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# GEOLOGY AND ECONOMIC MINERALS OF CANADA

R. J. W. Douglas,
Scientific Editor

DEPARTMENT OF
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CANADA

# CRETACEOUS MACROFAUNAS

*by* J. A. Jeletzky

Considerable parts of the Cretaceous System are present throughout much of western and arctic Canada, the faunal successions of which are shown in Table XI-8. None of these faunal successions, however, is complete, and the missing standard zones and stages vary greatly from one region to another.

Only a few groups of macrofossils are practically useful for subdivision of the Canadian Cretaceous rocks. As in some other systems, ammonites are by far the most useful index fossils but are rather unevenly distributed. They may be extremely rare or absent in the Neocomian (Berriasian to Aptian) part of the system, and there less reliable index fossils such as species of *Inoceramus* and *Buchia* (also known as *Aucella*) have to be used. These two pelecypod genera occur in abundance and variety in most marine facies. The remaining pelecypods, including the Trigoniidae, appear to be far too long-ranging or facies-bound to be useful. Although valuable for intercontinental correlation, crinoids and belemnites are too rare and restricted in occurrence for regional or interregional zonal indices. The sponges, echinoderms, corals, brachiopods, gastropods, and crustaceans are very rare and little understood.

In non-marine rocks, reptiles, especially dinosaurs, have been found to be the best index fossils available, but they are rather unevenly distributed and generally rare. More common, but often less reliable, are non-marine mollusca, plants, and ostracoda.

## Boundaries and Major Divisions

The lower boundary of the system is drawn at the base of the Berriasian stage which includes the *Berriasella grandis* zone. The upper boundary is placed at the top of the Maestrichtian stage where ammonites, belemnites, inocerami, dinosaurs, and other Mesozoic index fossils apparently disappear completely (Jeletzky, 1962; Jeletzky and Clemens, 1965). The two-fold subdivision of the Cretaceous System is followed. The boundary between the Lower and Upper Cretaceous is drawn between the Albian and Cenomanian stages as defined by Muller and Schenck (1943), Cobban and Reeside (1952, p. 104), and Jeletzky (1968). In the western Interior region this boundary is placed tentatively between *Neogastroplites mclearni* and *N. septimus* zones.

A close similarity of all boreal marine faunas of Canada with those of northern Eurasia permits general use of the international standard stages based on West European fossil zones and type localities. Furthermore, it is easy to use these stages in the non-marine sequences because of widespread intertonguing with marine rocks. A separate stage scale has recently been proposed by Russell (1964) for the non-marine Cretaceous of the western Interior region. These stages are used as regional zones.

The international standard stages can also be used in the North Pacific faunal realm. However, the North Pacific faunas of Canada have to be correlated with the mixed faunas of South America, India, and Madagascar before they can be correlated with the international standard stages and zones (Popenoe, *et al.*, 1960) and regional zones of other parts of Canada.

