MEDDELELSER OM GRØNLAND
UDGIVNE AF
KOMMISSIONEN FOR VIDENSKABELIGE UNDERSØGELSER I GRØNLAND
Bd. 169 · Nr. 4

GRØNLANDS GEOLOGISKE UNDERSØGELSE

SOME DOLERITE DYKES IN THE SOUTHERN PART OF THE GODTHAAB DISTRICT, WEST GREENLAND

BY

STIG BAK JENSEN

WITH 1 FIGURE IN THE TEXT
AND 1 PLATE

KØBENHAVN
C. A. REITZELS FORLAG
BIANCO LUNOS BOGTRYKKERI A/S
1962

CONTENTS

Abstract.

The dykes described from the southern Godthaab district are all dolerites, which show varying degrees of uralitisation. The main minerals are plagioclase, pyroxene, uralite, and ore: olivine has only been found in one specimen from a dyke contact.

A study of samples collected at varying altitudes within the Grædefjord dyke and the Amitsuarssuk dyke (0–600 m and 365–1150 m respectively) indicates that no noteworthy differentiation has taken place during or after the intrusion.

The two dyke generations which in the field could be distinguished around Amitsuarssugssuaq are petrographically indistinguishable.

I. INTRODUCTION

The pre-Cambrian gneiss and schist area in West Greenland is pierced by several generations of basic dykes. By means of these dykes it is possible to distinguish various orogenic cycles and certain post-orogenic events (RAMBERG 1948, BERTHELSEN 1957), and accordingly the dykes have a special significance in the study of the chronology of the basement rocks. Post-orogenic movements and their kinematics are elucidated by means of post-orogenic basic dykes. The age of the movements and the different dyke generations can be dated in relation to one another. The basic dykes are therefore of great importance for the geology of the whole of West Greenland, and it will be of value to distinguish the various generations and their relative age.

The post-orogenic doleritic dykes dealt with here were mapped in 1952 on behalf of Grønlands Geologiske Undersøgelse (the Geological Survey of Greenland) under the leadership of mag. scient. K. ELLITSGAARD-RASMUSSEN, and samples were collected from the dykes. The dykes are located in the area around Sermilik and Grædefjord 75–100 km south of Godthaab (fig. 1). The author did not participate in the field work, but the samples were handed over to him for examination and description.

The dykes are found in amphibolite facies and local granulite facies gneisses of pre-Cambrian age. It is not yet possible to correlate them with the doleritic dykes from the Gardar period in South-west Greenland (WEGMANN 1938, pp. 83–93), (BONDAM 1956, p. 15), or with the doleritic dykes in the Sukkertoppen district (RAMBERG 1948a and b, BERTHELSEN 1957, BERTHELSEN and BRIDGWATER 1960).

Acknowledgment.

The author is indebted to mag. scient. K. ELLITSGAARD-RASMUSSEN for permission to work up the samples collected under his leadership, and for the permission to publish the present paper. During the study of the material, Mr. Ellitsgaard-Rasmussen has generously placed his field observations at the author's disposal.

Professor, dr. phil., A. NOE-NYGAARD, head of the Mineralogical Museum, Copenhagen, has placed the facilities of the Museum at the disposal of the author and has guided him during the work.

Dr. phil. A. BERTHELSEN and mag. scient. J. BONDAM have shown their interest in the work in participating in many discussions, which have been very inspiring to the author.

Dr. phil. H. PAULY of the Cryolite Company Øresund, has kindly determined the ore minerals of the dykes and has assisted in the preparation of the microphotographic work.

Miss M. MOURITZEN, cand. polyt., has kindly performed chemical analyses of material from two of the dykes.

Miss E. GLEERUP kindly translated the manuscript.

For all this help I wish to express my cordial thanks.

Geological Institute of the University, Copenhagen,
Geological Survey of Greenland.

STIG BAK JENSEN.

II. REVIEW OF FIELD SETTING

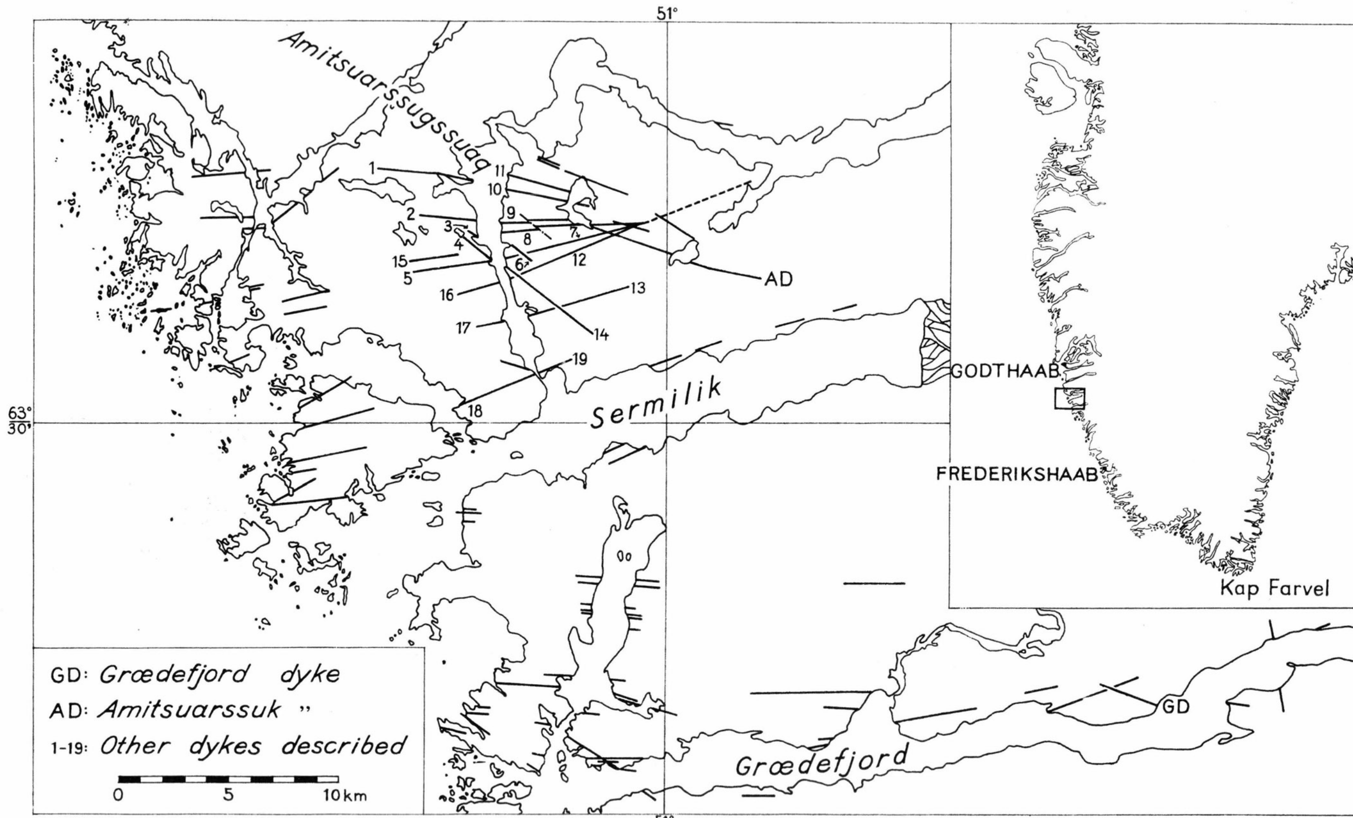
As the field observations and the collection of samples of the dyke material treated in this paper were made in connection with a reconnaissance, the age relationships of the dykes could only be determined locally. The present paper should therefore be regarded as an attempt—through a petrographic study of the dyke samples already collected—to support future investigations in the field.

Moreover, the samples from two of the dykes offered the possibility of investigating whether differentiation has taken place within a single dyke.

On the north coast of Grædefjord, about 30 km from its mouth, runs the Grædefjord dyke, from which samples taken from both the contacts and the centre at different levels, have been examined (fig. 1).

East of Amitsuarssugssuaq, which is a branch fjord on the north side of Sermilik, there is a broad dyke, called the Amitsuarssuk dyke (fig. 1). Samples from the central parts of this dyke taken at different levels have likewise been examined.

Around Amitsuarssugssuaq the gneiss is penetrated by many dolerite dykes, which are referable to at any rate two generations, the oldest of which seems to be fan-shaped with the trend of the dykes varying from 65° to 105° from south to north at Amitsuarssugssuaq. These dykes are cut by dykes of the younger generation trending ca. 130°. The age of the Amitsuarssuk dyke in relation to these two systems is



On the basis of Geodetic Institutes map.

Fig. 1. Dyke map of the Sermilik-Grædefjord area showing the location of the dykes described.

unknown, but judging by its direction in about 110°, it must be assumed to belong to the younger generation.

The broad dykes around Amitsuarssugssuaq were numbered during the mapping (fig. 1). In all 19 individuals were numbered, but some of these can be joined across the fjord so that there are in fact only 10 dykes, as follows:

	West side		East side	Width of dyke
Older dykes:			dyke 11	
	dyke 1	=	dyke 10	50 m
	dyke 2	=	dyke 9	45 m
	dyke 3	=	dyke 8	20 m
	dyke 5	=	dyke 7	30 m
	dyke 16	=	dyke 12	20 m
	dyke 17	=	dyke 13	12 m
	dyke 18	=	dyke 19	
Younger dykes:	dyke 4	=	dyke 14	12 m
			dyke 6	

There are examples of "en échelon" arrangements of the dykes, e. g. west of the fjord at dyke 5 and dyke 15. Possibly some of the dykes may take an "en échelon" course under the fjord; however, this is of minor importance, as both parts belong to the same generation. The correlation made is supported by dykes 1 and 10, which are identical. In the field dyke 1 was seen to have been altered by movements in the dyke parallel to the contact; this was not observed in dyke 10, but the microscopic examination revealed that the two parts consist of the same type of amphibolitised dolerite (p. 28), which has not been observed in other dykes of the same generation.

Intersections between the two systems were found at dyke 7, which is cut by dyke 6, and at dyke 13, which is cut by dyke 14. There are no visible contacts where dykes 14 and 12 intersect. Where dyke 12 joins two other dykes (dyke 7 and probably dyke 8) east of Amitsuarssugssuaq, no intersection is seen. These dykes must have originated at the same time.

