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The Precambrian Geology of Vest-Finnmark, Northern Norway

BY

PER HOLMSEN, PETER PADGET
AND EERO PEHKONEN

SAMMENDRAG:

VESTFINNMARKS PREKAMBRISKE GEOLOGI

WITH 23 TEXT-FIGURES, 2 PLATES AND 7 TABLES

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Preface.

In the summers of 1954—55 the Geological Survey of Norway (Norges geologiske undersøkelse) carried out geological mapping in the westerly part of Finnmarksvidda. The geological survey was made by the geologists Tore Gjelsvik, Per Holmsen, Christoffer Oftedahl, Peter Padget and Eero Pehkonen. J. C. Green and G. C. McCandless acted as field assistants, (the former to Oftedahl, 1954, the latter to Padget, 1955). The sub-division of the work is shown in fig. 1 of this paper.

Map sheets on a scale of 1 in 50 000 served as a basis for the field mapping.

The main emphasis was placed on the systematic geological mapping of the bed-rock. But much attention was also given to the study of ore mineralization, especially sulphide deposits. To this end experiments were made with geochemical methods of field prospecting. Chief chemist Brynjolf Bruun with assistants joined in this work, and the Survey's mobile field laboratory was stationed in the area. Radiometric surveys and small magnetic surveys were also carried out. Some attention was given to the examination of loose, ice-transported blocks with a view to the possibility of finding indications of ore deposits.

The main results were presented as a preliminary report at a winter meeting of Scandinavian geologists in Oslo in 1956 (Padget, 1956).

It is with certain misgivings that we submit the map with description and interpretation for printing at this early stage. One

argument against printing is the fact that the time spent so far on investigations of this extensive area has been far too short. Further work both microscopical and chemical in the laboratory is also most desirable. Many problems are still unsolved or only vaguely interpreted. This particularly concerns the stratigraphical succession of the rocks of the whole area and to some extent even more limited parts of it.

On the other hand we think that the investigations have so greatly advanced our knowledge of the geological features of this part of Finnmarksvidda compared to what was previously known that we consider it worth while to make the information public now.

Holmsen, Padget and Pehkonen were requested to work out a map with description. The results have been compiled and the English text written by Padget with the active assistance of Holmsen and Pehkonen. The Norwegian summary was written by Per Holmsen.

According to the authors' wish the geological map — printed on a scale of 1 in 250 000 — must be regarded as provisional only but suitable for forming the basis for more detailed investigations. Uncertain interpretations and unsolved problems are indicated in the text with the hope that further observations will throw light on them and lead to their solution.

Norges geologiske undersøkelse, 21. December 1956.

Sven Føyn
Director

Introduction.

The present publication deals mainly with an area lying in the westerly part of Finnmark, Northern Norway, but also extending into the southeasterly corner of Troms. It borders on Finland to the south and southwest. The main bulk of the area mapped, covering about 5000 sq.kms, lies within the map sheets Masi, Nabar, Lappoluobbal, Kautokeino and Agjet.

Geologically the area lies immediately to the south and southeast of the well-known «Hyolithus zone» (autochthonous or parautochthonous Caledonides). In its stratigraphy, structure and petrology it clearly shows affinities with the extensive tracts of Precambrian in N. Finland and N. Sweden.

As is the case over much of Finnmarksvidda the topography is rather subdued with undulating relief between 350 and 600 m. Occasional mountains rise out of the general plateau-like surface, as for example Čaravarre (891 m). Certain rivers, such as the Kautokeino-elv are deeply entrenched in the topography, though often drainage is poor with extensive areas of bog. This is particularly the case in the southwest and south.

The main drainage is nevertheless to the north via the Kautokeino-elv and Reisen-elv.

Access to the area is afforded by the north-south going road between Alta and Kautokeino. No other roads exist. The rivers are to some extent navigable by boat.

Emphasis has been placed on a systematic mapping of the bedrock with a view to finding ore deposits. Lesser attention has been

paid to loose glacial deposits except where these contain mineralized blocks.

It is commonly thought that inner Finnmark, or Finnmarksvidda, as it is called, is devoid or at least poor in exposures of bed-rock. This is often the case in certain specific areas but otherwise careful search can bring to light sufficient exposures to allow a fairly detailed geological map to be drawn.

The bed-rock is often obscured by bog and by glacial and fluvio-glacial deposits. Vegetation is usually limited to bog plants on the wetter ground and to mosses (reindeer moss), and stunted birches on the drier parts. The most continuous exposures are on the higher ground and along the sides of the more important rivers.

Previous work in the area.

Very few geological investigations of any sort had been carried out in the area previous to the present survey. The only published information was that of Tellef Dahll (see in Reusch, Dahll og Corneliussen, 1891). He subdivided the rocks as follows:

a) Gaisa system, roughly equivalent to the Caledonides,
b) A basement complex («Grundfjeldet») roughly corresponding to the Precambrian.

The latter is divided into two by a NNE—SSW going belt of granite. Of further interest is the assignment of certain little metamorphosed rocks in the westerly part of the present area of investigation to the Raipas formation (a formation seen around Alta to the north). Immediately east of this comes an area of «Gaisa» rocks which includes some graphitic schists with pyritic impregnations. All the above as well as smaller areas of basic rocks (gabbro, amphibolite, serpentine) would now be included in the basement complex (i. e. Precambrian).

A further important step towards an understanding of the geological relationships was carried out in the early years of the century by Holtedahl (1918). He not only firmly established the true distinction between the basement rocks (Grunnfjell) and the Caledonides but also showed that the Raipas rocks were most probably Precambrian, occurring as tectonic «windows» in the Cale-

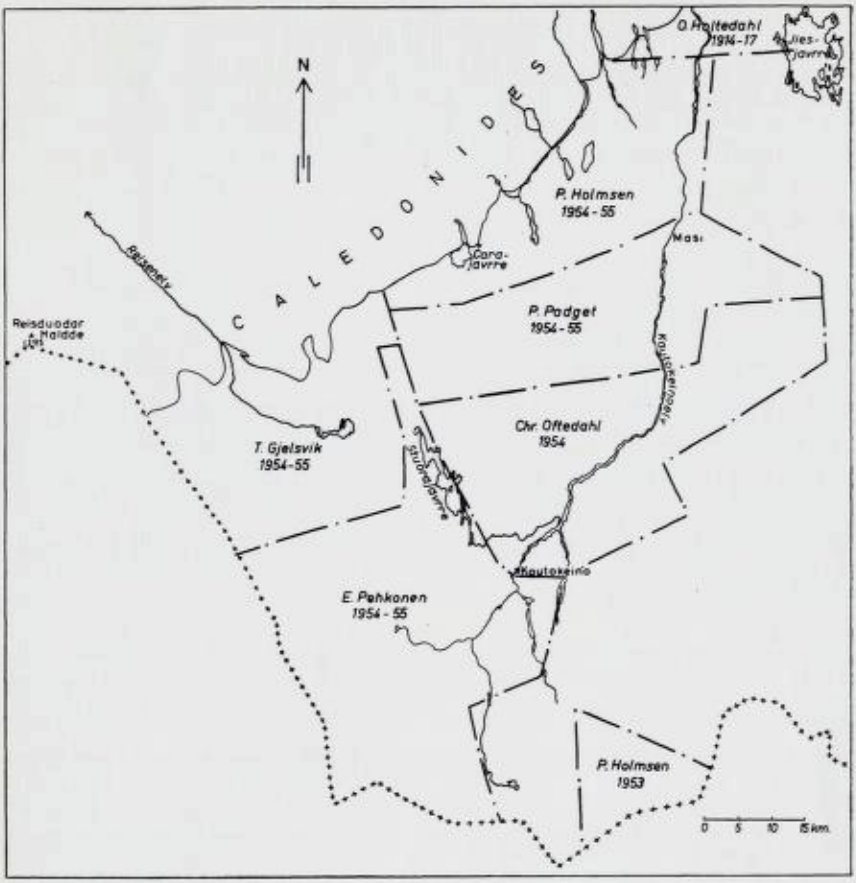

Fig. 1. Map showing the areas surveyed by individual geologists.
Kart som viser de enkelte geologers arbeidsområder i grove trekk.

donide schists. Of particular interest are his remarks on the Precambrian of the present area. Though admittedly the result of only a brief E—W traverse between Masi and the lake Čarajavrre, he rightly distinguished between the rocks in the neighbourhood of Čarajavrre (i. e. his «Jori» area) and those east of «Sadnojavrre». The former are little metamorphosed sediments and eruptives and were called Raipas by Dahll; the latter are more altered and include quartz-biotite schists often with albite, and eruptives (now represented by amphibolite), hornblende-schist and quartzite (at Masi).

By virtue of his remarks on the Precambrian elsewhere in Finnmark, notably in the SE part of the «Alten» map sheet around Alta, it is possible to effect certain comparisons. These will be dealt with in more detail in a later chapter.

In the latest «Norges Geologi» (Holtedahl, 1953, pp. 126—8) brief remarks are included on the Precambrian rocks, mainly derived from the traverse described above.

General outline of the geology.

A glance at the geological map shows that the rocks have a general north-south trend though admittedly with certain irregularities. They are often, though not always, steeply dipping. In both respects they differ from the shales of the Hyolithus zone which rest with marked stratigraphical unconformity upon them. The Hyolithus zone represents therefore the effective NW limit of the area under consideration.

A main feature of the geology is the existence of granitic rocks in the east and west. In between, the rocks are mainly layered, schistose types wich become less and less metamorphosed towards the centre, notably around the mountain Čaravarre. The more easterly of the granitic areas obviously belongs to the central granite-gneiss area shown on Holtedahl's map and earlier recognized by Dahll (see map in Reusch, 1891).

The schistose rocks west of this granite area consist mainly of quartzites, greenstones, greenschists, mica-schists and argillites. They have commonly been referred to, *en bloc*, as the westerly supracrustals as distinct from the easterly supracrustals east of the central granite-gneiss area. They are often folded and their continuity broken by faults and overthrusts which run parallel or sub-parallel to the strike of the rocks.

Stratigraphy.

In the central and northerly parts of the area layered rocks are present for the most part. They include sandstones, grits, quartzites, argillites, mica-schists, greenstones, greenschists and hornblende

schists. Differences in degree of metamorphism are indicated, for example by grits and sandstones on the one hand and quartzites on the other. Metamorphic, schistose types are also common as relics in the granite-rich areas to the east and west.

It is often possible to divide the rocks into distinct formational units. Unfortunately the continuity of any one formation across the area is broken by faulting and/or overthrusting. It is also liable to change its character due to metamorphism or metasomatism or both. Stratigraphical correlation is therefore very uncertain and as yet no uniform stratigraphical sequence for the whole area has yet been agreed upon. Most of the stratigraphy discussed below concerns the non-granitic areas.

In the first instance it is necessary to describe the stratigraphy of specific areas after which correlations can be attempted with the reservation that further work outside the present area as well as within it may necessitate changes.

The description will therefore be as follows:

1. Čaravarre—Guivevarre.
2. Časkias—Stuorajavrre.
3. Agjet.
4. Kautokeino (Kautokeino conglomerate).
5. Likča—Čuojajavrre.
6. Masi—Fidntjokka.
7. Datkovarre.
8. Suolovuobme—Soadnjojavrre—Masijokka.

The above descriptions are arranged in such a way that there is some sort of connection between them, either geographical or stratigraphical. A short discussion of the most likely correlations is given in conclusion.

1. Čaravarre—Guivevarre.

It it most natural to begin in a part of the area where the rocks are least metamorphosed. Such is the case along a distinct ridge of high ground with the summit point of Čaravarre in the north and Guivevarre to the south. The slopes to the west are also taken into consideration. In general one may say that there is a fairly continuous succession upwards from a group of greenstones into sandstones, grits and argillites (fig. 2).

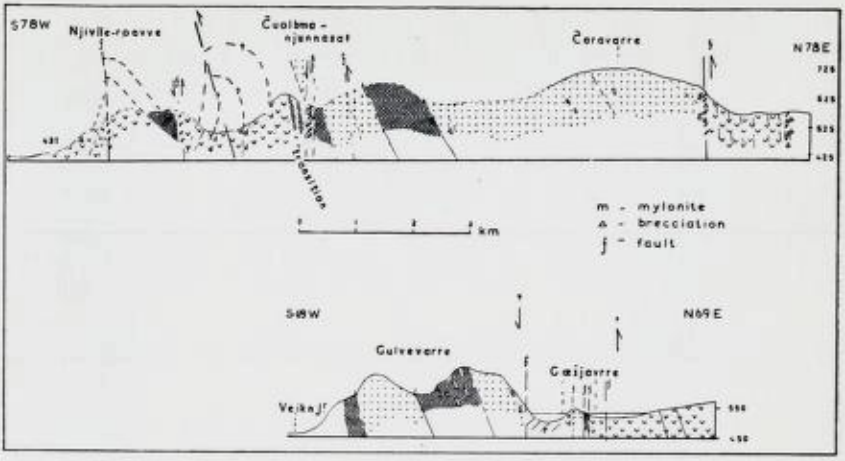

Fig. 2. Profiles across the Čaravarre—Guivevarre ridge. For legend see fig. 3.
Tverrprofiler over fjellrekken Čaravarre—Guivevarre. Tegnforklaring se fig. 3.

a) Greenstones: a varied group forming part of a broad belt coincident with the Stuorajavrre drainage basin. Further comment is reserved till later (see under «Greenstones», p. 53).

b) Transition beds: these occur between the greenstones and the overlying argillites and consist of interbanded green, grey and brownish lustrous schists. They are seen in a stream section 1 km. SW of Čuolbmajavrre and on the Suvravarre mountain.

c) Argillites: grey and brownish with dolomitic horizons to the north. Also a distinct carbonate-breccia/conglomerate a little north of Čuolbmajavrre.

d) Massive feldspathic grit. A narrow zone of feldspathic grit (arkose) runs from Čuolbmajavrre southwards. At its base it is faintly interbanded with some greenish schists. It probably thins out to the south.

On Guivevarre, however, a further thickness of coarse grit appears at an equivalent stratigraphical horizon (see map, fig. 3). This is a compact grit with fragments of quartz, microcline, microperthite and «felsite» in a quartz-sericite matrix.

It is probably faulted out to the north.

e) Argillite. An important member (and facies type) of the succession which succeeds the afore-mentioned grit quite abruptly.

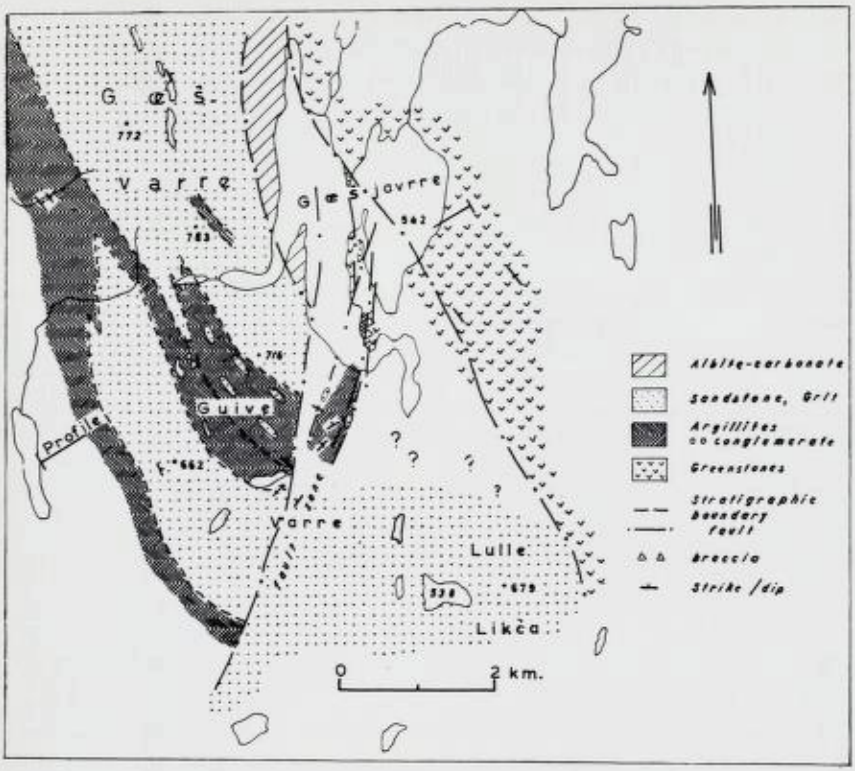

Fig. 3. Geological map of the Gæšvarre—Guivevarre region. For profile see fig. 2.
Geologisk kart over området Gæšvarre—Guivevarre. Profil se fig. 2.

The best exposures are to be found on the westerly slopes of Čaravarre. The rocks are typically dark, fine-grained and shaley. In some cases tiny cubes of pyrite are common. Very thin-splitting shales («paper-shales») were observed at one place with clastic mica flakes on the lamellae surfaces. Certain types are lighter coloured (buff) and slightly coarser in grain size (about 0.06 mm). They might be conveniently termed silty argillites. Thin section of one of the latter showed the rock to be compact with a muscovitic matrix, having also biotite, carbonate and a little chlorite.

The formation is a typical shallow water type. Corresponding rocks later in geological time would most certainly yield fossils. At one place suncracks were observed.

It is in this formation that Holmsen has observed grey dolomitic layers north of Čuolbmajavrre (fig. 4).

f) Main Grit formation. This, the youngest member of the succession hereabouts, forms the higher part of the Čaravarre — Guivevarre ridge. On the east side of this ridge the formation is limited by a major fault. On the west it has a sharp though normal stratigraphic contact with the underlying argillites. There is no specially marked conglomerate zone at the base. The minimum thickness for the formation is estimated to be 2500 m. It consists generally of thick or massive-bedded sandstone and grits with conglomeratic layers locally.

Feldspar is conspicuous and in places the rock might almost be described as an arkose. Current-bedding is also common and shows clearly that the beds «young» to the east. Those shown in the profile (fig. 2) are therefore not inverted. At some places thicknesses of silty argillite are interbedded with the grits.

The conglomeratic horizons are distinctly lens-like, impersistent over long distances and polymictic. At one place, due east of Čuolbmajavrre the basal layers are somewhat conglomeratic with pebbles up to 3—4 cms across. These are mainly of resistant types such as quartz, microcline, quartzite, microperthite and a fine-grained felsitic rock (?keratophyre). Spectacular conglomerates are exposed in a valley cutting across the main ridge. Here large pebbles and boulders occur through many meters and red jasper is particularly common. In a smaller lens on Gæšvarre (see map, fig. 3) jasper, greenschist and quartzite are the main types.

Finally mention must be made of some rather special conglomerates occurring on Guivevarre immediately SW of the lake Gæšjavrre (see map, fig. 3). The stratigraphical succession is shown diagrammatically in fig. 4. Thus between the two horizons of grit, silty argillite, distinctly conglomeratic, occurs. At its base a variety of pebbles (mostly small, the size of a pea or a walnut) occur including greenschist, phyllite, buff-coloured silty argillite, dark quartzite, red jasper, quartz and granite. Also a rather distinctive schist — purplish in colour. The matrix is also that of a silty argillite. Cross-bedding is common and beautiful ripple-marks were observed at two places. Also certain other structures which closely resemble swash-marks (Shrock, p. 129) and lobate rill marks (Shrock,

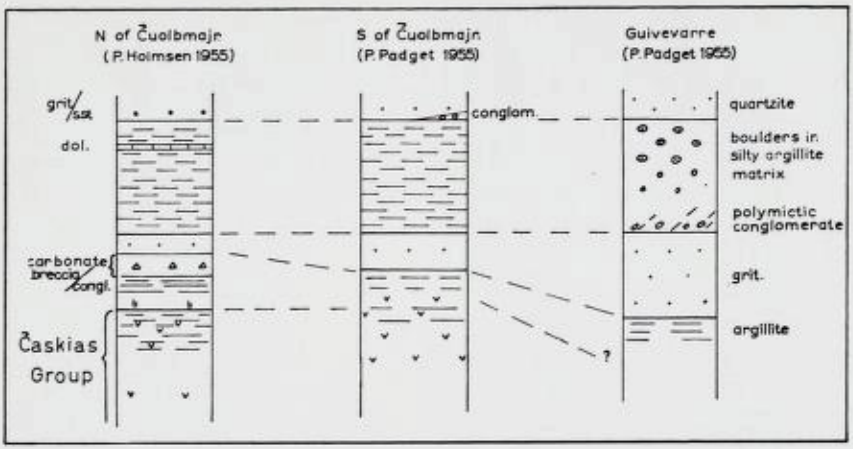

Fig. 4. Three representative sections of the stratigraphy on the Čaravarre—Guivevarre ridge. Not to scale.

Forsøk på stratigrafisk korrelasjon av tre representative snitt fra lagrekken på Čaravarre—Guivevarre-fjellene. Ikke i målestokk.

p. 131). These are all clearly shallow-water features and, after Shrock, indicate that the beds are not inverted.

Going NE and upwards in the succession there is a notable increase in the number and size of the pebbles. Large boulders are finally encountered, which may be only slightly rounded. Strangely enough they are mainly quartzose types with a number of brown weathering dolomitic types. They are overlain quite abruptly by quartzites (the quartzitic texture is due to proximity to a major fault crossing Gæšjavrre). This conglomerate has only a limited extent to the north and though faulted off to the east has probably only a limited extension in that direction also.

2. Časkias—Stuorajavrre.

Due west of the Čaravarre area a broad belt of greenschists, greenstones, etc. occurs. The easterly fringe of this belt abuts on to the Čaravarre-Guivevarre area described above. The rocks, while mainly greenish in colour, include a variety of types: greenschists, hornblende-schists, more massive greenstones, agglomerates representing the layered types along with thin horizons of crystalline, brown weathering metalimestone in some places. Also characteristic

are layers of dark pelitic schist, sometimes slightly graphitic. In contrast to these are coarse and medium-grained amphibolites and diabases which presumably represent rocks of intrusive character.

Since the rocks are most continuously exposed on the mountain called Časkias it is proposed to refer to them as the *Časkias-Group*. Similar rocks are represented on both sides of Stuorajavrre and apparently continue southwards beyond Galanito to the edge of the mapped area.

3. Agjet.

In the ground south of the Čaravarre-Guivevarre area and due west of Kautokeino the Časkias Group appears to be underlain by a distinctive quartzite formation. The relationships are well seen east and north-east of Agjet mountain in an anticlinal structure. (Further descriptions are given under «structure».) The contact appears to be a normal stratigraphic one and therefore gives a satisfactory base to the Časkias group which is lacking further north.

The quartzite, hereafter termed the Agjet Quartzite, occurs in three separated outcrops. Following Pehkonen's description it shows evidence of having been strongly metamorphosed and completely recrystallized with total disappearance of the original clastic structure. The main mineral is quartz which occurs in large ragged-edged grains with undulating extinction. Muscovite and biotite flakes are also common, giving the rock a distinct schistosity. On the schistose surfaces slender needles of sillimanite occur in clusters.

In the northerly part of the anticlinal structure and in the separate wedge-like outcrop to the west, deformation is not quite so intense and in a few places fuchsite mica has been observed. Plagioclase (An_{35}) and small microcline grains also occur sporadically but no sillimanite. At another place clinozoisite (in the north end of Čunočærro) occurs along with quartz, microline and a little plagioclase (An_{15}).

The transition upwards from the quartzite into the Časkias group is described by Pehkonen as follow: the sillimanite-bearing quartzite goes first over to a narrow zone of white, glassy quartzite which contains fuchsitic layers. Close to the contact occurs grey, biotitic arkose of a glassy character and rose-red in colour. The feldspar is mainly microcline and albite. The quartz is in rounded grains but nevertheless shows weak undulating extinction.

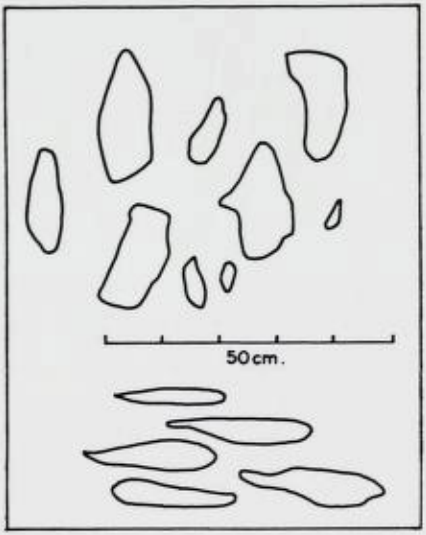

Fig. 5. Drawing of pebbles in the Kautokeino conglomerate: uppermost, on bedding surfaces, lowermost, in section at right angle to schistosity. *Tegninger av boller i Kautokeino-konglomeratet: øverst på lagflater, nederst i snitt loddrett på skifrigheten.*

4. Kautokeino — (The Kautokeino Conglomerate).

In the neighbourhood of Kautokeino it is not easy to see the true geological relations due to paucity of exposures. There is a rather unusual conglomerate which is not found elsewhere in the area. The most well known exposure is in a quarry about 1 km. NE of the hotel in Kautokeino. Also at about 500 m ESE of the church a 1 km. broad zone of conglomerate begins. Other exposures occur to the SSE of Kautokeino. In all of them the rocks have a NS strike and a steep, usually easterly dip.

In outcrop the conglomerate has a brownish weathering surface while the fresh matrix is dark bluish black. The light coloured pebbles consist of quartz, light coloured quartzite (50 %) and crystalline carbonate (50 %) according to C. Oftedahl. They are clearly pressed and elongated, giving a good lineation direction (175/40). Pehkonen's examination shows that they are large, flattened and from 5—20 cms long. The greatest length measured was 40 cms. Thickness varies from 0,5—8 cm with an average around 2—3 cms. The appearance of the pebbles on bedding surfaces and in vertical section is shown in fig. 5.

Macroscopically the pebbles seem to be mainly composed of

white, fine-grained quartzite. In thin-section however, they are clearly a fine-grained «calciferous sandstone» with grains of quartz and plagioclase in a matrix of crystalline carbonate. Some of the pebbles show large, pale-coloured hornblende crystals of secondary origin, along with a little biotite. In some pebbles darker banding may possibly represent original bedding. There are also pebbles richer in quartz as well as «glassy» quartzites. Certain pebbles with a grey or brownish grey colour are specially rich in scapolite; the latter having quartz and carbonate as included minerals.

The matrix is rich in hornblende and biotite. The former occurs in long blades, often clustered around the pebbles or penetrating them. The biotite occurs most commonly on schistose surfaces or in lens-like aggregates. Chlorite, quartz, carbonate, plagioclase (An_{20-30}) are all found with epidote and sulphides as accessories.

The conglomerate as a whole is rich in carbonate (recrystallized) which occurs in veins 2—3 cms broad, cutting across the schistosity. Carbonate is also often present as zones around the pebbles, especially around the edges. The sulphides, including chalcopyrite and pyrite, are also found around the pebbles, and usually in association with the carbonate.

The conglomerate clearly forms a significant element of the stratigraphy hereabouts. It is conformable to other beds in the neighbourhood and appears to be underlain by argillites (exposed south of Kautokeino) which are in turn underlain by the Časkias group.

On a broader scale the conglomerate may be equivalent to one of the horizons of argillite exposed on Čaravarre-Guivevarre to the NNW.

5. Likča—Čuojajavrre.

A broad and conspicuous belt of green-coloured rocks (e. g. greenstones, greenschists, diabase) occurs to the east of Čaravarre. It is separated from the succession on Čaravarre by a major fault.