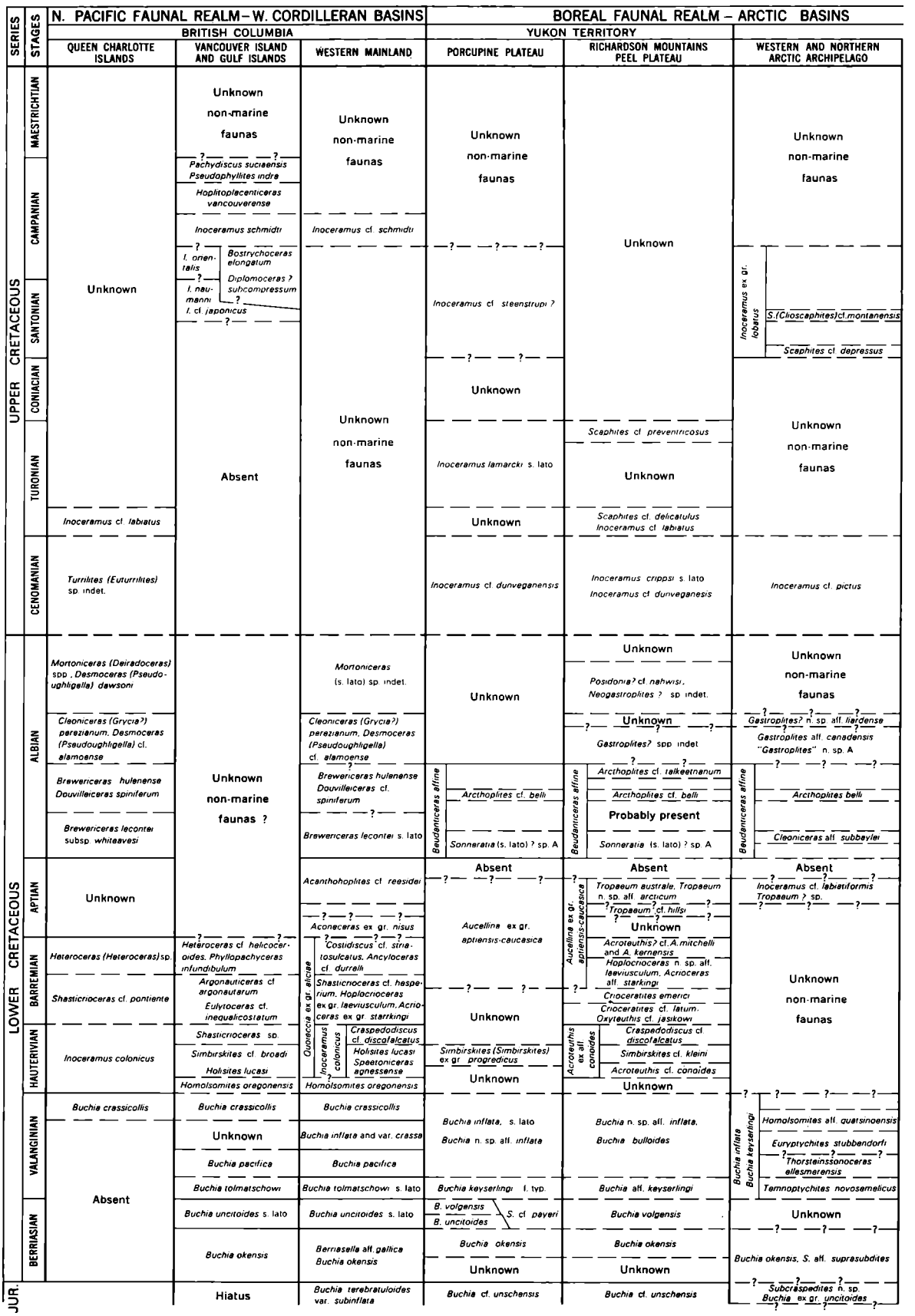
## Marine Faunal Realms

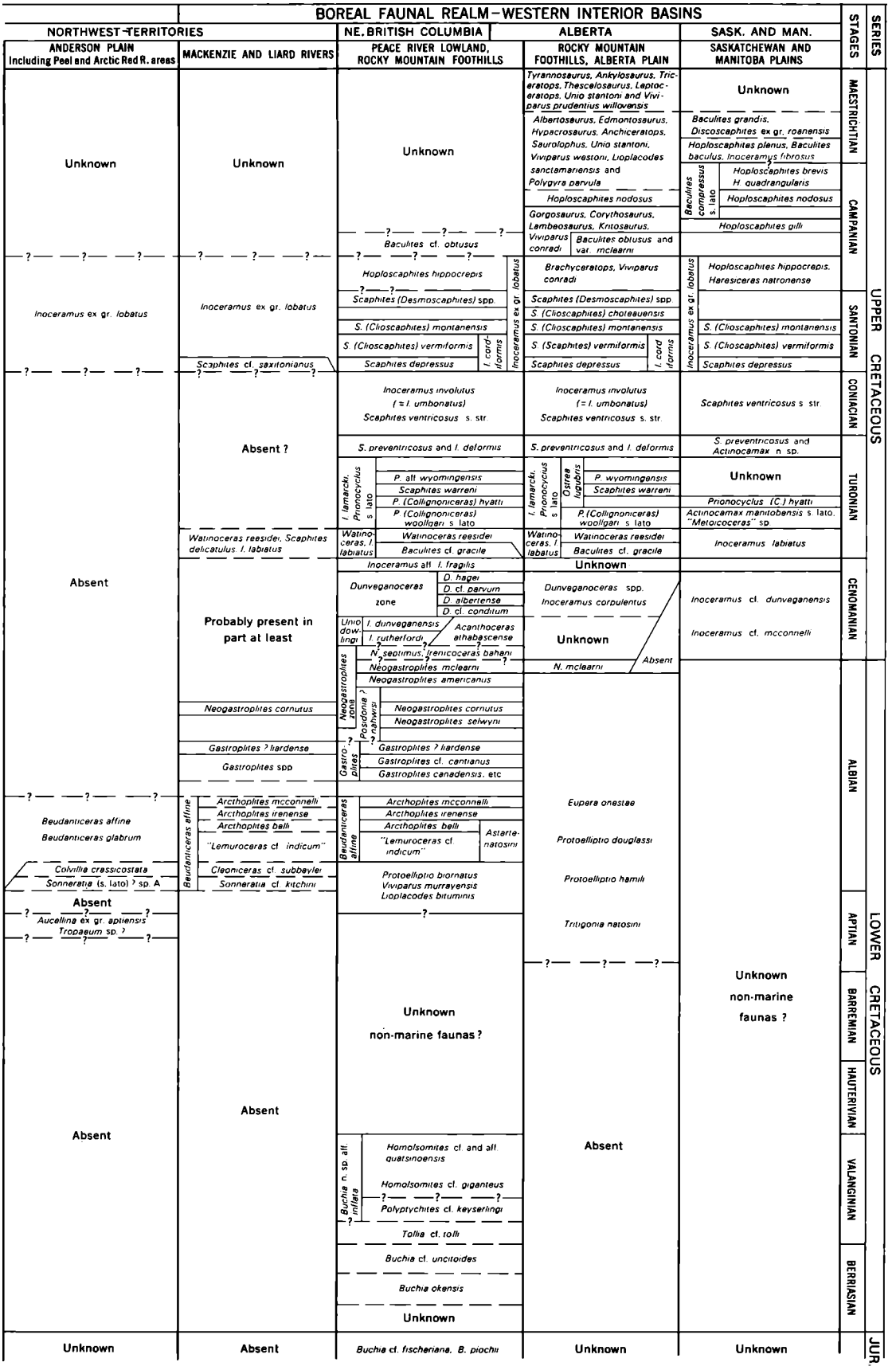
On the whole, the Cretaceous was a time of a progressively increasing differentiation of marine paleozoogeographical provinces or faunal realms. This differentiation was caused by a gradual but major redistribution of land and sea areas in western and arctic Canada during the Lower Cretaceous, followed in the late Upper Cretaceous by a gradual retreat of the seas beyond the present shoreline, completed apparently before the end of the Maestrichtian.

Two principal faunal realms existed throughout Cretaceous time. The North Pacific realm was dominated by marine faunas closely related to those of the Indo-Pacific region, Tethyan, and Andean Geosynclines (Jeletzky, 1965). Its faunas are, however, peculiar in that a number of endemic taxa are present, e.g., *Homolsomites, Shasticrioceras, Shastoceras, Buchia tolmatschowi, Buchia pacifica,* as well as others diagnostic of the Pacific slope of Siberia, Japan, Alaska, and California–Oregon region, e.g., *Inoceramus* ex gr. *naumanni–orientalis–schmidti, Inoceramus colonicus,* and yet others diagnostic of the boreal realm, e.g., *Tollia, Subcraspedites, Simbirskites, Hoplocrioceras, Tropaeum,* and a number of *Buchia* species. The North Pacific realm was restricted to the western Cordilleran region and to the Peace River region during Berriasian to Barremian time. Thereafter it was restricted to the western Cordillera region alone.

