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THE SUCCESSION OF FOSSIL FAUNAS IN THE EASTERN PART OF JASPER PARK.*

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INTRODUCTION.

The faunas considered in this paper represent sections in the eastern ranges of the Rocky Mountains which lie near the 53d parallel. Most of these sections are exposed along the valley of the Athabasca River where it cuts across the eastern ranges of the Rocky Mountains and in tributary valleys, in Jasper Park. This great trench across the eastern ranges displays the structure and succession of faunas quite as admirably as the well known Bow River section,[1] 180 miles to the southeast.

A reconnaissance examination of the Athabasca River section was made by McEvoy[2] a number of years ago and the strip of coal-bearing Mesozoic rocks which the Athabasca River crosses near the eastern entrance to the Park has been described by Dowling.[3] Lamb[4] and Kindle[5] have described

* Published with permission of Director, Geological Survey, of Canada.

[1] McConnell, R. G., Report on the geological structure of a portion of the Rocky Mountains, Can. Geol. Surv. Ann. Rept. 2:D, 1887.

Shimer, H. W., Upper Palaeozoic Faunas of the Lake Minnewanka Section, near Banff, Alta., Contri. to Canadian Palaeontology, G. S. C. Bull. 42, 1-84, Pls. I-VIII, 1926.

Kindle, E. M., Standard Palaeozoic Section of Rocky Mts. near Banff, Alta., Pan-American Geologist 42, 113-124, 1924.

Warren, P. S., Banff Area, Alberta, G. S. C. Mem. 153, 1927.

[2] McEvoy, James, Report on the Geology and Natural Resources of the Country Traversed by the Yellow Head Pass route from Edmonton to Tete Juane Cache, comprising portions of Alberta and British Columbia, G. S. C. Ann. Rept. 11:D, 1900.

[3] Dowling, D. B., Coal fields of Jasper Park, Alta., G. S. C. Summ. Rept., 1910, pp. 150-168, 1911; Geology of Roche Miette map area, Jasper Park, Alta., G. S. C. Summ. Rept. 1911, pp. 201-219, 1912.

[4] Lamb, L. M., The occurrence of Helodont Teeth at Roche Miette and Vicinity, Alta., G. S. C. Vict. Mus. Bull. I, pp. 17-20, 1913.

[5] Kindle, E. M., Three New Devonian Fossils from Alberta, Pan-American Geologist, 42, 217-218, pl. 14, 1924.

certain fossils from the eastern border of the Park. A popular account of the geology of the Park has also been recently prepared by the writer.[6]

But, from the standpoint of the geologist, no satisfactory description of the formations or their faunas has appeared.

The present paper is based on a season's work in Jasper Park which was undertaken at the request of the Commissioner of Parks, Mr. J. B. Harkin, who has initiated the wise policy of issuing for the benefit of the general public geological guide books of simple type which will enable intelligent visitors to carry away some of the message which the mountains may give the layman if it is not too deeply buried in the technical language of the geologist. A considerable part of the trails in the southern half of the Park were rapidly traversed in getting for this purpose a general knowledge of the geology of the Park. But the section along the Athabasca River between Henry House where the splendid 3,500 foot Palisade section is exposed to Fiddle Creek near the eastern limit of the Park and certain other sections were studied in some detail.

MAJOR STRUCTURAL FEATURES.

The sections with which the present study chiefly deals lie between the eastern slopes of Roche à Perdrix, which is located southeast of Brule Lake, on the eastern border of the Park and the village of Jasper and near the south end of Medicine Lake. The mountain ranges of this region trend in a northwest-southeast direction at about 45 degrees. Four major thrust faults trending in the general direction of the mountain ranges are the large factors in repeating the Palaeozoic section along Athabasca River between Brule Lake and Jasper. The most easterly of these faults brings the easternmost range of the Rockies in contact with the Mesozoic rocks at Brule Mines and east of Roche à Perdrix where Palaeozoic rocks are overthrust to the east above the Mesozoic. The best contact of the Palaeozoic and Mesozoic known along the entire Rocky Mountain front is exposed at the first named locality.

A map by J. A. Allan[7] published in 1925, which shows the

[6] Kindle, E. M., "Geological Story of Jasper Park" (in press), Canadian National Parks Branch, Dept. of Interior, Ottawa, 1929.

