CANADA

EDITION 1 46 P/6

DESCRIPTIVE NOTES

Map-area 46 P/6 is underlain almost exclusively by the basement complex, containing only one infolded lense of metasediments of the Penrhyn Group. The complex is very heterogeneous on a scale too small to be resolved by the present study and consists of a variety of layered and foliated gneissic rocks (Āggdn), chiefly of granodioritic composition with common leucocratic granitic, quartz monzonitic and granodioritic varieties and minor dioritic gneiss. Granitic sills and masses are plentiful as are small, tectonically disrupted amphibolite dykes (Ām). Large and small lensoid bodies of rusty and brown weathering biotite paragneiss (Ān), in places garnet-or hornblende-bearing, associated with layers or sills of amphibolite (Ām) lie within the complex. Lack of continuity with rocks of the Penrhyn Group and lack of lithologies common to it (particularly marble) support assignment of these units to the basement complex.

Metasedimentary rocks comprising a faulted, southerly dipping panel within the complex are assigned to the Penrhyn Group. Orthoquartzite (APq) and minor associated garnet-sillimanite paragneiss (APn) and amphibolite (APm) lie on rusty hornblende paragneiss (Ān) and granodioritic gneiss of the complex and are overlain by a thick carbonate unit (APc) with small interbedded calcium-silicate gneiss and paragneiss layers. To the east the metasediments are intruded by a small granodioritic pluton (Ag), now foliated, and to the west they can be traced into thicker successions of the Group in map-area 46 P/5. The southern and upper contact of the metasedimentary rocks is with foliated granodiorite (Āg) and gneiss of the complex. Foliation attitudes in all three units suggest that there the complex lies on top of the Group.

As noted above, foliated and massive granitic plutons are common in the area. Sills and lenses of pegmatite lie within the Penrhyn Group. Diabase dykes (Hd), most trending northwesterly, were observed wherever foot traverses were made and can be assumed to be plentiful throughout the area. Some clearly were intruded along pre-existing fault zones for although surrounding units are displaced, the dykes are unaffected.

Earliest structures in the complex testify to an involved sequence of tectonic and intrusive events (D_1), full understanding of which is lacking. Formation of gneissic layering and foliation and rare attenuated folds may have preceded deposition of the Penrhyn Group. Conceivably some structures in the gneiss may have preceded deposition of paragneiss (Ān) of the complex but no evidence has been acquired to support such a contention. Early (D_2) structures in the Penrhyn Group are presumed to be represented by ubiquitous foliation (S_2). Nearly isoclinal upright to overturned folds may also be manifestations of D_2 in some cases but on the basis of their trend and the likelihood that S_2 is folded by them, are assigned to D_3. Coaxial upright folds such as those observed in the marble unit are likely D_4 features. A multititude of extensive northerly and northwesterly trending faults with apparent left-lateral displacement formed during D_6. Within the map-area, cumulative apparent displacement on six of the largest faults is about 6 km.

GENERAL GEOLOGY

The Foxe Fold Belt extends in an east-northeast direction from southern Melville Peninsula to central Baffin Island. It is composed of granitoid gneissic rocks of Archaean age (2500 Ma and older) overlain by meta-sedimentary rocks of Early Proterozoic age (approximately 2500 to 1700 Ma) of the Penrhyn and Piling 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 Archaean rocks form a basement complex predominantly of granitoid gneiss (Āggdn) and foliated granitic rocks (Āg) with relatively minor amounts of amphibolite (Ām) and paragneiss (Ān) and other meta-sedimentary rocks (Āq, Ānb). The gneissic and plutonic rocks are largely of quartz monzonitic to granodioritic 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 ubiquitous but not always 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 to 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 APnc) and marble (APc) with some quartz-biotite psammite (APqb, APqm, APp) and calcium-silicate gneiss (APcs) and minor quartzite (APq), garnet, biotite and sillimanite schists (APnb), and meta-volcanic rocks (APm, APvb, APva). 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 renders its delineation difficult. 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 quartzo-feldspathic grit. 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 greywacke. The top of this unit has not been observed. The relationship of present to original thickness of the Group 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 humite 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 andalucite are common in meta-psammitic 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 (D_1) is inferred to have affected the basement complex prior to deposition of the Penrhyn Group. Little is known of this phase. The second phase (D_2), the earliest observed in the Penrhyn Group, is believed to have formed attenuated isoclinal folds and ubiquitous foliation (S_2). In all but a few outcrops S_2 is parallel to bedding (S_0). Meagre evidence suggests that the trend of D_2 structures may have been northerly. The effects of D_2 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 (D_3 and D_4) produced prominent meso-and megascopic folds that impose an east-northeast structural grain in the Foxe Fold Belt. D_3 folds are tight to nearly isoclinal and usually recumbent. Axial plane foliation (S_3) is nearly parallel to limbs (S_0) and hence to S_2 rendering separation of phases D_2 and D_3 very difficult. D_4 folds are coaxial, or nearly so, with D_3 but are more open and generally upright or slightly overturned. Mesoscopic D_4 folds can often be observed to have deformed earlier structures.

