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GRØNLANDS GEOLOGISKE UNDERSØGELSE

GEOLOGICAL RECONNAISSANCE MAP
OF THE COUNTRY BETWEEN LATITUDES
69°N AND 63°45'N, WEST GREENLAND

BY

ARNE NOE-NYGAARD AND HANS RAMBERG

WITH 2 SHEETS

KØBENHAVN

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BIANCO LUNOS BOGTRYKKERI A/S

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PREFACE

A considerable amount of information on the geology of Greenland had been gained on numerous expeditions during the last hundred years, but a systematic geological mapping had not been undertaken, when in the late thirties the initiative was taken to organise a regular Geological Survey of Greenland. Owing to the war it was not until early in 1946 that this Survey (Grønlands Geologiske Undersøgelse) was established.

At the outset several of the more remote regions were, oddly enough, better known than the inhabited parts of Greenland. For this reason therefore, when the systematic work began in the summer of 1946 West Greenland was chosen as the first region to be mapped, and also because this part of the country is the most accessible and that in which the topographical mapping had at that time gone farthest. In addition, if economic mineral deposits should be found as a result of the systematic geological work, they would be easier to work here than in other parts of the country.

Of primary importance in 1946, was to begin the mapping of the Precambrian areas which occupy about $\frac{5}{6}$ of the whole country, and of which we had only scanty knowledge. A second task of major importance, to begin with, was the teaching and training of a number of young Danish geologiststudents for future work in the Precambrian. In this connection it must be borne in mind that as Denmark proper consists mainly of young sediments from the Cretaceous and Tertiary periods and Quaternary deposits, there was no tradition for geological work in Precambrian gneisses.

The senior author was entrusted with the execution of the mentioned double task, but since he had previously only worked as a petrologist with volcanics it was evident that most problems would be new to him and could not be handed by himself alone.

It was obvious that he must first go and find a capable and willing man, familiar with the problems of the old crystalline complexes, who could join the field work from the very beginning. Professor TOM BARTH brought me in contact with Professor HANS RAMBERG, then Oslo, who after having heard of the task and the terms readily declared himself

willing to join the newly established Geological Survey of Greenland (G.G.U.). During five summers in Greenland and a winter in Copenhagen in the mineralogical museum of the university, RAMBERG worked with us; from him comes the major part of the new geological thoughts expressed in the map which is herewith presented to the public. After he had left, a generation of young geologists was able to take over.

In 1946 the geodetic survey was able to deliver us blue-prints of the newly made 1:250 000 scale map of the Holsteinsborg area, and consequently we set to work here, this region being as suitable as anyone else on the west coast. In the following years we continued the work, first northwards and later southwards following the completion of the topographical map sheets. We are indebted to the Geodetic Institute in Copenhagen, because we were willingly provided with ad hoc pieces of topographical maps, blueprints and airphotographs in such a way as to be always able to conduct a planned field season with a sufficient supply of reliable topographical maps.

In 1956 Professor H. RAMBERG and the senior author were able to compile the results of the work of the first ten year period, herewith presented as a reconnaissance map of a Precambrian region of West Greenland, being about 200 km broad and having a length of about 600 km.

Professor A. BERTHELSEN and Mr. RÖHLING from the G.G.U. have taken much pains in making the present map ready for printing and later on in reading galley proofs of it, and BERTHELSEN also provided the final wording of the accompanying text.

The structural division of the pre-Nagssugtôqidian belt on the key map is also due to Dr. BERTHELSEN, and is mainly the result of later, specialized work within the region represented on the reconnaissance map.

Many have helped us during the work in the field, geologists, skip-pers and many others, and during the preparation of the map at home. To all, none mentioned and none forgotten, I wish to express the sincere thanks of us both.

11th March, 1961.

ARNE NOE-NYGAARD.

EXPLANATORY NOTES TO THE MAP

The area covered by the two map sheets is some 600 km in length, stretching from Jakobshavn Isfjord in the north to Buksefjorden in the south. Apart from the local development of a level strandflat, the region is mountainous with altitudes from a few hundred metres to well over a thousand metres. The many and narrow fjords which dissect the inland offer some remarkable geological panoramas.

Although this region forms part of the western flank of the basin-shaped depression occupied by the Inland Ice, the crystalline basement rocks belong to the Canadian shield. In composition and structure the West Greenland schist/gneiss area is also comparable with other pre-Cambrian shield areas such as the Scandinavian shield and the "Archean" portions of peninsula India.

