FOLLDAL VERK A/S

(188) (189)

BORHULL NR. 226, GRIMSDALEN

100 Ö, 650 N, 49° fall mot S.

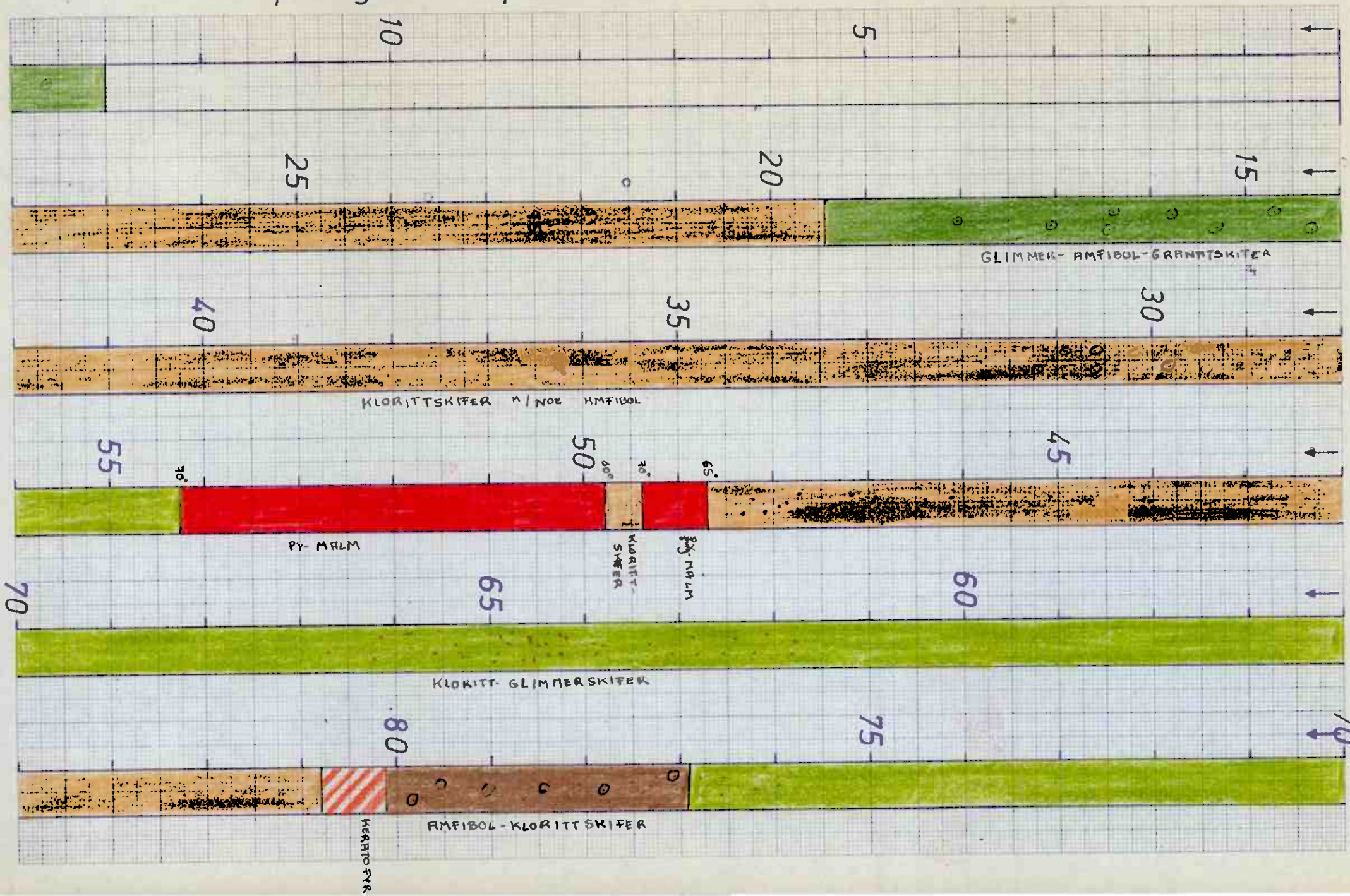
KJERNEBESKRIVELSE:

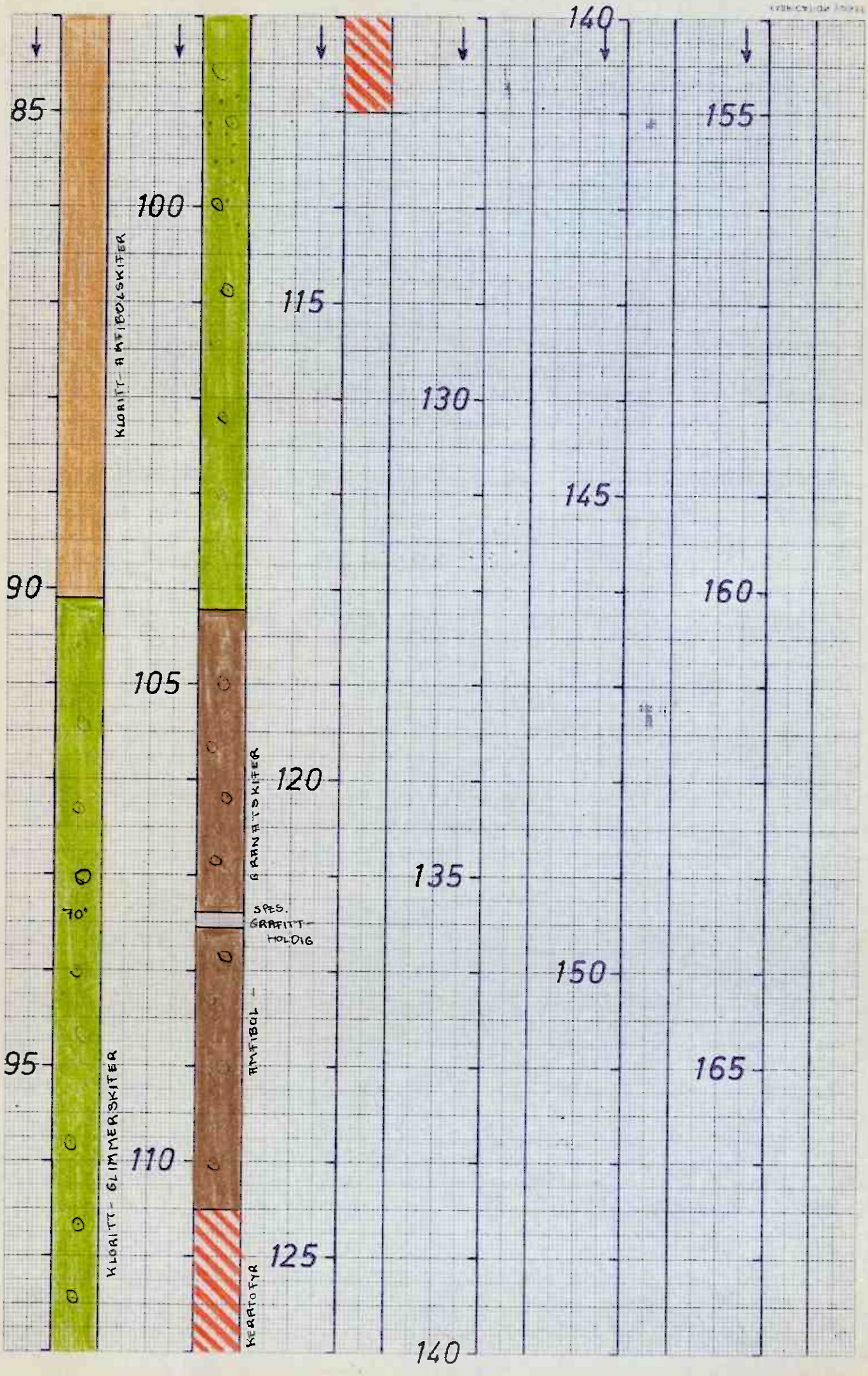
	Kjernene starter på ca. 13,00 m.
13,00 - 19,40	Glimmer - amfibol - granatskifer med uorienterte cm-store amfibolnåler. B.A. blir etter hvert forholdsvis mere kvartsförende.
19,40 - 48,67	Klorittskifer med noe amfibol. Amfibolnålene er delvis orientert etter foliasjonsretningen som eller defineres av vekselvise lag av kloritt og feltspat. Lokalt keratofyrparti ved 23,80 m. Spredtvis granater spesielt i området rundt 30 m. Herfra og nedover vokser granatene i lagene. Spor av Fe-sulfid fra 41,30 m. Foliasjonsretning ved 22,50 m og 36,30 m h.h.v. 75 og 80°.
48,60 - 49,37	Middelskornet massiv py-malm, med karakteristisk porfyrisk struktur. Begge malmgrensene er pseudokordante og övre og nedre har h.h.v. ca. 65 og 70° fall i hullet.
49,37 - 49,75	Klorittskifer med mindre klyser av melkekvarts.
49,75 - 54,23	Nesten finkornet massiv py-malm. Muligens noe CuFeS2. Mindre kvartsrike partier. Fra 53,80 - 53,90 m parti med kloritt-glimmerskifer. Malmgrensen ved 54,23 m er pseudokordant og har 60° fall i hullet, men den övre ved 49,75 m er diskordant med 70° fall i hullet.
54,23 - 76,90	Kloritt glimmerskifer med noe amfibol, som delvis uorienterte små nåler. "Klyser" av melkekvarts. Fra 59,70 - 60,75 m lokalt mindre sulfidimpregnasjon, vesentlig py. Særlig markant er dette fra 64,15 - 65,00 m, der en finner sulfidet (py) som slirer parallelt med foliasjonsretningen. De underste lagene ned mot 76,90 m utgjöres av klorittskifer med noe granat og amfibol.
76,90 - 80,10	Amfibolitt klorittskifer med noe granat. Lokal py-impregnasjon, spesielt fra 77,10 - 78,10 m.
80,10 - 80,80	Keratofyr med noe amfibol.
80,80 - 90,10	Kloritt amfibolskifer. Spor av sulfid (py, cu). Lokale partier med noe granat (små 0,2 cm). Veksling mellom h.h.v. kloritt og amfibolrike lag.

90,10 - 104,20	Kloritt glimmerskifer med noe granat. Noe sausserittiserte partier med "epidot/feltspatskyer" Lokale sulfidimpregnasjoner. Foliasjonsretning ca. 70° (gj.sn.) Lagene blir etter hvert mere kvartsrike. Noe py-holdig sone fra 99,20 - 100,- m.
104,20 - 107,85	Amfibol - granatskifer med opp til 1 cm store granater (roterte) og flere cm lange tynne amfibolnåler. Melkekvartspartier av ca. 10 cm lengde, noe karbonat.
107,35 - 107,45	Grafittholdig parti i ovennevnte skifer.
107,45 - 110,50	Samme skifer som för grafittpartiet. Foliasjonsretning ca. 60° (gj.sn.).
110,50 - 112,00	Keratofyr med små granater og amfibolnåler.

JUNI, 1975.

The petrografical profile of the borehole nr. 226

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KLORITT- AMFIBOLSKIFER
KLORITT- GLIMMERSKIFER
70°
GRANATSKIFER
SPES. GRAFITT- HOLDIG
AMFIBOL-
KERATOFYR

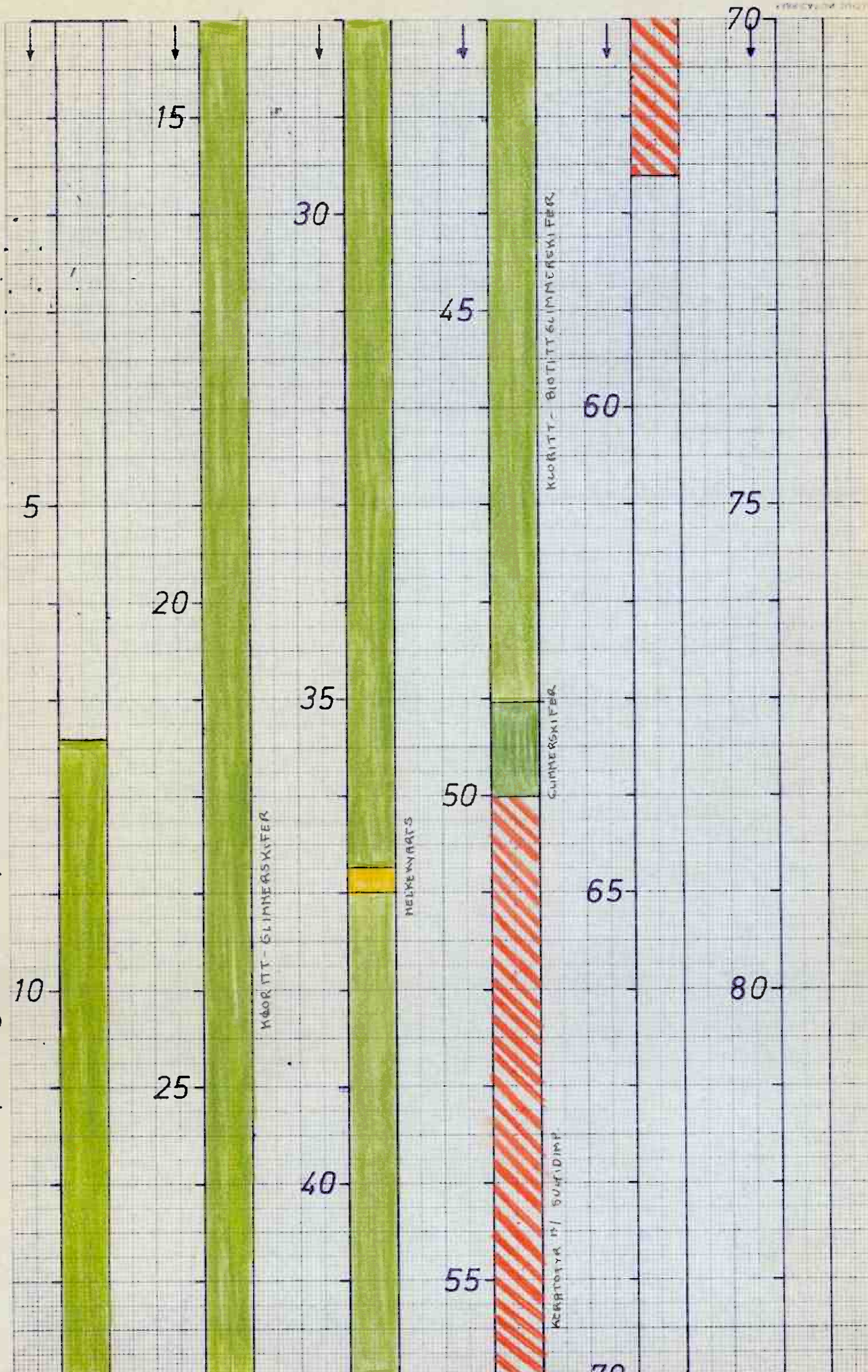
BORHULL NR. 225, GRIMSDALEN.

260 N, 0 Ö.V., 55° fall mot S.

Kjernebeskrivelse:

0,00 - 7,40	Overdekke.
7,40 - 36,70	Kloritt-glimmerskifer med foliasjon definert ved vekselvise lag av kloritt og feltspat. Foliasjonsretning gjennomsnittlig 65°. De förste metrene ptygmatisk foldet. Klyser av melkekvarts. Svake spor av Fe-sulfid (py, cu) rundt 19 m. Stedvis forholdsvis biotittrike partier. Foliasjonsretning ved 30,10 m er bare 60°.
36,70 - 37,00	Melkekvarts.
37,00 - 49,05	Kloritt biotittglimmerskifer som gradvis blir mer glimmerförende, samt mindre kvarts - epidott-klyser.
49,05 - 50,00	Glimmerskifer med forholdsvis finkornig muskovitt/biotitt.
50,00 - 56,60 m	Uren keratofyr med amfibol samt sulfidimpregnasjoner, noe magnetkis.

The petrografical profile of the borehole nr. 226



FOLLDAL VERK A/S

BORHULL NR. 224, GRIMSDALEN.

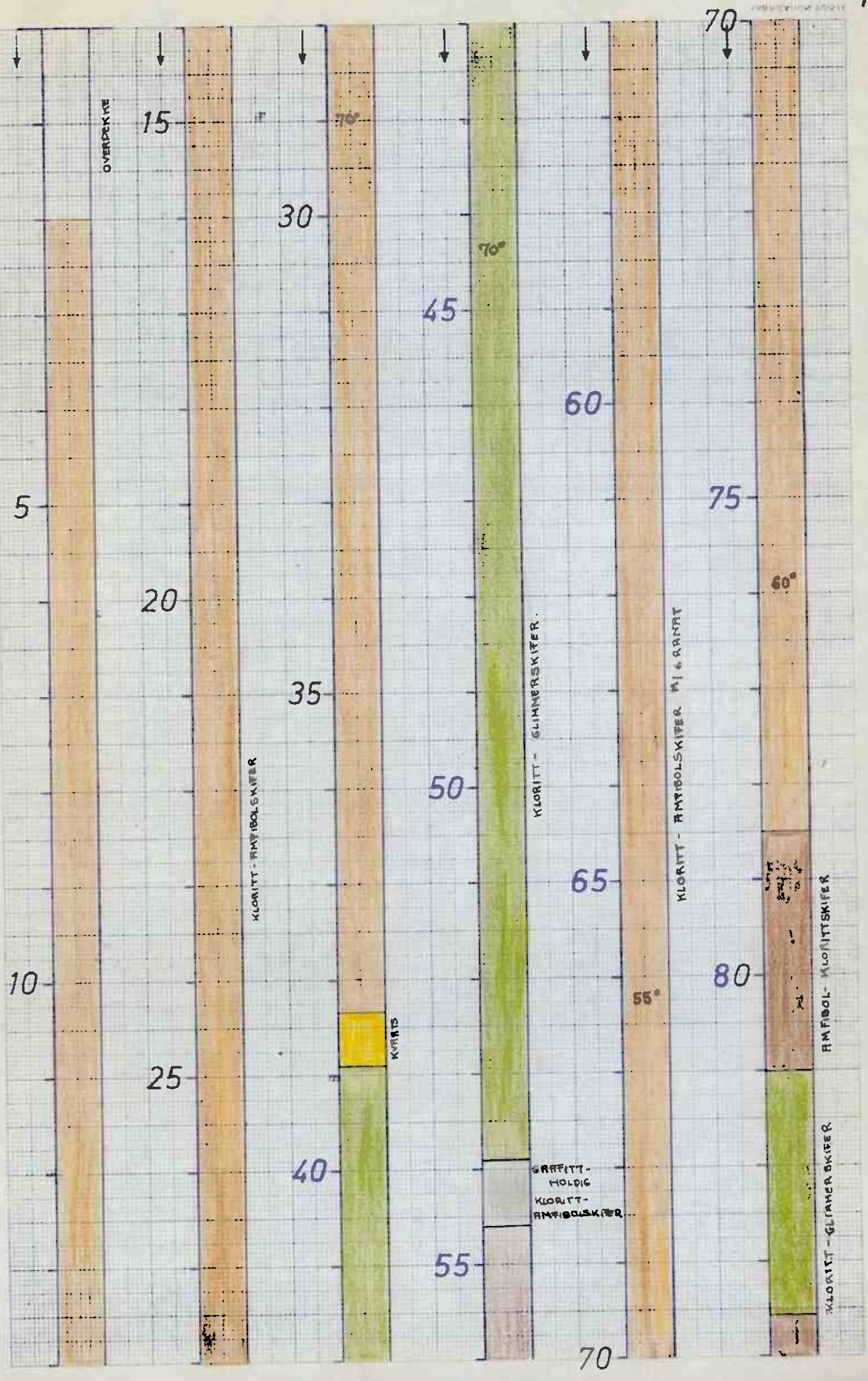
2000 Ö, 825 N, fall på 50° mot S.

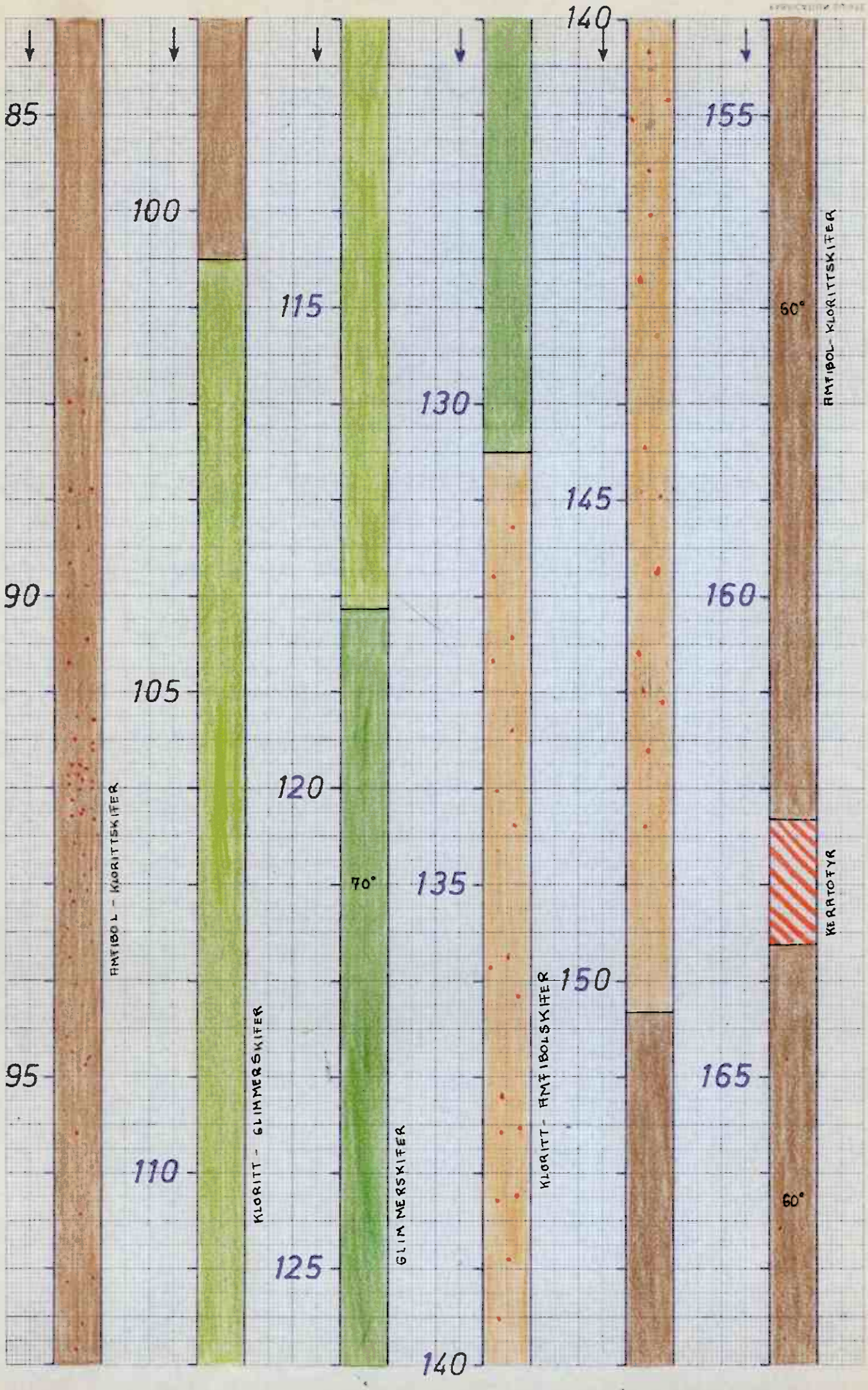
0,00 - 2,00	Overdekke.
2,00 - 38,30	Kloritt-amfibolskifer. De første metrene med tildels mye rust og forvitring. Foliasjonen defineres med vekselvise lag av h.h.v. kloritt/amfibol og feltspat. Spor av sulfid (py). Lokalt varierende kloritt og amfibolinnhold. Foliasjonsretning ved 29,50 m er 70°.
38,30 - 38,80	Melkekvarts.
38,80 - 53,90	Kloritt glimmerskifer med noe amfibol. Stedvise py-impregnasjoner, som slirer i b.a. spesielt fra 41 - 43 m. Foliasjonsretning 70° (gj.sn.)
53,90 - 54,00	Grafittholdig kloritt amfibolskifer.
54,60 - 78,50	Kloritt amfibolskifer med granater (små 0,3 cm). Klyser av melkekvarts. Granatene forsvinner gradvis etter et par meter for så å komme igjen. Foliasjonsretning ved 66,50 m er 55°.
78,50 - 81,00	Amfibol - klorittskifer med opp til cm store delvis uorienterte amfibolnåler. Spor av sulfid (py, cd) fra omkring 79 m. Foliasjonsretning ved 76,40 m er 60°.
81,00 - 83,20	Kloritt glimmerskifer med spes. muskovittrike partier.
83,20 - 100,50	Amfibol klorittskifer. Ptygmatisk foldestruktur. Lokale Fe-sulfidimpregnasjoner, spes. rundt 92 m som slirer i lag med foliasjonsretningen.
100,50 - 118,10	Kloritt glimmerskifer med flere små kvarts feltspat epidottskyer ("klyser"). Lokalt mere små uorienterte amfibolnåler enn andre steder.
118,10 - 130,50	Glimmerskifer med noe kloritt og amfibol. Foliasjonsretning ca. 70°. Lokale mer klorittrike partier. Ved 122,50 m tynne lag av grafitt i skiferen, som ved 128 - 130 m gradvis går over i putestruktur.
130,50 - 150,30	Kloritt - amfibolskifer med sulfidimpregnasjoner (vesentlig py som slirer).
150,30 - 162,30	Amfibol klorittskifer, lokalt med granat. Foliasjonsretning ca. 60° ved 157,30 m.
162,30 - 163,50	Keratofyr med amfibol og granat (små 0,2 cm), og amfibolnålene tilsynelatende bare delvis orienterte etter foliasjonen.

163,50 - 181,70	Amfibol klorittskifer med spor av Fe-sulfid. Ptygmatisk foldestruktur. Lokale glimmer (muskovitt) ansamlinger, kvartsklyser og noe karbonat. Foliasjonsretning ved 166,20 m er ca. 60°.
182,30 - 201,10	Amfibol klorittskifer, stedvis med noe granat. Spor av sulfid. Delvis uorienterte amfibolnåler.
201,10 - 205,50	Keratofyr med amfibol.
205,50 - 210,60	Kloritt amfibolskifer med klyser av melkekvarts og lokale Fe-sulfidimpregnasjoner.
210,60 - 211,90	Keratofyr med små tynne delvis uorienterte amfibolnåler.
211,90 - 214,90	Amfibol granatskifer med små granater i veksling med opp til 20 cm brede keratofyrlag.
214,90 - 218,00	Keratofyr med få spredte amfibolnåler som
218,00 - 220,00	gradvis går over i keratofyr med större og lengre amfibolnåler.
220,00 - 222,70	Amfibol/granatskifer med klyser av epidot, kvarts og feltspat.
222,70 - 223,50	Melkekvarts.
223,80 - 228,00	Kloritt amfibolskifer med slirer av melkekvarts. Foliasjonsretning ved 225 m er 60°. Lokale spredte granater i de underste lagene.
228,00 - 228,50	Kreatofyr med glimmer (muskovitt).
228,50 - 236,70	Kloritt amfibolskifer med vekselvise tynne lag som h.h.v. keratofyr og amfibol/klorittskifer. Noen mindre kvartsklyser og granat som vokser nedover i lagene.
236,70 - 237,40	Keratofyr med amfibol, små uorienterte nåler.
237,40 - 269,30	Amfibol - kloritt - glimmerskifer m/granat. Amfibolnålene tilsynelatende delvis orientert i foliasjonsretningen som ved 254 m er 60°. Py-impregnasjon fra 2570,- m, særlig markert fra 259,90 - 261,10
269,30 - 274,80	Glimmer klorittskifer som gradvis går over i keratofyr med glimmer og granater (sammenpressede).

Juni, 1975.

The petrografical profile of the borehole nr. 224

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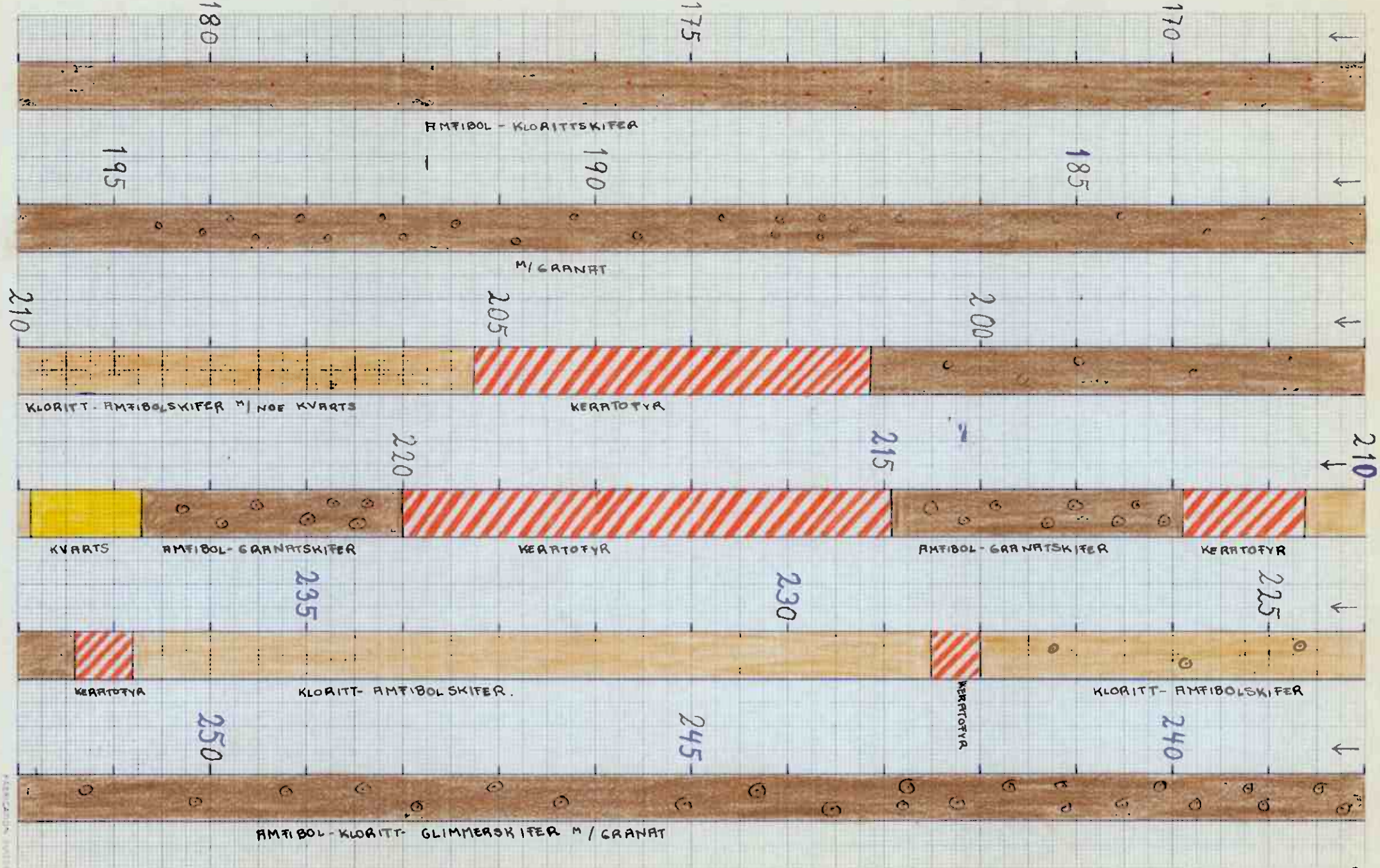
AMFIBOL - KLORITTSKIFER
KLORITT - GLIMMERSKIFER
GLIM MERSKIFER
70°
KLORITT - AMFIBOLSKIFER
AMFIBOL- KLORITTSKIFER
60°
KERATOFYR
60°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AMFIBOL - KLORITTSKIFER
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M/ GRANAT
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KLORITT - AMFIBOLSKIFER M/ NOE KVARTS
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AMFIBOL - GRANATSKIFER
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KERATOFYR
KLORITT - AMFIBOLSKIFER.
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KLORITT - AMFIBOLSKIFER
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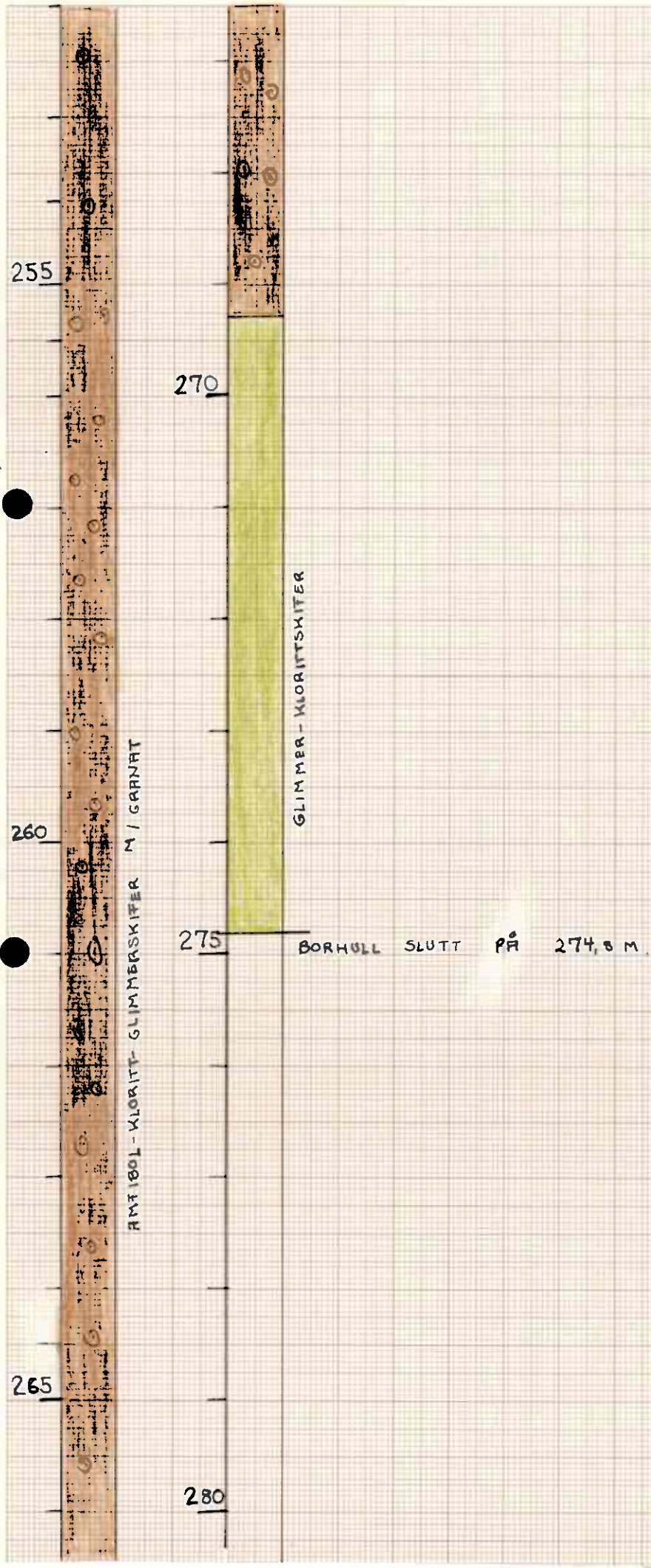
AMFIBOL - KLORITT - GLIMMERSKIFER M / GRANAT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AMFIBOL-KLORITT-GLIMMERSKIFER M/GARNAT
GLIMMER-KLORITTSKIFER
BORHULL SLUTT PÅ 274,8 M.

FOLLDAL VERK A/S

BORHULL NR. 223, GRIMSDALEN

1100 Ö, 750 N, 52° fall mot S.

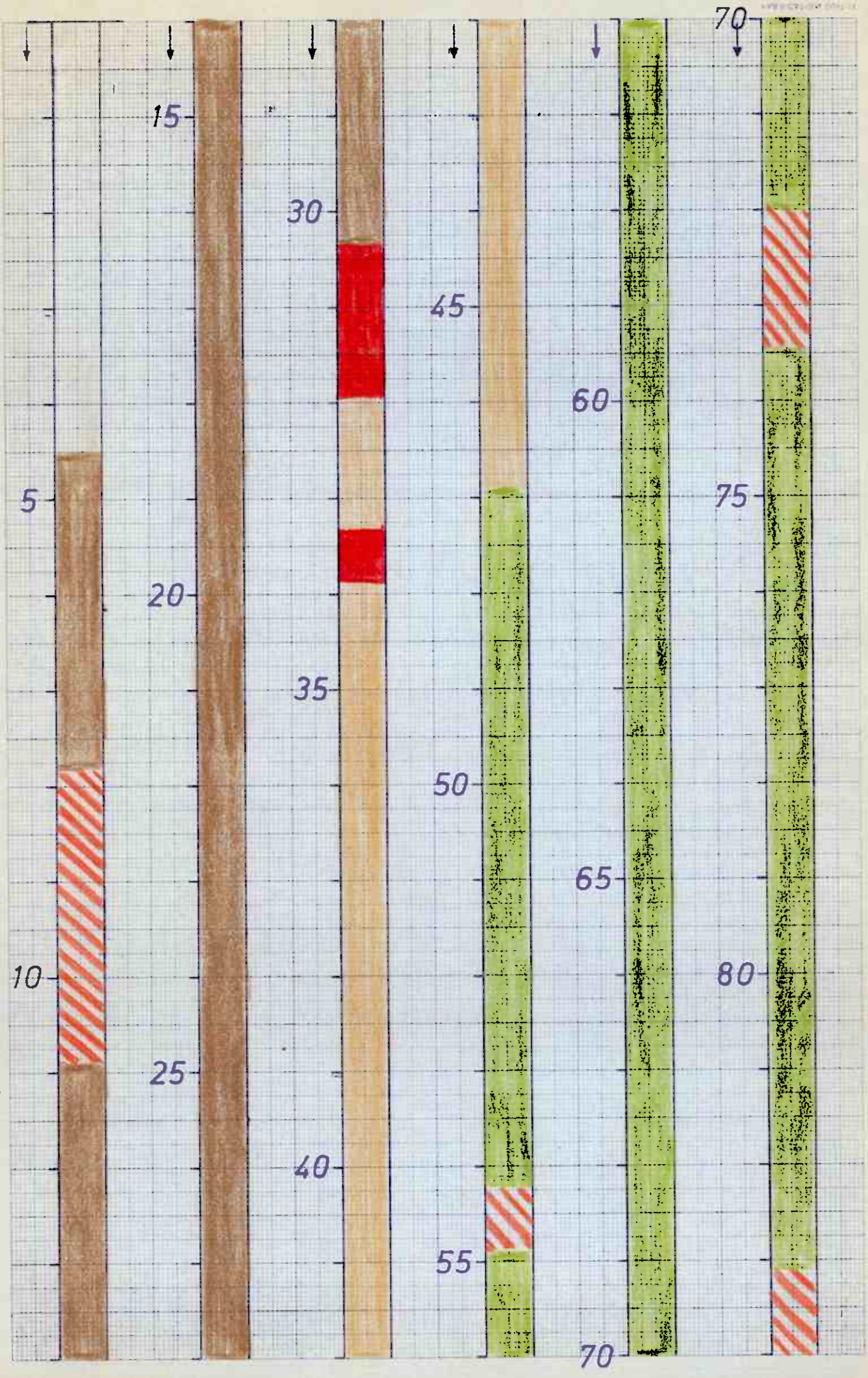
KJERNEBESKRIVELSE:

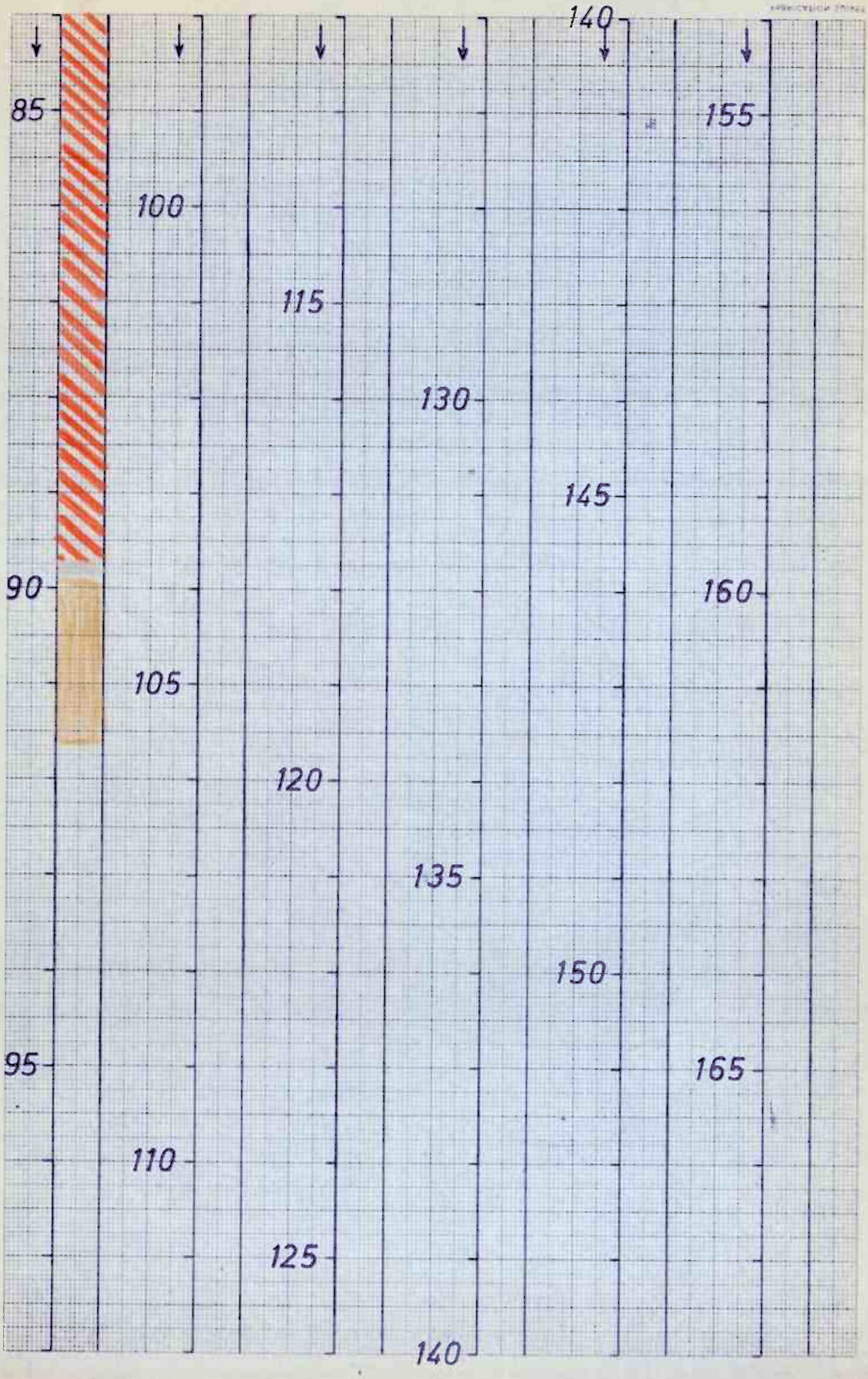
0,00 - 4,60	Overdekke.
4,60 - 7,80	Amfibol - granatskifer med slirer av mer kvartsrike lag. Foliasjonen defineres h.h.v. av lag med kloritt/amfibol og feltspat. Retningen er gjennomsnittlig ca. 60°.
7,80 - 10,90	Keratofyr med amfibol og granat. Amfibolnålene bare delvis orienterte etter foliasjonen.
10,90 - 30,35	Amfibol - klorittskifer + granat (0,5 cm) og noe karbonat. Lokal py-impregnasjon fra 20 - 30 m.
30,35 - 31,95	Finkornet massiv sulfidmalm, sannsynligvis vesentlig pyritt (noe cu). Etter 15 cm följer en 10 cm lang py-holdig "kvartsklyse".
31,95 - 33,30	Py-holdig klorittskifer.
33,30 - 33,80	Massiv finkornet py-malm. Ikke markerte grenser til h.h.v. overliggende, underliggende b.a.
33,80 - 46,90	Kloritt-amfibolskifer med stedvise Fe-sulfid-impregnasjoner, især de förste metrene etter overliggende malmsone. Mindre keratofyrpartier i denne b.a. Fe-sulfidet forsvinner delvis ved 37,- m for så å komme mer markant tilbake ved. 42,50 m. Foliasjonsretningen ved 41,- m er 60°.
46,90 - 54,20	Kloritt-glimmerskifer ± granater (1-2 cm, ikke vel utviklet) samt noe karbonat.
54,20 - 54,90	Keratofyr med granat og amfibol.
54,90 - 72,00	Kloritt glimmer amfibolskifer ± granat (0,5 cm) B.A. blir etterhvert sterkere glimmerförende samtidig som granatene vokser.
72,00 - 73,45	Keratofyr med amfibol, dvs. delvis uorienterte nåler.
73,45 - 83,10	Kloritt glimmerskifer ± amfibol. Spor av Fe-sulfid (py, cu) rundt 70,00 - 73,50 m. Foliasjonsretning ved 71,30 m er 60°.
83,10 - 89,73	Keratofyr med granat og amfibol i veksling med tynne amfibol-glimmerskiferlag.