[7] Geological Map of Alberta: Scientific and Industrial Research Council of Alberta.

area covered by this paper in two colors as undifferentiated Palaeozoic and Lower Mesozoic and Lower Cretaceous, indicates plainly the northwest-southeast trend for more than 350 miles of the structural features which in western Alberta have given rise to the Rocky Mountains and the great plains east of them.

THE MIETTE RANGE SECTION.

The oldest rocks known in the eastern part of the Park are well exposed on the northern slopes of Roche Miette, the

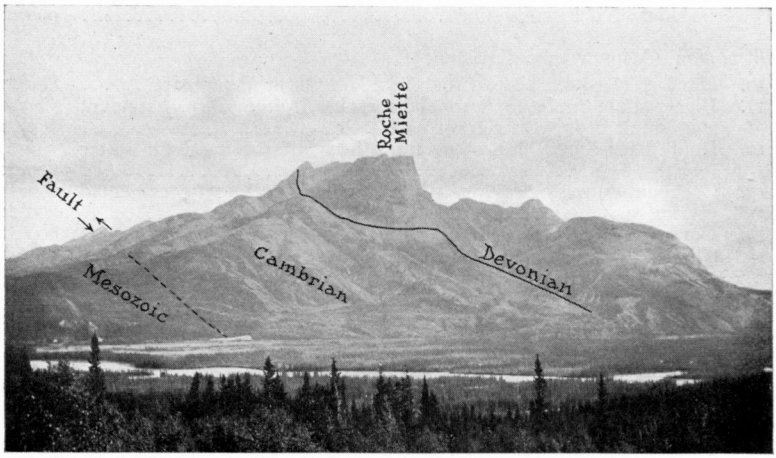

Fig. 1. View of north end of Miette Range showing location of systemic boundaries of the Miette Range section. Athabasca River in middle ground.

quaintly sculptured peak which stands at the northern end of the Miette Range two miles south of Pocahontas. A great thrust fault along the eastern base of this Range brings the Cambrian in contact with the Mesozoic. The section given below begins about half a mile west of Miette creek on the western side of the fault, starting in the Cambrian sediments and terminating near the top of the Devonian at the old lime kiln on the east side of Rocky river valley. (See Figure 1.)

Cambrian

1.	Limestone with bands of oolitic structure (Base of section) ...	65′±
2.	Covered	75′
3.	Limestone weathering buffish brown	35′
4.	Green clay shale soft and altered by crushing	20′
5.	Very thin bedded limestone, layers ¼″ or less, with paper thin shale bands between. Carries trilobite fragments	8′

6. Heavy bedded limestone with numerous calcite seams in lower part. Weathers buffish brown. No fossils seen ..... 50′
7. Covered ..... 350′±
8. Dark grey heavy bedded limestone somewhat saccharoidal in some beds and splitting very easily on weathering at right angles to bedding. Middle beds with worm tube (?) structure. No fossils seen ..... 600′±
9. Thin bedded fine textured magnesian limestone in strata varying in thickness from a fraction of an inch to one or more feet. Many beds in middle part with salt crystal pseudomorphs, ripple marks (rare) and mud cracks. The layers also show on weathered surfaces fine laminae thin as paper representing periodic planes of deposition. This limestone is a light grey on fresh surface but weathers to a brownish buff and at a distance has the appearance of a buffish brown shale. No fossils found ..... 900′±

Devonian (Minnewanka limestone)

10. Hard grey rough bedded limestone, fossils in upper part ..... 800′±
11. Black shale fissle to hard slaty rock, *Styliolina* sp. abundant in some beds (Miette shale) ..... 600′±
12. Rubbly hard grey limestone thick beds alternating with softer shaly beds ..... 400′±
13. Grey limestone breaking easily, of coarse loosely cemented texture ..... 200′±
14. Dark grey calcareous shale quite hard with few or no fossils 800′±
15. Cliff shows about 600′ of lead grey heavy bedded limestone, very hard, of the Vaughanite type. Fossils scarce but available with sufficient search. *Sp. whitneyi, Athyris sp.* and small Productus only forms seen ..... 600′±

The beds from 1 to 9 are regarded as Upper Cambrian in age.

