The Shaler Supergroup and revision of Neoproterozoic stratigraphy in Amundsen Basin, Northwest Territories[1]

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Abstract: Elevation of the Shaler Group to supergroup status and the following internal revisions are proposed in order to more properly reflect rock units of the Amundsen Basin. The names Escape Rapids, Mikkelsen Islands, Nelson Head and Aok are proposed to replace the lower clastic, cherty carbonate, upper clastic, and orange-weathering stromatolite members of the Glenelg Formation in Minto and Cape Lambton inliers, informal map units 19 to 21, 22, 23, and 24 in the Coppermine area and informal map units P1, P2, P3, and P4a in Brock Inlier, respectively. Collectively these are to be known as the Rae Group; the name Glenelg Formation is abandoned. The former Reynolds Point Formation is raised to group status and comprises the Grassy Bay, Boot Inlet, Fort Collinson and Jago Bay formations, which replace the lower clastic, lower carbonate, upper clastic and upper carbonate members in Minto Inlier and informal map units P4b, P4c, lower P4d and upper P4d in Brock Inlier, respectively.

Résumé : On propose d'élever le Groupe de Shaler au rang de Supergroupe, et d'apporter les modifications internes suivantes pour offrir une meilleure image des unités lithologiques du bassin d'Amundsen. Les appellations de formations d'Escape Rapids, de Mikkelsen Islands, de Nelson Head et d'Aok sont proposées afin de remplacer : le membre clastique inférieur, le membre de carbonate cherteux, le membre clastique supérieur et le membre stromatolitique à altération orange, respectivement, de la Formation de Glenelg dans les boutonnières de Minto et de Cape Lambton; les unités cartographiques 19-21, 22 , 23 et 24, respectivement, dans le secteur de Coppermine; et les unités cartographiques P1, P2, P3 et P4a, respectivement, dans la boutonnière de Brock. Ensemble, ces formations constituent le Groupe de Rae; l'appellation de Formation de Glenelg est abandonnée. L'ancienne Formation de Reynolds Point est élevée au rang de groupe et comprend les formations de Grassy Bay, de Boot Inlet, de Fort Collinson et de Jago Bay qui remplacent : le membre clastique inférieur, le membre carbonaté inférieur, le membre clastique supérieur et le membre carbonaté supérieur, respectivement, dans la boutonnière de Minto; et les unités cartographiques P4b, P4c, la partie inférieure de P4d et la partie supérieure de P4d, respectivement, dans la boutonnière de Brock.

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INTRODUCTION

The first complete geological reconnaissance of Victoria and Banks Islands was that of Washburn (1947), who recognized the similarity of Proterozoic strata of the Coppermine area and the Duke of York Inlier on the south shore of Victoria Island. Later, Thorsteinsson and Tozer (1962), proposed the name "Shaler Group" and its original formational subdivisions for the thick sequence of Proterozoic sedimentary strata that are exposed in Minto and Cape Lambton inliers (Fig. 1). Shaler Group strata were later recognized on the adjacent northern mainland coast in Brock Inlier (Cook and Aitken, 1969) and the Coppermine area where they are called Rae Group (Baragar and Donaldson, 1973). Stratigraphic correlation and sedimentological studies indicate that the inliers were part of the formerly contiguous intracratonic Amundsen Basin (Fig. 1).

Jefferson (1985) realized the need for further subdivision of the upper Shaler Group in southwest Minto Inlier and proposed the name Kuujjua Formation for a prominent quartzarenite unit, originally defined as an upper member of the Kilian Formation (Thorsteinsson and Tozer, 1962). Rainbird (1993) included the Natkusiak Formation, a basaltic succession which conformably overlies the Kuujjua Formation, with the Shaler Group. In this paper and henceforth we prefer to exclude the Natkusiak Formation from the proposed Shaler Supergroup, because of its contrasting lithological character and its partly unconformable relationship with underlying sedimentary strata (Table 1). Furthermore, the 723 Ma age of the Natkusiak Formation (Heaman et al., 1992) places it in Sequence C of Young et al. (1979), equivalent to the Windermere Supergroup in the Cordillera. It is generally accepted that sedimentary strata of the Shaler Supergroup, described herein, are equivalent to Sequence B of the Mackenzie Mountains Supergroup in the Cordillera (see Young et al., 1979).