There are no multiple or composite dykes, and no xenoliths in the dykes. The contacts with the surrounding gneisses are always sharp.

III. MINERALOGICAL AND PETROGRAPHICAL METHODS

The chief minerals in the dykes are plagioclase, pyroxene, and hornblende. The composition or type of these minerals was determined by means of the optical constants, which were measured with a Leitz universal stage. It was not possible to determine the optical properties of the pyroxene or hornblende in all the thin sections. In some cases the RI of hornblende was measured in order to supplement the data on the mineral.

Plagioclase is the mineral which has aroused the greatest interest, being that which is best preserved in the dykes and most abundantly present. The determination of the plagioclase was made by the methods of both M. Reinhard (1931) and A. Köhler (1942). Instead of Reinhard's curves, the new curves of van der Kaaden (1951) were used, which distinguish between high and low temperature optics, and instead of Köhler's curves those of H. Tertsch (1942), which represent a further development of Köhler's method. The optic orientation of the twin axis in relation to the indicatrices of the two individuals were used for plagioclase determinations by Reinhard's method. The angles between the α, β, and γ of a pair of twins were measured (the angles $\alpha\alpha$, $\beta\beta$, and $\gamma\gamma$), and these values give, by means of Tertsch's curves, the anorthite content. It is an advantage to use both methods in the determination of plagioclase, as it requires no time for extra measurements. On the other hand, it turned out to be less profitable to use intergrowth planes or 2V in the determination of anorthite, for with these the uncertainty of measurement is much greater.

If we compare the results of measurements obtained by the two methods, it turns out that in both cases the measurements fit low temperature plagioclases. Considering the content of anorthite (An $^0/_0$), there are some differences between the two methods in several cases. The three angles from which the anorthite content is computed according to Tertsch's curves, often give a spread. This may be due to 1) uncertainty of measurement, 2) the measured points in the two individuals of the twin not having the same composition, or 3) the curves not being entirely accurate. As the curves are drawn, the steeper the curve, the less will a small uncertainty of measurement make itself felt. If we consider the set of curves for each twin law, it turns out that the deviations occur in certain places.

The albite law: For values exceeding 35 $^0/_0$ An, the $\alpha\alpha$-curves are rather steep. Within the same area, the $\beta\beta$-curves are rather flat, and the $\gamma\gamma$-curves steep. The $\beta\beta$-values may be expected to differ from the other two in some cases. This is seen, for instance, in sample 7308B (table 5): 55, 41, 48 % An, where the van der Kaaden values are 50 and 49 % An. An increase of the angle $\beta\beta$ by 5° would give 50 % An instead of 41 % An. The $\gamma\gamma$-values differ occasionally from the others, e. g. in 6517A (table 2): 63, 60, 56 % An, where the van der Kaaden values are 60 and 54 % An; i.e. there is a considerable spread of these values.

The Carlsbad law: The flattest course of a curve is found for the $\alpha\alpha$-values exceeding 55 % An, for the $\beta\beta$-values under 20 % An and above 75 % An. The $\gamma\gamma$-curves, however, are rather steep. Some $\alpha\alpha$-values also prove to be deviating; some measurements are entirely above these curves: in 6574D (table 9) the angle is 119°; 112° gives 73 % An. The van der Kaaden curves here give 67 % and 65 % An. In all the measurements the $\gamma\gamma$-values are somewhat below the others, which might indicate that these curves have been drawn a little too low. This was also noted by Oftedahl (1938, p. 16). With the exception of the above-mentioned two cases, there is good agreement between the curves.

The albite-Carlsbad law: The $\alpha\alpha$-curves as well as the $\beta\beta$-curves are steep, with the exception of the $\beta\beta$-curves over 65 % An. The $\gamma\gamma$-curves, however, are flat. The $\gamma\gamma$-values found differ rather much from the other two values, in addition it will be seen that the $\gamma\gamma$-values are lower; only 3 $\gamma\gamma$-values out of 30 determinations are on a level with the other values, e.g. 6582D (table 5): 52, 54, 43 % An, where the van der Kaaden values are 52 and 51 % An. For $\gamma\gamma$-values of 50 % An, the angle $\gamma\gamma$ must be 2° larger, which does not exceed the accuracy of measurement, but as nearly all the $\gamma\gamma$-values are lower than the other two, it would seem that the $\gamma\gamma$-curves have been placed too low. The same was pointed out by Sørensen (1950, p. 531). If we compare the $\alpha\alpha$- and the $\beta\beta$-values with the corresponding van der Kaaden values, the Tertsch values will often be a little higher.

The pericline law: Only few of these twins have been measured. The $\alpha\alpha$-curves above 35 % An are steep, those under 35 % An are flat. The $\beta\beta$-curves are flat if over 35 % An, but steep if less. The $\gamma\gamma$-curves are rather steep. The two methods are apparently in good agreement with one another.

In several of the descriptions of samples from the dykes, the type of ore mineral is stated. The determination of these was carried out by Dr. Hans Pauly, of the Cryolite Company "Øresund".

IV. THE GRÆDEFJORD DYKE

On the north side of Grædefjord, about 30 km from the mouth, the gneiss is penetrated by a 20–25 m broad vertical doleritic dyke trending 120° (fig. 1). It has been traced towards the north-west, and samples have been taken at four altitudes, from the central part as well as from the contact. The contact samples were taken ca. 1 m from the contact. To the north-west the dyke crosses an older dyke trending 60°.

The following samples were examined:

600 m:	contact: 6518,	centre: 6519
400 m:		– 6517
200 m:		– 6515
0 m:	contact: 6512,	– 6513

Contact of the Grædefjord dyke.

The contact rock is a fine-grained, dark greyish-blue, splintery dolerite. On disintegration, the rock is penetrated by rather planar, parallel, rust-coloured cracks. Its texture is subdoleritic. The dyke consists of plagioclase, pyroxene (augite), ore, hornblende (uralite), chloritic material, biotite, apatite, and some quartz. In addition the sample from 0 m (6512) contains olivine and a little serpentine. In the sample from 600 m (6518), however, neither olivine nor pseudomorphs of it have been found (table 1). The top sample is altogether more altered than the sample from the 0 m level.

Plagioclase occurs in laths up to 1 mm long and 0.1–0.2 mm broad having undulatory extinction. Most often thin wedge-shaped twin lamellae occur. The composition ranges from labradorite to andesine (table 2). A few zoned plagioclases have been seen. The grains are saussuritised in some measure and contain small hornblende aggregates along their edges and along cracks. The saussuritisation is strongest in the uppermost sample.

The pyroxene grains are up to 1 mm in size. Their shape is determined by the adjoining plagioclase laths or by other pyroxene grains. There is only one type of pyroxene, and the optic determination (table 3) shows that it is an augite. Along the edges and along transverse cracks the grains are uralitised. They may enclose plagioclase laths to a greater or less extent (pl. 1, fig. 1).

Olivine, which has only been found in the 0 m sample (6512), occurs as rounded grains, which often contain ore inclusions and are somewhat serpentinised along the edges. The composition is $Fo_{57}Fa_{43}$, computed from the axial angle.

The ore grains are compact or irregularly dendritic, and consist of magnetite with ilmenite lamellae. A few ilmenite grains and small pyrite grains are found in the 0 m sample (6512), and the 600 m sample (6518) contains small magnetite grains converted to some degree into limonite. In most cases the ore grains lie in the uralitised marginal zone of the dark minerals, and in the 0 m sample associated with olivine. In the same sample the ore is seen to enclose plagioclase; in between there is a zone of hornblende or chlorite. From the same sample it has also been seen to be slightly enclosed by plagioclase.

Hornblende occurs as small grains in the transformed plagioclase patches, and as uralite in columnar aggregates which are pleochroic: γ bluish-green, α yellowish-green.

Biotite is found as brown pleochroic scales, generally occurring in company with ore grains. Some interstitial quartz is present, once only it has been seen with a myrmekitic texture. In the altered top sample the joints are occasionally coloured by iron oxides.

Centre of the Grædefjord dyke.

The dyke is made up of the same rock at the different levels. It is a dark bluish-grey fine- to medium-grained dolerite with a subdoleritic texture. The samples bear evidence of rather strong alteration: the pyroxene has been uralitised, and the plagioclase saussuritised, the lowermost and the uppermost samples having been most strongly altered. In addition there occur ore, secondary hornblende, biotite, apatite, and in the matrix quartz and a good deal of chloritic material. Some potash felspar is found interstitially in the uppermost two samples (table 1).

The plagioclase laths may be up to 3 mm long, but the majority are less than 1 mm. They are built up of thin twin lamellae with a strong undulatory extinction. The composition is labradorite to andesine (table 2) with the lowest anorthite content in the peripheral parts of the grains. The laths are xenomorphic, and minor individuals may be entirely or partially enclosed by pyroxene. Saussuritisation has taken place along cracks or in large portions of the grains. Of the newly formed components, hornblende occurs in addition to sericite and epidote (pl. 1, fig. 2).

The pyroxene is colourless; the grains are xenomorphic, less than 1 mm in size, and several often lie together. Twins parallel to (100) occur. The measured optic constants (table 3) show that the pyroxene is augite. The edges of the grains, or large portions of them, have become uralitised.

The hornblende formed by uralitisation is pleochroic: γ is dark green, α is colourless to light green. The same type of hornblende is formed secondarily as small prisms in plagioclases and in the matrix in small columnar aggregates up to 0.05 mm in size. In these aggreates a good deal of chloritic material of a light green colour is also found.

Ore occurs as small equant grains and as 0.8 mm large dendritic grains with inclusions of biotite and quartz. The big grains are made up of magnetite with ilmenite lamellae. Pure ilmenite grains as well as chalcopyrite and pyrrhotite likewise occur. The grains are associated with the dark minerals and have not been observed in the plagioclase. The ore grains are for the most part surrounded by a narrow zone of hornblende or biotite, the latter as small brown pleochroic scales.

Determinations of specific gravity in the Grædefjord dyke.