The trilobite fragments found by the writer at one or two horizons in the lower part of this section were too poor for determination but specimens collected by Dowling in the older beds of the Miette section were identified by Raymond[8] who considers them to indicate a horizon about the same as the upper part of the Gallatin limestone of Montana.

The section corresponds to the Banff section nearly 200 miles to the southeast in the absence of the Silurian and Ordovician systems. The Devonian rests upon the Cambrian without evident unconformity as it does in the Bow River section.[9] The novel feature of the Devonian section is the thick band of black shale with its Styliolina fauna which is unknown in any of the Rocky Mountains Park sections. This black shale appears to represent a relatively deep water facies of a part of the magnesian limestone of the Minnewanka for-

[8] Summ. Rept. for 1911, Can. Geol. Surv., p. 208.

[9] This contact may be seen a few hundred feet east of the gorge cut by stream crossing highway 1⅞ miles west of the Pocahontas coal mine.

mation. It is here designated the Miette member of the Minnewanka limestone. The latter name seems applicable to the remainder of the Devonian sediments of this section.

THE PALISADE SECTION.

Southwest of the Miette range section 15 miles the precipitous face of the Palisade scarp rises 3,500 feet above Athabasca River exposing the whole of the Devonian, much of the Carboniferous at the top and several hundred feet of pre-Devonian rocks at the base in a section which dips gently away from the cliff face and river valley. The rocks of this section above the basal 400 feet are accessible only along the course of a brook which reaches the Athabasca 7 miles north of Jasper at Swift's Ranch, where covered intervals prevent complete examination of the section.

This section is as follows starting with the base of the oldest sediments which are of late Cambrian or "Ozarkian" age:

Sarcees Series

1.	Hard semilithographic limestone in bands a few feet thick separated by bands of dark shaly limestone weathering into thin sheets ⅛ inch thick. Beautifully laminated limestone with layers 1/16 inch or less thick show the lamination in weathered surfaces. There are also present bands of limestone showing either tiny limestone pebbles or a variety of brecciation	200′
2.	Hard laminated limestone interbedded with shaly bands and beds of magnesian limestone	250′±
3.	Thin bedded limestone subcrystalline texture (no lamination) (20a). Small brachiopods, gastropods and trilobites common. "Ozarkian" fauna	10′
4.	Covered	200′
5.	Olive grey shale with magnesian limestone interpolated. Barren	140′

Devonian (Minnewanka limestone)

6.	Dark grey generally magnesian limestone with hard shaly calcareous beds with only a few fucoid-like marking seen. (Partly covered.) (Base of Devonian)	1500′
7.	Hard bluish grey limestone. Varied fauna *Sp. whitneyi,* etc.	1000′

Carboniferous

8.	Grey shale with calcareous bands	400′
9.	Grey limestone	100′+

The fine lamination of the limestone in division 1 of this section is the most noteworthy feature of the oldest beds in the section. This lamination as disclosed by weathering is shown by the photograph (Fig. 2). On fresh surfaces it is not evident, the rock showing the fine texture of Vaughanite

limestone. But a chip thin enough to transmit light shows clearly translucent and opaque parallel bands averaging about six to a millimeter with an occasional band as thick as one millimeter. Etching in HCl results in the relatively thin opaque bands withstanding the acid better than the thicker light colored ones, which contain less Ca_2CO_3 than the darker laminae. These laminae might be interpreted as having an annual, a diurnal or consecutive tidal significance. The writer believes that they have probably had a tidal origin as laminae

Fig. 2. Laminated limestone from No. 1 of Palisade section. The lower half of larger specimen has been etched with HCl. About ⅔ nat. size.

of many estuarine deposits now forming have.[10] They probably represent lagunal deposits protected from strong wave action with a salinity unfavorable to marine life.

The lower 450 feet of the section appear to be entirely barren of fossils. Barrenness or scarcity of fossils characterizes all of the well laminated limestones known to the writer in other regions and appears to be generally the result of conditions unfavorable to marine life.

