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CARBONIFEROUS AND PERMIAN FORMATIONS,
SOUTHWESTERN DISTRICT OF MACKENZIE

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INTRODUCTION

Carboniferous and Permian strata in southwestern District of Mackenzie were studied by the author in 1957; some preliminary description has been given by Douglas and Norris (1959, 1960)¹. In these papers no new formation names were proposed and the strata were designated, both in the text and on the accompanying geological maps, as numbered map-units. Several of the map-units are good formations that can be traced over a considerable part of northwestern Canada. They will be fully described in a forthcoming Geological Survey Bulletin. In the present summary the formations are named and related to the map-units used by Douglas and Norris.

Five new formation names are proposed—Yohin, Clausen, Flett, Etanda, and Fantasque. The Yohin, Clausen, and Flett formations form part of a single, continuous succession on the west side of Yohin Ridge, about 12 miles south of South Nahanni River and about 22 miles west of South Nahanni (GSC Prel. Map 23-1960, lat. 61°66'N, long. 123°55'W). This is the 'Jackfish Section' of Patton (1958, p. 313), and it was from this section that he described and named the Mattson formation. Type localities for the Etanda and Fantasque formations are on the west flank of Kotaneelee Range and southwest of Mount Merrill, respectively.

¹ Dates in parentheses refer to publications listed in the References.

NOMENCLATURE OF STRATIGRAPHIC UNITS

This Report		Douglas and Norris (1959) Fort Liard and La Biche Map-areas		Douglas and Norris (1960) Virginia Falls and Sibbeston Lake Map-areas		Patton (1958) Jackfish Section
Fantasque formation		Map-unit 9		—		—
Upper member		Upper (8c)		Upper (33c)		Mattson formation (unit 4)
Mattson Middle formation member	Mattson Middle formation (8b)	Mattson Middle formation (33b)	Mattson Middle formation (33)	Mattson Middle formation (33b)	Mattson Middle formation (33b)	
Lower member	Lower (8a)	Lower (33a)	Lower (33a)	Lower (33a)	Lower (33a)	
Etanda formation	Flett formation	Map-unit 4 (part)	Map-unit 7	Map-unit 29 (part)	Map-unit 32	Unit 3
	Clausen formation		Map-unit 6		Map-unit 31	Unit 2
	Yohin formation		Map-unit 5		Map-unit 30	Unit 1

YOHIN FORMATION

The type section—600 feet thick—is a prominent and almost-vertical cliff on the west side of Yohin Ridge, from which the formation takes its name. The formation is mainly thin-bedded, grey, medium-grained sandstone, with several major black-shale units, mostly non-calcareous or only slightly calcareous. The base of the formation is concealed beneath a slope of sandstone talus, and the only identifiable fossils at the type section were collected from this talus. They comprise fragments of Leptaena, Rhipidomella, and Chonetes.

No precise dating of the Yohin formation could be made on the basis of fossils collected at the type section. As map-unit 30 (Virginia Falls and Sibbeston Lake map-areas), it was traced along the north side of Tlogotsho Plateau and correlated with beds on Clausen Creek and also with a resistant unit on Bluefish Mountain. Fossils from the unit on Bluefish Mountain include Chonetes sp., Productella cf. P. pyxidata Hall, Spirifer cf. S. marionensis Shumard, Punctospirifer sp., and Composita sp. The sum total of palaeontological evidence, admittedly meagre, suggests that the formation is of early Mississippian age.

CLAUSEN FORMATION

The type section, 551 feet thick, is on the west side of Yohin Ridge. The formation is named after Clausen Creek which drains much of the low-lying area west of Yohin Ridge. The Clausen formation is map-unit 6 of Fort Liard and La Biche map-areas and map-unit 31 of Virginia Falls and Sibbeston Lake map-areas.

The formation is almost unfossiliferous. It consists of black or dark grey shale, non-calcareous or only slightly calcareous, with scattered layers of pyritic nodules. A partly concealed interval with poor exposures separates the Clausen from the underlying Yohin formation. The contact is however, probably normal and conformable.

No fossils were found in the type section, but on the basis of a suggested Mississippian age for the underlying Yohin formation, the Clausen is assumed to be Mississippian. This dating is consistent with a few fragments of Torynifer sp. and Spirifer sp. found in a section at the headwaters of Clausen Creek.

FLETT FORMATION

The type section, whose thickness is 1,982 feet, is on the west side of Yohin Ridge. The name is after Flett Creek which rises in the Flett formation on Liard Range and flows eastwards into Liard River. The formation comprises limestone—thin-bedded, partly crinoidal and partly argillaceous—with considerable calcareous shale which is present both as distinct units and interbedded with limestone. Two well-developed sandstone zones are present in the upper half and there is some dolomite near the top. Contact with the underlying Clausen formation is conformable and distinct.

