Energy, Mines and Resources Canada / Énergie, Mines et Ressources Canada

Geological Survey of Canada
Commission géologique du Canada

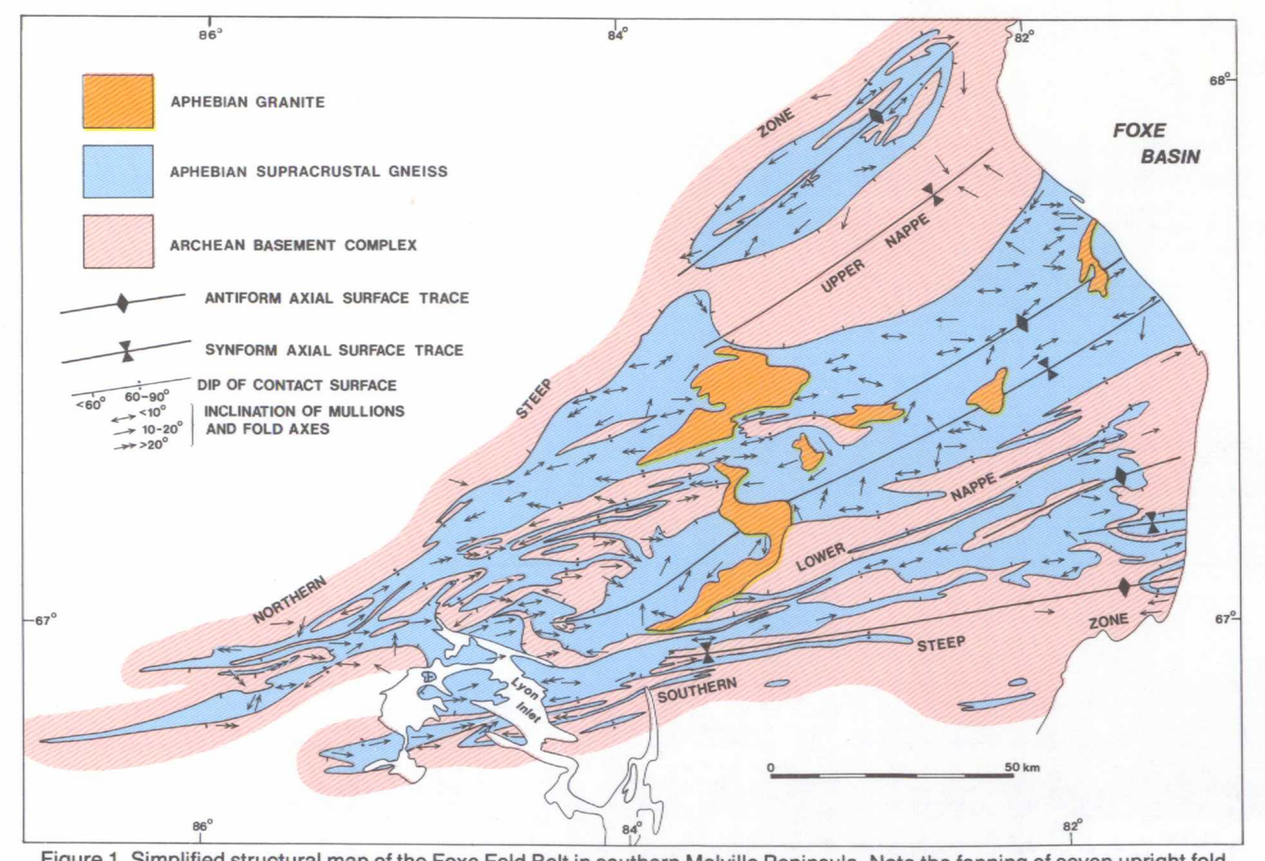


Figure 1. Simplified structural map of the Foxe Fold Belt in southern Melville Peninsula. Note the fanning of seven upright fold axial surface traces from southwest to northeast in the region between the north and south steep zones.

