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REPORT ON GEOLOGICAL MAPPING IN HOME BAY MAP AREA (NTS 27A), JUNE AND JULY, 1979

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Abstract

The Aphebian Piling Group in Foxe Fold Belt in the vicinity of Cape Hooper, N.W.T. overlies a basement complex of probable Archean or early Aphebian granitoid rocks. It has been divided into two major units. The lower part mainly is made up of quartzites and rocks thought to be derived from muscovitic quartzites and schists. These include cordierite-garnet-K feldspar gneisses. Migmatitic biotite-rich schists and gneisses derived from greywacke turbidites make up the upper unit. Minor amphibolite present in both units may represent syndepositional dykes, flows and sills.

Metamorphism involving the breakdown of muscovite and quartz to sillimanite and K feldspar, and of sillimanite and biotite to cordierite and garnet appears to have occurred before or during the earliest recognized phase of deformation which involved recumbent isoclinal folding. Intrusions of megacrystic quartz monzonite cut anatectic granitoid pegmatites produced during this prograde metamorphism, but contain the schistosity developed during the earliest deformation. A second deformation produced anticlinal ridges cored by basement gneisses trending north-south and overturned

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to the west with variably plunging hinges. A third event involved tight folding with easterly to southeasterly trending axial surfaces generally overturned towards the north, and variable shallowly plunging hinges. The fourth deformation was similar to the third, but produced folds with axial surface traces trending approximately east-northeast. Interference between sets of structures is generally visible only on the map scale.

Rock Units

Rocks in the Home Bay map area have been divided into five major units; two of which (quartzite and paragneiss) make up the Piling Group (Aphebian), and overlie pre-Piling Group basement complex of presumed Archean or early Aphebian age. Finally, two generations of igneous material intrude the three older units: one is granitic and syn-tectonic, the other basaltic and post-tectonic. The units are described in sequence from oldest to youngest.

1. Basement Complex (Āgg, Āa)

This assemblage of dominantly granitoid rocks, ranging from quartz dioritic to granitic in composition, forms the cores of most major structures in the area. The label "basement" is applied because the complex apparently is Archean and/or early Aphebian in age and formed a substratum during deposition of the Piling Group (Jackson and Morgan, 1978, p. 250). However, since neither angular discordance nor basal conglomerate was observed in the area, the presence of an unconformity is only inferred.

The gneisses are generally fine to medium grained, grey to orange-pink in colour, with variable development of layering, schistosity and mineral elongation. Layering, generally on the scale of 1-10 cm is most common but the component of granitoid rocks without layering is significant. These bodies may be pre- or post-Piling Group intrusions which did not cross the unconformity.

Amphibolite (map unit Aa) is locally abundant in the basement complex and commonly has the overall form of boudinaged dykes or sills. Although they are considered diagnostic of the basement complex, the presence of some amphibolite in the Piling Group makes this criterion tenuous. It is also impossible to tell what proportion, if any, of the amphibolite in the basement complex represents pre-Piling Group dykes and sills, and what proportion comprises feeders to dykes and sills emplaced in the Piling Group.

Identification of basement complex rocks in the field is often based on negative mineralogical criteria such as the lack of garnet, cordierite, sillimanite, graphite and other minerals diagnostic of a metasedimentary origin although allanite may be a positive indicator mineral.

Syn-tectonic and post-tectonic pegmatites with a range of compositions similar to that of the gneisses form a small component of the complex.

2. Piling Group (AP)

A. Quartzite Unit (APqu)

This unit, which overlies the basement complex, is characterized by the presence of quartzite (APq) and quartzofeldspathic rocks thought to have been derived from muscovitic quartzites and schists. Although quartzite occurs exclusively in the quartzite unit, some migmatitic paragneiss (APmp) typical of the overlying unit is also present.

