



**GEOLOGICAL SURVEY
OF CANADA**

*ECONOMIC GEOLOGY
REPORT No. 1*

**GEOLOGY AND ECONOMIC
MINERALS OF CANADA**

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Scientific Editor**

**DEPARTMENT OF
ENERGY, MINES AND RESOURCES**

CANADA

Distribution and General Features

Faunas of Jurassic age are present in arctic and western Canada, which regions represent two distinctive zoogeographical provinces (Table XI-7). The arctic area includes the northern part of the Canadian arctic islands, northwestern parts of the Northwest Territories, and northern and central Yukon. The western area includes the subsurface of the southern part of the Prairie Provinces, Manitoba, Saskatchewan, and eastern Alberta, the Rocky Mountains and Foothills, various parts of central and western British Columbia, including Vancouver Island and the Queen Charlotte Islands.

The subdivision of the Jurassic into zones and stages is based on ammonites, and in the Upper Jurassic also on representatives of the pelecypod genus *Buchia*. The ammonites also establish the zoogeographical provinces. Of other invertebrates belemnites, pelecypods, gastropods, corals, a few brachiopods, echinoderms, arthropods, and microfaunas occur. There are a few marine vertebrate remains. Of the invertebrate macrofossils, pelecypods and gastropods have also provided valuable guide fossils. Microfaunas have particular importance in the subsurface where macrofossils are rarely available.

A great number of faunal gaps, often coincidental with absence of sediments, are characteristic of the Jurassic in Canada. This is evident when comparing the Jurassic faunas of western Canada with those of northwestern Europe or other parts of the world. A considerable number of the ammonites characteristic of certain zones are missing, sometimes amounting to the greater part of a stage.

Zoogeography

Lower Jurassic ammonite faunas in Canada do not show any zoogeographical differences. Their character is not basically different from that of those of other parts of the world, and most show close affinities, even at the specific level, to the Lower Jurassic ammonites of northwestern Europe. As far as the Hettangian ammonites of British Columbia are concerned, similarities to the north-eastern Alps exist mainly on generic level. Thus, the well-known cosmopolitan character of the Lower Jurassic ammonite faunas is also clearly evident in both western and arctic Canada. Lower Jurassic pelecypods seem to be evenly distributed in these areas, and even show a considerable independence of facies. Corals are, however, restricted to southwestern British Columbia, where they are found in rocks closely associated with volcanic and greywacke sequences.

The same zoogeographical conditions exist in the lower Bajocian, earliest Middle Jurassic. In the middle

Bajocian, the Bathonian, lower and middle Callovian — that is throughout most of the Middle Jurassic, as the presence of upper Callovian is not recognized in Canada — clear zoogeographical differences in the ammonite faunas are apparent, particularly between arctic and western Canada. The arctic province is characterized, in ascending order, by the genera *Arkelloceras* (probably middle Bajocian), *Cranoccephalites* (upper Bajocian and lower Bathonian), *Arctoccephalites* (mainly middle Bathonian), *Arcticoceras* (upper Bathonian), and various arctic species of the genus *Cadoceras* (upper Bathonian and lower Callovian). With few exceptions these faunas are more or less completely represented in East Greenland, Spitsbergen, Frans Josef Land, Novaya Zemlya, and northern Siberia but are still unknown in western Canada. In the western province, the middle Bajocian is characterized uniformly by such genera as *Stephanoceras*, *Stemmatoceras*, *Teloceras*, *Chondroceras*, and others, which are all absent in the arctic province. No typical arctic Bathonian ammonites were found in the western province. The lower Callovian ammonite genera of western Canada as *Paracephalites*, *Warrenoceras*, *Paracadoceras*, *Lilloettia*, *Imlayoceras*, and *Kepplerites* are absent in arctic Canada, but also within the western province some differences in the lower Callovian ammonite fauna seem to exist. The genera *Paracephalites*, *Warrenoceras*, and *Imlayoceras* of the Fernie Group of the Rocky Mountains and Foothills have hitherto not been found in any area of British Columbia whereas *Lilloettia* and *Paracadoceras* found in British Columbia do not appear in the Fernie Group. On the other hand, close faunal and stratigraphic relationships exist between the Callovian ammonite faunas of the Fernie Group and those of the United States western Interior. A fairly rich *Cadoceras* fauna different from that of other parts of western Canada and arctic Canada is present on Vancouver Island.

