

DESCRIPTIVE NOTES

Map-area N6 P/4 has rocks of the basement complex in its southern half overlain by the Penrhyn Group to the north. Both successions are cut by major faults that extend beyond the area. The broad expanse of basement complex was mapped only in reconnaissance fashion to outline foliation trends and assess lithologic variation. No mappable units were discovered. Live elsewhere in the fold belt, an intimate and unindifferentiated mixture of granulitic gneiss (Aggn) and foliated and massive plutons (Ag) characterize the complex.

A nearly complete representation of lithologies of the Penrhyn Group is presented. The basal sequence of orthoquartzite (Apn) and minor rusty paragneiss (Apn) lies on the basement complex across the central part of the area, along the southeastern border and in the northwest corner. The overlying carbonate unit (Apc) is thickest in the northwest and thins toward the southern boundary of the Group. This unit passes upward into paragneiss (Apn) which contains numerous interbeds of marble and calcium-silicate gneiss (Apc-s). In the vicinity of Quartzite Lake these interbeds pass northward into a thick massive marble unit. Whether such a transition is a facies change or a result of extensive tight folding and disruption of beds is not known. In the northeastern part of the area, what is believed to be the same marble unit passes into a broad expanse of shallow-dipping calcium-silicate gneiss with interbedded marble. Above this variable unit is a schistose unit containing a folded sheet of granulitic gneiss (Aggn). The paragneiss passes upward into massive well bedded quartz-biotite psammite and minor schist (Apc-s) across an arbitrary contact. Metamorphic grade appears to be uniform throughout the area except in the uppermost psammite unit where in one locality garnet with possible andalusite was noted.

Major structures in the area are two extensive sheets of gneiss of the basement complex. The gneissic sheet northeast of Quartzite Lake extends into map-area N6 P/3 and lies within the upper half of the Penrhyn Group. No clear evidence of its mode of emplacement was observed. Not being mantled by the basal sequence of the Group, it does not appear to be a core of a large recurrent fold, nor is there any evidence of thrust faulting of either its upper or lower contact. It may be a highly deformed granitic sill that intruded the Group but if so it has been reconstituted by deformation and metamorphism to exactly resemble gneiss of the basement complex. It presumably has undergone D₂ folding with the Penrhyn Group. The gneissic sheet southwest of Quartzite Lake is more probably the core of a recurrent D₂ fold modified by thrust faulting as it is partially mantled by orthoquartzite and along its southern margin is apparently faulted against the main mass of the complex. A possible extension of this structure is found to the west in map-area N6 Q/1. A recurrent synformal structure possibly complementary to this D₂ fold is exposed in the southwestern part of the area and is illustrated on the cross-section accompanying map-sheet 46 P/3. A thin, tectonically attenuated succession of orthoquartzite, paragneiss, marble and a small unit possibly of acid volcanic rock (Apc-v) is exposed in the core.

A series of upright and southerly overturned folds formed during D₃ and D₄ have had major influence on the areal distribution of units in this area and deformed the gneissic sheets and D₂ folds described above. Variation in plunge of these structures (easterly in the northeast, westerly in the south and southeast) is presumed to have been caused by folding during D₃ but the form of these folds is uncertain. A small dome structure of orthoquartzite cores by gneiss at the middle of the west border of the area, is likely part of a D₃ fold brought up by interference between D₄ folding and this late transverse warping. D₄ faulting along north-westerly trends produced little detectable offset but very prominent geographic lineaments.

GENERAL GEOLOGY

The Foxe Fold Belt extends in an east-northeast direction from southern Melville Peninsula to central Baffin Island. It is composed of granulitic gneissic rocks of Archean age (2500 Ma and older) overlain by meta-sedimentary rocks of Early Proterozoic age (approximately 2200 to 1700 Ma) of the Penrhyn and Pilling Groups. These have undergone polyphase deformation and metamorphism mostly during the Hudsonian Orogeny. Generation and emplacement of plutonic rocks preceded, accompanied and followed deformation. Diabase dykes of presumed Late Proterozoic age cut older rocks.

