SVERIGES GEOLOGISKA UNDERSÖKNING

SERIE C NR 643 AVHANDLINGAR OCH UPPSATSER ÅRSBOK 63 NR 6

NILS H. MAGNUSSON

THE ORIGIN OF THE IRON ORES IN CENTRAL SWEDEN AND THE HISTORY OF THEIR ALTERATIONS

PART II: ILLUSTRATIONS AND INDEX

STOCKHOLM 1970

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ILLUSTRATIONS AND INDEX

WITH ONE MAP IN TWO SHEETS INSIDE BACK COVER
AND
293 FIGURES FOLLOWED BY INDEX

STOCKHOLM 1970

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ILLUSTRATIONS

Samtliga kartor i svarttryck har för spridning godkänts
i rikets allmänna kartverk den 3.3.1970.

Fig. 1. The basement of Central Sweden after the Svecofennian folding. (According to N. H. Magnusson.)

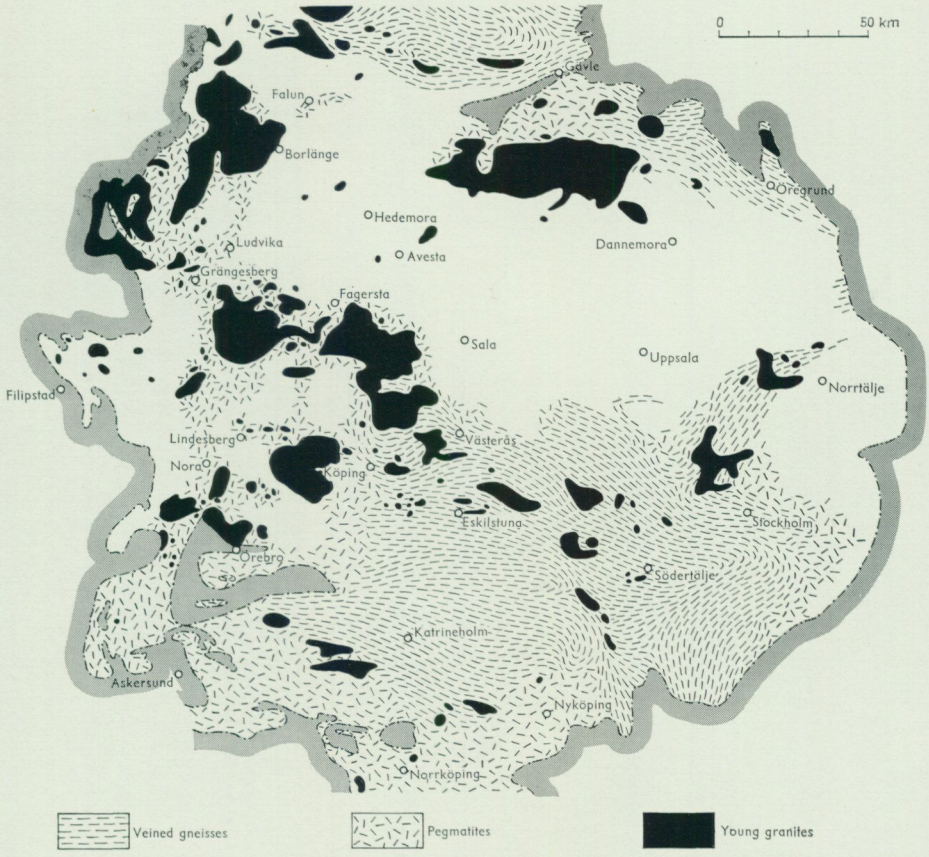


Fig. 2. The distribution of the late Svecofennian veined gneisses, pegmatites and granites in Central Sweden. (After N. H. Magnusson.)

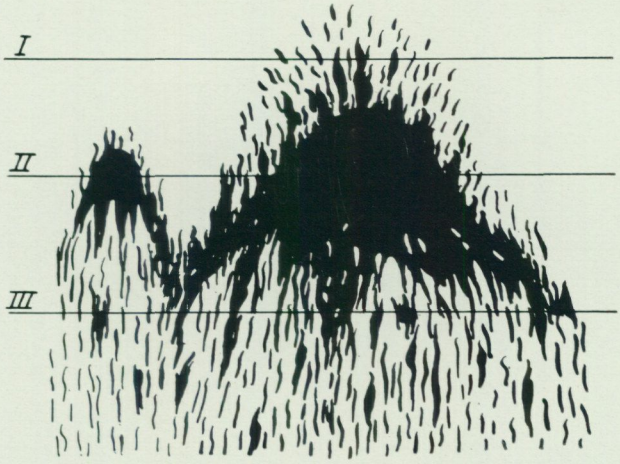
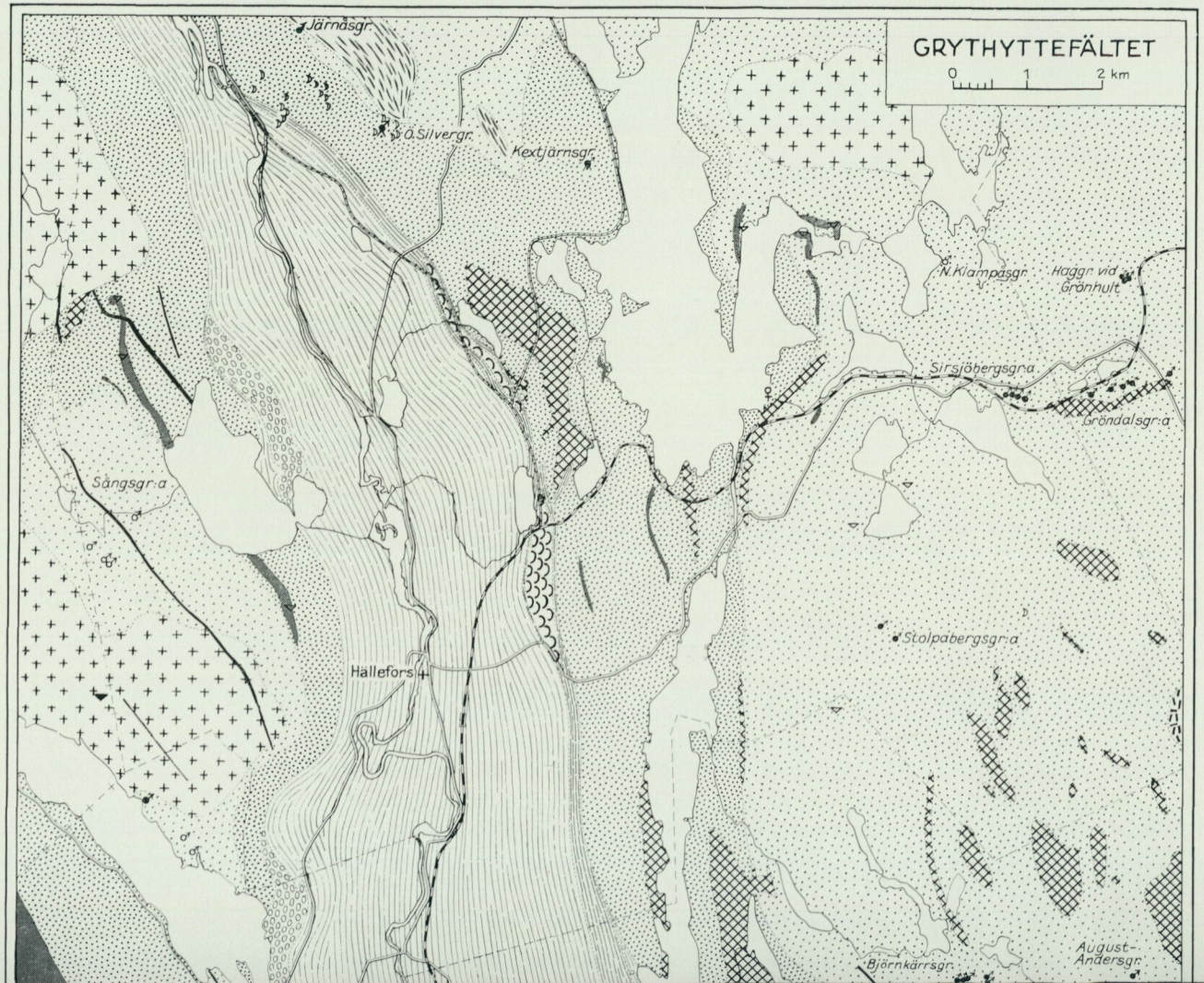