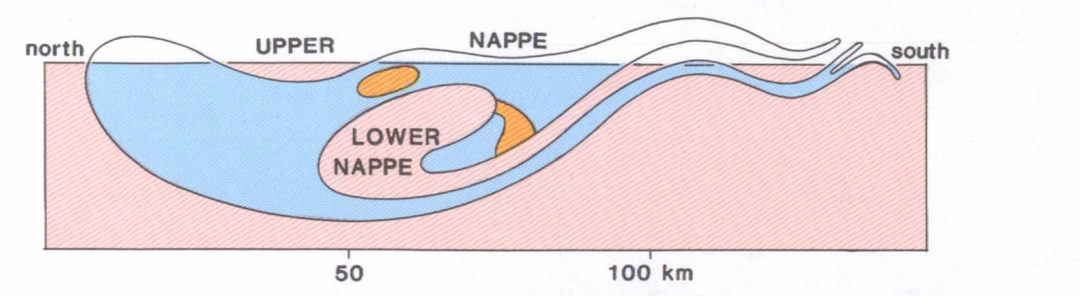


Figure 2. Simplified vertical cross-section of the Foxe Fold Belt along the east coast of the Melville Peninsula (view northeast). The vertical dimension is not constrained and probably is exaggerated. Coloured areas are the same as in Figure 1.

LEGEND

This legend is common to Sheets 1 and 2 of Map 1655A
Some map units shown in the legend may not appear on this sheet

CENOZOIC

QUATERNARY

- **Qu** — *Unconsolidated glacial drift with associated marine, lake, river and bog deposits, includes some periglacial slope deposits and felsenmeer*

PALEOZOIC

ORDOVICIAN AND SILURIAN

- **OSc** — *Dolomite and limestone*

NEOHELIKIAN OR HADRYNIAN

- **NHd** — *Diabase dykes*

APHEBIAN

- **Ag** — *Aplitic to pegmatitic granitic rocks; mainly granodiorite; massive and foliated; includes xenoliths of older rocks*

PENRHYN GROUP (APq-APqb)

- **APqb** — *Medium-to fine-grained quartzofeldspathic psammitic gneiss with biotite schist or marble laminae* (APqb)*; muscovite-biotite gneiss* (APqm)*; black, fissile very fine grained pelite* (APp)*; intercalated psammitic and pelitic gneiss* (APnqb)
- **APn** — *Medium grained pelitic gneiss with graphite, garnet, cordierite and sillimanite* (APn)*; subordinate leucosomatic veins and laminae; rusty weathering gossanous quartz-graphite schist* (APr)
- **APcs** — *Medium grained, laminated calcium-silicate gneiss and marble; major minerals are plagioclase, diopside, microcline, quartz and calcite*
- **APc** — *Coarse grained white calcite marble; commonly has dispersed diopside, scapolite, plagioclase, microcline, quartz and graphite*
- **APm** — *Medium-to fine-grained, massive and foliated amphibolite; some biotite-garnet amphibolite*
- **APq** — *Coarse grained white quartzite, minor disseminated biotite, feldspar sillimanite and garnet; some lenses of biotite-sillimanite-graphite-quartz schist*

ARCHEAN OR APHEBIAN

- **AAm** — *Medium grained, foliated amphibolite, metagabbro and hornblende plagioclase gneiss*
- **AAub** — *Coarse grained, serpentinized pyroxene-bearing ultramafic rock*

ARCHEAN

- **Agdn** — *Granitoid gneiss; medium-to coarse-grained layered biotite-hornblende granite to granodiorite gneiss with rare amphibolite lenses* (Agdn)*; hornblende granodiorite and amphibolitic gneiss* (Agm)*; granitoid agmatite* (Agn)*; foliated porphyritic to megacrystic granite* (Ag)

PRINCE ALBERT GROUP (AAif-AAnm)

