# A sandstone dyke in the Julianehåb granite of Qeqertarssuaq, Julianehåb district

by

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Abstract

A dyke of well sorted sandstone in the Julianehåb granite is described. The grains (mainly rounded quartz) are cemented by hematite. It is suggested that wind-blown sand has filled a joint and that the hematite is a secondary product of iron-hydrates.

## Introduction

Qeqertarssuaq ("the big island") is an oval-shaped island elongated NE-SW to the WSW of Niaqornaq. A strip of low land divides the two hilly parts of the island each reaching elevations of around 350 m. The low land is marked by a huge WNW striking fault (fig. 1) which reappears to the east on the Narssaq peninsula. This is one of the main faults of Southern Greenland.

At the end of August 1959 the author, as a member of the Geological Survey of Greenland, had the opportunity to map the SE shore of the island by boat. As far as has been mapped the coastal region consists of Julianehåb granite, cut by several dykes (SCHARBERT 1959).

The purpose of this paper is to describe a sandstone dyke found in the Julianehåb granite on Qeqertarssuaq and to discuss its origin.

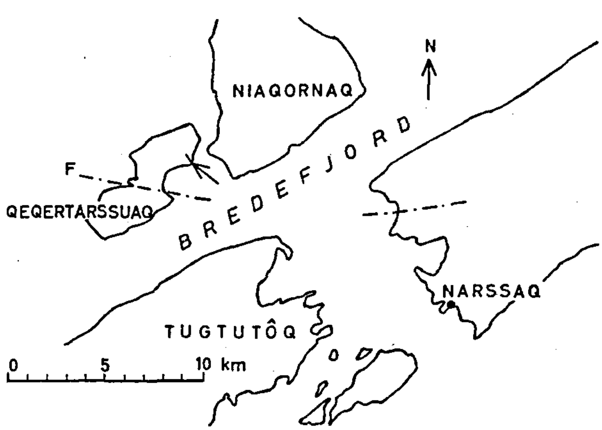


Fig. 1. Sketch-map of the area in question. The arrow marks the position of the sandstone dyke. F=major fault.

## The sandstone dyke

*1. Geology*

The dyke under consideration is located in the north-eastern part of the island (fig. 1). It is vertical with a NW trend and follows a minor crush-zone. The dyke is about 1,5 m wide and shows a faint lamination along its margin. Since only the coastal region was mapped the total length of the dyke is not known, but about 30 m has been observed.

*2. Petrography*

The rock (GGU 43502) is reddish-brown, sometimes even red in colour with more or less densely scattered grey particles which occasionally are elongated but not oriented. The surface has a glassy luster.

Under the microscope the rock shows a texture known from sediments. Table 1 gives the mineralogical composition of the sandstone dyke. Column a) cites the total composition while column b) indicates the composition minus the cement, recalculated to 100 %.

Table 1

| | a) | b) |
|---|---|---|
| Quartz | 54.6 % | 75.2 % |
| Chert | 13.8 | 19.0 |
| Felspar | 3.7 | 5.1 |
| Rock-fragments | 0.5 | 0.7 |
| Cement | 27.4 | – |

The preponderance of quartz over felspar and the rock-fragments is striking.

The quartz grains are well rounded falling into the "rounded" and "sub-rounded" categories of PETTIJOHN (1957, p. 59). They do not show signs of strain but are occasionally broken by post-diagenetic movements into small angular fragments. In table 1 a small amount of rock-fragments is listed. These are polygranular pebbles while the quartz occurs as single grains. In some of the quartz grains the so-called "Liesegang'sche Ringe" have been observed, reflecting the circulation of iron hydrates into fractures in the grains. They have the brown colour of limonite.

A few felspar grains are dispersed throughout the rock. They are predominantly microcline with the characteristic cross-hatch-twinning and thin perthite strings. The microcline grains fall in the coarser grain size fraction and are not as well rounded as quartz. The optical properties resemble those from the microcline of the Julianehåb granite ($2V_X \sim 80°$, $a \wedge X \sim 15°$). A few angular grains of plagioclase strongly altered into sericite are also present.

The cement is opaque with a slight reddish shade in plane polarized light. A X-ray examination shows that the opaque material of the cement is hematite. Fig. 2 illustrates a powder diffraction diagram of the rock in which the hematite peaks are clearly marked ("H"). According to ROOKSBY (1961) the peaks are similar to those indicated for $\alpha$-$Fe_2O_3$ (hematite) (see table 2).

