromya* aff. *simplex* Warren.

Pleuromya sp. aff. *simplex* Warren
Plate III, figures 9, 10

The two specimens figured were found east of Landing Lake and on the east side of Intrepid Inlet, 12 miles north of Cape Canning, respectively. At the latter locality the form is associated with other pelecypods and *Pseudolioceras* aff. *compactile* (Simpson). Other specimens were found east of Mould Bay weather station, where they are associated with *Coeloceras spinatum* n. sp., *Pseudolioceras,* and others. This form is similar to certain varieties of *Pleuromya simplex* Warren (1932, p. 24, Pl. 2, figs. 4, 5) from the Middle Bajocian Rock Creek member of the Fernie group in the Rocky Mountains and Foothills in Western Canada, but the Prince Patrick Island specimens are too poorly preserved to permit any decision as to their identity with *P. simplex.*

Gresslya cf. *rotundata* (Phillips)
Plate II, figure 7

cf. *Amphidesma rotundatum* Phillips, 1835, p. 132, Pl. 12, fig. 6.

The specimen figured, which was collected on the west side of Intrepid Inlet, is very similar to Phillips' specimen from the "Upper Lias Shale" of Yorkshire, but is somewhat larger. *G. rotundata* (Phillips) occurs, according to Rosenkrantz (1934, p. 117), in East Greenland in beds with *Pseudolioceras compactile, P. württenbergeri* and other characteristic Toarcian fossils.

Gresslya aff. *abducta* (Phillips)
Plate XVI, figure 4

The specimen figured was found 1 mile east of Point Wilkie associated with *Leioceras opalinum* (Reinecke), *Ludwigia m'clintocki* (Haughton), *Goniomya* cf. *v-scripta* (Sowerby), and *Oxytoma septentrionalis* (Haughton). Both umbos and part of the posterior margin are broken off, but the general shape of the specimen is that of *Gresslya abducta* (Phillips). *G. abducta* (Phillips) occurs in the Inferior Oolite of England.

Goniomya cf. *v-scripta* (Sowerby)
Plate VI, figures 8, 9

One imprint of the left valve and a fragment of the right of a *Goniomya* were collected in the *Leioceras opalinum* bed 1 mile east of Point Wilkie, where they are associated with this ammonite and other pelecypods. The type of the sculpture is similar to the specimen figured by Quenstedt (1858, Pl. 45, fig. 1). The very fine dots mentioned by him as occurring on the thin concentric lines on his specimens are not visible in the Prince Patrick Island form.

Oxytoma jacksoni (Pompeckj)
Plate VI, figures 1a, b, 2a, b, 3

Avicula sp. cf. *inaequivalvis* Newton and Teal, 1897, p. 502, Pl. 40, fig. 4.
Avicula sp. Newton and Teal, 1898, p. 650, Pl. 29, fig. 1.
Pseudomonotis jacksoni Pompeckj, 1900, pp. 60-62, Pl. 1, figs. 13-16.

This species, which seems to be a Lower Bajocian index fossil, was found in talus 10 miles north of Cape Canning and at another locality at the east side of Intrepid Inlet, where it is associated with *Ludwigia m'clintocki* (Haughton). Other specimens were collected by Tozer on Cameron Island.

The species is known only from fragments. Most of the Franz Josef Land specimens, described by Newton and Teal (1897, 1898) and Pompeckj (1900), are even more incomplete than those from the Canadian Arctic. The general outline of the species suggested by Newton and Teal (1897, Pl. 40, fig. 4) agrees fairly well with the Canadian specimens.

The largest Prince Patrick Island specimen (Pl. VI, fig. 3) is preserved as an imprint showing fairly strong ribs with three finer intercalated ribs of which the middle one is stronger than the two others. This type of sculpture is, however, not clearly developed or is absent in the upper region of the shell, where only the stronger ribs remain. The left valve (Pl. VI, fig. 1a) shows the concentric elements of the sculpture and the larger posterior wing. However, in this case the posterior, anterior, and lower margins of the shell are broken away, and the pointed extension of the posterior wing mentioned by Newton and Teal (1898, p. 650, Pl. 29, fig. 1) can only be imagined from the form of the concentric sculpture elements. The flat right valve (Pl. VI, figs. 2a, b) is very similar to Newton and Teal's right valve (1898, Pl. 29, fig. 1), but the posterior wing is broken off in this specimen also.

Several fragments show the triangular ligament groove on the broad area, which was described by Pompeckj (1900, p. 61).

Oxytoma septentrionalis (Haughton)
Plate VI, figures 4-7

Monotis septentrionalis Haughton 1858, p. 245, Pl. 9, figs. 6, 7.

Several, mostly incomplete, specimens of this species were found associated with other pelecypods and *Leioceras opalinum*. The posterior ear is much longer than is shown in Haughton's figure, but was only preserved in one of the specimens in Tozer's collection. Haughton has already mentioned that the illustration of the ribs in his fig. 6 is incorrect. The specimens before me have about 17 stronger radiating ribs that are almost unrecognizable in the upper part of the shell. Between two of these stronger ribs finer striae are intercalated. As stated by Haughton, the right valve is less convex than the left and its sculpture is much weaker.

One imperfect specimen was found associated with *Coeloceras spinatum* n. sp., *Pseudolioceras* aff. *compactile* (Simpson), *Cucullaea* sp. and other pelecypods in the Toarcian east of Mould Bay weather station.

Inoceramus lucifer Eichwald
Plate XIV, figures 1a-c, 2;
Plate XV, figure 2; Plate XVI, figures 1, 2

Inoceramus lucifer Eichwald, 1871, pp. 194, 195, Pl. 18, figs. 5-7.
Inoceramus lucifer Imlay, 1955, p. 86, Pl. 8, figs. 1, 5-10.

This species is common in talus below the *Arkelloceras* bed 10 miles north of Cape Canning on the east side of Intrepid Inlet. One specimen was found in the same piece of rock with *Arkelloceras mclearni* thus ascertaining the occurrence of this species in the *Arkelloceras* bed. Both the large and small specimens have the mytiloid outline and the concave anterior margin, which are characteristic of this species. The hingeline of the large specimen is not fully preserved; it is fairly short in the smaller specimens. The large specimen has three major con-

strictions and a few coarse ribs occur near these constrictions, as already stated by Imlay (loc. cit.) for his Alaskan species. The young specimens have very fine concentric ribs.

According to Imlay (loc. cit.) in Alaska this species ranges through the Lower and Middle Bajocian up to the European zone of *Otoites sauzei*.

Inoceramus sp.

Plate XIV, figure 3; Plate XV, figures 1, 4; Plate XVI, figure 3; Plate XVII, figures 1a, b, 3

Associated with *Arkelloceras tozeri* n. sp., and *A. mclearni* n. sp., are some *Inocerami* that are clearly distinguished from the latter species by their elongated, not inflated shape, the absence of the anterior concave zone beneath the umbos, and the absence of constrictions.

The small specimen Pl. XIV, fig. 3, resembles the young form of Eichwald's (1871, Pl. 20, figs. 4, 5) *Inoceramus ambiguus*. The large specimen Pl. XV, fig. 1; Pl. XVII, figs. 1a, b, which probably belongs to the same species as the small one, is, however, distinguished clearly from Eichwald's (loc. cit. Pl. 20, fig. 2) adult *I. ambiguus* by the absence of sharp concentric ribs.

The specimen Pl. XVI, fig. 3, which was found associated with some specimens of *Pholadomya* on the east side of Mould Bay in a bed of uncertain age, seems to be closely related to *Inoceramus* sp. from the *Arkelloceras* bed. The indeterminable fragments figured on Pl. XV, fig. 4 and Pl. XVII, fig. 3 were collected in a bed apparently younger than the *Arkelloceras* bed.

Plagiostoma sp. indet.

Plate XIV, figure 4; Plate XVII, figure 2

Three and a half miles north of Salmon Inlet one left and one right valve of a *Plagiostoma*, together with a fragment of a *Trigonia*, were found in debris. The bed from which these fossils originated is unknown, but Tozer (personal communication) believes it possible that they are Triassic in age.

The anterior margin of this moderately convex form is straight, the posterior forms a half-circle. The umbos are low. The two comparatively small ears are of equal size and are clearly separated from the shell. The sculpture of the shell, which is best preserved in the posterior part of the right valve, consists of fine radiating, somewhat wavy ribs crossed by fine concentric lines that give a dotted appearance to the ribs.

This form resembles *Plagiostoma semicircularis* Goldfuss (1826-1833, p. 83, Pl. 101, figs. 6a, b) from the upper part of the Middle Jurassic, but is distinguished from it by the equal size of the ears and finer sculpture.

Pecten (*Camptonectes*) sp.

Plate XV, figure 3

The figured specimen, which was found in talus on the east side of Intrepid Inlet 10 miles north of Cape Canning, probably came from

the *Arkelloceras* bed. Both ears and the sculpture of the shell are incompletely preserved. This form may be related to *Pecten* (*Camptonectes*) *lens* Sowerby.

THE LOCALITIES AND THEIR FAUNAS

The position of the Jurassic outcrops from which the fossils described in this paper were collected are indicated on Figure 1 by numbers that correspond with those used below. The description of the type section and the lithology there and at other localities are based on Tozer's field investigations (Tozer, 1956 and personal communication). A few of the writer's provisional fossil and age determinations, published in Tozer's report (1956), are altered in this paper.

A. TYPE SECTION

The fossiliferous Jurassic rocks with which this report is primarily concerned have been designated the Wilkie Point formation by Tozer (1956).

The type section (*see* Plate XVIII) is situated on the east side of Intrepid Inlet between 11 and 12 miles north of Cape Canning. The lower beds are well exposed on the coast, whereas the higher units appear a short distance inland. The sequence is as follows:

		Thickness (in feet)	
		Unit	Total from base
8	Sandstone and sand; light grey to white, very fine grained, mainly massive but in part crossbedded; weathers to castellated forms	130	560
7	Sandstone and sand; yellowish orange, medium grained, with reddish brown, hard bands; much fossil wood	180	430
6	Sandstone and sand; light grey, fine grained, with dusky red, fossiliferous, hard bands and grey phosphatic nodules; *Arkelloceras tozeri* n. sp., *A. mclearni* n. sp., *Inoceramus lucifer* Eichwald, *Inoceramus* sp. (Field No. 54-6-18A, G.S.C. Cat. No. 24661). Exact age questionable	70	250
5	Sandstone and sand; light grey, fine grained; lenticular 6-inch conglomerate of fragments of underlying sandstone at base	50	180
4	Sandstone; pale reddish brown, fine grained, calcareous; lower contact indefinite; *Leioceras opalinum* (Reinecke) (Field No. 54-6-24, G.S.C. Cat. No. 24658) *Lower Bajocian*	5	130
3	Sandstone and sand; soft, light grey, fine grained	98	125
2	Sandstone; pale reddish brown, fine grained; *Ludwigia m'clintocki* (Haughton), *Oxytoma jacksoni* (Pompeckj) (Field No. 54-6-24A, G.S.C. Cat. No. 24648) *Lower Bajocian*	2	27
1	Sandstone; soft, light grey, fine grained	25	25
	Covered interval to sea-level, probably representing lower parts of the Wilkie Point formation	100	

The Devonian sandstones that underly the Jurassic strata on the west side of Intrepid Inlet are not exposed in this section.

In the type section the total thickness of the Wilkie Point formation is more than 600 feet. According to Tozer (1956, p. 21) the lower beds are thinner on the Manson Point peninsula, whereas the upper units (7 and 8 in the type section) maintain a constant thickness throughout the area. The thinning of the lower beds, by which the total thickness of the Wilkie Point formation west of Intrepid Inlet is reduced to about 500 feet, may according to Tozer be due in part to an unconformity.

