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IV

No. 1. NOMENCLATURE OF SOME CAMBRIAN
CORDILLERAN FORMATIONS

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INTRODUCTION

This is the second title on this subject, the first having appeared in 1908.¹ Since that date a few new names for formations of Cambrian age in the Cordilleran area have been proposed, and I now have two new ones and a definition of one used by me in 1912.²

THE PTARMIGAN FORMATION

The name Ptarmigan formation is proposed for a series of limestones and interbedded shales that occur above the Mount Whyte formation of the Lower Cambrian and beneath the Cathedral formation of the Middle Cambrian in Alberta and British Columbia, Canada.

Type locality.—Southeast slope of Ptarmigan Peak above Ptarmigan Lake 4.75 miles (7.6 km.) northeast of Lake Louise Station on the Canadian Pacific Railroad, Alberta.

¹ Smithsonian Misc. Coll., Vol. 53, 1908, No. 1, pp. 1-12.

² Fort Mountain. Monogr. U. S. Geol. Surv., No. 51, p. 131, footnote a.

Derivation.—From Ptarmigan Peak and Lake, the type locality.

Character.—Arenaceous gray limestones with interbedded bands of thinner bedded, dark bluish-black limestones and some interbedded bands of shale.

Thickness.—At Ptarmigan Peak 516 feet (157.3 m.). At Ross Lake, 8.5 miles (13.6 km.) west-southwest of Ptarmigan Lake, 664 feet (202.4 m.).

Organic remains.—Middle Cambrian fauna (lower) including the *Albertella* fauna of Alberta and British Columbia.

SECTION AT PTARMIGAN PASS AND PEAK

The typical section was measured on the east and northeast face of Ptarmigan Peak above the Pass and Lake. It is 5.5 miles (8.8 km.) northeast of Lake Louise Station on the Canadian Pacific Railroad, Alberta, Canada. The summit of Ptarmigan Peak is formed from the Cathedral limestone, and a fine section is exposed from the summit down to the lake and on the northeast slope down to the pre-Cambrian.¹

CATHEDRAL FORMATION: MIDDLE CAMBRIAN

Feet

1. Massive-bedded, arenaceous, cliff-forming limestone, mostly of a light gray color but with a few dark, lead-colored bands of more or less irregular boundaries above and below. The dark bands are usually formed of more thinly bedded and a finer arenaceous limestone. 2,100

No fossils except traces of annelid borings.

The thickness of 2,100 feet is an estimate based on the height of the mountain and the height of the base of the light gray arenaceous limestone above Ptarmigan Lake.

PTARMIGAN FORMATION

1a. Thin-bedded, fine-grained, hard, dark gray to grayish-black arenaceous limestone 46

Fauna: (63b) *Zacanthoides cimon* Walcott

Neolenus constans Walcott

This bed usually breaks down to form a slope beneath the massive Cathedral limestone, but in places it forms a steep, low escarpment.

1b. Finely arenaceous limestone in thick alternating bands of a light gray and dark lead gray color. The lower 20 feet is a light gray, finely arenaceous laminated limestone, the lamellæ showing finely on the weathered surface 270

Fauna: Traces of annelid borings occur abundantly within the layers and on their surface. The Ross Lake shale member of the Ptarmigan formation, if present, should occur about 100 feet down in this section.

¹ Smithsonian Misc. Coll., Vol. 53, 1910, p. 429.

	Feet
1c. Massive-bedded, bluish-gray and light gray more or less finely arenaceous limestone with many dark layers of oolitic limestone, the oolites varying from 5 to 25 mm. in diameter.....	110
Fauna: A few minute fragments of trilobite tests were seen.	
1d. Thin-bedded, dark, bluish-gray limestone that may or may not form a portion of the cliff.....	28
Fauna: (63d) <i>Lingulella</i> sp. undt.	
<i>Wimanelia</i> ?	
<i>Ptychoparia</i> (granulated species)	
<i>Ptychoparia</i> ? <i>cilles</i> Walcott	
<i>Crepicephalus chares</i> Walcott	
1c. Finely laminated and shaly bluish-gray limestone with a few intercalated thin hard layers.....	62
This band of almost fissile limestone and shale is a marked feature in the section. It is crossed diagonally by joint planes that cause it to weather into projecting points that give the effect of the irregular surface of dogtooth spar. This may be seen on the face of the cliffs of Ptarmigan Mountain for a long distance, also on Fort Mountain on the southeast side of the Pass.	
<hr/>	
Total thickness of Ptarmigan formation.....	516