Beginning with the lower Oxfordian of the Upper Jurassic, the differences between the arctic and western faunal provinces of Canada are no longer recognizable, at least on the basis of present knowledge. The ammonite genera *Cardioceras* and *Amoeboceras* of the lower and upper Oxfordian and lower Kimmeridgian respectively are uniformly distributed in both arctic and western Canada and the same applies to the upper Oxfordian–lower Kimmeridgian pelecypod guide species *Buchia concentrica*. Also in younger Upper Jurassic beds the various *Buchia* species appear widely distributed in both northern and western Canada. However, as ammonites of these beds are extremely rare, it cannot yet be stated with confidence that no different faunal provinces existed in Canada during the late Upper Jurassic.

With the exception of the corals that seem to be restricted to regions of British Columbia, no other groups

TABLE XI-7

Distribution and succession of Jurassic guide fossils

EPOCH	STAGES	ARCTIC ISLANDS	RICHARDSON AND BRITISH MOUNTAINS	CENTRAL YUKON TERRITORY	SOUTHERN YUKON TERRITORY	QUEEN CHARLOTTE ISLANDS	VANCOUVER ISLAND	WESTERN AND INTERIOR PARTS OF BRITISH COLUMBIA	ROCKY MOUNTAINS	SOUTHERN PLAINS			
UPPER JURASSIC	Tithonian	Purbeckian s. st. (Aquilonian, upper Volgian)	<i>Buchia fischeriana</i> <i>Buchia piochii</i>	<i>Buchia fischeriana</i> <i>Buchia piochii</i>	Not known	Absent	<i>Buchia cf. blanfordiana</i>	<i>B. terabrataloides</i> <i>B. fischeriana</i>	<i>Buchia cf. fischeriana</i> <i>Titentis occidentalis</i> <i>Buchia piochii</i>	Present			
		Portlandian or lower Volgian	<i>Buchia mosquensis</i> <i>Buchia</i> spp.	<i>Buchia mosquensis</i> <i>Buchia</i> spp.				Not known	Absent		<i>Buchia mosquensis</i>	<i>Buchia mosquensis</i>	<i>Buchia mosquensis</i>
		Upper Kimmeridgian											
	Middle Kimmeridgian	<i>Amoeboceras</i> sp. <i>Buchia concentrica</i>	<i>Amoeboceras</i> sp. <i>Buchia concentrica</i>	Not known	Absent	<i>Buchia concentrica</i>	<i>Amoeboceras</i> spp. <i>Buchia concentrica</i>	<i>Amoeboceras</i> spp. <i>Buchia concentrica</i>					
	Lower Kimmeridgian												
	Upper Oxfordian	<i>Cardioceras</i> aff. <i>mirum</i>	<i>Cardioceras</i> spp.	<i>Cardioceras</i> spp.	Absent	<i>Cardioceras</i> spp.	<i>Cardioceras</i> spp.	<i>Cardioceras</i> spp. <i>Golathiceras cf. crassum</i>					
Lower Oxfordian	Not Known	Not Known	Not Known	Not Known	Not Known	Not Known	Not Known	Not Known					
MIDDLE JURASSIC	Upper Callovian	Not Known	Not Known	Not Known	Not Known	Not Known	<i>Cadoceras</i> spp.	<i>Lilloistia lilloistensis</i> <i>Stenocadoceras</i> spp. <i>Pseudocadoceras</i> spp.	Not Known	Not Known			
	Middle Callovian	Not Known	Not Known	Not Known	Not Known	Not Known	Not Known	Not Known	Not Known	Not Known			
	Lower Callovian	<i>Cadoceras septentrionale</i> <i>Cadoceras bodylevskyi</i>	<i>Cadoceras septentrionale</i>	<i>Cadoceras</i> spp.	<i>Cadoceras</i> spp.	<i>Keoplenites</i> spp.	<i>Keoplenites</i> spp. <i>Cadoceras</i> sp. <i>Paracadoceras</i> sp. etc.	<i>Imlyoceras maitense</i> <i>Keoplenites mcleani</i> <i>Keoplenites</i> aff. <i>K. tychois</i> <i>Warranoceras henryi</i> <i>Peracephalites glabrescens</i> <i>P. hashimotoi</i>	<i>K. mcleani</i>				
		<i>Keoplenites</i> not known	<i>Keoplenites</i> not known	<i>Cadoceras</i> spp.	<i>Cadoceras</i> spp.	Not Known	Not Known	Not Known	Not Known				