The earliest fossils found in this section were discovered at the head of the irrigation ditch on the Swift ranch in a

[10] Kindle, E. M., Intertidal Zone, Basin of the Wash, Bulletin U. S. National Research Council (in press).

coarsely textured limestone in which the "Ozarkian" fauna is represented by an abundance of small fossils which are listed in the table. Divisions 2 and 3 appear to represent Walcott's Mons formation. The only fossils found in the lower 800 feet of the section occur in the 10 foot bed No. 3 but the 340 feet of olive shales and covered beds which follow it are believed to fall in the Sarceen series of Walcott. In the lower part of the Devonian terrane fossils are scarce and poorly preserved as in most sections of the Minnewanka limestone elsewhere. In the upper half of the Devonian section there is an abundance of fossils.

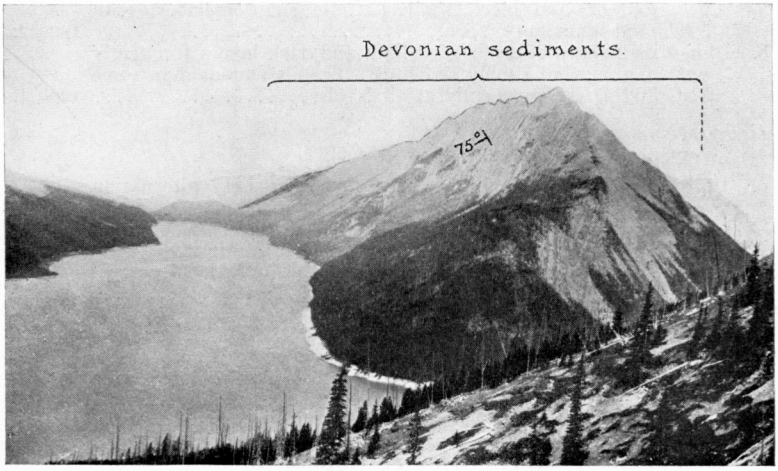

Fig. 3. View of Devonian section looking north from south end of Medicine Lake.

Few Carboniferous fossils were collected from the Carboniferous portion of the Palisades section because of its relative inaccessibility. The character of these faunas is well shown in the section along the Medicine Lake and Maligne Lake trail which follows:

MEDICINE LAKE SECTION.

The major part of the south end of the mountain ridge on the east side of Medicine Lake is composed of Devonian sediments. A section across the mountain from the Jacques Lake trail to the Medicine Lake trail starting near Beaver Lake and including Carboniferous rocks south of the junc-

tion of the two trails exposed on the mountain slope east of Maligne River is shown below:

Sarceen Series

1.	Drab sandy fine textured rock with laminae of paper thinness	60′
2.	Light colored quartzite	5′
3.	Light colored magnesian limestone lower third crushed by thrust fault, apparently grading to quartzite	180′
4.	Grey mostly thin bedded limestone with occasional heavy beds of quartzite interpolated	200′
5.	Heavy bedded light colored magnesian limestone. No fossils found	75′

Devonian (Minnewanka limestone)

6.	Massive or heavy bedded magnesian limestone D. 58°	1000′±
7.	Drab shales with several limestone bands and near middle a bed 300′ of coal black shale (Miette shale member, with *Styliolina* abundant)	1300′±
8.	Limestone mostly heavy bedded light and dark layers frequently with a somewhat rubbly structure. Fossils abundant in some beds and a few apparently at all levels	1200′±

Mississippian

Banff Shale

9.	Bluish grey shale nearly black at and near base alternating with calcareous bands which in much of lower part of series alternate regularly in 4″ or 5″ bands. A 100′ band of limestone lies near the middle of shale series. In lower 300′ fossils very scarce. Terebratuloids and an occasional crinoid stem were seen	700′±

Rundle Limestone

10.	Dark to light grey limestone in heavy beds full of fossils, *Productus* etc. and grading below into top of above section which is also rich in fossils	450′±

MALIGNE LAKE SECTION.

The north end of Maligne Lake lies approximately six miles south of Medicine Lake. About 2 miles north of Maligne Lake the trail between the two lakes passes from limestones with Pennsylvanian fossils to a series of shales and coarse conglomerates which are apparently of great thickness. The north end of the Maligne Lake basin and the upper part of the Maligne River valley are cut in these shales, conglomerates and sandstones. The Maligne Mountains located southwest of Maligne Lake valley appear to be composed entirely of these beds along the Shovel Pass trail. The only fossils found in them were Lingulas and very small fish fragments which were collected in a ravine one-half mile northeast of the game warden's cabin at Lake Maligne. These beds are provisionally regarded as Triassic in age.

