On the Structure of a High-metamorphic Gneiss Complex in West Greenland, with a general Discussion on related Problems.

By

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Abstract

An area within the central part of the pre-Cambrian mountain chain—the Nagssugtôqidian belt—recrystallised under granulite facies conditions in West Greenland has been investigated. It is shown that the folding style is simple and only indicative of moderate tangential compression, while the tectonics at a higher level recrystallised under amphibolite facies conditions is more complicated. In tabular form the main results are shown on p. 264, where folding style, regional facies and granitization/degranitization has been put together and compared.

I. Introduction.

When the Geological Survey of Greenland (G. G. U.) was established in 1946, the work in the pre-Cambrian was entrusted the senior author (A. N-N). It was planned, if possible to make a reconnaissance map of the pre-Cambrian areas between Disko Bay in the north and Arsuk fjord in the south over a period of ten years; together with this work it was decided to carry out more detailed investigations in districts of special scientific interest within the area. The greater part of the field work proper carried out in Greenland to the present day has been conducted by Dr. HANS RAMBERG Oslo/Chicago.

During the laboratory work in Copenhagen we found that in many cases the air-photographs were able to yield considerable geological information, and in the winter 1949 the senior author tried to make an interpretation of an area with a good many "closed structures" in the inland region to the South of Nordre Strømfjord. At the same time new topographical maps of the same region became available from the Geodetic Institute in Copenhagen, and it became a matter of considerable significance to make an effort to trace the geological structures in a suited area in the field and to compare with the results which could be obtained from the air-photographs, after the geology along the shores of the fjords in the area was known. The results obtained were quite satisfactory.

The area chosen for the purpose is situated to the South of Nordre Strømfjord near the bend of the fjord (52° 10′ W – 53° 35′ W and 67° 25′ N – 67° 45′ N); it is part of the "Isortoq gneiss complex", which includes the high-metamorphic rocks of the central part of the Nagssugtôqidian mountain chain (RAMBERG, 1948); the gneisses of the region are recrystallized under granulite facies conditions, except for a few incoherent patches in the eastern part where amphibolite-facies prevails. This facies completely predominates in the region a few miles further east in the "Egedesminde gneiss complex" (RAMBERG, 1948).

The field work on which this paper is based was carried out from 8/8 to 1/9 1949 by the authors jointly; from 22/8–1/9 we were accompanied by Mr. H. SØRENSEN, mag. scient. and Mr. M. WALTHER. Base camps from which excursions on foot were made, were carried inland with assistance of our skipper Mr. CHR. PEDERSEN and his crew from the G. G. U. motor-yawl "N. V. Ussing"; furthermore, a canvas rowing boat, "Peter", was used to cover the shores of the big lake Nagssugtûtâta tasiat, this trip being made by Mr. H. SØRENSEN and the junior author.

A preliminary report on the results[1]) was delivered on the fifth convention of Scandinavian Geologists at Copenhagen in 1951 by A. BERTHELSEN. An abstract in Danish was printed in the Bull. Danish Geol. Soc. 12. part 1. p. 153.

II. Division of the gneisses.

Quite apart from the classification into facies we have found it necessary to make a two-fold division of the gneisses in the area in order to arrive at a satisfactory petrological interpretation in harmony with the structural geology; the reason for this division and the problems related to it will be mentioned later (p. 263).

I. The first includes the metamorphosed sedimentary members of the Nagssugtôqidian geosyncline.

II. The second comprises the reactivated basement rocks underneath it.

The geosynclinal deposits.

Stratification: The most striking feature of this series is the astonishing similarity it shows to unaltered, stratified sedimentary rocks when seen in sections at some distance. (fig. 1). The stratification is brought out by the interstratified marbles and lime-silicate (skarn) rocks, amphibolites in more or less altered stages and light granulites in the hypersthene-gneiss, which in itself often shows stratification due to layers rich in amphiboles or feldspars recpectively.

The hypersthene-carrying amphibolites are at least in part of magmatic origin since they may still show an intrusive relationship to the host rock (fig. 2); however, gradual transitions also occur from hypersthene-bearing amphibolites to hypersthene gneisses, and the association of garnet-rich hypersthene-amphibolites with marbles seem to indicate that other types were derived from impure limestones and not from geosynclinal basalts. No remnants of pillow structures were revealed during

[1]) In this report no division of the gneisses was made, as it mostly was based on the fieldwork, during which the junior author did not work in the agmatitic region described on page 255 (fig. 4).