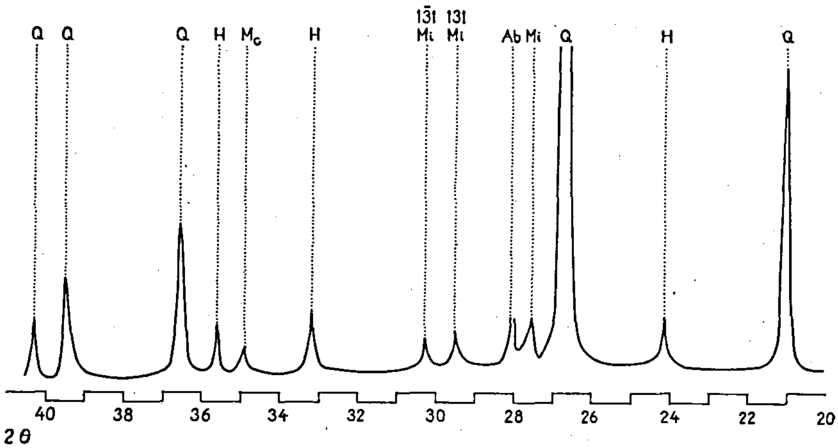


Fig. 2. X-ray powder diffraction diagram of GGU 43502. 2Θ 20–40°, Cu Kα radiation, scanning speed 0,5°/min. The characteristic peaks of hematite are present: d=3,67, 2,69, 2,51. Note the high triclinicity of the microcline. Q=quartz, H=hematite, Ab=Albite, Mi=microcline, Mc=mica.

Table 2

| Peaks observed | Peaks after Rooksby |
|---|---|
| d 3.71 | d 3.67 |
| 2.70 | 2.69 |
| 2.512 | 2.514 |
| 1.84 | 1.838 |
| 1.453 | 1.452 |

Besides the quartz peaks and a little mica ("Mc") the high triclinicity of the microcline ("Mi") is given by the pair d(131)–d(1̄31) showing the similarity of this mineral to the microcline in the Julianehåb granite (Scharbert, unpublished data).

The grey particles in the hand specimen are chert. Its percentage is rather high (table 1). In the following discussion on the grain size distribution this constituent has been counted because it seems to be a post-diagenetic product. This is indicated by the bizarre shape of the individuals and by the absence of strain effects in contrast with the other rock components. A slight crystallization into very tiny birefringent areas (chalcedony?) is often seen.

There are a few bleached micas in the rock. No accessory minerals have been detected with certainty, but no heavy mineral separation was carried out by the author.

### *3. Grain size Analysis*

The measurement of the rock components was done by the traverse method elaborated by Münzner and Schneiderhöhn (1953). 1058 traverses were measured, with the exception of the chert grains. A rather complicated calculation leads to the real grain size of each component

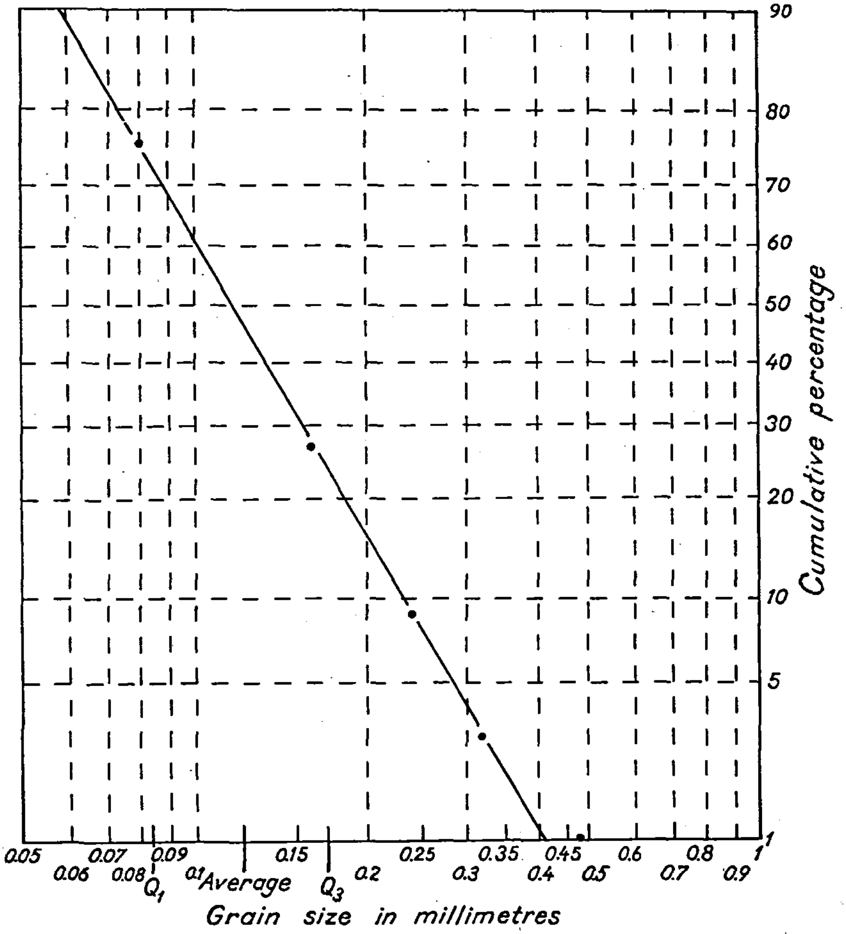


Fig. 3 Grain size distribution plotted on log probability paper.