THE CRETACEOUS SECTION.

The writer has not attempted to measure any long or complete section of the Cretaceous sediments faulted in between the two mountain ranges composed of Palaeozoic rocks on the east side of Jasper Park. But the following short section north of Bedson Station one-half mile will indicate the character of the sediments in a part of the Cretaceous section which is probably not far from the middle of the Villeneuve Creek section seven miles to the southeast of Bedson where Dowling[11] reported a Cretaceous section 3,497 feet thick.

1.	Conglomerate with large pebbles mostly of well-rounded water worn quartzite, but some of magnesian limestone	15′
2.	Shaly sandstone and covered	30′
3.	Drab grey rock largely argillaceous but apparently with considerable magnesian limestone (unlike anything else in section)	3′
4.	Shaly and often cross bedded sandstone and soft grey or dark shale and an occasional coal seam or band of black carbonaceous shale a foot or less thick	55′
5.	Hard fine textured calcareous rocks and shale	5′
6.	Bituminous coal. Many fern fragments in top	10″
7.	Coarse sandstone and interbedded shale	3′
8.	Hard shale (good plants)	0″ to 6′
9.	Coal	1′

The Cretaceous sediments which were formerly correlated with the Kootenay formation[12] are here correlated with the Lower Blairmore on the evidence of the plants listed on another page of this paper. The Cretaceous section includes in addition to many thin coal seams three workable beds which Dowling has reported to be respectively 5, 10 and 13 feet thick.

CAMBRIAN FAUNA.

Crepicephalus cf. *C. iowensis* (Owen)
Ptychoparia affinis Walcott
Ptychoparia cf. *P. wisconsonensis* (Owen)
Dicellomus, sp. ind.

This fauna, which is the oldest known in the region, was collected by Dowling from beds near the base of the Miette range section which appear to lie in the lower part of the Cambrian section recorded by the writer in this paper. It indicates a horizon now generally regarded as Upper Cambrian. It was found, Dowling states, in a yellow band near

[11] Summ. Rept., Geol. Surv. Can., for 1910, p. 156.
[12] Ibid., p. 155.

the thrust fault which separates the Cambrian from the Cretaceous on the eastern side of the Miette range. The 2,000 feet or more of Pre-Devonian sediments lying above this fauna in the Roche Miette section have yielded no determinable fossils but the finely laminated character of the upper part of them leads the writer to correlate No. 9 of the Miette section with the beds of the Palisade section numbered 1 and 2.

Fauna of the Sarceen Series.[13]

Brachiopoda
Eoorthis ochus Walcott
Eoorthis ochus var. *concentrica* C. H. K.
Eoorthis cf. *ochus* Walcott
Huenella jasperensis C. H. K.
Syntrophia convexa C. H. K.

Gastropoda
Raphistoma sp. undet.

Trilobita
Tostonia cf. *iole* Walcott
Hardyia metion Walcott ?
Symphysurina walcotti C. H. K.

The fauna listed above from number 3 of the Palisade section falls in the group of faunas which have come to be known through the work of Dr. E. O. Ulrich as the "Ozarkian fauna." Attention is here called to the fact that this fauna immediately follows a limestone series characterized by a most unusual type of fine lamination (see Fig. 2). This lamination is to be regarded as representing novel conditions and a special facies not of a new system but probably of upper Cambrian sedimentation. The "Ozarkian" fauna which follows it is likewise regarded as a special biota segregated from the ordinary Upper Cambrian fauna and specialized by special conditions just as the laminated limestone after which it appears has been.

None of the sections which include the Devonian and Pre-Devonian rocks in the Park show either Ordovician or Silurian faunas, both systems being absent.

[13] Determinations of species by Cecil H. Kindle. Species marked C. H. K. will be described in the October Canadian Field Naturalist, 1929.

DEVONIAN FAUNA.