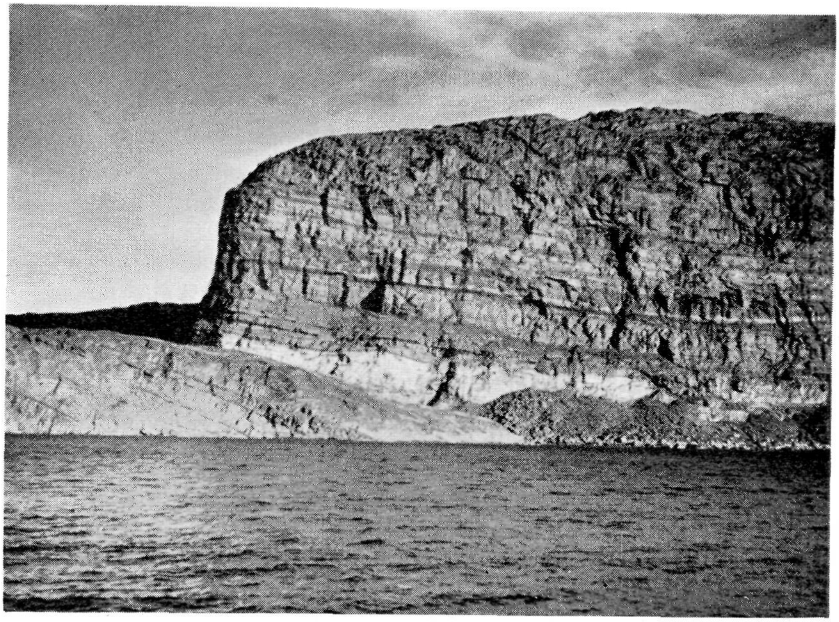


Fig. 1. The Nuk mountain (502 m) on the small peninsula north of the Nagssugtûtâ fjord. View from the south. The mountain shows a sequence of granulites (light), hypersthene-gneisses and amphibolites (dark).

our investigation, a fact which together with the intrusive relationship mentioned above favours the concept that the magmagenous amphibolites were once sills intruded into the geosynclinal sediments and not poured out as submarine lavaflows. Ultrabasic rocks occur as irregular bands and lenticles associated with the amphibolites and the hypersthene gneisses; their mode of occurrence is very similar to that described by H. Sørensen from Tovqussaq, West Greenland (Sørensen, 1953).

As a whole the amphibolites in the granulite facies area show conformable relationship to the other rock types and may succesfully be used in tracing the original bedding of the metamorphosed and deformed complex.

Marbles. The sedimentary origin of the marbles seems beyond doubt. Occasionally they carry appreciable amounts of graphite. The marble layers vary in thickness from few decimeters to almost a hundred meters. The marble now found in this high-metamorphic complex of rocks only represents relics; the skarn zones bordering or replacing the marble bands, clearly show the former instability of these.

Quartzite was only found at two localities (which probably belong to the same stratigraphical horizon) as a dense, pinkish to yellowish grey rock. At both localities the quartzite, which attained a thickness of several meters, was enclosed between layers of white, coarsely crystalline marble.

Quartzites may formerly have been present in a much larger quantity

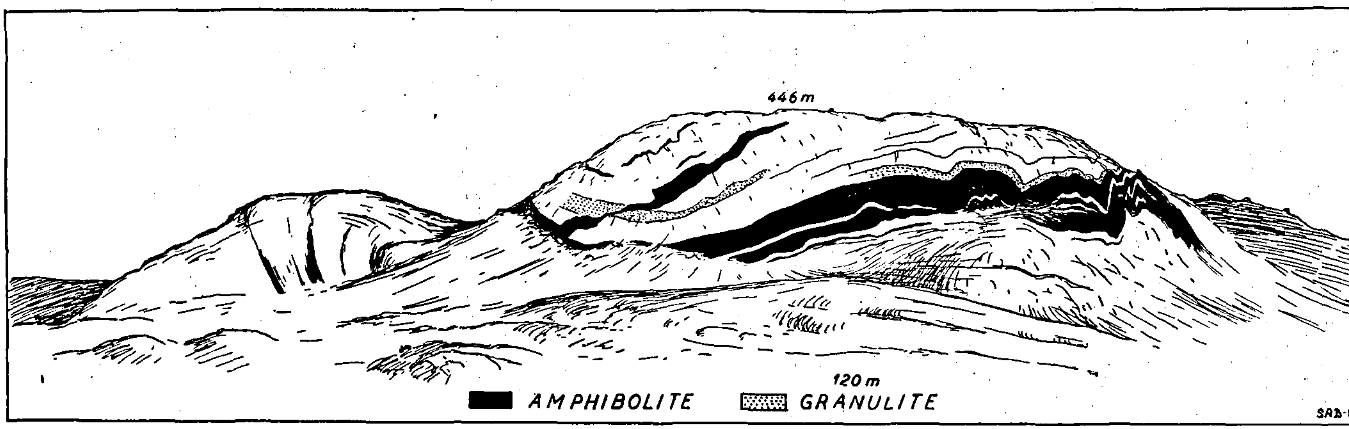


Fig. 2. View towards the northeast from the pass leading to Tiggâp tasiat from the small bay southwest of Eqaluarssuit. The amphibolite shows relic apophyses transgressing into the rocks now converted into hypersthene-gneiss and granulite. (The apparent overfolding is due only to the perspective). The drawing is based on field sketches and photographs.

which would be very likely in a series of geosynclinal sediments, so far however, we have only met with these rocks, where they have escaped the metamorphic and metasomatic alterations protected by the marbles.