The quartzite unit ranges to 2000 m in thickness with lithological layering on a scale of 0.1-1.0 m. Amphibolite (APa) is abundant locally. Orthoquartzite (APq) and graphite schist (APgs) are subordinate but distinctive components. Light grey to cream coloured feldspathic gneisses and schists, which are generally more quartz-rich than the quartzofeldspathic gneisses of the basement complex and contain a higher proportion of K feldspar relative to plagioclase, are most abundant in the unit. Minerals indicative of sedimentary origin, such as cordierite, garnet and graphite, are common but are locally rare near the basement complex-quartzite unit contact; this makes precise location of the contact difficult.

B. <u>Migmatitic Paragneiss Unit</u> (APmpu)

This unit generally overlies the quartzite unit (APqu) but in many places directly overlies the basement complex. It is the youngest unit of the Piling Group. Minimum thickness estimates are impossible to make because of the complexity of folding.

The paragneiss (APmp) is rusty brown to black in colour with a distinct striping produced by sills of white granitoid material (Alg) averaging 1-3 m in thickness and an average spacing of 10 m. The paragneiss itself is a migmatite made up of two components:

dark schists and gneisses, more biotite-rich than the basement complex or the quartzite unit, and white pegmatitic laminae. The dark layers are fine to coarse grained, typically rusty weathering, and contain biotite, graphite, cordierite and garnet. Lenses of green, fine grained calcsilicate form a minor but diagnostic component of the unit. The leucocratic granitoid component (Alg) takes the form of laminae, veins, lenses, sills and dykes, from several millimetres to a few tens of metres thick. This component is medium to coarse grained and consists of white feldspars, quartz, biotite and, less commonly, cordierite and/or garnet. Thick sills are shown on the map as leucogranite (Alg). The genetic relationship of the two components of migmatitic paragneiss is discussed in the metamorphic petrology section.

3. Intrusive Rocks (Amg, Hd)

A. Megacrystic-Quartz-Montonite (Amg)

Several large bodies of megacrystic quartz monzonite occur in the southeast corner of the area and elsewhere in masses too small to map. They appear as semiconformable intrusions in the migmatitic paragneiss unit and the upper part of the quartzite unit. The plutons contain a planar fabric produced by the preferred orientation of K feldspar megacrysts (up to 2 x 5 cm) parallel to a weak biotite foliation. Quartz monzonite dykes cross granite produced during anatexis of the migmatitic paragneiss, but appear to contain the same schistosity as the granite and paragneiss. Rare xenoliths of rock closely resembling gneisses of the basement complex suggest that the quartz monzonite is intruded from depth. The megacrystic rocks probably belong to the quartz monzonite-monzocharnockite suite (Jackson and Morgan, 1978) covering tens of thousands of kilometres of the granulite facies terrane south of Home Bay map area.

Post-kinematic white biotite pegmatitic granite dykes from 1 to 10 m in width, with varying trends and generally steep dips, are present but not representable at the scale of mapping.

B. Diabase Dykes (Hd)

Vertical, generally northwest-striking dykes of aphanitic to medium grained, pyroxene-plagioclase-magnetite diabase up to 40 m in thickness crosscut all other rock types in the area. The only exception in terms of trend occurs on the south shore of Kekertaluk Island and to the southwest where a diabase dyke trends northeast. They are fresh and, with the exception of minor reddening of their wall rocks, do not have any obvious contact metamorphic effects. Although their trend is consistent with a Franklinian correlation (Fahrig et al., 1971), the proximity of Baffin Bay and the olivine flood basalts at Cape Dyer raises the possibility that some of the dykes may be Tertiary.

Structural Geology

Fold structures and related planar and linear fabrics in the area were divided into four groups which are developed in both Piling Group metasedimentary rocks and the basement complex. Evidence of pre-Piling Group deformation of the basement complex, with the exception of development of gneissosity, has been totally obscured. The map pattern is largely the expression of the three latest sets of structures.

1. $\underline{D_1}$

Early recumbent isoclinal folding produced a stratiform axial planar schistosity and probably caused widespread imbrication and isoclinal folding of quartzite and migmatitic paragneiss in Piling Group rocks. Macroscopic D_1 folding of basement complex granitoid rocks and Piling Group paragneisses was observed mostly in the northwest corner of the area from Kekertaluk Island north to Ilutalik Island. In this zone upright D_3 folds with oppositely dipping limbs tilt up multiple imbrications of basement gneisses and metasediments. A similar structural pattern may be present elsewhere in the map area but is difficult to distinguish due to "basement-like" quartzo-feldspathic paragneisses in the quartzite unit. Mesoscopic folds assignable to D_1 are very rare. A locally developed mineral lineation which is folded by later deformations is tentatively assigned to a D_1 age.

