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Critical review

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Abstract: In the Colville Hills region of the Northwest Territories, the Lower to Middle Devonian succession consists of variably brecciated limestone and dolostone that historically has been assigned to the Bear Rock Formation. Nonbrecciated strata within this interval can be assigned to the Arnica and Landry formations, but bedrock exposure is too sparse to permit these units to be mapped. In view of the internal complexity of this stratigraphic succession, the term 'Bear Rock assemblage' is applied to this interval. Only limited age constraints on these strata have been reported. Conodont assemblages collected in 2015 demonstrate that the succession ranges from lowermost Emsian to lower Eifelian (*dehiscens* to *costatus* zones). This is comparable to the inferred age of Bear Rock Formation in the Franklin Mountains and Mackenzie Mountains. Thermal alteration of most samples is low, but one sample records evidence of higher maximum temperatures, possibly related to hydrothermal alteration.

Résumé : Dans la région des collines Colville, dans les Territoires du Nord-Ouest, la succession du Dévonien inférieur et moyen est formée de calcaires et de dolomies variablement bréchifiés qui avaient été jusque-là attribués à la Formation de Bear Rock. Dans cet intervalle, les strates non bréchiques peuvent être attribuées aux formations d'Arnica et de Landry, mais les affleurements rocheux sont trop épars pour que l'on puisse les cartographier. Étant donné la complexité interne de cette succession stratigraphique, nous appellerons cet intervalle « assemblage de Bear Rock ». On n'a publié que peu d'information sur les limites chronologiques de ces strates. Les associations de conodontes recueillies en 2015 montrent que la succession s'étend de l'Emsien basal à l'Eifélien inférieur (de la Zone à dehiscens à la Zone à costatus). Cet âge est comparable à celui qui est présumé pour la Formation de Bear Rock dans les monts Franklin et les monts Mackenzie. L'altération thermique de la plupart des échantillons est faible, mais l'un d'eux contient des preuves de l'existence de températures maximales plus élevées, probablement associées à une altération hydrothermale.

INTRODUCTION

In 1968, the bedrock geology of the Colville Hills region of the Northwest Territories was mapped at reconnaissance scale by the Geological Survey of Canada as part of Operation Norman (Aitken et al., 1969; Aitken and Cook, 1970; Cook and Aitken, 1971). The lower part of the Devonian succession in the Colville Hills was found to consist of dolostone and limestone in which units of carbonate breccia were prominent and widely distributed (Cook and Aitken, 1971, p. 9). These strata were assigned to the Bear Rock Formation of Hume and Link (1945). Subsequently, it was suggested (Cook and MacLean, 1993) that nonbrecciated strata within the Bear Rock interval may be assignable, in ascending order, to Arnica Formation (dolostone) and Landry Formation (limestone).

During the summer of 2015, two of the present authors (K.M. Fallas and R.B. MacNaughton) undertook 1:250 000 scale bedrock mapping in the Colville Hills region of the Northwest Territories (NTS map areas 96K, 96L, 96M, and 96N; Fig. 1). In the course of that work, bulk samples for conodont analysis were collected from probable exposures of Bear Rock, Arnica, and Landry formations. The conodonts thus obtained have been studied by the first author (S. Gouwy). This report presents the results of that study, which significantly improve the age constraints on this interval in the Colville Hills. Also addressed is the question of how best to treat the lithostratigraphy of these strata for mapping purposes in the Colville Hills in light of the contested status of the Bear Rock Formation (*see* discussion in Morrow, 2012).

STRATIGRAPHY

Summary of Paleozoic stratigraphy

The Paleozoic outcrop stratigraphy of the Colville Hills is summarized in Figure 2. Strata assigned to Bear Rock Formation by Cook and Aitken (1971) lie disconformably upon fossiliferous, silicified carbonate rocks of Mount Kindle Formation (Upper Ordovician to Lower Silurian). Carbonate rocks of Tatsieta Formation may be present locally beneath Bear Rock Formation (Cook and MacLean, 1993; Fallas et al., 2015). Bear Rock strata are overlain conformably by rubbly, fossiliferous limestone, locally shaly, that is assigned to the Hume Formation (Middle Devonian). Cook and Aitken (1971, p. 9) described the Bear Rock Formation as consisting "…of laminated to thick-bedded, pale brown, very fine-crystalline dolomites; thin-bedded, pale grey-weathering, pelletal limestones; and rarely exposed white gypsum. Thick units of dolomite and limestone solution breccia occur widely, and the bedded carbonates are commonly brecciated."