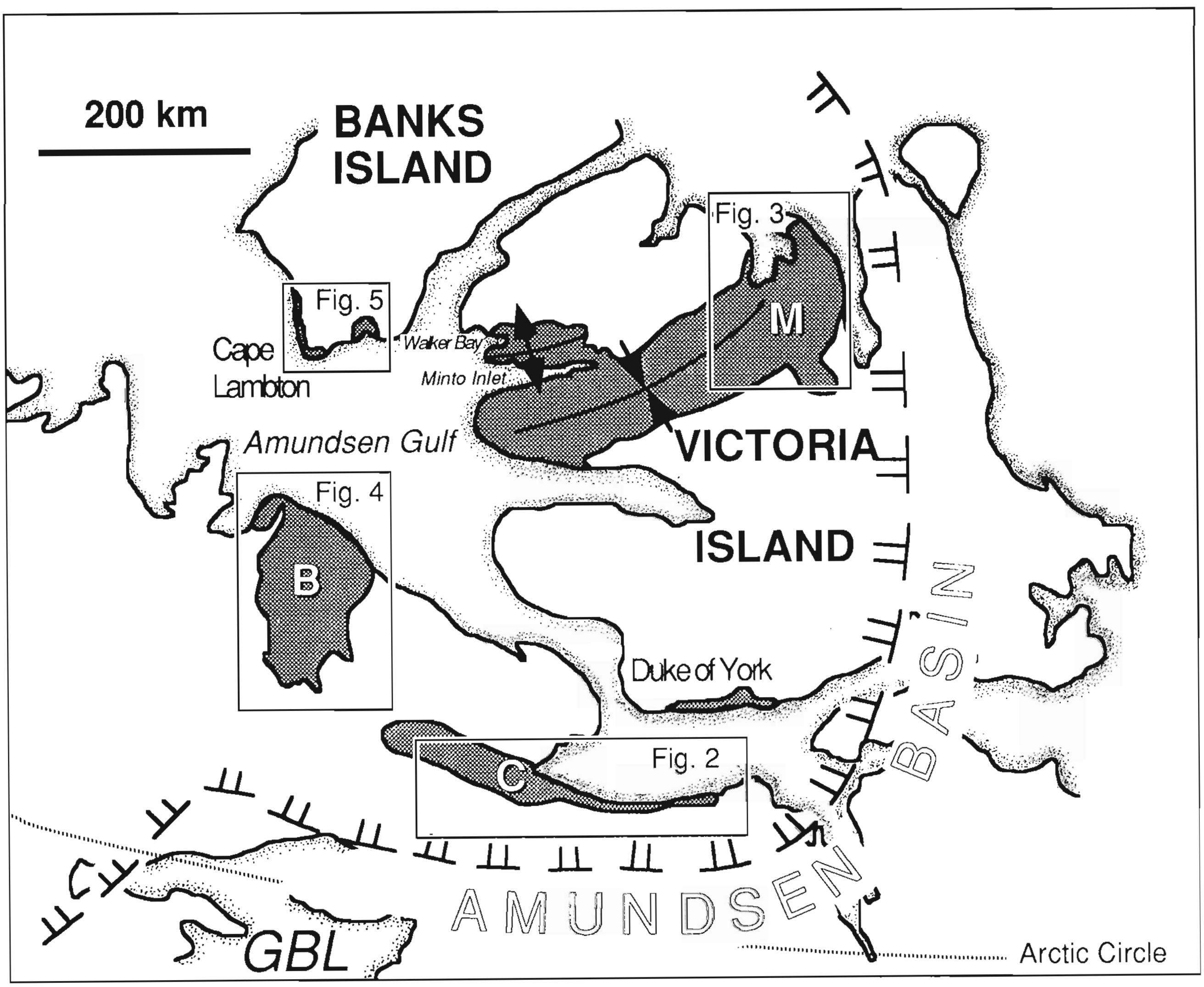

Figure 1. Location of Neoproterozoic inliers comprising Amundsen Basin of northwestern Canada. B=Brock Inlier, C=Coppermine area, M=Minto Inlier, GBL=Great Bear Lake.

Numerous sills and dykes, equivalents of the Natkusiak Formation basalts, intrude the Shaler Supergroup throughout Amundsen Basin. These were dated by U-Pb method on baddeleyite providing a minimum age for the Shaler Supergroup of 723 Ma (Heaman et al., 1992). A maximum age of 1077 Ma was determined from U-Pb analysis of detrital zircon from the Nelson Head Formation in Minto Inlier (Rainbird and McNicoll, unpub. data, 1993).

Field studies by ourselves and other workers over the past 25 years have established that formations and members of the Shaler Group are similar throughout the Amundsen Gulf region. Presently, the nomenclature used to describe packages of rocks within the region does not properly reflect these similarities, largely because the original mapping was done by different geologists who concentrated their studies in single areas and therefore did not recognize the regional consistancy of rock units. The intent of this paper is to revise stratigraphic nomenclature in Amundsen Basin.

THE SHALER SUPERGROUP: PROPOSED GROUP AND FORMATIONAL SUBDIVISIONS

Formational status is proposed for informal members of the former Glenelg and Reynolds Point formations on the basis that they are mappable at 1:50 000 scale and was traced throughout Amundsen Basin (Thorsteinsson and Tozer, 1962; Rainbird et al., 1992; Morin and Rainbird, 1993; see Table 1). Therefore, we propose elevating the Glenelg Formation and Reynolds Point Formation to group status and Shaler Group to supergroup status.

Field studies in 1993 confirmed that the Rae Group in the Coppermine area contains the same rock units as does the Glenelg Formation in Minto Inlier and map units P1, P2, P3, and P4a in Brock Inlier (Table 1). Therefore, we propose retention of the name Rae Group for these strata throughout Amundsen Basin and abandonment of the name Glenelg. Retention of more than one name for the same rocks would be confusing, particularly since we propose the same formation names in all areas. Although we acknowledge that use of the word Glenelg is well established in previous publications, so is the Rae Group, and rather than abandon Rae Group and raise the Glenelg to group status, we prefer to discard the term Glenelg.

Rae Group

The Rae Group (Baragar and Donaldson, 1973) as herein defined, includes strata of Proterozoic age above rocks of the Coppermine River Group in the Coppermine area (Fig. 2) and rocks of Goulburn Supergroup in Minto Inlier (Fig. 3). Elsewhere the base is not exposed. The group is conformably

Table 1. Proposed revisions to stratigraphic nomenclature in Amundsen Basin. These revisions apply also to Cape Lambton and Duke of York inliers (Fig. 1).

