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FIELD EVIDENCE OF VERY OLD PRECAMBRIAN ROCKS IN THE GODTHÅB AREA, WEST GREENLAND

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The Godthåb area, situated in the old central gneiss complex of West Greenland, has yielded two of the oldest radiometric dates yet obtained from Greenland. They are both K/Ar biotite dates, one of 2710 ± 130 m.y. on granodiorite gneiss from Godthåb (Armstrong, 1963), and the other of 2610 ± 50 m.y. on gneiss collected 55 km to the north and on the opposite side of Godthåbsfjord (Larsen and Møller, this report). The latter gneiss shows evidence of having undergone retrograde metamorphism from granulite facies to amphibolite facies, and its date is presumed to be related to this retrogression (Windley, in press).

Mild reactivation of parts of the central complex is indicated by several younger dates, most of them about 1800 m.y. (Larsen and Møller, this report). The same authors report a K/Ar biotite date of 1820 ± 30 m.y. from a late pegmatite associated with the anatectic Qôrqut granite in the central part of Godthåbsfjord. This granite is probably polycyclic, but appears to have attained its present form in the core of a narrow, elongated thermal dome.

The writer's field work during the last two summers around and east of Godthåb has shown that this area has been through at least one period of plutonic activity earlier than the one which ended

about 2600 - 2700 m.y. ago. An important swarm of metamorphosed basic dykes - the Ameralik dykes - provides the best key to the history of the area (McGregor, 1966). Dykes considered to belong to this swarm have now been recognised for a distance of 120 km along the strike and 30 km across the strike, and there is no reason to suppose that they will not be found over an even larger area. All the Ameralik dykes have been affected by later plutonic activity, and it is unlikely that the swarm occurs in an unaltered state anywhere in West Greenland.

The Ameralik dykes are similar to other swarms of basic dykes which have been involved in later orogenies, for example the Kangâmiut dykes within the Nagssugtoqidian mobile belt (Ramberg, 1949), which the writer has seen at Søndre Strømfjord. On the other hand, they lack the characteristic features of basic dykes considered to have been intruded under plutonic conditions, of which the writer has recognised several types in Godthåbsfjord. Where Kangâmuit dykes can be recognised in the Nagssugtoqidian belt it is possible to say with certainty that the rocks that they cut are reworked pre-Nagssugtoqidian basement (Pulvertaft, in press). In the same way, the writer considers that the rocks cut by the Ameralik dykes belong to a reworked basement within the pre-Nagssugtoqidian, pre-Ketilidian complex.

The area east of Godthåb is made up of structural units containing many Ameralik dykes or recognisable relics of them separated by units in which no dykes have been found. The dykes are so abundant in those units where they are found at all, that failure to find them in the adjacent units may be taken to indicate that the rocks forming these are younger than the dykes. These rocks include large bodies of intrusive granite rocks, recrystallized during later deformations to homogeneous gneiss, a sequence of supracrustal rocks (amphibolite and sillimanite-bearing arkosic and pelitic gneisses) that crops out on Rypeøen, a small island 3 km south-east of Godthåb, and other amphibolite units that can be traced continuously for several tens of kilometres.

The rocks cut by the Ameralik dykes in the Godthåb area have been so strongly deformed and migmatized that very little can be said about their pre-dyke character except that they included homogeneous granitic rocks, and that rocks of undoubted supracrustal origin are rare or absent. The writer prefers to consider as still open the question of the relation of the Ameralik dykes to the stratiform anorthosites that characterize other parts of the central complex of West Greenland (cf. Windley, in press).

All the Ameralik dykes have been strongly deformed, most of them more than once, and very few of them are still clearly discordant. Over much of the area they have been so strongly migmatized that their origin as dykes might not be recognised by anyone not familiar with the swarm in places where it is less altered. While it is clear that there have been several phases of deformation, migmatization and intrusion of granitic rocks after the intrusion of the Ameralik dykes and before the formation of the Qôrqut granite and associated rocks, the relations of the different phases to one another and their correlation from one part of the area to another are not fully understood yet.

The oldest post-Ameralik dyke rocks recognised are abundant lithologically characteristic granitic sheets that cut the dykes and their country rocks in the outer part of Ameralik fjord, 15 to 30 km south-east of Godthåb. Very similar granitic sheets have been found in those parts of the Godthåb area itself where later migmatization has not been strong, but only in structural units where Ameralik dykes have been found. This and other similarly rather inconclusive evidence suggests that there may have been a period of plutonic activity after the intrusion of the Ameralik dykes, but before the deposition of the supracrustals.

The supracrustal gneisses, the granitic sheets, the Ameralik dykes, and the rocks they cut have all been affected by a deformation characterized by abundant minor folds overturned almost everywhere towards the east. Other evidence suggests that this deformation consisted of major overthrusting or nappe folding with movement from

west to east. It was followed by a period of plutonic activity whose effects become stronger across the Godthåb area from east to west, and which culminated in the vicinity of Godthåb itself in a phase of very strong migmatization and intrusion of a calc-alkaline suite of intrusive rocks. The oldest intrusive rocks were probably diorites and the youngest were plutons of granitic to granodioritic composition. This part of the area was then subjected to an intense stretching deformation. The granitic plutons rose diapirically, arching the rocks above them into elongated domes, and now form concordant cores of homogeneous pale gneiss in the domes. The youngest plutonic rocks at Godthåb are undeformed pegmatites containing blue-green apatite and dark grey, smokey plagioclase, and it is probable that the date of 2710 ± 130 m.y. from Godthåb represents the cooling of the area after the intrusion of these pegmatites.

There are abundant heavily migmatized Ameralik dykes only 2 km east of Godthåb, and both the dykes and the basement rocks they cut must therefore be older than the 2700 m.y. date. Consideration of the complex sequence of events that affected the area after the intrusion of the Ameralik dykes raises the possibility that the dykes may be considerably older than 2700 m.y., and that the rocks they cut may prove to be very old indeed, perhaps even as old as the Lower Katarchean rocks (3600 - 3660 m.y.) of the Kola Peninsula (Polkanov et al, 1966).

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GEOLOGICAL INVESTIGATIONS ON DALAGERS NUNATAKKER, WITH SPECIAL REFERENCE TO METAMORPHOSED BASIC DYKES

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Geological mapping of a group of nunataks in the Frederikshåbs Isblink area (approximately 230 km^2) has revealed different ages of metamorphosed basic dykes within the Precambrian gneisses. The dykes are small but are locally abundant and their presence provides an insight into the complex history of the gneisses. The nunataks are an extension of the pre-Ketilidian gneiss complex of the Frederikshåb area (see Jensen, 1966 and this report) and rock types mapped on the nunataks have much similarity to those of the Frederikshåb area.