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BULLETIN 116

**LOWER JURASSIC AND BAJOCIAN
AMMONOID FAUNAS OF NORTHWESTERN BRITISH
COLUMBIA AND SOUTHERN YUKON**

Hans Frebold



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OF NORTHWESTERN BRITISH COLUMBIA
AND SOUTHERN YUKON

By
Hans Frebold

DEPARTMENT OF
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FAUNAS OF NORTHWESTERN BRITISH COLUMBIA
AND SOUTHERN YUKON

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Preface

Except for a few references in older reports, rocks of the Jurassic System remained little known in northwestern British Columbia and southern Yukon. Ammonites collected in recent years are described in this report and show that the Lower and part of the Middle Jurassic System are well represented. The ammonite faunas, which contain some elements of world-wide distribution hitherto not found in North America, permit correlation with similar rocks in the Arctic Islands and with the Jurassic Fernie Group of Alberta and British Columbia.

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

OTTAWA, January 29, 1963

Bulletin 116 — Ammoniten-Faunen des unteren Juras
und des Bajocians im nordwestlichen
Britisch-Kolumbien und südlichen
Yukon.
Von Hans Frebold

Бюллетень 116 Геологическое Управление
Канады
Нижнеюрские и байоские
аммонитовые фауны северо-
западной Британской Ко-
лумбии и южного Юкона.
Автор: Ганс Фреболд

LOWER JURASSIC AND BAJOCIAN AMMONOID FAUNAS OF NORTHWESTERN BRITISH COLUMBIA AND SOUTHERN YUKON

Abstract

Numerous ammonites found in recent years in northwestern British Columbia, particularly in the Telegraph Creek and Tulsequah areas, demonstrate the presence of parts of the following Lower Jurassic and lower Middle Jurassic stages: Hettangian (*Psiloceras canadense*), lower Sinemurian (*Paracoronoceras* cf. *P. gmündense*, *Arnioceras?* sp. indet.), Pliensbachian (*davoei* zone: *Prodactylioceras davoei*, *Becheiceras bechei*; lower part of *margaritatus* zone: *Amaltheus stokesi*, *Arietoceras algovianum*, *Leptaleoceras pseudoradians*), lower Toarcian (*Harpoceras* cf. *H. exaratum*, *Peronoceras* cf. *P. fibulatum*, *Dactylioceras* sp.), upper Toarcian (*Grammoceras* aff. *G. fallaciosum*, *Catulloceras?* sp.), middle Bajocian (*sowerbyi* zone: *sonniniids*; *sauzei* and *humphriesianum* zones: *Chondroceras allani*, *stephanoceratids*).

Almost all the Lower Jurassic subdivisions are present in the Whitehorse area of southern Yukon, where, however, no middle Bajocian is known.

Major gaps in the sequence in both southern Yukon and northwestern British Columbia are: the upper Sinemurian and lower Pliensbachian, and the upper part of the Pliensbachien. Some minor gaps also occur.

Some of the ammonite genera are new for North America, i.e., *Liparoceras* (*Becheiceras*), *Arietoceras*, and *Leptaleoceras*. The two last-named genera, which are represented by numerous specimens and various species, are known particularly from mediterranean regions (southern France and Italy). No new genera or species could be distinguished, most of the Lower Jurassic ammonites are cosmopolitan, either identical with or closely related to well-known species.

Résumé

Depuis quelques années, on a découvert une foule d'ammonites dans le Nord-Ouest de la Colombie-Britannique, surtout dans les régions de Telegraph Creek et de Tulsequah. Ces fossiles démontrent que des parties des étages suivants de l'Eojurassique et du Mésojurassique inférieur y sont présents: l'Hettangien (*Psiloceras canadense*), le Sinémurien inférieur (*Paracoronoceras* cf. *P. gmündense*, *Arnioceras?* esp. indét.) le Pliensbachien (zone à *Davoei*: *Prodactylioceras davoei*, *Becheiceras bechei*; le bas de la zone à *Margaritatus*: *Amaltheus stokesi*, *Arietoceras algovianum*, *Leptaleoceras pseudoradians*), le Toarcien inférieur (*Harpoceras* cf. *H. exaratum*, *Peronoceras* cf. *P. fibulatum*, *Dactylioceras* sp.), le Toarcien supérieur (*Grammoceras* aff. *G. fallaciosum*, *Catulloceras?* sp.), et le Bajocien moyen (zone à *Sowerbyi*: *Sonniniidés*; zones à *Sauzei* et à *Humphriesianum*: *Chondroceras allani*, *Stéphanocératidés*).

Dans la région de Whitehorse (Sud du Yukon), presque toutes les subdivisions de l'Eojurassique sont représentées, sauf le Bajocien moyen, autant qu'on sache.

Dans le Sud du Yukon comme dans le Nord-Ouest de la Colombie-Britannique, les lacunes les plus importantes dans la succession sont: le Sinémurien supérieur, le Pliensbachien inférieur et le haut du Pliensbachien. Il y a aussi quelques lacunes mineures.

Certains des genres d'ammonites sont nouveaux en Amérique du Nord: *Liparoceras* (*Becheiceras*), *Arietoceras* et *Leptaleoceras*. On sait que ces deux derniers, représentés par une foule de spécimens et diverses espèces, abondent surtout dans les régions de la Méditerranée (Sud de la France et d'Italie). On n'a pu distinguer de nouveaux genres ni de nouvelles espèces, car la plupart des ammonites de l'Eojurassique sont répandues dans le monde entier; elles sont soit identiques à des espèces bien connues soit étroitement apparentées avec elles.

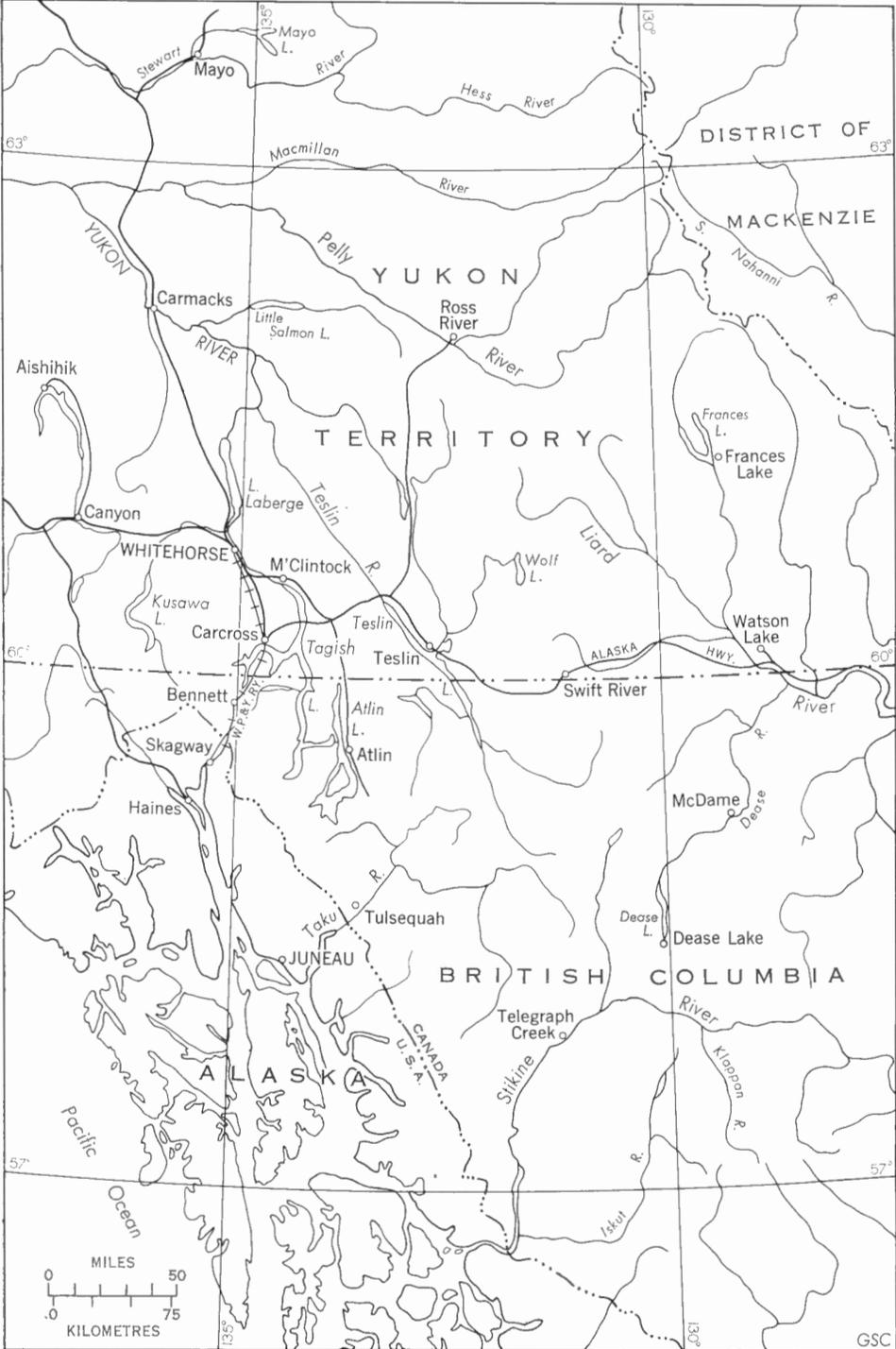


FIGURE 1. Index map of northwestern British Columbia and southern Yukon.

Introduction

Until recent years little was known of the Jurassic rocks and their faunas in the northwestern parts of British Columbia; only a few fossils and sections had been mentioned by Kerr (1948a, b)¹. Systematic field work conducted by officers of the Geological Survey of Canada has now produced a rich and highly interesting suite of guide fossils and associated faunas that permit a detailed subdivision of the Jurassic rocks. The bulk of the material was collected by J. G. Souther in the Telegraph Creek and Tulsequah areas, smaller collections were made by J. D. Aitken in the Atlin area and by R. L. Christie in the Bennett area.

In the Whitehorse area of southern Yukon a number of the northwestern British Columbia species were collected by J. O. Wheeler. The presence of Jurassic rocks in this area had been known for many years, but with a few exceptions (Whiteaves, 1889; Lees, 1934) the faunas concerned remained undescribed. S. S. Buckman offered some identifications of ammonites on which a subdivision of the Lower Jurassic rocks was based (*see* Cockfield and Bell, 1926), but this material is poorly preserved and in part unreliable for age determinations.

The ammonites collected in southern Yukon and northwestern British Columbia include some highly interesting genera hitherto unknown in North America. Poorly preserved specimens, particularly from the Toarcian and middle Bajocian, cannot be identified with confidence. Nevertheless, they are described here along with the well-preserved material because of their importance for the stratigraphic subdivision and the age determination of the beds concerned.

¹Names and/or dates in parentheses are those of *References* cited at end of this report.

Fossil Localities
Northwestern British Columbia

a. Telegraph Creek Area

1. GSC loc. 32825. Grizzly Glacier. Lat. $57^{\circ}10'27''$ N, long. $130^{\circ}29'27''$ W. Souther, 1957.
Psiloceras canadense Frebold
Hettangian
2. GSC loc. 28782. Ridge east of Hankin Peak. Lat. $57^{\circ}10'18''$ N, long. $130^{\circ}28'58''$ W. Souther, 1956.
Psiloceras canadense Frebold
Hettangian
3. GSC loc. 32802. Grizzly Glacier. Lat. $57^{\circ}10'32''$ N, long. $130^{\circ}25'34''$ W. Souther, 1957.
Amaltheus stokesi (Sowerby)
Arieticerias cf. *A. algovianum* (Oppel)
Pliensbachian
4. GSC loc. 32773. South fork of Ball Creek. Lat. $57^{\circ}10'38''$ N, long. $130^{\circ}25'06''$ W. Souther, 1957.
Arieticerias algovianum (Oppel)
Arieticerias cf. *A. gerardi* Monestier
Arieticerias aff. *A. ruthenense* (Reynès)
Leptaleoceras pseudoradians (Reynès)
Ammonite gen. et sp. indet. 2
Pliensbachian
5. GSC loc. 37110. 3 miles east of junction of More Creek and Iskut River. Lat. $57^{\circ}00'36''$ N, long. $130^{\circ}33'44''$ W. Souther, 1958.
Sonniniids gen. et sp. indet.
Middle Bajocian
6. GSC loc. 37109. 4 miles southwest of 180 Lake. Lat. $57^{\circ}19'17''$ N, long. $130^{\circ}23'36''$ W. Souther, 1958.
Stephanoceratids gen. et sp. indet.
Middle Bajocian
7. GSC loc. 48624. East bank of Glenora Creek, $\frac{1}{4}$ mile from mouth of creek. Stikine River area. Lat. $57^{\circ}50'20''$ N, long. $131^{\circ}23'00''$ W. F. A. Kerr, 1926.
Peronoceras cf. *P. fibulatum* (Sowerby)
Toarcian

b. Tulsequah Area

8. GSC loc. 40463. Elevation 4,830'. North-northwest above One-Way Lake. Lat. $58^{\circ}38'10''$ N, long. $132^{\circ}33'10''$ W. Souther, 1959.
Arnioceras? sp. indet.
Sinemurian
9. GSC loc. 40422. Elevation 4,850' in west side of cirque, southwest end of King Salmon Lake. Lat. $58^{\circ}39'58''$ N, long. $132^{\circ}54'30''$ W. Souther, 1959.
Liparoceras (*Becheiceras*) *bechei* (Sowerby)
Ammonite gen. et sp. indet.
Pliensbachian
10. GSC loc. 40473. $\frac{1}{2}$ mile southwest of Harrison Lake. Lat. $58^{\circ}36'10''$ N, long. $132^{\circ}35'48''$ W. Souther, 1959.
Amaltheus stokesi (Sowerby)
Pliensbachian