89,73 - 89,85	Grafittskifer med spredte porfyriske pyritt-krystaller.
89,85 - 91,63	Kloritt-amfibolskifer med tildels store (2-3 cm) delvis orienterte amfibolnåler.

Juni 1975.

The petrografical profile of the borehole nr. 223

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FOLLDAL VERK A/S

DIAMANTBORHULL NR. 222

Grimsdalen:
Petrografisk beskrivelse av malmsone og nærmeste sidebergarter.

31,00 - 35,65	Klorittisk og lettere serisittisk og epidottisk, kvartsrik, plagioklasisk sliregneis som inneholder ujevn spredte små nåle porfyroblaster av hornblende og aktinolitt (uorinenterte) og roterte små ksenoblaster av lys-rosa fargede granat. Det fins bare sjelden enkelte små ksenoblaster av FeS_2 på stedet. Gjennomsnittsfall av foliasjon i hullet er 55^o-60^o. På stedet det viser seg at bergart er lett flat ptygmatisk foldet, men det fins disharmonisk ptygmatisk foldning av cm amplitude mellom 35,40 - 35,65 m.
35,65 - 37,10	Stort sett mellomkornet massiv FeS_2 malm med porfyrisk og kataklastisk struktur med stort sett markert parallell bånd-stripe tekstur. Det fins enkelte innfelte striper av metakvartsitt matriks og enkelte inkluderte rester (boller, striper og uregelmessige linser) av metakvartsitt, kvarts og $CeFe(CO_3)_2$. Gjennomsnittsfall av foliasjon i malmsone er 55^o-60^o.
37,10 - 37,85	Klorittisk og lett biotittisk lett karbonatisk grönn slireglimmerskifer som inneholder enkelte uregelmessige innfelte striper av metakvartsitt matriks. Det fins enkelte små spredte ksenoblaster og hypidioblaster FeS_2 på stedet. Gjennomsnittsfall av foliasjon i hullet er 60^o men bergarten er lett flatt foldet på stedet disharmonisk ptygmatisk med cm amplitude.
37,85 - 38,30	Mellomkrystalinsk massiv FeS_2 malm stort sett det samme som mellom 35,65 - 37,10 m. Gjennomsnittsfall av foliasjon av malmen i hullet er 55^o-60^o. Mellom 38,00 - 38,30 m fins uregelmessige innfelte striper av finkornet Fe_3O_4.
38,30 - 39,80	Klorittisk og lett biotittisk, lett karbonatisk, plagioklasisk, på stedet kvartsrik sliregneis og sliregneis - glimmerskifer med innfelte striper av metakvartsitt. På steder fins uorienterte, spredte kneble- og nåle porfyroblaster av hornblende aktinolitt. Det fins enkelte små knesoblaster og hypidioblaster av FeS_2 på stedet og sjelden fins små knesoblaster av Fe_3O_4. Gjennomsnittsfall av foliasjon i hullet er 55^o-60^o. Det viser seg at bergarten på stedet er ptygmatisk, stort sett disharmonisk foldet (amplitude cm og dm).
39,80 - 40,20	Stort sett mellomkornet FeS_2 malm det samme som mellom 37,85 - 38,30 m. Begge malmgrenser er diskordant og har fall i hullet 45^o på 39,80 m og på 40,20 m. Mellom 39,95 - 40,00 m fins innfelte striper av klorittisk, amfibolittisk og lett epidottisk grönn slireskifer, som har fall i hullet omkring 40^o-50^o og som er disharmonisk foldet.

40,20 - 41,20 Klorittisk og lett biotittisk sliregneis og sliregneis glimmerskifer, stort sett det samme som mellom 38,30 - 39,80 m. Det fins sterkere anrikning av spredte ksenoblaster av FeS_2 på stedet og det fins enkelte innfelte striper av sterk mobilisert biotitt, gjennomsnittsfall av foliasjon i hullet er 60°. Bergart er flat foldet bare på enkelte steder fins tendens til ptygmatisk disharmonisk foldning.

41,20 - 46,15 Mellomkornet massiv FeS_2 malm med porfyrisk og kataklastisk struktur. Det fins enkelte innfelte striper av uregelmessige linser av klorittisk, amfibolittisk slireskifer og grönnskifer på stedet og enkelte innfelte striper av metakvartsitt og uregelmessige små innfelte linse-striper av finkornet Fe_3O_4 som har gjennomsnittsfall i hullet 55°-60°. Det fins en mengde uorienterte kneble og nåle-porfyroblaster av amfibol. Malmen viser seg å være fattig på $CuFeS_2$. Malmgrensen er stort sett lett diskordant og har fall i hullet på 41,20 m 50° og på 46,15 m 60°. Mellom 41,65 - 41,70 m, mellom 42,00 - 42,10 m og mellom 45,05 - 41,15 m fins posisjoner av klorittisk, lettere amfibolittisk og lett epidottisk grönn slireskifer ofte med innfelte striper av metakvartsitt matriks. Det fins bare sjelden små spredte korn av FeS_2 i grönn slireskifer, som har gjennomsnittsfall i hullet 55°-60°. Grenser med malmen er alltid lett diskordante.

46,15 - 50,00 Klorittisk, lett biotittisk, lettere serisittisk kvartsrik sliregneisskifer og sliregneis glimmerskifer. Det fins bare på enkelte steder uorienterte små nåle og kneble porfyroblaster av hornblende aktinolitt. Bergarten inneholder en mengde uregelmessige innfelte striper og linsestriper av metakvartsitt matriks. Det fins enkelte ksenoblaster og hypidioblaster av FeS_2, som stort sett er jevnt spredt men sterkere omkring av FeS_2 fins mellom 46,15 - 47,60 m. Mellom 46,20 - 46,25 m og på 46,30 m (2 striper 1. = 1 cm, 2. 0,5 cm) og mellom 46,80 - 46,85 m og på 46,95 m fins posisjoner av finkornet og mellomkornet FeS_2 med 40 - 50 % SiO_2 i grunnmasse. I gneis-slireskifer fins bare sjelden enkelte små ksenoblaster av Fe_3O_4. Gjennomsnittsfall av foliasjon i hullet er 50°. Mellom 47,85 - 47,90 m er posisjon av hvit lateralsekretisk SiO_2.

Tverrfjellet, 2.10.1974.

(M. Motys)

BORHULL NR. 222, GRIMSDALEN.

200øÖ - 670 N

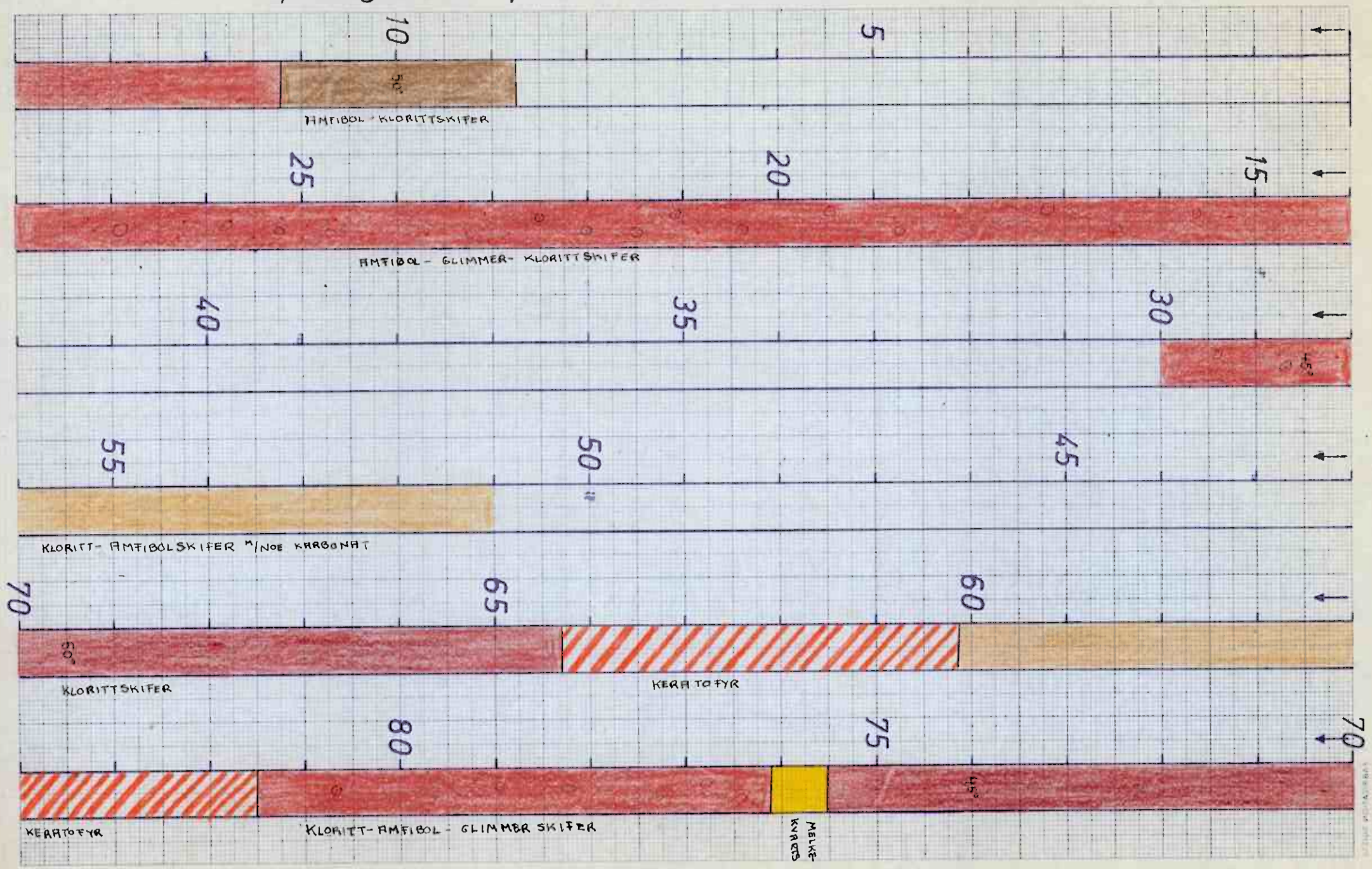
KJERNEBESKRIVELSE:

0,00 - 8,80 m	Overdekke.
8,80 - 11,20 m	Amfibol - klorittskifer med glimmer, vesentlig muskovitt. Foliasjonsretning 50° ved 10 m, kjennetegnes ved vekselvise lag av amfibol/kloritt og lys feltspat. Amfibolnålene er små (0,1 - 1,0 cm) og tilsynelatende uorienterte.
11,20 - 30,00 m	Amfibol - glimmer - klorittskifer m/små forvitrede granater. Stedvis melkekvartspartier på opptil 20 cm lengde. Spor av sulfid (Py,). Noe karbonat enkelte steder. I forbindelse med "melkekvartsklysene" finner en mindre keratofyrpartier. Foliasjonsretning på 45° ved 28,50 m. Kasse 4 og 5 mangler (dvs. fra 31,- - 50,- m, innsendte kisprøver ?)
51,00 - 60,10 m	Kloritt - amfibolskifer m/noe karbonat. Spredte små delvis orienterte amfibolnåler, samt noen mindre melkekvartsklyser.
60,10 - 64,30 m	Keratofyr med litt amfibol og noe granater (0,5 cm)
64,30 - 75,50 m	Klorittskifer, lokalt med glimmer og granater. Sistnevnte forholdsvis store 1 - 2 cm, men ikke vel utviklet. Foliasjonsretning varierer fra 50 - 45°, h.h.v. 69,50 - 74 m.
75,50 - 76,10 m	Melkekvarts.
76,10 - 81,50 m	Kloritt - amfibol - glimmerskifer ± granater. Överst et lite granatinnhold som avtar sakte nedover. Foliasjonsretning ca. 45° (gj.snittlig).
81,50 - 85,10 m	Keratofyr med amfibol og granat. Gradvise overganger fra h.h.v. over underliggende bergart. Svake spor av Fe-sulfid (py).
85,10 - 93,00 m	Kloritt-glimmerskifer, avbrudt av mindre keratofyrsoner. En del granat (forholdsvis stor). B.A. går delvis over i keratofyr + granater og amfibol.
93,00 - 99,20 m	Glimmerskifer med slirer av karbonat i foliasjonsretningen, som gjennomsnittlig er omtrent 60°.
99,20 - 111,20 m	Keratofyr med granat (stor, lite utviklet) og amfibol samt noe glimmer. B.a. går etterhvert over i mer kvartsrik keratofyr - amfibol og granat, men med en del glimmer. Spredte sulfidimpregnasjoner (py, cu) særlig markant fra 106 - 110 m.

112,20 - 122,50 m	Vekselvise lag (på vel en meters tykkelse) av glimmerskifer og keratofyr med glimmer. Begge er amfibolförende, mens sistnevnte også har granat. Svake tegn på Fe-sulfid (py).
122,50 - 124,70 m	Glimmerskifer med amfibol og granat.
124,70 - 131,00 m	Kloritt - glimmerskifer ± amfibol delvis orientert i foliasjonsretningen (ca. 45°).

Juni 1975.

The petrografical profile of the borehole nr. 222



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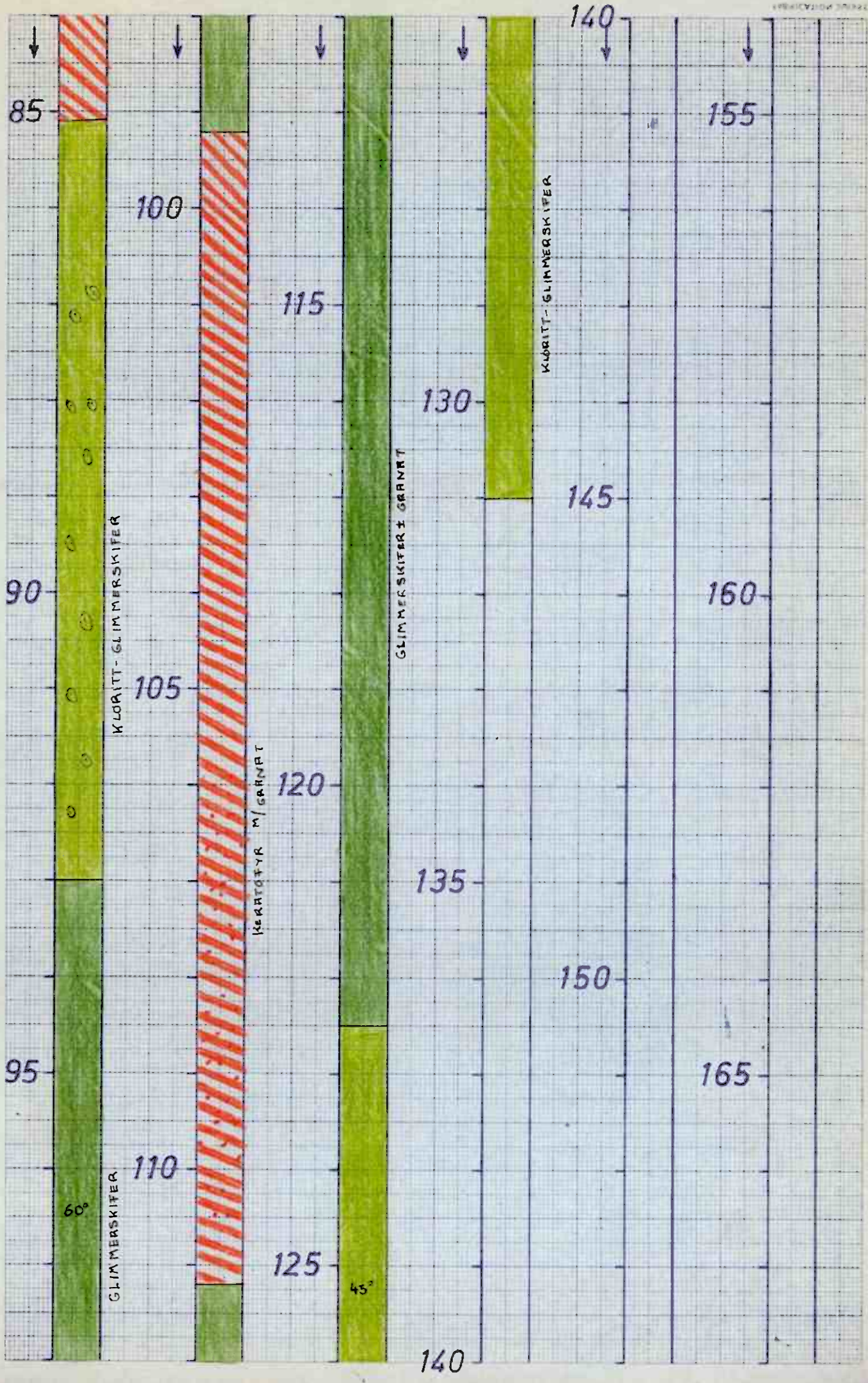
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KLORITT-GLIMMERSKIFER
GLIMMERSKIFER
KERATOFYR M/GRANAT
GLIMMERSKIFER ± GRANAT
KLORITT-GLIMMERSKIFER
60°
45°

BORHULL NR. 221, GRIMSDALEN

700 Ö - 830 N, fall på 80° mot S.

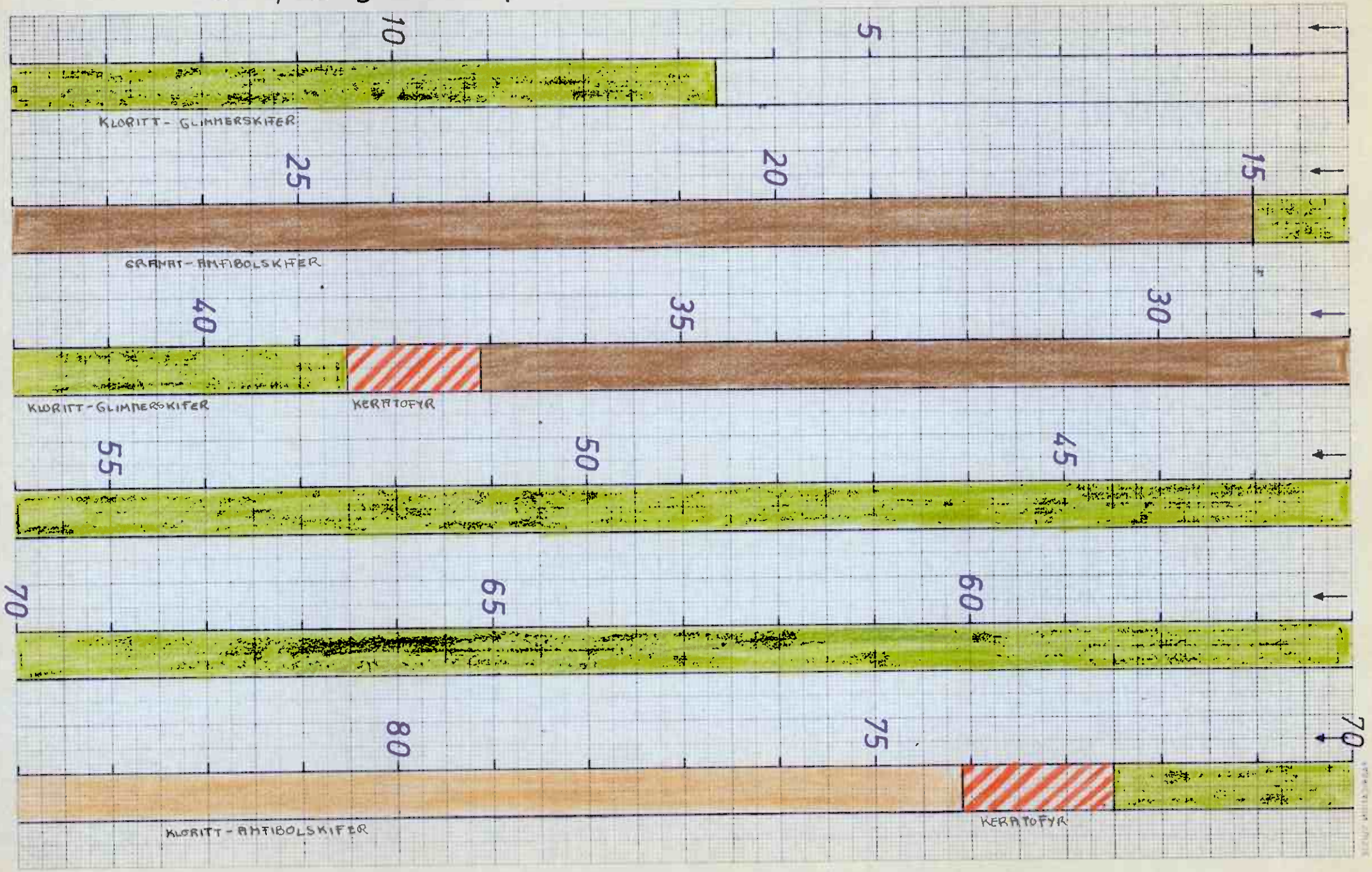
KJERNEBESKRIVELSE:

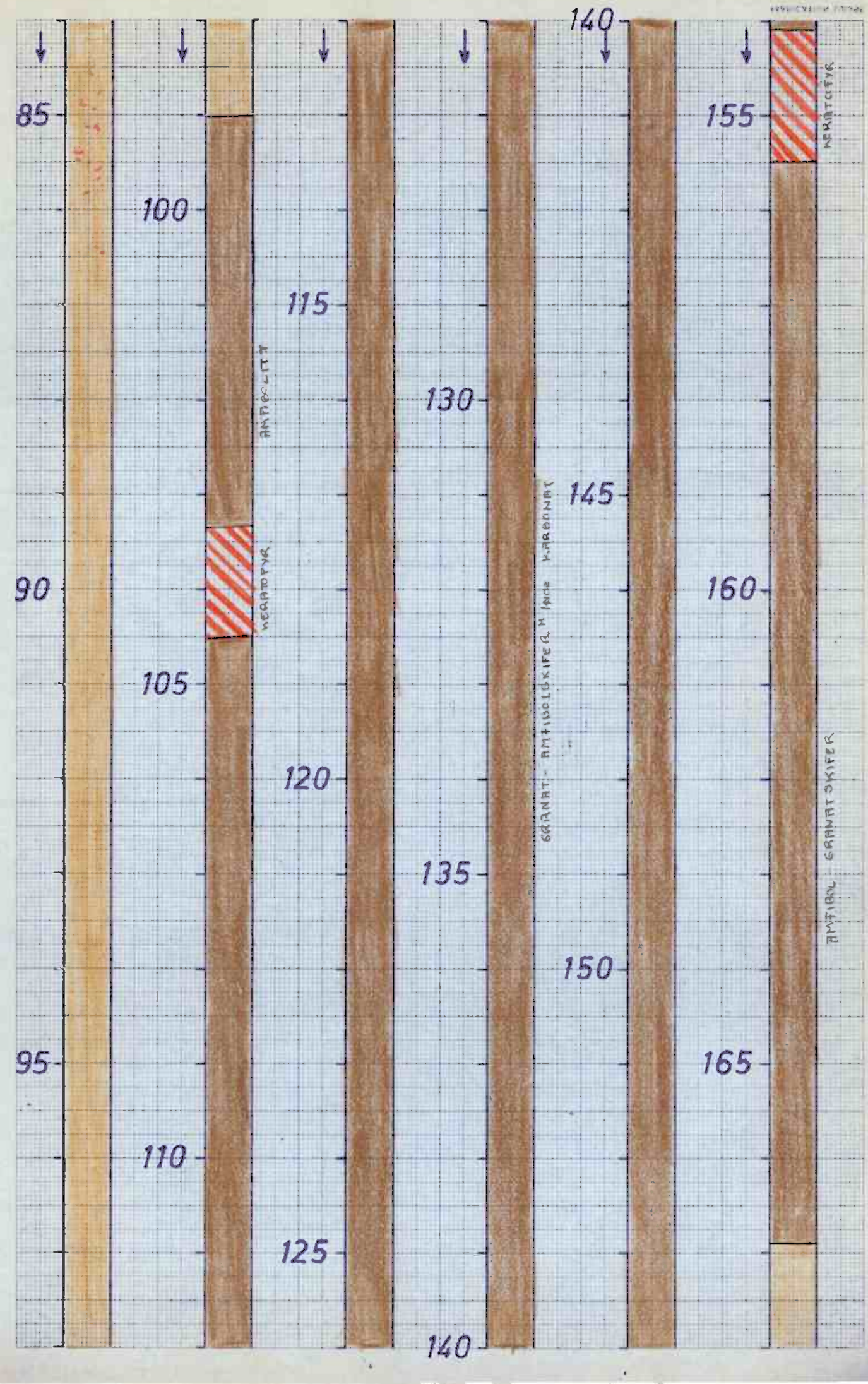
0,00 - 6,60	Overdekke.
6,60 - 15,00	Kloritt-glimmerskifer ± granat. Granatene små, opptrer først fra omlag 10 m og nedover, enkelte spredte små amfibolnåler uorienterte i forhold til foliasjonsplanet. Også mindre markante spor av sulfid (py). Foliasjonen defineres h.h.v. av vekslende lag av feltspat og kloritt, stedvis også glimmer (muskovitt) ansamlinger. Foliasjonsretningen gjennomsnittlig rundt 60°, ved 9 m.
15,00 - 37,10	Granat amfibolskifer som gradvis går over i mer klorittaktig skifer. Denne har spredte "klyser" av melkekvarts, på enkelte steder også noe mere glimmer. Foliasjonsretning ved 28,00 m ca. 55°.
37,10 - 38,50	Karbonatholdig keratofyr bergart med spredte små amfibolnåler.
38,50 - 72,70	Kloritt-glimmerskifer med sulfidspor rundt 44,- - 46,- m (vesentlig py, noe cu), spredte melkekvartsklyser, en del amfibolnåler. I de underste lagene opptrer opptil et par cm store pseudomorfe amfibolnåler.
72,70 - 74,10	Keratofyr med noe amfibol og granater, som ligger spredte er små og uorienterte.
74,10 - 99,00	Kloritt amfibolskifer hvor det på enkelte steder (84 - 88 m) er mer amfibol samt en del granater. Rundt 85 m også spor av Fe-sulfid (py, cu). Foliasjonsretning 70° (gj.sn.).
99,00 - 103,30	Mer amfibol-preget bergart med en del granater.
103,30 - 104,50	Keratofyr med små amfibolnåler og granater.
104,50 - 130,00	Granat amfibolskifer med noe karbonat.
130,00 - 154,10	Amfibol klorittskifer med vekslende små partier av keratofyr. Sistnevnte av varierende størrelse (0,10 - 1,00 m) og inneholdende granater og enkelte spredte amfibolnåler. Bergarten går nærmest over i amfibolitt i de undre lag. Her inneholder den også noe Fe-sulfid (py).
154,10 - 155,50	Keratofyr med små og få granater og amfibolnåler.

155,50 - 166,90	Amfibol - granatskifer med opp til cm store amfibolnåler. Noen mindre keratofyrsoner. Foliasjonsretning rundt 161 m er 70°, her inneholder b.a. også noe sulfid.
166,90 - 185,40	Klorittskifer med en del amfibol og glimmer på enkelte steder. Noe sulfid rundt 173,0 (py, cu). Spredtvis keratofyrpartier som blir lengre i de underste lagene. Markante spor av sulfid fra 180 - 185 m.
185,40 - 194,20	Kerafofyriske partier med mindre amfibolittpartier i. Keratofyren inneholder amfibol og spor av Fe-sulfid.
194,20 - 219,00	Amfibolholdig skifer med granater av varierende störrelse. Foliasjonsretning 60° ved 200 m. Mindre keratofyrpartier i skiferen. En del Fe-sulfid (py). Forholdsvis store krystaller av granater og amfibol i de underste lagene.
219,00 - 226,50	Keratofyr med noe pyritt (eventuelt andre sulfider). I de siste fire metrene har en opp til 2 cm store amfibolnåler.
226,50 - 262,00	Kloritt amfibolskifer med noe sulfid (py, cd). Foliasjonsretningene ved 277 m er 40°. Små "klyser" av melkekvarts. Tildels mer Fe-sulfid ved 233 - 240 m, lite granater. B.A. blir etterhvert mer klorittisk preget og vi får saussurittisering og epidot. Fremdeles noe Fe sulfid ved 260 m. Her er foliasjonsretningen ca. 45°.
262,00 - 277,10	Glimmer/klorittskifer med en del granater. Noe sulfid (py, cd, cu) og spredte melkekvarts partier fra 271,5 m.
277,10 - 280,00	Keratofyr, hvor det fremdeles er spor av Fe-sulfid, vesentlig py.
280,00 -	Kloritt-glimmerskifer med noe granater, også her spredte spor av py.

Juni, 1975.

The petrografical profile of the borehole nr. 221

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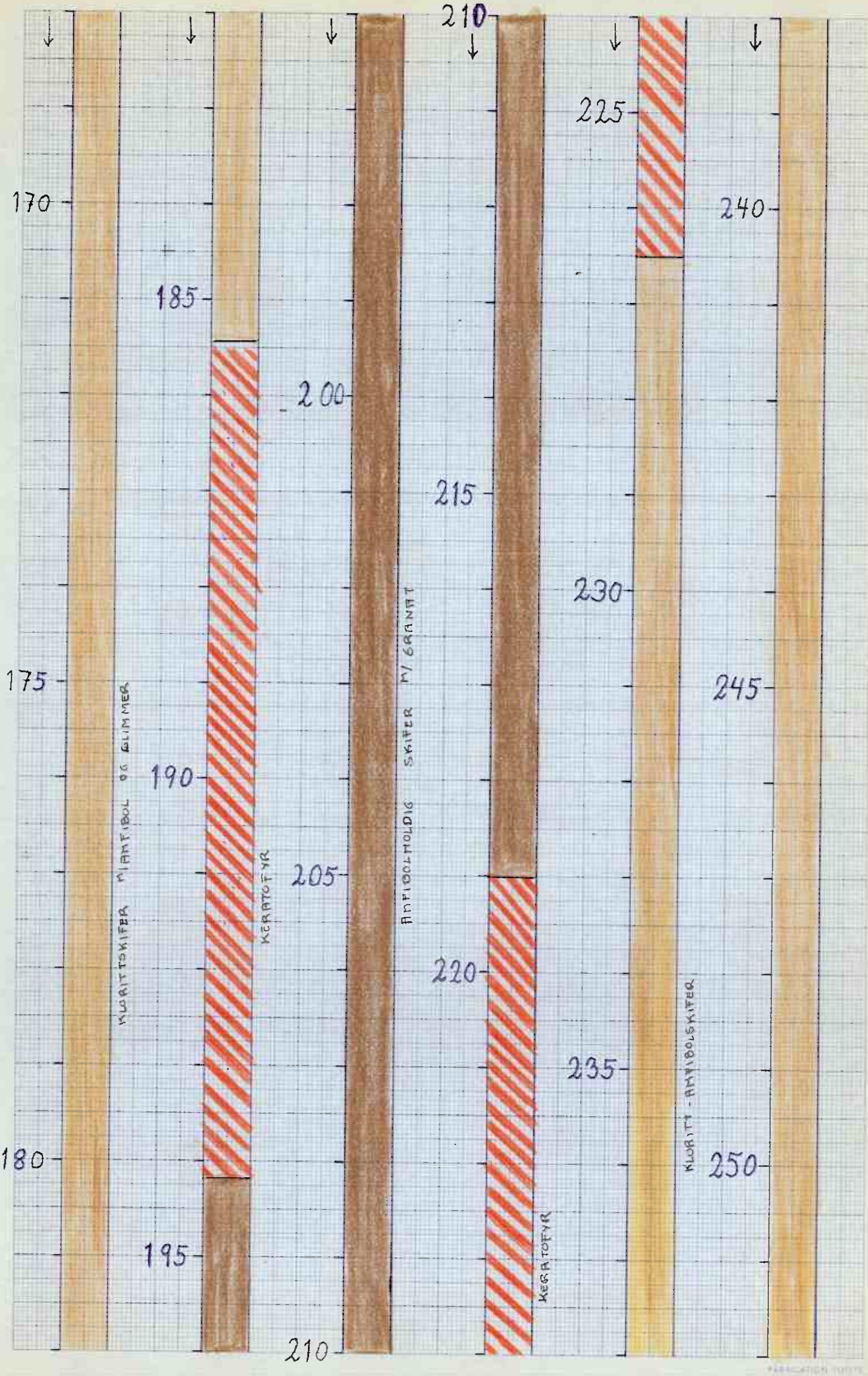
ANDESITT
KERATOFYR
GRANAT- AMFIBOLSKIFER M/ LAG M/ KARBONAT
KERATOFYR
AMFIBOL - GRANATSKIFER

321

221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KLORITTSKIFER M/AMFIBOL OG GLIMMER
KERATOFYR
AMFIBOLHOLDIG SKIFER M/GRANAT
KERATOFYR
KLORITT-AMFIBOLSKIFER

BORHULL nr. 220 - GRIMSDALEN

700 Ø - 825 N, 55° fall m.S.

Kjernebeskrivelse.

0,0 - 4,0	Overdekke.
4,0 - 14,1	Amfibol - glimmer - klorittskifer ± granat. Överst et lite granatinnhold som avtar gradvis nedover og forsvinner ved ca. 8 m. Amfibolnålene er små og tynne, og er ufullstendig orientering i foliasjonsplanet. Foliasjonen defineres ellers av en veksling mellom mm-tykke lag rike på h.h.v. feltspat og kloritt. Svake spor av Fe-sulfid (pyritt). Foliasjonsretning gjennomsnittlig 55-60°, 13,75 - 14,1 m. Tett av små feltspatlinser (2-3 mm).
14,1 - 52,0	Amfibol - klorittskifer, ± glimmer. Överst er en del av sprekkene fylt med karbonat. Flere opptil m-tykke lag av granatamfibolskifer ± glimmer. 21-23 m har sulfidspor (mest py, noe cp). Flere små(10-20 cm) kvarts-feltspat-epidot"klyser". Foliasjonsretning ca. 55° (gjennomsnitt).
52,0 - 54,1	Keratofyr med små amfibolnåler og små granater. 4-5 cm lag rike på amfibol og granat finnes.
54,1 - 67,6	Amfibol - klorittskifer ± granat. Lokalt glimmer-förende. Karbonat i enkelte sprekker. Fra 63,5 m og nedover i gradvis mer granat. Foliasjonsretning gjennomsnittlig 60-65°.
67,6 - 68,5	Granat - amfibolskifer med litt karbonat.
68,5 - 73,9	Amfibol - klorittskifer, lokalt med glimmer. Noen små (10-20 cm) epidotholdige kvarts - feltspat "klyser".
73,9 - 75,8	Keratofyr m/amfibol og granat. Gradvis overgang mot overliggende bergart.
75,8 - 80,75	Klorittskifer ± amfibol. Foliasjonsretning 75-80°.
80,75 - 81,1	Kvarts-epidot-karbonatbergart (linse ?)
81,1 - 88,8	Amfibol-klorittskifer. Foliasjonsretning 70°.
88,8 - 89,5	Melkekvarts.
89,5 - 90,8	Amfibolitt ("urent") keratofyrlag m/noe glimmer.

90,8 - 111,1 Amfibol-klorittskifer, lokalt m/biotitt. Amfibol porfyroblaster 1 cm. forekommer lokalt, ellers er amfibolnålene små og ligger ufullstendig orientert i foliasjonsplanet. Foliasjonsretning 65-70°

111,1 - 118,5 Keratofyr. Den inneholder to ca. 40 cm tykke amfibolrike lag. Keratofyren förer granat (2 cm) og små amfibolnåler. Foliasjonsretning 80-85°.

118,5 - 155,0 Kloritt - granat-amfibolskifer med tynne urene keratofyrlag og små "klyser" av melkekvarts (30 cm). Granatinnholdet öker nedover mot 155,0. Foliasjonsretning ved 122 m 65° - ved 143 m 85°.

155,0 - 168,30 Granat - amfibol - klorittskifer. Amfibolnålene er tynne og tilsynelatende uorienterte.

168,30-174,15 Stort sett klorittisk, på steder lettere epidottisk og amfibolittisk (mange små uorienterte nåle porfyroblaster av amfibol) og lett karbonatisk $CaFe(CO_3)_2$ - $CaFe(CO_3)_2$ slire gneisskifer med mange små ksenoblaster av granat. Det fins flere 0,5 - 1,0 cm. mellomlag av lys-grå metakvartsitt som inneholder bare enkelte små ksenoblaster av FeS2 og mere sjelden av Fe_3O_4. Bergart er på steder sterk ptygmatisk foldet (amplitude 1-5 cm). Gjennomsnittsfall av foliasjon i hullet er omkring 60°.

174,15-174,95 Lett klorittisk og serisittisk, grå-hvit tett metakvartsitt som inneholder enkelte innfelte striper av kloritt-serisittisk slireskifer, som inneholder enkelte store (1-3 mm diameter) eller små ksenoblaster eller hypidioblaster av FeS_2, som på steder konsentrerer seg i striper.

174,95-175,20 Klorittisk, lett biotittisk, lettere karbonatisk $CaFe(CO_3)_2$ - $CaMg(CO_3)_2$ slire grönnskifer, som inneholder mange innfelte striper og mellomlag av lys-grå metakvartsitt som inneholder stort sett svak impregnasjon (ksenoblaster) av FeS_2. Sjelden fins små idioblaster av FeS_2 og enkelte små spredte korn av FeS. Mellom 174,90 - 175,20 fins sterkere mobilisert biotitt og kloritt og det fins sterkere impregnert FeS_2 (sjelden FeS og Fe_3O_4). Gjennomsnittsfall av foliasjon i hullet er omkring 60°.

175,20-179,05 Finkornet massiv FeS_2 malm med karaklastisk-porfyrisk struktur. Malmen er CuFeS2 litt rikere mellom 175,20 - 176,20 m, men mellom 176,20 - 178,20 m fins malmen rik på jevn spredt Zn(Fe)S. Mellom 175,90 - 176,05 m fins posisjon av grå-hvit metakvartsitt med svakt innhold av FeS_2 ksenoblaster (spredt). Mellom 178,40 - 179,05 m fins sjelden enkelte tynne (maks. 1 mm) innfelte striper av finkornet Fe_3O_4 som har gjennomsnittsfall i hullet omkring 70°. Malmgrensen på 175,20 m er pseudokonkordant og har fall i hullet 60°. Malmgrensen på 179,05 m er diskordant og har fall i hullet 75°.

Gjennomsnittsanalyseresultater av malmposisjon er 0,65 % Cu, 2,30 % Zn og 40,59 % S.

179,05-187,65 Klorittisk og lett biotittisk, lettere epidottisk, lettere serisittisk grönn slireskifer, som på enkelte steder er lett karbonatisk $CaFe(CO_3)_2$ - $CaMg(CO_3)_2$ (enkelte store ksenoblaster og hypidioblaster). Det fins også mange små uorienterte nåle-porfyroblaster på enkelte steder. Det fins mange innfelte striper og mellomlag av grå-hvit metakvartsitt. Mellom 187,15 - 187,20 m er posisjon av hvit lateral-sekretisk kvarts med hypidioblaster og ksenoblaster av $CaFe(CO_3)_2$ - $CaMg(CO_3)_2$ ved grenser. Det fins spredte korn av FeS_2 og sjelden av FeS men mellom 179,05 - 183,00 m er denne meget svake impregnasjon av metallsulfider litt mere markert. Gjennomsnittsanalyseresultater fra dette område er 0,02 % Cu, 0,14 % Zn og 0,80 % S. Gjennomsnittsfall av foliasjon i hullet er omkring 60-65°, men på enkelte steder 75-80°. Bergarten er på enkelte steder flatt foldet, eller disharmonisk ptygmatisk foldet.

187,65-197,40 Granat-amfibol-klorittskifer m/pyrittimpregnasjon. Uorienterte små, tynne amfibolnåler. Gjennomsnittlig foliasjonsretning ca. 75°.

197,40-205,80 Keratofyr m/max. 2 cm. store xenomorfe granater. Tynne striper rike på kloritt og muskovitt. Lokalt py-impregnasjon.

FOLLDAL VERK ⅛

BORHULL NR. 203, GRIMSDALEN (Tverrliseter).