Prior to the present report, direct biostratigraphic evidence for the age of the Bear Rock Formation in the Colville Hills was limited to the ostracod *Moelleritia canadensis* Copeland 1962, of probable early Middle Devonian (Eifelian) age, which was collected during Operation Norman (Cook and Aitken, 1971). Additional fossil remains recovered during that work consisted of fragmentary, nondiagnostic brachiopods, nautiloids, and gastropods. More recently, specimens of acanthodian and arthrodire fishes have been described from exposures of Bear Rock Formation along Anderson River (Cumbaa and Schultze, 2002; Schultze and Cumbaa, 2017).

Description of Bear Rock, Arnica, and Landry formations

Efforts at delineating Bear Rock, Arnica, and Landry formations in the Colville Hills during 2015 fieldwork met with limited success, but it was possible to characterize each unit in general terms. Strata assigned to Bear Rock Formation consist of limestone and dolostone, as well as dolomitic limestone and calcareous dolostone, which have been brecciated to varying degrees (Fig. 3). Fresh colours include beige, light to medium brown, and medium to dark shades of grey, whereas weathering colours are dominantly light grey. Within clasts and undisturbed beds, crystal size ranges from cryptocrystalline to medium (rarely coarsely) crystalline. Sucrosic textures are present in some dolomitic exposures. Rubble pack-breccia to float-breccia are the most common breccia textures and clasts within breccia horizons are pebble to cobble size. Coarse white calcite crystals fill pore space between clasts in some outcrops. Bed thicknesses are highly variable, ranging from thickly laminated to thickly (rarely very thickly) bedded. Undisturbed beds may be massive or preserve parallel bedding or lamination, wavy bedding, crosslamination, or microbial lamination; similar fabrics can be seen in clasts in some breccia beds. Peloidal and, less commonly, oolitic horizons are present locally. Fossils are restricted to rare ostracods and gastropods. Bear Rock Formation outcrops are commonly fetid (petroliferous).

Strata assigned to Arnica Formation during mapping consist of crystalline dolostone (finely to coarsely crystalline) that commonly is vuggy. On fresh surfaces, Arnica Formation shows shades of pale grey, pale brown, or beige, and it weathers light grey. Exposures are medium to thick bedded. Beds are faintly laminated, parallel laminated or bedded, or irregularly bedded. Some outcrops are slightly petroliferous. By contrast, exposures assigned to Landry Formation (Fig. 4) consist of limestone (including crystalline limestone and lime mudstone) that varies from very finely to medium crystalline. Fresh surfaces are generally dark grey or brown, and outcrops weather to paler shades of grey or, less commonly, brown. Bedding can be massive, irregularly microbially laminated with vuggy textures following the laminae, or well laminated with peloidal textures. Some outcrops are strongly petroliferous. Minor zones of brecciation are locally present.

