Bergvesenet

Postboks 3021, 7002 Trondheim

Rapportarkivet

Bergvesenet rapport nr	Intern Journal nr	Internt arkiv nr	Rapport lokalisering	Gradering
BV 2193				**Fortrolig**
Kommer fra ..arkiv Sulitjelma Bergverk A/S	Ekstern rapport nr "522240003"	Oversendt fra	Fortrolig pga	Fortrolig fra dato:

Tittel

Rapport fra Beiarn og Saltdal.

Forfatter	Dato	Bedrift
BADHAM N	1968	Sulitjelma Gruber A/S

Kommune	Fylke	Bergdistrikt	1: 50 000 kartblad	1: 250 000 kartblad

Fagområde	Dokument type	Forekomster
Råstofftype	Emneord	

Sammendrag

Generell berggrunnskartlegging i Beiardalen. Nederst i stratigrafien granittisk gneis, deretter veksling av skifer og marmor / dolomitt. Mindre talk -kropp påvist, men for urein og liten til å være av økonomisk interesse. Saltdal. Beiarn.

Report on Beiardal Map. Nick Badham

Traverses were made in the NE region from the granite gneiss - probably, in fact, sparagmite here - out for 3 - 4 kms. A basic stratigraphy was set up. It consists generally of alternations of schists and marbles, with the margins parallel to the regional schistosity S1. Some of the schists are distinct, and some are not so. This, coupled with the facts that thicknesses charge a little, and that mineral proportions alter along strike, means that it is hard to distinguish any ore group, unless more of the succession be seen. This basic division pasists round to the NW corner of Bjellavatn, where there is a contorted zone, with miner folds plunging at 20 - 30° to the north west. Apart from the fact that this is late stage folding in S1, with a weak development of S2, little more can be said, because exposure is minimal here.

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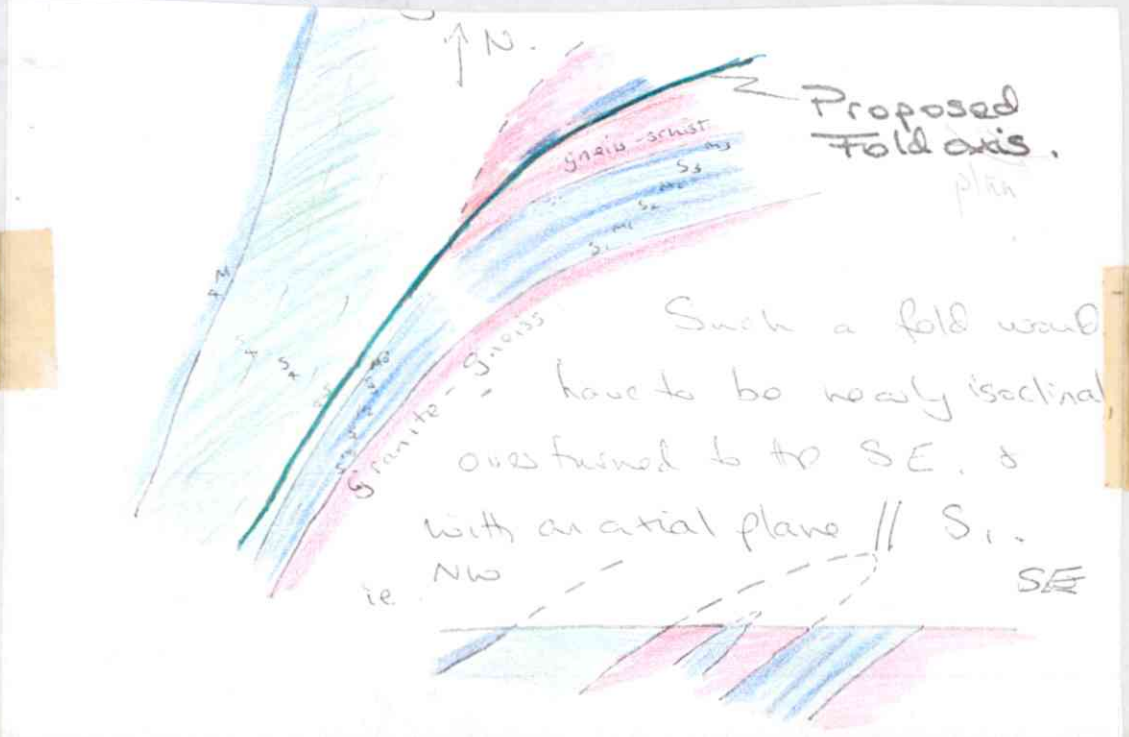

052.009

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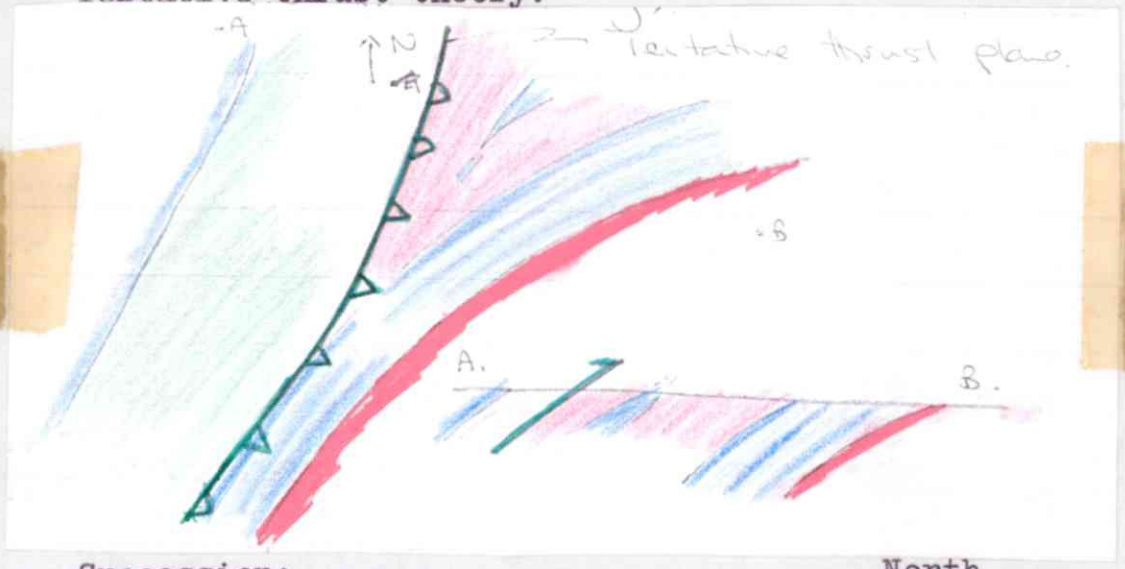

Succession:	North
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Schists 4	Gneissose schists
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Schists 3	Schists 3
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Granite gneiss	Granite gneiss

Granite Gneiss:

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Coarse, massive biotite-muscovite schists. They contain boudined tenses of quartzite in layers, some calc-schist bands and an amphibolite band and have large, brown, broken garnets in many of these bands.

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In the east, toward the top of this group are thick muscovite schists (musc. up to 50%) with intercalated quartzites. These thin westward and one goes by 060185 - this is probably a fold closure, rather than a lateral facies charge. The top 5 m are always pure marble, and contain, along a part of its length a metabasic body, composed mainly of talc.

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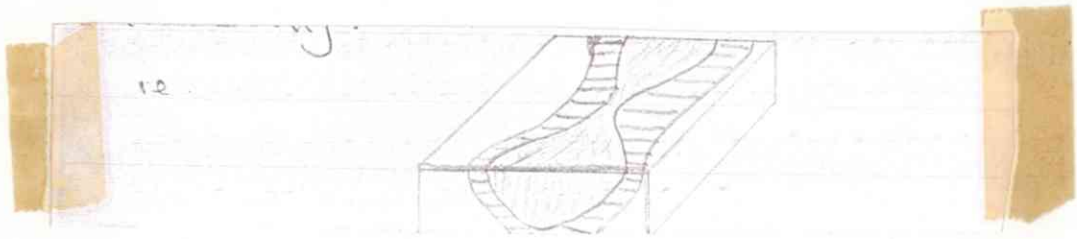

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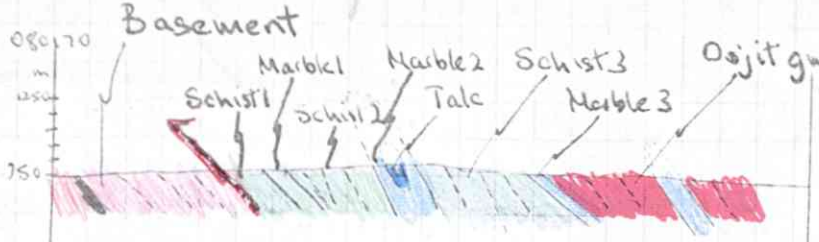
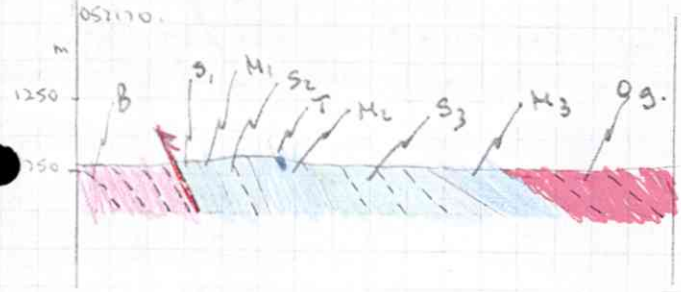
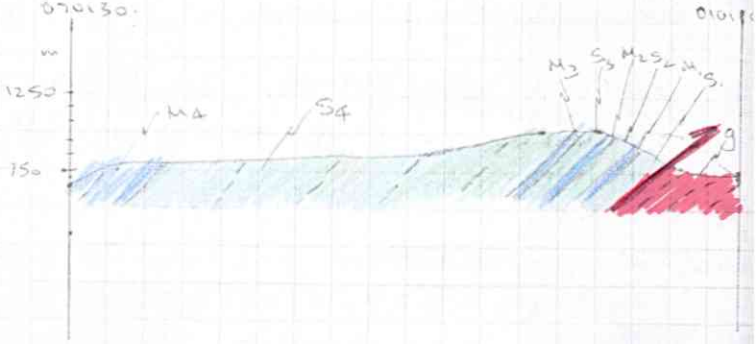


Section 057170 to 057210. Scale: Vert = Horiz = 1cm : 500m.



Section 010110 to 070130. Scale 1cm



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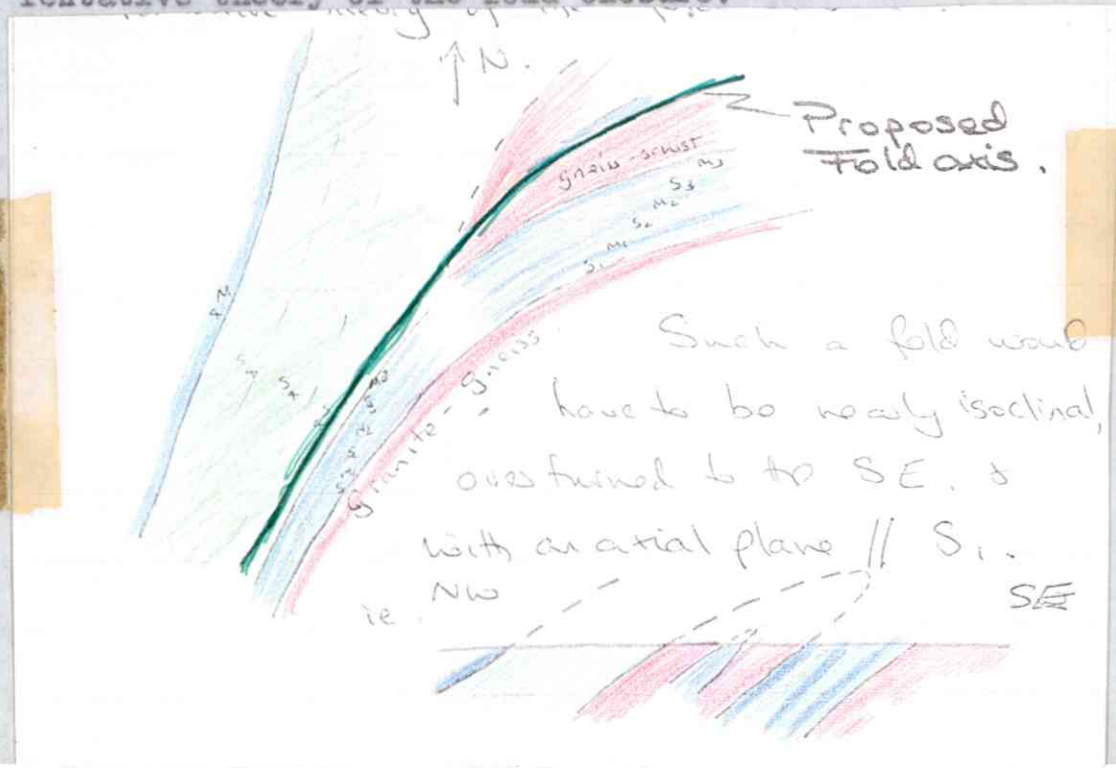

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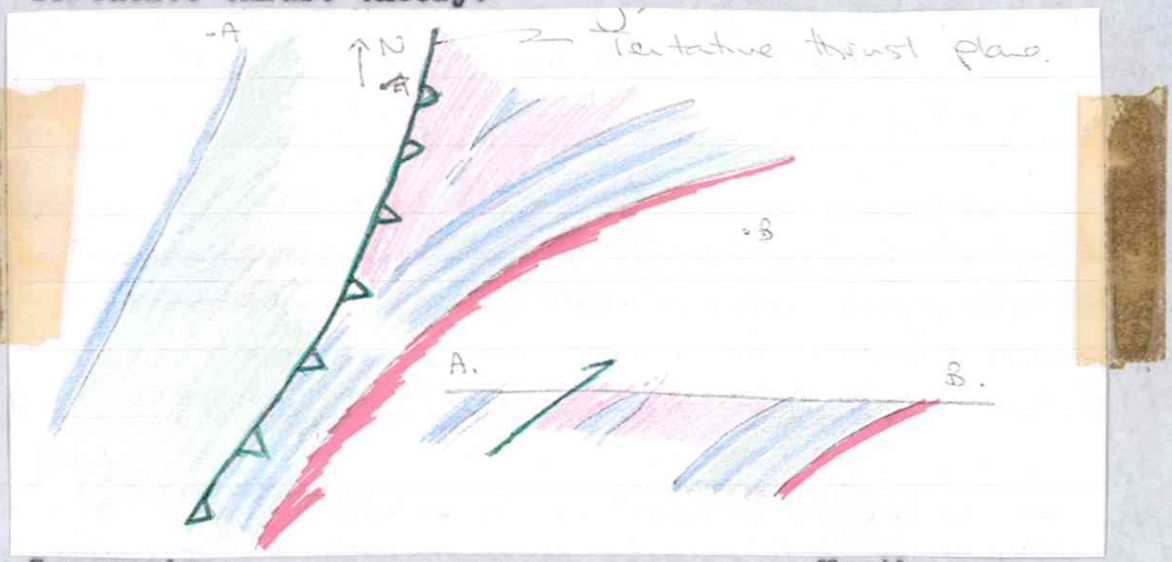

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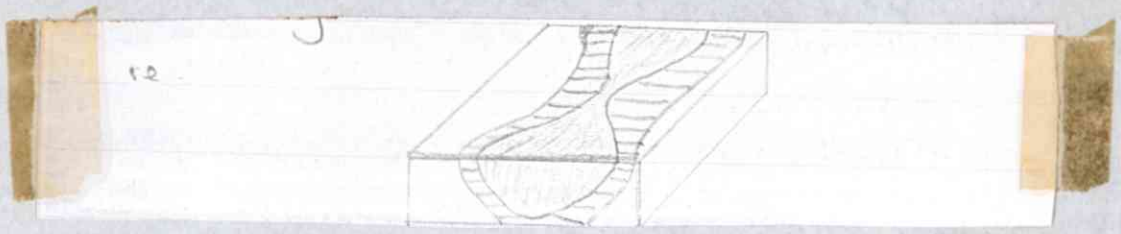

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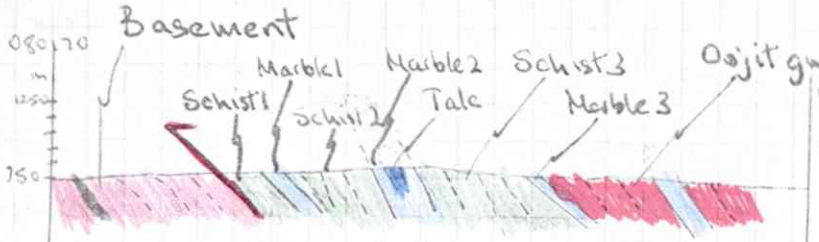

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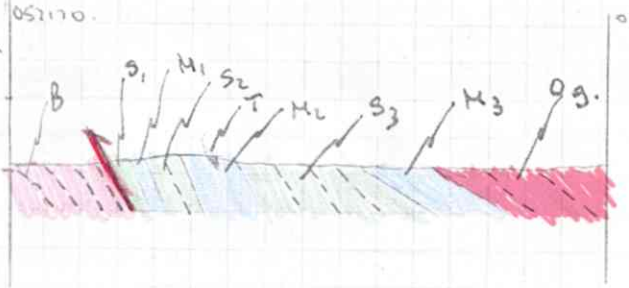

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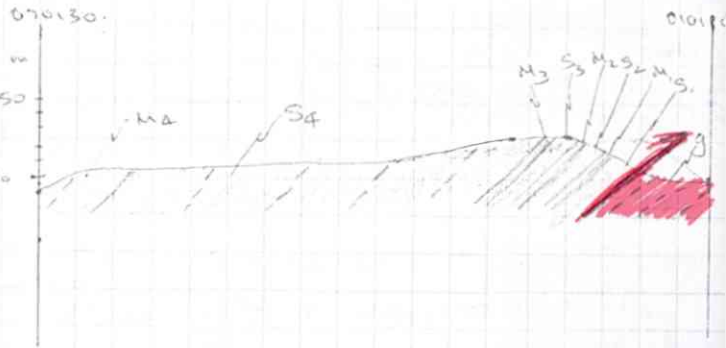

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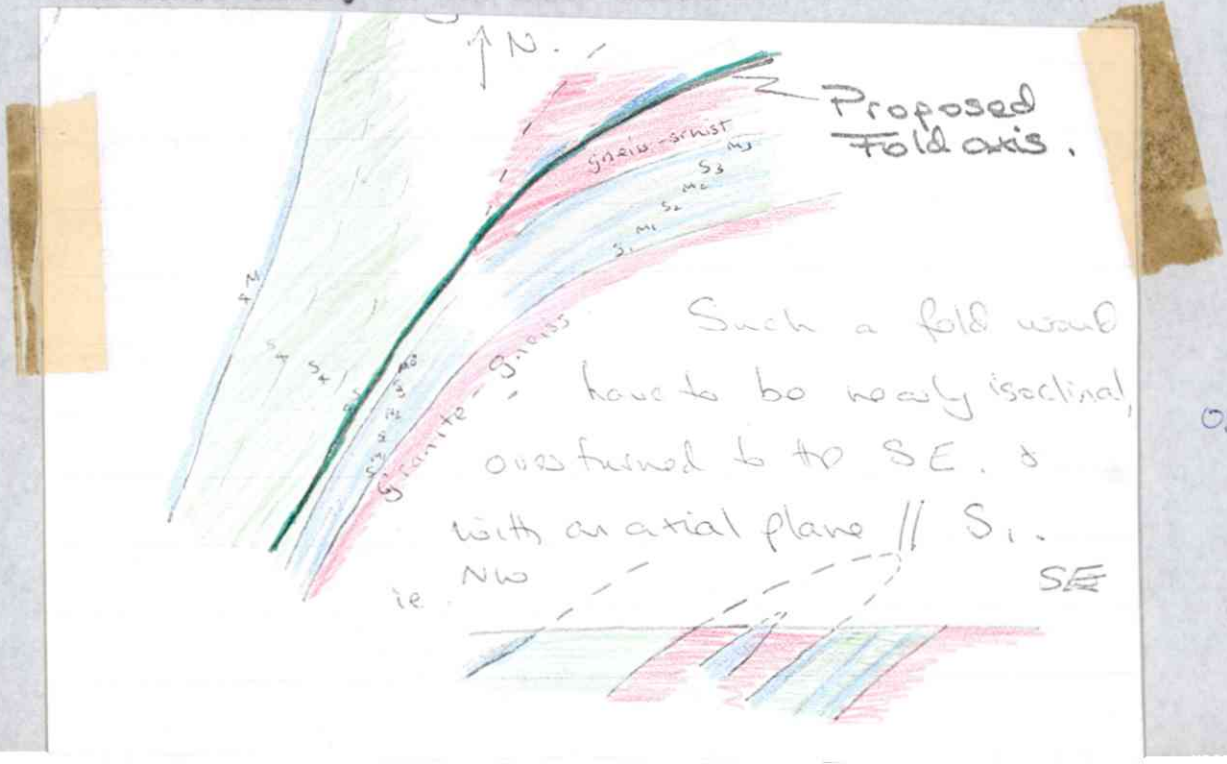

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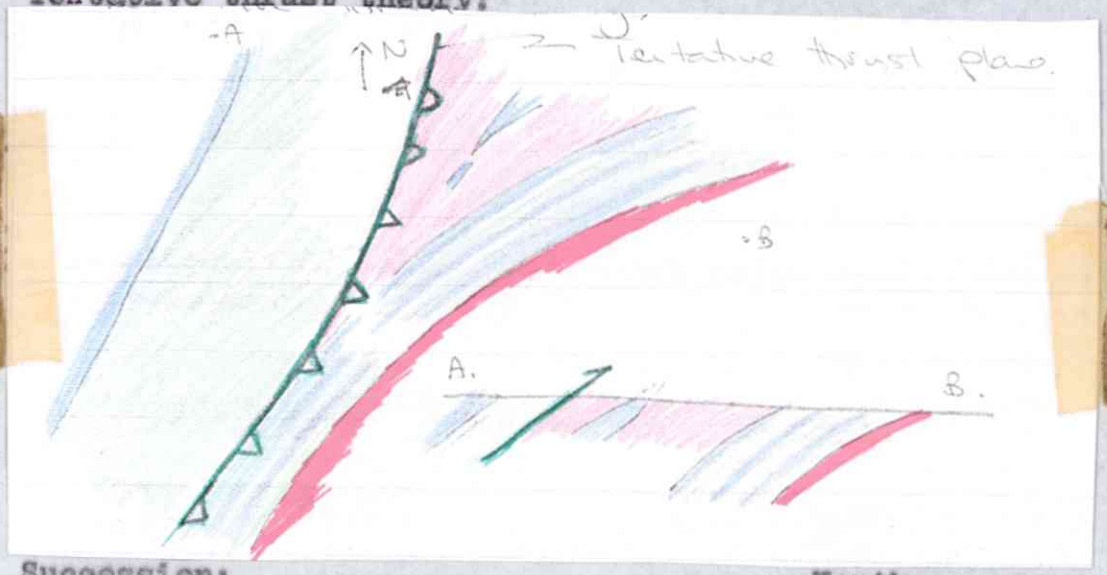

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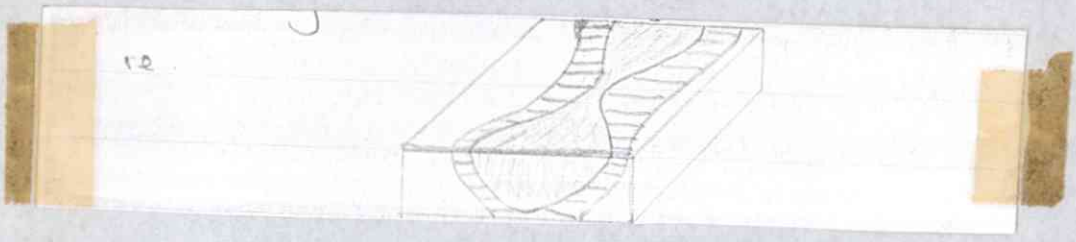

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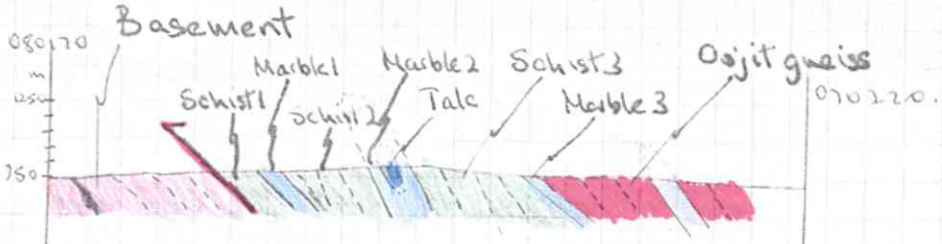
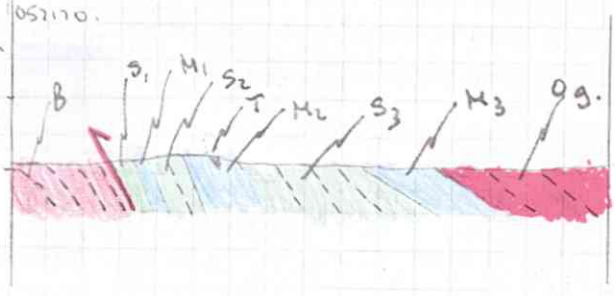
- Section 080170 to 070220. Scale : Vertical = Horizontal = 500 m : 1 cm



Section 057170 to 057210. Scale : Vert = Horiz = 1 cm : 500 m.