The Archean rocks form a basement complex predominantly of granulitic gneiss (Aggn) and foliated quartzite (Apc) with relatively minor amphibolite (Am) and minor quartzite (Aq) and other meta-sedimentary rocks (Aq-s). The gneissic and plutonic rocks are largely of quartz monzonitic to granulitic composition; leucocratic and mafic varieties of gneiss are also common but do not constitute a large volume of the complex. Gneissic layering and mineral foliation formed of biotite and hornblende are usually clearly visible. Plutonic rocks emplaced during at least three episodes of igneous activity can be differentiated locally but cannot easily be mapped regionally because they are compositionally similar to one another and the gneiss which appears to be both host and parent to them. Deformed amphibolitic bodies, presumed to be dykes, are often observed within the complex and sometimes at the contact with the Penrhyn Group. With few exceptions they have not been observed within the Group and are presumed to pre-date it. Meta-sedimentary and meta-volcanic rocks not demonstrably part of the Penrhyn Group have in some places been assigned to the basement complex but their affinity is uncertain given the evident intricacies of stratigraphy and structure. Some lithologic similarity to rocks of the Prince Albert Group in northern Melville Peninsula exists but such correlation is tenuous at best.

The Penrhyn Group consists of paragneiss (Apn Apc) and marble (Apc) with some quartz-biotite psammite (Apc-s) and calcium-silicate gneiss (Apc-s) and minor quartzite (Aq). Garnet, biotite and sillimanite schists (Apc-s), and meta-volcanic rocks (Apc-v), complete understanding of the stratigraphic succession is lacking as most units are discontinuous and lensoid and the possibility of the existence of facies changes, unconformities and cryptic early structures of deformation and metamorphism. A general order to the units can be indicated, nonetheless. A thin (50-100 m) basal sequence includes orthoquartzite, rusty sillimanite schist, a suspected meta-regolith and minor amphibolite, marble and quartz-feldspathic gneiss. This sequence is overlain by a predominantly calcareous unit of marble, calc-silicate gneiss and interbedded quartz-biotite-feldspar paragneiss. The calcareous unit is followed by a thick unit of paragneissic rocks with a thin bed of schistose paragneiss at its base, and a unit of marble, calcium-silicate gneiss and biotite quartzite. At the highest observed structural and stratigraphic levels is a unit of quartz-biotite-muscovite psammite and greenschist. The top of this unit has not been observed. The relationship of present to original thickness of the unit is well disguised by the rival processes of thinning during deformation, repetition by folding and dilation by syntectonic plutonism.

The Penrhyn Group appears to lie unconformably on the basement complex. Tectonism has obliterated any angular discordance and unconformable relationships are inferred because of the clear lithologic contrast and the common presence of the thin orthoquartzite unit with rare feldspathic grit beds lying upon a variety of rock types in the complex. The uppermost unit of the Penrhyn Group may be separated from the rest of the Group by an unconformity. Contrasts in intensity of metamorphism and deformation and unexplained structural discordance support such an interpretation but rapid transitions or faulting remain viable alternate explanations.

Metamorphism of the Penrhyn Group produced two lithologic suites. Most of the Group is in uppermost amphibolite facies and contains the assemblages garnet-biotite-sillimanite and cordierite-sillimanite-garnet in paragneiss and in marble, diopside-forsterite-calcite as well as scapolite and a hornblende group mineral. Rocks of the uppermost unit of the Group are in greenschist facies and contain chlorite-muscovite-quartz in pelitic units. Porphyroblasts of a mineral tentatively identified as andalusite are common in meta-psammite units and tremolite occurs sporadically in calcareous rocks.