Granulite. Next to the hypersthene-gneiss granulite is the predominating rock in the area. During mapping garnet-biotite-bearing quartzo-

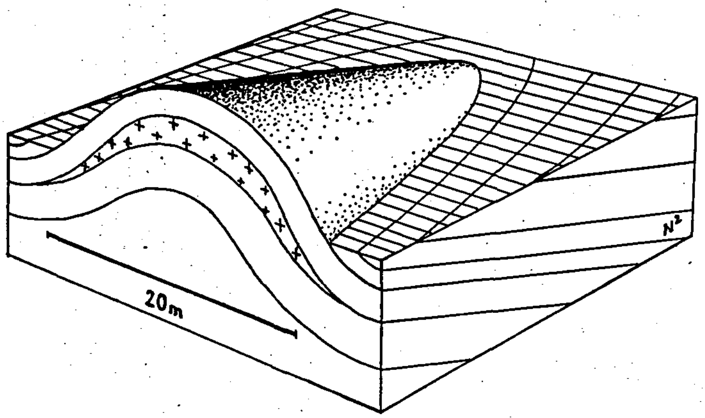


Fig. 3. Generalized diagram of an "anticlinal pegmatite". The migrating and/or secreted pegmatic material evidently became locked up in the anticlinal arch, whereby a "lacolithic" pegmatite resulted. The diagram is based on observations made in the narrow anticline south of Tiggâp tasiat.

feldspathic rocks with parallel orientated texture were headed under this group, together with sillimanite-bearing types of khondalitic affinity. The thickness of the granulites may amount to several hundred meters, but they are often found as layers alternating with hypersthene-gneiss layers in which cases both generally are 10–30 m thick then.

The association of granulites with marble, the presence of sillimanite-bearing types and the occurrende of graphite-carrying granulites all strongly suggest a sedimentary origin of this rock suite.

Hypersthene-gneiss. Ramberg (1948) described this rock as a metamorphic hypersthene-bearing quartz-diorite, it is: an enderbitic gneiss. The foliation is well developed and a marked lineation parallel to the planar structure is often seen.

The gneiss usually shows a banded structure due to thin amphibolitic layers and feldspar-rich schlieren, the individual layers, however, have no sharp contacts.

The intercalation of granulites and marbles and the lack of any intrusive contact, indicate that the enderbitic gneisses are to be considered as metamorphosed sedimentary rocks which have suffered a large scale transformation during the metamorphic evolution.

An additional evidence of the sedimentary origin is given by the occurrence of the so called "rust zones" (sulphide-bearing zones) in the hypersthene gneiss. (Ramberg 1948, and Pauly 1948).

Pegmatites were found as conformable veins and secretions in the

Fig. 4. Agmatitic hypersthene-gneiss with angular to subangular inclusions of hypersthene-bearing amphibolite. South coast of the Kangerdluarssuk fjord.

amphibolites and the hypersthene-gneisses. Evidently the pegmatites of this area are secretion and replacement products (RAMBERG, 1948 and 1949). A beautiful example was found in the core of the anticline immediately south of Tiggâp tasiat. It is shown in a generalized diagram in fig 3.

Supposed basement rocks.

The rocks considered to be basement rocks include the agmatitic hypersthene-gneiss with associated amphibolitic rocks found in the anticline east of the small fjord Kangerdluarssuk (around Ungôriarfik, 730 m) and the migmatitic rocks, which form the high mountain rising with a steep escarpment to the east of the southern part of Nagssugtûtâta tasiat.

The agmatitic hypersthene-gneiss shows angular to subangular inclusions of hypersthene-bearing amphibolite (fig. 4).

An agmatitic structure may develop in several ways and at different stages in an orogenetic evolution; (fig. 5).

1: It may be a relic structure in the reactivated basement gneiss—the original agmatite being created by processes described below under 2, 3, 4, and 5,—or

2: it may develop during the reactivation of the basement by purely mechanical deformation, especially of amphibolitic layers, or

3: it may develop when reactivated granitic material from the basement migrates upwards. This mode of formation demands that a higher degree of metamorphism (i. e. granulite facies) is reached during the last epoch of folding (which reactivates the basement) than was the case, when the basement first became consolidated.

4a: The metamorphic differentiation (degranitization and granitization) (p. 263—64) tends to create an agmatitic front in the uppermost parts of the granitization level.

4b: Where mobilized material of granitic composition migrates towards still higher levels (into green-schist-facies) the emplacement may attain

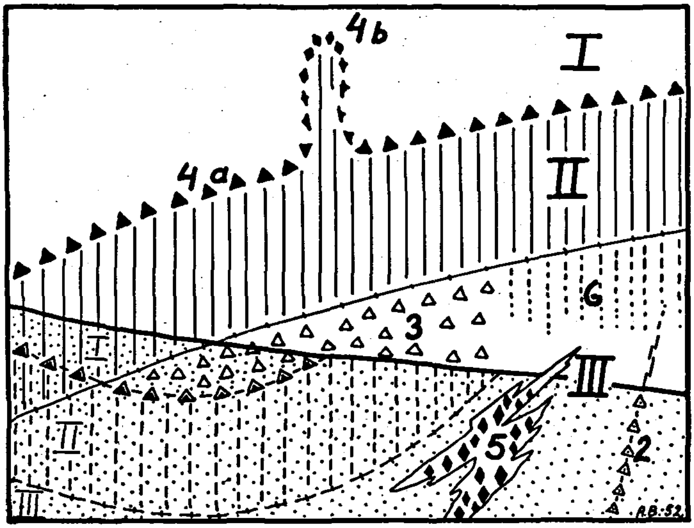


Fig. 5. Schematic presentation of the various ways in which an agmatitic structure may develop.

