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Geological Map of the Area between Kattuglehø and Grimsdal, Dovre/Oppland

Report

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N-2580 Folldal, October 1981

Geological Map of the Area between Kattuglehø and Grimsdal, Dovre/Oppland

1. General remarks

Along the staked-out profiles x = 3800 to x = 6800 all geological data available were collected and the petrology plotted onto grid paper on a scale 1 : 5.000. Where there were no outcrops on these profiles striking 323° in 200 m distances, the nearest outcrops were plotted. Between the profiles only the more striking features such as big quartz bodies and iron hydroxide zones were mapped out. If necessary the grid was extended by using compass and altimeter with the aid of the 1 : 50.000 map 1519 III Hjerkinn.
This applies especially to the steep slope southeast of the southernmost peak of Kattuglehø, where there exists no survey at all. However even there the map should be fairly exact.
To the map belong two field books with detailed outcrop descriptions (in German), a geological section, and two cover sheets showing strike/dip and fold axes respectively. All angles refer to 360° circle.
For better orientation the conspicuous moraine at the upper end of Veslebekk valley and the topographic mark on the eastern top of Storberg were plotted on both the map and the cover sheets.

2. Petrology

The true thickness of the whole sequence between the Kattuglehø Gula Group rocks and Grimsdalen road is about 1.700 m along section I, assuming an average dip of about 33°.
About two thirds of the sequence are greenschists and amphibolites, the rest leucocratic meta-volcanics. The term green-

schist was used as a collective name. Next to greenschists sensu strictu (meta-volcanics) it comprises chlorite schists, phyllites, albite chlorite phyllites, carbonate phyllites and gneiss phyllites (after SYMPOSIUM 1967). These rocks may in part be of sedimentary origin but are probably mostly meta-tuffites. Rocks of probably prevailing sedimentary origin such as mica schists, a few gneisses rich in muscovite, and some graphite schists are of minor importance.

Transitions between most rock types occur. Greenschists with an appreciable amount of amphiboles macroscopically perceptible are called "amphibole schists" in the description (corresponds to "prasinite" in alpine literature). Massive meta-igneous rocks with a light (or even white) groundmass and amphibole phenocrysts were called "amphibole keratophyre" and given the keratophyre signature, regardless of the amount of amphibole.

The most common transition is that between greenschists and meta-tuffs of keratophyric composition. Colour and feldspar content do not always correspond, so the distinction had sometimes to be arbitrary.

Some of the greenstones may well prove to be spilites, i.e. basaltic rocks characterized by the assemblage albite-chlorite, which are commonly associated with quartz keratophyres and keratophyres.

Many greenschists and amphibole schists and even some of the more massive amphibolites contain light (to dark) brown carbonate, probably ankerite to siderite. In some gneisses, probablekeratophyric meta-tuffs, brown carbonate was found, too. In the felsic rocks it is always disseminated, whereas in the greenschists and amphibole schists it can be enriched in layers as well.

Many greenschists contain carbonate besides pyrite, which could be seen at the few fresh samples. If the rock displayed fresh carbonate besides rusty points, the latter where supposed to be weathered sulfide. If the rock showed rusty points but no fresh carbonate, this was marked with capital

R in the field books.

3. Quartz-carbonate concretions, quartz bodies, and quartzites

Many greenschists having carbonate in the groundmass also contain quartz-carbonate concretions. In general they are of fist to bread-loaf size, but can exceed one meter in diameter. The main constituents are quartz and the brown carbonate already mentioned. Sometimes additional white carbonate was found. The carbonate content decreases with increasing size of the concretion, quartz becoming the main constituent. But even in most quartz bodies exceeding one meter in size, which are often isolated from the country rock, brown carbonate is still found. Then they often contain light brown to pink garnet as accessory mineral.
The smaller concretions are sometimes folded.