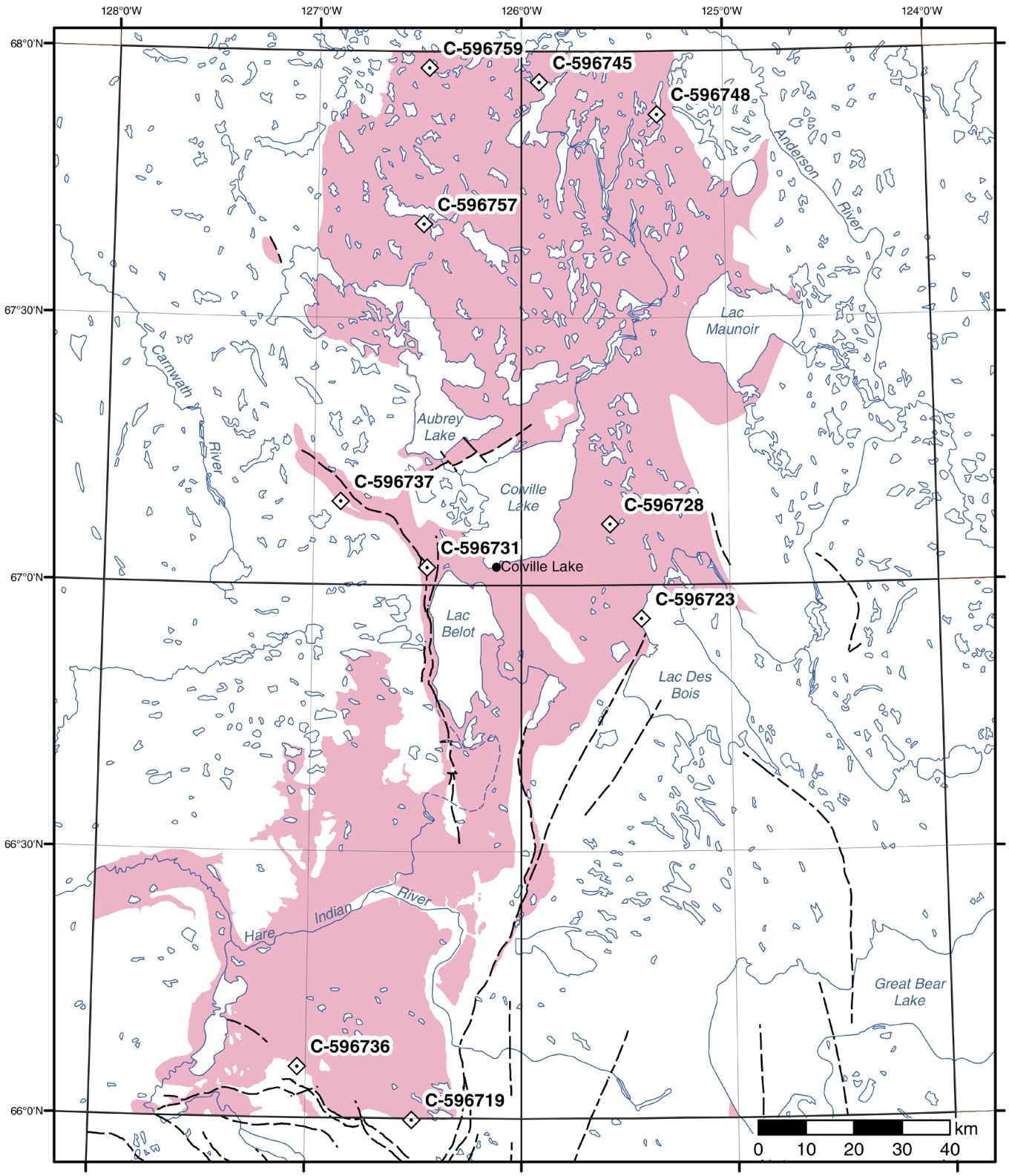

Figure 1. Distribution of 'Bear Rock assemblage' (pink shaded area) in the Colville Hills with conodont sample locations. Faults shown as dashed black lines.