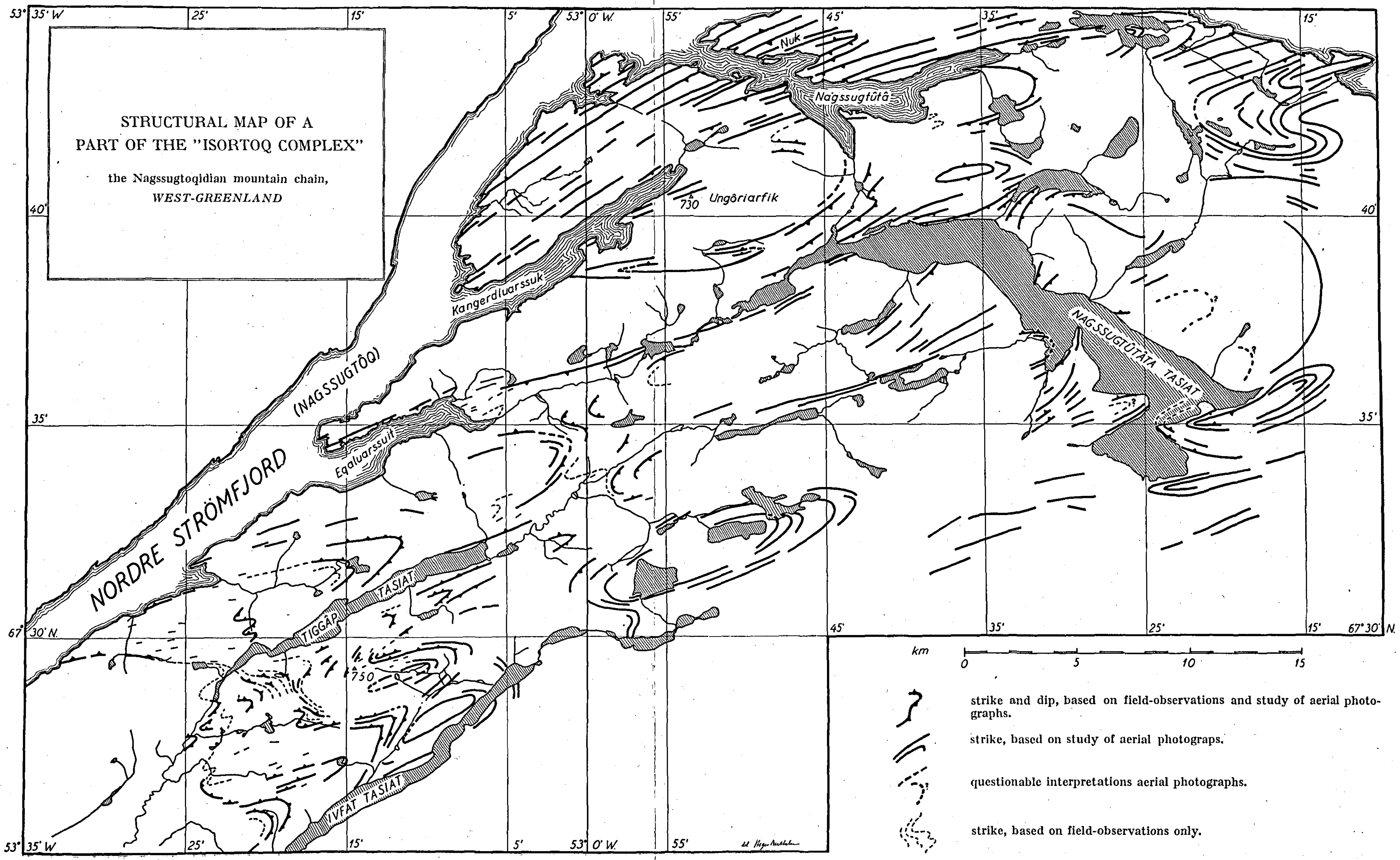
I Upper floor
II Intermediate floor } in younger orogene.
III Lower floor
I Upper floor
II Intermediate floor } in basement (dotted) (part of an older orogene).
III Lower floor
6: Relic granitization structures (migmatites) formed during progressive metamorphism. For further explanation (2, 3, 4a, 4b, 5) see text, p. 255—56.

an intrusive character, and gradual transitions therefore exist into the type described under 5.

(Group 4 includes most of the agmatites usually described as caused by anatexis and palingenesis).

5: Furthermore the agmatitic structure may be explained as relic intrusion breccias. The mere fact that acid rocks usually constitute the host-rock for the basic inclusions, demands the introduction of acid prim-orogenic intrusions.

The agmatite met with in the area treated here can hardly be explained unless it is considered as representing parts of a reactivated basement. The exceedingly well preserved primary (sedimentary) structures (p. 251) and the lack of agmatitic structures in the greater part of the investigated area tends to show that little or no tectonic influence due to granitization was


STRUCTURAL MAP OF A
PART OF THE "ISORTOQ COMPLEX"
the Nagssugtoqidian mountain chain,
WEST-GREENLAND
NORDRE STRÖMFJORD
(NAGSSUGTÔQ)
Kangerdluarssuk
Eqaluarssuit
Nuk
Nagssugtûtâ
730 Ungôriarfik
NAGSSUGTÛTÂTA TASIAT
TIGGÂP TASIAT
IVFAT TASIAT
750
53° 35' W
25'
15'
5'
53° 0' W.
55'
45'
35'
25'
15'
40'
35'
67° 30' N.
67° 30' N.
km
0
5
10
15
strike and dip, based on field-observations and study of aerial photographs.
strike, based on study of aerial photograps.
questionable interpretations aerial photographs.
strike, based on field-observations only.

displayed by the basement before granulite facies conditions were reached. Moreover however, as every evidence of prim-orogenic intrusion is lacking (the quartz-diorite in all probability being a highly metamorphosed sedimentary rock), the explanations offered under 1 and 2 on page 255 are the most probable.