	Bathonian	<i>Arcticoceras ishmeae</i>	<i>Arcticoceras kochi</i>	<i>Arcticoceras</i> spp.	<i>Arcticoceras</i> spp.	Not Known	Not Known	Not Known	Not Known				
		<i>Arctocephalites</i> spp.	<i>Cadoceras crassum?</i>	<i>Arctocephalites elegans</i>	<i>Arctocephalites?</i> sp.	Not Known	Not Known	Not Known	Not Known				
		<i>Cranoc. vulgans</i>	Not Known	Not Known	Not Known	Not Known	Not Known	Not Known	Not Known				
	Upper Bajocian	Not Known	<i>Cranocephalites borealis</i>	Not Known	Not Known	Not Known	Not Known	Not Known	Not Known				
	Middle Bajocian	<i>Arkeloceras</i> spp. <i>Inoceramus lucifer</i>	<i>Arkeloceras elegans</i> <i>Inoceramus lucifer</i>	Not Known	Not Known	Possibly present in part	<i>Stephanoceras</i> spp. <i>Chondroceras</i> spp.	<i>Stephanoceras</i> spp. <i>Chondroceras</i> spp.	<i>Stephanoceras</i> spp. <i>Stemmatoceras</i> spp. <i>Chondroceras</i> spp.	Present			
	Lower Bajocian	<i>Leioceras opalinum</i> <i>Pseudoloceras m'clintocki</i> <i>D. jacksoni</i>	<i>Eryctis cf. howelli</i> and <i>Pseudoloceras</i> sp.	Not Known	Not Known	Not Known	Not Known	<i>Tmatoceras regleyi</i>	Not Known				
LOWER JURASSIC	Toarcian	<i>Pseudoloceras compacta</i> <i>Catacoeloceras spinatum</i>	<i>Pseudoloceras</i> sp.	Not Known	Not Known	<i>Grammoceras</i> aff. <i>G. fallaciosum</i>	<i>Herpoceras</i> spp. <i>Dactyloceras</i> spp.	<i>Herpoceras</i> spp.	<i>Grammoceras boreale</i> <i>Phymatoceras</i> sp.	<i>Grammoceras boreale</i> <i>Phymatoceras</i> sp.			
		<i>Dactyloceras commune</i> <i>Herpoceras cf. exaratum</i>	<i>Dactyloceras commune</i> <i>Herpoceras</i> sp.	Not Known	Not Known	?	Not Known	<i>Dactyloceras</i> spp. <i>Herpoceras cf. exaratum</i>	<i>Dactyloceras</i> sp. <i>Herpoceras cf. exaratum</i>				
	Pliensbachian	Not Known	<i>Amatheus stokesi</i>	Not Known	Not Known	<i>Amatheus stokesi</i> <i>Ameliceras</i> spp. <i>Leptaleoceras</i> sp.	Possibly present	<i>Amatheus stokesi</i> <i>Ameliceras</i> spp. <i>L. pseudoradians</i>	<i>Amatheus</i> spp. <i>Amatheus stokesi</i>	Absent			
		Not Known	Not Known	Not Known	Not Known	<i>Prodcyloceras</i> sp.	Not Known	<i>Becheiceras cf. bechei</i>	Not Known				
Sinemurian	<i>Echioceras</i> s.l.	<i>Echioceras</i> s.l.	Not Known	Not Known	Probably absent	<i>Fanninoceras</i> spp. <i>Tropidoceras</i>	<i>Fanninoceras</i> <i>Acenthopleuroceras</i>	<i>Platyleuroceras</i> sp.	<i>Phnodoceras</i> sp.				
	<i>Gleviceras</i> sp.	<i>Arctosterocheras jeletzkyi</i> <i>Oxynoticeras oxynotum</i> <i>Gleviceras</i> sp.	Not Known	Not Known	Probably absent	<i>Echioceras</i>	<i>Echioceras</i>	<i>Echioceras</i> sp.	<i>Eoderoceras</i> sp.				
	Not Known	Not Known	Not Known	Not Known	Probably absent	<i>Asteroceras?</i>	<i>Asteroceras</i> sp.	<i>Asteroceras</i> sp.	Not Known				
Hettangian	<i>Anelites</i> s.l.	<i>Anelites</i> s.l.	Not Known	Not Known	Not Known	<i>Arnioceras</i> sp. <i>Paracorniceras</i> cf. <i>gmündense</i>	<i>Arnioceras</i> spp.	<i>Arnioceras</i> spp. <i>Corniceras</i>	<i>Anelites</i> spp. <i>Arnioceras</i> spp.				
	Not Known	Not Known	Not Known	Not Known	Not Known	Not Known	Not Known	<i>Pai (Curv.) columbiana</i> <i>Paioceras canadense</i> <i>Pai.</i> aff. <i>planorbis</i>	Not Known				

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seem to be dependent on facies. This may be due partly to the fact that such groups have not yet been studied to the same extent as the ammonites.