2. $\underline{D_2}$

Macroscopic folds with northerly-striking axial surface traces generally verging westerly and with variably plunging hinges are defined as D_2 structures. These folds are spread at roughly 15-20 km intervals. Rare minor folds appear consistent with a compressional, as opposed to gravitational, origin for D_2 folds although some macroscopic structures on Nedlukseak Island have a "cascading" symmetry. Both layering and the early schistosity in Piling Group rocks are isoclinally folded by D_2 structures; but more open, though commonly overturned, D_2 folds seem to characterize the more homogeneous basement complex. Five of the six major structures assigned to the D_2 set are anticlines cored somewhere along their length by basement complex rocks.

3. $\underline{D_3}$

The geometry of folds of the third major deformation is defined by macroscopic folds with axial surface traces trending west-northwest and a dominant northerly vergence. They are best developed in the northern half of the area where D_3 fold hinges plunge gently east and west. This set of folds is characterized by a chevron style with oppositely dipping limbs. In places, D_1 and D_2 isoclines appear to have been transposed parallel to the trend of the D_3 folds.

4. $\underline{D_4}$

A set of macroscopic folds with axial surface traces trending east-northeast is weakly developed, mainly in the west-central part of the area. Folds of this set appear to be similar in style to D_3 folds, and may be gradational into them through east-trending structures.

5. Discussion

In spite of the observation that D_2 and D_3-D_4 folds have different styles and orientations, in most cases they are not separable in the field. The three sets of structures are visible on map scale, but even there (see, for example, the D_2 and D_3 folds in the northeast portion of the area from Nudlung Island to Nedlukseak Island) axial surface traces bend into transitional trends, obscuring the distinction. Due to the lack of minor folds, the coarse grained nature of the rocks and the absence of axial planar schistosity development during post-D_1 deformation, overprinting of early structures by later structures on a mesoscopic scale, was rarely recognized. Thus, in zones of penetrative D_3 and D_4 deformation, D_2 structures are either opened up and destroyed or are rotated into the D_3 or D_4 flattening plane, becoming indistinguishable from these later structures. The low angle between D_3 and D_4 also makes folds of these sets hard to separate.

Metamorphic Petrology

According to Jackson and Morgan (1978, p. 261) the study area lies within a zone along the southern margin of the Foxe Fold Belt which underwent granulite facies metamorphism and is intruded by quartz monzonitic and monzocharnockitic plutons (megacrystic granitoids of this study). The main mineral transformations which the rocks have undergone on their way to the granulite facies may be expressed by two solid-phase reactions plus anatexis, all of which define "isograds" to the west and north of the Home Bay area.

Relationships nearer the lower grade synclinorial core of the Foxe Fold Belt in the western part of map area 27B (Tippett, 1978, 1979), where non-migmatitic metawacke turbidites are transformed into migmatitic paragneiss, suggest that the granitoid component is derived by partial melting (anatexis) leaving a residual component (restite) enriched in biotite and other aluminosilicate minerals.

The first significant recrystallization of the restite (or original metasediment, depending on the relative sequence of anatexis and reaction) involved the breakdown of muscovite in the presence of quartz to form sillimanite and K feldspar. In the second transformation sillimanite and biotite reacted to form cordierite and garnet. The pair garnet-cordierite, while not common, has been observed in most parts of the area; the absence of sillimanite may be explained by the second reaction with biotite stoiciometrically in excess in metasedimentary gneisses.

Retrogressive alteration is a common feature of some minerals in the area: cordierite is generally altered to greenish pseudomorphs, hampering identification in the field, and chloritized biotite occurs sporadically. Epidote veins are common in granitoid rocks.

Economic Geology

Indications of economic mineralization were not observed during mapping in Home Bay map area.

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