	I*	II	III	Locality Stations
Brachiopoda				
Athyris angelica Hall			X	4, 13, 14a 14b, 15h, 20f, 20h
Atrypa reticularis Linn.			X	10c
Camarotoechia sp.			X	4, 13, 4b, 15h, 20f
Camarotoechia n. sp.			X	14a
Camarotoechia cf. *jasperensis* Kelly			X	15h
Camarotoechia cf. *shimeri* Kelly			X	13, 20h
Camarotoechia nordeggi Kindle			X	13
Camarotoechia horsfordi (Hall)			X	20h
Chonetes cf. *setigera*			X	20h
Chonetes sp. undet.			X	3
Cyrtina sp.			X	13
Leiorhynchus sp. undet.			X	13
Leiorhynchus n. sp.			X	10c
Leiorhynchus athabascense Kindle			X	13
Leiorhynchus glaber Kindle			X	13
Leiorhynchus cf. *limitaris*			X	2b
Martinia ? sp.	X			8c
Martinia sp.			X	13
Platyrachella cyrtiniformis (H. & W.)			X	10a, 13
Productella sp.			X	13, 14a, 20f
Productella coloradensis Kindle			X	2b, 4, 13, 14b, 15b
Productella coloradensis var. *plicatus* Kindle			X	13
Productella cf. *depressa* Kindle			X	14b
Productella depressa Kindle			X	14a
Productella laminata Kindle			X	13
Schizophoria sp.			X	13
Schizophoria striatula			X	13
Schuchertella sp.			X	4
Schuchertella n. sp.			X	13
Schuchertella chemungensis			X	13, 15h
Spirifer whitneyi Hall			X	2b, 13, 14a, 14b, 20f 20h
Spirifer whitneyi var. *animasensis* (Girty)			X	4, 10a, 13, 14b
Spirifer near *eriensis* Grabau	X			8c
Spirifer sp. undet.	X			8c
Pelecypoda				
Aviculopecten cf. *insignis* Hall			X	13
Crinipecten ? sp.			X	20h
Leptodesma sp.			X	20h
Ontaria ? sp.			X	20h
Pterinea cf. *strictus* Hall			X	15h
Pterochaenia sp.			X	20h
Pterochaenia sp. near *P. fragilis*			X	20h
Glossites ? sp.			X	13
Gastropoda				
Bellerophon sp.			X	20f
Callonema ?			X	15h
Euomphalus eurekensis Walcott			X	13, 15h
Loxonema ?			X	15h

*I and III represent respectively lower and upper divisions of the Minnewanka limestone; II represents the Miette black shale member of the Minnewanka limestone. Collecting stations are indicated by arabic numbers.

	I*	II	III	Locality Stations
Loxonema sp.			X"	20h
Loxonema cf. *nobile* Walcott			X	10c
Phragmostoma sp.			X	20h
Straparollus cf. *newarkensis* Walcott			X	20h
Pteropoda				
Styliolina fissurella (Hall)		X		8b, 15h
Tentaculites n. sp. cf. *T. bellulus*		X		15h
Cephalopoda				
Bactrites cf. *aciculum* Hall			X	20h
Platyschisma ambiguum Walcott			X	15h
Orthoceras sp.			X	13, 15h, 20f, 20h

A stromatoporoid coral, *Stromotopora* sp. undet., occurs abundantly in certain bands in the lower division of the Minnewanka limestone. Other fossils are scarce and difficult to extract from the tough dolomitic matrix. The core of the anticlinal mass of Roche à Perdrix east of Pocahontas five miles includes the basal Minnewanka limestone which is crowded with stromatoporoids in limestone beds with a fetid odor. The known fauna of the Lower Minnewanka limestone is small and shows nothing in common with the Upper Devonian fauna which characterizes the upper part of the Minnewanka limestone. The presence in it of a *Spirifer* of the *S. criensis* type suggests for it a Lower Devonian horizon. The occurrence above it of a black shale *Styliolina fisserella* fauna which is considered to probably represent a Middle Devonian fauna leads the writer to the opinion that both Lower and Middle Devonian time have representatives in the two sparse faunas recorded.

MISSISSIPPIAN FAUNA.[14]

	I*	II	Locality Stations
Blastoidea			
Pentremites sp.		X	16b
Pentremites sp. A		X	20
Pentremites sp. B		X	20
Crinoidea			
Crinoid discs			2d
Bryozoa			
Fenestella sp.	X	X	2d, 16b

*"I" Represents the Banff shale; "II" represents the Rundle limestone. Collecting stations are indicated by arabic numbers.