- **AAnm** — *Quartz-feldspar-biotite/muscovite paragneiss; some hornblende paragneiss* (AAnm)*; fine grained amphibolite gneiss and foliated amphibolite dykes* (AAm)
- **AAb** — *Coarse grained massive and foliated anorthositic gabbro; minor amphibolite*
- **AAub** — *Serpentinized ultramafic rock*
- **AAln** — *Leucocratic layered quartzofeldspathic gneiss*
- **AAif** — *Iron formation: mainly banded quartz magnetite; minor iron sulphide and iron silicate*

Lithological contact surface trace (defined, approximate, gradational)
Bedding and gneissosity (horizontal, inclined, vertical) 25
Mineral foliation and schistosity (horizontal, inclined, vertical) 40
Fold axial surface (inclined, vertical) 60
Fold axis, mineral lineation, rodding and mullion trend and plunge 20
Fault surface trace (defined, approximate, assumed)

Geology by T.M. Gordon, J.R. Henderson, M.N. Henderson, I.E. Hutcheon, A.V. Okulitch, and J.E. Reesor 1976-77; J. Vrona 1976; M. Mazurski and P.J. Chernis 1977

Compiled by J.R Henderson, 1985

Geological cartography by L.A. Daley, Geological Survey of Canada

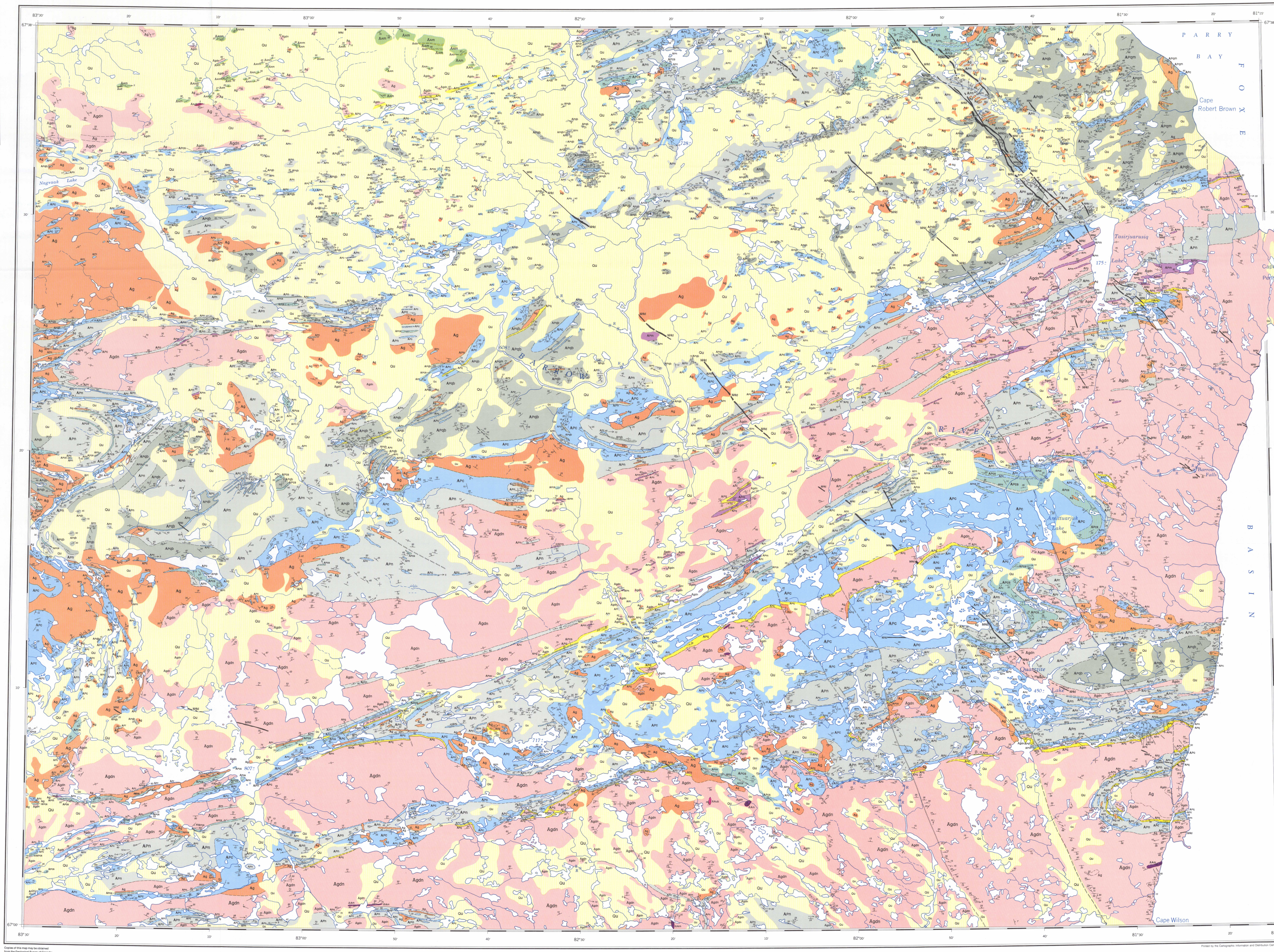
Any revisions or additional geological information known to the user would be welcomed by the Geological Survey of Canada