GEOLOGICAL DIVISION OF THE MAP AREA

The map area may be divided into two major units each of which owes its development to a pre-Cambrian orogeny (1, 2). The two epochs of mountain building were separated by a period during which regional swarms of basic dykes (among others the Kangâmiut dolerites) were intruded into the stiffened schist/gneiss complexes formed during the first cycle of orogeny. These dykes and the enclosing schists and gneisses build up the southern part of the map area. North of a zone extending from Itivdleg across Søndre Strømfjord, these old rocks are cut off and reworked by the younger *Nagssugtôqidian* folding (2) which has left its traces in the whole of the northern part of the map area. Until a definite correlation with the *Ketilidian* rocks from Southern Greenland has been established, the old schists and gneisses of the southern part of this map will simply be spoken of as *pre-Nagssugtôqidian*.

Post-Nagssugtôqidian rocks are only represented by 1) a few kerantitic dykes found within the Holsteinsborg district, 2) a few dolerite dykes (among others, a peculiar globular dyke (3) in the vicinity of Egedesminde, 3) Tertiary basalt, which forms a few small islands in Disko Bugt.

THE NAGSSUGTÔQIDIAN FOLD BELT

This may be divided into three complexes, the *Egedesminde*, the *Isortoq* and the *Ikertôq* complexes each of which has passed through its particular metamorphic development (1, 2, 4). The *Isortôq* complex forms the central part of the deeply eroded mountain chain and contains rocks belonging to the granulite facies. The dominant rock type is an enderbitic gneiss, but intercalations of granulite s. s., graphite-bearing khondalite, pyroxene granulites with some associated ultrabasic rocks, marbles and reaction skarns are also found (5, 6). In the two flanking complexes, the southern *Ikertôq* and the northern *Egedesminde* complex, the rocks have recrystallised under amphibolite or epidote-amphibolite facies conditions. Granodioritic hornblende- or biotite-gneisses are typical of these complexes. In the archipelago north of Egedesminde rocks of obvious metasedimentary origin, with sills and phacoliths of epidote-amphibolite, are found (7). Layers of mica schist and amphibolite form prominent intercalations in the gneisses around Christianshaab. In the southern *Ikertôq* complex, a large part of the banded gneisses may represent completely reworked pre-Nagssugtôqidian rocks while the associated bands and inclusions of amphibolite undoubtedly represent the deformed and recrystallised Kangâmiut dolerites. The anorthositic massif at Itivdlînguaq is (8) attributed with a pre-Nagssugtôqidian age.

The structural pattern of the Nagssugtôqidian fold belt seems rather uniform. The fold axes trend almost E—W in the southern *Ikertôq* complex, while they show a more ENE orientation in the central *Isortoq* complex (5). In the *Egedesminde* complex, the axial trend curves into a NE direction towards Christianshaab.

THE PRE-NAGSSUGTÔQIDIAN ROCKS

The southern part of the map area, where the rocks have been left undisturbed by the Nagssugtôqidian diastrophism, has been divided into 5 complexes (9). The northernmost, the *Kangâmiut* complex, is built up of granulite facies rocks (2). The predominant rock is an enderbitic gneiss which is often rich in more basic fragments and inclusions (10). In this gneiss there occur conformable layers of granulites s. s. and basic pyroxene granulites. Ultrabasic rocks (11, 12, 13, 14) are common and inclusions of reaction skarn may also be met with. In contrast with the *Isortoq* complex, the pre-Nagssugtôqidian complexes do not contain pure marble layers. The *Alângua* complex (15) is characterised by its

lower degree of metamorphism (amphibolite facies) and the abundance of rocks of obvious supracrustal origin (garnet/sillimanite-bearing biotite schists, diopside-amphibolites and various skarn rocks). Ultrabasic rocks are also very common in this complex. Various hornblende- and biotite-gneisses represent migmatized parts of the original supracrustal Alângua series. Although the Alângua complex structurally overlies the southern *Nordland* complex, it is locally overridden by this latter. The intervening *Finnefjeld* complex, which is made of a monotonous hornblende/biotite gneiss of quartz-dioritic composition, owes its development to its particular structural relation to the *Alângua* complex. The *Nordland* complex forms a structural unit but is heterogeneous with regard to mineral facies since its original granulite facies rocks have in places been retrogressively metamorphosed into amphibolite facies rocks (9, 15). Lithologically the *Nordland* complex can be described as a more intensely metamorphosed and migmatized equivalent of the Alângua complex. Ultrabasites, which in the Fiskefjord region reach dimensions of several cubic kms., and smaller bodies of pyroxene diorite are commonly encountered in the *Nordland* complex. The *Godthaab* complex (9, 12) shows a highly varied series of amphibolite facies rocks, comprising various gneisses, amphibolites, garnet/sillimanite-bearing biotite schists, anorthositic (16) and gabbro-anorthositic rocks as independent layers and as inclusions in gneiss, ultrabasic rocks, reaction skarns and subordinate amounts of siliceous gneiss. Anticlinal core granites and an abundance of pegmatites (17) bear witness of powerful granitisation. At Qôrqut a discordant body of potassic granite is found. Metabasaltic dykes are not uncommon in the southern part of the complex (18).