Several big quartz bodies could be mapped out, the biggest one 70 x 35 m in size. Their genesis is of special interest as zones rich in iron hydroxide are bound to the unit which is richest in quartz bodies. The zone of brown weathered greenschists folllowing the southeastern rim of that unit might perhaps finally turn out to be a gossan. The big quartz bodies look like vein quartzes but prooved to be more or less conformable. They can laterally dissolve into numerous small bodies ("quartz-rich" signature) or even disappear completely, but normally appear again after a few hundred meters, generally bound to felsic rocks. Beyond the area mapped they continue westwards.
Some of the bigger quartz bodies contain greenschists or mica schists which may have been pressed in during orogenesis.
The only accessory mineral found is pinkish to light brown garnet, most probably the same garnet that occurs in the much smaller quartz bodies of certain sedimentary to early diagenetic origin.

Following STANTON (196) the stable coexistence of pyrite and siderite (at 25°C and 1 atm total pressure) requires a slightly to fairly reducing environment on condition that the solution is fairly basic to slightly acid. If the latter is the case, siderite is stable in the presence of amorphous silica. Thus the big quartz bodies - provided their nature is similar to that of the small ones - may throughout have formed during sedimentation or early diagenesis.

What has commonly been called keratophyre or meta-keratophyre in this region actually is more often a quartz keratophyre. (after STRECKEISEN 1978), containing quartz as a constituent next to albite (quartz phenocrysts in many samples).
While keratophyres plot in the andesite field, quartz keratophyres would correspond to dacitic rocks.
Furthermore the quartz keratophyres pass into what STRECKEISEN (1973) calls quartzolites, more or less pure quartzites of igneous origin. All felsic units mapped out are more or less abundant in quartzite and quartzitic gneisses, but they seem to be concentrated in the vicinity of the big quartz bodies and in the zones given the "quartz-rich" signature.
The terms "keratophyre" and "quartz keratophyre" imply secondary albitization of feldspar. Metamorphic alteration of the bulk chemistry is unlikely, as the mineral assemblage indicates only greenschist facies, chlorite and muscovite coexisting, and carbonate between silicates being preserved.
Thus a metasomatic - probably auto-metasomatic - albitization is likely to have happened, which may have been accompanied by silification. Pure silica magmas are at least unlikely, and only the few fine-stratified quartzites including some graphite-bearing quartzites might be interpreted as metasediments.
As there seems to be a relation between the country rock being silicified and the presence of quartz bodies, the latter may as well - at least in part - owe their existence to a metasomatic process.

This does not necessarily contradict the above-mentioned. Early diagenetic or auto-metasomatic, in any case a very early - a "pre-secondary" formation can be assumed.

4. Tectonics

"Schlingen" tectonics as presented by SCHACK-PEDDERSEN (1976) do not meet the actual structure of the area which is far more simple. In the northeastern part of the mapped area the main foliation strikes west. In the central and southwestern part it turns to southwest and in the upper left corner of the map to west again. This may be due to the behaviour of the Kattuglehø Gula group rocks as a rigid block during folding or to the intercalation of big greenschist and amphibolite bodies into unit 10 (see below). However the fold axes do not follow this bend but dip more or less westwards in the whole area.
The easiest way to explain this is assuming rather flat lying folds where a minimal shifting of the fold axis renders possible a great change in strike. Thus the numerous outcrops showing on a much smaller scale narrow flat-lying and slightly westwards dipping folds probably reflect the gross tectonic pattern.
The eastern rim of the Gula group displays exactly the same structural features. The foliation is generally less well-developped, but the few strike values that could be gained agree with those south or east of the propagated nappe border. The fold axes continue to dip slightly westwards.
The main rocks exposed at the edge of the Gula group are brown micaschists and brown gneisses. But there occur also amphibolites as well as leucocratic intercalations that are probably meta-volcanics, even if they are subordinate.
The first rocks of probable sedimentary origin, the micaschists west of x = 6050 appear not far from the Gula group. They look exactly like muscovite schists at x=6120/y=1020

which are intercalated in brown gneisses of the Gula group. All these facts are rather in favour of a conformable sequence than of any tectonical border at the slope of Kattuglehø.