Succession of Faunas

The succession of ammonites and buchias is shown in Table XI-7; the latter is based on studies mainly by J. A. Jeletzky. The succession of ammonites in the Lower Jurassic and the lower Bajocian established in various areas of Canada is in agreement with standard sequences in northwestern Europe, and the Hettangian is similar to a certain degree to that of the northeastern Alps. Wherever in Canada a more continuing section could be studied it follows the European pattern and that of other parts of the world, and accordingly the same succession of ammonite zones as in Europe can be applied to the Lower Jurassic of Canada. However, the local or regional incompleteness of the Canadian Lower Jurassic zonal sequence has to be emphasized. The absence of the Hettangian faunas so richly represented in parts of British Columbia in other areas of western and northern Canada is caused by non-deposition of beds of this age. Lower and upper Pliensbachian have now been found in western Canada and are considered to be primarily absent in other areas.

The succession of ammonite faunas and ammonite zones of the Canadian arctic in the upper Bajocian, Bathonian, and Callovian (Table XI-7) is almost the same as the succession in East Greenland established by Callomon (1959). In the middle Bajocian of western Canada, ammonite faunas follow again the northwest European pattern whereas the succession of ammonite faunas in the uppermost Bathonian and the lower Callovian of the Fernie Group in the Rocky Mountains and Foothills is almost

completely the same as in the western Interior of the United States. The absence of upper Callovian ammonites in western Canada and the western Interior indicates a considerable gap in the sequence. In the Oxfordian and lower Kimmeridgian, the succession of ammonite fauna is the same as known from other parts of the world, but in the younger Upper Jurassic stages, ammonites are very rare and, if present, poorly preserved. Consequently, the subdivision of the beds concerned is based mainly on various *Buchia* species that show a zonal arrangement similar to that of other regions.

Selected References

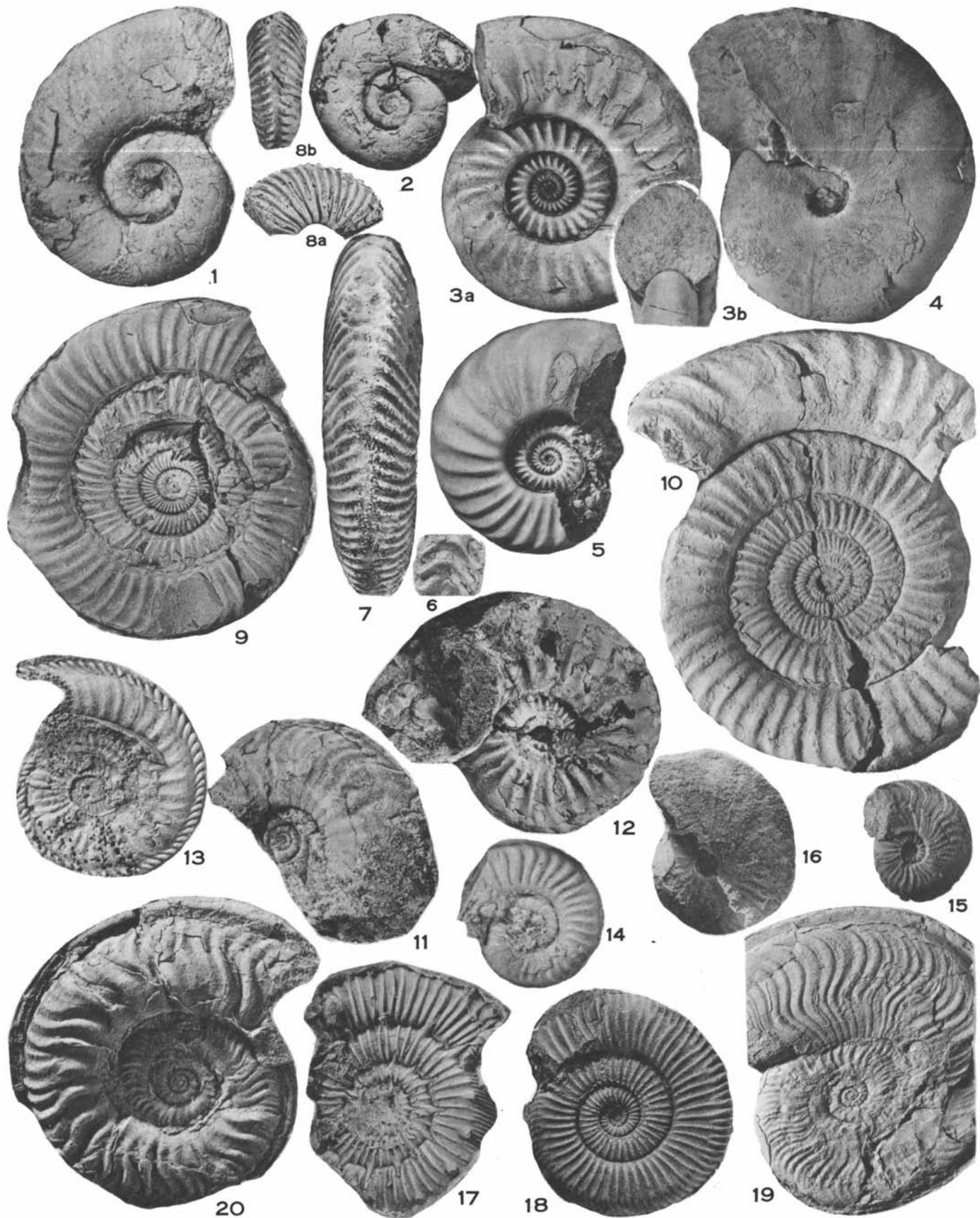
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PLATE XIX. Lower Jurassic Ammonites