K. Ellitsgaard-Rasmussen has determined the specific gravity of some samples from the Grædefjord dyke, and found the following values:

	Contact	Centre
600 m	3.09 (sample 6518)	3.00 (sample 6519)
400 m	3.03 (– 6516)	3.06 (– 6517)
200 m	3.00 (– 6514)	3.02 (– 6515)
0 m	3.04 (– 6512)	3.01 (– 6513)

Table 1: Grædefjord dyke: Modal composition (in volume per cent)

	Contact		Centre			
	0 m	600 m	0 m	200 m	400 m	600 m
	(6512)	(6518)	(6513)	(6515)	(6517)	(6519)
plagioclase	52	29	14	34	32	27
olivine	7	–	–	–	–	–
pyroxene	14	10	11	10	15	13
ore	10	5	5	4	5	4
biotite	7	1	1	1	1	1
saussurite	5	6	36	10	6	13
serpentine	2	–	–	–	–	–
hornblende and chlorite	2	44	31	37	35	36
apatite	tr.	tr.	1	tr.	tr.	tr.
quartz	1	5	1	4	6	6

Table 2. Plagioclase determinations in the Grædefjord dyke *).

	van der Kaaden		Tertsch					mean low-temp.
	twin law	low-temp. opt. An %	$\alpha\alpha$	$\beta\beta$	$\gamma\gamma$	low-temp. opt. An %	high-temp. opt. An %	
0 m contact:								
6512 A	C	55–56	104	128	51	57 56 55	54 52 45	56
A_p	–	45						
B	C	(52–53)	98	130	60	53 57 66	52 53 58	
C	A	49–50	158	144	50	50 43 46	50 54 37	46
D	C	53–60	98	126	48	53 55 51	52 52 41	53
E	C	61–62	113	147	55	– 64 59	70 58 49	61
F	C	59–60	105	134	51	58 59 54	54 54 44	57
G	A	58–55	146	132	57	60 58 53	55 53 42	57
600 m contact:								
6518 A	C	52–52	111	134	46	67 59 48	60 54 39	
B	C	60–60	112	139	50	75 61 53	75 55 43	
C	C	60–60	116	139	51	– 61 54	– 55 44	
D	C	59–60	113	136	48	– 59 50	65 54 41	
E	A–C	57–52	60	55	24	61 65 52	56 62 37	59
F	A	41–40	169	42	42	43 40 44	46 – 36	42
G	A–C	57–53	68	74	27	57 64 57	53 62 41	59
0 m centre:								
6513 A	A	53–53	166	38	46	45 36 43	47 – 34	41
B	A–C	45–49	93	95	18	44 47 36	47 50 –	46 $(-\gamma\gamma)$
C	A–C	44–34	106	108	14	41 41 31	45 45 –	41 $(-\gamma\gamma)$
D	A	35–40	169	38	38	44 36 36	46 – –	38
E	A–C	54–54	75	78	17	53 55 34	52 54 –	54 $(-\gamma\gamma)$
E_{1p}		30						
F	A	58–51	150	52	64	57 58 59	54 38 49	58
200 m centre:								
6515 A	A–C	60–60	52	64	26	66 67 55	59 74 39	63
A_p	–	50–49	94	86	24	46 51 52	48 52 37	49
B	A–C	60–57	60	66	26	61 65 55	56 61 39	60
B_p	–	45–45	100	104	18	43 43 35	47 47 –	41
C	A–C	59–58	62	69	27	60 62 57	55 59 40	60
D	C	63–61	119	146	53	– 64 57	– 58 47	60
E	A–C	55–57	68	74	25	57 58 54	54 56 38	56
F	C	58–58	106	132	50	59 58 53	55 53 43	57
G	A–C	60–60	58	65	24	62 65 52	56 62 37	60
400 m centre:								
6517 A	A	60–54	142	137	60	63 60 56	57 55 45	60
B	C	56–57	109	130	50	62 57 53	58 53 43	57
C	C	54–55	106	126	48	59 55 51	55 52 42	55
D	A	56–58	144	44	59	62 43 55	56 – 44	
E	A–C	54–53	55	62	27	64 70 57	57 67 41	64
F	A–C	58–58	51	63	25	62 68 54	56 65 38	61

(continued)

Table 2 (continued).

	van der Kaaden		Tertsch					mean low-temp.
	twin law	low-temp. opt. An %	$\alpha\alpha$	$\beta\beta$	$\gamma\gamma$	low-temp. opt. An %	high-temp. opt. An %	
600 m centre:								
6519 A	C	60–60	112	138	51	73 60 55	62 55 45	
B	A–C	61–60	53	58	20	65 77 40	58 76 –	71 ($-\gamma\gamma$)
C	C	60–61	112	139	49	73 61 52	62 55 43	
D	C	48–45	97	113	43	52 50 45	51 48 37	49
E	A–C	68–70	46	55	29	70 85 60	61 – 43	78 ($-\gamma\gamma$)
F	A–C	59–60	52	58	23	65 78 50	59 76 36	71 ($-\gamma\gamma$)
G_1	A–C	54–54	65	68	22	58 62 46	54 60 34	60 ($-\gamma\gamma$)
G_2	A	61–63	47	133	67	70 48 61	63 35 53	60
H	C	65–60	112	34	56	73 64 61	63 58 51	66
I	C	58–58	107	133	53	60 58 57	56 53 47	58

The average of the individual samples according to table 2 (calculated on the basis of the van der Kaaden values):

0 m contact:	6512A to G – B	:	57 % An, variation 49–62 % An.
	6512 A_p	:	45 % An.
	6512 B	:	53 % An, high temp.?
600 m contact:	6518A to G – F	:	57 % An, variation 52–60 % An.
	6518 F	:	41 % An.
0 m centre	6513 ABEG	:	52 % An, variation 45–58 % An.
	6513 CD	:	variation 34–44 % An.
	6513 E_p	:	30 % An.
200 m centre	6515 A to G	:	59 % An, variation 55–63 % An.
	6515 A_p B_p	:	with lower anorthite content.
400 m centre	6517 A to F	:	56 % An, variation 53–60 % An.
600 m centre	6519 A to I – D	:	61 % An, variation 54–70 % An.
	6519 D	:	48–45 % An.

*) In the tables of the plagioclase determinations the measured individuals are indicated by a letter added to the sample number; c, m, or p means that the measurement was in the centre, intermediate zone or periphery of the grain. In general the measurements were made in the central parts of the grains. On a few occasions two sets of twins were determined in the same grain. The twin laws are abbreviated to: A = albite, C = Carlsbad, A–C = albite-Carlsbad, A–A = albite-ala, P = pericline.

Table 3. Pyroxene determinations in the Grædefjord dyke.

	2V(+)	c ∧ γ
0 m contact: 6512 A	–	38°
B	30°	–
C	36°	–
D	–	38°
E	46°	40°
F	44°	38°
600 m contact: 6518 A_1	38°	45°
A_2	–	44°
B	40°	38°
C	41°	40°
D	38°	–
E	42°	45°
F	41°	40°
G	–	46°
0 m centre: 6513 A	42°	45°
B	42°	40°
C	–	46°
D	50°	48°
E	–	30°
F	–	49°
200 m centre: 6515 A	46°	42°
B	48°	40°
C	–	39°
E	38°	48°
F	44°	38°
G	–	48°
400 m centre: 6517 A_1	44°	44°
A_2	44°	42°
B	44°	–
C	40°	42°
D	43°	44°
600 m centre: 6519 A	44°	38°
B	41°	44°
C	44°	50°
D	42°	39°

Description of individual specimens.

0 m, contact (6512).

It is a fine-grained blackish-blue rather fresh splintery dolerite. The texture is subdoleritic. Plagioclase is found as laths, size 0.7 × 0.1 mm, built up of twin lamellae. They have undulatory extinction, and a single big individual with zonal structure was seen. The composition is labradorite to andesine (table 2) with decreasing anorthite content outwards in the grains. Larger plagioclase laths may be partially enclosed by pyroxene or dendritic ore grains, and small laths are found to be entirely surrounded by pyroxene (pl. 1, fig. 1).

Olivine is seen in this sample as colourless rounded grains, size 0.1–0.3 mm. For the most part ore is found in the edges of the olivine grains, or it occurs as inclusions, most abundantly where the olivine grains are serpentinised. The olivine quite obviously crystallised before the plagioclase and pyroxene, and the grains at times lie in small clusters. The axial angle of the olivine was determined to be $2V(-) =$ 78°, 74°, 78°, 79°, the average (77°) corresponding to a composition of $Fo_{57}Fa_{43}$.

Pyroxene is present as colourless grains rarely attaining a size of 1 mm; the majority of the grains are 0.1–0.2 mm. They are xenomorphic, their shape being determined by the adjoining minerals. The optical determination (table 3) shows it to be augite.

A fairly great quantity of ore is present in the form of irregularly dendritic grains. Fewer ore grains are more compact. The larger grains consist of magneto-ilmenite, and occasional ilmenite grains and small sulphide grains occur. Where ore grains are adjacent to plagioclase, there is a thin zone of hornblende, biotite or chlorite. Pyroxene may enclose ore grains, and ore is found along or in olivine. Biotite is seen as small scales, most often occurring adjacent to ore.

Hornblende is formed secondarily in plagioclase, in the edge of pyroxene (uralite) and in the matrix. It is green and slightly pleochroic. Small apatite prisms are seen in the plagioclases; serpentine is developed after the olivine, and some interstitial quartz is present.

600 m, contact (6518).

The rock is a fine-grained greyish-blue dolerite, which on weathering is traversed by rusty-coloured joints. Neither olivine nor pseudomorphs of it were observed in this sample. The texture is subdoleritic.

The plagioclase laths are up to 1 × 0.2 mm in size. They are undulatory, and a very few grains showing a somewhat zonal structure occur. The composition is labradorite to andesine (table 2). They are saussuritised along cracks, and fairly large portions of plagioclases may also have been altered (pl. 1, fig. 2).

The pyroxene has an augitic composition (table 3) and is found in colourless grains up to 1 mm in size. The majority of the grains are under $^1/_2$ mm in size, and have been rather strongly uralitised in their outer portions, and the central parts of the pyroxene grains may have been similarly altered. Occasional pyroxene twins occur.

Ore is chiefly found towards the border of pyroxene, and has not been observed in plagioclase. The grains consist of magnetite with ilmenite lamellae, and in addition small magnetite grains, partially altered to limonite, are present. The ore grains are surrounded by a thin rim of hornblende or small biotite grains.

The hornblende formed by uralitisation of pyroxene is pleochroic, with γ bluish-green and α yellowish-green.