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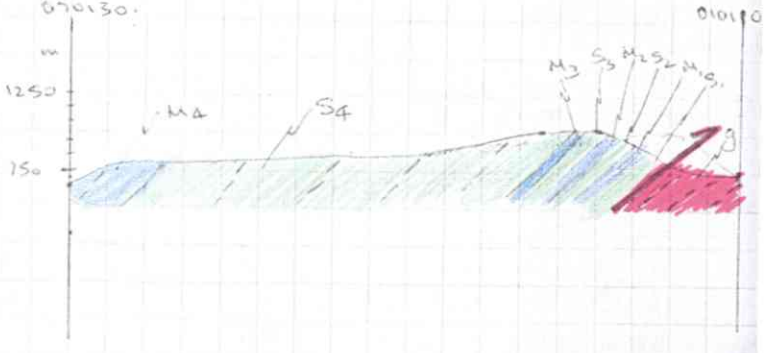
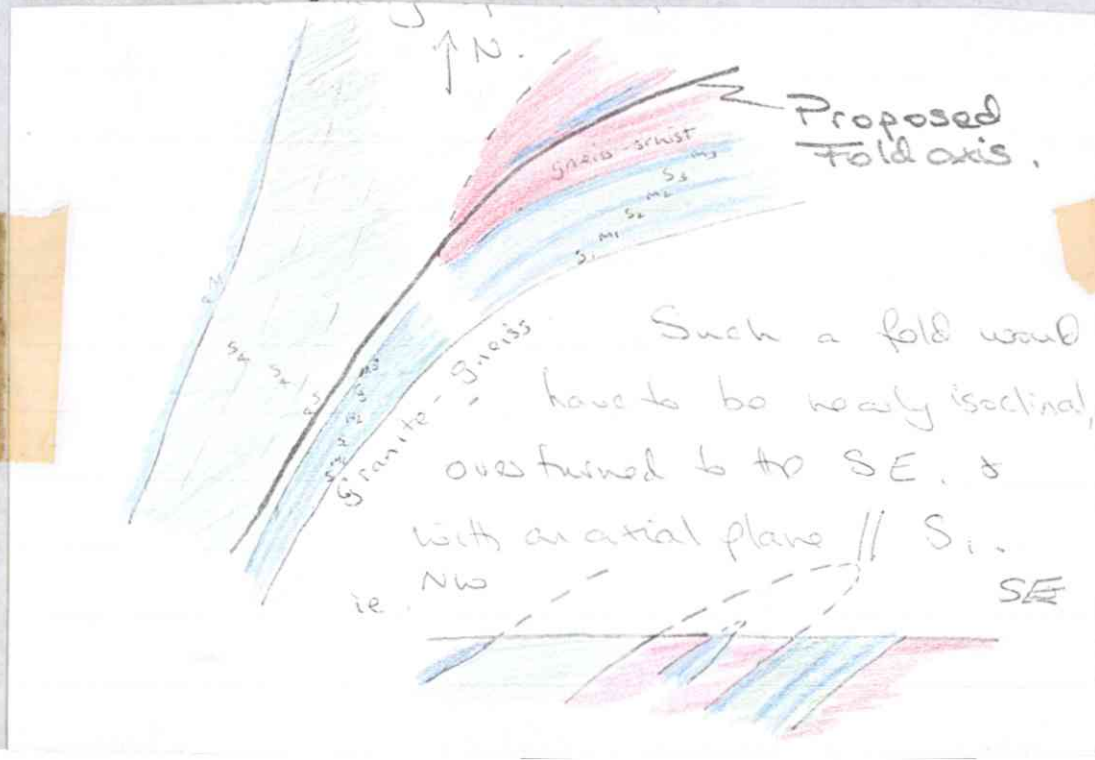


Report on Beiardal Map. Nick Badham

Traverses were made in the NE region from the granite gneiss - probably, in fact, sparagmite here - out for 3 - 4 kms. A basic stratigraphy was set up. It consists generally of alternations of schists and marbles, with the margins parallel to the regional schistosity S1. Some of the schists are distinct, and some are not so. This, coupled with the facts that thicknesses charge a little, and that mineral proportions alter along strike, means that it is hard to distinguish any ore group, unless more of the succession be seen. This basic division pasists round to the NW corner of Bjellavatn, where there is a contorted zone, with miner folds plunging at 20 - 30° to the north west. Apart from the fact that this is late stage folding in S1, with a weak development of S2, little more can be said, because exposure is minimal here.

To the south of this gap the succession of schist 1 → marble 3 is similar, but thinned, to its northern equivalent, but the schists structurally above marble 3 here are clearly different to those to the north - the "gneiss"-like schists. This difference may be due to lateral charges in ore unit, but I think not. Thus, either there is a thrust, cutting out those gneissose schists, and bringing in semipolites and a linestone - this I find unlikely because no such thrust can be seen in the field above marble 3, and because a thrust is unlikely first to cut across S and then to run parallel to it, as this must have done, were it a thrust - or there is a fold closure. This latter alternative is plausible, because of the evidence of fold closures in the gneiss-like schist, and because of the general microfold, but it is impossible to prove.

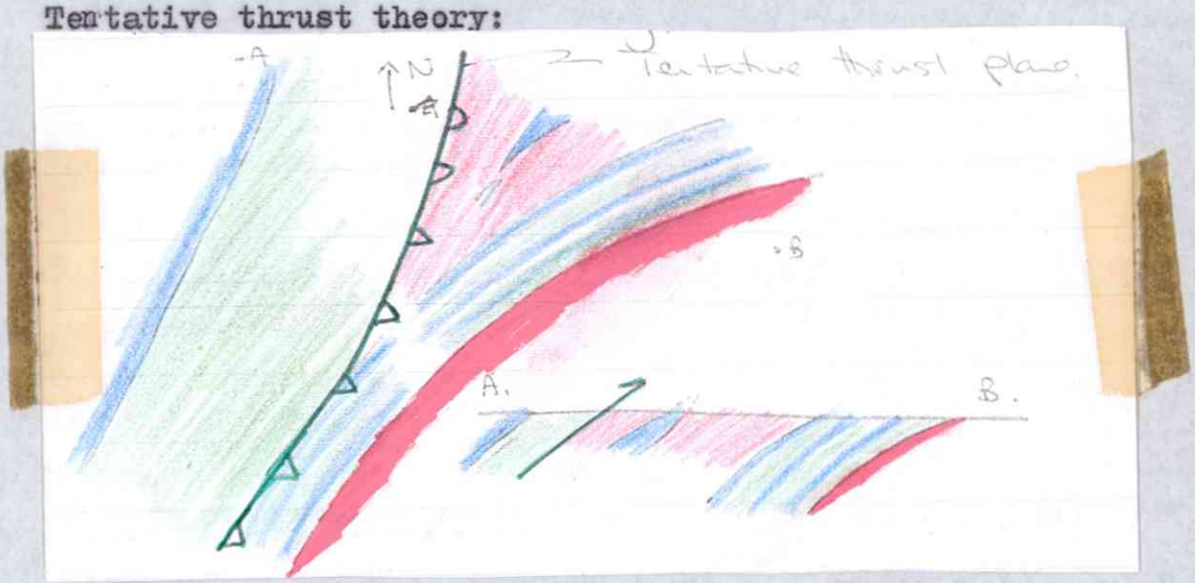
Tentative theory of the fold closure:



052.009

Such a theory reguires the schist 4 and marble 4 to be equivalents of schist 3 and marble 3. While this is possible - considering the scale of the fold, and realising that thinning may have occured on the overturned limb - I find it hard to believe it.

Tentative thrust theory:



Succession:	North
Marble 4	
Schists 4	Gneissose schists
Marble 3	Marble 3
Schists 3	Schists 3
Marble 2	Marbles 2
Schists 2	Schists 2
Marble 1	Marbles 1
Schists 1	Schists 1
Granite gneiss	Granite gneiss

Granite Gneiss:

Pale quartso, felspathic, weakly foliated Rock. Very little mica, and this mostly Biotite. Foliation // S1. It is a gneiss. It contains, within it, near the contact with the metasediments, a boudined band of biotite schist and an amphibole: epidote-felspar rock, all with a rims of very contorted biotite up to 1 m thick. This was a plane of movement, and may represent a substantial thrust. The amph.: Ep: Fsp rock is probably a metamorphosed basic to intermediate igneous rock. The biotite schists are claarly of sedimentary origin, and so it is concluded that the whole of the

granite-gneiss seen is, in fact, sparagmite, with sediments thrust over it, and the time basement further to the south, structurally beneath it.

Schist 1:

Base = 1 m felspatic gneiss. Rotted. This is in contact with the granite, and may actually be part of it. Next are 2 m of pale, rusty weathering muscovite schist, and then 5 m of graphite - muscovite schist - the graphite is up to 50% around 040165, but is elsewhere 20 - 30%. This horizon may represent the thrust plane.

Above this is a quartzite horizon, up to 2 m thick, but very pinched and folded. Around 040105 there are some schists just below this containing up to 20% black macrocrystalline kyanite. Then come a series of semi-polites with some biotite-amphibole bands, some thin quartzites, one of which contains specks of haematite at 080184, and a 3 m micaceous marble. In the east there are more quartzites. The top is generally coarse and richer in biotite.

Marble 1:

Base is a prominent ½ m white quartzite. The rest is well crystallised marble and dolomite, pale yellow in colour.

Schist 2:

Coarse, massive biotite-muscovite schists. They contain boudined tenses of quartzite in layers, some calc-schist bands and an amphibolite band and have large, brown, broken garnets in many of these bands.

Marble 2:

Base = 15 cm garnet band with 40% Ca rich garnets in amphibolite. 2 - 3 m of calc-schists above, and then alternations of ~ (1 m beds of marble cum dolomite and garnet amphibolite- ore of the latter being 2 m thick and having 40% large garnets. These amphibolites thicker to the east but disappear to the west. They are gone by 050180.

In the east, toward the top of this group are thick muscovite schists (musc. up to 50%) with intercalated quartzites. These thin westward and one goes by 060185 - this is probably a fold closure, rather than a lateral facies charge. The top 5 m are always pure marble, and contain, along a part of its length a metabasic body, composed mainly of talc.

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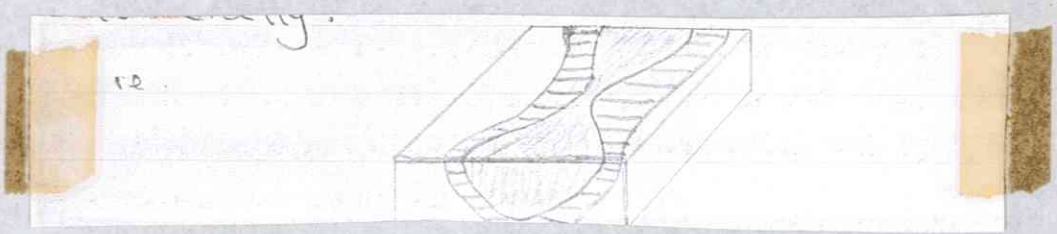

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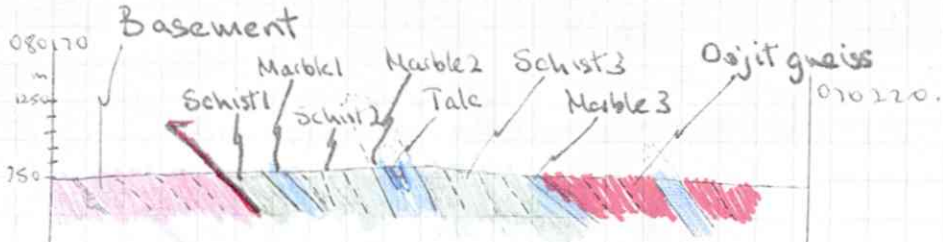

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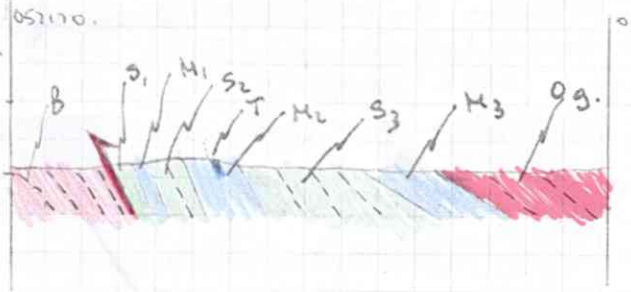

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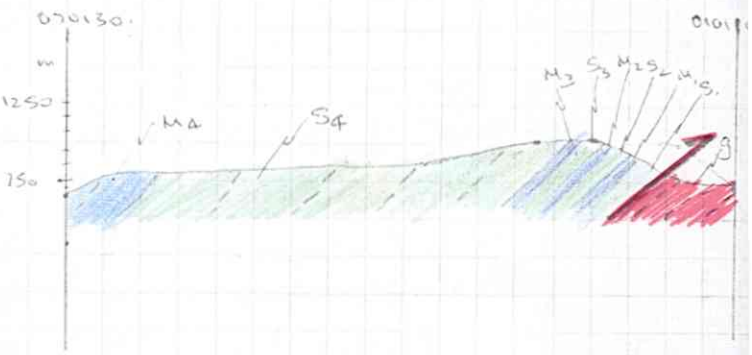

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N B J E L L A A V D

Ölfjeldryggen

Kartblad:

Beiardal Junkerdal

Platt - Badham

Målestokk	Tegn.	
	Trac. Stabell Olsen	
	Kfr.	
Erstatning for:		
	Erstattet av:	

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	Trac. Svarstad Olsen
	Kfr.
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Ölfjeldsryggen

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Format A3

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Platt-Badham

NORWAY-NORGE 1:50,000

FIRST EDITION—AMS

BEIARDAL

SHEET 2028 I

AMS SERIES M711

LEGEND—TEIKNTYDING

- International boundary with marker — *Riksgrense, grenseröys, -merke*
- Province boundary — *Fylkesgrense*
- District, town boundary — *Heradsgrense, bygrense*
- Parish boundary — *Soknegrense*
- Crown lands boundary — *Statsålmenningsgrense*
- Main road; Route number—*Hovudveg, vegnummer* — 50
- Secondary road—*Bygdeveg*
- Private road—*God privat köyreveg*
- Cart road—*Kjerreveg*
- Winter road; Track—*Vinterveg. Lite synleg stig (ferdaveg)*
- Path, distinct—*Klövveg, gangveg, tydeleg tråkka stig*
- Path with markers—*Vardesett stig og blåmerkt skogsveg*
- Telephone or telegraph line; Station — *Telefon-telegraflinje, stasjon*
- Power transmission line; Power station, transformer station — *Elektrisk leidning, kraft el. transformatorst.*
- Rocks: Awash; Sunken—*Båe i sjömalet. Båe under vatnet*
- Sandy foreshore flat—*Havstrand med fjöre og slaggrunnslinje*
- Marsh—*Myr*
- Coniferous woods—*Barskog*
- Deciduous woods—*Lauvskog*

- Railroad, double track; Stations; Halt — *Jarnveg (tvispora), stasjon, stoppestad*
- Railroad, single track; Caretakers house — *Jarnveg (einspora), vaktarhus*
- Railroad, narrow gauge, electric tramway — *Tertiær jarnveg, elektrisk sporveg*
- Railroad under construction — *Jarnveg som er i bygging*
- Streetcar line — *Trallebane, hestejarnveg*
- Aerial cableway—*Togbane (taubane)*
- Church; Parish, chapel—*Hovudkyrkje. Soknekyrkje. Kapell*
- Cemeteries—*Kyrkjegard*
- Factory, power station, etc.; Mill — *Större fabrikk, drift, kraftverk, mylne o.l.*
- Brickworks; Small mill; Sawmill — *Teglverk; Mylne (mölle), kvern; Sag*
- Mine, mining claim; Quarry—*Gruve, skjerp; Steinbrot*
- Wireless telegraph station—*Trådlaus stasjon*
- Airfield; Parade ground—*Flyplass. Eksismo*
- Horizontal control points—*Trigonometrisk punkt*
- Lighthouse, light; Beacon; Air navigation light — *Fyr, lykt. Sjömerke. Luftfyr*
- Fishers or hunters cabin, cattle camp, etc. — *Fiskarbu, skyttarbu, felæger o.l.*
- Farms; Farm, mountain pasture—*Gard, småbruk, plass, sæter*
- Cottage, school, hotel, meetinghouse, tourist shelter, inn, sports-hunters cabin, small farm, small power station, mill, etc. — *Villa, skole, hotell, bedehus, turisthytte, gjestgjevarhus, sports-jakthytte, mindre bruk, lite kraftverk, mölle o.l.*

AMS M711
First Edition–AMS

Prepared by the Army Map Service (PV), Corps of Engineers, U. S. Army, Washington, D. C. Copied in 1952 from Norge 1:50,000, Norges Geografiske Oppmåling, Sheet K 14, 1944. Sheet size changed and planimetric detail partially revised.

Målestokk, Scale 1:50,000

1 0 1 2 3 Miles

1000 500 0 1000 2000 3000 4000 Meters

1000 500 0 1000 2000 3000 4000 Yards

EKVIDISTANSE, CONTOUR INTERVAL 30 METERS

TRANSVERSE MERCATOR PROJECTION

HORIZONTAL DATUM: EUROPEAN DATUM

BLACK NUMBERED LINES INDICATE THE 1,000 METER UNIVERSAL TRANSVERSE MERCATOR GRID ZONE 33, INTERNATIONAL SPHEROID

RUTENETT UTM SONE 33, SORTE TALL

THE LAST THREE DIGITS OF THE GRID NUMBERS ARE OMITTED
TALLENE ANGIR KM.

HEIGHTS IN METERS

USERS NOTING ERRORS OR OMISSIONS ON THIS MAP ARE URGED TO MARK HEREON AND FORWARD DIRECTLY TO COMMANDING OFFICER, ARMY MAP SERVICE, WASHINGTON, D. C. MAPS SO FORWARDED WILL BE RETURNED OR REPLACED IF DESIRED.

RUTETILVISING (KARTREFERENSE), NÆRMESTE 100 m.	
Eksempel: TRIGONOMETRISK PUNKT 986	
km aust / km nord	99,7 / 11,7
TRIGONOMETRISK PUNKT	997117
Merk at komma slöyfes og at 100 km tallene-de små tallene 4 aust og 74 nord-IKKE skal tas med.	
Ved meldinger utover 100 km eller hvis mere enn ett rutenett er merket på kartet, skal også 100 km ruten angis:	
TRIGONOMETRISK PUNKT	VQ997117
Ved meldinger utover 9° nord, syd eller 18° aust, vest. skal også soneområde angis:	
TRIGONOMETRISK PUNKT	33WVQ997117

SONEOMRÅDE GRID ZONE DESIGNATION: 33W

100 KM RUTE 100,000 M. SQUARE IDENTIFICATION

VQ | WQ

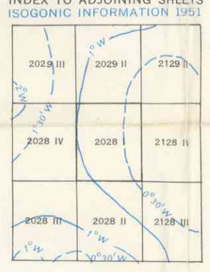
500

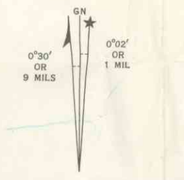
IGNORE the SMALLER figures of any grid number; these are for finding the full coordinates. Use ONLY the LARGER figures of the grid number; example: 7404 000

TO GIVE A STANDARD REFERENCE ON THIS SHEET TO NEAREST 100 METERS		
SAMPLE POINT: HORIZONTAL CONTROL POINT 986		
1. Locate first VERTICAL grid line to LEFT of point and read LARGE figures labeling the line either in the top or bottom margin, or on the line itself: Estimate tenths from grid line to point:	99	7
2. Locate first HORIZONTAL grid line BELOW point and read LARGE figures labeling the line either in the left or right margin, or on the line itself: Estimate tenths from grid line to point:		11 7
SAMPLE REFERENCE:		997117
If reporting beyond 100,000 meters or if sheet bears an overlapping grid, prefix 100,000 Meter Square Identification, as:		VQ997117
If reporting beyond 9°N-S or 18°E-W, prefix Grid Zone Designation, as:		33WVQ997117

INDEX TO ADJOINING SHEETS

ISOGONIC INFORMATION 1951





APPROXIMATE MEAN DECLINATION 1952 FOR CENTER OF SHEET
ANNUAL MAGNETIC CHANGE 8' EASTERLY

Use diagram only to obtain numerical values. To determine magnetic north line, connect the pivot point "P" on the south edge of the map with the value of the angle between GRID NORTH and MAGNETIC NORTH, as plotted on the degree scale at the north edge of the map.

MISVISING 1952 I GRADER OG MINUTTER, OGI STREKER ÅRLIG FORANDRING 8' ELLER 2,4‴ AUST.

Diagrammet gir bare tallverdiene. Retningen for Magnetisk Nord bestemmes ved å forbinde pivotpunktet "P" i söndre rammekant, med dét punkt på skalaen i nordre rammekant, som svarer til misvisingen regnet i forhold til RUENETT NORD (GN).

GLOSSARY–FORKORTELSER

Bh	bedehus — meetinghouse	ned	nedre — lower
bg	berg — mountain, rock	n	nordre — northern
Bvs	brannvaktstasjon — fire station	nt	nut — peak
bk	bekk — brook, creek	PA	postapneri — post office
DS	dampskipsstoppested — port	Pæd	prestegard — vicarage
Elektr Vk	elektrisitetsverk — power station	RS	redningsstasjon — rescue station
ev	elv — river	San	sanatorium — sanatorium
Fbr	fabrikk — factory	Sph	sportshytte — sports cabin
Fb	fiskarbu — fishers cabin	skj	skjær — rock, skerry
fj	fjell — mountain	Sk	skole — schoolhouse
fd	fjord — fiord	Sb	skytterbu — hunters hut
fs	foss — waterfall	st	store — great
Fl	felager — cattle camp	str	straum — stream, current
gd, gd	gard — farm	sd	sund — sound
hg	haug — hill, hillock	sæ	sæter — mountain-pasture
hd	höyde, högd, hovd — hill	sl	stöl — shieling
hmr	hamar — crag	s	söndre — southern
hl	holme — islet	TS	telegrafstasjon — telegraph station
in, ind	indre — inner	td	tind — peak, pinnacle
Jh	jakthytte — hunters cabin	tj	tjern, tjörn — lakelet, pool
Kp	kamp — hill, hilltop	Th	turisthytte — tourists shelter
Kpl	kapell — chapel	Tk	tömmerkoie — lumber shanty
KnP	knapp — peak	UH	Ungdomshus — meetinghouse
Knt	knatt — peak	vn	vann, vatn — lake (lakelet)
Kl	kolle — knoll	v	vestre — western
L	lade, löe — barn	Vk	verk — factory, works
ld	land — land	Vb	vokterbolig — caretakers house
Ldh	landhandleri — shop	Vl	voll — plain, meadow
l	lille, litle, lisle — little	Yt	ytre — outer
LS	lodsstasjon — pilot station	ö	östre, austre — eastern
M	meieri — dairy	öv	övre — upper
m	mellem, midtre — middle		

BEIARDAL
NORWAY

~~Platt~~
Badham

REWRITE OF NOTE BOOK

8th July. Base Telegraphstue 1. (078172)
Traverse to North. Coarse Bi-Mu schists just to N of last outcrop of gnt.gneiss. Granite gneiss is generally well foliated pale guartzo fsp rock dipping gently N, with dip increasing toward contact from 15° to 30°. These first schists contain boudins of vein quartz, intruded//to the foliation (S).

Above this is massive schist of similar composition. This contains amphibolitised bands. It varies in coarseness.

Next is a good quartzite, with specks of ore - prob. haematite-in. It shows good microfolding or t-w axis, of S, which here dips generally at 30 - 40° at 000°.

Above this is a "dirty" marble - about 5 m thick. Then mica schists with a prominent ½ m white quartzite that does not seem to be so boudined out as others. This makes the base of a thick marble of dolomite sequence.

Above this are schists with quartz vein in of varying grain size. Dip 320 at 347°. Called Exposure (1) (072186). This too contains an amphibolitised band, and also some scattered large garnets. Calcschists bands. One of these garnetbands is 6" thick and continuous along strike for 100 m. It is over 50% garnet - exposure (2) (at 072188).

Then in cliff at 070188 are a series of dolomite/marble and amphibole + garnet + biotite bands. One of these latter is 2 m thick with 40% garnets, of poor quality.

On the Southern margins of hill 823 (070189) is talc - exps (3) - probably from the metamorphism of basic and ultrabasic rocks. The care of this is of serpentine mineral. Chlorite, talc and altered felspar (scapolite). A marble lies to the North - clear and pure and coarsely crystalline.

Grening Setting up a basic stratigraphy.

Granite Gneiss	1.	Granite gneiss Foliated gneiss
Schist	2.	Rusty Bi-Mu svhists and quartzites + amphs. Graphite at base 50 m
Marble 1	3.	Dirty Marble (Pieske) 15 m
Schist 2	4.	Schists. Semipelitie + calc bands.

052.008

Marble 2	5.	Marbles and dolomites. 2' white quartzite at base.
Schist 3	6.	Thick schists + quartz boudins + calc layers.
Marble 3	7.	Marbles. Garnet amph. at base. Mica schists + 6" garnet band. Marble/amph. bands + 2 m garnet band.
Schist 4	8.	Schists - very rich in musc. Thin. Rusty.
	9.	Talc etc.
Marble 4	10.	Marbles.