The Boreal faunal realm characterized by marine faunas almost identical to those of northern Eurasia was restricted to the Arctic Archipelago and parts of the mainland in northern Yukon during Berriasian to Aptian time. In Albian and Upper Cretaceous time it also included most of the Interior Plains and eastern Cordillera region. On the basis of the generally minor differences between the Albian and Upper Cretaceous marine faunas of the western Interior region and those of arctic Canada, two groups of marine basins may be distinguished in this realm.

**TABLE XI-8** | *Succession and distribution of Upper and Lower Cretaceous faunas*




BOREAL FAUNAL REALM—WESTERN INTERIOR BASINS
NORTHWEST TERRITORIES
ANDERSON PLAIN Including Peel and Arctic Red R. areas
MACKENZIE AND LIARD RIVERS
NE. BRITISH COLUMBIA
PEACE RIVER LOWLAND, ROCKY MOUNTAIN FOOTHILLS
ALBERTA
ROCKY MOUNTAIN FOOTHILLS, ALBERTA PLAIN
SASK. AND MAN.
SASKATCHEWAN AND MANITOBA PLAINS
STAGES
SERIES
UPPER CRETACEOUS
LOWER CRETACEOUS
JUR.
MAESTRICHTIAN
CAMPANIAN
SANTONIAN
CONIACIAN
TURONIAN
CENOMANIAN
ALBIAN
APTIAN
BARREMIAN
HAUTERIVIAN
VALANGINIAN
BERRIASIAN
Unknown
Absent
Absent ?
Probably present in part at least
Absent
Absent
Absent
Unknown
Absent
Unknown
Inoceramus ex gr. lobatus
Scaphites cf. saxitonianus
Watinoceras reesidei, Scaphites delicatulus, I. labiatus
Neogastroplites cornutus
Gastroplites ? liardense
Gastroplites spp
Beudanticeras affine
Beudanticeras glabrum
Colvillia crassicostata
Sonneratia (s. lato) ? sp. A
Aucellina ex gr. aptiensis
Tropaeum sp. ?
Unknown
Baculites cf. obtusus
Hoploscaphites hippocrepis
Scaphites (Desmoscaphites) spp.
S. (Cleoscaphites) montanensis
S. (Cleoscaphites) vermiformis
Scaphites depressus
Inoceramus involutus (= I. umbonatus)
Scaphites ventricosus s. str.
S. preventricosus and I. deformis
I. lamarcki, Prionocyclus s. lato
P. aff. wyomingensis
Scaphites warreni
P. (Collignoniceras) hyatti
P. (Collignoniceras) woolligari s. lato
Watinoceras, I. labiatus
Watinoceras reesidei
Baculites cf. gracile
Inoceramus aff. I. fragilis
Dunveganoceras zone
D. hageri
D. cf. parvum
D. albertense
D. cf. conditum
Unio dowlingi
I. dunveganensis
I. rutherfordi
Acanthoceras athabascense
N. septimus, Irenicoceras bahani
Neogastroplites mclearni
Neogastroplites americanus
Neogastroplites zone
Posidonia ? nahwisi
Neogastroplites cornutus
Neogastroplites selwyni
Gastroplites ? liardense
Gastroplites zone
Gastroplites cf. cantianus
Gastroplites canadensis, etc
Arcthoplites mcconnelli
Arcthoplites irenense
Arcthoplites belli
"Lemuroceras cf. indicum"
Beudanticeras affine
Astarte-natosini
Protoelliptio biornatus
Vivipanus murrayensis
Lioplacodes bituminis
Homolsomites cf. and aff. quatsinoensis
Homolsomites cf. giganteus
Polyptychites cf. keyserlingi
Buchia n. sp. aff. inflata
Tollia cf. tolli
Buchia cf. uncitoides
Buchia okensis
Unknown
Buchia cf. fischeriana, B. piochii
Tyrannosaurus, Ankylosaurus, Triceratops, Thescelosaurus, Leptoceratops, Unio stantoni and Viviparus prudentius willovensis
Albertosaurus, Edmontosaurus, Hypacrosaurus, Anchiceratops, Saurolophus, Unio stantoni, Viviparus westoni, Lioplacodes sanctamariensis and Polygyra parvula
Hoploscaphites nodosus
Gorgosaurus, Corythosaurus, Lambeosaurus, Kritosaurus, Viviparus conradi
Baculites obtusus and var. mclearni
Brachyceratops, Viviparus conradi
Scaphites (Desmoscaphites) spp.
S. (Cleoscaphites) choteauensis
S. (Cleoscaphites) montanensis
S. (Scaphites) vermiformis
Scaphites depressus
Inoceramus involutus (= I. umbonatus)
Scaphites ventricosus s. str.
S. preventricosus and I. deformis
I. lamarcki, Prionocyclus s. lato
Ostrea lugubris
P. wyomingensis
Scaphites warreni
P. (Collignoniceras) woolligari s. lato
Watinoceras, I. labiatus
Watinoceras reesidei
Baculites cf. gracile
Unknown
Dunveganoceras spp.
Inoceramus corpulentus
Unknown
N. mclearni
Absent
Eupera onestae
Protoelliptio douglassi
Protoelliptio hamili
Tritigonia natosini
Absent
Unknown
Baculites grandis, Discoscaphites ex gr. roanensis
Hoploscaphites planus, Baculites baculus, Inoceramus fibrosus
Baculites compressus s. lato
Hoploscaphites brevis
H. quadrangularis
Hoploscaphites nodosus
Hoploscaphites gilli
Inoceramus ex gr. lobatus
Hoploscaphites hippocrepis, Haresiceras natronense
S. (Cleoscaphites) montanensis
S. (Cleoscaphites) vermiformis
Scaphites depressus
S. preventricosus and Actinocamax n. sp.
Unknown
Prionocyclus (C.) hyatti
Actinocamax manitobensis s. lato, "Metoicoceras" sp.
Inoceramus labiatus
Inoceramus cf. dunveganensis
Inoceramus cf. mcconnelli
Unknown non-marine faunas ?