[14] Determinations of Mississippian and Pennsylvanian species have been made by Miss A. E. Wilson.

Brachiopoda	I*	II	Locality Stations
Brachiopod fragments			2d
Athyris n. sp.			2d
Camarotoechia sp.			2d
Camarotoechia elegantula Rowley		X	16b
cf. *Cliothyridina* sp.		X	20, 16b
Cliothyridina new sp.			2d
Cliothyridina lata Shimer		X	16b
Cliothyridina parvirostris (Meek and Worthem)		X	16b
Composita sp. (very close to *C. trinuclea* (Hall))			2d
Composita humilis Girty	X	X	16a, 20
cf. *Diaphragmus elegans* (Norwood and Pratten)		X	16b
cf. *Enmetria* sp.			2d
Leptaena cf. *analoga* (Phillips)			33c
cf. *Marginifera* sp.		X	20
Orthothetes sp.		X	20
Productella concentrica (Hall)			33c
Productus sp.		X	20
Productus blairi Miller		X	20, 33c
Productus fernglenensis Weller		X	16b
Productus gallatinensis Girty		X	16b, 20
Productus minnewankensis Shimer		X	20
Productus ovatus Hall		X	16b
Reticularia pseudolineata (Hall)		X	16b, 33c
Rhynchopora sp.		X	20
cf. *Schellwienella* sp.			2d
Spirifer sp.			2d
Spirifer sp. very like *S. cascadensis* Warren			33c
Spirifer centronatus Winchell		X	16b, 33c
Spirifer centronatus minnewankensis Shimer		X	20
Spirifer sp. undet. cf. *S. mesistrialis* Hall var.		X	16b
Spirifer mesistrialis Hall var.			33c
Spirifer missouriensis Swallow		X	16b
Spiriferella sp.		X	20
Spiriferina sp.	X		16a
Squamularia sp.		X	16b
Pelecypoda			
cf. *Allorisma albertensis* Shimer			33c
Gastropoda			
Euconospira sp.		X	20
Orthonychia acutirostris (Hall)			33c
Strophostylus sp. cf. *S. carlayanus* (Hall)		X	16b

PENNSYLVANIAN FAUNA.

Anthozoa	Locality Stations
Cyathophyllum ? sp. (new form)	17
Lithostrotion whitneyi Meek	17
Syringopora sp.	17
Syringopora pennsylvanica Shimer	26
cf. *Tripophyllum* sp.	26, 27
Blastoidea	
Pentremites sp. A.	27
Pentremites sp. B.	27

	Locality Stations
Brachiopoda	
Camarotoechia sp.	27
cf. *Composita subtilita* (Hall)	27
Spirifer sp.	26
Spirifer sp. A. (very similar to the Mississippian form *S. cascadensis* Warren)	27
Spiriferina sp.	27
Pelecypoda	
cf. *Parallelodon obsoletum* Meek	28
Gastropoda	
Gastropoda fragments	26

TRIASSIC FAUNA.

Beds which are supposed to be of Triassic age in which dark shales are a conspicuous element outcrop along Rocky River below Jack Creek and along the lower part of Jack Creek. These have yielded only indeterminable fossil fragments.

JURASSIC FAUNA.

The writer has not studied any section which included the Jurassic beds but Dowling collected two marine faunules from sandstones at levels 100 and 200 feet below the plant-bearing Cretaceous beds on Fiddle Creek below the mouth of Sulphur Creek. From these Dr. P. E. Raymond[15] determined the following species:

Arctica (Cyprina) occidentalis
Nemodon sulcatinus
Gryphaea planoconvexa
Ostrea strigilecula
Terebratulina

Raymond correlated this fauna with the Ellis formation of Montana and the Yellowstone Park.

CRETACEOUS FLORA.