The rocks show a striking similarity to those of the Časkias group both in general order of thickness and in the various petrographic types present. Thus dark pelitic schists are interbedded with the greenschists, greenstones and diabases. Good sections are visible 1—1,5 km W of Bartašjavrre. Agglomerate often

occurs in conspicuous zones, the most extensive being that on Likča. The main differences seem to lie in the comparative rarity of the graphitic schists.

Towards the east, thicker horizons of a dark slightly schistose shale appear, notably in the direction of Soadnjojavrre and Njargga-javrre. They appear to be older than the beds described above.

6. Masi—Fidnatjokka.

One of the most conspicuous rock formations is the quartzite which runs in a broad curving zone from Masi south-west to Fidnatjokka and south to cross the Kautokeinoelv.

In the field it is usually light-coloured, white, grey or pale pink. Often it shows good regular bedding and quite frequently good jointing. At some places it is massive. Current-bedding is not unknown and minor discordances in the sedimentary laminae are frequent. A distinct banding is also often conspicuous and seems to be due to one or more causes, e. g.:

a. mica-rich as against mica-poor layers,
b. feldspar-rich as against feldspar-poor layers,
c. carbonate-rich as against carbonate-poor layers, the former giving rise to a pitting on weathered surfaces.
d. colour banding with more pigment (Fe) in some layers. Horizons with pebbles, coarse, sandy material (grit) occur occasionally.

In thin-section the quartzite consists mainly of quartz grains but with appreciable amounts of feldspar (often microcline) and micas (muscovite, biotite, more rarely fuchsite). Small quantities of carbonate are also sometimes present.

Within the quartzite area, narrow zones of greenschist and mica-schist occur (see map, plate 1). Their stratigraphic relationship to the quartzite is uncertain but those forming the mountain Orvušvarre, east of Masijokka possibly overlie it. The quartzite appears far to the south (SE of Oskal).

Deserving of special mention is a conglomerate horizon which is apparently basal to the quartzite. Owing, however, to tectonism (overthrusting) it may also come to lie within the body of the quartzite and show various degrees of deformation. It is well exposed in a steep cliff on the east side of the Kautokeinoelv opposite Masi and is hereafter referred to as the *Masi Conglomerate*. Other occurrences are shown on the map of the area (Pl. I).

Its basal character can be seen near Hoigadanjavrre, a small lake about 4 km SW of Storfossen. Here it is little deformed and passes upwards into almost sandy rocks which higher up are quartzitic. Pebbles of granite, quartz, quartzite were noted in lenses several metres thick. Far to the north (Gumppinjunne, near Avjovarre) the quartzite apparently lacks the conglomerate at its base.

Elsewhere the conglomerate shows evidence of deformation in larger or smaller degrees. The total thickness is 50 m at a maximum. The pebbles are commonly deformed, but it is possible to recognize quartz, quartzite (a grey coloured variety), as well as the pink granitic types. Holmsen also reported a greenstone fragment from the exposures near Masi. The matrix consists commonly of carbonate, mica (including fuchsite) a little tourmaline and rutile.

On account of this distinctive petrography (fuchsite-bearing, granite pebbles) it is a most convenient mapping horizon.

7. Datkovarre.

The oval-shaped area west of Biggejavrre consists of two main stratigraphic units, namely, a considerable (and unknown) thickness of green hornblende schists underlying a thickness of mica- and quartz-mica-schists. Most of the rocks are fine-grained, dark in colour and some have a weak sulphide (pyrrhotite) impregnation. Mica flakes are often conspicuous and appear to have a parallel planar orientation. No graphitic rocks were found. At one place ripple-marks were observed. The junction with the hornblende schists is a perfectly conformable one with interbanding through a few metres. A thinly splitting, highly schistose rock is characteristic for the contact zone. No natural upper limit to the mica- and quartz-mica schists has been found.

Correlation is most uncertain. It is possible that the schists represent the metamorphosed equivalents of the argillites of Čaravarre. Alternatively they may belong to a horizon low in the Časkias Group.

The term *Mica Schist Group* is proposed as an arbitrary and non-committal name for the non-hornblende schists.

8. Suolovuobme—Soadnjojavrre—Masijokka.

The large, rhomb-shaped area in the north-east is dominated by schists which have locally been highly disturbed, probably as a

result of gliding and thrusting. It is therefore exceedingly difficult to reach any firm conclusions as to the general details of the succession. The account is therefore limited to a description of the main rock types present and to the few cases where the true succession is more or less certain.

Of the layered rocks the commonest are:

I. greenschists — usually rich in hornblende but locally with chlorite as the main mineral.

II. quartz-mica schists — widespread and usually alternating with more quartzites and more micaceous layers; quartz-mica schists with hornblende are common in exposures in the Njakkalækšejokka, a tributary of the Masijokka.

III. grey quartzite — a distinctive type occurring respectively 3 km E and 4 km NE of Soulovuobme.

IV. dark, dense, fine-grained schists with a weak sulphide impregnation (pyrrhotite or pyrite).

V. graphite-schist — a distinctive rock which occurs at many localities. It is possible that the various occurrences belong to one of two or three horizons. The possible connections are shown in the map, fig. 6. Impregnations of pyrrhotite, and a little chalcopyrite are commonly present, the former giving rise to areas of rust on weathering.

VI. albite-schists — a few outcrops show enrichment in albite, notably in the Njakkalækšejokka.

Intrusive rocks are probably represented by certain amphibolites and hornblendites, notably from Buvrašvarre (2 small isolated outcrops), and from the ground immediately north of Masijokka. These generally have a tendency to lie conformable to the enclosing schists.

It is evident that the graphite-schist is often a horizon of movement and hence shows considerable variation in thickness, often disappearing completely. The hornblende-schists apparently constitute a formational unit and in the Masijokka, and just S of the road-bridge, can be seen to underlie conformably a thickness of dark micaschists. This seems to hold in 2 parallel stream sections further north-east (e. g. Njakkalækšejokka, see profiles, fig. 7). Elsewhere hornblende-schists commonly lie upon the other schists. In some cases the contact is tectonic but it may well be stratigraphic in others.

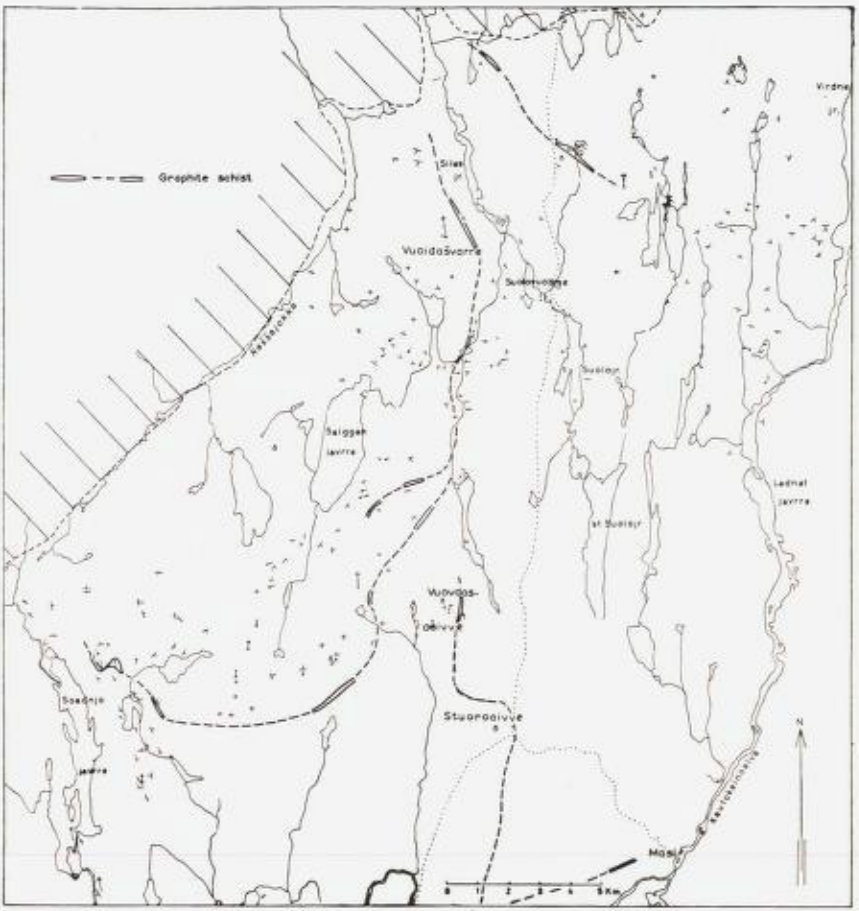

Fig. 6. Map of the Soadnjojavrre—Suolovuobme region showing irregularity of bedding, fold axes and lineation. Possible trend of graphite schist.

Kart over området Soadnjojavrre—Suolovuobme som viser uregelmessigheter av lagstilling, foldningsakser og linjestrukturer. Mulig forløp av grafittskifer.

Correlation.

In the fore-going, certain correlations have been suggested, usually between adjacent areas. This is apt to be more certain along the strike than across it.

A schematic review is given in fig. 8 where the correlations, both certain and doubtful are indicated. It has to be admitted,

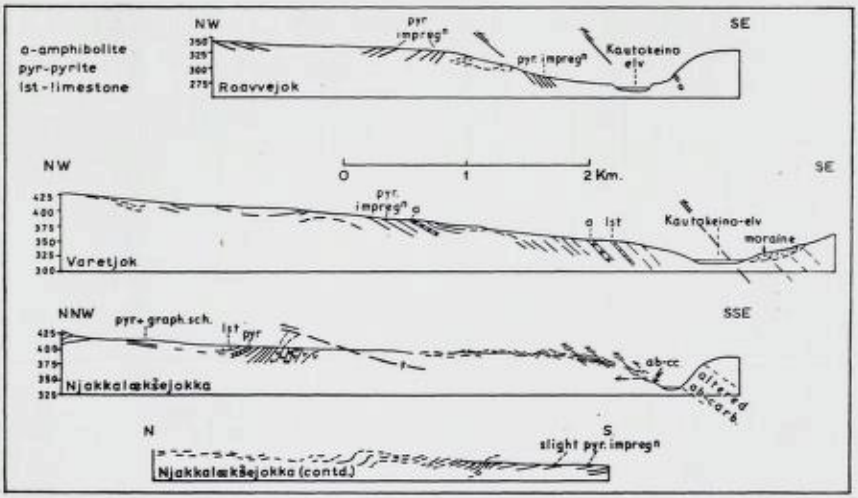

Fig. 7. Profiles in 3 streams between Masijokka road-bridge and Masi.
Tre brekkeprofiler mellom Masijokka bro og Masi.

however, that a general stratigraphical succession for the whole area has not yet been agreed upon.

Regarding areas 1—3, fairly certain correlations have been arrived at. Also area 4 (Kautokeino). The correlation of 5 with 1—4 however depends entirely on its similarity to the Časkias group (as in area 2 for example). Areas 6 and 7 are difficult to correlate owing to their having tectonic contacts on all sides. It is by no means certain that they belong to one and the same schist group (i. e. Mica-Schist Group).

Area 6 (Masi Quartzite and Conglomerate) is also difficult to place in the sequence since it has a thrust contact with other rocks. The Quartzite however may be correlated with either the grits of Čaravarre or with the Agjet quartzite. Of the two a correlation with the latter seems much more likely. The presence of fuchsite mica is common to both and on certain rather indirect structural evidence the two may well be one and the same formation. The base of the quartzite is not however exposed at Agjet as the succession does not go low enough. However, no basal conglomerate resembling the Masi Conglomerate is present at the base of the well exposed Čaravarre Grit.

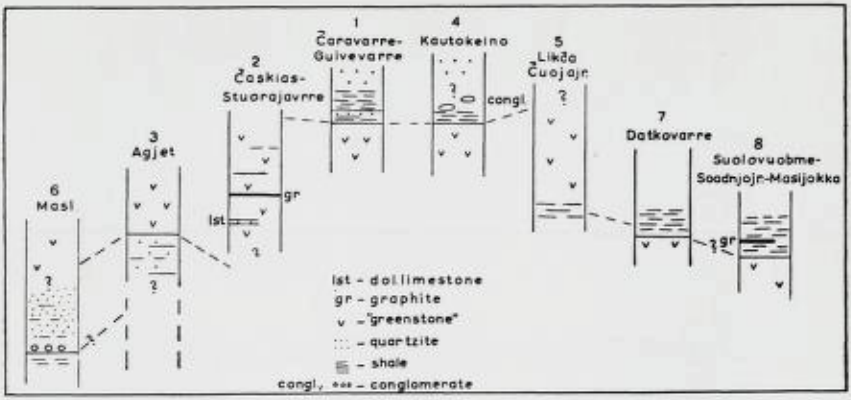

Fig. 8. Diagram to show the suggested correlation of the main formational units. Not to scale.

Diagram som viser forsøksvis korrelasjon av de viktigste formasjoner. Ikke i målestokk.

A correlation between Vest-Finnmark, N. Finland and N. Sweden is at yet impossible. A glance at the published work in the whole Lappland area (fig. 9) shows an absence of information adjacent to Norway. It is therefore extremely hazardous to attempt correlation with, for example, Mikkola's well studied area.

Granitic Rocks.

Rocks of granitic or semi-granitic character make up an important part of the Precambrian geology of Vest-Finnmark. As stated earlier they occur in two broad belts, one in the west and the other in the east. The latter clearly forms a part of the central granite-gneiss area of inner Finnmark. Between these belts the rocks are mainly schistose (the westerly supracrustals), but they contain two granitic bodies of intrusive type (Naššajokka and Datkovarre granites). Granitization in this inter-granite area is limited to a small occurrence in the vicinity of Bartašjavrre and an even smaller one about 2 km SE of Masi. In both cases albite is the main feldspar present along with quartz.

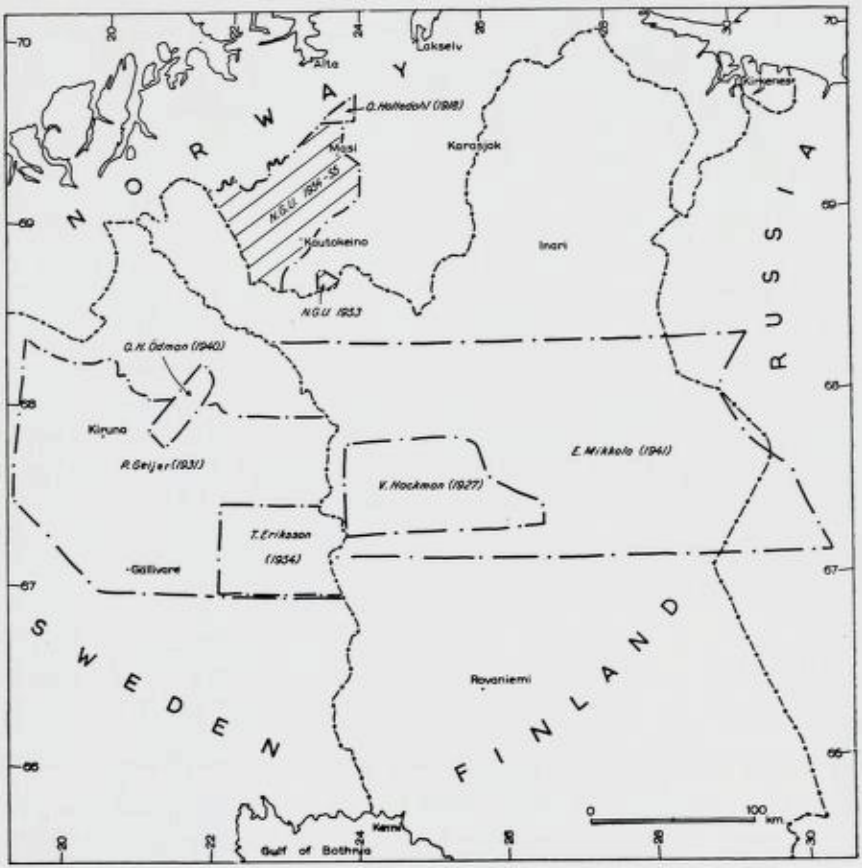

Fig. 9. Map showing location of areas in Lappland for which geological information is available.

Kart som viser beliggenheten av områder i «Lappland» hvorfra geologiske opplysninger er tilgjengelige.

The two main belts of granitic rocks are in the highest degree inhomogeneous. Variable amounts of granitic material (quartz, feldspar, mica) are associated with schists. The latter are clearly relics from former schistose formations which have been later granitized. The most persistent types are the quartzites and amphibolites but junctions are often diffuse and a gradual transition to granite or granite-gneiss is common. More massive granite bodies are however found locally.

The granitic rocks as a whole are therefore treated as follow:

1. Naššajokka granite,
2. Datkovarre granite,
3. Eastern zone,
4. Western zone.

1. The Naššajokka Granite.

In the northerly part of the area (P. Holmsen's area), close to the Hyolithus zone a body of albite granite occurs in the schists of area 8. Good exposures occur in and near the Naššajokka, a stream flowing nearly along the contact of this group with the basal layers of the Hyolithus zone.

The granite has reddish albite feldspar and is quite massive. It appears to have a fine-grained chilled border zone. Apophyses of albite granite occur in the wall-rocks. It seems to be in all respects intrusive.

2. The Datkovarre Granite.

A sharply defined mass of granite is located some 8 km. SW of Biggeluobbal. It gives rise to two hills trending parallel to each other in a NNE direction and forming the highest parts of Datkovarre.

The granite was first discovered in 1954 by Padget who along with G. C. McCandless subjected it to more detailed examination in 1955. Special attention was paid to the contact phenomena. Details are shown in the sketch-map, fig. 10.

The granite is clearly a tabular or sill-like body lying conformably in mica-schists. It shows its greatest extension between SSW and NNE, i. e. parallel to the fold axes and regional lineation. The area of granite exposed is about 2 square kilometres. It disappears down the plunge of the lineation to the SSW. Relics of the roof are probably represented by schists on the highest parts of Datkovarre. Relics of the granite to the west and north separated from the main outcrop probably represent former extensions of the granite in these directions. The deduced form of the granite as seen in cross-section, i. e. right angles to lineation, is shown in fig. 11.

The granite itself is commonly massive though frequently shows planar foliation. It is largely composed of albite (An_{10}),

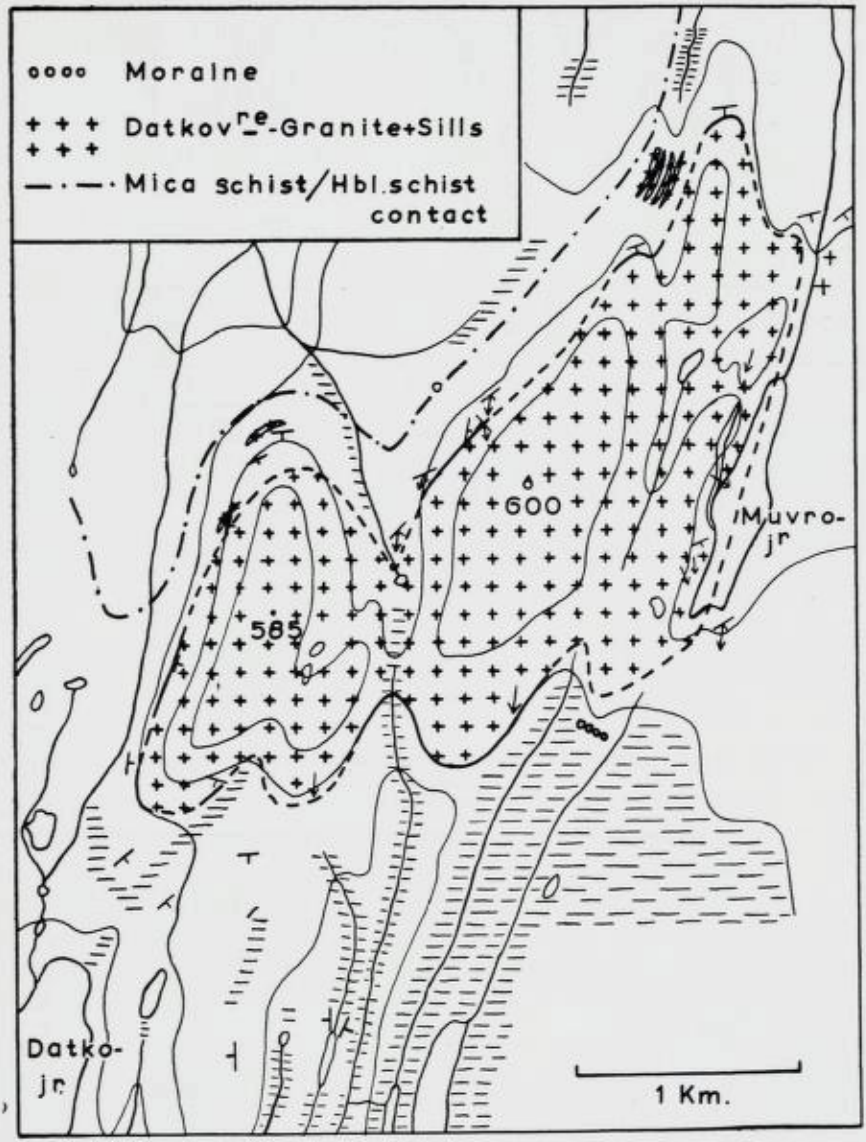

Fig. 10. The Datkovarre granite (after G. C. McCandless).
Datkovarre-granitten (etter G. C. McCandles).

quartz and small quantities of microcline, biotite and muscovite. The albite tends to be slightly porphyritic while the quartz often appears to have corroded the feldspars. In addition there are numerous irregular veins and bodies of milky white quartz in many places and more coarsely crystalline pegmatite areas in others.

The upper and lower limits of the granite are multiple in that there is a zone, typically about 20 m thick, in which «screens» of mica-schist alternate with sills of granite and quartz.

Individual sills vary from 1—2 metres and these are sometimes more fine-grained than the normal granite. They can be rarely followed for more than a few hundred metres.

At some places, notably along the eastern margin (W side of Muvrojavrre) the schists are steeply bent up against and around the granite (fig. 11). Extensive screens of schist are included within the granite. Shearing is often evident. The whole seems to indicate a forceful intrusion of granitic material into the schists, probably travelling up the lineation and fold axes from the SSW.

3. Eastern Zone.

The granitic rocks in the easterly part of the area extend from the region of Dabmutjavrre south and SSW to Særradas and possibly to the extreme SE corner of the area. They are clearly only the westerly part of the extensive granite/gneiss area of inner Finnmark (see map of Tellef Dahll in Reusch, 1891). Its border with the schists is quite sharp and appears to pass conformably beneath them on Værdnjašrapesvarre. South of here, however, it is clearly disconformable and cuts across the Masi Quartzite on Særradas. Within the area of the granitic rocks large and small lenses, schlieren, relics etc. of schists occur. These include mica-schists, greenschists, quartzites — all common types in the so-called westerly supracrustals, and soapstone (east of Dabmutjavrre). It is concluded that the eastern zone is one of extensive granitization of the synkinematic type (cf. Misch, 1949, pp. 209—245).

A full and detailed petrographical study of the rocks has not yet been possible. It is however convenient to distinguish granitized schists on the one hand from certain bodies of pegmatite-granite with reddish feldspar on the other. The first are characterized by rapid variation from layer to layer: granitic layers alternate with mica- and hornblende schists: contacts between layers are often

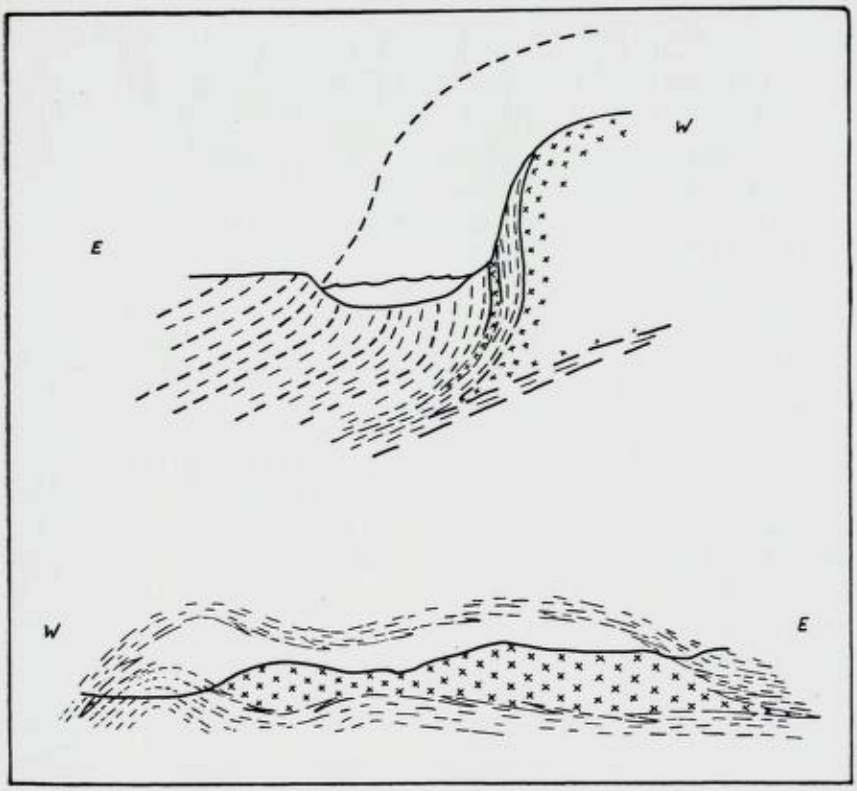

Fig. 11. The Datkovarre granite: uppermost, easterly contact near Muvrojavrre, lowermost, hypothetical section across body showing relation to the schists.

Datkovarre-granitten: øverst den østlige kontakt nær Muvrojavrre, nederst hypotetisk snitt gjennom granitten som viser forholdet til skifrene.

diffuse and schlieren of granite are common. The second are more homogeneous and coarse-grained. Quartz, microcline, albite-oligoclase, muscovite are the main minerals. The pegmatite appears to cut the granitized schists and is therefore later in age. It may however be part of the same granitization process. A body of pegmatite at Garggo-luobbal was subjected to more systematic examination owing to the presence in it of large «books» of muscovite mica. It occurs as a lens about 100 m long, 8—10 m thick at a maximum, with a N—S strike and westerly dip. The host rocks are mainly biotite-, biotite-hornblende schists, partly granitized and with a NE—SW

strike. The pegmatite therefore lies disconformable to the host rocks. Its contact with them is fairly sharp except at the ends where it tends to be diffuse. For occurrence of mica see under «Economic Geology».

Fine-grained aplitic granites also occur on Særradas and consist of quartz, microcline, oligoclase.

There is no evidence that the rocks form part of an older basement complex to the supracrustals.

4. Western Zone.

The large and prominent zone of granitic rocks to the west (see map, plate 1) has in general a NNW—SSE extension. At a maximum it is 20—25 km. broad and is clearly a continuation of similar rocks found in nearby Finland. As is the case for the eastern zone, time has not been available for a thorough petrographical study and observations in the field are not as complete as could be desired, especially in the northern part. In addition exposures are few in certain areas, due to the cover of loose deposits and vegetation.

The rocks are generally speaking banded granite-gneisses which, from the large numbers of inclusions of supracrustal schists, appear to be the result of granitization. Both the granitization and metamorphism appear to be of a high grade and the rocks are both recrystallized and completely lacking in original structures. Locally the gneiss passes into a homogeneous granite, and it is often difficult to draw sharp boundaries. Of the original supracrustals quartzite and amphibolite are the best preserved. The more important of these are shown on the regional map of the area.

A more detailed microscopical examination has been carried out by Pehkonen on the more southerly part of the western zone. It has also been possible to examine certain unpublished maps of the geology on the Finnish side of the border. The cooperation and courtesy of Arvo Matisto, of the Geological Survey of Finland, is greatly acknowledged in this respect.