Judging from the observations from the lake-shore and the study of the air-photographs, the migmatitic rocks east of Nagssugtûtâta tasiat show a domelike structure. As far as facies goes these rocks take a position intermediate to the areas to the west, where granulite facies prevails, and the country to the east, where amphibolite-facies predominates.

The migmatite is traversed by rather diffuse ghostly veins rich in light material of quartzo-feldspatic composition, which seems to have been secreted by or squeezed into and/or through the rock. Original structures therefore are extremely difficult to trace.

III. The structure.

The granulite facies area:

An impression of the structure may be obtained from a study of plate VI. An attempt has here been made to combine the structures observed during the fieldwork with those found when studying the air-photographs covering this area—heavy lines. Where the interpretations are disputable, a broken heavy line has been used. The broken thinner line indicates structures based on field evidence only. Where no dip is given, field-observations are lacking.

During the elaboration of this plate due consideration has been given to the disturbing and deflecting effect of the topography, without pretending the accuracy which would have resulted from a construction of a sea-level structural map. With the amount of possible errors committed in the interpretation, the method used should be sufficient.

The aim of this short survey was rather to get an impression of the structures in a very deep section of an orogenic belt than to establish a stratigraphical sequence, we are—how regrettable it may be—not yet able to reproduce any comprehensive sections. The petrological characters have already been discussed in brief (p. 251-255).

The fold-axis strikes ENE-WSW and has mostly a moderately ENE-plunge (10–35°), but occasionally it shows culminations and depressions, the plunge thus sometimes being towards WSW (fig. 6 and 7). North of the small fjord Kangerdluarssuk the axis is horizontal, except around the

[1]) From the rowing boat a dark dyke rock (presumably amphibolite) was seen to cut the migmatite, and moreover, the dyke seemed to enclose fragments of the surrounding gneiss. If this "long distance observation" is reliable, we have either a post-orogenic dyke—or a pre-Nagssugtoqidian gneiss. As no postorogenic dykes have been observed in this or the adjacent areas except for a Tertiary dyke in the northern part of the Egedesminde complex—(Ellitsgaard-Rasmussen, 1951), the latter alternative, the existence of a basement-gneiss, seems most probable.

The intrusive-breccia character may be explained by the brittleness of at least the upper parts of the basement as opposed to the softer sediments of the geosyncline, where generally concordant intrusions are found (page 252).

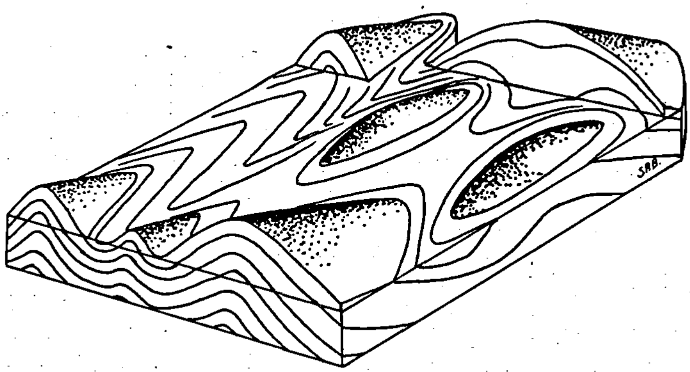


Fig. 6. Generalized diagram. To the left a plunging anticline, to the right a larger plunging anticline with small culminations in the adventive folds. Compare with plate VI south of the southernmost part of Tiggâp tasiat.

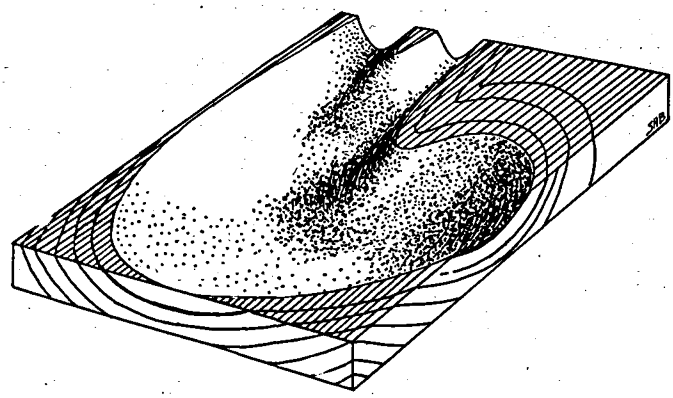


Fig. 7. Generalized diagram of a composite syncline. Compare with plate VI in the extreme northeastern corner.

entrance of the Nagssugtûtâ-fjord, where a culmination is found. The horizontal position of the fold-axis prevails too north of the Nrd. Strømfjord (Nagssugtôq), whereby a structural pattern is created, which could be taken for having been caused by isoclinal folds (fig. 8). There are, however, no reasons to assume that the type of folding changes on the short distance to the north of the main fjord.

