CORRELATION OF THE APHEBIAN SUPRACRUSTAL SEQUENCES, NAIN PROVINCE, NORTHERN LABRADOR

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INTRODUCTION

A brief examination of the Aphebian supracrustal sequence in northern Labrador, the Ramah, Mugford, and Snyder Groups, was made in August 1977 with the aim of establishing whether detailed stratigraphic correlations could be made between the three groups. Recent work by Knight (1973), Morgan (1976), and Morgan and Knight (1977) on the Ramah Group; Smyth (1975) on the Mugford Group; and Speer (1976) on the Snyder Group has established the internal stratigraphy of each sequence, thus allowing such a study.

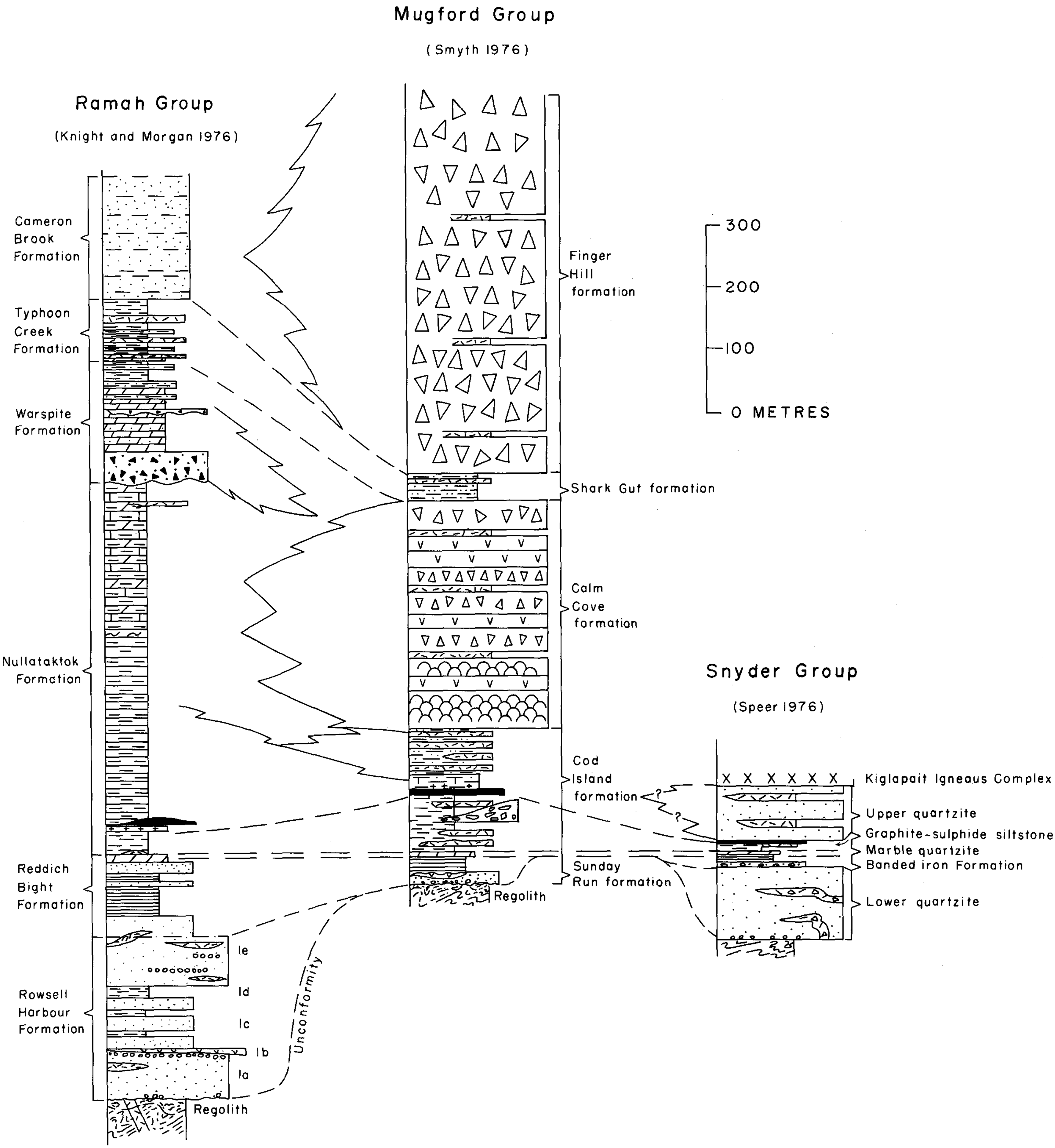
All three groups unconformably overlie Archean gneisses of the Nain Province and a thick regolith is locally developed below the Ramah and Mugford Groups.