B. OTHER LOCALITIES

1. *3 miles southeast of Mould Bay weather station*
   Field No. 54-8-18A G.S.C. Catalogue No. 24650
   Within 20 feet of the Jurassic/Devonian contact.
   Dactylioceras commune (Sow.) var. a
   Age: Toarcian

2. *Hill 1½ miles north of Mould Bay weather station*
   Field No. 54-8-3 G.S.C. Catalogue No. 24651
   Disintegrated outcrop.
   Dactylioceras commune (Sow.) var. a
   Age: Toarcian

3. *Hill 1 mile north of Mould Bay weather station*
   Field No. 54-8-2 G.S.C. Catalogue No. 24652
   Conglomeratic sandstone, very near base of Jurassic section.
   Dactylioceras commune (Sow.) var. a
   D. commune (Sow.) var. b
   Age: Toarcian

4. *East side of Mould Bay, 5 miles north of weather station*
   Field No. 54-8-7B G.S.C. Catalogue No. 24643
   Phosphatic nodules in disintegrated outcrops.
   Dactylioceras cf. *commune* (Sow.) var. a
   Age: Toarcian

5. *¾ mile south of Mould Bay weather station*
   Field No. 54-8-10 G.S.C. Catalogue No. 24644
   Phosphatic nodules in disintegrated outcrops.
   Dactylioceras ? or *Coeloceras* ? sp. indet.
   Age: Toarcian

6. *3¾ miles northeast of Mould Bay weather station*
   Field No. 54-8-21C G.S.C. Catalogue No. 24641
   Phosphatic nodules in disintegrated outcrop.
   Coeloceras spinatum n. sp.
   Pseudolioceras aff. *compactile* (Simpson)
   Cucullaea sp., *Protocardia striatula* (Phillips)
   Pleuromya sp. aff. *simplex* Warren
   Age: Toarcian

7. *East of Landing Lake*
Field No. 54-5-30 G.S.C. Catalogue No. 24642
Phosphatic nodules in lower part of sequence.
Coeloceras spinatum n. sp.
Pseudolioceras aff. *compactile* (Simpson)
Pleuromya sp. aff. *simplex* Warren
Age: Toarcian

8. *East side of Intrepid Inlet, 12 miles north of Cape Canning at elevation of about 50 feet*
Field No. 54-6-22A G.S.C. Catalogue No. 24645
Phosphatic nodules.
Pseudolioceras aff. *compactile* (Simpson)
Belemnites sp., *Nucula* ? sp. indet.
Pleuromya sp. aff. *simplex* Warren, *Oxytoma* sp.
Age: Toarcian

9. *East side of Intrepid Inlet, 11 miles north of Cape Canning*
Field No. 54-6-23 G.S.C. Catalogue No. 24649
Phosphatic nodules at elevation of about 80 feet.
Pseudolioceras aff. *compactile* (Simpson)
Belemnites sp. indet.
Protocardia striatula (Phillips)
Pleuromya aff. *simplex* Warren
Age: Toarcian

10. *West side of Intrepid Inlet, west of Disappointment Point*
Field No. 54-6-2A G.S.C. Catalogue No. 24646
Talus.
Pseudolioceras ? sp. indet
Belemnites sp.
Gresslya rotundata (Phillips)
Age: Toarcian or Lower Bajocian

11. *About 5½ miles W 10° N of Disappointment Point*
Field No. 54-8-23B G.S.C. Catalogue No. 24647
Pseudolioceras aff. *compactile* (Simpson)
Age: Toarcian

12. *One mile east of Wilkie Point*
Field No. 54-4-24 G.S.C. Catalogue No. 24655
Talus on disintegrated outcrop.
Leioceras opalinum (Reinecke)
Ludwigia m'clintocki (Haughton)
Goniomya cf. *v-scripta* (Sowerby)
Oxytoma septentrionalis (Haughton)
Gresslya aff. *abducta* (Phillips)
Age: Lower Bajocian

13. *East side Intrepid Inlet, 7 miles east of weather station*
Field No. 54-8-17 G.S.C. Catalogue No. 24656
From red sandstone on disintegrated outcrop.
Ludwigia m'clintocki (Haughton)
Age: Lower Bajocian

14. *West side Intrepid Inlet, 3 miles north of Disappointment Point*
Field No. 54-6-4A G.S.C. Catalogue No. 24657
Leioceras opalinum (Reinecke)
Age: Lower Bajocian

15. *Point Wilkie*
No field No. G.S.C. Catalogue No. 24659
Talus.
Leioceras opalinum (Reinecke)
Belemnites sp. indet.
Age: Lower Bajocian

16. *East side of Intrepid Inlet, 10 miles north of Cape Canning*
No field No. G.S.C. Catalogue No. 24654
Oxytoma jacksoni (Pompeckj)
Age: Lower Bajocian

17. *4 miles north of Salmon Point*
Field No. 54-6-15A G.S.C. Catalogue No. 24663
From talus of disintegrated outcrop.
Belemnoids (same forms as in collection No. 19).

18. *3 miles S 30° E of Mould Bay weather station*
Field No. 54-8-12A G.S.C. Catalogue No. 24664
Talus from red sandstone and grey phosphatic nodules.
Cranocephalites vulgaris Spath
Arctocephalites ? sp. indet. 2
Cylindroteuthis sp.
Inoceramus sp. indet.
Pecten sp. indet.
Age: Upper Bathonian or Lower Callovian

19. *3 miles S 30° E of Mould Bay weather station*
Field No. 54-8-12 G.S.C. Catalogue No. 24665
In situ, from red sandstone.
Arctocephalites sp. indet. 1
Belemnoid fragments
Age: Upper Bathonian or Lower Callovian

20. *East side of Intrepid Inlet, 10½ miles north of Cape Canning*
Field No. 54-6-18 G.S.C. Catalogue No. 24660
Talus from unit 6.
Arkelloceras tozeri n. sp.
Arkelloceras mclearni n. sp.
Belemnoids
Inoceramus lucifer Eichwald
Inoceramus sp.
Pecten (*Camptonectes*) sp.
Age questionable.

21. *East side of Intrepid Inlet*
Field No. 54-6-21C G.S.C. Catalogue No. 24662
From sandstones, probably part of unit 7 of type section.
Inoceramus sp. indet.
Age questionable.

22. *East side Mould Bay*
Field No. 54-8-6A G.S.C. Catalogue No. 24669
Inoceramus sp.
Pholadomya sp.
Age: ? Middle Jurassic

23. *3½ miles north of Salmon Point*
Field No. 54-6-10 G.S.C. Catalogue No. 24653
Trigonia sp. indet.
Plagiostoma sp.
Age: Unknown, possibly Triassic

AGE DETERMINATION AND CORRELATION

The fossils collected at the various localities indicate the presence of marine Toarcian, Lower Bajocian, and Upper Bathonian or Lower Callovian on Prince Patrick Island. The Toarcian is characterized by two ammonite-faunas, i.e. in ascending order: the *Dactylioceras* fauna and the *Pseudolioceras-Coeloceras* fauna. A third fauna, consisting of *Pseudolioceras* without *Coeloceras* is considered to be probably of the same age as the *Pseudolioceras-Coeloceras* fauna. Lower Bajocian is indicated by *Leioceras opalinum* and *Ludwigia m'clintocki*. Additional, apparently significant fossils in these beds are *Oxytoma septentrionalis* (Haughton) and *Oxytoma jacksoni* (Pompeckj). Upper Bathonian or Lower Callovian is shown by the presence of *Cranocephalites*. The position of the bed with the new genus *Arkelloceras* is doubtful, it may be Upper Bajocian or Upper Bathonian-Lower Callovian.

The correlation of the Jurassic sequence in Prince Patrick Island with other Arctic occurrences and the northwest European standard section is illustrated in Table II (in pocket) and discussed in the following section. In the stratigraphic chart (Table II) Arkell's revised (1956) northwest European zone sequence is chosen as basis for the correlations; the column "Northern Alaska" of this chart is based on Imlay's recent paper (1955) and the column "East Greenland" mainly on Rosenkrantz (1934), Spath (1932, 1935, 1936), and Arkell (1956). The stratigraphy of the Canadian Arctic occurrences, other than Prince Patrick Island, is derived from the writer's unpublished preliminary identifications of fossils collected during recent field work by members of the Geological Survey of Canada.

TOARCIAN

Dactylioceras bed

The bed with *Dactylioceras commune* (Sowerby) forms the base of the Jurassic sequence in Prince Patrick Island. It consists of con-

glomerate and rests with an angular unconformity on the Devonian Melville Island formation (Tozer, 1956, p. 18). *Pseudolioceras* and *Coeloceras* found in younger parts of the Prince Patrick Island Toarcian do not appear in the *Dactylioceras* bed.

In the northwest European standard section, *Dactylioceras commune* (Sowerby) is common in the zone of *Hildoceras bifrons,* which forms the lower part of the Upper Toarcian, and is equivalent to the middle part of the Whitbian in English sections.

The *Dactylioceras* bed is also present in other parts of the Canadian Arctic Archipelago, i.e., Cornwall Island and Axel Heiberg Island. Unfortunately the specimens from Axel Heiberg Island are too unsatisfactorily preserved for exact identification.

In the Canadian Arctic coast region no equivalents of the Prince Patrick Island *Dactylioceras* beds are known. In the Aklavik area the base of the Jurassic is formed by beds of Early Lias age (fossils concerned as yet undescribed) and it is possible that the Toarcian is absent in this region.

Coarsely ribbed Dactylioceratids comparable to *D. commune* are known from northern Alaska, i.e. from the Kingak shale, South Barrow test well on the Arctic Coastal Plain (Imlay, 1955, p. 88), and the beds concerned may be correlated with the Prince Patrick Island *Dactylioceras* bed.

In other parts of the Arctic Dactylioceratids are known to be present in the Spitsbergen (Frebold, 1929b) and East Greenland Toarcian (Rosenkrantz 1934, p. 118) but the forms occurring there are not *D. commune* and may belong to beds slightly different in age from that of the Prince Patrick Island *Dactylioceras* bed.

In the Jurassic Fernie group of the Rocky Mountains and Foothills of Western Canada *Dactylioceras* occurs associated with *Harpoceras* cf. *exaratum* in a facies similar to that of the South German *Posidonomya* shale, Quenstedt's (1858) Lias Epsilon (Frebold, 1957, pp. 10, 11), but the state of preservation of these Dactylioceratids does not permit any accurate identification. The Toarcian of the Fernie group may be slightly younger than the Prince Patrick Island *Dactylioceras* bed.

Pseudolioceras-Coeloceras bed

The bed with phosphatic nodules containing *Pseudolioceras* aff. *compactile* (Simpson), *Coeloceras spinatum* n. sp., *Coeloceras* aff. *desplacei* (d'Orbigny), and some pelecypods is, according to Tozer (1956, p. 21), about 100 feet above the base of the Jurassic sequence. The main exposures of this bed are 3¾ miles northeast of the Mould Bay weather station and immediately east of Landing Lake.

The stratigraphic position of this bed in comparison with the northwest European standard section is Upper Toarcian. *Pseudolioceras compactile* (Simpson) occurs in England in the Striatulum subzone of the Jurense zone, i.e. at the base of the Yeovilian. Related forms

such as *P. württenbergeri* occur in the same zone in northwestern Germany.

This bed is very widely distributed in Arctic regions. It is present in Axel Heiberg Island, where *Coeloceras spinatum* n. sp. and *Pseudolioceras* aff. *compactile* were found (*see* p. 3), and in parts of Spitsbergen where it is developed in the same phosphatic nodules facies as on Prince Patrick Island (Frebold, 1929a, b, 1930), and East Greenland (Rosenkrantz, 1934, p. 118). In northern Alaska *P.* cf. *compactile* occurs, according to Imlay (1955, p. 89), in the uppermost beds of the Kingak shale in Ignek Valley. Equivalents of this bed have, however, not yet been found in the Canadian Arctic coast region. *Coeloceras spinatum* is a new form in this widespread Arctic marker bed. It has not been found in Spitsbergen, where, however, a related form, i.e. *C. polare* Frebold (Frebold 1929b, 1930) occurs.

Compared with the northwest European standard section it seems possible that equivalents of the *Phymatoceras lilli* and *Haugia variabilis* subzones, which form the uppermost part of the Whitbian and the lower part of the Jurense zone, are missing. However, beds of equivalent ages may be concealed on Prince Patrick Island.

Toarcian beds younger than the Striatulum subzone are not indicated in Prince Patrick Island. As the lower part of the Toarcian is also missing, it can be assumed that the Upper Lias of Prince Patrick Island is very incomplete with only two of the sixteen European subzones represented (*see* Table I, p. 32).

LOWER BAJOCIAN

Leioceras opalinum bed

Beds with *Leioceras opalinum* (Reinecke), *Ludwigia m'clintocki* (Haughton), *Oxytoma septentrionalis* (Haughton), *O. jacksoni* (Pompeckj), and other pelecypods have been found in the type section on the east side of Intrepid Inlet, at Wilkie Point, and also at Disappointment Point on the west side of Intrepid Inlet. In the type section north of Cape Canning these beds consist of pale reddish brown, fine-grained sandstone.