Accessory apatite is found, and near plagioclase interstitial quartz occurs, which here may have a myrmekitic texture. Occasional big quartz grains may be up to 0.1 mm in size. No interstitial potash felspar has been observed.

0 m, centre (6513).

The rock is a fine- to medium-grained dark bluish-grey dolerite with coarser patches of a subophitic to subdoleritic texture. Irregularly scattered among the coarser patches lies a microcrystalline matrix consisting predominantly of secondarily formed green hornblende and a light-green chloritic material (penninite has been found in several places). The dyke consists of plagioclase, pyroxene, secondary hornblende, biotite, chlorite, ore, sericite, epidote, and minor quantities of quartz and apatite (table 1).

The plagioclase laths are less than 1 mm long. They are undulatory, but no zoning has been observed. The composition is labradorite to andesine (table 2) with the lowest anorthite content peripheral in the grains. Laths embedded in pyroxene may be somewhat wedge-shaped. The plagioclases are penetrated by saussuritised cracks, and much plagioclase is so highly transformed that it is only recognisable from the ghostly remnants of twin lamellae. The changed portions contain newly formed hornblende, sericite, and epidote.

The pyroxene grains may be up to 1 mm in size. They are colourless to faintly brownish, non-pleochroic. The external portions are most often uralitised. The determination of the pyroxene showed it to be augite (table 3).

Hornblende lies in the microcrystalline matrix in 0.05 mm columnar bundles, which are pleochroic: γ is bluish-green, α is light green. The same type of hornblende is formed by uralitisation of pyroxene and in plagioclase.

Ore is present as irregular dendritic grains up to 0.8 mm in size. They are chiefly made up of magnetite with ilmenite lamellae, and may contain inclusions of biotite and quartz. The ore is especially found in the matrix, but is also seen in the pyroxene. Biotite occurs as brown pleochroic scales, most frequently lying close to the ore. Apatite prisms are seen in the plagioclase and in pyroxene, and minor quantities of interstitial quartz are present.

200 m, centre (6515).

The rock is a fine to medium-grained bluish-grey dolerite with a subdoleritic texture. The plagioclases are somewhat altered, and the pyroxene patches uralitised, in particular along their edges, though the sample is fairly fresh. Besides plagioclase and pyroxene, it consists of ore, secondary hornblende, biotite, sericite, epidote, quartz, apatite, and chloritic material (table 1).

The plagioclase laths are $^1/_2$–2 mm long, and extinguish unevenly. They are pierced by saussuritised cracks, and large portions—especially in the centres of the grains—are likewise saussuritised. The plagioclase determination give for the central parts labradorite, for the peripheral portions andesine (table 2).

Pyroxene is found in colourless to slightly brownish xenomorphic grains under 1 mm in size. Twins are developed in a few grains. The optic determination shows it to be augite (table 3). One pyroxene has been seen to be partially enclosed by plagioclase, but the opposite is generally the rule. The edges of the grains, and locally larger portions of them, are uralitised, giving rise to the development of green pleochroic hornblende. The same hornblende is also found in the transformed portions of the plagioclase.

Ore occurs in irregular dendritic grains, which may contain small inclusions. The greater part of it consists of magneto-ilmenite, and some sulphides are also present here. Further, unmixed ilmenite occurs, after the exsolution of magnetite. The ore grains are surrounded by a zone of hornblende of variable thickness, or biotite is present here in pleochroic brown to yellowish-brown or green scales.

Apatite prisms are seen in the plagioclase. Quartz is found interstitially in grains up to 0.2 mm in size, which may have a myrmekitic texture with plagioclase; no potassium felspar was found in the sample. Some chloritic material occurs interstitially.

400 m, centre (6517).

The rock is a fine- to medium-grained bluish-grey dolerite, consisting of plagioclase, pyroxene, hornblende, ore, biotite, sericite, epidote, quartz, chlorite, and some potash felspar (table 1). The texture is subdoleritic; occasional plagioclase laths may enclose pyroxene to some extent, but more frequently the opposite is the case. Minor quantities of a fine-grained matrix, made up of hornblende, small plagioclase laths, a good deal of quartz, some chloritic material, and a little potash felspar, are present.

The plagioclase laths are up to $1^1/_2$ by $^1/_2$ mm in size, and are built up of thin twin lamellae. They have undulatory extinction, and large parts of the grains are often saussuritised. Their composition is labradorite (table 2).

The pyroxene grains, which are augitic (table 3), are up to 1 mm in size. They are xenomorphic, faintly brownish, but not pleochroic. A few twins occur. The grains are strongly uralitised along all the edges, often also in the centres, where green pleochroic hornblende is now found. The same type of hornblende is formed secondarily in plagioclase, where it occurs as small grains together with sericite and epidote.

The ore grains are dendritic and often have small inclusions. The larger grains consist of magneto-ilmenite. Scattered sulphide grains and pure ilmenite grains also occur. Haematite develops from magneto-ilmenite, and some ilmenite lamellae have been strongly altered. The ore is found in the mafic portions surrounded by hornblende, and small quantities of brown and green pleochroic biotite are also found here.

Quartz, which may have a micrographic texture, occurs interstitially, and a diminutive quantity of potassium felspar is found here. Quartz grains up to 0.2 mm in size are also present. Joints in the dyke are coloured by iron oxides.

600 m, centre (6519).

A fine- to medium-grained grey dolerite, somewhat altered. The texture is subdoleritic. The sample consists of plagioclase, pyroxene, ore, uralite, biotite, quartz, apatite, sericite, epidote, chloritic material, and some potash felspar (table 1).

The plagioclase laths are up to 1 mm long, with thin twin lamellae. They are undulatory, but in addition a very few grains are seen to be zoned. The composition varies from labradorite to andesine (table 2). The plagioclases are somewhat saussuritised.

Pyroxene occurs in xenomorphic grains, which are colourless to faintly brownish, but not pleochroic. They are up to 1 mm in size, and twins have developed in some grains. The pyroxene is augite (table 3). The grains have been rather heavily uralitised; especially along their edges, hornblende is distinctly visible as green pleochroic patches. The same hornblende is also present in the altered portions of plagioclase, together with sericite and epidote grains.

Xenomorphic ore grains are found associated with the mafics. The larger grains consist of magnetite with ilmenite lamellae, and small grains of chalcopyrite and pyrrhotite are also present. In general the ore is surrounded by green hornblende, or it occurs in company with biotite scales, which are pleochroic in browns and greens.

Apatite prisms can be seen in the plagioclases. Quartz is found interstitially in the form of grains up to 0.2 mm in size or as smaller grains in a micrographic intergrowth with potash felspar. Joints in the dyke are coloured by iron oxides.

V. THE AMITSUARSSUK DYKE

The dyke is located east of Amitsuarssugssuaq, a branch of Sermilik fjord entering at the outer part of its north side (fig. 1). The dyke is vertical and trends ca. 110°. It was followed from 365 m to 1150 m altitude, although covered, at an altitude of ca. 400 m, by a local glacier. There is no doubt, however, that it is the same dyke that occurs on either side of the glacier. To the WNW, a dyke with the same direction was observed at an altitude of 20 m, and most likely it is the same dyke but it was not followed out. Not only are the trends of the dykes in the two places the same, but also their breadths are fairly similar: at 1150 m the dyke is ca. 35 m and at 20 m ca. 45 m broad.

The following samples from the central part of the dyke have been examined:

1150 m: 7308
700 m: 7309
365 m: 7316
20 m: 6582

All the samples consists of fine- to medium-grained dolerite with thin plagioclase laths. Occasional pyrite grains under $^1/_2$ mm in size and small biotite scales are seen in the specimen. The weathered surface of the rock is of a mottled appearance, with irregular dark patches up to $^1/_2$ cm in size, interspersed with light-coloured patches rich in plagioclase. The two kinds of patches ramify into one another.

The dyke is made up of plagioclase, pyroxene (strongly uralitised), hornblende, ore, biotite, sericite, epidote, quartz, and apatite (table 4). The uppermost three samples are very heavily altered: the plagioclase is rather highly saussuritised, the dark patches uralitised. The original texture cannot be determined with certainty, but is thought to have been subdoleritic.

The plagioclase laths often exhibit a faint brownish tint, and are built up of thin twin lamellae. Their size may be up to $1^1/_2$ mm, but the majority are less than 1 mm. Their composition is labradorite to andesine (table 5). The individual laths are highly undulatory, and often have an outermost thin edge rich in albite. They are saussuritised along cracks, or large portions of them have been altered, presenting a granular appearance due to the presence of small columnar aggregates of green pleochroic hornblende, sericite, and epidote. Apatite prisms are also seen in the plagioclase.

The dark patches are uralitised. The central parts are of a greenish-brown non-pleochroic colour. Under crossed nicols they appear as fine-grained aggregate patches. The peripheral parts consist of small green pleochroic hornblende crystals. It cannot be decided whether the central non-pleochroic portions are made up of hornblende (uralite) or of chloritic material. At a single point in the top sample (7308) non-transformed pyroxene was observed in the centre of a dark patch pierced by ore coated cracks.

It is the same type of hornblende that is formed by the uralitisation as is found in the plagioclase. It is pleochroic, with γ dark-green and α olive-green to yellowish-green; the RI determinations gave α: 1.68, γ: 1.71, which together with the values for 2V and $c \wedge \gamma$ (table 7) shows that it is a common hornblende.

Ore is most frequently found in the outer portions of the dark patches in grains up to $^1/_2$ mm in size. Dendritic grains rarely occur, and the large ore grains have generally developed as skeletal crystals enclosing small dark patches. In the sample from 700 m (7309) the larger grains consist of ilmenite lamellae, in some measure changed to leucoxene. Small sulphide grains occur in association with limonite. Small ore grains may also be seen in the centres of the dark portions, and occasionally in the plagioclase.

Biotite is present as brown pleochroic grains up to 0.15 mm in size. They are generally adjacent to ore grains.

Quartz is of common occurrence in the form of xenomorphic grains up to 0.5 mm in size. It is found interstitially, and is often developed here as myrmekite together with albitic plagioclase, while potash felspar has not been observed.

The 20 m sample (6582) resembles the other three samples. Ore grains developed as skeletal crystals are less common here; the degree

Table 4. The Amitsuarssuk dyke Modal composition (in volume per cent).