The Flett formation is moderately fossiliferous throughout. Five faunal assemblages were collected; these are listed below in ascending order (A to E). They range in age from upper Kinderhook to lower Chester.

A. 0-288 feet above base:

Dictyoclostus burlingtonensis (Hall)
Echinoconchus alternatus (Norwood and Pratten)
Chonetes illinoisensis Worthen
Chonetes sp. B
Camarotoechia allani Warren
Spirifer centronatus of authors
Spirifer rowleyi Weller
Platyrachella ? rutherfordi (Warren)
Brachythyris cf. chouteauensis Weller
Cleiothyridina cf. obmaxima McChesney
Phillipsia sp.

The following talus fossils can be fairly safely added to this list:

"Michelinia" sp.
Lingula sp.
Rhipidomella cf. missouriensis (Swallow)
Schizophoria cf. sedaliensis Weller
Schellwienella inequalis (Hall)
Pseudosyrinx gigas Weller
Punctospirifer cf. subtexta (White)
Athyris ? sp.
Imitoceras ? sp.
"Leda" sp.
Grammysia cf. longwelli Branson

The following ostracods¹ were collected from the top 20 feet of the sequence:

Cribroconcha aff. C. costata Cooper
Graphiadactyllis cf. spinosus Moery
? Amphissites sp.
? Seminolites sp.
Glyptopleurina n. sp.

B. 1,052-1,308 feet above base:

Kakwiphyllum sp.
Ekvasophyllum sp.
Orthotetes cf. keokuk ? (Hall)
Chonetes sp.
Dictyoclostus indet.
Buxtonia sp.
Camarotoechia sp.
Spirifer sp. A
Spirifer cf. bifurcatus Hall
Platyrachella ? rutherfordi ? (Warren)
Torynifer cf. pseudolineata (Hall)
Composita sp.
Pentremites cf. godoni De France

C. 1,645 feet above base:

Diphyphyllum sp.
Lyropora sp.
Dictyoclostus cf. tenuicostatus (Hall)
Camarotoechia sp. A

D. 1,832 feet above base:

Amplexi - Zaphrentis sp.
Rhipidomella sp.
Dictyoclostus cf. inflatus (McChesney)
Dictyoclostus cf. parvus (Meek and Worthen)
Spirifer cf. pellaensis Weller
Brachythyris cf. subcardiformis (Hall)
Dimegelasma sp.
Torynifer cf. setigera (Hall)

E. 1,880 feet above base:

Rhipidomella sp.
Spirifer sp. indet.
Spirifer cf. leidyi Norwood and Pratten

¹ Ostracods listed in this report were identified by M. J. Copeland, Geological Survey of Canada.

Composita cf. trinuclea (Hall)
Glyptopleuroides perplexus Croneis and Gutke
G. girtyi Croneis and Gutke
Paraparchites nicklesi (Ulrich)
Kirkbyella quadrata Croneis and Gutke
Cribroconcha cf. costata Cooper
Cavellina cf. parallela Croneis and Gutke
Polytilites cf. wilsoni Croneis and Gutke
Chesterella cf. exuta Croneis and Gutke
Oliganiscus cf. geisi Croneis and Gutke
Oliganiscus ? sp.
Bairdia cf. golcondensis Croneis and Gale
Graphiadactyllis (Bassleria) cf. lineatus (Ulrich and Bassler)
Bairdia sp.
Acratia sp.
Glyptopleura sp.
Graphiadactyllis ? sp.
Healdia sp.

The Flett formation is widespread. It is mapped in Fort Liard and La Biche map-areas as map-unit 7 and in Virginia Falls and Sibbeston Lake map-areas as map-unit 32. The formation is typically developed on Liard Range where it is a conspicuous scarp-former. It also occurs on Bluefish Mountain, Twisted Mountain, and along the north side of Tlogotsho Plateau. Farther west, as the escarpment is followed toward the northernmost extension of Tlogotsho Plateau, the Yohin-Clausen-Flett sequence loses its identity within a thick succession of shales and minor sandy beds. This shale-sandstone development beneath the Mattson formation continues southward over and into La Biche Valley, and also occurs on the south side of Tlogotsho Plateau and the west side of Kotaneelee Range. These beds comprise the Etanda formation.