200 V - 650 N, fall på 55° mot S.

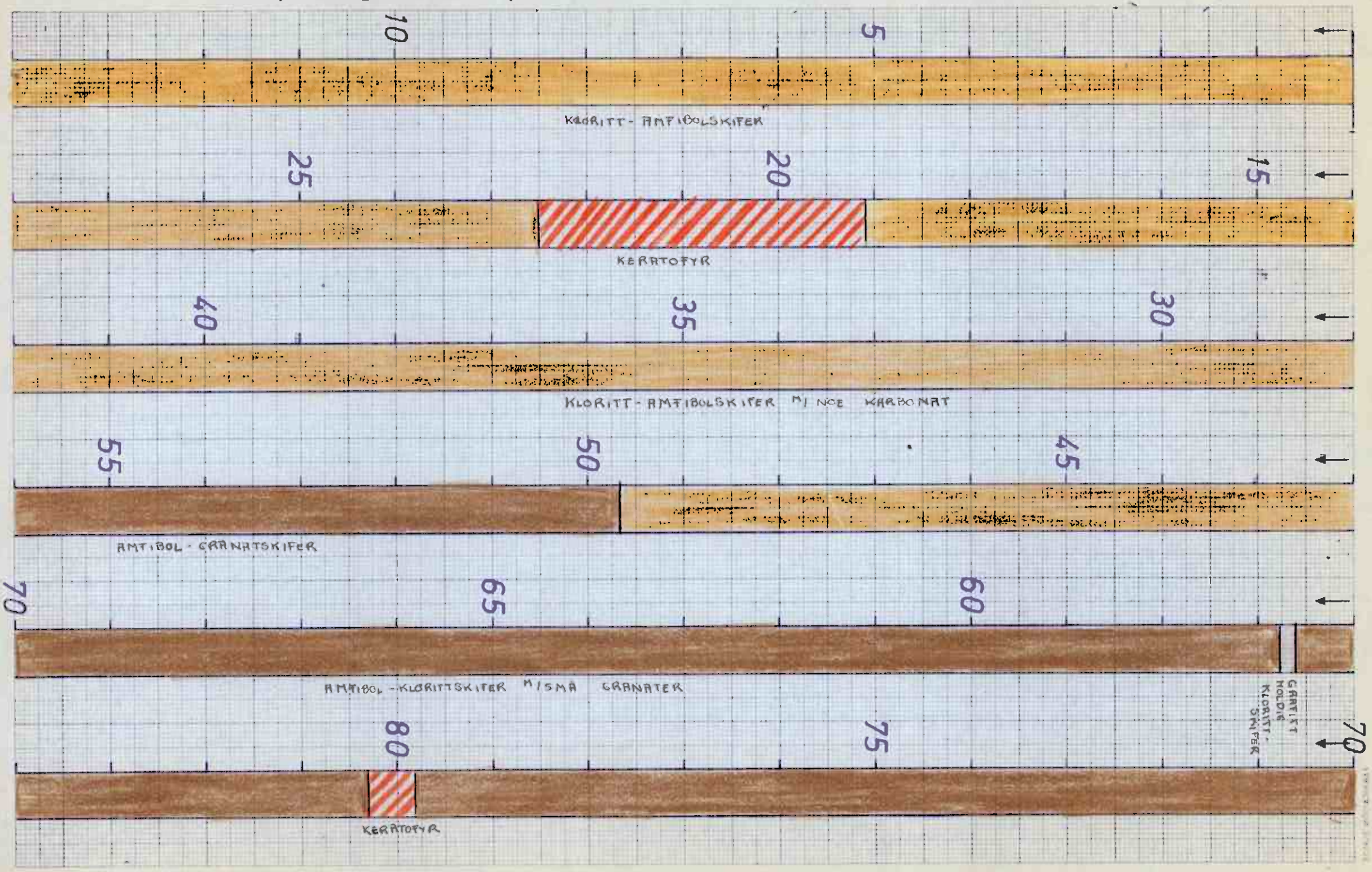
KJERNEBESKRIVELSE:

0,00 - 19,10	Kloritt - amfibol - glimmerskifer, lokalt med mindre granat. En del forvitring/rust og spes. i tynne soner med mer keratofyraktig preg. Amfibolnålene bare delvis orientert etter foliasjonen, som ellers defineres ved vekselvise lag av kloritt og feltspat. Foliasjonsretning ved 18,50 m er 70°. Spor av Fe-sulfid (py).
19,10 - 22,50	Keratofyrsone med amfibol og granat. Førstnevnte uorienterte og opp til 1 cm lengde. Midt i keratofyren mindre kloritt biotittglimmerskiferlag. Lokale mindre sulfidimpregnasjoner (py, noe cu).
22,50 - 49,60	Kloritt - amfibolskifer med noe karbonat og mindre uorienterte amfibolnåler. Spor av Fe-sulfid. Lokalt ca. 1 m langt keratofyrparti med amfibol og pressede granater. Stedvis ganske mye glimmer/biotitt i skiferen. Foliasjonsretning ved 39,50 m er 60°.
49,60 - 56,60	Amfibol - granatskifer med spor av sulfid (py, spesielt rundt 50 m). Amfibolnålene er delvis orientert etter foliasjonsretningen som er 50° ved 53 m.
56,60 - 56,75	Grafittholdig klorittskifer.
56,75 - 79,80	Amfibol klorittskifer med små granater. Sulfidimpregnasjoner py (cu), forholdsvis forvitret. Midt i denne sonen dvs. fra 64,20 - 64,30 m et nytt grafittholdig parti svært likt foregående Granatene forsvinner ved 65 m. Foliasjonsretning ved 68,50 m er 70°.
79,80 - 80,90	Keratofyrsone med uorienterte amfibolnåler og små granater.
80,90 - 102,40	Amfibol - klorittskifer. Fremdeles spor av sulfid, ligger i slirer parallelt med foliasjonen. Spredtvise klyser av metakvarts og lokale partier med granat. Amfibolnålene (av varierende størrelse) er delvis uorienterte.
102,40 - 109,30	Amfibol - granatskifer med lokale mindre keratofyrsoner. Svake spor av Fe-sulfid.

109,30 - 131,35	Amfibol - granatskifer med forholdsvis mye glimmer/biotitt, Noe Fe-sulfid, spesielt rundt 119 m. "Klyser" slirer av melkekvarts (3-5 cm lengd Foliasjonsretning ved 125,45 m er 75°.
131,35 - 131,50	Massiv småkornig kataklastisk S-kismalm. Både övre og nedre malmgrense er pseudokordante og har ca. 80° fall i hullet.
131,50 - 143,10	Kloritt - amfibolskifer med slirer av sulfid. Foliasjonsretning ved 140 m er 60°.
143,10 - 145,50	Overliggende lag går gradvis over til amfibolittisk b.a. med tildels store sammenvokste granater (1 - 3 cm) forholdsvis mye glimmer og opp 3 cm lange uorienterte amfibolnåler.
145,50 - 154,65	Keratofyr med noe amfibol og granat. Spor av Fe-sulfid, iblandt ganske velutviklede py-krystaller. B.a. er avbrudt av lokale klorittskiferpartier i de underste lagene.
154,65 - 166,25	Kloritt - glimmer - amfibolskifer med noe karbonat. Mer kvartsholdig etter hvert.
166,25 - 168,50	Amfibol - granatskifer med små granater og amfibolnåler. Forholdsvis kvartsholdig, nærmest keratofyr i den siste meteren.
168,50 - 171,90	Keratofyr.
171,90 - 172,80	Klorittskifer. De förste cm sterkt grafittholdig.

JUNI, 1975.

The petrografical profile of the borehole nr. 203



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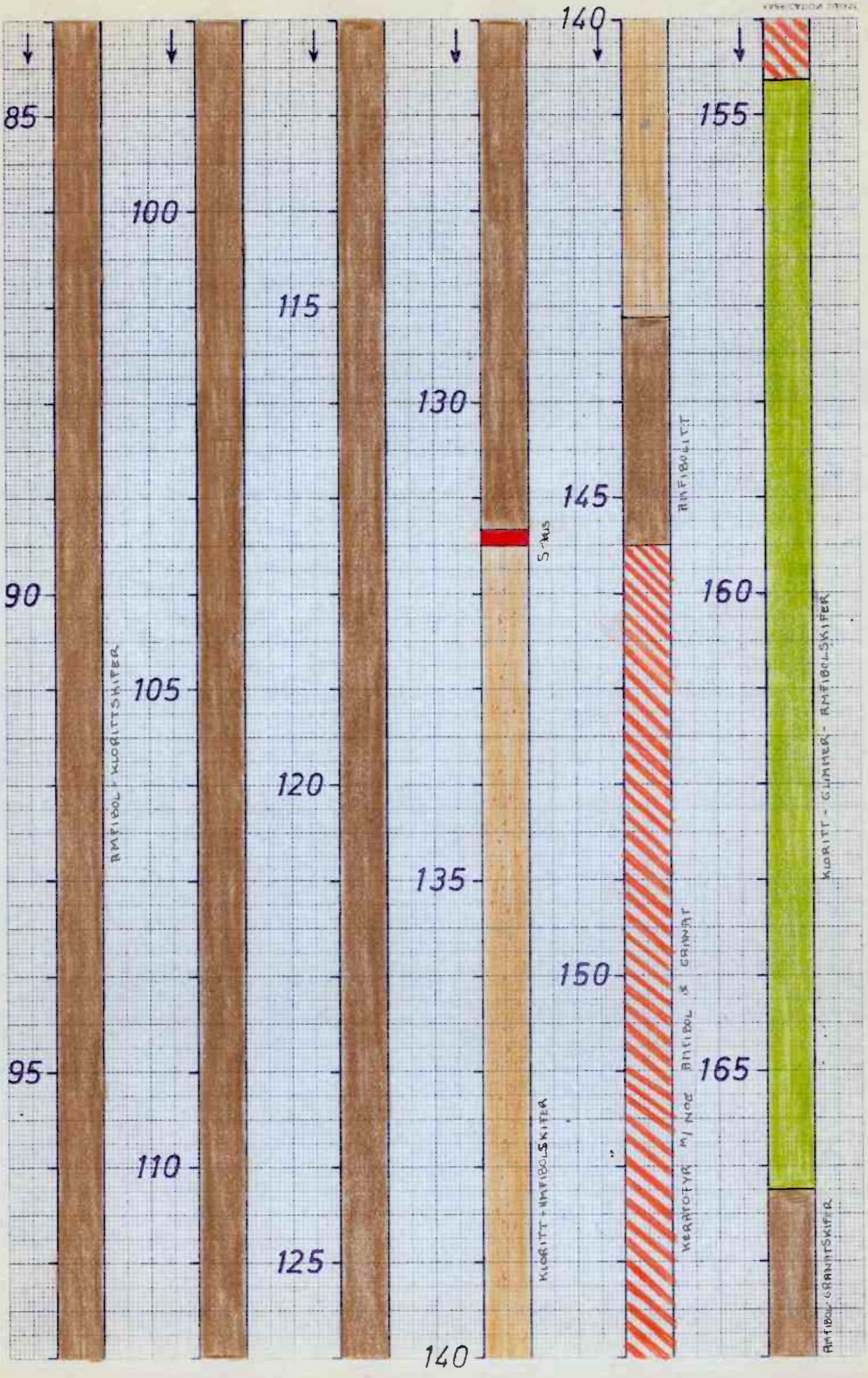
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AMFIBOL + KLORITTSKIFER
KLORITT + AMFIBOLSKIFER
S'KUS
KERATOFYR M/ NOE AMFIBOL & GRANAT
AMFIBOLITT
KLORITT - GLIMMER- AMFIBOLSKIFER
AMFIBOL-GRANITTSKIFER

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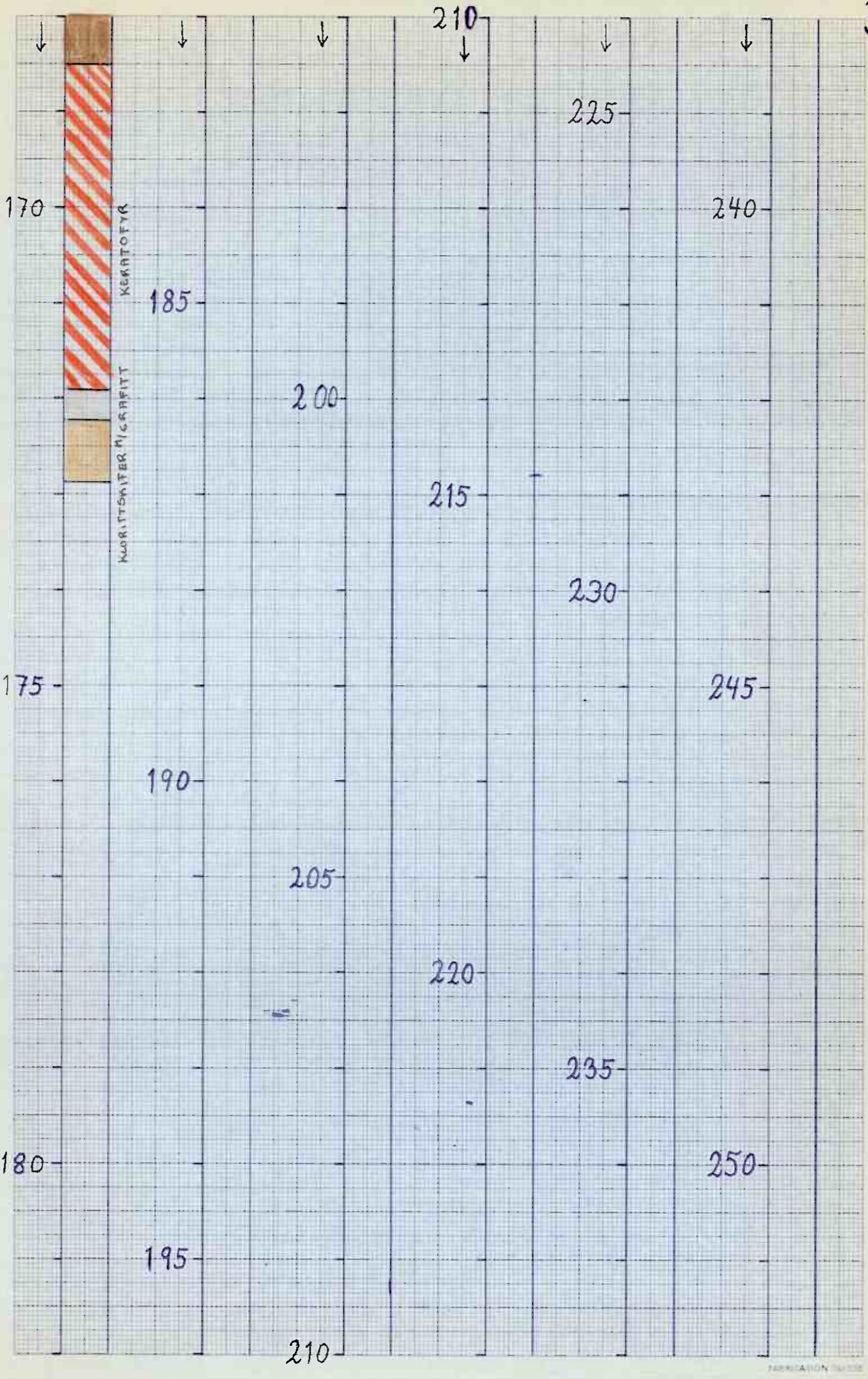
KERATOFYR
KLORITSKIFER MED GRAFITT
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The Borehole no. 197, Grimsdalen.

The brief petrografical description.

0,00 - 0,90	The fluvioglacial gravel and sand and bottom-load
0,90 - 3,40	The chloritic and sericitic and talcic (deferificated biotite too) mica schist with many crushed rodlike and acicular porphyroblasts of hornblende and locally with little grains of garnet too. The structure is fludial and crumpled. The average gradient of this foliation is 70°-75° around. This rock is locally strongly crumpled and folded.
3,40 - 6,10	The strongly chloritic weakly amphibolitic greenschist and gneissic greenschist with a lot of little grains of garnet. Some flakes of biotite are locally only present too. The structure is massive-sheeting and massive-banking. The average gradient of this foliation is 65° about.
6,10 - 47,30	The chloritic and sericitic and talcic mica schist, locally biotitic as well as at 0,00 - 3,40 m mostly. Locally are present some thin schliers or little irregular intercalations of a graphitic phyllitic matrix (in example at 34,70 m, 39,00 - 39,10 m and at 47,00 - 47,30 m about). Locally are present some irregular chambres of a zoisite-epidote matrix The average gradient of this foliation is 60°-65° about. Between 29,90 - 30,20 m is present a myllonitic and tectonic breccies with a lot of schliers and chambres of white secretion quartz, with many thin irregular schliers of a dark myllonitic matrix and with some very little chambres of pyrrhotite, together with calcopyrite locally too, but more scarcely only. Pyrite (lenticles or flakes) are more scarce present too but also locally only. Between 27,30 - 27,50 m, 27,80 - 28,00 m and between 44,20 - 44,45 m are present positions of a white barren secretion quartz.

This borehole no. 197, Grimsdalen was stopped at 47,30 m on September 9th 1970 at 13.30 p.m.

(M. Motys).

Borehole no. 196, Grimsdalen.

The brief petrografical description.

0,00 - 12,80 — The chloritic, amphibolitic and garnet gneissic schist with a lot of little acicular and rodlike porphyroblasts of hornblende. Locally only are present some little allotriomorphic grains of pyrite. The structure is fluidial and schistose too. Locally is this rock folded and crumpled too. The average gradient of this foliation is 50^{o}-55^{o}. Between 5,60 - 6,40 m is a position of a keratophyre rock with weak chloritic substance and with some rodlike and acicular porphyroblasts of hornblende and with some grains of garnet too. Between 3,20 - 3,50 m is present a position of a quartz tectonic breccic. The groundmass is a barren white quartz.

12,80 - 14,75 — The very strong impregnation of sulphides in a quartzite (pyrite mostly, but locally with schliers, which are reach of sphalerite). The structure is massive and a texture is cataclastic and porphyric. The result of the chemical analyse from this position between 12,80 - 14,75 m is: Cu 0,61, Zn 4,60 S 40,70

14,75 - 22,10 — The strongly chloritic and weakly b iotitic green-schist, locally gneissic-greenschist with some schliers or pellets of a quartz and of a quartz-feldspatic matrix. This rock are present a lot of little allotriomorphic, hypidiomorphic and scarce antomorphic grains of pyrite. The structure is phacoidal schistose, rope and fluidial too. The average gradient of this foliation is 55^{o} about.

22,10 - 24,60 — The chloritic and weakly biotitic gneissic schist with a lot of little grains of garnet and with some little irregular chambres or irregular little spots or schliers of pyrrhotite and locally more scarcely of chalcopyrite too. Some allotriomorphic and hypidiomorphic grains of FeS_2 are present too. The structure is fluidial, rope and phacoidal schistose too. The average gradient of this foliation is 55^{o}-60^{o} around. The result of the chemical analyse from this position between 22,10 - 24,60 m is: Cu 0,13 , Zn 0,25 , S 2,50

24,60 - 27,90 — The chloritic and weakly biotitic gneissic schist with a schistose and banking structure. The average gradient of this foliation is 60^{o}-65^{o} about.

27,90 - 64,10 — The motley serie of a chloritic and sericitic quartzy mica schist and of a sericitic and chloritic weakly biotitic gneissic mica schist with a lot of irregular and big enough grains of garnet. Scarcely

and locally only are present some rodlike and acicular porphyroblasts of hornblende. Locally are present some schliers of a barren white secretion quartz. The structure is sheeting and banking mostly. The average gradient of this foliation is 45^{o}-50^{o} around. Between 46,10 - 46,80 m and between 48,10 - 48,40 m are present much more flakes of biotite (biotitic gneissic mica schist). Between 30,70 - 31,00 m, 32,50 - 32,80 m, 33,60 - 33,70 m, 58,40 - 58,70 m and between 63,60 - 64,10 m are present the positions of a graphitic and phyllitic schist, mostly with a lot of flakes or cavers on foliation plates of pyrrhotite and pyrite weakly too. Between 28,50 - 29,00 m, 31,00 - 34,10 m are present positions of a strongly sericitic and chloritic phyllitic schist locally with some thin schliers or intercalations with a weak graphitic substance and with some flakes of pyrrhotite or pyrite and with some allotriomorphic grains of pyrite too. The structure is phyllitic schistose mostly and locally weakly crumpled too. Between 36,00 - 38,20 m is present a position of a weakly biotitic keratophyre with a lot of grains of garnet. The structure is massive and little bit sheeting too. Between 45,00 - 45,50 m is present a posotion of a white barren secretion quartz.

64,10 - 65,90 The gray metaquartzite, very weakly sericitic and with a weak chloritic substance. Some little and very little grains of garnet are present too. The structure is massive mostly.

This borehole no. 196 Grimsdalen was stopped at 65,90 m on September 7th 1970 at 11.30 a.m.

(M. Motys).

FOLLDAL VERK A/S

Bk. 196 Grimsdalen

DRIFTSANALYSER

Tatt 19

Skift	% Cu	% Zn	% S	% Fe				% H₂O	Sikt	Anmerkning
Rågodsstrøm	0.61	4.60	40.70		Fra	12.	80 -	14.	75 m	
Cu-konsentrat	0.13	0.25	2.50		"	22.	10 -	24.	60 "	
Cu-avgang										
Zn-konsentrat										
Zn-avgang										
S-konsentrat										
S-avgang										
Cu-retur										
Zn-retur										
Cu-tørke										
Zn-tørke										
S-tørke I										
S-tørke II										

Folldal Verk 17/9 19 70

J. Jensen

A.-S. ÆTHER, HAMAR

The borehole no. 195 GRIMSDALEN

The brief petrografical description.

0,00 - 11,25	The chloritic. amphibolitic and garnet gneiss or gneissic schist with little rodlike and acicular porphyroblasts of hornblende. The structure is fluidial and schistose. Locally only are present some allotriomprphic and hypidiomorphic grains of pyrite. The average gradient of this foliation is 40°-45°. This rock is folded and crumpled locally too. Between 2,90 - 3,40 m, 4,00 - 4,40 m and between 7,00 - 7,35 m are present positions of a amphibolitic and weakly chloritic keratophyre with little rodlike and acicular porphyroblasts of hornblende. The structure is massive and banking too. Between 4,50 - 4,80 m is present a lot of positions of a barren white secretion quartz.
11,25 - 11,65	The very strong impregnation of sulphides (pyrite mostly only). The structure is massive and the texture is cataclastic and porphyric. The result of the chemical analyse from this position between 11,25 - 11,64 m is: Cu 0,38, Zn 5,40, S 43,75.
11,65 - 12,05	The very strongly chloritic and weakly biotitic gneissic greenschist with a strong impregnation of sulphides (pyrite mostly) and with some schliers and chambres of a secretion barren quartz. The sulphides impregnation creats some homogenitic chambres or lenticles too. The structure is phacoidal and phacoidal schistose. The result of the chemical analyse from this position between 11,65 - 12,05 m is: Cu 0,39, Zn 0,80, S 21,70.
12,05 - 13,60	The little bit more weakly chloritic and biotitic quartzy gneiss or gneissic schist. Locally with some irregular grains or little lenticles of pyrite. The structure is phacoidal, phacoidal schistose and crumpled too. This rock is folded by the folds of a cm and dm amplitude and crumpled too. The average gradient of this foliation is 55°-60° but 70° about.
13,60 - 21,50	The strongly chloritic and biotitic gneissic schist and gneissic greenschist with a phacoidal and phacoidal schistose structure and with some poor impregnation of sulphides (pyrite mostly only each creats some little lentivles, little chambres and hypidiomorphic or allotriomorphic grains, scarcely automorphic too). This rock is locally folded and curmpled too by flat folds mostly. The average gradient of this foliation is 60°-70° about. Between 17,00 - 17,50 m and between 18,30 - 18,50 m are present a lot of schliers or positions of quartzite with some schliers of massive pyritic impregnation (in example in 18,30 m and in 18,45 m). Between 21,00 - 21,30 m is present a position of a white barren secretion quartz.

21,50 - 22,20	The strongly quartzy, little bit chloritic and weakly biotitic gneiss or gneissic schist with a lot of little chambres or schliers of a pyrite. The structure is phacoidal and phacoidal schistose. The average gradient of this foliation is 70^{o}-75^{o} about.
22,20 - 25,40	The strongly chloritic and weakly biotitic greenschist and gneissic greenschist as well as in 13,60 - 21,50 m but with not so much schliers of a quartz matrix and without so strong crumpling and folding. The average gradient of this foliation is 70^{o}-80^{o} about.
25,40 - 45,30	The chloritic and amphibolitic and garnet gneissic schist as well as in 0,00 - 11,25 m. Between 27,50 - 28,00 m, 31,20 - 31,70 m, 34,20 - 34,70 m, 36,50 - 36,90 m and between 38,10 - 38,70 m are present positions of a amphibolitic keratophyre, locally with grains of garnet too. Between 30,00 - 30,20 m, 37,80 - 38,00 m and between 42,60 - 42,70 m are present positions of a quartz (secretion) breccies with some inclusions of a chloritic schist. At 42,75 m are present some little schliers and little chambres of pyrite only in this secretion quartz.
45,30 - 46,25	The chloritic and biotitic gneissic schist with a lot of little lenticles and allotriomorphic grains of FeS_2. The structure is phacoidal schistose and fluidial. The average gradient of this foliation is 55^{o}-60^{o} about.
46,25 - 47,45	The strongly chloritic and weakly amphibolitic (some little rodlike porphyroblasts of hornblende) greenschist and gneissic greenschist with a fluidial and phacoidal-schistose structure. This rock is strongly folded and crumpled too. The average gradient of this foliation is 60^{o}-65^{o} about.
47,45 - 47,70	The very strong impregnation in a strongly chloritic garnet and weakly amphibolitic greenschist. The sulphides impregnation (pyrite mostly) creats homogenitic schliers and positions, which are parallel with this total foliation. The structure is phacoidal and phacoidal schistose. The average gradient of this foliation is 60^{o} about. The result of the chemical analyse from this position between 47,45 - 47,70 m is: Cu 0,40 - Zn 3,60 - S 34,90.
47,70 - 49,35	The very strong impregnation of the ore sulphides (pyrite mostly) in a quartzite. Locally are present more sphalerite and scarcely some little chambres of chalcopyrite too, in example between 48,90 - 49,35 m. The structure is massive and the texture is cataclastic. The result of the chemical analyse from this position between 47,70 - 49,35 m is: Cu 0,85 - Zn 1,80 - S 34,10.
49,35 - 51,00	The very strong impregnation in a chloritic and weakly biotitic greenschist and gneissic greenschis with a lot of positions schliers or chambres of a massive very strong impregnation of sulphides

	like in 47,70 - 49,35 m. Locally a little schliers or little chambres and more scarce of chalcopyrite to is phacoidal and phacoidal schisto gradient of this foliation is 60°- result of the chemical analyses fr between 49,35 - 51 00 m are: Betwe m Cu 0,95 - Zn 5,00 - S 31,90. Bet 51,00 m Cu 0,66 - Zn 4,80 - S 29,4
51,00 - 56,40	The motley serie of a strongly chl and weakly biotitic gneissic greens gneissic schist, locally with some hypidiomorphic grains or with littl pyrite. Between 55,80 - 55,95 m are of little irregular schliers and ir of pyrrhotite only. Between 55,50 - present a lot of grains of garnet. is phacoidal schistose and fluidial locally only folded and crumpled. T gradient of this foliation is 55°-6 52,20 - 52,35 is present position o with some poor impregnation of pyri is massive.
56,40 - 57,00	The very strongly quartzy, weakly cl with a lot of little chambres and ve lenticles of pyrrhotite. The structu and sheeting.
57,00 - 58,30	The chloritic and sericitic phylliti a parallel schistose and little bit schistose structure. Locally only ar crushed grains of garnet and crushed phyroblasts of hornblende. Between 5 is present white barren secretion qu average gradient of this foliation i Locally is this rock folded by the f a cm, dm amplitude.
58,30 - 64,10	The sericitic, chloritic, quartzy gn schist, locally with a lot of big cr of garnet and locally with some crush porphyroblasts of hornblende (locally The structure is fluidial rope and ph schistose. The average gradient of th is 60° about.
64,10 - 64,60	The quartzy keratophyre with not much garnet locally and with few little po (acicular and rodlike) of hornblende. is massive.
	This borehole no. 195, Grimsdalen was 64,60 m on August 27th 1970 at 15.30 p

(M. Motys).

FOLLDAL VERK A/S

Bh. 195 Grimsdalen

DRIFTSANALYSER

Tatt 19

Skift:	% Cu	% Zn	% S	% Fe				% H_2O	Sikt	Anmerkning
Rågods, tørt	0.38	5.40	43.7%		Ft 2	11.25	-	11.65	m	
Cu-konsentrat	0.39	0.80	21.7%		"	11.65	-	12.05	"	
Cu-avgang	0.40	3.60	34.9%		"	47.45	-	47.70	"	
Zn-konsentrat	0.85	1.80	34.10		"	47.70	-	49.35	"	
Zn-avgang	0.95	5.-	31.9%		"	49.35	-	50.35	"	
S-konsentrat	0.66	4.80	29.4%		"	50.35	-	51.00	"	
S-avgang										
Cu-retur										
Zn-retur										
Cu-tørke										
Zn-tørke										
S-tørke I										
S-tørke II										

Folldal Verk 11/9 1970

J. Jensen

A. BÆTHER, HAMAR

FOLLDAL VERK A/S

Bl. 194 Grimsdalen

DRIFTSANALYSER

Tatt 19

Skift:	% Cu	% Zn	% S	% Fe				% H_2O	Sikt	Anmerkning
Rågods, tørt	0.66	3.60	40.4		Fra	27.	–	28.	20 m	
Cu-konsentrat	0.62	5.60	40.8		"	28.	20 –	30.	20 "	
Cu-avgang	0.22	0.80	11.5		"	30.	20 –	32.	20 "	
Zn-konsentrat	0.66	0.50	49.4		"	32.	20 –	34.	20 "	
Zn-avgang	0.28	0.70	13.7		"	34.	20 –	36.	20 "	
S-konsentrat										
S-avgang										
Cu-retur										
Zn-retur										
Cu-tørke										
Zn-tørke										
S-tørke I										
S-tørke II										

Folldal Verk 16/9 1970

J. Jensen

A. GETHER, HAMAR

The borehole no. 194, Grimsdalen.

The brief petrografical description.

0,00 - 25,80	The sericitic and little bit chloritic gneissic mica schist, locally with some irregular bigger grains of garnet. The structure is fluidial, rope and locally crumpled too. This rock is oftenly crumpled and locally folded by the folds of a cm and dm amplitude. The average gradient of this foliation is 60° around. Between 0,40 - 2,50 m is position a keratophyre rock with some schliers of a chloritic and sericitic mica schists matrix. The structure is phacoidal and sheeting Between 2,50 - 3,30 m is present a position of a graphitic quartzy phyllitic schist with a sheeting and thin-banking structure. Between 10,10 - 11,20 m and between 15,40 - 18,40 m are present a positions of a keratophyre with some little chambres of chloritic matrix and locally with some grains of garnet. The structure is massive. Between 18,40 - 18,80 m is present some position of a tectonic breccic. Between 19,00 - 19,60 m is present a position of a massive white gray metaquartzite.
25,80 - 27,00	The strongly chloritic weakly biotitic and amphibolitic gneissic schist with a lot of grains of garnet and with little rodlike and acicular porphyroblasts of hornblende. The structure is fluidila ans schistose and locally phacoidal-schistose too. Mostly is this rock crushed by many tectonic and myllonitic zones. Locally are present some allotriomorphic and hypidiomorphic grains of pyrite only The average gradient of this foliation is 45°-50° about.
27,00 - 30,20 3,20 m	The very strong impregnation of the sulphides in a quartzite (pyrite mostly, but locally with some more clear schliers which have much more sphalerite in). The structure is massive mostly and the texture is cataclastic and porphyric Locally are present some little acicular and rodlike porphyro-blasts of hornblende (in example between 27,80 - 27,95 m) together with schliers of a chloritic matrix The results of the chemical analyses from this position between 27,00 - 30,20 m are: Between 27,00 - 28,20 m: Cu 0.66 , Zn 3,60, S 40,45 and between 28,20 - 30,20 m: Cu 0.62 , Zn 5,60 S 40,85
30,20 - 36,20	The strongly chloritic and biotitic gneissic schist and gneissic greenschist, without garnet and with-out porphyroblasts of hornblende Thsi rock has very strong impregnation of pyrite mostly (hypidio-morphic and allotriomorphic grains, but locally big idiomorphic too), but locally are present some little schliers or little chambres of phyrrhotite

and more scarcely of chalcopyrite together too. Locally are present some compact positions of a very strong impregnation in quartzite mostly like between 27,00 - 30,20 m, in example between 31,85 - 31,95 m. The total structure of this rock is fluidial, rope and phacoidal schistose. The average gradient of this foliation 50°-55° about. The result of the chemical analyses from this position between 30,20 - 36,20 m are: Between 30,20 - 32,20 m is: Cu 0,22 , Zn 0,80, S 11,50 . Between 32,20 - 34,20 m is: Cu 0,66 , Zn 0,50, S 19,40, between 34,20 - 36,20 m is:Cu 0,28 , Zn 0,70 , S 13,75

36,20 - 40,30 The strongly chloritic, biotitic or more weak biotitic gneissic greenschist, locally only with some rodlike and acicular porphyroblasts of hornblende and with some little hypidiomorphic and more scarcely antomorphic grains of pyrite. The structure is fluidial, rope and crumpled and phacoidal schistose too. Locally is this rock strongly folded and crumpled, by the diagonal folds of a mm, cm and dm amplitude. The average gradient of this foliation is 60°-70° around.

40,30 - 42,10 The strongly chloritic and very weakly biotitic and scarcely sericitic gneissic schist with a maculose and maculose schistose structure. Some allotriomorphic little grains of pyrite are present scarce only. The average gradient of this foliation is 70° about.

42,10 - 47,90 The chloritic and little bit, weakly sericitic quartzy gneissic mica schist with a lot of, locally big irregular grains of garnet. Some epidotided rodlike porphyroblasts of hornblende are locally present too. The structure is sheeting and banking but phacoidal schistose locally too. The average gradient of this foliation is 60°-65° about.

47,90 - 49,00 The weakly chloritic keratophyre with many acicular porphyroblasts of hornblende and with a lot of grains of garnet Some total grain clongation of porphyroblasts of hornblende is clear. The structure is massive and locally little bit sheeting. Locally are present some little allotriomorphic grains of pyrite and little flakes of pyrrhotite.

49,00 - 49,20 The sericitic and chloritic phyllitic schist with a fluidial and crumpled structure, strongly folded and crumpled locally. The average gradient of this foliation is 45°-50° about.

This borehole no. 194, Grimsdalen was stopped at 49,20 m on August 22nd 1970 at 13.00 p.m.

(M. Motys).

The borehole no. 193, Grimsdalen.

The brief petrografical description.

0,00 - 2,10	The white gray, weakly sericitic quartzite, massive with a lot of joints which have some thin limonitic covers on plates.
2,10 - 8,40	The strongly quartzy, chloritic schist with a lot of rodlike and acicular porphyroblasts of hornblende. The structure is sheeting and massive too. The average gradient of this foliation is 80° about.
8,40 - 19,10	The motley serie of a chloritic, amphibolitic and garnet, gneissic schist with some flakes of biotite too, locally more strongly chloritic too. The structure is fluidial and phacoidal schistose, locally weakly folded too. The average gradient of this foliation is 75°-80° about. Between 12,20 - 12,80 m is present a myllonitic tectonic zone. Between 13,30 - 13,40 m, 13,90 - 14,00 m are present a white barren secretion quartz. Between 8,60 - 9,00 m and between 18,00 - 18,15 m are present positions of a hornblende and garnet ceratophyre rock with massive structure mostly.
19,10 - 19,35	The strongly chloritic weakly biotitic greenschist locally with some schliers of a quartz matrix and locally with some spots of a soda-lime feldspar or scarcely of a carbonate (dollomite). The structure is phacoidal schistose. The average gradient of this foliation is 80° about.
19,35 - 19,50 0,15 m	The very strong impregnation of sulphides (pyrite mostly) in a quartzite. The structure is massive and a texture is porphyric and cataclastic. The result of the chemical analyse from this position between 19,35 - 19,50 m is: Cu , Zn , S
19,50 - 19,60	The chloritic and hornblende and biotitic gneissic schist, with some very poor impregnation of pyrite mostly only. The structure is phacoidal and phacoidal schistose. The average gradient of this foliation is 80° about. The result of the chemical analyse from this position between 19,50 - 19,60 m is: Cu Zn , S
19,60 - 19,80 0,20 m	The very strong impregnation of sulphides as well as in 19,35 - 19,50 m. The result of the chemical analyse from this position between 19,60 - 19,80 m is: Cu Zn , S
19,80 - 20,50	The weakly chloritiv and weakly biotitic gneiss or gneissic schist with a poor impregnation of pyrite mostly. The structure is fluidial and phacoidal-schistose. This rock is folded by the folds of a cm and dm amplitude. The average gradient of this

foliation is 70° about but 60° and 80° locally too. The result of the chemical analyse from this position between 19,80 - 20,50 m is: Cu , Zn , S

20,50 - 24,80 The motley serie of a chloritic, amphibolitic and very weakly biotitic gneissic schist with a very poor impregnation of FeS_2 mostly only. This rock has a phacoidal schistose and fluidial structure, locally strongly folded and crumpled. The average gradient of this foliation is 60°, but mostly 70°-80° about. Between 21,90 - 22,00 m is present white barren secretion quartz. Between 22,85 - 23,00 m is present 22,85 - 23,00 m is present a chloritic and weakly biotitic gneiss, crumpled, with a crumpled, maculose and phacoidal structure and with some poor impregnation of pyrite mostly only too.

24,80 - 24,90 (0,10 m) The very strong impregnation of sulphides (pyrite mostly) in a quartzite. The structure is massive and the texture is cataclastic. The result of the chemical analyse from this position between 24,80 - 24,90 m is: Cu , Zn , S

24,90 - 25,15 The very strongly chloritic weakly biotitic gneissic greenschist with a very poor impregnation of pyrite mostly. The structure is phacoidal and phacoidal schistose. The average gradient of this foliation is 75°-80° about. The result of the chemical analyse from this position between 24,90 - 25,15 m is: Cu Zn , S

25,15 - 26,80 (1,65 m) The very strong impregnation of sulphides (pyrite mostly) in a quartzite with a massive structure and with a cataclastic and porphyric texture. Locally are present some 1-3 cm thickness schliers or intercalations of a chloritic and weakly biotitic greenschist or gneissic greenschist in example in 25,60 - 25,70 m, 25,80 - 25,90, (5,0 cm), 26,00 and in 26,10 m. The result of the chemical analyse from this position between 25,15 - 26,80 m is: Cu , Zn , S

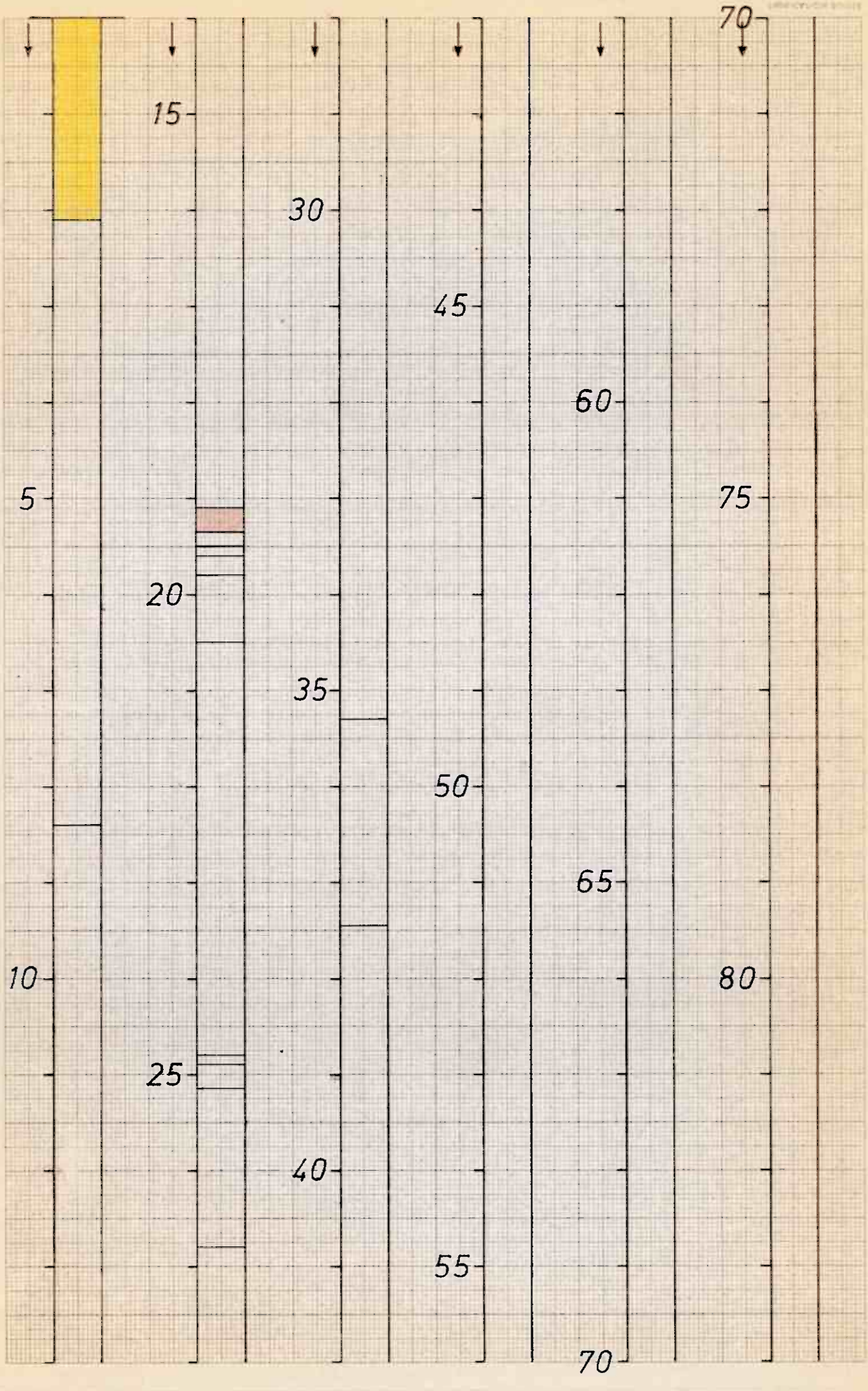
26,80 - 35,30 The motley serie of a chloritic and strongly chloritic and biotitic and locally amphibolitic (with a acicular and rodlike porphyroblasts of hornblende) and garnet gneissic schist with a fluidial or a phacoidal-schistose structure. This rock is locally folded and crumpled too. Locally is present some poor impregnation of hypidiomorphic grains of FeS_2. The average gradient of this foliation is 60°-65° about.

35,30 - 37,45 The sericitic and weakly chloritic keratophyric mica schist, with some grains of garnet locally too. The structure is banking and sheeting. The average gradient of this foliation is 60°-65° about.

This borehole no. 193 was stopped at 35,45 m on August 19th 1970 at 16.30 p.m.

(N. Motys).

The petrografical profile of the borehole nr.



The borehole no. 192, Grimsdalen.

The brief petrografical description.

0,00 - 1,10	The strongly chloritic greenschist, locally with a lot of little schliers of a quartz or more scarcely of a quartz-feldspatic matrix. The structure is schistose and fluidial locally too. This rock is locally folded too (crumpled schist). The average gradient of this foliation is 75^{o} about.
1,10 - 28,90	The motley serie of a chloritic, sericitic gneissic schist with some flakes of biotite on the plates of a foliation. Some spots or little lenticles of a carbonatic matrix (dolomote-ancerite) are locally present too. The structure is schistose phacoidal schistose and fluidial locally too. The average gradient of this foliation is 70^{o} - 80^{o} but locally 20^{o} - 30^{o} too. This rock is locally folded by the folds of a mm, cm and dm amplitude (crumpling too).
28,90 - 31,70	The chloritic phyllitic schist with fuchsite and with some schliers with a weak graphitic substance. Locally only are present some little schliers of a quartz matrix mostly only. Some flakes of biotite are present more scarcely too. The structure is phacoidal schistose and fluidial or rope. This rock is oftenly strongly folded and crumpled (crumpled schist). The average gradient of this total foliation is 75^{o} about.
31,70 - 32,60	The graphitic phyllitic schist, chloritic too with some little schliers or little lenticles of fuchsite. The structure is phacoidal schistose and this rock is very strongly folded. Oftenly are present a lot of flakes of phyrrothite. The average gradient of this foliation is 75^{o} about.
32,60 - 40,80	The chloritic and amphibolitic gneissic greenschist with a lot of flakes of biotite too and locally with some spots of carbonates. Some hornblende porphyroblast are oftenly crushed. Locally only are present some schliers with a weak graphitic substance. This rock has crumpling structure and fluidial or maculose schistose locally too. The crumpling is very strong. The average gradient of this foliation is 40^{o}-50^{o} but 70^{o} about too.
40,80 - 45,70	The chloritic, amphibolitic and garnet schist with very much acicular and rodlike porphyroblasts of hornblende, with some chambres of

zoisite-apidote matrix and with sericitic too. The texture is blastoporphyric and blastoophitic the structure is massive or little bit sheeting locally only. Between 41,40 - 41,60 m, 42,30 - 42,60 m, 43,40 - 43,55 m and between 45,30 - 45,50 m are present the positions of a phyllitic graphitic and chloritic schist with a lot of schliers of a quartz matrix and locally with some flakes of pyrrhotite too. This phyllitic schist are crumpled oftenly or strongly folded. The structure is schistose, fluidial and phacoidal schistose. The average gradient of foliation is 30° about but locally 70° too.

45,70 - 52,10 The strongly chloritic and biotitic gneissic greenschist with a lot of little schliers, little pellets or spots of a quartz and of a quartz-feldspatic matrix. The structure is fluidial, rope and phacoidal schistose. This rock is strongly folded locally and crumpled oftenly. The average gradient of this foliation is 55°-60° about. Between 48,30 - 48,80 m are present a lot of grains of garnet and some rodlike and acicular porphyroblasts of hornblende Between 47,10 - 47,30 m is present position of a white barren secretion quartz.

This borehole no. 192 Grimsdalen was stopped at 52,10 m on August 19th 1970 at 19.00 p.m.

(M. Motys).