The stratigraphic position of these beds is determined by the presence of *Leioceras opalinum* (Reinecke), which, in the northwest European standard sequence, characterizes the lowermost zone of the Bajocian. As *Ludwigia m'clintocki* (Haughton) was found associated with *Leioceras opalinum,* the age of this ammonite, hitherto uncertain, has now been determined.

Rocks of Early Bajocian age are also present in other parts of the Canadian Arctic Archipelago, as for instance on Cameron and Axel Heiberg Islands, although no typical *L. opalinum* was found at these localities and it is possible that the beds concerned are slighty younger than the Opalinum zone. No Lower Bajocian has been proven in

Spitsbergen[1] or East Greenland. It is remarkable that no Lower Bajocian has yet been found in the Canadian Arctic coast region. From northern Alaska Imlay (1955, pp. 75, 81) reports Lower Bajocian on the basis of some ammonites determined as *Tmetoceras* sp., *Pseudolioceras whiteavesi* White, and *Erycites howelli* White. No equivalents of the Opalinum zone are known to be present in the Rocky Mountains and Foothills Jurassic. In the Whitesail Lake area, British Columbia, however, Lower Bajocian is indicated by the presence of *Tmetoceras regleyi* Dumortier (Frebold, 1951b).

MIDDLE BAJOCIAN TO LOWER CALLOVIAN

No fossils have been found on Prince Patrick Island that could establish the presence of Middle or Upper Bajocian or Lower Bathonian. Upper Bathonian or Lower Callovian, however, is indicated by a bed with *Cranocephalites*. In Tozer's (1956, p. 19) type section of the Wilkie Point formation part of the missing stages may be represented by 50 feet of apparently unfossiliferous sandstone and sand with a lenticular 6-inch basal conglomerate that rests on the *Leioceras opalinum* sandstone and is overlain by the *Arkelloceras* bed. The basal conglomerate with fragments of the underlying Opalinum sandstone indicates an erosional interval that may account for part of the missing Bajocian and Bathonian zones. Unfortunately the age of the *Arkelloceras* bed on top of the unfossiliferous sandstone is uncertain, as indicated in the discussion that follows.

Arkelloceras bed

The *Arkelloceras* bed has been found only in the type section of the Wilkie Point formation north of Cape Canning. It consists, according to Tozer (1956, p. 19), of 70 feet of light grey, fine-grained sandstone and sand with dusky red, fossiliferous, hard bands and grey phosphatic nodules. The sandstone and sand are similar to the underlying unfossiliferous sandstones and sands.

The fauna of this bed consists of *Arkelloceras tozeri* n. sp., *A. mclearni* n. sp., *Inoceramus lucifer* Eichwald, *Inoceramus* sp., and *Pecten* (*Camptonectes*) sp. The slight resemblance of *Arkelloceras* with *Garantia* (*see* p. 9) may suggest an age close to that of *Garantia*, i.e. younger Bajocian, but the evidence is not conclusive. Nor can an exact age determination be based on *Inoceramus lucifer* Eichwald, whose full stratigraphic range is unknown, though in Alaska it is restricted to the Lower and Middle Bajocian (Imlay, 1955, p. 86).

The possibility of a younger age of the *Arkelloceras* bed, i.e. Bathonian or Lower Callovian, is also present and could be suggested for the following reason.

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[1]Imlay's, 1955, p. 75, statement that "the lower Bajocian species of *Pseudolioceras* and *Erycites* in Alaska are similar to species in the Barents Sea area", is erroneous. In the Barents Sea region *Pseudolioceras* has been found only in Spitsbergen, where it is an important index fossil of the Toarcian and where it is associated with *Coeloceras*, *Dactylioceras* and other typical Toarcian ammonites (Frebold, 1929b, 1930, 1935, 1951a).

Above the *Arkelloceras* bed are, according to Tozer (loc. cit.), 180 feet of yellowish orange, medium-grained sandstone and sand, with reddish brown, hard bands and much fossil wood. Tozer (loc. cit., p. 20) states that this sandstone (unit 7 of the type section, *see* p. 17) is similar to a sandstone with fossil wood that occurs 3 miles south of the Mould Bay weather station on top of the *Cranocephalites* bed. These conditions do not prove but may suggest that the stratigraphic position of the *Arkelloceras* bed is about the same as that of the *Cranocephalites* bed.

The present state of our stratigraphic knowledge of the beds concerned thus leaves two main alternatives for the age of the *Arkelloceras* bed, i.e. Upper Bajocian or Upper Bathonian-Lower Callovian. On the basis of the present material no decision can be made as to which of the alternatives is correct.

Cranocephalites bed

The *Cranocephalites* bed has been found at a single locality, 3 miles south 30 degrees east of the Mould Bay weather station. It underlies sandstones with fossil wood similar to those of unit 7 in the type section north of Cape Canning.

The index fossil of the Prince Patrick Island *Cranocephalites* bed is *Cranocephalites vulgaris* Spath. Associated are *Cylindrotheutis* sp., and some pelecypods.

When describing the East Greenland *Cranocephalites* beds Spath (1932, p. 145) placed them in the Upper Bathonian and correlated them with the northwest European zone of *Clydoniceras discus*. The only slightly younger *Arctocephalites* beds were regarded by the same author as equivalents of the Yorkshire Cornbrash with *Kamptokephalites* and *Dolikephalites* and of his uppermost Bathonian *herveyi* zone. Donovan (1953, p. 133), however, believes it equally probable that both the *Cranocephalites* and *Arctocephalites* beds might be assigned to Spath's *herveyi* zone, which is equivalent to Arkell's *macrocephalus* zone. As Arkell and others regard this zone as the base of the Callovian, both the *Cranocephalites* and *Arctocephalites* beds and the somewhat younger *Arcticoceras* beds could therefore be regarded as of Callovian age. Consequently Arkell, (1956) places the *Cranocephalites* and *Arctocephalites* beds in the Callovian. As far as the *Arctocephalites* beds are concerned a Callovian age seems to be fairly well substantiated. Representatives of this genus occur in East Greenland, according to Spath (loc. cit.) as high as the *Arcticoceras* beds, which, according to him, belong to the Callovian.

In the Alaskan Tuxedni formation *Cranocephalites* has been found associated with *Reineckeia* and *Planisphinctes* immediately above supposed equivalents of the Parkinsoni zone containing *Sphaeroceras, Leptosphinctes* and *Stephanoceras* (Imlay, 1952, p. 980). From these stratigraphic relationships of *Cranocephalites* Imlay (loc. cit., pp. 980, 981, and 1953, stratigraphic charts) concludes that this genus existed

early in the Bathonian. Arkell (1956, p. 536), however, regards the association of the Callovian genus *Reineckeia* with *Cranocephalites* as a proof of its Callovian age. This opinion is furthermore supported by the fact, that in East Greenland *Cranocephalites* occurs only 20 feet below the *Arctocephalites* bed. The writer, therefore, favours the opinion expressed by Spath, Donovan, and Arkell and assigns both the *Cranocephalites* and *Arctocephalites* beds to a stratigraphic position close to the Upper Bathonian and Lower Callovian boundary. Further field evidence will be required before an exact age determination can be made.

It is still uncertain whether *Arctocephalites* beds are represented in Prince Patrick Island. The two forms of *Arctocephalites*? sp. indet., described in this paper, could also have occurred in the *Cranocephalites* bed.

Equivalents of the *Arctocephalites* beds (not the *Cranocephalites* beds) are known in the Richardson Mountains of the Canadian Arctic coast region. Beds with *Cadoceras*, which have not been found on Prince Patrick Island, occur in that region also. In northern Alaska both *Cranocephalites* and *Arctocephalites* are unknown, but Lower Callovian with *Arcticoceras* and *Pseudocadoceras* is locally present.

The *Cranocephalites* and *Arctocephalites* beds and Lower Callovian strata with *Arcticoceras, Cadoceras, Kepplerites* and others are well-known in parts of East Greenland (Spath, 1932) and from the Barents Sea area. In the Fernie group of the Canadian Rocky Mountains and Foothills *Cranocephalites* and *Arctocephalites* are unknown (Frebold, 1957), but Lower Callovian with *Arcticoceras, Cadoceras, Kepplerites*, and other characteristic ammonites is well represented.

NONMARINE UPPER JURASSIC

No fossils have been found on Prince Patrick Island that would indicate the presence of marine beds of Upper Callovian, Oxfordian, Kimmeridgian, or Portlandian ages. According to Tozer (1956, p. 19), the upper part of the Wilkie Point formation consists of two sandstone and sand units, the lower one (unit 7 of the type section) with much fossil wood. A bed exposed on the west side of Intrepid Inlet 4 miles north of Salmon Point, according to Tozer (loc. cit. p. 20) is probably equivalent to this lower unit and has a 3-foot coal seam. In the type section at Wilkie Point this unit is 180 feet thick. According to Tozer the upper sand unit (unit 8 of the type section) is 130 feet thick, mainly massive, and weathers to castellated forms.

These two sand units of the upper Wilkie Point formation are overlain by the predominantly sandy Mould Bay formation which, however, rests locally directly on the Devonian Melville Island formation. Tozer (1956, p. 23) has stated that the Mould Bay formation in places lies on beds low in the Wilkie Point formation and therefore concludes that the Mould Bay beds overlap and locally rest unconformably upon the Wilkie Point formation. According to Jeletzky (personal information to Dr. Tozer, *see* Tozer, 1956, p. 24) the *Aucella* fauna of the

Mould Bay formation indicates a Purbeckian or Upper Tithonian age. Some of the *Aucella* lots, however, may be of lowermost Cretaceous age. This age determination confirms the opinion of the Upper Jurassic age of the two upper sandy units of the Wilkie Point formation.

The nonmarine Upper Jurassic sediments of Prince Patrick Island are at least partly represented in a similar facies on other islands of the Canadian Arctic Archipelago, i.e. on Axel Heiberg Island, and Cornwall Island (personal information by Dr. Tozer). However, nonmarine sedimentation or non-deposition apparently lasted longest on Prince Patrick Island, as marine *Cadoceras* beds, so far unknown on Prince Patrick Island, are present on Cornwall Island and in the western part of Axel Heiberg Island. Furthermore, in contrast with the nonmarine development on Prince Patrick Island marine Oxfordian with *Cardioceras* (yet undescribed) is present on eastern Axel Heiberg Island. In certain regions of Axel Heiberg Island nonmarine Upper Jurassic sedimentation seems to have been restricted to part of Oxfordian time only. This is shown by the presence of marine Upper Jurassic beds, possibly of Kimmeridgian and Portlandian age, which overly the nonmarine beds.

Marine Upper Jurassic strata are also present in the Aklavik area and neighbouring Canadian Arctic coast regions. In the foothills of the Brooks Range and the Arctic Coastal Plain of northern Alaska, Callovian, marine Upper Oxfordian, Kimmeridgian, and Lower Portlandian beds are known to be present (Imlay, 1955).

In view of these widely distributed marine sediments in adjoining Arctic regions the nonmarine development of the Upper Jurassic beds on Prince Patrick Island is remarkable.

REMARKS ON PALÆOGEOGRAPHY

For many years the few fossils collected on Prince Patrick Island by M'Clintock's expedition and described by Haughton (1858) were the only reliable evidence for the existence of Jurassic strata in the Canadian Arctic Archipelago. Opinions on the Jurassic palæogeography of these regions were therefore very little substantiated. During recent field investigations in the Archipelago, particularly those carried out by members of the Geological Survey of Canada, a considerable number of other Jurassic localities in these regions have been found and the maximum extent of Jurassic seas in the Canadian Arctic can be estimated as shown in Figure 2.

The stratigraphic data at present available show very clearly that several Jurassic transgressions, interrupted by times of regressions, followed one another in these regions and that these transgressions apparently varied in extent from place to place. For example the Oxfordian transgression, which is clearly indicated in parts of Axel Heiberg Island, did not invade Prince Patrick Island, although that region had been invaded by the sea during parts of the Early and Middle Jurassic.