North to northeasterly trending broad transverse flexures (D_5) alter 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 (D_6). Most fault displacements appear to be left-lateral and east-side-up.

Metamorphism is believed to have accompanied all phases of deformation except D_5 and D_6. It possibly reached its zenith during D_3 but mineral recrystallization outlasted much of the penetrative deformation.

Massive and foliated plutonic rocks (Ag), chiefly of hornblende and biotite granodiorite quartz monzonite and granite intrude the basement complex and the Penrhyn Group. Resembling granitoid 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 (Āg). 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 mappable only as migmatite (Ang) although large screens and zenoliths can be distinguished in places. Common local formation of pegmatite and leucocratic granitic rock (Ag) is believed coeval with deformation also. Massive, often cross-cutting plutons (Ag) invaded the Penrhyn Group after cessation of deformation.

Available results of radiometric analyses indicate formation of the basement complex prior to 2500 Ma with some events occurring possibly as long as 3000 Ma ago (R.K. Wanless, personal communication, 1976). Deformation of the basement and the Penrhyn Group may have taken place 2134 Ma ago (Jackson and Taylor, 1972) and again during the Hudsonian Orogeny (circa 1700 Ma ago). Post-tectonic plutons (1600 Ma old; Heywood, 1966) were emplaced into the fold belt late in the orogenic history. Following extensive uplift and erosion, diabase dykes (Hd) presumed to be part of the Mackenzie dyke swarm of circa 1000 Ma age (Fahrig, 1970) cut rocks of the fold belt. These are spatially associated with faults and fractures formed during D_6 tectonism. Subsequent uplift and erosion was followed by deposition of Ordovician carbonate rocks, remnants of which lie north and south of the fold belt.

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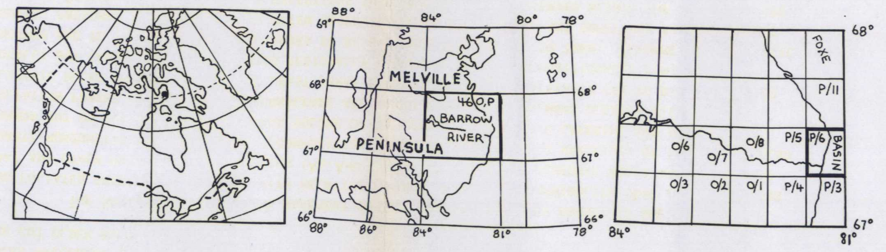
Geological mapping by: T. Gordon, A. V. Okulitch

Cross-sections by: A. V. Okulitch

Descriptive notes by: A.V. Okulitch

Draughting by: A. V. Okulitch

Notice of any revisions or additional geological information known to users of these maps would be gratefully received by the authors.



LEGEND

LATE(?) PROTEROZOIC
HADRYNIAN

Hd	Brown weathering, dark green to black, fine to medium grained pyroxene diabase.

INTRUSIVE CONTACT

Ag	Orange and buff weathering, white, tan and grey, massive and foliated, medium to coarse grained, biotite and hornblende granodiorite, quartz monzonite, granite and leucocratic equivalents. [illegible]
Ang	Migmatite composed of units An and Ag in lit-par-lit, zenolithic and texturally transitional variations. [illegible]

INTRUSIVE CONTACT

EARLY PROTEROZOIC
APHEBIAN
PENRHYN GROUP

APva	White and light green weathering, light grey, massive, layered aphanitic siliceous rock (acid volcanic rock?).
APvb	Green to dark green actinolite greenstone (basic to intermediate volcanic rock?).
APqm	Grey, fine to medium grained, thin to thick bedded, quartz-muscovite-feldspar psammite, some with andalucite (?) porphyroblasts; muscovite schist, meta-greywacke.
APp	Black, fissile, very fine grained, "sooty" pelite.
APqb	Grey, fine to medium grained, thin to thick bedded, quartz-biotite-feldspar psammite and meta-greywacke, some with garnet and rarely cordierite. Gradational contacts with unit APn in some areas.