Observations.—The Ptarmigan formation is indicated in the Ross Lake section by 664 feet (202.4 m.) of hard, thin layers of more or less arenaceous limestones above the Mount Whyte formation and beneath the massive Cathedral limestones. Owing to the rapid change in character of many of the limestones within a short distance in many instances it is difficult to trace the upper and lower boundaries of a series of beds, like those of the Ptarmigan formation. Frequently a modified alteration resulting from compression or mag-nesian infiltration will completely change the appearance of the beds, and often what appears to be a solid, massive-bedded limestone, when seen in a cliff, may be a thin-bedded fossiliferous limestone where broken down by erosion. On Mount Stephen I measured the horizon of the Ptarmigan formation in the great eastern cliffs of the mountain and there all the beds appeared to form one great series of massive layers 1,560 feet (475.6 m.) in thickness.¹ To determine the distribution and thickness of the Ptarmigan formation in the Cordilleran area will require the extensive and thorough examination of most if not all of the accessible sections of the Middle Cambrian strata of the Canadian Rocky Mountains. It is possible that the formation is only a broad local lentile that was deposited in a depression of the Lower Cambrian sea bed. My first field impres-sion was that the Ptarmigan limestone was deposited locally in a

¹ Canadian Alpine Club Journal, Vol. I, 1908, p. 239.

shallow basin largely as oolites before the coming of the physical change that produced the great Cathedral limestones.

It may be that it is an error to include the Ross Lake shale with its *Albertella* fauna in the Ptarmigan formation. That is one of the problems for the future worker in this field to determine.

THE ROSS LAKE SHALE MEMBER OF THE PTARMIGAN FORMATION (ALBERTELLA ZONE)

A name proposed for the fine siliceous shale carrying the *Albertella* fauna in the Ptarmigan ? formation.

Type locality.—In cliffs above Ross Lake, 1 mile (1.6 km.) south-southwest of Stephen Station on the Continental Divide and south of the Canadian Pacific Railroad.

Derivation.—From Ross Lake where the shale is finely exposed in the cliffs above the Lake.

Character.—Dark gray, fine siliceous shale with local fillets and thin layers of gray limestone.

Thickness.—From 7 to 11 feet (2 to 3.3 m.).

Organic remains.—The known fauna includes the following:

- Sponge spicules
- Eocystites* ? sp. undt.
- Micromitra* (*Paterina*) *wapta* Walcott
- Obolus parvus* Walcott
- Acrothele colleni* Walcott
- Wimanella simplex* Walcott
- Hyolithellus flagellum* (Matthew)
- Hyolithellus hectori* Walcott
- Hyolithes cecrops* Walcott
- Agraulos stator* Walcott
- Olenopsis* cf. *americanus* Walcott
- Albertella bosworthi* Walcott
- Albertella helena* Walcott
- Vanuxemella nortia* Walcott
- Bathyriscus rossensis* Walcott

FORT MOUNTAIN FORMATION

In 1908 the quartzitic sandstones of this formation were described as the "Fairview formation."¹ As that name, however, was pre-occupied in American geologic nomenclature, and as the lower part of the formation was subsequently found exposed at several places on the east side of the Bow River Valley, it was decided to apply the name Fort Mountain sandstone to the whole, from the typical

¹ Smithsonian Misc. Coll., Vol. 53, 1908, p. 5.

exposures on Fort Mountain,¹ which is situated on the northeastern side of Bow Valley about 5 miles (8 km.) northeast of Lake Louise Station on the Canadian Pacific Railroad, Alberta, Canada. Here the basal conglomerate is seen in contact with the pre-Cambrian and above it there is a band of shale 44 feet (13.4 m.) thick. This basal conglomerate has a thickness of 360 feet (109.7 m.) and is much coarser than on Saddle Mountain or Mount Temple.