All the above-mentioned five complexes seem to form a lithological as well as structural unit, although each complex shows its own specific structural characteristics. The axial trend of the pre-Nagssugtôqidian fold belt is largely north-south to north-east, i. e. the old chain makes a small angle with the present shore line.

The intrusion of the pre-Nagssugtôqidian basic dykes occurred in two periods, which were separated by the formation of a system of NE-striking dextral wrench faults affecting the region between Sukkertoppen and Godthaab (9). (Since an even record of faults could not be obtained from the reconnaissance work, such features, even where proved by more detailed mapping have been omitted on the geological map.) The dolerite dykes intruded after this period of faulting include the Kangâmiut swarm proper, typically developed north of Sukkertoppen.

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M.D.G.F. = Meddelelser fra Dansk Geologisk Forening (Bull. Geol. Soc. Denmark), M.o.G. = Meddelelser om Grønland, both published in Copenhagen.

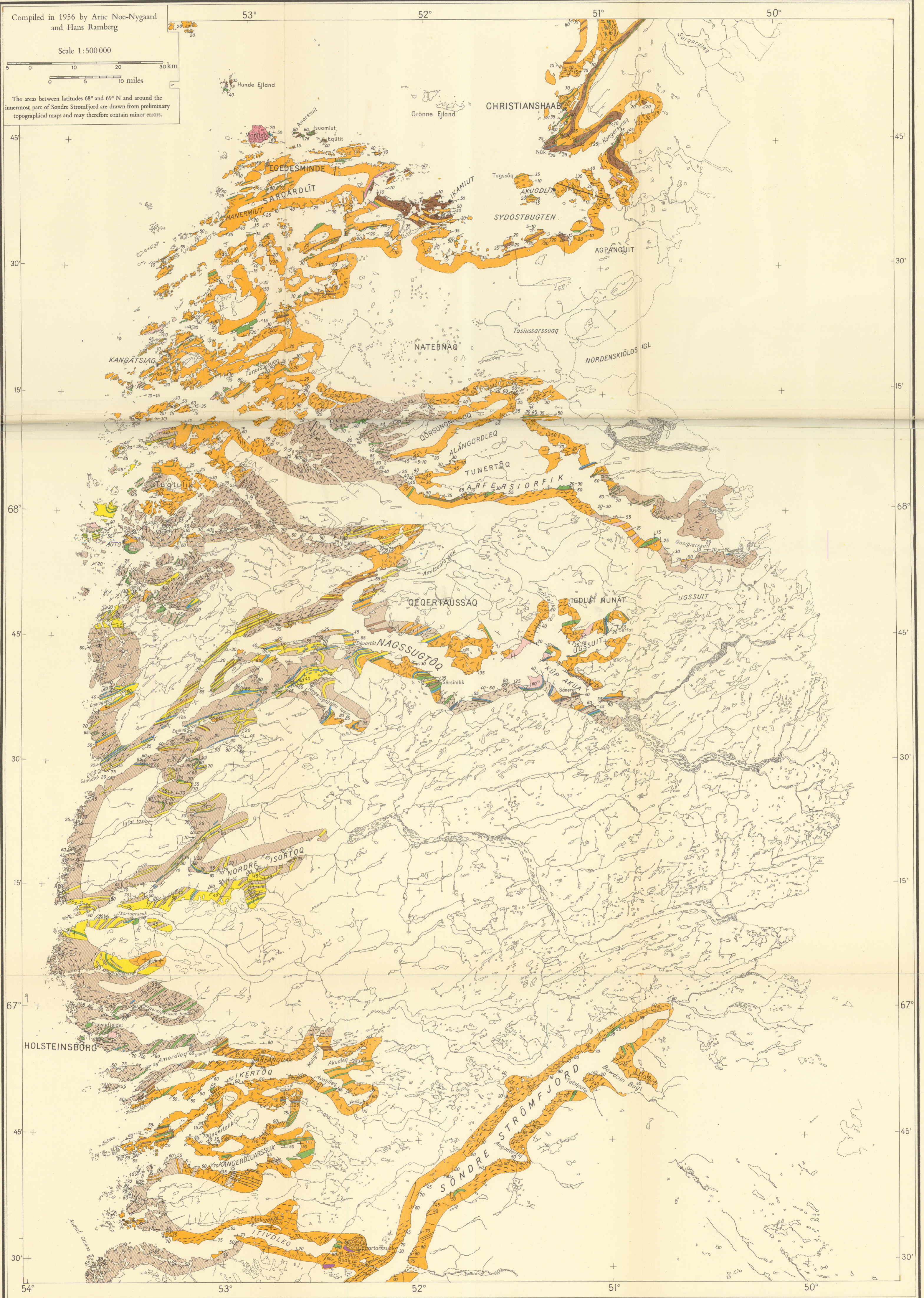
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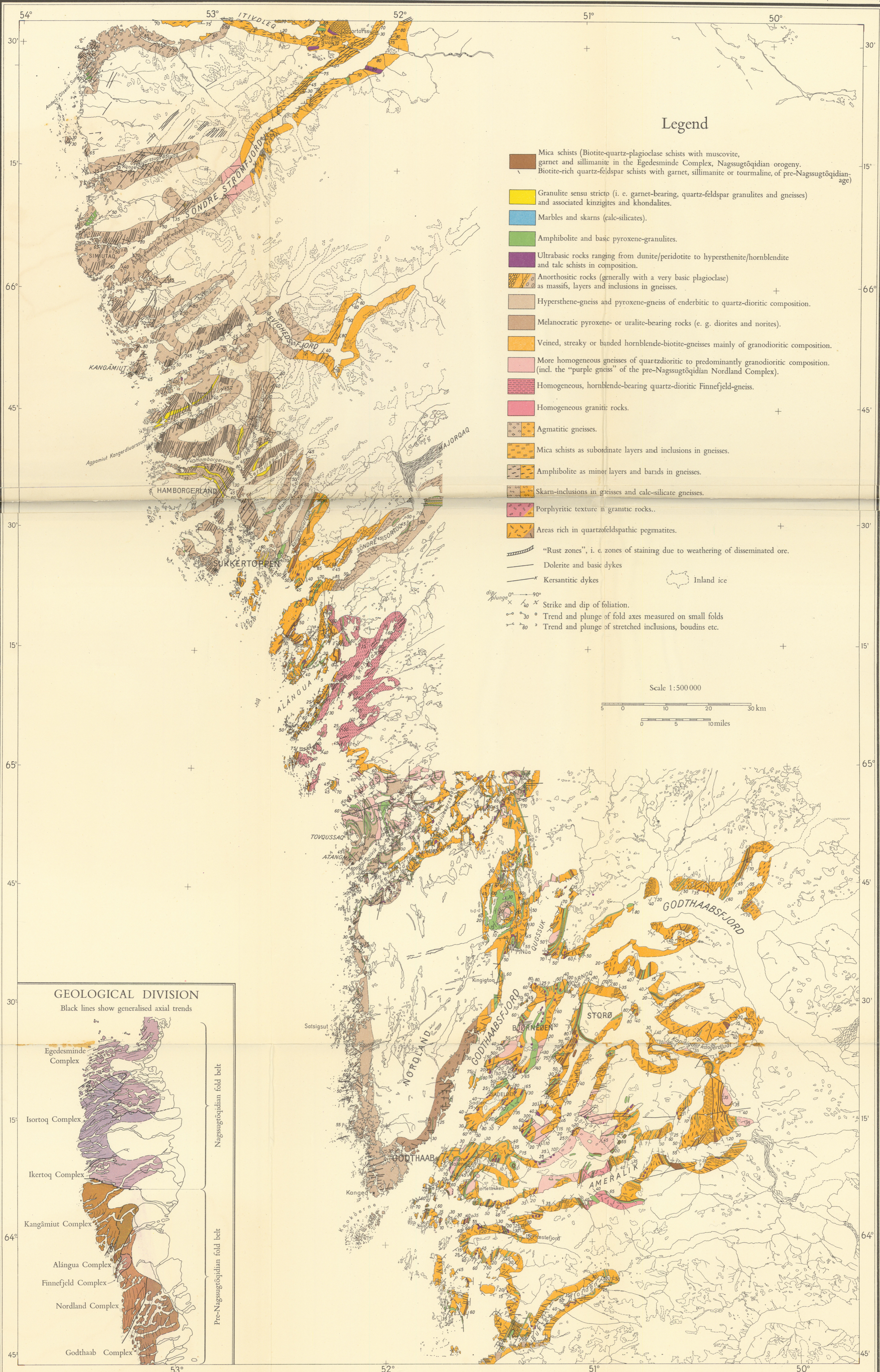
GEOLOGICAL RECONNAISSANCE MAP

OF THE COUNTRY BETWEEN LATITUDES 69°N AND 63°45'N, WEST-GREENLAND

MEDD. OM GRØNLAND BD. 123 NR. 5 (ARNE NOE-NYGAARD OG HANS RAMBERG)

(NORTHERN PART)





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