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|---------------|--|-----------|---|
| Figure 1 | <i>Eolytoceras tasekoi</i> Frebold. Hettangian; Taseko Lakes, British Columbia; 20059. | Figure 9 | <i>Paracaloceras multicosatum</i> Frebold. Hettangian; Taseko Lakes, British Columbia; 19939. |
| Figure 2 | <i>Psiloceras</i> ex aff. <i>planorbis</i> (Sowerby). Hettangian; Taseko Lakes, British Columbia; 20053. | Figure 10 | <i>Paracoronoceras</i> cf. <i>gmündense</i> (Oppel). Laberge Group, Sinemurian; Atlin, British Columbia; 15969. |
| Figures 3a, b | <i>Psiloceras canadense</i> Frebold. Hettangian; Taseko Lakes, British Columbia; 62504. | Figure 11 | <i>Oxynoticeras oxynotum</i> (Quenstedt). Upper Sinemurian; Aklavik Range, N.W.T.; 14631. |
| Figure 4 | <i>Discamphiceras?</i> <i>tipperi</i> Frebold. Hettangian; Taseko Lakes, British Columbia; 19926. | Figure 12 | <i>Arctoasteroceras jeletzkyi</i> Frebold. Upper Sinemurian; Aklavik Range, N.W.T.; 14623. |
| Figure 5 | <i>Psiloceras (Curviceras) columbiae</i> Frebold. Hettangian; Taseko Lakes, British Columbia; 19921. | Figure 13 | <i>Amaltheus stokesi</i> (Sowerby). Upper Pliensbachian; southern Yukon; 15974. |
| Figure 6 | <i>Psiloceras (Curviceras) columbiae</i> Frebold. Hettangian; Taseko Lakes, British Columbia. | Figure 14 | <i>Arietoceras</i> cf. <i>A. algovianum</i> (Oppel). Upper Pliensbachian; Telegraph Creek, British Columbia; 15989. |
| Figure 7 | <i>Charmasseiceras marmoreum</i> (Oppel). Hettangian; Taseko Lakes, British Columbia; 20056. | Figure 15 | <i>Fanninoceras kunae</i> var. <i>latum</i> McLearn. Maude Formation, Pliensbachian; Queen Charlotte Islands; 9058. |
| Figures 8a, b | <i>Charmasseiceras marmoreum</i> (Oppel). Hettangian; Taseko Lakes, British Columbia; 20052. | Figure 16 | <i>Fanninoceras fannini</i> McLearn. Maude Formation, Pliensbachian; Queen Charlotte Islands; 6493. |

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- Figure 17 *Catacoeloceras spinatum* (Frebold). Wilkie Point Formation, Toarcian; Prince Patrick Island; 13361.
- Figure 18 *Dactyloceras commune* (Sowerby). Wilkie Point Formation, Toarcian; Prince Patrick Island; 13355.

- Figure 19 *Harpoceras* cf. *H. exaratum* (Young and Bird). Toarcian; Tulsequah, British Columbia; 16003.
- Figure 20 *Grammoceras boreale* (Whiteaves). Laberge Group, Toarcian; southern Yukon; 9703.