Base map assembled by the Geological Survey of Canada from maps published at 1:250 000 scale by the Mapping and Charting Establishment, Department of National Defence, 1980, and the Army Survey Establishment R.C.E., 1980

Copies of the topographical editions covering this map area may be obtained from the Canada Map Office, Department of Energy, Mines and Resources, Ottawa, Ontario, K1A 0E9

The proximity of the North Magnetic Pole causes the magnetic compass to be erratic in this area

Mean magnetic declination 1987, 39°03′ West, decreasing 2.5′ annually. Readings vary from 41°54′ W in the NE corner to 35°56′ W in the SW corner



DESCRIPTIVE NOTES

This map was compiled from the results of mapping at 1:50 000 scale during 1976 and 1977 under the direction of A.V. Okulitch. The area lies north of the settlement of Repulse Bay and south of the settlement of Hall Beach. The region is most easily reached from Hall Beach which is served by regularly scheduled aircraft from Montreal, and where fixed-wing aircraft on oversize tires may be chartered. However relatively few natural landing strips are present in the area except along the coast. Bedrock exposure is generally abundant especially in areas underlain by Penrhyn Group metasedimentary rocks. Snow-free ground conditions may be expected during July and August.

The first geological mapping in the area was done in 1964 under the direction of W.W. Heywood (Heywood, 1967). The region to the west of Map 1655A was mapped in the early 1970's under the direction of J.E. Reesor and published as Map 1510A to accompany Bulletin 324 (Henderson, 1983).

The Proterozoic Foxe Fold Belt is part of an 1.8-1.9 Ga orogen which forms an 800 km-wide arc bounded on the concave side by the Archean craton of Ungava and on the convex side by the Archean craton of Melville Peninsula (Henderson, 1984). Tight and upright folds in multiply-deformed Aphebian Penrhyn Group and Archean basement gneisses at the southwestern end of Foxe Fold Belt north of Repulse Bay diverge into a fan, also known as a virgation, that opens northeastward toward the Foxe Basin (Fig. 1).

Tight, upright folds dominate the map pattern at the southwestern end of Foxe Fold Belt (Henderson, 1983), but toward the east coast of the peninsula the upright folds are fewer, larger and more open, and the first-order structure of the belt can be seen to be a pile of reclined and recumbent folds and nappes composed of km-thick sheets of Aphebian and Archean gneisses (Figs. 1,2).