PTARMIGAN PEAK SECTION

Two miles (3.2 km.) to the north, on the northeast side of Ptarmigan Peak, the Fort Mountain formation is much thinner. A measured section gave:

	Feet
1. Thick-bedded, light gray, occasionally cross-bedded, quartzitic sandstone with a little trace of purple color in a few layers.....	260
2. Light gray to brownish gray sandstone in thin layers.....	22
3. Massive-bedded conglomerate, with white quartz pebbles and fragments of dark and greenish fine, arenaceous shale in a coarse sandstone matrix	170
Total	452

[UNCONFORMITY]

PRE-CAMBRIAN ARENACEOUS SHALES

The impression given by the above section is that the sediments were deposited on the slopes of a pre-Cambrian shore line and did not accumulate to the thickness of the deposits seen 3 miles (4.8 km.) to the south-southwest at Fort Mountain.

FAIRVIEW MOUNTAIN SECTION

On the north face of Fairview Mountain above Lake Louise, 6 miles (9.6 km.) southwest of Fort Mountain, the Lake Louise shale forms a slight break in the cliffs that affords a foothold for small coniferous trees and there is usually a quantity of green mosses or lichens. Below the green vegetation the Fort Mountain formation forms a wall of hard quartzitic sandstones. This same feature is also present on the north face of the adjoining Saddle Mountain and eastward on the cliffs of Mount Temple and in the Valley of the Ten Peaks, above Moraine Lake. At Fairview Mountain the section below the Lake Louise shale is as follows:

¹ See Monogr. U. S. Geol. Surv., No. 51, 1912, p. 131 footnote a.

FORT MOUNTAIN FORMATION

Feet

1. Massive-bedded, purplish, hard cliff-forming fine-grained, quartzitic sandstone in layers 6 inches to 3 feet thick, forming a vertical cliff in its upper 150 feet (45.7 m.). Color gray in upper layers and gradually becoming purplish colored with gray bands. Some layers are slightly cross-bedded 350

On Mount Temple this sandstone has a strong purple color and in the lower portion bands of arenaceous purple shale.

2. Hard gray, rather coarse-grained sandstone in the upper 200 feet (60.9 m.) with bands of shaly beds from a few inches to a foot or more in thickness. Below the sandstone becomes coarser and passes into a fine quartz conglomerate forming massive layers..... 570

3. Siliceous, gray and greenish gray shale..... 20+

Slope covered with débris.

On the north slope of Saddle Mountain a mile (1.6 km.) southeast this shale has a thickness of 28 feet (8.5 m.) and below it about 100 feet (30.4 m.) in thickness of coarse gray sandstone to fine conglomerate is exposed. On the north slope of Mount Temple 2.5 miles (4 km.) northeast of Saddle Mountain the basal beds of the lower portion of the sandstone and fine conglomerate beds of the Fort Mountain formation rest on the dark, pre-Cambrian arenaceous shales. The section above is not accessible for measurement.

Ten miles (16 km.) further southeast on Little Vermilion Creek the basal conglomerate is in massive layers, but the contact with the pre-Cambrian is obscured by débris.

Summary.—The Fort Mountain formation consists of four members in its greatest development:

	Feet
a. Quartzitic sandstone	350
b. Coarse sandstone	570
c. Siliceous shale	44
d. Arenaceous, quartzitic conglomerate	360

Total 1,324

It is delimited above by the Lake Louise shale and below by the basal conglomerate resting on various beds of the arenaceous pre-Cambrian shales.

ELDORADO FORMATION

Type locality.—Prospect Peak, Eureka District, Nevada.

Derivation.—From Eldorado Mine on east slope of Prospect Peak.

Character.—Gray compact limestone in massive layers.

Thickness.—3,050 feet (929.8 m.) in the Eureka District, Nevada.

Organic remains.—Middle Cambrian fauna.