Fig. 3. Diagram illustrating the author's views on the relationship between the veined gneisses and the younger granites and pegmatites associated with them. The black veins in the lower part of the diagram (level III) represent granitic material soaking the veined gneisses and collecting later at a higher level (II) into more and more homogeneous granite masses. From these pegmatitic material was later injected into the overlying country-rocks, forming there pegmatite accumulations (level I) apparently unrelated to any granite massif. However such a massif is certainly to be found at depth, and under this granite the occurrence of veined gneisses has to be expected. (After N. H. Magnusson.)


GRYTHYTTEFÄLTET
0 1 2 km
Järnasgr.
Ö. Silvergr.
Kextjärnsgr.
N. Klampasgr.
Haggr. vid Grönhult
Sirsjöbergsgr:a
Gröndalsgr:a
Sångsgr:a
Hällefors
Stolpabergsgr:a
Björnkärrsgr.
August-Andersgr.

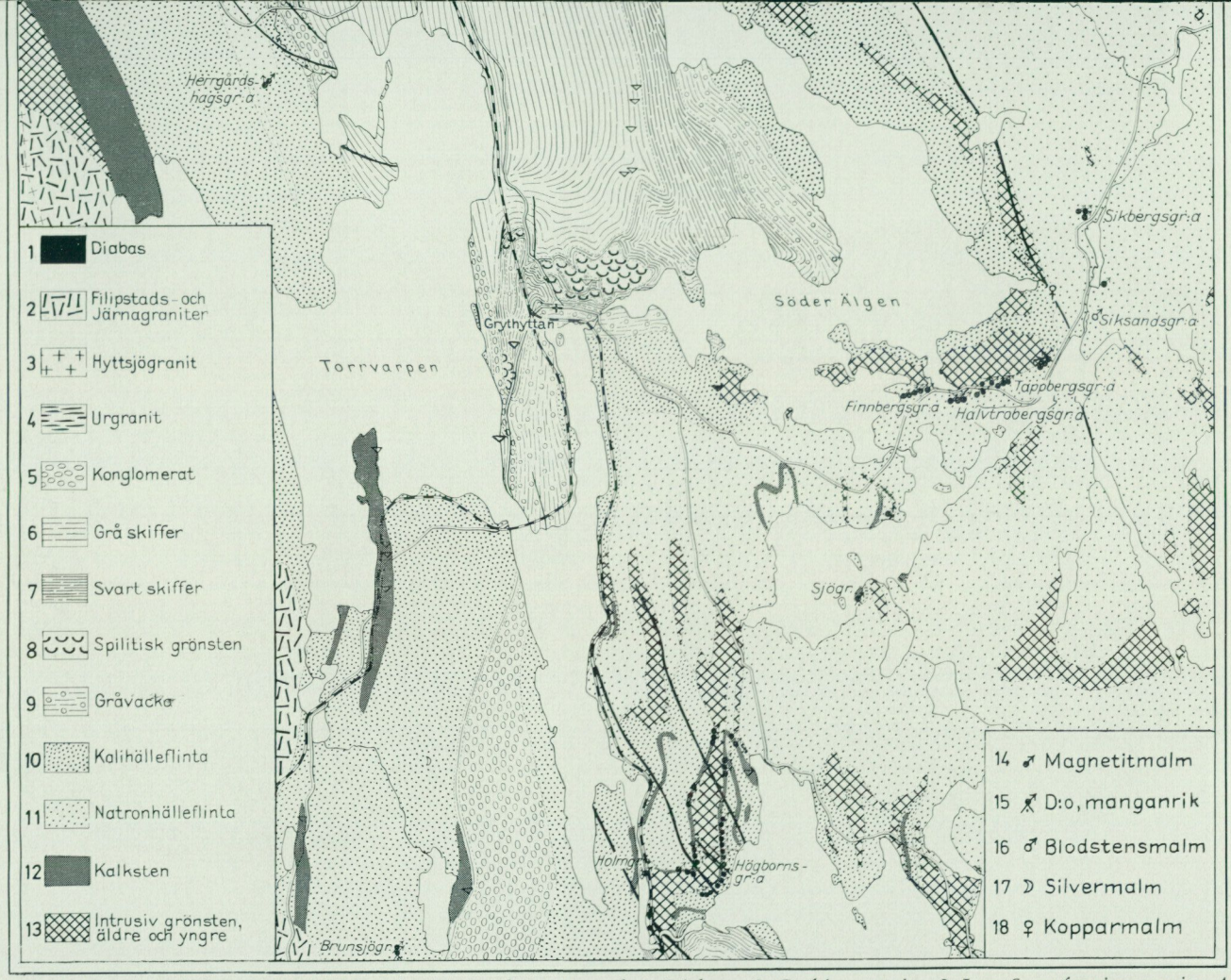


Fig. 4. Geological map of the Grythyttan field. (After N. Sundius.) Legend: 1. Diabase; 2. Gothian granite; 3. Late Svecofennian granite; 4. Synorogenic Svecofennian granite; 5. Conglomerate; 6. Grey schist; 7. Black schist; 8. Spilitic greenstone; 9. Greywacke; 