Precambrian geology of the Upernavik – Red Head region (72°15′-75°15′N), northern West Greenland

Jan C. Escher and Ole Stecher

A geological reconnaissance of the region between 72°15′ and 74°15′N was made by Escher & Pulvertaft (1968) during the summer of 1967. In 1977 the region was revisited by J. E. and O. S. and the geological survey was extended as far north as Steenstrup Gletscher (75°15′N) (fig. 7). Both investigations aimed at the production of a 1:500 000 geological map sheet of the Mârmorilik – Red Head region. The GGU motor cutter *K. J. V. Steenstrup* with Andreas Viðstein as skipper provided logistic support for the summer's work.

This part of Greenland's coast mainly consists of islands and peninsulas and is very suitable for field work from a boat. Winter ice normally disappears before July giving boats free access to most of the fjords. Stable weather conditions during the summer months, the generally gentle topographic relief of the region and the very good degree of rock exposure make the region ideal for field work.

A large body of hypersthene granite, called the Prøven charnockite, occurs in the southern part of the region. It is flanked by a zone of migmatites, north of which a basement gneiss and a metasedimentary sequence (Red Head formation) are the main stratigraphic units. Leucocratic garnet granite sheets and veins intrude all the rock types. Metamorphism is in

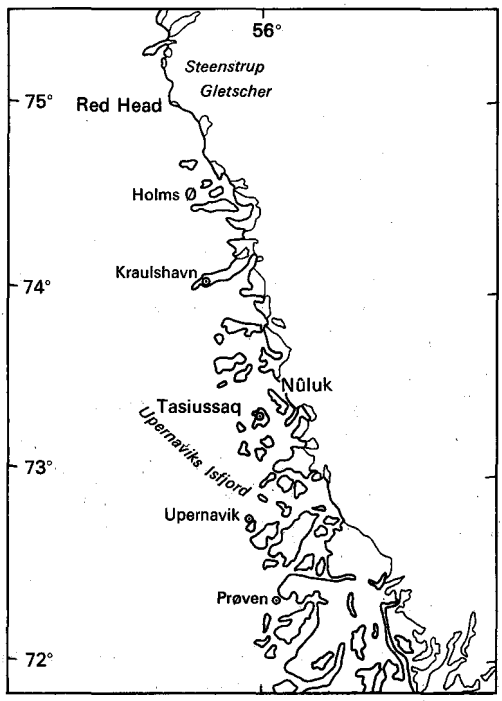

Fig. 7. Index map of the west coast between 72° and 75°N.

amphibolite and granulite facies. Deformation has been intense except for the areas of granitic rocks. Many marble horizons contain iron sulphides and other ore minerals.

A Rb-Sr whole rock study of the main rock types encountered has been begun by F. Kalsbeek (GGU).

Basement gneiss

Grey biotite gneiss lies below the metasedimentary sequence (Red Head formation) and is the oldest unit of the region. It is intensely folded, tonalitic-granodioritic in composition and resembles the main 2800–3000 m.y. old gneiss of the Fiskenæsset and Frederikshåb regions. The contact relationship between basement gneiss and the metasediments varies from sharp to gradational and is concordant because of strong deformation.

Certain rock types only occur in the basement gneiss:

(a) concordant amphibolite layers,

(b) abundant amphibolite inclusions, many of which are derived from discordant basic dykes,

(c) ultramafic lenses which in places are well preserved peridotites and dunites,

(d) few inclusions of leucogabbro anorthosite with well preserved igneous texture.

Metasediments

The name Red Head formation is informally proposed for a sequence of metasediments which are well exposed on the island of Red Head (75°05'N) and which covers most of the region north of Tasiussaq (73°20'N). This formation includes the 'red-brown gneiss' of Escher & Pulvertaft (1968). It mainly consists of sillimanite-graphite-garnet gneiss with layers of metapelitic schist, marble and quartzite. Gneiss and schist are typically rusty, red-brown weathered due to iron sulphides.

Horizons rich in biotite gneissic balls, resembling a conglomerate structure, are frequently observed in the gneiss.

Layers of metapelitic schist often occur in the gneiss and along the contact with the basement. The schist layers are generally less than 3 m thick and are very rich in sillimanite with lesser amounts of garnet, biotite, muscovite and graphite.