Specimen numbers. 2 S Garnet musc. Bi. schist from band in Marble 3.

3 S Talc.

Contact of gneiss seen on return is in

Schists 1 proper.

Musc. graphite schists 5 m.

Muscovitite 2 m.

Felspatic gneiss 1 m.

Gneiss.

The graphite schists are very contorted and rusty weathered. They certainly are a plane of movement, but on what scale is impossible to tell - they may be a large thrust.

July 9th.

Exposure (4) - 092176. Granite gneiss sensu stricts is here underlain by a series of biotitites and amphibole, epidote, felspar rocks. These contain a foliation//S of the granite. The contact is near 100% biotite, a metre, and so thick, which has clearly been a plane of movement. Then what are in effect biotite schists come in. These thicken and thin along the outcrop, and are clearly boudins - they do not maintain the same structural horizon, but get lower to the south. The granite thins to the NE, but always remains between these rocks and schists 1. Dip of contact is 15° at 340°.

Schists 1 down here show a typical contact with the granite, and then go to normal schists + quartzites. No marbles are seen until 095195. Here is 15 m of impure marble dipping gently to the north.

Schists above this are variable and thick, and then we come on to marble 3 with garnet and amphibole bands. Above this are muscovitites and muscovite schists, weathering very rusty, with 4 or 5 prominent quartzite bands 1 - 2 m thick, dip. 55° at 350°. This zone is 30 m thick here, where as it was only some 2 - 5 m at hill 823. Then again above this are garnetiterous schists. Exposure (5) (088200) Hill 793. Thickenned lens of talc rock, thinning to E and W along strike. Above this are thick marbles.

This lens contains many smaller lenses and streaks of different rock types.

Included are - Garnet + staurolite amphibolite in serpentine (?).
- Talc + altered fsp.
- Serpentine streaks.

In general the talc is dominant and other rocks form small 5 m x 1 m lenses.

Exposure 6 (077193). Looking back at hill 793.

On top of exps. (6) is talc felspar rock again, with tenses of staurolite garnet amphibolite. Staurolite crystals up to 30 m long seen. 2 tenses - 30 m x 5 m of amphibole chlorite rock with very large cubes of magnetite - up to 10%.

Quartzites in the rusty zone here are thinner and so is the rusty schists. The talc assemblage thins again to the west. Marbles are still to N of talc.

Specimens: S51 = Amph (?) + magnetite.
S52 = Asbestos from thin vein.
S53 = Serpentine/talc.
S54 = Staurolite, musc., garnet, biotite rock.

July 10th.

Traced the biotite lens in the granite gneiss (exps. ④) round to prove it to be part of basement, not schists 1. Many littologies in it. Each boudin seems to be some 100 m long, and lower than that are to the north. It fades out to 1 m thick behind the hut.

Schists 1 have very prominent quartzites in the east, on to the Junkerdal Map, including ore 10' thick. These are however often boudined. These appears to be a fold here as dip of S is 20° at 290° at 094193.

Dip of base of marble 3 is 55° at 338 so the fold must be contained in schists 2 marble 3 sequence.

Hill 656 (09920) has schists 4 on southern edge - very rusty and with quartzite bands, and then has marbles above those. Dip of these is 50° - 60° at 348°. There is then a series of alternating marble and rusty (muscovite) schists and quartzite bands, before thick marbles on the N of the hill.

The talc body must have thinned out by here, although there is a ½ m amphibolite band. The talc only really appears 1 km to the west of this hill at 091203.

July 11th.

Trying to follow marble 1 and 2 to see which is which. Schists 2 have large garnets in some bands, and are generally coarse than the others.

Schist 2 and marbles 2 and 3 go round a flexure or there is a discontinuity around 090195. There is no exposure in this grand so it is hard to decide which marble that at 095195 is.

Talc at top of 793 has garnets up to 30% in many bands. Possibility of ky here, though no definate crystals seen. Amph + mag + garnet suggest a basic rather than ultrabasic origin.

To north of 793 is thick marble, and with a great thickness of minteresting schists, containing 3 prominent quartzite horizons.

These dip at 65° at 350° and are some 2 m thick. They are fairly boudined and broken. These schists also contain thin marble bands. Then here is a much thicker marble - very pure. Then, at 075203 begins a sequence of coarse, almost gneissose schists of very uniform littology. There are bi., gutz., fsp. schists. At 070209 is a marble again, with thin politic rusty (musc.) schists at its margins. Then to the N is more "gneissose" schist. The schists bordering the marble seem to be at first finer equivalents of the "gneissose" ore, and then to be musc. - schists. At 068208 are two large boudins of quartzite, which correlate to thinner bands in the marble-marginal schists. The "gneissose" schist closes round this marble schist sequence in a small lake, and then to the west another such sequence opens out:

Coming back round lake and marbles - that at hill 792, then being schist, then thin marbles then (exposure (8)) at 060186 is another talc body.

Looking east at hill 823 the talc thins down to the lake and swings to the north. It also closes downwards - ie it is a 3 boudin.

The talc at 060186 has amph + gnt + musc schists with no staurolite, solid talc tenses a few metres long// to S, magnetite (?) amph. tenses, serpentine tenses, pure talc tenses of the dominant talc + altered felspar rock swinging around all these.

Walking south the is more marble touching the talc, then schists, then another marble that links to that on hill 070183. Thrust the schists above this have thinned considerably to the west. Dip here is 35° at 342°.

Exposure (7) , 30 m above contact is a thick kosic band before the graphite schists, dipping 25° at 068180.

Grening. Revised "stratigraphy".

"Ooj.t. gneiss".	Gneissose schist (+ mbles. + schists + qutzs.)
Mble 3.	Marble - usually clean + dolomitic.
Sch. 3.	Schists - minteresting.
Mble 2.	Containing the talc body. Thick rusty schists + quartzites in fast, thin in west.
Sch. 2.	Schists - mbles. + amphs. + qutzites.
Mble 1.	Marble - thick + clean.
Sch. 1.	Schists - + qutz. + thin dirty marble.
	Granite gneiss.

Specimers - S_7 = Muscovitite
S_8 = Magnetitic rock.

July 12th.

Dip in marble 2 in east edge of Hill 932 (051177). Marble is thicker here.

Granite contact runs up S edge of this hill. Marble 1 seems to be absent here in the schist 1 sequence. Dip in marble 3 at 043177 is 40° at 310. There is no talc here. Following this marble back, the talc thins out by 054183, schists to N of marble 3 dip 40° at 305°, so contact has swung a lot, and succession here has thimed.

Further to sw. strike has swung more - dips 60 at 300° 030160.

Traversing back to Bjellavatn from 018165. Thick schists + calc bands + garnet bands ⟶ 5 m marble ⟶ garnet mica schist (40° at 288°) ⟶ 8 m marble ⟶ gnt. mica schist + quartzites ⟶ 3 m marble ⟶ very contorted garnet mica schist ⟶ coarse felspatic schist (psammite) ⟶ 15 m marble ⟶ 10 m semipolites ⟶ 50 m marble (marble 2) (all before this is part of schist 3 sequence) ⟶ calcschists + marble bands 30 m ⟶ 20 m marble (marble 1) ⟶ thin semipolites ⟶ 2 m quartzite ⟶ Exposure (8) (039165) ky musc.schist ⟶ musc. schists ⟶ graphite schists ⟶ granite gneiss.

All between granite + marble 1 is schist 1. Graphite at the contact is up to 50% in a 3 m band for 100 m laterally. Kyanite is dark coloured and up to 30% in a 1 m band, dipping 50° at 315°.

Specimers $S8_1$ = ky. musc. schist.
$S8_2$ = graphite schist.

July 13th.

Walking down to Storsletten. Granite contact followed and mapped, dip 10° at 290° in one place, but usually nearer 340°. Contact cuts across streams generally here after following them on top. Exposure lost in trees.

July 14th in gjestgiveri.

July 15th.

Walked up to 426, but John's leg bad, so carried him back to hotel.

July 16th.

Walked up to Bjellavatn. Exposure nearest lake at 023151 in musc. schist - prob. within 10 m of contact with granite. Schists above up to hill 804 (021156). Many quartzites and calc schist bands. Marble at top, 20 m thick. Dip 50° at 320°. More schists + quartzites + garnets to nw. Then 30 m marble. Then schists with garnets. Very tightly folded on ew. axis, with plunge of 20° to east.

Long graps of no expose to nw. Then schists - very psammitic - at 018163. No good foliation, but miner folds plunging 30° at 320°. Most of valley to north is morsaine.

These schists cannot be correlated with those mapped to the ne. of the morsaine, and there is probably a fold of fault running through this gap. The intensity of miner folding, observing S_1 and developing S_2 suggests a fold. A closure of schists over marble at 021165 seems to fit with this idea. I have no idea what the fold does, unless i plot all fabrica or a stereogram.

Walking to nw. from last exposure are old exposures of rusty schists and garnet schists, getting less folded to the nw., and with S_1 becoming more prominent. There are some graphitic schists.

On west side of Harodalen at 998162, after long bog with no exposure, is coarse semipolite and musc. schist. Dip 40° at 260°. Large quartzite boudins in bands. Weakly or non garneti-ferous.

This does not seem to be equivalent to the "gneiss" to the ne., allthough there is no exposure to tell between them.
Dip at 592 is 50° at 270°. Garnet schists are now pedominert (993160). Large and small garnets, between 10% and 50% of the rock. Dip is 70° at 280°. There are mesofolds with 50 m amphitudes in this garnetiferous band. The band strikes north up the hill.
To n. of the garnet band is a linestone - dip 35° at 275°. This fairly thick and going down into the valley - 1 m not
Walking back further to so. much the same succession is seen, with better exposure. ie. Garnet schists → thick and varied schists with garnet band near its eastern margin, and rusty zones either side of it → marble 3 → garnet semipolites → marble 2 → schists (much more contorted with miner folds plunging 15° at 005°). Dip at 011131 is 60° at 290° → quartzite bands → marble 1 → schists and rusty bands → graphitic schist → granite gneiss at 017140.

July 17th.

Half way up Bjellavatn, just ne. of hill 721 granite contact is exposured,
The usual contact succession is present, but there is very little kyanite in the schists above the quartzite.
Thin marble 1 at 100 m above lake, then schist 2 and marble 2. Marbles thicker to the south, but contain their characterisitc components throughout a few boulders of a talc. Felspar rock lie about here - very large ores. Perhaps there is another talc body soon.
Ore band in schists 2 has garnet and kyanite in, but neither in large quartities.
Strike swings round base of lake - check tomorrow.
Walking wnw. on a traverse from 000100. Marble 3 is of usual thickness. The schists beyond it go.
Rusty polites + lsts. + quartzites → semipolitic biotite schists → coarse psammitic "schists" in 5 - 10% large garnets (50° at 290°) → great thickness of garnet mica schists and semipolites with rusty zone at base. (These don't quite tie up with the garnet poor schist, sequence to the north, but there may be some slight compositional change along strike) → Psammitic schists → garnet rich schists → limestone + amphs.
Walking back further to north same succession is observed.
No economic minerals - in fact no "minerals" at all.

July 18th.
Heavy rain and low cloud. Visibility 20 m.

July 19th.
Very bad weather with poor visibility west to south end of Bjellavatn, to follow granite and marble 1 across Bjellåga stream. Impossible to continue further up hill, because of low cloud. Strike has swung to nw. - se., and dip generally steepers round here. All sequence seen is normal. Came across Nils Hollanders camp. He is not working because of the weather, so I too am giving up. He is looking for minerals - and finding small amounts - in the granite - which is probably sparagmite here.

July 20th.
Walked down to Storsletten.

July 21st.
To Bolna. Purpose - to see out ky. + quartz. Structure, outcrop and interpret them. Also look for ore minerals.
In afternoon, distinctive "mappable" lithologies were looked for.
1/. Augen gneiss.
2/. Quartz + graphite schist.
3/. Quartzite + ky (in places) + musc. schist.
4/. Schists.
5/. Psammites.

Also boulders of a matic felspar and amphibole - and chlorite? - rock of what was probably a gabbro. Ølnes says it outcrops further up, and was a gabbro, but is now mainly chlorite, epidote and Na-felspar.

22nd July.
Traverse from 120742 to 128753.
1 400 m se. of transformer hut (T.H.) is quartzo felspathic pale hard massive psammite, gently folded about a near vertical axis. Prominent schistosity (S_1). Dip avg. = 80^{o} at 230^{o}. Less than 10% mica. This continuos to nne., with fairly constant lithology. Some quartz crystals are well rounded suggesting that they may still be sedimentary remnants. At this grain size it is probable that they were either pat of "turbidite" (sensulate) or continental sandstones, as the fel-

spar must come from day minerals or reconstitute from other sedimentary felspar. The latter is most plausible, seeing we are on a basement granite and that these are "Vorland" sediments. In places Bi contact 30%, and ditto for muscovite - perhaps from local patches of other sediment in an equivalent dominatly of quarts and felspar/kaolin - the weathering products of the basement "granite".

(2) Coarse bi. musc. semi. - polites musc. semi. - polites. Variable coarseness. Transformer H is 300 m at 016°. Biotite often crinkles by later folds, out of plane of Si. Dip of S_1 = 75° at 234°, but again, gently folded. S_2 is weakly developed. In places this sequence contains minute specks of haematite and golena and some iron sulphide. Also a few thin calcareous bands and streaks of fluorspar in places.

(3) 200 m at 0600 from TH. Quartz., flsp., musc. psammites, with 20% mica. Small specks of mineral - both haematite and falena - but very sparse. Bands of Bi.rich rock. This similar to (1) but with more mica. Dip 70 - 80° at 240°.

(4) 150 m of no exposure and then 2 patches of rock in place. The southern most is psammite like (3) dipping 20° at 058°. It has calc bands. The secand is musc. schist with up to 2% pyrite. Dip 350° at 046°. These are close, at 100 m at 336° from T.H.

(5) 50 m at 324° from T.H. Musc. schists with pyrite, fine muscovite bands and quartzites - very refolded and boudinnage common in these. S generally dips 40° at 078° to 500 or 0480, but varies. The quartzites contain only very sparse kyanite or a rough check.

6 20 m to n. of 5. Massive semi. - polite. Dip 80° at 050°. Up to 1% pyrite.

(7) 300 m at 250° from T.H. in stream. Augen gneiss. Quartz and felspar well segregated, and streaked and folded biotite between. Dip of S_1 between 70° at 030, of vertical striking 120° - 300°. The banding is // to S_1. A few small epidote patches seen, and also bi.rich bands.

(8) 600 m at 244° from T.H. in stream. Psammites, semipolites, quartzite (greenish + banded) and graphite schist, some 5 - 10 m thick. Dip 85° at 238° → 45° at 220°. Both up and down.

Stream, within graphite schist are thin tenses of quartz. Cavernous and covered with an iron , but clear and pure inside, with no minerals. The lower of these is 20 m long and 3 m wide. It thins to east and dissappears under boulders to the west.

20 m to north is more augen gneiss. This is better crystallised, and more schistose.

Walking from (8) to 137750, up stream.

The second quartz tens is up to 5 m thick and 800 m long. It dips // to its contacts, which are // to S_1, at 50° at 220°.

Joint planes in it at - 60° at 015°
55° at 216° (S_1)
45° at 96°
85° at 312°

On both sides of it are thin wedges of psammites and semi-polites and graphite schist, before augen gneiss. Top is observed by and boulders. 100 m further up stream, however, psammittes are in contact with augen gneiss on both sides - so no quartz here, ever though graphite schist is present.

(9) In same quartz body, ½ way up.

Thebouldering psammites have calc bands. Contact dip 35° at 192°.

(10) At top of quartz body, where it dissappears, there are veins and pods of quarts in the augen gneiss and metasediments.

Quartz is intrusive. The pods are // to S_1, so intrution was syn of post formation of S_1, but pne. the later folding that elsewhere S_2, as the sediments and quartz contain these folds.

Walking back to ssw. from 10 .

Augen gneiss first, which still seems different (more sinuous

micas) than that to n. Bi.rich banded horizons. Exposure of this for 200 m, then 50 m no exposures.
(11) 300 m south of (10) . Augen gneisses dipping 85° at 004° → vertical, strike 94° - 274°, S_1 is very folded here.
(12) 50 m to S of (11) 50% musc. in a musc. schist, with 2 - 3% pyrite. Dip 30° at 206°. Quartzites at top of ridge, and then more musc. schists. Look for ky later.
13Ky. 150 m to n. of Ølnes' hut - O.H.
Much quartzite, associated, and muscovite too. The ky. % age varies between 10 and 40%, 1 recon (up to 5% pyrite also) in quartzite. There is also a lot of vein quartz. Dip is variable and very folded, but generally steeply at 035°.

Greening.
Traverse 1 - 8. Section, showing S_1 dips at contact N.

July 23rd.
(14) To n. of augen gneiss is a green basic rock, dip 30° at 220°, about 5 m thick at 138757. This prob. a metamorphosed dyke and small intention. of dolerite/gabbro, in basement granite. All ground is a coarsely crystalline, unlineated quartz, fsp., biotite rock - granitic looking, but probably not so in composition. This becomes lineated near the margin. Where the quartz is intruded augen gneiss. This is slightly different from the other augen gneisses to south which are prob. granitised sediment of sediment of sparagmite age - not part of basement as such. Foliation in margine of granite here dips = 15° at 266°. There are many shallow open folds of 20 m amphitude here, with an axis plunging about 10° at 245°. Often, near the contact, the augen have become hands of biotite. A small quartz vein at 145748 has a little well crystallised galena in, but very small amment. This vein is related to the quartz body, and is // to S_1.

(15) ½ km from lake, at 314° is quartz to granite (to distinguish it from the other augen gneiss it is called granite here) contact. The edge zone is very veined. There are sparse, small patches of mineralisation with pyrite, pyrohotite, pyrite, chalco pyrite and a rather pale yellow sulphide - probably a "mixture" of 2 of the afarementioned, ie of intermediate composition.
Musc. graphite schists in thin slivers stuck or to edge of quartz - still pme. and white. Quartz is 20 m thick and contact, and a plane in it dip 45° at 226°. South contact has slivers of graphite schist and then a thin layer of psammites and quartzite before the augen gneiss, dipping 55° at 222°.

16 147745. Metabasic rock - gabbro. Amph., chlorite, fsp., (epidote?) assemblage. Dip 55° at 221°. This is generally poorly foliated, except at margins, suggesting it is late stage. 50 m to west is augen gneiss swinging round base of gabbro, dip 10° at 130° round here. Thus gabbro seems to have affected S by its intrusion. Quartz contact retains same strike, however, so effect is local.

Further to sw. is banded amphibolite, 55° at 238°, microfolded along an axis plunging 15° at 154°.

(12) Revisited. Base of cliff is bi. semipolite, 5 m thick. 30° at 190°. ⌊ 1 m of fsp. psammite. Musc. schist with quartzites, muscovitites and thin (½ m) band of kyanite. Ky % ago 20% usually. All have accessery pyrite. Then semipolites 5 m. Then musc.guartz schist 2 m, then quartzites + musc. schists - very refolded, plunge at 10° at 220°, 30 m. Dip is 30° at 220°. Further to south miner folds plunge 30° at 142°. It is probable that we have 2 periods of later folds. An earlier set plunging se., nw. and a later set plunging sw, buckling the first ores, so that they plunge both ways. This

gives a small scale dome and basin effect to the beds with local dips pointing in all directions.

(17) Miner folds in se.-nw. axis refolded in ne.-sw. axis, so axis of first are plunges both ways, 20 m to s. is quartz, fsp., musc., semipolite - 85° at 215°. These 3. Specks of haematite and galena, 30 m to s. dip = 80° at 058° - ie it is generally vertical.
100 m across to s. is this, then bi. semipolite and then quartz fsp. psammites 1.

(18) 200 m over, near 2ndstream. Psammites 1, 50° at 128°.
Succession obtained off 2 traverses is:

1) Quartz, fsp. psammites. 1, 18, 19, 22.
2) Bi., musc. semipolites and psammites. 2, 3, 17, 32, 33.
3) Musc. schists and musc. and quartzite and ky. 4, 5, 13, 12, 20, 29.
4) Semipolites and psammites. 6, 30.
5) Augen gneiss and psammitic bands. 7, 10, 11, 23, 25.
6) Psammites, semipolites and graphite schist + calc schists containing quartz. 8, 9, 15 etc.
7) Augen gneiss - basement.

July 24th

19 1 type psammites 45° at 214. Continues 300 m to south - not going further.

20 T.H. purpose to follow ky upwards and note % ages etc. 40 m to nw. of T.H. are quartz musc. rocks with pyt. + psammitic bands. Also accessary haematite. 70° at 040°. Miner folds plunge 045° at 15°. Ky is thin ½ m band, very pinched, sinuous and folded. 20% ky, about in quartzite. Succession = 1 m quartzite + ky (sparse) → 1 m quartz musc. schist → ½ m quartzites 20% ky + quartzveins → 1 m quartzite + ky (sparse) → 1 m muscovitite → 5 m quartz, musc., pyt schist → 3 type psammites. Dip is near vertical.
Ky containing quartzites thin to east and west, when musc., quartz, pyt. schist closes round these tenses.

There is ky in most of the rocks but the muscovitites, but in very low %ages. These beds are so much more folded than others that this is probably an early fold crest.
To east of this tens psammites runs the quartz, musc., pyt. rock, with no quartzites running through, in surface.
300 m further up the ridge semipolites and psammites dip 70° at 068°, to south of musc., quartz, pyt. rock in contact with it. Thus the contact of 2 3 swings here. ½ km up it is back again an old line.
A base of 836 ridge is a 20 m amplitude fold plunging 090° at 20°. On north edge of this ridge is a ½ - 1 m band of quartzite containing a little kyanite, in quartz, musc., pyt. rock. Weather atrocious so down below clouds.

7 Revisited, then 8 to study "irregular gneiss" and see if it is the same as the basement gneiss. I think it is now.
The 2nd stream north of T.H. is cut in semipolites and graphite schist between the 2 augen gneisses. Fault. Still coloured different on map, far distinction.

No exposure in streams, after they join.

21 Farily basic massive unlineated rock with bi., chl., fsp, and little quartz. This is part of basement and is probably a meta intermediate dyke (diorite) and perhaps an "acidified" basic (dolerite) dyke.
200 m to south-west is more of this, surrended by augen gneiss. Dip is vert., strike 128° here.
Augen gneiss seen in stream at 122755 - not sure which part of it though.
A boulder of rounded augen gneiss fragments in graphite schist seen. This looks like a fault brecoia, suggesting that the contact is a fault, up which quartz was emplaced.

22 Weather so bad that have retired to Randalselven to de a section.
1 type psammites here, by bridge and for 200 m up stream. These gently folded on axis plunging 15° at 150°. Odd patches with more bi. and musc. One band has magnetite and small garnets. Dip 20° at 138° at bridge. 50° at 205°, 200 m to n. Then no more exposure.

July 25 th.

23 Irregular gneiss. Dip 75 at 028. It still has Odd bi. rich horizons, indicating perhaps that it is granitised sediment - hard to forget bi. separating from qutz. and fsp. and vica versa.

200 m to SE is same
100 m to E is same
100 m to NE of last is "gabbro" - very metamorphosed.

On top of hill, at 147746, gabbro runs to sw. of augen gneiss, with contact running nw. se. This is mapped in. Patches of net veining in gabbro. It veins the augen gneiss along s. It is chilled against the gneiss, but is foliated in its margins. The gneiss is best around it slightly. Thus the gabbro is late stage metamorphic. Prob. intruded into a still hot region, during copling, and this promoted very slow cooling and high wup's . Hence the gabbro minerals would adjust to their chlorite, epidote, felspar assemblage, yet s. would be bent by instrusion. The slow coolinger high wup may have helped lingering "Hydsthemal" conditore nearly -ie the quartz and mineral intrusion.

24 Quarts contact swings to south here in a large ridge on top of the hill. Dip of top contact is shown by slivers of semipolite adhering, to be 50° at 252° at 150744. The quartz then shallows in dip and its ground outerop thickens. It is actually some 25 m thick. N contact dips 30° at 242° on the "crest" of this swing against augen gneiss. Sediment thickens around quartz because of shallowing too. Contacts are full of quartz veins, but no mineral.

Quartz tongues off at "crest" of swing into 2 bodies, apparently. These may be continuous and may be separate "blips". They are always in a metasedimentary avelope.

25 Small patch of pyrite mineralisation at 150743. Schists here lie virtually horizontal on quartz.

Sediments continue to east up hill, with some good tens of quartz in - 30 m and 2 m, between the two gneisses. They are thick and folded on east-west axis, very operly.

26 Is graphite schist in metaseds., dipping 35° at 114°. The main quartz body defineately ends at the base of the hill, where it is nearly horizontal.

27 Gneiss folded round at base of quartz at 149743. Dip 35° at 310°.

28 Gneiss on hill below gabbro 100 m south of 27.

x 200 m east of 1038 is contact of gneiss with sedimente. Gabbro has out by here. Seds. and semipolites and psammites of 4 type, as lower down. Dip vertical, strike 300°.

29 Just of south edge of ridge are quartzites and muscovitite. Very dip torted. 1 small amount of ky in some. 20 m thick.

30 Seds. in stream in contact with gabbro streak, with gneiss to north of this. 45° at 105°, but probably totated by slumping.

31 Gabbro in contact with gneiss, before seds., so gneiss does surround gabbro. South is vertical,strikign 044°.

Grening

Sections through quartz body.

