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**REVISION OF THE LOWER CRETACEOUS OF THE
WESTERN INTERIOR OF CANADA**

BY
F. H. Mc Learn



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Illustration

Figure 1. Table showing correlation of Lower Cretaceous formations and their stratigraphic positions with relation to certain known fossil zones. Facing page - 1

LOWER CRETACEOUS

LOWER CRETACEOUS										
Neo-comian	Bar-remian	Aptian	Albian				EUROPE			
Kootenay		Blairmore group						BLAIRMORE		
Nikanassin		Blairmore group						MOUNTAIN PARK		
		Cadomin	Luscar	Mountain Park						
Bullhead group		Fort St. John group						PINE VALLEY		
Dunlevy		Gething	Moosebar	Commotion	Hasler	Goodrich	Cruiser			
Bullhead group		Fort St. John group						WEST PEACE VALLEY		
Dunlevy		Gething	Moosebar	Gates	Hasler	Goodrich	Cruiser			
Bullhead group		Fort St. John group						SIKANNI CHIEF RIVER		
		Buckinghorse								
		Sikanni								
		4th. ss.								
		3rd. ss.								
		Fort St. John group						LIARD RIVER		
		Lepine								
		Scatter								
		Garbutt								
		↓								
		Fort St. John group						EAST PEACE VALLEY		
		Shaftesbury								
		Peace R.								
		Cadotte ss.								
		Sh. ss.								
McMurray ?		Loon River						EAST ATHABASKA VALLEY		
McMurray		Fort St. John group								
		'Pelican shale'								
		Grand Rapids								
		Clearwater								
		Lemuroceras and B. affine						AMMONOID ZONES		
		Inoceramus downingi								
		'Astarte' natosini								
		Elliptio hamili								
		Elliptio biornatus								
		Neogastropilites						PELECYPOD ZONES		
		Gastropilites								
		Inoceramus cadottensis								
		P. nahvisi								
		Posidonomya nahvisi var. goodrichensis								

Figure 1

Table showing correlation of LOWER CRETACEOUS formations and their stratigraphic positions with relation to certain known fossil zones.

Geological Survey, Canada

Figure 1
Table showing correlation of LOWER CRETACEOUS formations and their stratigraphic positions with relation to certain known fossil zones.

REVISION OF THE LOWER CRETACEOUS OF THE WESTERN INTERIOR OF CANADA

INTRODUCTION

Recent studies require a revision of the Lower Cretaceous correlation table constructed 12 years ago (McLearn, 1932)¹. The additions and alterations are based on field studies by officers of the

¹ A list of references is given at the end of this report.

Geological Survey and on palaeontological studies by the writer. A revision by Dr. L. F. Spath (1942) of the age of the "Ammonite Bed" of the Abur group in India also calls for changes in our Canadian correlations.

Although considerable progress has been made in the study of our Lower Cretaceous a final revision is not yet possible. The new table (See Figure 1) embodies the most reasonable correlations that can be made with the evidence now available. It is hoped that it will be of use to geologists investigating the petroleum resources of the Canadian interior and, in particular, the Foothills and northern Great Plains.

Acknowledgment is made to Mr. C. R. Stelck, formerly with the British Columbia Department of Mines, and Dr. A. O. Hayes, who was in charge of a field party for the Socony Vacuum Oil Company, for information kindly furnished.

THE NON-MARINE SOUTHWEST

In Blairmore and Castle River areas, the Lower Cretaceous includes sandstones, shale, and coal of the non-marine Kootenay formation overlain by conglomerates, sandstones, and shales of the non-marine Blairmore group. At the base of the Blairmore is a persistent conglomerate. With some variations this assemblage persists for a great distance northwest along the Foothills.

In Mountain Park area the section differs somewhat from that at Blairmore, and McKay (1930) has proposed a somewhat different classification and a new nomenclature. At the base are mainly freshwater sandstones, shales, and very rare and thin coal seams of the Nikanassin. Then follow the beds of the Blairmore group, including the basal, probably non-marine conglomerates of the Cadomin formation, the mostly freshwater sandstones, shales, and coal seams of the Luscar formation, and the apparently non-marine sandstones and shales of the Mountain Park formation.