The Penrhyn Group comprises the supracrustal component of the fold belt and is between 2.5 and 1.8 Ga old; it is mainly quartzose, carbonate, calcium silicate, quartzofeldspathic and pelitic lithologies reminiscent of continental shelf sedimentary facies. The Archean basement rocks are mainly granitoid orthogneisses ranging in age from approximately 2.7 to 2.5 Ga (Henderson, 1983). A few remnants of 2.9 Ga supracrustal gneisses correlated with the Prince Albert Group (Heywood, 1967; Frisch, 1982; Henderson, 1983) are the oldest rocks identified in the area.

Penrhyn Group unconformably overlies Archean granitoid gneiss, but strong layer-parallel fabrics obscure any angular discordance at the contact, and in many places a tectonic contact is more likely. However, the base of the group commonly is marked by a massive pure quartzite about 10 m thick which in places may be underlain or interbedded with lenses of rusty-weathering graphite schists. In a few places massive amphibolite up to 30 m thick overlies the Archean gneiss or the basal quartzite.

Marble and calcium-silicate gneiss are widespread as well as abundant near the base, but psammitic and pelitic gneiss (possibly metaturbidite) are the most abundant components of the group. In Melville Peninsula a progressive increase in the amount of pelitic and psammitic gneiss relative to marble and calcium-silicate gneiss takes place from southwest to northeast along strike of the fold belt. Total thickness of Penrhyn Group rocks exposed in the map area is not great, perhaps ten kilometres. Structural thickening and thinning of more than ten times is apparent in individual units so original thickness estimates are very uncertain. Bedding is the only primary fabric recognized in the Penrhyn Group.

Geothermobarometric studies of paragneisses collected from along and across strike of Foxe Fold Belt in Melville Peninsula indicate that a post-kinematic thermal culmination occurred 1806 ± 16 Ma ago at about 700°C and 500 MPa (Henderson, 1983). Assuming that similar conditions prevailed during deformation, the exhumed fold belt formed at about 18 km depth.

The last folding of the rocks involved a very strong component of strike-parallel extension; Henderson (1981) documented examples of sheath folds with subhorizontal X-axes at many scales within the fold belt. (The central axis of a sheath fold is the X-axis, and the long and short axes of elliptical sections normal to X are referred to as Y and Z respectively.) Strong horizontal regional extension is best explained by a non-coaxial strain (simple shear) regime in order to eliminate the "space problem" created by pure shear. Sheath folds formed in simple shear should show systematic S or Z shaped asymmetries when viewed in XZ profile for sinistral or dextral shear-senses, respectively. Henderson (1984) drew attention to several regional scale S shaped folds on steeply dipping limbs of the late upright folds on the margin of the Lower Nappe of basement gneiss as well as the Northern Steep Zone (Fig. 1) and suggested, that if these features are XZ-profiles of sheath folds, the final folding occurred during sinistral transpression (cf. Sanderson and Marchini, 1984).

Prior to the final folding the Aphebian Penrhyn Group was folded with subhorizontal axial surfaces and interleaved with immense sheets of Archean gneiss. The most spectacular example of a nappe structure identified in the fold belt is the Upper Nappe (Fig. 1) where a 20 by 70 km elliptical window in the Archean allochthon reveals complexly folded early Proterozoic rocks below. The nappe transport directions are not known, but because the nappes appear to cut down into Archean terranes north and south of the steep zones (Fig. 2) it may be assumed that they verge either east or west. The earliest recognizeable deformation of the Penrhyn Group is indicated by the ubiquitous presence of layer-parallel mineral foliation (S_1). However this foliation was never observed to parallel axial planes of folds, so it is assumed that the earliest folds have been completely obliterated by the later deformations in the fold belt in Melville Peninsula.