S N along 148 longditude.

27th July.

32 Weakly micaceous pale massive psammites 50° at 224° = 1.

33 Psammites with more mica. pale. Gently folded round agently eastward plunging axis. 25° at 190° and 30° at 240°. 200 m to north and bi. semipolites. All these = 2. These dip steeply to north.

Going up stream with quartz in, to map bodies exactly on 1 : 10 000.

Augen gneiss at base - 30° at 040°.

1st body is 20 m and 5 m maximum.

2nd body is not continuous right up to the top, but is 2 bodies. The lower ore is 200 m long + 4 m wide. "Sediments" run right through, however, where there is no quartz. 2rd body is over 10 m thick, dipping 40° at 220°. It swings away from stream and then back to its old strike. This is because it goes over the axis of a small sw. gently plunging fold. ie.

The seds. here are up to 10 m thick on the south side. After very contorted with slightly overturned (to the north) microfolds. These are probable dragfolds on a thrust. s

They are clearly lier than the later, open, shallow plunging micra folds.
Many small pods of quartz in sediments up here, some more than 1 m long.

Quartz body on top is now completly sorted out. It is up to 20 m thick. At top end dip shallows and sings round and then the body goes above the hill, because the plunge of the fold is steeper than that of the hill.

The small tenses of quartz to the north of the main body are not tension gash fills as they are surrounded by a sedimentary evelope. They must either be folded with faulted equivalents of the main body. Since the certaining sediments dip south under augen gneiss it is most probably fault repeated - only an isocline could do this other wise and there is no evidence for isoclines. The increase in contortion in harrow zones suggests a small thrust as well.

Walking from 160738 to 1214 peak. - Sediments sometimes with quartz in, repeat themselves up the hillside, because of small tight folds. Often one limb of these folds is missing, and perhaps a small thrust is present - these are impossible to see in the graphite schists. Most of these folds plunge at some 20° to sw., but some plunge to ne., so there is later folding on another axis.

Section 1 km west of 1214 peak - north + south.

The silver mines are outcrops of quartz with argentiferous galena in them. The quartz bodies are also very broken, with slivers of graphite schist amongst them.

July 28th.

Walking up ky from (13) to top, to get some idea of what it is doing. A (13) The beds are vertical, very contorted, and certain a remarkable number of well crystallised minerals including kyanite, quartz, pyrophyllite, a green mica, muscovite (talc?) and pyrite. The ky % is very great in 3 or 4 thick quartzite beds. The succession also includes chlorite bands, (Chlorite and kyanite in association. Must be retrograde from bi., while ky has resisted better) quartzites and quartz, musc. rocks and is rimmed by the quartz, musc., pyt. rusty schist, as always. This centortion is not echoed in the psammites of either side, so this zone may be a fold cone of a thrust.

200 m to the ese. is the continuation of the 13 ridge, but now it has much less kyanite - barely 10%. The quartzite are dominant but thinner. There is no development of macrocrystalline minerals. There is a slight southerly swing in the strike of the ridge here, and quartzites and qntz. musc. pyt. schists close round the ky outcrop.

These rocks also contain streaks of this unknown purple mineral.

37 300 m at 140° from 13 . Strike is 140°, dip vertical. Musc. pyt. qntz. schist with much purple mineral.

There are two possibilities.
Either the red line is a thrust, or there is a fold - shown in green.

The contortion of the quartzites and musc. rocks, and their vertical dip, compared to that of 40° - 60° of the psammites to the north, suggests a thrust. So far does the lack of cornelation either side, as might be expected, were this a fold. Such a thrust is almost cortainly folded, as is that between quartz and basement, but the ky zone does not seem to reappear.

Walking up sw. side of 1214 mapping the exact outcrops of quartz and sediment on the basement, so that folds and faults may emerge. The folds and thrusts explain the sudden terminations of successions into the hillside. All the quartz and sediments can be seen clearly lying on the top of the basement here.

Walking back down to cross to eastern end of 1086 ridge. Psammites (4) are barked at 40^{o} at 200^{o} against vertical and very contorted quartzites, and muscovitites (3). To the north, in the valley augen gneiss outcrops, dipping gently to north, with just beneath it, psammites (3) also dipping north. Further up sediments appear, folded into basement. This suggests that the 2 augen gneisses are one and the same here.
Section NS.

The 4 psammites here are almost gneisses, and have amph. bands, and also specks of galena.

Walking again up Nasa hillside, to check outcrops it seems that the folds are much tighter than I originally thought, and that ore limb (southern) may be thickenned, while the other (N) may often be thinned, and ever become a small thrust.

Thus the quartz may be thick in one place, and absent in another.

As well as these folds are others to them, so the plunge charges, and quartz comes in and out of the hill in the other dimension. In places quartzite can be seen quartz directly, and this is prob. how the quartz body was formed.

Back on north edge of quartz by lake at 149744. Contact is very veined with quartz, and there is 1 - 2 m of sedm. before the augen gneiss. These are often very baked in appearance, and are frequently brecciated, with gaps filled both with quartz and graphite schist - of boulder found in stream lower down. This is proof of movement and probably a largish fault.

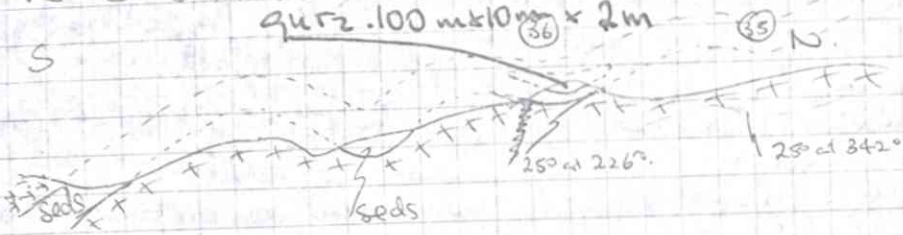
(40) Graphite schist appearing from beneath the gneiss. Also calc schists and a quartzite. Gabbro lies on top of the gneiss. Augen gneiss also lies below graphite schist here (140744). This graphite schist could be part of quartz and related sediments are also of 3 - 4 transition.
Found later that in fact it doesn't dip underneath, but comes out in a tight fold against gabbro gneiss.

Here this may be a thrust, or may be an overturned fold limb, where as further up it is almost certainly a thrust.

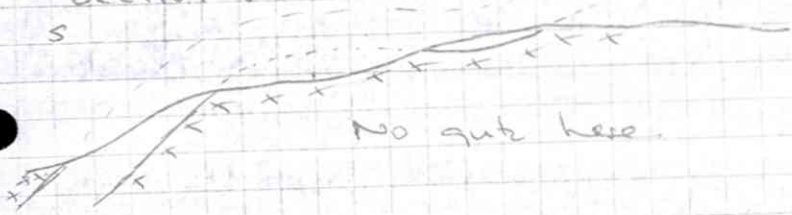
These graphite schists of all appear in an open fold, plunging 15° to the west, but are also folded tightly about a north- south axis, with the eastern limb overturned. These seds. don't lie up with those round the musc. qntz. pyt.(3)→psammite (4) junction.

29

N-S section ¼ km west of 1214 peak.

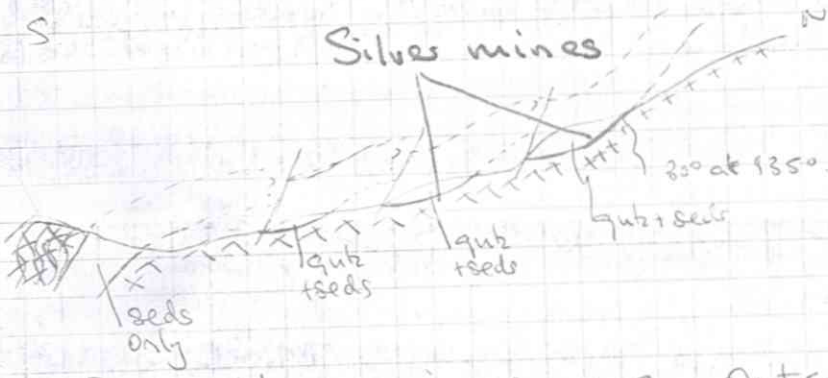


Section N-S ½ km West of 1214 peak



Top of 1214 is all Angel gneiss of basement. It often contains thin streaks of purple mineral.

Section N-S ½ km ~~West~~ East of 1214.



The silver mines are outcrops of quartz with argentiferous galena in them. The quartz bodies are also very broken, with slivers of graphite schist amongst them.

July 28th

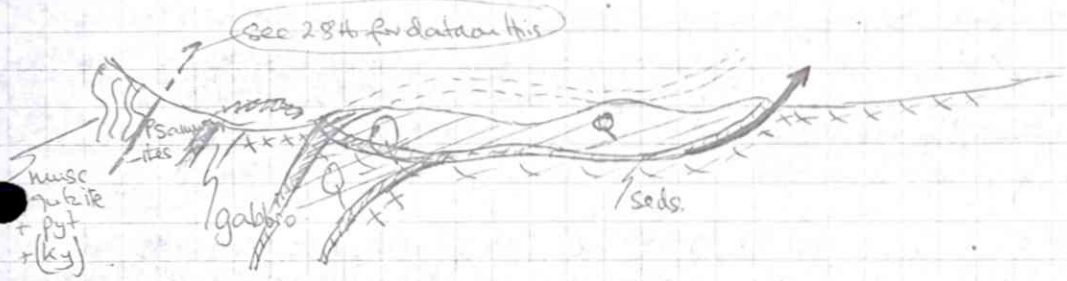
Walking up ky from (13), to top, to get some idea of what it is doing. At (13) the beds are vertical, very contorted, & contain a remarkable

Sides 20-21

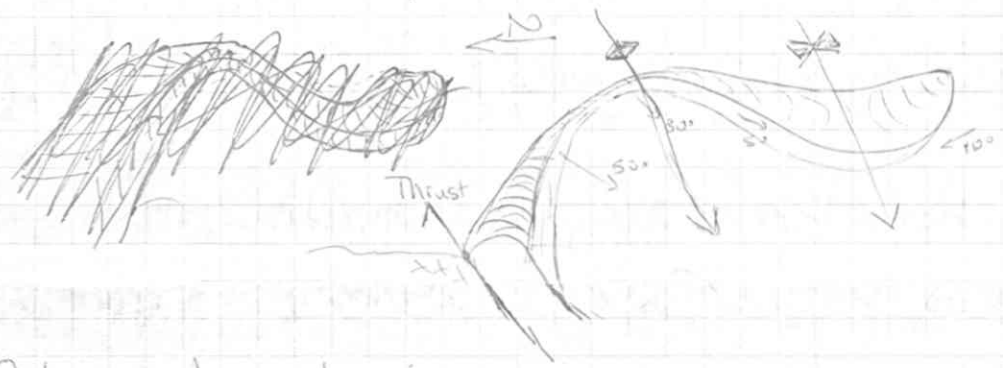
27

W 146743 E 152743.

S 150740 N. 150744.



Attempted 3D picture of quartz is:—



Outcrop of quartz is:-

sods → N.

Fault breccia along this contact

The sods are thickened over the ground by folds which appear to be missing one limb, i.e. see over the section of the outlier of quartz & quartzite

Badham

REWRITE OF NOTE BOOK

8th July. Base Telegraphstue 1. (078172)
Traverse to North. Coarse Bi-Mu schists just to N of last outcrop of gnt.gneiss. Granite gneiss is generally well foliated pale guartzo fsp rock dipping gently N, with dip increasing toward contact from 15° to 30°. These first schists contain boudins of vein quartz, intruded // to the foliation (S).

Above this is massive schist of similar composition. This contains amphibolitised bands. It varies in coarseness.

Next is a good quartzite, with specks of ore - prob. haematite-in. It shows good microfolding or t-w axis, of S, which here dips generally at 30 - 40° at 000°.

Above this is a "dirty" marble - about 5 m thick. Then mica schists with a prominent ½ m white quartzite that does not seem to be so boudined out as others. This makes the base of a thick marble of dolomite sequence.

Above this are schists with quartz vein in of varying grain size. Dip 320 at 347°. Called Exposure (1) (072186). This too contains an amphibolitised band, and also some scattered large garnets. Calcschists bands. One of these garnetbands is 6" thick and continuous along strike for 100 m. It is over 50% garnet - exposure (2) (at 072188).

Then in cliff at 070188 are a series of dolomite/marble and amphibole + garnet + biotite bands. One of these latter is 2 m thick with 40% garnets, of poor quality.

On the Southern margins of hill 823 (070189) is talc - exps (3) - probably from the metamorphism of basic and ultrabasic rocks. The care of this is of serpentine mineral. Chlorite, talc and altered felspar (scapolite). A marble lies to the North - clear and pure and coarsely crystalline.

Grening Setting up a basic stratigraphy.

Granite Gneiss	1.	Granite gneiss Foliated gneiss
Schist	2.	Rusty Bi-Mu svhists and quartzites + amphs. Graphite at base 50 m
Marble 1	3.	Dirty Marble (Pieske) 15 m
Schist 2	4.	Schists. Semipelitic + calc bands.

052.008

Marble 2	5.	Marbles and dolomites. 2' white quartzite at base.
Schist 3	6.	Thick schists + quartz boudins + calc layers.
Marble 3	7.	Marbles. Garnet amph. at base. Mica schists + 6" garnet band. Marble/amph. bands + 2 m garnet band.
Schist 4	8.	Schists - very rich in musc. Thin. Rusty.
	9.	Talc etc.
Marble 4	10.	Marbles.

Specimen numbers. 2 S Garnet musc. Bi. schist from band in Marble 3.

3 S Talc.

Contact of gneiss seen on return is in

Schists 1 proper.

Musc. graphite schists 5 m.

Muscovitite 2 m.

Felspatic gneiss 1 m.

Gneiss.

The graphite schists are very contorted and rusty weathered. They certainly are a plane of movement, but on what scale is impossible to tell - they may be a large thrust.

July 9th.

Exposure (4) - 092176. Granite gneiss sensu stricts is here underlain by a series of biotitites and amphibole, epidote, felspar rocks. These contain a foliation//S of the granite. The contact is near 100% biotite, a metre, and so thick, which has clearly been a plane of movement. Then what are in effect biotite schists come in. These thicken and thin along the outcrop, and are clearly boudins - they do not maintain the same structural horizon, but get lower to the south. The granite thins to the NE, but always remains between these rocks and schists 1. Dip of contact is 15° at 340°.

Schists 1 down here show a typical contact with the granite, and then go to normal schists + quartzites. No marbles are seen until 095195. Here is 15 m of impure marble dipping gently to the north.

Schists above this are variable and thick, and then we come on to marble 3 with garnet and amphibole bands. Above this are muscovitites and muscovite schists, weathering very rusty, with 4 or 5 prominent quartzite bands 1 - 2 m thick, dip. 55° at 350°. This zone is 30 m thick here, where as it was only some 2 - 5 m at hill 823. Then again above this are garnetiterous schists.
Exposure (5) (088200) Hill 793. Thickenned lens of talc rock, thinning to E and W along strike. Above this are thick marbles.

This lens contains many smaller lenses and streaks of different rock types.

Included are - Garnet + staurolite amphibolite in serpentine (?).
- Talc + altered fsp.
- Serpentine streaks.

In general the talc is dominant and other rocks form small 5 m x 1 m lenses.

Exposure 6 (077193). Looking back at hill 793.

On top of exps. (6) is talc felspar rock again, with tenses of staurolite garnet amphibolite. Staurolite crystals up to 30 m long seen. 2 tenses - 30 m x 5 m of amphibole chlorite rock with very large cubes of magnetite - up to 10%.

Quartzites in the rusty zone here are thinner and so is the rusty schists. The talc assemblage thins again to the west. Marbles are still to N of talc.

Specimens: S51 = Amph (?) + magnetite.
S52 = Asbestos from thin vein.
S53 = Serpentine/talc.
S54 = Staurolite, musc., garnet, biotite rock.

July 10th.

Traced the biotite lens in the granite gneiss (exps. ④) round to prove it to be part of basement, not schists 1. Many littologies in it. Each boudin seems to be some 100 m long, and lower than that are to the north. It fades out to 1 m thick behind the hut.

Schists 1 have very prominent quartzites in the east, on to the Junkerdal Map, including ore 10' thick. These are however often boudined. These appears to be a fold here as dip of S is 20° at 290° at 094193.

Dip of base of marble 3 is 55° at 338 so the fold must be contained in schists 2 marble 3 sequence.

Hill 656 (09920) has schists 4 on southern edge - very rusty and with quartzite bands, and then has marbles above those. Dip of these is 50° - 60° at 348°. There is then a series of alternating marble and rusty (muscovite) schists and quartzite bands, before thick marbles on the N of the hill.

The talc body must have thinned out by here, although there is a ½ m amphibolite band. The talc only really appears 1 km to the west of this hill at 091203.

July 11th.

Trying to follow marble 1 and 2 to see which is which. Schists 2 have large garnets in some bands, and are generally coarse than the others.

Schist 2 and marbles 2 and 3 go round a flexure or there is a discontinuity around 090195. There is no exposure in this grand so it is hard to decide which marble that at 095195 is.

Talc at top of 793 has garnets up to 30% in many bands. Possibility of ky here, though no definate crystals seen. Amph + mag + garnet suggest a basic rather than ultrabasic origin.

To north of 793 is thick marble, and with a great thickness of minteresting schists, containing 3 prominent quartzite horizons.

These dip at 65° at 350° and are some 2 m thick. They are fairly boudined and broken. These schists also contain thin marble bands. Then here is a much thicker marble - very pure. Then, at 075203 begins a sequence of coarse, almost gneissose schists of very uniform littology. There bi., gutz., fsp. schists. At 070209 is a marble again, with thin politic rusty (musc.) schists at its margins. Then to the N is more "gneissose" schist. The schists bordering the marble seem to be at first finer equivalents of the "gneissose" ore, and then to be musc. - schists. At 068208 are two large boudins of quartzite, which correlate to thinner bands in the marble-marginal schists. The "gneissose" schist closes round this marble schist sequence in a small lake, and then to the west another such sequence opens out:

Coming back round lake and marbles - that at hill 792, then being schist, then thin marbles then (exposure ⑧) at 060186 is another talc body.

Looking east at hill 823 the talc thins down to the lake and swings to the north. It also closes downwards - ie it is a 3 boudin.

The talc at 060186 has amph + gnt + musc schists with no staurolite, solid talc tenses a few metres long// to S, magnetite (?) amph. tenses, serpentine tenses, pure talc tenses of the dominant talc + altered felspar rock swinging around all these.

Walking south the is more marble touching the talc, then schists, then another marble that links to that on hill 070183. Thrust the schists above this have thinned considerably to the west. Dip here is 35° at 342°.

Exposure (7) , 30 m above contact is a thick kosic band before the graphite schists, dipping 25° at 068180.

Grening. Revised "stratigraphy".

"Ooj.t. gneiss".	Gneissose schist (+ mbles. + schists + qutzs.)
Mble 3.	Marble - usually clean + dolomitic.
Sch. 3.	Schists - minteresting.
Mble 2.	Containing the talc body. Thick rusty schists + quartzites in fast, thin in west.
Sch. 2.	Schists - mbles. + amphs. + qutzites.
Mble 1.	Marble - thick + clean.
Sch. 1.	Schists - + qutz. + thin dirty marble.
	Granite gneiss.

Specimers - S_7 = Muscovitite
S_8 = Magnetitic rock.

July 12th.

Dip in marble 2 in east edge of Hill 932 (051177). Marble is thicker here.

Granite contact runs up S edge of this hill. Marble 1 seems to be absent here in the schist 1 sequence. Dip in marble 3 at 043177 is 40° at 310. There is no talc here. Following this marble back, the talc thins out by 054183, schists to N of marble 3 dip 40° at 305°, so contact has swung a lot, and succession here has thimed.

Further to sw. strike has swung more - dips 60 at 300° 030160.

Traversing back to Bjellavatn from 018165. Thick schists + calc bands + garnet bands ⟶ 5 m marble ⟶ garnet mica schist (40° at 288°) ⟶ 8 m marble ⟶ gnt. mica schist + quartzites ⟶ 3 m marble ⟶ very contorted garnet mica schist ⟶ coarse felspatic schist (psammite) ⟶ 15 m marble ⟶ 10 m semipolites ⟶ 50 m marble (marble 2) (all before this is part of schist 3 sequence) ⟶ calcschists + marble bands 30 m ⟶ 20 m marble (marble 1) ⟶ thin semipolites ⟶ 2 m quartzite ⟶ Exposure (8) (039165) ky musc.schist ⟶ musc. schists ⟶ graphite schists ⟶ granite gneiss.

All between granite + marble 1 is schist 1. Graphite at the contact is up to 50% in a 3 m band for 100 m laterally. Kyanite is dark coloured and up to 30% in a 1 m band, dipping 50° at 315°.

Specimers $S8_1$ = ky. musc. schist.
$S8_2$ = graphite schist.

July 13th.
Walking down to Storsletten. Granite contact followed and mapped, dip 10° at 290° in one place, but usually nearer 340°. Contact cuts across streams generally here after following them on top. Exposure lost in trees.

July 14th in gjestgiveri.

July 15th.
Walked up to 426, but John's leg bad, so carried him back to hotel.

July 16th.
Walked up to Bjellavatn. Exposure nearest lake at 023151 in musc. schist - prob. within 10 m of contact with granite. Schists above up to hill 804 (021156). Many quartzites and calc schist bands. Marble at top, 20 m thick. Dip 50° at 320°. More schists + quartzites + garnets to nw. Then 30 m marble. Then schists with garnets. Very tightly folded on ew. axis, with plunge of 20° to east.
Long graps of no expose to nw. Then schists - very psammitic - at 018163. No good foliation, but miner folds plunging 30° at 320°. Most of valley to north is morsaine.
These schists cannot be correlated with those mapped to the ne. of the morsaine, and there is probably a fold of fault running through this gap. The intensity of miner folding, observing S_1 and developing S_2 suggests a fold. A closure of schists over marble at 021165 seems to fit with this idea. I have no idea what the fold does, unless i plot all fabrica or a stereogram.
Walking to nw. from last exposure are old exposures of rusty schists and garnet schists, getting less folded to the nw., and with S_1 becoming more prominent. There are some graphitic schists.
On west side of Harodalen at 998162, after long bog with no exposure, is coarse semipolite and musc. schist. Dip 40° at 260°. Large quartzite boudins in bands. Weakly or non garnetiferous.

This does not seem to be equivalent to the "gneiss" to the ne., allthough there is no exposure to tell between them.
Dip at 592 is 50° at 270°. Garnet schists are now pedominert (993160). Large and small garnets, between 10% and 50% of the rock. Dip is 70° at 280°. There are mesofolds with 50 m amphitudes in this garnetiferous band. The band strikes north up the hill.
To n. of the garnet band is a linestone - dip 35° at 275°. This fairly thick and going down into the valley - 1 m not
Walking back further to so. much the same succession is seen, with better exposure. ie. Garnet schists → thick and varied schists with garnet band near its eastern margin, and rusty zones either side of it → marble 3 → garnet semipolites → marble 2 → schists (much more contorted with miner folds plunging 15° at 005°). Dip at 011131 is 60° at 290° → quartzite bands → marble 1 → schists and rusty bands → graphitic schist → granite gneiss at 017140.

July 17th.
Half way up Bjellavatn, just ne. of hill 721 granite contact is exposured, with
The usual contact succession is present, but there is very little kyanite in the schists above the quartzite.
Thin marble 1 at 100 m above lake, then schist 2 and marble 2. Marbles thicker to the south, but contain their characterisitc components throughout a few boulders of a talc. Felspar rock lie about here - very large ores. Perhaps there is another talc body soon.
Ore band in schists 2 has garnet and kyanite in, but neither in large quartities.
Strike swings round base of lake - check tomorrow.
Walking wnw. on a traverse from 000100. Marble 3 is of usual thickness. The schists beyond it go.
Rusty polites + lsts. + quartzites → semipolitic biotite schists coarse psammitic "schists" in 5 - 10% large garnets (50° at 290°) great thickness of garnet mica schists and semipolites with rusty zone at base. (These don't quite tie up with the garnet poor schist, sequence to the north, but there may be some slight compositional change along strike) → Psammitic schists garnet rich schists limestone + amphs.
Walking back further to north same succession is observed.
No economic minerals - in fact no "minerals" at all.

July 18th.
Heavy rain and low cloud. Visibility 20 m.

July 19th.
Very bad weather with poor visibility west to south end of Bjellavatn, to follow granite and marble 1 across Bjellåga stream. Impossible to continue further up hill, because of low cloud. Strike has swung to nw. - se., and dip generally steepers round here. All sequence seen is normal. Came across Nils Hollanders camp. He is not working because of the weather, so I too am giving up. He is looking for minerals - and finding small amounts - in the granite - which is probably sparagmite here.

July 20th.
Walked down to Storsletten.

July 21st.
To Bolna. Purpose - to see out ky. + quartz. Structure, outcrop and interpret them. Also look for ore minerals. In afternoon, distinctive "mappable" lithologies were looked for.

1/. Augen gneiss.
2/. Quartz + graphite schist.
3/. Quartzite + ky (in places) + musc. schist.
4/. Schists.
5/. Psammites.

Also boulders of a matic felspar and amphibole - and chlorite? - rock of what was probably a gabbro. Ølnes says it outcrops further up, and was a gabbro, but is now mainly chlorite, epidote and Na-felspar.