At present the following Jurassic transgressions are indicated in the Canadian Arctic Archipelago by diagnostic fossils:

1. Toarcian—Prince Patrick, Cornwall, Axel Heiberg Islands.
2. Lower Bajocian—Prince Patrick, Cameron, Cornwall, and Axel Heiberg Islands.
3. Upper Bathonian or Lower Callovian—Prince Patrick Island. Not substantiated in other parts of the Archipelago.
4. Lower Callovian—Cornwall and Axel Heiberg Islands. Apparently regression period in Prince Patrick Island. Not proved on other islands.
5. Oxfordian—Axel Heiberg Island. Apparently regression period in Prince Patrick and Cornwall Islands. Not proved on other islands.
6. Kimmeridgian-Portlandian—Indicated in Axel Heiberg Island only. Apparently regression period in Prince Patrick Island.
7. Tithonian—Prince Patrick and Axel Heiberg Islands.

This picture may be changed or completed by new discoveries. Times of regression are indicated by absence of index fossils, presence of conglomerates indicating erosional intervals, or presence of nonmarine beds. Thus, in Prince Patrick Island the temporary regression in latest Toarcian time is indicated by the absence of uppermost Toarcian index fossils, a regression after the Early Bajocian is indicated by the absence of index fossils and a conglomerate between the Lower Bajocian *Leioceras* bed and the *Arkelloceras* bed. The regression in Prince Patrick Island in Late Jurassic times is shown by the absence of marine and occurrence there of nonmarine strata.

At present no Jurassic rocks older than Upper Toarcian are known in the Canadian Arctic Archipelago. Apparently the first Jurassic transgression over these regions took place at this Late Toarcian time. Spitsbergen and parts of East Greenland were also covered by sea. It is remarkable that no traces of this widespread Arctic transgression have so far been found in the Aklavik area of the Canadian Arctic coast region, which was invaded in Sinemurian and perhaps Hettangian times. The Toarcian transgression reached parts of the foothills region of the Brooks Range and the Arctic Coastal Plain of northern Alaska.

Whether the Early Bajocian transgression, clearly indicated in Prince Patrick Island, actually covered part of the Barents shelf and those parts of East Greenland which were invaded in Toarcian time is doubtful. The Bajocian fauna described by Pompeckj (1900) from Franz Josef Land may be slightly younger or older. This Early Bajocian transgression did not apparently reach the Canadian Arctic Coast regions although it covered parts of northern Alaska.

The transgression of Prince Patrick Island during the time of deposition of the *Arkelloceras* beds is not indicated as yet in any other region, but the Late Bathonian or Early Callovian transgression with its *Cranocephalites* fauna, which in the Canadian Arctic Archipelago is as yet only indicated on Prince Patrick Island, reached both the Barents shelf area and part of East Greenland. The slightly younger or almost contemporary *Arctocephalites* fauna invaded the Richardson Mountains area of the Canadian Arctic Coast region but typical representatives of this fauna have not been found on Prince Patrick Island.

During the long period of Late Jurassic regression in Prince Patrick Island indicated by nonmarine sediments, other parts of the Arctic were invaded by the sea. At least temporary invasions are proved in parts of the Canadian Arctic Archipelago and Arctic Coast regions, parts of northern Alaska, in the Barents shelf area, and in parts of East Greenland. Not before the end of the Jurassic period, i.e., in Tithonian time, was Prince Patrick Island again submerged by the sea, a submergence whose traces are also found in other parts of the Canadian Arctic and in parts of East Greenland.

As shown on the palæogeographic map (Figure 2), the known facts on the distribution or former distribution of Jurassic rocks in Canada do not justify acceptance of a Jurassic seaway from the Arctic sea to Western Canada via the Mackenzie River region. The writer's view on this matter is expressed in another paper (Frebold, 1957, p. 44) from which this figure is taken.

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TABLE I

CORRELATION OF THE PRINCE PATRICK ISLAND TOARCIAN WITH THE NORTHWEST EUROPEAN STANDARD SECTION

	Northwest European Substages *(Arkell, 1933)*	Northwest European Zones *(Arkell, 1956)*	Northwest European Subzones *(Arkell, 1956)*	Prince Patrick Island
TOARCIAN	Yeovilian	Lytoceras jurense	Pleydellia aialensis	not identified probably absent
			Dumortieria moorei	
			Dumortieria levesquei	
			Phlyseogrammoceras dispansum	
			Grammoceras struckmanni	
			Grammoceras striatulum	Pseudolioceras compactile, Coeloceras spinatum
	Whitbian		Haugia variabilis	not identified
			Phymatoceras lilli	
		Hildoceras bifrons	Dactylioceras braunianum	Dactylioceras commune var.
			Peronoceras fibulatum	
			Frechiella subcarinata	
		Harpoceras falcifer	Ovaticeras pseudovatum	absent
			Harpoceras falcifer	
			Harpoceras exaratum	
		Dactylioceras tenuicostatum	Dactylioceras tenuicostatum	
			Tiltoniceras acutum	

PLATES I TO XVIII

PLATE I

(All figures natural size)

Types in collections of the Geological Survey of Canada

Figure 1. *Dactylioceras commune* (Sowerby) var. a. (Page 2.) Lateral view. Toarcian Whitby, England. Hypotype, G.S.C. No. 13,354.

Figure 2. *Dactylioceras commune* (Sowerby) var. a. (Page 2.) Lateral view. Wilkie Point formation. Toarcian. Hill 1 mile north of Mould Bay weather station. Hypotype, G.S.C. No. 13,355.

Figures 3a, b. *Dactylioceras commune* (Sowerby) var. b. (Page 3.) 3a lateral view, 3b venter. Wilkie Point formation. Toarcian. Same locality. Hypotype, G.S.C. No. 13,356.

Figures 4a-d. *Dactylioceras commune* (Sowerby) var. a. (Page 2.) 4a lateral view, 4d venter of last whorl, 4b, c rubber cast of inner whorls of same specimen, 4b lateral view, 4c venter and cross-section. Wilkie Point formation. Toarcian. 3 miles southeast of Mould Bay weather station. Hypotype, G.S.C. No. 13,357,a.

Figures 5a, b. *Dactylioceras commune* (Sowerby) var. a. (Page 2.) 5a lateral view, 5b venter. Wilkie Point formation. Toarcian. Hill 1 mile north of Mould Bay weather station. Hypotype, G.S.C. No. 13,358.

Figure 6. *Dactylioceras commune* (Sowerby) var. a. (Page 2.) Rubber cast. Wilkie Point formation. Toarcian. 3 miles southeast of Mould Bay weather station. Hypotype, G.S.C. No. 13,359,a.

Figures 7a, b. *Dactylioceras commune* (Sowerby) var. a. (Page 2.) 7a lateral view of whorl fragment, 7b cross-section and impression of venter of preceding whorl. Wilkie Point formation. Toarcian. Same locality. Hypotype, G.S.C. No. 13,360.

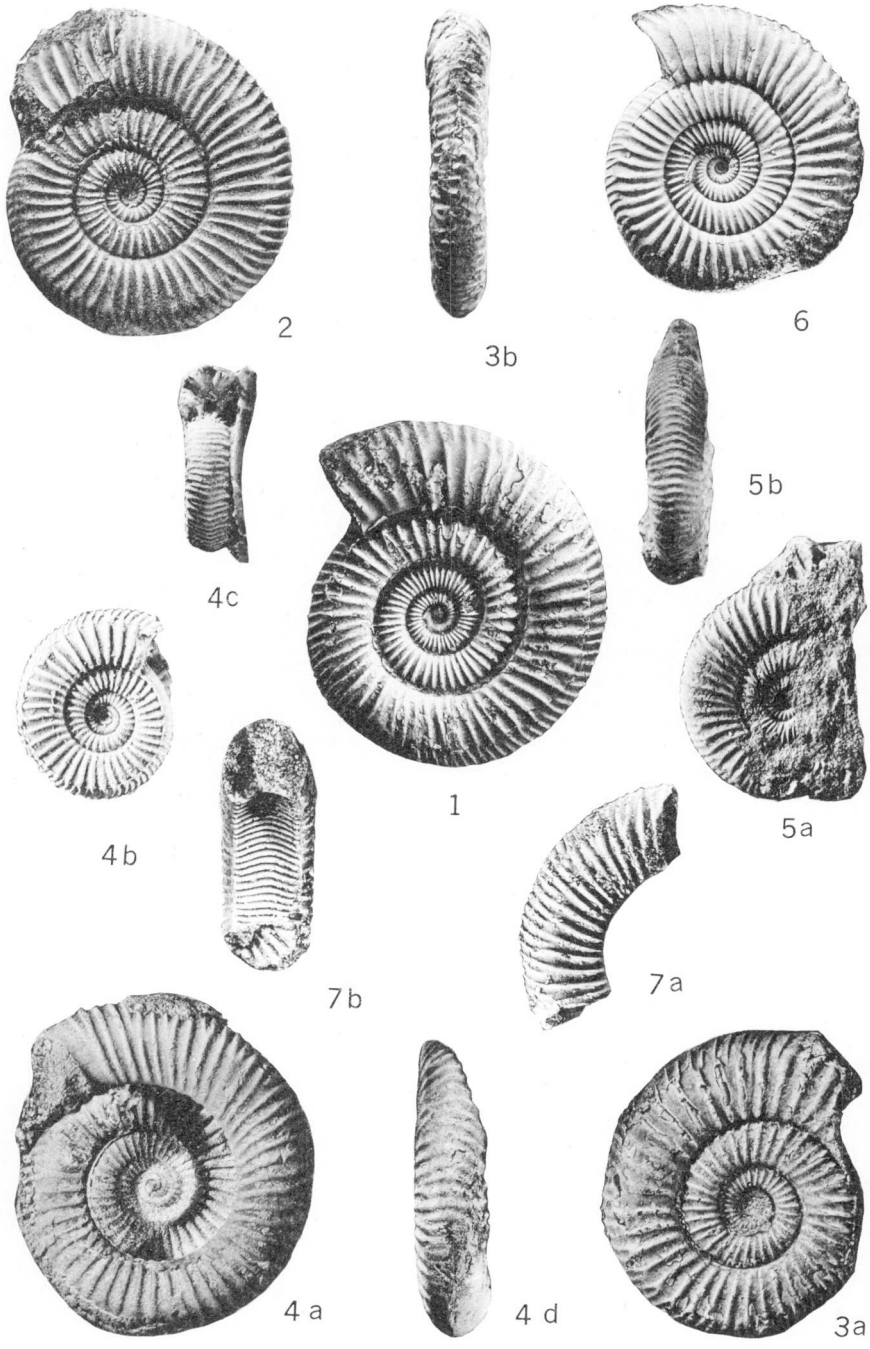

2
3b
6
4c
5b
1
4b
5a
7b
7a
4a
4d
3a

PLATE II

(All figures natural size)

Types in collections of the Geological Survey of Canada

Figures 1a-e. *Coeloceras spinatum* n. sp. (Page 3.) 1a (rubber cast) and 1b lateral view, 1c, 1d ventral view, 1e cross-section. Wilkie Point formation. Toarcian. 3¾ miles northeast of Mould Bay weather station. Holotype, G.S.C. No. 13,361,a-c.

Figure 2. *Coeloceras spinatum* n. sp. (Page 3.) Wilkie Point formation. Toarcian. Ventral view. Same locality. Paratype, G.S.C. No. 13,362.

Figure 3. *Coeloceras spinatum* n. sp. (Page 3.) Wilkie Point formation. Toarcian. Suture line. Same locality. Paratype, G.S.C. No. 13,363.

Figures 4a, b. *Coeloceras spinatum* n. sp. (Page 3.) Wilkie Point formation. Toarcian. 4a lateral, 4b ventral view. Same locality. Paratype, G.S.C. No. 13,364.

Figure 5. *Coeloceras* aff. *desplacei* (d'Orbigny). (Page 4.) Ventral view of specimen figured Plate III, fig. 1. Wilkie Point formation. Toarcian. Same locality. Hypotype, G.S.C. No. 13,365.

Figure 6. *Cucullaea* sp. (Page 12.) Both valve with imprint of *Pseudolioceras* sp., *Coeloceras* sp. and others. Wilkie Point formation. Toarcian. Same locality. Hypotype, G.S.C. No. 13,366.

Figure 7. *Gresslya* cf. *rotundata* (Phillips). (Page 14.) Left valve. Wilkie Point formation. Toarcian. West side Intrepid Inlet. West of Disappointment Point. Hypotype, G.S.C. No. 13,367.