10. Potassic hälleflinta; 11. Sodic hälleflinta; 12. Limestone and dolomite; 13. Intrusive greenstone; 14. Magnetite ore; 15. Manganiferous iron ore; 16. Hematite ore; 17. Silver ore; 18. Copper ore.

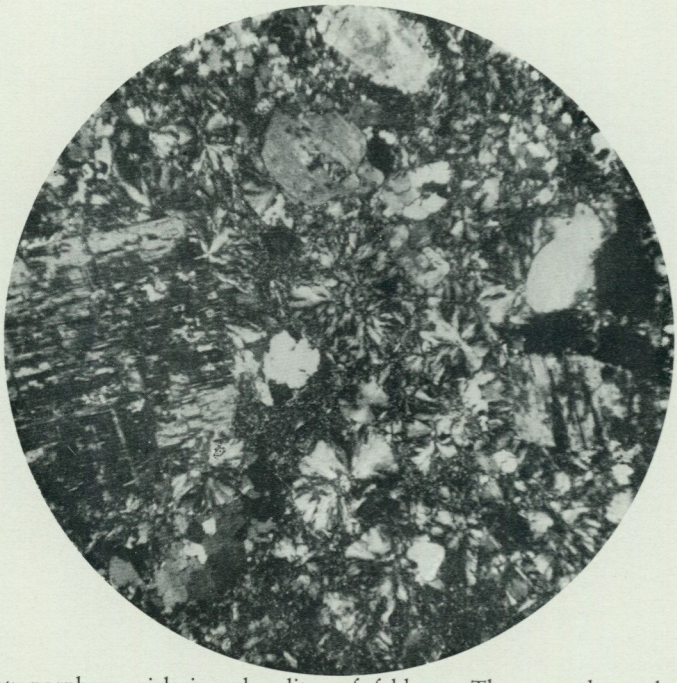


Fig. 5. Quartz-porphyry, rich in spherulites of feldspar. The groundmass between these consists of dense feldspar aggregates poor in quartz. Three amygdules of quartz are discernable in the photo. Thin section, + nic., magnification 30 ×. The Grythyttan field. (After N. Sundius.)

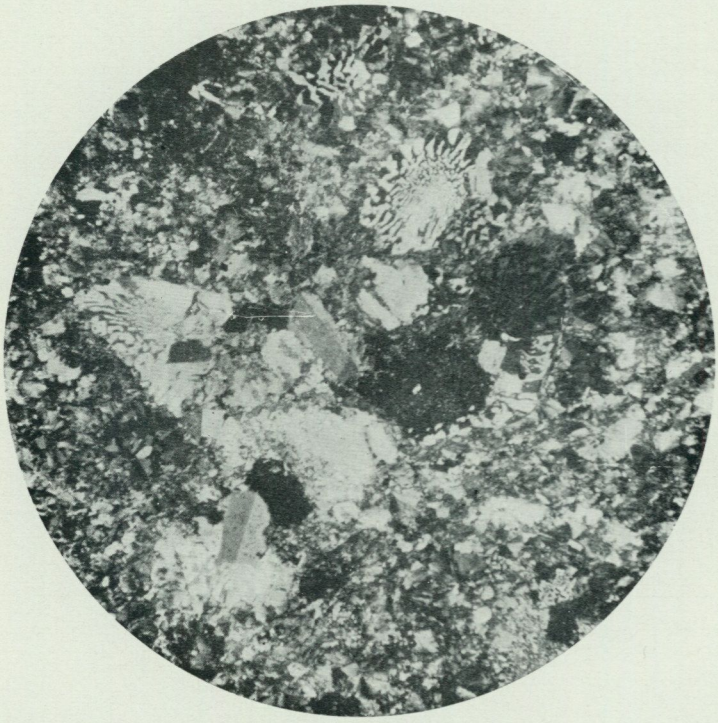


Fig. 6. Quartz-porphyry. Phenocrysts of albite and albite-granophyre in a groundmass rich in spherulites. A granophyric protuberance from an albite-phenocryst is shown in the upper part to the left. Thin section, + nic., magnification 16 ×. The Grythyttan field. (After N. Sundius.)

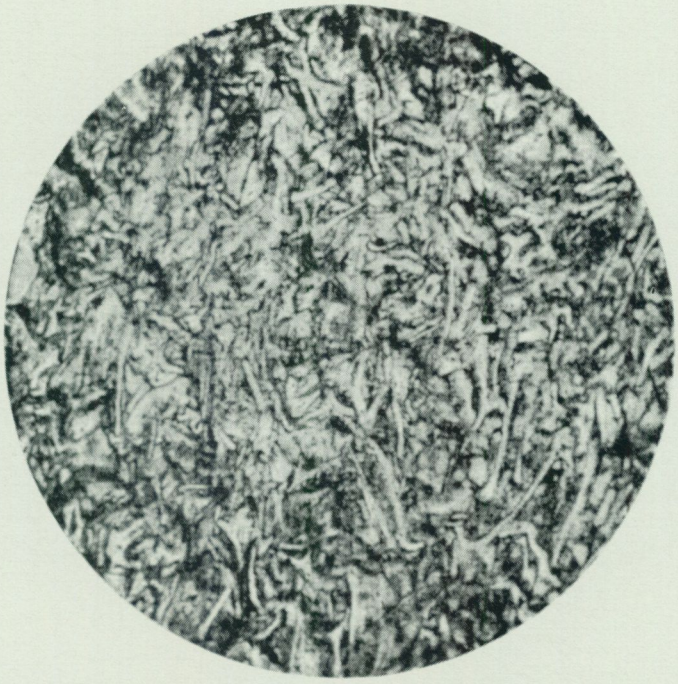


Fig. 7. Tuffitic hälleflinta showing vitroclastic structure. Small fragments of pumice split into minute fragments and recrystallized to an allotriomorphic mixture of quartz and feldspar in a dense slaty mass. Thin section, ord. light, magnification 33 ×. The Grythyttan field. (After N. Sundius.)