The dip being moderate (only exceptionally reaching and exceeding 45°) overturned folds are not met with. An exception, however, is the small recumbent fold observed in the escarpment—facing the south-west—on the unnamed 750 m mountain north of Ivfat tasiat fig. 9. This fold is most probably due to local shearing between the individual layers forming a great syncline.

One of the greatest difficulties met with in this area, where the outcrops are so excellent, was the discrimination between the original bedding and the metamorphic foliation.

Fig. 8. Aerial view of the coast north of Nordre Strømfjord (Nagssugtôq), where a linear pattern is created by the horizontal course of the fold axis. (Published with special permission from the Geodetic Institute, Copenhagen).

The study of the exceedingly well exposed plunging anticline north of Ivfat tasiat (fig. 10) in the southwestern border region of the map (plate VI), however, proved that the granulitic and amphibolitic rocks were safe elements to use, when tracing the original bedding. The marble layers turned out to be valuable too, but their greater ability to die out along the strike, together with their greater plasticity, when accumulated in larger masses, reduce their value as trace horizons to a certain extent. (METZGER, 1947).

The incompetent (compared to the granulites and amphibolites) beds of hypersthene-gneisses, however, seem to be more structurally controled by the foliation, than by the bedding. In the above mentioned anticline these *foliation-planes showed an unexpected arrangement, dipping steeply around the anticlinal axis* (fig. 11). Thus measurements of the foliation planes may locate an anticlinal or synclinal structure, the dip of the flanks of the fold, however, can only be obtained when competent layers are found.

The orientation of the foliation planes follows the regional trend of the fold axis, but intersects the minor culminations and depressions. In these

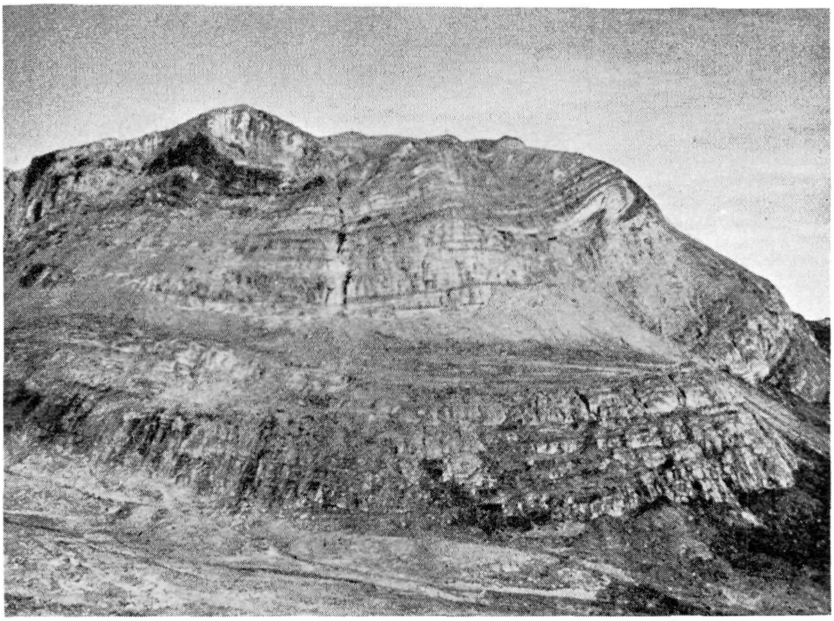


Fig. 9. Unnamed mountain (750 m) between Tiggâp tasiat and Ivfat tasiat. View towards northeast. Note the small overturned isoclinal fold in granulitic rocks in the southeastern flank of the mountain, which as a whole shows a synclinal structure.

a marked disagreement may therefore exist between measurements in competent and incompetent layers.

Besides the planar foliation a lineation usually occurs. The orientation of the lineation is similar to that of the foliation, that means: the lineation is parallel to the intersection between the foliation plane and the regional fold axis.

Where smaller axial culminations occur in the auxiliary folds in incompetent layers of hypersthene-gneiss (fig. 12), the foliation and lineation may obscure the closening of the structure, in the end of the culmination where the axis plunges in a direction opposite to that showed by the regional fold axis. The two small culminations inside the anticline north of Ivfat tasiat offer a good illustration of this phenomenon.

These examples show that the culminations have been present at least in an embryonic form, when the regional folding which was accompanied by the formation of the foliation planes took place.

The development of the foliation planes seems to be related to a small scale folding of the drag fold type, judging from observations in the field. In this way the peculiar tightening of the planes above the anticlinal crest and the widening above the synclines may be explained.

Cleavage planes spreading towards the crest of a fold have been explained by compression of the fold posterior to the formation of the cleavage (ERNST CLOOS, 1937, p. 65).

If we also assume that the foliation planes originally were parallel to

Fig. 10. Symmetrical and plunging anticline found in the extremely southwestern corner of plate VI. The photo was taken from the northwestern flank of the fold. The layer *cropping out continuously in the small escarpment is an amphibolitic rock.*

the axial plane of the main fold, we may by the same way of deduction conclude, that in the area treated in the present paper, not shortening but widening took place posterior to the formation of the foliation planes. Although this way of explanation presents interesting perspectives, it should not be taken for more than a suggestion.