	20 m (6582)	365 m (7316)	700 m (7309)	1150 m (7308)
plagioclase	28	27	24	25
pyroxene	6	–	3	1
ore	6	5	5	5
biotite	1	3	2	1
saussurite	12	8	6	12
hornblende and chlorite	38	48	51	48
apatite	tr.	tr.	tr.	tr.
quartz	9	9	9	8

Table 5. Plagioclase determinations in the centre of the Amitsuarssuk dyke.

	van der Kaaden		Tertsch					mean low-temp.
	twin law	low-temp. opt. An %	$\alpha\alpha$	$\beta\beta$	$\gamma\gamma$	low-temp. opt. An %	hiph-temp. opt. An %	
20 m: 6582 A	A	45–44	166	47	50	45 48 47	48 25 43	47
B	C	51–50	98	117	45	53 52 47	52 49 39	51
C	A	47–48	157	40	47	52 38 44	51 - 35	45
D	A–C	52–51	78	81	21	52 54 43	51 53 43	53 ($-\gamma\gamma$)
E	A–C	54–50	80	84	23	51 52 50	51 52 36	51
F	A	48–48	157	46	51	51 46 48	51 34 45	48
365 m: 7316 A	A–C	47–45	84	99	20	49 45 40	50 48 -	47 ($-\gamma\gamma$)
B	C	48–48	92	110	42	49 49 43	49 48 36	47
C	A–C	49–51	82	88	20	50 50 40	50 51 -	50 ($-\gamma\gamma$)
D	C	48–47	91	104	40	49 47 41	49 46 35	46
E	C	45–48	90	108	44	48 49 46	49 48 38	48
F	A–C	45–48	91	87	18	47 48 36	49 50 -	48 ($-\gamma\gamma$)
700 m: 7309 A	C	53–52	104	122	46	57 54 48	54 51 40	53
B	A	48–45	161	45	49	49 44 46	50 33 36	46
C	C	48–47	95	103	46	46 47 48	47 46 40	47
D	A	50–52	153	43	52	55 41 49	52 - 38	48
E	A	56–50	154	47	54	54 48 51	52 35 40	51
F	C	42–41	89	81	38	48 39 39	49 39 -	42
G	A–C	55–53	115	111	20	58 62 40	57 59 -	60 ($-\gamma\gamma$)
1150 m: 7308 A	A–C	51–54	74	78	20	54 55 40	52 54 -	55 ($-\gamma\gamma$)
B	A	50–49	153	43	51	55 41 48	53 - 45	
C	A–C	58–59	65	79	22	58 55 46	54 54 34	57 ($-\gamma\gamma$)
D	C	51–51	100	119	45	54 53 48	52 50 39	52
E	C	39–39	65	77	36	37 37 37	39 37 34	37
F	A–C	50–54	79	84	25	51 52 53	51 52 37	52
G	A	51–52	152	45	56	56 45 52	53 - 41	

Averages of the individual samples according to table 5 (computed from the van der Kaaden values):

20 m: 6582 A to F: 49 % An, variation 44–54 % An.
365 m: 7316 A to F: 47 % An, variation 45–51 % An.
700 m: 7309 A to G: 49 % An, variation 41–56 % An.
1150 m: 7308 A to G − E: 53 % An, variation 49–59 % An.
7308 E : 39 % An.

of transformation of the plagioclase is about the same as in the other samples. The occurrence of quartz is likewise the same, while so much pyroxene is still preserved in the centres of the mafic portions that it could be determined optically to be augite (table 6). These pyroxene remnants are pierced by ore-coated cracks, as was also observed at a single point in the sample from 1150 m (7308).

Tabel 6. Pyroxene determinations in the Amitsuarssuk dyke.

	2 V (+)	c ∧ γ
20 m: 6582 A	42°	–
B	46°	47°
C	40°	–
D	–	38°

Tabel 7. Hornblende determinations in the Amitsuarssuk dyke.

	2 V (–)	c ∧ γ
20 m: 6582 A	66°	–
B	64°	–
365 m: 7316 A	59°	–
B	54°	--
C	76°	–
D	58°	–
700 m: 7309 A	68°	–
B	54°	22°
C	56°	–
1150 m: 7308 A	50°	20°
B	60°	17°
C	60°	–

Description of individual specimens.

20 m, centre (6582).

It is a fine- to medium-grained greenish-black dolerite with plagioclase laths up to $1^1/_2$ mm long, and some few biotite scales under $^1/_2$ mm. It consists of plagioclase, pyroxene which is strongly uralitised, hornblende, ore, biotite, sericite and epidote, quartz, apatite, and some chloritic material (table 4). The texture is indistinct, owing to the degree of alteration.

Most of the plagioclases are up to $^1/_2$ mm in size, and built up of thin twin lamellae. They are undulatory, often of a yellowish-brown colour, and opaque owing to saussuritisation. The plagioclase determinations give andesine to labradorite (table 5).

The dark portions consist predominantly of uralitised pyroxene: hornblende is found peripherally, and also irregularly distributed in the central parts. Unaltered pyroxene is still recognisable at a few points in the centres of the dark portions, where it was determined to be augite (table 6), but otherwise they appear under crossed nicols with aggregatic extinction, and in plane-polarised light are faintly brownish, non-pleochroic.

Ore is chiefly found as compact grains 0.2–0.3 mm in size, and often containing small inclusions. The highly dendritic grains commonly found in the other samples from the dyke, are rare. Ore also occurs as a coating on cracks in pyroxene, which accordingly present a strong relief, and might recall hypersthene or olivine.

Hornblende is formed by uralitisation. It is pleochroic: γ is dark bluish-green, α is light green. 2V(−) is about 65° (table 7). The same type of hornblende is found in the altered parts of plagioclase together with sericite and epidote.

Biotite is seen as irregular brown pleochroic grains up to 0.1 mm in size, lying in the edge of ore grains, or they themselves contain small ore inclusions.

Quartz is found in interstitial grains up to $^1/_2$ mm in size. They contain fewer inclusions than the plagioclases, but also show undulatory extinction. No interstitial potash felspar has been observed, but where plagioclase laths bound on quartz they have an albitic edge. Small apatite prisms are found in plagioclase.

355 m, centre (7316).

The rock is a greenish-black medium-grained dolerite with a mottled appearance, as described above. The dark minerals are bluish-black as well as greenish-black in the specimen, and ore grains and biotite scales are seen. The minerals are plagioclase, uralite after pyroxene (probably also with chlorite here), secondary hornblende, sericite, and epidote, ore, biotite, quartz, and apatite (table 4). The primary texture is indeterminable, as the dark minerals are highly altered.

The majority of the plagioclase laths are about $^1/_2$ mm in size, built up of thin twin lamellae. Their composition is andesine to labradorite (table 5) with albitic external zones. They are highly undulatory, but only a single zoned grain has been found. The grains are of a faint brownish colour. They are saussuritised especially along their edges and along joints, and contain hornblende, sericite, and epidote grains. On the whole there are many inclusions, e.g. apatite grains; in general, however, there is no ore.

The primary pyroxene cannot be recognised any longer. The central parts of the dark patches have aggregate extinction and are generally non-pleochroic. Possibly some chlorite is present here in addition to hornblende; the latter is seen distinctly in the peripheral parts as small pleochroic grains: γ is dark bluish-green, α is light brownish-green. RI: γ 1.71, α 1.68. This and the 2V (table 7) show that it is a common hornblende. Ore is not found centrally in the dark patches, but is associated with the peripheral zones of these latter. Occasionally small ore grains are seen among the plagioclases. The greater number of the ore grains are developed as skeletal crystals, and are up to 0.25 mm in size.

Biotite is present as brown pleochroic grains, ca. 0.15 mm in size, occurring in company with ore grains of varying size. The optic angle is very small. In a biotite grain a zircon 0.1 mm long was seen, surrounded by a pleochroic halo about 0.02 mm broad and lightest in its outermost part. Several other biotite grains contain dark patches of the same appearance as the pleochroic halo.

Quartz is found interstitially. A few rounded grains are $^1/_2$ mm in size. Where quartz grains border on plagioclase laths, these latter have a peripheral zone rich in albite. Potash felspar has not been observed. The sample contains small red scales, which most often occur together with ore or biotite. Their RI is higher than that of balsam.

700 m, centre (6309).

The rock is a fine- to medium-grained greenish-black dolerite with a mottled appearance on the weathered surface. A few small pyrite grains are seen. The primary texture is no longer visible, the pyroxene being almost entirely uralitised. The dyke consists of plagioclase, uralitised pyroxene, ore, hornblende, sericite, epidote, biotite, quartz, and apatite (table 4).

The plagioclase laths are up to $1^1/_2$ mm in length. They show undulatory extinction, and are of a faint brown colour. Their composition is andesine to labradorite (table 5), with a decreasing anorthite content in the peripheral parts; often the laths are surrounded by an albitic rim. They are somewhat saussuritised, and contain small hornblende grains, sericite, and epidote. Furthermore apatite prisms are seen in the plagioclase.

The same common green hornblende (table 7) is formed secondarily in plagioclase in small grains as by uralitisation of pyroxene. This is most distinctly seen along the edge of the mafic portions, in whose centres small remnants of pyroxene still persist, but the greater part consists of brownish non-pleochroic secondarily developed minerals occurring in very small grains. Possibly chlorite is present here in addition to hornblende.

Angular ore grains with many inclusions are up to $^3/_4$ mm in size. They occur especially in the edges of the mafic portions, while only few are found in the central parts. In some few places small ore grains are also found in the plagioclases. The larger grains consist of ilmenite lamellae largely changed to leucoxene, and in addition small sulphide grains are found together with limonite. Brown pleochroic biotite scales often are found adjacent to the ore.

A good deal of quartz occurs interstitially in irregularly shaped grains, which may be up to $^1/_2$ mm in size. It is found together with albitic plagioclase in a micrographic texture; no potash felspar has been observed here.

1150 m, centre (7308).

The rock is a fine- to medium-grained greenish-black dolerite which is mottled on the weathered surface, like the other samples. It is made up of plagioclase, hornblende, ore, biotite, sericite, epidote, quartz, apatite, remnants of pyroxene, and chlorite (table 4). The texture would seem to have been subdoleritic or doleritic, but this cannot be made out with certainty, the primary pyroxenes being almost totally uralitised.

The plagioclase laths are up to $1^1/_2$ mm long, and are faintly brownish. They are undulatory, but rarely zoned, and their composition is labradorite to andesine (table 5) with a decreasing anorthite content outwards. The plagioclases contain large saussuritised portions with fine-grained hornblende, sericite, and epidote.