THE GREAT MARINE EXPANSION OF THE NORTH

To the north a very different situation exists, for there the Lower Cretaceous includes a large proportion of marine beds that record southward invasions of the Boreal sea. Just as the non-marine Blairmore group is typical of the southwest, so the dominantly marine Fort St. John group is specific of the north. In the lower part of the section, however, non-marine beds persist north along the Foothills, where they form the greater part of the Bullhead group.

The Lower Cretaceous section in Pine River Valley, as revised by Wickenden and Shaw (1943), includes the conglomerates, sandstones, shale,

and coal of the mostly freshwater Bullhead group overlain by formations of the Fort St. John group. The latter group includes the marine shales of the Moosebar; the conglomerate, sandstone, and shale of the partly marine and partly non-marine Commotion formation; the shales of the marine Hasler; the sandstones of the marine Goodrich; and the shales of the marine Cruiser formations.

Spivak (1944) has traced the Goodrich formation into the Peace River foothills where the section is much like that on the Pine. The Commotion formation, however, is partly replaced by shale, so that only a small and lower part remains as the marine sandstone of the Gates formation in western Peace River Valley. The Hasler thus has a longer downward range than in Pine Valley, as it includes equivalents of Commotion strata.

On Sikanni Chief River, adjacent to the Alaska Highway, Hage (1944) has recognized several formations, including a somewhat modified Bullhead group and two formations included by him in the Fort St. John group. The lower, which he names the Buckinghorse formation, is a thick succession of dark, marine shales, and the higher formation, which he calls the Sikanni, consists of marine sandstone and shale. The Sikanni contains, in its lower part, four sandstone members that Hage refers to as the first, second, third, and fourth sandstones.

Kindle (1944) has studied the Lower Cretaceous section on Liard River. There, a thick, probably marine shale, the Garbutt, is overlain by marine sandstone and shale, comprising the Scatter formation. Above this is another thick marine shale formation, the Lepine.

No recent work has been done on the lower Peace River section. It is not known whether the sandstone, found at the base of the Cretaceous section in deep wells near the town of Peace River, should be considered a western extension of the McMurray formation or merely a sandy phase at the base of the Loon River formation. The marine shales of the Loon River, the mostly marine shales and sandstones of the Peace River formation, and the marine shales of the Shaftesbury formation are included in the Fort St. John group. It may be recalled that the upper or Cadotte member of the Peace River formation, near the town of Peace River, consists of massive sandstone and is at least in part of non-marine origin, whereas to the north, below Cadotte River, it has passed over into marine, thinly bedded shale and sandstone. The name Shaftesbury has been proposed (McLearn and Henderson, 1944) to include what was formerly called the Fort St. John formation in the eastern Peace River section.

The classification and nomenclature of the Lower Cretaceous section on lower Athabaska River remains as before. The mostly non-marine sandstones of the McMurray formation, with their peculiar, large scale, foreset beds, are overlain by the marine sandstones and shales of the Clearwater, by the mostly freshwater sandstones of the Grand Rapids formation, and by the marine shale of the 'Pelican Shale' formation. All three can be placed in the Fort St. John group.

CORRELATIONS

Use of Floras

No new information has been published on our Lower Cretaceous floras and the succession of Kootenay, Lower Blairmore, and Upper Blairmore floras (McLearn, 1916, 1929; Berry, 1929) still stands.

Kootenay flora, as known in the southwest, has not yet been located farther north along the Foothills in either the Nikanassin or

Dunlevy formations. These formations are, consequently, only correlated with the Kootenay on the basis of a similar stratigraphic position.

Lower Blairmore flora has proved to be a useful criterion for correlating the lower part of the Blairmore group with the Luscar, Gething, and equivalent formations, and is so used by W. A. Bell of the Geological Survey. Its correlation with the Aptian of Europe continues to stand.

Upper Blairmore flora has not been found at any new locality and is, as yet, only known from the Castle River and Blairmore areas of southwestern Alberta. This flora is correlated with the Albian of Europe.

In the north, a few dicotyledons have been found in the Commotion formation of Pine River Valley and its probable equivalent in the Monkman Pass area. Bell assigns them an Albian correlation.