11. GSC loc. 43659, 43660. 2 miles south of King Salmon Lake. Lat. 58°40'42"N, long. 132°55'45"W. Souther, 1960.
Amaltheus stokesi (Sowerby)
Arieticerias algovianum (Oppel)
 Pliensbachian
12. GSC loc. 43668. Bug Mountain. Lat. 58°41'45"N, long. 133°04'24"W. Souther, 1960.
Arieticerias algovianum (Oppel)
 Pliensbachian
13. GSC loc. 40424. Elevation 4,810'. South of west end of King Salmon Lake. Lat. 58°41'09"N, long. 132°55'04"W. Souther, 1959.
Productylioceras davoei (Sowerby)
 Pliensbachian
14. GSC loc. 43651. 5½ miles southeast of Mount Lester Jones and 6 miles southwest of King Salmon Lake. Lat. 58°40'45"N, long. 133°06'44"W. Souther, 1960.
Dactylioceras sp. indet.
 Early Toarcian
15. GSC loc. 40475. ¼ mile southwest of Frozen Lake. Lat. 58°40'06"N, long. 133°03'18"W. Souther, 1959.
Peronoceras sp. indet.
Dactylioceras sp. indet.
 Early Toarcian
16. GSC loc. 40430. West end of One-Way Lake. Lat. 58°37'39"N, long. 132°33'42"W. Souther, 1959.
Harpoceras cf. *H. exaratum* (Young and Bird)
Harpoceras sp. (juvenile)
Laevicornaptychus
 Early Toarcian
17. GSC loc. 40438. Elevation 4,770'. South above west end of King Salmon Lake. Lat. 58°41'13"N, long. 132°53'42"W. Souther, 1959.
Harpoceras cf. *H. exaratum* (Young and Bird)
 Early Toarcian
18. GSC loc. 40431. ½ mile southwest of Tangle Lake. Lat. 58°48'12"N, long. 133°06'32"W. Souther, 1959.
Harpoceras cf. *H. exaratum* (Young and Bird)
 Aptychi
 Early Toarcian
19. GSC loc. 40447. Elevation 1,780'. South side of creek bottom (creek flowing out of One-Way Lake). Lat. 58°39'38"N, long. 132°40'50"W. Souther, 1959.
Harpoceras cf. *H. exaratum* (Young and Bird)
 Early Toarcian
20. GSC loc. 40449. Elevation 1,765'. South side of creek flowing out of One-Way Lake. Same position as No. 19. Souther, 1959.
Harpoceras cf. *H. exaratum* (Young and Bird)
Harpoceras sp. (juvenile)
Laevicornaptychus
 Early Toarcian
21. GSC loc. 43650. Ridge southwest of Sumstua River. Lat. 58°37'35"N, long. 132°50'50"W. Souther, 1960.
Harpoceras cf. *H. exaratum* (Young and Bird)
 Early Toarcian

Lower Jurassic and Bajocian Ammonoid Faunas

22. GSC loc. 43669. Kowatua Creek. 4 miles east of Wade Lake. Lat. 58°40'58"N, long. 133°05'40"W. Souther, 1960.
Harpoceras cf. *H. exaratum* (Young and Bird)
Early Toarcian
23. GSC loc. 43642. North side of Niagara Mountain. Lat. 58°29'36"N, long. 132°27'54"W. Souther, 1960.
Harpoceras cf. *H. exaratum* (Young and Bird)
Early Toarcian
24. GSC loc. 43680. Ridge north of Cleaver Lake. Lat. 58°29'36"N, long. 132°27'54"W. Souther, 1960.
Chondroceras allani (McLearn)
Chondroceras sp.
Middle Bajocian
25. GSC loc. 43681. Ridge north of Cleaver Lake. Talus block, 10 feet above GSC loc. 43680. Souther, 1960.
Chondroceras allani (McLearn)
Middle Bajocian
26. GSC locs. 40434, 40452, 40462. Stratigraphy Canyon. Lat. 58°29'24"N, long. 132°27'02"W. Souther, 1959.
Chondroceras allani (McLearn)
Middle Bajocian
27. GSC loc. 43675. Ridge east of Cleaver Lake. Same position as Nos. 24, 25. Souther, 1960.
Stephanoceratidae, gen. et sp. indet.
Middle Bajocian
28. GSC loc. 43673. Ridge north of Cleaver Lake. Lat. 58°29'03"N, long. 132°28'24"W. Souther, 1960.
Stephanoceratidae, gen. et sp. indet.
Middle Bajocian
29. GSC loc. 43679. Headwaters of creek draining northeast end of plateau to north of Cleaver Lake. Same position as No. 28. Souther, 1960.
Stephanoceratidae, gen. et sp. indet.
Middle Bajocian

c. Bennett Area

30. GSC loc. 17600. Lat. 59°36'30"N, long. 134°16'20"W. Christie, 1951.
Catulloceras? sp. indet.
Toarcian
31. GSC loc. 17601. Lat. 59°26'10"N, long. 134°04'30"W. Christie, 1951.
Prodactylioceras davoei (Sowerby)
Pliensbachian
32. GSC loc. 21949. Golden Gate. Same position as No. 30. Christie, 1952.
Catulloceras? sp. indet.
Toarcian

d. Atlin Area

33. GSC loc. 19639. 1½ miles south of Janus Point, on the mainland shoreline. Lat. 59°15'N, long. 133°45'W. From transported limy concretion in Laberge conglomerate. Aitken, 1951.
Paracoroniceras cf. *P. gmündense* (Oppel)
Sinemurian

Southern Yukon

34. GSC loc. 5275. Wheaton area (exact position unknown). D. D. Cairnes, 1916.
Paracoronicerias cf. *P. gmündense* (Oppel)
 Sinemurian
35. GSC locs. 24830-24839. Ridge between Idaho Hill and Mount Bush. Elevation 5,200'.
 Lat. 60°18'57"N, long. 135°02'42"W. Wheeler, 1952.
Amaltheus stokesi (Sowerby)
Arieticerias algovianum (Oppel)
Leptaleoceras pseudoradians (Reynès)
 Pliensbachian
36. GSC locs. 17323, 20318. Elevation 6,500'. 3 miles northeast of Dundalk. Lat.
 60°05'06"N, long. 134°46'15"W. Wheeler, 1949, 1951.
Catulloceras? sp. indet.
 Toarcian
37. GSC loc. 17322. Elevation 5,700'. 3 miles northeast of Dundalk. Same position as No.
 36. Wheeler, 1949.
Catulloceras? sp. indet.
 Toarcian
38. GSC loc. 19574. Five Finger Rapids on Yukon (formerly Lewes) River. Lat.
 62°16'10"N, long. 136°21'12"W. Cockfield and Lees, 1933.
Grammoceras? *boreale* (Whiteaves)
Grammoceras aff. *G. fallaciosum* (Bayle)
 Late Toarcian
39. GSC loc. 43825. Rink Rapids on Yukon (formerly Lewes) River. Lat. 62°19'32"N,
 long. 136°22'12"W. Dawson, 1887.
Grammoceras? *boreale* (Whiteaves)
 Late Toarcian
40. GSC loc. 7966. Marsh Lake and McClintock River (exact position unknown). A. H.
 Bell, 1924.
Grammoceras aff. *G. fallaciosum* (Bayle)
 Late Toarcian

Description of Ammonites

Superfamily PSILOCERATAEAE Hyatt, 1867

Family PSILOCERATIDAE Hyatt, 1867

Subfamily PSILOCERATINAE Hyatt, 1867

Genus *Psiloceras* Hyatt, 1867

Psiloceras canadense Frebold

Plate I, figures 1-5b

Psiloceras canadense Frebold, 1951, p. 3, Pl. 1, figs. 1-6; Pl. 2, fig. 1; Pl. 3, fig. 1.

Material. Numerous specimens from Telegraph Creek area (GSC locs. 32825, 28782).

Description and remarks. The few better preserved specimens of the material consist mainly of imprints and whorl fragments; some of the better preserved specimens show most of the features characteristic of this species, which was previously described from the Tyaughton Creek area of southern British Columbia (Frebold, 1951). However, the sutures are not visible.

The species is somewhat similar to certain species of *Waehneroceras* Hyatt, *Storhoceras* Lange (Lange, 1941, p. 41), and *Megastomoceras* Lange (op. cit.) which, according to Lange, are Psiloceratinae. Arkell (1957, p. L236), however, considers them as Schlotheimiidae. *Psiloceras canadense* is distinguished from *Waehneroceras* and *Storhoceras* mainly by the absence of ribs on the venter and from *Megastomoceras* (according to Lange a subgenus of *Storhoceras*) by the absence of strong ribs on the venter in young stages of growth and by the suture line, which in *Megastomoceras* is more incised and has more suspended auxiliaries.

Age. Hettangian, lowermost Jurassic. No other ammonites were found associated with this species.

Family ARIETITIDAE Hyatt, 1874

Subfamily ARIETITINAE Hyatt, 1874

Genus *Paracoronicer* Spath, 1922

Paracoronicer cf. *P. gmündense* (Oppel)

Plate I, figures 6, 7; Plate II, figure 1

Material. Two specimens from the Laberge Group: specimen GSC 15969 from GSC loc. 19639, Atlin area; specimen GSC 15970 from GSC loc. 5275, Wheaton area.

Description. Specimen GSC 15969 (Pl. I, figs. 6a, b; Pl. II, fig. 1) has at a diameter of 90 mm (the maximum diameter is considerably larger) the following

dimensions: whorl height 21 (0.23), whorl thickness 17 (0.19), umbilical width 53 (0.59).

The specimen is wide-umbilicate. The cross-section is higher than thick, rectangular to elliptic. Venter with a keel bordered on both sides by furrows which are separated from the flanks by low ridges. Ribs almost straight, inclined forward, in their upper third bent forward. Intervals between ribs about twice the thickness of the ribs. At a diameter of 70 mm, there are forty-six ribs. No nodes or tubercles are present.

The external lobe is deeper than the first lateral, and the second lateral saddle higher than the first.

Specimen GSC 15970 (Pl. I, fig. 7) is smaller and not so well preserved as the one described above. The ventral furrows are not clearly visible on the last whorl. The cross-sections of the inner whorls are more quadratic. At a diameter of about 22 mm ventral furrows are still absent. No suture lines can be seen.

Remarks. In general outline, cross-section, and number of ribs the specimens are similar to *Paracorniceras gmündense* (Opper) and *P. ophioides* (d'Orbigny) (see Reynès, 1879, Pl. 16, figs. 1, 2). Spath (1922, p. 173) established for the *gmündense* group the genus *Paracorniceras*.

Occurrence and age. Both specimens were found in the Laberge Group. In Europe *P. gmündense* occurs in the *gmündensis* subzone of the Sinemurian.

Subfamily ARNIOCERATINAE Spath, 1924

Genus *Arnioceras* Hyatt, 1867

Arnioceras? sp. indet.

Plate I, figures 8a, b

Material. One specimen from the Tulsequah area, GSC loc. 40463.

Description. The specimen is an imprint showing a few remnants of the last whorl and parts of the suture line. Dimensions are:

Diameter	Whorl height	Whorl thickness	Umbilical width
47	11 (0.23)	not measurable	27 (0.57)

The specimen is evolute, wide-umbilicate, the whorls slowly increase in height, flanks slightly convex. Ribs almost straight, thickest and slightly bent forward in outermost part of whorl, rursiradiate and present on innermost visible whorls. There are thirty-six ribs on the last whorl. Intervals between ribs about twice the size of the ribs. Venter is not clearly visible, apparently fairly narrow and with keel that seems to be bordered by furrows.

The visible parts of the suture line are very simple, first lateral lobe trifold, second lateral saddle very broad.

Remarks. As the cross-section and the shape of the venter are not sufficiently known, no definite generic assignment is attempted. The specimen resembles *Arnioceras bodleyi* (Buckman) as figured by Wright (1878-86, Pl. 1, figs. 4, 5) but the ribs of Wright's specimens are not as rursiradiate. There are also some resemblances with the genus *Epammonites* Spath (Spath, 1922, p. 173).

Age. Probably lower Sinemurian.

Superfamily EODEROCERATAEAE Spath, 1929

Family LIPAROCERATIDAE Hyatt, 1867

Genus *Liparoceras* Hyatt, 1867

Subgenus *Becheiceras* Trueman, 1918

Becheiceras cf. *B. bechei* (Sowerby)

Plate III, figure 1; Plate IV, figure 1; Plate V, figure 1

Material. One specimen from Tulsequah area, GSC loc. 40422.

Description. The specimen is a well-preserved mould with only a few remnants of the shell still present; body-chamber is entirely missing. Dimensions are as follows:

Diameter	Whorl height	Whorl thickness	Umbilical width
193	95 (0.48)	104 (0.54)	22 (0.11)

The specimen is sphaerocone, involute, narrow-umbilicate, the flanks are moderately convex, slightly flattened between the lateral rows of tubercles. Flanks grade into the broad round venter. The last whorl is slightly thicker than high, greatest thickness at about half the height of the flanks. Transition to the deep umbilicus, which has steep walls, is rounded. Sculpture has apparently been very fine; fine ribs are recognizable only where small remnants of the shell are preserved.

One row with stronger tubercles is present somewhat above the half height of the flanks, another row with apparently less and finer tubercles is below the middle of the flank.

Suture line is deeply incised. The external lobe is much shorter than the large first lateral that undercuts the slender first lateral saddle.

Remarks. In general shape, in suture line, and in tubercles, the specimen is similar to *Becheiceras bechei* (Sowerby). Unfortunately, only small remnants of the ribs are preserved and no comparison with the ribs of *B. bechei* can be made. Furthermore the fine longitudinal striation, which is present on the shell of this species, is not preserved on the Canadian specimen. As stated by Wright (1878-86, p. 381), these fine striae are limited to the structure of the shell and are absent on the mould.