Fig. 8. Agglomeratic hälleflinta. 3/4 of nat. size. The Grythyttan field. (After N. Sundius.)

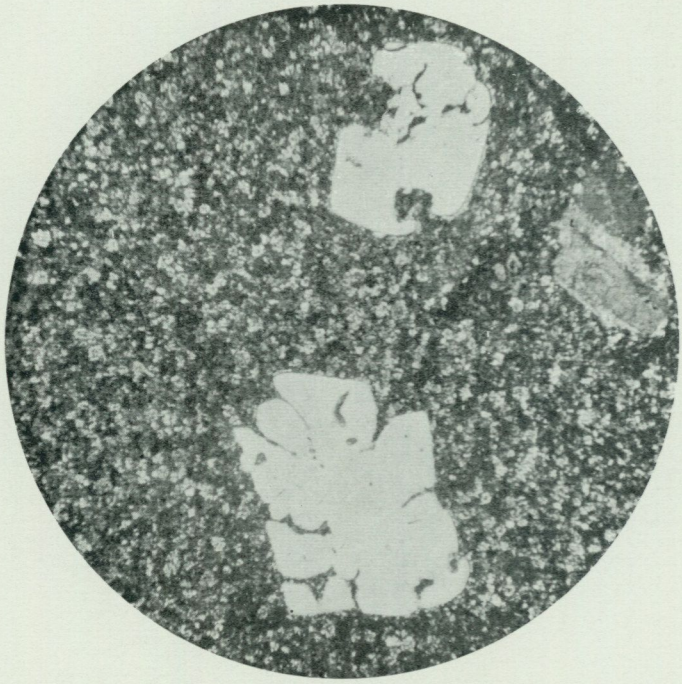


Fig. 9. Quartz-porphyry with corroded phenocrysts of quartz. Thin section, + nic., magnification 15 ×. The Grythyttan field. (After N. Sundius.)

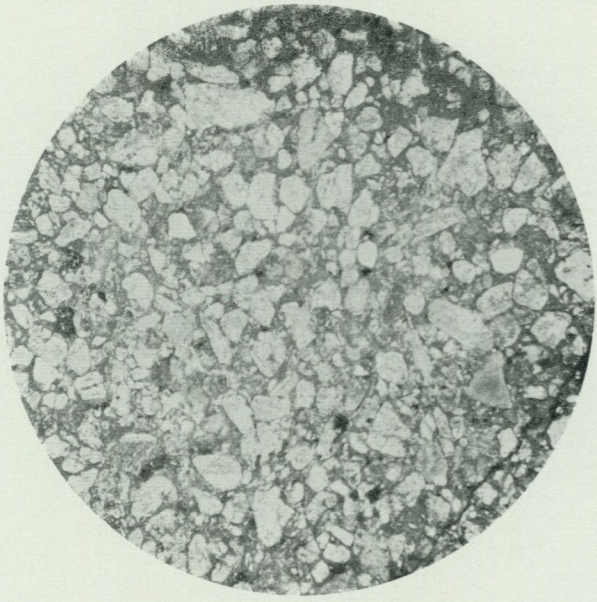


Fig. 10. Greywacke containing fragments of albite, quartz, quartz-prophyry, trachyte, and keratophyre in a dense groundmass rich in sericite and biotite. Thin section, ord. light, magnification 12 ×. The Grythyttan field. (After N. Sundius.)

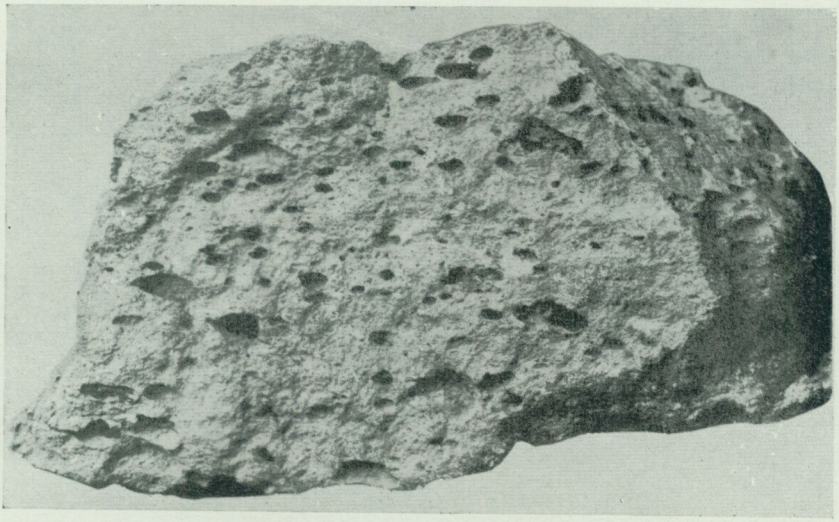


Fig. 11. Spilitic greenstone with amygdules of carbonate removed by weathering. 3/5 of nat. size. The Grythyttan field. (After N. Sundius.)

Fig. 12. Inclusion in spilite-breccia. Amygdules of carbonate in a dense groundmass made up of laths of albite and chlorite. Thin section, ord. light, magnification 16 ×. The Grythyttan field. (After N. Sundius.)