The following components are recognized on the Norwegian side of the border.

a. Quartzites
b. Amphibolites
c. Sillimanite-gneiss
d. Hornblende-pyroxene gneiss

e. Biotite-plagioclase gneiss
f. Granites
g. Pegmatites
h. Aplite-granite
i. Hornblende-granite.

a. Quartzites. The elongated quartzite outcrop in the extreme south-west of the area and close to the state border is usually white or pinkish in colour and much recrystallized. It consists of quartz (71,8 %), feldspar (28,1 %), ore, zircon (0,1 %). The quartz has undulating extinction; the feldspar is mainly cloudy albite (An_5) with a little microcline. At some places micaceous layers and veins of red aplite occur.

To the SW of Galanito two narrow strips of quartzite with a N—S strike contain sillimanite. The rock is grey in colour. It also contains mica orientated in a planar fashion. Both muscovite and biotite are present, the latter sometimes with a weak pleochroism. Thin layers with fuchsite were noted at one place. The sillimanite is clearly of secondary origin and apparently related to the deformation of the rock. It occurs as fibrous, needle-like clusters on surfaces of schistosity. A little microline and plagioclase are also present, the former increasing towards the west in the direction of more vigorous granitization. The plagioclase also becomes more sodic and cloudy in this direction.

The sinuous outcrop of quartzite coincident with the high ground known as Agjet resembles that described above. It is strongly metamorphosed and recrystallized. A distinct schistosity is developed in some places due to the parallel planar orientation of the mica flakes. Sillimanite needles occur in clusters on these surfaces of schistosity, and fuchsitic mica is also seen at a few places.

The detached wedges of quartzite west of the main mass have a more variable mineral composition and the deformation is less. Quartz and plagioclase (An_{35}) are the main minerals with a little biotite, muscovite, microcline and sillimanite. Clinozoisite is present at one place.

b. Amphibolites. A large number of lenses of amphibolite are known and these are especially common in the eastern part of the area. The largest, which cuts the quartzite on the state boundary (extreme SW corner), is dark and fine-grained. It contains pyroxene

(pigeonite), altered to hornblende and a little plagioclase (An_{30}) with ore, epidote and chlorite as accessories. Usually the lenses are smaller and consist mainly of hornblende and plagioclase (An_{35}). Usually all traces of original structures have disappeared and the lens itself may be gneissic, granitized or cut by aplite and pegmatite veins. Parallel orientation of the hornblende-needles is also common, giving a lineation.

c. Sillimanite-gneiss. The rock is typically banded and contains quartz, microcline and hornblende layers. The sillimanite occurs in needles. The gneiss as a whole occurs as a narrow, discontinuous zone (N—S trend) in the area of granite-gneiss a few kilometres east of Galanito.

d. Hornblende-pyroxene gneiss. The rock is greenish in colour and consists mainly of plagioclase (An_{15}), hornblende and a pyroxene with an unusually large extinction angle (74°). From an X-ray film it is most certainly diopside. Titanite is quite common; ore, epidote and microcline occur in accessory amounts. Other exposures are similar but sometimes show more quartz and microcline. Dark layers rich in hornblende and diopside, the latter a pale green colour, are also typical for this gneiss which may be interpreted as a highly metamorphosed lime-bearing layer. It is perhaps worth comparing it with some of the older quartzites of the «Lapponia» series in N. Finland. Mikkola (1941, p. 168) states that lime-silicates such as epidote, hornblende and diopside are very characteristic of the quartzites there.

e. Biotite-plagioclase gneiss. Rocks of this type occur most abundantly to the west, on Bastevarre and both north and south of Goatte-luobbal. A typical sample of a grey gneiss type contains plagioclase 54,2 %, quartz 36,4 %, biotite 4,3 %, microcline 3,2 %, muscovite 1,4 % and ore 0,4 % with a little zircon. The plagioclase (An_{15}) occurs in rounded, often sericitized grains; the quartz has typical undulatory extinction and the mica flakes give the characteristic gneissic texture. Often however the gneiss is inhomogeneous, having bands of microcline or quartz in a plagioclase-rich matrix. The plagioclase (An_{10}) is both cloudy and sericitized. The microcline has the typical cross-hatch twinning and is clearly of later formation than the plagioclase. The commonest type of gneiss is light-coloured and has small microcline grains between somewhat larger grains of quartz and plagioclase. Flakes of biotite, orientated parallel to each

other have an intense pleochroism. At some places this rock goes over to a very quartz-rich or feldspar-rich gneiss. At others the biotite is accompanied by hornblende crystals with the usual green pleochroism. Reddish microcline gneiss is also common and locally can almost be termed microcline-granite. The gneiss as a whole is cut by narrow veins of red microcline pegmatite.

f. Granites. Characteristic for the easterly part of the zone is the presence of more homogeneous bodies of granite though it is often difficult to find sharp contacts between them and other rocks. Several lenses of amphibolite are contained within the granite and a lesser amount of biotite-plagioclase gneiss is also known to occur. The largest granite bodies are totally lacking in lineation or foliation. They can be conveniently divided into two groups on a colour basis: red and grey. The red type is dominant in the ground due west of Fallevaraš and thin sections show that the colour is due to the large amount of microcline. The grey type is especially common around Fallevaraš and has a larger amount of plagioclase (An_{25}) and quartz than microcline. The grain size also tends to be greater than in the red type. The plagioclase occurs as rounded grains which are not sericitized. Small hornblende crystals with a dark green pleochroism are also common. Accessory minerals include ilmenite, epidote, zircon.

g. Pegmatites. Throughout the granite-gneiss area a larger number of pegmatite veins, both narrow and broad are known. They are clearly the youngest rocks and are usually cross-cutting with regard to the other rocks. See fig. 12. It is also deduced that pegmatite is especially common on lines of supposed fracture, notably on and near Agjet montain. Pegmatite also occurs in the crests of certain folds (see fig. 12). The pegmatite is also shown to cut the albite-carbonate rocks at a locality 8 km south of Agjet and is therefore younger. The largest outcrop of pegmatite is on the western side of Agjet where both grey and white types occur. In a broad pegmatite vein on Hansavarre (4 km. W of Bastevarre) the graphic-granite structure is well developed.

h. Aplite-granite. Numerous exposures of a pale-reddish aplite-rock occur in a zone trending N—S in the extreme SW of the area. The rock is mainly composed of quartz, plagioclase and microcline. Biotite is only sparsely present. Muscovite, sillimanite, epidote and ore occur in accessory amounts. The plagioclase (An_{10}) is in lath-

In general, pelitic rocks are used as a basis of comparison. They occur in subordinate amounts in the Časkias group but are more common in the other formations, except for the Masi Quartzite. Index minerals apparently critical for the increasing metamorphism are chlorite, brown biotite, garnet, (staurolite) and sillimanite.

The least metamorphosed rocks are clearly those on and around Čaravarre. These were known to the earlier workers in the area (T. Dahll in Reusch, 1891, Holtedahl, 1918). As indicated under «Stratigraphy» the most common rocks are argillites, sandstones, grits which are usually compact but lack metamorphic textures. Features of primary deposition (sun-cracks, ripple-marks) were observed at several places. Only locally, close to fault-planes, is recrystallization evident.

The chlorite zone is located both east, south and west of Čaravarre. It is less easy to define and lies mainly in an area of «greenstones» (Časkias Group). The more pelitic layers however have already attained a weakly schistose character and often have lustrous surfaces with mica and chlorite in rocks of suitable composition. Good examples of this are seen in a stream 0.5— 1.0 km SW of Čuolbmajavrre. Other «greenstone» members commonly show chlorite and are visibly metamorphosed. Agglomeratic layers show slight deformation of the fragments.

The biotite zone is characterized by the appearance of brown biotite mica. The best example of this is on Datkovarre where secondary biotite is commonly developed in schists of the Dark Schist Group. The commonest rock types are biotite schists, quartz-biotite schists. Primary depositional features are rare, though ripple-marks were observed at one place. There is no special rise in metamorphism close to the Datkovarre granite.

No garnetiferous schists were seen though amphibole schists with ordinary green hornblende occur in the area (i. e. in the direction of the Masijokka and towards Biggejavrre). It seems likely that the schists lie close to the beginning of the garnet zone or may even belong to its early lower part.

Similar schists occur in the Masijokka-Suolovuobme area to the north. Here hornblende schists are common, otherwise biotite and quartz-biotite schists are the rule. Garnets are in the main absent but were found abundantly and up to 1 cm. in size at one locality, about 5.5 km SW of Suolovuobme. It seems therefore more

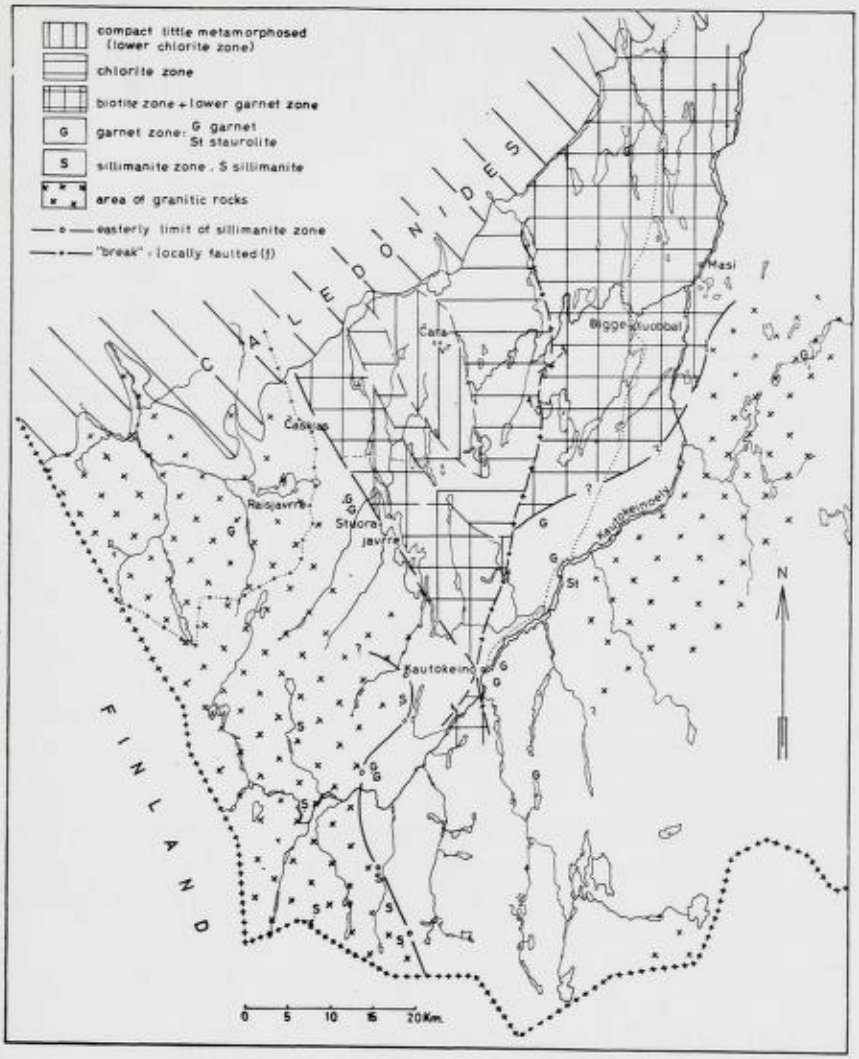

Fig. 13. Map showing the distribution of the metamorphic zones and areas of granitic rocks.

Kart som viser utbredelsen av de metamorfe soner og områder med granittiske bergarter.

convenient to speak, for the time being, of a zone corresponding to the biotite zone plus the lower part of the garnet zone. The extension of this zone west and south-west of Čaravarre is less

clearly defined, but apparently forms a belt trending nearly NW—SE. It lies between the chlorite zone and a zone of more highly metamorphosed rocks containing garnets close to the granitic area. Both ordinary green as well as actinolitic hornblende are reported by Pehkonen from thin sections of greenschists.

The garnet zone proper is characterized more particularly by garnets in mica- and hornblende-biotite-schists. Staurolite was found in a biotite-schist at one locality a little south of Miron. Localities are indicated by the symbols G (garnet), St (staurolite) on the map, fig. 13. Though few they do seem to lie in a zone conformable to and slightly within the limits of the granitic rocks. The schists as a whole lack all features of original deposition and seem to be in a higher grade of metamorphism than those of previously described zones. They may be safely assigned to the conventional garnet zone.

The sillimanite zone begins with the appearance of sillimanite. It is mainly confined to the western zone of granitic rocks where metamorphism is obviously high. Typical rock types include sillimanite-gneiss, sillimanite quartzite, the critical index mineral representing pelitic layers in the original unmetamorphosed rocks. See also under «Granitic Rocks» (western zone). It is also possible that further search may reveal the presence of a sillimanite zone in the eastern zone of granitic rocks. There is no indication of this as yet.

The regularity of the metamorphic zones is disturbed by a line of «break» which appears to run in a general N—S direction (see map, fig. 13). There is a contrast in degree of metamorphism shown by the rocks on opposite sides, those to the east normally belonging to a higher grade. This abrupt rise is readily apparent in the field. In its northern part, Holmsen reports that biotite-schists are apparently adjacent to weakly metamorphosed argillites in the vicinity of Soadnjojavrre, thus supporting the observation of Holtedahl (1918, p. 210). To the south of Kautokeino similar weakly metamorphosed argillitic rocks are found adjacent to garnet-biotite schists. In between, the break is less well known but about 2.5 km N of Njarggajavrre a NE—SW trending fault separates shales (slightly schistose) from greenschist. In a more general way there is a contrast between the rocks west of Njarggajavrre and those to the east, the latter being more highly metamorphosed. In this

area it can also be shown that there is considerable mylonitization of the rocks in several parallel zones. The «break» here therefore may be due to postmetamorphic faulting. Further north there is no positive evidence as yet for a fault. Southwards faulting is also common (e. g. W of Miron) and may be the explanation here. The break is worthy of more study.

The albite-carbonate rocks.

Rocks especially rich in albite and carbonate occur at various places throughout the area of investigation. In the field they are often light-coloured and contrast sharply with the greenstones and greenschists in which they usually occur. There is strong evidence that they are later in origin than the schists and often seem to be located on zones of brecciation and fracture.

Several occurrences have been examined in detail and the results are presented below.

1. Masijokka. The main exposures occur in the walls of the Masijokka canyon downstream from a point 1½ km. S of the road-bridge (fig. 14). Here a sequence of schists with a north-south strike is thrust upon a hornblende-schist formation (see Masijokka thrust, p. 68). The former and parts of the latter show clear enrichment in albite and carbonate with almost complete destruction of the original schistosity at some places. At others the rocks are less altered, and their original character (quartzites, mica-schists, amphibolites, graphite-schist) is discernible.

Where the carbonate component is especially large, weathering is rapid and leads to cavernous structure in the rocks. More often, however, the carbonate is intimately associated with other minerals and identification of the rock in hand specimens is difficult without previous microscopical knowledge. The following types are distinguished by Padget for the Masijokka occurrence:

I. white rock: schistose and with planar foliation, chlorite occurs on schistosity planes, otherwise rock composed of albite, quartz (clinozoisite, rutile).

II. grey rock: fine-grained, non-schistose and occasionally having clusters of yellowish carbonate (dolomite) and green actinolite; in the main fine-grained aggregate of albite, quartz, carbonate.

III. red rock: as for II but with slight hematite staining; occasional blebs of quartz give the rock a conglomeratic appearance; other minerals include plagioclase (An_{10}), carbonate, chlorite, (titanite).

IV. spotted schist: biotite flakes orientated parallel with each other and having scapolite poikiloblasts.

In general, then, the main minerals are albitic feldspar, quartz and carbonate. Common, but less abundant minerals include epidote (clinozoisite), actinolite, hematite and scapolite. Prehnite was identified from a joint filling. Magnetite, pyrite, chalcopyrite, ilmenite, molybdenite were noted in very minor quantities.

Table 1

	Weight %		Cation %		Ions +	Ions —
	1	2	1	2	1	2
SiO_2	47.17	59.55	45.3	54.1	8.8	
TiO_2	1.28	1.41	0.9	1.0	0.1	
Al_2O_3	13.57	16.96	15.4	18.2	2.8	
Fe_2O_3	2.49	0.22	1.8	1.5		0.3
FeO	10.83	1.56	8.7	1.2		7.5
MnO	0.20	0.03	0.2	tr		0.2
MgO	7.34	1.77	10.5	2.4		8.1
CaO	11.55	5.30	11.9	5.2		6.7
Na_2O	2.62	9.25	4.7	16.2	11.5	
K_2O	0.42	0.20	0.5	0.2		0.3
H_2O	1.35	0.60	(0.8)	(3.6)	(2.4)	
CO_2	0.95	3.08	(1.2)	(3.8)	(2.6)	
P_2O_5	0.13	0.09	0.1	0.1		
Sum	**99.90**	**100.02**	**100.0**	**100.1**	**23.2**	**23.1**

1. Greenschist (U6/179) Masijokka, Vest-Finnmark.
2. Altered greenschist, (U6/220) Masijokka, Vest-Finnmark.
Analyst: E. Christensen, Laboratory, Geological Survey of Norway.

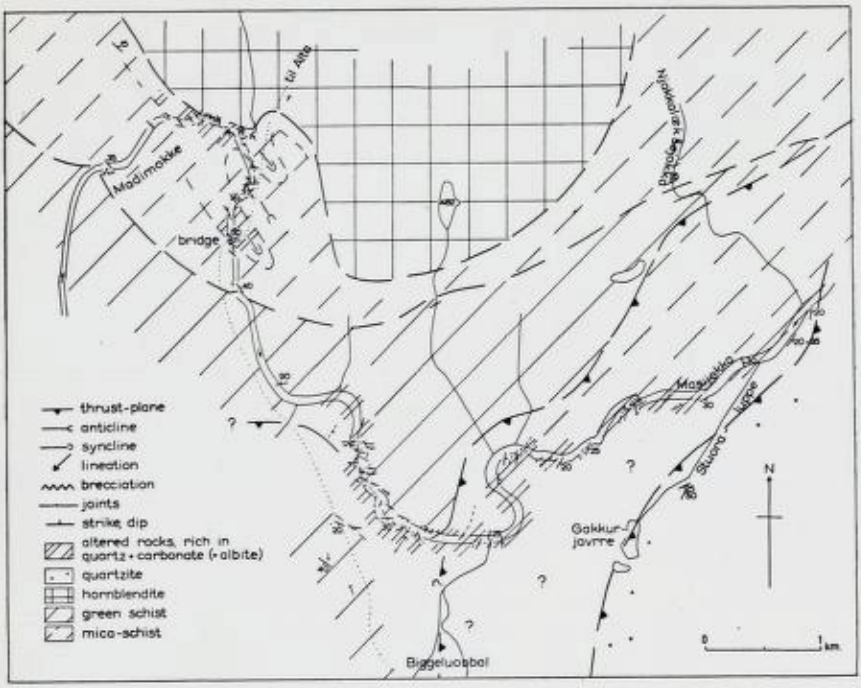

Fig. 14. Geological map of the surroundings of the Masijokka river
Geologisk kart over området langs Masijokka.

It is clear therefore that we are dealing with a distinct mineral paragenesis which gives rise to rocks entirely different from their original character both in mode of occurrence, in hand specimen and under the microscope.

In order to investigate this alteration more quantitatively chemical analyses of two samples were carried out, one of the hornblende-schist and one from an altered part of this schist formation nearby. The alteration occurred as a diffuse area of light-coloured rock in the dark greenschist. The analyses are presented in Table 1, where there is clearly an enrichment in Na, Si, CO_2 and H_2O in the altered rock.

Calculation to cation % on the lines suggested by Barth (1948, 1955) is also given and enables an estimate of the ions lost as well as gained to be obtained. Mineralogically it seems that the lime (? and magnesia) necessary to form carbonate is derived entirely

from the hornblende. There is even a loss of Ca along with Fe and Mg.

Several other types of altered rock were analysed for Na_2O and K_2O by the flamephotometric method. The results are presented below; the sample (U6/220) subjected to full silicate analysis (see table I) is presented also for comparison.

Table 2

	K_2O	Na_2O
U6/122 red rock	2.55	6.80
U6/173 red rock	3.67	4.73
U6/200 grey rock	0.13	7.60
U6/181 red rock (pseudo-conglomerate)	0.40	6.30
U6/176 white rock	0.10	8.88
U6/220 white rock	0.20	9.25

Analyst: E. Christensen, Laboratory, Geological Survey of Norway.

They all show a clear preponderance of Na_2O over K_2O and thus bear out the microscopic evidence where albite feldspar is a major mineral constituent.

2. *Gæšjavrre*. The lake called Gæšjavrre is located east of the Čaravarre—Guivevarre ridge, where there is a marked discordance between the Main Grit and the Likča—Čuojajavrre greenstones (?Časkias Group). That this is a major fault line there can be no doubt. The Grit is compact, quartzose and mylonitized for several metres from the contact and the greenschist is much brecciated. The fault broadens out into a zone around Gæšjavrre (fig. 3). Within this zone and along its continuation northwards, the rocks show a marked enrichment in carbonate (brown weathering), probably dolomite. Feldspars (albite) up to 2 cms across are embedded in it along with detached fragments of wall rock (greenschist, quartzite) — the latter showing all degrees of alteration. In fact the rock, as exposed in massive blocks a little north of Gæšjavrre, looks like a cross between a conglomerate and breccia. The paragenesis and

general mode of occurrence however leave no doubt that it belongs to the albite—carbonate group. A silicate analysis of a typical sample without the obvious fragments of greenstone etc. is given in Table 3, (Riettejokka) and further supports the conclusion.

Table 3

	wt %	Eq. mol. prop	Cation %
SiO_2	62.86	10424	60.25
TiO_2	0.50	62	0.36
Al_2O_3	13.03	2550	14.74
Fe_2O_3	1.05	132	0.76
FeO	1.36	189	1.09
MnO	0.03	4	0.02
MgO	2.37	588	3.40
CaO	4.29	765	4.42
Na_2O	7.27	2346	13.56
K_2O	1.05	222	1.28
H_2O	0.50	(554)	(3.20)
CO_2	5.57	(1266)	(7.32)
P_2O_5	0.13	18	0.10
Sum	**100.01**	**17300**	**99.98**

Calculated mode:

Albite	68.0	ca. An_5
Anorthite	3.0	
Biotite	6.7	
Carbonate:		
$FeCO_3$ 0.3		
$MgCO_3$ 3.3	7.3	
$CaCO_3$ 3.7		
Apatite	0.2	
Quartz	16.3	
	101.5	

Riettejokka (T 7/44). P. Padget collection 1955.

Analyst: E. Christensen, Laboratory, Geological Survey of Norway.

3. Avžže. In a north-south going valley about 5,5 kms east of Kautokeino rocks rich in albite and carbonate are especially common. They probably form part of a broad zone extending northwards across the Kautokeinoelv (see map of the area). In this zone carbonate occurs both in veins and in irregular lenses. Thin sections of the rock show albite, quartz and sometimes biotite to be present. There is also strong evidence that faulting has taken place; brecciation structures are commonly traceable, and much of the quartz shows undulating extinction. Sulphides are present in small quantities near the road-bridge over the Čabardasjokka. The altered rocks seem to have been originally greenstones, (?Časkias Group). It should be emphasized that less altered types are common within the general zone of alteration.

4. East of Kautokeino. A parallel zone a little nearer Kauto-

keino also seems to correspond to a major fault zone (see map of the area plate 1). It shows similar albite-rich rocks, but systematic field work has not yet been carried out.

5. *Galanito*. Between Galanito and Kautokeino a number of exposures and loose blocks of reddish-brown rock occur. The rock is medium-grained and consists mainly of lath-like plagioclase of composition An_{10}. The central parts of the crystals are clouded with sericite and chlorite flakes. Quartz, chlorite, epidote, microcline and ore occur as accessories. Veins of dark red hematite occur in a few places. The north-westerly contact zone is brecciated and contains zones of a reddish carbonate (ankerite-dolomite) with quartz veins. Veins of carbonate also penetrate the wall rocks (locally agglomerate). The south-easterly contact is not well exposed, but appears to be brecciated with albite veins penetrating the diabasic wall-rock.

The occurrence is clearly of the albite-diabase type except that albite-rich rocks are separated from carbonate. It also appears rather vein-like *en masse* but is clearly later than the surrounding schists and is located on a breccia zone.

6. *Časkias (Bidjovagge)*. On the gentle northerly slopes of the mountain called Časkias, 10 km N of Raisjavrre and 1 km east of the Troms/Finnmark border, a zone of light-coloured rock occurs in the prevailing greenschists and diabases. The latter are steeply dipping and form a part of the Časkias group. Thinner horizons of slightly graphitic schist are also present.

The zone which runs parallel to the strike of the rocks is from 1—1½ km long and 150—200 m wide at a maximum. More particularly, it is confined to a zone of amphibolite or diabasic rock, about 500 m wide with subsidiary graphite layers.

The light-coloured rock has been called a quartzite in the field, but thin-section analysis shows it to be composed mainly of fine-grained albite, quartz and carbonate. There is also a rock termed leuco-diabase, which has an ophitic texture and is rich in both hornblende and carbonate. This is presumably a less completely altered diabase. Carbonate also occurs as distinct lenses, schlieren, in diabase. It is not uncommon to find chalcopyrite, pyrite and hematite associated with such rocks. The presence of these minerals is in fact the reason for certain mineral claims and for current exploration by diamond-drilling.

There is evidence to show that a certain amount of brecciation of the rock has taken place within the zone. Thus the graphitic schist is locally brecciated and at one place has a chalcopyrite infilling. Shearing and small-scale crumpling of the beds are also seen. The existence of a fold feature is difficult to prove owing to the very steep dip of the beds.

The secondary mineral paragenesis therefore is mainly carbonate, albite and quartz with variable amounts of chalcopyrite and pyrite and hematite. Traces of molybdenite were also found. The presence of a radioactive mineral in the rock is also known, but has not yet been identified.

This paragenesis clearly shows strong resemblance to that in the Masijokka and elsewhere. It also occurs in amphibole-bearing rocks and where there is some evidence of brecciation (faulting).

7. Njallavžže. In the westerly part of the area, Njallavžže, a tributary valley to the Raisjavrre—Reisadalen drainage, has good outcrops of carbonate-rich rocks. From the regional geology it is clear that these lie in a broad zone of greenstones and greenschists. The latter show highly irregular dips and strikes near the valley, and as mentioned above, are rich in carbonate. It seems likely that a fracture zone runs more or less parallel with Njallavžže, (i. e. SW—NE) and thus crosses the prevailing strike of the beds (NNW—SSE). Some of the rocks are radioactive. A typical specimen is dull reddish in colour and in thin section is seen to consist mainly of albite, quartz and biotite. The albite crystals are much broken with displacement of the twin lamellae and showing undulose extinctions. The quartz also shows undulose extinction. Fragments of both quartz and albite have greenish biotite wrapped around them and the whole is impregnated with carbonate. Often thin sections show variable amounts of hornblende.

Mineralogically therefore the rocks resemble those previously described. The chief difference however, is the later brecciation which the albite and quartz have undergone. This does not, however, preclude the possibility that the alteration as a whole was located on an earlier formed fracture zone in the greenschists. A chemical analysis (Table 4) shows that the rocks lie close to those from the Masijokka except in the higher Fe content. This seems to be readily explained by the presence of the fine-grained hematite pigment which gives the rocks a dull red colour.