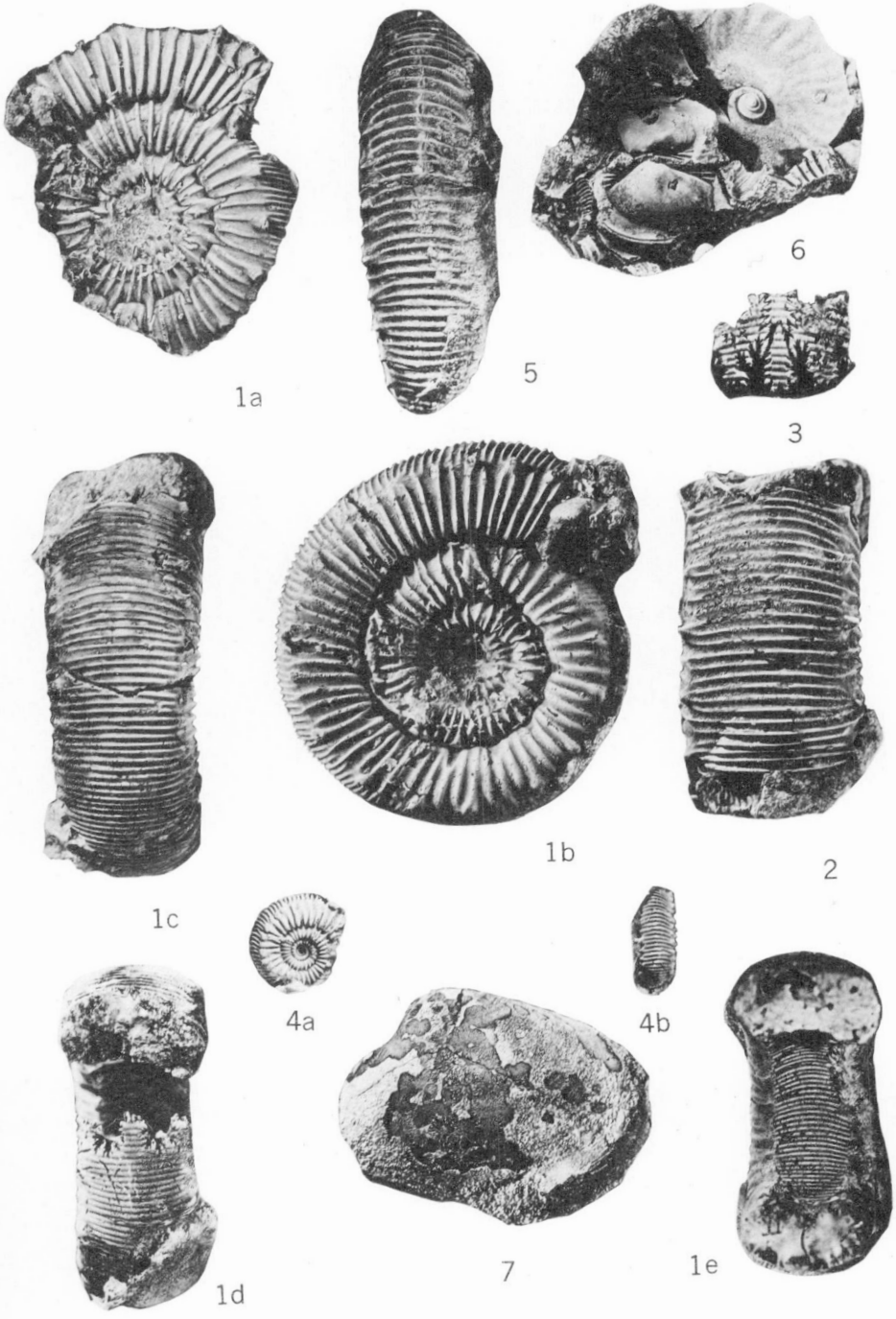

1a
5
6
3
1c
1b
2
4a
4b
1d
7
1e

PLATE III

(All figures natural size)

Types in collections of the Geological Survey of Canada

Figure 1. *Coeloceras* aff. *desplacei* (d'Orbigny). (Page 4.) Lateral view of specimen figured Plate II, figure 5. Wilkie Point formation. Toarcian. 3¾ miles northeast of Mould Bay weather station. Hypotype, G.S.C. No. 13,365.

Figures 2a, b. *Coeloceras* aff. *desplacei* (d'Orbigny). (Page 4.) 2a lateral view, 2b venter. Wilkie Point formation. Toarcian. Same locality. Hypotype, G.S.C. No. 13,368.

Figure 3. *Pseudolioceras* aff. *compactile* (Simpson). (Page 5.) Ventral view. Wilkie Point formation. Toarcian. Same locality. Hypotype, G.S.C. No. 13,369.

Figure 4. *Pseudolioceras* aff. *compactile* (Simpson). (Page 5.) Ventral view. Wilkie Point formation. Toarcian. ¾ mile south of Mould Bay weather station. Hypotype, G.S.C. No. 13,370.

Figures 5a-c. *Pseudolioceras* aff. *compactile* (Simpson). (Page 5.) 5a lateral view, 5b cross-section, 5c venter. Wilkie Point formation. Toarcian. East side of Intrepid Inlet, 12 miles north of Cape Canning at elevation of about 50 feet. Hypotype, G.S.C. No. 13,371.

Figure 6. *Pseudolioceras* aff. *compactile* (Simpson). (Page 5.) Lateral view. Toarcian. Strandfiord, Axel Heiberg Island. Hypotype, G.S.C. No. 13,372.

Figure 7. *Cucullaea* sp. (Page 12.) Rubber cast of imprint of left valve. Wilkie Point formation. Toarcian. 3¾ miles northeast of Mould Bay weather station. Hypotype, G.S.C. No. 13,373.

Figure 8. *Cucullaea* sp. (Page 12.) Left valve. Wilkie Point formation. Toarcian. Same locality. Hypotype, G.S.C. No. 13,374.

Figure 9. *Pleuromya* sp. aff. *simplex* Warren. (Page 13.) Left valve. Wilkie Point formation. Toarcian. East of Landing Lake. Hypotype, G.S.C. No. 13,375.

Figure 10. *Pleuromya* sp. aff. *simplex* Warren. (Page 13.) Right valve. Wilkie Point formation. Toarcian. East side Intrepid Inlet, 11 miles north of Cape Canning. Hypotype, G.S.C. No. 13,376.

Figure 11. *Protocardia striatula* (Phillips). (Page 13.) Left valve. Wilkie Point formation. Toarcian. Same locality. Hypotype, G.S.C. No. 13,377.

Figure 12. *Protocardia striatula* (Phillips). (Page 13.) Right valve. Wilkie Point formation. Toarcian. 3¾ miles northeast of Mould Bay weather station. Hypotype, G.S.C. No. 13,378.

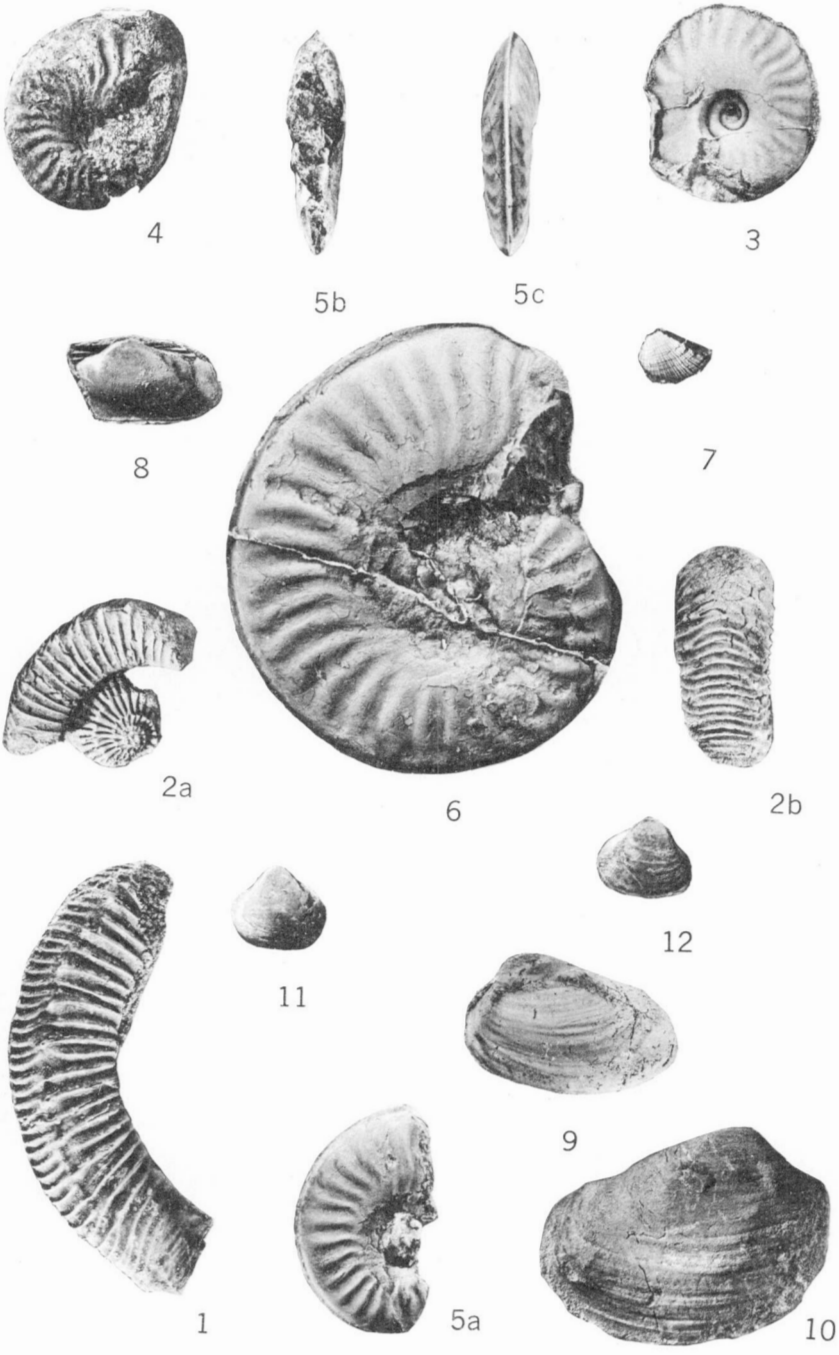

4
5b
5c
3
8
7
6
2a
2b
12
11
9
1
5a
10

PLATE IV

(All figures natural size)

Types in collections of the Geological Survey of Canada

Figure 1. *Leioceras opalinum* (Reinecke). Rubber cast. (Page 6.) Lateral view. Wilkie Point formation. Lower Bajocian. 1 mile east of Wilkie Point. Hypotype, G.S.C. No. 13,379.

Figure 2. *Leioceras opalinum* (Reinecke). Rubber cast. (Page 6.) Lateral view. Wilkie Point formation. Lower Bajocian. Same locality. Hypotype G.S.C. No. 13,380.

Figure 3. *Leioceras opalinum* (Reinecke). Rubber cast. (Page 6.) Lateral view. Wilkie Point formation. Lower Bajocian. Same locality. Hypotype, G.S.C. No. 13,382.

Figures 4a, b. *Leioceras opalinum* (Reinecke). (Page 6.) 4a suture line, 4b cross-section. Wilkie Point formation. Lower Bajocian. Same locality. Hypotype, G.S.C. No. 13,383.

Figures 5a-c. *Leioceras opalinum* (Reinecke). (Page 6.) 5a lateral view, 5b cross-section, 5c venter. Wilkie Point formation. Lower Bajocian. 1 mile east of Wilkie Point. Hypotype, G.S.C. No. 13,384.

Figure 6. *Leioceras opalinum* (Reinecke). (Page 6.) Lateral view. Wilkie Point formation. Lower Bajocian. 1 mile east of Wilkie Point. Hypotype, G.S.C. No. 13,385.

1

5b

2

4b

4a

3

5a

5c

6

PLATE V

(All figures natural size)

Types in collections of the Geological Survey of Canada

Figure 1. *Leioceras opalinum* (Reinecke). Rubber cast. (Page 6.) Lateral view. Wilkie Point formation. Lower Bajocian. 1 mile east of Wilkie Point. Hypotype, G.S.C. No. 13,381.

Figure 2. *Leioceras opalinum* (Reinecke). Rubber cast. (Page 6.) Lateral view. Wilkie Point formation. Lower Bajocian. Same locality. Hypotype, G.S.C. No. 13,386.

