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DESCRIPTIVE NOTES

Previous work

The previous map of metamorphic grade of basement rocks of northern Melville Peninsula (Heywood et al., 1978) shows that the region is underlain by mainly amphibolite grade rocks, except for the northwest corner where granulites are located, and the northeast where greenschist grade rocks occur. Subsequent mapping in both these areas has confirmed the published pattern of higher and lower grades (Schau and Ashton, 1985; Schau and Becket, 1986; Schau and Digel, 1989; Schau, in press). The amphibolite grade of most the area is confirmed by further petrographic studies (Mazurski, 1982; Henderson, 1983; Frisch, 1982; Schau et al. 1991; Schau, in press). Later Proterozoic supracrustals are weakly metamorphosed (Frisch, 1982; Schau and Becket, 1986). Paleozoic carbonates have undergone several stages of diagenesis (Bolton et al., 1977). Although selected regions have been mapped, about a third of the area has not been covered in a systematic manner. Parts of the northeast and southwest quadrants of the map show few assemblage localities suggesting that these areas need more detailed petrological investigations.

Brief Metamorphic History

Northern Melville Peninsula consists of a basement gneiss horst bordered by the Foxe Basin Lowland carbonates. The mainly amphibolite grade basement gneisses contain evidence of a long and complex history. Two supracrustal groups and several dyke sets serve as markers to help unravel the sequence of metamorphism.

There are two metamorphic discontinuities in the region. One is a tectonic contact between the base of the granulite-amphibolite terrain of the northwest (the northwest domain) and the main amphibolite grade rocks, which is marked on the map, where known, as a thrust. The other is the vertical high-strain zone that separates the Proterozoic amphibolite grade rocks (Penrhyn domain) to the south-east from the Archean amphibolite grade rocks.

In the northwest domain, the rocks consist of high grade tonalite-granodiorite gneisses, cut by early leucogranites and the earliest recognized metamorphosed mafic sills and dykes and later cut by granodiorite plutons and metadiabase. The domain is modelled as a gently bent slab with granulite grade in the lower part and amphibolite grade on top yielding a map pattern with granulite grade at the margins and amphibolite grade in the centre. Thus the progression from amphibolite to granulite is prograde within the domain but tectonic at the base of the domain.

In the main domain, amphibolite grade gneisses intruded by synorogenic plutons are widespread, but to the east, near Richards Bay and along the lower reaches of the Aiguttalik River, supracrustal rocks of lower amphibolite and upper greenschist grades suggest that grade may gradually diminish eastward on a regional scale. The area consists of an Archean supracrustal and/or hypabyssal association that rests, possibly unconformably on granodioritic gneisses. The Prince Albert Group is a heterogeneous sequence containing protoliths of extreme compositions such as meta-ultramafic units, quartzite, and banded iron formation, as well as more common volcanic and other clastic rocks intruded by sills and dykes of the Tasijuaq Suite of metagabbro. These aforementioned units have been deformed together in a complex series of events starting with initial thrusting and interleaving of gneisses and supracrustals, followed by later folding, plutonism and metamorphism. Well-layered gneisses, derived in part from the supracrustals, as well as undifferentiated granitic gneisses were formed at this time. Early metadiabase dykes traversed these rocks and the region was, in turn, intruded by Archean plutons. The age of the metamorphism and concurrent plutonism of the two domains discussed above is late Archean, based on ongoing isotopic studies of Rb/Sr and Sm/Nd and U/Pb systems (Frisch, 1982; R. McNutt, pers comm). The domains were joined near the end of this metamorphic event.

Metamorphism of the Penrhyn domain metamorphism is early to mid Proterozoic in age (Henderson, 1983). The Penrhyn Group, a quartzite, carbonate, and pelite sequence, rests unconformably on amphibolite grade gneisses containing remnants of the Prince Albert Group. It has been deformed at least twice, intruded, and metamorphosed to moderate to high amphibolite grades (Henderson,1983, 1984, 1988; Mazurski, 1982). The northwest contact of the Penrhyn Group is a high strain zone, and other, subparallel, coeval, narrow high strain zones cut the area northwest of the zone (cf. Schau and Digel, 1989).

All three domains were uplifted in mid-Proterozoic time and latitudinal faults with local hydrothermal alteration cut the region. Roche Bay granites are small mirolitic granite stocks emplaced in and near faults. Lowgrade, middle to late Proterozoic sandstones rest unconformably on the gneisses and are minimally deformed. Two sets of fresh mafic dykes traverse the region. Faults have been variously reactivated, and fault blocks variably tilted. Unmetamorphosed Ordovician carbonates were deposited on a late Proterozoic peneplain, and Devonian and Cretaceous faulting formed the horst (Bolton et al., 1977).