FOLLDAL VERK A/S

Bl. 187 Grimsdalen

DRIFTSANALYSER

Tatt 19

Skift:	% Cu	% Zn	% S	% Fe				% H_2O	Sikt	Anmerkning
Rågods tørt	0.13	4.40	31.25		FT2	258.25	–	259.00	m	
Cu-konsentrat	0.47	5.-	36.50			259.-	–	259.4	%	
Cu-avgang										
Zn-konsentrat										
Zn-avgang										
S-konsentrat										
S-avgang										
Cu-retur										
Zn-retur										
Cu-tørke										
Zn-tørke										
S-tørke I										
S-tørke II										

Folldal Verk 17/5 19 70

J. Jensen.

The borehole no. 187, GRIMSDALEN.

	The brief petrografical description.
0,00 - 14,50	The fluvioglocial gravel and sund and bottom-load.
14,50 - 21,30	The strongly chloritic, weakly carbonatic gneissic schist with a fluidial structure. This rock is locally folded and oftenly crumpled. Between 15,75 - 15,90, 18,60 - 18,70 m and between 19,70 m - 20,20 m are present the positions of a barren white secretion quartz. The average gradient of this foliation is 40^{o}-45^{o} about.
21,30 - 22,70	The strongly chloritic gneissic greenschist with many little grains of garnet. The structure i schistose and fluidial too. The average gradient is 45^{o}-50^{o} about.
22,70 - 36,20	The chloritic and weakly biotitic gneissic schist oftenly strongly folded by the diagonal folds of a mm, cm and dm amplitude and crumpled too. The structure is crumpled, fluidial and phacoidal schistose too. The average gradient of this foliation is 45^{o}-50^{o} about.
36,20 - 37,20	The chloritic and weakly biotitic gneissic schist as well as at 22,70 - 36,20 m, but with many little grains of garnet.
37,20 - 37,60	The myllonitic, graphitic schist with a pell-mell, myllonitic structure and with a lot of little flakes or little chambres of pyrrhotite mostly only.
37,60 - 39,20	The chloritic and weakly biotitic gneissic schist with garnet as well as at 36,20 - 37,20 m.
39,20 - 42,10	The chloritic and sericitic phyllitic schist with a parallel schistose structure. The average gradient of this foliation is 60^{o} about.
42,10 - 43,00	The strongly biotitic and little bit chloritic gneiss with some little grains of garnet. Locally are present some schliers and lenticles of white barren secretion quartz. The structure is fluidial and phacoidal-schistose. This rock is crumpled and strongly folded too. The average gradient of this foliation is 60^{o} about.
43,00 - 60,00	The chloritic and weakly biotitic gneissic schist and gneissic greenschist with many little grains of garnet. The structure is fluidial and phacoidal-schistose. The average gradient of this foliation is 60^{o} about. Between 49,00 - 51,00 m is this rock strongly infiltrated by a quartz feldspatic matrix.

60,00 - 69,30	The chloritic and sericitic phyllitic schist as well as at 39,20 - 42 10 m. The average gradient of this foliation is 70°-80° about. Between 60,10 - 60,20 m, 60,30 - 60,80 m, 64,20 - 64,50 m and between 68,40 - 68,80 m are present positions of a phyllitic graphitic schist with flakes of pyrrhotite on foliation plates oftenly.
69,30 - 72,10	The strongly chloritic and weakly biotitic gneissic greenschist as well as at 43,00 - 60,00 m with many grains of garnet.
72,10 - 73,00	The hornblende, garnet keratophyre rock with many flakes of biotite and with some little chambres of chloritic matrix. The structure is massive.
73,00 - 82,20	The biotitic and chloritic, garnet gneissic schist and gneissic greenschist with a fluidial and crumpled and phacoidal-schistose structure. This rock is strongly folded and crumpled. The average gradient of this foliation is 50°-60° about but between 81,00 - 82,00 m 0° about.
82,20 - 84,30	The chloritic and weakly sericitic gneissic. phyllitic schist with some flakes of biotite too. The structure is sheeting and schistose. The average gradient of this foliation is 50° about.
84,30 - 90,30	The myllonitic and tectonic zone with a strongly graphitic, phyllitic myllonitic schist with many schliers or little flakes of pyrrhotite. Between 86,00 - 87,00 m and between 87,40 - 88,20 m are present the positions of a myllonitic tectonic breccie. Between 88,70 - 89,50 m is present chloritic and weakly biotitic gneissic schist like at 82,20 - 84,30 m, with a gradient of foliation 75° about in average.
90,30 - 112,90	The chloritic and weakly biotitic and garnet gneissic schist as well as at 43,00 - 60,00 m. The average gradient of this foliation is 45°-50°, but locally 70°-80° about too. Between 92,70 - 94,30 m is present strongly biotitic gneiss with bigger grains of garnet.
112,90 - 114,30	The biotitic and chloritic, weakly carbonatic gneiss with a crumpled and maculose structure.
114,30 - 146,60	The complex of a strongly chloritic, weakly biotitic and weakly amphibolitic gneissic schist, locally with many grains of garnet and with a lot of schliers of a quartz and of a quartz feldspatic matrix. The structure is fluidial and phacoidal schistose and this rock is locally strongly folded and crumpled. The average gradient of this foliation is 60°-70° about. Between 122,00 - 122,60 m and between 138,20 - 138,90 m are present position of a keratophyre with some rodlike and acicular porphyroblasts of hornblende and with some chambres and schliers of a zoitzite-epidote matrix. Some 5 cm thick positions, lenticles of a barren white secretion quartz are present on many places too.

146,60 - 149,10 The chloritic and biotitic gneiss, weakly carbonatic with a maculose and maculose schistose structure.

149,10 - 258,25 The chloritic, biotitic and gneiss and gneissic schist with a fluidial and phacoidal schistose structure. This rock is oftenly strongly folded and crumpled. The average gradient of this foliation is 65°-70° about. Between 153,90 - 155,00 m, 162,40 - 162,40 m, 188,80 - 189,90 m, 190,60 - 191,80 m, 198,00 - 198,60 m, 236,20 - 236,80 m, 241,00 - 241,60 m, 248,70 - 250,00 m and between 250,90 m - 252,00 m are present positions of keratophyre with many little rodlike and acicular porphyroblasts of hornblende and with a lot of grains of garnet oftenly too, scarcely with some flakes of biotite. The structure is massive mostly. Between 165,80 - 165,70 m, 176,80 - 177,00 m, 182,20 - 182,40 m, 211,50 - 211,75 m, 234,40 - 234,60 m, 242,00 - 242,20 m are present positions of a white barren secretion quartz (locally tectonic breccic too). Between 164,40 - 169,00, 172,00 - 178,20 m and between 181,10 - 183,90 m and between 199,40 - 200,70 m are present positions of a tiny-grained chloritic, feldspatic amphibolitic with a sheeting and massive-schistose and maculose-schistose structure. Locally are present some spots of carbonates, some little grains of garnet and some flakes of biotite too, but locally only. Between 208,00 - 217,00 m ca. are present a lot of allotriomorphic and hypidiomorphic grains of pyrite only.

258,25 - 259,40 The very strong impregnation of sulphides (pyrite mostly) in quartzite with some schliers and intercalations og a strongly chloritic and weakly biotitic gneissic greenschist with a phacoidal schistose and myllonitic structure, ca. between 258,45 - 258,75 m. Another positions of ore body has a massive structure with a cataclastic and porphyric structure. The result of the chemical analyses from this position between 258,25 - 259,45 m are: Between 258,25 - 259,00 m: Cu 0,13 %, Zn 4,40 %, S 31,25 %. Between 259,00 - 259,40 m is: Cu 0,47 %, Zn 5,00 %, S 36,50 %.

259,40 - 266,60 The chloritic and biotitic and weakly biotitic gneiss and gneissic schist with some poor impregnation of pyrrite mostly, but scarce are present locally only some little chambres of chalcopyrite too. Locally are present some little grains of garnet. The allotriomorphic and hypidiomorphic grains of pyrite are acummulated locally too schliers and lenticles, 1-3 cm thick maximally (in example in 262,70 m and in 262,90 m about.) The structure of this rock is fluidial and phacoidal-schistose. This rock is oftenly strongly folded and crumpled. The average gradient of this foliation is 65°-70° about.

266,60 - 272,80	The chloritic and weakly biotitic and weakly sericitic gneissic schist, locally with some flakes or with some very little schliers of pyrrhotite. Some little allotriomorphic grains of pyrite are present scarce only. The structure of this rock is fluidial and crumpled and this rock is trongly folded and crumpled oftenly. The average gradient of this foliation is 65^{o}-70^{o} about.
272,80 - 278,10	The keratophyre rock with a big crushed grains of garnet and with a lot of little and bigger rodlike and acicular porphyroblasts (crushed oftenly too) of hornblende. Locally are present chlorite and some little flakes of biotite. The structure is massive mostly and the texture is blastoophitic and blastoporphyric. Locally only are present some little, oftenly irregular chambres or schliers of pyrrhotite.
278,10 - 278,70	The chloritic, weakly sericitic and weakly talcic phyllotite or phyllitic schist with a crumpled and fluidial structure. Some little irregular schliers with a weak graphitic substance are locally present too. The average gradient of this foliation is 70^{o} about. This rock is folded and strongly crumpled too.
	This borehole no. 187, Grimsdalen was stopped at 278,70 m on September 10th at 23.00 in the night.

(M. Motys).

The borehole no. 186, GRIMSDALEN.

The brief petrografical description.

0,00 - 22,40	The motley serie of a chloritic and biotitic garnet gneissic mica schist, with a fluidial or phacoidal schistose structure. This rock is very strongly crumpled but more flat only. The average gradient of this foliation is 50^{o}-55^{o} about, but 35^{o}-40^{o} locally too.
22,40 - 73,50	The serie of a strongly chloritic weakly biotitic greenschist or gneissic greenschist locally only with not much little grains of garnet locally only. Some chambres or schliers of a zoisite-epidote matrix are present locally only too. Locally are present some small position of a white barren secretion quartz scarce with some included grains of a carbonate (dolomite-ancerite). The structure is fluidial and phacoidal or phacoidal schistose. This rock is oftenly crumpled and folded by the diagonal and flat folds of a mm, cm and dm amplitude. The average gradient of this foliation is 55^{o}-60^{o} about but locally 80^{o}-85^{o} too.
73,50 - 85,30	The strongly chloritic and biotitic greenschist and gneissic greenschist with a lot of little schliers and little intercalations of a quartz and of a quartz fedlspatic matrix (locally with some little grains of a garnet in). This rock is very strongly folded and crumpled. The structure is fluidial and phacoidal or phacoidal schistose. The average gradient of this foliation is 50^{o}-55^{o} about.
85,30 - 98,20	The strongly chloritic gneissic greenschist with little grains of garnet and with a massive-sheeting structure, locally with some little intercalations of a chloritic and hornblende gneiss with garnet and biotite too. The average gradient of this foliation is 60^{o}-65^{o} around.
98,20 - 173,40	The motley serie of a strongly chloritic and biotitic gneissic schist and gneissic greenschist with a fluidial and phacoidal schistose structure with some little allitriomorphic and hypidiomorphic grains of FeS_2 locally only and with a lot of thin positions or intercalations of a hornblende and garnet keratophyre rock in example in 100,50 - 101,20 m, 102,50 - 102,90 m, 110,00 - 111,30 m, 119,30 - 119,90 m, 121,40 - 121,80 m, 126,50 - 126,90 m, 127,40 - 129,00 m, 129,90 - 130,50 m, 140,30 - 141,30 m, 146,40 - 146,80 m, 152,90 - 153,50 m, 165,00 - 166,40 m, 169,70 - 170,15 m, 173,75 - 174,00 m. Between 108,00 - 110,00 m and between 138,40 - 140,30 m are present positions of a garnet, hornblende, chloritic and biotitic gneiss

or gneissic schist with a fluidial and crumpled and phacoidal schistose structure. In the position between 138,40 - 140,30 m are present a lot of hypidiomorphic and allotriomorphic grains of FeS_2 mostly only. Between 107,00 - 108,00 m and between 111,30 - 113,50 m are present positions of a strongly chloritic, weakly biotitic and carbonatic, feldspatic, gneissic greenschist with a massive - maculose structure mostly. Between 141,30 - 141,90 m 147,40 - 148,00 m, 148,20 - 148,50 m, 159,40 - 159,70 m and between 163,90 - 164,50 m and 176,15 - 170,30 m are present positions of a white barren secretion quartz, locally breccic type with some little inclusions of a chloritic matrix

173,40 - 179,40 — The chloritic, weakly biotitic and garnet gneissic schist, scarce with some grains of FeS_2 and scarce with some rodlike or acicular porphyroblasts of hornblende. The structure is phacoidal-schistose and fluidial and this rock is oftenly crumpled and folded by the flat and diagonal folds of a mm, cm and dm amplitude. The average gradient of this foliation is 50^{o}-55^{o} around.

179,40 - 180,25 (0,85 m) — The very strong impregnation of sulphides (mostly pyrite) in a quartzite with a cataclastic and porphyric texture and with a massive structure mostly. Between 179,80 - 179,90 m is present a position of a strongly chloritic weakly biotitic greenschist with some very poor impregnation of FeS_2 mostly only. The result of the chemical analyse from this position between 179,40 - 180,25 m is: Cu , Zn , S
But some very little chambres of $CuFeS_2$ and FeS are locally only present too. The structure is phacoidal-schistose and gradient of foliation 60^{o}-65^{o} about.

180,25 - 180,50 — The strongly chloritic and weakly biotitic greenschist with a phacoidal schistose structure and with some little flakes or allotriomorphic grains of FeS_2 locally and scarcely only. The result of the chemical analyse from this position between 180,25 - 180,50 m is: Cu , Zn , S

180,50 - 182,25 (1,75 m) — The very strong impregnation of sulphides in quartzite as well as in 179,40 - 180,25 m. Between 181,22 - 181,25 m is present a intercalation of a strong chloritic greenschist as well as in 180,25 - 180,50 m. The result of the chemical analyses from this position between 180,50 - 182,25 m are:
Between 180,50 - 181,25 m: Cu , Zn , S
Between 181,25 - 182,25 m: Cu , Zn , S

182,25 - 182,40 — The strongly chloritic greenschist as well as in 179,80 - 179,90 m but with more little irregular chambres or flakes of calcopyrite and of pyrrhotite too. The result of the chemical analyse from this position between 182,25 - 182,40 m is: Cu Zn , S

182,40 - 182,60 0,20m — The very strong impregnation of sulphides in quartzite as well as in 179,40 - 180,25 m. The result of the chemical analyse from this position between 182,40 - 182,60 m is: Cu , Zn S

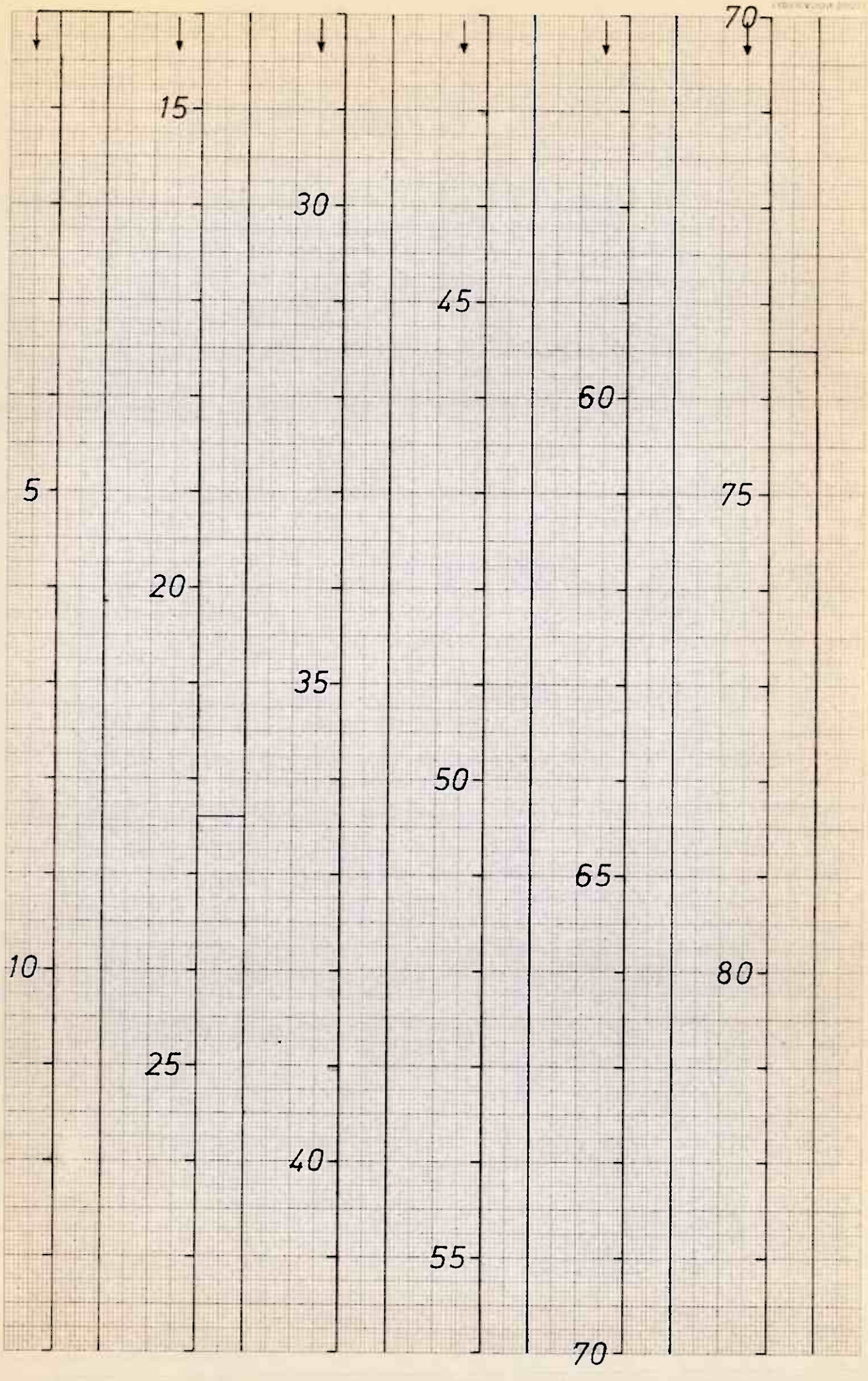
182,60 - 184,00 — The strongly quartzy chloritic and weakly biotite gneissic schist with a myllonitic, crumpled and phacoidal-schistose structure. In this rock are present a poor impregnation of pyrite mostly (a lot of hypidiomorphic and allotriomorphic grains of FeS_2). The average gradient of this foliation is 60^{o} about. The result of the chemical analyse from this position between 182,60 - 184,00 m is: Cu , Zn , S

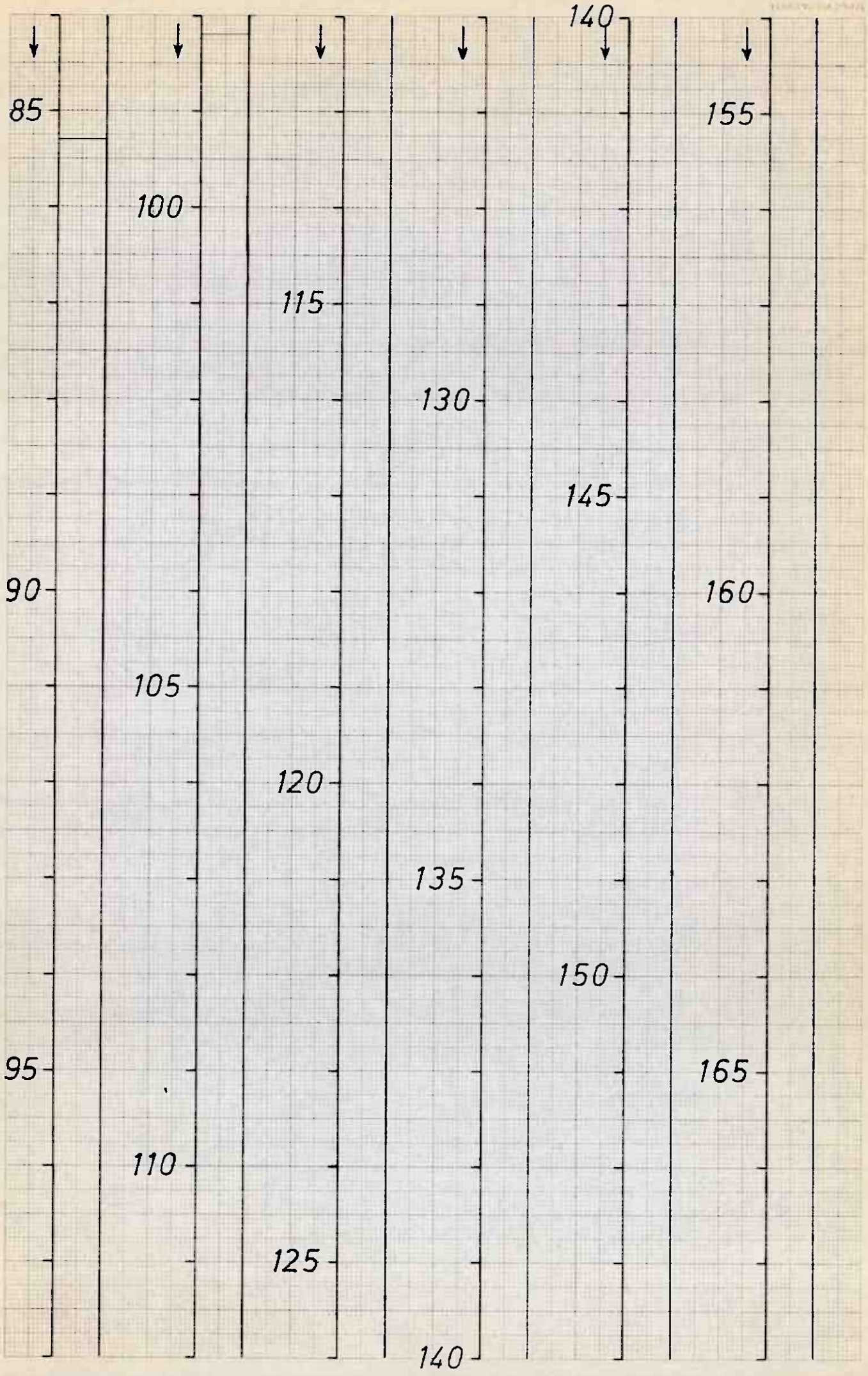
184,00 - 187,50 — The strongly chloritic and more weakly biotitic phyllitic and locally gneissic greenschist with a lot of schliers or pellets of a quartz matrix and with a lot of allotriomorphic and hypidiomorphic grains of pyrite. The structure is pell-mell crumpled myllonitic and phacoidal-schistose. This rock is folded locally too by the folds of a cm, and dm amplitude. The average gradient of this foliation is 60^{o}-65^{o} around.

This borehole no. 186, Grimsdalen was stopped at 187,50 m on September 3rd 1970 at 11.30 a.m.

(M. Motys).

The petrografical profile of the borehole nr.

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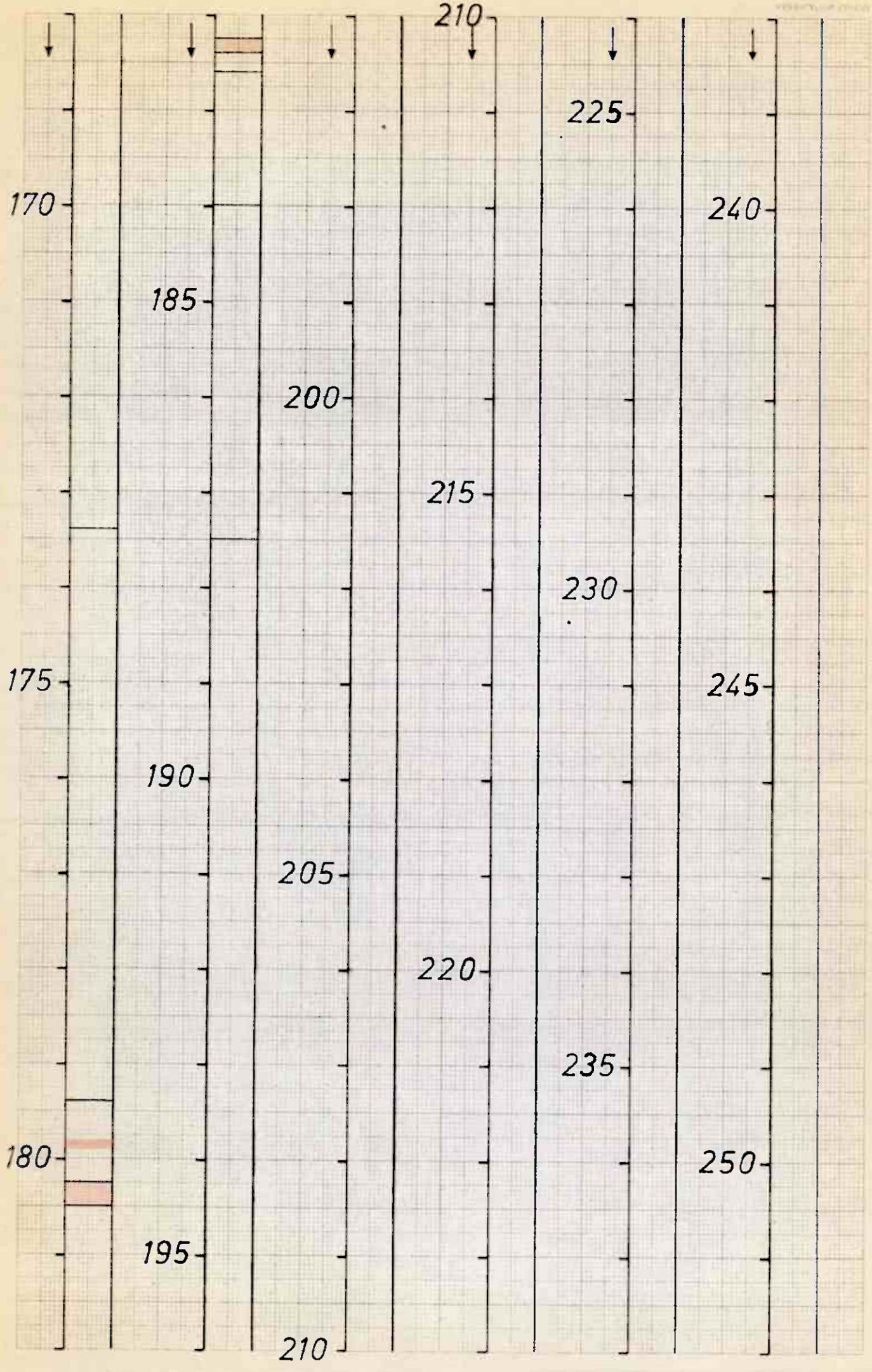
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The borehole no. 185, G R I M S D A L E N .

The brief petrografical description.

0.00 - 73,20	The motley serie of a chloritic, hornblende and biotitic gneissic schist and a chloritic biotitic hornblende gneiss. Some little grains of garnet are present very scarce only. The structure is fluidial and phacoidal schistose. The average gradient of this foliation is 60°-70° about but this rock is folded very strong locally and crumpled too, by the oblique folds of a mm, cm and dm amplitude. Between 17,70 - 17,85 m, 18,80 - 18,90 m and between 36 30 - 36,50 m are present a white barren secretion quartz. Between 47,70 - 48,30 m, 49,40 - 49,70 m, 50,30 - 50,60 m are present the positions of a hornblende, garnet and weakly biotitic ceratophyre rock with a massive structure, without a clear grain clongation of the acicular or rodlike porphyroblasts of hornblende. Between 62,10 - 63,60 m is present a position of a chloritic, hornblende and garnet gneissic schist.
73,20 - 76,00	The amphibolitic, chloritic gneiss with a big rodlike porphyroblasts of hornblende and with some grains of garnet. The structure is sheeting. The average gradient of this foliation is 70°-80° about.
76,00 - 78,50	The quartzy, weakly chloritic, sericitic schist with some little flakes of biotite too. The structure is banking or sheeting. The average gradient of this foliation is 65° about.
78,50 - 81,00	The chloritic and hornblende gneissic schist with some grains of garnet, with a fluidial and phacoidal structure. This rock is mostly folded and scrumpled. The average gradient of this foliation is 70° about, but locally 0°-20° about too.
81,00 - 81,90	The hornblende, garnet ceratorphyre rock with some little flakes of biotite weakly too, with a massive and sheeting structure. The acicular and rodlike porphyroblasts of hornblende have locally not so clear grain clongation.
81,90 - 83,00	The strongly chloritic and weakly biotitic greenschist with some little schliers of a quartz or of a quartz-feldspatic matrix. Some little and small hypidiomorphic grains of pyrite are present but locally only. The structure of this rock is fluidial and phacoidal schistose and mostly is this rock strongly folded and scrumpled too. The average gradient of this foliation is 50° around.

83,00 - 86,20 The chloritic and carbonatic gneissic schist with a maculose and maculose-schistose structure. Some little flakes of biotite are locally present too. The average gradient of this foliation is 65° around.

86,20 - 117,00 The motley serie of a strongly chloritic and biotitic greenschist and locally a gneissic greenschist like in 81,90 - 83,00 m. The average gradient of this foliation is 70° and 75°-80° about locally too. Between 106,30 - 106,50 m is position of white barren secretion quartz.

117,00 - 154,40 The motley serie of a strongly chloritic and biotitic garnet and hornblende gneissic schist with a phacoidal-schistose, rope and fluidial structure, locally folded by the oblique and flat folds. The average gradient of this foliation is 45°-50° about but 60° too. Between 122,40 - 123,20 m, 124,80 - 125,10 m, 125,80 - 126,60 m, 131,60 - 132,40 m, 133,30 - 134,20 m, 137 00 - 138,00 m and between 141,80 - 142,40 m are present positions of a hornblende and garnet ceratophyre rock with a massive or little bit sheeting structure. Between 135,00 - 135,90 m is present a hornblende and strongly chloritic gneissic schist, without garnets grains mostly.

154,40 - 154,80 The very strong impregnation of pyrite mostly in a quartzite with some inclusions of a chloritic matrix locally. The structure is massive and the texture is porphyric and cataclastic. The result of the chemical analyse from this position between 154,40 - 154,80 m is: Cu Zn S

154,80 - 155,05 The chloritic, garnet, biotitic and hornblende gneissic schist as well as in 117,00 - 154,40 m, with a very poor impregnation of pyrite mostly only. The result of the chemical analyse from this position between 154,80 - 155,65 m is: Cu Zn S

155,05 - 155,30 The very strong impregnation of pyrite mostly in quartzite as well as in 154,40 - 154,80 m. The result of the chemical analyse from this position between 155,05 - 155,30 m is: Cu Zn S

155,30 - 156,25 The chloritic, biotitic, quartzy, gneissic schist with a phacoidal and pell-mell structure and with some poor impregnation of sulphides (pyrite mostly, but some little chambres of $CuFeS_2$, ZnS and FeS are locally present too. The result of the chemical analyse from this position between 155,30 - 156,25 m is: Cu , Zn S

156,25 - 156,50 The very strong impregnation of sulphides(pyrite mostly) in quartzite as well as in 154,40 - 154,80 m but with more schliers and chambres of a chlorit matrix and with some inclusions of a quartz matrix too. The result of the chemical analyse from this position between 156,25 - 156,50 m is: Cu Zn S

156,50 - 156,70 The strongly chloritic and biotitic gneissic greenschist with a lot of schliers of a quartz matrix, with a phacoidal and phacoidal-schistose structure. Some poor impregnation of sulphides (pyrite mostly) is present too. The result of the chemical analyse from this position between 156,50 - 156,70 m is:
Cu Zn S

156,70 - 156,90 The very strong impregnation in quartzite as well as in 154,40 - 154,80 m. The result of the chemical analyse from this position between 156,70 - 156,90 m is: Cu Zn S

156,90 - 166,40 The strongly chloritic, weakly gneissic greenschist and greenschist, with some small and little porphyroblasts of hornblende locally only and with some spots of carbonate (dolomite) locally too. Some hypidiomorphic grains of pyrite are present oftenly. The structure is phacoidal schistose and fluidial. The average gradient of this foliation is 55^{o}-60^{o} about, but locally 70^{o} too.

166,40 - 170,00 The strongly chloritic, weakly biotitic gneissic schist with a phacoidal schistose and maculose schistose structure and with a lot of hypidiomorphic and allotriomorphic grains of FeS_2. The average gradient of this foliation is 60^{o}-65^{o} about.

170,00 170,50 The weakly chloritic and weakly sericitic, quartzy keratophyre rock scarce with some little grains of garnet. The structure is banking or sheeting. The average gradient of this foliation is 70^{o} about.

This borehole no. 185 was stopped at 170,50 m on August 27th 1970 at 10.30 a.m.

(M. Motys).

The borehole no. 184, Grimsdalen.

The brief petrographical description.

0,00 - 37,10	The strongly chloritic biotitic and weakly amphibolitic gneissic greenschist with a lot of little schliers and pellets of a quartz and of a quartz fedlspatic matrix. The structure is schistose and phacoidal schistose. This rock is locally strongly folded and crumpled too. The average gradient of this foliation is 60° - 65° about.
37,10 - 76,30	The motley serie of the chloritic amphibolitic and garnet gneissic schist with schistose and phacoidal schistose and fluidial structure. Locally is this rock folded or crumpled too, by the folds of a dm, cm and mm amplitude. Some idiomorphic and hypidiomorphic grains of pyrite are present locally too, mostly around 37,00 - 37,80 m. The average gradient of this foliation is 45°-50° and 60°-65° around. Between 18,70 - 19,00 m, 19,40 - 19,60 m, 40,50 - 40,60 m, 40,80 - 40,90 m, 54,70 - 54,90 m, 55,60-- 55,90 m, 57,10 - 57,30 m, 59,50 - 59,80mm 70,70 - 70,80 m and between 75,20 - 75,30 m are present positions of a barren section quartz, locally with some spots or pellets of carbonates (ankerite). Between 50,70 - 51,80 m, 52,60 - 52,90 m, 58,50 - 58,90 m, 60,10 - 61,00 m and between 66,10 - 66,90 are present positions of a hornblende and garnet keratophyre.
76,30 - 77,05 0,75 m	The very strong impregnation of sulphides in quartzite (pyrite mostly). The structure is massive and the texture is cataclastic. The result of the chemical analyse from this ore position between 76,30 - 77,05 m is: Cu Zn , S
77,05 - 77,30	The strongly chloritic greenschist with some flakes of biotite and with some little grains of garnet with very poor impregnation of pyrite mostly. The structure is phacoidal schistose. The average gradient of this foliation is 50°-60° about. The result of the chemical analyse from this position between 77,05 - 77,30 m is: Cu , Zn , S
77,30 - 78,15 0,85m	The very strong impregnation of sulphides as well as in 76,30 - 77,05 m. The result of the chemical analyse from this position between 77,30 - 78,15 m is: Cu Zn S
78,15 - 78,50	The quartzite and weakly chloritic quartzite schist with a very poor impregnation of sulphides (pyrite mostly) with some spots or

grains of ancerite. The result of the chemical analyse from this position between 78,15 - 78,50 m is: Cu Zn S

78,50 - 79,30
0,80 m

The very strong impregnation of sulphides (pyrite mostly) as well as in 76,30 - 77,05 m. The result of the chemical analyse from this position between 78,50 - 79,30 m is: Cu Zn , S

79,30 - 81,90

The biotitic, chloritic and hornblende gneissic greenschist without garnet with some hypidiomorphic and idiomorphic grains of pyrite locally only. And with more strong impregnation of sulphides (pyrite mostly) between 81,35 - 81,50m and between 81,80 - 81,90 m. Between 81,50 - 81,80 m is present a white barren secretion quartz. The result of the chemical analyse from this position between 79,30 - 81,90 m is: Cu , Zn ,S

81,90 - 87,90

The chloritic, amphibolitic gneissic greenschist as well as in 0,00 - 37,00 m, without garnet but with some hypidiomorphic and idiomorphic grains of pyrite locally only. The average gradient of this foliation is 50° around.

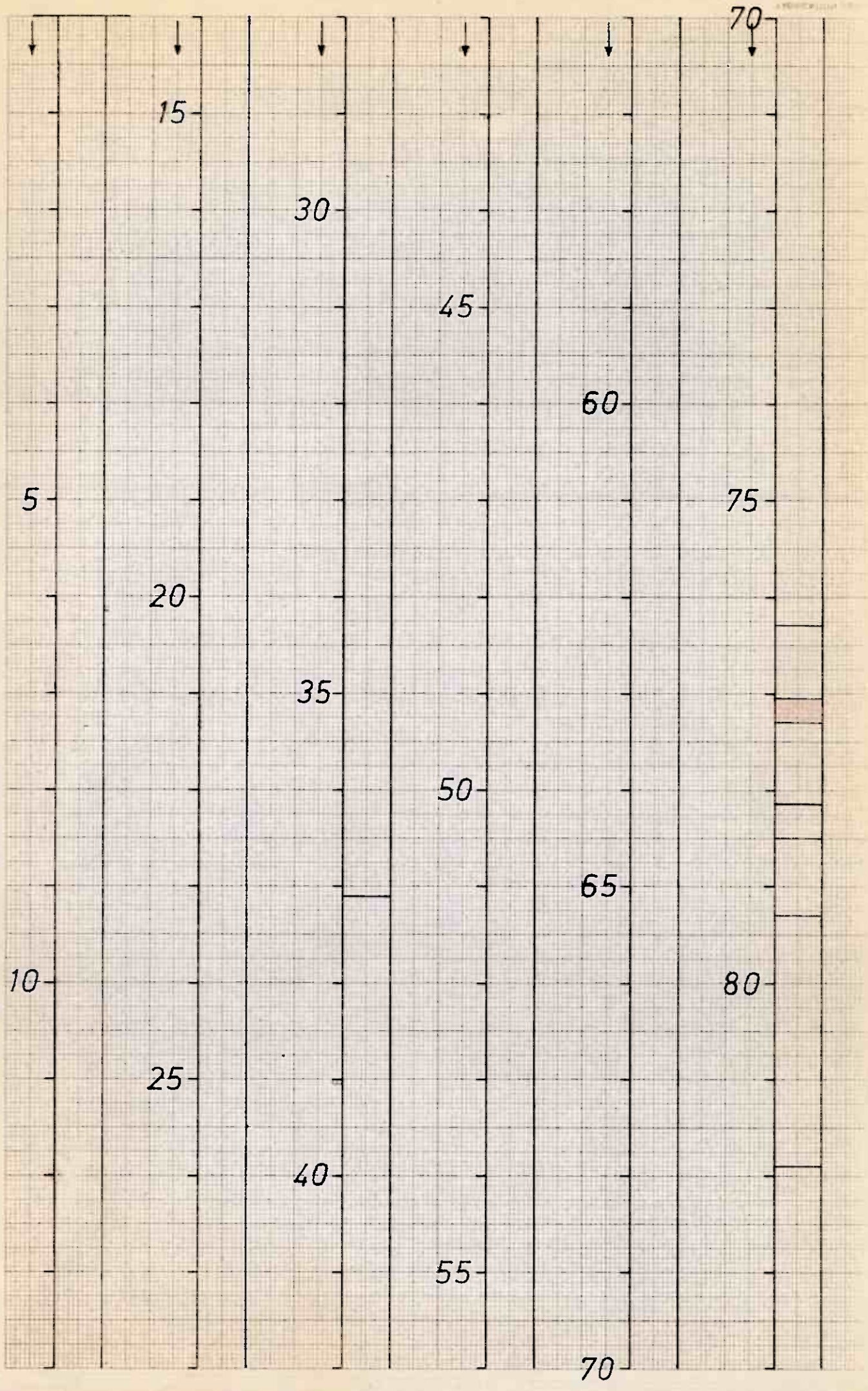
87,90 - 103,90

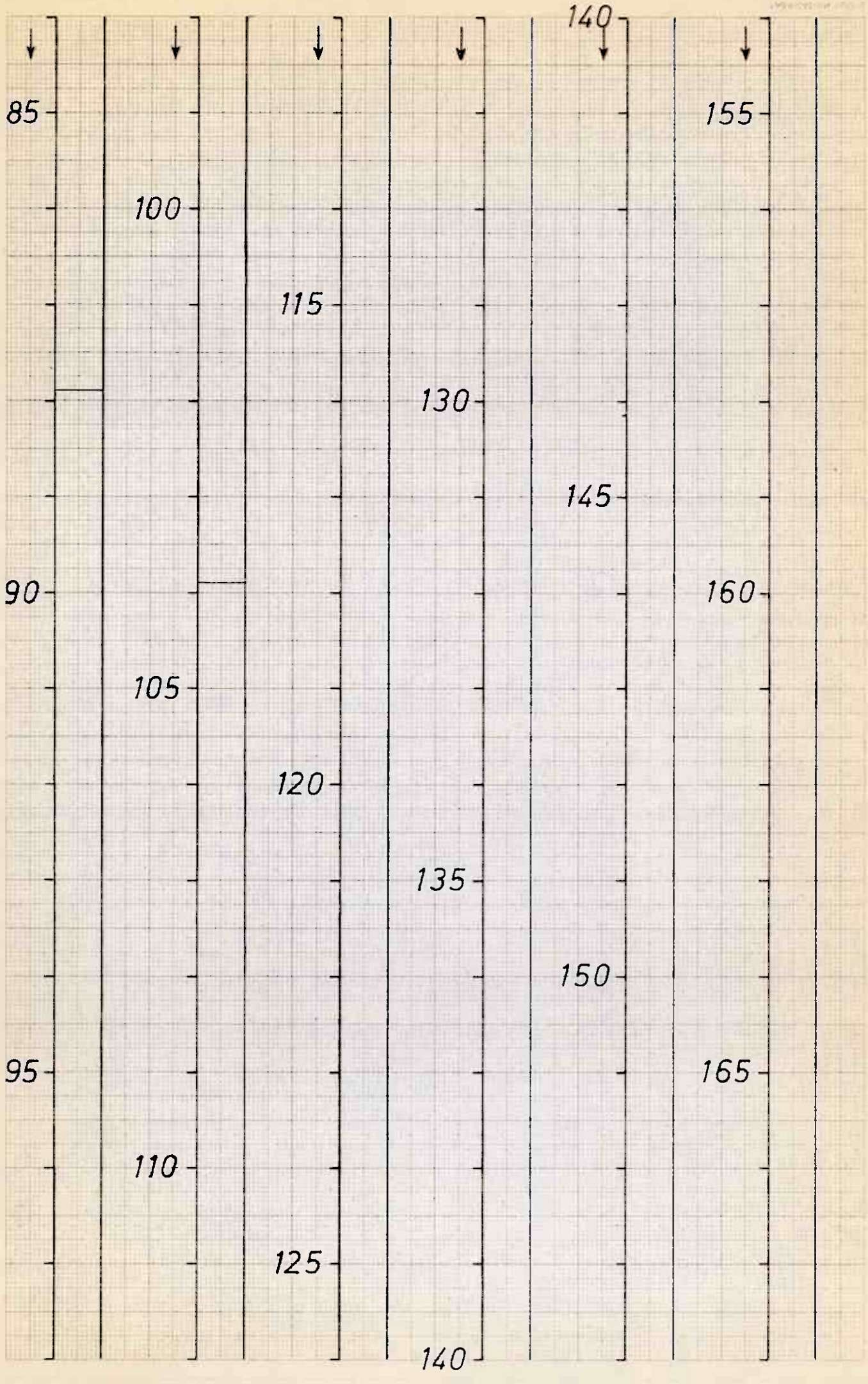
The strongly sericitic and chloritic phyllitic micaschist with some grains of garnet and with porphyroblasts of hornblende locally and with some little schliers with a graphitic substance locally (in example between 89,10 - 89,30 m and between 101,40 - 101,60 m). The structure is fluidial and phacoidal schistose. Locally is this rock folded too. Between 90,00 - 99,60 m is present a white barren secretion quartz. The average gradient of this foliation is 50°-60° about.

This borehole no. 184, Grimsdalen was stopped at 103,90 m on August 20th 1970 at 10,00 a.m.

(M. Motys).