No marine fossils are known from the 3,500 feet of Cretaceous sediments which Dowling[16] measured in the intermontane section south of Pocahontas. Fossil plants are common in certain zones in the shales and sandstones of the coal-bearing Cretaceous beds which are faulted in between

[15] Dowling, D. B., Can. Geol. Survey Summ. Rept. 1911, p. 206.
[16] Dowling, D. B., Can. Geol. Surv. Summ. Rept. for 1910, p. 156.

two Palaeozoic mountain ranges near the eastern border of the park. Collections made at three localities near Athabasca River have been determined by Dr. W. A. Bell whose list of species and his observations concerning them follow:

		Locality Stations
Sagenopteris cf. *nervosa* Fontaine	rare	7
Cladophlebis n. sp.	common	9h
Ginkgoites arcticus (Heer)	common	12
Ptilophyllum dunkerianum (Geoppert)	rare	7
Pagiophyllum sp. cf. *Elatides curvifolia* (Dunker)	rather common	12
Athrotaxopsis grandis Fontain	rather common	12
Pityophyllum graminaefolium ? (Knowlton)	very rare	9h
Elatocladus smittiana (Heer)	rather rare	12

"The presence of *Ptilophyllum dunkerianum* and *Athrotaxopsis grandis* seemingly indicates a Lower Blairmore rather than a Kootenay age for the beds containing them. The florole has the following species that are likewise present in the Brule coal field,—*Sagenopteris* cf. *nervosa, Ginkgoites arcticus, Athrotaxopis grandis,* and *Elatocladus smittiana. Ptilophyllum dunkerianum* is a form that some authors would probably identify as *Dionites buchianus abietinus* and is likewise a constituent of the Lower Blairmore flora. *Pityophyllum graminaefolium* is a very common form in the Canadian Kootenay and is represented here doubtfully by a single specimen."

The Brule coal field which is separated from the Pocahontas area by a range of mountains composed of Palaeozoic rocks has furnished twenty-two species of Lower Blairmore plants.[17]

FOSSIL COLLECTING STATIONS CITED IN LISTS.

2b Railway cut north of Jasper 3¼ miles .....(*Devonian*)
2d Railway cut north of Jasper 3⅛ miles ..(*Mississippian*)
3 Cement quarry on railway, 4 miles north of Jasper (*Devonian*)
4 Immediately north of No. 3 .....(*Devonian*)
7 Mine dump at Pocahontas .....(*Cretaceous*)
8b Gorge Northwest side of Roche Miette.....(*Devonian*)
8c Gorge Northwest side of Roche Miette.....(*Devonian*)
9h North of Bedson ½ mile,—No. 8 of Cretaceous section (*Cretaceous*)
10a Side of highway 1 mi. North of Rocky River near lime kiln .....(*Devonian*)
10c Side of highway, near station 10a .....(*Devonian*)

[17] McKay, R. B., Summ. Rept. for 1928, Pt. B (in press), Geol. Surv. Can., 1929.

12 Trail to Punch bowl near Pocahontas ..... (*Cretaceous*)
13 Maligne gorge, Northeast of Jasper 5 miles.. (*Devonian*)
14a Mouth of Two Valley gorge East of Maligne Canyon 3 miles ..... (*Devonian*)
14b Lower than 14a 125 feet and in same section (*Devonian*)
15h Southeast corner Medicine Lake ..... (*Devonian*)
16a Southeast of Medicine Lake about 1 mile, first creek crossing trail from Medicine Lake ..... (*Mississippian*)
16b Locality above ..... (*Mississippian*)
17 Big bend in Maligne River at trail side some 2 miles north of Maligne Lake ..... (*Pennsylvanian*)
18 Moraine of Glacier on Mt. Unwin, West side Maligne Lake ..... (*Devonian*)
20 Eastside Maligne Lake, 2 mi. South of Game Warden's cabin back of deep cove ..... (*Mississippian*)
20f North of Jasper 7 miles on Swift's ranch brook (Palisade section) ..... (*Devonian*)
20h Above 20f, 350 feet ..... (*Devonian*)
21 E. of highway bridge over Athabasca River sulphur spring
26 Southeast of Interlachen ¾ mile ..... (*Pennsylvanian*)
27 Northeast of Interlachen about 1 mile at road side (*Pennsylvanian*)
28 Ridge Northwest of Mt. Cinquefoil and 300 yards southeast of highway ..... (*Pennsylvanian*)
33c Half mile northeast of Jacques Lake at trail side (*Mississippian*)

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