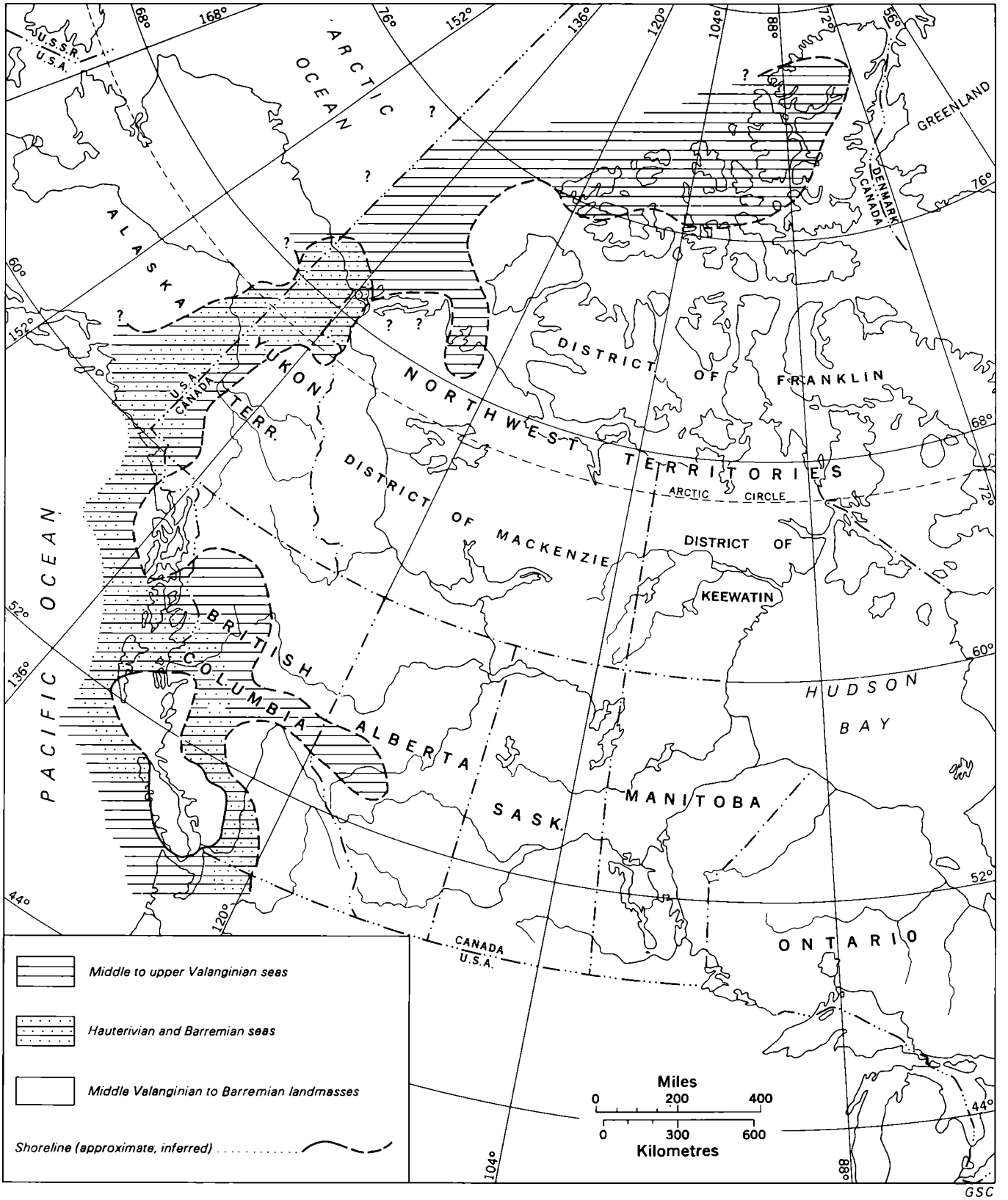



**FIGURE XI-2. Inferred maximum extent of Lower Cretaceous (Berriasian to Barremian) seas in western and arctic Canada.**