The petrografical profile of the borehole nr.

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The borehole no. 183, GRIMSDALEN.

The brief petrografical description.

0,00 - 13,40 The talc-chloritic and sericitic phyllitic schist, with some little flakes of pyrrhutite scarce only too. The structure is paralell schistose. The average gradient of this foliation 80°-85° around. Between 12,25 - 12,30 m is present a position with a weak graphitic substance. Between 12,40 - 12,65 m is present position of a white barren secretion quartz.

13,10 - 18,10 The carbonatic, chloritic and more weakly sericitic phyllitic greenschist with a lot of little schliers little spots or pellets of a carbonats (dolomite, ancerite, calcite.) Some little irregular grains or flakes of pyrite are present locally only. The structure is maculose and maculose schistose. The average gradient of this foliation is 70°-80° around.

18,10 - 20,40 The talc-chloritic and sericitic, phyllitic schist as well as in 0,00 - 13,40 m. The average gradient of this foliation is

20,40 - 22,00 The amphibolitic and garnet gneiss granulite with a sheeting or banking structure. The hornblende creats a lot of acicular or rodlike porphyroblasts but without some clear grain elongation. The garnet creats very much idiomorphic grains.

22,00 - 23,40 The strongly, chloritic, amphibolitic and garnet gneissic greenschist with a phacoidal and phacoidal schistose structure. The hornblende creats much very little acicular porphyroblasts. Locally are present some lenticles chambres of a chloritic, talc and zoisite-epidotic matrix. The average gradient of this foliation is 55°-60° around.

23,40 - 24,90 The strongly biotitic and chloritic, gneissic greenschist with a phacoidal and phacoidal-schistose structure. The average gradient of this foliation is 60°-65° around.

24,90 - 37,30 The motley serie of a strongly chloritic, biotitic and garnet greenschist and of a strongly chloritic garnet greenschist, with a phacoidal-schistose and phacoidal structure. Some little schliers with a very weak impregnation of a graphitic substance are present locally only, but between 36,30 - 36,60 m is present a position of a strongly graphitic phyllitic schist with a lot of little flakes or irregular little chambres of pyrrhotite and of pyrite too. The structure is pell-mell, phacoidal and phacoidal schistose. The average gradient of the foliation between 24,90 - 37,30 m is 70° around.

37,30 - 48,50 The motley serie of a strongly chloritic, biotitic and garnet greenschist and gneissic-greenschist with a phacoidal and phacoidal-schistose structure Some schliers, pellets or chambres of a white barren secretion quartz are present very oftenly. Locally is this rock folded by the diagonal folds of a mm, cm and dm amplitude. The average gradient of this foliation is 50°-55° around.

48,50 - 72,80 The motley serie of a strongly chloritic and biotitic gneissic-greenschist and greenschist with a phacoidal-schistose, phacoidal and with a schistose structure. This rock is locally folded by the folds of a mm, cm and dm amplitude. Some irregular grains or some flakes of pyrite are locally present too. Between 51,20 - 56,60 m and between 61,20 - 65,60 m are present some mylloniti and tectonic zones of this rock. The average gradient of foliation is 20° about only.

72,80 - 104,40 The strongly chloritic gneissic-grenschist with a lot of schliers or little intercalations of quartz or of a quartz-feldspatic matrix. The structure is banking and schistose. This rock is locally strongly folded by the folds of a mm, cm and dm amplitude. Garnet isn't present. The average gradient of this foliation is 65°-70° about. Some idiomorphic and hypidiomorphic grains of pyrite are present locally only. Some little flakes of biotite are present more scarcely only. Between 100,40 - 101,00 m is present position of a white barren secretion quartz with some inclusions of a chloritic matrix.

104,40 - 105,40 The talcis, chloritic and weakly hornblende and weakly carbonatic (dollomite-ankerite) green mica schist with little bit sericite too. The structure is very small maculose schistose but more massive with only little bit clear sheeting. Locally only are present some flakes or little lenticles of pyrite mostly only.

105,40 - 111,50 The strongly chloritic gneissic greenschist as well as in 72,80 - 104,40 m. The average gradient of this foliation is 70°-75° around. Between 108,20 - 108,60 m is present a position of a chloritic, amphibolitic and garnet keratophyre or granulite gneiss, with only little bit clear grain clongation of acicular or rodlike porphyroblasts of hornblende.

111,50 - 129,20 The strongly chloritic gneissic greenschist as well as in 72,80 - 104,40 m but with some little grains of garnet or with some schliers in which are acumulated them. The structure is more phacoidal-schistose. The average gradient of this foliation is 70°-80° around. Between 113,00 - 113,80 m is present a position of a amphibolitic keratophyre, locally with some chambres or pellets of a zoisite-epidote and epidote matrix. Between 118,70 - 119,00 m is present a position of a white barren secretion quartz with some little inclusions of a chloritic matrix, of biotite

flakes and with chambres of a zoisite-epidote and of a epidote matrix.

129,20 - 130,20 The hornblende and chloritic keratophyre with some little schliers and chambres of a zoisite-epidotic matrix. This grain clongation of acicular or rodlike porphyroblasts of hornblende is little bit clear. The structure is massive and sheeting.

130,20 - 133,10 The strongly chloritic and very weakly biotitic greenschist and gneissic greenschist, without grains of garnet, but with flakes, little chambres or idiomorphic and hypidiomorphic grains of pyrite. The structure is paralell schistose and phacoidal-schistose. The average gradient of this foliation is 70°-75° around.

133,10 - 140,00 The strongly myllonitic and tectonic zone in a strongly chloritic greenschist and in chloritic gneissic greenschist and between 136,40 - 138,00 m and between 138,60 - 139,00 m in a hornblende keratophyre . This rock is oftenly very strongly folded too. Some idiomorphic and hypidiomorphic grains and flakes of pyrite are present too.

140,00 - 142,00 The chloritic, amphibolitic and garnet gneissic greenschist with a sheeting structure. The rod-like and acicular porphyroblasts of hornblende haven't a clear grain clongation. Some flakes of biotite are locally present too. The average gradient of this foliation is 80° around.

142,00 - 143,60 The talcic, chloritic and weakly sericitic green mica schist, locally only with some little acicular or rodlike porphyroblasts of hornblende (aktinolite). The structure is massive and schistosity isn't so clear. Some little flakes of FeS_2 mostly are locally only present too.

143,60 - 151,20 The chloritic and amphibolitic gneissic schist with a lot of rodlike and acicular porphyroblasts of hornblende, without a clear grain clongation Garnet isn:t present mostly. Between 145,40 - 145,70 m is present a white barren secretion quartz, which has locally only some little inclusions or little chambres of a chloritic matrix.

151,20 - 154,80 The strongly chloritic and quartzy gneissic greenschist with some little grains of garnet too and with some flakes of biotite. Some little hypidiomorphic grains or flakes are created by pyrite locally too. The structure is schistose and phacoidal schistose. The average gradient of this foliation is 60° around.

154,80 - 159,40 The chloritic, amphibolitic and garnet gneiss or gneissic schist. The acicular and rodlike porphyroblasts of hornblende have locally only little

bit clear a total grain clongation. The structure is sheeting and banking. The average gradient of this foliation is 70° around.

159,40 - 169,20 The strongly chloritic, biotitic, weakly amphibolitic greenschist and locally gneissic greenschist with some little grains of garnet. Pyrite creats locally some idiomorphic and hypidiomorphic grains or flakes. The structure is schistose and phacoidal schistose. The average gradient of this foliation is 70°-80° but 85° about too. Between 161,20 - 161,40 m is present a white barren secretion quartz.

162,20 - 171,00 The hornblende keratophyre, locally only with some irregular schliers or irregular chambres of a zoisite-epidote and of a epidote matrix. The structure is massive mostly, but locally sheeting little bit too.

171,00 - 174,60 The strongly chloritic biotitic and hornblende green gneissic schist with much schliers or pellets of a white barren secretion quartz, with spots of carbonates (dollomite - ankerite) locally too and with a lot of rodlike and acicular porphyroblasts of hornblende. Flakes of biotite are present too. Small and little grains of garnet are present more weakly. The structure is schistose and phacoidal-schistose and this rock is folded locally too. The average gradient of this foliation is 70°-80° around.

174,60 - 176,05 The chloritic, amphibolitic and garnet gneiss or gneissic schist. The structure is fluidial and schistose and phacoidal-schistose. The rock is oftenly folded by the folds of a mm, cm and dm amplitude. The average gradient of this foliation is 70° around.

176,05 - 177,40 The chloritic and hornblende keratophyre schist with a lot of grains of garnet. The little rodlike and acicular porphyroblasts of hornblende habe little bit clear a total grain clongation. The structure is massive and little bit banking.

177,40 - 207,40 The motley serie of a chloritic and hornblende green gneissic schist and of a chloritic, amphibolitic greenschist and of a chloritic and a hornblende gneiss with a lot of lottle and small grains of garnet and with very much schliers and pellets of a white barren secretion quartz or of a quartz matrix. The structure is schistose, phacoidal-schistose and fluidial locally too. This rock is locally strongly folded too. The average gradient of this foliation to 195,00 m is 70°-80° around, but after 195,00 m 60° about. Between 178,40 - 178,70 m, 185,40 - 186,50 m and between 189,20 - 189,80 m are present the positions of a amphibolitic and garnet keratophyre gneiss, strongly quartzy as well as in 169,20 - 171,00 m. Between 178,90 - 179,10 m, 193,10 -

193,30 m and between 196,20 - 196,40 m are present the positions of a white barren secretion quartz.

207,40 - 209,40 — The chloritic and biotitic gneissic greenschist, without grains of garnet and with some little porphyroblasts of hornblende scarcely only. Some spots flakes of pyrite or irregular lenticles which are following a schistosity are present but not so much. The structure is schistose, fluidial and phacoidal-schistose. This rock is locally strongly folded by the folds of a cm and dm amplitude. The average gradient of this foliation is 50° about. The result of the chemical analyse from this position between 207,40 - 209,40 m is: Cu , Zn , S

209,40 - 209,50 (0,10 m) — The very strong impregnation of pyrite mostly in a quartzite. The structure is massive and the texture is cataclastic and porphyric. The result of the chemical analyse from this ore position between 209,40 - 209,50 m is: Cu , Zn , S

209,50 - 209,70 — The myllonitic chloritic gneissic schist, with biotite and locally with some rodlike and crushed porphyroblasts of hornblende and with some chambres and spots which have a strong impregnation of pyrite mostly only. Locally are present some schliers and pellets of a quartz (secretion, barren only). The structure of this rock is phacoidal and pell-mell. The result of the chemical analyse from this position between 209,50 - 209,70 m is: Cu , Zn , S

209,70 - 211,00 — The strongly chloritic gneissic-greenschist with some rodlike and crushed porphyroblasts of hornblende, locally with some flakes of biotite and with some pellets or schliers of a quartz. Locally are present some irregular grains or irregular little lenticles of pyrite mostly only. The structure is phacoidal schistose and fluidial. Locally is this rock folded too. The average gradient of this foliation is 60° about. The result of the chemical analyse from this position between 209,70 - 211,00 m is: Cu , Zn , S

211,00 - 211,20 — The myllonitic, chloritic gneissic-greenschist as well as in 209,50 - 209,70m. The result of the chemical analyse from this position between 211,00 - 211,20 m is: Cu , Zn , S

211,20 - 219,80 — The strongly, chloritic, little bit biotitic greenschist or weakly gneissic greenschist, with a lot of schliers and pellets of a quartz matrix and locally only with some spots or grains of carbonates (dollomite-ancerite). Locally are present some irregular lenticles, spots and irregular little chambres of pyrite. The structure

is phacoidal and phacoidal schistose. The average gradient of this foliation is 50°-60° around. The result of the chemical analyse from this position between 211,20 - 212,00 m is:
Cu , Zn , S

219,80 - 221,00 The sericitic, chloritic and garnet mica schist with some rodlike and acicular porphyroblasts of hornblende. The structure is sheeting and fluidial. The average gradient of this foliation is 70°-80° about.

221,00 - 229,00 The motley serie of a chloritic, weakly sericitic phyllitic schist, locally with some very little intercalations with a weak graphitic substance (between 226,80 - 227,40 m). In 227,10 m is present a position (1-1,5 cm) with a graphitic substance and with a very poor impregnation of pyrrhotite and scarce of pyrrite too. The structure is schistose and phacoidal schistose. The average gradient of this foliation is 80° about.

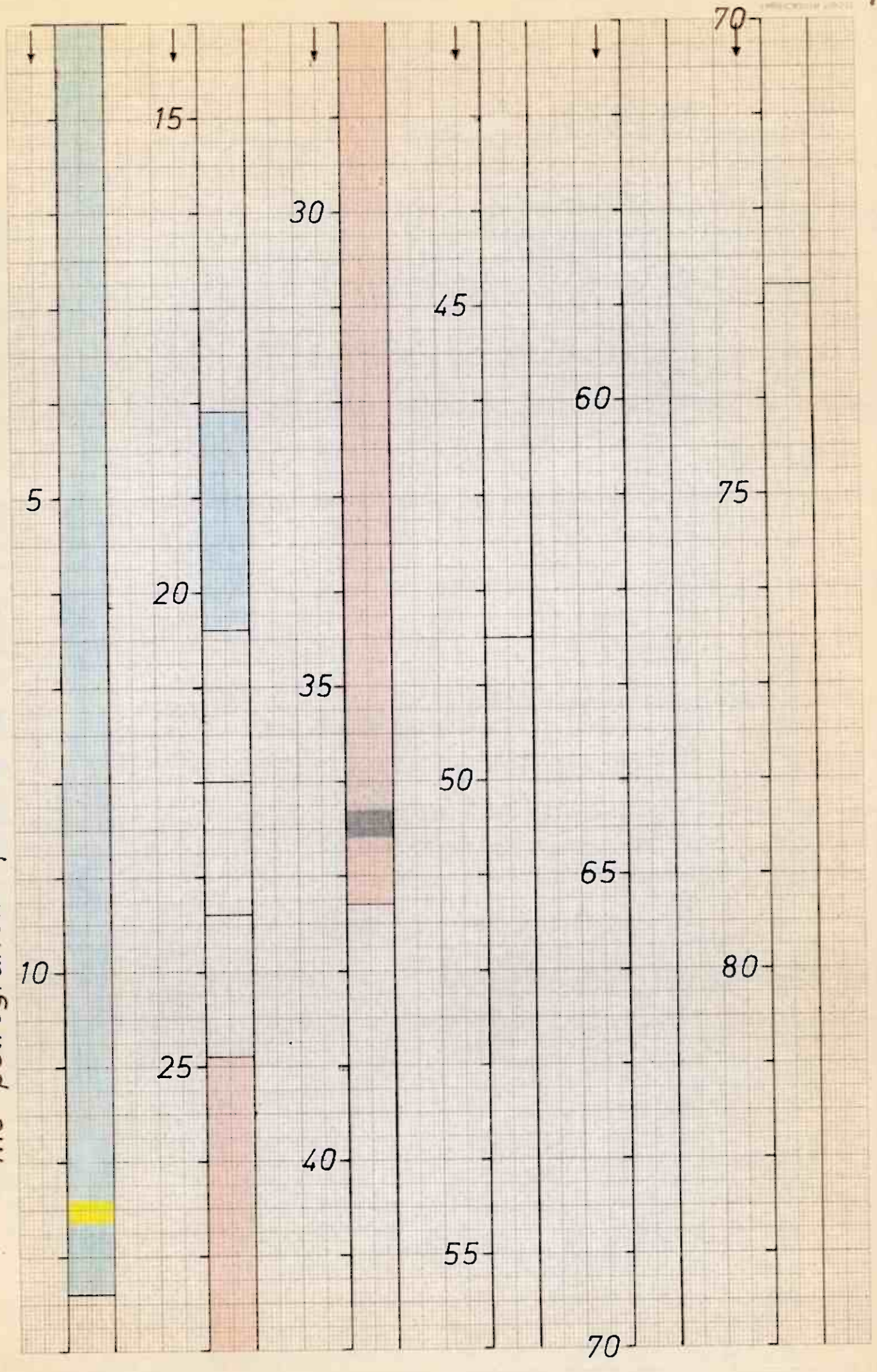
229,00 - 230,10 The quartzy keratophyre rock with acicular porphyroblasts of hornblende and with grains of garnet locally too. Locally are present some lenticles of quartz. The structure is massive and locally phacoidal.

230,10 - 234,00 The chloritic phyllitic schist, with some schliers and pellets of a quartz matrix. The structure is schistose and phacoidal schistose. Locally is this rock folded too. Locally only are present some grain of garnet (scarce only). The average gradient of this foliation is 50° about.

234,00 - 234,80 The sericitic, chloritic mica schist with some grains of garnet as well as in 219,80 - 221,00.

This borehole no. 183 was stopped at 234,80 m on August 14th 1970, at 16.00 p.m.

(M. Motys).


The petrografical profile of the borehole nr.
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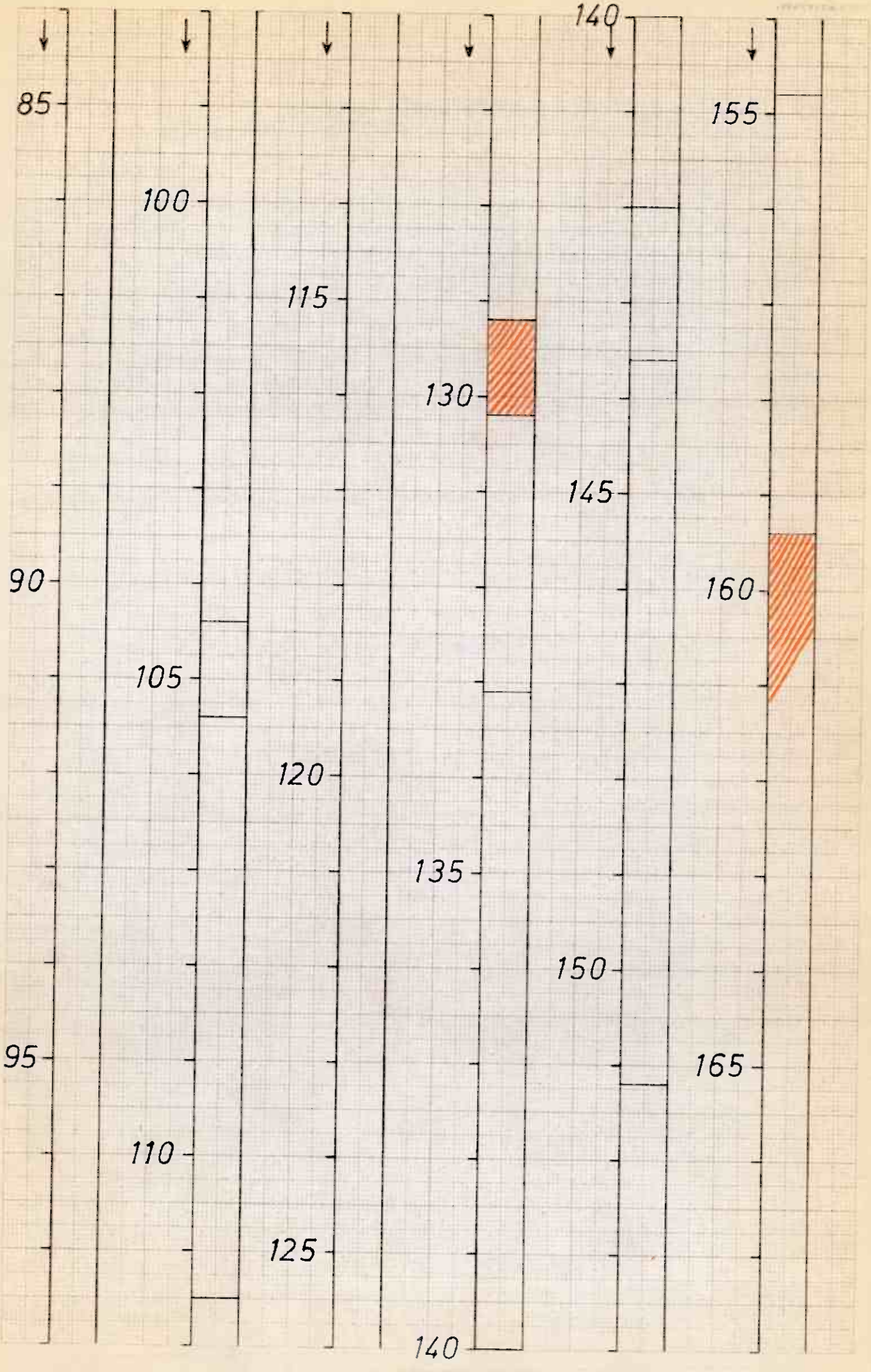
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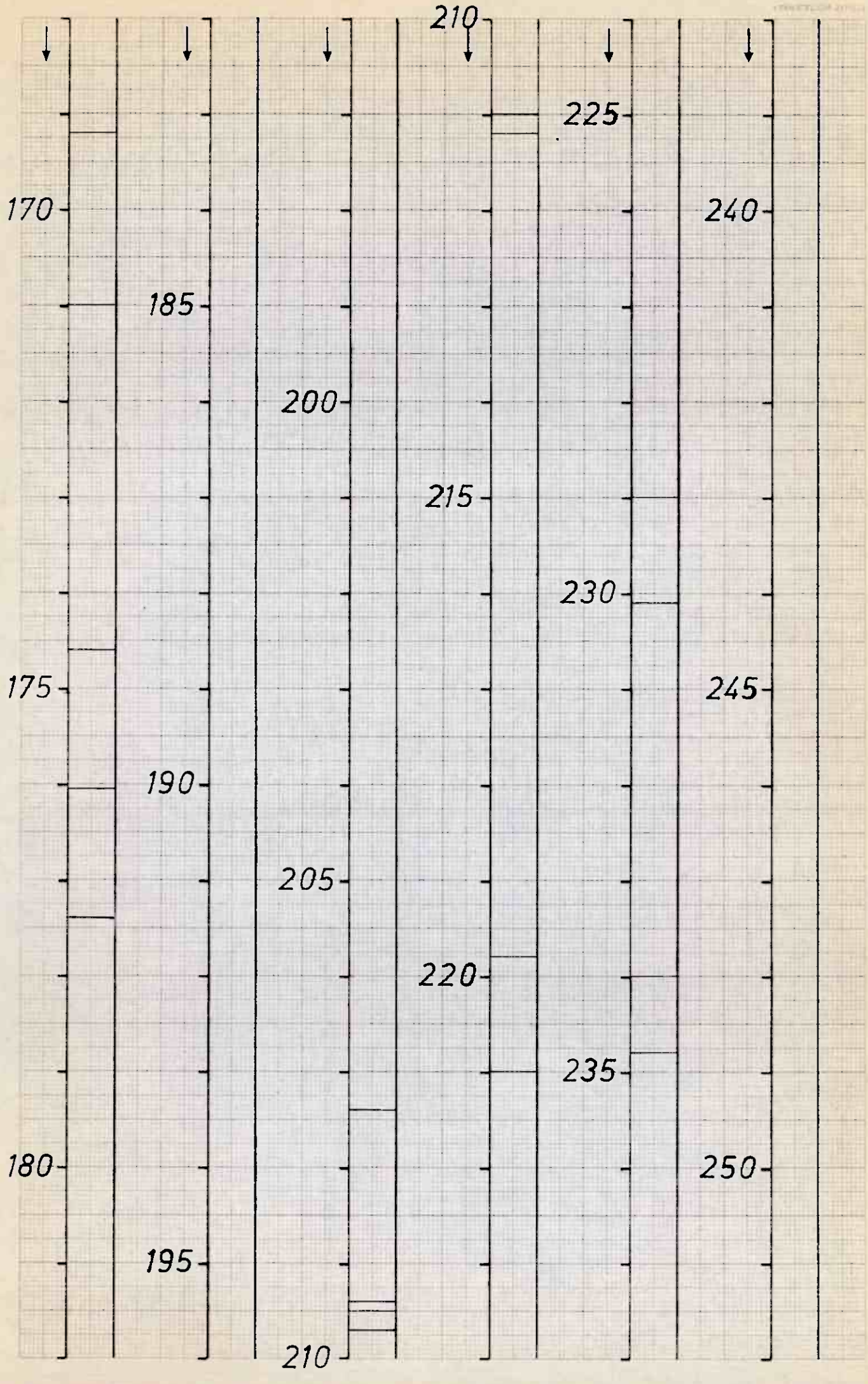
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THE BOREHOLE Nr. 181, Grimsdalen.

The brief petrografical description.

0,00 - 3,90	The strongly chloritic, weakly amphibolitic greenschist with many flakes of biotite on the plates of foliation mostly. Some schliers or lenticles intercalations of quartz matrix (scarcely with grains or spots of carbonates or soda-lime feldspars too) are present too. Some hypidiomorphic and idiomorphic grains of FeS_2 are present locally too, but not very much. The structure is phacoidal schistose and phacoidal. The average gradient of this foliation is 70^o about.
3,90 - 5,40	The chloritic and hornblende gneissic greenschists with a lot of little grains of garnet and with a lot of acicular and rodlike porphyroblasts of hornblende without a clear grain elongation. Locally are present small and little hypidiomorphic or automorphic grains of FeS_2. The structure is fluidial and rope, with a lot of detail folds of a dm, cm and mm amplitude. The average gradient of this foliation is 70^o-80^o around.
5,40 - 6,10	The keratophyre, little bit chloritic and sericitic schist with a lot of small grains of garnet and with some little schliers or lenticles which are created by garnet matrix. some little rodlike and acicular porphyroblasts of hornblende are present locally too. The structure is massive and little bit sheeting. The average gradient of this foliation is 70^o-75^o about.
6,10 - 16,30	The strongly chloritic greenschist, with some little flakes of biotite and with some little acicular or rodlike porphyroblasts of hornblende locally and more scarcely only, but with a lot of schliers, pellets and little lenticles of a quartz or of a quartz-feldspatic matrix. Some hypidiomorphic or idiomorphic grains of FeS_2 are present locally only too. The texture is fluidial, rope and phacoidal schistose. This rock is very detail folded locally byt the folds of a dm, cm and mm amplitude The average gradient of this foliation is 70^o about.
16,30 - 16,70	The metakeratophyre with some small and little grains of garnet and with not much little acicular or rodlike porphyroblasts of hornblende. Scarce are present some little

hypidiomorphic grains of FeS_2. Some irregular oblique schliers of a quartz matrix are locally present too. The structure is massive without a clear grain clongation.

16,70 - 18,20 The strongly chloritic gneissic greenschist as well as in 6,10 - 16,30 m. but more strongly folded. The average gradient of this foliation is 60°-70° about.

18,20 - 19,80 The chloritic and amphibolitic gneiss with a sheeting structure. The little rodlike and acicular porphyroblasts of hornblende haven't so clear a total grain clongation. Some little grains or spots of carbonates are locally present too. The average gradient of this foliation is 30°-40° around.

19,80 - 20,30 The strongly chloritic greenschist as well as in 0,00 - 3,90 m, but very strongly folded by the folds of a dm, cm and mm amplitude. The average gradient of this foliation is 70°-80° around.

20,30 - 20,70 The keratophyre rock with not much little acicular and rodlike porphyroblasts of hornblende. Scarce are present some hypidiomorphic grains of FeS_2. Some schliers and positions of a secretion, white barren quartz are present locally too. The structure is massive, without a clear total grain clongation.

20,70 - 28,80 The strongly chloritic gneissic greenschist as well as in 16,70 - 18,20 m. The average gradient of this foliation is 70°-80° around. Between 24,40 - 24,55 m, 24,70 - 24,85 m and between 28,50 - 28,60 m are present some positions of a barren white secretion quartz. Between 26,80 - 28,20 m is present a position of a keratophyre rock with a lot of acicular and rodlike porphyroblasts of hornblende and with some small grains of garnet locally too. Some grain clongation of the hornblende porphyroblast isn't so clear every where. The structure is massive and sheeting. The average gradient of this foliation is 70°-75° around.

28,80 - 37,15 The chloritic and amphibolitic gneissic greenschist with a lot of grains of garnet. Some schliers or pellets of white secretion quartz are locally present too. Locally are present some thin schliers of a keratophyre rock which is like in 20.30 - 20,70 m. The structur is sheeting and phacoidal schistose. Locally is this rock folded by the folds of a dm, cm and mm amplitude. The average gradient of this foliation is 70°-80° around. Between 36,00 - 37,15 m is present some very weak impregnation of pyrite (hypidiomorphic little grains). The result of the chemical analyse from this position between 36,00 - 37,15 m is: Cu 0,05 %, Zn 0,10 %, S 1,00 %.

37,15 - 37,50

The strongly chloritic gneissic greenschist, with a fluidial and rope-schistose structure as well as in 6,10 - 16,30 m., but with some poor impregnation of FeS_2. The average gradient of this foliation is 75^{o}-80^{o} around. The result of the chemical analyse from this position between 37,15 - 37,50 m is: Cu 0,05%, Zn 0.10 %, S 2,50 %.

37,50 - 37,80

The very strong impregnation of pyrit in quartzite. More weakly is present sphalerite and very scarce pyrrhotite and chalcopyrite. The structure is massive and texture cataclastic mostly. Locally only are present some schliers on lenticles of barren quartz matrix. The result of the chemical analyse from this ore position between 37,50 - 37,80 m is: Cu 0,20 %, Zn 8,00 %, S 40,00 %.

37,80 - 38,80

The chloritic and weakly amphibolitic gneissic schist as well as in 6,10 - 16,30 m but with more flakes of biotite and with some poor impregnation of FeS_2 mostly only. This impregnation is little bit strongly between 38,50 - 38,80 m. The average gradient of this foliation is 60^{o}-70^{o} around. The result of the chemical analyse from this position between 37,80 - 38,80 m is: Cu 0,05 %, Zn 0,40 S 1,50 %.

38,80 - 39,40

The very strong impregnation of pyrite mostly in a quartzite. Some little schliers or pellets of a chloritic matrix are present locally only (in 38,90 and in 39,20 m and 39,25 about). The structure is massive and the texture is cataclastic mostly. The result of the chemical analyse from this ore position between 38,80 - 39,40 m is: Cu 0,30 % Zn 6,50 %, S 38,50 %.

39,40 - 50,70

The strongly chloritic, weakly amphibolitic gneissic greenschist, locally only with some flakes of biotite and weakly with sericite too. In this rock are present many grains (small hypidiomorphic and allotriomorphic) of pyrite, which are acumulated locally in some little schliers, pellets or chambres. The structure is fluidal and phacoidal-schistose. This rock is locally strongly folded by the folds of a dm, cm and mm amplitude. The average gradient of this foliation is 75^{o}-80^{o} around, but 85^{o} too. The result of the chemical analyse from the position between 39.40 - 40,00 m is: Cu 0,00 %, Zn 0,20 %, S 1,00 %.

50,70 - 52,00

The sericitic and chloritic, strongly quartzy gneissic mica schist, with some irregular and deformated grains of garnet. Locally only are present some schliers of

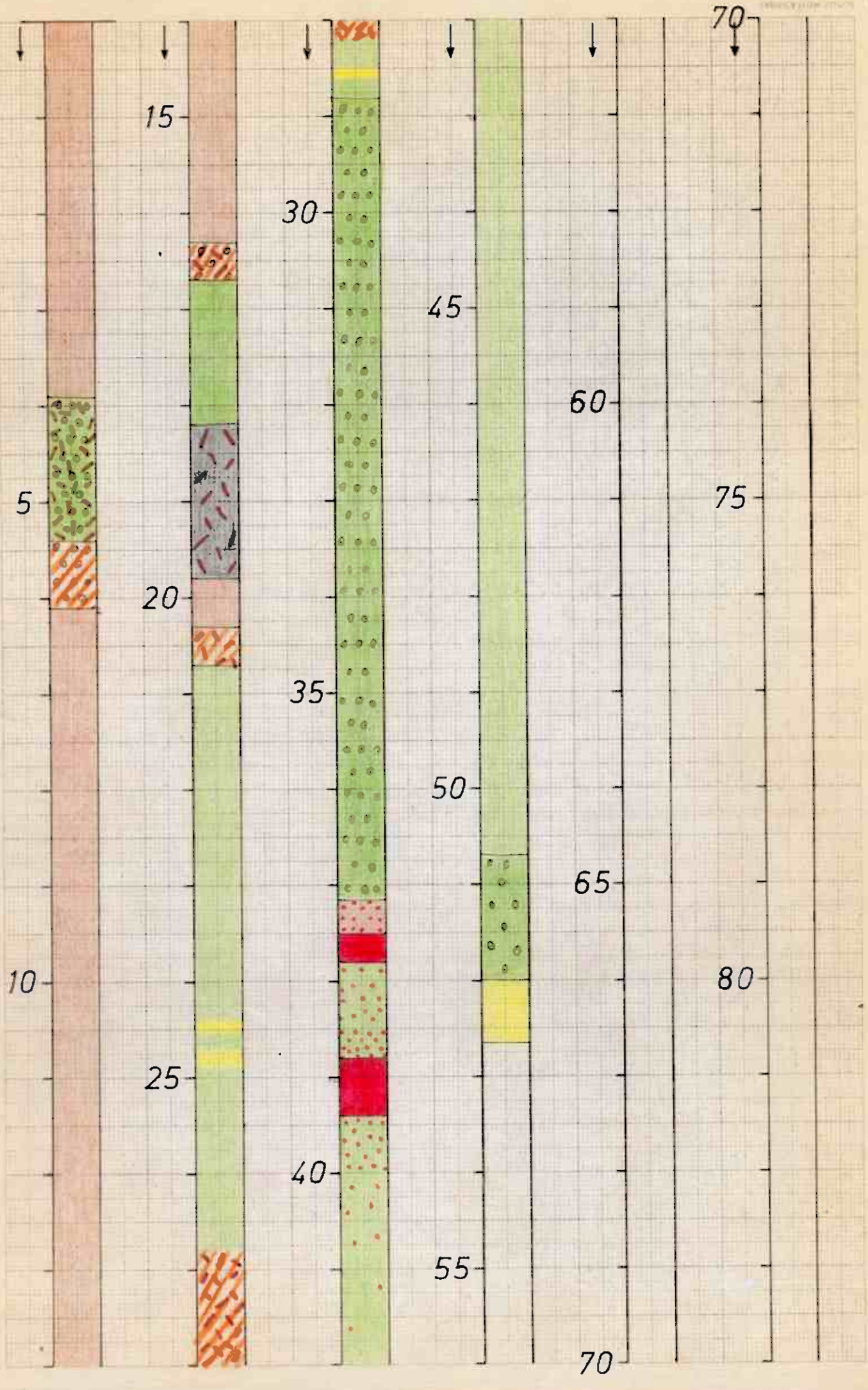
a white barren secretion quartz. Some little hypidiomorphic and allotriomorphic grains of pyrite are present but locally only and scarce. The structure is sheeting and phacoidal schistose and rope too. The avreage gradient of this foliation is 75°-85° about. Locally is this rock folded by the flat folds of a dm and cm amplitude.

52,00 - 52,65 The white and locally little bit pink-white secretion quartz barren only. Some little chambres (inclusions) of a chloritic matrix are present at 52,00 m and 52,10 m around. The structure is massive with a irregular system of joints.

This borehole no. 181 was stopped at 52,65 m on Juli 21sth 1970 at 10.30 a.m.

(Milosh Motys).

The petrografical profile of the borehole nr.181, Grimsdalen.



FOLLDAL VERK A/S

Bk 180 Grimsdalen

DRIFTSANALYSER

Tatt 19

Skift:	% Cu	% Zn	% S	% Fe				% H_2O	Sikt	Anmerkning
Rågods, tørt	0.05	0.10	1.–		Fra	222.	15 –	224.	85	
Cu-konsentrat	0.30	3.–	39.5		"	224.	55 –	225.	15	
Cu-avgang	0.20	1.75	18.–		"	225.	15 –	225.	50	
Zn-konsentrat	0.30	3.20	39.–		"	225.	50 –	225.	80	
Zn-avgang	—	0.10	1.–		"	225.	80 –	227.	15	
S-konsentrat	—	—	—		"	227.	15 –	230.	–	
S-avgang		Bk 181			Grimsdalen					
Cu-retur	0.05	0.10	1.–		Fra	36.	–	37.	15	
Zn-retur	0.05	0.10	2.50		"	37.	15 –	37.	50	
Cu-tørke	0.20	8.–	40.–		"	37.	50 –	37.	80	
Zn-tørke	0.05	0.40	1.50		"	37.	80 –	38.	80	
S-tørke I	0.20	6.50	38.50		"	38.	80 –	39.	40	
S-tørke II	—	0.20	1.–		"	39.	40 –	40.	–	

Folldal Verk 4/8 19[illegible]

A.S.ÆTHER, HAMAR

FOLLDAL VERK A/S

Bk 180 Grimsdalen

DRIFTSANALYSER

Tatt 19

Skift:		% Cu	% Zn	% S	% Fe				% H_2O	Sikt	Anmerkning
Rågods, tørt	1.	0.05	0.10	1.-		Fra	222	15	224	85	
Cu-konsentrat	2.	0.20	3.-	39.5		"	224	85	225	15	
Cu-avgang	3.	0.20	1.75	18.-		"	225	15	225	50	
Zn-konsentrat	4.	0.20	3.20	39.-		"	225	50	225	80	
Zn-avgang	5.	—	0.10	1.-		"	225	80	227	15	
S-konsentrat	6.	—	—	—		"	227	15	230	-	
S-avgang			Bk 181	Grimsdalen							
Cu-retur	1.	0.05	0.10	1.-		Fra	36	-	37	15	
Zn-retur	2	0.05	0.10	2.50		"	37	15	37	50	
Cu-tørke	3	0.90	8.-	40.-		"	37	50	37	80	
Zn-tørke	4	0.05	0.40	1.50		"	37	80	38	85	
S-tørke I	5	0.20	6.50	38.50		"	38	80	39	40	
S-tørke II	6.	—	0.20	1.-		"	39	40	40	-	

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A. SÆTHER, HAMAR

BOREHOLE NO. 180. GRIMSDALEN.

The brief petrografical description.

0,00 - 14,30	The chloritic and little bit seritic and biotitic, phyllitic mica schist, locally with some little schliers and pellets of quartz matrix, oftenly together with some carbonates too (ancerite, dollomite). Between 10,40 - 10,60 m, 11,80 - 12,10 m are present the positions of the same phyllitic mica schist more calearcose with a strong graphitic substance and with some flakes of pyrrhotite. The average gradient of this foliation is 75° - 80° about.
14,30 - 15,00	The amphibolitic gneiss or bneissic schist with chlorite and flakes of biotite and with a lot of grains of garnet too. The structure is banking and schistose. The average gradient of this foliation is 70° - 80° about.
15,00 - 32,20	The biotitic and strongly chloritic gneissic greenschist with a lot of grains of garnet and with a lot of schliers,-pellets and little intercalations of quartz matrix. Between 19,60-20,00 m, 20,10 - 20,50 m, 21,25 - 21,30 m, 21,90 - 21,95 m and between 28,70 - 29,00 m and 29,60 - 30,00 m are present positions with a graphitic substance and with some flakes of pyrrhotite together. The structure is banking and schistose snd locally are this rock folded by the folds of a cm, mm amplitude. The average gradient of this foliation is 50° - 60° about, but locally 0° - 10° only.
32,20 - 33,40	The strongly quartzy, little bit chloritic and little bit seritic schist with a lot of flakes of pyrrhotite on the plates of this foliation. The average gradient of this foliation is 50° about.
33,40 - 37,40	The chloritic, phyllitic and graphitic schist, locally with a lot of schliers and pellets of quartz (secretion). Some positions or intercalations have more strong a graphitic pigmentation (substance) with a lot of flakes of pyrrhotite together (in example between 31,40 - 31,55 m, 32,70 - 33,10 m and 36,00 - 37,10 m). The structure is phacoidal-schistose, but locally myllonitic, pell-mell tectonic and myllonitic sones).
37,40 - 67,50	The strongly chloritic, locally biotitic and seritic, garnet phyllitic mica schist with a phacoidal-schistose structure. This rock has a lot of grains of garnet. The average gradient of this foliation is 60° about. This rock is very strongly folded locally too. Between 40,90 - 41,30 m and between 46,00 - 46,35m are present the positions of a chloritic, phyllitic and graphitic schist as well as in 33,40 -

37,40 m.
Between 59,10 - 59,30 m and between 67,00 - 67,20 m are present some positions of a white secretion barren quartz.

67,50 - 70,20 — The strongly chloritic and biotitic greenschist with a lot of little schliers and little intercalations of a quartz or quartz-feldspatic matrix too. Some flakes or flat chambres of FeS are present locally only. Garnet isn't present. The structure is schistose and phacoidal-schistose. This rock is folded locally too by the detail folding of a mm and cm amplitude. The average gradient of this foliation is 70° - 80° about.

70,20 - 73,30 — The strongly chloritic and biotitic, garnet, phyllitic mica schist as well as in 37,40 - 67,50 m but with much more little grains of garnet.

73,30 - 84,80 — The chloritic and amphibolitic gneissic greenschist, locally with some little intercalations which have much more quartz-feldspatic matrix. The structure of this rock is parallel schistose and sheeting and locally is this rock very strongly folded by the folds of a mm, cm and dm amplitude. The average gradient of thsi foliation is 50° - 60° about, but 0° - 10° locally too.

84,80 - 106,80 — The biotitic, chloritic and amphibolitic, carbonatic keratophyre schist. The structure is massive and sheeting.

106,80 - 221,60 — The motley serie of an amphibolitic, biotitic and strongly chloritic gneissic greenschist and of an amphibolitic and chloritic and biotitic gneiss, which have a phacoidal-schistose and schistose structure and which are very strongly folded locally by the folds of a mm, cm and dm amplitude. Some lottle positions of a white, barren, secretion quartz are locally present too (in example between 123,50 - 123,60 m, 133,10 - 133,25 m, 151,30 - 151,50 m, 159,60-159,75 m, 176,80 - 177,00 m. The average gradient of this foliation is 70° and 80° around, but locally 50° - 60° about too.
Between 115,50 - 115,85 m, 135,10 - 135,50 m, 145,40 - 145,70 m, 151,30 - 160,00 m, 143,20 - 143,60 m, 158,50 - 158,90 m, 159,10 - 159,40 m, 187,40 - 187,90 m, 194,50 - 195,50 m, 198,70 - 199,60 m, 199,90 - 200,20 m, 204,70 - 205,50 m, 208,10 - 209,00 m, 211,70 - 213,30 m, 215,50 - 215,70 m, 221,70 - 221,80 m are present positions of a keratophyre or keratophyre schist with a lot of or not much acicular or rodlike porphyroblasts of hornblende and with grains of garnet and locally with FeS_2 or FeS too but scarely only.