Table 4

	wt %	Eq. mol. prop	Cation %
SiO_2	58.61	9720	54.48
TiO_2	0.05	6	0.03
Al_2O_3	16.84	3296	18.48
Fe_2O_3	3.22	404	2.26
FeO	0.92	128	0.72
MnO	0.03	4	0.02
MgO	1.44	357	2.00
CaO	5.12	913	5.12
Na_2O	9.23	2978	16.69
K_2O	0.15	32	0.18
H_2O	0.90	(1000)	(5.60)
CO_2	3.43	(780)	(4.37)
P_2O_5	0.01	2	0.01
Sum	**99.95**	**17840**	**99.99**

Calculated mode:

Albite	83.5	ca. An_5
Anorthite	4.0	
Biotite	6.5	
Carbonate:		
$CaCO_3$	4.3	
$(Mg, Fe)CO_3$	0.1	
Hematite	2.1	
	100.5	

Njallavžže (S 7/156) T. Gjelsvik collection 1955.

Analyst: E. Christensen, Laboratory, Geological Survey of Norway.

8. Other occurrences. Numerous small-scale occurrences are known, often limited to a single exposure. They all occur in the «greenstone» area (Časkias Group) and a few show additional features of interest. Thus veins of albite—carbonate rock are seen to cut diabase on the east-side of Časkias (see map, fig. 23). At Čuojavarre, SE of Stuorajavrre magnetite and iron and copper sulphides are sparsely distributed in a vein whose limits are unfortunately not well exposed. An analysis of the albite—carbonate rock is presented in Table 5, where the high Fe content (cf. Table 6) is accounted for by the presence of visible amounts of Fe ore in the hand specimen. A further example is on the west-facing slopes of the area known as *Suvravarre,* where a thick diabase shows gradual alteration to an albite—carbonate rock. At an intermediate stage albite porphyroblasts occur in the diabase which still retains a vague ophitic texture. The hornblende also disappears and its place is taken by carbonate and chlorite (?penninite). Certain joints have a vein-like infilling consisting of quartz, carbonate and chalcopyrite.

Table 5

	wt %	Eq. mol. prop	Cation %
SiO_2	52.64	8730	51.55
TiO_2	2.96	369	2.18
Al_2O_3	14.81	2898	17.11
Fe_2O_3	4.81	602	3.55
FeO	1.01	141	0.83
MnO	0.02	3	0.02
MgO	2.50	620	3.66
CaO	4.21	751	4.43
Na_2O	8.58	2768	16.34
K_2O	0.11	24	0.14
H_2O	0.45	(500)	(0.30)
CO_2	5.66	(1286)	(7.59)
P_2O_5	0.21	30	0.18
S	3.05	(951)	(5.62)
— O for S	1.14		
Sum	**99.88**	**16936**	**99.99**

Calculated mode:

Albite	81.5	ca. An_5
Anorthite	4.0	

Carbonate:

$CaCO_3$	3.4
$MgCO_3$	3.4
$FeCO_3$	0.8
Chlorite	0.8
Pyrite	2.8
Quartz	1.1
Apatite	0.4
Ore	3.1
	101.3

Čuojavarre (Stuorajavrre) T 7/2028. E. Pehkonen collection.

Analyst: E. Christensen, Laboratory, Geological Survey of Norway.

At *Riettejavrre* similar relationships to those at Suvravarre are seen. The occurrence (due east of Čaravarre summit), though small, is considered very typical.

Finally *north of Dædnomuotke* in the western part of the area, Gjelsvik found a vein of carbonate with a little chalcopyrite and bornite.

Conclusions. The albite—carbonate rocks occur almost entirely in areas of greenstone, greenschist or diabase (Časkias Group), and never in areas of granitization or granite-gneiss. They show a particular concentration along or close to lines of faulting or brecciation. At Njallavžže a later brecciation of the albite—carbonate rock was observed.

The rocks form a distinct mineral paragenesis involving alteration of the host rocks (greenstones etc.) by addition of Na, Si, CO_2 and H_2O, and loss of Fe, Mg and Ca. The movement of these

elements appears to have been metasomatic. Only in the case of joint fillings can a fluid phase be postulated and is quantitatively of minor importance.

Comparisons elsewhere.

Apparently similar rocks are described from the extensive Precambrian terrain of N. Finland. Thus Hackman (1927, p. 23—24) mentions a leucodiabase consisting of carbonate, albite, muscovite, iron-ore and pyrite in thin veins and schlieren from the town of Sirkka at the foot of Levitunturi.

Again Väyrynen (1938, p. 74) speaks of an albite-fels with carbonate, albite, quartz, chlorite, a pale-coloured amphibole and ore. This he considered to be a sufficiently distinct rock to have a specific name. He therefore introduced the term Karjalite (Karjalitt) from Karjala, the Finnish word for Karelia where several occurrences of the rock are known. Both coarse and fine-grained types occur. They normally have an irregular, partly vein-like form.

Finally, Mikkola (1941, p. 253) describes an albitic diabase with dolomitic carbonate. The rock weathers white or slightly reddish and has an irregular vein-like character. The rock is typically fine-grained and the mineral grains distinctly anhedral. There is no particular mention of sulphides. Mikkola's analysis is given in Table 6 for comparison with those from Vest-Finnmark. Both Väyrynen and Mikkola have expressed views on the origin of the rocks. Väyrynen, for example, considers them to be the end member of a series of basic rocks, thereby implying a magmatic origin. Mikkola (1941, p. 253) believes that «.... the entire formation of these rocks is duly to be explained by the extreme concentration of highly aqueous late magmatic solutions charged with carbon dioxide of which the crystallization occurred at very low temperature». He also emphasizes the relation to diabases containing albite. For the Vest-Finnmark occurrences special emphasis is placed on the metasomatic migration of elements and their location on fracture zones.

The ultimate derivation of the added material (CO_2, H_2O, Na, Si) is as yet undecided for Vest-Finnmark, but it may be derived from the same magmatic reservoir as that responsible for the basic rocks. However, a time interval probably intervenes since the albite—carbonate rocks are mainly post-metamorphism and post-faulting.

Table 6

	1	2	3	4	5
SiO_2	58.61	52.64	62.86	59.55	60.54
TiO_2	0.05	2.96	0.50	1.41	0.45
Al_2O_3	16.84	14.81	13.03	16.96	11.85
Fe_2O_3	3.22	4.81	1.05	0.22	0.10
FeO	0.92	1.01	1.36	1.56	0.81
MnO	0.03	0.02	0.03	0.03	0.05
MgO	1.44	2.50	2.37	1.77	3.82
CaO	5.12	4.21	4.29	5.30	5.94
Na_2O	9.23	8.58	7.27	9.25	6.66
K_2O	0.15	0.11	1.05	0.20	0.30
H_2O	0.90	0.45	0.50	0.60	0.52
CO_2	3.43	5.66	5.57	3.08	8.46
P_2O_5	0.01	0.21	0.13	0.09	0.17
S		3.05			
Sum	**99.95**	101.02	**100.01**	**100.02**	**99.67**
— O for S		1.14			
		99.88			

1. Njallavžže: Specimen, S7/156 of radioactive rock from canyon wall: T. Gjelsvik collection 1955.
2. Čuojavarre: E of Stuorajavrre: typical albite—carbonate rock with sulphides T7/2028: E. Pehkonen collection 1955.
3. Riettejokka: N of Gæšjavrre: typical alteration (albite—carbonate) rock, T7/44: P. Padget collection 1955.
4. Masijokka: 3 km SSE of road-bridge, from floor of canyon. P. Padget collection 1954 (as given in Table 1).
5. W.shore of Kitinen River in the village of Petkula, Sodankylä. Albite rock (karjalite). Mikkola, 1941, p. 254.

Analyses 1—4 carried out by E. Christensen, Laboratory, Geological Survey of Norway.

«Greenstones».

Under the heading of «greenstones» are included several types of rock, usually greenish in colour and chemically similar but varying in mode of origin and mode of occurrence. They include on the one hand green schists and agglomerates, sedimentary or pyroclastic in origin; on the other, diabases, dolerites, hornblendites and amphibolites of intrusive origin.

It is convenient to distinguish:

1. Later basic intrusives: post-metamorphism, probably post-kinematic also:
2. Intrusives and extrusives associated with the Časkias Group.

1. Later basic intrusives. There rocks are usually of basic or ultrabasic type and quantitatively are not very important. However, they presumably represent a distinct phase of igneous intrusion, later than the regional metamorphism, tectonic deformation and probably also the metasomatic alteration (albite—carbonate rocks). The following groups are distinguished:

a) Dolerites — medium-grained rocks occurring in dyke-like or lens-like bodies and containing pyroxene, sometimes altered in part to hornblende. In one case it was shown that the pyroxene was pigeonite. Olivine, usually altered to serpentine is also common and a little titanite and ore are usually present. The outstanding occurrences are in the easterly granitic area, namely on Særradas and Gætkaš, where dykes a few metres wide cut both the coarse pegmatites as well as the metamorphosed and granitized rocks, proving conclusively their later intrusive character. In mode of occurrence Oftedahl reports that they resemble dykes of the Oslo region. Chilled margins were seen in a few places.

Similar rocks were seen in the valley north of Avžže, about 6 km NE of Kautokeino. Here their limits are not so clearly defined but they appear to be intrusive into the albite—carbonate rocks which are the result of metasomatic alteration of greenschists etc. Chilled margins were observed. Plagioclase (An_{10}, An_{35}), hornblende with cores of pyroxene are the main minerals. Titanite and «ore» are accessory. An ophitic texture is often visible.

b) Albite-diabases. These consist mainly of albitic feldspar and hornblende in a weakly metamorphosed condition. They are quantitatively more important than the dolerites and occur in thick, lens-like bodies often more or less conformable with the host-rocks. The chief occurrences are around the Fidnatjokka with extensions NE and SW; near Biennejavrre (3 km E of Masi) and Storfossen on the Kautokeinoelv. Smaller occurrences are known from Garrovarre (NE of Miron fjellstue) and Spielggajavrre, just south of Biggejavrre. It will be seen that

Table 7

	1	2	
	wt %	wt %	mol. prop
SiO_2	48.64	54.63	9060
TiO_2	2.60	2.18	272
Al_2O_3	13.15	13.85	1355
Fe_2O_3	3.47	5.60	351
FeO	10.68	5.24	729
MnO	0.25	0.10	14
MgO	6.45	3.88	962
CaO	8.13	6.91	1232
Na_2O	3.26	5.93	956
K_2O	0.88	0.71	75
H_2O	2.10	0.58	322
CO_2		0.23	52
P_2O_5	0.14	0.15	11
Sum	**99.75**	**99.99**	15391

CIPW norm		
	Q	1.79
	Or	4.17
	Ab	50.09
	An	9.01
Di	Wo	9.80
Di	En	7.51
Di	Hy	1.24
Hy	En	2.11
Hy	Hy	0.34
	Mt	8.14
	Il	4.13
	Ab	0.37
	Cc	0.52
		99.22

1. Albite-diabase: average of 3, N. Finland (Mikkola, 1941, pp. 249—250).
2. Exposures at side of lake Biennejavrre, 3 km E of Masi, Vest-Finnmark.

Analyst: E. Christensen. Laboratory, Geological Survey of Norway.

these localities correspond almost exactly with the Masi Quartzite belt. They show their greatest elongation parallel to the strike of the Quartzite.

Mineralogically they consist of green hornblende, albite (An_{5-10}) often with a pinkish colour and small quantities of titanite and epidote. The feldspar is usually fairly clear and often, though not always, in elongated laths forming a sub-ophitic to ophitic texture. Grain size is variable, varying from fine-grained to coarse-grained. There is also variation in the colour index. Small quantities of ore minerals are usually present, e. g. ilmenite, magnetite and locally pyrite or pyrrhotite. A magnetic anomaly at Fidnatjokka (see also under «Economic Geology») may be due to the presence of such minerals.

There is often the sharpest contrast between the unmetamorphosed character of the albite-diabase and the host rock. The latter, usually quartzite, is often highly deformed and much

recrystallized due to thrusting. It is therefore suggested that the diabases were intruded into these planes or zones of movement.

Chemical analysis of a typical specimen from Biennejavrre is given in Table 7 above. Also given is a composite analysis of 3 so-called albite-diabases from N. Finland (see Mikkola, 1941).

c) Hornblendites. These rather distinctive rocks are characterized by the presence of hornblende with only small amounts of other minerals. The chief occurrences lie between the Masijokka and the road junction where the road from Masi joins the main Alta—Kautokeino highway (plate 1). They occur in the Dark Schist Group and are intruded into both mica-schists and green-schists. Four distinct and separated masses occur and all appear to be rather thick and lens-like. They lie apparently more or less conformable to the schists and there is often evidence of movement in the schists immediately below.

Hornblende and biotite are the main constituents. Carbonate, scapolite and chlorite are also present in some samples from the large lens exposed in a north loop of the Masijokka, 1 km. NNW of the road-bridge and are apparently later alteration products. The scapolite is filled with a large number of tiny mineral inclusions. There is no marked foliation or schistosity and the rocks seem best interpreted as sill-like intrusions.

d) Quartz-diorite. The rock is located on some high ground called Junkavarre, 2 km W of Galanito where two exposures only are known. There are, however, a large number of loose blocks of the same rock to be seen on the hill. The deduced form is that of an oval with the longer axis nearly E—W. No contacts with the surrounding rocks are exposed but veins of the nearby pegmatite-granite cut the quartz-diorite in one exposure. (See map, plate 1.)

Mineralogically the rock is grey in colour and of medium grain. It consists of plagioclase in laths, and often with a distinct zonal structure. The outer part has plagioclase of composition An_{15} becoming more anorthitic towards the centre. The feldspar is however generally much altered and both sericite and scapolite are commonly present. Hornblende and quartz are also common while microcline, biotite, titanite and

ore occur as accessories. The microcline appears to be younger than the plagioclase feldspar.

Rocks with a similar mineralogy are described from N. Finland (Mikkola, 1941, pp. 269—273).

Regionally speaking it should be noted that the rock occurs near a sharp swing in the general strike direction. The distinctive chemical composition and apparently circumscribed nature of the outcrop suggest that the rock is intrusive though this is by no means proved. It appears, however, to be at least pregranitization in age.

2. Časkias Group. Some description of the rock types of this group has already been given in the section on Stratigraphy. They are dominantly «greenstones» in the widest sense, though clearly including several different types. It is convenient to distinguish the following:

a) pyroclastics,
b) lavas,
c) intrusives.

a) Pyroclastics. Agglomerates with large and small angular fragments of «greenstone» (and occasionally phyllite) in a «greenstone» matrix, e. g. NNW—SSE trending zone on Likča mountain. Fine-grained tuffs are less easy to prove. The metamorphism frequently destroys the finer clastic texture as may be seen in similar rocks around Alta (Raipas). It is possible that some of the greenschists are altered pyroclasts. Certain greenschists, 4,1 km E of Časkias (774) had a very tuffitic character in thin-section according to Pehkonen (fig. 23).

b) Lavas. It is rarely possible to prove the existence of former lava flows due to later metamorphism of the rocks. A few structures do however suggest a lava origin for some of the greenstones. Thus Holmsen found a vague curvaceous banding in certain greenstones in the Likča area, which he interpreted as a former pillow-lava. This and several other greenstones elsewhere are often cavernous, suggesting the existence of segregations of former carbonate (?zeolite) minerals. Again in some greenstones a porphyritic structure is present which could be interpreted as relict amygdules.

Finally mention should be made of thick units of a rather dense, fine-grained greenstone which are apparently interlayered

with the other rocks. A good example occurs on Biello-gielas, SE of Čaravarre. These may possibly represent thick lava flows, possibly of submarine character.

At one place (Čuojavarre), near the SE end of Stuora-javrre, Pehkonen has shown that such a rock is locally discordant and shows a fine-grained (?chilled) border zone.

c) Intrusives. At many places coarse to medium-grained rocks (diabases) occur. They have rather irregular shapes but show elongation in the direction of the main strike. A few are shown on the map of the area.

Mineralogically they consist of hornblende and often also albite, the latter occasionally sericitized. Chlorite, biotite, epidote, titanite, apatite and ore may be present in small amounts. Primary pyroxene is sometimes visible and an ophitic texture may be preserved. They thus resemble the albite-diabases described above. At a few places similar rocks show a banding and resemble amphibolites more closely. This is more particularly the case in the areas of granitization. Some rocks especially rich in hornblende are virtually hornblendites and mineralogically and texturally resemble those from the Dark Schist Group described above.

Conclusions. The Časkias Group as a whole presumably represents a major and prolonged phase of igneous activity. It is not therefore unreasonable to have both extrusive and intrusive rocks represented. Whether the albite-diabases and hornblendites of this group belong to the same phase of intrusion as those described previously is not known. It seems more likely that some at least are contemporaneous with the formation of the group. Others may be later (i. e. post-metamorphism, post-deformation). The dolerites clearly belong to the latter.

Volcanic groups resembling the Časkias Group are well known from the remainder of the Precambrian of Lapland. Mikkola (1941, pp. 259—261) speaks of the «average greenstone magna» of Lapland, and an average of 8 analyses shows a close correspondence with Daly's plateau basalt (Daly, 1933, p. 17). Too few analyses are available from Vest-Finnmark to allow comparisons but it seems highly probable that there is a general similarity.

Fuchsite-bearing rocks.

Since the beginning of the survey in Vest-Finnmark the attention of the geologists has been continually arrested by bright green fuchsite mica in certain quartzitic and conglomeratic rocks. The outstanding examples are the Agjet Quartzite and the Masi Conglomerate. In the former, the fuchsite occurs in thin lamellae in the slightly arkosic quartzite. In the latter it occurs as slender, pale green laths in the planes of schistosity between granite and quartz pebbles.

Numerous loose fragments of both are common in morainic and fluvio-glacial sediments.

Little quantitative work has been carried out, but chemical analysis of a particularly rich sample from a road-side exposure, near Fidnatjokka, showed 1400 g/ton Cr. This may be compared with certain determinations from Mikkola's area in the southern part of Lapland (Rankama and Sahama, 1950, p. 623):

Quartzites	68—200	g/ton
Al-rich schists	410—680	»
Carbonate rocks . .	2	»

Little mention is made by Mikkola of the occurrence of fuchsite, an exception being a green carbonate rock from the Nilivaara—Jeesiöjärvi region in Kittilä in which the green colour is ascribed to fuchsite (1941, p. 215).

Generally speaking, however, fuchsite is very often found in metamorphosed rocks, especially micaceous quartzites and mica-schists (Winchell, 1933, p. 270), and the occurrences in Vest-Finnmark may be regarded as normal.

Rankama and Sahama (1950, p. 623) point out the tendency for Cr to concentrate in ultrabasics and on weathering in resistates along with Al and Fe.

Regarding origin of the Cr it would appear therefore that small quantities were present in the sediments, possibly in the form of chromite derived from the weathering of ultra-basic roks. On metamorphism the Cr entered into the mica molecule.

Sodic feldspar in the rocks of Vest-Finnmark.

A striking feature of the rocks of Vest-Finnmark is the relative abundance of albite feldspar. This has become increasingly evident with the progress of the microscopical investigation. The main rock groups concerned include:

a. Dark Schist Group: 3 occurrences where the schists have the paragenesis albite-mica-quartz. (Njakkalækšejokka, roadside exposure ca. 1 km SE of the road junction to Masi, Havggajavvre 6,5 km W of the road junction). Quantitatively very small.
b. Datkovarre and Naššajokka granites: These are principally albite granites and are of intrusive origin.
c. Granitic zones, eastern and western. The feldspar formed as a result of granitization is commonly albite or oligoclase as in the biotite-plagioclase gneiss. The pegmatite, aplite granite and hornblende granite also have a similar feldspar. But it should be remembered that K-feldspar is also often abundant locally and may exceed the albite quantitatively.
d. Albite-diabases. Albite is a common component of certain diabasic intrusives, notably those in the Masi Quartzite and those in the areas of «greenstone» (Časkias Group).
e. Albite—carbonate rocks. The widespread occurrences of this group are often especially rich in albite (up to 10 % Na_2O in analysis). They represent a process of later metasomatism, involving enrichment in Na.
f. Časkias Group. In addition to the albite-diabases certain fine-grained greenschists also show albite in small quantities.

The interesting feature is the occurrence of albite in rocks taken from different parts of the area and from different geological milieux. Thus it occurs in intrusive rocks with both basic affinities (albite-diabases) and acid affinities (granite). It is also introduced by metasomatic transfer as in the granitized rocks and the albite—carbonate rocks. The occurrence in the schists is more difficult to understand, but it is to be expected in those of suitable chemical composition metamorphosed in greenschist or low epidote-amphibolite facies. Some metasomatism may have been in operation here also.

The albite has therefore a wide distribution in both time and space.

Structure.

During the course of the field-work a considerable amount of structural information has accumulated. This includes mylonitization, brecciation and recrystallization of the rocks as seen in individual exposures, while mapping has revealed the existence of both major and minor folds as well as certain major faults and overthrusts. It has to be admitted that many small details are not readily explicable and lack of exposures frequently prevents a structure to be followed in its entirety. The uncertainty regarding stratigraphical correlation also hinders full understanding. Even so the regional picture and general style of tectonics can be demonstrated. See map, Pl. II.

In the first instance it is convenient to divide the area up into 4 distinct tectonic regions, as indicated in fig. 15. These are:

1) Westerly region:
2) Easterly region:
3) Datkovarre region:
4) Masijokka—Suolovuobme region.

1) Westerly region. This includes nearly 70 % of the total area and is dominated by beds having a fairly constant or gradually changing strike. This varies between NNW and NW but local irregularities occur as in the ground west of Galanito, where a more E— W strike is attained. In general the present layering represents the original layering of the beds. In the granitized area granitic layers alternate with more schistose layers, and it is perhaps more true to speak of foliation. The main structural elements are:

a. Folds.

I. The Čuojajavrre syncline, east of Čaravarre. The thick «greenstone» group (?Časkias Group) is folded into a syncline with a NNW—SSE strike. It is entirely deduced from a progressive change in the value and direction of dip on crossing the strike.

II. West of Čuolbmajavrre. Folds with axes NNW—SSE deduced from similar evidence to I.

III. Agjet anticline, east of Kautokeino, A sharp fold outlined by the Agjet Quartzite—Časkias Group contact. Axis NS in south, NNE—SSW in north, plunging in both directions, i. e. S and NNE. Westerly limb cut out by a steeply inclined reversed fault.

IV. The Favresjokka anticline in the extreme south of the area. An anticlinal fold with an axial trend NNW—SSE, plunging in both directions. It is on the axial continuation of the Agjet anticline.

V. Agjet—Časkias syncline. General axial direction N—S. The existence of this syncline is less well substantiated. It is largely determined by the nature of the dips around Agjet, south and east of Časkias and west of Stuorajavrre. The central part is poorly exposed and less well known. Its axis does however conform to the regional trend, while in the Agjet region it could be the complementary syncline to the Agjet and Favresjokka anticline. In the much studied area of Časkias the steep or vertical beds are located on the axial part of the fold.

b. Culminations. Several of the above folds show axial culminations (and depressions). They are indicated on the map (pl. II). The most important are those at Agjet and Favresjokka. A depression may separate the two.

c. Small folds. Several small folds are often present but these do not always have their axes parallel to the regional trend (see map).

d. Lineation. This feature also shows divergences from the regional plan, especially in the more extensively granitized area. The direction of plunge, however, is usually away from the axes of culmination.

e. Faults. These are also of major importance in the structure of the westerly region. Owing to difficulties of stratigraphical correlation, however, it is not always certain what is the extent of displacement or its direction. A further complication is the steep dip of the beds in which the faults occur. The chief faults are as follows:

I. Agjet: a steep reversed fault cuts out the westerly limb of the Agjet anticline. Two parallel faults probably separate the quartzite wedges from each other and from the Časkias Group to the west. See profile, fig. 16. There is much coarse-grained pegmatite located along the presumed fault-planes. These faults probably continue towards Stuorajavrre where they are lost.

II. Čuolbmajavrre. Good exposures around this lake and to

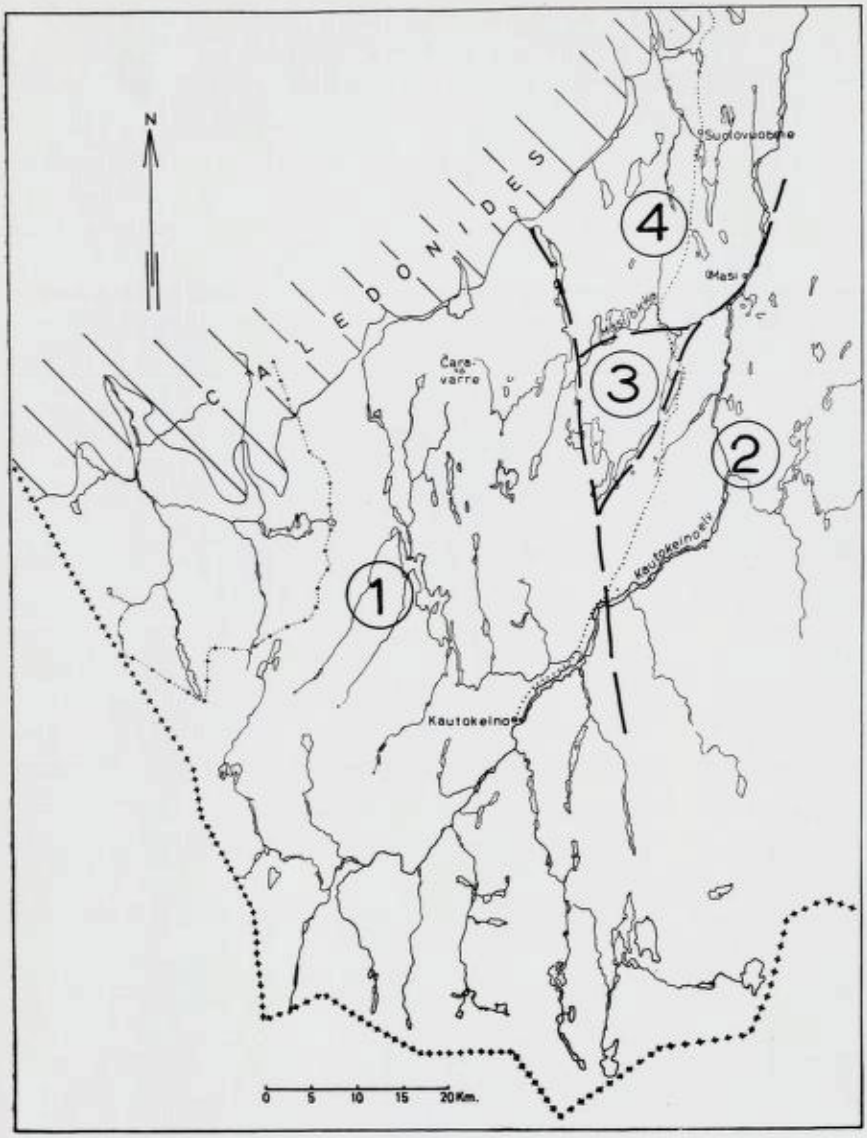

Fig. 15. Map showing the four main structural units.
Kart som viser de fire strukturelle hovedenheter.

the west enable fairly detailed mapping to be effected. The main faults trend NNW and their relation to folding is shown in a profile, fig. 2. The fault crossing Čuolbmajavrre shows intense brecciation of the wall rocks and invasion by secondary carbonate. It also breaks across the strike of the beds and has several branch faults. Brecciated graphite schist is commonly found at some place along the fault. Breccation on Časkias itself is accompanied by rock alteration (albite—carbonate rocks). There is a possibility that this fault and others between Čuolbmajavrre and Časkias continue southwards to join up with those between Stuorajavrre and Agjet.