An impure dolostone is common to the lower parts of all three Groups and has been used as a marker horizon for detailed stratigraphic correlations between the sequences. These rock stratigraphic correlations throw doubt on the accuracy of the radiometric ages available from the Ramah and Mugford Groups. The stratigraphy of the three groups is summarized below and in Table 1. The reader is referred to the referenced literature for detailed descriptions.

RAMAH GROUP

The Ramah Group (Daly, 1902; Taylor, 1969; Knight, 1973; Morgan, 1975; and Knight and Morgan, 1976) is the best preserved and best studied of the three groups. It consists of two distinct sedimentary sequences separated by the dolostone marker bed. The basal sequence consists of arenitic clastic sediments which unconformably overlie a peneplain and regolith developed upon Archean granitic gneisses. Two formations comprise this basal sequence. The basal Rowsell Harbour Formation (Knight and Morgan, 1977) consists of white and purple quartzites with units of mudstone and slate and a single subaerial volcanic flow. Five members are present (Knight, 1973; Knight and Morgan, 1976) which were deposited in a sublittoral to littoral sand flat environment. The uppermost member consists of white and, rarely, green quartzites with thin greenish mudstone units and some quartz pebble conglomerates. This member passes gradationally upwards into the Reddick Bight Formation (Knight and Morgan, 1976), which consists of a complex of lithofacies interpreted to have been deposited in a deltaic environment. Gray, massive, graded and cross-bedded sandstones, turbidite sandstones, local mudflows, black quartzites and distinctive units of laminates of shale and siltstone or very fine sandstone comprise this complex which coarsens upwards to gritty sandstone and is capped by the marker bed of dolostone to sandy dolostone. The detritus of the two basal formations appears to have been transported by dominantly northward directed currents.

A thick sequence of fine lutites overlies the dolostone marker bed, beginning with the Nullataktok Formation (Knight and Morgan, 1976). This formation consists of black, pyritiferous, graphitic shales at the base which pass gradually into color banded mudstones, now slates. About 50 m above the base of this formation, a horizon of sedimentary pyrite and a chert bed occur. The sequence continues with banded mudstones, which become increasingly calcareous and dolomitic upwards. Lensoid deposits of sandy, intraclastic breccia and units with deformed bedding and slumping become increasingly common upwards. This indicates that the generally



Mugford Group
(Smyth 1976)
Ramah Group
(Knight and Morgan 1976)
Cameron Brook Formation
Typhoon Creek Formation
Warspite Formation
Nullataktok Formation
Reddich Bight Formation
Rowsell Harbour Formation
Ie
Id
Ic
Ib
Ia
Regolith
Unconformity
Finger Hill formation
Shark Gut formation
Calm Cove formation
Cod Island formation
Sunday Run formation
Regolith
300
200
100
0 METRES
Snyder Group
(Speer 1976)
Kiglapait Igneous Complex
Upper quartzite
Graphite-sulphide siltstone
Marble quartzite
Banded iron Formation
Lower quartzite

quiet basinal conditions were frequently jarred by tectonic instabilities. An episode of major instability is probably represented by the overlying Warspite Formation (Knight and Morgan, 1976), which consists of sandy intraclastic dolomitic debris flow deposits associated with dolomitic sandstones and thin bedded dololutites. Fine grained clastic deposition slowly resumed, resulting in deposition of argillites and mudstones mixed with dololutites which pass upwards into black shales of the Typhoon Creek Formation. This formation, when traced southward in the group, contains increasing quantities of white to gray, laminated argillites and a bed of quartzitic concretions. Graywacke sandstone of the Cameron Brook Formation (Knight and Morgan, 1976) which are rich in fresh plagioclase and fine grained volcanic detritus gradationally overlie the Typhoon Creek Formation.

Numerous diabase sills intrude the Ramah sediments at various levels of the stratigraphy and a single ultramafic flow intrudes the Nullataktok Formation near Little Ramah Bay and Bears Gut (Morgan, 1975).

MUGFORD GROUP

The Mugford Group (Daly, 1902; Taylor, 1970; Barton, 1975; Smyth, 1976) lies upon an irregular unconformity which was onlapped southwards by progressively younger sedimentary units in the initial stages of sedimentation. The oldest unit, the Sunday Run formation[1], occurs only in the northwest of the group. It thins rapidly southward and pinches out completely in a few kilometres. The formation consists of a lower unit of cross-bedded sandstones, pebbly and gritty gray sandstone, and some conglomerate lenses, and an upper unit of purplish laminite dominated by very fine and fine sandstone laminae with laminated and flaser beds of shale. The shale laminae become more abundant as the sequence fines upwards. Two thin oxidized basaltic flows occur locally on Finger Hill Island. The lithologies of the formation compare very favorably with the Reddick Bight Formation of the Ramah Group. The Sunday Run formation is capped by a thin bedded and laminated impure dolostone marker bed which to the southeast lies upon the unconformity and correlates with the dolostone marker bed of the Ramah Group. The dolostone is overlain by black shales with some dolostones and beds of pyritiferous chert, chert and pyritiferous mudstone of the Cod Island formation. Tectonic instabilities during deposition of the formation produced a spectacular 30 m thick intraformational mass flow deposit on the northeast side of Grimmington and Cod Islands.