22nd July.
Traverse from 120742 to 128753.
1 400 m se. of transformer hut (T.H.) is quartzo felspathic pale hard massive psammite, gently folded about a near vertical axis. Prominent schistosity (S_1). Dip avg. = 80° at 230°. Less than 10% mica. This continuos to nne., with fairly constant lithology. Some quartz crystals are well rounded suggesting that they may still be sedimentary remnants. At this grain size it is probable that they were either pat of "turbidite" (sensulate) or continental sandstones, as the fel-

spar must come from day minerals or reconstitute from other sedimentary felspar. The latter is most plausible, seeing we are on a basement granite and that these are "Vorland" sediments. In places Bi contact 30%, and ditto for muscovite - perhaps from local patches of other sediment in an equivalent dominatly of quarts and felspar/kaolin - the weathering products of the basement "granite".

(2) Coarse bi. musc. semi. - polites musc. semi. - polites. Variable coarseness. Transformer H is 300 m at 016°. Biotite often crinkles by later folds, out of plane of Si. Dip of S_1 = 75° at 234°, but again, gently folded. S_2 is weakly developed. In places this sequence contains minute specks of haematite and golena and some iron sulphide. Also a few thin calcareous bands and streaks of fluorspar in places.

(3) 200 m at 0600 from TH. Quartz., flsp., musc. psammites, with 20% mica. Small specks of mineral - both haematite and falena - but very sparse. Bands of Bi.rich rock. This similar to (1) but with more mica. Dip 70 - 80° at 240°.

(4) 150 m of no exposure and then 2 patches of rock in place. The southern most is psammite like (3) dipping 20° at 058°. It has calc bands. The secand is musc. schist with up to 2% pyrite. Dip 350° at 046°. These are close, at 100 m at 336° from T.H.

(5) 50 m at 324° from T.H. Musc. schists with pyrite, fine muscovite bands and quartzites - very refolded and boudinnage common in these. S generally dips 40° at 078° to 500 or 0480, but varies. The quartzites contain only very sparse kyanite or a rough check.

6 20 m to n. of 5. Massive semi. - polite. Dip 80° at 050°. Up to 1% pyrite.

(7) 300 m at 250° from T.H. in stream. Augen gneiss. Quartz and felspar well segregated, and streaked and folded biotite between. Dip of S_1 between 70° at 030, of vertical striking 120° - 300°. The banding is // to S_1. A few small epidote patches seen, and also bi.rich bands.

(8) 600 m at 244° from T.H. in stream. Psammites, semipolites, quartzite (gneenish + banded) and graphite schist, some 5 - 10 m thick. Dip 85° at 238° → 45° at 220°. Both up and down.

Stream, within graphite schist are thin tenses of quartz. Cavernous and covered with an iron , but clear and pure inside, with no minerals. The lower of these is 20 m long and 3 m wide. It thins to east and dissappears under boulders to the west.

20 m to north is more augen gneiss. This is better crystallised and more schistose.

Walking from (8) to 137750, up stream.

The second quartz tens is up to 5 m thick and 800 m long. It dips // to its contacts, which are // to S_1, at 50° at 220°.

Joint planes in it at - 60° at 015°
55° at 216° (S_1)
45° at 96°
85° at 312°

On both sides of it are thin wedges of psammites and semi-polites and graphite schist, before augen gneiss. Top is observed by and boulders. 100 m further up stream, however, psammittes are in contact with augen gneiss on both sides - so no quartz here, ever though graphite schist is present.

(9) In same quartz body, ½ way up.

Thebouldering psammites have calc bands. Contact dip 35° at 192°.

(10) At top of quartz body, where it dissappears, there are veins and pods of quarts in the augen gneiss and metasediments.

Quartz is intrusive. The pods are // to S_1, so intrution was syn of post formation of S_1, but pne. the later folding that elsewhere S_2, as the sediments and quartz contain these folds.

Walking back to ssw. from 10 .

Augen gneiss first, which still seems different (more sinuous

micas) than that to n. Bi.rich banded horizons. Exposure of this for 200 m, then 50 m no exposures.

(11) 300 m south of (10) . Augen gneisses dipping 85° at 004° ⟹ vertical, strike 94° - 274°, S_1 is very folded here.

(12) 50 m to S of (11) 50% musc. in a musc. schist, with 2 - 3% pyrite. Dip 30° at 206°. Quartzites at top of ridge, and then more musc. schists. Look for ky later.^

13Ky. 150 m to n. of Ølnes' hut - O.H.

Much quartzite, associated, and muscovite too. The ky. % age varies between 10 and 40%, 1 recon (up to 5% pyrite also) in quartzite. There is also a lot of vein quartz. Dip is variable and very folded, but generally steeply at 035°.

Greening.

Traverse 1 - 8. Section, showing S_1 dips at contact N.

July 23rd.

(14) To n. of augen gneiss is a green basic rock, dip 30° at 220°, about 5 m thick at 138757. This prob. a metamorphosed dyke and small intention. of dolerite/gabbro, in basement granite. All ground is a coarsely crystalline, unlineated quartz, fsp., biotite rock - granitic looking, but probably not so in composition. This becomes lineated near the margin. Where the quartz is intruded augen gneiss. This is slightly different from the other augen gneisses to south which are prob. granitised sediment of sediment of sparagmite age - not part of basement as such. Foliation in margine of granite here dips = 15° at 266°. There are many shallow open folds of 20 m amphitude here, with an axis plunging about 10° at 245°. Often, near the contact, the augen have become hands of biotite. A small quartz vein at 145748 has a little well crystallised galena in, but very small amment. This vein is related to the quartz body, and is // to S_1.

(15) ½ km from lake, at 314° is quartz to granite (to distinguish it from the other augen gneiss it is called granite here) contact. The edge zone is very veined. There are sparse, small patches of mineralisation with pyrite, pyrohotite, pyrite, chalco pyrite and a rather pale yellow sulphide - probably a "mixture" of 2 of the aforementioned, ie of intermediate composition.
Musc. graphite schists in thin slivers stuck or to edge of quartz - still pme. and white. Quartz is 20 m thick and contact, and a plane in it dip 45° at 226°. South contact has slivers of graphite schist and then a thin layer of psammites and quartzite before the augen gneiss, dipping 55° at 222°.

16 147745. Metabasic rock - gabbro. Amph., chlorite, fsp., (epidote?) assemblage. Dip 55° at 221°. This is generally poorly foliated, except at margins, suggesting it is late stage. 50 m to west is augen gneiss swinging round base of gabbro, dip 10° at 130° round here. Thus gabbro seems to have affected S by its intrusion. Quartz contact retains same strike, however, so effect is local.

Further to sw. is banded amphibolite, 55° at 238°, microfolded along an axis plunging 15° at 154°.

(12) Revisited. Base of cliff is bi. semipolite, 5 m thick. 30° at 190°. ∠1 m of fsp. psammite. Musc. schist with quartzites, muscovitites and thin (½ m) band of kyanite. Ky % ago 20% usually. All have accessery pyrite. Then semipolites 5 m. Then musc.guartz schist 2 m, then quartzites + musc. schists - very refolded, plunge at 10° at 220°, 30 m. Dip is 30° at 220°. Further to south miner folds plunge 30° at 142°. It is probable that we have 2 periods of later folds. An earlier set plunging se., nw. and a later set plunging sw, buckling the first ores, so that they plunge both ways. This

gives a small scale dome and basin effect to the beds with local dips pointing in all directions.

(17) Miner folds in se.-nw. axis refolded in ne.-sw. axis, so axis of first are plunges both ways, 20 m to s. is quartz, fsp., musc., semipolite - 85° at 215°. These 3. Specks of haematite and galena, 30 m to s. dip = 80° at 058° - ie it is generally vertical.
100 m across to s. is this, then bi. semipolite and then quartz fsp. psammites 1.

(18) 200 m over, near 2ndstream. Psammites 1, 50° at 128°.
Succession obtained off 2 traverses is:

1) Quartz, fsp. psammites. 1, 18, 19, 22.
2) Bi., musc. semipolites and psammites. 2, 3, 17, 32, 33.
3) Musc. schists and musc. and quartzite and ky. 4, 5, 13, 12, 20, 29.
4) Semipolites and psammites. 6, 30.
5) Augen gneiss and psammitic bands. 7, 10, 11, 23, 25.
6) Psammites, semipolites and graphite schist + calc schists containing quartz. 8, 9, 15 etc.
7) Augen gneiss - basement.

July 24th

19 1 type psammites 45° at 214. Continues 300 m to south - not going further.

20 T.H. purpose to follow ky upwards and note % ages etc. 40 m to nw. of T.H. are quartz musc. rocks with pyt. + psammitic bands. Also accessary haematite. 70° at 040°. Miner folds plunge 045° at 15°. Ky is thin ½ m band, very pinched, sinuous and folded. 20% ky, about in quartzite. Succession = 1 m quartzite + ky (sparse) → 1 m quartz musc. schist → ½ m quartzites 20% ky + quartzveins → 1 m quartzite + ky (sparse) → 1 m muscovitite → 5 m quartz, musc., pyt schist → 3 type psammites. Dip is near vertical.
Ky containing quartzites thin to east and west, when musc., quartz, pyt. schist closes round these tenses.

There is ky in most of the rocks but the muscovitites, but in very low %ages. These beds are so much more folded than others that this is probably an early fold crest.
To east of this tens psammites runs the quartz, musc., pyt. rock, with no quartzites running through, in surface.
300 m further up the ridge semipolites and psammites dip 70° at 068°, to south of musc., quartz, pyt. rock in contact with it. Thus the contact of 2 3 swings here. ½ km up it is back again an old line.
A base of 836 ridge is a 20 m amplitude fold plunging 090° at 20°. On north edge of this ridge is a ½ - 1 m band of quartzite containing a little kyanite, in quartz, musc., pyt. rock. Weather atrocious so down below clouds.

7 Revisited, then 8 to study "irregular gneiss" and see if it is the same as the basement gneiss. I think it is now. The 2nd stream north of T.H. is cut in semipolites and graphite schist between the 2 augen gneisses. Fault. Still coloured different on map, far distinction.

No exposure in streams, after they join.

21 Farily basic massive unlineated rock with bi., chl., fsp, and little quartz. This is part of basement and is probably a meta intermediate dyke (diorite) and perhaps an "acidified" basic (dolerite) dyke.
200 m to south-west is more of this, surrended by augen gneiss. Dip is vert., strike 128° here.
Augen gneiss seen in stream at 122755 - not sure which part of it though.
A boulder of rounded augen gneiss fragments in graphite schist seen. This looks like a fault brecoia, suggesting that the contact is a fault, up which quartz was emplaced.

22 Weather so bad that have retired to Randalselven to de a section.
1 type psammites here, by bridge and for 200 m up stream. These gently folded on axis plunging 15° at 150°. Odd patches with more bi. and musc. One band has magnetite and small garnets. Dip 20° at 138° at bridge. 50° at 205°, 200 m to n. Then no more exposure.

July 25 th.

23 Irregular gneiss. Dip 75 at 028. It still has Odd bi. rich horizons, indicating perhaps that it is granitised sediment - hard to forget bi. separating from qutz. and fsp. and vica versa.

200 m to SE is same

100 m to E is same

100 m to NE of last is "gabbro" - very metamorphosed. On top of hill, at 147746, gabbro runs to sw. of augen gneiss, with contact running nw. se. This is mapped in. Patches of net veining in gabbro. It veins the augen gneiss along s. It is chilled against the gneiss, but is foliated in its margins. The gneiss is best around it slightly. Thus the gabbro is late stage metamorphic. Prob. intruded into a still hot region, during copling, and this promoted very slow cooling and high wup's . Hence the gabbro minerals would adjust to their chlorite, epidote, felspar assemblage, yet s. would be bent by instrusion. The slow coolinger high wup may have helped lingering "Hydsthemal" conditore nearly -ie the quartz and mineral intrusion.

24 Quarts contact swings to south here in a large ridge on top of the hill. Dip of top contact is shown by slivers of semipolite adhering, to be 50° at 252° at 150744. The quartz then shallows in dip and its ground outerop thickens. It is actually some 25 m thick. N contact dips 30° at 242° on the "crest" of this swing against augen gneiss. Sediment thickens around quartz because of shallowing too. Contacts are full of quartz veins, but no mineral.

Quartz tongues off at "crest" of swing into 2 bodies, apparently. These may be continuous and may be separate "blips". They are always in a metasedimentary avelope.

25 Small patch of pyrite mineralisation at 150743. Schists here lie virtually horizontal on quartz.

Sediments continue to east up hill, with some good tens of quartz in - 30 m and 2 m, between the two gneisses. They are thick and folded on east-west axis, very operly.

26 Is graphite schist in metaseds., dipping 35° at 114°. The main quartz body defineately ends at the base of the hill, where it is nearly horizontal.

27 Gneiss folded round at base of quartz at 149743. Dip 35° at 310°.

28 Gneiss on hill below gabbro 100 m south of 27.

x 200 m east of 1038 is contact of gneiss with sedimente. Gabbro has out by here. Seds. and semipolites and psammites of 4 type, as lower down. Dip vertical, strike 300°.

29 Just of south edge of ridge are quartzites and muscovitite. Very dip torted. 1 small amount of ky in some. 20 m thick.

30 Seds. in stream in contact with gabbro streak, with gneiss to north of this. 45° at 105°, but probably totated by slumping.

31 Gabbro in contact with gneiss, before seds., so gneiss does surround gabbro. South is vertical,strikign 044°.

Grening

Sections through quartz body.

S N along 148 longditude.

27th July.

32 Weakly micaceous pale massive psammites 50° at 224° = 1.

33 Psammites with more mica. pale. Gently folded round agently eastward plunging axis. 25° at 190° and 30° at 240°. 200 m to north and bi. semipolites. All these = 2. These dip steeply to north.

Going up stream with quartz in, to map bodies exactly on 1 : 10 000.

Augen gneiss at base - 30° at 040°.

1st body is 20 m and 5 m maximum.

2nd body is not continuous right up to the top, but is 2 bodies. The lower ore is 200 m long + 4 m wide. "Sediments" runs right through, however, where there is no quartz. 2rd body is over 10 m thick, dipping 40° at 220°. It swings away from stream and then back to its old strike. This is because it goes over the axis of a small sw. gently plunging fold. ie.

The seds. here are up to 10 m thick on the south side. After very contorted with slightly overturned (to the north) microfolds. These are probable dragfolds on a thrust. s

They are clearly lier than the later, open, shallow plunging micra folds.
Many small pods of quartz in sediments up here, some more than 1 m long.

Quartz body on top is now completly sorted out. It is up to 20 m thick. At top end dip shallows and sings round and then the body goes above the hill, because the plunge of the fold is steeper than that of the hill.

The small tenses of quartz to the north of the main body are not tension gash fills as they are surrounded by a sedimentary evelope. They must either be folded with faulted equivalents of the main body. Since the certaining sediments dip south under augen gneiss it is most probably fault repeated - only an isocline could do this other wise and there is no evidence for isoclines. The increase in contortion in harrow zones suggests a small thrust as well.

Walking from 160738 to 1214 peak. - Sediments sometimes with quartz in, repeat themselves up the hillside, because of small tight folds. Often one limb of these folds is missing, and perhaps a small thrust is present - these are impossible to see in the graphite schists. Most of these folds plunge at some 20° to sw., but some plunge to ne., so there is later folding on another axis.

Section 1 km west of 1214 peak - north + south.

The silver mines are outcrops of quartz with argentiferous galena in them. The quartz bodies are also very broken, with slivers of graphite schist amongst them.

July 28th.

Walking up ky from (13) to top, to get some idea of what it is doing. A (13) The beds are vertical, very contorted, and certain a remarkable number of well crystallised minerals including kyanite, quartz, pyrophyllite, a green mica, muscovite (talc?) and pyrite. The ky % is very great in 3 or 4 thick quartzite beds. The succession also includes chlorite bands, (Chlorite and kyanite in association. Must be retrograde from bi., while ky has resisted better) quartzites and quartz, musc. rocks and is rimmed by the quartz, musc., pyt. rusty schist, as always. This centortion is not echoed in the psammites of either side, so this zone may be a fold cone of a thrust.

200 m to the ese. is the continuation of the 13 ridge, but now it has much less kyanite - barely 10%. The quartzite are dominant but thinner. There is no development of macrocrystalline minerals. There is a slight southerly swing in the strike of the ridge here, and quartzites and gntz. musc. pyt. schists close round the ky outcrop.

These rocks also contain streaks of this unknown purple mineral.

37 300 m at 140° from 13 . Strike is 140°, dip vertical. Musc. pyt. qntz. schist with much purple mineral.

There are two possibilities.
Either the red line is a thrust, or there is a fold - shown in green.

The contortion of the quartzites and musc. rocks, and their vertical dip, compared to that of 40° - 60° of the psammites to the north, suggests a thrust. So far does the lack of cornelation either side, as might be expected, were this a fold. Such a thrust is almost cortainly folded, as is that between quartz and basement, but the ky zone does not seem to reappear.

Walking up sw. side of 1214 mapping the exact outcrops of quartz and sediment on the basement, so that folds and faults may emerge. The folds and thrusts explain the sudden terminations of successions into the hillside. All the quartz and sediments can be seen clearly lying on the top of the basement here.

Walking back down to cross to eastern end of 1086 ridge. Psammites (4) are barked at 40^{o} at 200^{o} against vertical and very contorted quartzites, and muscovitites (3). To the north, in the valley augen gneiss outcrops, dipping gently to north, with just beneath it, psammites (3) also dipping north. Further up sediments appear, folded into basement. This suggests that the 2 augen gneisses are one and the same here.
Section NS.

The 4 psammites here are almost gneisses, and have amph. bands, and also specks of galena.

Walking again up Nasa hillside, to check outcrops it seems that the folds are much tighter than I originally thought, and that ore limb (southern) may be thickenned, while the other (N) may often be thinned, and ever become a small thrust.

Thus the quartz may be thick in one place, and absent in another.

As well as these folds are others to them, so the plunge charges, and quartz comes in and out of the hill in the other dimension. In places quartzite can be seen quartz directly, and this is prob. how the quartz body was formed.

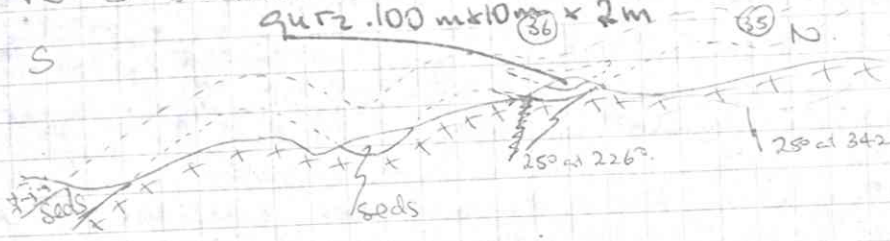
Back on north edge of quartz by lake at 149744. Contact is very veined with quartz, and there is 1 - 2 m of sedm. before the augen gneiss. These are often very baked in appearance, and are frequently brecciated, with gaps filled both with quartz and graphite schist - of boulder found in stream lower down. This is proof of movement and probably a largish fault.

40 Graphite schist appearing from beneath the gneiss. Also calc schists and a quartzite. Gabbro lies on top of the gneiss. Augen gneiss also lies below graphite schist here (140744). This graphite schist could be part of quartz and related sediments are also of 3 - 4 transition.
Found later that in fact it doesn't dip underneath, but comes out in a tight fold against gabbro gneiss.

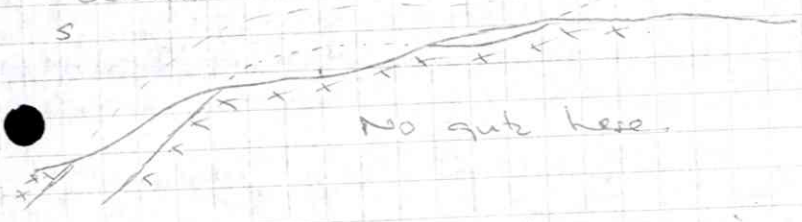
Here this may be a thrust, or may be an overturned fold limb, where as further up it is almost certainly a thrust.

These graphite schists of all appear in an open fold, plunging 15^{o} to the west, but are also folded tightly about a north- south axis, with the eastern limb overturned. These seds. don't lie up with those round the musc. qntz. pyt.(3) → psammite (4) junction.

N-S section ½ km west of 1214 peak.



Section N-S ½ km west of 1214 peak



Top of 1214 is all Angel gneiss of basement. It often contains thin streaks of purple mineral.

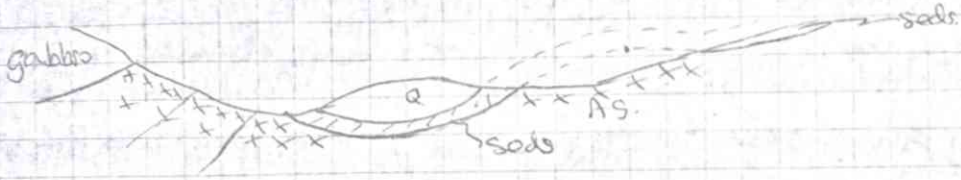
Section N-S ½ km ~~west~~ East of 1214.

The silver mines are outcrops of quartz with argentiferous galena in them. The quartz bodies are also very broken, with slivers of graphite schist amongst them.

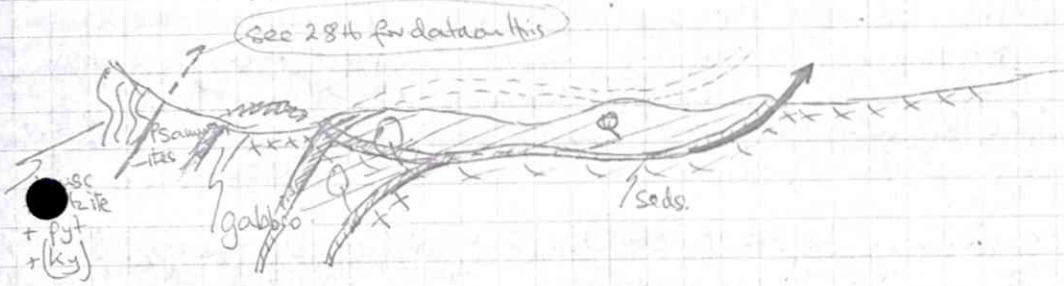
July 28th

Walking up ky from (13) to top, to get some idea of what it is doing. At (13) The beds are vertical, very contorted, & contain a remarkable

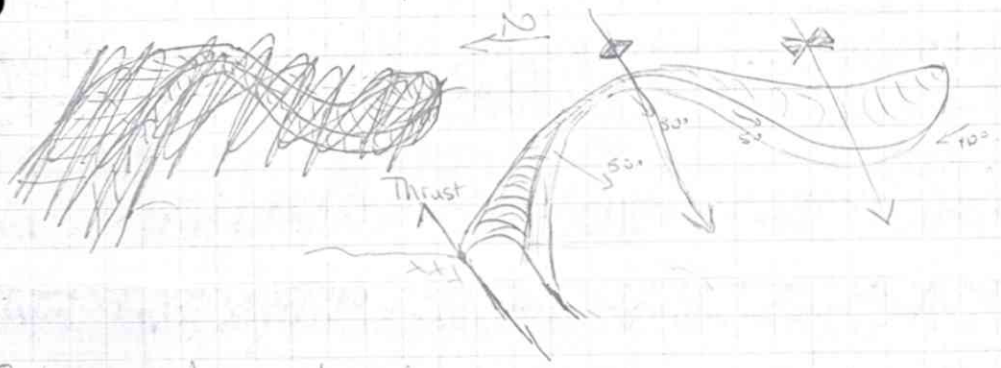
W 146743 E 152743.



S 150740 N. 150744.



Attempted 3D picture of quartz is:—



Outcrop of quartz is:-

→ N.

Fault breccia along this contact

The sods are thickened over the ground by Blds which appear to be missing one limb, i.e see over fig section of the outline of quartz & quartzite

REWRITE OF NOTE BOOK

8th July. Base Telegraphstue 1. (078172)
Traverse to North. Coarse Bi-Mu schists just to N of last outcrop of gnt.gneiss. Granite gneiss is generally well foliated pale guartzo fsp rock dipping gently N, with dip increasing toward contact from 15° to 30°. These first schists contain boudins of vein quartz, intruded//to the foliation (S).

Above this is massive schist of similar composition. This contains amphibolitised bands. It varies in coarseness.

Next is a good quartzite, with specks of ore - prob. haematite-in. It shows good microfolding or t-w axis, of S, which here dips generally at 30 - 40° at 000°.

Above this is a "dirty" marble - about 5 m thick. Then mica schists with a prominent ½ m white quartzite that does not seem to be so boudined out as others. This makes the base of a thick marble of dolomite sequence.

Above this are schists with quartz vein in of varying grain size. Dip 320 at 347°. Called Exposure (1) (072186). This too contains an amphibolitised band, and also some scattered large garnets. Calcschists bands. One of these garnetbands is 6" thick and continuous along strike for 100 m. It is over 50% garnet - exposure (2) (at 072188).

Then in cliff at 070188 are a series of dolomite/marble and amphibole + garnet + biotite bands. One of these latter is 2 m thick with 40% garnets, of poor quality.

On the Southern margins of hill 823 (070189) is talc - exps (3) - probably from the metamorphism of basic and ultrabasic rocks. The care of this is of serpentine mineral. Chlorite, talc and altered felspar (scapolite). A marble lies to the North - clear and pure and coarsely crystalline.

Grening Setting up a basic stratigraphy.