If metamorphic processes had obscured the bedding, and/or if erosion had selected the outcrops in an unfavourable way which would have been very well thinkable, as the massive hypersthene-gneiss is most resistant against erosion, we might be confronted with an area, where the foliation-planes were the only traceable structure. The picture of the structure thus obtained, would be quite different. The folds would be steep of a type often described as "Fliessfalten" (fig. 13).

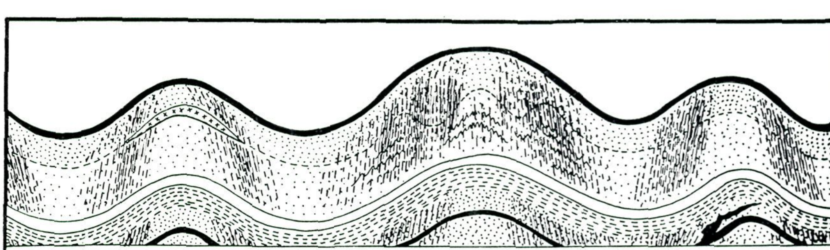


Fig. 11. Generalized diagram, showing the arrangement of the foliation planes in the incompetent layers (of hypersthene-gneiss) in relation to the original structures.

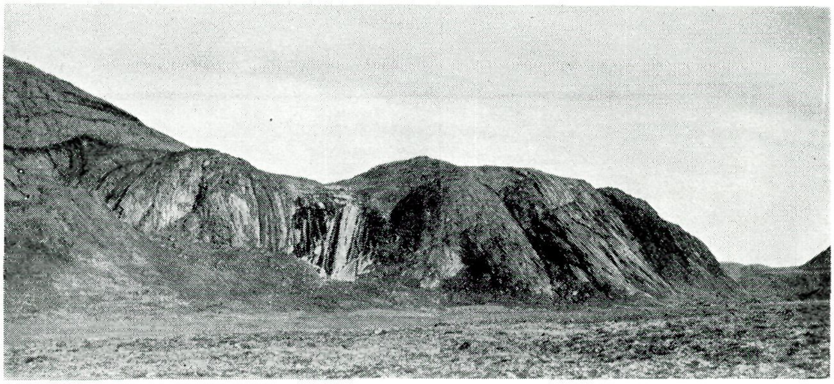


Fig. 12. Composite core of plunging anticline south of Eqaluarssuit. The two prominent ice-polished cores of hypersthene-gneiss are surrounded by amphibolite and granulite. A water fall divides the two cores.

The amphibolite facies area.

The change in type or style of folding, when entering the amphibolite facies area to the north-east, is beautifully desplayed in the country north-east of Nagssugtûtâta tasiat, where dome-like structures are found.

In the northern part of what seems to be a "Napoleon's cap-shaped" syncline the fold-axis dips to the south-south-east, or at right angles to the general direction of the fold-axis.

In the dome-like structure south of this syncline we have (p. 257) mentioned an intrusion breccia, where an amphibolite cuts the gneiss.

The abnormal structures in this small area may be explained in two ways:

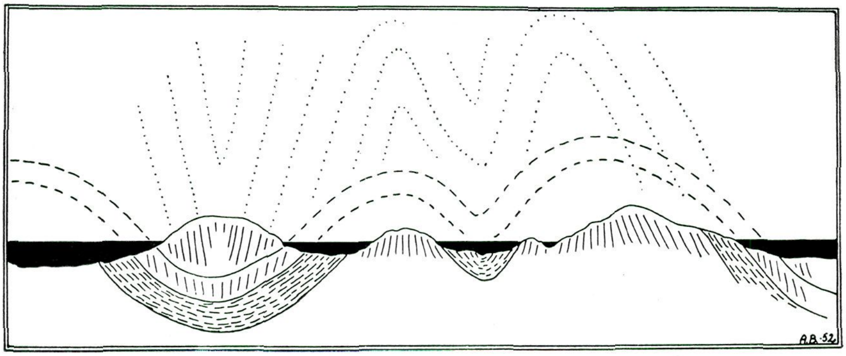


Fig. 13. Example of possible misinterpretation of the structures, due to scarcety of outcrops and selective erosion. (The black colour may represent an alluvial cover, for example). The dotted lines show the false impression of the structure brought out by a misinterpretation of the foliation planes. The broken lines show the true structures indicated by original stratification.

1: They are relic-structures in basement rocks.

2: They are caused by more deep-seated irregularities, and have been recorded in the migmatites, becauses of the greater plasticity and mobility of these rocks.

The above mentioned intrusion breccia seems to eliminate the second way of explanation. So far, however, this disputable observation stands alone, the explanation offered under two can not be completely set apart.

IV. Discussion.

The analysis of the present area as well as the reconnaissance work in other parts of the pre-Cambrian of West Greenland tends to show that the deepest known parts of an eroded mountain chain—in our case the Nagssugtôqidian chain—i. e. the granulite-facies areas, are characterized by a simple type or style of folding (whereas foliation structures may be markedly developed). Higher levels, however, exhibit more complicated folding structures. This fact may be explained by assuming a large scale metasomatism within the orogene, whereby the deepest parts (granulite- facies) become degranitized, while somewhat higher levels at the same time undergo granitization (amphibolite to epidote-amphibolite-facies). (Ramberg, 1951, Noe-Nygaard, 1952).