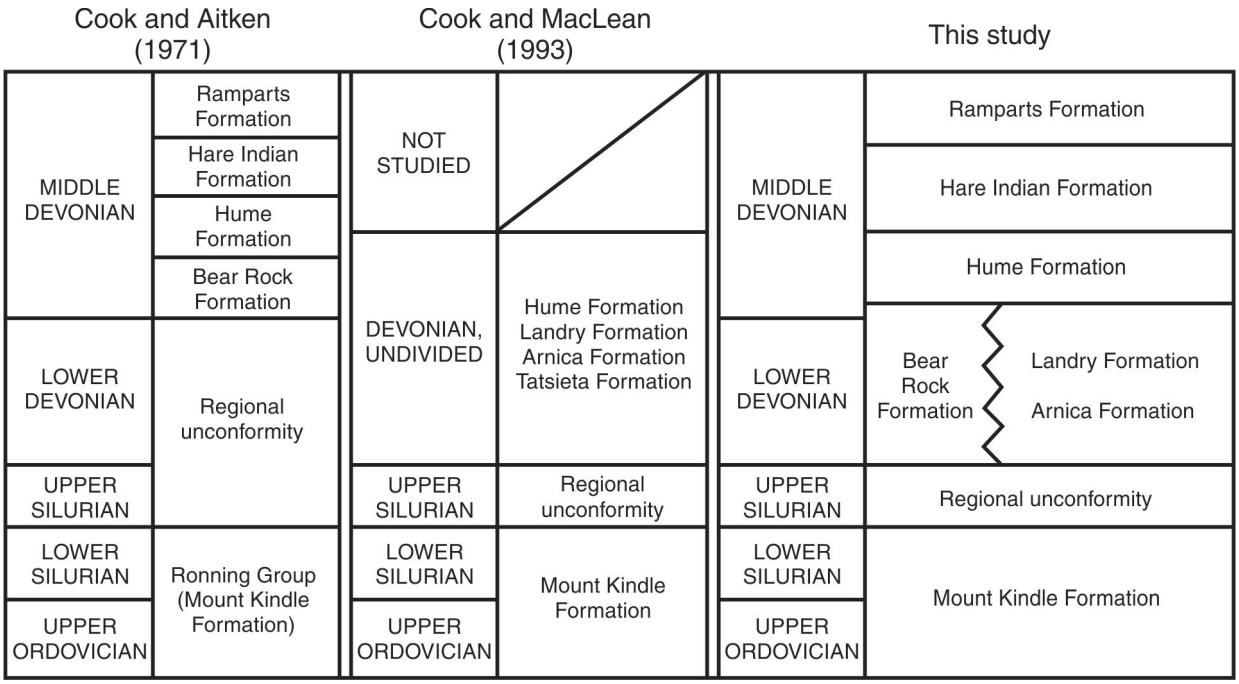

Figure 2. Upper Ordovician to Devonian lithostratigraphy of the Colville Hills. Diagonal lines denote units not included in the geographically limited study area of Cook and MacLean (1993). The stratigraphic succession summarized here is underlain and overlain by regional unconformities (Cook and Aitken, 1971; Fallas et al., 2015).

Figure 3. Limestone breccia of Bear Rock Formation exposed on the Jacques Range. Note well developed cavernous porosity and near-total obliteration of original bedding. Co-ordinates: 66.039727°N, 127.504235°W. Photograph by K.M. Fallas. 2017-079

Figure 4. Well bedded and laminated limestone assigned to Landry Formation at Big Eagle Rock. Co-ordinates: 66.320815°N, 127.260257°W. Photograph by K.M. Fallas. 2017-080

Application of the term 'Bear Rock Assemblage'

As the preceding descriptions show, there is significant overlap in lithology between the Bear Rock Formation and the Arnica and Landry formations. The degree of brecciation is the most striking point of difference. These similarities suggest an interfingering relationship between Bear Rock and the other two units, like that documented in other areas (e.g. Morrow, 1991; Meijer Drees, 1993). Outcrops are too poorly exposed and widely separated for the units to be mapped separately, and there is no observable geographic trend to the distribution of brecciated versus nonbrecciated facies.

Although Bear Rock Formation is a distinctive, stratiform unit that has been applied widely in the eastern Mackenzie Mountains, Franklin Mountains, and interior plains of northern mainland Canada (e.g. Hume and Link, 1945; Tassonyi, 1969; Pugh, 1983; Morrow, 1991; Meijer Drees, 1993), its detailed correlation has proven to be challenging, especially in the subsurface. Various authors have supported its broad application in the surface and subsurface (Tassonyi, 1969), its restriction to the surface and shallow-subsurface realms (Meijer Drees, 1993), its elevation to group status (Pugh, 1983; Norris, 1985), or even its abandonment (Gal et al., 2009). Resolution of such questions is beyond the scope of this report, but bedrock maps arising from the 2015 field season (K.M. Fallas, work in progress, 2017) will need to present the lithostratigraphy of the Bear Rock interval in an appropriate way. The literature points to at least three possible approaches, briefly summarized and discussed here. The present authors note that they disagree with the abandonment of the Bear Rock Formation, which is a validly named, regionally mappable unit that has priority over other named units in this interval—facts not addressed by Gal et al. (2009) in their very brief justification for their proposal. The approaches listed below assume the validity of the Bear Rock Formation.

1) In the Mackenzie Valley and Mackenzie Mountains, the existence of tongues of Arnica and Landry formations within the Bear Rock Formation was documented by Morrow (1991), who considered that the tongue of Landry Formation was locally thick enough to constitute a Landry Member. Thus, all the strata under consideration might be included in the Bear Rock Formation, as was done by Cook and Aitken (1971). This is an attractive option, but is complicated by the recent proposal to abandon the Bear Rock Formation (Gal et al., 2009), which requires a more formal rebuttal than can be offered here.

2) Some workers have proposed that Bear Rock Formation be raised to the status of a regional "Group" (e.g. Pugh, 1983; Norris, 1985); however, this proposal appeared only in a brief footnote in Pugh (1983, p. 27) and to the knowledge of the present authors was never formalized. Morrow (1991, p. 12) acknowledged the desirability of establishing group-level nomenclature for these strata, but offered several cogent arguments against the use of the name Bear Rock for such a new lithostratigraphic unit.

3) Morrow (1991, 2012) subdivided the Silurian-Devonian succession of the northern mainland into a number of assemblages of genetically related formations. One of these, the "Bear Rock assemblage" (Morrow, 2012; = "Arnica-Bear Rock assemblage" of Morrow, 1991) includes the Bear Rock Formation and its correlative units, including the Arnica and Landry formations. Pending a much-needed, formal lithostratigraphic review, the term 'Bear Rock assemblage' provides a convenient, well understood means of grouping these strata, and will be applied on maps based on the 2015 fieldwork (K.M. Fallas, work in progress, 2017).

