THE PRECAMBRIAN ROCKS OF THE UPERNAVIK - KRAULSHAVN AREA (72° - 74°15'N), WEST GREENLAND

A. Escher and T. C. R. Pulvertaft

In an attempt to complete the mapping of sheet IV of the 1:500 000 map series, a reconnaissance was carried out of the coastal region of West Greenland between 72° and 74°15'N in the period 30. 6 to 24. 8. 1967.

Prior to the writers' mapping virtually nothing was known of the geology of this part of Greenland other than that it was formed of gneisses and other crystalline rocks.

The two most striking features discovered by the writers are i) the occurrence of a very large mass of uniform porphyritic granite in the southern part of the area, and ii) the development of granulite facies gneisses around and to the north of Upernavik. A K/Ar age determination on biotite from Upernavik gave 1680 ± 40 m.y., indicating that these rocks belong to the Nagssugtoqidian mobile belt (see Larsen, 1966 and this report).

The Prøven granite: This granite emerges from beneath the Tertiary basalts south-east of Prøven and occupies the entire country in a roughly NE-trending area extending to Upernaviks Isstrøm. The aerial extent of granite outcrop exceeds 2500 km^2.

Along its southeastern margin the granite is more in the nature of a homogeneous biotite gneiss or augen gneiss, and is flanked by metagreywacke of the Nukavsak Formation (Henderson and Pulvertaft, 1967), which is intensely veined by concordant to sub-concordant garnet-biotite-bearing leucogranite sheets. At the contact the metagreywacke dips under the homogeneous gneiss at 45-50°. The contact is a transition through about 50 m in which the metagreywacke becomes totally recrystallised to a coarser rock

devoid of banding and the garnet-biotite leucogranite sheets disappear, the few leucocratic veins in the homogeneous gneiss being thin quartzo-feldspathic veins typical of granitic terrain.

For the greater part the Prøven granite is a rather uniform coarse-grained rock with feldspar megacrysts up to 4 cm long, locally reaching 10 cm in length and at least superficially resembling rapakivi feldspars. When fresh the rock is greenish, but the surface is usually altered and the rock appears brownish. The characteristic mafic mineral is biotite; garnet appears locally and hypersthene is a common constituent north-west of the axis of the body. In many places the granite has a weak foliation, and sometimes there are well-oriented inclusions of fine granular semipelite. Mafic layering describing swirly structures is of rare and local development, but its occurrence is taken to be an indication of a fluid or at least plastic stage in the evolution of the granite.

The north-western margin of the granite is not well defined. Migmatitic granulite facies nebulitic gneiss rises in steeply flanked domes surrounded by granite and in places there are sheets of granite in the gneisses. Hypersthene is generally present in the granite towards its north-western margin, and here the rock is better termed charnockite or enderbite according to the plagioclase: K feldspar ratio.

In many places the Prøven granite is penetrated by irregular sheets and veins of coarse-grained white garnetiferous leucogranite, this feature becoming particularly marked as the gneiss areas are approached. The same leucogranite forms the granitic component of the migmatitic granulite facies gneiss which it penetrates in thin lit-par-lit veins as well as big sheets.

The actual contact between gneisses and Prøven granite is everywhere a transition zone from a few metres to more than 50 m wide. It is important to note that at the contact the gneisses almost invariably dip under the Prøven granite; it is clear that the Prøven granite occupies a higher structural position than the granulite facies gneisses.

The gneisses may for convenience be provisionally grouped into two divisions - the red-brown gneiss and the grey gneiss - according to the colours of the weathered surfaces. These colours are only the superficial expression of more significant differences. The grey gneiss appears to be structurally lower than the red-brown gneiss and is only seen north of Tasiussaq Bugt ($73^{o}15'$N).

Disregarding the leucocratic vein material, the lithology of the red-brown gneiss division is remarkably uniform. Where this gneiss has been metamorphosed in a closed system (i.e. is unmigmatised) it shows exactly the same lithology and type of banding as the Nukavsak Formation and in some localities the same type of tight folding as mentioned by Henderson and Pulvertaft (1967, p.12). This suggests that this division represents a highly metamorphosed greywacke suite and, in view of the similar structural position of this gneiss and the Nukavsak Formation with respect to the Prøven granite, that it may even be the equivalent of the Nukavsak Formation.

A thick horizon of pale grey glassy quartzite is developed in the red-brown gneiss east of Upernavik. There is a single horizon with ultrabasic lenses in the red-brown gneiss but otherwise basic rocks are virtually unknown in this division. Occasional thin graphitic horizons weather to a rusty ochre colour; one near Upernavik has been mined in the past.

The grey gneiss is rather uniform and in many places nebulitic. Near the contact with the red-brown gneiss it locally grades into a leucocratic siliceous gneiss or quartzite. Unlike the red-brown gneiss it is characterised by the presence of many basic and ultrabasic horizons with thicknesses varying from 10 cm to 20 m.

Metamorphism: The metagreywacke and homogeneous gneiss along the south-eastern margin of the Prøven granite have amphibolite facies mineral assemblages, but on the north-west side of this granite the rocks have the typical appearance and assemblages of the hornblende-granulite subfacies of the granulite facies. The

granitic rocks have the assemblage antiperthitic plagioclase-quartz-microcline-hypersthene±biotite while the mineral assemblage in the gneisses is commonly plagioclase-quartz-garnet-biotite± hypersthene ±microcline. Platy blue quartz was frequently observed. The rare basic-ultrabasic lenses consist mainly of hypersthene, diopside and plagioclase.

Until the remainder of the rock collection has arrived from Greenland it is not possible to fix the northern limit of granulite facies rocks, but north of 73°45' not only does sillimanite appear, indicating a more aluminous composition, but also the general aspect of the rocks changes and no longer recalls granulite facies terrain.

Structure: The structural pattern throughout most of the area is characterised by large recumbent isoclinal folds, domes and basins. It is thus very similar to the structural pattern found in the Umanak area (Henderson and Pulvertaft, 1967).

The best structures were seen between Gieseckes Isfjord and Holms Ø. In this area the grey gneisses and overlying red-brown gneisses area are folded together into a succession of large isoclinal folds which face consistently to the NNW. The dip is generally low and the isoclinal folds are often almost flat-lying. In a few places it can be seen that the isoclinal folds are refolded by domes, basins and even even overturned structures. The contrast between the light coloured grey gneiss, which forms the cores of the folds, and the surrounding darker red-brown gneiss makes these structures very conspicuous in the field.

References

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