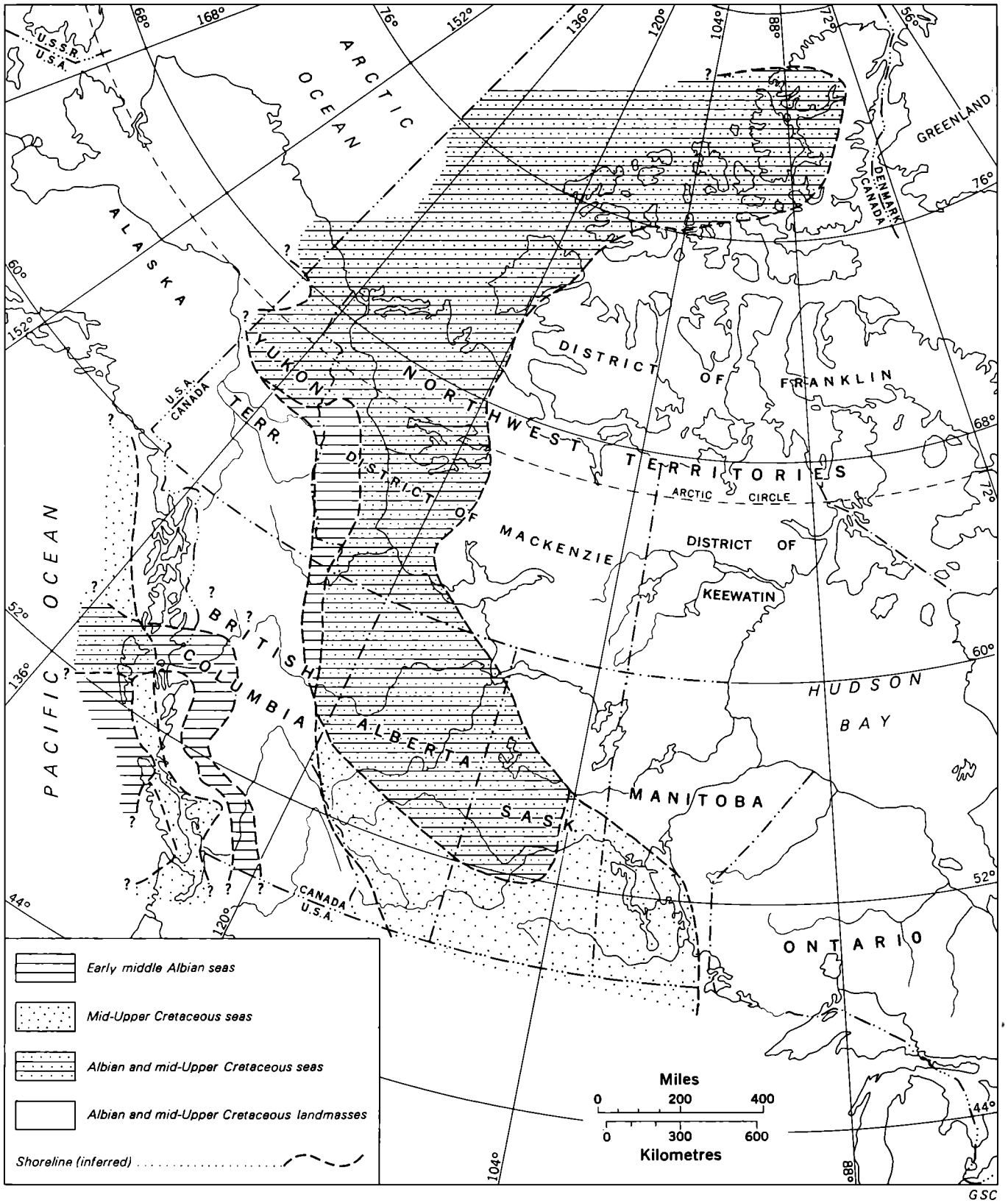



**FIGURE XI-3.** Inferred maximum extent of Early middle Albian and mid-Upper Cretaceous seas in western and arctic Canada.

A characteristic feature of most boreal Cretaceous faunas in Canada is their lack of diversity; they are, as a rule, dominated by only a few, or even a single, molluscan species occurring in great abundance. This extreme faunal depauperation was probably caused by a relative coldness of water and abundance of silt and clay particles compared to more southerly regions of North America and to the North Pacific realm.

The marine faunas of the North Pacific realm contain a great variety of ammonite, pelecypod, and gastropod species and genera. This is especially true of the mid- to late Upper Cretaceous faunas of the Nanaimo Group (Usher, 1952; Whiteaves, 1876-1903) on Vancouver Island.

Even the earliest Cretaceous, Berriasian, marine faunas of the western Cordillera and Peace River regions differ markedly from their arctic counterparts in the presence of Tethyan ammonites such as *Berriasella, Spiticeras, Neocomites,* and marked endemism of *Buchia* species (Jeletzky, 1964, 1965). However, these endemisms are strongly tempered by the presence of a number of species and genera common to the boreal and North Pacific realms which permit reasonably accurate zonal correlations of their Berriasian faunas. The same conditions persisted through Valanginian, Hauterivian, and Barremian times.

The relatively easy exchange of the Berriasian to Barremian marine faunas between the western Cordillera, Peace River, and arctic regions of Canada was facilitated by the existence of at least two apparently more or less narrow seaways as shown in Figure XI-2. Dawson Strait apparently extended from the Kluane Lake–St. Elias area into the Dawson City area, and thence into the northern Yukon and northern Richardson Mountains. Vanderhoof Strait extended from the headwaters of Skeena River into the Carbon Creek area connecting Bowser and Peace River Basins (Fig. XI-2). The inferred maximum extent and general configuration of the Berriasian to Valanginian seas of western and arctic Canada is exemplified by those of the mid- to late Valanginian time; Berriasian and Lower Valanginian seas were similarly distributed but somewhat less widespread. A strong regression resulted in an apparently complete withdrawal of the Hauterivian seas from the Peace River region and their restriction to the depositional troughs in western Cordillera, northern Yukon, and northern Richardson Mountains. The Barremian seas were apparently as extensive as the Hauterivian seas, except that they also penetrated at times into the Peace River region via Vanderhoof Strait (Jeletzky and Tipper, 1968).

In the western Cordillera, Aptian seas were even more restricted than those of Hauterivian–Barremian time. So far as known, they were limited by strong early Aptian uplifts of Vanderhoof and Dawson Straits. However, in northern Yukon and Richardson Mountains Aptian seas were almost as widespread as the Barremian. They probably extended along the Arctic coast to connect directly with the Aptian seas of the European arctic. This radically new configuration of Aptian land and seas (Warren and Stelck, 1961) was similar to that of early middle Albian time (Fig. XI-3), except that the arctic Aptian seas apparently did not extend south beyond Dawson City area, southern Richardson Mountains and a narrow belt of the Arctic coast between the Mackenzie Delta and Darnley Bay area. The complete isolation of the Aptian western Cordilleran marine basins from those of the arctic and western Interior regions persisted throughout Albian and Upper Cretaceous time and is reflected by almost total dissimilarity of the faunas. Except for the extremely rare occurrence of *Arcthoplites* ex gr. *belli* in the *Brewericeras hulenense* fauna of Queen Charlotte Islands (Jones, Murphy, and Packard, 1965; McLearn, *in press)* and the occurrence of *Inoceramus* cf. *labiatus* in the Honna and Skidegate Formations of the same area, the North Pacific and Boreal realms of Canada lack any common species following the Barremian whereas the western Cordilleran basins have a great many species in common with Japan, India, Pacific coast of Siberia, California, etc.

The western Interior boreal basins were connected with the Gulf of Mexico Tethyan seas as early as the middle Albian (Warren and Stelck, 1961). This connection persisted thereafter at least until late Santonian–early Campanian time and possibly into Maestrichtian time. The rather restricted Pacific Upper Cretaceous transgression probably began in Santonian time, except in Queen Charlotte Islands but the western Interior Upper Cretaceous transgression apparently reached its maximum already in lower Turonian (*Inoceramus labiatus*) time.

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Most of the older references have been omitted. They can be found in bibliographies attached to the reports of McLearn and Kindle (1950) or of the writer.