CONODONT BIOSTRATIGRAPY AND THERMAL MATURITY

Sample locations are shown on Figure 1 and location information for conodont samples is given in the Appendix. Samples were collected from outcrops assigned to Bear Rock Formation (six samples), Arnica Formation (three samples), and Landry Formation (one sample). One sample (GSC Curation Number C-596736) was collected less than 5 m above the contact between the Mount Kindle and Bear Rock formations, but all others came from isolated outcrops for which stratigraphic position could not be constrained precisely. The sample of Landry Formation (GSC Curation Number C-596731) was barren, as was one Bear Rock Formation sample (GSC Curation Number C-596737). The remaining samples yielded conodonts. The following lists give the faunal composition for each sample, as well as the thermal maturity as indicated by colour alteration index (CAI). Selected conodonts are illustrated in Plate 1, and the systematics of selected species is discussed in the next section of this report.

GSC Curation Number C-596719 (Arnica Formation):

Indeterminate coniform elements – 7 specimens

Ozarkodina sp. – 13 specimens

Steptotaxis? sp. S Uyeno 1990 – 5 specimens

Chronostratigraphy: Emsian (Early Devonian)

Biostratigraphy: *dehiscens – inversus* zones

Thermal maturity: CAI 1–1.5.

GSC Curation Number C-596723 (Arnica Formation):

Ozarkodina sp. – 5 specimens

Chronostratigraphy: Silurian–Devonian

Thermal maturity: CAI 1–1.5.

GSC Curation Number C-596728 (Bear Rock Formation):

Indeterminate coniform element – 2 specimens

Ozarkodina sp. – 7 specimens

Chronostratigraphy: Silurian–Devonian

Thermal maturity: CAI 1–1.5.

GSC Curation Number C-596736 (Arnica Formation):

Indeterminate ramiform element – 9 specimens

Ozarkodina sp. – 1 specimen

Pelekysgnathus sp. – 1 specimen

Chronostratigraphy: Late Silurian–Devonian

Thermal maturity: CAI 1–1.5.

GSC Curation Number C-596745 (Bear Rock Formation):

Neopanderodus cf. *N. transitans* Ziegler & Lindström 1971 – 7 specimens

Ozarkodina sp. – 13 specimens

Pandorinellina expansa Uyeno & Mason 1975 – 6 specimens

Pandorinellina sp. – 5 specimens

Chronostratigraphy: Emsian (Early Devonian) – middle Eifelian (Middle Devonian)

Biostratigraphy: *inversus* – *costatus* zones

Thermal maturity: CAI 1–1.5.

GSC Curation Number C-596748 (Bear Rock Formation):

Panderodus/Neopanderodus ? sp. – 1 specimen

Chronostratigraphy: Ordovician – Middle Devonian

Thermal maturity: CAI 1–1.5.

GSC Curation Number C-596757 (Bear Rock Formation):

Indeterminate ramiform element – 1 specimen

Ozarkodina sp. – 1 specimen

Chronostratigraphy: Silurian–Devonian

Thermal maturity: CAI 1–1.5.

GSC Curation Number C-596759 (Bear Rock Formation);

Neopanderodus sp. – 70 specimens

Pandorinellina sp. – 2 specimens

Steptotaxis? sp. S Uyeno 1990 – 1 specimen

Chronostratigraphy: Emsian (Early Devonian)

Biostratigraphy: *dehiscens* – *inversus* zones

Thermal maturity: CAI 4–6, texturally altered conodonts

Five of the samples, including both from the Arnica Formation and three from the Bear Rock Formation, yielded conodont assemblages that only permitted age assignments to the level of periods (Ordovician to Devonian or Silurian to Devonian). Regrettably, the stratigraphically well constrained sample (GSC Curation Number C-596736) was from one of these collections. Two samples from the Bear Rock Formation and one from the Arnica Formation contained conodonts that allow an age assignment down to the conodont zone level. Based on those three samples the maximum demonstrated range of the 'Bear Rock assemblage' in the Colville Hills is *dehiscens* to *costatus* zones (lowermost Emsian to lower Eifelian). This agrees well with the age of this interval as presently understood to the west, in the areas of Mackenzie Plain and in the Mackenzie Mountains (e.g. Morrow, 1991, 2012; Meijer Drees, 1993).