Granite Gneiss	1.	Granite gneiss Foliated gneiss	
Schist	2.	Rusty Bi-Mu svhists and quartzites + amphs. Graphite at base	50 m
Marble 1	3.	Dirty Marble (Pieske)	15 m
Schist 2	4.	Schists. Semipelitic + calc bands.	

052.008

Marble 2	5.	Marbles and dolomites. 2' white quartzite at base.
Schist 3	6.	Thick schists + quartz boudins + calc layers.
Marble 3	7.	Marbles. Garnet amph. at base. Mica schists + 6" garnet band. Marble/amph. bands + 2 m garnet band.
Schist 4	8.	Schists - very rich in musc. Thin. Rusty.
	9.	Talc etc.
Marble 4	10.	Marbles.

Specimen numbers. 2 S Garnet musc. Bi. schist from band in Marble 3.

3 S Talc.

Contact of gneiss seen on return is in

Schists 1 proper.

Musc. graphite schists 5 m.

Muscovitite 2 m.

Felspatic gneiss 1 m.

Gneiss.

The graphite schists are very contorted and rusty weathered. They certainly are a plane of movement, but on what scale is impossible to tell - they may be a large thrust.

July 9th.

Exposure ④ - 092176. Granite gneiss sensu stricts is here underlain by a series of biotitites and amphibole, epidote, felspar rocks. These contain a foliation//S of the granite. The contact is near 100% biotite, a metre, and so thick, which has clearly been a plane of movement. Then what are in effect biotite schists come in. These thicken and thin along the outcrop, and are clearly boudins - they do not maintain the same structural horizon, but get lower to the south. The granite thins to the NE, but always remains between these rocks and schists 1. Dip of contact is 15° at 340°.

Schists 1 down here show a typical contact with the granite, and then go to normal schists + quartzites. No marbles are seen until 095195. Here is 15 m of impure marble dipping gently to the north.

Schists above this are variable and thick, and then we come on to marble 3 with garnet and amphibole bands. Above this are muscovitites and muscovite schists, weathering very rusty, with 4 or 5 prominent quartzite bands 1 - 2 m thick, dip. 55° at 350°. This zone is 30 m thick here, where as it was only some 2 - 5 m at hill 823. Then again above this are garnetiterous schists. Exposure (5) (088200) Hill 793. Thickenned lens of talc rock, thinning to E and W along strike. Above this are thick marbles.

This lens contains many smaller lenses and streaks of different rock types.

Included are - Garnet + staurolite amphibolite in serpentine (?).
- Talc + altered fsp.
- Serpentine streaks.

In general the talc is dominant and other rocks form small 5 m x 1 m lenses.

Exposure 6 (077193). Looking back at hill 793.

On top of exps. (6) is talc felspar rock again, with tenses of staurolite garnet amphibolite. Staurolite crystals up to 30 m long seen. 2 tenses - 30 m x 5 m of amphibole chlorite rock with very large cubes of magnetite - up to 10%.

Quartzites in the rusty zone here are thinner and so is the rusty schists. The talc assemblage thins again to the west. Marbles are still to N of talc.

Specimens: S51 = Amph (?) + magnetite.
S52 = Asbestos from thin vein.
S53 = Serpentine/talc.
S54 = Staurolite, musc., garnet, biotite rock.

July 10th.

Traced the biotite lens in the granite gneiss (exps. (4)) round to prove it to be part of basement, not schists 1. Many littologies in it. Each boudin seems to be some 100 m long, and lower than that are to the north. It fades out to 1 m thick behind the hut.

Schists 1 have very prominent quartzites in the east, on to the Junkerdal Map, including ore 10' thick. These are however often boudined. These appears to be a fold here as dip of S is 20° at 290° at 094193.

Dip of base of marble 3 is 55° at 338 so the fold must be contained in schists 2 marble 3 sequence.

Hill 656 (09920) has schists 4 on southern edge - very rusty and with quartzite bands, and then has marbles above those. Dip of these is 50° - 60° at 348°. There is then a series of alternating marble and rusty (muscovite) schists and quartzite bands, before thick marbles on the N of the hill.

The talc body must have thinned out by here, although there is a ½ m amphibolite band. The talc only really appears 1 km to the west of this hill at 091203.

July 11th.

Trying to follow marble 1 and 2 to see which is which. Schists 2 have large garnets in some bands, and are generally coarse than the others.

Schist 2 and marbles 2 and 3 go round a flexure or there is a discontinuity around 090195. There is no exposure in this grand so it is hard to decide which marble that at 095195 is.

Talc at top of 793 has garnets up to 30% in many bands. Possibility of ky here, though no definate crystals seen. Amph + mag + garnet suggest a basic rather than ultrabasic origin.

To north of 793 is thick marble, and with a great thickness of minteresting schists, containing 3 prominent quartzite horizons.

These dip at 65° at 350° and are some 2 m thick. They are fairly boudined and broken. These schists also contain thin marble bands. Then here is a much thicker marble - very pure. Then, at 075203 begins a sequence of coarse, almost gneissose schists of very uniform littology. There bi., gutz., fsp. schists. At 070209 is a marble again, with thin politic rusty (musc.) schists at its margins. Then to the N is more "gneissose" schist. The schists bordering the marble seem to be at first finer equivalents of the "gneissose" ore, and then to be musc. - schists. At 068208 are two large boudins of quartzite, which correlate to thinner bands in the marble-marginal schists. The "gneissose" schist closes round this marble schist sequence in a small lake, and then to the west another such sequence opens out:

Coming back round lake and marbles - that at hill 792, then being schist, then thin marbles then (exposure (8)) at 060186 is another talc body.

Looking east at hill 823 the talc thins down to the lake and swings to the north. It also closes downwards - ie it is a 3 boudin.

The talc at 060186 has amph + gnt + musc schists with no staurolite, solid talc tenses a few metres long// to S, magnetite (?) amph. tenses, serpentine tenses, pure talc tenses of the dominant talc + altered felspar rock swinging around all these.

Walking south the is more marble touching the talc, then schists, then another marble that links to that on hill 070183. Thrust the schists above this have thinned considerably to the west. Dip here is 35° at 342°.

Exposure (7) , 30 m above contact is a thick kosic band before the graphite schists, dipping 25° at 068180.

Grening. Revised "stratigraphy".

"Ooj.t. gneiss".	Gneissose schist (+ mbles. + schists + qutzs.)
Mble 3.	Marble - usually clean + dolomitic.
Sch. 3.	Schists - minteresting.
Mble 2.	Containing the talc body. Thick rusty schists + quartzites in fast, thin in west.
Sch. 2.	Schists - mbles. + amphs. + qutzites.
Mble 1.	Marble - thick + clean.
Sch. 1.	Schists - + qutz. + thin dirty marble.
	Granite gneiss.

Specimers - S_7 = Muscovitite
S_8 = Magnetitic rock.

July 12th.

Dip in marble 2 in east edge of Hill 932 (051177). Marble is thicker here.

Granite contact runs up S edge of this hill. Marble 1 seems to be absent here in the schist 1 sequence. Dip in marble 3 at 043177 is 40° at 310. There is no talc here. Following this marble back, the talc thins out by 054183, schists to N of marble 3 dip 40° at 305°, so contact has swung a lot, and succession here has thimed.

Further to sw. strike has swung more - dips 60 at 300° 030160.

Traversing back to Bjellavatn from 018165. Thick schists + calc bands + garnet bands → 5 m marble → garnet mica schist (40° at 288°) → 8 m marble → gnt. mica schist + quartzites → 3 m marble → very contorted garnet mica schist → coarse felspatic schist (psammite) → 15 m marble → 10 m semipolites → 50 m marble (marble 2) (all before this is part of schist 3 sequence) → calcschists + marble bands 30 m → 20 m marble (marble 1) → thin semipolites → 2 m quartzite → Exposure (8) (039165) ky musc.schist → musc. schists → graphite schists → granite gneiss.

All between granite + marble 1 is schist 1. Graphite at the contact is up to 50% in a 3 m band for 100 m laterally. Kyanite is dark coloured and up to 30% in a 1 m band, dipping 50° at 315°.

Specimers $S8_1$ = ky. musc. schist.
$S8_2$ = graphite schist.

July 13th.
Walking down to Storsletten. Granite contact followed and mapped, dip 10° at 290° in one place, but usually nearer 340°. Contact cuts across streams generally here after following them on top. Exposure lost in trees.

July 14th in gjestgiveri.

July 15th.
Walked up to 426, but John's leg bad, so carried him back to hotel.

July 16th.
Walked up to Bjellavatn. Exposure nearest lake at 023151 in musc. schist - prob. within 10 m of contact with granite. Schists above up to hill 804 (021156). Many quartzites and calc schist bands. Marble at top, 20 m thick. Dip 50° at 320°. More schists + quartzites + garnets to nw. Then 30 m marble. Then schists with garnets. Very tightly folded on ew. axis, with plunge of 20° to east.
Long graps of no expose to nw. Then schists - very psammitic - at 018163. No good foliation, but miner folds plunging 30° at 320°. Most of valley to north is morsaine.
These schists cannot be correlated with those mapped to the ne. of the morsaine, and there is probably a fold of fault running through this gap. The intensity of miner folding, observing S_1 and developing S_2 suggests a fold. A closure of schists over marble at 021165 seems to fit with this idea. I have no idea what the fold does, unless i plot all fabrica or a stereogram.
Walking to nw. from last exposure are old exposures of rusty schists and garnet schists, getting less folded to the nw., and with S_1 becoming more prominent. There are some graphitic schists.
On west side of Harodalen at 998162, after long bog with no exposure, is coarse semipolite and musc. schist. Dip 40° at 260°. Large quartzite boudins in bands. Weakly or non garneti-ferous.

This does not seem to be equivalent to the "gneiss" to the ne., allthough there is no exposure to tell between them.
Dip at 592 is 50° at 270°. Garnet schists are now pedominert (993160). Large and small garnets, between 10% and 50% of the rock. Dip is 70° at 280°. There are mesofolds with 50 m amphitudes in this garnetiferous band. The band strikes north up the hill.
To n. of the garnet band is a linestone - dip 35° at 275°. This fairly thick and going down into the valley - 1 m not
Walking back further to so. much the same succession is seen, with better exposure. ie. Garnet schists → thick and varied schists with garnet band near its eastern margin, and rusty zones either side of it → marble 3 → garnet semipolites → marble 2 → schists (much more contorted with miner folds plunging 15° at 005°). Dip at 011131 is 60° at 290° → quartzite bands → marble 1 → schists and rusty bands → graphitic schist → granite gneiss at 017140.

July 17th.
Half way up Bjellavatn, just ne. of hill 721 granite contact is exposured, with
The usual contact succession is present, but there is very little kyanite in the schists above the quartzite.
Thin marble 1 at 100 m above lake, then schist 2 and marble 2. Marbles thicker to the south, but contain their characterisitc components throughout a few boulders of a talc. Felspar rock lie about here - very large ores. Perhaps there is another talc body soon.
Ore band in schists 2 has garnet and kyanite in, but neither in large quartities.
Strike swings round base of lake - check tomorrow.
Walking wnw. on a traverse from 000100. Marble 3 is of usual thickness. The schists beyond it go.
Rusty polites + lsts. + quartzites → semipolitic biotite schists coarse psammitic "schists" in 5 - 10% large garnets (50° at 290°) great thickness of garnet mica schists and semipolites with rusty zone at base. (These don't quite tie up with the garnet poor schist, sequence to the north, but there may be some slight compositional change along strike)
Psammitic schists garnet rich schists limestone + amphs.
Walking back further to north same succession is observed.
No economic minerals - in fact no "minerals" at all.

July 18th.
Heavy rain and low cloud. Visibility 20 m.

July 19th.
Very bad weather with poor visibility west to south end of Bjellavatn, to follow granite and marble 1 across Bjellåga stream. Impossible to continue further up hill, because of low cloud. Strike has swung to nw. - se., and dip generally steepers round here. All sequence seen is normal. Came across Nils Hollanders camp. He is not working because of the weather, so I too am giving up. He is looking for minerals - and finding small amounts - in the granite - which is probably sparagmite here.

July 20th.
Walked down to Storsletten.

July 21st.
To Bolna. Purpose - to see out ky. + quartz. Structure, outcrop and interpret them. Also look for ore minerals. In afternoon, distinctive "mappable" lithologies were looked for.
1/. Augen gneiss.
2/. Quartz + graphite schist.
3/. Quartzite + ky (in places) + musc. schist.
4/. Schists.
5/. Psammites.

Also boulders of a matic felspar and amphibole - and chlorite? - rock of what was probably a gabbro. Ølnes says it outcrops further up, and was a gabbro, but is now mainly chlorite, epidote and Na-felspar.

22nd July.
Traverse from 120742 to 128753.
1 400 m se. of transformer hut (T.H.) is quartzo felspathic pale hard massive psammite, gently folded about a near vertical axis. Prominent schistosity (S_1). Dip avg. = 80° at 230°. Less than 10% mica. This continuos to nne., with fairly constant lithology. Some quartz crystals are well rounded suggesting that they may still be sedimentary remnants. At this grain size it is probable that they were either pat of "turbidite" (sensulate) or continental sandstones, as the fel-

spar must come from day minerals or reconstitute from other sedimentary felspar. The latter is most plausible, seeing we are on a basement granite and that these are "Vorland" sediments. In places Bi contact 30%, and ditto for muscovite - perhaps from local patches of other sediment in an equivalent dominatly of quarts and felspar/kaolin - the weathering products of the basement "granite".

(2) Coarse bi. musc. semi. - polites musc. semi. - polites. Variable coarseness. Transformer H is 300 m at 016°. Biotite often crinkles by later folds, out of plane of Si. Dip of S_1 = 75° at 234°, but again, gently folded. S_2 is weakly developed. In places this sequence contains minute specks of haematite and golena and some iron sulphide. Also a few thin calcareous bands and streaks of fluorspar in places.

(3) 200 m at 0600 from TH. Quartz., flsp., musc. psammites, with 20% mica. Small specks of mineral - both haematite and falena - but very sparse. Bands of Bi.rich rock. This similar to (1) but with more mica. Dip 70 - 80° at 240°.

(4) 150 m of no exposure and then 2 patches of rock in place. The southern most is psammite like (3) dipping 20° at 058°. It has calc bands. The secand is musc. schist with up to 2% pyrite. Dip 350° at 046°. These are close, at 100 m at 336° from T.H.

(5) 50 m at 324° from T.H. Musc. schists with pyrite, fine muscovite bands and quartzites - very refolded and boudinnage common in these. S generally dips 40° at 078° to 500 or 0480, but varies. The quartzites contain only very sparse kyanite or a rough check.

6 20 m to n. of 5. Massive semi. - polite. Dip 80° at 050°. Up to 1% pyrite.

(7) 300 m at 250° from T.H. in stream. Augen gneiss. Quartz and felspar well segregated, and streaked and folded biotite between. Dip of S_1 between 70° at 030, of vertical striking 120° - 300°. The banding is // to S_1. A few small epidote patches seen, and also bi.rich bands.

(8) 600 m at 244° from T.H. in stream. Psammites, semipolites, quartzite (greenish + banded) and graphite schist, some 5 - 10 m thick. Dip 85° at 238° ⟶ 45° at 220°. Both up and down.

Stream, within graphite schist are thin tenses of quartz. Cavernous and covered with an iron , but clear and pure inside, with no minerals. The lower of these is 20 m long and 3 m wide. It thins to east and dissappears under boulders to the west.

20 m to north is more augen gneiss. This is better crystallised and more schistose.

Walking from (8) to 137750, up stream.

The second quartz tens is up to 5 m thick and 800 m long. It dips // to its contacts, which are // to S_1, at 50° at 220°.

Joint planes in it at - 60° at 015°
55° at 216° (S_1)
45° at 96°
85° at 312°

On both sides of it are thin wedges of psammites and semi-polites and graphite schist, before augen gneiss. Top is observed by and boulders. 100 m further up stream, however, psammittes are in contact with augen gneiss on both sides - so no quartz here, ever though graphite schist is present.

(9) In same quartz body, ½ way up.

Thebouldering psammites have calc bands. Contact dip 35° at 192°.

(10) At top of quartz body, where it dissappears, there are veins and pods of quarts in the augen gneiss and metasediments.

Quartz is intrusive. The pods are // to S_1, so intrution was syn of post formation of S_1, but pne. the later folding that elsewhere S_2, as the sediments and quartz contain these folds.

Walking back to ssw. from 10 .

Augen gneiss first, which still seems different (more sinuous

micas) than that to n. Bi.rich banded horizons. Exposure of this for 200 m, then 50 m no exposures.
(11) 300 m south of (10) . Augen gneisses dipping 85° at 004° → vertical, strike 94° - 274°, S_1 is very folded here.
(12) 50 m to S of (11) 50% musc. in a musc. schist, with 2 - 3% pyrite. Dip 30° at 206°. Quartzites at top of ridge, and then more musc. schists. Look for ky later.^
13Ky. 150 m to n. of Ølnes' hut - O.H.
Much quartzite, associated, and muscovite too. The ky. % age varies between 10 and 40%, 1 recon (up to 5% pyrite also) in quartzite. There is also a lot of vein quartz. Dip is variable and very folded, but generally steeply at 035°.

Grening.
Traverse 1 - 8. Section, showing S_1 dips at contact N.

July 23rd.
(14) To n. of augen gneiss is a green basic rock, dip 30° at 220°, about 5 m thick at 138757. This prob. a metamorphosed dyke and small intention. of dolerite/gabbro, in basement granite. All ground is a coarsely crystalline, unlineated quartz, fsp., biotite rock - granitic looking, but probably not so in composition. This becomes lineated near the margin. Where the quartz is intruded augen gneiss. This is slightly different from the other augen gneisses to south which are prob. granitised sediment of sediment of sparagmite age - not part of basement as such. Foliation in margine of granite here dips = 15° at 266°. There are many shallow open folds of 20 m amplitude here, with an axis plunging about 10° at 245°. Often, near the contact, the augen have become bands of biotite. A small quartz vein at 145748 has a little well crystallised galena in, but very small amment. This vein is related to the quartz body, and is // to S_1.

15 ½ km from lake, at 314° is quartz to granite (to distinguish it from the other augen gneiss it is called granite here) contact. The edge zone is very veined. There are sparse, small patches of mineralisation with pyrite, pyrohotite, pyrite, chalco pyrite and a rather pale yellow sulphide - probably a "mixture" of 2 of the afarementioned, ie of intermediate composition.
Musc. graphite schists in thin slivers stuck or to edge of quartz - still pme. and white. Quartz is 20 m thick and contact, and a plane in it dip 45° at 226°. South contact has slivers of graphite schist and then a thin layer of psammites and quartzite before the augen gneiss, dipping 55° at 222°.

16 147745. Metabasic rock - gabbro. Amph., chlorite, fsp., (epidote?) assemblage. Dip 55° at 221°. This is generally poorly foliated, except at margins, suggesting it is late stage. 50 m to west is augen gneiss swinging round base of gabbro, dip 10° at 130° round here. Thus gabbro seems to have affected S by its intrusion. Quartz contact retains same strike, however, so effect is local.

Further to sw. is banded amphibolite, 55° at 238°, microfolded along an axis plunging 15° at 154°.

12 Revisited. Base of cliff is bi. semipolite, 5 m thick. 30° at 190°. 1 m of fsp. psammite. Musc. schist with quartzites, muscovitites and thin (½ m) band of kyanite. Ky % ago 20% usually. All have accessery pyrite. Then semipolites 5 m. Then musc.guartz schist 2 m, then quartzites + musc. schists - very refolded, plunge at 10° at 220°, 30 m. Dip is 30° at 220°. Further to south miner folds plunge 30° at 142°. It is probable that we have 2 periods of later folds. An earlier set plunging se., nw. and a later set plunging sw, buckling the first ores, so that they plunge both ways. This

gives a small scale dome and basin effect to the beds with local dips pointing in all directions.

(17) Miner folds in se.-nw. axis refolded in ne.-sw. axis, so axis of first are plunges both ways, 20 m to s. is quartz, fsp., musc., semipolite - 85° at 215°. These 3. Specks of haematite and galena, 30 m to s. dip = 80° at 058° - ie it is generally vertical.
100 m across to s. is this, then bi. semipolite and then quartz fsp. psammites 1.

(18) 200 m over, near 2ndstream. Psammites 1, 50° at 128°.
Succession obtained off 2 traverses is:

1) Quartz, fsp. psammites. 1, 18, 19, 22.
2) Bi., musc. semipolites and psammites. 2, 3, 17, 32, 33.
3) Musc. schists and musc. and quartzite and ky. 4, 5, 13, 12, 20, 29.
4) Semipolites and psammites. 6, 30.
5) Augen gneiss and psammitic bands. 7, 10, 11, 23, 25.
6) Psammites, semipolites and graphite schist + calc schists containing quartz. 8, 9, 15 etc.
7) Augen gneiss - basement.

July 24th

19 1 type psammites 45° at 214. Continues 300 m to south - not going further.

20 T.H. purpose to follow ky upwards and note % ages etc. 40 m to nw. of T.H. are quartz musc. rocks with pyt. + psammitic bands. Also accessary haematite. 70° at 040°. Miner folds plunge 045° at 15°. Ky is thin ½ m band, very pinched, sinuous and folded. 20% ky, about in quartzite. Succession = 1 m quartzite + ky (sparse) → 1 m quartz musc. schist → ½ m quartzites 20% ky + quartzveins → 1 m quartzite + ky (sparse) → 1 m muscovitite → 5 m quartz, musc., pyt schist → 3 type psammites. Dip is near vertical.
Ky containing quartzites thin to east and west, when musc., quartz, pyt. schist closes round these tenses.

There is ky in most of the rocks but the muscovitites, but in very low %ages. These beds are so much more folded than others that this is probably an early fold crest.
To east of this tens psammites runs the quartz, musc., pyt. rock, with no quartzites running through, in surface.
300 m further up the ridge semipolites and psammites dip 70° at 068°, to south of musc., quartz, pyt. rock in contact with it. Thus the contact of 2 3 swings here. ½ km up it is back again an old line.
A base of 836 ridge is a 20 m amplitude fold plunging 090° at 20°. On north edge of this ridge is a ½ - 1 m band of quartzite containing a little kyanite, in quartz, musc., pyt. rock. Weather atrocious so down below clouds.

7 Revisited, then 8 to study "irregular gneiss" and see if it is the same as the basement gneiss. I think it is now.
The 2nd stream north of T.H. is cut in semipolites and graphite schist between the 2 augen gneisses. Fault. Still coloured different on map, far distinction.

No exposure in streams, after they join.

21 Farily basic massive unlineated rock with bi., chl., fsp, and little quartz. This is part of basement and is probably a meta intermediate dyke (diorite) and perhaps an "acidified" basic (dolerite) dyke.
200 m to south-west is more of this, surrended by augen gneiss. Dip is vert., strike 128° here.
Augen gneiss seen in stream at 122755 - not sure which part of it though.
A boulder of rounded augen gneiss fragments in graphite schist seen. This looks like a fault brecoia, suggesting that the contact is a fault, up which quartz was emplaced.

22 Weather so bad that have retired to Randalselven to de a section.
1 type psammites here, by bridge and for 200 m up stream. These gently folded on axis plunging 15° at 150°. Odd patches with more bi. and musc. One band has magnetite and small garnets. Dip 20° at 138° at bridge. 50° at 205°, 200 m to n. Then no more exposure.

July 25 th.

23 Irregular gneiss. Dip 75 at 028. It still has Odd bi. rich horizons, indicating perhaps that it is granitised sediment - hard to forget bi. separating from qutz. and fsp. and vica versa.

200 m to SE is same

100 m to E is same

100 m to NE of last is "gabbro" - very metamorphosed. On top of hill, at 147746, gabbro runs to sw. of augen gneiss, with contact running nw. se. This is mapped in. Patches of net veining in gabbro. It veins the augen gneiss along s. It is chilled against the gneiss, but is foliated in its margins. The gneiss is best around it slightly. Thus the gabbro is late stage metamorphic. Prob. intruded into a still hot region, during copling, and this promoted very slow cooling and high wup's . Hence the gabbro minerals would adjust to their chlorite, epidote, felspar assemblage, yet s. would be bent by instrusion. The slow coolinger high wup may have helped lingering "Hydsthemal" conditore nearly -ie the quartz and mineral intrusion.

24 Quarts contact swings to south here in a large ridge on top of the hill. Dip of top contact is shown by slivers of semipolite adhering, to be 50° at 252° at 150744. The quartz then shallows in dip and its ground outerop thickens. It is actually some 25 m thick. N contact dips 30° at 242° on the "crest" of this swing against augen gneiss. Sediment thickens around quartz because of shallowing too. Contacts are full of quartz veins, but no mineral.

Quartz tongues off at "crest" of swing into 2 bodies, apparently. These may be continuous and may be separate "blips". They are always in a metasedimentary avelope.

25 Small patch of pyrite mineralisation at 150743. Schists here lie virtually horizontal on quartz.

Sediments continue to east up hill, with some good tens of quartz in - 30 m and 2 m, between the two gneisses. They are thick and folded on east-west axis, very operly.

26 Is graphite schist in metaseds., dipping 35° at 114°. The main quartz body defineately ends at the base of the hill, where it is nearly horizontal.

27 Gneiss folded round at base of quartz at 149743. Dip 35° at 310°.

28 Gneiss on hill below gabbro 100 m south of 27.

x 200 m east of 1038 is contact of gneiss with sedimente. Gabbro has out by here. Seds. and semipolites and psammites of 4 type, as lower down. Dip vertical, strike 300°.