III. Kautokeino—Galanito fault. A fault trending almost NE—SW caused considerable brecciation of the wall-rocks. It is here accompanied by secondary carbonate and a broad zone of rock rich in albite.

IV. Njallavžže. The «greenstones» have a NW—SE trend in the north-west of the area, but along Njallavžže a zone of brecciation runs NE—SW across this trend, giving rise to highly irregular dips in the wall rocks. The latter are accompanied by much carbonate, albite and biotite. (See also under «Albite—carbonate rocks»). There is also much micro-brecciation of the albite grains.

V. Gæšjavrre fault. This is a major fault, largely determining the easterly limit of the Čaravarre-Guivevarre ridge. It separates the Main Grit of Čaravarre from «greenstones» (?Časkias Group). Close to the fault the quartzite is much recrystallized and mylonitized while the «greenstones» are brecciated. The fault widens to embrace nearly all Gæšjavrre and within this zone detached wedges of quartzite (Main Grit), argillite and greenschist occur. See detailed map, fig. 3. Here the fault shows a tendency to cut across the strike of the Grit formation. It seems most likely that the fault is steeply inclined with a large downthrow of several hundred metres to the west.

VI. Čuojajavrre. Nearly along the axis of the Čuojajavrre fold (i. e. NNW—SSE) a thick greenstone unit (in the ?Časkias Group) is much crushed, sheared and slicken-

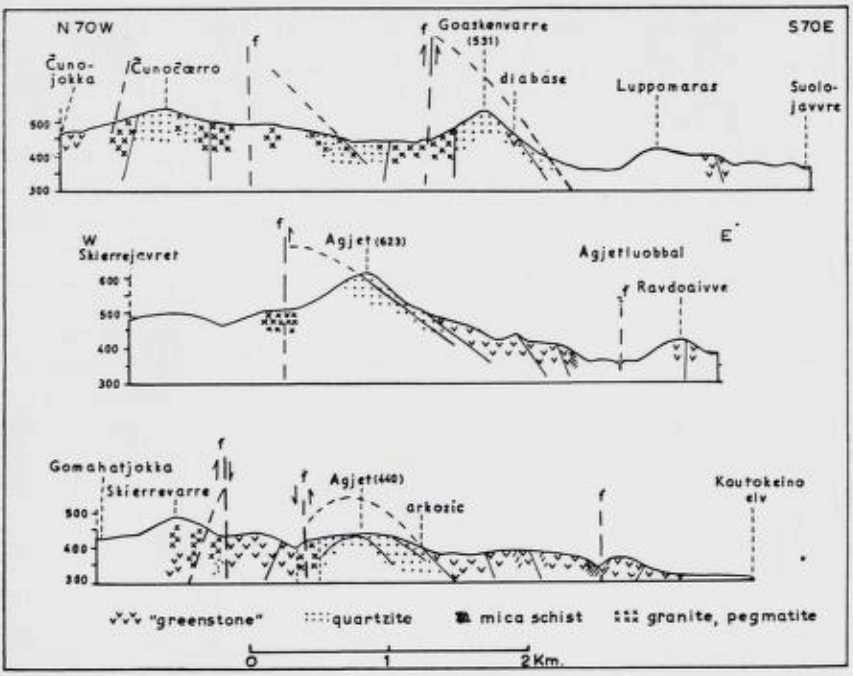

Fig. 16. Profiles across the Agjet anticline. The uppermost lies farthest north. *Profiler over Agjet-antiklinalen, det nordligste øverst.*

sided. Its northerly continuation to Bartašjavrre is marked by secondary feldspathization. Just north of Bartašjavrre lake, more or less homogeneous granite is found in a few isolated exposures.

VII. Avžže. East of Kautokeino. Here the pronounced N—S valley in which Avžže lies runs more or less along a major fault zone, rich in albite—carbonate rocks. It apparently continues northwards across the Kautokeino-elv where it brings a narrow wedge of quartzite rocks against «greenstones».

VIII. Magjetjokka. At least two major faults appear to be present juding from exposures in the river and a little to the east of it. The first brings mica-schists (overlain by quartzite) against quartzites, and seems to have its

southerly continuation in the ground 2 km east of Kautokeino. It thus seems to limit the quartzite wedge mentioned under VII to the west. The second fault appears to lie within quartzitic rocks, and possibly continues southwards in the direction of Kautokeino. It might help to explain the pronounced deformation of the pebbles in the Kautokeino conglomerate. Further work is necessary in the Magjetjokka area and in the ground south and north.

2) Easterly Region. This extends from Masi to Biggejavrre, Spielggajavret and southwards. It corresponds roughly with the outcrop of the Masi Quartzite and schists etc. in the ground to the east. The strike changes gradually from NNW—SSE in the south to NNE—SSW in the north with only local deviations. The lineation, fold axes and faults all appear to be more or less conformable to each other, and to the regional strike.

In general it may be said that the structure is one of major folds broken by faults. It thus resembles the structure of the westerly region but is considerably more complicated in detail. The main structural units are:

a. The Orvušvarre—Fidnatjavrre «syncline»,
b. The Værdnjaš anticline,
c. The Dabmutjavrre syncline,
d. The Masi Overthrust.

a. *Orvušvarre—Fidnatjavrre «syncline».* Study of the Masi Quartzite shows it to be disposed in a synclinal form with an axis trending mainly NNE. Its westerly limb shows easterly dips and there is every reason to suppose that its contact with underlying schists is a thrust one. Near Masi for example the quartzite and its basal conglomerate (Masi Conglomerate) is much deformed while the underlying rocks are also slightly folded and sheared. In the ground immediately east of Biggejavrre the quartzite has a broader outcrop. Here the distinctive basal conglomerate is repeated several times by thrusting and in addition to the imbrication the quartzite is often very highly deformed with complete loss of bedding and intense recrystallization. In extreme cases secondary quartz veins are generated in the body of the quartzite. It can often be shown that the deformation occurs in zones, each of which is inclined to the

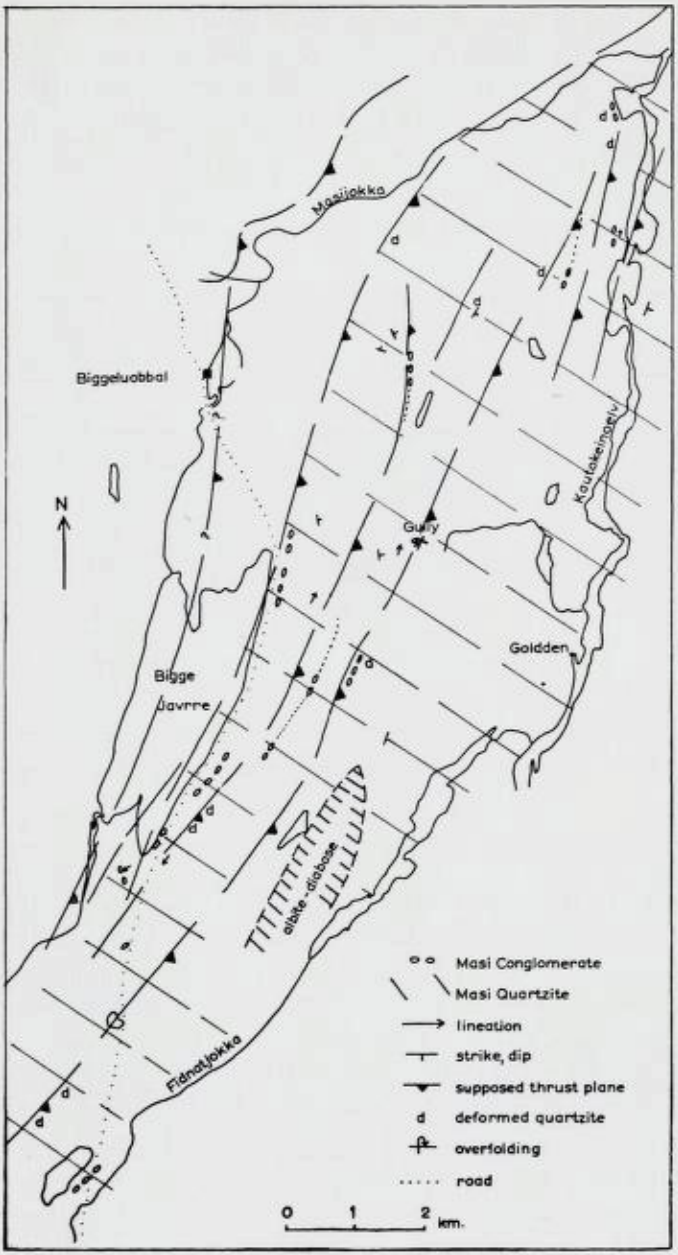

Fig. 17. Imbrication of the Masi quartzite, E of Biggejavrre.
Forskyvningstektonikk i Masi-kvartsitten, øst for Biggejavrre.

east, and presumably represents a thrust-plane. Unfortunately, it is rarely possible to see the deformation in three dimensions. An exception to this is in a deep gully (see map, fig. 17), an old glacial overflow channel. Here the quartzite is overfolded to the WNW through several metres. Minor thrust-planes are common and are inclined down to the east. Strong lineation is developed parallel to the fold axes and marked jointing at right angles. Recrystallization quartz-veins are common. The easterly limb of the syncline seems to have a rather gentle westerly dip. The basal conglomerate is seen in various degrees of deformation. The extraordinary thing however is that the zones of deformation also appear to dip to the west. One of these, close to the base of the quartzite, appears to have been intruded by sills of albite-diabase. It may be interpreted as a thrust-plane.

The axial zone is clearly complicated but one would expect higher beds in the stratigraphical sequence here. Certain «greenstones» forming much of Orvušvarre and others SE of Fidnatjavrre may be such beds (?Časkias Group). Mica-schists are also common south of Fidnatjavrre. There is good evidence for at least one major fault within this axial zone. It is presumed to limit the greenstones on Orvušvarre to the east and travels SSW across the Kautokeinoelv. Drag-folding observed in the cliffs on the east side of this river seems to show overturning to the SE.

b. *Værdnjaš anticline*. This fold is less well known. It apparently has a NNE—SSW axis and plunges to the NNE. A study of the strike directions measured by Oftedahl suggests that it also plunges to the SSW. An axial culmination is therefore postulated. The core of the fold is mainly mica-schist, much granitized.

c. *Dabmutjavrre «syncline»*. The evidence for a synclinal structure here is limited to observations made in and around the small elongated lake called Dabmutjavrre (see map, fig. 18). The tectonics are exceedingly complicated and seem to be a combination of thrusting, normal faulting and folding. Further work is necessary to the north. The facts are briefly as follows: Quartzite (presumably the Masi Quartzite) is disposed in a syncline which plunges to the NNW. It is, however, broken by faults trending in a more N—S direction along its core. Here

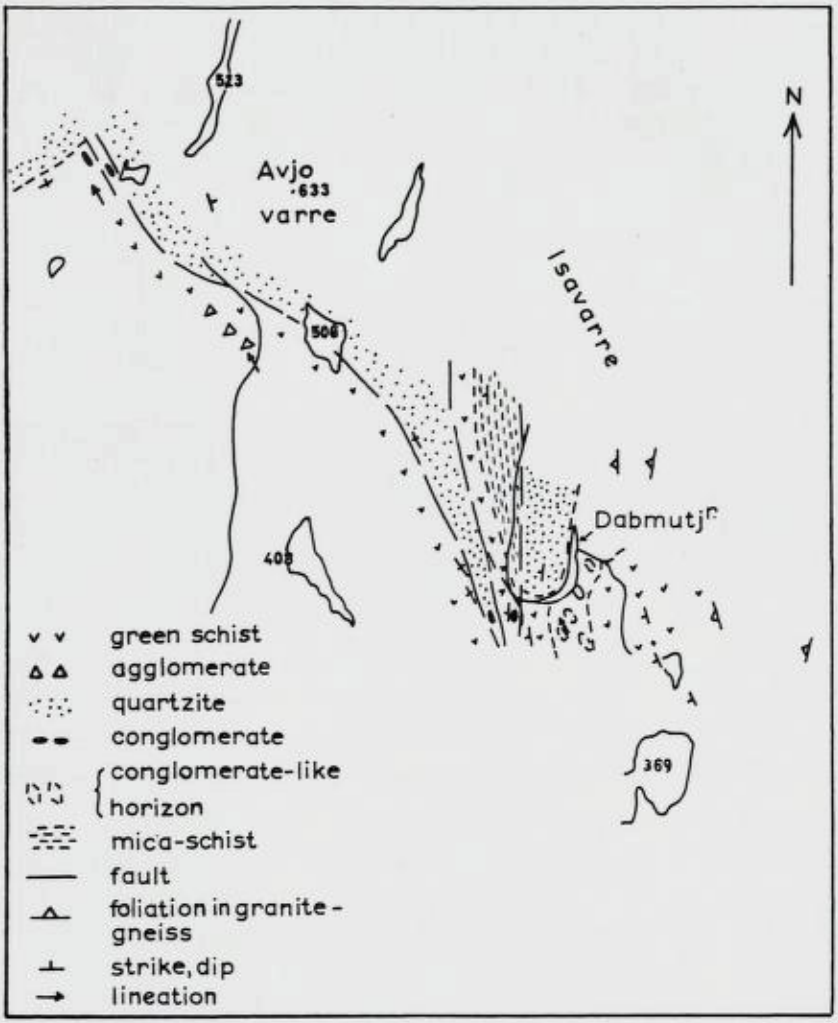

Fig. 18. Geological map of the Dabmutjavrre region.

Geologisk kart over området omkring Dabmutjavrre.

narrow strips of mica-schist and greenschist occur. Mylonitization of the quartzite is seen at a few places. The quartzite on the western limb of the syncline is clearly faulted against agglomerates and greenschists. The basal conglomerate in a deformed condition is seen in one or two places here though

possibly separated by faults from the quartzite (see map, fig. 18). The conglomerate is strangely enough missing on the easterly limb of the syncline but at the anticipated horizon a peculiar conglomerate-like rock occurs. This may be seen on the east side of Dabmutjavrre and on the strike to the south. It is uncertain whether it is a true conglomerate, but in any case it differs completely in petrography from the characteristic Masi Conglomerate. Padget suggests that the Quartzite and Masi Conglomerate may be separated from the greenschists by a thrust-plane which has been later folded into a syncline. Faulting may be both pre- and post-thrusting. The relationships are shown diagrammatically in fig. 19.

d. *The Masi Overthrust.* In the discussion on the Orvušvarre—Fidnatjavrre syncline the overthrust nature of its westerly limb was indicated. Details were also given of the imbrication of the Masi Quartzite and Conglomerate. A weaker deformation of the underlying schists was also indicated (e. g. fig. 7). Similar features may be observed to the south where it seems that the Masi Quartzite is everywhere thrust up on the schists to the west. The thrust is everywhere quite steep, probably hading at a small angle to the east. This thrust contact therefore provides a convenient westerly limit to the «Easterly Region» as a whole.

Conclusion: The synclinal structures of the easterly region are clearly complementary to each other and represent a fold system with transverse culminations. In the schematic, explanatory profile (fig. 19) these folds are shown in relation to some of the «faults». Some of the latter are clearly steep reversed faults (or overthrusts) with movement in a westerly direction, e. g. Masi overthrust. It is suggested that this overthrust reappears on the east side of the syncline. Almost exactly the same structure is deduced for the Dabmutjavrre syncline. It thus seems that the beds have first been thrusted and later folded into synclines. This may have something to do with the behaviour of a thick quartzite formation during orogenesis.

3. Datkovarre region and 4. Masijokka—Suolovuobme region. These occur between the easterly and westerly regions and show distinctive structural characters. They appear to form one unit

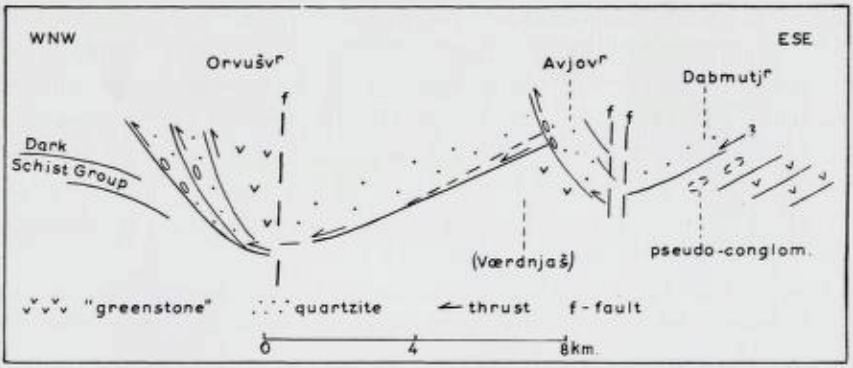

Fig. 19. Diagrammatic section between Orvušvarre and Dabmutjavrre to show the suggested relationships. Vertical scale much exaggerated.

Skjematisk snitt mellom Orvušvarre og Dabmutjavrre som viser de antatte strukturelle forhold. Høydemålestokken sterkt overdrevet.

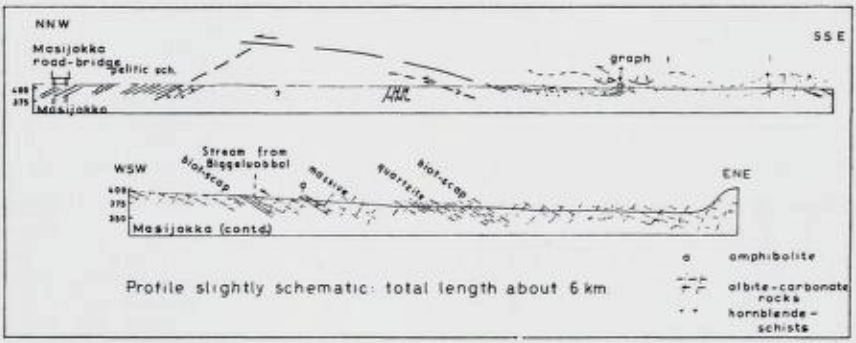

Fig. 20. Profile (slightly diagrammatic) along the Masijokka river, showing thrusting and rock alteration.

Profil (lett skjematisk) langs Masijokka, som viser skyvning og omvandling.

divided into two by a marked culmination (see map, pl. 2). There are many similarities between the schists on the north and south sides of the culmination.

3. Datkovarre region. This 3-sided region has a relatively simple structure. It consists of a syncline whose axis plunges gently (10°—15°) to the SSW. The plunge probably becomes less in this direction. Lineation and minor fold axes all have the same trend.

Joints are commonly found at right angles. The whole sequence of schists appears to be thrusted up on the axis of culmination. This is especially evident in the canyon of the Masijokka, south of the road-bridge (see figs. 14, 20). There is first and foremost a discordance in strike between the allochthonous and autochthonous schists. Secondly there is a contrast in stratigraphy, viz. greenschists (culmination) as against a varied series of mica-, graphite-, quartz-schists (allochthonous). Secondary alteration with development of albite—carbonate rocks is abundant. Mechanical discordance, brecciation and mylonitization are visible at various places in the Masijokka canyon.

It is proposed to call this thrust the *Masijokka thrust*. Its westerly continuation is not seen but a connection is suggested with certain faults north of Njarggajavrre (see map, pl. 2 and fig. 14).

4. Masijokka—Suolovuobme region. This region north of the culmination extends as far as the Hyolithus zone. Its structure is most complicated and it is difficult to give even a general idea. Generally speaking the beds are much more gently dipping than is the case for regions 1. and 2. The rock sequence also contains horizons of graphitic schist and gliding or thrusting have undoubtedly taken place on them. As a result the graphite itself is often disrupted, brecciated and much thinned out. The probable trace of the outcrop is shown in the map, fig. 6. It is also difficult to establish a certain stratigraphical sequence.

Regarding fold-axes and lineation it is clear that these are in the highest degree irregular (see map, fig. 6). The closest approach to a system is near the culmination where they plunge to the north, as would be expected. Similarly, near the Masi overthrust, on the west side of the Kautokeinoelv, they are aligned parallel with each other and with the front of overthrusting.

The Soadnjojavrre—Kautokeino «break». The junction between region 1. and region 2—4 is one of considerable interest. It runs from Soadnjojavrre in the north, through Njarggajavrre and southwards to pass probably to the west of Kautokeino. In the first instance it appears to separate areas of contrasting metamorphic grade. That to the east is usually higher than that to the west. This is most marked in the region of Soadnjojavrre (P. Holmsen) and around Kautokeino (E. Pehkonen). It is common to find argillites against mica- or garnet-mica schists. In between it can be shown

that mechanical brecciation and mylonitization of the rocks have occurred. A striking example is in the region of Njarggajavrre and northwards where at least two N—S zones of mylonitization are known. There is also a fault with a NE—SW trend which cuts across the strike of schists and mylonite alike (see Pl. II).

The numerous faults near the Magjetjokka also appear to lie almost exactly on this line of break.

There is evidence therefore that for part of its course the break is one of faulting.

Economic Geology.

In the course of the systematic mapping considerable attention was paid to rocks and minerals having possible economic value. A review of the more significant finds is presented below and their location shown on the accompanying map (fig. 21). A classification is proposed and used as a basis for description.

In addition to examination of exposures of bed-rock, ore-prospecting has also been carried out by more indirect means. Thus examination has been made of loose, ice-transported blocks in the hope of finding ore-bearing types which can be traced back to their source. Again small magnetic surveys have been carried out in areas of known or suspected Fe mineralization. Finally, certain geochemical techniques, notably the «siltmethod», have been employed in the hope of defining more accurately dispersions (Cu, Zn, Pb) from known ore occurrences and finding new ones.

The following classification is proposed:

Metallic minerals.

a. Layered (sedimentary) deposits: mainly impregnations of pyrite-pyrrhotite-(chalcopyrite) in dark, often graphitic schists. Dark Schist Group and Časkias Group.
b. Epigenetic deposits: chalcopyrite, pyrite, hematite as vein fillings and in metasomatic alteration. Radioactive mineral (?uraniferous) also probably belongs here.

Non-metallic minerals.

a. Graphite.
b. Limestones.
c. Talc-serpentine.
d. Mica.

Metallic minerals. a. Layered (sedimentary) deposits.

1. *Dark Schist Group.* At certain horizons in this group dark, pelitic schists have impregnations of pyrite or pyrrhotite, more rarely chalcopyrite. No deposits have yet been found meriting further development. The occurrences are to be found at various places from the Masijokka northwards to Suolovuobme. They have historical interest in that Tellef Dahll registered certain claims on them. He also included the rocks in his Gaisa system (lower division) mentioning specifically the occurrence of graphite. The following occurrences may be mentioned:

I. *Masijokka,* northerly loop in river, 1 km NNW of road-bridge. Brecciated graphite schist with infilling of pyrrhotite and a little chalcopyrite. Geochemical prospecting north and south of river failed to reveal any anomaly. Analysis of sample (U6/56d) Cu — 0.45 % : Ni — 0.07 % : Co — 0.02 % : S — 35.57 % : (Co/Ni — 0.286).

II. *Varetjokka,* a stream close to the road to Masi: dark, pelitic schists with a weak pyrrhotite and pyrite impregnation.

III. *Njakkalækšejokka,* a stream SW of road to Masi, entering Masijokka on its NW bank. Mica- and quartz-mica schists show a weak pyrite impregnation through several metres. Graphitic schists show also an impregnation as elsewhere. Locally brecciation of the graphitic layer is visible and there is a distinct sulphide infilling.

IV. *Ruvvačokka.* Near the road, 4 km due north of Suolovuobme. Here a horizon of graphite schist, partly brecciated, occurs on the north side of Ruvvačokka. It shows an impregnation of pyrite, and a little chalcopyrite.

V. *Salgganjokka.* 3.5 km SW of Suolovuobme. Graphitic schist with chalcopyrite and pyrrhotite. An analysis gave the following: Cu — 0.63 %, S — 19.98 %, Co — 0.012 %, Ni — 0.07 %, Co/Ni — 0.17.

As indicated in the stratigraphical section graphite schist occurs at various places and may possibly belong to one or two horizons. It frequently gives rise to rust on weathering due to slight iron sulphide content. No economic significance can be attached to these occurrences. Geochemical prospecting on and around them has not shown any significant anomaly as regards Cu, Zn or Pb though locally slightly higher values were noted (e. g. Ingajok, a small

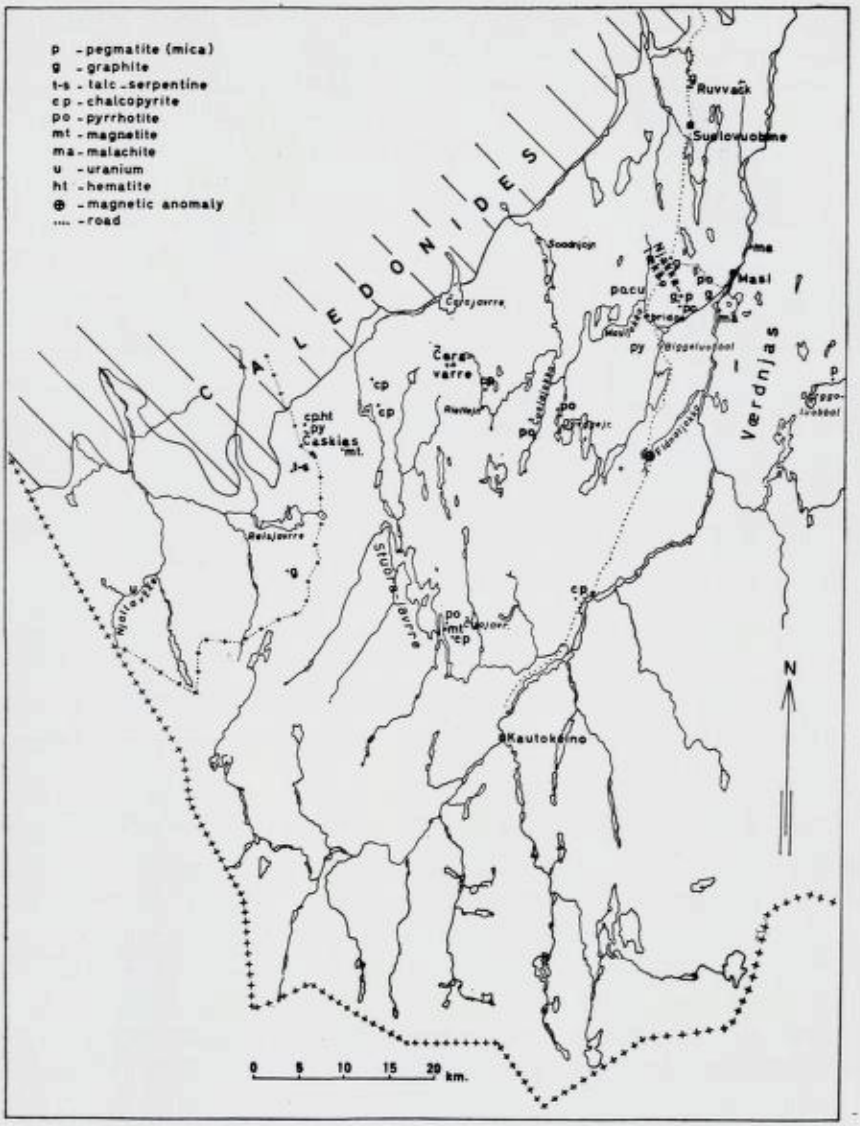

Fig. 21. Map showing location of minerals and rocks of economic interest.
Kart som viser opptreden av mineraler og bergarter av økonomisk interesse.

stream a little north of the Masijokka, near its junction with the Kautokeinoelv).