The conodont colour alteration index (CAI) in most of the samples is 1–1.5, indicating maximum temperatures of less than 60°C. In one sample (GSC loc. C-596759) the CAI is 4–6 (190–550°C), with conodonts that have sugary, texturally altered surfaces. Some conodonts in that sample are deformed (Pl. 1, fig. 18), some are partially white (Pl. 1, fig. 19, 20) or even striped (Pl. 1, fig. 21), and a few are completely deprived of fixed carbon. The presence of several CAI values in one sample, even in a single conodont element, and the sugary surface of the elements point to hydrothermal alteration of the conodonts (Königshof, 2003). There are no obvious sources of hydrothermal alteration in the area where this sample was collected, which is along the northern edge of NTS 96-M, where no faults or folds have been mapped at surface. An industry reflection-seismic line (now in public domain) that passes near the outcrop is not of sufficient quality for interpreting geological features.

CONODONT SYSTEMATICS

Genus *Neopanderodus* Ziegler and Lindström, 1971

Type species: *Neopanderodus perlineatus* Ziegler and Lindström, 1971

Neopanderodus cf. *N. transitans* Ziegler and Lindström, 1971

Plate 1, figures 16, 17

Remarks: the specimens resemble *N. transitans* in the position of the longitudinal furrow on the obverse side somewhat behind the middle and the ellipsoidal cross-section of the basal part with a sinus at the longitudinal furrow. Ornamentation (striations) is missing, possibly due to chemical alteration of the coniform elements. The specimens can be distinguished from *N. perlineatus* by the position of the longitudinal furrow that is close to the posterior margin in the latter. *N. transitans* is known from the Upper Emsian to the uppermost Middle Devonian (Ziegler, 1975).

Genus *Pandorinellina* Müller and Müller, 1957

Type species: *Pandorina insita* Stauffer 1940

Pandorinellina expansa Uyeno and Mason, 1975

Plate 1, figures 13–15

Pandorinellina expansa n. sp. UYENO and MASON, 1975, p. 718–720, Plate 1, figures 6, 9, 11–19.

Pandorinellina expansa Uyeno and Mason. KLAPPER in Ziegler (ed.) 1977, p. 435, 436, *Pandorinellina* Plate 1, figures 9–17.

Pandorinellina expansa Uyeno and Mason. UYENO, 1990, p. 96–97, Plate 5, figures 24–29; Plate 6, figures 7, 8; Plate 7, figures 21–26, 31; Plate 8, figures 1–3, 18; Plate 9, figures 23–25, 30.

Description: P-element with a large basal cavity showing the largest expansion at about mid-length of the unit, tapering briskly anteriorly and more gradually toward the posterior tip. The blade is higher in the anterior third and slightly offset laterally. This part of the blade consists of high denticles, increasing in height posteriorly. The lower part of the blade consists of closely positioned denticles, fused at their bases and more uniform in height.

Remarks: the species can be distinguished from *Pandorinellina exigua* by the much larger basal cavity. In the Canadian Arctic islands, *Pandorinellina expansa* also has been identified: in the Blue Fiord, Bird Fiord, and Strathcona Fiord formations and the upper part of the Undivided Devonian Carbonates on southeastern Grinnell Peninsula (Uyeno, 1990); from the Eids Formation on Bathurst Island (McGregor and Uyeno, 1972; Uyeno and Mason, 1975); and from the Blue Fiord Formation on Cameron Island (Uyeno and Mayr, 1979). It was also reported in Yukon within the Ogilvie Formation (Perry et al., 1974) and the Prongs Creek Formation (Uyeno and Mason, 1975). *Pandorinellina expansa* ranges from the late Lower to early Middle Devonian (Klapper, 1977).

Genus *Steptotaxis* Uyeno and Klapper, 1980

Type species: *Pelekysgnathus pedderi* Uyeno and Mason, 1975

Steptotaxis? sp. S Uyeno, 1990

Plate 1, figures 1–12

Steptotaxis ? sp. S UYENO, 1990, p. 64, Plate 7, figures, 8–12, 18–20, 29, 30, 34–38; Plate 8, figures 23–33; Plate 10, figures 1–17; Plate 13, figures 15–19, 25–29, 32–34.

Description: I-element. Element has a long, narrow, gently curved ridge from anterior to posterior margin, bearing low denticles. Several denticles may be bent laterally. One or two lateral ridges bearing one or two denticles are developed joining the main ridge at the cusp. Basal cavity is symmetrically (fig. 4) or asymmetrically (fig. 8) expanded posteriorly.