Minto Inlier existing [1]			Minto Inlier proposed				Brock Inlier existing [2]		Brock Inlier proposed					Coppermine Area existing [3]		Coppermine Area proposed				
Shaler Group		Natkusiak				Natkusiak 1100m														
Shaler Group		Kuujjua	Shaler Supergroup		Franklin Gabbro sills and dykes	Kuujjua 120m														
Shaler Group		Kilian	Shaler Supergroup		Franklin Gabbro sills and dykes	Kilian 550m														
Shaler Group		Wynniatt	Shaler Supergroup		Franklin Gabbro sills and dykes	Wynniatt 550m														
Shaler Group		Minto Inlet	Shaler Supergroup		Franklin Gabbro sills and dykes	Minto Inlet 260m	Shaler Group	Unit P5	Shaler Supergroup		Franklin Gabbro sills and dykes	Minto Inlet 200m								
Shaler Group	Reynolds Point Fm.	upper carbonate member	Shaler Supergroup	Reynolds Point Group	Franklin Gabbro sills and dykes	Jago Bay 65m	Shaler Group	Unit P4d	Shaler Supergroup	Reynolds Point Group	Franklin Gabbro sills and dykes	Jago Bay 50m								
Shaler Group	Reynolds Point Fm.	upper clastic member	Shaler Supergroup	Reynolds Point Group	Franklin Gabbro sills and dykes	Fort Collinson 170m	Shaler Group	Unit P4d	Shaler Supergroup	Reynolds Point Group	Franklin Gabbro sills and dykes	Fort Collinson 50m								
Shaler Group	Reynolds Point Fm.	lower carbonate member	Shaler Supergroup	Reynolds Point Group	Franklin Gabbro sills and dykes	Boot Inlet 500m	Shaler Group	Unit P4c	Shaler Supergroup	Reynolds Point Group	Franklin Gabbro sills and dykes	Boot Inlet 500m								
Shaler Group	Reynolds Point Fm.	lower clastic member	Shaler Supergroup	Reynolds Point Group	Franklin Gabbro sills and dykes	Grassy Bay 200m	Shaler Group	Unit P4b	Shaler Supergroup	Reynolds Point Group	Franklin Gabbro sills and dykes	Grassy Bay 100m								
Shaler Group	Glenelg Fm.	orange-weathering stromatolite mbr.	Shaler Supergroup	Rae Group	Franklin Gabbro sills and dykes	Aok 40m	Shaler Group	Unit P4a	Shaler Supergroup	Rae Group	Franklin Gabbro sills and dykes	Aok 50m			Shaler Supergroup	Rae Group	Franklin Gabbro		Aok <20m
Shaler Group	Glenelg Fm.	upper clastic member	Shaler Supergroup	Rae Group	Franklin Gabbro sills and dykes	Nelson Head >300m	Shaler Group	Unit P3	Shaler Supergroup	Rae Group	Franklin Gabbro sills and dykes	Nelson Head 460m	Rae Group	Unit 23	Shaler Supergroup	Rae Group	Franklin Gabbro		Nelson Head 90m
Shaler Group	Glenelg Fm.	cherty carbonate member	Shaler Supergroup	Rae Group	Franklin Gabbro sills and dykes	Mikkelsen Islands 400m	Shaler Group	Unit P2	Shaler Supergroup	Rae Group	Franklin Gabbro sills and dykes	Mikkelsen Islands 240m	Rae Group	Unit 22	Shaler Supergroup	Rae Group	Franklin Gabbro		Mikkelsen Islands 260m
Shaler Group	Glenelg Fm.	lower clastic member	Shaler Supergroup	Rae Group	Franklin Gabbro sills and dykes	Escape Rapids >500m	Shaler Group	Unit P1	Shaler Supergroup	Rae Group	Franklin Gabbro sills and dykes	Escape Rapids 910m	Rae Group	Unit 21	Shaler Supergroup	Rae Group	Franklin Gabbro	Escape Rapids	Bloody Fall Mbr. 635m
														Rae Group	Unit 20	Shaler Supergroup	Rae Group	Franklin Gabbro	Escape Rapids	Nipartoktuak Mbr. 150m
														Rae Group	Unit 19	Shaler Supergroup	Rae Group	Franklin Gabbro	Escape Rapids	Hihotok Mbr. 200m

1. Thorsteinsson and Tozer 1962, Young and Long 1977b, Rainbird et al. 1992
2. Cook and Aitken 1969, Jones et al. 1992
3. Baragar and Donaldson 1973

overlain by rocks of the Reynolds Point Group in Minto and Brock inliers (Fig. 4); unconformably overlain by rocks of Tertiary age in Cape Lambton Inlier (Fig. 5); and unconformably overlain by strata of Cambrian age in the Coppermine area. There has been some controversy as to the stratigraphic position of the basal Paleozoic unconformity within the Coppermine area (Baragar and Donaldson, 1973; Dixon, 1979; Campbell, 1983; 1985). However, fieldwork in 1991 and 1993 indicates that strata above a conspicuous brown-weathering stromatolitic unit within map unit 24 (Baragar and Donaldson, 1973) contain vermiform trace fossils, arthropod tracks, and scratch marks: they are Cambrian rather than Proterozoic. The confusion arose because there are more than ten metres of paleotopography on the Proterozoic-Phanerozoic unconformity (Baragar and Donaldson, 1973; Dixon, 1979; Campbell, 1983; Jefferson and Young, 1989). As a result, it is easy to get the impression that Cambrian sedimentary rocks, deposited in paleovalleys, are stratigraphically below paleohills of the brown-weathering stromatolitic unit. Our 1993 field studies indicate that the same relationships exist in the western part of the Duke of York Inlier (Fig. 1), where paleohills of Proterozoic

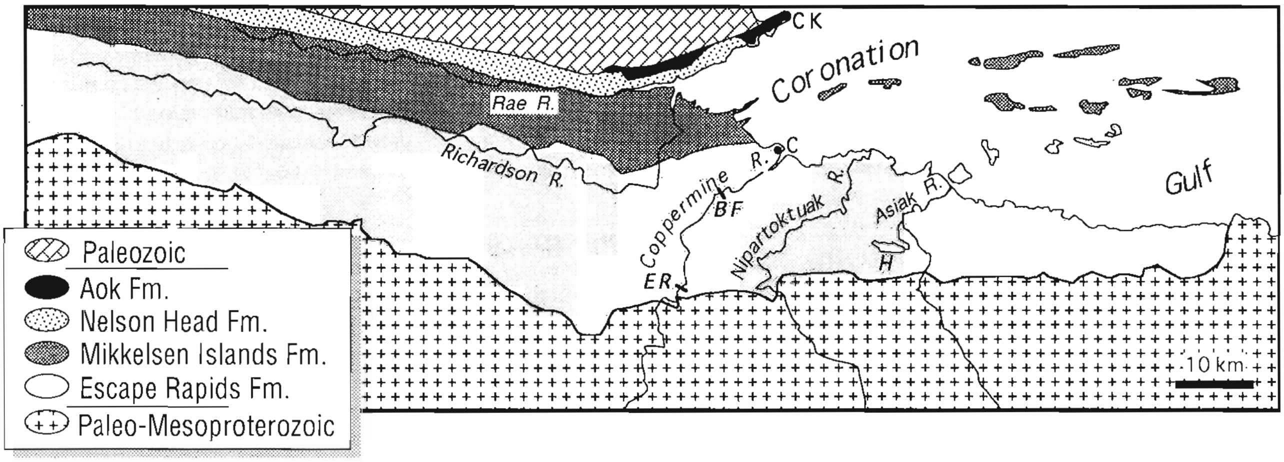

Figure 2. Generalized geology and geographic features in the Coppermine area (Fig. 1). C=Coppermine, BF=Bloody Fall, ER=Escape Rapids, H=Hihotok Lake, CK=Cape Kendall.