POSSIBLE UNCONFORMITY

APn	Brown, rusty and tan weathering, buff and grey, fine to medium grained, quartz-biotite-feldspar, quartz-feldspar-biotite-garnet-sillimanite and quartz-feldspar-biotite-garnet-cordierite paragneiss. [illegible]
APcs	Grey and grey-green, medium to coarse grained, thin bedded, calcium-silicate gneiss and marble-quartzite with quartz-calcite-plagioclase-diopside and accessory scapolite, actinolite, graphite, epidote and biotite. Commonly interbedded with and passing laterally into unit APc.
APc	White, grey and grey-blue, medium to coarse grained, massive and bedded marble with calcite-diopside-microcline-quartz and minor dolomite, scapolite, phlogopite, graphite, a humite group mineral and pyrite. Interbedded with and passing laterally into unit APcs. Includes small beds of unit APq. Pegmatite of unit Ag is ubiquitous.
APnb	Brown and rusty weathering, schistose, biotite-garnet-sillimanite paragneiss.
APnc	Rusty, fine to medium grained, graphitic paragneiss with pyrite and pyrrhotite.
APm	A dark green, fine to medium grained, massive and foliated amphibolite; some biotite-garnet amphibolite.
APq	White to grey-blue, medium to coarse grained, massive and faintly bedded, orthoquartzite with minor feldspar, white mica and phlogopite. Minor quartzo-feldspathic grit, grey-green biotite-chlorite rock (meta-regolith ?). Biotite-garnet-sillimanite schist and amphibolite.

PROBABLE UNCONFORMITY

ARCHAEAN

Āg	Orange and buff weathering, grey and pink, medium to coarse grained foliated granodiorite, quartz monzonite, granite and leucocratic varieties [illegible]
Āggdn	Orange, grey and tan, medium to coarse grained, layered and foliated, biotite and hornblende granodioritic, quartz monzonitic and leucocratic gneiss. Includes rocks of units Āg, Āq and small bodies of Ām.
Ām	Dark green foliated amphibolite, meta-gabbro and hornblende-plagioclase gneiss.
Āub	Dark green, coarse grained, serpentinized pyroxene-bearing ultramafic rock.
Ān	Quartz-biotite-feldspar paragneiss, some with hornblende; migmatite with unit Āg.
Ānb	Rusty weathering, schistose biotite paragneiss.
Āq	White, medium to coarse grained, massive orthoquartzite.

Geological boundary (defined, approximate)

Boundary of areas extensively drift-covered.

PLANAR STRUCTURES

Bedding and compositional layering (horizontal, inclined, vertical)

Foliation, schistosity, gneissic layering, cleavage and axial planes (horizontal, inclined, vertical; dip unknown) [illegible]

Foliation, cleavage and axial planes (inclined, vertical) associated with folds of later phases observed to have deformed bedding and 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 earlier structures and believed to have formed late in the tectonic history.

Structural form line (on cross-sections).

LINEAR 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, rodding and mullion and fold axes associated with folds observed to have deformed bedding and 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.

FAULTS

High angle fault (defined, approximate) arrows indicate apparent relative movement

Low angle fault (defined, approximate) teeth in direction of dip.

FOLDS

Antiform (defined, approximate) upright; recumbent or overturned

Synform (defined, approximate) upright; recumbent or overturned

Arrow indicates plunge of fold; number indicates postulated affinity with deformational phase.

? A high degree of uncertainty or interpretation in the position or the nature of the symbol used is indicated.

Position of ends of cross-section.