Polyphase structures indicating numerous episodes of deformation of the basement complex and the Penrhyn Group exist throughout the fold belt but unequivocal sequential relationships among them are rare. The earliest deformational phase (D₁) is inferred to have affected the basement complex prior to deposition of the Penrhyn Group. Little is known of this phase. The second phase (D₂), the earliest observed in the Penrhyn Group, is believed to have formed attenuated isoclinal folds and subhorizontal foliation (S₂). In fact, only an outcrop is parallel to bedding (S₂). Nearge evidence suggests that the trend of D₂ structures may have been northerly. The effects of D₂ on the Penrhyn Group remain problematical, but may be responsible for some of the observed discontinuity of units described above.

The third and fourth phases (D₃ and D₄) produced prominent meso- and megascopic folds that impose an east-northeast structural grain in the Foxe Fold Belt. D₃ folds are tight to nearly isoclinal and usually recurrent. Axial plane foliation (S₃) is nearly parallel to limbs (S₂) and hence to S₂ rendering separation of phases D₃ and D₄ very difficult. D₄ folds are coaxial, or nearly so, with D₃ but are more open and generally upright or slightly overturned. Mesoscopic D₄ folds can often be observed to have deformed earlier structures.

North to northeasterly trending broad transverse flexures (D₅) after the plunges of pre-existing folds. Few mesoscopic structures associated with this phase were observed. Steeply dipping fractures and faults, many with northerly and northwesterly trends are evidence of the last phase of deformation (D₆). Most fault displacements appear to be left-lateral and east-side-up.

Metamorphism is believed to have accompanied all phases of deformation except D₅ and D₆. It possibly reached its zenith during D₃ but mineral recrystallization outlasted much of the penetrative deformation.

Massive and foliated plutonic rocks (Ag), chiefly of hornblende and biotite granulite quartz monzonite and granite intrude the basement complex and the Penrhyn Group. Resembling granulitic rocks of the complex, separation of these is based largely on field relationships. Foliated plutonic rocks, except where observed to have intruded the Penrhyn Group, are assigned to the complex (Ag). Where intrusive into the Group they (Ag) are considered to be pre- or syntectonic with the main phases of deformation. In some localities intimate mixing with and partial melting of paragneiss has created rock haploids (Am) although mullion and fold axes associated with folds observed to have deformed bedding or early foliation. Foliation (plunging, horizontal) formed by bedding-foliation and foliation-foliation intersection, mineral growth and fold axes associated with folds observed to have deformed bedding, early foliation and/or pre-existing structures.

Lineation (plunging, horizontal) formed by bedding-foliation intersection, mineral growth, rodding and mullion/earliest or only observed. Lineation (plunging, horizontal) formed by bedding-foliation and foliation-foliation intersection, mineral growth and fold axes associated with folds observed to have deformed bedding or early foliation. Lineation (plunging, horizontal) formed by bedding-foliation and foliation-foliation intersection, mineral growth and fold axes associated with folds observed to have deformed bedding, early foliation and/or pre-existing structures. Lineation (plunging, horizontal) formed by cleavage-bedding and cleavage-foliation intersection and fold axes associated with gentle folds believed to have formed late in the tectonic history.

High angle fault (defined, approximate); arrows indicate apparent relative movement. Low angle fault (defined, approximate); teeth in direction of dip. Antiform (defined, approximate). Recumbent or overturned. Synform (defined, approximate). Recumbent or overturned.

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Metamorphic minerals: A andalusite, C cordierite, G garnet, P phlogopite, Sc scapolite, T tremolite, Ac actinolite, Ch chlorite, M muscovite, S sillimanite, St staurolite.