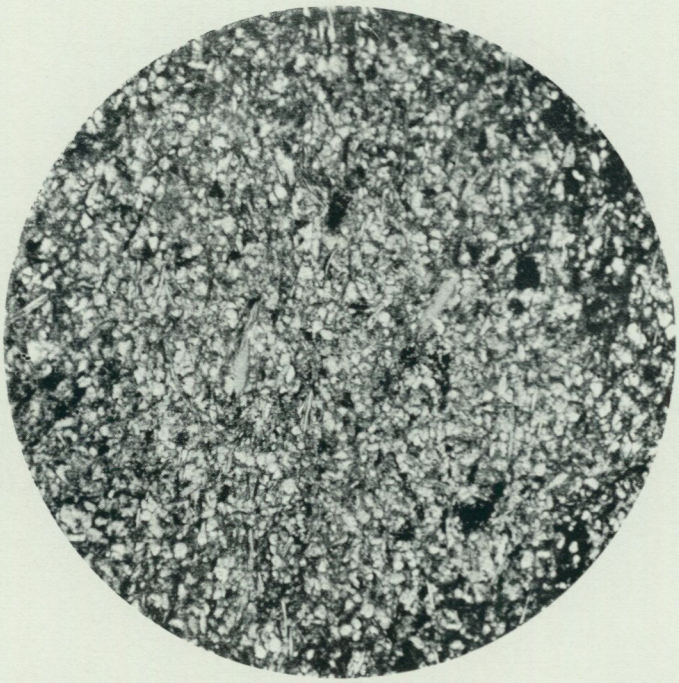


Fig. 13. Layer of the upper grey slate, crowded with small fragmental grains of quartz and albite. Thin section, ord. light, magnification 32 ×. The Grythyttan field. (After N. Sundius.)

Fig. 14. Schistose conglomerate. The Grythyttan field. (After N. Sundius.)

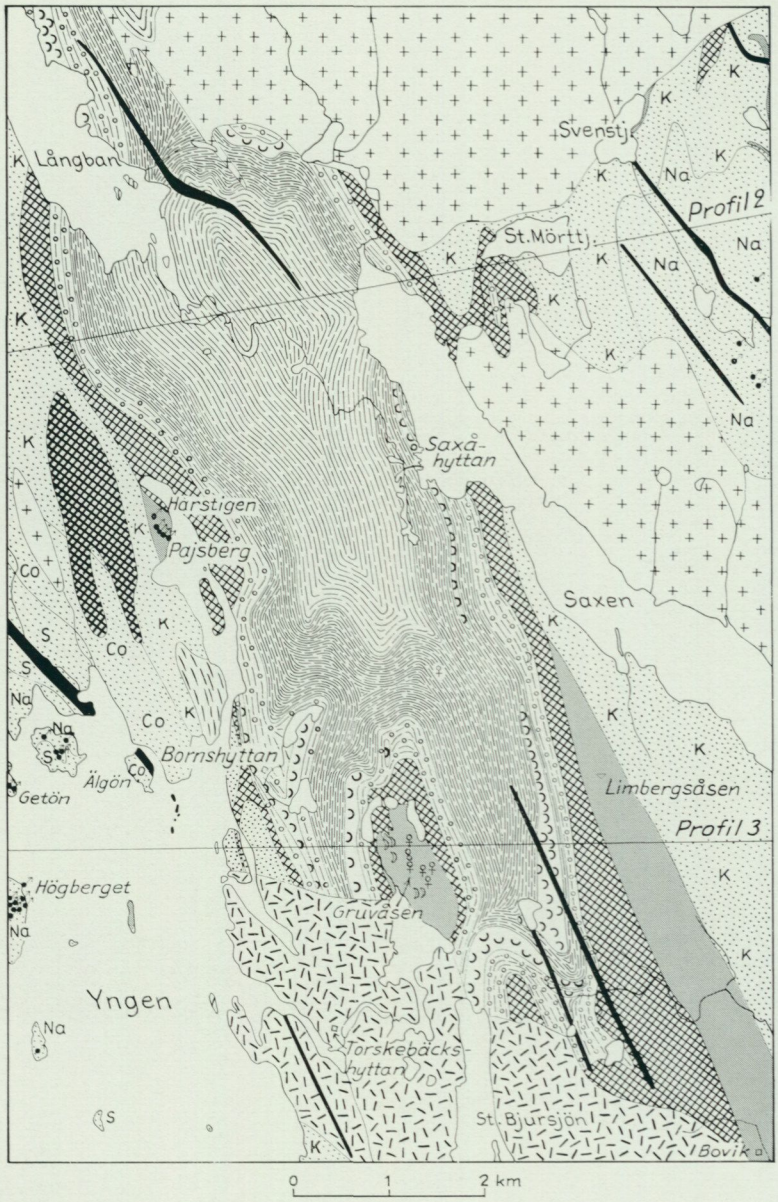


Fig. 15. Geological map of the Saxå field. (After N. H. Magnusson.) Legend: 1. Diabase; 2. Gothian granite; 3. Late Svecofennian palingenic granite; 4. Svecofennian gabbro and diorite; 5. Svecofennian synorogenic granite; 6. Upper grey schist; 7. Lower black schist; 8. Greywacke and bedded hälleflinta; 9. Layers of spilite; 10. Layer of massive greenstone (a sill); 11. Potassic leptite; 12. Potassic leptite rich in cordierite and andalusite; 13. Sodic leptite rich in phenocrysts; 14. Sodic leptite in general; 15. Limestone and dolomite; 16. Iron ore; 17. Copper ore; 18. Lead ore.