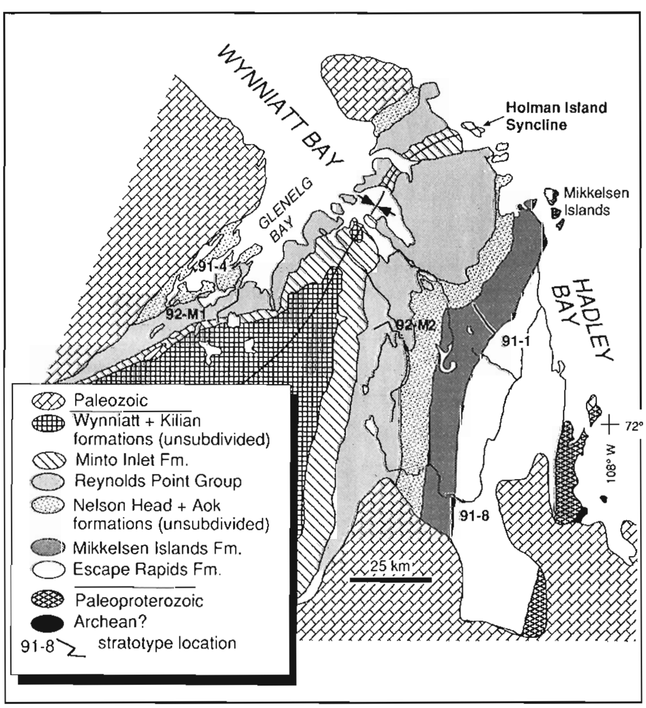

Figure 3. Geology, location of stratotypes and geographic features in northeast Minto Inlier, Victoria Island (Fig. 1).

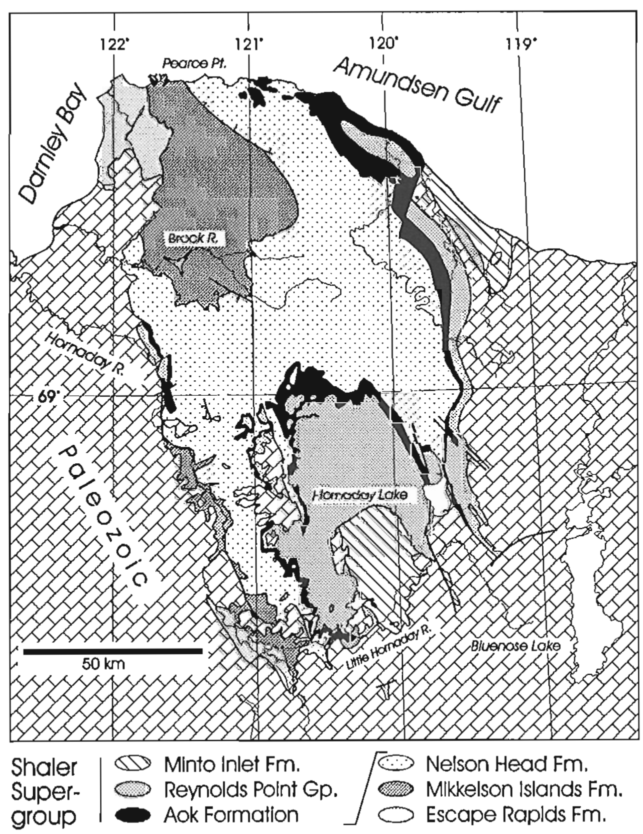

Figure 4. Geology and geographic features in Brock Inlier (Fig. 1).

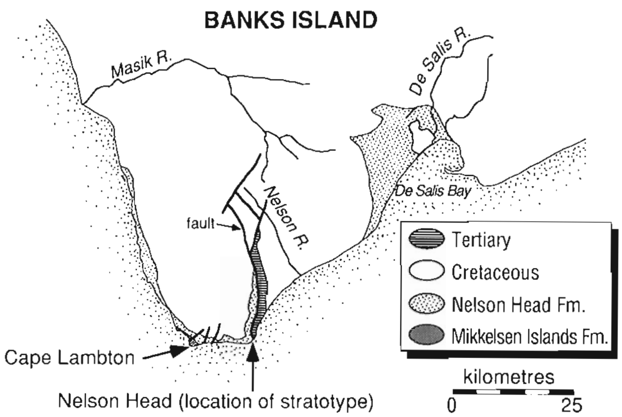

Figure 5. *Geology and geographic features in Cape Lambton Inlier, southern Banks Island (after Miall 1976; Fig. 1).*

quartzarenite and one prominent paleohill of brown-weathering stromatolite protrude above recessive sandstones and carbonates of the Cambrian Old Fort Island Formation (Campbell, 1985). Identical stratigraphic problems were resolved by Jones et al. (1992) in Brock Inlier.

We propose to replace informal map units throughout Amundsen Basin with formations. The names Escape Rapids, Mikkelsen Islands, Nelson Head, and Aok are suggested for the lower clastic, cherty carbonate, upper clastic, and orange-weathering stromatolite members of the Glenelg Formation in Minto and Cape Lambton inliers (Rainbird et al., 1992), map units 19 to 21, 22, 23, and 24 in the Coppermine area (Baragar and Donaldson, 1973), and map units P1, P2, P3, P4a in Brock Inlier (Jones et al., 1992), respectively (Table 1). Wherever possible, names were chosen from geographic features in areas where rock units are well-exposed; however, due to lack of geographic names this could not always be adhered to.

Escape Rapids Formation

The Escape Rapids Formation forms the base of the Rae Group and the Shaler Supergroup and is named for Escape Rapids in the Coppermine River (67°37'N, 115°44'W; Fig. 2). The lower boundary stratotype of the Escape Rapids Formation is about 3 km upstream from Escape Rapids, where drab-coloured sandstone and siltstone of the Hihotok Member overlies red sandstone and volcaniclastic conglomerate of the Husky Creek Formation (Coppermine River Group) with low angular erosional unconformity. The stratotype section was not measured in detail, but is exposed along the cutbank of the Coppermine River between Escape Rapids and Bloody Fall (Fig. 2).