Structural note: Description of structures is facilitated by separation into six phases using criteria such as fold style and orientation and sequential relationships among folds. Such separation does not imply presence of discrete events, particularly in the case of phases D₂, D₃ and D₄ which may well be partly or wholly synchronous in some areas. No bounds on the time spans represented by the phases are implied as only the broadest limitations can be placed on the beginnings and ends of orogenic events. Large folds on the map are given numbers corresponding to the phase postulated to be responsible for them. Mesoscopic structures are assigned a position in the tectonic hierarchy based on interpretation of local field relationships only in the unit within which they were observed. This position cannot be directly related to deformational phases which formed the large folds. For these preliminary maps, no attempt has been made to integrate all mesoscopic features into a megascopic structural synthesis.

Cross-sections portray the inferred form of structures and show apparent dips (in the section) of lithologic contacts and foliation. Vertical proportions are not to scale. The horizontal reference line represents an approximate mean elevation along the line of section and is usually within 200 m. of sea level. Structures appearing on cross-sections are highly interpretative. Some features, particularly faults, will often not appear on the map as they were not observed in the field.

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LEGEND

Late (?) Proterozoic: Hydrous. Orange and buff weathering, white, tan and grey massive and foliated, medium to coarse grained, biotite and hornblende granulite, quartz monzonite, granite and leucocratic gneiss. These have undergone polyphase deformation and metamorphism mostly during the Hudsonian Orogeny. Generation and emplacement of plutonic rocks preceded, accompanied and followed deformation. Diabase dykes of presumed Late Proterozoic age cut older rocks.

Early Proterozoic: Amphibolite. White and light green weathering, light grey, massive, layered amphibolite. Siliceous rock (acid volcanic rock?). Green to dark green actinolitic greenschist (basic to intermediate volcanic rock).

Grey, fine to medium grained, thin to thick bedded, quartz-muscovite-feldspar psammite, some with andalusite (?) porphyroblasts/muscovite schist, meta-greenschist.

Black, fissile, very fine grained, "sooty" pelite.

Grey, fine to medium grained, thin to thick bedded, quartz-biotite-feldspar psammite and meta-greenschist, some with garnet and rarely cordierite, granulitic contacts with unit Apc in some areas.

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Grey and grey-green, medium to coarse grained thin bedded, calcium-silicate and interbedded quartz-biotite-feldspar paragneiss. The calcareous unit is followed by a thick unit of paragneissic rocks with a thin bed of schistose paragneiss at its base, and a unit of marble, calcium-silicate gneiss and biotite quartzite. At the highest observed structural and stratigraphic levels is a unit of quartz-biotite-muscovite psammite and greenschist. The top of this unit has not been observed. The relationship of present to original thickness of the unit is well disguised by the rival processes of thinning during deformation, repetition by folding and dilation by syntectonic plutonism.

White, grey and grey-blue, medium to coarse grained, massive and bedded marble with calcite-diopside-microcline-quartz and minor biotite scapolite, phlogopite, graphite, a hornblende group mineral and tremolite. Interbedded with and passing laterally into unit Apc. Includes small beds of unit Apc. Pegmatite of unit Ag is ubiquitous.

Brown and rusty weathering, schistose, biotite-garnet-sillimanite paragneiss. Rusty, fine to medium grained, graphitic paragneiss with pyrite and pyrrhotite.

A dark green, fine to medium grained, massive and foliated amphibolite; some biotite-garnet amphibolite.

White to grey-blue, medium to coarse grained, massive and faintly bedded, orthoquartzite with minor feldspar, white mica and phlogopite. Minor dark green amphibolite. Dark green, medium to coarse grained, massive and foliated amphibolite; some biotite-garnet-sillimanite schist and amphibolite.

Orange and buff weathering, grey and pink, medium to coarse grained, foliated granulite, quartz monzonite, granite and leucocratic gneiss. These have undergone polyphase deformation and metamorphism mostly during the Hudsonian Orogeny. Generation and emplacement of plutonic rocks preceded, accompanied and followed deformation. Diabase dykes of presumed Late Proterozoic age cut older rocks.