2. *Časkias Group*. Dark pelitic schists occur also in the Časkias Group, and some of these are slightly sulphide-bearing. Such an impregnation occurs at a point 5 km SE of Raisjavrre.

In conclusion it may be said that the sulphides are believed to be largely of syngenetic origin. Locally gliding on the graphite horizons has brought about brecciation and here a local increase of sulphide occurs as an infilling.

b. Epigenetic deposits.

I. *Časkias* (Bidjovagge). Chalcopyrite, pyrite and hematite are found in a N—S trending zone on the gently shelving north side of the mountain Časkias. The zone is partly one in which the prevailing greenstones, greenschists etc. have been metasomatically altered with the formation of albite—carbonate rocks. The sulphide occurs as a breccia-infilling and as an impregnation along with carbonate in the schists.

II. *Suvravarre*. East of Časkias and 5 km W of Čuolbmajavrre certain diabases are metasomatically altered (to albite—carbonate rocks) and a few joints have an infilling of quartz—carbonate and to a lesser extent sulphide.

III. *Riettejavrre*. Similar to II but on an even smaller scale.

IV. *Čuojavarre*. A little to the south-east of Stuorajavrre the «greenstones» show mineralization in joints and in zones. This may be considered a good example of the mode of occurrence of minerals. Pehkonen's map is given in fig. 22. It might be added that pyrite occurs as an impregnation in a zone 150 × 20 m wide at the contact between a diabase and greenschist. Analysis showed it to contain Cu 0.05 %, Zn 0.1 %, Ni not found.

V. *Masijokka roadbridge*. Schists locally altered to albite—carbonate rocks (+ some quartz) and cut by veins of carbonate with aggregations of pyrite. Analysis of latter gave the following: Ni — 0,19 %, Co — 0,53 %, (Co/Ni — 2.80).

VI. *Njallavžže*. In the west of the area the canyon-like valley called Njallavžže has good exposures of rock in its walls (see map, fig. 21). Carbonate is particularly evident and thin sections show the presence of albite and mica. The rock is brecciated but clearly belongs to the albite—carbonate group.

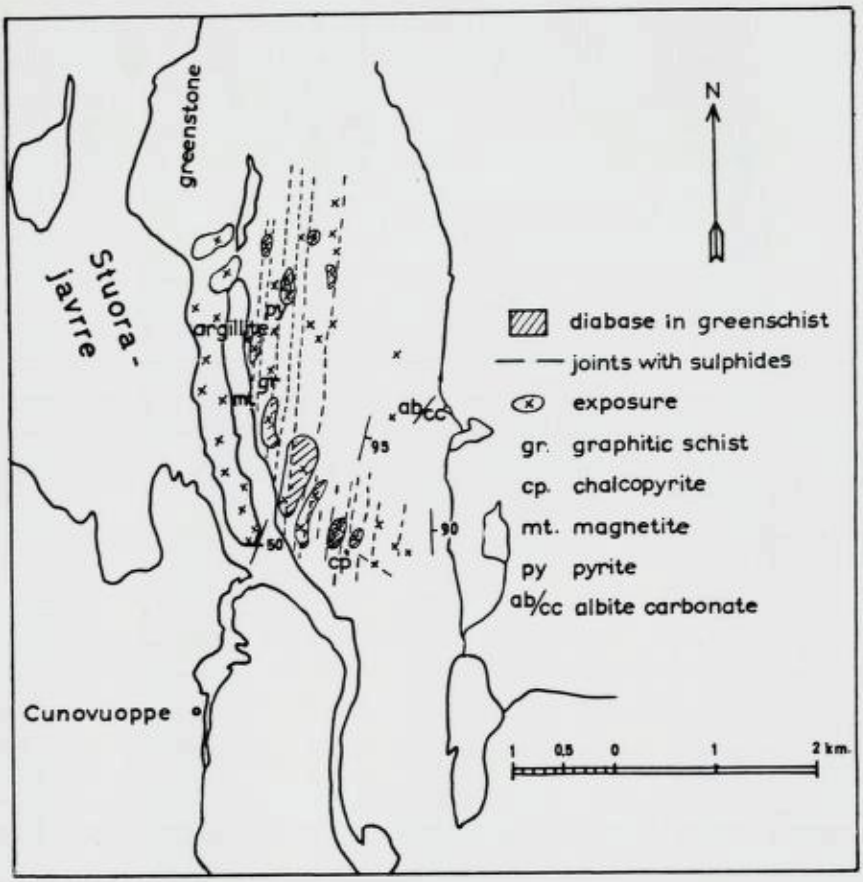

Fig. 22. Map showing occurrence of ore minerals on Čuojavarre.

Forekomster av ertsmineraler på Čuojavarre. (cp: kobberkis, mt: magnetitt, py: svovlkis.)

Parts of it are radioactive, as discovered in 1954 by T. Gjelsvik, due to a fine-grained impregnation of a uraniferous mineral (oral communication from Gjelsvik).

The occurrences I—VI therefore show clear relationships to the albite—carbonate rocks which are largely the result of metasomatic alteration. It is well to remember that all occurrences of albite—carbonate rocks do not contain sulphides or other minerals. The paragenesis however contains

traces of other minerals, notably hematite (e.g. Avžže), molybdenite (MoS_2) in very, very small amounts and occasionally bornite (Cu_5FeS_4).

VII. *Davggejavrre.* A little to the north and north-east of the lake Davggejavrre (north of Njarggajavrre) good exposures occur. These are locally rusty in two zones due to a weak impregnation of pyrrhotite. This is associated with a white, particularly hard quartzose rock. There is evidence of mylonitization of the rocks in the vicinity. No geochemical anomaly (Cu, Zn, Pb) of significance was found.

VIII. *Čuojajokka.* The stream draining Čuojajavrre northwards to the Masijokka is crossed by a NNW-trending zone of rust. It is apparently due to a weak pyrrhotite impregnation in greenschists and greenstones, with at least one thin graphitic layer. No geochemical anomaly was found in the sediments of the Čuojajokka.

IX. *Miscellaneous.*

Chalcopyrite was found in small amounts associated with a garnet-amphibolite rock about 1 km W of Mirovarre Several small trial pits had been dug. The best sample showed 1 % Cu.

Magnetite was found in narrow zones, parallel with the schists at two places, namely on the eastern part of Časkias and Čuojavarre (SE corner of Stuorajavrre). Magnetic measurements showed a striking anomaly in both cases but only over a limited extent. On Časkias (fig. 23), the magnetite has apparently been introduced into joints along with other minerals (carbonate, albite). The joints are believed to be the result of faulting in greenschists (tuffs) close to the rigid mass of albite-diabase. Maximum thickness of the magnetite is 15 cms.

Malachite ($CuCO_3 \cdot H_2O$) was noticed as a staining at one or two places in the cliffs along the Kautokeinoelv, notably east of Habatjavrre and at a point 4 km NE of Masi. Samples from the latter showed the presence of chalcopyrite, pyrrhotite and magnetite, the latter occurring as alteration veins in the pyrrhotite. The occurrences are small but are apparently in rocks having undergone pronounced tectonic deformation (e. g. Masi overthrust).

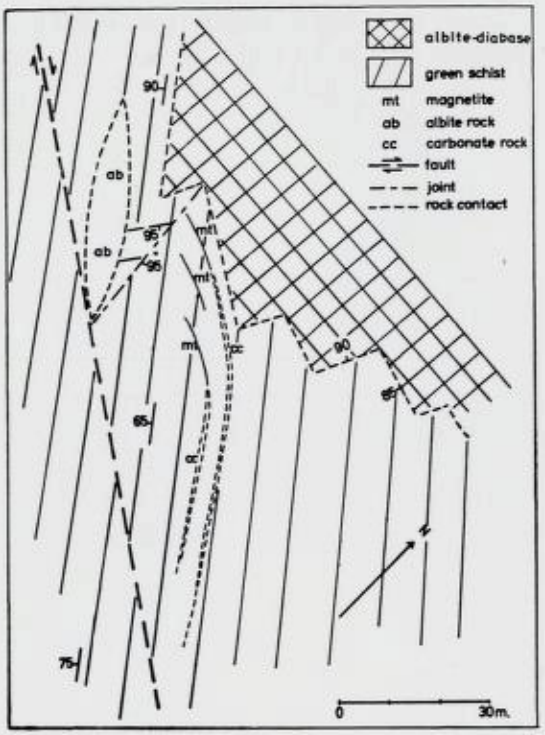

Fig. 23. Area showing albite-carbonate paragenesis, 4, 1 km east of Časkias (774).

Område som illustrerer paragenesen albitt/karbonat, 4, 1 km øst for toppen 774 av Časkias.

X. *Fidnatjokka* — a magnetic anomaly is shown on the compass-variation map of North-Norway (B. Trumpy, 1945) at a point close to the road-bridge over the river Fidnatjokka. A detailed magnetic survey has shown the anomaly to have an extension of 700 m in a NE—SW direction and to be at its maximum 6 % above normal. There are, however, no exposures of bed-rock in the vicinity owing to a thick covering of sand, gravel and moraine.

Non-metallic minerals.

a. *Graphite:* As indicated earlier, graphite schists occur in the Dark Schist Group between the Masijokka and the Suolovuobme area. Here they are often discontinuous and have acted as horizons of gliding and overthrusting. Local thickening and thinning is common. It seems likely that occurrences of graphite belong to one or two horizons only. The graphite is fine-grained. The best

exposures are: on Guorbbavarre (ca 8—9 km SW of Suolovuobme) and Ruvvačokka (4 km N of Suolovuobme). The Časkias Group also contains horizons of graphite schist, but these are usually poor in graphite.

A few analyses on C of graphitic schists belonging to the Časkias Group are given below:

Silicified graphite schist (T7/1002) Mirovarre . . 0.40 %
Graphite schist (T7/1058) Buolanjavrre . . . . 7.89 %
Graphite schist (T7/1009) Mirojokka . . . . . 26.37 %
Analyst: R. Larssen. Laboratory, Geological Survey of Norway.

b. Limestones: It is a characteristic of the area that bedded limestones are rare. Most of the known horizons appear in the northerly part of the area, notably in the ground west of Čuolbmajavrre and between Čarajavrre and Soadnjojavrre. They are commonly crystalline, brown weathering layers of dolomitic composition, but contain small quantities of quartz and possibly a little feldspar.

Analysis of a typical specimen shows the carbonate to be a dolomite with 1 % $FeCO_3$, thus accounting for the brownish colour on weathering.

The carbonate of the albite—carbonate paragenesis is normally far too impure for economic purposes. It sometimes occurs alone in certain fault zones and a good example is mentioned by Holtedahl (1915, p. 122). The analysis is as follows: $CaCO_3$ — 61.15 %, $MgCO_3$ — 31.0 %, insol. — 6.31 %.

c. Talc-serpentine rock: at the contact between a granitic rock and amphibolite, 4.5 km N of Raisjavrre a talc-serpentine rock was found by Gjelsvik.

d. Mica: in the granitized areas coarsely pegmatitic rocks sometimes occur. This is particularly the case in the easterly zone in the areas of Værdnjaš.

Close examination of one of these «pegmatites» was carried out at Garggo-luobbal, 16 km SE of Masi and on the extreme east of the area surveyed. Here a lens of coarse pegmatitic rock occurs about 200 m north of the small hamlet on the shore of Garggo-luobbal. It is about 100 m long and has a north-south strike and westerly dip.

The host rocks are biotite-, biotite-hornblende schists with variable amounts of quartz, and feldspar — the result of regional granitization. These schists strike more NE—SW. The pegmatite consists mainly of quartz, feldspar and muscovite mica with a few small, brownish garnets. The mica occurs in «books» and shows the following qualities:

1. cleavage: good but many surfaces are not completely smooth.
2. hardness: rather brittle, moderately flexible.
3. size: pieces up to 22 cm across were fairly common but the remainder usually less.
4. colour: fairly good but centre of crystals brownish or greenish.
5. impurities: a few grains of feldspar and quartz; a little iron oxide.
6. «reeves» i. e. linear structures on cleavage surfaces forming a 60° angle with each other: common.

The richest part of the pegmatite lens lies towards the centre where a small pit has been sunk. Here the pegmatite lens as a whole is about 5 m thick and has a sharp contact with the schists of the hanging wall. Away from this centre the lens becomes thinner and contacts with the schists less sharp. The mica is also more irregularly distributed and in smaller crystals. Several other lenses of smaller size occur to the north.

SAMMENDRAG

Vestfinnmarks prekambriske geologi.

Forord

(ved direktøren for Norges geologiske undersøkelse).

Somrene 1954 og 1955 utførte Norges geologiske undersøkelse en geologisk kartlegging av vestre del av Finnmarksvidda.

De geologiske undersøkelsene i marken ble utført av geologene Tore Gjelsvik, Per Holmsen, Christoffer Oftedahl, Peter Padget og Eero Pehkonen. Som feltassistenter deltok J. C. Green (1954, for Oftedahl) og G. C. McCandless (1955, for Padget). Den regionale fordeling av arbeidet er vist i denne avhandlings fig. 1.

Som topografisk kartgrunnlag for arbeidet i marken er brukt gradteigskart i målestokk 1 : 50 000.

Hovedvekten har vært lagt på den systematiske geologiske kartlegging av berggrunnen. Men det har dessuten vært lagt atskillig vekt på studiet av malmmineraliseringer, særlig sulfidforekomster. I den forbindelse ble det utført forsøk med geokjemiske feltmetoder. I dette arbeid deltok laboratorieingeniør Brynjolf Bruun med assistenter, og institusjonens mobile feltlaboratorium ble stasjonert i området. Radiometriske målinger og mindre magnetometriske målinger har også vært utført. Blokkstudier er viet en del oppmerksomhet, også med tanke på muligheten av å få indisier på malmforekomster.

Hovedreseultatene ble fremlagt som en foreløpig meddelelse på et nordisk geologisk vintermøte i Oslo i januar 1956 (Padget, 1956).

Det er under noen tvil vi går til trykning av kart med beskrivelse og tolkning allerede nå. Argumentet mot trykning nå er at den anvendte tid har vært for kort til at undersøkelsene i det store område kunne bli tilstrekkelig detaljerte. Også i laboratoriet ville videre undersøkelser være ønskelige (mikroskopi- og kjemiske studier). En

rekke problemer er ennå uløst eller usikkert tolket, således den stratigrafiske rekkefølge av bergartene i området som helhet, ja til dels også innenfor mer begrensede deler av det.

Vi mener på den annen side at kjennskapet til de geologiske forhold i denne del av Finnmarksvidda er nådd et så betydelig skritt fremover ved disse undersøkelsene, i forhold til det lille man visste på forhånd, at det har sin store verdi at materialet legges fram for offentligheten nå.

Holmsen, Padget og Pehkonen ble anmodet om å utarbeide kart med beskrivelse. Sammenstillingen av resultatene, og utarbeidelsen av den engelske tekst, er gjort av Padget, med aktiv medvirkning av Holmsen og Pehkonen. Den norske tekst er skrevet av Per Holmsen.

Forfatterne ber om at det geologiske kartet — trykt i målestokk 1 : 250 000 — må bli betraktet som et oversiktskart, som kan danne grunnlag for fremtidige og mer detaljerte undersøkelser. Usikre tolkninger og uløste problemer er antydet i teksten, i det håp at nye observasjoner vil kaste lys over problemene og føre til deres løsning.

Innledning.

Nærværende publikasjon angår ca. 5000 km^2 av Kautokeino herred og omfatter et område hovedsakelig vest for Kautokeinoelven, innenfor gradteigskartene Masi, Nabar, Lappoluobbal, Kautokeino og Agjet. I nord har området sin naturlige geologiske grense langs «Hyolithussonen», i syd danner riksgrensen mot Finland grensen for undersøkelsene, i vest er området begrenset av fylkesgrensen mot Troms.

Det er alminnelig antatt at Finnmarksvidda er så overdekket at fast fjell så godt som ikke er synlig. Dette er imidlertid bare tilfelle for visse begrensete myrområder. Ellers vil en omhyggelig avsøkning at terrenget oftest gi anledning til ikke så rent få observasjoner av fjellunderlaget. I ellers sterkt overdekkete områder er det særlig langs elvene og i breelvløpene man finner gode blotninger. Langs de store elvene Kautokeinoelven og Masijokkas nedre løp finnes fjellet godt blottet, likeså i fjellpartiene Časkias, Čaravarre, Gæšvarre og Likča hvor blotningene er særdeles tallrike.

Tidligere geologiske undersøkelser.

Opplysninger om de geologiske forhold innen området er særdeles få. Tellef Dahll ga den første beretning (se Reusch, Dahll og Corneliussen, 1891). Blant Finnmarkens geologiske formasjoner utskilte han *Gaisa systemet* (i hovedtrekkene svarende til hva vi nå oppfatter som kaledonidene) som diskordant overleirer *Raipas systemet* (en formasjon som vi nå vet tilhører prekambrium) som særlig opptrer i Alta. De eldste bergarter i det indre Finnmark henregnet han til *Urformasjonen*. Av særlig interesse er at han henregnet en gruppe lite omvandlete bergarter omkring Juri til Raipas. Feilaktig henregnet han grafittskiferen på Beskades til Gaisa systemet.

Et neste skritt videre i retning av den geologiske forståelse ble tatt av Holtedahl i begynnelsen av dette århundre (Holtedahl 1918). Han erkjente den virkelige relasjon mellom grunnfjellet og kaledonidene, og viste dessuten at Raipas-bergartene høyst sannsynlig tilhørte prekambrium, i Alta-området opptredende som et «vindu» i kaledonidene. Av særlig interesse for vårt område er hans opptegnelser fra en tur til Juri-området. På grunnlag av hans beskrivelser av prekambrium ellers i Finnmark, særlig i den sydøstlige del av Alten-bladet (på begge sider av Alteelven) er det mulig å gjennomføre visse sammenligninger, som nærmere omtales under et senere avsnitt. I Norges Geologi (Holtedahl 1953) er gitt en kort omtale av de prekambriske bergarter, vesentlig på det samme grunnlag som arbeidet av 1918.

De geologiske hovedtrekk.

Et blikk på det geologiske kart gir med en gang inntrykk av en tredeling av området, med granittområder i øst og vest, med suprakrustale bergarter i området mellom dem. Det østlige granittområdet henger sammen med det store granittområdet i det sentrale Finnmark, vist på Holtedahls oversiktskart og tidligere rekognosert av Tellef Dahll. Bergartene vest for dette og som inntar en bred stilling i nærværende publikasjon har tidligere leilighetsvis vært betegnet som det vestlige suprakrustalområde som motstykke til det østlige suprakrustalområde omkring Anarjokka—Karasjokka i

øst. Granittområdet i vest henger sammen med et tilsvarende område på finsk side av riksgrensen, og det gjelder i det hele at bergartene på norsk side slutter seg nær til de tilsvarende bergarter i de tilstøtende deler av Finland (og Sverige). I hovedtrekkene gir bergartene inntrykk av å ha et nord—syd gående strøk, om enn med atskillige unntagelser. Ofte, men slett ikke over alt, har de en steil lagstilling. Bergartene i det vestlige suprakrustalområde består av kvartsitter, grønnskifre med og uten hornblende, argilliter og glimmerskifre. De er oftest foldet, men lagenes kontinuitet er brutt av forkastninger og overskyvninger som løper parallelt eller subparallelt med bergartenes strøk.

Mot nordvest blir kartbildet brutt av hyolithussonens flatt liggende kambriske lag som overleirer de oftest steilt stående prekambriske lag i en utpreget stratigrafisk diskordans. Hyolithussonen utgjør den naturlige nordvestlige begrensning av det undersøkte område.

Stratigrafi. I den midtre og nordlige del av området er der overveiende lagdelte bergarter: sandsteiner, arkoser, kvartsitter. Videre argilliter (finkornige, svakt omvandlete leirrike sandsteiner) og glimmerskifre. Videre grønne skifre, dels lite omvandlete klorittrike, utpreget planskifrige grønne bergarter, dels også mer omvandlete hornblenderike bergarter med utpreget linjestruktur. Grønnsteiner med massiv habitus opptrer alminnelig både blant grønnskifre og glimmerskifre. Et større område med yngre albittgranitt opptrer i den nordlige midtre del av feltet.

Det faller naturlig å inndele bergartene i bestemte grupper og formasjoner. Uheldigvis er samtlige kontakter mellom de forskjellige formasjoner overdekket eller brutt av forkastninger eller/og overskyvninger, hvorfor et hvert forsøk på å stille opp en stratigrafisk rekkefølge mellom bergartene må bli meget usikker. Det har heller ikke lykkes å komme til enighet mellom medarbeiderne om et samlet stratigrafisk aldersskjema som gjelder hele området. For å kunne komme dette nærmere en løsning er det derfor i første omgang nødvendig å beskrive stratigrafien innenfor særskilte begrensete områder, hvoretter et forsøk på stratigrafisk korrelering kan gjøres, med den reservasjon at fremtidig arbeid utenfor og innenfor området kan gjøre det nødvendig å revidere den oppfatning man på denne måte kommer til. Beskrivelsen omfatter følgende områder:

1. Čaravarre—Guivevarre.
2. Časkias—Stuorajavrre.
3. Agjet.
4. Kautokeino. (Kautokeino-konglomeratet.)
5. Likča—Čuojajavrre.
6. Masi—Fidnatjokka.
7. Datkovarre.
8. Suolovuobme—Soadnjojavrre—Masijokka.

Beskrivelsen er ordnet i en slik rekkefølge at der er en eller annen forbindelse mellom de enkelte områder, enten geografisk eller stratigrafisk. En kort diskusjon av den sannsynligste korrelering følger etterpå.

1. *Čarajavrre—Guivevarre.* Dette er kanske det lavest metamorfe område i Vestfinnmarks prekambrium, hvorfor det er naturlig å begynne med dette. Området danner en markert høyderygg fra Čarajavrre i nord til Guivevarre i syd, med vestskråningen av dette høydedrag inkludert. I hovedsaken kan man si at bergartene danner en noenlunde kontinuerlig serie fra grønne skifre med grønnsteiner nederst (i vest) gjennom argilliter, konglomerater og dolomittlag, til kvartsitter og arkoser øverst i lagrekken (i fjelltoppene i øst). Bergartene kan stratigrafisk oppfattes som fortsettelse oppover i lagrekken av de grønne bergarter i Stuorajavrres nedslagsfelt vestenfor.

a. Grønne skifre med grønnsteiner, en variert gruppe med både sedimenter og eruptiver, som inntar et bredt område i Stuorajavrres nedslagsfelt. Nærmere omtale se under «grønnsteiner» (p. 95—98).

b. Overgangslag bestående av tydelig lagdelte fyllitter av fremherskende grønne og grågrønne farger, til dels også brune.

c. Argillitter. Grå og brunaktige med dolomittlag i den nordlige del av feltet. Mektige dolomittlag forekommer i Jægeloaivve og i dalsøkket vestenfor. Ett eller flere distinkte lag av karbonatbreksje eller karbonatisk konglomerat forekommer like nord for Čuolbmajavrre og i dalsøkket vest for Jægeloaivve.

d. Massive arkoser og kvartsitter («sparagmittiske kvartsitter»), En smal sone av kvartsitt (delvis arkoseaktig) stryker sydover fra Čuolbmajavrre, hvor den ved undersiden er utydelig veksellagdelt med noen grønne skifre. Den tynner sannsynligvis ut mot syd. En likeledes tynn sone av kvartsitt forekommer nord for Čuolbmajavrre.

På Guivevarre opptrer en grovkornig arkose (grit) i tilsvarende stratigrafisk horisont (se kart fig. 3). Dette er en kompakt «grit» med korn av kvarts, mikroklin, mikropertitt og felsitt i en kvarts-serisitt-grunnmasse. Den er sannsynligvis begrenset ved forkastning i nord.

e. Argillitt. Et viktig ledd i faciesmessig henseende av lagrekken som følger oppad etter den ovenfor omtalte «grit» består av mørke, finkornige, nesten uomvandlete fyllitter. De beste blotninger sees i vestskråningen av Čaravarre-massivet. Små terninger av svovlkis kan undertiden sees. Meget tynnspaltende skifer er iakttatt med klastiske glimmerflak på lagflatene. Enkelte noe grovkornigere typer finnes også. Formasjonen synes å være en typisk gruntvanndannelse. Lignende sedimenter fra senere geologiske tider kunne ventes å føre fossiler. Holmsen fant i denne formasjon grå dolomittiske lag nord for Čuolbmajavrre.

f. Hovedkvartsittformasjonen. Dette yngste ledd av serien danner den høyere del av fjellryggen Čaravarre-Guivevarre. På østsiden av fjellryggen er denne formasjon begrenset av en hovedforkastning. På vestsiden synes den å ha en skarp, men normal stratigrafisk kontakt mot den underliggende argillitt-formasjon. Der er intet utpreget konglomerat ved undersiden. Mektigheten kan anslåes til minst 2500 meter. Den inneholder enkelte lokale konglomeratlag lenger oppe, men er hovedsakelig en kvartsittisk «sparagmittformasjon». Feldspat opptrer i enkelte lag så vidt alminnelig at bergarten i internasjonal terminologi vil bli betegnet arkose. Skråskiktning er alminnelig og viser at lagene ligger normalt med østlig fall, ikke invertert, slik at de yngste lag ligger østligst.

Konglomeratlagene synes å være linseformete og kan ikke følges langt. De er gjennomgående polymikte, særlig et konglomerat i Salggevarre som har boller av kvarts, granitt og en rekke forskjellige tette felsittiske porfyrer, samt et konglomerat syd for Čaravarre i en dal som skjærer tvers igjennom fjellrekken, som inneholder opptil hodestore boller av forskjellige kvartsitter, og hvor boller av rød jaspis er spesielt karakteristisk. Blokker av dette konglomerat er ført med isen nordover og er alminnelig ved stranden ved Čarajavrres sydøstre ende. En mindre linse av konglomerat på Gæšvarre (se kart fig. 3) inneholder boller av jaspis, grønnskifer og kvartsitt som de alminneligste.

Et siste spesielt konglomerat forekommer på Gæšvarre kort

SW for Gæšjavrre. Den stratigrafiske lagfølge er vist i diagrammet fig. 4. Ved basis har det boller av nøtte- til valnøttstørrelse av grønnskifer, fyllitt, lærfarget sandsteinsskifer, mørk kvartsitt, rød jaspis, kvarts og granitt, og dessuten en særpreget skifer med purpuraktig farge. Grunnmassen er sandsteinsskifer-aktig. Skråskiktning er alminnelig og bølgeslagsmerker ble iakttatt to steder.

Oppover i lagrekken mot NE øker antallet og størrelsen av bollene.

2. *Časkias—Stuorajavrre.* Vest for Čaravarreområdet opptrer et bredt belte av grønne skifre, grønnsteiner etc. Det er hovedsakelig et sedimentkompleks, men med en særdeles heterogen sammensetning og metamorf facies. Sedimentene varierer fra grønne leirskifre, gjennom karbonatbetonte sådanne til dolomittlag på den ene side. På den annen side er der grovkornigere sedimenter og til dels grønnsteinskonglomerat. Et trekk i bildet er små linser av jernglans eller/og magnetitt, samt grafittskifer. Grafittskiferen opptrer i Bidjovagge sammen med kvartsitt, ca. 3 km lenger øst, samt i Sieidašjokka hvor grafittskiferen opptrer sammen med en grå leirskifer (svakt fyllittisk) med primær lagdeling som avviker til dels sterkt fra den sekundære skifrighet.

Massiver av grønnstein er av to slags, en type er en grovkornig amfibolitt samt en mer finkornig til middelskornig dolerittisk hornblendeførende grønnstein. Den siste type er upresset og er uten tvil av intrusiv karakter. Visse mellomformer av grønnstein er av tvilsom opprinnelse.