Figures 3a, b. *Ludwigia m'clintocki* (Haughton). (Page 7.) 3a lateral view, 3b cross-section. Wilkie Point formation. Lower Bajocian. Same locality. Hypotype, G.S.C. No. 13,387.

Figures 4a, b. *Ludwigia m'clintocki* (Haughton). (Page 7.) 4a lateral view, 4b venter. Wilkie Point formation. Lower Bajocian. Hypotype, G.S.C. No. 13,388.

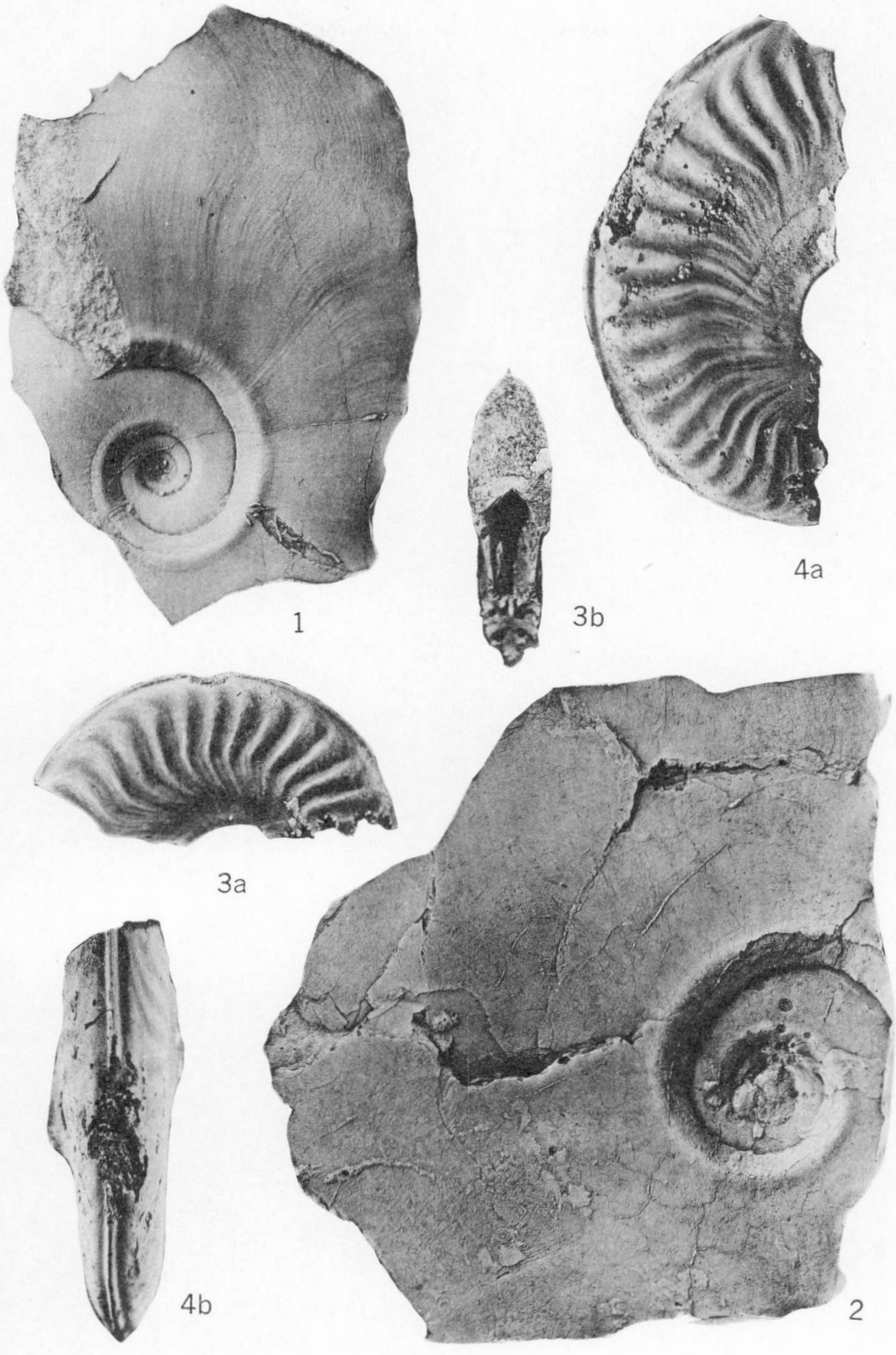

1
3b
4a
3a
4b
2

PLATE VI

(All figures natural size)

Types in collections of the Geological Survey of Canada

Figures 1a, b. *Oxytoma jacksoni* (Pompeckj). (Page 14.) 1a left valve, 1b inner side of left valve. Lower Bajocian. Cameron Island. Hypotype, G.S.C. No. 13,389.

Figures 2a, b. *Oxytoma jacksoni* (Pompeckj). (Page 14). 2a right valve, 2b inner side of right valve. Wilkie Point formation. Lower Bajocian. East side of Intrepid Inlet. 10 miles north of Cape Canning. In talus. Hypotype, G.S.C. No. 13,390.

Figure 3. *Oxytoma jacksoni* (Pompeckj). (Page 14). Rubber cast. Sculpture of large specimen. Wilkie Point formation. Lower Bajocian. East side of Intrepid Inlet. Hypotype, G.S.C. No. 13,391.

Figure 4. *Oxytoma septentrionalis* (Haughton). (Page 15.) Fragment of right valve. Wilkie Point formation. Lower Bajocian. 1 mile east of Wilkie Point. Hypotype, G.S.C. No. 13,392.

Figure 5. *Oxytoma septentrionalis* (Haughton). (Page 15.) Left valve. Wilkie Point formation. Lower Bajocian. Same locality. Hypotype, G.S.C. No. 13,393.

Figure 6. *Oxytoma septentrionalis* (Haughton). (Page 15.) Left valve. Wilkie Point formation. Lower Bajocian. Same locality. Hypotype, G.S.C. No. 13,394.

Figure 7. *Oxytoma septentrionalis* (Haughton). (Page 15.) Left valve. Wilkie Point formation. Lower Bajocian. Same locality. Hypotype, G.S.C. No. 13,395.

Figure 8. *Goniomya* cf. *v-scripta* (Sowerby). (Page 14.) Rubber cast. Left valve. Wilkie Point formation. Lower Bajocian. Same locality. Hypotype, G.S.C. No. 13,396.

Figure 9. *Goniomya* cf. *v-scripta* (Sowerby). (Page 14.) Right valve. Wilkie Point formation. Lower Bajocian. Same locality. Hypotype, G.S.C. No. 13,397.

1a

8

2b

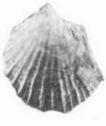
4

3

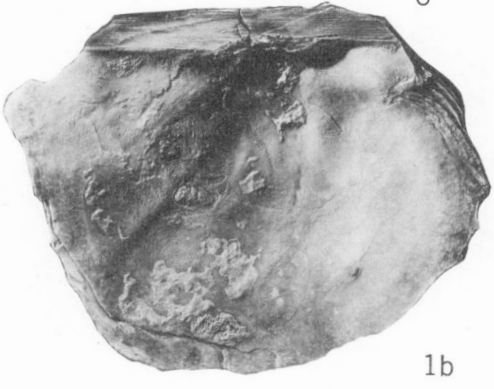
5

2a

6



7



1b

9

PLATE VII

(All figures natural size)

Types in collections of the Geological Survey of Canada

Figures 1a-c. *Cranocephalites vulgaris* Spath. (Page 8.) 1a lateral view, 1b venter and cross-section, 1c venter. Wilkie Point formation. *Cranocephalites* bed. Upper Bathonian or Callovian. 3 miles S 30° E of Mould Bay weather station. Talus. Hypotype, G.S.C. No. 13,398.

Figure 2. *Cranocephalites vulgaris* Spath. Rubber cast. (Page 8.) Lateral view. Wilkie Point formation. *Cranocephalites* bed. Upper Bathonian or Callovian. Same locality. Talus. Hypotype, G.S.C. No. 13,399.

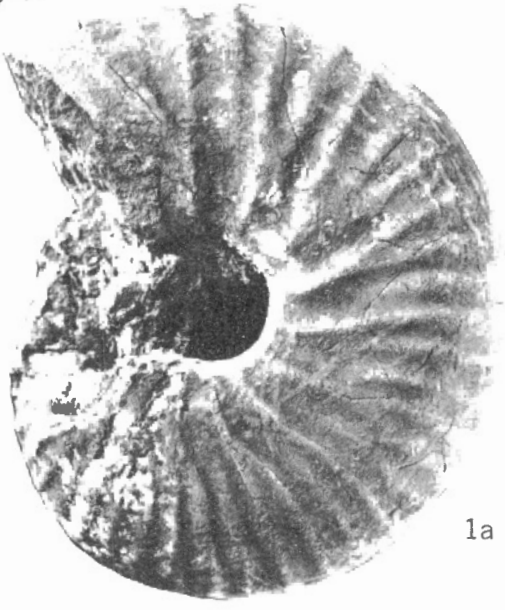
Figure 3. *Arctocephalites* ? sp. indet. 1. (Page 9.) Lateral view. Wilkie Point formation. *Cranocephalites* bed? Upper Bathonian or Callovian. Same locality. Talus. Hypotype, G.S.C. No. 13,400.

2

1b

3

1c



1a

PLATE VIII

(All figures natural size)

Types in collections of the Geological Survey of Canada

Figures 1a-c. *Cranocephalites vulgaris* Spath. (Page 8.) 1a lateral view, 1b venter, 1c rubber cast of preceding whorl. Wilkie Point formation. *Cranocephalites* bed. Upper Bathonian or Callovian. 3 miles S 30° E of Mould Bay weather station. Talus. Hypotype, G.S.C. No. 13,401.

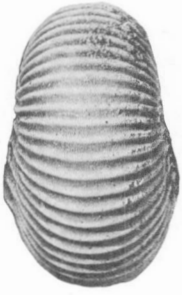
Figures 2a, b. *Arctocephalties* ? sp. indet. 2. (Page 9.) 2a lateral view, 2b venter. Wilkie Point formation. *Cranocephalites* bed? Upper Bathonian or Callovian. Same locality. Talus. Hypotype, G.S.C. No. 13,402.

Figures 3a-c. *Arctocephalties* ? sp. indet. 2. (Page 9.) 3a lateral view, 3b venter, 3c cross-section. Wilkie Point formation. *Cranocephalites* bed? Upper Bathonian or Callovian. Same locality. Talus. Hypotype, G.S.C. No. 13,403.

1a

1b

2b



1c

3b

2a

3c

3a

PLATE IX

(All figures natural size except 3b)

Types in collections of the Geological Survey of Canada

Figures 1a-d. *Arkelloceras tozeri* n. sp. (Page 10.) 1a lateral view, 1b lateral view of inner whorls, 1c venter of 1b, 1d rubber cast of venter of penultimate whorl. Wilkie Point formation. *Arkelloceras* bed. Exact age questionable. 10 miles north of Cape Canning, east side of Intrepid Inlet. Holotype, G.S.C. No. 13,404, a.

Figures 2a, b. *Arkelloceras tozeri* n. sp. Rubber cast. (Page 10.) 2a lateral view, 2b venter. Wilkie Point formation. *Arkelloceras* bed. Exact age questionable. Same locality. Paratype, G.S.C. No. 13,405.

Figures 3a, b. *Arkelloceras tozeri* n. sp. (Page 10.) 3a venter of young specimen, 3b the same enlarged 2x. Wilkie Point formation. *Arkelloceras* bed. Exact age questionable. Same locality. Paratype, G.S.C. No. 13,406.