5. Description of mapping units

Unit 1: Minimum true thickness ca. 350 m, thereof 210 m mapped out. Greenschists comparatively rich in feldspar, towards southeast carbonaceous, sporadically very rich in carbonate. Minor amphibolite schists, in profile 5600 one layer of massive amphibolite about 10 m thick. In profiles 5400 and 5600 in the uppermost part of the cliff towards Grimsdal a conspicuous iron hydroxide zone in gray and greenschists (can be seen from the Dovre - Faldet road). No other intermediate or felsic intercalations. In the slope about 100 m above the bottom of Grimsdal muscovite schists appear amidst greenschist outcrops.
The rocks are interpreted as basic meta-tuffites that pass occasionally into basic meta-tuffs or into clayey-silty meta-sediments.

Unit 2: True thickness about 100 m. Gray to white gneisses and schists, mostly slightly greenish, are the common rock type. In the southern part they are rich in muscovite. In profile 5800 a slightly greenish gray massive fine-grained garnetiferous gneiss occurs, but is yet far from being widespread. A thin layer of massive amphibolite is exposed in profile 5600. The rocks of this unit pass gradually into those of unit 1 by becoming greenish and displaying thin greenschist intercalations.
The sequence can be explained as rather intermediate to acid meta-tuffs with some intercalations of felsic to basic igneous rocks.

Unit 3: A marker between units 2 and 4. Thickness less than 10 m. Greenschist rich in feldspar and comparatively massive, in part even amphibolitic, in profile 5400 bearing big garnets.

Unit 4: True thickness about 75 m. Light gray to white gneisses and schists. Numerous small quartz bodies are a striking feature. Greenish gneisses and thin greenschist intercalations are rare. Supposed to be of exclusive volcanic origin. Mainly quart tophyres and keratophyres and the corresponding meta-tuffs.

Unit 5a: True thickness about 280 m. While along profile 5400 mainly light gray to white keratophyric gneisses (as in unit 4) are exposed, those are of minor importance in the profiles 5800 to 6600. There they often pass laterally or vertically into massive deep-gray gneisses that display garnet and biotite porphyroblasts in a very fine-grained groundmass.
Black laminated shales, some of them containing graphite, seem to be wide-spread, but are poorly exposed. They are often found in the rubble. They occur together with dark gray to sometimes black quartzitic gneisses and quartzites. In profile 6000 and on line x = 5850 some micaschist occurs. At 6600/-278 a brown weathering breccia is exposed. At 6000/-108 a boulder consisting of a massive quartz-pyrite rock was found next to an iron hydroxide zone. Such zones are found at various places but are always of inferior qualitiy.

Unit 5b: Between profiles 5400 and 6200 greenschists are exposed in the midst of zone 5a, a bigger body in the north, a smaller one in the south. Along the constructed section their true thickness is 95 and 25 m respectively, but further northeast they build up more than one third of the whole sequence. Some of the greenschists are carbonaceous, some rich in feldspar. In profile 6200 amphibolite is exposed. The dark gray rocks mentioned above occur again as intercalations, especially the fine-grained gneisses

Unit 5 is supposed to be a sequence of intermediate to basic meta-tuffs, that interdigitate with each other. The amount of

meta-igneous rocks seems to increase towards northeast.
If there is any true meta-igneous rock between profiles 5400 and 6200, it is probably the deep-gray fine-grained gneiss (and the amphibolite in profile 6200). The shales and graphite schists probably represent former tuffites, perhaps even pure sediments.

Unit 6a: True thickness about 265 m, thereof 15 to 25 m felsic intercalations. - Greenschists, in some places containing carbonate, towards north and east more often quite rich in feldspar. Amphibole schists are found be ides greenschists between profiles 5600 and 6200. They definitely prevail in profile 5600, where they are accompanied by fine-grained amphibolites. They contain sulfide at 5780/490-520. In some places the greenschists display rusty points of 1 to 2 mm size, which might be weathered sulfide (wide-spread in profiles 6400 and 5800.