Black shales, calcareous silvery gray mudstones, color banded mudstones, argillites, cherts and thin beds of sandstones overlie the basal black shales. The basal sequence of the formation thus correlates closely with lithologies of the Nullataktok Formation of the Ramah Group. Fine to medium grained tuffs with minor agglomerates occur towards the top of the formation. The definite pyroclastic deposits suggest that the banded mudstones and cherts present in the lower part of the formation and in the Ramah Group are in part of volcanogenic origin.

Diabase sills cut the Cod Island formation and are pervasive towards the top. The sills were interpreted as flows by early workers (*e.g.* Douglas, 1953). This presented problems in stratigraphic correlations within the Mugford Group as the sills are not present everywhere. An ultramafic sill which was analysed as a basaltic komatiite (Barton, 1975) occurs near the top of the formation on the southwest side of the Mugford Tickle.

The overlying formation, the Calm Cove formation, consists of basaltic pillow lavas overlain by a thick sequence of massive and blocky mafic flows with intercalated volcanic breccias. The breccias are monolithologic and consist of angular, unsorted basalt fragments; from a few centimetres to over a metre in size; they commonly grade into massive basalt. The breccias lack grading or bedding. These breccias are believed to be subaerial flows which have been broken up by gas or steam explosion.

A thin unit of siliceous and calcareous argillite and tuff, named the Shark Gut formation, follows; it marks a cessation in volcanic activity. This unit can be best correlated with either the top of the Warspite Formation or the base of the Typhoon Creek Formation of the Ramah Group.

The uppermost formation of the Mugford Group, the Finger Hill formation, consists of 600 m of massive, mafic volcanic breccias with minor tuffs and diabase sills. It is interpreted as having formed dominantly in subaerial conditions.

SNYDER GROUP

The Snyder Group (Wheeler, 1942; Morse, 1961; Morse, 1969; Speer, 1976) is preserved in the metamorphic aureole of the Elsonian Kiglapait layered intrusion. Metamorphic grade reaches hornblende and pyroxene hornfels facies (Speer, 1976) but the rocks are little deformed and primary sedimentary structures are well preserved.

Speer (1976) recognized five formations. We agree with his divisions but disagree with some of his lithological identifications and formation names. The lowest division, the basal quartzite formation, is 120 m thick and unconformably overlies Archean gneisses. A poorly to well sorted 12 m thick unit of feldspathic sandstone with lesser conglomerate, quartzite and green amphibolitic pelites form the base of the sequence. These are overlain by well sorted, coarse to fine, white, often spotted, quartzites. White quartz pebbles are scattered throughout the sequence and occasionally a lens or bed of conglomerate occurs. The sequence is cross-bedded with herringbone structure; some ripple marks were also seen. Paleocurrent directions indicate that the sediments were predominantly transported northwards.

The basal formation is overlain by a conglomerate of large pebbles set in a pelitic matrix and gray sandstones overlain by a sequence of interbedded sandstones and laminites which compare favorably with the Reddick Bight Formation and Sunday Run formation of the northern supracrustal sequences. Speer (1976) called this unit the banded iron formation because of iron silicates identified in thin section and by microprobe analyses. Although the unit shows secondary iron and manganese oxides on joints and weathered surfaces, it is not visibly ferruginous on fresh surfaces. Iron content is certainly less than 15 percent and, although pods consisting solely of orthopyroxene and grunerite are present, these do not warrant use of tbe term "iron formation" for the unit. The unit comprises pebbly mudstones, gray cross-bedded sandstones, graded to massive sandstones, and laminated fine grained sandstones. Internal deformations, slump folds, and intraformational clasts are common features. The formation is interpreted as having been deposited in part by turbidity currents and may in part be a deltaic deposit like the Reddick Bight Formation with which it is correlated.

The laminated sandstones are overlain by a 10 m thick yellow weathering, sandy dolostone unit, referred to by Speer as the quartzite-marble formation. This calcsilicate horizon correlates with the dolostone marker bed in the sequences to the north.