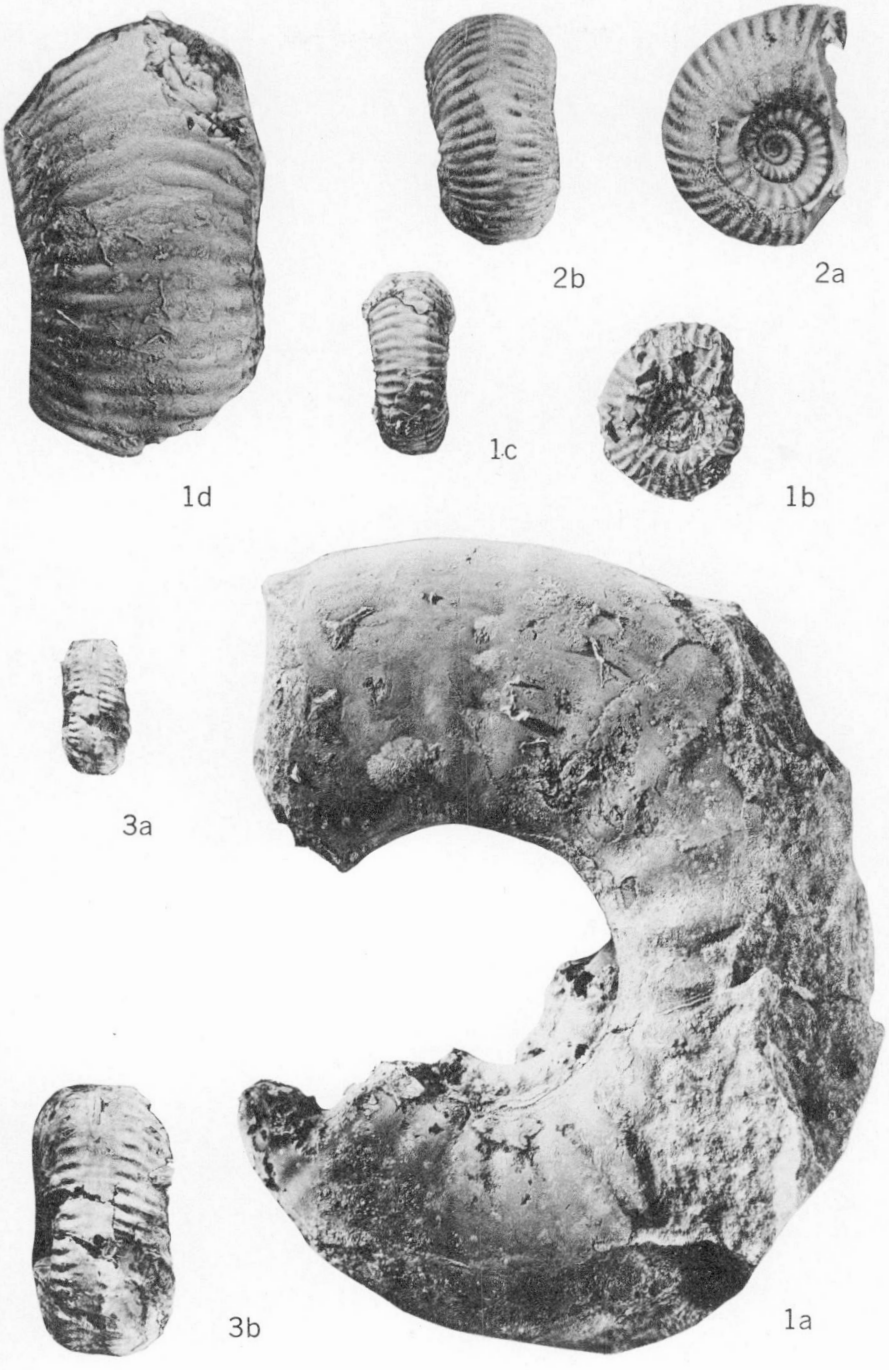

1d
2b
2a
1c
1b
3a
3b
1a

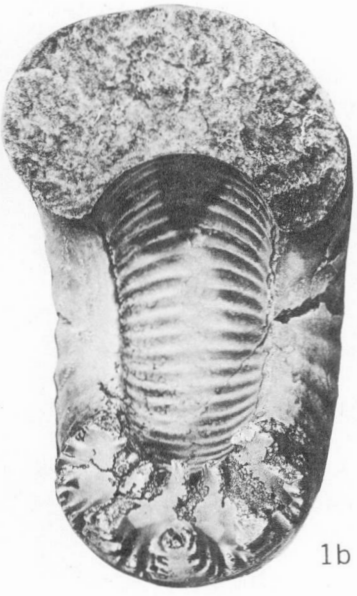
PLATE X

(All figures natural size)

Types in collections of the Geological Survey of Canada

Figures 1a-c. *Arkelloceras tozeri* n. sp. (Page 10.) Same specimen as Plate XI, figures 2a, b. 1a lateral view, 1b cross-section and imprint of venter of penultimate whorl, 1c rubber cast of inner whorls. Wilkie Point formation. *Arkelloceras* bed. Exact age questionable. 10 miles north of Cape Canning, east side of Intrepid Inlet. Paratype, G.S.C. No. 13,407.

Figures 2a, b. *Arkelloceras tozeri* n. sp. (Page 10.) 2a (rubber cast) venter, 2b cross-section. Wilkie Point formation. *Arkelloceras* bed. Exact age questionable. Same locality. Paratype, G.S.C. No. 13,408.



1b

1c

2a

2b

1a

PLATE XI

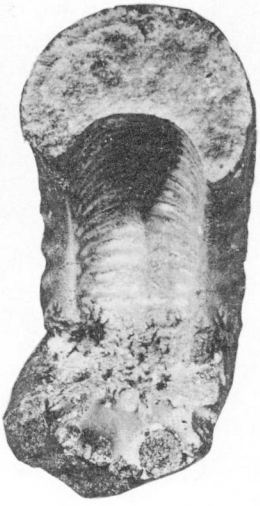
(All figures natural size)

Types in collections of the Geological Survey of Canada

Figures 1a-c. *Arkelloceras tozeri* n. sp. (Page 10.) 1a lateral view, 1b cross-section, 1c (plaster cast) venter of penultimate whorl. Wilkie Point formation. *Arkelloceras* bed. Exact age questionable. 10 miles north of Cape Canning, east side of Intrepid Inlet. Paratype, G.S.C. No. 13,409.

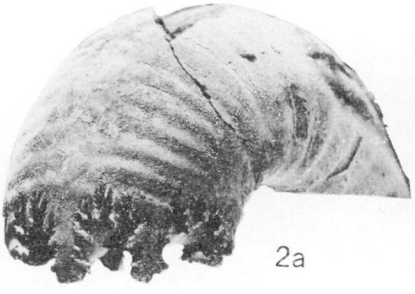
Figures 2a, b. *Arkelloceras tozeri* n. sp. (Page 10.) Same specimen as Plate X, figures 1a-c. 2a suture line (at beginning of last whorl), 2b venter of last whorl. Wilkie Point formation. *Arkelloceras* bed. Exact age questionable. Same locality. Paratype, G.S.C. No. 13,407.

1a



1b

1c



2a

2b

PLATE XII

(All figures natural size, except figures 2f, g and 3c)
Types in collections of the Geological Survey of Canada

Figures 1a-c. *Arkelloceras mclearni* n. sp. (Page 11.) 1a lateral view, 1b cross-section and venter of young specimen, 1c venter of last whorl. Wilkie Point formation. *Arkelloceras* bed. Exact age questionable. 10 miles north of Cape Canning, east side of Intrepid Inlet. Holotype, G.S.C. No. 13,410.

Figures 2a-g. *Arkelloceras mclearni* n. sp. (Page 11.) 2a lateral view (without inner whorls), 2b venter of penultimate whorl, 2c venter of last whorl, 2d lateral view of inner whorls (2g enlarged 2x), 2e venter of inner whorl (2f enlarged 2x). Wilkie Point formation. *Arkelloceras* bed. Exact age questionable. Same locality. Paratype, G.S.C. No. 13,411.

Figures 3a-c. *Arkelloceras mclearni* n. sp. (Page 11.) 3a lateral view of young specimen (3c enlarged 2x), 3b venter. Wilkie Point formation. *Arkelloceras* bed. Exact age questionable. Paratype, G.S.C. No. 13,412.

2a

2b

2c

2d

2e

2f

1c

2g

3a

3b

3c

1b

1a

PLATE XIII

(All figures natural size)

Types in collections of the Geological Survey of Canada

Figures 1a-d. *Arkelloceras mclearni* n. sp. (Page 11.) 1a (rubber cast) lateral view of penultimate whorl, 1b venter of last whorl, 1c lateral view of last whorl, 1d (rubber cast) venter of penultimate whorl. Wilkie Point formation. *Arkelloceras* bed. Exact age questionable. 10 miles north of Cape Canning, east side of Intrepid Inlet. Paratype, G.S.C. No. 13,413.

Figures 2a-c. *Arkelloceras mclearni* n. sp. (Page 11.) 2a lateral view of whorl fragment, 2b venter, 2c (rubber cast) venter of penultimate whorl. Wilkie Point formation. *Arkelloceras* bed. Exact age questionable. Same locality. Paratype, G.S.C. No. 13,414.

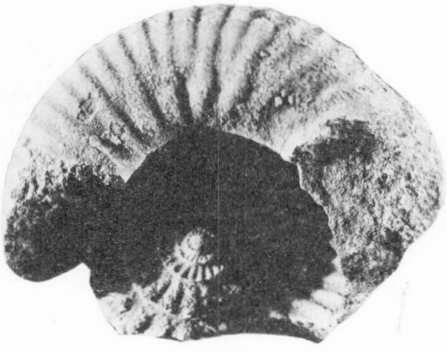
Figures 3a, b. *Arkelloceras mclearni* n. sp. (Page 11.) 3a venter of whorl fragment, 3b cross-section. Wilkie Point formation. *Arkelloceras* bed. Exact age questionable. Same locality. Paratype, G.S.C. No. 13,415.

2a

2c

2b

1b

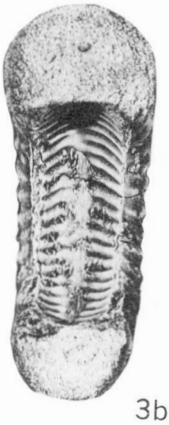


1c

1d

3a

1a



3b

PLATE XIV

(All figures natural size)

Types in collections of the Geological Survey of Canada

Figures 1a-c. *Inoceramus lucifer* Eichwald. (Page 15.) Young specimen. 1a right valve, 1b left valve, 1c front view. Wilkie Point formation. Talus below *Arkelloceras* bed. Exact age questionable. 10 miles north of Cape Canning, east side of Intrepid Inlet. Hypotype, G.S.C. No. 13,416.

Figure 2. *Inoceramus lucifer* Eichwald. (Page 15.) Front view. Same specimen Plate XV, figure 2, and Plate XVI, figure 2. Wilkie Point formation. Talus below *Arkelloceras* bed. Exact age questionable. Same locality. Hypotype, G.S.C. No. 13,417.

Figure 3. *Inoceramus* sp. (Page 16.) Left valve of small specimen. Wilkie Point formation. Talus below *Arkelloceras* bed. Exact age questionable. Same locality. Hypotype, G.S.C. No. 13,418.

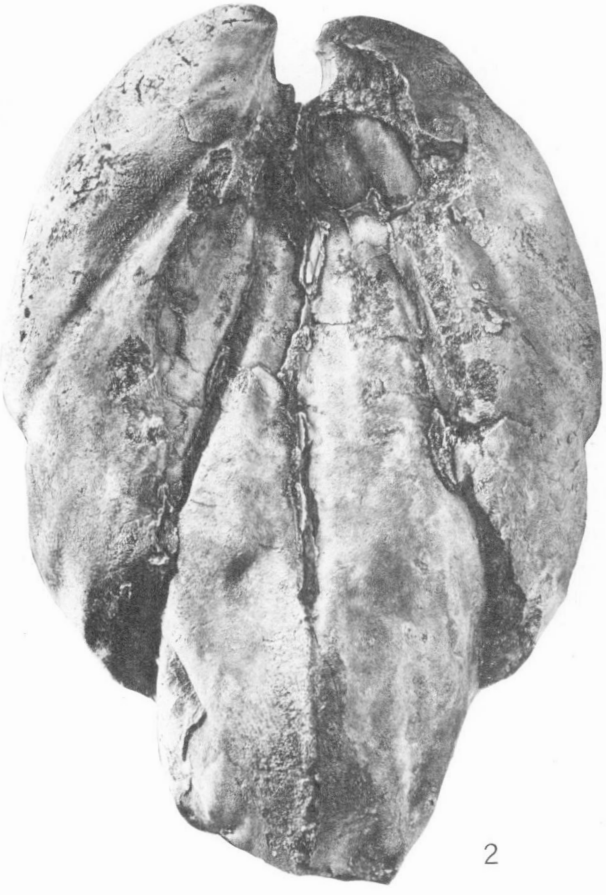
Figure 4. *Plagiostoma* sp. (Page 16.) Left valve. Possibly Triassic. $3\frac{1}{2}$ miles north of Salmon Point. Hypotype, G.S.C. No. 13,419.