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## PLATE XXIII. Early Lower Cretaceous (Berriasian and Valanginian) Fossils, North Pacific and Boreal Realms

Figures 1a-1b *Acroteuthis subquadratus* (Roemer). Upper Valanginian; Northwest Territories; 17253.

Figures 2a-2c *Buchia inflata* (Toula) var. *crassa* (Pavlow). Mid-Valanginian; British Columbia; 17333.

Figures 3a-3d *Buchia tolmatschowi* (Sokolov) f. typ. Lower Valanginian; British Columbia; 16623.

Figures 4a-4c *Buchia crassicollis* (Keyserling) f. typ. Upper Valanginian; British Columbia; 16659.

Figures 5a-5b *Buchia volgensis* (Lahusen) s. str. Upper Berriasian; Northwest Territories; 16601.

Figures 6a-6c *Neocomites (Neocomites?)* aff. *indomontanus* Uhlig. Middle Valanginian; British Columbia; 17223.

Figures 7a-7b *Spiticeras (Spiticeras)* sp. indet. Juven., upper Berriasian; British Columbia; 16608.

Figures 8a-8b *Tollia (Tollia) paucicostata* (Donovan) var. Lower Valanginian; British Columbia; 16626.

Figures 9a-9c *Buchia uncitoides* (Pavlow) var. *acutistriata* (Crickmay). Upper Berriasian; British Columbia; 16603.

Figures 10a-10b *Tollia (Subcraspedites)* aff. *analogus* (Bogoslovsky). Upper Berriasian; Yukon; 17138.

Figures 11a-11c *Buchia keyserlingi* (Lahusen) f. typ. Lower Valanginian; Northwest Territories; 17163.

Figures 12a-12b *Tollia (Tollia) tolli* (Pavlow) var. *latelobata* Pavlow. Lower Valanginian; Northwest Territories; 17167.

Figures 13a-13c *Buchia okensis* (Pavlow). Lower Berriasian; Northwest Territories; 17122.

Figures 14a-14b *Berriasella* aff. *gallica* Mazenot. Lower Berriasian; British Columbia; 21835.

## PLATE XXIV. Mid-Lower Cretaceous (Hauterivian and Barremian) Fossils, North Pacific Realm

Figures 1a-1c *Speetoniceras agnessense* Imlay. x1, lower Hauterivian; British Columbia; 21821.

Figures 2a-2d *Inoceramus colonicus* Anderson. x1, Hauterivian and lower Barremian; British Columbia; 21822.

Figures 3a-3b *Costidiscus* cf. *striatisulcatus* (d'Orbigny). x1, upper Barremian; British Columbia; 21823.

Figures 4a-4b *Crioceratites (Hemihoplites)* n. sp. ex aff. *C. (H.) soulieri* (Matheron). x1, Barremian; British Columbia; 21824.

Figures 5a-5b *Heteroceras (Heteroceras)* cf. *heliceroides* (Karsten). x1, upper Barremian; British Columbia; 21825.

Figures 6a-6c *Homolsomites oregonensis* (Anderson). x1, lower Hauterivian; British Columbia; 21826.

Figure 7 *Eulytoceras* n. sp. ex aff. *E. inaequalicostatus* (d'Orbigny). x1, Barremian; British Columbia; 21827.

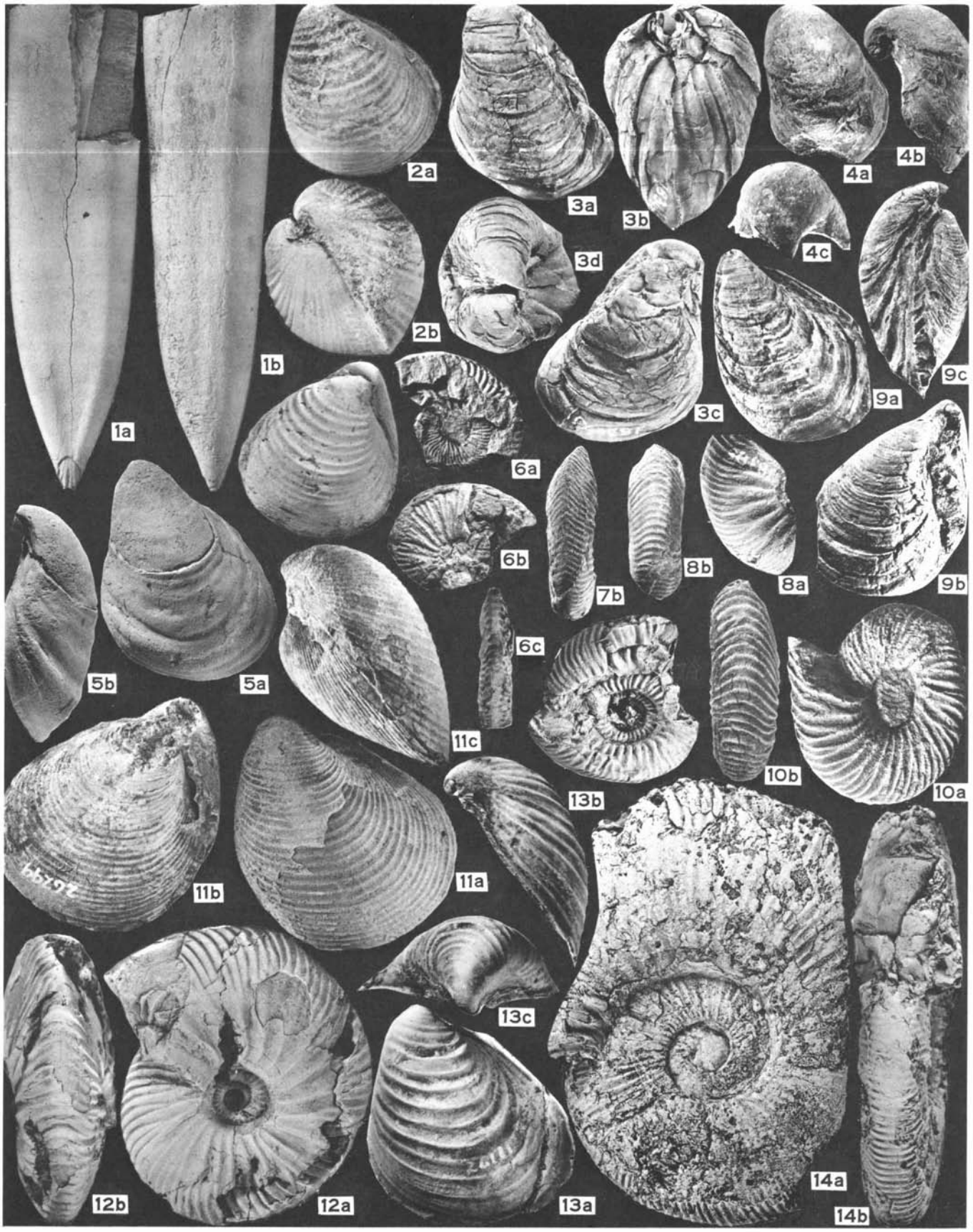
Figures 8a-8b *Phyllopachyceras infundibulum* (d'Orbigny). x1, Barremian; British Columbia; 21828.