Unit 6b: Greenish-gray to gray or even white gneisses and schists, both rich in biotite, are intercalated in the northern part of unit 6a. Two layers could be mapped out, each of them representing a couple of thin gray bands interdigitating with greenschists The area northeast of section 5400 is hidden under moraines. But there is much evidence that at least one layer continues towards northeast. Between the profiles 4000 and 3800 several bands of gray rocks appear again, intimately digitated with greenschists(not on the map).

Unit 7: The rocks of this unit, although chiefly greenschists, were given an extra signature because of the significant iron hydroxide concentration. The greenschists are almost carbonate free. The few meta-keratophyric intercalations that occur, have nearly always changed colour into brown. However gray to white gneisses without iron hydroxide occur between profiles 5600 and 5800 amidst the most striking brown zone.
The by far biggest part of the brown rocks are altered greenschists, mostly blady and often disintegrated into small pieces. Wherever in the whole area these decomposed brown greenschists occur, they are almost always free of vegetation though forming

a very soft ground. This might be due to the concentration of certain cations in the circulating solutions.
If this unit contains a gossan, the latter is intensely leached. Sulfide or sulfate have not been found. At 6000/530 some greenschists display big brown stains. With the exception of point 5800/500 such stains have not been found in the other units. There sulfide occurs in addition.
A bore-hole beginning at 5810/780 (i.e. somewhat southwards of the southern end of the plotted moraine) and dipping 45° in 119° would cross the unit at 55 m and unit 8 (which in part also weathers brown) at a distance of 30 m.

Unit 8: True thickness about 40 m along the constructed section, maximal thickness about 90 m further east. Massive to blady gray to white schists and gneisses, often extremely quartzitic. The gneisses of profiles 5600 to 4800 contain biotite, the amount of this mineral increasing towards northeast. In profile 4800 a biotite gneiss occurs but is of minor importance. Thin muscovite schist intercalations occur, but cannot be mapped out.
The gneisses are sometimes slightly to fairly greenish, especially along profile 4800, where pink garnet is abundant in some places. Along profiles 6200, 5200, 4200, and 3800 there are a few outcrops of amphibole ker-tophyre. A minor greenschist intercalation occurs east of line x = 4100. At 3800/940 pyrite was found. . There and at 3800/960 the greenschists have in part brown colour. The iron hydroxide zones betweenprofiles 5000 and 5200 and at 4120/925 are striking.
The whole unit is extremely rich in quartz. Between line x = 4300 and profile4600 numerou s small quartz bodies are evenly distributed while at x = 3800 the quartz is concentrated in one big body of 70 m length. Some of the gray gneisses contain lapilli. With the exception of the intercalated greenschists the unit can be interpreted as a series of fairly acid to intermediate igneous rocks and meta-tuffs, most of the rocks being rather quartzkeratophyres than keratophyres.

Unit 9a: True thickness along the constructed section about 150 m,

maximal thickness further northeast nearly 200 m..
Gray intercalations are very rare, greenschists being by far more important. Profiles 5800 to 5400 are rich in green phyllite to micaschist, 5400 and 5800 contain minor amphibolite.
Amphibole schists are wide-spread along profile 5800 and of minor importance along line x = 6350 and profile 6000.
At 6200, 4400, 4200, and 3800 some brown weathering greenschists occur. Pyrite was found at 5315/1150, 4400/1150, 4400/1135, 4200/1063, 4200/1000, and 4000/1095.
All green rocks of this unit are very often rich in carbonate and contain carbonate-quartz-concretions. Feldspar-rich greenschists are frequent between profiles 5400 and 5800.

Unit 9c: Northeast of profile 4800 the greenschists interdigitate with gray gneisses. The thin greenschist band that follows between these gneisses and unit 10 consists of carbonaceous greenschists and some dark green gneisses west of profile 4600, whereas garnet amphibole "garben" schists follow east of 4400. The latter resemble amphibole keratophyres, but their groundmass is often distinctly green.

Unit 9b: The gray to white gneisses mentioned above form a brown-coloured cliff towards Veslebekk valley. They are rich in garnet. Fine-grained quartzites are abundant. At 4400/1190 some thin graphite schists were found. Pyrite was found at 4000/1160.