1a

1c

1b

4



2

3

PLATE XV

(All figures natural size)

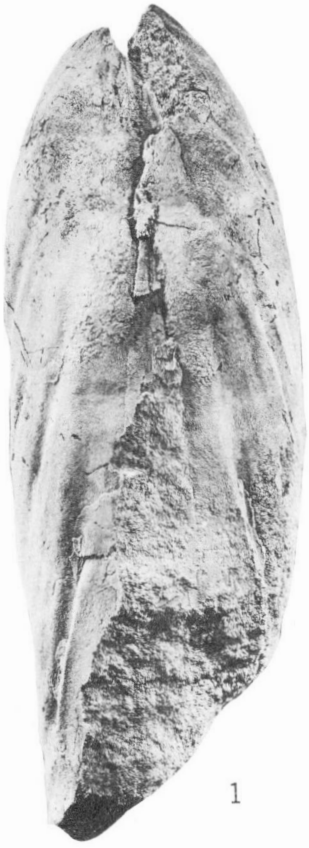
Types in collections of the Geological Survey of Canada

Figure 1. *Inoceramus* sp. (Page 16.) Front view. Same specimen as Plate XVII, figures 1a, b. Wilkie Point formation. *Arkelloceras* bed. Exact age questionable. 10 miles north of Cape Canning, east side of Intrepid Inlet. Hypotype, G.S.C. No. 13,420.

Figure 2. *Inoceramus lucifer* Eichwald. (Page 15.) Left valve. Same specimen as Plate XIV, figure 2, and Plate XVI, figure 2. Wilkie Point formation. Talus below *Arkelloceras* bed. Exact age questionable. Same locality. Hypotype, G.S.C. No. 13,417.

Figure 3. *Pecten* (*Camptonectes*) sp. (Page 16.) Left valve. Wilkie Point formation. Talus below *Arkelloceras* bed. Exact age questionable. Same locality. Hypotype, G.S.C. No. 13,421.

Figure 4. *Inoceramus* sp. (Page 16.) Left valve. Wilkie Point formation. Probably from unit 7 of type section. Exact age questionable. Same locality. Hypotype, G.S.C. No. 13,422.



1

3

2

4

PLATE XVI

(All figures natural size)

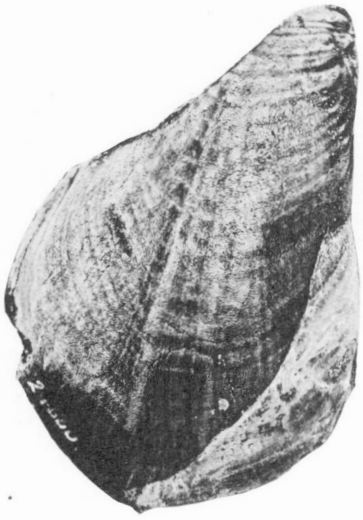
Types in collections of the Geological Survey of Canada

Figure 1. *Inoceramus lucifer* Eichwald. (Page 15.) Right valve. Wilkie Point formation. Talus below *Arkelloceras* bed. Exact age questionable. 10 miles north of Cape Canning, east side of Intrepid Inlet. Hypotype, G.S.C. No. 13,423.

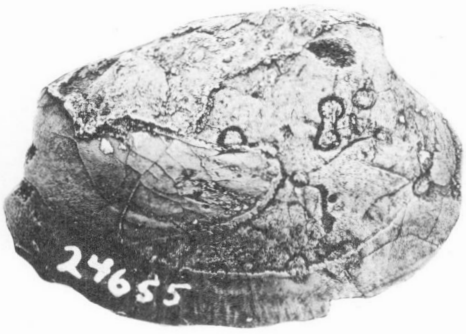
Figure 2. *Inoceramus lucifer* Eichwald. (Page 15.) Right valve. Same specimen as Plate XIV, figure 2, and Plate XV, figure 2. Wilkie Point formation. Talus below *Arkelloceras* bed. Exact age questionable. Same locality. Hypotype, G.S.C. No. 13,417.

Figure 3. *Inoceramus* sp. (Page 16.) Left valve. Wilkie Point formation. Exact questionable. East side of Mould Bay. Hypotype, G.S.C. No. 13,424.

Figure 4. *Gresslya* aff. *abducta* Phillips. (Page 14.) Right valve. Wilkie Point formation. Lower Bajocian. 1 mile east of Point Wilkie. Hypotype, G.S.C. No. 13,425.



1



4

3

2

PLATE XVII

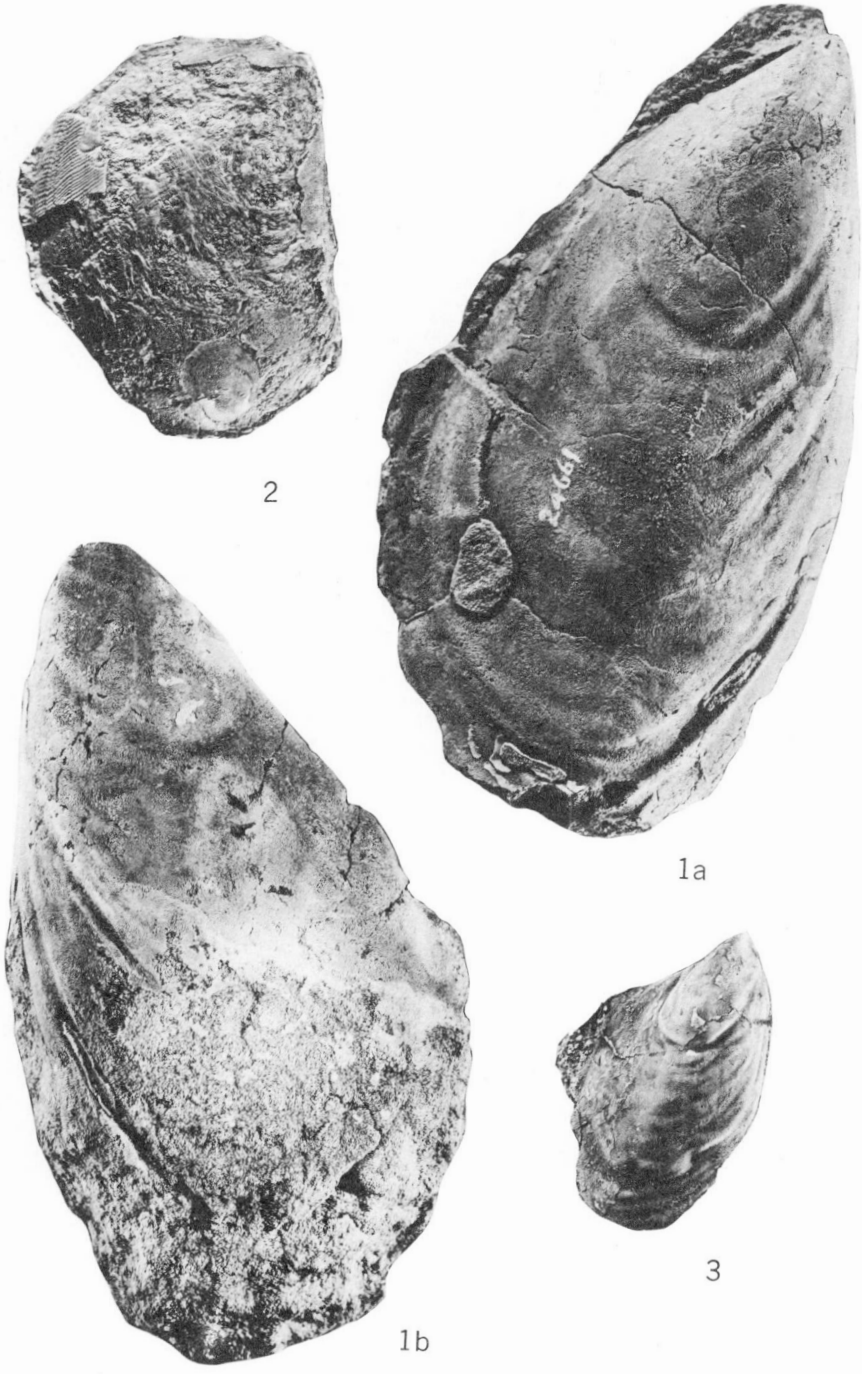
(All figures natural size)

Types in collections of the Geological Survey of Canada

Figures 1a, b. *Inoceramus* sp. (Page 16.) 1a right valve, 1b left valve. Same specimen as Plate XV, figure 1. Wilkie Point formation. *Arkelloceras* bed. Exact age questionable. 10 miles north of Cape Canning, east side of Intrepid Inlet. Hypotype, G.S.C. No. 13,420.

Figure 2. *Plagiostoma* sp. (Page 16.) Right valve. Possibly Triassic. $3\frac{1}{2}$ miles north of Salmon Point. Hypotype, G.S.C. No. 13,426.

Figure 3. *Inoceramus* sp. (Page 16.) Right valve. Wilkie Point formation. Probably from unit 7 of type section. Exact age questionable. 10 miles north of Cape Canning, east side of Intrepid Inlet. Hypotype, G.S.C. No. 13,427.



2

1a

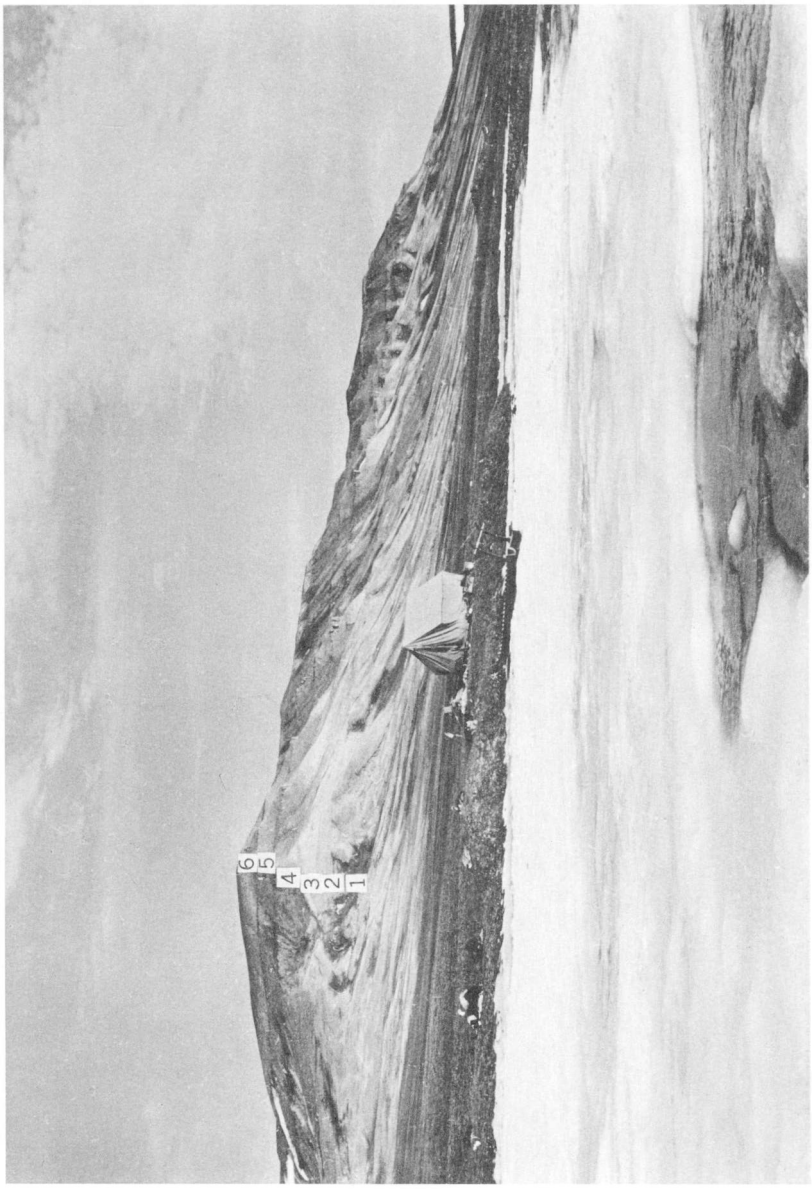
1b

3

PLATE XVIII

Type section of the Wilkie Point formation, east side Intrepid Inlet, 12 miles north of Cape Canning, Prince Patrick Island. E. T. Tozer photo.

See description of beds 1-6 on page 17.


6
5
4
3
2
1