Også på en annen måte er dette felt særlig heterogent, nemlig i metamorf henseende. Mens de finklastiske skifre i den østre del av feltet virker nesten uomvandlet, er skifrene i selve Časkiasfjellet med Bidjovagge for det meste grovkornige kalksilikatglimmerskifre. Det synes derfor i første omgang som om den vestre del av feltet fremtrer i en høyere metamorf facies. Det kan imidlertid muligens bero på at sedimentene i den østre del av feltet har vært karbonatfri og at sedimentene i den vestre del av feltet har inneholdt karbonatmineraler primært, hvorfor metamorfosen i virkeligheten bare har kunnet sette spor etter seg her i form av kalksilikat-mineraler. Fullt klart er dette forhold imidlertid ikke for nærværende, men det er ikke utelukket at metamorfosen tiltar mot vest, jfr. granittområdet og den høyere metamorfose i sydvest.

Siden bergartene i det omtalte kompleks er best blottet på fjellpartiet Časkias, foreslåes betegnelsen *Časkiasgruppen.*

3. Agjet. Dette område er undersøkt av Pehkonen. Časkiasgruppen synes å være underleiret i syd av en karakteristisk kvartsittformasjon, *Agjetkvartsitten.* Forholdene kan best studeres øst og nordøst for fjellet Agjet, i en antiklinal struktur. Kontakten synes å være stratigrafisk normal, og danner derfor en naturlig undre begrensning av Časkiasgruppen, en grense som ikke kan studeres lenger nord.

Agjetkvartsitten forekommer i tre atskilte blotninger. Ifølge Pehkonen har den åpenbart gjennomgått en høy metamorfose og er fullstendig rekrystallisert med fullstendig utviskning av den opprinnelige klastiske tekstur. Muskovitt og biotitt gir bergarten en klar skifrighet. På skifrighetsflatene opptrer tynne nåler av sillimannitt i klumper.

I den nordlige del av antiklinalstrukturen og i den adskilte kileformete blotning i vest er deformasjonen ikke fullt så intens. Noen steder er fuksitt observert. Plagioklas (An_{35}) og små mikroklinkorn opptrer sporadisk, men ikke sillimannitt.

Overgangen oppad fra kvartsitten til Časkiasgruppen beskrives av Pehkonen slik: sillimannittkvartsitten går først over i en smal sone av hvit, glassaktig kvartsitt med fuksittlag. Nær kontakten opptrer grå, biotittførende arkose med klastisk karakter og rosa farge. Feldspaten er hovedsakelig mikroklin og albitt. Kvartskornene er rundet, men med svakt undulerende utslukning.

4. Kautokeino. (Kautokeino-konglomeratet.) Området omkring Kautokeino kirkested er i vid omkrets dekket av løse avleiringer i en grad som selv på Finnmarksvidda er enestående, og det er derfor ikke mulig å danne seg et klart bilde av fjellbygningen. Der opptrer imidlertid et særpreget konglomerat som ellers ikke forekommer. Den beste blotning ligger i et steinbrudd snaut 1 km nord for gjestgiveriet. En rekke blotninger finnes også i området sydøst for det sted hvor kirken lå før krigen, og de er arrangert på en stjert-om stjert måte (en échelon). Konglomeratet er i disse blotninger ledsaget av en mørk kvartsitt.

Konglomeratet har en brunlig forvitringsfarge mens den friske grunnmasse er mørk blåsort. De lyse boller består av kvarts, lys

kvartsitt og krystallinsk karbonatbergart. De er både presset og strukket, og frembyr derfor både en planstruktur og en linjestruktur. De største boller kan være opp til 40 cm lange.

5. Likča—Čuojajavrre. Et bredt belte av grønnaktige bergarter opptrer øst for Čaravarre og Čarajavrre, adskilt fra den mektige kvartsittiske arkoseformasjon ved en hovedforkastning.

Bergartene minner på mange måter meget om Časkiasgruppens typer, både i petrografisk henseende og med hensyn til lagtykkelser. Hovedforskjellen synes å være at grafittskiferen mangler. Mørke pelittiske fyllitter veksler med grønnskifer og grønnstein. Gode snitt er synlig i området 1—1,5 km vest for Bartašjavrre og fremfor alt omkring fjellpartiet Likča. Bergartene i dette fjellparti består av både sedimenter og eruptiver, alle grønnaktige. Et grovt konglomerat eller konglomeratisk breksje stryker nordvest—sydøst kort øst for vannskillet mellom Soadnjojavrre og Čarajavrre fra Hyolithussonen og sydøstover, men kan ikke følges lenger enn til kort vest for varden på Likča. Det er en formasjon ikke ulik et agglomerat. Grønne finklastiske bergarter kan best fortolkes som tuffblandete sedimenter. I den nordlige del av fjellpartiet opptrer en finkornig massiv grønnstein med strukturer som minner om lava med blærerom. Strukturer i lignende bergart nær Soadnjojavrre minner om pillowlavaenes strukturer, og er rimeligvis det. Der opptrer også finkornige grønnsteiner som sannsynligvis er av intrusiv karakter.

En grå til svakt rødligbrun fyllitt stryker med steil skifrighet over den østlige del av Likča-fjellet og er etter all sannsynlighet en fortsettelse av den grå fyllitt ved Masijokkas utløp av Soadnjojavrre.

6. Masi—Fidnatjokka. En av de mest fremtredende og stratigrafisk viktige formasjoner er kvartsitten som stryker i en bred, bøyet sone fra Masi mot sydvest til Fidnatjokka og videre mot syd tvers over Kautokeinoelven.

I felt er den vanligvis lys, hvit, grå eller svakt rødlig. Den viser ofte regelmessig benkning og ofte god spaltbarhet. Noen steder er den massiv. Skråskiktning er ikke ukjent og små diskonformiteter er alminnelig i sedimentlagene. Den inneholder vekslende

mengder feldspat, glimmer, karbonatmineraler og kloritt. Enkelte konglomerathorisonter eller grovklastiske lag forekommer.

Innen kvartsittområdet forekommer smale soner av grønne skifre og glimmerskifre (se kartet Pl. 1). Deres stratigrafiske stilling vis à vis kvartsitten er usikker, men grønnskiferen i Orvušvarre øst for Masijokkas sammenløp med Kautokeinoelven overleirer sannsynligvis kvartsitten.

Kvartsitten opptrer langt syd (sydøst for Oskal).

Et ganske spesielt konglomerat fortjener særskilt omtale. Det er fuksittførende, rødlig, med vesentlig granittboller. Godt blottet er det langs Kautokeinoelven tvers overfor Masi, og er derfor betegnet *Masi-konglomeratet*. Det danner tilsynelatende basis for Masikvartsitten, men kan også opptre inne i kvartsittformasjonen på grunn av overfoldninger eller overskyvninger.

Dets basale karakter kan studeres nær Hoigadanjavrre, en liten sjø ca 4 km sydvest for Storfossen (Kautokeinoelven). Her er det lite deformert og går oppad over i nesten sandsteinsaktig bergart som høyere oppad er kvartsittisk. Boller av kvarts, granitt og kvartsitt ble iakttatt i linseformete partier, flere meter tykke. I nord (Gumppinjunne nær Avjovarre) mangler konglomeratet øyensynlig ved kvartsittens underside.

7. Datkovarre. Det ovale område vest for Biggejavrre består av to stratigrafiske hovedledd, nemlig en grønn hornblendeskifer med betydelig (og ukjent) tykkelse som underleirer en glimmerskifer- og kvartsglimmerskiferformasjon. Bergartene er overveiende finkornige, mørke, og delvis med en svak impregnasjon av magnetkis.

En korrelasjon med andre bergarter er meget usikker. Padget mener at disse formasjoner muligens kan representere de høyere metamorfe ekvivalenter til Argillittene på Čaravarre, eller muligens, som et alternativ, en lav horisont i Časkias-gruppen. Betegnelsen glimmerskifergruppen foreslås som en nøytral betegnelse for de ikke-hornblendeførende skifre.

8. Suolovuobme—Soadnjojavrre—Masijokka. Det store nordlige område domineres av bergarter som lokalt er blitt sterkt forstyrret, antagelig ved glidninger eller forskyvninger. Det er derfor vanskelig å komme frem til en entydig fortolkning av lagfølgen.

Området omfatter en rekke forskjellige formasjoner og bergartstyper av høyst forskjellig opprinnelse. Der opptrer:

1. grønnskifre — vanligvis hornblenderike, men lokalt med kloritt som hovedmineral.
2. kvartsglimmerskifre — vidt utbredt og oftest vekslende med kvartsittlag og mer glimmerrike lag; kvartsglimmerskifer med hornblende er alminnelig i blotninger langs Njakkalækšejokka, et tilløp til Masijokka.
3. grå kvartsitt — en karakteristisk biotittførende type omkring og nord for Suolovuobme og vest for Silesjavrre.
4. mørke finkornige skifre med svak sulfidimpregnasjon.
5. grafittskifer — en karakteristisk bergart som opptrer mange steder. Det er mulig at grafittskiferen i dette område utgjør en enkelt stratigrafisk sone. En mulig fortolkning er gitt i kartet fig. 6. Grafittskiferen er vanligvis impregnert med magnetkis som er årsaken til den til dels sterke rustdannelse og dessuten noen steder en viss mengde kobberkis.
6. albittskifre — noen få steder fremviser en anrikning av albitt, særlig i Njakkalækšejokka.
7. grønnsteiner — massive hornblendebergarter som særlig er alminnelige i den østlige og nordøstlige del av dette område. De er høyst sannsynlig av intrusiv karakter, men har deltatt i fjellkjedebevegelsene sammen med sedimentene. Et karakteristisk mineral i disse er skapolitt.
8. albittgranitt — et stort sammenhengende felt av yngre, klart gjennomsettende intrusivfelt stikker ut under Hyolithussonen langs Naššjokka. Det inneholder også mer basiske varieteter ved sammenløpet mellom Naššajokka og Ruoddojokka. Små, lagergangformete partier av albittgranitt forekommer temmelig alminnelig over størstedelen av feltet.
9. lys kvartsitt med albitt — av høyst usikker stratigrafisk stilling opptrer i den østlige del av området som et foldet og delvis av tektoniske forstyrrelser avbrutt lag.
10. Karbonatlag — i den østligste del av området langs Virdnejavrre, som lag i en lys finkornig serisittkvartsitt. Det er en uren dolomitt eller kalkstein, som inneholder omtrent like meget kvarts som kalkspat (karbonat).
11. lys serisittkvartsitt — opptrer kun lengst i nordøst langs Virdnejavrre. Hører muligens til de eldste formasjoner innen området.

Korrelering. Å stille opp en stratigrafisk aldersrekkefølge mellom alle disse typer lar seg for tiden ikke gjennomføre, og det er så store usikkerhetsmomenter knyttet til en korrelasjon med bergartene i de øvrige områder at en slik vil bli nærmest verdiløs. Grafittskiferen har vært forsøkt benyttet som ledehorisont, men den ligger stratigrafisk forskjellig i forhold til de andre bergarter i forskjellige deler av området. Ved Ruvvačokka f. eks. ligger grafittskiferen, først omtalt av Tellef Dahll, under grønnskifer som igjen underleirer den mørke eller grå kvartsitt, mens grafittskiferen i Vuovdašvarre tilsynelatende ligger *mellom* to formasjoner, hvorav den øvre, en kvartsitt-glimmerskifer-formasjon har stor likhet med den mørke eller grå kvartsittformasjon nord for Suolovuobme, og den undre vesentlig består av grønne skifre. I syd omkring Buvrašvarre, er grafittskiferen overleiret av grønne skifre av sikker sedimentær opprinnelse (grønnsteinskonglomerat og grønne leirskifre). De store stratigrafiske uoverensstemmelser kan vel forklares ved overskyvninger innen deler av området. Men det er allikevel vanskelig å komme til klarhet over hva som er eldst og yngst. Innenfor Časkias-gruppen forekommer grafittskiferen som lag i grønne skifre. Det er således vanskelig å opprettholde grafittskiferen som en bestemt enkelt ledehorisont.

Ifølge P. Padgets mening er områdene 1—3 noenlunde sikkert korrelert, likeså område 4 (Kautokeino). Korrelering mellom område 5 og 1—4 bygger derimot utelukkende på likheten med bergartene i Časkias-gruppen. Områdene 6 og 7 er vanskelig å korrelere med de øvrige på grunn av at områdene er begrenset på alle sider ved tektoniske dislokasjoner.

Område 6 (Masi-kvartsitten og Masi-konglomeratet) er vanskelig å plasere i bergartsrekkefølgen på grunn av formasjonens skyvekontakter mot andre bergarter. Den kan muligens korreleres enten med Čaravarre-kvartsitten eller Agjet-kvartsitten, hvorav den siste synes mest sannsynlig. Tilstedeværelsen av fuksitt er alminnelig i begge, og på grunnlag av visse temmelig indirekte strukturelle forhold kan de to bli fortolket som en og samme formasjon. Derimot er intet basalkonglomerat av samme type som Masi-konglomeratet tilstede ved basis for Čaravarre-kvartsitten.

En korrelering mellom Vest-Finnmark, Nord-Finland og Nord-Sverige lar seg ikke gjennomføre for nærværende.

Granittiske bergarter.

Som tidligere omtalt inntar granittiske og semi-granittiske bergarter en stor del av det prekambriske område i Vest-Finnmark, i hovedsaken begrenset til to brede belter, et vestlig og et østlig. Det sistnevnte utgjør en del av det sentrale gneisgranitt-område i indre Finnmark. Mellom de to belter består bergartene for en vesentlig del av suprakrustaler, men inneholder dog bl. a. to intrusive kropper av granittiske bergarter (Naššajokka og Datkovarre). Granittiseringen innen dette suprakrustalområde er begrenset til et lite område i nærheten av Bartašjavrre og et enda mindre ca 2 km SE for Masi. I begge tilfeller er albitt hovedfeldspaten ved siden av kvarts.

De to hovedbelter av granittiske bergarter er sterkt inhomogene. Variable mengder granittisk bergart er assosiert med skifre, som klart er å oppfatte som relikter av tidligere skifer-formasjoner, mer eller mindre granittiserte. De mest resistente bergartstyper er kvartsitter og amfibolitter, men begrensningene er ofte diffuse, og gradvise overganger til granitt eller gneisgranitt er alminnelige.

De granittiske bergarter kan derfor inndeles slik:

1. Naššajokka-granitten
2. Datkovarre-granitten
3. Den østlige sone.
4. Den vestlige sone.

1. Naššajokka-granitten, som delvis fortsetter inn under Hyolithus-sonens bergarter, er et massiv av albittgranitt, gjennomsettende med intrusiv kontakt mot grønne skifre tilhørende område 8. Gode blotninger i Kattoaivve og langs elvene Roddojokka og Naššajokka. Feldspaten består av albitt, rødlig av farge, men bergartens tekstur er rent granittisk. Grensen mot sidesteinen (sydvestligst) er finkornet. Ved sammenløpet av de to nevnte elver opptrer en mørk eruptivbergart av diorittisk utseende, gjennomsatt av en gang av finkornig mørk eruptivbergart, begge innen granittlegemet. Disse ulike bergarter kan lettest fortolkes som eldre differensiasjonsledd av det samme magma som til slutt størknet som albittgranitt.

2. Datkovarre-granitten utgjør en skarpt definert granittmasse beliggende ca 8 km SW for Biggeluobbal. Detaljer fremgår av fig. 10.

Granitten er et tavleformet legeme som ligger konformt i glimmerskifer. Dets lengste utstrekning er SSW—NNE, hvilket er parallelt med foldningsaksen og den regionale linjestruktur. Se fig. 11.

Granitten er i alminnelighet massiv, dog ofte med en planstruktur. Den består i hovedsaken av albitt (An_{10}), kvarts og litt mikroklin, biotitt og muskovitt. Albitten har en tendens til å være svakt porfyrittisk mens kvartsen ofte synes å ha korrodert feldspaten. Der er tallrike årer og klumper av hvit melkekvarts og mange steder mer grovkornige pegmatittmasser.

Grensen både ved over- og undersiden utgjøres av tallrike lagerganger av granitt og kvarts vekslende med glimmerskifer. Tykkelsen av denne overgangssone er ca. 20 m.

3. Den østlige sones granittiske bergarter strekker seg fra Dabmutjavrre mot syd og SSW til Særradas og muligens til det ytterste sydøstlige hjørne av området. De danner tydelig den vestlige del av det store sentrale gneisgranittiske område (se Tellef Dahlls kart i Reusch, 1891). På Værdnjašrapesvarre grenser det mot skifrene skarpt og konformt, lenger syd er grensen klart diskonform, og på Særradas overskjærer grensen Masi-kvartsitten. Innenfor granittområdet opptrer små og store linser, slirer etc. av skifre som omfatter glimmerskifre, grønnskifre og kvartsitter, m. a. o. typer som er alminnelige i det vestlige suprakrustalområde. Det trekkes herav den slutning at det østlige belte representerer en gjennomgripende granittisering av synkinematisk type.

Grensen utgjøres ved Dabmutjavrre av en overgangssone med tallrike granittganger østover. Gangene er mest konforme, enkelte pegmatittiske masser er gjennomsettende. Etter som man kommer østover, forsvinner restene av suprakrustaler mer og mer, og til slutt er det bare granitt. Men en viss planstruktur finnes i granitten øst for Vuoddašjavrre.

En stor pegmatittmasse finnes ved Gargoluobbal. Den er ca 100 meter lang, opptil 8—10 meter tykk. Den skjærer gjennom biotitt-hornblende-skifer.

Der er ingen evidens for at granitten utgjør et eldre basalkompleks for suprakrustalene.

4. Den vestlige sone har i hovedsaken en NNW—SSE lengdeutstrekning, dens bredde er opp til 20—25 km. Den danner fortsettelsen av et lignende bergartskompleks i Finnland.

Heller ikke denne sone er blitt underkastet en fullstendig petrografisk undersøkelse, og området er sterkt overdekket, mest i den nordlige del.

Bergartene er i det store og hele båndete gneisgranitter og synes på grunnlag av et stort antall innesluttede rester av suprakrustaler å dømme, å være et resultat av granittisering. Lokalt går gneisbergartene over i homogen granitt og skarpe grenser kan vanskelig trekkes. Likesom i den østlige sone er kvartsitt og amfibolitt best bevart under granittiseringen.

Pehkonen, som har undersøkt området i felt, har også undersøkt bergartene i mikroskop. Han inndeler dem i følgende:

a. Kvartsitter
b. Amfibolitter
c. Sillimannitt-gneis
d. Horblende-pyroxen-gneis
e. Biotitt-plagioklas-gneis
f. Granitter
g. Pegmatitter
h. Aplitt-granitt
i. Hornblende-granitt

Blant kvartsittene er der to smale striper nord for Galanito som inneholder lag av fuksitt (krom-muskovitt), og det samme er til dels tilfellet med området ved Agjet. Dette kan bety at denne kvartsittformasjon bør parallelliseres med Masi-kvartsitten, som også må inneholde enkelte lag av fuksitt, idet løse blokker av fuksittkvartsitt er alminnelige nordover mellom Biggejavrre og Suolovuobme. Masi-konglomeratet inneholder fuksitt flere steder.

Sillimannitt synes å være et vanlig mineral i disse kvartsittene i vest, og finnes også i en gneisaktig bergart som forekommer øst for Galanito.

For den mikroskopiske undersøkelse henvises til den engelske tekst.

På finsk side har geologen Arvo Matisto (Geologiska forskningsanstalten) arbeidet i flere år, og takket være hans velvillige bistand har de norske geologer fått anledning til å studere en del upubliserte geologiske karter fra finsk side av grensen.

Metamorfosen. Det vil allerede av de tidligere avsnitt ha fremgått at der i Vestfinnmarks suprakrustalområde er bergarter

som er påfallende lite omvandlet i betraktning av den høye geologiske alder og i forhold til de tilstøtende deler av samme fjellkjedesystem i Sverige og Finland. Området omkring Čaravarre danner et slags minimum av omvandling; utover fra dette område tiltar omvandlingen sonevis. Omvandlingen som ansees for å være i det vesentlige betinget av høyere temperatur, kulminerer i den østlige og den vestlige granittiske sone (fig. 13). Pelittiske sedimentbergarter er brukt som sammenligningsgrunnlag i denne forbindelse, og index mineraler er kloritt, brun biotitt, granat (staurolitt) og sillimannitt. Der er visse brudd i den regelmessige oppbygging av disse metamorfe soner som er antatt å skyldes store post-metamorfe forkastninger (Padget).

Albitt—karbonat-bergarter. Bergarter anriket på albitt og karbonatmineraler forekommer mange steder over hele området. Det er grunner til å tro at de er dannet senere enn skifrene, og det later til at de er knyttet til soner hvor der har foregått tektoniske bevegelser.

Fig. 14 illustrerer forholdene ved Masijokka. En skiferserie er skjøvet over en annen (hornblende)skifer-formasjon, *Masijokka-skyvningen.* Det overliggende og en del av det underliggende viser anrikning av albitt og karbonat, ledsaget av nesten hel forsvinning av den opprinnelige skifrighet på noen steder, andre steder er bergartene mindre omvandlet. Denne anrikning er ikke alltid synlig uten mikroskopets hjelp. Følgende typer kan utskilles: hvit, grå, rød samt flekket. Mineralinnholdet er albitt, kvarts, karbonatmineral. Disse er vanlige. Mindre vanlig er epidot (klinozoisitt), aktionolitt, hematitt, skapolitt. Sjelden prehnitt (i en sprekkefylling), magnetitt, svovlkis, kobberkis, ilmenitt, molybdenglans.

Denne mineralparagenese viser bergarter helt forskjellig fra den opprinnelige karakter. For å belyse omvandlingen ble der utført to kvantitative kjemiske analyser, den ene av hornblendeskifer, den annen av et omvandlet parti av samme. Tabell I. Omvandlingen fremtrer som et diffust begrenset parti av lys bergart i mørk grønnskifer. Beregnede kationprosenter etter Barth (1948, 1955) er også oppført i tabell I. Det synes som om kalk og magnesia, nødvendig til å danne karbonater, tas fra hornblenden, og at endog et overskudd av Ca forsvinner sammen med Fe og Mg. Der tilføres kullsyre, vann og Na-silikat.

Langs hovedforkastningen øst for fjellrekken Čaravarre—Guivevarre er bergartene anriket på karbonat. Forkastningen vider seg ut til en bred sone omkring Gæšjavrre (fig. 3) hvor bergartene øyensynlig er sterkt breksjert. I en karbonatrik grunnmasse (som forvitrer med brun farge) ligger krystaller av feldspat (albitt) og av løsrevne stykker av sidesteinen. Analyse av et stykke mest mulig fri for stykker av sidesteinen er gitt i Tab. 3.

Lignende albitt—karbonatbergarter forekommer langs Avžžedalen 5,5 km øst for Kautokeino (avžže = dal med bratte sider). Her er sannsynligvis en forkastningssone langs dalen. En tilsvarende parallellsone nærmere Kautokeino, likeledes visstnok en forkastningssone, inneholder lignende bergarter.

Mellom Galanito og Kautokeino opptrer rødbrune bergarter bestående hovedsakelig av listeformet plagioklas (An_{10}), ved siden av underordnet kvarts, kloritt, epidot, mikroklin og erts. Grensen for dette område i nordvest er breksjert og inneholder soner av rødlig karbonat (ankerittisk dolomitt?) med kvartsårer. Den sydøstlige grense er dårlig blottet, men synes å være breksjert med albittårer som gjennomtrenger den diabasaktige sidestein.

Den kobberførende sone i Bidjovagge (Časkias) består av en lys kvarts-bergart som inneholder albitt og karbonat i betraktelige mengder. Der er også en finkornig bergart med ofittisk textur, kalt leuko-diabas, som er rik på hornblende og karbonat. Ved siden av opptrer grafittskifer, grønnskifre og grønnsteiner. Den kobberførende bergart og sidesteinen er til en viss grad breksjert.

Også i Njallavžže opptrer albitt—karbonat-bergarter i forbindelse med en oppbrudt sone. Små forekomster av lignende bergarter, ofte begrenset til en enkelt blotning er kjent fra flere steder i Časkiasgruppen, således ved Čuojavarre, Suvravarre, Riettejavrre og nord for Dædnomuotke. Noen av disse steder inneholder karbonatbergartene litt kobberkis.

I tillegg til de av Padget omtalte forekomster må nevnes et område av karbonatbergarter med kobberkis ved Devkišjokka nord for Stuorajavrre. Hovedbergarten er en diabasaktig grønnstein. Karbonatene forekommer som årer og uregelmessige partier i grønnsteinen. Antagelig er karbonatmineralene dannet som utsondringer i grønnsteinen, dannet ved metamorf differensiasjon. Padget mener å kunne betegne vandringen av de forskjellige elementer som en metasomatisk prosess.

Albitt—karbonatbergartene forekommer nesten utelukkende i områder med grønnskifer, grønnstein og diabaser, glimmerskifer etc., og aldri i de granittiserte områder. De opptrer fortrinsvis i eller nær forkastningslinjer eller breksjerte soner. Bergartene utgjør en distinkt mineralparagenese som innebærer en omvandling av moderbergarten ved tilførsel av Na, Si, CO_2 og H_2O og tap av Fe, Mg, Ca.

Lignende bergarter er beskrevet fra Nord-Finnland. Hackman (1927) beskriver en leukodiabas bestående av karbonat, albitt, muskovitt, jernerts og svovlkis i årer og slirer nær byen Sirkka ved Levitunturi. Väyrynen (1938) omtaler en albittfels med karbonat, albitt, kvarts, kloritt, lys amfibol og erts under navn av Karjalitt (det finske ord for Karelen er Karjala). Flere forekomster er kjent, delvis med uregelmessig form, delvis som årer. Mikkola (1941) beskriver en albittrik diabas med dolomittisk karbonat, med en årelignende forekomstmåte. Analyse se Tabell 6. Väyrynen anser bergartene for å være endeleddet av en basisk bergartsserie, hvilket innebærer en magmatisk opprinnelse. Mikkola forklarer bergartene som dannet ved lav temperatur, avsatt av vandige oppløsninger (sen-magmatiske) som har vært rike på kullsyre.

Grønnsteiner. Denne betegnelse omfatter flere bergartstyper, vanligvis grønne av farge, og med lignende kjemisk sammensetning, men av forskjellig opprinnelse og forekomstmåte. De omfatter på den ene side grønnskifre og agglomerater, sedimentære eller pyroklastiske av opprinnelse. På den annen side omfatter de diabaser, doleritter, hornblenditter og intrusive amfibolitter. Det er praktisk å skille mellom

1. Yngre basiske intrusiver, som antas å være post-metamorfe, muligens også post-kinematiske.
2. Intrusiver og extrusiver tilhørende Caskias-gruppen.

Den første kategori omfatter vesentlig basiske og ultrabasiske bergarter som er mindre viktige i kvantitativ henseende. Men de utgjør sannsynligvis en distinkt fase av intrusiv virksomhet, yngre enn den regionale omvandling av de øvrige bergarter, og også i det vesentlige yngre enn den tektoniske deformasjon og metasomatiske omvandling. Av slike bergarter forekommer doleritter, albittdiabaser, hornblenditter og kvartsdioritter. Dolerittene er til dels nokså

friske av utseende, undertiden sees avkjølingskontakter mot sidesteinen (Særradas). De optrer i gangform eller som linseformete legemer. De fleste forekomster er i den østlige del av området, langs Kautokeinoelven nord for Masi og i selve granittområdet østenfor (Særradas og Gætkaš). Enkelte doleritter av denne type forekommer også på Časkias, hvor de er klart gjennomsettende Časkias-gruppens grønne skifre, samt nord for Avžže. Teksturen er som regel tydelig ofittisk. Mineralene er ofte lite omvandlet. Olivin er dog oftest omvandlet til serpentin, pyroksen delvis til hornblende, men plagioklasen er mer frisk (An_{35}—An_{10}).