Spath (1938, p. 74) included one specimen of Quenstedt's *Ammonites striatus* (Quenstedt, 1884, p. 234, Pl. 29, fig. 8) in *B. bechei* (Sowerby). *B. gallicum*

Spath (Spath, 1938, p. 77, Pl. 8, figs. 6a, b; Pl. 11, fig. 3; Pl. 25, figs. 2a, b) is closely related to *B. bechei*, but is more compressed in young stages and its ribs become more widely spaced much more rapidly (op. cit.). These features could not be seen, and as the suture lines of *bechei* and *gallicum* are similar, it cannot be decided to which of the two species the Canadian specimen belongs. *Becheiceras nautiliforme* (Buckman), which according to Spath (op. cit., p. 79), includes some of the specimens described by Quenstedt as *Ammonites striatus* (Quenstedt, 1884, Pl. 29, figs. 4-6 and 1?), has a broader venter and coarser tuberculation than *bechei* and *gallicum*. By the broader venter this species is also distinguished from the Canadian specimen.

Occurrence and age. The specimen is the first *Liparoceras* found in Canada. According to Spath (1938, p. 76), *B. bechei* occurs in Europe in the *bechei* and *figulinum* subzones that form the upper part of the Pliensbachian zone of *Prodactylioceras davoei*.

Family AMALTHEIDAE Hyatt, 1867

Genus *Amaltheus* de Montfort, 1808

Amaltheus stokesi (J. Sowerby)

Plate II, figures 2-6

Ammonites stokesi J. Sowerby, 1818, p. 205, Pl. 191

Amaltheus margaritatus Montfort, Wright, 1882, Pl. 56, fig. 15.

Amaltheus cf. *A. nudus* (Quenstedt), Imlay, 1955, p. 87, Pl. 10, fig. 5.

Amaltheus stokesi (J. Sowerby), Howarth, 1958, p. 3, Pl. 1, figs. 5, 7, 12-14; Pl. 2, figs. 1, 3, 10;
Text-figs. 4-5

Amaltheus sp. Frebold, 1960, p. 4.

For additional synonymy see Howarth, 1958, p.3.

Material. Several specimens from Telegraph Creek area (GSC loc. 32802), from Tulsequah area (GSC locs. 40473, 43659, 43660), from Whitehorse area (GSC locs. 24833, 24834, 24836).

Description. Most of the specimens are flattened or are imprints from which rubercasts were made. A few fragments show the elliptical cross-section. Each whorl covers about half of the preceding whorl. Flanks grade into the keeled venter, keel has fairly strong chevrons. Ribs are comparatively strong, slightly sigmoidal, most bifurcate in the outer part of the whorl but trifurcation occurs occasionally. Secondary ribs are thinner than the primaries, their connection with the chevrons of the keel is clearly visible. There are no tubercles, spiral striae are not preserved. The largest complete specimen in this collection (GSC 15973) has a diameter of 57 mm.

Specimen GSC 15973, Plate II, figure 2, is a typical representative of this species. GSC 15974, Plate II, figure 3, has finer ribs but still has the strong chevrons of *stokesi*.

Remarks. According to Howarth (op. cit., p. 5), *A. stokesi* is closely related to *A. margaritatus* de Montfort, which has smaller and more numerous chevrons and a more differentiated keel. There is no specimen in the Yukon and British Columbia collections which could be confidently assigned to *A. margaritatus*. Some small poorly preserved ammonites collected in the Bennett area, northwestern British Columbia, may also belong to *A. stokesi*.

Occurrence. In the Whitehorse, Telegraph Creek and Tulsequah areas the species is associated with *Arietoceras*. In England (see Howarth, 1957, p. 194; 1958, pp. VIII-XIV), *A. stokesi* is characteristic of the lower part of the zone of *A. margaritatus* (lower part of upper Pliensbachian).

Family DACTYLIOCERATIDAE Hyatt, 1867

Genus *Prodactylioceras* Spath, 1923

Prodactylioceras davoei (Sowerby)

Plate III, figure 2

Ammonites davoei J. Sowerby, 1822, p. 71, Pl. 350.

Ammonites davoei Sowerby, d'Orbigny, 1842-1849, p. 276, Pl. 81, figs. 1, 2.

Aegoceras davoei Sowerby, Wright, 1878-86, p. 346, Pl. 31, figs. 1, 2.

Ammonites davoei Sowerby, Quenstedt, 1883-85, p. 298, figs. 6-14.

Material. One well-preserved imprint from GSC loc. 40424 in Tulsequah area, and one faint imprint from GSC loc. 17601, Laberge Group, Bennett area.

Description. The rubbercast of the well-preserved imprint is shown on Plate III, figure 2. The ammonite is evolute and wide-umbilicate. On the younger whorls tubercles are more frequent than on the older whorls and lie in the transition zone of flanks and venter. On the older whorls they are near the middle of the flanks. Commonly two ribs of the inner part of the whorls join in a tubercle but separate again in their outer part. Some tubercles are stronger than others. No suture line visible.

Specimen GSC 15983 is not figured, and is a very faint imprint with the fine ribs and some of tubercles still recognizable.

Remarks. Judging from illustrations of *P. davoei* (Sowerby) given by Quenstedt (1883-85, Pl. 38, figs. 6-14), Wright (1878-86, Pl. 31, figs. 1, 2)¹ and others the species is variable, particularly in the thickness of ribs and nodes. The writer considers all these specimens belong to one and the same species. Specimen GSC 15982 belongs to a variety with fine ribs and tubercles. According to illustrations of complete specimens (see for instance Quenstedt (op. cit.) and Wright (op. cit.)),

¹Donovan, 1954, p. 35, determined Wright's specimen as *Prodactylioceras* aff. *davoei* (Sowerby) and states that the ribs of this specimen are drawn too widely spaced on the venter in Wright's figure 2.

the last whorl has more widely spaced and coarser ribs. This stage is not preserved in the Canadian specimens.

Occurrence. In Europe the species is characteristic of the uppermost zone of the lower Pliensbachian.

Genus *Dactylioceras* Hyatt, 1867

Dactylioceras sp. indet.

Plate V, figures 7, 8

Material. Many small specimens and one medium-sized from Tulsequah area (GSC locs. 40475, 43651).

Description. All are preserved as imprints or as one-sided specimens. They are wide-umbilicate, evolute. Specimen GSC 15999 (Pl. V, fig. 7) has at a maximum diameter of about 23 mm numerous fine, equally spaced, straight ribs. Some primaries are bifurcated in the ventro-lateral area, there are also short intercalated secondaries. Slight protraction of the secondaries can be seen on a small part of the venter. Suture lines and cross-section are not visible. The inner whorls seem to have the same kind of ribbing.

The medium-sized specimen (GSC 16000, Pl. V, fig. 8) has a maximum diameter of about 33 mm. Its inner whorls are very similar to those of the smaller specimen described above. On the last whorl some ribs are divided with the point of division somewhere between the ventro-lateral and umbilical border. This specimen is probably the same species as the smaller ones.

Remarks. The specimens do not permit specific identification. *D. commune* (Sowerby) (see Wright, 1878-86, Pl. 83, figs. 3-4, Pl. 84, figs. 1-3) has less numerous ribs at the same stage of growth. *D. annulatum* (Sowerby) (see Wright, op. cit., Pl. 84, figs. 7, 8) has finer ribs than the Tulsequah specimens. The holotype of *D. kanense* McLearn (1932, p. 59, Pl. 4, figs. 1, 2) from Queen Charlotte Islands is similar but its ribs are more flexuous. *D. (Orthodactylites) directum* Buckman (1926, Pl. 654, figs. 1, 2) is also similar but is distinguishable by more secondary ribs with the point of division near the ventro-lateral border.

Occurrence. The genus *Dactylioceras* is represented in Canada by various species. Its age is early Toarcian.

Genus *Peronoceras* Hyatt, 1867

Peronoceras cf. *P. fibulatum* (Sowerby)

Plate V, figure 9; Plate VIII, figures 7, 8

Material. Two specimens from Stikine River area (GSC loc. 48624), some doubtful fragments from the Tulsequah area (GSC loc. 40475).

Description. Specimen GSC 16032 (Pl. VIII, fig. 8) is more or less complete, it is slightly contorted and the innermost whorls are not preserved or covered. It is wide-umbilicate and evolute, flanks are slightly convex, venter is almost flat.

In the anterior part of the last whorl the ribs are finer, more numerous and slightly sharper than on the middle and posterior parts, where they are thicker and more rounded. There are looped and single ribs. The single ribs are regularly intercalated between two pair of looped ribs, which have a rounded, fairly thick tubercle at the ventro-lateral margin. These tubercles were originally the bases of spines, some remnants of which are preserved. The looped ribs are subdivided at this tubercle in secondaries that are finer than the primary ribs. Some of the single ribs are also bifurcated, others remain single. All secondaries cross the venter transversely. No looping of ribs can be seen on the preceding whorls, but this may be a factor of preservation. The ribs of the inner whorls are fairly strong.

Specimen GSC 16033 (Pl. VIII, fig. 7) is similar in general shape and ribbing to the specimen GSC 16032, and is probably the same species. No looping of ribs could be seen on the penultimate whorl of this specimen.

Specimen GSC 16001 (Pl. V, fig. 9) is a one sided whorl fragment, venter is not preserved and suture line is not visible. Ribs are fairly fine, almost straight, some remain single, others are looped in pairs to a ventro-lateral tubercle.

Remarks. Specimens GSC 16032, 16033 are very similar to the holotype of *Peronoceras fibulatum* (Sowerby) (1823, p. 147, Pl. 407, fig. 2; and Dean, *et al.*, 1961, Pl. 73, fig. 2). Sowerby's figure barely shows the single ribs without spines which are intercalated between pairs of looped ribs and which are mentioned in Sowerby's description. These single ribs can be seen on the photograph of the holotype given by Dean, *et al.* (op. cit.). Contrary to the two British Columbia specimens, the holotype shows clearly the looped ribs on the penultimate whorl.

Donovan (1954, pp. 20, 53) states that Wright's (1878-86) specimens figured on Plate 85, figures 5, 6, 8, 10, 11, as *fibulatum* Sowerby belong to this species but mentions that the inner whorls appear to be badly drawn. They appear, indeed, to have much finer ribs than the holotype. No looped ribs are present on Wright's figure 5, which is hereby distinguished from the holotype and from the British Columbia specimens.

The two specimens are very close to *Peronoceras fibulatum* (Sowerby) but the differences mentioned, possibly caused by unsatisfactory preservation, do not allow positive specific identification.

The fragment GSC 16001 (Pl. V, fig. 9) is too small to be specifically identified. *P. fibulatum* (Sowerby) has a similar kind of ribbing at comparable stages of growth.

The poorly preserved specimen described by the author (1957a, p. 46, Pl. 18, fig. 1) from the Fernie Group does not belong to *subarmatus* Young and Bird but is closer to *fibulatum* Sowerby.

Occurrence. *Peronoceras fibulatum* (Sowerby) is the index fossil of the *fibulatum* subzone of the *Hildoceras bifrons* zone in the upper part of the lower Toarcian.

Superfamily HILDOCERATAACEAE Hyatt, 1867

Family HILDOCERATIDAE Hyatt, 1867

Subfamily ARIETICERATINAE Howarth, 1955

Genus *Arieticeras* Sequenza, 1885*Arieticeras algovianum* (Oppel)

Plate III, figures 3-5; Plate IV, figure 2; Plate V, figures 2, 3

Ammonites radians amalthei Oppel, 1854, p. 51, Pl. 3, fig. 1.*Ammonites algovianus* Oppel, 1862, p. 137.*Ammonites algovianus* Oppel, Reynès, 1868, p. 92, Pl. 2, fig. 1.*Arieticeras algovianum* (Oppel), Monestier, 1934, p. 55, Pl. 7, figs. 1-4.Other synonyms *see* Monestier 1934.

Material. Numerous specimens from the Laberge Group in Whitehorse area (GSC locs. 24830-24839), and from the Telegraph Creek and Tulsequah areas (GSC locs. 32802, 32773, 43668, 43659, 43660).

Description. Cross-section high oval to almost rectangular; flanks slightly convex with gentle slope to the fairly wide umbilicus and the more or less flattened venter. Keel fairly high and rather sharp, in some specimens bordered by shallow furrows or flat zones (GSC 15984, 15985, Pl. III, figs. 4, 5). Ribs more or less inclined backwards, most are almost straight to slightly sigmoidal, in outermost part of whorl sharply bent forward, undivided. In the larger specimen (GSC 15986, Pl. IV, fig. 2) the ribs are much more sigmoidal on last whorl than on preceding one.

Suture line slightly incised, ventral lobe shorter than first lateral, second lateral about half as deep as first lateral. There are two umbonal lobes. Lateral lobes trifid, saddles bifid.

Some specimens are slightly distinguishable from the specimens described by a more elliptical cross-section and absence of the flat zones bordering the keel, and having a few more ribs. They are very similar to *A. ruthenense* var. *A. meneghiana* Monestier (1934, p. 59, Pl. 8, figs. 38-40). The holotype of *A. ruthenense* (Reynès) (Reynès, 1868, p. 94, Pl. 2, fig. 4) is, however, different from both the British Columbia and Monestier's specimens, which at about the same diameter have fewer ribs than the holotype. Therefore, the British Columbia specimens (GSC 15987, 15988, 15989, Pl. III, figs. 3a, b; Pl. V, figs. 2, 3) are not identified with *A. ruthenense* (Reynès). They may represent specimens transitional from *A. algovianum* (Oppel) to *A. ruthenense* (Reynès). They are here referred to as *A. cf. algovianum*.

Remarks. *Arieticeras ruthenense* (Reynès) and *A. domarense* Meneghini are closely related species. They are distinguished from *A. algovianum* by the presence of considerably more ribs.

Occurrence and age. At all Yukon and northwestern British Columbia localities *A. algovianum* is associated with *Amaltheus stokesi* (Sowerby). This association belongs to the lower part of the zone of *Amaltheus margaritatus*, lower part of upper Pliensbachian.