29 Just of south edge of ridge are quartzites and muscovitite. Very dip torted. 1 small amount of ky in some. 20 m thick.

30 Seds. in stream in contact with gabbro streak, with gneiss to north of this. 45° at 105°, but probably totated by slumping.

31 Gabbro in contact with gneiss, before seds., so gneiss does surround gabbro. South is vertical,strikign 044°.

Grening

Sections through quartz body.

S N along 148 longditude.

27th July.

32 Weakly micaceous pale massive psammites 50° at 224° = 1.

33 Psammites with more mica. pale. Gently folded round agently eastward plunging axis. 25° at 190° and 30° at 240°. 200 m to north and bi. semipolites. All these = 2. These dip steeply to north.

Going up stream with quartz in, to map bodies exactly on 1 : 10 000.

Augen gneiss at base - 30° at 040°.

1st body is 20 m and 5 m maximum.

2nd body is not continuous right up to the top, but is 2 bodies. The lower ore is 200 m long + 4 m wide. "Sediments" runs right through, however, where there is no quartz. 2rd body is over 10 m thick, dipping 40° at 220°. It swings away from stream and then back to its old strike. This is because it goes over the axis of a small sw. gently plunging fold. ie.

The seds. here are up to 10 m thick on the south side. After very contorted with slightly overturned (to the north) microfolds. These are probable dragfolds on a thrust. s

They are clearly lier than the later, open, shallow plunging micra folds.
Many small pods of quartz in sediments up here, some more than 1 m long.

Quartz body on top is now completly sorted out. It is up to 20 m thick. At top end dip shallows and sings round and then the body goes above the hill, because the plunge of the fold is steeper than that of the hill.

The small tenses of quartz to the north of the main body are not tension gash fills as they are surrounded by a sedimentary evelope. They must either be folded with faulted equivalents of the main body. Since the certaining sediments dip south under augen gneiss it is most probably fault repeated - only an isocline could do this other wise and there is no evidence for isoclines. The increase in contortion in harrow zones suggests a small thrust as well.

Walking from 160738 to 1214 peak. - Sediments sometimes with quartz in, repeat themselves up the hillside, because of small tight folds. Often one limb of these folds is missing, and perhaps a small thrust is present - these are impossible to see in the graphite schists. Most of these folds plunge at some 20° to sw., but some plunge to ne., so there is later folding on another axis.

Section 1 km west of 1214 peak - north + south.

The silver mines are outcrops of quartz with argentiferous galena in them. The quartz bodies are also very broken, with slivers of graphite schist amongst them.

July 28th.

Walking up ky from (13) to top, to get some idea of what it is doing. A (13) The beds are vertical, very contorted, and certain a remarkable number of well crystallised minerals including kyanite, quartz, pyrophyllite, a green mica, muscovite (talc?) and pyrite. The ky % is very great in 3 or 4 thick quartzite beds. The succession also includes chlorite bands, (Chlorite and kyanite in association. Must be retrograde from bi., while ky has resisted better) quartzites and quartz, musc. rocks and is rimmed by the quartz, musc., pyt. rusty schist, as always. This centortion is not echoed in the psammites of either side, so this zone may be a fold cone of a thrust.

200 m to the ese. is the continuation of the 13 ridge, but now it has much less kyanite - barely 10%. The quartzite are dominant but thinner. There is no development of macrocrystalline minerals. There is a slight southerly swing in the strike of the ridge here, and quartzites and gntz. musc. pyt. schists close round the ky outcrop.

These rocks also contain streaks of this unknown purple mineral.

37 300 m at 140° from 13 . Strike is 140°, dip vertical. Musc. pyt. qntz. schist with much purple mineral.

There are two possibilities.
Either the red line is a thrust, or there is a fold - shown in green.

The contortion of the quartzites and musc. rocks, and their vertical dip, compared to that of 40° - 60° of the psammites to the north, suggests a thrust. So far does the lack of cornelation either side, as might be expected, were this a fold. Such a thrust is almost cortainly folded, as is that between quartz and basement, but the ky zone does not seem to reappear.

Walking up sw. side of 1214 mapping the exact outcrops of quartz and sediment on the basement, so that folds and faults may emerge. The folds and thrusts explain the sudden terminations of successions into the hillside. All the quartz and sediments can be seen clearly lying on the top of the basement here.

Walking back down to cross to eastern end of 1086 ridge. Psammites (4) are barked at 40° at 200° against vertical and very contorted quartzites, and muscovitites (3). To the north, in the valley augen gneiss outcrops, dipping gently to north, with just beneath it, psammites (3) also dipping north. Further up sediments appear, folded into basement. This suggests that the 2 augen gneisses are one and the same here.
Section NS.

The 4 psammites here are almost gneisses, and have amph. bands, and also specks of galena.

Walking again up Nasa hillside, to check outcrops it seems that the folds are much tighter than I originally thought, and that ore limb (southern) may be thickenned, while the other (N) may often be thinned, and ever become a small thrust.

Thus the quartz may be thick in one place, and absent in another.

As well as these folds are others to them, so the plunge charges, and quartz comes in and out of the hill in the other dimension. In places quartzite can be seen quartz directly, and this is prob. how the quartz body was formed.

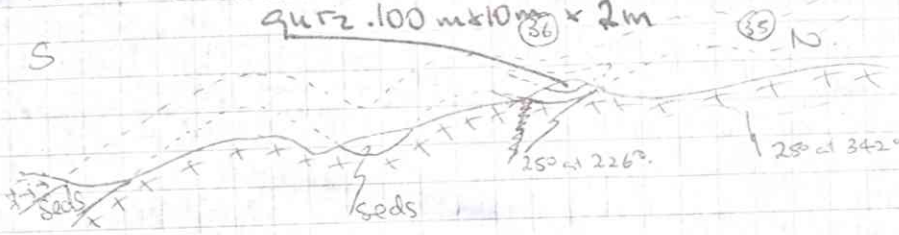
Back on north edge of quartz by lake at 149744. Contact is very veined with quartz, and there is 1 - 2 m of sedm. before the augen gneiss. These are often very baked in appearance, and are frequently brecciated, with gaps filled both with quartz and graphite schist - of boulder found in stream lower down. This is proof of movement and probably a largish fault.

40 Graphite schist appearing from beneath the gneiss. Also calc schists and a quartzite. Gabbro lies on top of the gneiss. Augen gneiss also lies below graphite schist here (140744). This graphite schist could be part of quartz and related sediments are also of 3 - 4 transition.
Found later that in fact it doesn't dip underneath, but comes out in a tight fold against gabbro gneiss.

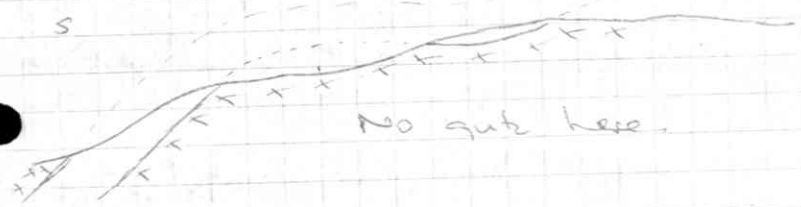
Here this may be a thrust, or may be an overturned fold limb, where as further up it is almost certainly a thrust.

These graphite schists of all appear in an open fold, plunging 15° to the west, but are also folded tightly about a north- south axis, with the eastern limb overturned. These seds. don't lie up with those round the musc. qntz. pyt.(3)→psammite (4) junction.

N-S section ½ km west of 1214 peak.

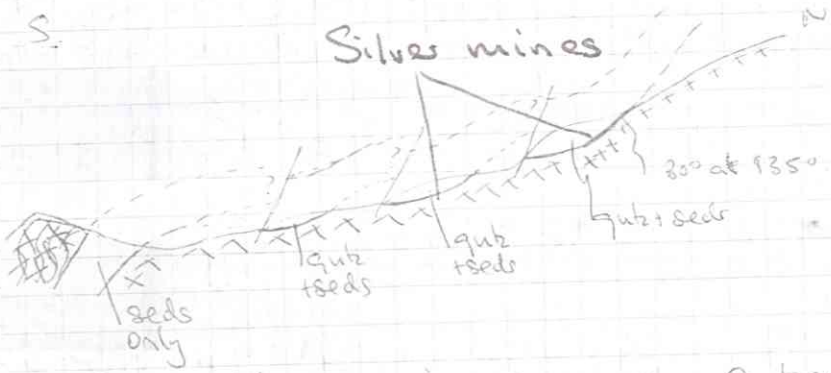


Section N-S ½ km west of 1214 peak



Top of 1214 is all Angel gneiss of basement. It often contains thin streaks of purple mineral.

Section N-S ½ km ~~west~~ East of 1214.

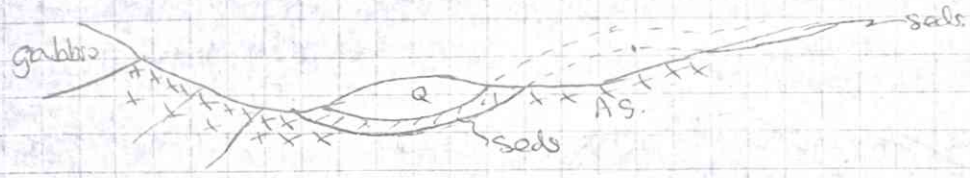


The silver mines are outcrops of quartz with argentiferous galena in them. The quartz bodies are also very broken with slivers of graphite schist amongst them.

July 28th

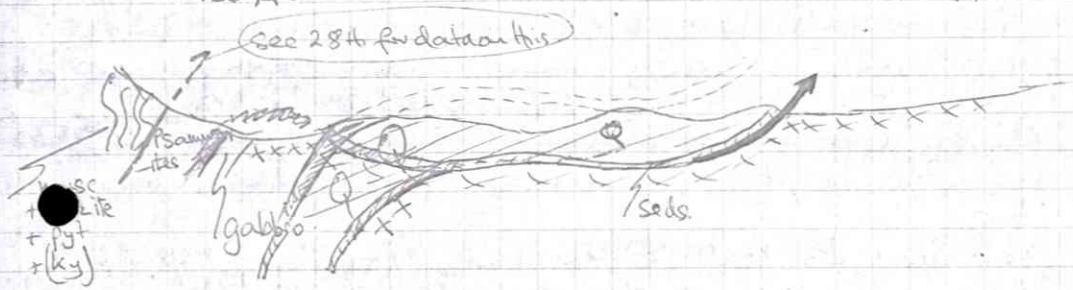
Walking up ky from (13), to top, to get some idea of what it is doing. At (13) The beds are vertical, very contorted, & contain a remarkable

E 152743.

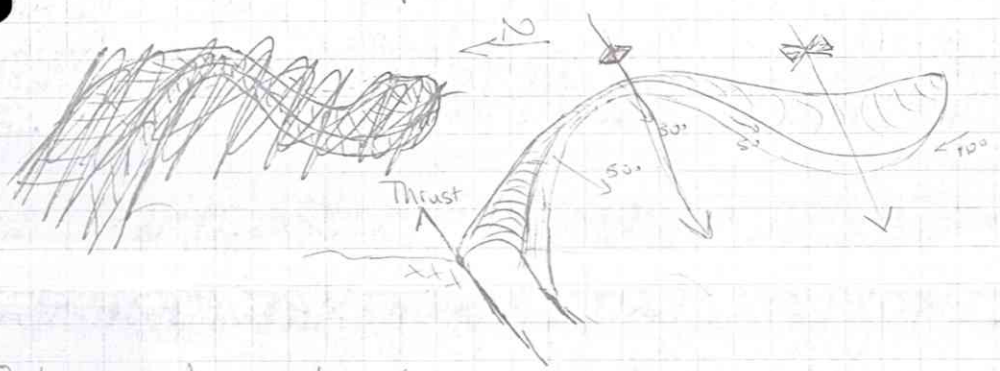


S 150740

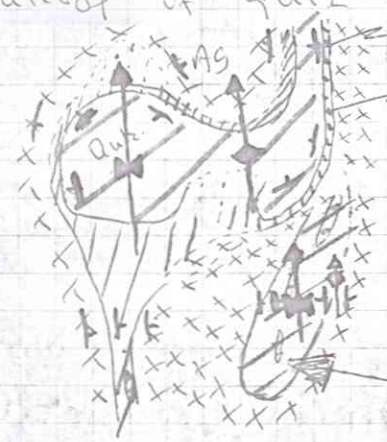
N. 150744.



Attempted 3D picture of quartz is:—



Outcrop of quartz is:-



Fault breccia along this contact

The sads are thickened over the ground by folds which appear to be missing one limb, ie see over fold section of the outline of quartz & quartzite

REWRITE OF NOTE BOOK

8th July. Base Telegraphstue 1. (078172)
Traverse to North. Coarse Bi-Mu schists just to N of last outcrop of gnt.gneiss. Granite gneiss is generally well foliated pale quartzo fsp rock dipping gently N, with dip increasing toward contact from 15° to 30°. These first schists contain boudins of vein quartz, intruded//to the foliation (S).

Above this is massive schist of similar composition. This contains amphibolitised bands. It varies in coarseness.

Next is a good quartzite, with specks of ore - prob. haematite-in. It shows good microfolding or t-w axis, of S, which here dips generally at 30 - 40° at 000°.

Above this is a "dirty" marble - about 5 m thick. Then mica schists with a prominent ½ m white quartzite that does not seem to be so boudined out as others. This makes the base of a thick marble of dolomite sequence.

Above this are schists with quartz vein in of varying grain size. Dip 320 at 347°. Called Exposure (1) (072186). This too contains an amphibolitised band, and also some scattered large garnets. Calcschists bands. One of these garnetbands is 6" thick and continuous along strike for 100 m. It is over 50% garnet - exposure (2) (at 072188).

Then in cliff at 070188 are a series of dolomite/marble and amphibole + garnet + biotite bands. One of these latter is 2 m thick with 40% garnets, of poor quality.

On the Southern margins of hill 823 (070189) is talc - exps (3) - probably from the metamorphism of basic and ultrabasic rocks. The core of this is of serpentine mineral. Chlorite, talc and altered felspar (scapolite). A marble lies to the North - clear and pure and coarsely crystalline.

Grening Setting up a basic stratigraphy.

Granite Gneiss	1.	Granite gneiss Foliated gneiss
Schist	2.	Rusty Bi-Mu schists and quartzites + amphs. Graphite at base 50 m
Marble 1	3.	Dirty Marble (Pieske) 15 m
Schist 2	4.	Schists. Semipelitic + calc bands.

052.008

Marble 2	5.	Marbles and dolomites. 2' white quartzite at base.
Schist 3	6.	Thick schists + quartz boudins + calc layers.
Marble 3	7.	Marbles. Garnet amph. at base. Mica schists + 6" garnet band. Marble/amph. bands + 2 m garnet band.
Schist 4	8.	Schists - very rich in musc. Thin. Rusty.
	9.	Talc etc.
Marble 4	10.	Marbles.

Specimen numbers. 2 S Garnet musc. Bi. schist from band in Marble 3.

3 S Talc.

Contact of gneiss seen on return is in

Schists 1 proper.

Musc. graphite schists 5 m.

Muscovitite 2 m.

Felspatic gneiss 1 m.

Gneiss.

The graphite schists are very contorted and rusty weathered. They certainly are a plane of movement, but on what scale is impossible to tell - they may be a large thrust.

July 9th.

Exposure (4) - 092176. Granite gneiss sensu stricto is here underlain by a series of biotitites and amphibole, epidote, felspar rocks. These contain a foliation//S of the granite. The contact is near 100% biotite, a metre, and so thick, which has clearly been a plane of movement. Then what are in effect biotite schists come in. These thicken and thin along the outcrop, and are clearly boudins - they do not maintain the same structural horizon, but get lower to the south. The granite thins to the NE, but always remains between these rocks and schists 1. Dip of contact is 15° at 340°.

Schists 1 down here show a typical contact with the granite, and then go to normal schists + quartzites. No marbles are seen until 095195. Here is 15 m of impure marble dipping gently to the north.

Schists above this are variable and thick, and then we come on to marble 3 with garnet and amphibole bands. Above this are muscovitites and muscovite schists, weathering very rusty, with 4 or 5 prominent quartzite bands 1 - 2 m thick, dip. 55° at 350°. This zone is 30 m thick here, where as it was only some 2 - 5 m at hill 823. Then again above this are garnetiterous schists. Exposure (5) (088200) Hill 793. Thickenned lens of talc rock, thinning to E and W along strike. Above this are thick marbles.

This lens contains many smaller lenses and streaks of different rock types.

Included are - Garnet + staurolite amphibolite in serpentine (?).
- Talc + altered fsp.
- Serpentine streaks.

In general the talc is dominant and other rocks form small 5 m x 1 m lenses.

Exposure 6 (077193). Looking back at hill 793.

On top of exps. (6) is talc felspar rock again, with tenses of staurolite garnet amphibolite. Staurolite crystals up to 30 m long seen. 2 tenses - 30 m x 5 m of amphibole chlorite rock with very large cubes of magnetite - up to 10%.

Quartzites in the rusty zone here are thinner and so is the rusty schists. The talc assemblage thins again to the west. Marbles are still to N of talc.

Specimens: S51 = Amph (?) + magnetite.
S52 = Asbestos from thin vein.
S53 = Serpentine/talc.
S54 = Staurolite, musc., garnet, biotite rock.

July 10th.

Traced the biotite lens in the granite gneiss (exps. (4)) round to prove it to be part of basement, not schists 1. Many littologies in it. Each boudin seems to be some 100 m long, and lower than that are to the north. It fades out to 1 m thick behind the hut.

Schists 1 have very prominent quartzites in the east, on to the Junkerdal Map, including ore 10' thick. These are however often boudined. These appears to be a fold here as dip of S is 20° at 290° at 094193.

Dip of base of marble 3 is 55° at 338 so the fold must be contained in schists 2 marble 3 sequence.

Hill 656 (09920) has schists 4 on southern edge - very rusty and with quartzite bands, and then has marbles above those. Dip of these is 50° - 60° at 348°. There is then a series of alternating marble and rusty (muscovite) schists and quartzite bands, before thick marbles on the N of the hill.

The talc body must have thinned out by here, although there is a ½ m amphibolite band. The talc only really appears 1 km to the west of this hill at 091203.

July 11th.

Trying to follow marble 1 and 2 to see which is which. Schists 2 have large garnets in some bands, and are generally coarse than the others.

Schist 2 and marbles 2 and 3 go round a flexure or there is a discontinuity around 090195. There is no exposure in this grand so it is hard to decide which marble that at 095195 is.

Talc at top of 793 has garnets up to 30% in many bands. Possibility of ky here, though no definate crystals seen. Amph + mag + garnet suggest a basic rather than ultrabasic origin.

To north of 793 is thick marble, and with a great thickness of minteresting schists, containing 3 prominent quartzite horizons.

These dip at 65° at 350° and are some 2 m thick. They are fairly boudined and broken. These schists also contain thin marble bands. Then here is a much thicker marble - very pure. Then, at 075203 begins a sequence of coarse, almost gneissose schists of very uniform littology. There bi., gutz., fsp. schists. At 070209 is a marble again, with thin politic rusty (musc.) schists at its margins. Then to the N is more "gneissose" schist. The schists bordering the marble seem to be at first finer equivalents of the "gneissose" ore, and then to be musc. - schists. At 068208 are two large boudins of quartzite, which correlate to thinner bands in the marble-marginal schists. The "gneissose" schist closes round this marble schist sequence in a small lake, and then to the west another such sequence opens out:

Coming back round lake and marbles - that at hill 792, then being schist, then thin marbles then (exposure (8)) at 060186 is another talc body.

Looking east at hill 823 the talc thins down to the lake and swings to the north. It also closes downwards - ie it is a 3 boudin.

The talc at 060186 has amph + gnt + musc schists with no staurolite, solid talc tenses a few metres long// to S, magnetite (?) amph. tenses, serpentine tenses, pure talc tenses of the dominant talc + altered felspar rock swinging around all these.

Walking south the is more marble touching the talc, then schists, then another marble that links to that on hill 070183. Thrust the schists above this have thinned considerably to the west. Dip here is 35° at 342°.

Exposure (7), 30 m above contact is a thick kosic band before the graphite schists, dipping 25° at 068180.

Grening. Revised "stratigraphy".

"Ooj.t. gneiss".	Gneissose schist (+ mbles. + schists + qutzs.)
Mble 3.	Marble - usually clean + dolomitic.
Sch. 3.	Schists - minteresting.
Mble 2.	Containing the talc body. Thick rusty schists + quartzites in fast, thin in west.
Sch. 2.	Schists - mbles. + amphs. + qutzites.
Mble 1.	Marble - thick + clean.
Sch. 1.	Schists - + qutz. + thin dirty marble.
	Granite gneiss.

Specimers - S_7 = Muscovitite
S_8 = Magnetitic rock.

July 12th.

Dip in marble 2 in east edge of Hill 932 (051177). Marble is thicker here.

Granite contact runs up S edge of this hill. Marble 1 seems to be absent here in the schist 1 sequence. Dip in marble 3 at 043177 is 40° at 310. There is no talc here. Following this marble back, the talc thins out by 054183, schists to N of marble 3 dip 40° at 305°, so contact has swung a lot, and succession here has thimed.

Further to sw. strike has swung more - dips 60 at 300° 030160.

Traversing back to Bjellavatn from 018165. Thick schists + calc bands + garnet bands → 5 m marble → garnet mica schist (40° at 288°) → 8 m marble → gnt. mica schist + quartzites → 3 m marble → very contorted garnet mica schist → coarse felspatic schist (psammite) → 15 m marble → 10 m semipolites → 50 m marble (marble 2) (all before this is part of schist 3 sequence) 0 m calcschists + marble bands 30 m → 20 m marble (marble 1) → thin semipolites → 2 m quartzite → Exposure (8) (039165) ky musc.schist → musc. schists → graphite schists → granite gneiss.

All between granite + marble 1 is schist 1. Graphite at the contact is up to 50% in a 3 m band for 100 m laterally. Kyanite is dark coloured and up to 30% in a 1 m band, dipping 50° at 315°.

Specimers $S8_1$ = ky. musc. schist.
$S8_2$ = graphite schist.

July 13th.
Walking down to Storsletten. Granite contact followed and mapped, dip 10° at 290° in one place, but usually nearer 340°. Contact cuts across streams generally here after following them on top. Exposure lost in trees.

July 14th in gjestgiveri.

July 15th.
Walked up to 426, but John's leg bad, so carried him back to hotel.

July 16th.
Walked up to Bjellavatn. Exposure nearest lake at 023151 in musc. schist - prob. within 10 m of contact with granite. Schists above up to hill 804 (021156). Many quartzites and calc schist bands. Marble at top, 20 m thick. Dip 50° at 320°. More schists + quartzites + garnets to nw. Then 30 m marble. Then schists with garnets. Very tightly folded on ew. axis, with plunge of 20° to east.
Long graps of no expose to nw. Then schists - very psammitic - at 018163. No good foliation, but miner folds plunging 30° at 320°. Most of valley to north is morsaine.
These schists cannot be correlated with those mapped to the ne. of the morsaine, and there is probably a fold of fault running through this gap. The intensity of miner folding, observing S_1 and developing S_2 suggests a fold. A closure of schists over marble at 021165 seems to fit with this idea. I have no idea what the fold does, unless i plot all fabrics or a stereogram.
Walking to nw. from last exposure are old exposures of rusty schists and garnet schists, getting less folded to the nw., and with S_1 becoming more prominent. There are some graphitic schists.
On west side of Harodalen at 998162, after long bog with no exposure, is coarse semipolite and musc. schist. Dip 40° at 260°. Large quartzite boudins in bands. Weakly or non garnetiferous.

This does not seem to be equivalent to the "gneiss" to the ne., allthough there is no exposure to tell between them.
Dip at 592 is 50° at 270°. Garnet schists are now pedominert (993160). Large and small garnets, between 10% and 50% of the rock. Dip is 70° at 280°. There are mesofolds with 50 m amphitudes in this garnetiferous band. The band strikes north up the hill.
To n. of the garnet band is a linestone - dip 35° at 275°. This fairly thick and going down into the valley - 1 m not
Walking back further to so. much the same succession is seen, with better exposure. ie. Garnet schists → thick and varied schists with garnet band near its eastern margin, and rusty zones either side of it → marble 3 → garnet semipolites → marble 2 → schists (much more contorted with miner folds plunging 15° at 005°). Dip at 011131 is 60° at 290° → quartzite bands → marble 1 → schists and rusty bands → graphitic schist → granite gneiss at 017140.

July 17th.
Half way up Bjellavatn, just ne. of hill 721 granite contact is exposured, with
The usual contact succession is present, but there is very little kyanite in the schists above the quartzite.
Thin marble 1 at 100 m above lake, then schist 2 and marble 2. Marbles thicker to the south, but contain their characterisitc components throughout a few boulders of a talc. Felspar rock lie about here - very large ores. Perhaps there is another talc body soon.
Ore band in schists 2 has garnet and kyanite in, but neither in large quartities.
Strike swings round base of lake - check tomorrow.
Walking wnw. on a traverse from 000100. Marble 3 is of usual thickness. The schists beyond it go.
Rusty polites + lsts. + quartzites → semipolitic biotite schists coarse psammitic "schists" in 5 - 10% large garnets (50° at 290°) great thickness of garnet mica schists and semipolites with rusty zone at base. (These don't quite tie up with the garnet poor schist, sequence to the north, but there may be some slight compositional change along strike)
Psammitic schists garnet rich schists limestone + amphs.
Walking back further to north same succession is observed.
No economic minerals - in fact no "minerals" at all.