The greenschists of unit 9 are interpreted as basic meta-tuffites that sometimes pass into purer sediments (micaschist) or met-tuffs, intermediate or basic igneous rocks being less important. The gray gneisses forming the cliff are probably intermediate to acid meta-tuffs. They often display relictic lapilli.

Unit 10a: True thickness along the constructed section 40 (southern) + 30 m (northern wing), broadening towards north.
Gray to white gneisses and schists, mostly rather massive than schistose, are the common rock. They are quite often distinctly greenish and rarely as pure as those of unit 8. A great part of

the gneisses are quartzitic. Quartzites are concentrated from profile 6800 to profile 6000. Between profile 6000 and line 5900 muscovite quartzites are exposed. They lead over to micaschists, the latter being intercalated in profiles 5600 to 4600, i.e. in the zone of reduced thickness.
Minor amphibole schists occur from profile 6400 to profile 6800. Amphibolite is only common in profile 6200 and in the upper part of profile 4400.
Amphibole keratophyres occur along line 6330 and profiles 6000 and 5200 and are wide-spread in the northeastern broadening zone (upper profiles 4400 to 3800).
Pyrite was found at 5310/1270, 5350/1250, and 6526/1025. Small iron hydroxide zones in profiles 6400 (greenschist) and 5600 (keratophyric gneiss) are of minor importance.
In section 4800 a biotite gneiss occurs, in the creek between profiles 5200 and 5400 a dark grayish-green gneiss rich in mica. The white to light gray gneisses of the upper wing of profile 6400 contain in part garnet and display locally rusty points. Dark grayish-green gneisses (line 6050) lead over to the massive greenschist and amphibole schist intercalation (unit 10b).

Unit 10b: True thickness along the section about 150 m, a few hundred meters in the western corner of the map.
Next to greenschists amphibolites and amphibole schists are a constituent part of this sequence. They are seldom carbonaceous. Some garnetiferous amphibole "garben" schists occur in profile 6600. Profile 6200 shows an increase of mica content towards the neighbouring micaschist (unit 10d)

Unit 10c: Maximal thickness about 140 m.This unit is the northeastern counterpart to unit 10b. Like that it is intercalated into unit 10a. Greenschists, quite often carbonaceous, and greenish-grayish gneisses. Amphibole schists lack. In profile 4000 some amphibolite occurs.

Unit 10d: True thickness about 30 m. Micaschists of the steep southern slope of Kattuglehø. Some of the rocks are rather

phyllites or quartz phyllites with an appreciable amount of quartz lenses. The rocks are in part carbonaceous. Quartz carbonate nodules occur. The micaschist becomes greenish towards west and probably passes into or digitates with the greenschists of unit 10b (no outcrops).

Compared to the other units described, unit 10 is quite heterogeneous. The rocks of unit 10a probably derive from keratophyric magmas, in part from basic magmas, whereas the intercalated and neighboured micaschists and phyllites may have been tuffites to rather pure sediments. The intercalated green rocks derive for the bigger part from basic magmas and tuffs that intercalate with basic meta-tuffites.

Unit 11: True thickness about 40 m along the section, broadening towards north. Greenschists rich in feldspar, often grayish. Amphibolites are a major constituent. They are sometimes very massive. In profile 4800 some biotite gneiss is exposed. Interpretation: Basic to intermediate tuffs and tuffites, basic igneous rocks.

Unit 12: Badly exposed. At 4800/1900 gray and greenish-gray gneisses. At line 6050 gray micaschists and quartz phyllites, that are carbonaceous and contain some quartz carbonate nodules. The following fuchsite-bearing marble belongs already to the Kula group.