Arieticerias cf. *A. gerardi* Monestier

Plate V, figures 6a, b

Material. Two specimens from Telegraph Creek area (GSC loc. 32773).

Description. Specimen GSC 15994 (Pl. V, fig. 6a) has the following dimensions:

Diameter	Whorl height	Whorl thickness	Umbilical width
24	7 (0.29)	—	12 (0.5)

Specimen GSC 15995 has about the same dimensions and is very similar to specimen GSC 15994. Both are very evolute, wide-umbilicate, with very slightly convex flanks and a keeled venter. The cross-section is rectangular, higher than thick. On specimen GSC 15994, flat zones border the ventral keel. The ribs on GSC 15995, which number twenty-seven, are almost straight, some are very slightly rursiradiate. In the ventro-lateral marginal zone they are bent forward. Ribs are present only in the outer three quarters of the whorl, earlier whorls seem to be without ribs. No suture line could be seen. The two specimens are similar to the largest of Monestier's specimens of *Arieticerias gerardi* (Monestier, 1934, p. 77, Pl. 8, fig. 35) but his specimen is slightly smaller and has four more ribs on the last whorl.

This species is possibly a young form of another *Arieticerias*. As there is not enough material available this possibility cannot be proved.

Age. Lower part of upper Pliensbachian, *margaritatus* zone.

Arieticerias aff. *A. ruthenense* (Reynès)

Plate IV, figures 3, 4

Material. Two specimens from Telegraph Creek area (GSC locs. 32802 and 32773).

Description. The two specimens are whorl fragments. The cross-section of specimen GSC 15992 (Pl. IV, fig. 3) is elliptical, the flanks are slightly convex, the venter has a comparatively high keel bordered on both sides by smooth zones. There are twenty-three sigmoid ribs on the half whorl. Specimen GSC 15993 has a similar outline and the same type of ribs. No suture lines could be seen on either specimen.

Remarks. Both specimens have considerably more and finer ribs than the associated *A. algovianum* (Oppel). *Leptaleoceras pseudoradians* (Reynès), how-

ever, has more ribs. Number and shape of the ribs are similar to those of *A. ruthenense* (Reynès) but the holotype of this species (Reynès, 1868, p. 94, Pl. 2, figs. 4a, b) has a considerably wider umbilicus at the same diameter as specimen GSC 15992. Accurate identification of the two fragments is impossible.

Age. Lower part of upper Pliensbachian, *margaritatus* zone.

Genus *Leptaleoceras* S. Buckman, 1918

Leptaleoceras pseudoradians Reynès

Plate IV, figures 5-7; Plate V, figures 4, 5

Ammonites pseudoradians Reynès 1868, p. 91, Pl. 1, figs. 4a-c.

Arietoceras pseudoradians (Reynès), Monestier, 1934, p. 63, Pl. 8, figs. 61, 68 (*non* fig. 62).

Leptaleoceras pseudoradians (Reynès), Howarth, 1957, p. 198, Pl. 17, figs. 1, 2.

Material. Numerous specimens from the Laberge Group in Whitehorse map-area (GSC locs. 24830, 24836), represented in Telegraph Creek (GSC loc. 32773) area.

Description. The specimens from the Whitehorse area are preserved as imprints, from which rubbrecasts were made, the specimens from the Telegraph Creek area are whorl-fragments.

The two whorl-fragments (GSC 15990, 15991, Pl. V, figs. 4, 5) have rectangular cross-sections, very slightly convex flanks with low, gently sloping umbilical wall. Venter with fairly high keel that is bordered on both sides by fairly large shallow furrows. Venter and flanks separated from one another by low ridges. These features are also more or less visible on the somewhat compressed imprints from the other localities.

Ribs of all specimens are slightly sigmoidal and numerous. They are undivided and the size of their intervals equals the size of the ribs. They are sharply bent forward at the ventro-lateral border. Specimen GSC 15998 (Pl. IV, fig. 7) has forty-eight ribs on its last whorl at a diameter of 31 mm, other specimens of about the same size have about the same number of ribs. The early whorls are not well preserved but seem to be smooth. No suture line could be seen.

Remarks. This species is clearly distinguished from *Arietoceras algovianum* (Oppel) with which it is associated, mainly by much more numerous and more sigmoidal ribs. The specimens are very similar to the holotype figured by Reynès (*op. cit.*) and the English specimen figured by Howarth. Monestier's two fragments have a similar ribbing.

Occurrence and age. Associated in northwestern Canada with *Arietoceras algovianum* (Oppel) and *Amaltheus stokesi* (Sowerby). In England and southern France the species belongs to the Pliensbachian zone of *Amaltheus margaritatus*.

Subfamily HARPOCERATINAE Neumayr, 1875

Genus *Harpoceras* Waagen, 1869

Harpoceras cf. *H. exaratum* (Young and Bird)

Plate VI, figures 1-5

Harpoceras cf. *H. exaratum* Donovan, 1954, pp. 20, 46.

Harpoceras cf. *H. exaratum* (Young and Bird), Frebold, 1962, p. 17, Pl. II, figs. 1-9; Pl. III, fig. 5.

For additional synonymy see Frebold and Little, 1962.

Material. Several specimens from various localities in the Tulsequah area (GSC locs. 40430, 40431, 40438, 40447, 40449, 43642, 43650, 43669).

Description. The specimens are flattened or preserved as imprints. They are moderately involute. Ribs of specimens with a diameter of about 40 mm or more are sickle-shaped and undivided, there are also some smaller forms with the same kind of ribbing. Other small specimens have numerous sigmoid ribs that are subdivided into two or three branches with the somewhat thickened point of division between the half height of the flank and the umbilical border (see Pl. VI, figs. 6, 7). In other small specimens fine intercalatory ribs are present. It could not be proved that the young forms with divided ribs belong to the same species as the larger specimens with sickle-shaped undivided ribs. In some of the larger specimens the density and strength changes in the course of the ontogenetic development. Thus, the largest specimen in this collection (GSC 16002, Pl. VI, fig. 1) has stronger and more widely spaced ribs at the beginning of the last whorl than at its end. The ribs continue in form of fine lines on the fairly high keel.

Associated with these harpoceratids and probably belonging to them are aptychi of the type of *Laevicornaptychus* (see Pl. VI, figs. 10-13).

Remarks. The specimens are very similar to *Harpoceras* cf. *H. exaratum* (Young and Bird) described by the author (see Frebold and Little, 1962) from the Salmo area, southern British Columbia, and belong probably to the same species.

Occurrence. *Harpoceras* cf. *H. exaratum* (Young and Bird) is of early Toarcian age. It is widely distributed in western Canada, i.e., in the Fernie Group and in the Salmo area of southern British Columbia.

Subfamily GRAMMOCERATINAE Buckman, 1904

Genus *Catulloceras* Gemmellaro, 1886

Catulloceras? spp. indet.

Plate VII, figures 5-9

Material. Numerous specimens from Bennett Lake (GSC locs. 21949, 17600), and Whitehorse areas (GSC locs. 17322, 17323, 20318).

Description. Most of the material consists of imprints, only a few whorl fragments were found. The preservation is unsatisfactory, no suture lines could be seen, the shape of the cross-section could not be determined with confidence, and the venter was visible in only a few specimens.

All are evolute, wide-umbilicate ammonites with whorls that increase very slowly in height. Flanks are moderately convex with gentle slopes to both venter and umbilicus. Ribs are undivided, almost straight with a slight forward bend in the ventro-lateral region. Some specimens have fewer and thicker ribs (GSC 16019, Pl. VII, fig. 5) whereas others have more numerous and thinner ribs (GSC 16020, 16023, Pl. VII, figs. 6, 9). In a few specimens, for example GSC 16021, 16022 (Pl. VII, figs. 7a, b, 8), a low keel is preserved.

Remarks. The poor preservation does not permit detailed comparisons. The specimens are, however, close to certain species of *Catulloceras*, which has a similar outline, ribs and keel.

Occurrence and age. Associated with other poorly preserved hildoceratids in the Laberge Group of Yukon and northwestern British Columbia. Toarcian.

Genus *Grammoceras* Hyatt, 1867

Grammoceras aff. *G. fallaciosum* (Bayle)

Plate VII, figures 1, 2

Material. Some imperfect impressions from the Laberge Group in southern Yukon (GSC locs. 7966 and 19574); possibly also represented in Telegraph Creek and Tulsequah areas.

Description. The best preserved and largest specimen is GSC 16015 (Pl. VII, fig. 1), which consists of parts of two whorls. The last whorl is fairly high and embraces about two thirds of the preceding one. The ribs are sigmoid, undivided, equally spaced, with intervals of about the same size as the ribs. The keel is fairly high. Specimen GSC 16016 (Pl. VII, fig. 2) is smaller and has the same type of ribs. None of the specimens shows the suture line.

Remarks. Somewhat similar, but more sickle-shaped ribbing occurs in the group of *Harpoceras falcifer*. Some small poorly preserved specimens from the Yukon, were studied by Buckman. His label attached to GSC 16016 reads as follows: "Loc. D.1. A platycone with flexed ribs which are flattened on top. Almost certainly *Pseudogrammoceras* and a species of the flexicostatis parallel with *P. pedicum* J. B. Grammoceatan, *struckmanni*." Ernst (1924-25, pp. 97-105) considers most of Buckman's species of the *fallaciosum* group as varieties of *fallaciosum* Bayle; the writer shares this opinion.

Another specimen (GSC 16018) that is too poorly preserved for illustration was determined by Buckman (label) as 'cf. *P. expeditum*'. None of the specimens

of this group hitherto found in southern Yukon is specifically determinable but all belong probably to the *fallaciosum* group. The best preserved specimen, GSC 16015 (Pl. VII, fig. 1), which was not studied by Buckman, is similar to the specimen of *G. fallaciosum* (Bayle) illustrated by Ernst (op. cit., Pl. 4, fig. 6).

At several localities in the Telegraph Creek and Tulsequah areas some very poorly preserved ammonites and imprints were found which have a similar type of ribbing. These ammonites seem to be related to those described above but are hardly determinable.

Occurrence and age. In Europe *G. fallaciosum* (Bayle) occurs in the *striatulum* subzone of the *Lytoceras jureense* zone (upper Toarcian). At one of the Yukon localities (GSC loc. 19574) *G. aff. fallaciosum* is associated with *Grammoceras? boreale* (Whiteaves).

Grammoceras? boreale (Whiteaves)

Plate VII, figures 3, 4

Schloenbachia borealis Whiteaves, 1889, p. 160, Pl. 21, fig. 5.

Material. Several specimens from the Laberge Group of two Yukon localities (GSC locs. 43825 and 19574).

Description. A detailed description of the holotype of the species was given by Whiteaves (loc. cit.). The holotype (GSC 9703) is refigured on Plate VII, figure 3; it is the only specimen found at GSC loc. 43825.

All the other specimens are from GSC loc. 19574. The best preserved one (GSC 16017, Pl. VII, fig. 4) shows some of the inner whorls with fairly fine and equally spaced ribs, which become much stronger on the last preserved whorl where they have the same rursiradiate shape as those on the last whorl of the holotype. Some bifurcate at or below the half height of the whorl, others are undivided.

The other specimens from the same locality are small and poorly preserved.

Remarks. Whiteaves (op. cit.) erroneously referred this species to the Cretaceous genus *Schloenbachia*. The species is, however, associated with *Grammoceras* aff. *G. fallaciosum* (Bayle) from the *Lytoceras jureense* zone of the upper Toarcian and is closely related to another species from the same zone, i.e. *Grammoceras? doerntense* (Denckmann) (Denckmann, 1887, p. 50, Pl. 8, figs. 4-6, non 1-3). The specimen illustrated by Denckmann (op. cit., fig. 5), is closest to the two Yukon specimens, but these have stronger and still more rursiradiate ribs.

Grammoceras doerntense Buckman (1887-1907, p. 182, Pl. 33, figs. 11, 12) and Janensch (1902, p. 78, Pl. 8, figs. 1-3) do not belong to *G. doerntense* (Denckmann) and are clearly distinguished by their simple and finer ribs from *G.? boreale* (Whiteaves).

Occurrence and age. Laberge Group, upper Toarcian, Yukon, locally associated with *Grammoceras* aff. *G. fallaciosum* (Bayle).

Family SONNINIIDAE Buckman, 1892

Genus et species indet.

Plate VIII, figures 9, 10

Material. Several fragmentary specimens from Telegraph Creek area (GSC loc. 37110).

Description. The poorly preserved fragments belong to different stages of growth. The illustrated specimens represent younger whorls. At this stage the ribs are more numerous and slightly bent forward and a low keel is present (*see* Pl. VIII, fig. 10). The slightly convex flanks seem to join the umbilical wall in a rounded edge; cross-section is lenticular.

There are some very poorly preserved whorl fragments of larger specimens. It is doubtful whether these belong to the same species as the specimens described. The cross-section at this stage of growth is lenticular to oval, the venter is narrowly rounded and a low keel is present. Broad, straight, rounded ribs are present on the inner part of the flanks; they disappear towards the venter.

Remarks. The specimens are too poorly preserved for detailed comparison, however, they do not belong to the genus *Sonninia* Bayle or related genera as no lateral tubercles seem to be present. The genus *Guhsania* McLearn described from the Hazelton Group of British Columbia (McLearn, 1926) is similar but is distinguished by its pronounced angular umbilical edge and possibly by a sharper venter. "*Sonninia*" *gracilis* (Whiteaves) (*see* Frebold, 1957a, p. 48, Pl. 29, figs. 1a, b) and other sonniniids of the Fernie Group are also somewhat similar but are too poorly preserved for detailed comparison.

Occurrence. The Canadian sonniniids hitherto described were found in the middle Bajocian. The specimens described here were collected from a horizon which is stratigraphically below a bed with middle Bajocian stephanoceratids.