At its present erosion level, Foxe Fold Belt in Melville Peninsula is defined by the extent of Penrhyn Group rocks: approximately coincident with the North and South steep zones (Fig. 1). Prior to erosion of windows in the Upper Nappe, it is conceivable that all of the Aphebian Penrhyn Group now exposed was buried beneath an Archean allochthon.

Numerous sills and plutons of late-to-post kinematic granite intrude Penrhyn Group. Commonly these granites are anomalously radioactive (Maurice, 1979), and limited uranium exploration was carried out in the fold belt in the late 1970's (Delpierre, 1982), based on regional lake sediment and water geochemical data (Geological Survey of Canada, 1978a, 1978b).

The youngest intrusive rocks in the region are northwest-striking diabase dykes of Neohelikian or Hadrynian age. These dykes occupy extensional fractures tapping a subcrustal magma source, and signify brittle extension of the lithosphere about 1 Ga ago.

Several remnants of Ordovician carbonate beds occur along the east coast of Melville Peninsula in the map area, and rest unconformably on the deeply eroded Precambrian surface.

During the Pleistocene Epoch the map area was covered by ice from the Baffin Island ice centre. A large mass of stagnant ice down-wasted in central Melville Peninsula at the end of the Wisconsinan glaciation, and glacio-fluvial sediments were deposited along the east coast of the peninsula during the deglaciation (Sim, 1960). Near the mouth of Jenness River, glacial meltwaters deposited multiple delta terraces as the land surface rose isostatically.

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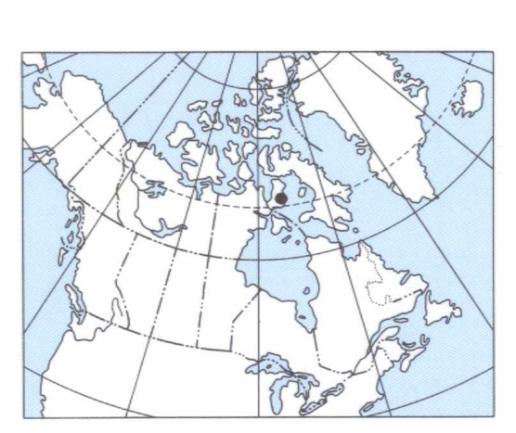
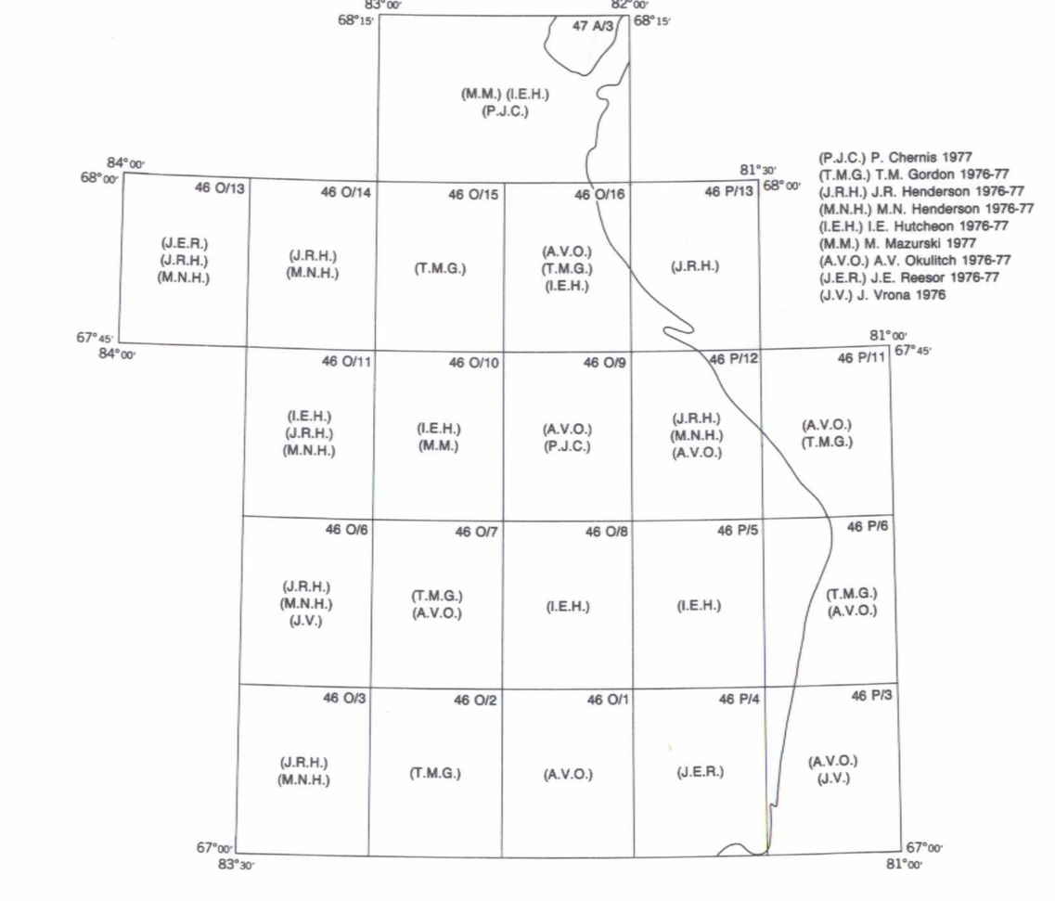