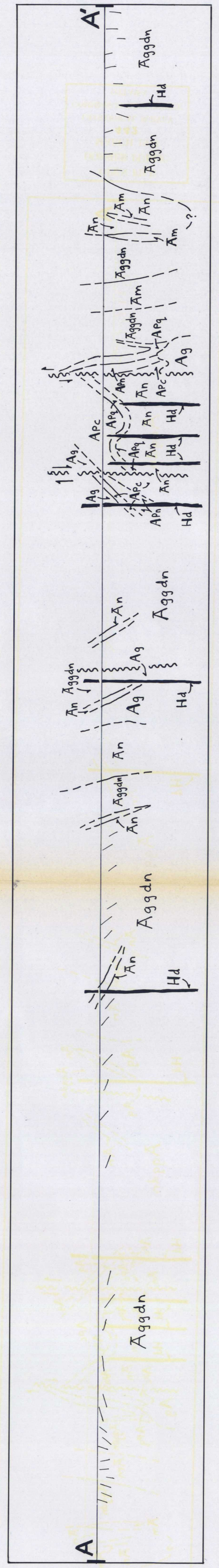
METAMORPHIC MINERALS

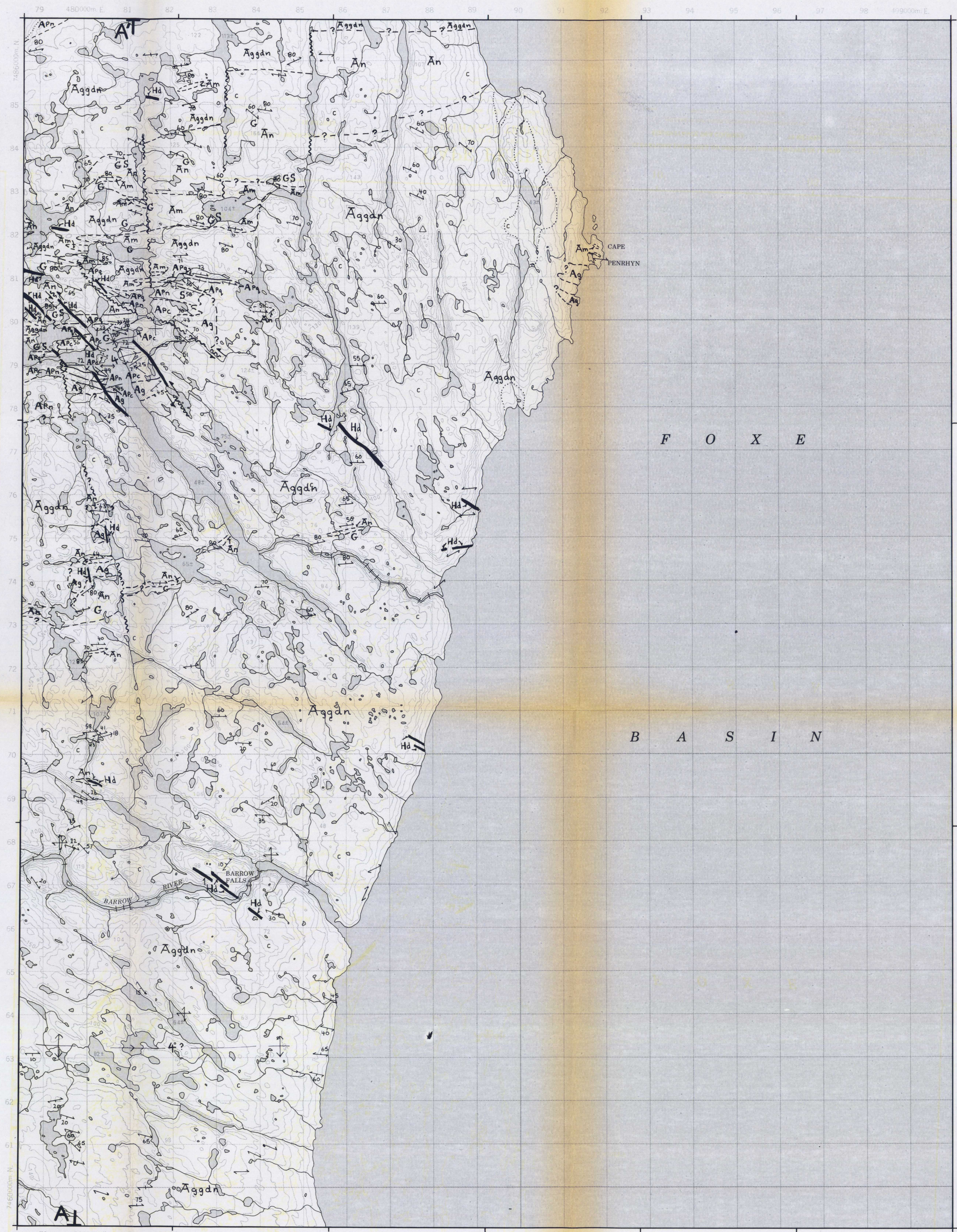
A andalucite	C cordierite	G garnet	P phlogopite	Sc scapolite	T tremolite
Ac actinolite	Ch chlorite	M muscovite	S sillimanite	St staurolite	

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, foliation and lineation. Such separation does not imply presence of discrete events, particularly in the case of phases D_2, D_3 and D_4 which may well be partly or wholly synchronous in some areas. No bounds on the time span 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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CAPE PENRHYN

DISTRICT OF FRANKLIN
NORTHWEST TERRITORIES

Scale 1:50,000 Échelle

ELEVATIONS IN METRES ABOVE MEAN SEA LEVEL

CONTOUR INTERVAL 10 METRES

ÉLÉVATIONS EN MÈTRES AU-DESSUS DU NIVEAU MOYEN DE LA MER

ÉQUIDISTANCE DES COURBES 10 MÈTRES

LEGEND - LÉGENDE

ROADS AND RELATED FEATURES — ROUTES ET OUVRAGES CONNEXES

LANDMARK FEATURES — POINTS DE REPÈRE

BOUNDARIES AND SURVEY CONTROL — FRONTIÈRES ET POINTS DE RÉFÉRENCES

DRAINAGE AND RELATED FEATURES — DRAINAGE ET OUVRAGES CONNEXES

RELIEF FEATURES — RELIEF

ONE THOUSAND METRE UNIVERSAL TRANSVERSE MERCATOR GRID ZONE 17

QUADRILLAGE DE MILLE MÈTRES UNIVERSEL TRANSVERSE DE MERCATOR

46 P/12	46 P/11
46 P/5	46 P/6
46 P/4	46 P/3

46 P/6

EDITION 1