July 18th.
Heavy rain and low cloud. Visibility 20 m.

July 19th.
Very bad weather with poor visibility west to south end of Bjellavatn, to follow granite and marble 1 across Bjellåga stream. Impossible to continue further up hill, because of low cloud. Strike has swung to nw. - se., and dip generally steepers round here. All sequence seen is normal. Came across Nils Hollanders camp. He is not working becauseof the weather, so I too am giving up. He is looking for minerals - and finding small amounts - in the granite - which is probably sparagmite here.

July 20th.
Walked down to Storsletten.

July 21st.
To Bolna. Purpose - to see out ky. + quartz. Structure, outcrop and interpret them. Also look for ore minerals.
In afternoon, distinctive "mappable" lithologies were looked for.
1/. Augen gneiss.
2/. Quartz + graphite schist.
3/. Quartzite + ky (in places) + musc. schist.
4/. Schists.
5/. Psammites.

Also boulders of a matic felspar and amphibole - and chlorite? - rock of what was probably a gabbro. Ølnes says it outcrops further up, and was a gabbro, but is now mainly chlorite, epidote and Na-felspar.

22nd July.
Traverse from 120742 to 128753.
1 400 m se. of transformer hut (T.H.) is quartzo felspathic pale hard massive psammite, gently folded about a near vertical axis. Prominent schistosity (S_1). Dip avg. = 80° at 230°. Less than 10% mica. This continuos to nne., with fairly constant lithology. Some quartz crystals are well rounded suggesting that they may still be sedimentary remnants. At this grain size it is probable that they were either pat of "turbidite" (sensulate) or continental sandstones, as the fel-

spar must come from day minerals or reconstitute from other sedimentary felspar. The latter is most plausible, seeing we are on a basement granite and that these are "Vorland" sediments. In places Bi contact 30%, and ditto for muscovite - perhaps from local patches of other sediment in an equivalent dominatly of quarts and felspar/kaolin - the weathering products of the basement "granite".

(2) Coarse bi. musc. semi. - polites musc. semi. - polites. Variable coarseness. Transformer H is 300 m at 016°. Biotite often crinkles by later folds, out of plane of Si. Dip of S_1 = 75° at 234°, but again, gently folded. S_2 is weakly developed. In places this sequence contains minute specks of haematite and golena and some iron sulphide. Also a few thin calcareous bands and streaks of fluorspar in places.

(3) 200 m at 0600 from TH. Quartz., flsp., musc. psammites, with 20% mica. Small specks of mineral - both haematite and falena - but very sparse. Bands of Bi.rich rock. This similar to (1) but with more mica. Dip 70 - 80° at 240°.

4 150 m of no exposure and then 2 patches of rock in place. The southern most is psammite like (3) dipping 20° at 058°. It has calc bands. The secand is musc. schist with up to 2% pyrite. Dip 350° at 046°. These are close, at 100 m at 336° from T.H.

5 50 m at 324° from T.H. Musc. schists with pyrite, fine muscovite bands and quartzites - very refolded and boudinnage common in these. S generally dips 40° at 078° to 500 or 0480, but varies. The quartzites contain only very sparse kyanite or a rough check.

6 20 m to n. of 5. Massive semi. - polite. Dip 80° at 050°. Up to 1% pyrite.

(7).300 m at 250° from T.H. in stream. Augen gneiss. Quartz and felspar well segregated, and streaked and folded biotite between. Dip of S_1 between 70° at 030, of vertical striking 120° - 300°. The banding is // to S_1. A few small epidote patches seen, and also bi.rich bands.

(8) 600 m at 244° from T.H. in stream. Psammites, semipolites, quartzite (gneenish + banded) and graphite schist, some 5 - 10 m thick. Dip 85° at 238° $\longrightarrow$ 45° at 220°. Both up and down.

Stream, within graphite schist are thin tenses of quartz. Cavernous and covered with an iron , but clear and pure inside, with no minerals. The lower of these is 20 m long and 3 m wide. It thins to east and dissappears under boulders to the west.

20 m to north is more augen gneiss. This is better crystallised, and more schistose.

Walking from (8) to 137750, up stream.

The second quartz tens is up to 5 m thick and 800 m long. It dips // to its contacts, which are // to S_1, at 50° at 220°.

Joint planes in it at - 60° at 015°
55° at 216° (S_1)
45° at 96°
85° at 312°

On both sides of it are thin wedges of psammites and semi-polites and graphite schist, before augen gneiss. Top is observed by and boulders. 100 m further up stream, however, psammittes are in contact with augen gneiss on both sides - so no quartz here, ever though graphite schist is present.

(9) In same quartz body, ½ way up.

Thebouldering psammites have calc bands. Contact dip 35° at 192°.

(10) At top of quartz body, where it dissappears, there are veins and pods of quarts in the augen gneiss and metasediments.

Quartz is intrusive. The pods are // to S_1, so intrution was syn of post formation of S_1, but pne. the later folding that elsewhere S_2, as the sediments and quartz contain these folds.

Walking back to ssw. from 10 .

Augen gneiss first, which still seems different (more sinuous

micas) than that to n. Bi.rich banded horizons. Exposure of this for 200 m, then 50 m no exposures.
(11) 300 m south of (10) . Augen gneisses dipping 85° at 004° → vertical, strike 94° - 274°, S_1 is very folded here.
(12) 50 m to S of (11) 50% musc. in a musc. schist, with 2 - 3% pyrite. Dip 30° at 206°. Quartzites at top of ridge, and then more musc. schists. Look for ky later.
13Ky. 150 m to n. of Ølnes' hut - O.H.
Much quartzite, associated, and muscovite too. The ky. % age varies between 10 and 40%, 1 recon (up to 5% pyrite also) in quartzite. There is also a lot of vein quartz. Dip is variable and very folded, but generally steeply at 035°.

Greening.
Traverse 1 - 8. Section, showing S_1 dips at contact N.

July 23rd.
(14) To n. of augen gneiss is a green basic rock, dip 30° at 220°, about 5 m thick at 138757. This prob. a metamorphosed dyke and small intention. of dolerite/gabbro, in basement granite. All ground is a coarsely crystalline, unlineated quartz, fsp., biotite rock - granitic looking, but probably not so in composition. This becomes lineated near the margin. Where the quartz is intruded augen gneiss. This is slightly different from the other augen gneisses to south which are prob. granitised sediment of sediment of sparagmite age - not part of basement as such. Foliation in margine of granite here dips = 15° at 266°. There are many shallow open folds of 20 m amphitude here, with an axis plunging about 10° at 245°. Often, near the contact, the augen have become bands of biotite. A small quartz vein at 145748 has a little well crystallised galena in, but very small amment. This vein is related to the quartz body, and is // to S_1.

15 ½ km from lake, at 314° is quartz to granite (to distinguish it from the other augen gneiss it is called granite here) contact. The edge zone is very veined. There are sparse, small patches of mineralisation with pyrite, pyrohotite, pyrite, chalco pyrite and a rather pale yellow sulphide - probably a "mixture" of 2 of the aforementioned, ie of intermediate composition.
Musc. graphite schists in thin slivers stuck or to edge of quartz - still pme. and white. Quartz is 20 m thick and contact, and a plane in it dip 45° at 226°. South contact has slivers of graphite schist and then a thin layer of psammites and quartzite before the augen gneiss, dipping 55° at 222°.

16 147745. Metabasic rock - gabbro. Amph., chlorite, fsp., (epidote?) assemblage. Dip 55° at 221°. This is generally poorly foliated, except at margins, suggesting it is late stage. 50 m to west is augen gneiss swinging round base of gabbro, dip 10° at 130° round here. Thus gabbro seems to have affected S by its intrusion. Quartz contact retains same strike, however, so effect is local.

Further to sw. is banded amphibolite, 55° at 238°, microfolded along an axis plunging 15° at 154°.

12 Revisited. Base of cliff is bi. semipolite, 5 m thick. 30° at 190°. 1 m of fsp. psammite. Musc. schist with quartzites, muscovitites and thin (½ m) band of kyanite. Ky % ago 20% usually. All have accessery pyrite. Then semipolites 5 m. Then musc.guartz schist 2 m, then quartzites + musc. schists - very refolded, plunge at 10° at 220°, 30 m. Dip is 30° at 220°. Further to south miner folds plunge 30° at 142°. It is probable that we have 2 periods of later folds. An earlier set plunging se., nw. and a later set plunging sw, buckling the first ores, so that they plunge both ways. This

gives a small scale dome and basin effect to the beds with local dips pointing in all directions.

(17) Miner folds in se.-nw. axis refolded in ne.-sw. axis, so axis of first are plunges both ways, 20 m to s. is quartz, fsp., musc., semipolite - 85° at 215°. These 3. Specks of haematite and galena, 30 m to s. dip = 80° at 058° - ie it is generally vertical.
100 m across to s. is this, then bi. semipolite and then quartz fsp. psammites 1.

(18) 200 m over, near 2ndstream. Psammites 1, 50° at 128°.
Succession obtained off 2 traverses is:

1) Quartz, fsp. psammites. 1, 18, 19, 22.
2) Bi., musc. semipolites and psammites. 2, 3, 17, 32, 33.
3) Musc. schists and musc. and quartzite and ky. 4, 5, 13, 12, 20, 29.
4) Semipolites and psammites. 6, 30.
5) Augen gneiss and psammitic bands. 7, 10, 11, 23, 25.
6) Psammites, semipolites and graphite schist + calc schists containing quartz. 8, 9, 15 etc.
7) Augen gneiss - basement.

July 24th

19 1 type psammites 45° at 214. Continues 300 m to south - not going further.

20 T.H. purpose to follow ky upwards and note % ages etc. 40 m to nw. of T.H. are quartz musc. rocks with pyt. + psammitic bands. Also accessary haematite. 70° at 040°. Miner folds plunge 045° at 15°. Ky is thin ½ m band, very pinched, sinuous and folded. 20% ky, about in quartzite. Succession = 1 m quartzite + ky (sparse) → 1 m quartz musc. schist → ½ m quartzites 20% ky + quartzveins → 1 m quartzite + ky (sparse) → 1 m muscovitite → 5 m quartz, musc., pyt schist → 3 type psammites. Dip is near vertical.
Ky containing quartzites thin to east and west, when musc., quartz, pyt. schist closes round these tenses.

There is ky in most of the rocks but the muscovitites, but in very low %ages. These beds are so much more folded than others that this is probably an early fold crest.
To east of this tens psammites runs the quartz, musc., pyt. rock, with no quartzites running through, in surface.
300 m further up the ridge semipolites and psammites dip 70° at 068°, to south of musc., quartz, pyt. rock in contact with it. Thus the contact of 2 3 swings here. ½ km up it is back again an old line.
A base of 836 ridge is a 20 m amplitude fold plunging 090° at 20°. On north edge of this ridge is a ½ - 1 m band of quartzite containing a little kyanite, in quartz, musc., pyt. rock. Weather atrocious so down below clouds.

7 Revisited, then 8 to study "irregular gneiss" and see if it is the same as the basement gneiss. I think it is now.
The 2nd stream north of T.H. is cut in semipolites and graphite schist between the 2 augen gneisses. Fault. Still coloured different on map, far distinction.

No exposure in streams, after they join.

21 Farily basic massive unlineated rock with bi., chl., fsp, and little quartz. This is part of basement and is probably a meta intermediate dyke (diorite) and perhaps an "acidified" basic (dolerite) dyke.
200 m to south-west is more of this, surrended by augen gneiss. Dip is vert., strike 128° here.
Augen gneiss seen in stream at 122755 - not sure which part of it though.
A boulder of rounded augen gneiss fragments in graphite schist seen. This looks like a fault brecoia, suggesting that the contact is a fault, up which quartz was emplaced.

22 Weather so bad that have retired to Randalselven to de a section.
1 type psammites here, by bridge and for 200 m up stream. These gently folded on axis plunging 15° at 150°. Odd patches with more bi. and musc. One band has magnetite and small garnets. Dip 20° at 138° at bridge. 50° at 205°, 200 m to n. Then no more exposure.

July 25 th.

23 Irregular gneiss. Dip 75 at 028. It still has Odd bi. rich horizons, indicating perhaps that it is granitised sediment - hard to forget bi. separating from qutz. and fsp. and vica versa.

200 m to SE is same

100 m to E is same

100 m to NE of last is "gabbro" - very metamorphosed. On top of hill, at 147746, gabbro runs to sw. of augen gneiss, with contact running nw. se. This is mapped in. Patches of net veining in gabbro. It veins the augen gneiss along s. It is chilled against the gneiss, but is foliated in its margins. The gneiss is best around it slightly. Thus the gabbro is late stage metamorphic. Prob. intruded into a still hot region, during copling, and this promoted very slow cooling and high wup's . Hence the gabbro minerals would adjust to their chlorite, epidote, felspar assemblage, yet s. would be bent by instrusion. The slow coolinger high wup may have helped lingering "Hydsthemal" conditore nearly -ie the quartz and mineral intrusion.

24 Quarts contact swings to south here in a large ridge on top of the hill. Dip of top contact is shown by slivers of semipolite adhering, to be 50° at 252° at 150744. The quartz then shallows in dip and its ground outerop thickens. It is actually some 25 m thick. N contact dips 30° at 242° on the "crest" of this swing against augen gneiss. Sediment thickens around quartz because of shallowing too. Contacts are full of quartz veins, but no mineral.

Quartz tongues off at "crest" of swing into 2 bodies, apparently. These may be continuous and may be separate "blips". They are always in a metasedimentary avelope.

25 Small patch of pyrite mineralisation at 150743. Schists here lie virtually horizontal on quartz.

Sediments continue to east up hill, with some good tens of quartz in - 30 m and 2 m, between the two gneisses. They are thick and folded on east-west axis, very operly.

26 Is graphite schist in metaseds., dipping 35° at 114°. The main quartz body defineately ends at the base of the hill, where it is nearly horizontal.

27 Gneiss folded round at base of quartz at 149743. Dip 35° at 310°.

28 Gneiss on hill below gabbro 100 m south of 27.

x 200 m east of 1038 is contact of gneiss with sedimente. Gabbro has out by here. Seds. and semipolites and psammites of 4 type, as lower down. Dip vertical, strike 300°.

29 Just of south edge of ridge are quartzites and muscovitite. Very dip torted. 1 small amount of ky in some. 20 m thick.

30 Seds. in stream in contact with gabbro streak, with gneiss to north of this. 45° at 105°, but probably totated by slumping.

31 Gabbro in contact with gneiss, before seds., so gneiss does surround gabbro. South is vertical,strikign 044°.

Grening

Sections through quartz body.

S N along 148 longditude.

27th July.

32 Weakly micaceous pale massive psammites 50° at 224° = 1.

33 Psammites with more mica. pale. Gently folded round agently eastward plunging axis. 25° at 190° and 30° at 240°. 200 m to north and bi. semipolites. All these = 2. These dip steeply to north.

Going up stream with quartz in, to map bodies exactly on 1 : 10 000.

Augen gneiss at base - 30° at 040°.

1st body is 20 m and 5 m maximum.

2nd body is not continuous right up to the top, but is 2 bodies. The lower ore is 200 m long + 4 m wide. "Sediments" runs right through, however, where there is no quartz. 2rd body is over 10 m thick, dipping 40° at 220°. It swings away from stream and then back to its old strike. This is because it goes over the axis of a small sw. gently plunging fold. ie.

The seds. here are up to 10 m thick on the south side. After very contorted with slightly overturned (to the north) microfolds. These are probable dragfolds on a thrust. s

They are clearly lier than the later, open, shallow plunging micra folds.
Many small pods of quartz in sediments up here, some more than 1 m long.

Quartz body on top is now completly sorted out. It is up to 20 m thick. At top end dip shallows and sings round and then the body goes above the hill, because the plunge of the fold is steeper than that of the hill.

The small tenses of quartz to the north of the main body are not tension gash fills as they are surrounded by a sedimentary evelope. They must either be folded with faulted equivalents of the main body. Since the certaining sediments dip south under augen gneiss it is most probably fault repeated - only an isocline could do this other wise and there is no evidence for isoclines. The increase in contortion in narrow zones suggests a small thrust as well.

Walking from 160738 to 1214 peak. - Sediments sometimes with quartz in, repeat themselves up the hillside, because of small tight folds. Often one limb of these folds is missing, and perhaps a small thrust is present - these are impossible to see in the graphite schists. Most of these folds plunge at some 20° to sw., but some plunge to ne., so there is later folding on another axis.

Section 1 km west of 1214 peak - north + south.

The silver mines are outcrops of quartz with argentiferous galena in them. The quartz bodies are also very broken, with slivers of graphite schist amongst them.

July 28th.

Walking up ky from 13 to top, to get some idea of what it is doing. A 13 The beds are vertical, very contorted, and certain a remarkable number of well crystallised minerals including kyanite, quartz, pyrophyllite, a green mica, muscovite (talc?) and pyrite. The ky % is very great in 3 or 4 thick quartzite beds. The succession also includes chlorite bands, (Chlorite and kyanite in association. Must be retrograde from bi., while ky has resisted better) quartzites and quartz, musc. rocks and is rimmed by the quartz, musc., pyt. rusty schist, as always. This centortion is not echoed in the psammites of either side, so this zone may be a fold cone of a thrust.

200 m to the ese. is the continuation of the 13 ridge, but now it has much less kyanite - barely 10%. The quartzite are dominant but thinner. There is no development of macrocrystalline minerals. There is a slight southerly swing in the strike of the ridge here, and quartzites and gntz. musc. pyt. schists close round the ky outcrop.

These rocks also contain streaks of this unknown purple mineral.

37 300 m at 140° from 13 . Strike is 140°, dip vertical. Musc. pyt. qntz. schist with much purple mineral.

There are two possibilities.
Either the red line is a thrust, or there is a fold - shown in green.
The contortion of the quartzites and musc. rocks, and their vertical dip, compared to that of 40° - 60° of the psammites to the north, suggests a thrust. So far does the lack of cornelation either side, as might be expected, were this a fold. Such a thrust is almost cortainly folded, as is that between quartz and basement, but the ky zone does not seem to reappear.

Walking up sw. side of 1214 mapping the exact outcrops of quartz and sediment on the basement, so that folds and faults may emerge. The folds and thrusts explain the sudden terminations of successions into the hillside. All the quartz and sediments can be seen clearly lying on the top of the basement here.

Walking back down to cross to eastern end of 1086 ridge. Psammites (4) are barked at 40° at 200° against vertical and very contorted quartzites, and muscovitites (3). To the north, in the valley augen gneiss outcrops, dipping gently to north, with just beneath it, psammites (3) also dipping north. Further up sediments appear, folded into basement. This suggests that the 2 augen gneisses are one and the same here.
Section NS.

The 4 psammites here are almost gneisses, and have amph. bands, and also specks of galena.

Walking again up Nasa hillside, to check outcrops it seems that the folds are much tighter than I originally thought, and that ore limb (southern) may be thickenned, while the other (N) may often be thinned, and ever become a small thrust.

Thus the quartz may be thick in one place, and absent in another.

As well as these folds are others to them, so the plunge charges, and quartz comes in and out of the hill in the other dimension. In places quartzite can be seen quartz directly, and this is prob. how the quartz body was formed.

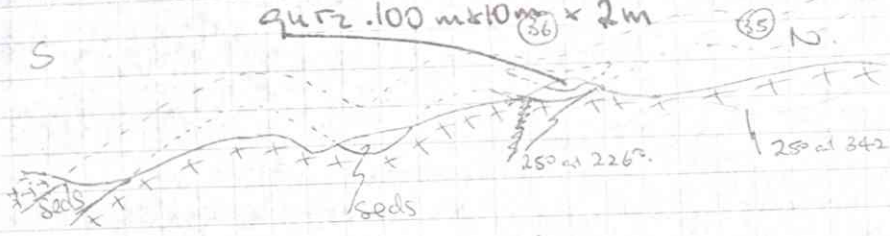
Back on north edge of quartz by lake at 149744. Contact is very veined with quartz, and there is 1 - 2 m of sedm. before the augen gneiss. These are often very baked in appearance, and are frequently brecciated, with gaps filled both with quartz and graphite schist - of boulder found in stream lower down. This is proof of movement and probably a largish fault.

40 Graphite schist appearing from beneath the gneiss. Also calc schists and a quartzite. Gabbro lies on top of the gneiss. Augen gneiss also lies below graphite schist here (140744). This graphite schist could be part of quartz and related sediments are also of 3 - 4 transition.
Found later that in fact it doesn't dip underneath, but comes out in a tight fold against gabbro gneiss.

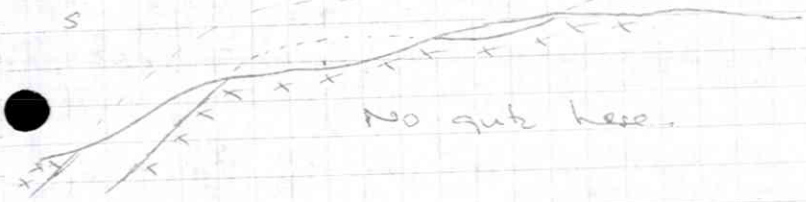
Here this may be a thrust, or may be an overturned fold limb, where as further up it is almost certainly a thrust.

These graphite schists of all appear in an open fold, plunging 15° to the west, but are also folded tightly about a north- south axis, with the eastern limb overturned. These seds. don't lie up with those round the musc. qntz. pyt.(3) → psammite (4) junction.

N-S section ¼ km west of 1214 peak.

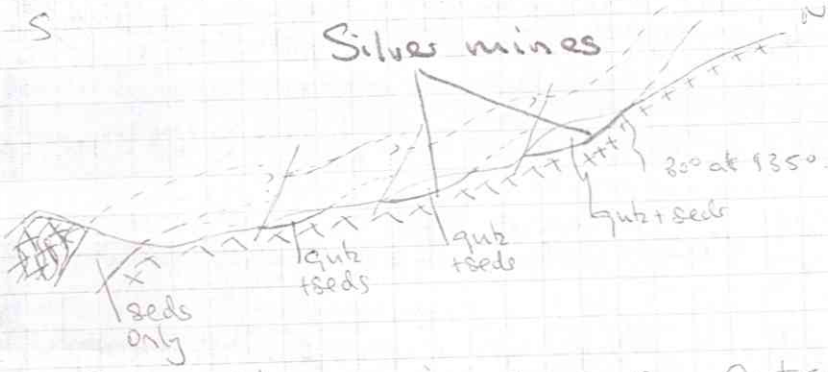


Section N-S ½ km west of 1214 peak



Top of 1214 is all Agen gneiss of basement. It often contains thin streaks of purple mineral.

Section N-S ½ km ~~west~~ East of 1214.



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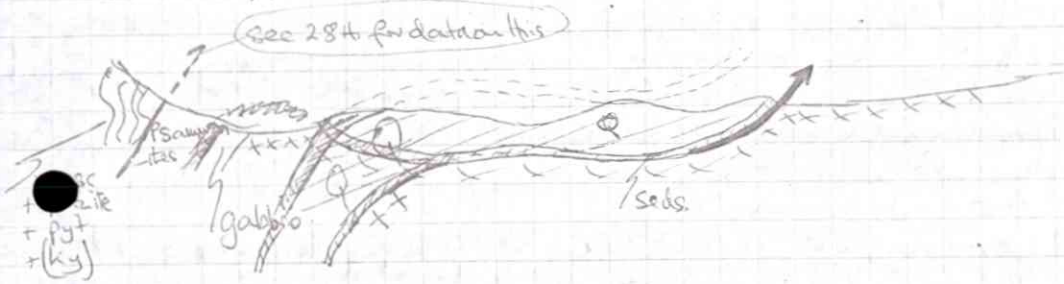
July 28th

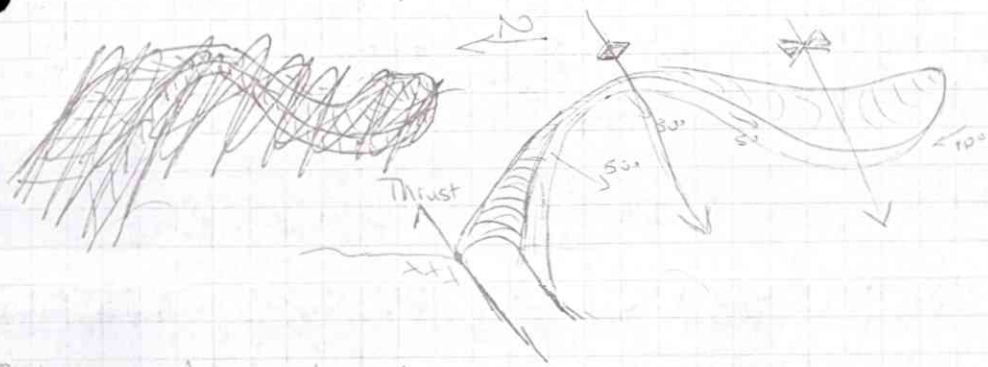
Walking up ky from (13), to top, to get some idea of what it is doing. At (13) the beds are vertical, very contorted, & contain a remarkable

le W 146743 E 152743.

S 150740 N. 150744.



Attempted 3D picture of quartz is:—



Outcrop of quartz is:-

seds → N.

Fault breccia along this contact

The seds are thickened over the ground by folds which appear to be missing one limb, ie see over fig section of the outline of quartz & quartzite