Remarks: no coronellan elements were found in the samples. *Steptotaxis*? sp. S Uyeno 1990 was described from the Blue Fiord Formation, Eastern Arctic Archipelago and may also have been recognized in Novaya Zemlya island group of northern Russia (Sobolev, 1984). The species is assigned to the Emsian (Uyeno, 1990).

CONCLUSIONS

Lower to Middle Devonian strata in the Colville Hills consist of limestone and dolostone that have been affected by brecciation to varying degrees. Where brecciation is strongly developed, assignment to Bear Rock Formation is appropriate. Outcrops that are not pervasively brecciated can be assigned to Arnica Formation (dolostone) or Landry Formation (limestone), but these two formations cannot be mapped in the region due to limited exposure. In view of the contested status of the Bear Rock Formation, the Lower to Middle Devonian succession will be assigned to the informal "Bear Rock assemblage" of Morrow (2012) on new GSC bedrock maps for the region (K.M. Fallas, work in progress, 2017). A regional-scale review of the Bear Rock Formation and its correlative units is strongly recommended.

Conodonts from 'Bear Rock assemblage' in the Colville Hills significantly improve the dating of these strata, which previously was based on a single species of ostracod (Cook and Aitken, 1971). The recovered assemblages indicate that these strata range from lowermost Emsian to lower Eifelian (*dehiscens* to *costatus* zones), similar to the inferred age of the Bear Rock Formation and its correlatives in the Franklin and Mackenzie mountains. Thermal maturity of the conodonts generally is low, but one sample records a higher maximum temperature and preserves evidence of hydrothermal alteration. The intensity and extent of hydrothermal influence in the region may be a fruitful subject for future study.

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Plate 1

Figures 1–4. *Steptotaxis*? sp. S, inner lateral, upper, outer lateral and lower view of I-element. GSC 137364. GSC loc. C-596719.

Figures 5–8. *Steptotaxis*? sp. S, inner lateral, upper, outer lateral and lower view of I-element. GSC 137365. GSC loc. C-596719.

Figures 9–12. *Steptotaxis*? sp. S, inner lateral, upper, outer lateral and lower view of I-element. GSC 137366. GSC loc. C-596759.

Figures 13–15. *Pandorinellina expansa*, upper, lateral and lower view of P-element. GSC 137367. GSC loc. C-596745.

Figures 16–17. *Neopanderodus* cf. *N. transitans*, lateral view of coniform elements. GSC 137368 and GSC 137369. GSC loc. C-596745.

Figure 18. Deformed coniform element with sugary surface texture. GSC 137372. GSC loc. C-596759.

Figure 19. Partially decoloured coniform element with sugary surface texture. GSC 137373. GSC loc. C-596759.

Figure 20. Partially white ramiform element with sugary surface texture. GSC 137370. GSC loc. C-596759.

Figure 21. Partially altered (striped pattern) coniform element with sugary surface texture. GSC 137371. GSC loc. C-596759.