The mafic patches may be up to $2^1/_2$ mm in size. Remnants of pyroxene have only been seen at a single point in the centre of a mafic patch, where it is pierced by ore-lined cracks. Otherwise cryptocrystalline brownish non-pleochroic secondary minerals possibly containing chlorite in addition to some hornblende, are found in these places. Hornblende is most distincly seen in the periphery of the mafic parts. It is pleochroic: γ is bluish-green, α is brownish-green; the optic determinations gave $2V(-) = 50–60°$, and $c \wedge \gamma$ at 17–20° (table 7), which correspond to a common hornblende.

Ore is found in dendritic grains and in angular skeletal crystals. Their size is about $^1/_2$ mm. Brown pleochroic biotite is generally seen in company with ore.

Interstitial quartz is fairly abundant, ramifying in between the plagioclases. These latter abut on the quartz with a thin albitic zone, while no interstitial potash felspar has been observed. The quartz grains may occasionally be up to 0.4 mm in size.

Chemical analyses from the Amitsuarssuk dyke.

Chemical analyses of two samples from the dyke were made by Miss M. Mouritzen, cand. polyt., namely sample 7316 from 365 m and sample 7308 from 1150 m (table 8). The norm was calculated for these analyses and compared with the mode, which was converted into weight percentages:

365 m (7316)		1150 m (7308)	
norm	mode	norm	mode
q 7.6	8 quartz	q 3.2	7 quartz
or 3.5		or 3.5	
ab 17.0	24 plagioclase	ab 24.0	22 plagioclase
an 25.3	7 saussurite	an 24.3	10 saussurite
wo 8.2		wo 9.2	
fs 17.8	50 uralite	fs 15.2	1 pyroxene
en 13.0		en 13.4	51 uralite
ap 0.5	tr. apatite	ap 0.5	tr. apatite
il 3.0		il 2.8	
mt 4.1	8 ore	mt 3.9	8 ore
	3 biotite		1 biotite

The norm and the mode show no great agreement, which is not to be wondered at considering the intensity of the secondary alteration that has given rise to the formation of new hydrous minerals. Neither does the determined anorthite content of the plagioclases agree with the calculations of the norm. The results from the norm with and without potash felspar (or) and from the average of the plagioclases measured (table 5), are:

	norm		mode
	with or	without or	
365 m (7316).........	55 % An	60 % An	47 % An
1150 m (7308).........	47 % An	50 % An	53 % An

As the plagioclase determinations were made on central parts of the grains, the average of these determinations must show a higher An % than that of the total plagioclase, the anorthite content of the grains being lower outwards, and several of the grains having an albitic edge. Some potassium may be found in the plagioclases, but it is also present in biotite and sericite which is not shown in the norm. The same applies to calcium, aluminium, and sodium, which are not only found in the plagioclases but also form part of the secondarily developed hornblende and epidote.

Table 8. Chemical analyses from the Amitsuarssuk dyke.

	365 m (7316)		1150 m (7308)	
	weight	kation	weight	kation
	%	%	%	%
SiO_2	50.43	49.5	49.93	48.3
TiO_2	2.08	1.5	1.91	1.4
Al_2O_3	12.34	14.2	13.30	15.2
Fe_2O_3	3.69	2.7	3.51	2.6
FeO	14.07	11.5	12.50	10.1
MnO	0.34	0.3	0.30	0.2
MgO	4.41	6.5	4.60	6.7
CaO	9.01	9.5	9.47	9.8
Na_2O	1.77	3.4	2.56	4.8
K_2O	0.55	0.7	0.57	0.7
P_2O_5	0.26	0.2	0.18	0.2
H_2O^+	1.03	–	1.07	–
H_2O^-	0.05	–	0.06	–
	100.03	100.0	99.96	100.0

VI. COMPOSITION OF THE GRÆDEFJORD DYKE AND THE AMITSUARSSUK DYKE AT DIFFERENT LEVELS

As will appear from the above descriptions, samples from different levels of the Grædefjord dyke and the Amitsuarssuk dyke have been examined. The vertical distance between the uppermost and the lowermost sample of the Grædefjord dyke is 600 m; as for the Amitsuarssuk dyke it is 1130 m or—as it is not quite certain that the lowermost sample is derived from the same dyke—785 m. Within these vertical distances no differentiation is seen in the dykes; at all levels they consist of dolerite, and there is no regular variation in the mineralogical composition of the latter.

Olivine is preserved in the contact sample taken at 0 m in the Grædefjord dyke (6512). It is the only sample containing olivine, and it is quite obvious that this olivine crystallised earlier than the other minerals.

VII. DYKE SYSTEMS AT AMITSUARSSUGSSUAQ

The two dyke systems at Amitsuarssugssuaq (p. 6 and fig. 1) were investigated in an attempt to distinguish petrographically between them. It turned out that the dykes of both generations consist of dolerite, and there are no characteristic differences between the rocks. The trends of the two generations, however, are different and may be used in referring a dyke to the older or the younger generation; nevertheless it should be borne in mind that the direction of the dykes of the older generation varies somewhat.

The older dyke generations.

From this generation, dykes 1, 10, 9, and 12 are described.

Dyke 1 (6190) and dyke 10 (6829).

These two northern dykes, located west and east of the fjord, are assumed to be identical. They are vertical, trend 100–105°, and are ca. 50 m broad. In dyke 1 west of the fjord, movements have taken place parallel with the dyke, causing its partial metamorphism into amphibolite. Dyke 1 is also cut by younger faults, and along these it is strongly amphibolitised. The same type of faults were investigated from dyke 14 of the younger generation (p. 34).

Contact-parallel movements were not observed in the field in dyke 10. If the two dykes are the same, it could have been expected that dyke 10 has been altered also. This turned out to be the case; the samples from the dykes, which macroscopically are fairly alike, under the microscope appear to have been altered in almost the same way. This supports the correlation made of the dykes west and east of the fjord.

The samples from the centres of the dykes are fine- to medium-grained, with a few plagioclases up to 2 mm in size. Their colour is greenish-black, with the light-coloured minerals ramifying reticulately in between the dark patches. The texture is xenomorphic-granular. The primary texture, which was, no doubt, subdoleritic (found in dyke 12 of the same generation) is not preserved. No orientation was seen in the samples examined, but in other parts of dyke 1 there is some schistosity parallel with the contact.

The dykes consist of green hornblende, plagioclase, ore, biotite, epidote, quartz, and apatite. In dyke 10, newly formed titanite was found adjacent to ore grains. The sample from dyke 10 (6829) seems on the whole to be somewhat more strongly altered than the sample from dyke 1 (6190).

The plagioclase laths are up to 2 mm long, but the greater number of them are about 1 mm. They are rather highly saussuritised, and contain grains of green hornblende, epidote, and in some places also biotite. They are somewhat undulatory, and in addition often have a thin peripheral zone of albite. The composition of the plagioclase (table 9) is, in the central parts of dyke 1, andesine to labradorite, which agrees with the other dykes from the same system (dyke 9 and 12). A grain in the same sample was found to contain 38 $^0/_0$ An in the central parts and 32 $^0/_0$ An peripherally (in the measurement, (010) of the crystal was used, no good twins having developed). This agrees well with the plagioclases in dyke 10, which have an andesine to oligoclase composition.

Green hornblende is formed by uralitisation of pyroxene and also in the plagioclase. It is found as aggregates up to 1 mm in size of xenomorphic grains after pyroxene, and in the plagioclase as prisms up to 0.3 mm long. The hornblende is pleochroic: γ dark green, α olive green. In dyke 10 (6829) its RI was determined to be: γ 1.71 and α 1.68. The 2V and $c \wedge \gamma$ were measured in the dykes (table 11), and these determinations show that it is a common hornblende. Twins have developed in several of the larger individuals.

Ore occurs as skeletal crystals in grains up to $1^1/_2$ mm in size in the uralitised portions; often a hornblende grain and an ore grain show partial intergrowth. In dyke 10 the grains are smaller and newly formed titanite is found near them.

Brown pleochroic biotite is found adjacent to ore grains, and in the hornblende aggregates as lobate grains. Furthermore, small biotite scales occur locally in the altered plagioclases.

Quartz is abundant interstitially in up to 1 mm lobate grains. They are often undulatory, and in some places a micrographic intergrowth of quartz and albite has developed. This albite is of the same type as the albite rim found around plagioclase.

In the plagioclases fairly large quantities of epidote have developed in addition to the hornblende; it is present in grains up to 0.2 mm in size. Accessory apatite occurs in small thick prisms as well as in long thin needles. Accessory red grains under 0.2 mm in size, probably iron oxides, are also seen.

Dyke 9 (6575).

The dyke is situated east of the fjord. It is 45 m broad, and the trend is almost east-west. It is a fine-grained bluish-black dolerite, whose primary texture cannot be made out owing to a high degree of uralitisation. It consists of plagioclase, hornblende, some remnants of pyroxene, ore, biotite, quartz, epidote, and apatite.