Use of Non-marine Faunas

The use of non-marine faunas in correlation has been limited. The fauna of the lower part of the Blairmore group is only well known in the locality where it was first described, that is the Blairmore area. Farther north, on Elbow River, Beach collected a small fauna with Elliptio cf. hamili, an index fossil of the Blairmore fauna that affords correlation with the lower part of the Blairmore of the type area. Hage also has collected species of this fauna, Sphaerium onestae and Corbula ? palliseri, in the Pekisko Creek Forest Reserve, recording the presence of lower Blairmore beds there. This fauna is not distributed widely enough for common use in correlation, but in the few places where it does occur it serves to confirm the evidence afforded by the more widespread Lower Blairmore flora.

Russell has studied the non-marine invertebrate fauna of the McMurray formation on lower Athabaska River. As known, it is a small fauna and has no species in common with the Lower Blairmore fauna. Russell (1932), however, notes that Elliptio biornatus shows considerable resemblance to Elliptio hamili in the Lower Blairmore fauna, and he considers that they are of about the same age. In the table, therefore, the McMurray formation is placed on the same stratigraphic level as the lower part of the Blairmore and its correlatives, the Luscar and Gething formations.

Use of Marine Faunas

A poorly preserved marine fauna occurs at the base of the Dunlevy formation of the Bullhead group, on Tepee Rocks spur in the Peace River foothills. It includes a few poor specimens of what appears to be a small species of Aucella. Although an actual identification cannot be made, the possibility that the lowermost part of this formation is of Jurassic age can be entertained. A larger species of Aucella occurs in the drift at a number of localities in the Foothills. Its actual position in the rock section, however, has not been determined.

The 'Astarte natosini' fauna is as yet little known. In drawing up the new table it is assumed to be of about the same age as the Lower Blairmore flora and non-marine fauna. In the Luscar formation it occurs in beds below those containing Lower Blairmore flora, and in the McMurray formation it occurs in beds above those with a non-marine fauna very similar to Lower Blairmore non-marine fauna.

The Beudanticeras affine fauna, with species of the ammonoid genera Beudanticeras and Lemuroceras and numerous pelecypods, occurs in the Clearwater formation on Athabaska River, in the base of the lower sandstone member of the Peace River formation, and in the Loon River

formation on Peace River. It may be noted that Spath has recently introduced the generic name Lemuroceras for ammonoids formerly referred to Deshayesites in the 'Ammonite Bed' of the Abur group in India and for those in the Clearwater formation on Athabaska River. It appears that this fauna extends far to the west, for Spivak has collected Beudanticeras, Yoldia cf. kissoumi, and other shells from the Moosebar and Gates formations in the Foothills in the Portage Mountain map-area, and Beudanticeras cf. affine from beds equivalent to a horizon low in the Moosebar in the Chinaman Lake map-area (Spivak, 1944). It follows that the Clearwater formation, probably the basal Grand Rapids, the Loon River, and the lower member of the Peace River formation should be correlated with the Moosebar and probably also with the Gates formation. Correlation of these marine formations with beds of the non-marine southwest is mainly an indirect one. Canadian beds carrying the B. affine and Lemuroceras fauna are correlated with the 'Ammonite Bed' in the Indian Abur group. As the age of this bed has recently been revised by Spath (1942) a fundamental revision of the correlation table is required. Formerly compared with the Aptian of Europe it is now correlated with the earlier part of the Albian stage. It follows that in the table the Clearwater and correlative formations must be placed not opposite the Luscar and lower part of the Blairmore group, but higher and on a level with some of the upper part of the Blairmore. No fossils have yet been found in the Buckinghorse formation, but the lower part may occupy the stratigraphic position of the Clearwater, Moosebar, etc. Some part of the Garbutt formation on Liard River may be equivalent also to the Clearwater and Moosebar, etc., but it has so far proved unfossiliferous and its downward limit is unknown. The Beudanticeras affine fauna has probably a wide distribution in Mackenzie Valley. Warren has recorded its presence on Great Bear Lake and Hume has collected it on Mackenzie River at the narrows about 15 miles below Oscar Creek.