This formation is described in detail by Arnold Hague as the Prospect Mountain limestone,¹ but as the term Prospect Mountain quartzite preceded it the term Eldorado was proposed by Walcott,² and the term Prospect Mountain restricted to include only the quartzitic sandstone beneath.³

¹ Third Ann. Rept., U. S. Geol. Surv., 1883, p. 254.

² Smithsonian Misc. Coll., Vol. 53, 1908, p. 184 (footnote).

³ Idem, p. 12.

DUNDERBERG FORMATION, WALCOTT¹

Type locality.—Hamburg Ridge, Eureka Mining District, Nevada.

Its distribution is shown on the geological map of the Eureka District accompanying the Third Annual Report of the United States Geological Survey (1883, pl. XXIV).

Derivation.—Dunderberg Mine, on Hamburg Ridge.

Character.—Arenaceous and calcareous shale with cherty nodules.

Thickness.—350 feet (106.7 m.) on Hamburg Ridge.

Organic remains.—Upper Cambrian.

This formation is described by Arnold Hague as the Hamburg shale, but as the Hamburg limestone preceded it the term Dunderberg was proposed by Walcott.¹

GORDON SHALE

A name proposed for the fine argillaceous shales carrying the *Albertella* fauna in Montana.

Type locality.—On Gordon Creek 6 miles (9.6 km.) from South Fork of Flathead River, Ovando quadrangle (U. S. G. S.), Powell County, Montana. The shale extends across the ridge between Gordon and Youngs Creeks, about half-way between Gordon Mountain and Cardinal Peak.

Derivation.—From Gordon Creek and Mountain.

Character.—Greenish and purplish fine argillaceous shale.

Thickness.—284 feet (86.3 m.) on ridge between Gordon and Youngs Creeks.

Organic remains.—The known fauna includes the following:

Algæ (4v)

Hyolithes cecrops Walcott (4v)

Micromitra (*Iphidella*) *nyssa* Walcott (4q)

Micromitra (*Iphidella*) *pannula* (White) (4v, 4q)

Obolus (*Westonia*) *ella* (Hall and Whitfield) (4v)

Lingulella sp. undt. (4v)

Acrothele colleni Walcott (4v, 4q)

Acrothele panderi Walcott (4v, 5j)

Wimanella simplex Walcott (4v, 4q, 4w)

Ptychoparia candace Walcott (4v, 4q)

Ptychoparia charax Walcott (4v, 4q)

Ptychoparia pylas Walcott (4q)

Zacanthoides cnopus Walcott (4v, 4q, 4w)

Olenopsis ? *americanus* Walcott (4v)

Albertella helena Walcott (4v, 5j)

Vanuxemella contracta Walcott (4v, 5j)

Bathyriscus belesis Walcott (4v, 4q)

Bathyriscus belus Walcott (4w)

¹ Smithsonian Misc. Coll., Vol. 53, 1908, p. 184 (footnote).

Locality 4q=about 315 feet (96 m.) above the unconformable base of the Cambrian and 190 feet (57.9 m.) above the top of the quartzitic sandstones, on the ridge between Gordon and Youngs Creeks, about half-way between Gordon Mountain and Cardinal Peak.

Locality 4v=about 200 feet (61 m.) above the unconformable base of the Cambrian and 75 feet (22.9 m.) above the top of the quartzitic sandstones, Gordon Creek, 6 miles (9.6 km.) from South Fork of Flathead River.

Locality 4w=same horizon as 4q above, on Youngs Creek, about 5 miles (8 km.) from its junction with Danaher Creek.

Locality 5j=above the quartzitic sandstones, about 6 miles (9.6 km.) west-northwest of Scapegoat Mountain, on the Continental Divide between Bar Creek and the headwaters of the south fork of North Fork of Sun River, Coopers Lake quadrangle (U. S. G. S.).

The first three localities are in Ovando quadrangle (U. S. G. S.); all four in Powell County, Montana.

CHISHOLM SHALE

See Smithsonian Miscellaneous Collections, Vol. 64, 1916, p. 409.