221,60 - 224,85

The chloritic, biotitic and amphibolitic gneissic greenschist without garnet, with a lot of schliers, positions or intercalations of a quartz or quartz-feldspatic matrix and with a lot of spots or grains of some carbonates (ancerite-dolomite). Some poor impregnation of FeS_2 mostly is present locally too. In 224,25 m (2 cm), in 224,35 m (2 - 3 cm) and in 224,55 m (1,5 cm) are present some little positions of a strong impregnation of FeS_2 mostly in a quartzite. Between 224,40 - 224,50 m and between 224,60 - 224,70 m are present positions of a white, barren secretion quartz. The structure is schistose and phacoidal-schistose. The average gradient of this foliation is 60° about, but locally 70° and more. This rock is strongly folded locally too. The result of the chemical analyse from this position between 222,15 - 224,85 m is:

1) Cu = %
Zn = %
S = %

224,85 - 225,15
0,30 m

The very strong impregnation of FeS_2 mostly in quartzite. The structure is massive and the texture is cataclastic and porphyric.
The result of the chemical analyse from this position between 224,85 - 225,15 m is:

2) Cu = %
Zn = %
S = %

225,15 - 225,50

The strongly chloritic and amphibolitic greenschist with a lot of rodlike and acicular porphyroblasts of hornblende. In 225,40 - 225,48 m and in 225,20 m (2,5 cm) are some positions of a strong impregnation of FeS_2 mostly in quartzite. In this rock are present also some grains or schliers of FeS_2 but some amorphic little forms or flakes of FeS too. Very scare is present $CuFeS_2$ too. The structure is phacoidal mostly and a texture is blastoporphyric.
The result of the chemical analyse from this position between 225,15 - 225,50 m is:

3) Cu = %
Zn = %
S = %

225,50 - 225,80
0,30 m

The very strong impregnation of FeS_2 mostly in quartzite. The structure is massive and the texture is cataclastic.
The result of the chemical analyse from this position between 225,50 - 225,80 m is:

4) Cu = %
Zn = %
S = %

225,80 - 233,70

The strongly chloritic, biotitic (weakly biotitic) green mica schist with a lot of schliers pellets and little intercalations of a quartz and locally only of a quartz-feldspatic matrix. The structure is phacoidal, phacoidal-schistose and maculose-schistose. Locally is this rock folded

too. In this rock are present very much hypidiomorphic and allotriomorphic grains of FeS_2 and locally automorphic too. The average gradient of this foliation is 50° - 60° about, but locally 30° - 40° about too.
The result of the chemical analyse from this position between 225,80 - 230,00 m are:
5) 225,80 - 227,15 m:
Cu = %
Zn = %
S = %
6) between 227,15 - 230,00 m:
Cu = %
Zn = %
S = %

233,70 - 240,20 The chloritic, seritic and little bit talcic phyllitic schist with phacoidal-schistose structure and which is very strongly folded by the detail folds of a mm. cm and dm amplitude. The average gradient of this foliation is 60° about. Between 237,10 - 237,20 m and between 237,25 - 237,35 m are present some intercalations with a graphitic pigmentation (substance), but not so strong, with not very much little flakes of pyrrhotite together. The flakes of pyrrhotite leaning on the plates of foliation. These graphitic intercalations are very detail folded too.

240,20 - 244,30 The keratophyre (para), with some little flat chambres or little schliers or little intercalations of a chloritic-seritic matrix and with some grains of garnet more scare with some little rodlike and acicular porphyroblasts of hornblende. The structure is sheeting and banking. The average gradient of this foliation is 50° - 60° about.

244,30 - 247,80 The phyllitic, chloritic, seritic and quartzy mica schist with a lot of grains of garnet. Some rodlike or acicular porphyroblasts of hornblende are present locally too. The structure is banking and acheeting. Between 245,60 - 245,80 m and between 246,40 - 246,55 m are present some positions of a white, barren secretion quartz. The average gradient of this foliation is 50° - 60° about, but locally 40° - 45° anly.

247,80 - 248,90 The keratophyre, with some grains of garnet. The structure is massive mostly.

248,90 - 251,50 The phyllitic, chloritic and seritic quartzy mica schist as well as in 244,30 - 247,80 m. The average gradient of this foliation is 70° - 75°, but 80° about too.

251,50 - 253,20 The chloritic, seritic and quartzy phyllitic schist or phyllite like in 233,70 - 240,20 m, locally only with some little schliers and very little intercalations with a graphitic substance (in example in 252,50 m around).

The average gradient of this foliation is 50° - 60° about.

253,20 - 253.70 The gray and bright gray quartzite with a lot of little thin intercalations or schliers with more strongly graphitic pigmentation. Some very little hypidiomorphic grains of FeS_2 are present locally and scare only. On the plates of a foliation are present some very little flakes of sericite. The structure is sheeting and banking. The average gradient of this foliation is 60° - 65° around.

This borehole no. 180 was stopped at 253.70 m on July 15th 1970 at 11.00 a.m.

(Milosh Motys).

Bh. 169 Grimsdalen

FOLLDAL VERK A/S

DRIFTSANALYSER

Tatt 19

Skift:	% Cu	% Zn	% S	% Fe				% H_2O	Sikt	Anmerkning
Rågods, tørt	0.27	2.75	38.75		Fra	146.	40 –	147.	- 2m	
Cu-konsentrat	0.10	0.90	2.75		"	147.	- –	147.	15 –	
Cu-avgang	0.25	3.60	38.50		"	147.	15 –	147.	30 -	
Zn-konsentrat	0.07	1.60	3.50		"	147.	30 –	147.	60 -	
Zn-avgang	0.43	5.40	37.75		"	147.	60 –	147.	90 -	
S-konsentrat	0.35	3. –	8. –		"	147.	90 –	148.	40 -	
S-avgang	0.55	3.20	32.5		"	149.	40 –	148.	75 -	
Cu-retur	–	–	1. –		"	148.	75 –	150	05 -	
Zn-retur	1.17	2.30	17. –		"	150.	05 –	151.	15 -	
Cu-tørke	0.52	3.40	38.50		"	151.	15 –	151.	30 -	
Zn-tørke	0.10	1. –	20. –		"	151.	30 –	151.	65 -	
S-tørke I	0,05	0,20	1.50		"	151.	65 –	153.	–	
S-tørke II										

Folldal Verk 7/8 19 70

A. BÆTHER, HAMAR

BOREHOLE NO. 169, GRIMSDALEN.

The brief petrografical description.

0,00 - 12,10	The amphibolitic and little bit cloritic greenschiest with a lot of little intercalations and schliers of a quartz-felspatic matrix. Locally are present some schliers or pellets or chambers of biotites flakes. Some carbonates (ancerite) are scarely present too. Some chambres or schliers of soiste-epidote minerals are situated locally too. The structure of this rock is schistose, banking and sheeting too. This rock is folded oftenly by the folds of a dm, cm and mm amplitude. The average gradient of this foliation is 50° about.
12.10 - 13,30	The cloritic, amphibolitic and feldspatic greenschiest with some little flakes of biotite too. Locally are present some schliers and pellets of a quartz-feldspatic matrix, offently with some irregular grains of ancerite. The structure is maculose and scarely schistose too.
13.30 - 26,10	The amphibolitic and chloritis greenschiest with flakes of biotite as well as in 0,00 - 12,10 m. The average gradient of this foliation is 80° - 85° about, but locally 50° only. In 25.50m is present a position of a secretion quartz (barren) with some chambers of carbonatic on the borders around.
26,10 - 29,40	The cloritic, amphibolitic greenschiest with flakes of biotite as well as in 13,30 - 26,10 m but with a lot of little frains of garnet too. The average gradient of this foliation is 80° - 85° around.
29,40 - 37,20	The chloritic and amphibolitic greenschist as well as in 0,00 - 12,10 m , but with not so much flakes of biotite. The average gradient of this foliation is 80° around. Between 30,10 - 31,20 m is present a position of a hornblende gneiss, with acicular and rod-like porphyroblasts of hornblende which have a little bit clear grain clongation. Some pellets or chambres or schliers of secretion quartz together with ancerite (carbonates) are present locally too (in example in 34,50 m).
37.20 - 40,00	The hornblende gneiss with not much chlorite too. The structure is schistose or sheeting. Locally are present some schliers or pellets of a quartz feldspatic matrix. The average gradient of this foliation is 85° about.
40,00 - 41,40	The chloritic and amphibolitic, feldspatic greenschist with maculose structure as well as in 12,10 - 13,30 m.

41,40 - 41,80	The amphibolitic keratophyre with a lot of little grains of garnet too. The structure is massive and a tecture is blastoporphyric.
41,80 - 52,00	The cloritic and amphibolitic greenschist as well as in 0,00 - 12,10 m, but withnot so much flakes of biotite. Locally are present some positions (intercalations of quartzite and more oftenly of a keratophyre with rodlike and acicular porphyroblasts of hornblende and with some grains of garnet. Some hypidiomorphic grains of FeS_2 are present locally too. The average gradient of this foliation is 80° - 85° about.
52,00 - 53,80	The hornblende gneiss as well as in 37,20 - 40,00 m.
53,80 - 58,00	The chloritic , amphibolitic gneissic schist as well as in 0,00 - 12,10 m, but not with so much flakes of biotite. The average gradient of this foliation is 75° around.
58,00 - 60,30	The chloritic , amphibolitic and feldspatic greenschist with a maculose structure as well as in 12,10 - 15,30 m.
60,30 - 68,50	The chloritic and amphibolitic greenschist as well as in 0,00 - 12,10 m, but with not so much flakes of biotite. The average gradient of this foliation is 80° and 85° about. In 65,35 - 65,45 m is present a position of a metaceratophyre with some inchesions of a zoisite-epidotic matrix and with some little chambres and irregular pellets of fyrrhotite.
68,50 - 71,10	The amphibolitic gneiss with some grains of garnet and with acicular and rodlike porphyroblasts of hornblende as well as in 37,20 - 40,00m. The average gradient of this foliation is 80° about.
71,10 - 71,60	The keratophyre with some rodlike and acicular porphyroblasts of hornblende, without clear grain clongation and with some small grains of garnet too. The structure is massive and little bit sheeting. The tecture is blastoporphyric.
71,60 - 86,40	The motley serie of the chloritic and amphibolitic greenschist as well as in 0,00 - 12,10 m, with a lot of interkalations of the keratophyre each is the same as in 41,40 - 41,80 m. The average gradient of this foliation is 70° around.
86,40 - 88,20	The hornblende keratophyre as well as in 41,40 - 41,80 m.
88,20 - 91,30	The keratophyre as well as in 71,10 - 71,60 m mostly.

91,30 - 104,90

The motley serie of the chloritic and amphibolitic greenschist as well as in 71,60 - 86,40 m. In 96,20 - 96,80 m is present more thick position of keratophyre with hornblende acicular porphyroblasts. Between 93,00 - 94,60 m are present some little grains of magnetite. In 99,80 m is present a position of secretion quarz together with some hypidiomorphic and idiomorphic grains of pyrite on the borders around.
The average gradient of this foliation is 70° - 80° around.

104,90 - 110,90

The amphibolitic and chloritic gneissic schist with flakes or chambres of flakes of biotite and with a poor impregnation of FeS_2 mostly only. The structure is schistose and banking. The average gradient of this foliation is 80° about.

110,90 - 114,40

The chloritic and amphibolitic gneissic schist with a lot of little grains of garnet and with a maculose or sheeting-maulose structure.

114,40 - 146,40

The motley serie of the chloritic and amphibolitic greenschist (like in 0,00-12,10 m) and of the amphibolitic and cloritic gneiss and gneissic schist with a lot of grains of garnet and w with some intercalations or positions of keratophyre (like in 71,10 - 71,60 m, in example in 118,60 - 118,90 m, 119,90 - 121,50 m, 123,30-123,90 m, 126,00 - 126,70 m, 128,00 - 129,50 m, 137,00 - 137,40 m, 140,20 - 141,10 m. The average gradient of this foliation is 75° - 85° about. Locally is this rock folded too. Some pellets and schliers of a white barren secretion quarts are locally present too. Between 141,10-141,20 m is present a position of a secretion quartz.

146,40 - 147,00
0,60 m

The very strong impregnation of pyrite mostly in a quartzite. The structure is massive and the tecture is cataclastic mostly.
The result of the analyse from this positions between 146,40 - 147,00 m is:
Cu= 0,27 %
Zn= 2,75 %
S = 38,75 %

147,00 - 147,15
0,15 m

The coarse-grained amphibolitic greenstone very strongly infiltrated by quartz-feldspatic matrix.
The result of the chemical analyse from this position between 147,00 - 147,15 m is:
2) Cu = 0,10 %
Zn = 0,90 %
S = 2,75 %

147,15 - 147,30
0,15 m

The very strong impregnation of FeS_2 mostly like in 147,00 - 147,15 m.
The result of the chemical analyse from this positions between 147,15 - 147,30 m is:
3) Cu = 0,25 %
Zn = 3,60 %
S = 38,50 %

147,30 - 147,60
0,30m

The coarse-grained gneiss, amphibolitic and cloritic with the big rodlike and acicular porphyroblasts of hornblende and with a very strong infiltration of quartz-feldspatic matrix. Some poor impregnation and some little schliers of little bit strong impregnation of FeS_2 mostly (weakly with FeS and very scarce with $CuFeS_2$) are present locally too. The structure is massive and little bit sheeting too, the texture is blastoporphyric.
The result of the chemical analyse from this position between 147,30 - 147,60 m is:
4) Cu = 0.07 %
Zn = 1.60 %
S = 3.50 %

147,60 - 147,90
0,30m

The strong impregnation of FeS_2 mostly and weakly with the other sulphides (like FeS and ZnS, and very scare with CuFeS too).
The result of the chemical analyse from this position between 147,60 - 147,90 m is:
5) Cu = 0.43 %
Zn = 5.40 %
S = 37.75 %

147,90 - 148,40
0,50m

The strongly chloritic hornblende greenschist with a lot of bigger rodlike and acicular porphyroblasts of hornblende and with flakes or very flat chambres of flakes of biotite. Locally are present some intercalations of metaquartzite with a strong impregnation of FeS_2 with ZnS, FeS and scarce $CuFeS_2$ toghether (in example between 148,12 - 148,14 m and between 148,24 - 148,30). Between 148,30 - 148,40 m is present more strong infiltration of quartz-feldspatic matrix. In this rock are present very poor impregnation of FeS_2, FeS and scarce of $CuFeS_2$ (some little amorphic forms) or of ZnS. The structure is sheeting and texture is blastoporphyric with little bit clear grain elongation.
The result of the chemical analyse from this position between 147,90 - 148,40 m is:
6) Cu = 0,35 %
Zn = 3,00 %
S = 18.00 %

148,40 - 148,75
0,35m

The strong impregnation of FeS_2 mostly in metaquartzite, with some amorphic forms (little) of $CuFeS_2$ but scarcely only and with ZnS and FeS scarely too. The result of the chemical analyse from this position between 148,40 - 148,75 m is:
7) Cu = 0.55 %
Zn = 3,20 %
S = 32.50 %

148,75 - 149.00

The strongly chloritic amphibolitic gneissic greenschist with a lot of budine-chambres or pellets of a barren secretion quartz. Some sulphides (FeS or FeS_2) are present too but very scare only. The structure is pell-mell and phacoidal-schistose.

149,00 - 150,05

The amphibolitic keratophyre rock, scarcely with some flake of biotite too and with a massive or pell-mell structure, but more with a fluidial structure. Hornblende creats some small acicular and rodlike porphyroblasts with a little bit clear grain elongation (along a fluidial or rope structure). Some sulphides are present very scarce only.
The result of the chemical analyse from this position between 148,75 - 150,05 m is:
8) Cu = 0.00 %
Zn = 0.00 %
S = 1.00 %

150,05 - 151,15
1,10 m

The strongly chloritic, biotitic and little bit hornblende gneissic greenschist with a little grains of garnet. Locally in this rock is present a more strong infiltration of a quartz-feldspatic matrix. All this position of this rock has a not so poor impregnation of sulphides (FeS_2, FeS but scarcely with ZnS and $CuFeS_2$ together). Some chambres or schliers or pellets of quartz are present locally too. The structure is phacoidal and phacoidal schistose.
The result of the chemical analyse from this position is:
9) Cu = 1.17 %
Zn = 2.30 %
S = 17.00 %

151,15 - 151,30
0,15 m

The very strong impregnation of FeS_2 mostly in quartzite as well as in 146,40 - 147,00 m.
The result of the chemical analyse from this position between 151,15 - 151,30 m is:
10) Cu = 0.52 %
Zn = 3.40 %
S = 38.50 %

151,30 - 151,65
0,35 m

The strongly chloritic, biotitic and little bit hornblende gneissic greenschist with some impregnation of a sulphides as well as in 150,05 - 151,15 m. The average gradient of this foliation is 80° - 85° about.
The result of the chemical analyse from this position between 151,30 - 151,65 m is:
11) Cu = 0.10 %
Zn = 1.00 %
S = 20.00 %

151,65 - 158,75

The strongly chloritic and biotitic gneissic greenschist as well as in 150,05 - 151,15 m but wuth very, very poor and weak impregnation of sulphides (FeS_2) only. The average gradient of this foliation is 80° - 85° about. The result of the chemical analyse from this position between 151,65 - 153,00 m is:
12) Cu = 0.05 %
Zn = 0.20 %
S = 1.50 %

158,75 - 169,10

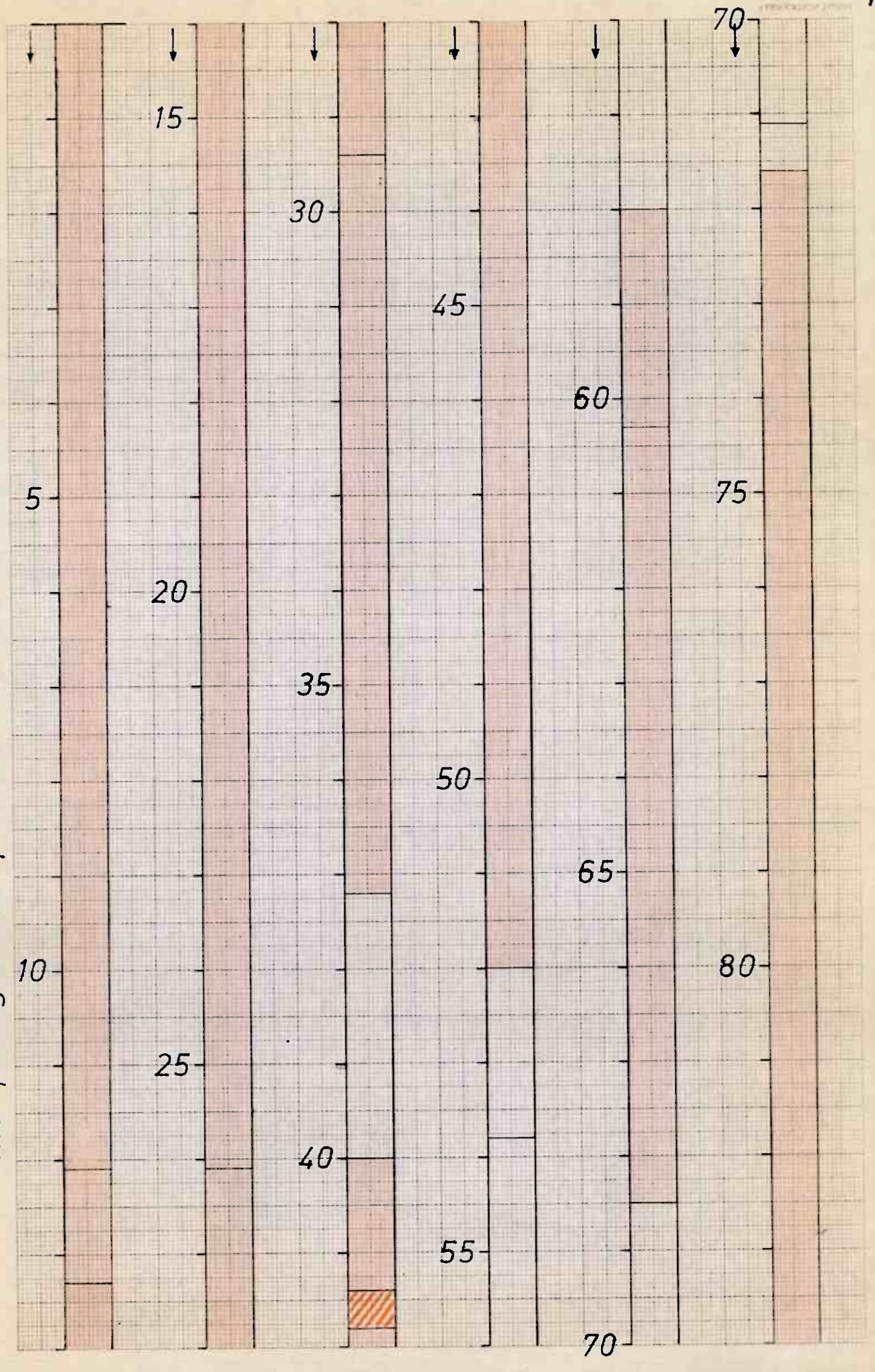
The chloritic, seritic mica schist with irreg-

ular grains of garnet and locally only with some rodlike and acicular porphyroblasts of hornblende and with a lot of schliers and pellets of a white barren secretion quartz. The structure is parallel schistose and locally phacoidal-schistose. The average gradient of this foliation is 65° - 80° about. Between 161,40 - 161,55m and between 162,30 - 162,35 m are present the positions with a poor graphitic substance together and with some very little flakes of pyrrhotite, but not so much.
Between 163,40 - 164,30 m is present a position of metaquartzite (barren only). Between 166,00 - 166,40 m is present a position of a white barren secretion quartz.

169,10 - 169,65 The metakeratophyre with a lot of grains of garnet. The structure is massive. Some ore sulphides isn't present.

This borehole was stopped at 169,65 m on July 8th 1970 at 7 p.m.

(Milosh Motys)


The petrografical profile of the borehole nr.
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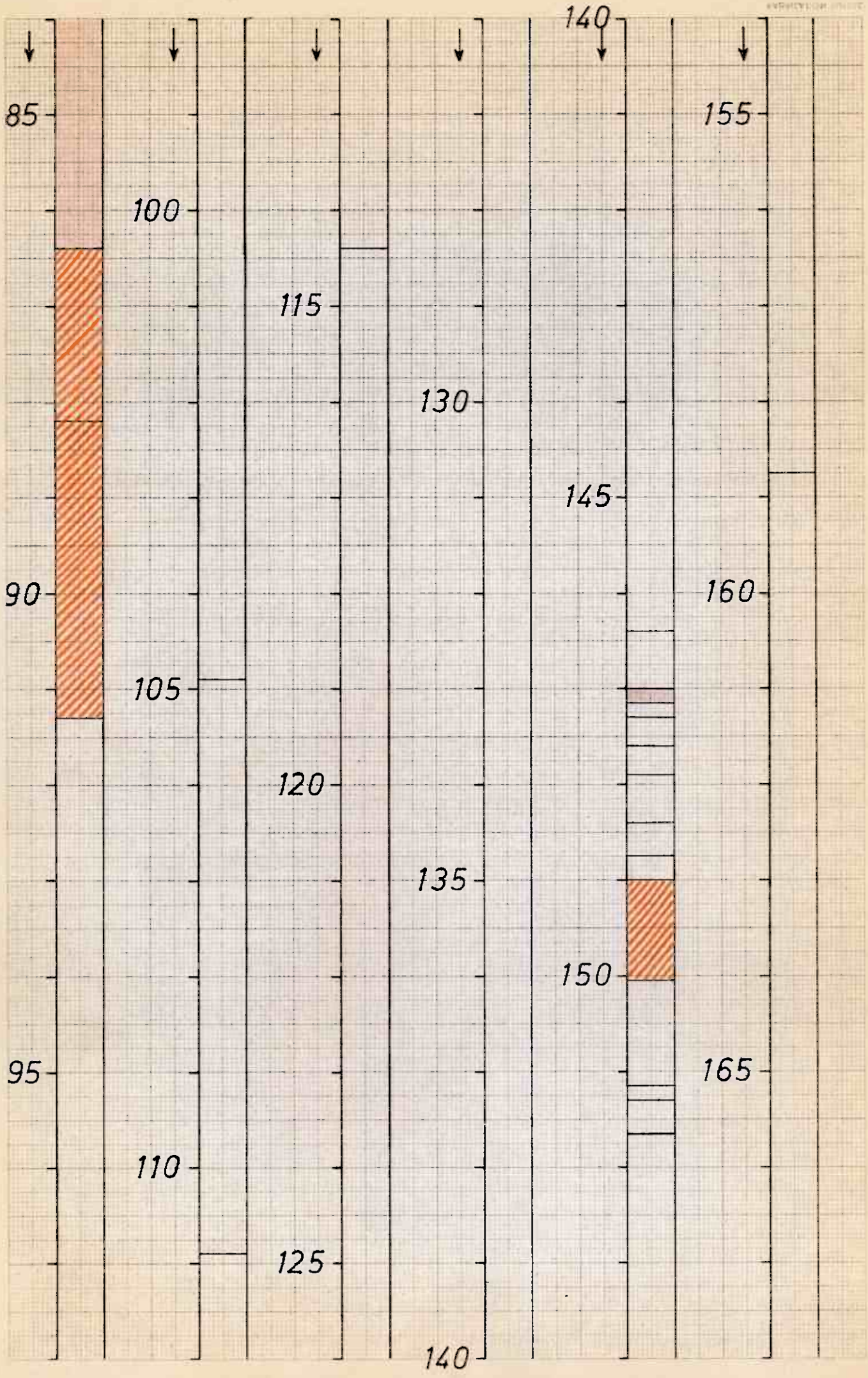
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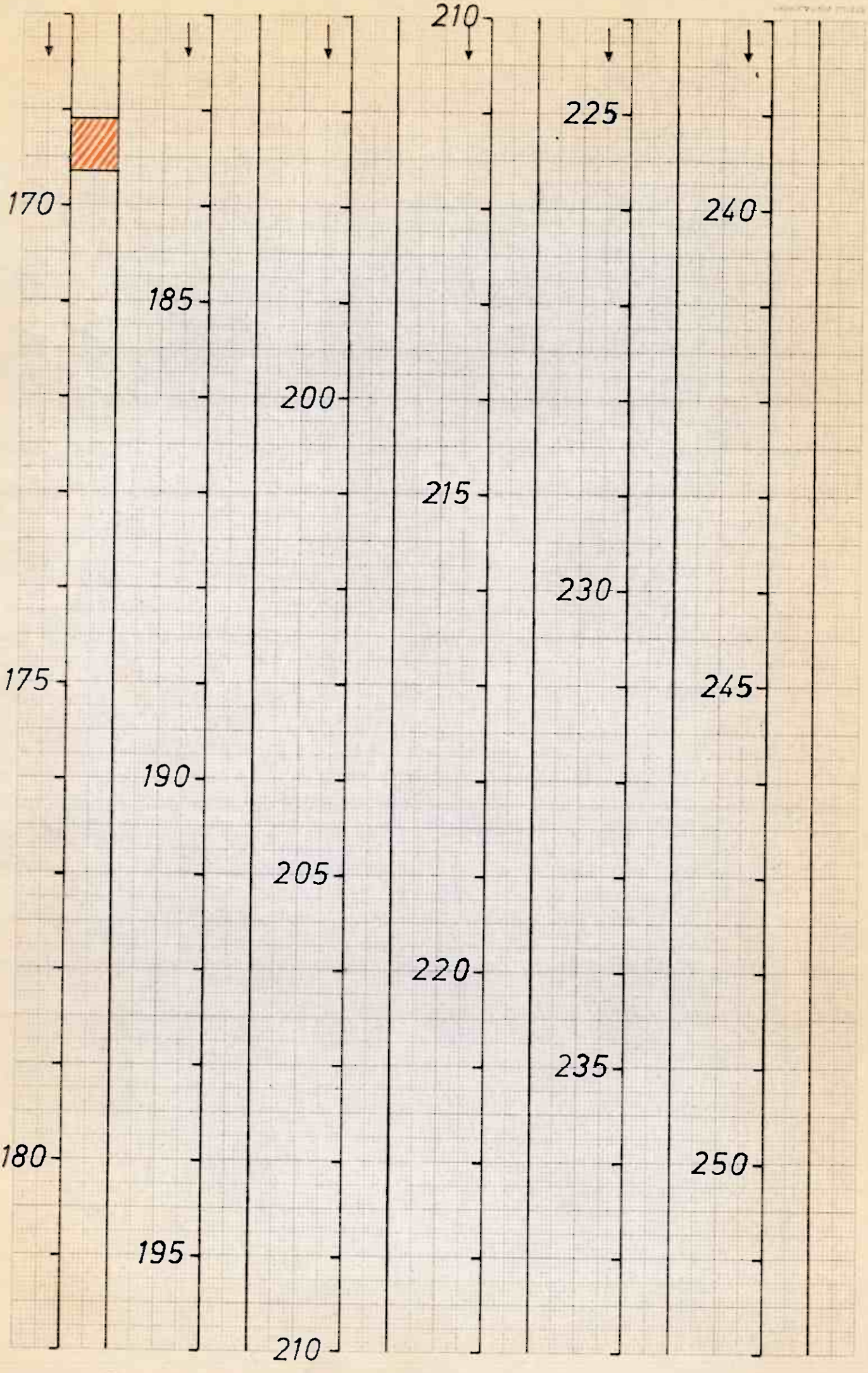
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FOLLDAL VERK A/S

DRIFTSANALYSER

Tatt 12/11 1969

Skift:	% Cu	% Zn	% S	% Fe				% H_2O	Sikt	Anmerkning
Rågods, tørt	0.09	0.40	2.–	Bh 168.	Grimsdalshytta			97.55	til	98.40 m 1.
Cu–konsentrat	0.24	4.40	12.28	" 168			"	98.40	"	99.65 " 2a
Cu–avgang	0.16	4.20	40.–	" 168			"	99.65	"	100.65 " 2b
Zn–konsentrat	0.04	0.60	2.–	" 168			"	100.65	"	102.05 " 3
Zn–avgang										
S–konsentrat										
S–avgang										
Cu–retur										
Zn-retur										
Cu–tørke										
Zn–tørke										
S–tørke I										
S–tørke II										

Folldal Verk ____________ 19____ [illegible signature]

A. SÆTHER, HAMAR

THE BOREHOLE NR. 168. , Grimsdalenhytta

The petrografical description.

0,00 - 9,10 The chloritic,carbonatic mica schist,with not much little flakes of biotite,on the plates of foliation mostly and with a lot of small irregular grains,little pellets and spots of carbonates(dolomite, magnesite and ancerite ?) and with some small schliers or spots of quartz matter too. Locally only are present some little scales of FeS or little,mostly hypidiomorphic and allotriomorphic grains of FeS_2 too. The total structure of this rock is maculose,but phacoidal and phacoidal-schistose locally too. The schistosity isn't so clear everywhere. The total colour of this rock is bright green-gray. The average gradient of this foliation is 70°-75° about.

9,10 - 11,50 The strongly chloritic,quartzy,little bit phyllitic mica schist, with very much little intercalations and with a lot of little schliers of quartz and with very much hypidiomorphic and allotriomorphic little grains of $FeO+Fe_2O_3$. Some little hypidiomorphic grains of FeS_2 arepresent too,but scarcely only. Scarcely also are present some small flakes of biotite,on the plates of foliation mostly. The total structure of this rock is parallel phaccidal-schistose and schistose with the detail little slip folds of the MM amplitude and locally of the CM and scarcely DM amplitude too. The total colour of this rock is green-gray and little bit bright and bright green-gray. The average gradient of this rock cleavage is 70° round.

11,50 - 12,10 The keratophyre rock,with a lot of small acicular and rodlike porphyroblasts of hornblende,with not clear the total grain clongation and locally with some irregular small intercalations or small schliers,which are created by the mobilisated flakes of the biotite,but with hornblede porphyroblasts in too. Locally are present some thin intercalations of the keratophyre rock too,but with the much more small acicular and rodlike porphyroblasts of hornblende and with more quartz then feldspar in the bassement matter. The structure of this rock is blastoporphyric mostly. The total colour of this rock is bright green-gray or little bit white green-gray. Locally are present some schliers or lenticles and pellets of quartz. The angle of dip of this the little bit clear total grain clongation (along the hornblende's acicular porphyroblasts) is 70° about.

12,10 - 27,40 The strongly chloritic gneisic mica schist,with a lot of parallel little schliers and little intercalations of the quartz and of the quartz-feldspar matter,with much very little acicular porphyroblasts of hornblende or actinolite and with not much small grains of garnet. Some sulphides are present scarcely only. The total structure of this rock is parallel schistose,bat strongly folded mostly by the slip folds of the DM,CM and MM amplitude. The total colour of this rock is green-gray and little bit dark green-gray too. The average gradient of this foliation is 50°- 60° about.

27,40 - 31,10 The keratophyre rock,with a lot of small acicular and rodlike porphyroblasts of hornblende,with some small grains of garnet and scarcely,locally only with some little flakes of biotite and with some small schliers,which are created by the little mobilisated scales of biotite too. Some sulphidic ore minerales isn't present mostly. The total structure of this rock is blastoporphyric,with some little bit clear grain clongation(along the porphyroblasts of hornblende). The total colour of this rock is very bright or white little bit green-gray or white gray. The total dip along the horn-

blende.acicular porphyroblasts is 75° about.(alon the little bit clear grain elongation).

31,10 - 52,50 The strongly chloritic,quartzy,little bit phyllitic mica schist, with a lot of little thin parallel intercalations or little schliers of quartz matter and locally with flakes of biotite(from 45,00m are present much more flakes or little schliers and pellets created by the flakes of biotite-the structure from 45,00m is more phaccidal and phaccidal schistose). Locally only are present some not thick intercalations of the chloritic,strongly quartzy, little bit amphibolitic(present some little acicular porphyroblasts of hornblende) gneisic schist,with some small hypidiomorphic and allotriomorphic grains of FeS_2(example round 44,60m). From 45,00m are present some little hypidiomorphic and allotriomorphic grains of FeS_2,scarcely some little flakes of FeS and very scarce some small amorphic forms of $CuFeS_2$. The total structure of this rock is parallel schistose and parallel phacoidal-schistose too,mostly with the strong folding of the slip folds of the DM,CM and MM amplitude. The total colour of this rock is green-gray and little bit more dark green-gray. The avrage gradient of this rock cleavage is 60° - 65° and 75° about.
Between 44,80 - 45,20m and between 49,00 - 49,50m are preset some position of the keratophyre rock as well as in 27,40 - 31,10m.

52,50 - 76,50 The chloritic,quartzy,little bit gneisic mica schist,with a lot of schliers,pellets,irregular intercalations and spots of quartz, with some very little acicular and rodlike porphyroblasts of hornblende,with the little bit clear total grain clongation along the schistosity,with some small flakes of biotite or with some little schliers created by the flakes of biotite. Locally are present some little hypidiomorphic or allotriomorphic grains of $FeO+Fe_2O_3$ and locally with some small hypidiomorphic and scarce little bit idiomorphic grains of FeS_2. The total structure of this rock is phacoidal and phacoidal-schistose. The total colour of this rock is green-gray,little bit more dark green-gray too. The average gradient of this rock cleavage is 55° - 65° round.
Between 68,70 - 70,40m is present some position of the keratophyre rock as well as in 27,40 - 31,10m.
Between 55,00 - 55,30m is present the position of the white,barren hydrothermal quartz.

76,50 - 82,90 The motley serie of the cloritic-sericitic,hornblende-garnet keratophyre rock,with some thin intercalations of the chloritic, amphibolitic gneisic schist. In the keratophyre rock are present some small rodlike and acicular porphyroblasts of hornblende and some small grains of garnet. The grain clongation along acicular porphyroblasts of hornblende is clear enough locally. The total structure of this rock is blastoporphyric mostly. The average colour of this rock is very bright gray and bright gray. The angle of dip along the acicular porphyroblasts of hornblende and along some not clear rock cleavage is 70° about.

82,90 - 89,60 The chloritic,quartzy,little bit gneisic mica schist as well as in 52,50 -76,50m,but with more strongly impregnation of pyritic grains. The average gradient of this foliation is 70° about.

89,60 - 92,10 The motley serie of the keratophyre rock,with some small rodlike and acicular porphyroblasts of hornblende and locally with some small and little grains of garnet and locally with some thin little intercalations of chlorite-quartzy matter and chloritic,amphibolitic gneisic schist. The total structure is blastoporphyric. the average colour of this rock is gray-white and white-gray. The average ahgle of dip of foliation along some intercalations is 70° - 75° round.

92,10 - 98,40 The chloritic,locally strongly chloritic,garnet and amphibolitic gneisic schist with some intercalations of the strongly chloritic garnet mica schist,with some not so much flakes of biotite. In the gneisic schist are present a lot of small and little acicular and rodlike porphyroblasts of hornblende,with little bit clear the total grain elongation and with a lot of small grains of garnet. Locally are present some schliers or irregular intercalations of the quartz or quartzite matter. Some hypidiomorphic or allotriomorphic grains of FeS_2 are present too,but not much,scarcely more. The total structure of this rock is blastoporphyric-schistose more and locally phacoidal and phacoidal-schistose too,with the little bit clear total average grain elongation along the acicular porphyroblasts of hornblende. The total colour of this rock is green-gray. The average gradient of this rock cleavage is 50° - 55°,but locally 60° - 65° maximally about.
Between 93,60 - 93,75m and between 94,00 - 94,05m(with the schliers created by the little flakes of biotite-mobilisated) are present some positions of the quartz or quartzite matter,barren only.
Between 94,35 - 94,40m and between 95,05 - 95,10m and 98,20 - 98,27m are present the positions of the white barren hydrothermal quartz.
Between 97,65 - 97,80m is present some position of the keratophyre rock as well as in 27,40 - 31,10m.
The result of the chemical analyse of this rock position between 97,55 - 98,40m is : Cu = 0,09% , Zn = 0,40% and S = 2,00%.

98,40 - 100,65 **2,25m** The very strog impregnation of FeS_2 mostly in the bright gray quartzite,locally with some small and little schliers and pellets of the quartz or quartzite matter. Between 99,65 - 100,65m is this impregnation much more strongly and this ore body position is more compact,without some schliers of the quartz-quartzitic matter.
The pyrite creat mostly hypidiomorphic and allotriomorphic grains, which have round some microscopic allotriomorphic grains or oftenly amorphic forms of ZnS and more scarcely of FeS or $CuFeS_2$. These sulphides creat also some irregular filling of the little microscopic joints in the pyritic grains.The other bassement matter creat quartz of quartzite locally with some chlorite atc.
The result of the chemical analyse of this ore position between 98,40 - 99,65m is : Cu = 0,24% , Zn = 4,40% , S = 12,28% .
The result of the chemical analyse of this ore position between 99,65 - 100,65m is : Cu = 0,16% , Zn = 4,20% and S = 40,00% .

100,65 - 102,05 The chloritic,amphibolitic gneisic schist or locally more gneisic mica schist with a lot of little acicular and rodlike porphyroblasts of hornblende,more scarcely with some small grains of garnet and with not mcuh small flakes of biotite,which are acumulated oftenly to some little schliers too. Locally are present some intercalations of the strohgly chloritic,biotitic mica schist,with more flakes of biotite and scarcely only with some little porphyroblasts of hornblende. Some impregnation of the sulphides is present scarce only (some hypidiomorphic and allotriomorphic grains of FeS_2 mostly).
The total structure of this rock is blastoporphyric-schistose and locally only phacoidal or phacoidal-schistose too.Some total grain elongation (alog the acicular porphyroblasts of hornblende) is clear enough. Locally is this rock folded by the more flat slip folds of the DM,CM and MM amplitude. The average colour of this rock is green-gray. The average gradient of this foliation is between 80° and 90° round.
Between 100,70 - 100,75m and between 101,50 - 101,55m are present some positions of the white barren quartz,which has locally only some small schliers(inclusions) created by the little flakes of mobilisated biotite.
The result of the chemical analyse of this rock position between 100,65 - 102,05m is : Cu = 0,04% , Zn = 0,60% and S = 2,00% .

102,05 - 107,80 The sericitic-cloritic,hornblende-garnet keratophyre schist(keratophyre tuphitic or tuphic material mostly),with some small acicular and rodlike porphyroblasts of hornblende and with some irregular,crushed grains of garnet(the maximally grain size is ½ - 1 cm in average). Some ore sulphides are present scarcely only(FeS_2). The total structure of this rock is fluidal-schistose and blastoporphyric-schistose. The total colour of this rock is white gray,locally little bit green white gray too. The average gradient of this rock cleavage is 80° - 85° about.

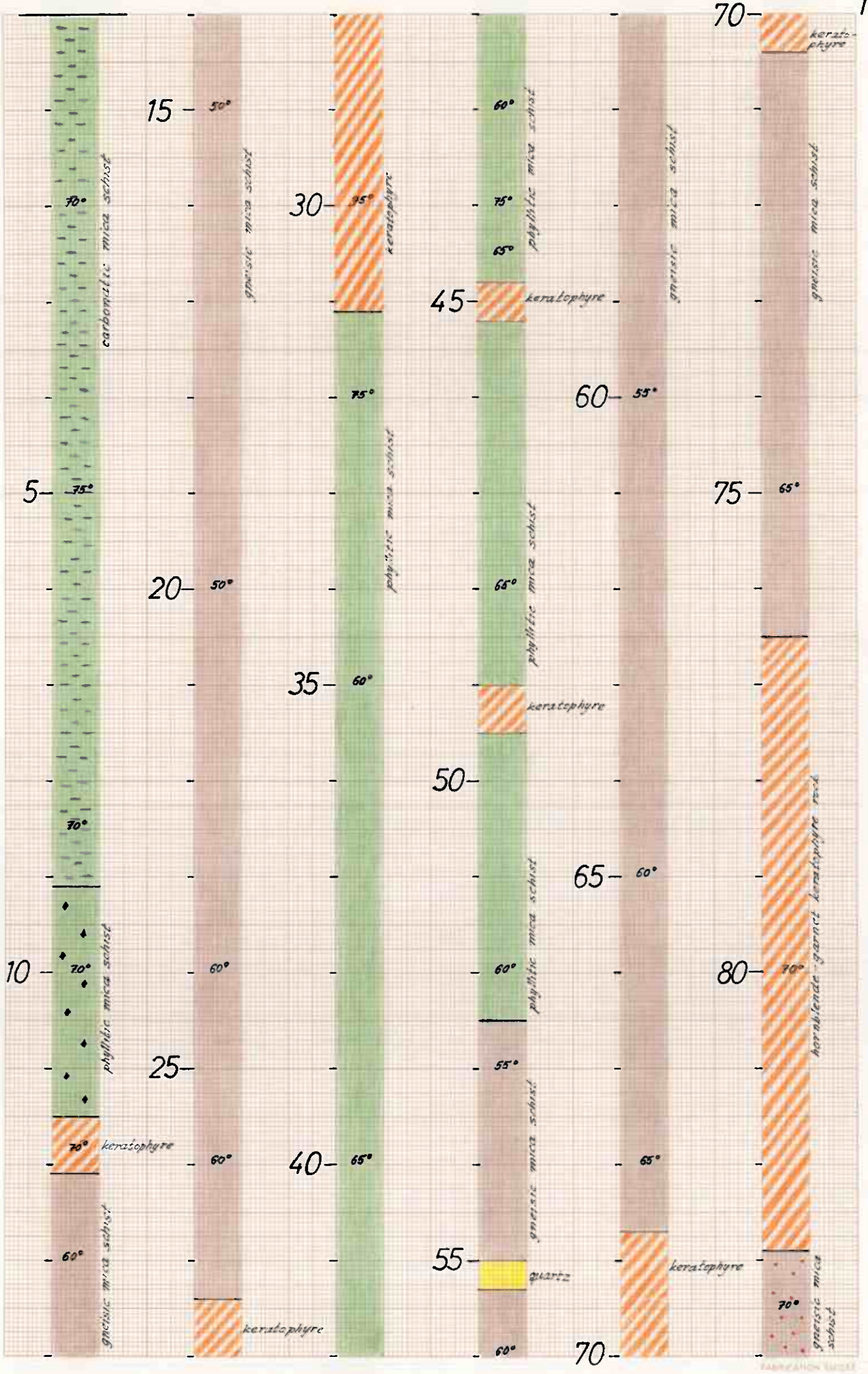
107,80 - 111,10 The strongly chloritic,quartzy and carbonatic mica schist,with a lot of schliers,pellets and spots of quartz,with much spots or irregular grains of carbonates(dolomite-ankerite ?) locally too with flakes of biotite(oftenly acumulated in some little schliers or pellets) and with not much small hypidiomorphic or allotriomorphic grains of FeS_2. Some ore sulphides impregnation is very poor and weak totally. The average total structure of this rock is maculose,phaccidal and phacoidal-schistose. The total colour of this rock is little bit green-gray and bright green-gray. The average gradient of this rock cleavage is 80° about.