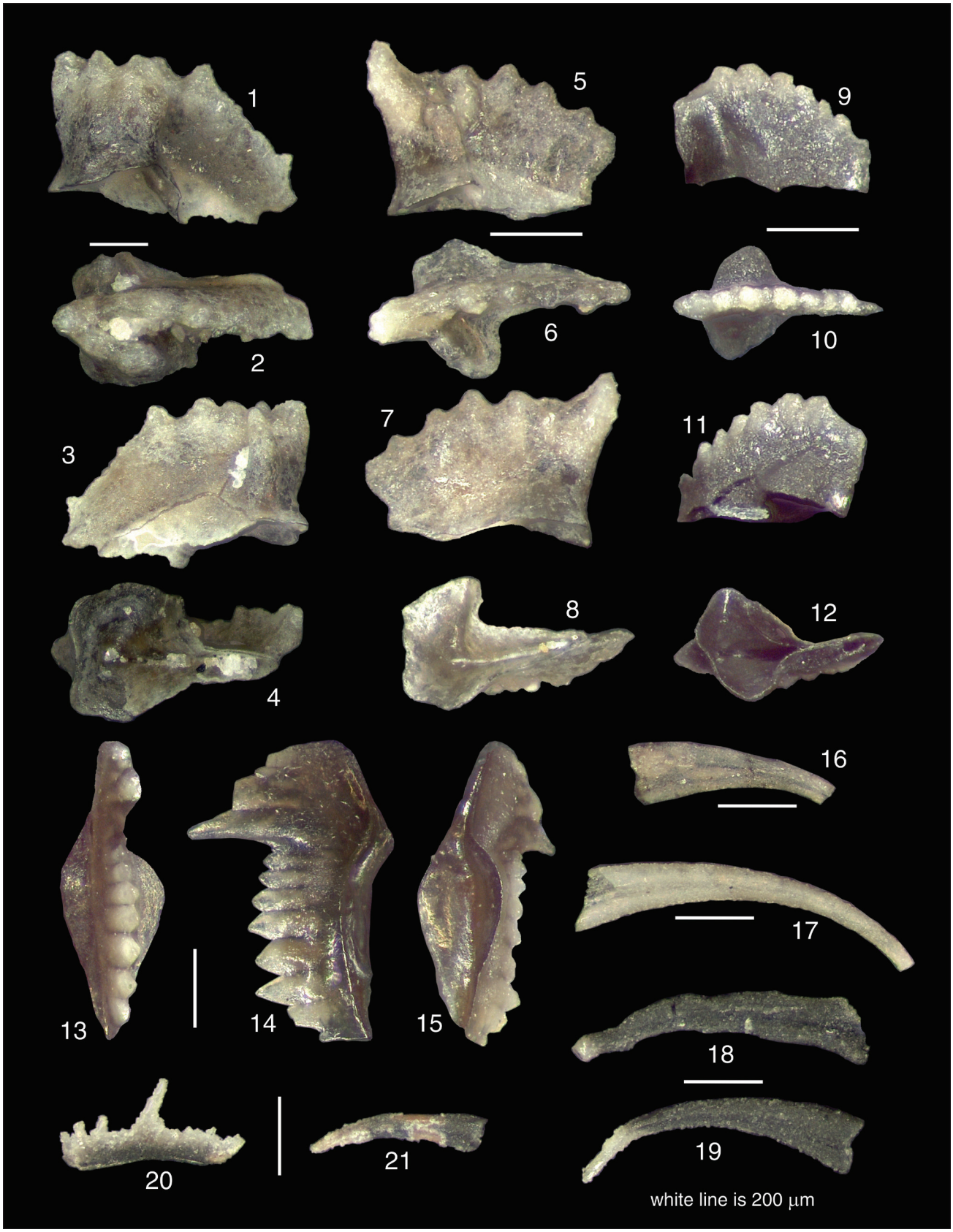

Plate 1: Photomicrographs of conodont material referred to in the text. The illustrated specimens are stored in the GSC Calgary conodont collection. White scale bar is 200 µm. All photographs by S. Gouwy.

APPENDIX – SAMPLE LOCATIONS

GSC Curation Number: C-596719; sample 15FNA009A01; Arnica Formation; station 15FNA009; latitude 65.99753334° N; longitude 126.50538° E; NAD83; NTS 096-E-15.

GSC Curation Number: C-596723; sample 15FNA014A01; Arnica Formation; station 15FNA014; latitude 66.93697667° N; longitude 125.4242416° E; NAD83; NTS 096-K-14.

GSC Curation Number: C-596728; sample 15FNA021A01; Bear Rock Formation; station 15FNA021; latitude 67.11432001° N; longitude 125.57095° E; NAD83; NTS 096-N-04.

GSC Curation Number: C-596731; sample 15FNA052A01; Landry Formation; station 15FNA052; latitude 67.03323001° N; longitude 126.4515433° E; NAD83; NTS 096-M-01.

GSC Curation Number: C-596736; sample 15FNA072A01; Arnica Formation; station 15FNA072; latitude 66.09591334° N; longitude 127.0369333° E; NAD83; NTS 096-L-03.

GSC Curation Number: C-596737; sample 15FNA082A01; Bear Rock Formation; station 15FNA082; latitude 67.15600501° N; longitude 126.8707233° E; NAD83; NTS 096-M-02.

GSC Curation Number: C-596745; sample 15MWB011A01; Bear Rock Formation; station 15MWB011; latitude 67.94261501° N; longitude 125.9113083° E; NAD83; NTS 096-N-13.

GSC Curation Number: C-596748; sample 15MWB012A02; Bear Rock Formation; station 15MWB012; Located at a cliff in area Colville Hills; latitude 67.88162501° N; longitude 125.3260366° E; NAD83; NTS 096-N-14.

GSC Curation Number: C-596757; sample 15MWB018A01; Bear Rock Formation; station 15MWB018; latitude 67.67666667° N; longitude 126.4785683° E; NAD83; NTS 096-M-09.

GSC Curation Number: C-596759; sample 15MWB019A01; Bear Rock Formation; station 15MWB019; latitude 67.96935167° N; longitude 126.4555° E; NAD83; NTS 096-M-16.