As defined here, the Escape Rapids Formation includes map units 19, 20, and 21 of Baragar and Donaldson (1973) in the Coppermine area; these subdivisions were not recognized elsewhere in Amundsen Basin. Descriptions of the Rae Group in the Coppermine area (e.g., Baragar and Donaldson, 1973; Dixon, 1979; Campbell, 1983) and our field studies reveal that units 19 and 21 are lithologically comparable and according to Campbell (1983), unit 20 pinches out east of the Coppermine River. For this reason we think a tripartite formational subdivision is unwarranted; however, member status for these rock units in the Coppermine area is suggested as in Table 1. The Hihotok Member is applied to map unit 19 and is named for a lake that drains into the Asiak River (67°40'N, 114°40'W; Fig. 2). It is exposed in a belt approximately 225 km long extending from about 50 km east of the Asiak River to the headwaters of the Richardson River (Baragar and Donaldson, 1973; Table 2 for description and interpretation).

The Nipartoktuak Member (map unit 20) conformably and gradationally overlies the Hihotok Member, and is named after outcrops along the Nipartoktuak River (67°42'N, 115°06'W; Fig. 2), southeast of Coppermine, and overlies the Hihotok Member along the Asiak River, along the Coppermine River immediately below Escape Rapids, and along the south branch of the Richardson River (Baragar and Donaldson, 1973; Table 2 for description and interpretation).

The Bloody Fall Member (map unit 21) sharply, but conformably, overlies the Nipartoktuak Member and is exposed from the mouth of the Asiak River (67°45'N, 114°25'W; Fig. 2) westward about 175 km to the headwaters of the Rae River. The name derives from Bloody Fall on the Coppermine River (67°44'N, 114°22'W; Fig. 2; lithological description in Table 2).

In Minto Inlier, the name Escape Rapids Formation is applied to the lower clastic member of the former Glenelg Formation (Dixon, 1979; Rainbird et al., 1992; Table 1). It outcrops only in northeast Minto Inlier, in isolated outcrops along the west coast of Hadley Bay and in creeks that drain into it from uplands to the east (Fig. 3).

In Brock Inlier, the name Escape Rapids Formation is applied to map unit P1 of Cook and Aitken (1969) (Table 1; description and interpretation in Table 2). It is exposed sporadically along the north shore of the Amundsen Gulf; thicker and more continuous sections occur in the upper reaches of the Brock River (Fig. 4). Cursory descriptions are given by Cook and Aitken (1969), Balkwill and Yorath (1971), and Jones et al. (1992), but the formation is quite similar to other occurrences in Amundsen Basin.

Mikkelsen Islands Formation

The Mikkelsen Islands Formation is named for a group of islands in Hadley Bay in northeast Minto Inlier (72°35'N, 108°25'W; Fig. 3). It is applied to the cherty carbonate member of the former Glenelg Formation in Minto and Cape Lambton inliers, map unit P2 in Brock Inlier and map unit 22 in the Coppermine area (Table 1). The composite stratotype proposed here comprises sections 91-8 and 91-1 of Rainbird et al. (1992), located on the east limb of the Holman Island Syncline (Fig. 3). The lower boundary stratotype is within section 91-8; the boundary is also exposed along the upper reaches of the Brock River (Fig. 4), and just west of the town of Coppermine (Fig. 2).

Table 2. Lithological description and inferred depositional enviroments of new formations in the Rae and Reynolds Point groups, Shaler Supergroup, Amundsen Basin.