Superfamily STEPHANOCERATAEAE Neumayr, 1875

Family SPHAEROCERATIDAE Buckman, 1920

Genus *Chondroceras* Mascke, 1907

The genus *Chondroceras* Mascke includes some Canadian forms originally described by McLearn as *Defonticeras* (McLearn, 1927, p. 72; 1929, p. 13) and *Saxitoniceras* (McLearn, 1927, p. 72; 1928, p. 21). Spath (1932, p. 10) and Arkell (1951-55, p. 72; 1957, p. L292) considered *Defonticeras* McLearn and *Saxitoniceras* McLearn as synonyms of *Chondroceras*. Westermann (1956, pp. 97,

106) retains *Defonticeras* and *Saxitoniceras* as subgenera of *Chondroceras*. He is of the opinion that *Saxitoniceras* is so considerably differentiated from *Defonticeras* in suture line, dimensions and sculpture, that it should be considered at least as a subgenus. With regard to the suture line of the type species of *Saxitoniceras*, i.e., *S. allani*, Westermann's figure (1956, p. 107, fig. 64), is a very simplified inaccurate copy of the same suture line given by McLearn (1927, Pl. 1, fig. 4), as McLearn's figure shows the suture line to be much more incised than Westermann's figure. The fact that the suture line of *S. allani* is taken at a smaller diameter than the suture lines of *Defonticeras* as figured by McLearn (1927, Pl. 1, fig. 3; 1929, Pls. 12, 13, 14, 15) accounts for minor differences in the degree of incision. A comparison of McLearn's suture lines of *Saxitoniceras allani* and *Defonticeras defontii* (McLearn, 1927, Pl. 1, figs. 3, 4) demonstrates their great similarity. As far as dimensions and sculpture are concerned specimens formerly described as *Defonticeras* and *Saxitoniceras* are not differentiated enough to justify separation into different subgenera. There is for instance a close relationship between *Chondroceras oblatum* (Whiteaves) formerly described as *Defonticeras*, and *Chondroceras allani* (McLearn) formerly assigned to *Saxitoniceras*. Both species have similar outline and sculpture and the only major difference is that the robust sculpture of *C. allani* appears at a later stage of growth in *C. oblatum*. The writer follows Spath and Arkell and considers *Defonticeras* McLearn and *Saxitoniceras* McLearn as synonyms of *Chondroceras* Mascke.

Chondroceras allani (McLearn)

Plate VIII, figures 1-5

Saxitoniceras allani McLearn, 1927, p. 72, Pl. 1, fig. 4.

Saxitoniceras allani McLearn, 1928, p. 21, Pl. 8, figs. 1, 2.

Chondroceras (Saxitoniceras) allani 1956, Westermann, p. 107, Pl. 12, fig. 3, Text-fig. 64.

Chondroceras allani var. Frebold, 1957a, p. 53, Pl. 27, figs. 2a, b.

Holotype is *Chondroceras allani* (McLearn), 1927, p. 72, Pl. 1, fig. 4; 1928, p. 21.

A detailed description of the holotype is given by McLearn (1928, p. 21, Pl. 8, figs. 1, 2).¹ This description is accurate except for the umbilical width at a diameter at 43 mm. The measurements of the holotype at 43 mm (maximum diameter is 45 mm) are as follows:

Diameter	Whorl height	Whorl thickness	Umbilical width
43	18 (0.42)	24 (0.56)	11 (0.26)

As already stated, Westermann's drawing of the suture line is a very simplified copy of McLearn's illustration, which shows all the fine incisions omitted in Westermann's figure. Westermann's illustration of the ammonite (1956, Pl. 12, figs. 3a-d) is not about natural size ("ca. lx") as stated by him. Thus the maximum diameter of his figure 3b is 55 mm whereas it is only 45 mm in the holotype specimen.

¹Westermann (1956, p. 107) thought that McLearn (1927) gave only a very unsatisfactory ("sehr mangelhafte") description of the holotype. McLearn's 1927 paper was a preliminary report followed by a detailed description in 1928, which apparently remained unknown to Westermann.

The holotype is refigured on Plate VIII, figures 1a-d, in true natural size.

Material. Many specimens from Tulsequah area (GSC locs. 40434, 40452, 40462, 43680, 43681).

Description. There are about ten fairly well-preserved specimens of different sizes, the largest one attaining a diameter of 47 mm. In addition, imprints and whorl fragments are present.

Specimen GSC 16025 (Pl. VIII, figs. 3a, b) is the largest of the better preserved specimens. On one side the last whorl is broken off and a younger ontogenetic stage of the ammonite is visible. At this stage the umbilicus is narrow and has fairly steep and high walls. The rounded whorl grades into the broad rounded venter. The primary ribs are bent forward and subdivided on the middle of the flank into two finer secondaries that cross the venter transversely. There are also intercalated secondaries that go down to the middle of the flank. The last whorl has a much wider umbilicus. In its posterior part the type of ribbing is still the same as on the preceding whorl but in the anterior part the ribs are stronger and much more widely spaced. The primaries bifurcate but some of the intercalated secondaries almost join the point of division of the primaries.

The dimensions of another complete specimen (GSC 16024, Pl. VIII, fig. 2) are as follows:

Diameter	Whorl height	Whorl thickness	Umbilical width
43	18 (0.42)	24 (0.56)	11 (0.26)

In the anterior part of the whorl the ribs are very similar to those in specimen Plate VIII, figure 3a, but they are less widely spaced. In the posterior part the ribs are finer, more narrowly spaced, with some trifurcated.

Remarks. The Tulsequah specimens agree very well with the holotype and with *C. allani* (Frebald, 1957a, p. 53, figs. 2a, b), which had been considered as a variety because the width of the umbilicus seemed to be wider than in the holotype (the width of the umbilicus of the holotype had been erroneously listed by McLearn as smaller than it actually is). One of the Tulsequah specimens (GSC 16026) shows inner whorls previously unknown, but the mouth is not as completely preserved as in the holotype. Only the posterior part of the mouth is present in a whorl fragment (*see* Pl. VIII, fig. 5).

Occurrence and age. *Chondroceras allani* (McLearn) was previously known from the middle Bajocian Rock Creek member of the Fernie Group.

Chondroceras sp.

Plate VIII, figure 6

Material. Several incompletely preserved specimens from GSC loc. 43680.

Description and remarks. Some of the specimens of *Chondroceras* associated with *C. allani* (McLearn) differ from the typical *allani* by a somewhat finer sculpture

(see Pl. VIII, fig. 6). They cannot be precisely identified and may belong to a different species.

Family STEPHANOCERATIDAE Neumayr, 1875

Genus et species indet.

Material. Several poorly preserved fragmentary specimens from Telegraph Creek area (GSC loc. 37109) and some from Tulsequah area (GSC locs. 43675, 43673, 43679).

Description. The fragment GSC 16034 from Tulsequah area has coarse primary ribs. At about half the height of the flanks the ribs are subdivided into three or more branches that cross the venter transversely. Each whorl embraces about half of the preceding one. The specimen is entirely flattened, and the shape of the cross-section is not determinable. The specimen resembles some species of Canadian *Stemmatoceras* but its preservation does not permit identification.

The specimens GSC 16035 and GSC 16036 from Telegraph Creek area are still poorer preserved and consist mostly of flattened parts of whorls. Suture lines and cross-sections are not visible. The primary ribs are subdivided at the middle of the flanks in three or more secondaries. In most of the specimens the point of division is marked by a tubercle. There are also some intercalated secondaries that reach down to the middle of the flanks. Most of the specimens have finer ribs than the Tulsequah specimen. Some impressions show that the ribs cross the venter transversely and without interruption.

The specimens may include several species that probably belong to *Stephanoceras* or *Stemmatoceras*; they are too poorly preserved to be illustrated.

Occurrences. The Tulsequah specimen GSC 16034 was found 100 feet below a bed containing the middle Bajocian species *Chondroceras allani* (McLearn). The Telegraph Creek fragments are about 20 to 30 feet above the horizon with sonniniids.

Ammonite gen. et sp. indet. 1

Plate II, figures 7-9

Material. Three specimens from Tulsequah area (GSC loc. 40422), two preserved as fragmentary imprints (specimens GSC 15979, 15980) and one as a fragment of a small specimen (GSC 15978).

Description. Specimens have apparently somewhat higher whorls and are less evolute than the associated *Arietoceras*. The flanks are very little convex, the venter seems to be narrow, the keel fairly low. Transition from flanks to venter is gradual, from flanks to umbilicus apparently abrupt. A low but steep umbilical wall is visible in specimens GSC 15979, 15980 illustrated on Plate II, figures 7, 9. The narrowly spaced, numerous ribs are fine, strongest on the outer half of the flank,

weaker on the inner half. The ribs are slightly sigmoidal, some bifurcate at about the middle of the flanks, in other specimens secondary ribs are intercalated. No suture line visible.

Remarks. The poor state of preservation does not allow identification. The specimens are clearly distinguished from the associated *Arieticer* by the presence of bifurcated and intercalated ribs. The small specimens of "*Harpoceras*" *isseli* Fucini from the upper Pliensbachian of Aveyron, southern France, figured by Monestier (1934, Pl. 1, figs. 25, 26) have a rather similar type of ribbing, but further comparison with the Canadian specimens is not possible.

Occurrence and age. Tulsequah area, associated with *Arieticer*. Upper Pliensbachian.

Ammonite gen. et sp. indet. 2

Plate II, figure 10

Material. A single small specimen (GSC 15981) from Telegraph Creek area (GSC loc. 32773).

Description. Evolute, wide-umbilicate, almost flat with slightly convex flanks, elliptical cross-section, fairly high and narrow keel that is bordered on both sides by flat zones. About nineteen faint, almost straight, very slightly sigmoid undivided ribs with large intervals, innermost whorls apparently smooth. Half of the last whorl belongs to the body-chamber. Only parts of the suture line are visible, it is simple with a few incisions. First lateral saddle broad, subdivided by one accessory lobe into two parts of equal size, first lateral lobe deep and large with beginning fine incisions at the bottom. Other elements of suture line are difficult to recognize.

The dimensions in millimetres are:

Diameter	Whorl height	Whorl thickness	Umbilical width
25	8 (0.32)	5 (0.2)	12 (0.48)

Remarks. The specimen may represent the young stage of a larger species. The associated *Arieticer* cf. *A. gerardi* Monestier that has a similar size is distinguished by stouter whorls, stronger and less distant ribs.

Other small forms from the same and other localities differ mainly in their sigmoid and more numerous ribs, they are specifically unidentifiable but are considered to be young stages of various species of *Arieticer*.

Occurrence. Lower part of upper Pliensbachian, *margaritatus* zone.

Comparisons with Other Faunas and Age Determinations

(See Table I)

Most of the Lower Jurassic ammonites from southern Yukon have never been described or figured although their presence has been known since preliminary determinations by S. S. Buckman were published (*see* Cockfield and Bell, 1926, p. 21).

The ammonites described in this report are new for the Jurassic System of northwestern British Columbia or have been only briefly mentioned in a preliminary paper (Frebald, 1958, p. 28). Some of the genera and species of the Lower Jurassic are entirely new for North America.

Hettangian

The oldest Early Jurassic ammonite in northwestern British Columbia hitherto known is *Psiloceras canadense* Frebold from the Telegraph Creek area. The species, which is absent in the Tulsequah area, was previously described from the Tyaughton Lake area, southern British Columbia. In this area *Psiloceras canadense* is associated with *Schlotheimia* and its age is Hettangian (Frebald, 1951, pp. 11, 12). In northwestern British Columbia, *Psiloceras canadense* was not found associated with other ammonites. The genus *Psiloceras* is known from Europe, Nevada, Peru, New Zealand, and Indonesia.

Psiloceras cf. *P. erugatus* Bean described by Lees (1934, p. 46, Pl. 6, figs. 1-4) from southern Yukon is very poorly preserved. The assignment of Lees' specimens to *Psiloceras* is perhaps open to question.

Lower Sinemurian

Lower Sinemurian beds in southern Yukon and northwestern British Columbia (at one locality in Tulsequah area) are indicated by a few arietitids. *Paracoronicerias* cf. *P. gmündense* (Oppel) and an *Arnioceras* described by Lees (1934, p. 46, Pl. 6, figs. 5-8) were found in southern Yukon, *Arnioceras*(?) sp. indet. in the Tulsequah area. In Canada other arietitids occur on the Arctic Islands, in the Richardson Mountains, the Fernie Group of the Rocky Mountains and Foothills, and in various parts of southern and western British Columbia.

The close relationship of the Canadian arietitids to European species is very well documented by the better material from the Tyaughton Lake area, southern British Columbia (Frebald, 1951).

Upper Sinemurian — Lower Pliensbachian

The next younger ammonites found in northwestern British Columbia and southern Yukon belong to the zone of *Productylioceras davoei*, which forms the uppermost zone of the lower Pliensbachian. They are *P. davoei* (Sowerby) found in southern Yukon and the Bennett and Tulsequah areas, in northwestern British Columbia, and *Becheiceras* cf. *B. bechei* (Sowerby) from the latter area only.