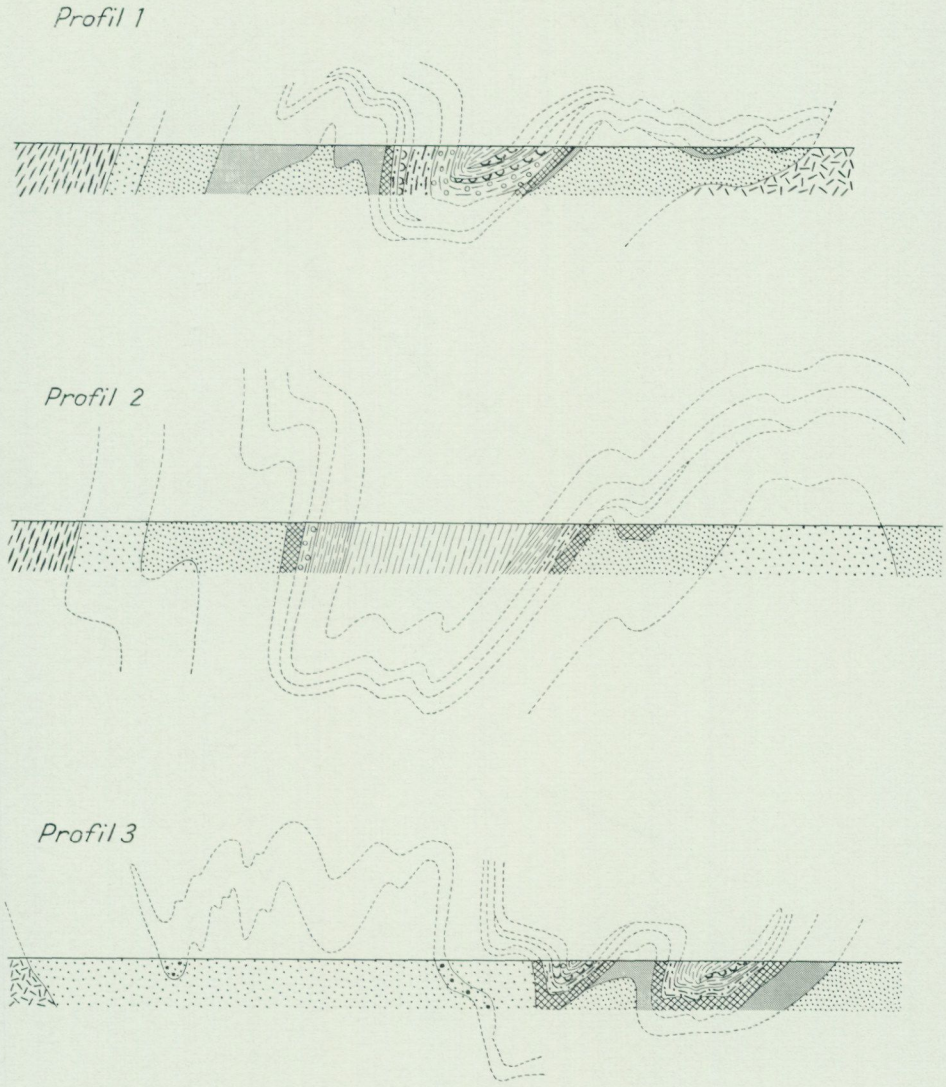


Fig. 16. Profiles through the Saxå field. (After N. H. Magnusson.) Legend: 1. Limestone and dolomite; 2. Sodic leptite; 3. Sodic leptite rich in phenocrysts; 4. Potassic leptite; 5. Massive greenstone; 6. Bedded hälleflinte; 7. Greywacke; 8. Spilite; 9. Black schist; 10. Grey schist; 11. Synorogenic granite; 12. Gothian granite.

1. Section across the Långban district, the northern part of the Saxå field, and the Gåsborn district (see fig. 50).

2. Section across the central part of the Saxå field and the Mörttjärn district.
3. Section across Lake Yngen and the southern part of the Saxå field.