Sample List

3740/1125 keratophyre with much chlorite and muscovite. rusty weathered carbonate. Pyrite
3800/940 keratophyre with rusty ?pyrite/?carbonate
4230/1195 keratophyre or quartz keratophyre with black intercalation. ? Graphite
4400/1220 amphibole garben schist with garnet
4790/1025 quartz keratophyre with subordinate pink garnet
4800/1040 keratophyre very rich in muscovite, actually a mica schist
4800/1645 greenish keratophyre
4800/1650 amphibole keratophyre with amphibole or chlorite in the ground mass
4790/1690 brown weathered gneiss rich in mica (biotite and muscovit
4795/1773 dark gray gneisses. Two samples
4800/1910 greenish keratophyre with sulfide
4815/1910 yellow to brown keratophyre, weathered, rusty points (?carbonate)
5390/-75 amphibole keratophyre with white ground mass
5405/-665 greenschist rich in feldspar, big garnets
5440/1515 gray quartzitic keratophyre with gray veins
5430/1520 dark gray gneiss with brownish layers rich in carbonate
5818/-775 quartzitic keratophyre, dark gray, probably containing graphite
5800/-350 massive dark biotite gneiss with rusty points, probably carbonate
5800/-200 keratophyre or quartz keratophyre rich in garnet, containing carbonatic layers
5800/360 amphibole keratophyre with rusty points, maybe sulfide
5780/490 dark green fine-grained amphibolite with sulfide

5790/515 keratophyric intercalation in amphibolite, containing sulfide
5800/1131 fine-grained amphibolite
5600/1215 greenish-gray gneiss, maybe leuco-amphibolite

6000/-875 fine-grained gray gneiss, laminated, biotite porphyroblasts

5988/-370 massive biotitegneiss, perhaps some amphibole layers, with brown rusty points and carbonate layers

6000/-155 ochre brown weathered rock, sulphurous smell

6008/-108 block, no outcrop. Quartz pyrite rock

6060/558 massive dark gneiss, probably a meta-tuff, comparatively fine-grained, many rusty points in the groundmass

6055/795 greenish keratophyre containing sulfide

6050/940 graphite schist

6050/1060 marble with some fuchsite, Gula group base

6200/-450 graphite-schist

6197/-382 black laminated quartzite to quartzitic gneiss

6255/-222 gray quartzitic gneiss or quartz keratophyre, fine-grained,with light brown garnets and biotite

6255/-210 the same, passing into amphibole keratophyre

6400/-475 black quartzite or quartz keratophyre, with weathered sulfide (?) in the groundmass

6400/-427 fine-grained laminated gray schist

6390/950 dark gray gneiss

6400/960 mylonite containing graphite

6525/1025 keratophyre rich in chlorite and muscovite, containing big pyrite crystals

6600/-278 brown weathered breccia

6620/-310 black schist

6600/600 amphibole keratophyre

6700/475 greenish keratophyre or quartz keratophyre out of a brown weathering zone

ca 6800/1700 brown gneiss with cavities (former ?sulfide) and manganese hydroxide