	STAGES	NORTHWEST EUROPEAN ZONES	NORTHWEST EUROPEAN SUBZONES	SOUTHERN YUKON	NORTHWESTERN BRITISH COLUMBIA		SOUTHERN PARTS OF BRITISH COLUMBIA		CANADIAN ROCKY MOUNTAINS AND FOOTHILLS	RICHARDSON AND BRITISH MOUNTAINS	CANADIAN ARCTIC ISLANDS	ALASKA PENINSULA (after Imlay, 1955; slightly modified)		
		(Middle Jurassic after Arkell, 1956; Lower Jurassic after Dean et al, 1961)	(Middle Jurassic after Arkell, 1956; Lower Jurassic after Dean et al, 1961)		Telegraph Creek Area	Tulsequah Area	Tyaughton Lake Area	Salmo and Nelson Areas					(after Imlay, 1955; slightly modified)	
MIDDLE JURASSIC	MIDDLE	<i>Stephanoceras humphriesianum</i>	<i>Teloceras blagdeni</i> <i>S. humphriesianum</i>	Not identified	<i>Stephanoceratids</i>	<i>Chondroceras allani</i> <i>Stephanoceratids</i>	<i>Chondroceras</i> sp.		<i>Chondroceras allani</i> , <i>Stephanoceras</i> , <i>Stemmatoceras</i> , <i>Teloceras</i> etc.	Not identified	Not identified	<i>Chondroceras</i> <i>Normannites</i> , <i>Teloceras</i> <i>Stemmatoceras</i> <i>Emileia</i>		
		<i>Otoites sauzei</i>												
		<i>Sonninia sowerbyi</i>	<i>Witchellia laeviuscula</i> <i>Shirburnia trigonalis</i> <i>Hyperlioceras discites</i>										<i>Sonniniids</i>	
	LOWER BAJOCIAN	<i>Graphoceras concavum</i>												
		<i>Ludwigia murchisonae</i>	<i>Brasilia bradfordensis</i> <i>Ludwigia murchisonae</i> <i>Ancalioceras</i> spp.											
		<i>Tmetoceras scissum</i>												
		<i>Leioceras opalinum</i>									<i>Erycites</i> cf. <i>howelli</i> , <i>Pseudolioceras</i>	<i>Leioceras opalinum</i> <i>Pseudolioceras m'clintocki</i> etc.	<i>Tmetoceras</i> , <i>Pseudolioceras</i> , <i>Erycites</i> <i>Pseudolioceras whiteavesi</i> , <i>Erycites howelli</i>	
LOWER JURASSIC	TOARCIAN	<i>Dumortieria levesquei</i>	<i>Pleydellia aalensis</i> <i>Dumortieria moorei</i> <i>Dumortieria levesquei</i> <i>Physeogrammoceras dispansum</i>	<i>Catullocceras</i> ? spp. indet.										
		<i>Grammoceras thouarsense</i>	<i>Grammoceras struckmanni</i> <i>Grammoceras striatulum</i>	<i>G. aff. fallaciosum</i> <i>G. boreale</i>	<i>Grammoceras</i> aff. <i>fallaciosum</i>	<i>Grammoceras</i> aff. <i>fallaciosum</i>								
		<i>Haugia variabilis</i>												
		<i>Hildoceras bifrons</i>	<i>Dactylioceras braunianum</i> <i>Peronoceras fibulatum</i> <i>Dactylioceras commune</i>		<i>Peronoceras</i> cf. <i>fibulatum</i>	<i>Dactylioceras</i> , <i>Peronoceras</i>								
		<i>Harpoceras falcifer</i>	<i>Harpoceras falcifer</i> <i>Harpoceras exaratum</i>			<i>Harpoceras</i> cf. <i>exaratum</i>								
		<i>Dactylioceras tenuicostatum</i>												
		<i>Pleuroceras spinatum</i>	<i>Pleuroceras hawskerense</i> <i>Pleuroceras apyrenum</i>		Unknown, probably absent									
	PLIENSBACHIAN	<i>Amaltheus margaritatus</i>	<i>Amaltheus gibbosus</i> <i>Amaltheus subnodosus</i> <i>Amaltheus stokesi</i>		<i>Amaltheus stokesi</i> , <i>Arietoceras algovianum</i> , <i>Leptaleoceras pseudoradians</i>									
		<i>Prodactylioceras davoei</i>	<i>Oisteroceras figulinum</i> <i>Androgynoceras lataecosta</i> <i>Androgynoceras maculatum</i>	<i>? Prodactylioceras</i>		<i>Becheioceras</i> cf. <i>bechei</i> <i>Prodactylioceras davoei</i>								
		<i>Tragophylloceras ibex</i>	<i>Beaniceras luridum</i> <i>Acanthopleuroceras valdani</i> <i>Tropidoceras masseanum</i>		Unknown, probably absent									
	SINEMURIAN	<i>Uptonia jamesoni</i>	<i>Uptonia jamesoni</i> <i>Platyleuroceras brevispina</i> <i>Polymorphites polymorphus</i> <i>Phricodoceras taylori</i>		Unknown, probably absent					Mainly volcanic rocks				
		<i>Echioceras raricostatum</i>	<i>Paltechioceras aplanatum</i> <i>Leptechioceras macdonnelli</i> <i>Echioceras raricostatum</i> <i>Cruciloboceras densinodulum</i>		Unknown, probably absent								<i>Xipheroceras</i> , <i>Deroceras</i>	
		<i>Oxynoticeras oxynotum</i>	<i>Oxynoticeras oxynotum</i> <i>Oxynoticeras simpsoni</i>											
<i>Asteroceras obtusum</i>		<i>Eparielites denotatus</i> <i>Asteroceras stellare</i> <i>Asteroceras obtusum</i>					<i>Asteroceras</i> cf. <i>stellare</i>							
<i>Caenisites turneri</i>		<i>Microderoceras birchi</i> <i>Caenisites brooki</i>												
<i>Arnioceras semicostatum</i>		<i>Euagassicerias sauzeanum</i> <i>Agassicerias scipionianum</i> <i>Coroniceras reynesi</i>	<i>Arnioceras</i> sp. <i>Paracoroniceras</i> cf. <i>gmündense</i>			<i>? Arnioceras</i> sp. indet.			<i>Arniotites kwakiutlanus</i>	<i>Arnioceras</i> sp. (<i>Oxytoma</i> bed and Nordegg Mbr.)				
<i>Arietites bucklandi</i>		<i>Arietites bucklandi</i> <i>Coroniceras rotiforme</i> <i>Coroniceras conybeari</i>					<i>Coroniceras bisulcatum</i>			<i>Arietites</i> s. l. gen. et sp. indet.	<i>Arietites</i> s. l. gen. et sp. indet.	<i>Coroniceras</i> and <i>Arnioceras</i>		
HETTANGIAN	<i>Schlotheimia angulata</i>	<i>Schlotheimia complanata</i> <i>Schlotheimia extranodosa</i>	Unknown	Unknown	Unknown		<i>Schlotheimia</i> cf. <i>acuticosta</i>							
	<i>Alsatites liasicus</i>	<i>Alsatites laqueus</i> <i>Schlotheimia portlocki</i>						Possibly present in part	Probably absent			<i>Waehneroceras</i> ?		
	<i>Psiloceras planorbis</i>	<i>Psiloceras johnstoni</i> <i>Psiloceras planorbis</i>	<i>Psiloceras</i> cf. <i>erugatus</i>	<i>Psiloceras canadense</i>			<i>Psiloceras canadense</i>					Unknown		

TABLE 1. Correlation of the Lower Jurassic and Bajocian beds of northwestern British Columbia and southern Yukon Territory

Both forms are well-known index fossils in Europe, they are unknown in other parts of Canada and the United States.

A coquina bed, about 50 feet below the horizon with *Amaltheus stokesi* and *Arieticerias algovianum* and consisting of gastropods and pelecypods (including *Weyla* sp.) was found by Souther (pers. com.) to be a marker bed in the Tulsequah area. As *Becheicerias* cf. *B. bechei* belongs to this horizon, its age is upper part of early Pliensbachian. The coquina is, according to Souther (pers. com.), underlain by a conglomerate that in turn rests on Triassic volcanic rocks. The absence of fossils of Hettangian or Sinemurian, and early lower Pliensbachian age in the Tulsequah area has thus to be explained by non-deposition during these times. Lower Sinemurian with *Arnioceras?* is known at only one locality (GSC loc. 40463).

Upper Sinemurian and early lower Pliensbachian faunas seem also to be absent in the Telegraph Creek area and southern Yukon.

Lower Part of Upper Pliensbachian

The lower part of the upper Pliensbachian is present in both southern Yukon and northwestern British Columbia (Bennett, Telegraph Creek, and Tulsequah areas). It has yielded an ammonite fauna rich in individuals and containing *Amaltheus stokesi* (Sowerby), *Arieticerias algovianum* (Oppel), *A. aff. A. ruthenense* (Reynès), *A. cf. A. gerardi* Monestier, and *Leptaleoceras pseudoradians* (Reynès). This very interesting fauna belongs to the lower part of the zone of *Amaltheus margaritatus*, i.e., the subzone of *A. stokesi*.

The genus *Amaltheus* has almost world-wide distribution, and is particularly abundant in parts of Europe. It occurs also in Alaska, but in Canada it was hitherto represented by only a few specimens in the Richardson Mountains (Frebald, 1960) and by one specimen (still undescribed) in the Fernie Group. The genus *Arieticerias* is known in Europe, particularly in southern France and Italy, in North Africa, and Caucasus. *Leptaleoceras pseudoradians* (Reynès) occurs in various parts of Europe. Southern Yukon and northwestern British Columbia are the only areas in North America where *Arieticerias* and *Leptaleoceras* have been found.

Upper Part of Upper Pliensbachian

No ammonites of late upper Pliensbachian age, i.e. of the subzones of *Amaltheus subnodosus* and *A. gibbosus* and of the *Pleuroceras spinatum* zone are known in North America. This may indicate that the ammonite faunas of this age are primarily absent.

Toarcian

Most of the Toarcian ammonite faunas from southern Yukon and northwestern British Columbia are poorly preserved and as far as they belong to the Hildoceratidae it is often impossible to make accurate genus identifications.

However, the occurrence of such genera as *Dactylioceras*, *Peronoceras*, and *Catulloceras?* illustrates clearly that beds of both early and late Toarcian age are present, at least locally. To the lower Toarcian belong beds in the Tulsequah

area which contain *Dactylioceras* and *Peronoceras*. They are equivalent in age to part of the European zone of *Hildoceras bifrons*. Still older and possibly equivalent to part of the *Harpoceras falcifer* zone are beds with ammonites tentatively assigned to *Harpoceras* cf. *H. exaratum* (Young and Bird). To the upper Toarcian belong beds with ammonites that seem to be related to *Grammoceras fallaciosum*. If the determination of these very unsatisfactorily preserved specimens is correct, they would be equivalent in age to the subzone of *Grammoceras striatulum* which forms part of the *Grammoceras thouarsense* zone. Beds with *G.* aff. *G. fallaciosum* are present in both southern Yukon and the Telegraph Creek and Tulsequah areas of northwestern British Columbia. In southern Yukon they also contain *Grammoceras? boreale* (Whiteaves) a species closely related to *Grammoceras doerntense* (Denckmann), which occurs in the *G. striatulum* subzone of northwest Germany.

Still younger than these ammonites is *Catulloceras? sp.* which occurs in southern Yukon, and the Bennett area, northwestern British Columbia. *Catulloceras? sp.* is here assigned to the zone of *Dumortieria levesquei*, which is close to the Toarcian-Bajocian boundary.

S. S. Buckman (see Cockfield and Bell, 1926, p. 21) has indicated the possibility that beds with *Pleydellia* are also present in southern Yukon. If his determinations could be confirmed the presence of the youngest Toarcian subzone, i.e., that of *P. aalensis* would be indicated in this area, but the specimens concerned are so poorly preserved that their accurate assignment to the genus *Pleydellia* is doubtful.

The Toarcian ammonites from southern Yukon and northwestern British Columbia although poorly preserved appear to be closely related or identical with forms of more or less world-wide distribution.

In other parts of Canada the Toarcian is widely distributed. In the Fernie Group of the Rocky Mountains and Foothills most of the ammonite genera found in southern Yukon and northwestern British Columbia are present, i.e., *Harpoceras*, *Dactylioceras*, *Peronoceras*, *Grammoceras*, and a similar subdivision of the Toarcian rocks is possible (Frebald, 1957a). The beds containing *Catulloceras?*, however, seem to be absent. In the Salmo and Nelson areas of southern British Columbia, *Harpoceras* cf. *H. exaratum* (Young and Bird) and *Dactylioceras* sp. occur (Frebald, 1959; Frebald and Little, 1962). Elsewhere in British Columbia other Toarcian ammonites, still undescribed, are present. Toarcian beds with *Dactylioceras*, *Catacoeloceras*, and *Pseudolioceras* have a wide distribution in the Canadian Arctic (Frebald, 1957b, 1960). On Queen Charlotte Islands (McLearn, 1932, 1949) and Vancouver Island (still undescribed) the Toarcian ammonites include, in addition to *Harpoceras* and *Dactylioceras*, the genus *Fanninoceras* which is unknown in other parts of Canada.

Lower Bajocian

The presence of ammonites of early Bajocian age in southern Yukon and northwestern British Columbia is doubtful. Some poorly preserved Hildocerataceae possibly belonging to *Leioceras* were found. In the Canadian Arctic parts of the

lower Bajocian are present, i.e., the *Leioceras opalinum* zone which is characterized in that area by the zone-fossil itself and *Pseudolioceras m'clintocki*. *Erycites howelli*, also of early Bajocian age, occurs in northern Yukon. In the Whitesail area of British Columbia *Tmetoceras* indicates the presence of the *Tmetoceras scissum* zone but in other parts of Canada no lower Bajocian seems to be present. It is probable that most of the ammonites of the lower Bajocian are primarily absent in southern Yukon and northwestern British Columbia.

Middle Bajocian

Middle Bajocian rocks are present in both Tulsequah and Telegraph Creek areas. In the Telegraph Creek area some sonniniids appear somewhat below a bed with stephanoceratids thus indicating the presence of two middle Bajocian zones. In the Tulsequah area *Chondroceras allani* (McLearn) was found associated with stephanoceratids (*Stemmatoceras?*) and pelecypods. Sonniniids are known also from others parts of Canada, i.e., from the Hazelton Group of Hudson Bay Mountains, British Columbia (McLearn, 1926) and from the Fernie Group near Lake Minnewanka, Alberta (Frebald, 1957a). They are also represented in the middle Bajocian of southern Alaska (Imlay, 1955, chart 1). *Chondroceras allani* (McLearn) occurs in the middle Bajocian Rock Creek member of the Fernie Group in the Rocky Mountains and Foothills, other species of *Chondroceras* are present on the Queen Charlotte Islands and in the Tyaughton Lake area of British Columbia. The genus is also present on the Alaska Peninsula (Imlay, op. cit.).