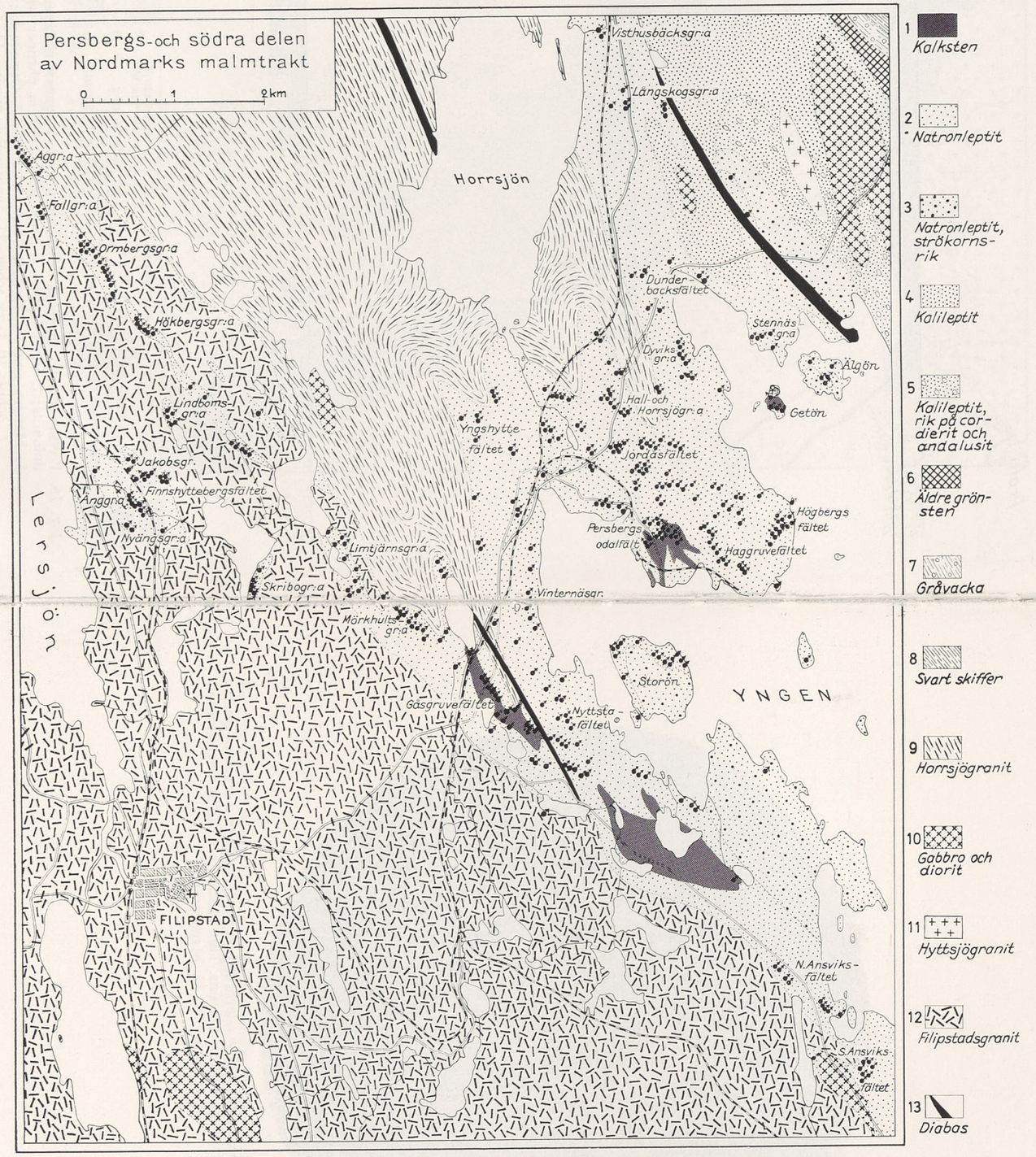


Fig. 17. Geological map of the Persberg district and the southern part of the Nordmark district. (After N. H. Magnusson.) Legend: 1. Limestone and dolomite; 2. Sodic leptite; 3. Sodic leptite rich in phenocrysts; 4. Potassic leptite; 5. Potassic leptite rich in cordierite and andalusite; 6. Old greenstone; 7. Greywacke; 8. Black schist; 9. Svecofennian synorogenic granite; 10. Gabbro and diorite; 11. Late Svecofennian, palingenic granite; 12. Gothian granite; 13. Diabase.

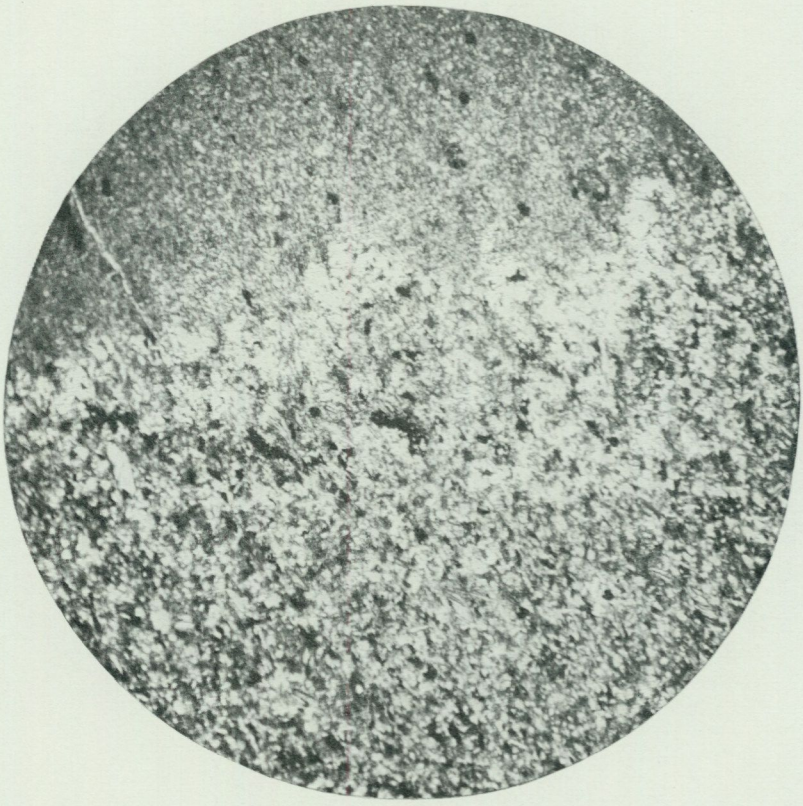


Fig. 18. Grey slate from the Saxå field. Below a layer rich in small fragmental grains of quartz and albite; above a layer poor in such grains. Thin section, ord. light, magnification 35 ×. (After N. H. Magnusson.)

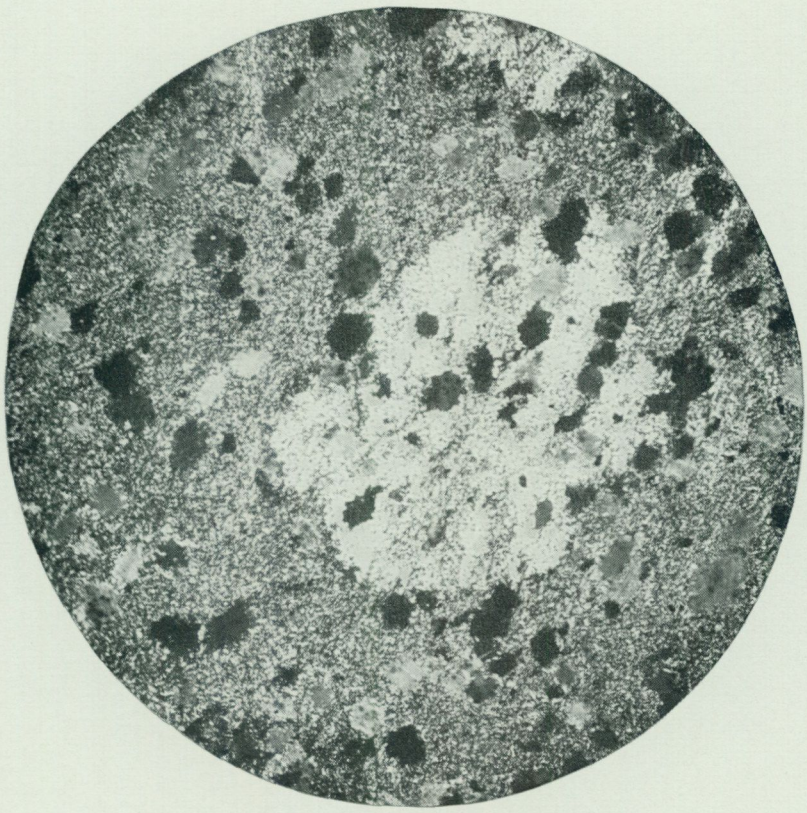


Fig. 19. Cordierite and biotite in a grey, cordierite-spotted slate from the Saxå field. Thin section, + nic., magnification 20 ×. (After N. H. Magnusson.)