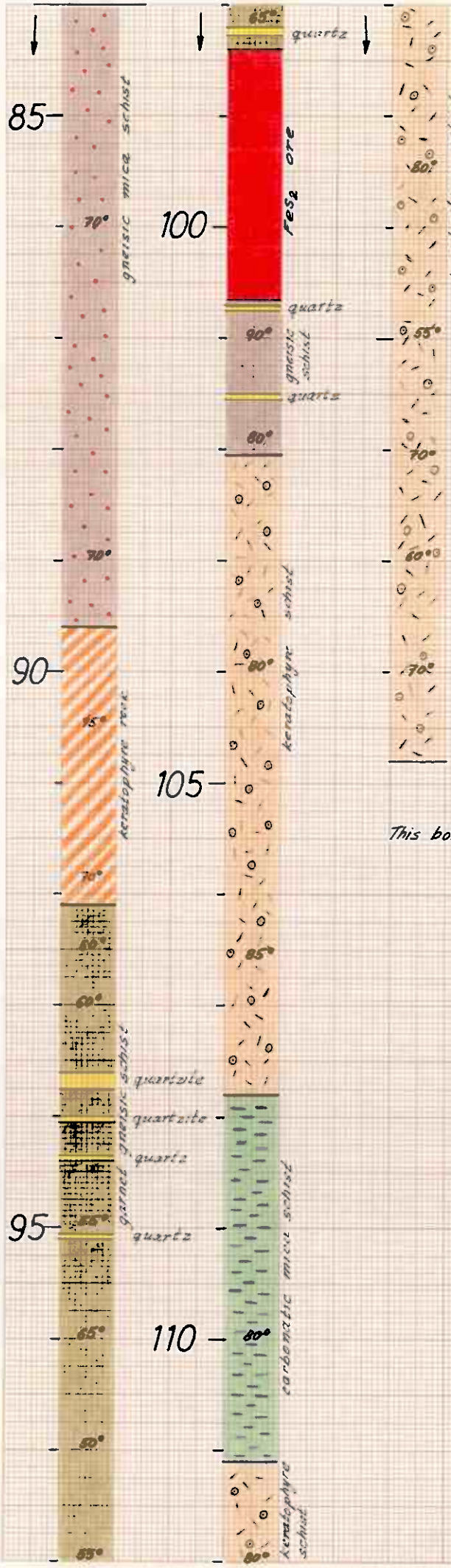
111,10 - 118,80 The sericitic and little bit chloritic,garnet and locally hornblende keratophyre schist,for the other as well as in 102,05 - - 107,80m,but locally with little bit more big crushed grains of garnet. The average gradient of this rock cleavage is 70° - 80°, but locally 55° and 60° round.

This borehole nr. 168. was stoped at 118,80m.

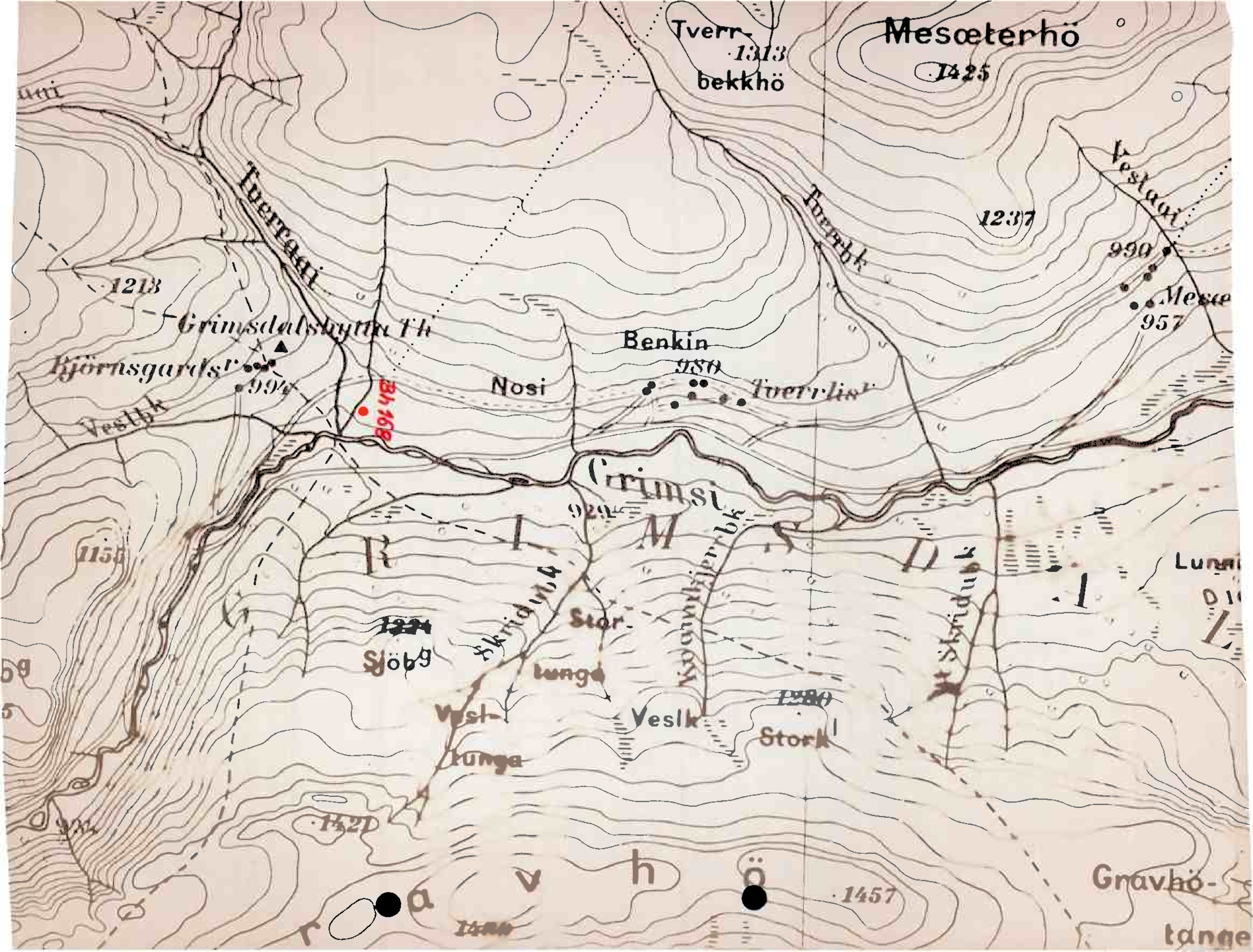
30.10.1969 M.Motys

The petrografical profile of the borehole nr. 168., Grimsdalen





This borehole was finished at 118,80 m.



Tverr-
1313
bekkhö
Mesœterhö
1425
Tverraai
1237
Vestaai
990
957
1213
Grimsdalshytta Th
Kjörnsgardsr
994
Benkin
980
Nosi
Tverrlia
Vestbk
Grimsa
924
G R I M S D A L
1155
Stor-
tunga
Vesl-
tunga
Veslk
Stork
1280
1421
1457
Gravhö

FOLLDAL VERK A/S

DRIFTSANALYSER

Tatt 27/10 1969

Skift:	% Cu	% Zn	% S	% Fe				% H_2O	Sikt	Anmerkning
Rågods, tørt	0.15	2.80	35.75	13/11-69 [illegible]			83.35	til	83.90 m	0.15
Cu–konsentrat	—	0.25	2 —				83.90	"	84.15 "	0.25
Cu–avgang	0.20	4 —	29.16				84.15	"	84.65 "	0.50
Zn–konsentrat	0.02	0.50	8.50				84.65	"	85.50 "	0.85
Zn–avgang	0.12	4.90	36.30				85.50	"	85.90 "	0.40
S–konsentrat	0.06	1.60	11.55				85.90	"	86.10 "	0.20
S–avgang	0.22	4.60	35 —				86.10	"	87.45 "	1.35
Fe–konsentrat	2.42	5.60	31.08				87.45	"	87.85 "	0.40
Fe–avgang	0.15	0.90	2.40				87.85		88.55 "	0.70
										2.0 m 2.5 m
Cu–tørke										
Zn–tørke										
S–tørke I										
S–tørke II										

Folldal Verk .... 19...... [illegible signature]

A. SÆTHER, HAMAR

THE BOREHOLE NR. 166. , Grimsdalen

The petrografical description.

0,00 - 8,70 The chloritic,amphibolitic gneisic schist,with a lot of rodlike and acicular little porphyroblasts of the hornblende,locally only with some small irregular grain s of garnet and with quartz-feldspar bassement matter(this rock is very strongly infiltrated by quartz-feldspar matter).The total structure of this rock is blastoporphyric and blastoporphyric-schistose with the little bit clear total grain clongation of the hornblende porphyroblasts. Some hornblende porphyroblasts but leaning transversal too. The total colour of this rock is bright green-gray or white green-grey. The average gradient of this rock cleavage is 75° about.

8,70 - 9,70 The keratophyre rock with very much very little porphyroblasts (acicular and rodlike) of hornblende and scarce only with some very little grains of garnet and with some thin little intercalations of the chloritic,amphibolitic gneisic schist(as well as in 0,00 - 8,70m) The total structure of this rock is blastoophitic and blastoporphyric with little bit clear totally grain clongation(of little hornblende porphyroblasts) and with little bit clear total schistosity locally too. The total colour of this rock is bright or white green-gray. The average gradient of this the total rock cleavage is 75° about.

9,70 - 12,00 The chloritic,amphibolitic gneisic schist as well as in 0,00 - 8,70m. The average gradient of this the total foliation is 70°- 75° about, but locally is this rock folded by the flat or locally also by the little bit more slip folds of the DM,CM and MM amplitude.
Between 10,90 - 11,30m is present some position of the keratophyre rock with a lot of hornblende acicular or rodlike porphyroblasts and with much small grains of the pink garnet. This rock has the blastoporphyric and porphyric structure withot some clear total grain clongation. The total colour of this rock is white gray.

12,00 - 16,20 The strongly chloritic,quartzy mica schist,with a lot of little schliers,little irregular intercalations,spots and little pellets of quartz,with much enough little hypidiomorphic or allotriomorphic grains of $FeO+Fe_2O_3$ and scarce only with some small flakes of biotite and very scarce with some little acicular porphyroblasts of the hornblende.Some little,hypidiomorphic or allotriomorphic grains of pyrite are locally present too,but very scarce only. This rock has the fluidal-schistose and locally little bit phacoidal schistose structure. The total colour of this rock is green-gray and little bit bright green-gray. Locally is this rock folded by the little bit flat,but locally more slip folds of the DM,CM and of the MM amplitude too. The average gradient of this rock cleavage is 60°,but somewhere 65° and 40°- 50° too.
Between 14,20 - 14,60m is present some position of the keratophyre as well as in 8,70 - 9,70m.
Between 15,60 - 15,95m is present the position of the tectonic quartz breccie with a lot of grains,spots or schliers of carbonates(dolomite+ancerite) and with very much scliers,pellets or irregular intercalations of chlorite or some inclusions of the strongly chloritic,quartzy mica schist. Locally are present some small hypidiomorphic and scarce idiomorphic grains of FeS_2.

16,20 - 18,00 The loss of the borehole's core.(tectonic zone ?).

18,00 - 19,10 The strongly chloritic,quartzy mica schist as well as in 12,00 - - 16,20m. The average gradient of this foliation is 65° - 70° about.

19,10 - 20,00	The keratophyre rock as well as in 8,70 - 9,70m.
20,00 - 21,70	The loss of the borehole's core (the tectonic zone ?).
21,70 - 22,00	The strongly chloritic,quartzy mica schist as well as in 12,00 - - 16 ,20m. The average gradient of this rock cleavage is 65°- 70° about.
22,00 - 22,25	The white hydrothermal barren quartz.
22,25 - 22,45	The keratophyre rock as well as in 8,70 - 9,70m.
22,45 - 22,60	The quartz tectonic breccie,with a lot of inclusions of the strongly chloritic,quartzy schist,with some spots or pellets of zoisite-epidotic matter and very scarce with some hypidiomorphic grains of pyrite.
22,60 - 34,80	The strongly chloritic,quartzy mica schist,with a lot of little schliers,pellets or little,mostly irregular intercalations and small spots too of the quartz,locally with not much little rodlike or acicular porphyroblasts of hornblende and very scarce with some small flakes of biotite. In this rock are present some little hypidiomorphic or allotriomorphic grains of $FeO+Fe_2O_3$ and some hypidiomorphic,allotriomorphic and scarcely automorphic grains of FeS_2. This impregnation is very poor and weak,wiyhout importance. Locally are present some little schliers or little intercalations of the chloritic,amphibolitic gneisic schist,infiltrated by the quartz feldspar matter,with much more rodlike and acicular porphyroblasts of hornblende. The total structure ofthis rock is rope-schistose and phacoidal-schistose,locally is this rock very strongly folded by the slip folds of the DM,CM and MM amplitude. The total colour of this rock is green-gray and little bit bright green-gray. The average gradient of this foliation is 65° about. In 24,50 - 27,50m,between 27,90 - 30,50m and between 31,00 - 33,oom is the lossing of the borehole's core.
34,80 - 37,60	The chloritic,amphibolitic ,quartzy gneisic schist,with a lot of small acicular and rodlike porphyroblasts of hornblende,which are locally with clear total grain elongation. In this rock are present some small mostly irregular grains of garnet. Some acicular or rodlike porphyroblasts of hornblende are transversal too. In this rock are present some very weak and poor impregnation of FeS_2mostly(hypidiomorphic,allotriomorphic and scarce only idiomorphic grains). The pyrite cceat also some small flakes which are situated on the plates of the foliation mostly. The total structure of this rock is blastoporphiric-schistose,with the little bit clear total grain elongation. The total colour of this rock is bright green-gray and green-gray. The average gradient of this rock cleavage is 55° round.
37,60 - 40,55	The strongly chloritic,quartzy mica schist,with very poor impregnation as well as in 22,60 - 34,80m. The average gradient of this the total rock cleavage is 50°- 55° about. The little bit strongly slip folding is present mostly too. Locally are present some mylonitic schliers and little intercalations.
40,55 - 44,50	The loss of the borehole's core(the tectonic zone ?).
44,50 - 45,20	The keratophyre rock as well as in 8,70 - 9,70m,but with more little the acicular or rodlike porphyroblasts of hornblende and with much more chlorite in. The total structure is more blastoophitic-schistose.
45,20 - 48,60	The strongly chloritic,quartzy mica schist as well as in 22,60 - - 34,80m,but locally with more small acicular or rodlike porphyroblasts of the hornblende. The average gradient of this foliation is 55° about.

Between 46,80 - 47,40m is present some position of the keratophyre rock as well as in 8,70 - 9,70m.

48,60 - 49,30 The keratophyre rock as well as in 8,70 - 9,70m.

49,30 - 59,00 The chloritic,amphibolitic,quartzy gneisic schist as well as in 34,80 - 37,60m,but with more little grains of garnet. The average gradient of this foliation is 50°- 55° about.

59,00 - 59,35 The loss of the borehole's core(the tectonic zone ?).

59,35 - 61,20 The keratophyre rock as well as in 8,70 - 9,70m.

61,20 - 76,70 The cloritic,locally more strongly chloritic gneisic schist as well as in 34,80 - 37,60m. The average gradient of this rock cleavage is 65°- 70° about,but locally only 80°- 85° too.
Between 65,10 - 65,70m , 73,10 - 73,50m , 74,40 - 75,00m , 75,35 - - 75,50m and between 76,00 - 76,25m are present some positions of the keratophyre rock as well as in 8,70 - 9,70m.
Between 75,30 - 75,35m and between 75,70 - 75,80m are present some positions of the barren quartz breccies,with some small inclusions of the strongly chloritic,quartzy matter.

76,70 - 77,00 The keratophyre rock as well as in 8,70 - 9,70m.

77,00 - 83,35 The strongly chloritic,amphibolitic gneisic mica schist as well as in 34,80 - 37,60m,but partly much more chloritic,with some small flakes of biotite and locally with a lot of schliers and pellets of quartz and locally is present some very weak and poor impregnation of FeS_2 mostly(the hypidiomorphic and allotriomorphic grains).
The average gradient of this rock cleavage is 55°- 60° round.
Between 77,50 - 78,15m , 78,60 - 78,70m, 78,80 - 78,90m , 79,00 - - 79,10m , 79,75 - 79,90m , 80,00 - 81,40m are present some positions of the keratophyre rock as well as in 8,70 - 9,70m.
Between 78,90 - 79,00m is present the position of the quartz breccie as well as in 22,45 - 22,60m.
Between ca 81,00 - 83,35m is the total core recovery 30 - 35 % only.

83,35 - 83,90
0,55m The very stron impregnation of FeS_2 mostly in the white gray quartzite,locally only with some little schliers of the quartz matter. The pyrite creat small hypidiomorphicand allotriomorphic grains,which has round some amorphic forms or allotriomorphic grains of FeS and fewly of ZnS and scarcely of $CuFeS_2$. Locally these sulphides filling some little microscopic joints in the pyritic grains.
The result of the chemical analyse of this ore position between 83,35 - 83,90m is : Cu = 0,15% , Zn = 2,80% and S = 35,75% .
The total core recovery of this position between 83,35 - 83,90m is : 31%.

83,90 - 84,15 The strongly chloritic,amphibolitic gneisic mica schist aswell as in 77,00 - 83,35m. The average gradient of this foliation is 55° about.
The result of the chemical analyse of this rock position between 83,90 - 84,15m is : Cu = 0,00% , Zn = 0,25% and S = 2,00% .
The total core recovery of this rock position between 83,90 - 84,15m is : 51% about.

84,15 - 84,65
0,50m The very strong impregnation of FeS_2 mostly in the gray quertzite locally with some little schliers and spots of the quartz matter. The pyrite creat small hypidiomorphic and allotriomorphic grains which have round some microscopic amorphic forms or allotriomorphic grains of ZnS mostly and locally of FeS too. Some little amorphic forms of $CuFeS_2$ are present too,but more scarcely. These the other sulphides creat locally some microscopic filling of the little joints,which are present in the grains of FeS_2.

The result of the chemical analyse of this ore position between 84,15 - 84,65m is : Cu = 0,20% , Zn = 4,00% and S = 29,16% .
The total core recovery of this rock position between 84,15 - - 84,65m is : 51% about.

84,65 - 85,50 The strongly chloritic,amphibolitic gneisic mica schist as well as in 77,00 - 83,35m. The average gradient of this foliation is 55° about.
The result of the chemical analyse of this rock position between 84,65 - 85,50m is : Cu = 0,02% , Zn = 0,50% and S = 8,50% .
The total core reco recovery of this rock position between 84,65 - - 85,50m is : 51% about.

85,50 - 85,90 (0,40m) The very strong impregnation of FeS_2 mostly as well as in 84,15 - - 84,65m,but more compact and without some schliers or pellets of the quartz matter.
The result of the chemical analyse of this ore position between 85,50 - 85,90m is : Cu = 0,12% , Zn = 4,90% and S = 36,30%.
The total core recovery of this ore position between 85,50 - 85,90m is : 51% about.

85,90 - 86,10 The strongly chloritic,amphibolitic gneisic micaschist as well as in 77,00 - 83,35m. The average gradient of this foliation is 50° - 55° about.
The result of the chemical analyse of this rock position between 85,90 - 86,10m is : Cu = 0,06% , Zn = 1,60% and S = 11,55% .
The total core recovery of this ore position between 85,90 - - 86,10m is : 51% about.

86,10 - 87,45 (1,35m) The very strong impregnation of FeS_2 mostly as well as in 85,50 - - 85,90m.
The result of the chemical analyse of this ore position between 86 ,10 - 87,45m is : Cu = 0,22% , Zn = 4,60% and S = 33,00% .
The total core recovery of this ore position between 86,10 - - 87,45m is : 51% about.

87,45 - 87,85 (0,40m) The very strong impregnation of FeS_2 mostly in the strongly chloritic,amphibolitic and quartzy gneisic mica schist. The pyrite creat some small hypidiomorphic,allotriomorphic and scarcely idiomorphic grains,which are acumulated in the schliers,pellets and some long and thin lenticles,parellel with the clear total schistosity. Round of these pyritic grains are situated some microscopic amorphic forms or allotriomorphic grains of ZnS,FeS and $CuFeS_2$. Locally $CuFeS_2$ creat some much more big amorphic forms which size is 0,5mm and scarcely 1mm and more. In this rock are present locally little bit flakes of biotite and hornblende creat much little acicular or rodlike porphyroblasts,which have the little bit clear total grain elongation. The total structure of this rock is blastoporphyric-schistose. The total colour of this rock is green-gray and more dark green-gray. The average gradient of this rock cleavage is 55° about.
The result of the chemical analyse of this strongly impregnated position between 87,45 - 87,85m is : Cu = 2,42% , Zn = 5,60% and S = 31,08% .
The total core recovery of this impregnated rock position between 87,45 - 87,85m is : 72% about.

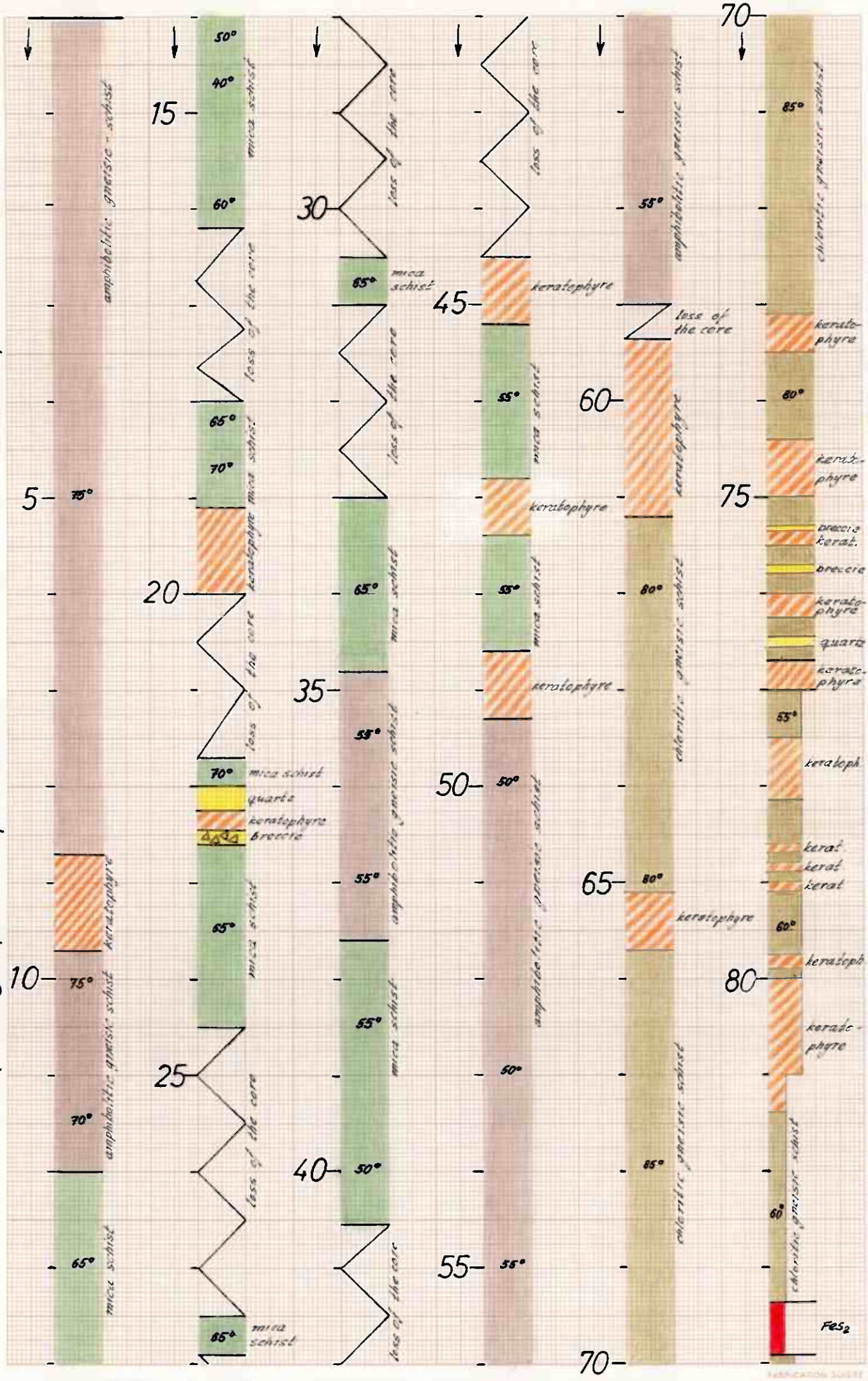
87,85 - 96,85 The very strongly chloritic,quartzy mica schist,locally only with some little acicular and rodlike porphyroblasts of hornblende,without some total orientation mostly. Some schliers and pellets, spots and little irregular intercalations creat quartz matter. In this rock are present a lot of little and small hypidiomorphic and allotriomorphic,but locally scarcely idiomorphic grains of FeS_2 mostly. This sulphidic impregnation is very poor and weak totally

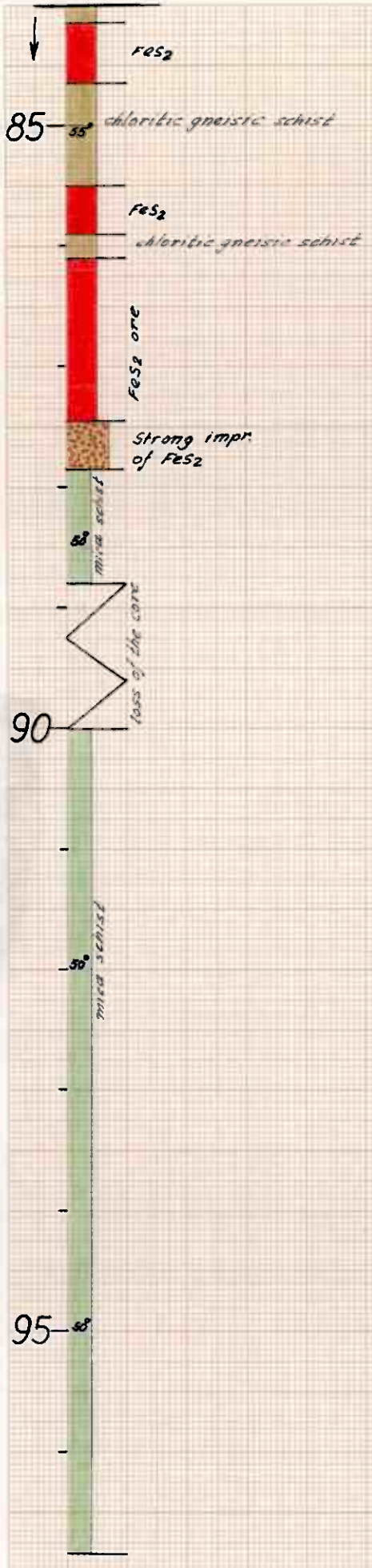
only. The structure of this rock is phaccidal, phaccidal schistose, but locally pell-mell only. The total colour of this rock is bright green-gray. The average gradient of this the total rock cleavage is 50° about.
Between 88,80 - 90,00m is the lossing of the core of this borehole (perhaps the strong tectonic zones).
The result of the chemical analyse of this rock position between 87,85 - 88,55m is : Cu = 0,15% , Zn = 0,90% and S = 2,40% .
The total core recovery of this rock position between 87,85 - - 96,85m is : 38% about.

This borehole was stoped at 96,85m.

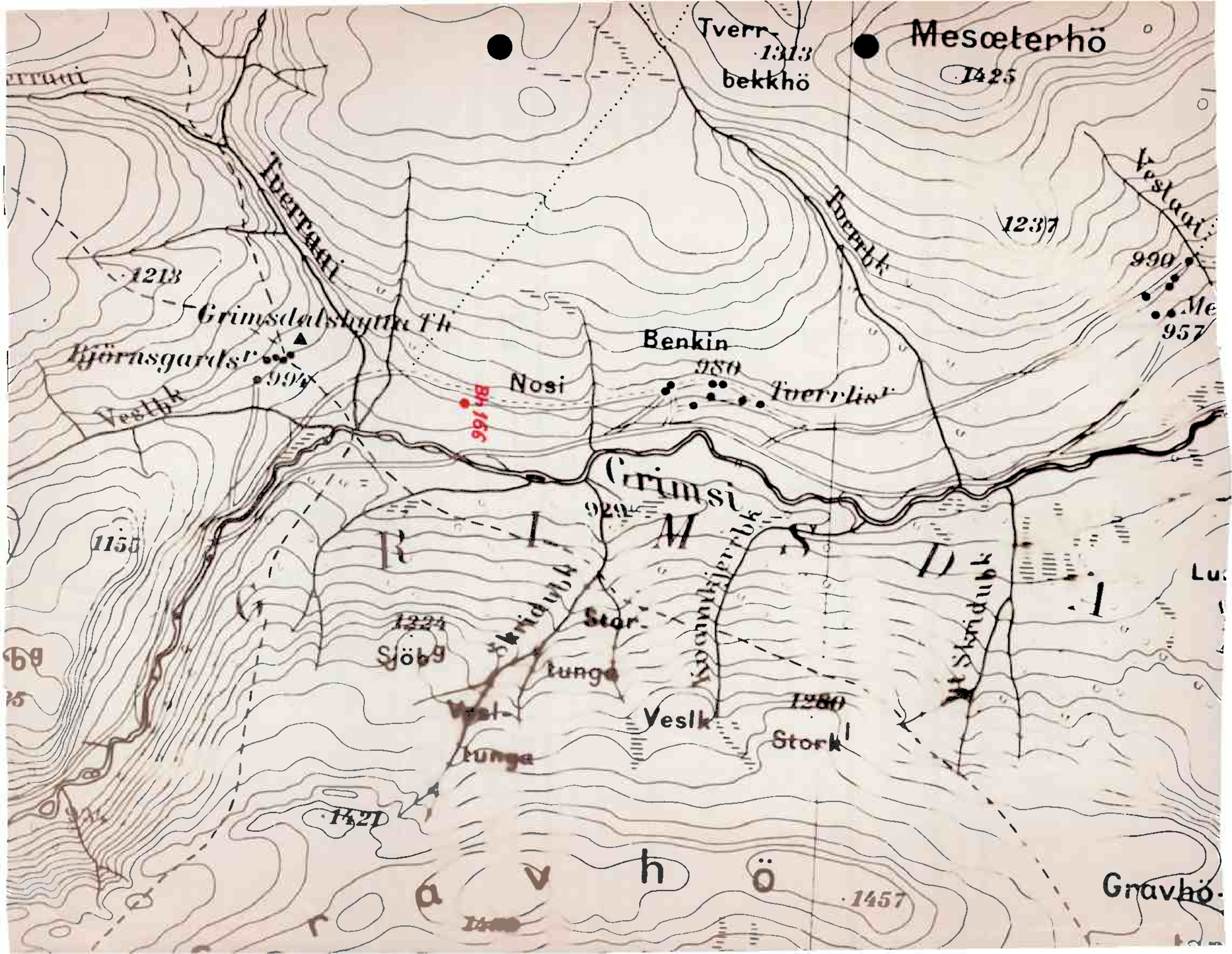
25.10.1969 M.Motys

The petrographical profile of the borehole nr. 166., Grimsdalen





This borehole was finished at 96,85 m.



Mesœterhö
Tverr-
1313
bekkhö
1425
1237
Tverrbk
990
957
1213
Grimsdalshytta Th
Björnsgardsr
994
Vestbk
Nosi
Bh 166
Benkin
980
Grimsi
924
1155
1324
Sjöbg
Skridubk
Stor-
tunge
Vesl-
tunge
Veslk
1280
Storkl
1421
1457
Gravhö

FOLLDAL VERK A/S

DRIFTSANALYSER

Tatt 21/10 1969

Skift:	% Cu	% Zn	% S	% Fe				% H_2O	Sikt	Anmerkning
Rågods, tørt	0.5	0.40	2.-	13h	165	Grimse/elm		18.65	71	60.86 m
Cu–konsentrat	0.38	1.-	35.21					60.86	"	61.06 "
Cu–avgang	0.18	0.80	6.33					61.06	"	61.25 "
Zn–konsentrat	0.44	3.20	35.21					61.25	"	62.12 "
Zn–avgang	0.08	0.85	4.68					62.12	"	62.50 "
S–konsentrat	0.53	3.70	40.44					62.50	"	63.73 "
S–avgang	0.10	0.30	2.-					63.73	"	64.05 "
Cu–retur	0.64	2.10	29.45					64.05	"	64.65 "
Zn–retur	0.14	0.70	8.50					64.65	"	66.30 "
Cu–tørke	0.03	0.40	1.70					70.15	"	72.75 "
Zn–tørke	0.30	2.60	34.90					72.75	"	74.60 "
S–tørke I	0.06	0.20	2.20					74.60	"	76.65 "
S–tørke II										

Folldal Verk ● 19 ●

A. SÆTHER, HAMAR

THE BOREHOLE nr. 165 , Grimsdalen

The petrografical description.

0,00 - 15,20 The amphibolitic,little bit chloritic,muskovitic and biotitic(oftenly deferificated)and locally garnetgnasic schist. The bassement matter is quartz and quartz-feldspar. In this rock are present a lot of small rodlike or acicular porphyroblasts of hornblende,which have some little bit clear grain clongation. Locally are present some small grains of garnet,mostly hypidiomorphic or allotriomorphic. Scarce only are present some little idiomorphic grains of $FeO+Fe_2O_3$, which are oftenly little bit deformated too. Some ore sulphides are present very scarce only or isn't present. Locally are present some schliers or little,mostly irregular intercalations of myllonitic matter,oftenly with some graphitic substance(example in 12,75m about). The total structure of this rock is porphyroblastic and fluidal-porphyroblastic. The total colour of this rock is bright gray or oftenly bright,little bit green-gray. The average gradient of this foliation,along grain clongation mostly is 50°about.

15,20 -15,70 The keratophyre,with little bit sericite,with not much little rodlike or acicular porphyroblasts of hornblende and with not much too hypidiomorphic or allotriomorphic grains of gernet. The total structure of this rock is porphyroblastic with little bit clear grain clongation only. Some ore sulphidic mineralisation isn't present mostly. The total average colour of this rock is very bright gray or white gray. The angle of dip of this grain clongation is 45°- 50° about.

15,70 - 17,20 The amphibolitic,little bit chloritic,muskovitic and biotitic(oftenly deferificated) and locally garnet gnasic schist as well as in 0,00 - 15,20m,but locally strongly folded by the folds of the DM, CM and MM amplitude. The average gradient of this foliation,mostly along this grain clongation is 50°- 60°round.

17,20 - 17,35 The quartzy breccie with the keratophyre matter too,with some irregular inclision of the chloritic matter,with rodlike or acicular porphyroblasts of hornblende locally too and with not much small pellets or spots of some carbonates and scarcely with some little grains of garnet. Locally,scarce are present some small allotriomorphic grains of FeS_2mostly only.

17,35 - 18,35 The keratophyre as well as in 15,20 - 15,70m. The angle of dip of this grain clongation is 55°- 60°about.

18,35 - 18,70 The chloritic,locally strongly chloritic gnasic schist,with a lot of small rodlike or acicular porphyroblasts of hornblende,oftenly with little bit clear grain clongation,locally with a lot of small, mostly hypidiomorphic or allotriomorphic grains of the garnet,with much irregular intercalations or schliers of quartz and quartz-feldspar matter. Locally only are present some intercalations,which are created by the strongly chloritic,quartzy,garnet mica scist or gnaisic mica schist. Some mineralisation of the ore sulphidic minerales isn't present mostly. The total structure of this rock is phacoidal schistose,locally fluidal-porphyroblastic. The total colour of this rock is green-gray or bright green-gray. The average gradient of this foliation is 60°round.

18,70 - 21,20 The chloritic,biotitic(locally little bit deferificated) gnasic schist,with a lot of small irregular grains of garnet and with many little acicular or rodlike porphyroblasts of hornblende,which have only little bit clear grain clongation. The bassement matter is created by quartz and quartz-feldspar. The total structure of this rock is parallel schistose,with very strong folding of the folds of the

DM,CM and MM amplitude. The total average colour of this rock is gray and locally more bright or more dark gray. The gradient of this foliationisn't stabil.

21,20 - 21,90 The strongly chloritic,locally chloritic,strongly quartzy,biotitic(oftenly deferificated) mica schist,with not much very small acicular porphyroblasts of hornblende,with a lot of schliers,pelets or irregular intercalations of quartz mostly,which has locally some small,irregular pots or pellets of some carbonates. Some ore sulphidic mineralisation isn't present mostly. The structure of this rock is ropy and fluidal or phacoidal schstose too. The total colour of this rock is green-gray. The average gradient of this foliation is 65° about. Locally on the plates of foliation are present some little scales or little covers of little scales, which are created by FeS.

21,90 - 23,20 The keratophyre as well as in 15,20 - 15,70m,but with more porphyroblasts of hornblende and oftenly with more big too. The grains of garnet are present very scarce only. Some grain clongation isn't clear mostly. Some ore sulphidic mineralisation isn't present.

23,20 - 23,70 The position of the barren white,hydrothermal quartz,with a lot of joints without some main orientation.

23,70 - 24,00 The strongly chloritic,locally chloritic,strongly quartzy,biotitic(oftenly deferificated) mica schist as well as in 21,20 - 21,90m The average gradient of this foliation is 65° round.

24,00 - 24,60 The keratophyre as well as in 15,20 - 15,70m,but with not so clear grain clongation.

24,60 - 24,80 The position of the barren white,hydrothermal quartz as well as in 23,20 - 23,70m.

24,80 - 29,25 The strongly chloritic,quartzy phyllitic mica schst,with not much little scales of biotite,with a lot of schliers,pellets,spots or irregolar intercalations and or withsome irregular lenticles of quartz. Locally only are present some little schliers or irregular intercalations of quartzy graphitic myllonitic matter. Some sulphidic mineralisation is present very scarce only (the little scales of FeS mostly). The total structure of this rock is phacoidal schistose or ropy. Locally is this rock slightly folded. The total colour of this rock is green-gray and little bit dark green-gray too. The average gradient of this foliation is 50°- 55° round.

29,25 - 31,20 The keratophyre as well as in 15,20 - 15,70m . The angle of dip of this grain clongation is 35°,but locally 10°- 15°round.

31,20 - 32,25 The strongly chloritic,quartzy schist,phyllitic mica schist as well as in 24,80 - 29,25m. The average gradient of this foliation is 40°- 50° round.

32,25 - 32,60 The keratophyre as well as in 15,20 - 15,70m. The angle of dip of this grain clongation is 45°round.

32,60 - 33,80 The strongly chloritic,quartzy and biotitic little bit gnasic myllonitic mica schist,with a lot of schliers,pellets,irregular intercalations andirregular lenticles of quartz and locally with some little schliers of the myllonitic and little bit graphitic substance. Some ore sulphidic mineralisation isn't present mostly or very scarce only (some little scales of FeS mostly). The total structure of this rock is phacoidal schistose and ropy. The total colour of this rock is green-gray and little bit dark green-gray. The average gradient of this foliation is 55°round.

33,80 - 34,30 The keratophyre as well as in 15,20 - 15,70m. The angle of dip of

This grain elongation is 45°- 50° round.

34,30 - 40,90 The amphibolitic,little bit chloritic,muscovitic and biotitic(oftenly little bit deferificated),scarcely garne gnasic schist as well as in 15,70 - 17,20m. The average gradient of this foliation,mostly along this little bit clear total grain elongation is 55°- 60° round.

40,90 - 41,40 The keratophyre as well as in 15,20 - 15,70m. The angle of dip of this grain elongation is 45° round.

41,40 - 42,90 The strongly chloritic,quartzy phyllitic mica schist as well as in 24,80 - 29,25m. The average gradient of this foliation is 60° round.

42,90 - 49,30 The motley serie of the keratophyre as well as in 15,20 - 15,70m and in 21,90 - 23,20m,locally with some little intercalations of the amphibolitic,little bit chloritic gnasic schist as well as in 15,70 - 17,20m. The average angle of dip of this total grain clongation or of this little bit locally clear foliation is 50°about.

49,30 - 56,70 The amphibolitic,little bit chloritic,muskovitic and little bit biotitic(oftenly little bit deferificated)and locally garnet gnasic schist as well as in 0,00 - 15,20m,but mostly with more clear total schistosity. The average gradient of this foliation, also along this the total little bit clear grain elongation is 65° round.

56,70 - 60,60 The chloritic,locally strongly strongly chloritc,gnasic schist as well as in 18,35 - 18,70m,but with more some chloritic,garnet quartzy mica schist or chloritic-garnet gnasic mica schist intercalations. Locally is present in this rock somevery poor and weak impregnation of FeS_2mostly(some little hypidiomorphic or allotriomorphic grains or some small scales of FeS too,but scarcely only). The average gradient of this foliation is 50°- 60° about,but locally 70°too.

60,60 - 6 0,75 The quartz's breccie,with some irregular inclusions of the amphibolitic,chloritic gnasic schist. The bassement matter is created by the barren white hydrothermal quartz.

60,75 - 60,86 The strongly chloritic,biotitic,mylonitic mica schist,with some more strong impregnation of FeS_2mostly(the allotriomorphic grains or the pellets of these grains).The total structure of thi position is ropy and phacoidal schistose. The total colour of this rock's position is dark green-gray. The average gradient of this foliation is 70°- 75° round.
The result of the chemical analyse from the rock's position between 58,60 - 60,86m .

60,86 - 61,06
0,20 m The strong impregnation of FeS_2 mostly in the gray quartzite, with some little schliers or pellets of the quartz.
The pyrite creat mostly hypidiomorphic and allotriomorphic grains, which have the border cceated by the allotriomorfic grains or irregular amorphic forms of ZnS and more scarcely of $CuFeS_2$ or FeS. These microskopic sulphides,more $CuFeS_2$ creat some filling of the microscopic joints in the FeS_2 grains.
The result of the chemical analyse from this ore position between 60,86 - 61,06m is :

61,06 - 61,25 The strongly chloritic,quartzy and biotitic,little bit mylonitic phyllitic mica schist as well as in 24,80 - 29,25m. Some sulphidic impregnation is present scarcely only. The average gradient of this foliation is 75°round. The result of the chemical analyse from this position betweem 61,06 - 61,25m is :

61,25 - 62,12 (0,87 m) The strong impregnation of FeS_2 mostly in the gray quartzite, locally with some little irregular intercalations or schliers of strongly chloritic, quartzy matter (in example in 61,70m : 1,5cm and between 6185 - 61,90m) and with some schliers of quartz. Some microscopic irregular, allotriomorphic grains of ZnS and some small microskopic amorphic forms of $CuFeS_2$ and FeS are present only on the borders of the pyritic, hypidiomorphic or allotriomorphic grains and these minerales filled some little, mostly microscopic joints in the pyritic grains.
The result of the chemical analyse from this ore position between 61,25 - 62,12m is :

62,12 - 62,50 The strongly chloritic, quartzy and little bit biotitic, myllonitic, locally little bit gneisic mica schist as well as in 32,60 - 33,80m but with a lot of small spots or little pellets of some carbonates. The average gradient of this foliation is 60° - 65° about.
Some poor impregnation of FeS_2 mostly is scarce present too.
The result of the chemical analyse from this rock position between 62,12 - 62,50m is :

62,50 - 63,73 (1,23 m) The very strong impregnation of FeS_2 in the gray quartzite mostly, locally only with some little irregular intercalations or schliers of chloritic matter, locally with some little pelets or schlierrs of quartz and locally with some small rodlike or acicular porphyroblasts of hornblende. Some microscopic impregnation is created by ZnS more and FeS and more scarcely by $CuFeS_2$. ZnS creat some small allotriomorphic grains or amorphic forms round the hypidiomorphic or allotriomorphic pyritic grains, and some amorphic forms which creat partly some filling of the little, mostly microscopic jointc in the pyritic grains. FeS and $CuFeS_2$ creat mostly some little microscopic amorphic forms on the borders of the pyritic grains or more some filling of the little, mostly microscopic joints in the pyritic grains.
The result of the chemical analyse from this ore positions between 62,50 - 63,73m is :

63,73 - 64,05 The strongly chloritic, quartzy and little bit biotitic, mylonitic, locally little bit gneisic mica schistas well as in 62,12 - 62,50m. The average gradient of this foliation is 65° about.
The result of the chemical analyse from this position between 63,73 - 64,05m is :

64,05 - 64,65 (0,60 m) The little bit more strongly impregnation of FeS_2 mostly in the irregular small positions of the gray quartzite (as well as in 61,25 -62,12m) and in the chloritic, locally strongly chloritic, gneisic shist as well as in 18,35 - 18,70m, which are present between them. The sulphidic ore minerales' impregnation is totally rather poor and weak only. The average gradient of this foliation is 70° round.