ETANDA FORMATION

The type section is on the west flank of Kotaneelee Range, about 1 1/2 miles north of Etanda Lakes, from which the formation is named. The formation consists mainly of siltstone, sandstone, and shale. It is predominantly dark coloured, essentially non-calcareous, and comprises 2,300 feet of beds. It is overlain conformably by the sandstones of the Mattson formation. The base was not seen.

The formation contains few fossils. Dictyoclostus burlingtonensis (Hall), Spirifer cf. S. keokuk (Hall), Brachythyris sp., and fragments of Camarotoechia were found near the base. Spirifer cf. S. pellaensis Weller and Leiorhynchus cf. L. carboniferum were found much higher in the section.

All of the section as exposed in the type area and on the west side of Kotaneelee Range is considered to be of Mississippian age. On general age relationships and stratigraphic position relative to the Mattson formation the Etanda is regarded as a facies equivalent of the Flett and possibly also part of the Clausen and Yohin formations.

The Etanda is included in map-unit 4 of Fort Liard and La Biche map-areas, and in map-unit 29 of Virginia Falls and Sibbeston Lake map-areas. Both of these map-units however, include beds much older than those exposed in the type area of the Etanda formation, especially to the west where the Devonian Nahanni formation has shaled out and no obvious lithological datum exists for the base of map-unit 4.

MATTSON FORMATION

This formation was named by Patton in 1958. The type section is on Yohin Ridge. Examination of the type section showed that it could be divided into the following three members, comprising a total of 3,160 feet of beds:

Lower Member (1,130 feet):

Sandstone, medium-bedded to massive; thin coal seam 940 feet from base; plant fragments and coal spores (see Hacquebard and Barss, 1957).

Middle Member (797 feet):

Massive sandstone, some shale interbeds; no fossils.

Upper Member (1,233 feet):

Sandstone and shale; more recessive than other members; includes only truly carbonate beds of formation, thin arenaceous limestone and dolomite near base, middle, and top of member; Spirifer rockymontanus Marcou, Spirifer boonensis Swallow and Composita cf. C. subtilita (Hall) near base, and productid fragments and Spirifer rockymontanus near top.

The Mattson formation conformably overlies the Flett formation and the contact is sharp. The upper contact with the overlying Cretaceous was not seen at the type section and additional beds assignable to the Mattson may be concealed beneath talus in the type section.

The Mattson forms the ridges of Liard, Kotaneelee, and La Biche Ranges and also the Tlogotsho Plateau. It is mapped in Fort Liard and La Biche map-areas as map-unit 8, and in Virginia

Falls and Sibbeston Lake map-areas as map-unit 33. In both cases three sub-units have been mapped, which correspond approximately to the members of the type section.

The Mattson cannot be older than Chester, as it rests conformably on the upper part of the Flett with its lower Chester ostracods and megafossils. The upper member contains Pennsylvanian brachiopods. The Mississippian-Pennsylvanian boundary must therefore lie somewhere within the formation, possibly near the coal seam (Hacquebard and Barss, 1957, p. 3).

In some sections Permian fossils occur in the highest beds of the Mattson—for instance at Tika Creek where the formation is very thick (4,672 feet). There, Kochiproductus sp., Canocrinella? sp. and Spiriferella sp. were found. A similar Permian fauna with Muirwoodia cf. M. mammatus (Keyserling) and Spiriferella sp. was also found close below the Cretaceous on the west flank of Liard Range near the headwaters of Sully Creek. Elsewhere, especially in the south and southwestern parts of the area, the Mattson is overlain by the cherty beds of the Fantasque formation.

FANTASQUE FORMATION

This formation, named after Fantasque Lake, includes the bedded cherts that occur above the Mattson formation on the flanks of Kotaneelee Range, La Biche Range and on the east side of the Beaver River basin. These rocks were first described by Kindle (1944, p. 5) whose section on the north side of Beaver River southwest of Mount Merrill is proposed as the type section. There, the Fantasque formation consists of massive and roughly laminated, grey or black chert overlain by calcareous sandstone; total thickness is 180 feet.

The Fantasque formation is map-unit 9 of Fort Liard and La Biche map-areas. It rests unconformably on the Mattson according to Douglas and Norris (1959, p. 13) and is itself bevelled northward by the Cretaceous. Triassic beds probably overlie the Fantasque in the southwestern part of the area.

The Mattson has yielded Pennsylvanian fossils, including Krotovia sp. Dictyoclostus cf. D. portlockianus, and Juresania sp., at several localities immediately beneath the Fantasque. No Permian fossils have been found in the Mattson in those sections where it is overlain by the Fantasque; presumably these younger beds have been removed by pre-Fantasque erosion. The Fantasque formation is assumed to be of Permian age.

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