Group	Unit	Thicknesses (m)	Description	Interpretation
Reynolds Point Group	Jago Bay Formation	<65 in NE Minto Inlier stratotype (text); >200 in SW Minto Inlier[1]; ~100 undivided Jago Bay / Ft. Collinson in Brock Inlier (P4d[2]).	Interbedded yellow-weathering, cross-bedded dolomitic quartzarenite, microbial laminate & dololutite. A distinctive, yellow-weathering stromatolite within 10 m of base[1;3] is columnar, laterally linked (cf. *Acaciella*) with abundant intercolumnar quartz. Upper part is recessive, yellow to pale grey parallel-laminated & mudcracked dolosiltite & magnesisiltite.	Marine intertidal to lagoonal, evolved upward into supratidal & restricted intertidal environment of the overlying Minto Inlet Formation
Reynolds Point Group	Fort Collinson Formation	65 at stratotype (see text); 170 at section near head of Glenelg Bay (92-M1 of [4]; 50 in SW Minto Inlier (section 4 of [1]); see above for Brock Inlier.	Lower part is quartzose sandstone rhythmite interbedded with medium bedded, fine-to-medium-grained dolomitic quartzarenite with ubiquitous herringbone crossbedding & subordinate sub-horizontal planar stratification to low-angle cross-bedding. Upper part is medium bedded, medium-grained quartzarenite with abundant trough to planar, mainly tabular cross-beds. Paleocurrents from cross-bedding in lower part of formation are bimodal-bipolar.; paleocurrents in upper part indicate unidirectional to polydirectional flow[1;4].	Deposition by rivers in lower part & reworking by marine currents in upper part.
Reynolds Point Group	Boot Inlet Formation	350 to >500 in NE Minto Inlier [4]; only upper 250 exposed in SW Minto Inlier[4]; <500 in Brock Inlier[2].	Cyclically alternating ooid grainstone, stromatolite & dolosiltite rhythmite magnafacies. Quartzarenite absent by definition from the gradational base of the formation (part of Grassy Bay Formation), quartzarenite gradually more abundant toward the top[1;3;4]. Thickest & most prominent formation of Reynolds Point Group.	Prograding & shoaling, storm-dominated ramp (grainstone = inner; stromatolite = mid; rhythmite = outer).
Reynolds Point Group	Grassy Bay Formation	60 at stratotype (see text); >200 in Glenelg Bay, NE Minto Inlier[4]; 50-100 in Brock Inlier[2]. This & above removed by pre-Cambrian erosion in Coppermine area.	Basal 1/3 is mudstone (similar to basal Nelson Head Fm.); coarsens upward to quartzarenite with mainly unidirectional planar-tabular cross-bedding; intraformational erosional unconformity; fining-upward succession of HCS-bedded quartzarenite & planar bedded dolosiltite/dololutite[3;4]. Exposed only in ravines; forms low talus-covered bench above the Aok Formation; in Brock Inlier forms recessive marker between two orange-weathering stromatolitic dolostones (Aok & Boot Inlet formations)[2].	Marine-deltaic at base; fluvial in middle; marine transgression (erosion) & storm reworking of top; gradual basin deepening; clastic starvation; carbonate development
Rae Group	Aok Formation	30 at type locality (see text), 20-30 in NE Minto Inlier, 0 at Cape Lambton; <20 in Coppermine area; 3-50 in Brock Inlier. Thicknesses from [12] & [5].	Cream-coloured & orange-brown weathering sideritic to ankeritic dolostone hosting stromatolite biostrome composed of juxtaposed bioherms of fanning digitate columnar (elongate in plan) stromatolites. Generally two biostromes separated by maroon & green shale. Magnetite or siderite iron formation is associated in Duke of York Inlier & Brock Inlier. Basal unit is intraformational dolosiltite-clast conglomerate in a matrix of medium grained glauconitic quartzarenite.	A remarkably extensive carbonate shelf deposit extending to Mackenzie Mountains[5]; suggestion of shaling out to north of Brock Inlier.
Rae Group	Nelson Head Formation	25 basal shale + >275 quartzarenite in NE Minto Inlier[4]; 110 shale + 530 quartzarenite at Nelson Head[1], see also [6]; 90 in Coppermine Area[7]; 460 in Brock Inlier[2].	Base: laminated black carbonaceous pyritic mudstone has sharp lower contact; laterally equivalent in NE Minto Inlier & Coppermine area to thin chert breccia & carbonaceous quartzarenite with unimodal trough crossbeds over paleokarst highs[9]. Basal members grade upward through laminated red siltstone & ripple-crosslaminated quartzarenite, to fine-to-medium-grained, white-to-light-pink quartzarenite with thin-intercalations of red ripple-cross-laminated to parallel-bedded siltstone & very fine quartzarenite. Top is planar parallel hummocky cross-bedded glauconitic quartzarenite wiith wavy-lenticular interbeds of very fine sandstone, parallel-laminated green siltstone, & <50% carbonaceous mudstone[6;8;9].	Mudstone-grading to quartzarenite: regionally prograding marine delta. Thin quartzarenites on paleokarst breccia: varied local fluvial systems; Upper thick arenites: NNW fluvial transport from distal to prox. craton.
Rae Group	Mikkelson Islands Formation	400-450 in NE Minto Inlier[9]; 260[7] or 460[10] in Coppermine Area; 240 in Brock Inlier[2]; >200 in Cape Lambton Inlier[1].	Typically laminated reddish to cream-coloured pale grey cherty aphanitic dolostone with stromatolites, intraformational flat-chip conglomerate, local dolarenite. Cherts are white to frothy black preserving abundant microfossils. Basal member is 3- to 4-m-thick pink & green stromatolitic dolosiltite & intraformational conglomerate interbedded with dark green-grey siltstone & mudstone. Basal contact is gradational in Coppermine area & locally unconformable elsewhere[9;12]	Breccia & columnar stromatolites: sub- to intertidal; cherts, tepee structures, beachrock & laminated stromatolites: upper intertidal to supratidal.
Rae Group	Escape Rapids Formation	200 + 150 + 635[7] in Coppermine area; 550 in NE Minto Inlier[11]; >900 in Brock Inlier [2].	Three distinct members in Coppermine River area[7]. <u>Hihotok</u> (lower) Member: fine-to-medium-grained, cross-bedded to ripple crosslaminated quartzarenite & litharenite interbedded with ripple crosslaminated to plane-laminated siltstone. <u>Nipartoktuak</u> (middle) Member: maroon to red & grey-green variegated plane-laminated mudstone & siltstone with less common interbeds of dark grey-brown ripple crosslaminated to small-scale-crossbedded sandstone. <u>Bloody Fall</u> (upper) Member: sharply conformable base, lithology similar to Hihotok except that up to 20 cm interbeds of argillaceous, concretionary limestone & stromatolitic dolostone are common near the top. This member is most representative of Escape Rapids Formation in Brock Inlier & NE Minto Inlier[1;2;12].	Hihotok: scours & HCS suggest storm activity in marine environment. Nipartoktuak: deeper marine (below wave base to shallow subtidal). Bloody Fall: subtidal to intertidal, shoaling upward.

1. Young & Jefferson, 1975; 2. Jones et al., 1992; 3. Young & Long, 1977b; 4. Morin & Rainbird, 1993; 5. Jefferson & Young, 1989; 6. Miall, 1976; 7. Worth, unpublished manuscript, 1973; 8. Conly, 1993; 9. Rainbird et al., 1992; 10. Baragar & Donaldson, 1973; 11. Dixon, 1979; 12. 1993 fieldwork.

In Minto Inlier, the Mikkelsen Islands Formation is exposed along a 15-20 km wide belt extending southward from Mikkelsen Islands approximately 100 km (Fig. 3). In Brock Inlier it is well exposed along the northern coastal mainland at Pearce Point, in the Brock River Canyon and near the junction of the Hornaday and Little Hornaday rivers (Cook and Aitken, 1969; Balkwill and Yorath, 1971; Jones et al., 1992; Fig. 4). In the Coppermine area it is exposed in an outcrop belt extending from the the eastern part of the Duke of York Inlier (Fig. 1), across islands in the Coronation Gulf southwestward through uplands between the Richardson and Rae rivers for about 300 km (Fig. 2). The Mikkelsen Islands Formation has been correlated with map unit H1 of the Mackenzie Mountains Supergroup in the Mackenzie Mountains (Young et al., 1979).

Nelson Head Formation

The Nelson Head Formation derives its name from an impressive promontory in Cape Lambton Inlier on the southern tip of Banks Island (Fig. 5). It is applied to the upper clastic member of the former Glenelg Formation in Cape Lambton and Minto inliers (Thorsteinsson and Tozer, 1962; Young and Long, 1977b), map unit P3 in Brock Inlier (Cook and Aitken, 1969) and map unit 23 in the Coppermine area (Baragar and Donaldson, 1973). We propose that the unit stratotype be located at Nelson Head, where the thickest known continuous exposure is preserved. This corresponds to section 74-MLA-36 of Miall (1976), located at 71°05′N, 122°53′W (Fig. 5). The lower boundary is not exposed at Nelson Head so the lower boundary stratotype is placed in the Brock River Canyon of Brock Inlier (69°19′N, 122°52′W; Fig. 4) where it is well exposed. The Mikkelsen Islands Formation is abruptly and conformably overlain by interbedded red siltstone and fine grained quartzarenite. In Minto Inlier and the Coppermine area, a paleokarst unconformity separates the Mikkelsen Islands Formation from shales and quartzarenite of the Nelson Head Formation (Rainbird et al., 1992).