PLATE XX. Middle Jurassic Ammonites and Pelecypods

- Figure 1 *Stephanoceras yakounense* McLearn. Yakoun Formation, middle Bajocian; Queen Charlotte Islands; 9057.
- Figure 2 *Normannites canadensis* McLearn. Yakoun Formation, middle Bajocian; Queen Charlotte Islands; 9019.
- Figure 3 *Zemistephanus funteri* McLearn. Yakoun Formation, middle Bajocian; Queen Charlotte Islands; 9007.
- Figure 4 *Chondroceras allani* (McLearn). Middle Bajocian; Tulsequah, British Columbia; 16024.
- Figure 5 *Warrenoceras rierdonense* (Imlay). Fernie Group, lower Callovian; Alberta; 14693.
- Figure 6 *Kosmoceras* (*Gulielmiceras*) *knechtli* Imlay. Lower Callovian; Esterhazy Shaft, Saskatchewan; 14696.
- Figure 7 *Torricellites?* *spinosum* Frebold. Fernie Group, lower Callovian; Alberta; 14710.

- Figure 8 *Keplerites newcombii* (Whiteaves). Yakoun Formation, lower Callovian; Queen Charlotte Islands; 5990.
- Figure 9 *Cobbanites* sp. indet. aff. *engleri* Frebold. Fernie Group, lower Callovian; Alberta; 12908.
- Figure 10 *Keplerites mcevoyi* (McLearn). Fernie Group, lower Callovian; Alberta; 5018.
- Figure 11 *Paracephalites glabrescens* Buckman. Fernie Group, upper Bathonian or lower Callovian; Alberta; 14705.
- Figure 12 *Imlayoceras mieltense* Frebold. Fernie Group, lower Callovian; Alberta; 14707.
- Figure 13 *Lima albertensis* McLearn. Fernie Group, upper Bathonian or lower Callovian; Alberta; 6075.
- Figure 14 *Corbula munda* McLearn. Enlarged x3, Fernie Group, upper Bathonian or lower Callovian; Alberta; 6092.

PLATE XXI. Middle Jurassic Ammonites and Pelecypods

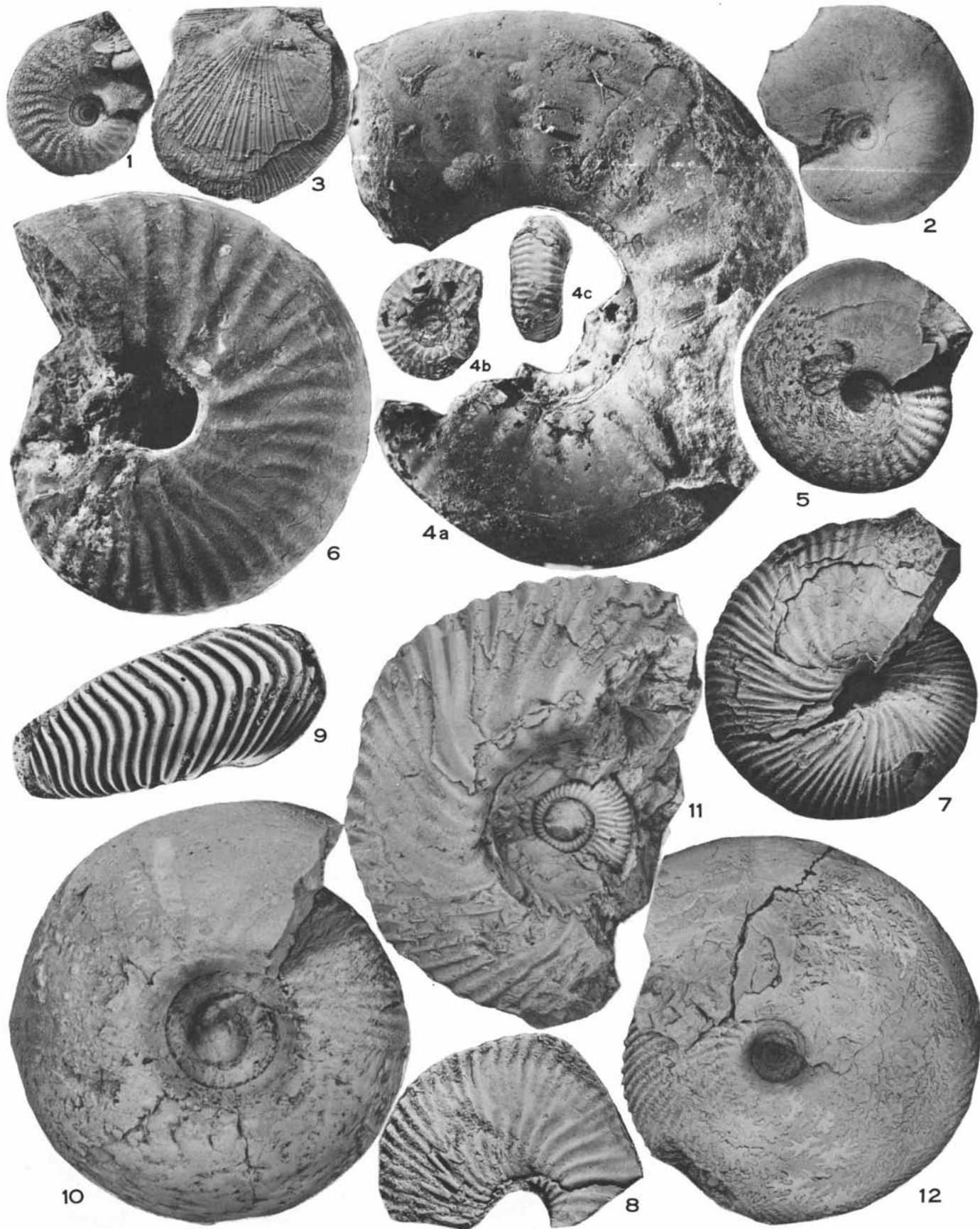
- Figure 1 *Pseudolioceras m'clintocki* (Haughton). Wilkie Point Formation, lower Bajocian; Mackenzie King Island; 14658.
- Figure 2 *Leioceras opalinum* (Reinecke). Wilkie Point Formation, lower Bajocian; Prince Patrick Island; 13379.
- Figure 3 *Oxytoma jacksoni* (Pompeckj). Wilkie Point Formation; lower Bajocian; Prince Patrick Island; 13390.
- Figures 4a-c *Arkelloceras tozeri* Frebold. Wilkie Point Formation, probably middle Bajocian; Prince Patrick Island; 13404.
- Figure 5 *Cranocephalites borealis* (Spath). Bug Creek Formation, upper Bajocian; Aklavik Range, N.W.T.; 15103.