Figures 9a-9c *Shasticrioceras* aff. *hesperium* Anderson. x1, Barremian; British Columbia; 21829.

Figures 10a-10c *Heteroceras (Heteroceras)* cf. *heliceroides* (Karsten). x1, upper Barremian; British Columbia; 21830.

Figures 11a-11b *Simbirskites (Hollisites) lucasi* Imlay. xl, lower Hauterivian; British Columbia; 21831.

(Plates XXIII–XXVIII — all figures are natural size unless otherwise stated)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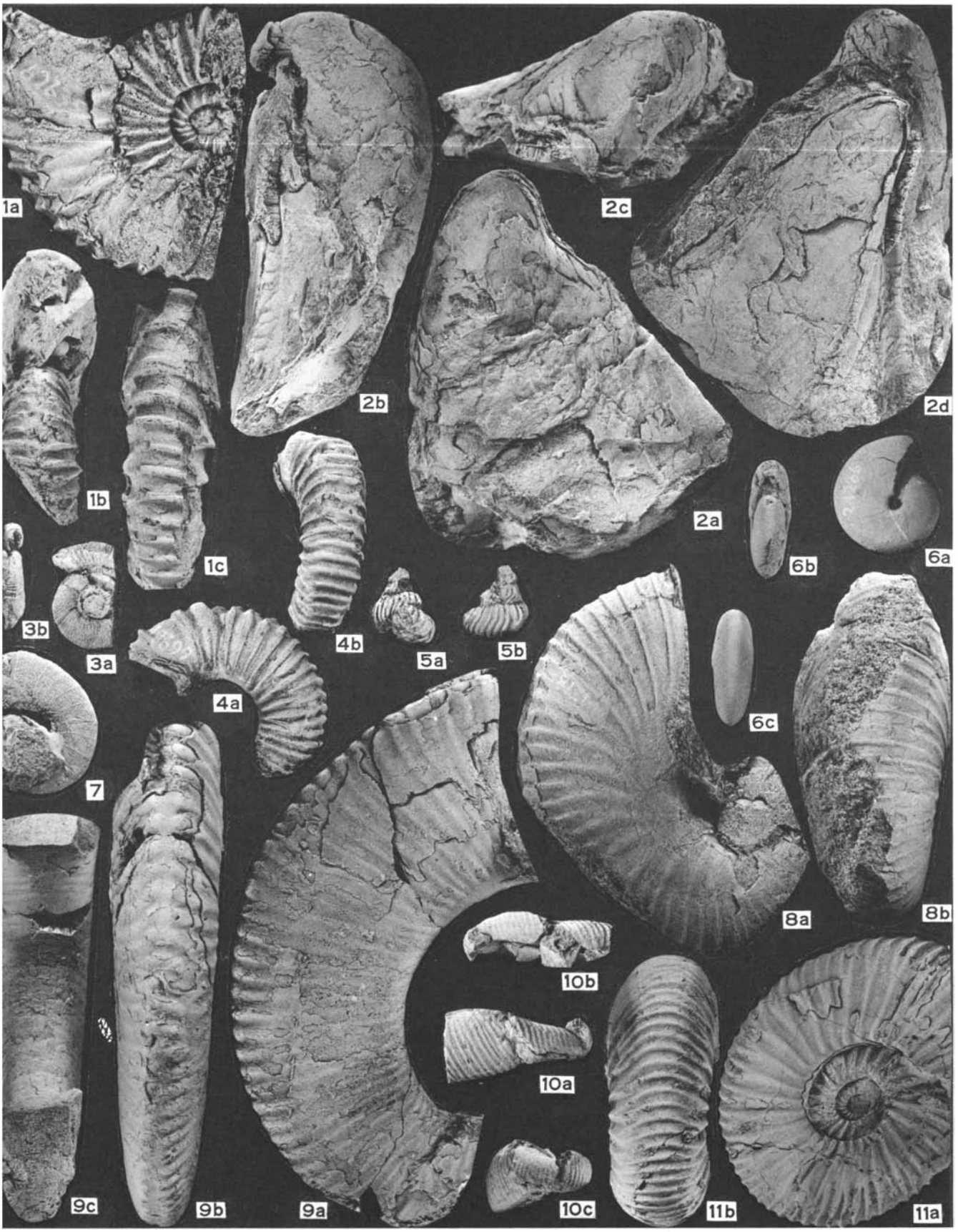
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10b
10c
11a
11b

## PLATE XXV. Mid- to Late Lower Cretaceous (Barremian to Albian) Fossils, North Pacific to Boreal Realms

Figures 1a-1b *Douvilleiceras spiniferum* (Whiteaves). Early middle Albian; British Columbia; 21240.

Figures 2a-2b *Cleoniceras (Grycia?) perezianum* (Whiteaves). Middle Albian; British Columbia; 21233.

Figures 3a-3c *Gabbioceras?* ex gr. *wintunium* Anderson. Lower Aptian or upper Barremian; British Columbia; 21818.

Figures 4a-4c *Douvilleiceras spiniferum* (Whiteaves). Early middle Albian; British Columbia; 5993.