The presence of middle Bajocian in southern Yukon is very doubtful. A "*Stephanoceras?*" mentioned by Wheeler (1961, p. 57) from the Whitehorse area is too poorly preserved to establish the presence of this stage in this area with confidence.

The Gaps in the Sequence

The sequence of Lower Jurassic and Bajocian rocks in northwestern British Columbia and southern Yukon is far from complete. Actually only parts of the various Lower Jurassic stages are indicated by index fossils. The absence of other index fossils may be due to many different causes or a combination of causes, including unsuitable environment and restriction of migration. Some of these factors may be the reason for the absence of a number of zone fossils. Two major gaps in the sequence, however, seem to have been caused by non-deposition. One of these includes the upper Sinemurian and the larger part of the lower Pliensbachian; the other is in the upper part of the Pliensbachian. The gaps are indicated by the absence of about eight ammonite zones. None of the numerous ammonites that in other parts of the world belong to these zones has ever been found. It is an interesting fact that these ammonites are also absent in other parts of western Canada and the author is inclined to conclude that time intervals concerned were times of general regressions in western Canada. In some areas, as for example the Salmo and Nelson areas of southern British Columbia, strong volcanic activity took place during these intervals whereas other regions were probably uplifted.

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PLATES I to VIII

PLATE I

(All figures natural size)

Psiloceras canadense Frebold (Page 6)

- Figures 1a, b. 1a, lateral view; 1b, ventral view. Hettangian. Hypotype, GSC 15964. Telegraph Creek area, GSC loc. 28782.
- Figure 2. Lateral view. Hettangian. Hypotype, GSC 15965. Telegraph Creek area, GSC loc. 28782.
- Figure 3. Lateral view. Hettangian. Hypotype, GSC 15966. Telegraph Creek area, GSC loc. 32825.
- Figures 4a, b. 4a, lateral view; 4b, ventral view. Hettangian. Hypotype, GSC 15967. Telegraph Creek area, GSC loc. 28782.
- Figures 5a, b. 5a, lateral view; 5b, ventral view. Hettangian. Hypotype, GSC 15968. Telegraph Creek area, GSC loc. 28782.

Paracoronicerias cf. *P. gmündense* (Oppel) (Page 6)

- Figures 6a, b. Same specimen as Pl. II, fig. 1. 6a, lateral view; 6b, ventral view. Sinemurian, Laberge Group. GSC 15969. Atlin area, GSC loc. 19639.
- Figure 7. Lateral view. Sinemurian, Laberge Group. GSC 15970. Southern Yukon, GSC loc. 5275.

Arnioceras? sp. indet. (Page 7)

- Figures 8a, b. 8a, lateral view of rubbercast; 8b, whorl fragment with suture line. Sinemurian. GSC 15971. Tulsequah area, GSC loc. 40463.



1a



3



2



4a



4b



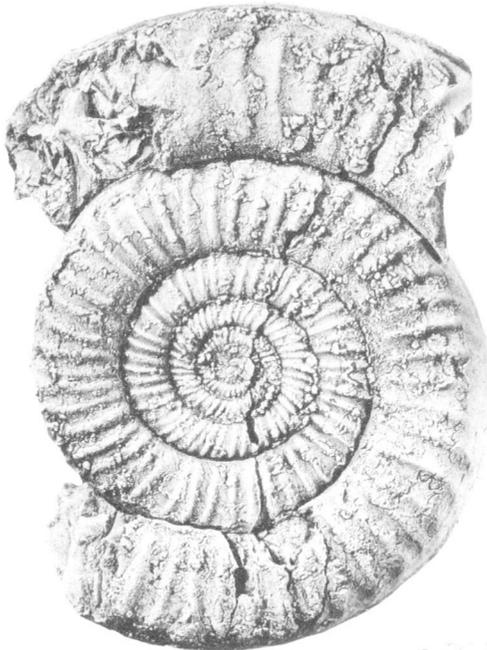
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5b



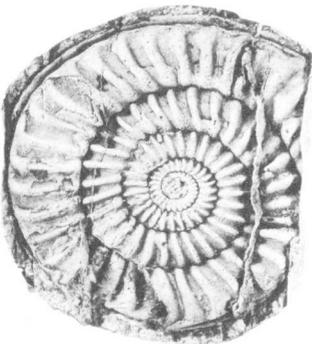
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6a



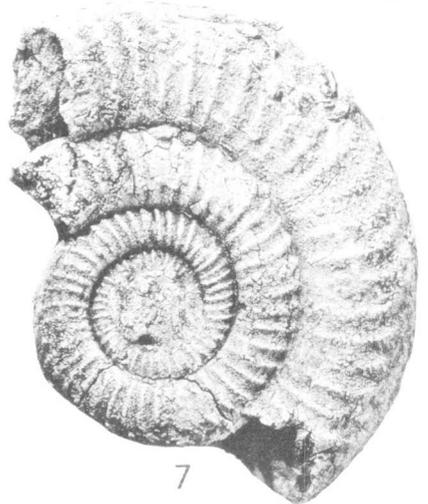
6b



8a



8b



7

PLATE II

(All figures natural size)

- Paracoronicerias* cf. *P. gmündense* (Oppel) (Page 6)
- Figure 1. Same specimen as Pl. I, figs. 6a, b. Lateral view. Sinemurian, Laberge Group, GSC 15969. Atlin area, GSC loc. 19639.
- Amaltheus stokesi* (J. Sowerby) (Page 9)
- Figure 2. Lateral view. Upper Pliensbachian. Hypotype, GSC 15973. Tulsequah area, GSC loc. 40473.
- Figure 3. Lateral view of rubbercast. Upper Pliensbachian. Hypotype, GSC 15974. Southern Yukon, GSC loc. 24833.
- Figure 4. Lateral view. Upper Pliensbachian. Hypotype, GSC 15975. Telegraph Creek area, GSC loc. 32802.
- Figure 5. Lateral view of rubbercast. Upper Pliensbachian. Hypotype, GSC 15976. Tulsequah area, GSC loc. 40473.
- Figure 6. Lateral view. Upper Pliensbachian. Hypotype, GSC 15977. Telegraph Creek area, GSC loc. 32802.
- Ammonite gen. et sp. indet. 1 (Page 22)
- Figure 7. Lateral view. Upper Pliensbachian. GSC 15979. Tulsequah area, GSC loc. 40422.
- Figure 8. Lateral view. Upper Pliensbachian. GSC 15978. Tulsequah area, GSC loc. 40422.
- Figure 9. Lateral view. Upper Pliensbachian. GSC 15980. Tulsequah area, GSC loc. 40422.
- Ammonite gen. et sp. indet. 2 (Page 23)
- Figure 10. Lateral view. Upper Pliensbachian. GSC 15981. Telegraph Creek area, GSC loc. 32773.



5



7



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1



8



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PLATE III

(All figures natural size except fig. 1)

- Figure 1. *Becheiceras* cf. *B. bechei* (Sowerby) (Page 8)
Same specimen as Pl. IV, fig. 1 and Pl. V, fig. 1. Cross-section and part of venter of last whorl. Lower Pliensbachian. GSC 15972. Tulsequah area, GSC loc. 40422. Reduced, actual diameter 193 mm.
- Figure 2. *Prodactylioceras davoei* (Sowerby) (Page 10)
Lateral view of rubbercast. Lower Pliensbachian, Laberge Group. Hypotype, GSC 15982. Tulsequah area, GSC loc. 40424.
- Figures 3a, b. *Arietoceras* cf. *A. algovianum* (Oppel) (Page 13)
3a, lateral view; 3b, cross-section and venter of last whorl. Upper Pliensbachian. Hypotype, GSC 15987. Telegraph Creek area, GSC loc. 32802.
- Figures 4a, b. *Arietoceras algovianum* (Oppel) (Page 13)
4a, lateral view; 4b, ventral view of whorl fragment. Upper Pliensbachian. Hypotype, GSC 15984. Telegraph Creek area, GSC loc. 32773.
- Figures 5a, b. *Arietoceras algovianum* (Oppel) (Page 13)
5a, lateral view; 5b, ventral view. Upper Pliensbachian. Hypotype, GSC 15985. Telegraph Creek area, GSC loc. 32773.



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3b



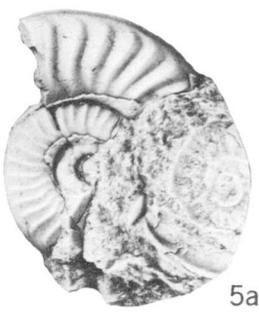
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4a



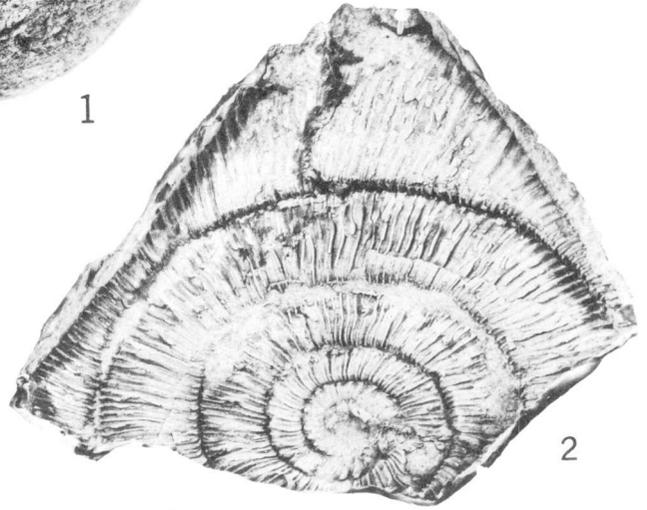
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5a



5b



2

PLATE IV

(All figures natural size except fig. 1)

Becheiceras cf. *B. bechei* (Sowerby) (Page 8)

- Figure 1. Same specimen as Pl. III, fig. 1, and Pl. V, fig. 1. Ventral view. Lower Pliensbachian. GSC 15972. Tulsequah area, GSC loc. 40422. Reduced, actual diameter 193 mm.

Arieticerias algovianum (Oppel) (Page 13)

- Figure 2. Lateral view of rubbercast. Upper Pliensbachian, Laberge Group. Hypotype, GSC 15986. Southern Yukon, GSC loc. 24834.

Arieticerias aff. *A. ruthenense* (Reynès) (Page 14)

- Figure 3. Lateral view. Upper Pliensbachian. GSC 15992. Telegraph Creek area, GSC loc. 32802.

- Figure 4. Lateral view. Upper Pliensbachian. GSC 15993. Telegraph Creek area, GSC loc. 32773.

Leptaleoceras pseudoradians (Reynès) (Page 15)

- Figure 5. Lateral view of rubbercast. Upper Pliensbachian, Laberge Group. Hypotype, GSC 15996. Southern Yukon, GSC loc. 24836.

- Figure 6. Lateral view of rubbercast. Upper Pliensbachian, Laberge Group. Hypotype, GSC 15997. Southern Yukon, GSC loc. 24836.

- Figure 7. Lateral view of rubbercast. Upper Pliensbachian, Laberge Group. Hypotype, GSC 15998. Southern Yukon, GSC loc. 24836.



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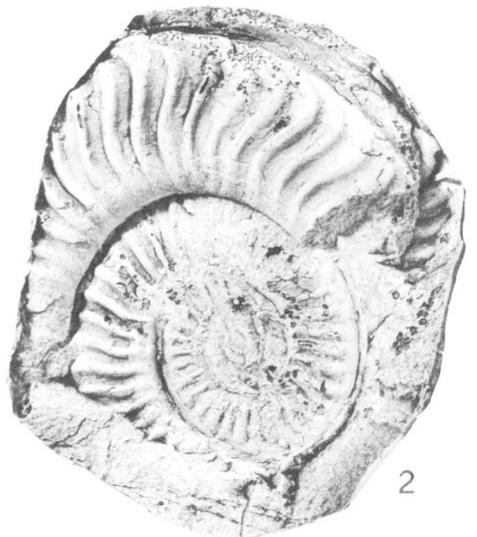
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PLATE V

(All figures natural size except fig. 1)

- Figure 1. *Becheiceras* cf. *B. bechei* (Sowerby) (Page 8)
Same specimen as Pl. III, fig. 1, and Pl. IV, fig. 1. Lateral view. Lower Pliensbachian. GSC 15972. Tulsequah area, GSC loc. 40422. Reduced, actual diameter 193 mm.
- Figure 2. *Arieticerias* cf. *A. algovianum* (Oppel) (Page 13)
Lateral view. Upper Pliensbachian. GSC 15988. Telegraph Creek area, GSC loc. 32802.
- Figure 3. *Arieticerias* cf. *A. algovianum* (Oppel) (Page 13)
Lateral view. Upper Pliensbachian. GSC 15989. Telegraph Creek area, GSC loc. 32773.
- Figure 4. *Leptaleoceras pseudoradians* (Reynès) (Page 15)
Lateral view. Upper Pliensbachian. Hypotype, GSC 15990. Telegraph Creek area, GSC loc. 32773.
- Figure 5. *Leptaleoceras pseudoradians* (Reynès) (Page 15)
Lateral view. Upper Pliensbachian. Hypotype, GSC 15991. Telegraph Creek area, GSC loc. 32773.
- Figures 6a, b. *Arieticerias* cf. *A. gerardi* Monestier (Page 14)
6a, lateral view of GSC 15994; 6b, lateral view of GSC 15995. Telegraph Creek area, GSC loc. 32773.
- Figure 7. *Dactylioceras* sp. indet. (Page 11)
Lateral view of rubbercast. Lower Toarcian. GSC 15999. Tulsequah area, GSC loc. 40475.
- Figure 8. *Dactylioceras* sp. indet. (Page 11)
Lateral view of rubbercast. Lower Toarcian. GSC 16000. Tulsequah area, GSC loc. 43651.
- Figure 9. *Peronoceras* sp. indet. (Page 12)
Lateral view. Lower Toarcian. GSC 16001. Tulsequah area, GSC loc. 40475.