- Figure 6 *Cranocephalites vulgaris* Spath. Wilkie Point Formation, lower Bathonian; Prince Patrick Island; 13398.
- Figure 7 *Arctoccephalites elegans* Spath. Bathonian; Richardson Mountains; 15108.
- Figure 8 *Arcticoceras kochii* Spath. Bathonian; Porcupine River, Yukon; 15117.
- Figure 9 *Arcticoceras ishmae* (Keyserling). Wilkie Point Formation, Bathonian; Prince Patrick Island; 15120.
- Figure 10 *Cadoceras septentrionale* Frebold. Savik Formation, Callovian; Axel Heiberg Island; 17657.
- Figure 11 *Cadoceras* cf. *falsum* Voronets. Savik Formation, Callovian; Axel Heiberg Island; 17659.
- Figure 12 *Cadoceras canadense* Frebold. Callovian; Aklavik Range, N.W.T.; 17664.

PLATE XXII. Upper and Middle Jurassic Ammonites and Pelecypods

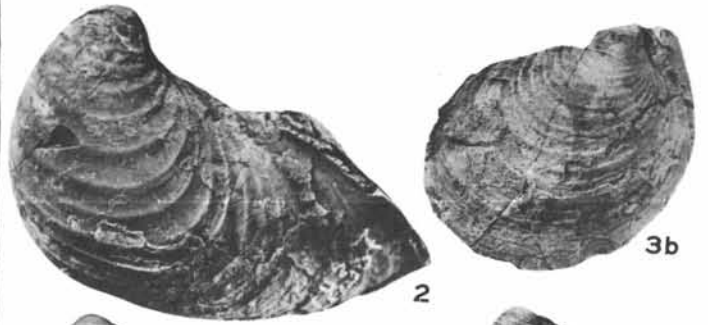
- Figure 1 *Titanites occidentalis* Frebold. Lower Kootenay Sandstone, Portlandian; Fernie, British Columbia.
- Figure 2 *Buchia* cf. *blanfordiana* (Stoliczka). Uppermost Portlandian?; Vancouver Island; 16584.
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- Figure 5 *Buchia mosquensis* (von Buch) sensu lato. Middle Kimmeridgian to lower Portlandian; Dave Lord Ridge, Yukon; 17990.
- Figure 6 *Buchia mosquensis* (von Buch) sensu lato. Middle Kimmeridgian to lower Portlandian; Richardson Mountains, Yukon; 17989.
- Figures 7a, b *Buchia concentrica* (Sowerby) var. *erringtoni* (Gabb). Tyughton Lake, British Columbia; 17012.