Exemplars of compilation techniques

Preparation of the Metamorphic Map of North America encourages experimentation with many diverse compilation strategies (Brodaric et al., 1992). For the northern Melville Peninsula pilot study area, a digital database containing point information (Schau et al., 1991) has been constructed and various thematic overlays have been extracted (Schau et al., 1992). This map shows the geology as a backdrop (see Schau, in press,c), metamorphic peak assemblage locations, later overprints, and the resulting generalization to a metamorphic grade assignment. The assignment of grades is derived from reported assemblages compared with characteristic assemblages of published metamorphic grids (cf. Carmichael in Davidson et al.,1990, p.27). Overprints are judged to be intense or moderate by the subjective criterion of amount of retrogradation of ferromagnesian minerals and feldspar.

This map subdivides the plutons as to their relative ages with respect to the major metamorphic episodes (Sinha et al., 1992), yielding, in effect, a map of heat input during regional metamorphism.

A third symbol set shows the development of textures associated with various stages of metamorphic reconstitution. In detail the map shows the distribution of several types of quartz:

1/ protolithic quartz (volcanic phenocrysts and sand grains), implying very little homogeneous strain throughout the history,
2/ polygonized quartz grains in foliation, implying early ductile deformation,
3/ sutured quartz grains implying recrystallization at peak conditions,
4/ undulatory extinction in quartz grains implying late brittle ductile deformation.

These categories reflect the five stages of metamorphism (see Schau 1986) in any given orogenic cycle. The combination of structural information with metamorphic history displayed here yields empirically defined domains of equivalent tectono-metamorphic activity (Schau et al., 1992).

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Digital map compilation by Mikkel Schau, K. Venance, E.Brodaric, and R. Berman 1993, Geological Survey of Canada

Digital cartography by R.L. Allard, with assistance from V. Dohar and M. Methot, Geological Survey of Canada

This map is a pilot study in the Metamorphic Map of North America Project, Project leader R.Berman, Geological Survey of Canada

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

Digital base map at the scale of 1:1 000 000 revised and assembled from the Digital Chart of the World by the Geological Survey of Canada

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

Mean magnetic declination 1992, 42°46' West, decreasing 20.5' annually. Readings vary from 34°53' West in the SW corner to 49°35' West in the NE corner

Elevation in feet above mean sea level

Geographical names subject to revision

OPEN FILE
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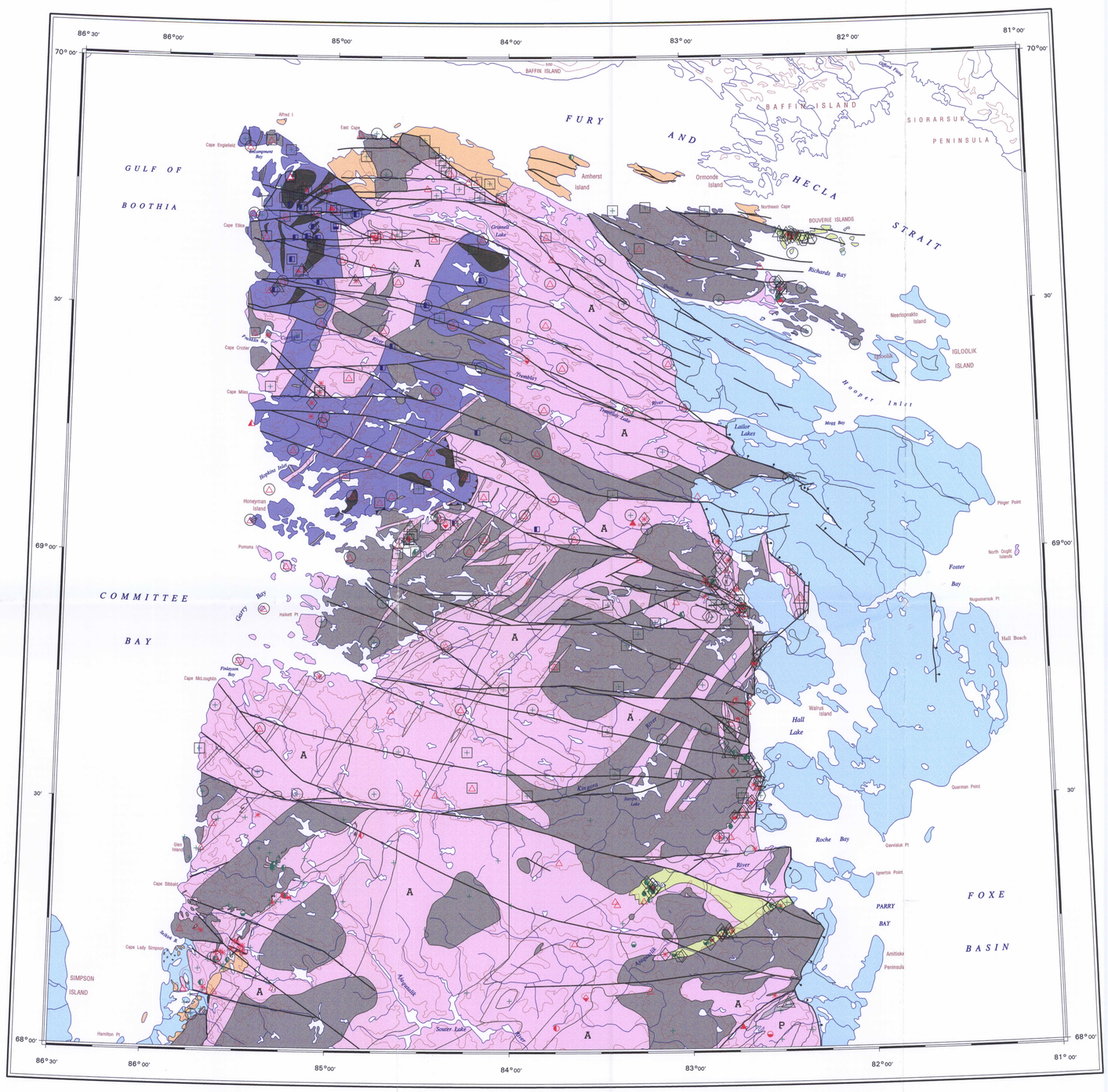
2595
GEOLOGICAL SURVEY OF CANADA
COMMISSION GÉOLOGIQUE DU CANADA
OTTAWA
1993