Copies of this map may be obtained
from the Geological Survey of Canada:
601 Booth Street, Ottawa, Ontario K1A 0E8
3303-33rd Street, N.W., Calgary, Alberta T2L 2A7

Recommended citation:
Henderson, J.R.
1987: Geology, southeastern Melville Peninsula, District of Franklin, Northwest Territories; Geological Survey of Canada, Map 1655A, scale 1:100 000



MAP 1655A

SHEET 2 OF 2

GEOLOGY

SOUTHEASTERN MELVILLE PENINSULA

DISTRICT OF FRANKLIN

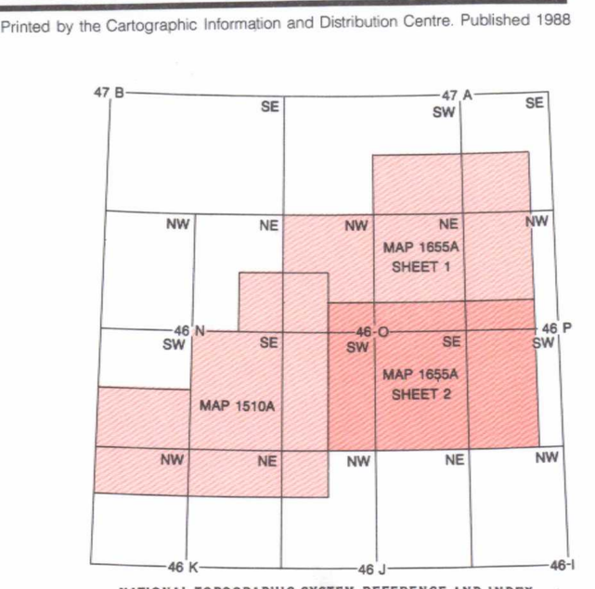
NORTHWEST TERRITORIES

Scale 1:100 000 - Échelle 1/100 000

Kilometres 2 0 2 4 6 8 Kilomètres

Universal Transverse Mercator Projection / Projection transverse universelle de Mercator

Printed by the Cartographic Information and Distribution Centre. Published 1988



NATIONAL TOPOGRAPHIC SYSTEM REFERENCE AND INDEX TO ADJOINING GEOLOGICAL SURVEY OF CANADA MAPS

MAP 1655A
SHEET 2 OF 2
SOUTHEASTERN
MELVILLE PENINSULA
DISTRICT OF FRANKLIN
NORTHWEST TERRITORIES