The Gastroplites fauna is of considerable value in correlation. Spath has recorded the genus Gastroplites in the Gault of Folkestone, England, and pointed out its Meso-Albian age. It occurs in the Cadotte member of the Peace River formation north of the town of Peace River, and also about 500 feet above the base of the Hasler formation at the mouth of Starfish (Deep) Creek in Peace River canyon, thus affording a valuable correlation across the plains. Although our collections from the Commotion formation in Pine River Valley contain no specimens of Gastroplites, collections from the upper part of this formation do contain Inoceramus cadottensis, which belongs to the Gastroplites fauna. This upper part of the Commotion, therefore, is equivalent to beds a few hundred feet above the base of the Hasler on Peace River. Going northward, the upper part of the Commotion seems to pass into shale and fine sandstone or siltstone of the lower part of the Hasler. From this it might be inferred that the Gates is a northward extension and remnant of the lower part of the Commotion and that the Hasler on Peace River extends much lower stratigraphically than it does in Pine Valley. This fauna has not been collected on Sikanni Chief River, but some high part of the Buckinghorse or some very low part of the Sikanni formation may contain beds equivalent in age to it. The Gastroplites fauna has been found on Liard River in the upper part of the Scatter and lower part of the Lepine formations. This part of the Liard River section, therefore, is to be correlated with the upper part of the Commotion formation on Pine River, the beds 500 feet above the base of the Hasler on Peace River, some high part of the Buckinghorse on Sikanni Chief River, and the Cadotte member of the eastern Peace River area. As the Gastroplites is a northern fauna it will likely be found at various places in the north, including Mackenzie Valley. It is probably represented in some of the Geological Survey's collections from Carcajou River and Sans Sault Rapids.

The Neogastroplites fauna occurs in the upper part of the Shaftesbury formation on the north side of Peace River east of the mouth of Cache Creek, where it includes Neogastroplites cornutus, N. selwyni,

Posidonomya nahwisi, and Nucula dowlingi. The species N. cornutus has also been found by Hage in the second sandstone of the Sikanni formation on Sikanni Chief River, thus affording a correlation of beds in two fairly widely separated localities. This fauna has always been assumed to be of Lower Cretaceous age because of the close relation of Neogastrolites to Gastrolites, the Lower Cretaceous age of which cannot be questioned.

The Goodrich fauna, although still little known and almost entirely undescribed, can be traced for a considerable distance along the Foothills. Two diagnostic fossils are Posidonomya nahwisi var. goodrichensis and P. nahwisi var. moberliensis. At many localities a species of Oxytoma is present. This fauna occurs in the Goodrich formation in Pine River Valley, where Wickenden and Shaw collected P. nahwisi var. goodrichensis and species of Oxytoma, Tancredia, Pecten, Thracia, Pleuromya, and Goniomya. A little farther north, Spivak, from the same formation on Coal Creek, a branch of Johnson Creek, has collected P. nahwisi var. goodrichensis and P. nahwisi var. moberliensis. This fauna has been collected too from the third and fourth sandstones of the Sikanni formation on Sikanni Chief and Buckinghorse Rivers, where P. nahwisi var. goodrichensis and species of Pinna, Pleuromya, Oxytoma, and Modiolus have also been found. On this basis the third and fourth sandstones at least are correlated with the Goodrich formation of Pine River and Coal Creek Valleys. Although the succession has not been studied minutely, the Goodrich fauna apparently overlies Neogastrolites cornutus locally. Not enough work has, however, been done to establish the distinctness of the Goodrich fauna as compared with the Neogastrolites. The former is, however, very close to the Neogastrolites, as it carries varieties of P. nahwisi. It must, therefore, be of similar age, and for this reason is placed in the Lower Cretaceous with the Neogastrolites fauna. On the other hand it must be admitted that the Goodrich fauna also shows some resemblance to Upper Cretaceous faunas, particularly if it includes Brachydontes multilinigerus. The Cruiser formation of west Peace Valley carries no fauna, so far as is known, and its exact age cannot be determined.

The base of the Upper Cretaceous is drawn at the base of the Dunvegan, where it has been fixed for some time. It is best left there unless new and positive evidence, such as the discovery of distinct Upper Cretaceous fossils in the Cruiser formation or in the Goodrich fauna, necessitates drawing it at a lower level.

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