- Figure 8 *Pleuromya postculminata* McLearn. Fernie Group, upper Bathonian or lower Callovian; Alberta; 6089.
- Figure 9 *Oxytoma blairmorensis* McLearn. Fernie Group, lower Callovian; Alberta; 6050.
- Figure 10 *Sonninia gracilis* (Whiteaves). Fernie Group, middle Bajocian; Alberta; 4809.
- Figure 11 *Inoceramus lucifer* Eichwald. Wilkie Point Formation, probably middle Bajocian; Prince Patrick Island; 13417.
- Figure 12 *Cardioceras canadense* Whiteaves. Fernie Group, Oxfordian; British Columbia; 7437.
- Figure 13 *Cardioceras* (*Scarburgiceras*) *alphacordatum* Spath. Fernie Group, Oxfordian; Alberta; 13892.
- Figure 14 *Amoeboceras* sp. indet. Mould Bay Formation; upper Oxfordian or lower Kimmeridgian; Mackenzie King Island; 15131.



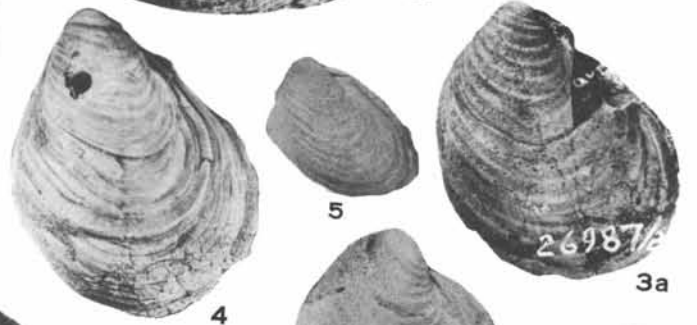


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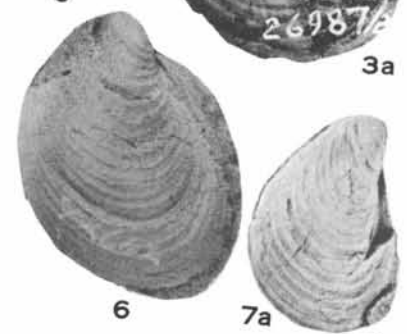
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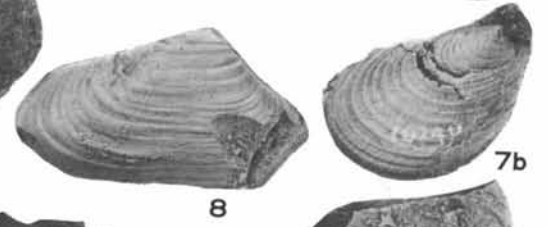
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6

7a



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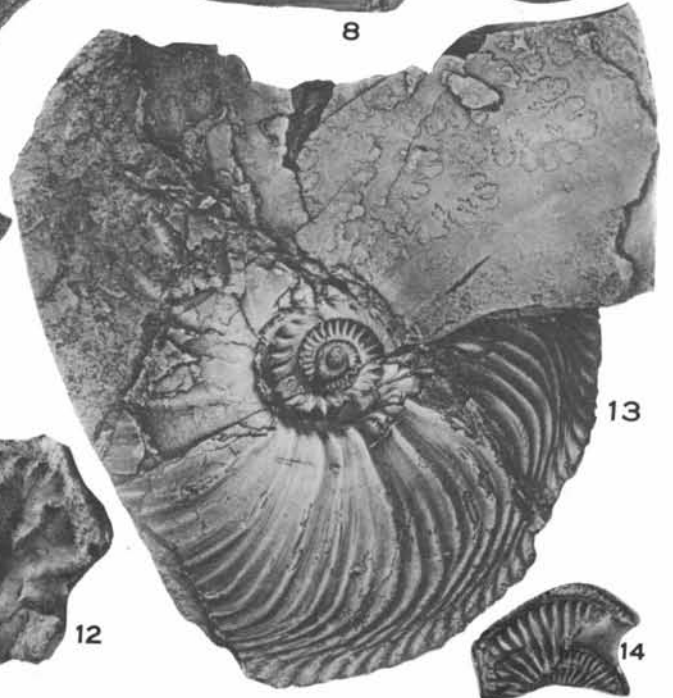
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