LEGEND

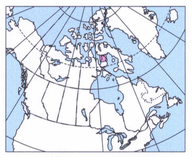
- *Unmetamorphosed*
- *Anchimetamorphozed, reaching greenschist in SW corner*
- *Greenschist*
  - *Bt-Chl-Ms-Qtz*
  - *Grt-Bt-Chl-Ms-Qtz*
  - *Srp-Chl*
  - *Tc-Chl-Cal*
  - *Act-Ep-Chl-Mag/Hpm*
- *Amphibolite (low to intermediate P)* — P -Early Proterozoic metamorphism; A -Archean metamorphism
  - *Hbl-Pl (Ep, Bt)*
  - *HBl-Pl-Qtz (Ep, Bt)*
  - Lower:
  - *Grt-Bt-Ms-Qtz-Bt*
  - *St-Bt-Ms-Qtz-Pl*
  - Middle:
  - *Di-Cal-Qtz*
  - *Crd-Bt-Ms-Qtz-Pl*
  - *And-Ms-Bt-Qtz-Pl*
  - *And-Sil-Ms-Bt-Qtz-Pl*
  - *Sil-Ms-Bt-Qtz-Pl*
  - Upper:
  - *Kfs-Sil-Qtz-Bt-Pl*
- *Granulite*
  - *Opx-Cpx-Grt-Pl*
  - *Opx-Cpx-Pl-Qtz*
  - *Opx-Pl-Kfs-Qtz*
  - *Cpx-Grt-Pl-Qtz*

GREENSCHIST OVERPRINT
- *Strong*
- *Moderate*
- *Granitic rocks (Bt-Fsp-Qtz)*

PLUTONIC ROCKS
- Mid-Proterozoic
- Early to Mid-Proterozoic (syn to post metamorphism)
- Late Archean (syn to post metamorphism)
- Archean

- *Geological contact.*
- *Fault.*
- *Normal fault (solid circle on hanging wall).*
- *Thrust fault (teeth on hanging wall).*

QUARTZ TEXTURES
- *Volcanic quartz*
- *Polygonized quartz*
- *Sutured quartz*
- *Sutured quartz with undulatory extinction*
- *Quartz with undulatory extinction*



INDEX MAP - LIEU DE LA CARTE

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METAMORPHIC MAP

NORTHERN MELVILLE PENINSULA

DISTRICT OF FRANKLIN

NORTHWEST TERRITORIES

Scale 1:500 000 - Échelle 1/500 000

Kilometres 10 0 10 20 30 40 Kilometres

Transverse Mercator Projection CM 84°00′, Scale Factor 1
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Projection transverse de Mercator CM 84°00′, Scale Factor 1
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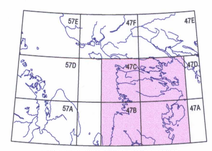

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