The upwards migrating granitic emanations lead to a surplus of quartzofeldspatic material in levels where granites and rocks with a granitic composition are stable. Regional granitization and the formation of diapirs (Wegmann, 1930) are consequently common features met with in these levels; and these processes contribute a degree of plasticity to their environment which therefore shows complicated structures. (Wegmann 1936).

Since generally these levels (amphibolite to epidote-amphibolite-facies) are the deepest ones laid bare by the erosin (especially in Caledonian and Variscian fold mountains), they have been looked upon as the "bottom floor" of the mountain chains where the sialic root underwent anatexis and palingenesis (Kennedy and Anderson, 1938, Umbgrove, 1950).

In the Nagssugtoqidian chain in West Greenland where the erosion has been more deep-reaching and where the ice-polished rocks are so exceedingly well exposed (similar exposition may hardly be obtained even in desert regions), nature itself has supplied science with the best thinkable sections for the study of "deep-tectonics".

As the division in facies levels according to the degree of metamorphism inside the Nagssugtôqidian mountain chain tends to show that granulite facies is a regional facies which is found below the "ocean of the granites", we think it justified to divide Wegmanns Unterbau (lower floor, l'infrastructure) into two separate levels (Stockwerke), the intermediate floor and the lower floor each of which is characterized by different metamorphic processes and different style or types of folding.

A synopsis of our present concept of the genetic relation between the degree of regional metamorphism and the style of deformation is given below in the table:

Metamorphic process	Degranitization	Granitization	Intrusion
Regional facies	Granulite-facies	Amphibolite- to Epidote-amphibolite-facies	Greenschist-facies
Structure	Simple folds	Domes, overturned folds etc. ("Fliessfalten")	Overfolds and overthrusts
Style	Lower floor (Unterbau) (l'étage inferieur)	Intermediate floor (Zwischenbau) (l'étage intermediaire)	Upper floor (Oberbau) (l'étage superieur)

Decreasing depth →

The transition from lower to intermediate floor seems not always to be a gradual one and divergences may exist in the directions of the fold-axis (BERTHELSEN, 1950). The lower part of the intermediate floor often shows domestructures (Kuppelbau), whereas the uppermost parts generally shows steeper folding. Thus, there seems to be a tendency of steepening of the folds upwards and a flattening downwards (in the lower floor, as defined by us) reminiscent of the downwards dying out of isoclinal folds.

The structure of the area described in the present paper may serve as an example of the type of folding in the lower floor (Unterbau).

The intermediate floor (Zwischenbau) includes "la tectonique profonde de type non tangentiel" as described by DEMAY from the French Central Plateau, (DEMAY, 1931, p. 687, 1936 and 1946), WEGMANN's lower level (Unterbau) (WEGMANN, 1935), the "Magma-tektonik" of H. CLOOS (CLOOS, 1935) and further partly covers 'les plis de fond' of ARGAND, (ARGAND (1924)).

Future work in granulite facies areas in the pre-Cambrian shields may show whether the working theory presented here can with any succes be applied to other deeply eroded mountain chains.

It is not in all cases, however, that granulite-facies areas should be expected to show simple structures. An upwards directed influence from the basement (3 on page 256) and a change in composition of the sediments in the geosyncline (6 in fig. 5) brought about through progressive metamorphism may have destroyed the primary structures making the type of folding here described from the lower floor impossible or extremely difficult to recognize. Retrograde metamorphism with accompanying deformation may further obscure the picture.

Whether or not the treated area "happened" to record the style of folding in the lower floor undisturbed it seems to us beyond doubt that the deepest known levels in the orogene only underwent slight compression and deformation.

Addendum: After this paper had gone to print we have recieved an interesting paper by P. MICHOT: Essai sur la Géologie de la Catazone (I et II) dealing with problems related to those discussed by us but attacked from a somewhat different angle. (Acad. Royale de Belgique. Bull. de la Classe des Sciences. 5 Série, Tome XXXVII et XXXVIII; 1951 et 1952.)

DANSK RESUMÉ

Vi har undersøgt et område, som er rekrystalliseret under granulitfaciesbetingelser, i den centrale del af den nagssugtôqidiske foldekæde i Vestgrønlands Prækambrium, udfra strukturelle synspunkter. Arbejdet i marken blev støttet af en analyse af luftfotografier.

Resultatet af undersøgelsen viser, at foldningstilen er simpel og ikke vidner om tangentiel sammenpresning i stor skala. Tektoniken i højere niveau — krystalliseret under amfibolit-facies betingelser — er mere kompliceret; først i endnu højere niveau — *grønskiferfacies* — møder vi overfoldninger og overskydninger, som vi kender dem fra Alperne. I skemaet, side 264 har vi sammenstillet foldningsstil, regional facies og de processer, der fører til henholdsvis »degranitisation«, »granitisation« og »intrusion«. Den simple foldningsstil i granulitfaciesområdet forståes bedst på baggrund af, at her finder en stofafgivelse til højere niveau sted, medens omvendt den mere komplicerede foldningsstil i amfibolitfaciesområdet bl. a. er en følge af stoftilførsel.

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