White calcite and dolomite marble horizons and layers of pale grey glassy quartzite also occur in the gneiss. The marble contains skarn minerals, iron sulphides and other ore minerals.

The lithology of the Red Head formation is remarkably uniform. Escher & Pulvertaft (1968) refer metasediments in the southern part of the region, south of the Prøven charnockite, to the Nukavsak Formation of the Umanak – Rink Isbræ region and imply their 'red-brown gneiss' is a stratigraphic equivalent. Both formations are considered to represent highly metamorphosed flysch sequences.

Prøven charnockite

This charnockite batholith was previously called 'the Prøven granite' by Escher & Pulvertaft (1968, 1976). However, a thin section study shows that hypersthene occurs through-

out the body and therefore the name 'the Prøven charnockite' is informally proposed instead. The batholith is named after the village of Prøven (72°25'N) and extends over the whole country south of Upernavik Isfjord (73°N) until it is covered by Tertiary basalts south-east of Prøven (*c.* 72°15'N).

The charnockite is typically a brown-weathering hypersthene granite and most of the batholith consists of a uniform coarse-grained rock with very weak foliation. The hypersthene content varies between 5 and 15 per cent and potash feldspar megacrysts occur often up to 5 cm long. Inclusions of grey biotite gneiss and biotite-garnet-graphite gneiss are common. Near its contact with the country rocks however, the charnockite is foliated and gneissified. The contact relationship with the gneiss of the migmatite zone varies from sharp to transitional.

As Escher & Pulvertaft (1976) remark, it is significant that at the contact of the batholith, the surrounding migmatites nearly everywhere dip under the charnockite, indicating that the body probably occupies a higher structural position than the migmatites.

Migmatite zone

A zone of brown-weathering migmatites extends northwards from the Prøven charnockite to the island of Tasiussaq (73°20'N). The intensity of the migmatisation gradually decreases northwards and north of Tasiussaq, the Red Head formation can be distinguished from the basement gneiss.

The neosome mainly consists of leucocratic garnet granite and other pegmatitic material; in the paleosome remnants of biotite-garnet-graphite gneiss and basement biotite gneiss can be recognised. Sillimanite is very rare in the migmatite zone.

Leucocratic garnet granite

This granite is the youngest plutonic rock of the region. Discordant irregular sheets and veins of coarse-grained leucocratic garnet granite are abundant in the Prøven charnockite and migmatite zone and also occur in the Red Head formation and basement gneiss. Where the granite is in granulite-facies metamorphism its quartz is greasy and bluish in appearance.

Dolerite dykes

Unmetamorphosed dolerite dykes up to 150 m thick occur throughout the region. Main trend is NW–SE and there are a few younger NE–SW trending dykes.

Metamorphism

The Prøven charnockite displays granulite-facies mineralogy with hypersthene, antiperthitic plagioclase and greasy, bluish quartz. North of the batholith, hypersthene occurs up to 73°15'N. Further north the rocks are gradually downgraded to amphibolite facies.

Structure

The Prøven charnockite and the leucocratic garnet granite are massive and weakly foliated. The rocks outside the batholith however, are strongly deformed with well-developed foliation and fold structures. North of the Upernavik Isfjord (73°N) up to the northern limit of the region (75°15′N), the foliation predominantly trends NE–SW and dips 20–60° to the south-east. North of Nûluk (73°30′N) up to 75°15′N the contacts between the basement gneiss and the Red Head formation are very distinct and show that the metasediments lie on top of the basement gneiss. The contacts generally also have low dips and are concordant because of strong deformation along them. However, when high cliff sections are seen from a distance, it is clear that the fairly uniform Red Head formation is structurally discordant to the more intensely and complex folded basement gneiss, indicating a considerable age difference between the two units.

The contrast between the grey basement gneiss, which forms the core of major fold structures, and the surrounding darker coloured rusty metasediments of the Red Head formation makes these structures very conspicuous in the field. The structural pattern of most of the region is apparently characterised by a few large-scale recumbent isoclinal folds although the inverted, almost flat-lying limbs of the nappe-like structures, have been squashed out. Younger open folds with NE and SE axial traces form well-developed dome and basin structures.

References

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O. S.,
Laboratoriet for Endogen Geologi,
Geologisk Institut,
University of Aarhus,
Ole Worms Alle,
8000 Aarhus C,
Denmark