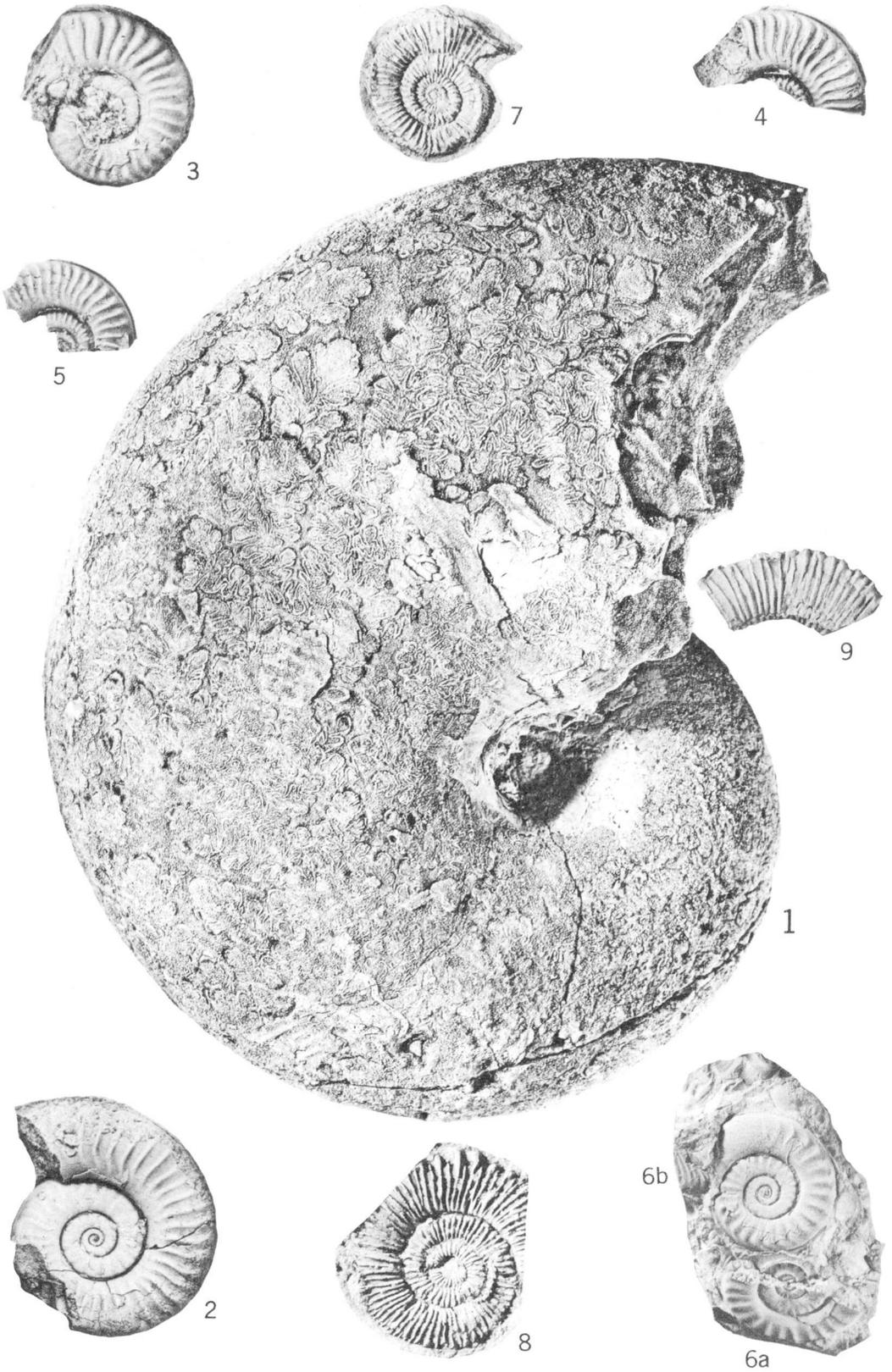


PLATE VI

(All figures natural size)

Harpoceras cf. *H. exaratum* (Young and Bird) (Page 16)

- Figure 1. Lateral view (imprint). Lower Toarcian. GSC 16002. Tulsequah area, GSC loc. 43642.
- Figure 2. Lateral view. Lower Toarcian. GSC 16003. Tulsequah area, GSC loc. 43669.
- Figure 3. Lateral view of rubbercast. Lower Toarcian. GSC 16004. Tulsequah area, GSC loc. 40430.
- Figure 4. Lateral view (imprint). Lower Toarcian. GSC 16005. Tulsequah area, GSC loc. 40438.
- Figure 5. Lateral view. Lower Toarcian. GSC 16006. Tulsequah area, GSC loc. 40449.

Harpoceras sp. juvenile. (Page 16)

- Figure 6. Lateral view. Lower Toarcian. GSC 16007. Tulsequah area, GSC loc. 40449.
- Figure 7. Lateral view. Lower Toarcian. GSC 16008. Tulsequah area, GSC loc. 40449.
- Figure 8. Lateral view. Lower Toarcian. GSC 16009. Tulsequah area, GSC loc. 40430.
- Figure 9. Lateral view. Lower Toarcian. GSC 16010. Tulsequah area, GSC loc. 40449.

Laevicornaptychus (Page 16)

- Figure 10. Lower Toarcian. GSC 16011. Tulsequah area, GSC loc. 40449.
- Figure 11. Lower Toarcian. GSC 16012. Tulsequah area, GSC loc. 40430.
- Figure 12. Lower Toarcian. GSC 16013. Tulsequah area, GSC loc. 40449.
- Figure 13. Lower Toarcian. GSC 16014. Tulsequah area, GSC loc. 40430.

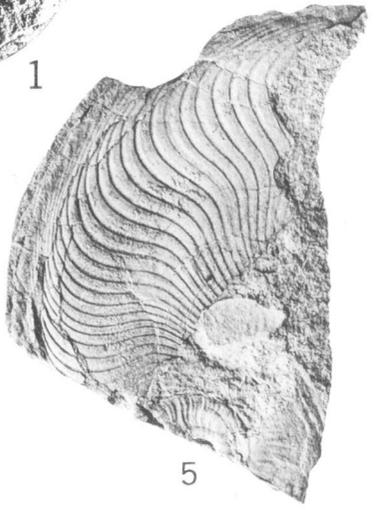
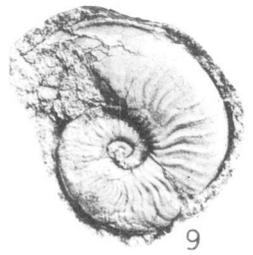


PLATE VII

(All figures natural size)

- Grammoceras* aff. *G. fallaciosum* (Bayle) (Page 17)
- Figure 1. Lateral view of rubbercast. Upper Toarcian, Laberge Group. GSC 16015. Southern Yukon, GSC loc. 19574.
- Figure 2. Lateral view of plastercast. Upper Toarcian, Laberge Group. GSC 16016. Southern Yukon, GSC loc. 7966.
- Grammoceras? boreale* (Whiteaves) (Page 18)
- Figure 3. Lateral view. Upper Toarcian, Laberge Group. Holotype, GSC 9703. Southern Yukon, GSC loc. 43825.
- Figure 4. Lateral view. Upper Toarcian, Laberge Group. GSC 16017. Southern Yukon, GSC loc. 19574.
- Catulloceras? sp. indet.* (Page 16)
- Figure 5. Lateral view of rubbercast. Upper Toarcian, Laberge Group. GSC 16019. Bennett area, GSC loc. 17600.
- Figure 6. Lateral view of rubbercast. Upper Toarcian, Laberge Group. GSC 16020. Bennett area, GSC loc. 21949.
- Figures 7a, b. 7a, lateral view; 7b, ventral view. Upper Toarcian, Laberge Group. GSC 16021. Bennett area, GSC loc. 17600.
- Figure 8. Lateral view of rubbercast. Upper Toarcian, Laberge Group. GSC 16022. Bennett area, GSC loc. 17600.
- Figure 9. Lateral view of rubbercast. Upper Toarcian, Laberge Group. GSC 16023. Bennett area, GSC loc. 21949.

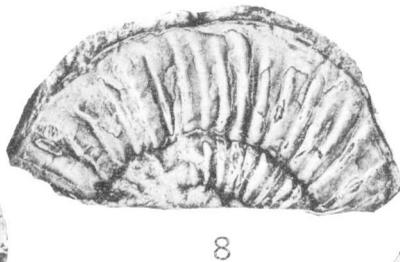
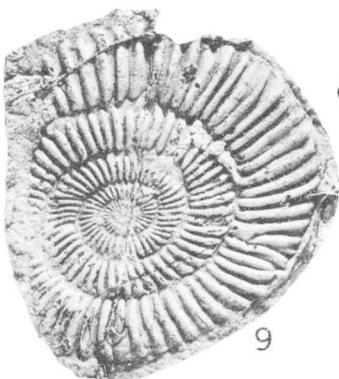
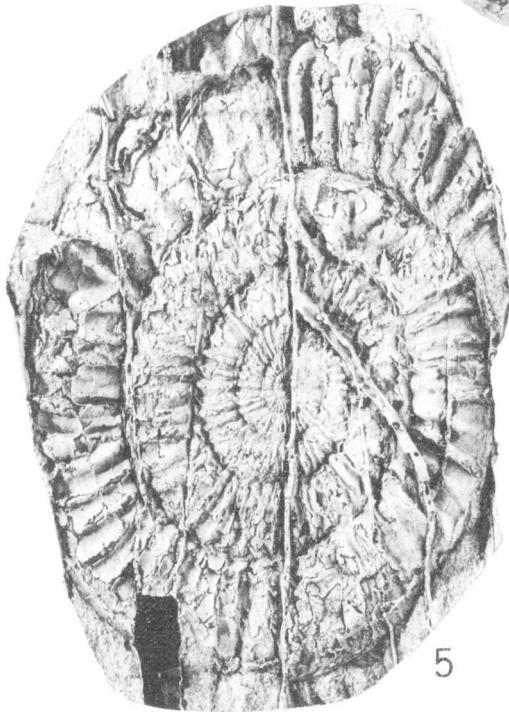
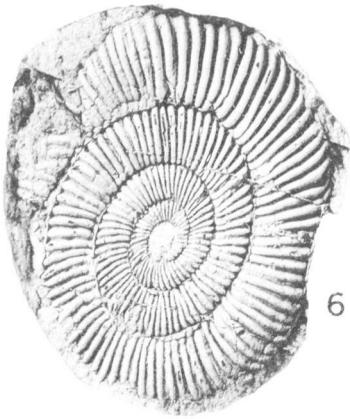


PLATE VIII

(All figures natural size)

Chondroceras allani (McLearn) (Page 20)

- Figures 1a-d. 1a, lateral view; 1b, cross-section and venter of last whorl; 1c, lateral view; 1d, lateral and ventral views. Holotype, GSC 9021. Middle Bajocian. Rock Creek Member, Fernie Group. Headwaters of Sheep Creek, Alberta.
- Figure 2. Lateral view. Middle Bajocian. GSC 16024. Tulsequah area, GSC loc. 43680.
- Figures 3a, b. 3a, lateral view; 3b, inner whorl. Middle Bajocian. GSC 16025. Tulsequah area, GSC loc. 43681.
- Figure 4. Juvenile specimen. Middle Bajocian. GSC 16027. Tulsequah area, GSC loc. 43681.
- Figure 5. Lateral view of fragment, Middle Bajocian. GSC 16026. Tulsequah area. GSC loc. 43681.

Chondroceras sp. indet. (Page 21)

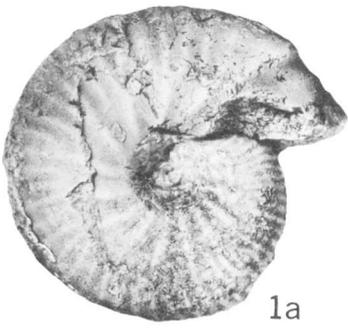
- Figure 6. Lateral view. Middle Bajocian. GSC 16028. Tulsequah area, GSC loc. 43680.

Peronoceras cf. *P. fibulatum* (Sowerby) (Page 11)

- Figure 7. Lateral view. Lower Toarcian. GSC 16033. Stikine River area. GSC loc. 48624.
- Figure 8. Lateral view. Lower Toarcian. GSC 16032. Stikine River area. GSC loc. 48624.

Sonniniids gen. et sp. indet. (Page 19)

- Figures 9, 10. Lateral views. Middle Bajocian. GSC 16030, 16031. Telegraph Creek area, GSC loc. 37110.



1a



1d



1c



7



3a



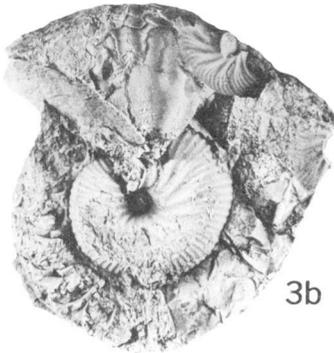
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3b



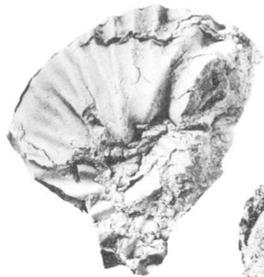
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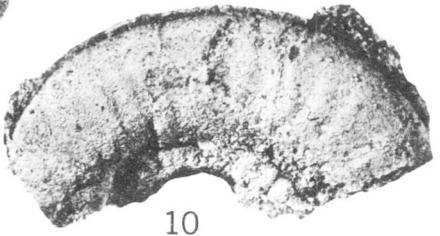
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