The Nelson Head Formation is exposed on both limbs of the Holman Island Syncline in northeast Minto Inlier; the thickest and best exposures are in the Glenelg Bay area (Fig. 3). In the Coppermine area it occurs to the west and northeast of Johansen Bay on southern Victoria Island (Duke of York Inlier; Fig. 1) and along a several kilometre-wide belt on the north side of the Rae River that stretches from Cape Kendall approximately 80 km westward (Fig. 2). It outcrops extensively in central Brock Inlier and throughout Cape Lambton Inlier. The Nelson Head Formation has been described in detail by Young and Jefferson (1975), Miall (1976), Rainbird et al. (1992), and Conly (1993) (summary in Table 2). Correlative strata to the Nelson Head Formation are the Tzesotene Formation and Katherine Group (units K1-K5) from the Mackenzie Mountains Supergroup (Young et al., 1979).

Aok Formation

The Aok Formation is a new name proposed for an informal unit referred to throughout Amundsen Basin as the orange weathering stromatolite biostrome (Jefferson and Young, 1989). The name was chosen from the Inuit word for the colour red or blood, as there are no geographic names in the type area and because an Inuit word for the colour orange does not exist. The Aok Formation is applied to the uppermost member of the former Glenelg Formation in Minto Inlier (Rainbird et al., 1992), map unit P4a in Brock Inlier (Jones et al., 1992) and the lower part of map unit 24 in the Coppermine area (Baragar and Donaldson, 1973; Table 1). The Aok Formation and succeeding strata of the Shaler Supergroup are not preserved in Cape Lambton Inlier.

The proposed unit stratotype is on a butte; the highest point on a large peninsula in the centre of Glenelg Bay, in northeast Minto Inlier (72°23′N, 111°24′W; Fig. 3 and 6). The lower boundary stratotype is in the same location (see Table 2 for description and interpretation). The Aok Formation is exposed on both limbs of the Holman Island Syncline in northeast Minto Inlier (Fig. 3), where it typically forms broad bench-like outcrops that can be traced for up to 100 km. In the Coppermine area, it occurs in one small outcrop at the west end of Johansen Bay on southern Victoria Island (Duke of York Inlier; Fig. 1) and along several isolated benches about 1 km north of the Rae River, near its mouth (Fig. 2). It occurs throughout Brock Inlier. According to Jefferson and Young (1989) the Aok Formation covers a depositional area of greater than 90,000 km^2 in Amundsen Basin.

The Aok Formation biostrome has been used as a marker for stratigraphic studies and regional mapping throughout Amundsen Basin and also in the Mackenzie Mountains area where it has been correlated to unit K-6 of the Katherine Group (Jefferson and Young, 1989). The biostrome may have

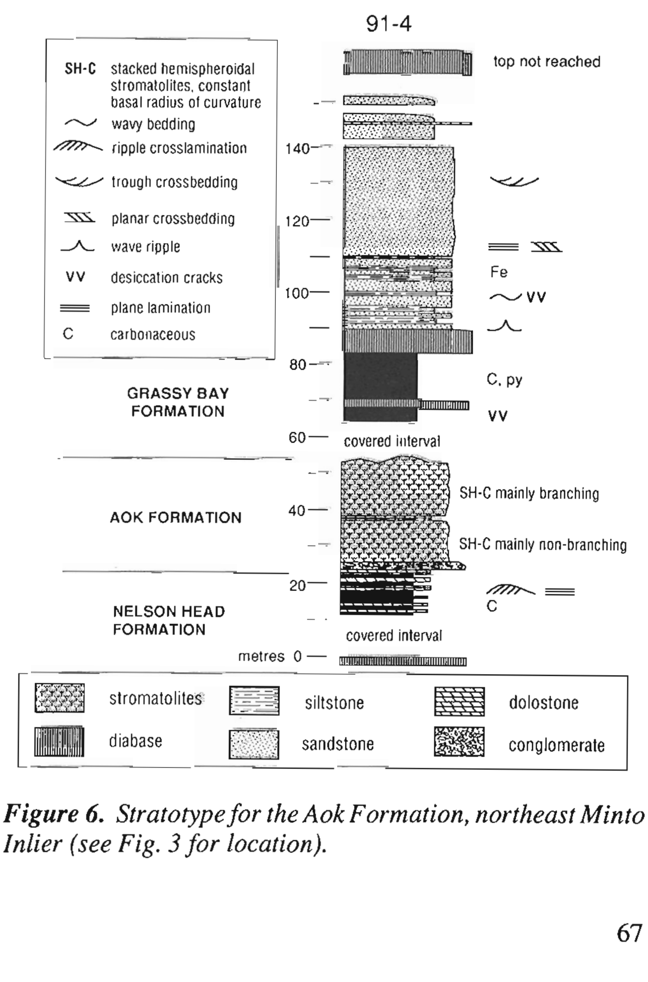

***Figure 6.** Stratotype for the Aok Formation, northeast Minto Inlier (see Fig. 3 for location).*

been continuous between the two regions, and if so, would have been one of the most extensive stromatolitic buildups known.

Reynolds Point Group

The former Reynolds Point Formation of Thorsteinsson and Tozer (1962) is herein elevated to group (see Table 1). We propose the names Grassy Bay, Boot Inlet, Fort Collinson, and Jago Bay to replace the lower clastic, lower carbonate, upper clastic, and upper carbonate members of the former Reynolds Point Formation, as originally described by Young and Long (1977a, b) in Minto Inlier, and informal map units P4b, P4c, and P4d in Brock Inlier (Jones et al., 1992; Table 1). The Reynolds Point Group is not known to be exposed elsewhere within Amundsen Basin, but does appear to correlate with the Little Dal Group of the Mackenzie Mountains Supergroup (cf. Aitken, 1981). All geographic features for which these formations are named are located at the western end of Minto Inlier between Minto Inlet and Walker Bay (1:250 000 NTS 87G/7; Fig. 1).

Grassy Bay Formation

The Grassy Bay Formation is applied to the lower clastic member of the Reynolds Point Formation in Minto Inlier and map unit P4b in Brock Inlier (Table 1), and is named after an inlet of Fish Bay on the northwest side of Minto Inlet, in southwest Minto Inlier (71°19'N, 117°42'W).