The plagioclase has a brownish tint, and is found in undulatory laths up to $1^1/_2$ mm long. Some grains may be fairly broad, and a zonal structure is observable in some of them. The composition is a basic andesine to labradorite (table 9), and the laths are often surrounded by a thin albitic rim. Many of the plagioclases are saussuritised, and

Table 9. Plagioclase determinations in dykes around Amitsuarssugssuaq.

	van der Kaaden		Tertsch					mean low-temp.
	twin law	low-temp. opt. An %	$\alpha\alpha$	$\beta\beta$	$\gamma\gamma$	low--temp. opt. An %	high-temp. opt. An %	
Older generation:								
Dyke 1: 6190								
A	A–A	51–51		curves	missing			
B	C	49–49	90	108	46	49 48 48	49 47 40	48
C_c		38						
C_p		32						
D	C	46–49	89	105	41	48 47 43	48 47 36	46
E	A–C	54–45	80	88	23	51 50 50	51 51 36	50
F	C	50–54	99	118	47	53 52 50	52 50 41	52
Dyke 10: 6829								
A	P	25–32	0	27	27	30 27 27	33 – –	28
B	P	36–30	4	26	26	38 37 37	40 – –	37
C	P	31–37	6	29	26	39 28 27	42 – –	31
Dyke 9: 6575								
A	A	60–54	137	44	62	62 43 57	60 – 47	
B	C	60–58	112	45	48	66 45 75	65 – 70	
C	A	49–48	155	36	43	53 34 45	52 – 40	49($-\beta\beta$)
D	C	44–48	93	102	43	50 46 45	50 46 37	47
E	C	66–69	114	134	44	– 59 46	– 54 38	
F	A–C	53–60	66	71	23	58 60 50	54 58 36	56
Dyke 12: 6574								
A	A	59–59	142	49	62	63 52 57	57 38 47	57
B_c	A	60–58	136	44	64	68 43 59	60 – 49	
B_m	–	60						
B_p	–	43						
C	C	62–61	114	144	53	– 63 57	– 57 47	60
D	C	67–65	119	156	55	– 68 60	– 61 49	64
E	C	62–67	118	154	55	– 67 60	– 60 50	64
F	A	65–61	133	46	66	70 46 60	63 35 51	
G	C	60–63	117	150	53	– 65 57	– 59 47	61
Younger generation:								
Dyke 14: 6587								
A	A–C	58–61	56	61	23	63 71 50	57 68 35	67 ($-\gamma\gamma$)
B	A–C	57–51	70	74	22	56 58 47	53 56 35	57 ($-\gamma\gamma$)
C	A–A	65–62		curves	missing			
D	C	52–52	99	119	47	53 53 50	52 50 41	52
E	C	50–55	106	126	43	59 55 45	55 52 37	53
F	C	50–50	103	120	41	56 53 43	53 50 36	51
G	A–C	60–63	48	56	27	62 83 57	57 83 41	
H	C	54–54	100	125	49	54 55 52	52 51 53	54

(continued)

Table 9 (continued).

Average of the individual samples according to table 9 (computed from the van der Kaaden values):

Dyke 1:	6190 A to F – C:	50 % An, variation 45–54 % An.
	6190 C:	38 % An, peripherally 32 % An.
Dyke 10:	6829 A to C:	32 % An, variation 25–37 % An.
Dyke 9:	6575 A to F:	56 % An, variation 44–69 % An.
Dyke 12:	6574 A to G:	62 % An, variation 58–67 % An.
Dyke 14:	6587 A to H:	56 % An, variation 50–65 % An.

Table 10. Pyroxene determinations in dykes 12 and 14.

	2V(+)	c ∧ γ
Older generation: Dyke 12: 6574 A	44°	37°
B	46°	43°
Younger generation: Dyke 14: 6587 A	45°	12°
B	39°	49°
C	34°	33°
D	43°	12°
E	38°	19°
F	45°	31°

Tabel 11. Hornblende determinations in dykes around Amitsuarssugssuaq.

	2V (–)	c ∧ γ
Older generation: Dyke 1: 6190 A	–	12°
B	80°	8°
C	82°	14°
D	–	30°
Dyke 10: 6829 A	–	10°
B	–	10°
C	–	7°
D	56°	15°
E	80°	17°
Dyke 9: 6575 A	–	16°
B	80°	–
C	68°	13°
D	–	17°
Younger generation: Dyke 14: 6587 A	77°	–
B	74°	–

they contain green hornblende and epidote in grains up to about 0.1 mm in size. But only in few places has sericite developed in the plagioclases.

Remnants of the primary pyroxene are only occasionally preserved in the dark portions. The greater part has been uralitised to a green hornblende of an aggregate-like occurrence, gathered in small xenomorphic crystals. The hornblende is most distinctly seen in the edge of the dark portions. It is pleochroic: γ dark green, α olive green. The 2V and $c \wedge \gamma$ have been determined (table 11), and show it to be a common hornblende.

Ore occurs as irregular skeletal crystals, up to 2 mm in size, in the dark portions. Biotite, which occurs in accessory proportions as small brown scales, often lies close to ore grains.

Vermicular quartz occurs interstitially among the plagioclase laths. No potash felspar has been found here, but from the albitic edge of the plagioclases small albitic "worms" may grow into the quartz, and once micrographic intergrowth of quartz and albite was observed. Apatite is found as an accessory.

Dyke 12 (6574).

This dyke and dyke 14 intersect, but no exposure is seen at the point of intersection. The trend of the dyke in 65° shows that it must belong to the older fan-shaped dyke generation. It is 20 m broad. The sample from the centre is fine-grained, greyish-black. It is the freshest sample from the older dyke generation, and its texture is subdoleritic: pyroxene occurs in xenomorphic grains in between the plagioclase laths. For the main part it crystallised after the latter, since some grains may enclose plagioclase. The dyke consists of plagioclase, pyroxene, ore, hornblende, quartz, biotite, and apatite.

The plagioclase laths are up to 1 mm long; only few of them are a little longer. They often exhibit a brownish hue, but they are fresh, being altered only along joints where fine-grained green hornblende is found. The laths are undulatory, and only a few of the broader ones exhibit a faint zoning. Their composition is labradorite (table 9), with a decreasing anorthite content outwards in the grains (6574B).

Pyroxene is found in colourless xenomorphic grains which are under $^1/_2$ mm in size and have often developed twins. Only one type of pyroxene is present, and the optic determinations (table 10) show it to be an augite. The grains are fresh, being only uralitised along their edges and around cracks with the formation of a green pleochroic hornblende of the same type as along cracks in the plagioclases.

Ore is found especially along the edge of pyroxene surrounded by a rim of hornblende. The grains are often dendritic and lobate. Small ore grains are found in pyroxene, and may occasionally be seen with plagioclase. The minerals represented are ilmenite, some chalcopyrite, haematite, and pyrrhotite. The ilmenite was no doubt exsolved from magneto-ilmenite. Brown pleochroic biotite scales are often seen associated with ore.

Small lobate quartz grains occur interstitially between the plagioclase laths. No albitic rims are developed around the plagioclases (the edges of the plagioclases have a higher RI than quartz); however, small patches of albite may occasionally be seen in quartz grains, while no interstitial potash felspar has been found. Small accessory apatite prisms occur.

The younger dyke generation.

Dyke 14 (6587).

The dyke is 10–15 m broad; it is vertical and trends 137°. The dyke is found on the east side of Amitsuarssugssuaq, and continues west of the fjord in dyke 4 (fig. 1). Dyke 14 cuts dyke 13 of the fan-shaped generation, and presents a sharp contact at the point of intersection. As mentioned in the description of dyke 12, the intersection with this latter is not visible. Dyke 14 has itself been displaced by a younger fault trending 50°–60° with a sinistral displacement (6587^b).

The sample from the centre of dyke 14 is greyish-blue, fine- to medium-grained. Its texture is subdoleritic, with a uniform distribution of the dark and light minerals. It consists of plagioclase, pyroxene, hornblende, ore, biotite, quartz, apatite, epidote, and sericite.

Most of the plagioclase laths are up to 1 mm long; only few attain a size of $1^1/_2$ mm. In general, the plagioclases are only altered around joints, where small grains of hornblende are developed, but sericitised patches occur locally in the plagioclase. Secondary epidote grains are present in some plagioclases, but sericite predominates, and hornblende is seen along joints. The plagioclase laths are faintly brownish and extinguish undulatorily; only in a couple of cases have broader laths been observed to have zonal structure. The composition is labradorite (table 9), with a decreasing content of anorthite towards the periphery of the laths. Often the plagioclases have an external albitic rim, which is most markedly developed where quartz grains are adjacent to them.

The pyroxene grains are colourless. Along their edges and along cracks they are uralitised. The optic constants of pyroxene (table 10) correspond to augite, and as in the older generation, the dyke contains only one pyroxene. Some pyroxene twins are present, and in places ore has been deposited on cracks in the pyroxene.

Hornblende is formed secondarily by uralitisation of pyroxene and on cracks in the plagioclases. It is pleochroic: γ bluish-green, α olive-green. It is a common hornblende with 2V(–) 74°–77° (table 11).

Ore occurs in grains up to $^1/_2$ mm in size, most often compact, hypidiomorphic or lobate. However, larger ore grains, developed as skeletal crystals are also found. The ore is found in the mafic portions, surrounded by a hornblende rim; often brown pleochroic biotite scales are likewise present here. Only in a few places are small ore grains found on the borders of plagioclases, and sometimes ore is seen on cracks in the pyroxene. The bulk of the ore is ilmenite, which occurs as remnants of larger grains which probably consisted of magneto-ilmenite. Occasional small sulphide grains occur also.

Quartz occurs interstitially as transparent lobate grains about 0.2 mm in size. The plagioclase laths adjacent to quartz have an albitic rim; micrographic intergrowth of quartz and albite have developed interstitially in some places.

Accessory apatite is found. Thin joints in the dyke are filled with quartz.

Fault cutting dyke 14 (6587^b).

In the fault the dyke is amphibolitised. It is cryptocrystalline to fine-grained, and its primary texture is no longer discernible. A parallel orientation may be seen locally along joints, which may be coated with ore or quartz. In the fault the dyke consists of very fine hornblende, which contains ore and scattered quartz-plagioclase patches up to 0.3 mm in size. Some hornblendes may be up to $^3/_4$ mm in size; they are xenomorphic, often exhibit twins, and are pleochroic: γ green, α yellowish to greenish-yellow. The ore grains are xenomorphic and up to 1 mm in size. Many small ore grains occur scattered in the cryptocrystalline hornblende patches. Quartz is present as angular or lobate grains under $^1/_2$ mm in size. Plagioclase lies together with them, and is often secondarily altered; in a single place small epidote grains were seen in an almost entirely altered plagioclase. The plagioclases are surrounded by a rim of albite. Accessory biotite is found also.

Large and small plagioclases in dyke 12 and dyke 14.

In the determinations of plagioclase in dyke 12 of the older generation and dyke 14 of the younger generation at Amitsuarssugssuaq, a distinction was made between big and small grains. All sizes of individuals, from the smallest to the largest, are found, and different plagioclase generations do not seem to be represented.

The measurements carried out show the following pattern of distribution:

	small grains	big grains
Dyke 12: 6574 A............		59–59 % An
B............		60–58 % An
C............		62–61 % An
D............	67–65 % An	
E............	62–67 % An	
F............	65–61 % An	
G............	60–63 % An	
mean:	64 % An	60 % An
variation:	60–67 % An	58–61 % An
Dyke 14: 6587 A............		58–61 % An
B............		57–51 % An
C............	65–62 % An	
E............		50–55 % An
F............		50–50 % An
G............		60–63 % An
H............	54–54 % An	
mean:	59 % An	56 % An
variation:	54–65 % An	50–63 % An

This would indicate that the anorthite content in the plagioclase grains has no regular relation to grain size, and that all the plagioclase grains belong to one generation.