mineral which is plotted on log probability paper (fig. 3). This gives a straight line which corresponds to a Gauss curve on normal paper. The cumulative curve drawn on single log paper and double log paper gives a shape with symmetry (skewness) $1{,}04$, typical for very good sorting. These two curves are not published here. On the grain distribution curve fig. 3 all the points lie on a straight line with the exception of that for the largest grain size ($0{,}48$ mm). This does not indicate severe deviation from the good sorting since this size class forms only 1 % of the rock. The rock has a log normal grain size distribution.

Another index of good sorting is the inclination of the line in fig. 3. From this we can calculate the "sorting coefficient" (So) with the following formula (PETTIJOHN 1957, p. 37): $So = \sqrt{Q_3/Q_1}$. $Q_3$ represents the grain size on the 25 % line and $Q_1$ the grain size on the 75 % line. In our case So = 1,43, a scale indicative of good sorting. During the calculation according to the traverse method a predominance of grain sizes up to 0,24 mm was found (fig. 4). In fig. 3 the 50 % line indicates the average grain size as being 0,12 mm. Altogether the investigations demonstrate very good sorting.

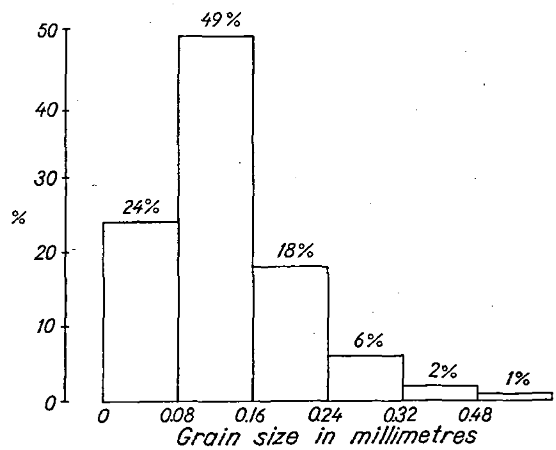


Fig. 4. Histogram of percentages of the different grain sizes.

*4. Origin*

Sandstones are very widely distributed in part of Southern Greenland ("Igaliko sandstone") and are mentioned by Ussing (1912), Wegmann (1938) and Poulsen (1958–1959) in his recent field reports for the Geological Survey of Greenland. These sandstones are classified as Gardar and were deposited on the deeply eroded sub-Gardar peneplain. The mapping in Southern Greenland showed that the Igaliko sandstone has formerly covered larger areas than it does today. Erosion has destroyed much of the sediments overlying the granite.

The sandstone consists of arkoses, mostly at the base of the series, and sandstones, sometimes slightly quartzitic. Wegmann, when discussing their origin, suggests that the quartz rich types are wind-blown (op. cit., p. 62). He also mentioned the good roundness of the quartz in the sandstone beds in contrast to the angular grains in the arkoses. But no intensive laboratory work has been done on this interesting rock.

Bearing in mind the composition of our "dyke" we must dismiss an origin by crumbling of granite in situ because the sorting (grain size as well as composition) is so good. From experience we know that sediments having a good sorting of the grain sizes, well rounded grains and a predominance of resistant minerals are characteristic of wind transported material. These properties all apply to the sandstone of the dyke discussed here.

The present author suggests the origin of the sandstone dyke to be as follows: a joint in the granite was filled from above by wind-driven material, presumably coming from granite areas (microcline). Probably after the deposition movements continued along the joint. Whether the granite was crushed after or before the deposition of the sand cannot be concluded. Anyway, after the deposition movements must have taken place as is seen from the angular quartz-fragments.

Hematite as cement in sandstone is also reported by PETTIJOHN (1957, p. 485) and he stresses its secondary character from limonite. In Southern Greenland iron-rich products are known from many dislocation and movement zones in the granite. Presumably during the deposition of the sand and during the movements the circulation of iron-hydrates was active cementing the grains. The transformation of the hydrates into secondary hematite could be explained by frictional heat generated during movements along this special movement zone into which the grains had fallen. ROOKSBY (1961, p. 376) indicates that the iron-hydrate goethite starts to decompose in air at around 250° C. Possibly such a temperature could be generated by frictional heat along faults.

## ACKNOWLEDGMENT

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