Orange, grey and tan, medium to coarse grained, layered and foliated, biotite and hornblende granulite, quartz monzonite, granite and leucocratic gneiss. These have undergone polyphase deformation and metamorphism mostly during the Hudsonian Orogeny. Generation and emplacement of plutonic rocks preceded, accompanied and followed deformation. Diabase dykes of presumed Late Proterozoic age cut older rocks.

Dark green foliated amphibolite, meta-gabbro and hornblende-plagioclase gneiss.

Dark green, coarse grained, serpentinized pyroxene-bearing ultramafic rock.

Quartz-biotite-feldspar paragneiss, some with hornblende/migmatite with unit Ag.

Rusty weathering, schistose biotite paragneiss.

White, medium to coarse grained, massive orthoquartzite.

Geological boundary (defined, approximate). Boundary of areas extensively drift-covered.

Bedding and compositional layering (horizontal, inclined, vertical). Foliation, schistosity, gneissic layering, cleavage and axial biotite and hornblende granulite, quartz monzonite, granite and leucocratic gneiss. These have undergone polyphase deformation and metamorphism mostly during the Hudsonian Orogeny. Generation and emplacement of plutonic rocks preceded, accompanied and followed deformation. Diabase dykes of presumed Late Proterozoic age cut older rocks.

Foliation, cleavage and axial planes (inclined, vertical); associated with folds of later phases observed to have deformed bedding or early foliation. Foliation, cleavage and axial planes (inclined, vertical); associated with folds observed to have deformed bedding, early foliation and/or pre-existing structures. Cleavage and axial planes (inclined, vertical); associated with gentle folds observed to have deformed early foliation structures and believed to have formed late in the tectonic history. Structural form line (on cross-sections).

Lineation (plunging, horizontal); formed by bedding-foliation intersection, mineral growth, rodding and mullion/earliest or only observed. Lineation (plunging, horizontal); formed by bedding-foliation and foliation-foliation intersection, mineral growth and fold axes associated with folds observed to have deformed bedding or early foliation. Lineation (plunging, horizontal); formed by bedding-foliation and foliation-foliation intersection, mineral growth and fold axes associated with folds observed to have deformed bedding, early foliation and/or pre-existing structures. Lineation (plunging, horizontal); formed by cleavage-bedding and cleavage-foliation intersection and fold axes associated with gentle folds believed to have formed late in the tectonic history.

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Map-area N6 P/4 has rocks of the basement complex in its southern half overlain by the Penrhyn Group to the north. Both successions are cut by major faults that extend beyond the area. The broad expanse of basement complex was mapped only in reconnaissance fashion to outline foliation trends and assess lithologic variation. No mappable units were discovered. Live elsewhere in the fold belt, an intimate and unindifferentiated mixture of granulitic gneiss (Aggn) and foliated and massive plutons (Ag) characterize the complex.

A nearly complete representation of lithologies of the Penrhyn Group is presented. The basal sequence of orthoquartzite (Apn) and minor rusty paragneiss (Apn) lies on the basement complex across the central part of the area, along the southeastern border and in the northwest corner. The overlying carbonate unit (Apc) is thickest in the northwest and thins toward the southern boundary of the Group. This unit passes upward into paragneiss (Apn) which contains numerous interbeds of marble and calcium-silicate gneiss (Apc-s). In the vicinity of Quartzite Lake these interbeds pass northward into a thick massive marble unit. Whether such a transition is a facies change or a result of extensive tight folding and disruption of beds is not known. In the northeastern part of the area, what is believed to be the same marble unit passes into a broad expanse of shallow-dipping calcium-silicate gneiss with interbedded marble. Above this variable unit is a schistose unit containing a folded sheet of granulitic gneiss (Aggn). The paragneiss passes upward into massive well bedded quartz-biotite psammite and minor schist (Apc-s) across an arbitrary contact. Metamorphic grade appears to be uniform throughout the area except in the uppermost psammite unit where in one locality garnet with possible andalusite was noted.

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