The dolostone is overlain by a mudstone hornfels named the graphite-sulfide siltstone formation by Speer (1976). Disseminated pyrite is abundant and gossans are locally developed. This formation can be correlated with the slates of the Cod Island formation and of the Nullataktok Formation to the north, and like its correlatives, it is intruded by ultramafic and diabase dikes and sills.

The stratigraphy of the Snyder Group up to this formation is consistent with both the Ramah and Mugford Groups. However, the overlying unit, the upper quartzite formation of Speer (1976), has no correlative in the northern sequences. The unit consists of rusty weathering, massive, medium to fine grained, gray quartzites with minor arkoses and pelites. Cross-bedding is locally developed. It is intruded by numerous mafic dikes and sills and Speer (1976) estimated that half its outcrop thickness is due to injection of sills. The upper quartzites may represent either local renewal of sublittoral sandflat deposition in this area or a thrusted wedge of the basal clastics, although Speer has described the contact with the underlying siltstones as transitional.

The Snyder Group is intruded by sills and dikes of Snyder breccia, a peculiar breccia composed of basement gneiss, amphibolites, mafic volcanic and ultramafic clasts in a fine grained, light gray matrix. The matrix has a composition approximating granodiorite (Barton and Barton, 1975) but how much of this represents comminuted basement clasts is not known.

CORRELATIONS

This study has shown that similarities in the stratigraphies of three groups allows good correlations. Present in each group is a sequence of gray sandstones and laminites which underlie a dolostone unit. This is the Reddick Bight Formation of the Ramah Group, the Sunday Run formation of the Mugford Group and the banded "iron formation" of the Snyder Group. Each of these units is overlain by black shales referred to as the Nullataktok Formation, the Cod Island formation and the graphite-sulfide siltstone formation in the respective groups. The lower quartzites of the Snyder Group compare lithologically and stratigraphically with the upper white quartzite member of the Rowsell Harbour Formation of the Ramah Group.

The likely volcanogenic origin of many of the banded mudstones of the Cod Island formation of the Mugford Group allows a better understanding of the genesis of the much thicker sequence of banded mudstones in the upper part of the Nullataktok Formation of the Ramah Group. The argillites and tuffs of the Shark Gut Formation correlate well with similar lithologies in the upper part of the Warspite Formation and the Typhoon Creek Formation of the Ramah Group. This would also suggest that the volcanic detritus found in the overlying Cameron Brook Formation of the Ramah Group was derived by erosion of the subaerial volcanic rocks of the Finger Hill formation of the Mugford Group.

RADIOMETRIC AGES

Lithological and stratigraphic evidence strongly suggests that the Ramah, Mugford and Snyder Groups are rock-stratigraphic equivalents. However, a satisfactory radiometric age has not been determined from any of the groups.

The groups are definitely Aphebian in age, being bracketed by the age of metamorphism of the underlying Archean gneisses (greater than 2,600 Ma) and the 1842 ± 17 Ma age of the intrusive Snyder Breccia which cuts the Snyder Group (Barton and Barton, 1975). The age of the breccia was determined from a six point Rb-Sr isochron on the breccia matrix. A Rb-Sr whole rock isochron from an altered tholeiitic flow and related feeder dike from near the base of the Ramah Group gave an age of 1892±92 Ma (Knight and Morgan, 1976). This age is considered by Morgan (in press) to be a minimum for the time of deposition of the Group.

The Mugford Group remains to be dated satisfactorily. Barton (1975) obtained a minimum K-Ar age of 1490 Ma from unaltered tholeiitic flows. A Rb-Sr whole rock isochron from altered and unaltered basalts and the ultramafic sill gave an age of 2369±55 Ma. However, this isochron is dependent on the analyses of the ultramafic sill, which Barton erronously interpreted as a flow and considered to be genetically related to the basalt flows. The sill clearly intrudes and hornfelses the overlying cherts and argillites. Without the analyses of the ultramafic sill, the remaining points define a line of slope corresponding to 2100 Ma but the scatter of the data do not define an isochron (Barton, 1975). Thus, this Rb/Sr date is suspect and the age of the Mugford Group is uncertain.

ECONOMIC GEOLOGY

The Aphebian supracrustal sequences in northern Labrador are remarkably devoid of visible mineralization. A small uranium occurrence (300 ppm) occurs at the contact of sandstone pillows and black shales near the base of the Sunday Run Formation at the north end of the Mugford Group (Smyth, 1976). Correlation with the Ramah Group suggests that the Reddich Bight Formation might be the best target for similar mineralization. A planned ground scintillometer survey of areas of the Ramah Group was not made due to instrument failure.

Footnote

[1] Formation names proposed for the Mugford Group in this report are informal.

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