VIII. CLASSIFICATION OF THE DYKES AND THE SEQUENCE OF CRYSTALLISATION

All the dykes investigated are dolerites. It will be seen from the Grædefjord dyke and the Amitsuarssuk dyke that there is no variation in the rock types from different levels within one and the same dyke. The primary minerals are plagioclase, pyroxene, ore, and accessory apatite. Only one sample (contact sample from 0 m (6512) from the Grædefjord dyke) was found to contain olivine, and the same sample contained also a little interstitial quartz. The other contact sample from the same dyke (6518 from 600 m), however, contained no remnants of olivine, nor was this mineral found in the samples from this or the other dykes examined. The composition of the plagioclase is labradorite to andesine, and augite is the only type of pyroxene present in the dykes. Biotite, hornblende, epidote, sericite, and quartz, all of them secondary minerals, also occur.

In table 12 the two chemical analyses from the Amitsuarssuk dyke (1 and 2) are compared with Daly's computed average for diabase (3), dolerite (4), and quartz-diabase (5) (R. A. DALY 1933, p. 18). The Amitsuarssuk dyke is rich in FeO; it contains a little less Al_2O_3, MgO, and K_2O, but some more TiO_2 than the average contents of diabase and dolerite (3 and 4), while there is less SiO_2 than in quartz diabase (5).

Table 12.

	1	2	3	4	5
SiO_2	50.43	49.93	50.48	49.94	52.34
TiO_2	2.08	1.91	1.45	1.57	1.82
Al_2O_3	12.34	13.30	15.34	14.50	13.70
Fe_2O_3	3.69	3.51	3.84	3.74	5.05
FeO	14.07	12.50	7.78	8.01	8.78
MnO	0.34	0.30	0.20	0.33	0.23
MgO	4.41	4.60	5.79	6.93	4.72
CaO	9.01	9.47	8.94	9.71	8.03
Na_2O	1.77	2.56	3.07	2.65	2.60
K_2O	0.55	0.57	0.97	0.97	1.17
H_2O^+	1.03	1.07	1.89	1.28	1.56
H_2O^-	0.05	0.06			
P_2O_5	0.26	0.18	0.25	0.37	–

1: Amitsuarssuk dyke, 365 m (7316), analysed by M. Mouritzen.
2: Amitsuarssuk dyke, 1150 m (7308), analysed by M. Mouritzen.
3: Diabase, average of 90 analyses, R. A. Daly (1933).
4: Dolerite, average of 20 analyses, R. A. Daly (1933).
5: Quartz diabase, average of 12 analyses, R. A. Daly (1933).

The sequence of crystallisation was the same in all the dykes. Only the 0 m contact sample (6512) from the Grædefjord dyke was found to contain olivine, which is distinctly older than plagioclase and pyroxene. The plagioclases must have begun to crystallise at an earlier date than the pyroxene, plagioclase laths partially enclosed by pyroxene, or small laths entirely embedded in pyroxene, often being found. Occasionally plagioclase laths slightly enclosing pyroxene may be observed, so the two minerals must also have crystallised at the same time, but pyroxene continued its crystallisation after the plagioclase had ceased to crystallise. The accessory apatite is seen to be embedded in plagioclase, and in places may also be found in pyroxene; thus apatite developed early.

Ore occurs among the other minerals and may surround plagioclase laths to some degree (pl. 1, fig. 1), but ore grains may also be seen to be enclosed by pyroxene grains; the ore must accordingly have crystallised later than the plagioclase, but simultaneously with the pyroxene, which continued its crystallisation after the formation of the ore. Besides, secondary ore was deposited on joints in olivine (pl. 1, fig. 1), on joints in pyroxene, and as small grains in the uralitised pyroxenes. Quartz occurs interstitially among the plagioclases, as also does some albite which occurs together with the quartz, or in the form of thin rims around plagioclases; a little interstitial potash felspar has also been found in association with quartz in some samples.

Secondary alterations are found in all the dykes. In the olivine-bearing sample (6512) the olivine grains are serpentinised to some extent. In all the samples the plagioclases are more or less altered, hornblende, epidote, and sericite in small grains having developed in them; pyroxene is strongly uralitised, which has given rise to the formation of green hornblende of the same type as that in the plagioclases. Biotite grains have developed sporadically, and most often occur in association with ore grains.

IX. REFERENCES

(Medd. D.G.F. = Meddelelser fra Dansk Geologisk Forening).
(M.o.G. = Meddelelser om Grønland).

BARTH, T. F. W., 1952: Theoretical Petrology. New York.

BERTHELSEN, A., 1957: The Structural Evolution of an Ultra- and Polymetamorphic Gneiss-Complex, West Greenland. Geol. Rundschau Bd. 46, Hft. 1.

BERTHELSEN, A. and D. BRIDGWATER, 1960: On the Field Occurrence and Petrography of some Basic Dykes of Supposed Pre-Cambrian Age. M. o. G. Bd. 123, Nr. 3.

BONDAM, J., 1955: Petrography of a Group of Alkali-Trachytic Dyke Rocks from the Julianehaab District, South Greenland. M. o. G. Bd. 135, Nr. 2.

BURRI, C., 1931: Bestimmung der Auslöschungsschiefe monokliner Augite und Hornblende auf (010) mittels beliebiger Schnitte. Schweiz. Min. u. Petr. Mitt. Bd. XI.

DALY, R. A., 1933: Igneous Rocks and the Depths of the Earth. New York.

EDWARDS, A. B., 1942: Differentiation of the Dolerites of Tasmania. Jour. Geology vol. L, no. 5 and 6.

HESS, H. H., 1941: Pyroxenes of Common Mafic Magmas. Am. Min. Vol. 26, no. 9 and 10.

VAN DER KAADEN, G., 1951: Optical Studies on Natural Plagioclase Feldspars with High- and Low-Temperature-Optics. Diss. Utrecht.

KROKSTRÖM, T., 1932–33: On the Ophitic Texture and the Order of Crystallization in Basaltic Magmas. Bull. Geol. Inst. Upsala Vol. XXIV.

KÖHLER, A., 1942: Die Abhängigkeit der Plagioklasoptik vom vorangegangenen Wärmeverhalten. Min. u. Petr. Mitt. N. F. Bd. 53.

OFTEDAHL, C., 1948: The Igneous Rock Complex of the Oslo Region. IX. The Feldspars. Vid. Akad. Skr. Oslo. I. Mat. Nat. Kl.

RAMBERG, H., 1948a: On the Petrogenesis of the Gneiss Complexes between Sukkertoppen and Christianshaab, West-Greenland. Medd. D. G. F. Bd. 11, Hft. 3.

— 1948b: On Sapphirine-Bearing Rocks in the Vicinity of Sukkertoppen (West Greenland). M. o. G. Bd. 142, Nr. 5.

REINHARD, M., 1931: Universaldrehtischmetoden. Basel.

ROGERS, A. F. R. and P. F. KERR, 1942: Optical Mineralogy. New York.

SØRENSEN, H., 1950: An Examination of the Plagioclases of Some Hekla Lavas. Medd. D. G. F. Bd. 11, Hft. 5.

TERTSCH, H., 1942: Zur Hochtemperaturoptik Basischer Plagioklase. Min. u. Petr. Mitt. N. F. Bd. 54.

WINCHELL, A. N., 1951: Elements of Optical Mineralogy, Vol. II. New York.

WEGMANN, C. E., 1938: Geological Investigations in Southern Greenland, Part I: On the Structural Division of Southern Greenland. M. o. G. Bd. 113, Nr. 2.

Færdig fra trykkeriet den 15. februar 1962.

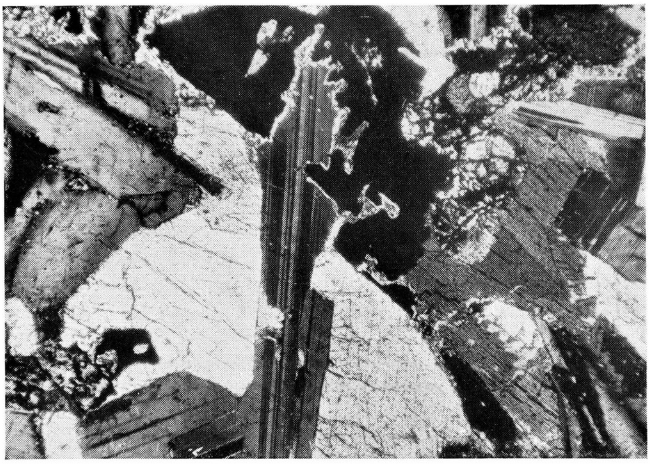


Fig. 1. Grædefjord dyke, 6512, contact specimen (0 m alt.), crossed nicols, × 90. In the middle a plagioclase lath surrounded by pyroxene (light) and ore. To the right of the large ore grain, olivine with ore-coated cracks is seen.

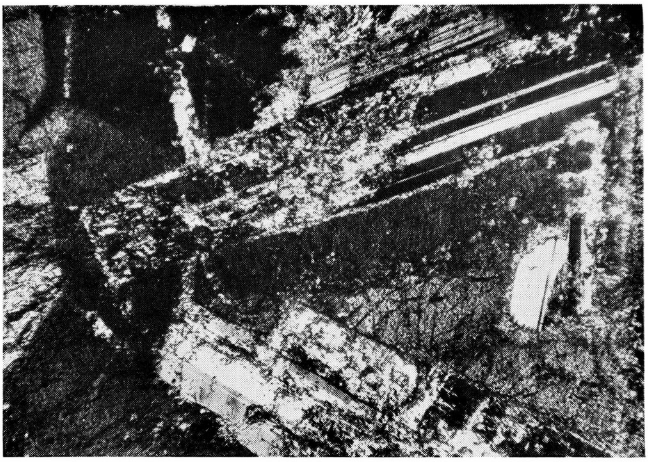


Fig. 2. Grædefjord dyke, 6513, central part (0 m alt.), crossed nicols, × 90. Partly saussuritised plagioclase laths in pyroxene, which latter is somewhat uralitised.