64,65 - 72,75 The chloritic, locally strongly chloritic gneisic schist as well as in 18,35 - 18,70m, locally with very poor and weak impregnation of FeS_2 mostly, but some microscopic impregnation of ZnS, $CuFeS_2$ and FeS is locally present too, very poor only. The average gradient of this foliation is 65° - 70° round.
The result of the chemical analyse from the rock position between 64,65 - 66,30m is :
The result of the chemical analyse from the rock position between 70,15 - 72,75m is :

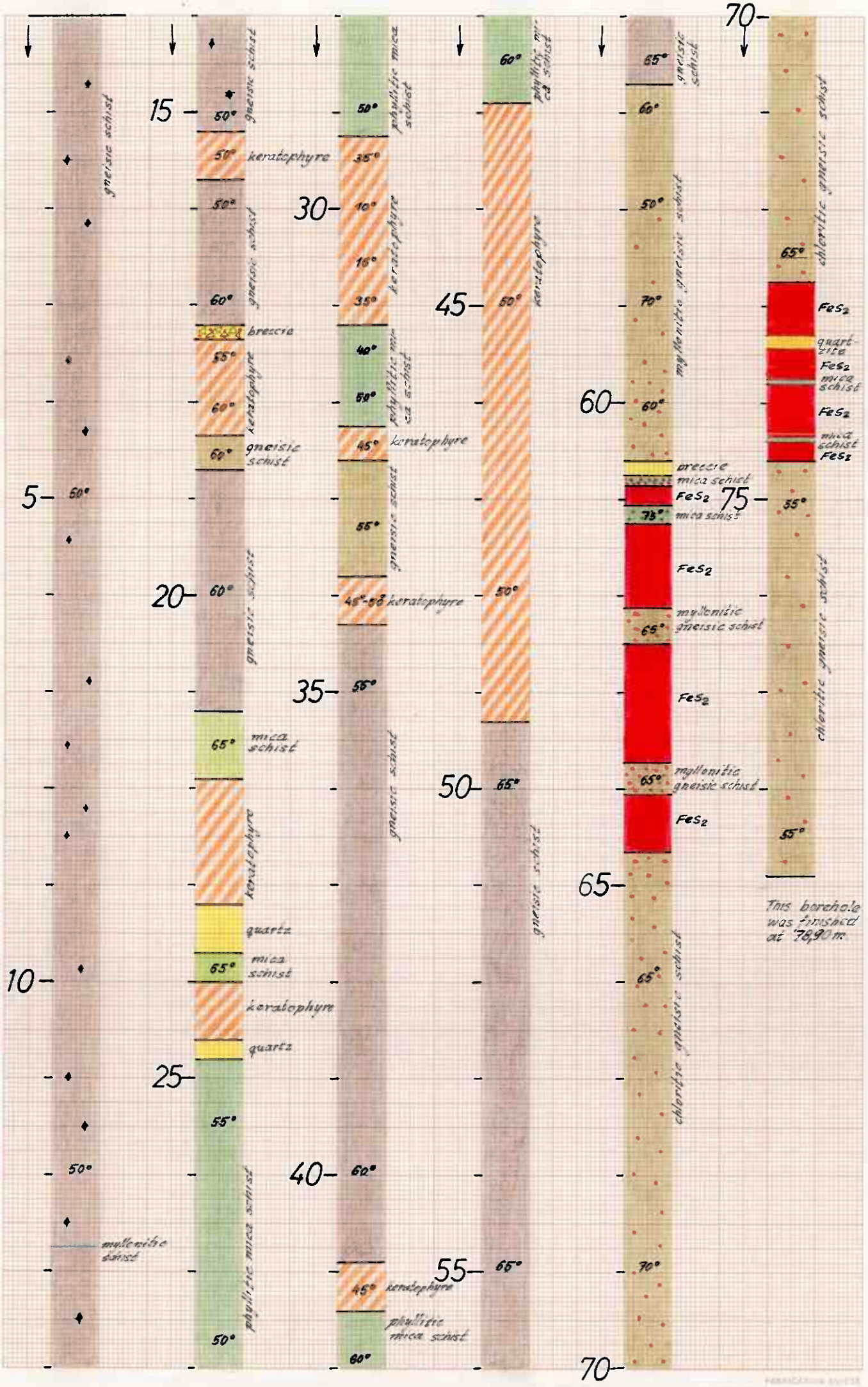
72,75 - 74,60 (1,85 m) The strong, locally very strong impregnation of FeS_2 mostly in the gray quartzite as well as in 62,50 - 63,73m. Between 73,30 - 73,43m

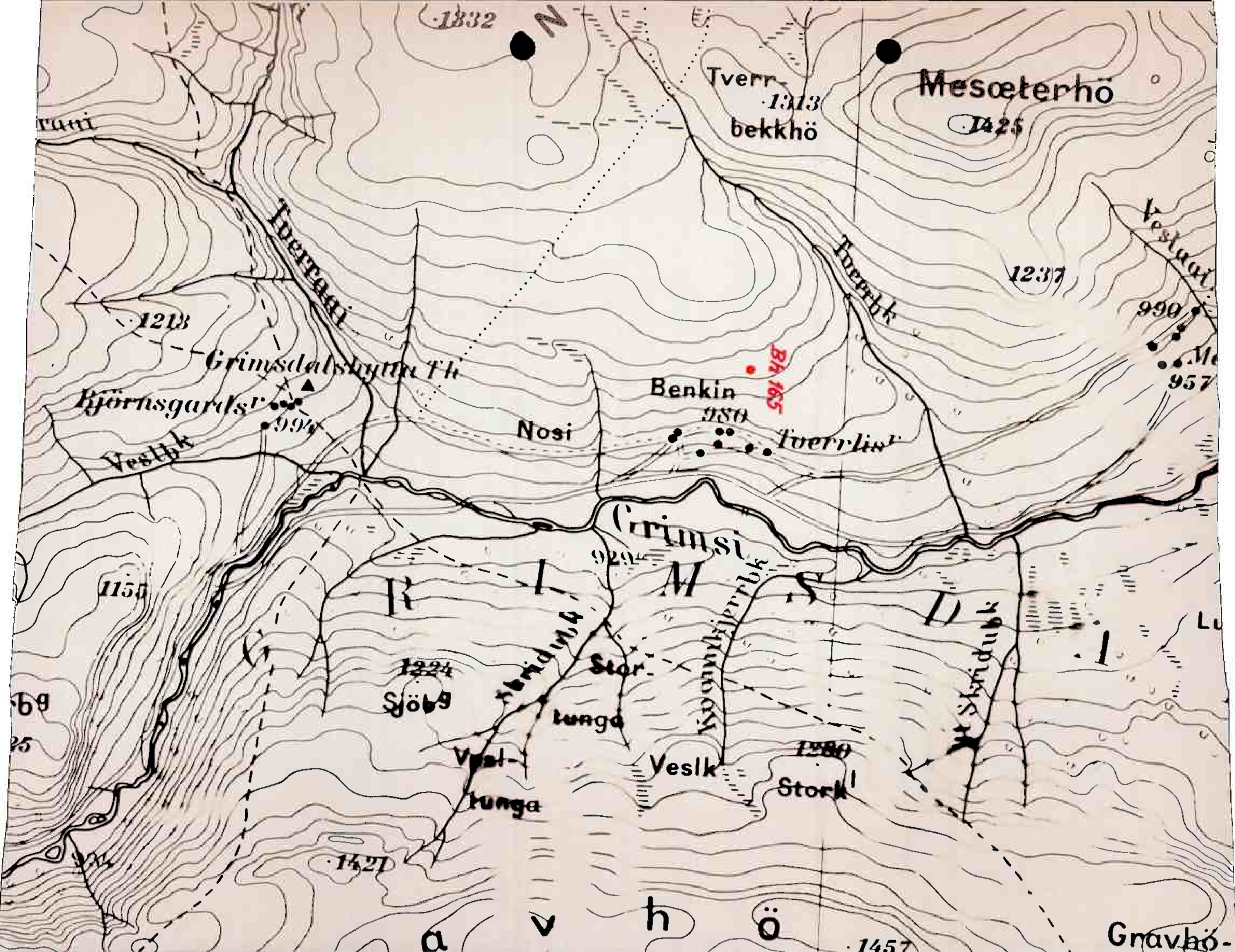
are present some schliers of the gray quartzite,which are barren well only. Between 74,35 - 74,40m and between 73,75 - 73,80m are present some positions of the strongly chloritic,quartzy mylonitic phyllitic schist as well as in 24,80 -29,25m,withot some ore sulphidic mineralisation.
The result of the chemical analyse from this ore position between 72,75 - 74,60m is :

74,60 - 78,90 The strongly chloritic,quartzy gneisic schist or gnasic mica schist with a lot of very small acicular or rodlike porphyroblasts of hornblende,which have mostly clear general grain elongation along the total schistosity. Locally only are present some little grains of garnet. The bassement matter is created by quartz and quartz-feldspar too with chlorite. Scarcely are present some spots of some carbonates and scarcely too are present some little allotriomorphic,scarce hypidiomorphic or idiomorphic grains of FeS_2. The total structure of this rock is ropy,phacoidal schistose and locally fluidal too. The total average colour of this rock is green-gray. The average gradient of this foliation is 55° rond.
The result of the chemical analyse from this rock position between 74,60 - 76,65m is :

This borehole nr. 165.,Grimsdalen was finished at 78,90m.

The petrografical profile of the borehole nr. 165, Grimsdalen





1332
N
Tverr-
1313
bekkhö
Mesœterhö
1425
Tverraai
1218
Grimsdalshytta Th
Björnsgardst
994
Veslbk
Nosi
Benkin
980
Bh 165
Tverrlist
Tverrbk
1237
990
957
Grimsi
929
G R I M S D A L
1155
1324
Sjöbg
Skridubk
Stor
tunga
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Stork
1280
Vesl-
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a v h ö
Gravhö-

FOLLDAL VERK A/S

DRIFTSANALYSER

Tatt 20/10 1969

Skift:	% Cu	% Zn	% S	% Fe				% H_2O	Sikt	Anmerkning
Rågods, tørt	0.18	0.30	6.60	Kh 164 Gjuvinfelan			59.	15 Tel	60.25	m
Cu–konsentrat	0.40	3.40	27.50	"		"	60.	25 "	61.–	"
Cu–avgang	0.06	0.35	2 –	"		"	61.	– "	61.40	"
Zn–konsentrat	0.42	2.70	35.21	"		"	61.	40 "	62.45	"
Zn–avgang	0.10	0.40	8.35	"		"	62	15 "	62.50	"
S–konsentrat	0.34	4.10	37.41	"		"	62.	80 "	63.70	"
S–avgang	0.04	0.40	2 –	"		"	63.	70 "	63.95	"
Cu–retur	0.33	4.20	39.06	"		"	63.	95 "	64.10	"
Zn-retur	0.15	1.20	6.80	"		"	64.	10 "	64.60	"
Cu–tørke	0.57	1.1	44.55	"		"	64.	60 "	64.68	"
Zn–tørke	0.04	0.35	1.30	"		"	64.	68 "	65.40	"
S–tørke I	0.24	4.20	39.33	"		"	65.	40 "	65.60	"
S–tørke II		0.65	4.–	"		"	65.	60 "	66.25	"

Folldal Verk .... 19 .... [illegible signature]

A. SÆTHER, HAMAR

FOLLDAL VERK A/S

DRIFTSANALYSER

Tatt 30/10 1969

Skift:	% Cu	% Zn	% S	% Fe				% H_2O	Sikt	Anmerkning
Rågods, tørt	0.40	4.80	38.50	Bh	164.	Grimsdalen		66.05	til	66.75 m
Cu–konsentrat	0.07	2.–	9.62			"		66.75	"	67.– "
Cu–avgang	0.18	5.80	42.35	"		"		67.–	"	67.35 "
Zn–konsentrat	0.11	0.70	4.10	"		"		67.35	"	68.45 "
Zn–avgang	0.07	0.40	3.30	"		"		91.20	"	91.48 "
S–konsentrat	0.26	2.70	36.80	"		"		91.48	"	91.60 "
S–avgang	0.09	1.10	6.60	"		"		91.60	"	91.95 "
Cu–retur	0.44	2.40	40.98	"		"		91.95	"	92.05 "
Zn-retur	0.04	0.55	5.78	"		"		92.05	"	92.20 "
Cu–tørke	0.30	2.90	41.49	"		"		92.20	"	92.65 "
Zn–tørke	0.06	0.50	4.13	"		"		92.65	"	94.02 "
S–tørke I	0.24	5.40	38.10	"		"		94.02	"	94.13 "
S–tørke II	0.03	0.40	2.54	"		"		94.13	"	95.20 "

Folldal Verk 19

[illegible]

A. SÆTHER, HAMAR

THE BOREHOLE nr. 164., Grimsdalen

The petrografical description.

0,00 - 8,45 The strongly chloritic,little bit biotitic(locally little bit deferificated) mica schist or green mica schist. Only locally are present some acicular porphyroblasts of actinolite or honblende(?)very little only. Scarce are present some hypidiomorphic or idiomorphic little grains of the magnetite and of pyrite too. The little flakes of the biotite are present on the plates of this foliation,but locally are transversal too. Some little pellets and very thin schliers which are parallel with the total foliation are created by quartz. The total structure of this rock is parallel slaty-flaking. The total colour of this rock is green-gray. The average gradient of this foliation is 80°- 85° about.

8,45 - 8,80 The keratophyre rock with a lot of small acicular porphyroblasts of hornblende and locally only with some little grains of garnet. The bassement matter of this rock is cceated by quartz-feldspar and quartz. The total structure of this rock is blastoporphyric with clear grain clongation(hornblende). The total colour of this rock is white little bit green gray. The angle of dip of this grain clongation is 80° about.

8,80 -10,90 The strongly carbonatic,chloritic and little bit biotitic green mica schist with very much spots and irregular grains of the carbonates (dolomite-ancerite?). Scarce only are present some little hypidiomorphic or automorphic grains of FeS_2. The total structure of this rock is pell-mell and blastoporphyric. The total colour of this rock is green-gray or little bit bright green-gray too. The average gradient of this not so clear foliation is 85° round.

10,90 - 11,80 The keratophyre rock with a lot of small rodlike and more acicular porphyroblasts of hornblende and with not much little grains of garnet. The bassement matter is cceated by quartz-feldspar. The grain clongation(of hornblende acicular porphyroblasts) is clear enough and has the angle of dip ca 80°- 85°. The total colour of this rock is white green-gray.

11,80 - 15,70 The strongly chloritic mica schist or green mica schist as well as in 0,00 - 8,45m. The average gradient of this foliation is 75°about.

15,70 - 16,50 The tectonic breccie with the bassement matter created by quartz and with some inclusions of the keratophyre like in 10,90 - 11,80m and with a lot of irregular inclusions of zoisite-epidote matter. Some ore mineralisation isn't present.

16,50 - 18,40 The chloritic and amphibolitic gnasic schist or gnasic mica schist scarcely with some little flakes of the biotite,with a lot of little acicular porphyroblasts of hornblende,which have mostly clear the total grain clongation,parallel with this foliation. Scarcely only are present some little grains of the garnet. Locally are present on the plates of this foliation some irregular flakes of FeS_2 and scarce of FeS. The total structure of this rock is blastoophitic-schistose with clear the total grain clongation. The total colour of this rock is bright green-gray. The average gradient of this foliation is 75° about.

18,40 - 19,70 The chloritic,strongly quartzy mica schist,with some small flakes of biotite,with a lot of schliers,pellets or with some little irregular intercalations of quartz,with not much smallspots or grains of carbonates locally too and somewhere with allotriomorphic grains or flakes of FeS_2 mostly. Scarce are present some little acicular

porphyroblasts of aktinolite or hornblende. The total structure of this rock is phaccidal and phaccidal schistose. The total colour of this rock green-gray and little bit bright green-gray. The average gradient of this foliation is 75°,but 80°and 90° too.

19,70 - 20,10 The keratophyre with some small acicular and rodlike porphyroblasts of hornblende and with not much little grains of garnet,the chlorite is present too. The total grain elongation of the hornblende porphyroblasts is clear enough. The total structure of this rock is blastoporphyric with little bit clear grain elongation. The total colour of this rock is white gray and little bit green white gray. The average gradient of this foliation is 70°- 75° about.

20,10 - 21,70 The strongly chloritic,strongly quartzy mica schist as well as in 18,40 - 19,70m. The average gradient of this foliation is 75° about.

21,70 - 22,30 The keratophyre rock with a lot of very little acicular porphyroblasts of hornblende which have clear total grain elongation,with chlorite little bit too,scarce with some very little grains of garnet and with some schliers and irregular intercalations of quartz in which are present some small allotriomorphic grains of FeS_2 mostly. The structure of this rock is blastoophitic or blastoporphyric with clear grain elongation(hornblende). The total colour of this roc rock is write little bit green gray. The angle of dip of this grain elangation and foliation is 70°- 75° about.

22,30 - 23,10 The strongly chloritic and strongly quartzy mica schist as well as in 18,40 - 19,70m. The average gradient of this foliation is 70° about. Locally are present some thin schliers or little intercalations of the myllonitic matter.

23,10 - 23,95 The keratophyre rock as well as in 21,70 - 22,30m,but with much more grains of garnet. The angle of dip of this total grain elongation is 80° about.

23,95 - 24,50 The strongly chloritic and strongly quartzy mica schist as well as in 18,40 - 19,70m,but locally with some spots and schliers of the myllonitic matter. The average gradient of this foliation is 70°- 75° about.

24,50 - 24,80 The keratophyre rock as well as in 8,45 - 8,80m,but mostly with the quartz tectonic breccie,barre n only.

24,80 - 38,50 The motley serie of the chloritic quartzy schist and mica schist as well as in 18,40 - 19,70m-but with much more schliers or irregular intercalations of quartz and locally with some very poor and weak impregnation of FeS_2 mostly. The average gradient of this foliation is 75°- 80°round,but 85°- 90° too.
Between 25,70 - 26,00m is present quartz breccie wits some spots and pellets of carbonates,locally only with some small allotriomorphic or hypidiomorphic grains of FeS_2. The same breccie is present between 37,00 - 37,25m.
Between 26,oo - 26,20m is present the position of the keratophyre rosk as well as in 19,70 - 20,10m.

38,50 - 39,00 The keratophyre rock as well as in 19,70 - 20,10m.

39,00 - 39,20 The tectonic,quartzy breccie,with a lot of schliers and inclusions of the strongly chloritic and biotitic mica schist,locally only with some small allotriomorphic,hypidiomorphic and scarce idiomorphic grains of FeS_2.

39,20 - 39,50 The keratophyre rock as well as in 19,70 - 20,10m.

39,50 - 43,00 The motley serie of the strongly chloritic,quartzy mica schist as well as in 18,40 - 19,70m. The average gradient of this foliation is 75° about. Locally are present some schliers of the myllonitic matter.

43,00 - 45,70 The gnasic,chloritic,little bit biotitic,hornblende and garnet schist,with a lot of small acicular and rodlike porphyroblasts of the hornblende with little bit clear the total grain clongation and with some small grains of garnet. The total structure of this rock is blastoporphyric-schistose,with little bit clear grain clongation(hornblende). The total colour of this rock is gray. The average gradient of this foliation is 80° round.

45,70 - 47,90 The motley serie of the keratophyre rocks,partly as well as in 8,45 - 8,80m and locallywith not much little porphyroblasts of hornblende and with not much grains of garnet,but with some thin schliers or intercalations of quartz. The angle of dip of this foliation and of this direction of the average grain clongation is 75°- 80° about.

47,90 - 48,40 The strongly chloritic gneisic schist,with a lot of rodlike and acicular porphyroblasts of hornblende(very little - size) and with quartz and quartz-feldspar matter in bassement matter mostly. The flakes of biotite,some little grains of garnet are present very scarce only. The total structure of this rock is blastoporphyric-schistose,with the clear grain clongation of hornblende porphyroblasts,which is parallel with the total schistosity. This rock is locally very strongly folded by the slip folds of the DM,CM and MM amplitude. The total colour of this rock is green-gray. The average gradient of this foliation is 75°- 80° about.

48,40 - 48,90 The keratophyre rock as well as in 8,45 - 8,8om.

48,90 - 49,8o The strongly chloritic and quartzy mica schists as well as in 18,40 - 19,70m,but oftenly with much more acicular and rodlike porphyroblasts of hornblende. The average gradient of this foliation is is 75°- 80° about.

49,80 - 51,40 The keratophyre rock as well as in 19,70 - 20,10m.

51,40 - 52,10 The strongly chloritic gnasic schist as well as in 47,90 - 48,40m, also strongly folded by the same slip folds. The average gradient of this foliation is 80° about.

52,10 - 53,50 The keratophyre rock as well as in 19,70 - 20,10m.

53,50 - 53,70 The strongly chloritic quartzy gnasic schist as well as in 47,90 - - 48,40m. The average gradient of this foliation is 85° round.

53,70 - 59,15 The very strongly chloritic,quartzy garnet mica schist,locally with some thin intercalations of the strongly chloritic gneisic schist(like in 47,90 - 48,40m) and locally with some thin intercalations of the keratophyre rock(like in 19,70 - 20,10m). In this rock are present locally some little acicular and rodlike porphyroblasts of hornblende. Locally are present schliers pellets and intercalations of quartz. The total structure of this rock is blastoporphyric-schistose and locally more phacoidal-schistose too. The total colou of this rock is green-gray. Locally is this rock folded by the slip and more flat folds of the DM,CM and MM amplitude. Somewhere are present some small spots or pellets of the carbonates(dolomite-ancerite). Some sulphides are present very scarce only. The average gradient of thi foliation is 70° and 75° about.

59,15 - 60,25 The strongly chloritic,quartzy mica schist with a lot of little grains of garnet,locally with some intercalations of the strongly chloritic gneisic schists which are present example in 47,90-48,4om too. The quartz creat a lot of schliers,spots and pellets and scarcely some little spots are created by some carbonates too. The biotite and some myllonitic matter are present locally scarce too. The total structure of this rock is phacoidal-schistose most-

ly.Some poor and weak impregnation of FeS_2 mostly and of $CuFeS_2$. FeS and ZnS scarcely are present in this rock too. The average gradient of this foliation is 70° round.
The result of the chemical analyse of the rock position between 59,15 - 60,25m is : Cu = 0,18% , Zn = 0,30% and S = 6,60%.

60,25 - 61,00
0,75m

The very strong impregnation of FeS_2 mostly in the bright gray quartzite,locally with some small schliers or pellets of the quartz or quartzite matter. Locally are present some little scliers of the chloritic matter.The pyrite creat small hypidiomorphic and allotriomorphic grains,with a lot of microscopic joints in and round with some amorphic forms of ZnS and very scarce of FeS and $CuFeS_2$. These other sulphides filling some joints in the pyritic grains too. The quartz from the quartzite cceat the bassement matter round.
The result of the chemical analyse of this ore position between 60,25 - 61,00m is : Cu = 0,40% , Zn = 3,40% and S = 27,50%.

61,00 - 61,40

The strongly chloritic quartzy mica schist as well as in 59,15 - 60,25m,but with more flakes of the biotite and with more schliers of the myllonitic matter. The total structure of this rock is maculose and phaccidal. Locally are present some rodlike and acicular porphyroblasts of hornblende. The average gradient of this foliation is 75° - 80° about.
The result of the chemical analyse of this rock position between 61,00 - 61,40m is : Cu = 0,06% , Zn = 0,35% and S = 2,00%.

61,40 - 62,45
1,05m

The very strong impregnation of FeS_2 mostly in the bright gray quartzite as well as in 60,25 - 61,00m.
The result of the chemical analyse of this ore position between 61,40 - 62,45m is : Cu = 0,42% , Zn = 2,70% and S = 35,21%.

62,45 - 62,80

The strongly chloritic quartzy mica schist as well as in 59,15 - 60,25m. The average gradient of this foliation is 75°- 80°round.
The result of the chemical analyse of this rock position between 62,45 - 62,80m is : Cu = 0,10% , Zn = 0,40% and S - 8,35%.

62,80 - 63,70
0,90m

The very stron impregnation of FeS_2 mostly in the quartzite as well as in 60,25 - 61,00m
Between 62,85 - 63,00m is present position of the strongly chloritic gneisic schist with the strongly impregnation of the FeS_2 mostly. Thés intercalation has phaccidal structure. The average gradient of this foliation is 75° about.
The result of the chemical analyse of this ore position between 62,80 - 63,70m is : Cu = 0,34% , Zn = 4,10% and S = 37,41%.

63,70 - 63,95

The strongly chloritic,quartzy little bit gneisic mica schist with a lot of schliers and pellets of quartz and withsome small rodlike and acicular porphyroblasts of hornblende,which have oftenly the little bit clear grain elongation,parallel with the total schistosity. The total structure of this rock is blasyoporphyric-schistose. In this rock is present the poor andvery weak impregnation of FeS_2 mostly. The average gradient of this foliation is 75° - 80°about.
The result of the chemical analyse of this rock position between 63,70 - 63,95m is = Cu = 0,04% , Zn = 0,40% and S = 2,00%.

63,95 - 64,10
0,15m

The very strong impregnation of FeS_2 mostly in the bright gray quartzite as well as in 60,25 - 61,00m.
The result of the chemical analyse of this ore position between 63,95 - 64,10m is : Cu = 0,33% , Zn = 4,20% and S = 39,06% .

64,10 - 64,60 The strong chloritic,quartzy mica schist as well as in 63,70 - -63,95m. The average gradient of this foliation is 75°- 80° about. The result of the chemical analyse of this rock position between 64,10 - 64,60m is : Cu = 0,15% , Zn = 1,20% and S = 6,80%.

64,60 - 64,68 (0,08m) The very strong impregnation of FeS_2 mostly in the bright gray quartzite,withsome amorphic microscopic forms of ZnS,FeS and $CuFeS_2$, round the hypidiomorphic or allotriomorphic FeS_2 grains or like some filling in the microscopic pyritic grains and the rock cement between the sulphides is created by the quartz of quartzite. The result of the chemical analyse of this ore position between 64,60 - 64,68m is : Cu = 0,57% , Zn = 1,10% and S = 44,55% .

6 4,68 - 65,40 The strongly chloritic quartzy mica schist as well as in 63,70 - 63,95m. The average gradient of this rock cleavage is 80° round. The result of the chemical analyse of this rock position between 64,68 - 65,40m is : Cu = 0,04% , Zn = 0,35% and S = 1,30% .

6 5,40 - 6 5,60 (0,20m) The very strong impregnation of FeS_2 mostly in the quartzite as well as in 64,60 - 6468m.
The result of the chemical analyse of this ore position betweem 65,40 - 65,60m is : Cu = 0,24% , Zn = 4,20% and S = 39,33% .

65,60 - 66,05 The strongly chloritic,quartzy mica schist as well as in 63,70 - 63,95m. The average gradient of this rock cleavage is 80° about. The result of the chemical analyse af this rock position between 65,60 - 66,05m is : Cu = o,oo% , Zn = 0,65% and S = 4,00% .

66,05 - 66,75 (0,70m) The very strong impregnation of FeS_2 mostly in the bright gray quartzite as well as in 60,25 - 61,00m. Between 66,05 - 66,10m is present some irregular position of the white quartz(hydrothermal) and between 66,10m and 66,15m and between 66,55 - 66,63m are present some chloritic quartzy schliers with the poor impregnation only.
The result of the chemical analyse of this ore position between 66,05 - 66,75m is : Cu = 0,40% , Zn = 4,60% and S = 38,50% .

66,75 - 67,00 The strongly chloritic,quartzy mica schist as well as in 63,70 - 63,95m. The average gradient of this foliation is 75° about. The result of the chemical analyse of this rock position between 66,75 - 67,00m is : Cu = 0,07% , Zn = 2,00% and S = 9,62% .

67,00 - 67,35 (0,35m) The very stron impregnation of FeS_2 mostly in the bright gray quartzite as wellas in 64,60 - 64,68m.
The result of the chemical analyse of this ore position between 67,00 - 67,35m is : Cu = 0,18% , Zn = 5,80% and S = 42,35% .

67,35 - 71,70 The strongly chloritic,quartzy mica schist as well as in 63,70 - 63,95m. With poor and weak impregnation of FeS_2 mostly too. The average gradient of this rock cleavage is 75°- 80° round.
Between 68,40 - 68,43m is present very strong impregnation of FeS_2 as well as in 64,60 - 64,68m.
Between 69,40 - 69,45m is present some tectonic breccie of the white quartz,with some little inclusions of the chloritic matter mostly.
Between 69,55 - 69,65m is present some tectonic breccie of the white quartz with some small inclusions of the chloritic,quartzy matter. This breccie is barren only.
The result of the chemical analyse of this rock position between 67,35 - 68,45m is : Cu = 0,11% , Zn = 0,70% and S = 4,10% .

71,70 - 72,05 The keratophyre rock as well as in 19,70 - 20,10m

72,05 - 72,30 The strongly chloritic,quartzy mica schist as well as in 63,70 - 63,95m. The average gradient of this foliation is 80° about.

72,30 - 72,55 The keratophyre rock as well as in 19,70 - 20,10m

72,55 - 72,70 The strongly chloritic,quartzy mica schist as well as in 63,70 - 63,95m. The average gradient of this rock cleavage is 80° round.

72,70 - 73,50 The keratophyre rock as well as in 19,70 - 20,10m.

73,50 - 74,00 The strongly chloritic,quartzy gneisic schist as well as in 47,90 - - 48,40m. The average gradient of this foliation is 80° about.

74,00 - 74,60 The keratophyre rock as well as in 10,90 - 11,40m.

74,60 - 85,70 The strongly chloriticquartzy micaschist as well as in 0,00 - 8,45m and locally as well as in 18,40 - 19,70m. These rocks are much more folded by the slip folds of the DM,CM and MM amplitude. Some sulphidic mineralisation is present scarce only. The average gradient of this foliation is 65°- 70° about.
Between 76,10 - 76,50m is present a position of the keratophyre rock as well as in 19,70 - 20,10m.

85.70 - 91,48 The strongly chloritic,amphibolitic and garnet gneisc schist and locally more gneisic mica schist. The bassement matter of this rock is created by quartz-feldspar or quartz.The hornblende creat a lot of little acicular and rodlike porphyroblasts,which have locally only some little bit clear the total grain clongation. The garnet creat very much small grains,hypidicmorphic and allotriomorphic mostly. The total structure of this rock is blastoporphyric and locally blastoophitic too. The total colour of this rock is green-gray and bright green-gray. The average gradient of this rock cleavage is 60°- 70° about.Scarce some impregnation of FeS_2.
Between 87,40 - 87,90m is present some position of the keratophyre rock as well as in 21,70 - 22,30m.
The result of the chemical analyse of this rock position between 91,20 - 91,48m is : Cu =0,07% , Zn = 0,40% and S = 3,30% .

91,48 - 91,60 (0,12m) The very strong impregnation of FeS_2 mostly in the quartzitewith some only microscopic substance of the amorphic or allotriomorphic forms of FeS,ZnS and $CuFeS_2$(Scarce only),which are situated oftenly round the hypidiomorphic or allotriomorphic grains of FeS_2,or which creat some irregular fillings in the microscopic joints ni the pyritic grains.
The result of the chmical analyse of this ore position between 91,48 - 91,60m is : Cu = 0,86% , Zn = 2,70% and S = 36,80%.

91,60 - 91,95 The strongly chloritic,quartzy mica schist as well as in 63,70 - 63,95m. The average gradient of this rock cleavage is 80° - 85° about.Between 91,68 - 91,73m is present the strong impregnation FeS_2
The result of the chemical analyse of this rock position between 91,60 - 91,95m is : Cu =0,09% , Zn = 1,10% and S = 6,60%.

91,95 - 92,05 (0,10m) The very stron impregnation of FeS_2 mostly in the bright gray quartzite as well as in 60,25 - 61,00m.
the result of the chemical analyse of this ore position between 91,95 - 92,05m is : Cu =0,44% , 2,40% and S = 40,98% .

92,05 - 92,20 The strongly chloritic quartzy mica schist as wellas in 63,70 - 63,95m. The average gradient of this foliation is 85° about.
The result of the chemical analyse of this rock position between 92,05 - 92,20m is : Cu =0,04% , Zn = 0,55% and S = 5,78% .

92,20 - 92,65 (0,45m) The very strong impregnation of FeS_2 mostly as well as in 60,25 - 61,00m.
The result of the chemical ajalyse of this ore position between 92,20 - 92,65m is : Cu =0,30% , Zn = 3,90% and S = 41,49% .

92,65 - 94,02 The strongly chloritic - quartzy mica schist as well as in 63,70-63,95m,but between 92,80 - 92,90m is present some strong infiltration of the hydrothermal white quartz with some more strongly impregnation of FeS_2 mostly only. The average gradient of this total rock cleavage is 85° about.
Between 93,50 - 93,60m is present some positon of the keratophyre rock as well as in 21,70 - 22,30m.
Between 93,70 - 93,80m is present some position of the quartz tectonic barren breccie,with some small schliers and irregular inclusions of the chloritic-quartzy matter.
The result of the chemical analyse of this rock position between 92,65 - 94,02m is : Cu = 0,06% , ZN = 0,50% and S = 4,13% .

94,02 - 94,13 0,11m The very strong impregnation of FeS_2 mostly as wellas in 91,48 - 91,60m.
The result of the chemical analyse of this ore position between 94,02 - 94,13m is : Cu = 0,24% , Zn = 5,40% and S = 38,10% .

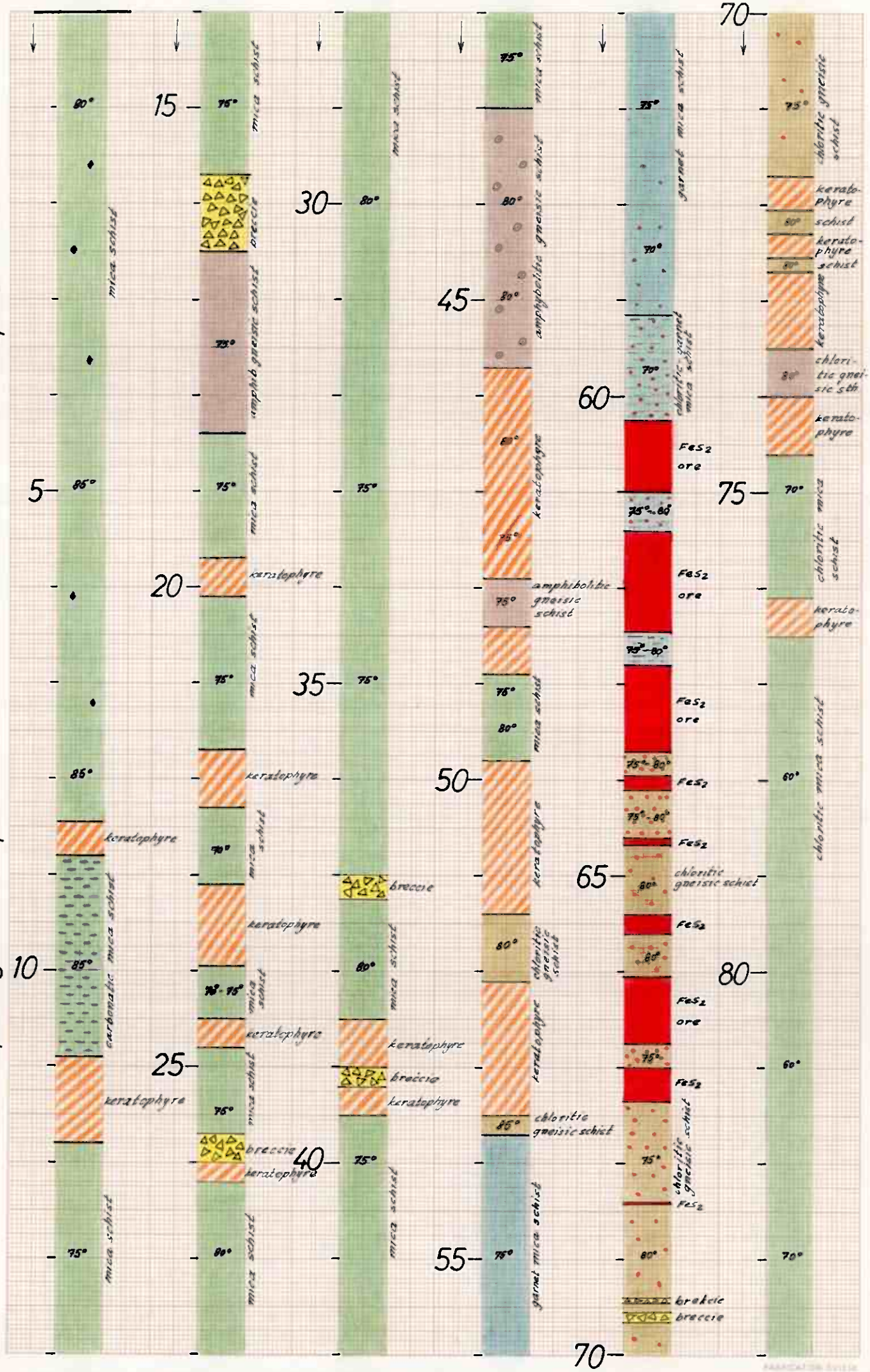
94,13 - 100,50 The strongly chloritic,quartzy mica schist,locally only with some little flakes of biotite and wit very much little schliers and pellets or spots of quartz and locally only with some small spots of the carbonates too,but scarcely only. Some impregnation of FeS_2 mostly is present very scarce only and more isn't present. The total structure of this rock is phacoidal and phacoidal-schistose. The average colour of this rock is bright green-gray or green-gray. The average gradient of this rock cleavage is 80°- 85° about.
The result of the chemical analyse of this rock position between 94,13 - 95,15m is : Cu = 0,03% , Zn = 0,40% and S = 2,54% .

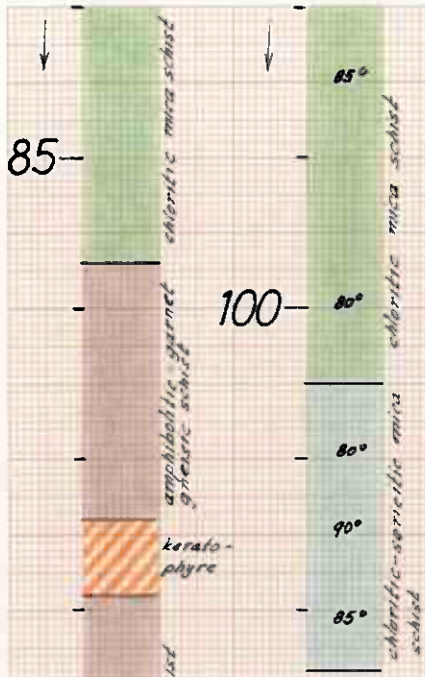
100,50 - 102,40 The strongly quartzy chloritic and sericitic mica schist with some feldspars in the bassement matter,scarce only with some little acicular porphyroblasts of hornblende and scarcely also with some irregular grains of garnet. Some sulphides are present very scarce only. The total structure of this rock is parallel schistose and parallel phacoidal-schistose too. The average colour of this rock is white gray and white little bit green-gay too. The average gradient of this foliation is 80° and locally 85° or 90° about.

This borehole was finished at 102,40m.

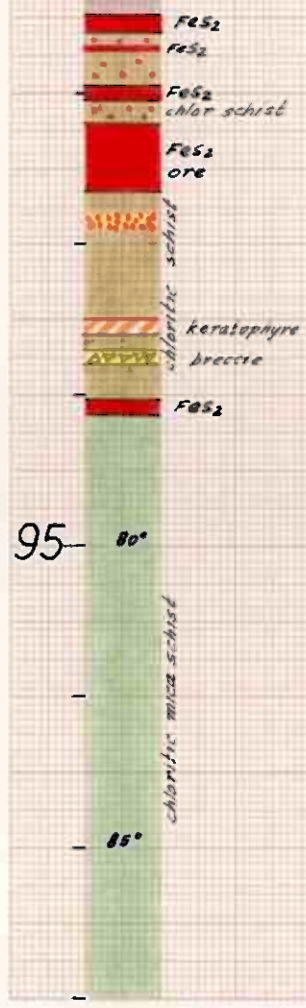
20.10.1969 M.Motys

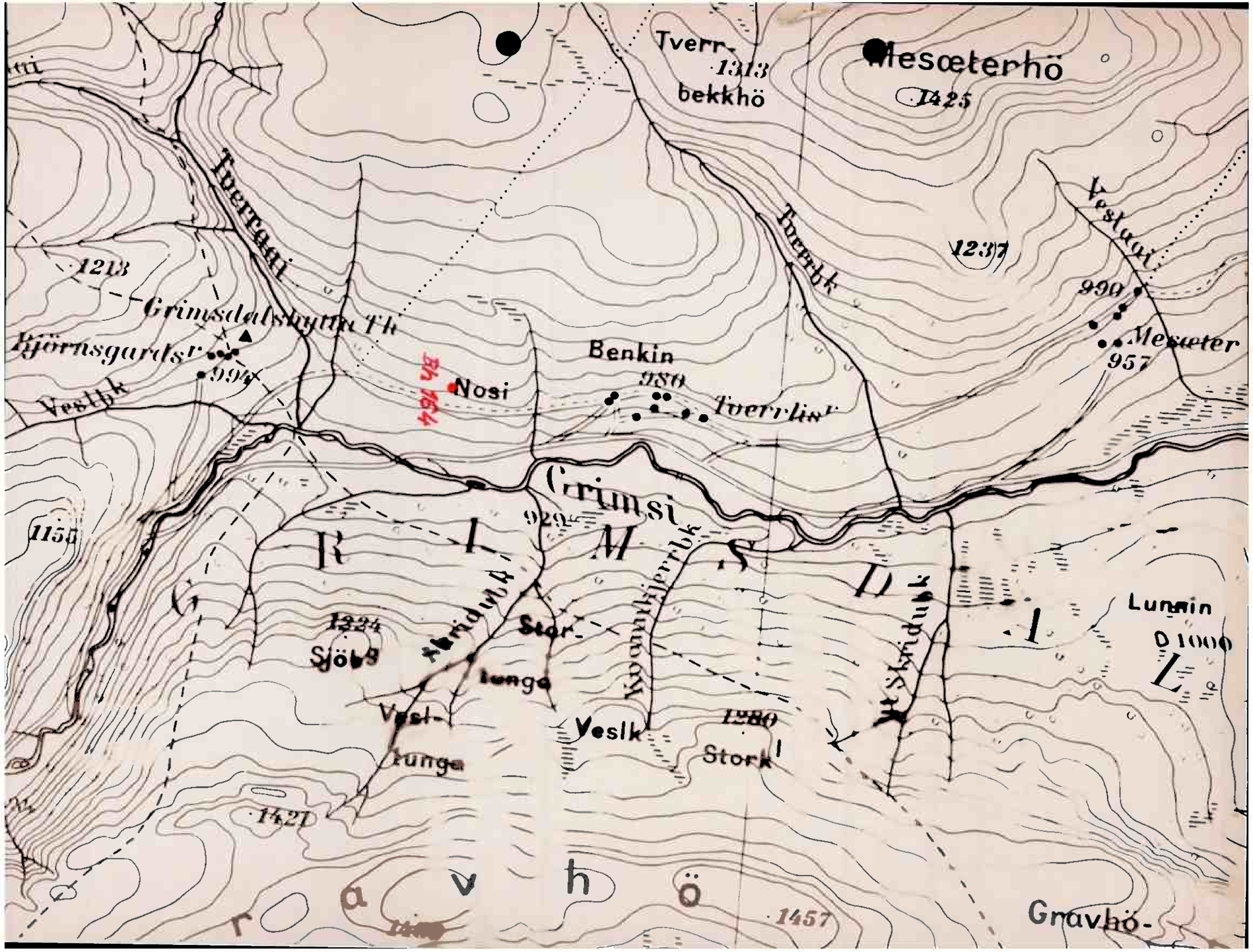
The petrografical profile of the borehole nr. 164., Grimsdalen





This borehole was finished at 102,40 m.





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