The proposed composite stratotype is in a narrow canyon at the head of one of the main tributaries draining into Wynniatt Bay, in northeast Minto Inlier (72°13'N, 109°50'W; Fig. 3). The lower half of the section is at the south end of the canyon and the upper half is near the north end. The section has been described and illustrated by Morin and Rainbird (1993, section 92-M2) and is chosen as the stratotype because it is probably the only locality where the basal contact is exposed and thus it also represents the lower boundary stratotype. The contact is characterized by stromatolitic dolostone overlain by thin parallel-laminated red mudstone, separated by 30 cm of interbedded wavy dolosiltite and red mudstone. A reference stratotype is located in the same section as the Aok Formation stratotype (Fig. 6), although the upper contact with the overlying Boot Inlet Formation is not exposed there (see Table 2 for description and interpretation). The Grassy Bay Formation appears to correlate with unit K-7 of the Katherine Group and the Mudcracked formation of the overlying Little Dal Group in the Mackenzie Mountains (cf. Aitken, 1981).

Boot Inlet Formation

The Boot Inlet Formation is applied to the lower carbonate member of the Reynolds Point Formation in Minto Inlier (Young and Long, 1977b) and map unit P4c in Brock Inlier (Jones et al., 1992; Table 1), and is named after a large inlet on the north side of Minto Inlet, in southwest Minto Inlier (71°25'N, 117°25'W).

The proposed stratotype is a continuation of the Grassy Bay Formation composite stratotype (Morin and Rainbird, 1993; section 92-M2). It begins at the junction of two main branches of the unnamed tributary, described above, that drains into Wynniatt Bay, in northeast Minto Inlier (72°16'N, 108°55'W; Fig. 3), and continues through a deep dry gorge that is about 1.5 km to the northwest. The lower boundary stratotype is located at the top of the Grassy Bay Formation stratotype and is a gradational contact between a ~2 m thick unit of parallel laminated carbonaceous mudstone and siltstone and an overlying coarsening upward succession of parallel laminated dolosiltite and wavy bedded dolarenite. A reference lower boundary stratotype is located in the canyon of the Hornaday River in Brock Inlier (69°00'N, 122°39'W), where the contact is much more gradational and the mudstone and siltstone unit at the top of the Grassy Bay Formation is more than 10 m thick (Table 2 for description and interpretation).

The Boot Inlet Formation correlates with the Platformal /Basinal assemblage and overlying Grainstone formation of the Little Dal Group in the Mackenzie Mountains (Aitken, 1981), although the rhythmite magnafacies generally is thinner and less well developed than it is in the Basinal assemblage.

Fort Collinson Formation

The Fort Collinson Formation derives its name from an abandoned Hudson's Bay Company trading post in Walker Bay (71°37'N, 117°50'W; Fig. 1), and is applied to the upper clastic member of the Reynolds Point Formation (Young and Long, 1977b) and the lower quartzose part of map unit P4d in Brock Inlier (Jones et al., 1992; Table 1).

The proposed stratotype is a continuation of the Boot Inlet Formation stratotype (Morin and Rainbird 1993, section M2). It begins near the bottom of a valley above a deep dry gorge (72°16'N, 110°00'W, Fig. 3). The lower boundary stratotype is at the same location and is at the top of the uppermost ooid grainstone bed, where there is a gradational change over ~50 m between sandy ooid grainstone of the Boot Inlet Formation upward into medium grained quartzarenite and sandstone rhythmite of the Fort Collinson Formation (Morin and Rainbird, 1993; Table 2 for description and interpretation). The Fort Collinson Formation may correlate with the upper part of the Grainstone formation of the Little Dal Group in the Mackenzie Mountains (cf. Aitken, 1981).

Jago Bay Formation

The Jago Bay Formation is applied to the upper carbonate member of the former Reynolds Point Formation (Young and Long, 1977b) and the upper carbonate-rich part of map unit P4d in the Brock Inlier (Jones et al., 1992; Table 1). It is named after an inlet on the north side of Walker Bay, in southwest Minto Inlier (Fig. 1).

The stratotype of the Jago Bay Formation in near the south end of Glenelg Bay in northeast Minto Inlier (section 92-M1 of Morin and Rainbird, 1993; 72°17'N, 111°25'W; Fig. 3). The lower boundary stratotype occurs at the same location and is gradational over about 10 m between parallel-laminated to thinly bedded, fine- to medium-grained, dolomitic quartzarenite of the Fort Collinson Formation and interbedded yellow-weathering, crossbedded dolomitic quartzarenite, microbial laminite and dololutite of the Jago Bay Formation. The Jago Bay Formation may correlate with the uppermost Grainstone formation of the Little Dal Group in the Mackenzie Mountains, although it has no lithological counterpart there.

Ungrouped formations

Formations above the Jago Bay Formation remain ungrouped and unrevised, except that the Minto Inlet Formation from Minto Inlier (Thorsteinsson and Tozer, 1962; Young, 1981; Phaneuf, 1993) is applied to map unit P5 of Brock Inlier (cf. Cook and Aitken, 1969; Jones et al., 1992; Table 1). Within Amundsen Basin, the overlying Wynniatt, Kilian, and Kuujjua formations have no counterparts beyond Minto Inlier (Table 1).

SUMMARY

Because we recognize that Neoproterozoic rock units are the same throughout Amundsen Basin, we propose the formation names Escape Rapids, Mikkelsen Islands, Nelson Head, and Aok to replace the lower clastic, cherty carbonate, upper clastic, and orange-weathering stromatolite members of the Glenelg Formation in Minto and Cape Lambton inliers, informal map units 19 to 21, 22, 23, and 24 in the Coppermine area and informal map units P1, P2, P3, and P4a in Brock Inlier. Collectively these are to be known as the Rae Group; the name Glenelg Formation is abandoned. The former Reynolds Point Formation is raised to group status and comprises the Grassy Bay, Boot Inlet, Fort Collinson, and Jago Bay formations, which replace the lower clastic, lower carbonate, upper clastic, and upper carbonate members in Minto Inlier and informal map units P4b, P4c, lower P4d, and upper P4d in Brock Inlier. These revisions require elevation of the Shaler Group to Shaler Supergroup.

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