Albittdiabasene er alminneligere enn dolerittene, er som regel svakt omvandlet, og formen er gjerne tykke linser mer eller mindre konforme med sidesteinen. De viktigste forekomster er ved Fidnatjokka, nær Biennejavrre og Storfossen ved Kautokeinoelven, Garrovarre (NE Miron), Spielggejavrre (S for Biggejavrre). Mineraler er grønn hornblende, albitt (An_{5-10}) oftest med en rødlig farge, foruten små mengder av titanitt og epidot. Små mengder ertsmineraler er som regel til stede, f. eks. ilmenitt, magnetitt, svovlkis og kobberkis.

Hornblenditter forekommer over store deler av områdets nordøstlige del, særlig omkring veidelet ved Stuoroaivve. Hornblende og biotitt er de viktigste mineraler, men karbonater, skapolitt og kloritt kan opptre i betydelige mengder. Skapolitt er for øvrig et meget alminnelig mineral i basiske amfibolitter, til dels også i doleritter. Holtedahl omtaler dette fra den nordøstligste del av området. Formen på legemene tyder på lagergang-formete intrusjoner.

Kvartsdioritt. Den eneste omtalte forekomst er på Junkavarre 2 km W Galanito. Den består av plagioklas, ofte med tydelig sonar textur, men oftest omvandlet til serisitt og skapolitt. Hornblende og kvarts er alminnelige, mens mikroklin, biotitt, titanitt og ertsmineraler bare forekommer som underordnet i mengde. Padget antar en intrusiv karakter (grensene overdekket), og at den muligens er dannet før granittiseringen av området.

Časkias-gruppen. Betegnelsen grønnstein må her oppfattes i videste betydning, og omfatter

1. Pyroklastiske bergarter.
2. Lavaer.
3. Intrusiver.

Bergarter av mulig pyroklastisk opprinnelse er omtalt av Holtedahl (1918, s. 119—120) fra Likča. Et grovt grønnsteinskonglomerat med boller som skiller seg svakt ut fra den grønne grunnmasse er iakttatt av Per Holmsen som en ca. 100 meter bred sone strykende NNW—SSE noe vest for toppen av Likča nordover til Hyolithussonen. Mot syd taper strukturene seg. Bruddstykkene er til dels kantet og overhodet ikke vel rundet. Det kan lettest forklares som et agglomerat. På grunn av omvandlingen er det vanskelig å påvise med sikkerhet om noen av de mer finkornige sedimenter i samme område er av direkte tuffittisk opprinnelse, men det forefaller ikke usannsynlig.

Lavaer opptrer med sikkerhet på Likča. Holtedahl (se ovenfor) angir grønnsteiner med mandelsteinsstruktur og ring- eller nyreformete strukturer. Disse er også iakttatt av Per Holmsen. Nærmere Soadnjojavrre har Per Holmsen iakttatt strukturer i en grønnstein som minner sterkt om strukturene i en pillow-lava. Det kan neppe herske tvil om at der blant grønnsteinsbergartene på Likča finnes lavaer. Sammensetningen av en slik bergart er oppgitt av Holtedahl (1918, s. 121) og svarer til en basisk andesitt.

Padget og Pehkonen omtaler forekomster av mulige lavabergarter, henholdsvis fra Biello-gielas (SE Čaravarre og Čuojavarre nær S-enden av Stuorajavrre).

Intrusiver opptrer hyppig i Časkiasgruppen som konkordante masser i skifrene. Noen enkelte er angitt på kartet. Omvandlingsgraden er noe forskjellig, men en ofittisk textur kan ofte skjelnes. De ligner meget de albittdiabaser som er omtalt i et tidligere avsnitt, og kan lett forveksles med dem. I Bidjovagge danner en grønnstein av denne type et goldt parti i kobbermalmforekomsten der. Den er der magnetittholdig. En rekke forekomster av grønnstein, til dels inneholdende små mengder kobberkis på karbonatganger etc., opptrer i et drag Suvravarre—Njivlleroavve—østsiden av Stuorajavrre. En del av dem er muligens omvandlete lavabergarter, men da der ikke foreligger kriterier for dette siste, er de allikevel oppfattet som intrusiver.

Časkias-gruppens bergarter er i det store og hele oppfattet som et resultat av eruptiv virksomhet. Gruppen utgjøres i stor utstrekning av sedimenter, hvorav finkornige grønne leirskifre utgjør en viktig del. De er trolig dannet av forvitringsmateriale fra grønne lavabergarter. Intrusivene er da noe yngre enn sedimentene. En del

av intrusivene er så rike på hornblende at de må betegnes som hornblenditter. Slike opptrer i umiddelbar nærhet av Bidjovagge kobberforekomst. En del av intrusivene i dette område er så lite presset at de må oppfattes som post-orogene, og kan da ikke adskilles fra albittdiabasene eller dolerittene beskrevet i tidligere avsnitt.

Fuksittførende bergarter. Fuksitt (kromglimmer, krom-muskovitt) opptrer som tidligere nevnt i Masi-konglomeratet, Masi-kvartsitten (løse blokker) og i Agjet-kvartsitten. En særlig rik prøve tatt nær Fidnatjokka ble analysert på krom, og viste 1400 g/t. Denne forekomstmåte for fuksitt er ikke uvanlig. Kilden for kromet tør være en primær gehalt av kromjernstein i sedimentet, oppstått ved forvitring bl. a. av ultrabasiske bergarter. Under metamorfosen inngår krom i muskovitten.

Strukturgeologisk oversikt.

Fattigdommen på gode blotninger av fjellgrunnen skaper den samme vanskelighet for en strukturgeologisk interpretering som den gjør for stratigrafisk korrelering og tektonisk inndeling. Det er hensiktsmessig å betrakte de fire følgende områder hver for seg.

1. Det vestlige område.
2. Det østlige område.
3. Datkovarre-området.
4. Masijokka—Suolovuobme-området.

1. Det vestlige område omfatter ca. 70 % av det hele. Bergartene har et noenlunde konstant eller gradvis varierende strøk NNW og NW, men lokale avvikelser forekommer vest for Galanito hvor strøket er mer W. I hovedsaken svarer skifrigheten til den opprinnelige lagdeling, endog inne i det granittiserte område. De struktuelle hovedelementer er:

a) Foldninger. Den mektige grønnskifergruppe (Časkiasgruppen?) øst for Čaravarre danner etter Padgets oppfatning en stor synklinal, Čuojajavrre-synklinalen, med strøk NNW. P. Holmsen er tilbøyelig til å oppfatte denne som den østlige del av en større synklinal, Čaravarre-synklinalen, hvor de to halvdeler av synklinalen er forrykket i forhold til hverandre ved hovedforkastningen øst for Čaravarre. Denne fortolkning innebærer at Čaravarre-kvartsitten oppfattes som den yngste formasjon, og at de to grønnskifer-forma-

sjoner øst og vest for Čaravarre er ekvivalente, nemlig Časkias-gruppen. I detalj er skifrene sterkt sammenfoldet med steile lagstillinger, slik at de samme lag opptrer gjentatte ganger i retning tvers på strøkretningen. P. Holmsen mener også at der er betydelige avvikelser mellom skifrigheten og den primære lagdeling; lokale observasjoner viser dette, særlig i området vest for Čuolbmajavrre.

Den intense sammenfoldning med steile lagstillinger går i det hele tatt igjen i meget store deler av området, mest tydelig i grønnskiferbergartene, men også lokalt i kvartsitten i Salggevarre.

I nord stikker kvartsitten inn under Hyolithussonen ved Sallejokka, men antagelig bare så vidt. Antagelig lukker synklinalen seg på dette sted.

Agjet-antiklinalen markeres av Agjet-kvartsittens kontakt mot Časkias-gruppen. Aksen er N—S i den sydlige del, NNE—SSW i den nordlige. Den vestlige skjenkel er avskåret ved en forkastning. Aksefall både mot S og NNE.

Favresjokka-antiklinalen i den sydligste del av området har strøk NNW—SSE med aksefall i begge retninger. Den danner den aksiale fortsettelse av Agjet-antiklinalen.

Agjet—Časkias-synklinalen har et generelt strøk N—S. Den er mindre vel definert.

b) Kulminasjoner. Flere av de foregående synklinaler viser aksekulminasjoner (og -depresjoner). Se kartet Pl. 2. De viktigste er Agjet- og Favresjokka-antiklinalenes kulminasjoner. En depresjon skiller de to fra hverandre.

c—d) Småfolder og linjestrukturer. Slike strukturer er meget alminnelige, og følger ikke alltid akseplanene for foldningene i større stil.

e) Forkastninger. På grunn av manglende blotninger, er det ofte vanskelig å avgjøre så vel beliggenhet som spranghøyde og hvilken side som er sunket. Den alminnelige steile lagstilling bidrar til å komplisere tolkningen ytterligere. De viktigste større forkastninger fremgår av kartet. For nærmere detaljer henvises til den engelske tekst.

2. *Det østlige område* strekker seg fra en linje Masi—Biggejavrre—Spielggajavret og østover. Strøket forandrer seg gradvis fra NNW i den sydlige del til NNE i den nordlige. Linjestrukturer, foldningsakser og forkastninger følger mer eller mindre dette strøk.

I hovedsaken synes området å bestå av store folder, brudt av forkastninger, hvorved strukturene kompliseres betraktelig. Følgende strukturelle enheter er viktige:

a) Orvušvarre—Fidnatjokka-synklinalen
b) Værdnjaš-antiklinalen
c) Dabmutjavrre-synklinalen
d) Masi-overskyvningen.

a) Orvušvarre—Fidnatjokka-synklinalen. Studier over Masikvartsitten viser at den er plasert i en synklinal struktur — med akse gjennomgående NNE. Den vestre skjenkel viser østlige fall av lagene. Kvartsittens kontakt mot underlaget må av sterke grunner antas å være en tektonisk skyvesone. Nær Masi er kvartsitten og dens basalkonglomerat (Masi-konglomeratet) sterkt deformert. Øst for Biggejavrre har kvartsitten større utbredelse, og her opptrer basalkonglomeratet flere ganger ved overskyvning samtidig som kvartsitten er meget sterkt deformert og rekrystallisert og primærstrukturene er gått tapt. Deformasjonen opptrer særlig i soner med østlig fall og som antas å representere skyveplan. Et snitt i en kløft (smeltevannsløp) viser en overfoldning mot WNW flere meter. Små skyveplan er alminnelige, med østlig fall.

Den østlige skjenkel viser moderat vestlig fall. Basalkonglomeratet finnes i forskjellige deformasjonsgrader. Deformasjonsplanene faller mot vest. I et av disse, nær kvartsittens basale del, er der intrudert lagerganger av albittdiabas. Det antas at dette er foregått i et skyveplan.

Sentralsonen er komplisert bygget. Man må vente å finne stratigrafisk høyere lag her. Visse grønnsteinsbergarter som danner det meste av fjellpartiet Orvušvarre, og andre lignende bergarter SE Fidnatjavrre kan fortolkes som yngre lag på dette grunnlag (Časkiasgruppen?). Det siste sted opptrer også glimmerskifre.

Der er gode grunner for å anta minst én hovedforkastning innenfor sentralsonen, hvorved Orvušvarre-grønnsteinsbergartene begrenses mot øst. Den fortsetter videre SSW over Kautokeinoelven. Dragfolder i skjæringene langs østsiden av elven synes å vise overfoldning mot SE.

b) Værdnjaš-antiklinalen er mindre kjent. Den har øyensynlig akseretning NNE med aksefall mot NNE. Oftedahls studier antyder

også aksefall mot SSW, hvorfor en aksekulminasjon antas. Kjernen i antiklinalen består vesentlig av glimmerskifre, sterkt granittiserte.

c) Dabmutjavrre-synklinalen. Grunnlaget for oppfattelsen av en synklinal struktur her er begrenset til observasjoner omkring Dabmutjavrre. Tektonikken er imidlertid svært komplisert og synes å innbefatte skyvning, forkastning og foldning. Masi-kvartsitten opptrer i en steil synklinal med aksefall mot NNW. Den er overskåret av forkastninger med mer N—S retning gjennom midten av synklinalen hvor smale striper av glimmerskifer og grønnskifer opptrer. Mylonittisering i kvartsitten kan sees noen steder. Kvartsitten i den vestlige skjenkel er ved forkastning brakt i nær kontakt mot agglomeratisk grønnstein og grønnskifer. Basalkonglomeratet (deformert) sees et par steder, hvor det er forkastet i forhold til kvartsitten. I den østlige skjenkel mangler Masi-konglomeratet, men i stedet opptrer en eiendommelig konglomeratlignende bergart i det tilsvarende nivå øst for Dabmutjavrre. Det er helt forskjellig fra Masi-konglomeratet i petrografisk henseende. Padget antar at Masi-kvartsitten med dets konglomerat kan være skilt fra grønnskifrene ved et skyveplan som senere er foldet ned i en synklinal. Forkastningene kan være både eldre og yngre enn skyvningen. Forholdene er illustrert ved diagrammet fig. 19.

d) Masi-overskyvningen er allerede antydet under omtalen av Orvušvarre—Fidnatjavrre-synklinalen. En svakere deformasjon av underlagets skifre var også antydet. Lignende forhold sees lenger syd hvor det synes at Masi-kvartsitten over alt er skjøvet mot vest over skifrene. Denne skyvekontakt danner således en naturlig vestgrense for det østlige område.

3. Datkovarre-området og 4. Masijokka-Suolovuobme-området. Disse områder synes å danne en enhet, men adskilt i to områder ved en kulminasjon (kartet Pl. 2). Der er likhetspunkter mellom de skifrige bergarter nord og syd for denne kulminasjon. Datkovarre-området har en trekantet form og utgjør en synklinal med moderat aksefall (10—15°) mot SSW. Hele skiferlagrekken synes å være skjøvet opp langs kulminasjonens akse som går langs Masijokka. Breksjering og mylonittisering kommer til syne flere steder langs Masijokkas canyon, nedenfor broen. Der er en kontrast mellom det overliggende (alloktone) og det underliggende (autoktone), både i strøk og fall og i stratigrafisk henseende. Denne tektoniske linje

er betegnet Masi-overskyvningen. Lag av grafittskifer synes å ha spilt rollen som glideplan. Mot vest kan denne linje følges (?) ved forkastninger nord for Njarggajavrre.

Området nord for denne linje, Masijokka—Suolovuobme, strekker seg inn under Hyolithussonen. Dets strukturer er meget kompliserte. Lagene har i dette område gjennomgående moderate, til dels meget svake fall, selv om der lokalt opptrer steile folder i liten skala. De enkelte lag opptrer derfor mange steder innen området, således grafittskifer. Et drag av grafittskifer kan således følges fra Ruvvačokka på Beskades mot syd (kartbildet blir preget av den lokale topografi) til området nord for Saivva nord for Masijokka, og muligens derfra videre frem til Soadnjojavrres østside (Holtedahl 1918, s. 118). Visse uoverensstemmelser mellom bergartenes stratigrafiske plasering i forhold til grafittskiferen kan forklares ved at forskyvninger og overskyvninger spiller en stor rolle i utformingen av tektonikken, og da særlig den omstendighet at grafittskiferen har fungert som smøring langs skyveplan.

Soadnjojavrre—Kautokeino-«bruddet».

Grensen mellom det vestlige område og de øvrige, som går fra Soadnjojavrre i nord over Njarggajavrre og passerer (antagelig) vest for Kautokeino, er av stor interesse fordi den bl. a. synes å skille områder med forskjellig metamorfosegrad. Bergartene østenfor opptrer i høyere metamorf facies. Forskjellen er særlig påfallende i nord, omkring Masijokkas øvre løp, hvor finkornige argillitter (fyllitt) står langs elven, mens der østenfor i Masivarre opptrer grovkornig glimmerskifer. Granatglimmerskifer opptrer langs Salgganjokka lenger i nordøst. I syd omkring Kautokeino er der også høyere omvandlete bergarter i øst enn i vest (Pehkonen). I grenseområdet forekommer breksjering og mylonittisering, særlig utpreget i området ved Njarggajavrre, hvor der er minst to mylonittiserte soner. Forkastninger nær Magjetjokka synes å ligge nesten nøyaktig på denne bruddlinje, og det antas derfor at for en dels vedkommende i hvert fall, skyldes bruddet forkastninger.

Økonomisk viktige bergarter.

Under kartleggingen var meget av oppmerksomheten rettet mot spørsmålet hvorvidt der fantes økonomisk verdifulle bergarter og mineraler. Se fig. 21. Geokjemiske undersøkelser etter «siltmetoden»

har vært forsøkt i håp om å finne tegn på en mineralisering av kobber (eventuelt sink og bly), mindre magnetiske undersøkelser har vært utført, bl. a. ved den magnetiske anomali ved Fidnatjokka, og undersøkelser av blokkinnholdet i forskjellige slags moreneavleiringer har vært gjort i håp om å finne malmblokker, og i den forbindelse studier over isens bevegelse og transportretninger for å kunne følge eventuelle malmblokker tilbake til kilden.

Padget foreslår følgende klassifikasjon:

I. Metalliske mineraler,
   a) i lagdelte bergarter (sedimentære).
   b) epigenetiske dannelser.
II. Ikke-metalliske mineraler,
   a) grafitt,
   b) kalkstein,
   c) talk — serpentin,
   d) glimmer.

I. a). Den mørke skifergruppe inneholder enkelte horisonter av pelittiske skifre og grafittskifer som fører impregnasjoner av svovlkis, magnetkis og kobberkis (sjelden). Følgende steder ble nærmere undersøkt:

Masijokka, sving av elven 1 km N Masijokka bru. Breksjert kvartsitt med kvartskonglomerat eller kvartsbreksje med grafittskifer som inneholder magnetkis med litt kobberkis. Geokjemisk prospektering på begge sider av elven viste ingen utpreget anomali. Analyse av stuff viste Cu — 0,45 %. Ni — 0,07 %. Co — 0,02 %. S — 35,57 %.

Varetjokka, en bekk nær veien til Masi. Mørk pelittisk skifer med svak impregnasjon av svovlkis og magnetkis.

Njakkalækšejokka, en bekk SW veien til Masi som faller ut i Masijokka. Glimmerskifer og kvarts-glimmerskifer med svak impregnasjon av svovlkis. Grafittskifer i dette område har en sterk impregnasjon av magnetkis, til dels som store klumpformete masser, som forvitrer lett og den dannete svovlsyre gjør større flater vegetasjonsløse. Geokjemisk prospektering på kobber ga negative resultater.

Ruvvačokka (Gruvfjellet), kjent fra Tellef Dahls beretninger. Grafittskifer med magnetkis og svovlkis, samt litt kobberkis.

Salgganjokka, sammenløpet med Javrehuošjokka, 4 km SW Suolovuobme. Grafittskifer med kobberkis og magnetkis, samt mindre parti av ren svovlkis. Betydelig geokjemisk anomali etter «silt-metoden». Analyse av et relativt rikt stykke med synlig kobberkis viste: Cu — 0,63 %. S — 19,98 %. Ni — 0,07 %. Co — 0,012 %. På grunn av den lave kobbergehalt i relativt gode stykker kan forekomsten avskrives som verdiløs.

Ingajokka, en bekk nær Masi. Geokjemisk anomali. Grafittskifer med magnetkis, ikke synlig kobberkis.

I Časkias-gruppens bergarter opptrer også mørke pelittiske skifre og grafittskifer, undertiden svakt sulfidførende. En slik impregnasjon finnes et sted 5 km SSW Raisjavrre, samt i en foss (grafittskifer) i elven Sieidašjokka ca. 1 km ovenfor sammenløpet med Njivlle-ædno.

Ertsforekomstene av den her omtalte type antas å være av sedimentær opprinnelse. En viss anrikning, særlig i breksjerte partier, har foregått under metamorfosen.

b) De epigenetiske dannelser omfatter kobberkis, svovlkis og hematitt (?) som sprekkefylninger og som følge av metasomatiske omvandlinger. Radioaktive mineraler (uran?) hører antagelig hit.

Bidjovagge-forekomsten er en impregnasjon av kobberkis, svovlkis og hematitt (?) i en sone som bl. a. inneholder grafittskifer og en albitt-kvartsitt med karbonater. Kobberkisen er funnet både i grafittskifer og i kvartsitten, men vesentlig i den siste bergart. Kobberkisen opptrer som sprekkefylninger eller uregelmessige «skyer» i kvartsitten med karbonat. Dette er den eneste forekomst som kan sies å være lovende av alle de undersøkte.

Suvravarre, et fjellområde øst for Njivlle-ædno. I grønnsteinsbergarter, noen med antydning av diabas-struktur, forekommer kobberkis sammen med karbonat og kvarts på sprekkefylninger og i klumpformete partier av helt ubetydelig størrelse.

Devkišjokka, som er det samme som det nedre løp av Njivlleædno. Helt tilsvarende dannelser som i Suvravarre.

Riettejavrre, lignende som ovenfor, bare enda mindre.

Čuojavarre, SE for Stuorajavrre, mineralisering på sprekker i «grønnstein». En impregnasjon av svovlkis i en sone 150 × 20 m forekommer ved grensen mellom diabas og grønnskifer. En analyse viste Cu — 0,05 % . Zn — 0,1 %. Ni — ikke påvist.

Masijokka bro, karbonatganger i skifre som lokalt er omvandlet til albitt-karbonat-bergart med kvartsårer. Karbonatgangene inneholder to forskjellige karbonatmineraler samt svovlkis i klumper. Analyse av svovlkis ga Ni — 0,19 %. Co — 0,53 %.

Njallavžže, en canyonformet dal i den vestligste del av området (Troms fylke). Breksjebergart tilhørende albitt-karbonat-typen inneholder radioaktive mineraler, således bl. a. uranbekerts og uranotil.

Ikke alle albitt-karbonatbergarter inneholder ertsmineraler, selv om ovennevnte forekomster omtalt under b) er knyttet til slike. Mineralparagenesen inneholder også spor av andre mineraler, således hematitt, molybdenglans (i meget små mengder), og leilighetsvis bornitt.

Padget beskriver videre noen ubetydelige forekomster av magnetkis etc. Kobberkis ble funnet i små mengder i en granat-amfibol-bergart 1 km W Mirovarre. Beste prøve viste 1 % Cu. Malakitt forekommer mange steder i grønnsteinsbergarter langs Kautokeinoelven nedenfor Masi.

Magnetittforekomster av helt ubetydelig størrelse er funnet mange steder i området, i form av tynne soner parallelt med skiferlagene. Padget nevner to, men der er flere. Padget oppfatter en forekomst på Časkias som en sprekkefylning. Per Holmsen har sett andre, således ved Ruvvačokka, i Salgganjokka, i Časkias. Dessuten hematittlag ved Čarajavrre, og oppfatter disse forekomster som lag i argillitter, altså som sedimentære.

En magnetisk anomali ved Fidnatjokka har vært kjent tidligere (Trumpy, 1945). Anomalien går 700 meter i NE retning. Der er ingen blotning av fast fjell og morenedekket er tykt. Geokjemiske undersøkelser ga ingen anomali. Trolig skyldes anomalien en magnetittgehalt i en grønnsteinsbergart, på samme måte som en grønnsteinsbergart midt i kobberfeltet i Bidjovagge inneholder en magnetittrik grønnstein som forårsaker en lignende magnetisk anomali der.

Ikke-metalliske mineraler.

Grafitt opptrer som finkornig bestanddel i skiferlag på mange steder i områdene, både i den mørke skifergruppe og i Časkiasgruppen. Grafitten er oppstått ved omvandling av kullstoff, avsatt fra levende organismer i en fjern geologisk fortid. Tellef Dahll oppdaget først at der var kullstoffrike skifre i Finnmark og sluttet derav (feilaktig) at skifrene var av paleozoisk alder. Han trodde for øvrig at det var steinkull. Padget har fått analysert tre prøver av grafittskifer med hensyn til kullstoff. De viste et innhold av henholdsvis 0,40 %, 7,80 %, 26,37 % C. Grafitten er for finkornet til at den kan utvinnes på lettvint måte, og er sannsynligvis verdiløs.

Kalksteiner. Rene kalksteinslag er sjeldne på Finnmarksvidda, om slike overhodet er kjent. I alminnelighet er det dolomittiske eller endog ankerittiske karbonatmineraler som danner lagene. De tykkeste kjente dolomittlag i det undersøkte område forekommer øst for Njivlle—Ædno, mellom Suvravarre og Čuolbmajavrre, samt vest for Sieidašjokka (nesten totalt overdekket). Forvitringsoverflaten er vanligvis brun av farge p. g. av et innhold av jernkarbonat (ankerittisk dolomitt). En typisk prøve viste seg å bestå av dolomitt med 1 % $FeCO_3$.

Sekundære karbonatutsondringer og -omvandlinger er alminnelige, særlig i albittparagenese. Holtedahl angir et eksempel med 61,15 % $CaCO_3$, 31,00 $MgCO_3$, uoppløselig 6,31 %.

Glimmer forekommer på pegmatittiske ganger og masser i det granittiserte område i øst, særlig omkring Værdnjaš. En slik pegmatittisk masse nær Gargoluobbal (16 km SE Masi) er omtrent 100 m lang, og inneholder krystaller av kvarts, feldspat og muskovitt samt litt granat. Det har vært forsøkt drift på glimmer, men kvaliteten er ikke så god at den betinger tilstrekkelig pris.

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The Precambrian Geology of Vest-Finnmark

Scale 1:250.000

0 10Km

Caledonides
Kaledonidene

Sandstone, grit, quartzite (Caravarre)
Sandstein, "grit", kvartsitt (Caravarre)

Argillite
Argillitt

"Greenstones" Časkias group ... agglomerate
"Grønstein" Časkias gruppe, ... agglomerat

"Greenstones" diabase, dolerite, hornblendite
"Grønstein": diabas, doleritt, hornblenditt

Mica-schist, quartz-mica schist, ... Kautokeino conglomerate
Glimmer og kvartsglimmerskifer, ... Kautokeino-konglomerat

Quartzite (Masi, Agjet) ... Masi conglomerate
Kvartsitt (Masi, Agjet) ... Masi-konglomerat

Albite-carbonate rocks
Albitt-karbonat-bergarter

Granitic rocks, massive and homogeneous
Granittiske bergarter, massive og homogene

Granitized areas. Relics of quartzite (yellow), "greenstone" (brown)
Granittiserte områder. Rester av kvartsitt (gul) og "grønstein" (brun)

Quartz-diorite (Junkavarre)
Kvarts-diorit (Junkavarre)

N

Granittiske bergarter, massive og homogene

Granitized areas. Relics of quartzite (yellow), "greenstone" (brown)
Granittiserte områder. Rester av kvartsitt (gul) og "grønstein" (brun)

Quartz-diorite (Junkavarre)
Kvarts-dioritt (Junkavarre)

rock boundary
bergartsgrense

rock boundary uncertain
usikker bergartsgrense

fault
forkastning

presumed fault
antatt forkastning

folded bedding planes
foldete lagflater

state boundary
riksgrensen

county boundary
fylkesgrensen

road
vei

summit point
fjelltopp

dwellings
bosteder

N

Structural map of Vest-Finnmark.

anticline

syncline

culmination

small anticline

fault

overthrust

lineation