Figures 5a-5b *Ancyloceras (Dissimilites)* n. sp. ex aff. *A. (D.) dissimile* (d'Orbigny). Barremian; British Columbia; 21819.

Figure 6 *Argonauticeras* aff. *argonautarum* Anderson. Lower Aptian or upper Barremian; British Columbia; 21820.

Figures 7a-7b *Brewericeras hulenense* (Anderson). Early middle Albian; British Columbia; 4984.

Figures 8a-8b *Aucellina gryphaeoides* (J. deC. Sowerby). Albian; British Columbia; 17396.

Figures 9a-9b *Arcthoplites belli* (McLearn). Early middle Albian; British Columbia; 17407.

Figures 10a-10b *Gastroplites canadensis* (Whiteaves). Late middle Albian; British Columbia; 7430.

Figures 11a-11b *Aucellina aptiensis* (d'Orbigny) Pompeckj, 1901, var. *nassibianzi* Sokolov, 1908. Aptian; Mackenzie District, N.W.T.; 17319.

Figures 12a-12b *Tropaeum* n. sp. aff. *arcticum* (Stolley). Early upper Aptian; Mackenzie District, N.W.T. (?); 17322.

Figures 13a-13b *Beudanticeras affine* (Whiteaves). Lower and early middle Albian; Alberta; 17400.

Figures 14a-14b *Neogastroplites maclearni* Reeside and Cobban. Late upper Albian; Alberta; 13658.

Figure 15 *Posidonia? nahwisi* (McLearn) var. *goodrichensis* (McLearn). Early upper Albian; British Columbia; 8943.

## PLATE XXVI. Upper Cretaceous (Turonian to Lower Campanian) Fossils, Boreal Realm

Figures 1a-1c *Inoceramus lamarcki* Parkinson. Upper Turonian; Alberta; 21836.

Figures 2a-2b *Scaphites depressus* Reeside. Basal Santonian; Alberta; 21837.

Figure 3 *Prionocyclus (Prionocyclus) wyomingensis* Meek var. *robusta* Haas. Late upper Turonian; Alberta; 21838.

Figures 4a-4b *Watinoceras* cf. *coloradoense* (Henderson). Lower Turonian; British Columbia; 21839.

Figures 5a-5b *Haresiceras natronense* Reeside. Early lower Campanian; Manitoba; 21840.

Figure 6 *Inoceramus labiatus* (Schlotheim). Lower Turonian; Alberta; 21841.

Figures 7a-7b *Scaphites carlilensis* Morrow. Mid-upper Turonian; Manitoba; 21842.

Figures 8a-8b *Prionocyclus (Prionocyclus) wyomingensis* Meek var. *elegans* Haas. Late upper Turonian; Alberta; 21843.

Figures 9a-9b *Prionocyclus (Collignoniceras) woolgari* (Mantell). Early upper Turonian; British Columbia; 21844.

Figure 10 *Desmoscaphites* aff. *bassleri* Reeside. Uppermost Santonian; Alberta; 21845.

## PLATE XXVII. Upper Cretaceous (Cenomanian to Maestrichtian) Fossils, Boreal Realm

Figures 1a-1b *Ponteixites robustus* Warren. Uppermost Campanian or ? basal Maestrichtian; Saskatchewan; 21846.

Figures 2a-2b *Inoceramus coulthardi* McLearn. Basal Santonian; British Columbia; 6104.

Figure 3 *Inoceramus patootensis* de Loriol. Upper Santonian to early lower Campanian; Alberta; 21847.

Figures 4a-4b *Baculites compressus eliasi* Cobban. Uppermost Campanian; Saskatchewan; 21848.

Figure 5 *Inoceramus corpulentus* McLearn. Upper Cenomanian; British Columbia; 6109.

Figure 6 *Scaphites hippocrepis* deKay. Early lower Campanian; Saskatchewan; 21849.

Figures 7a-7b *Scaphites nodosus* Owen. Mid-upper Campanian; Saskatchewan; 5369.

Figure 8 *Inoceramus steenstrupi* de Loriol. x½, early lower Campanian and ?upper Santonian; Northwest Territories; 21851.

Figures 9a-9b *Scaphites brevis* Meek. Uppermost Campanian or ?basal Maestrichtian; Saskatchewan; 21852.

Figures 10a-10b *Scaphites (Discoscaphites)* ex gr. *roanensis* Stephenson. Lower? Maestrichtian; Saskatchewan; 21853.

## PLATE XXVIII. Mid- to Late Upper Cretaceous (Santonian to Campanian) Fossils, North Pacific Realm

Figures 1a-1b *Inoceramus schmidti* Michael s. str. Early upper Campanian?; British Columbia; 5832.

Figures 2a-2b *Inoceramus naumanni* Yokoyama s. str. Upper Santonian?; British Columbia; 21832.

Figures 3a-3b *Epigoniceras epigonum* (Kossmat). Upper Santonian to early lower Campanian; British Columbia; 10015.

Figures 4a-4b *Neophylloceras ramosum* (Meek). Latest upper Campanian?; British Columbia; 5811.

Figures 5a-5c *Inoceramus elegans* Sokolov. Early upper Campanian?; British Columbia; 21833.

Figure 6 *Nostoceras hornbyense* (Whiteaves). Latest upper Campanian?; British Columbia; 10069.

Figure 7 *Bostrychoceras elongatum* (Whiteaves). x½, upper Santonian to early lower Campanian; British Columbia; 10062.

Figure 8 *"Hamites" obstrictus* Jimbo. Latest upper Campanian?; British Columbia; 5958.

Figures 9a-9c *Inoceramus* cf. *sachalinensis* Sokolov. Early upper Campanian?; British Columbia; 21834.

Figures 10a-10b *Schluteria selwyniana* (Whiteaves). Upper Santonian to early lower Campanian; Washington, U.S.A.; 5803b.

Figures 11a-11b *Ptychoceras vancouverense* Whiteaves. Upper Santonian to early lower Campanian; British Columbia; 5798.

Figures 12a-12b *Pachydiscus suciaensis* (Meek). Latest upper Campanian?; British Columbia; 10035.