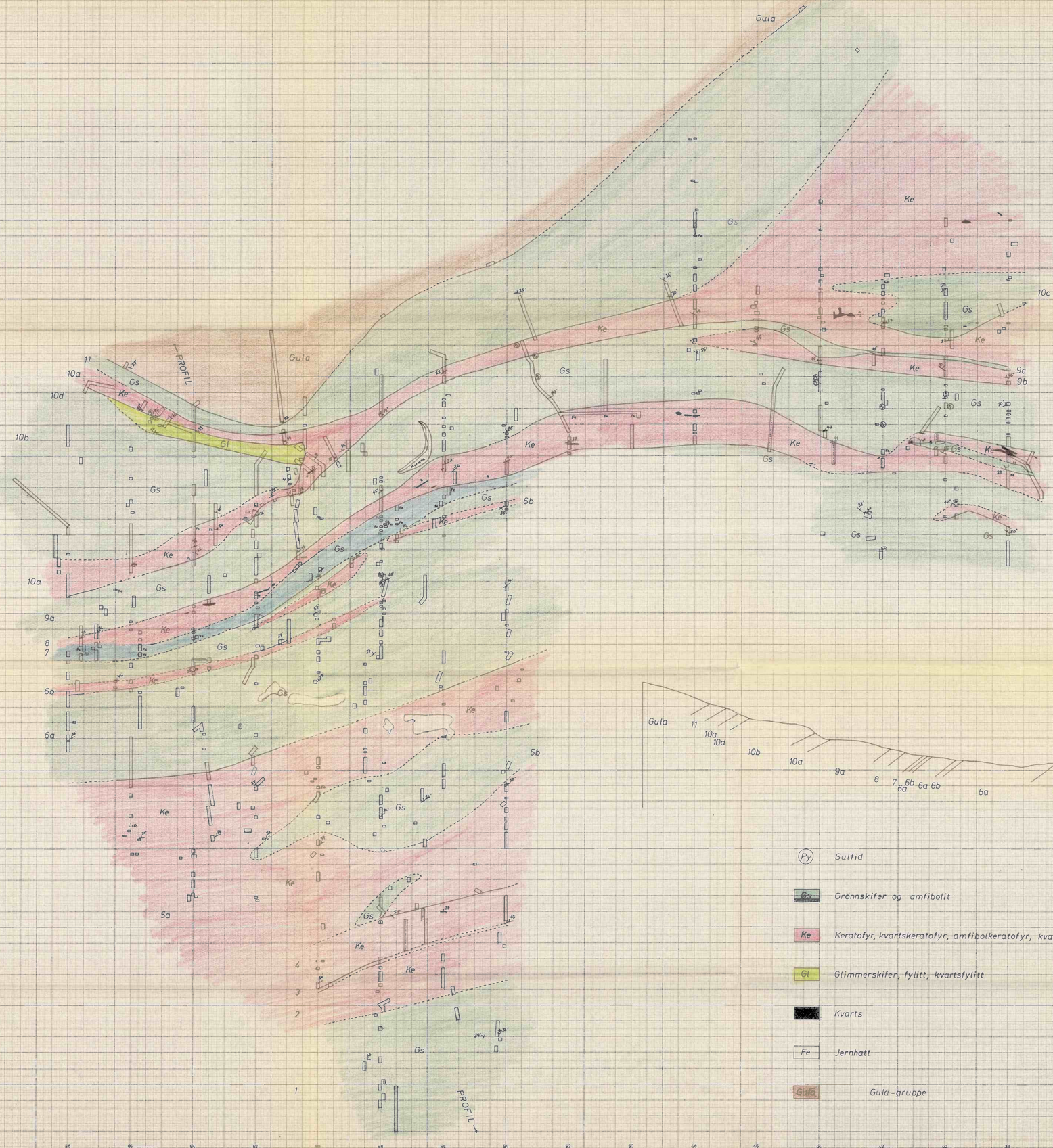
4385/1190 graphite schist

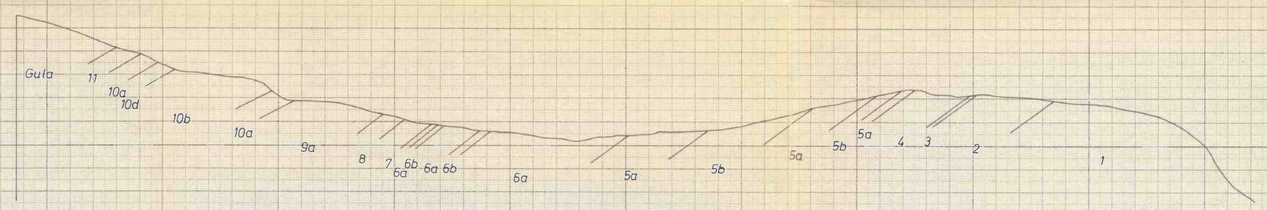
3970/1625 quartzitic gneiss

GEOLOGISK KART OVER OMRÅDET MELLOM GRIMSDALEN OG KATTUGLEHÖI (DOVRE/OPPLAND)

EWALD TRILLER
1981

1 : 5000





Py Sulfid

Gs Grönnskifer og amfibolit

Ke Keratofyr, kvartskeratofyr, amfibolkeratofyr, kvartsitt

Gl Glimmerskifer, fylitt, kvartsfylitt

Kvarts

Fe Jernhatt

Gula Gula-gruppe

323°
N