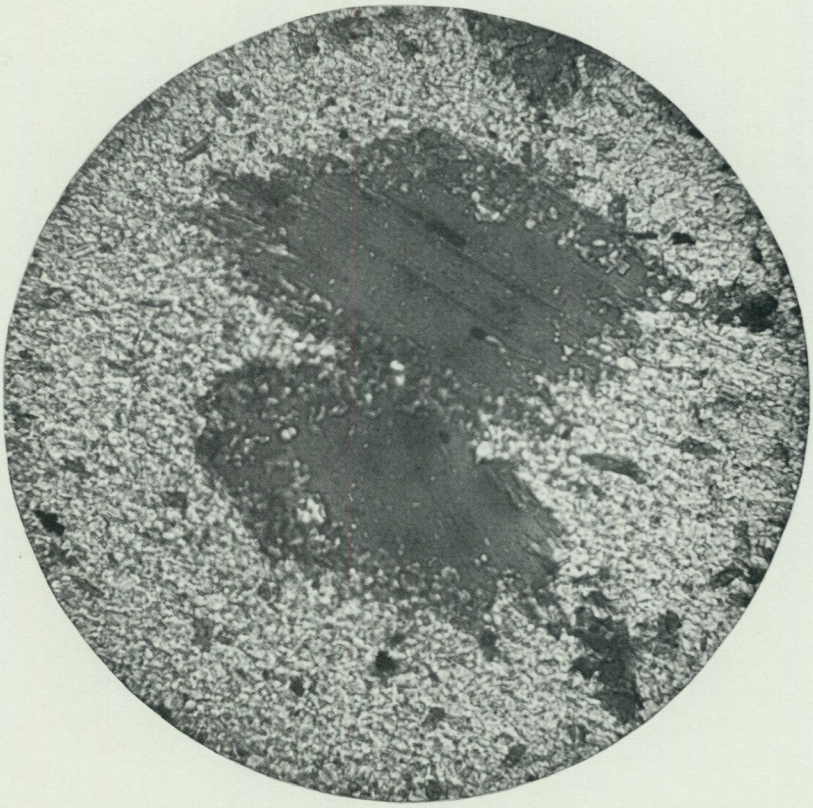


Fig. 20. Biotite porphyroblasts in grey cordierite-spotted slate. Detail from fig. 19. Thin section, ord. light, magnification 60 ×. (After N. H. Magnusson.)

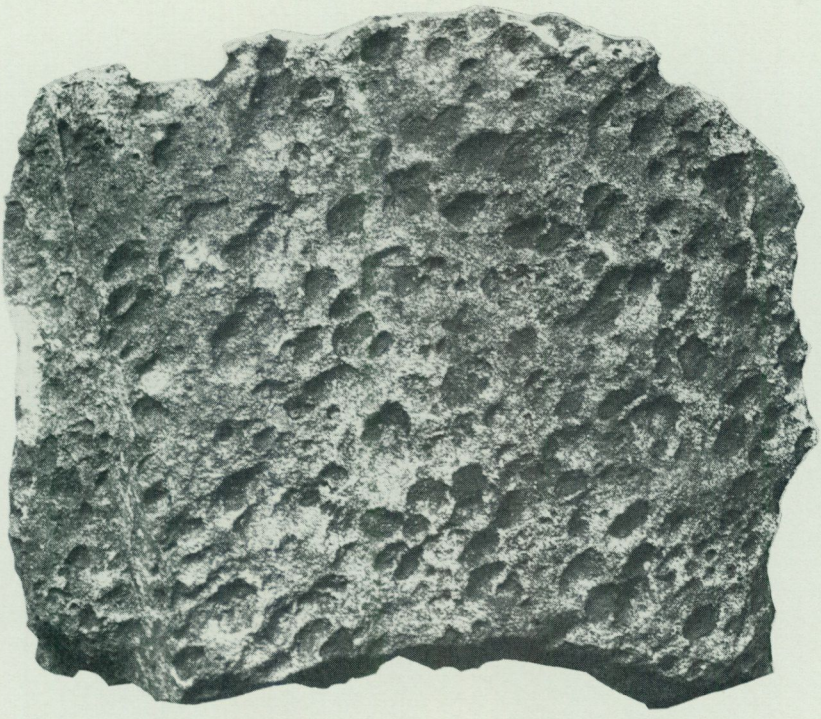


Fig. 21. Gneissic cordierite-spotted grey slate. 2/3 of nat. size. From the northern part of the Saxå field. (After N. H. Magnusson.)

Fig. 22. Outcrop of black slate rich in rounded concretions of quartz with apatite. From the southern part of the Saxå field. (After N. H. Magnusson.)

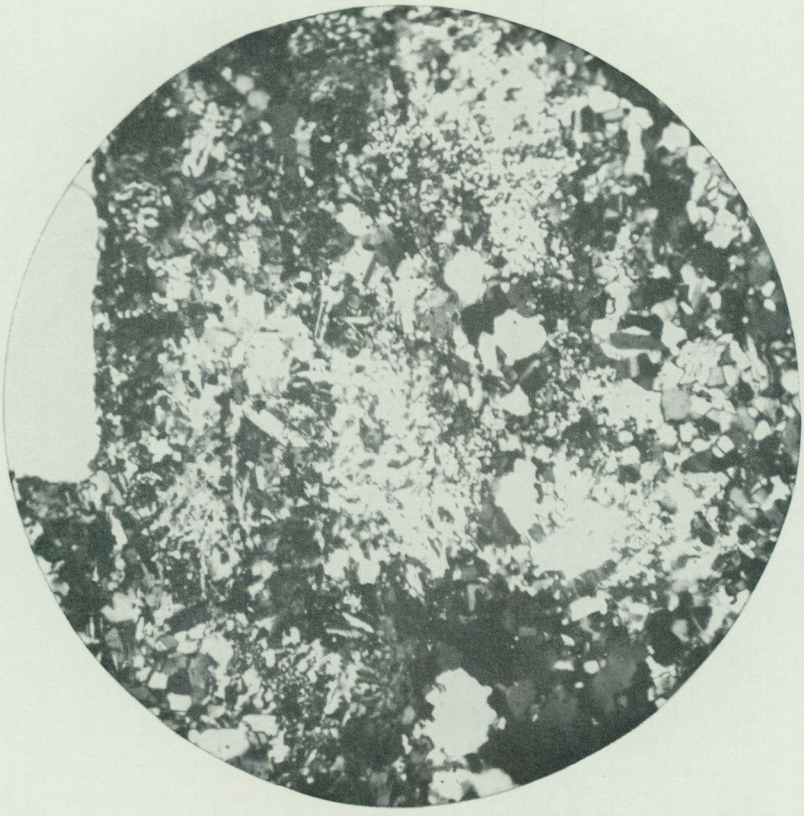


Fig. 23. Reticulating quartz – an inherited texture in leptite. Thin section, + nic., magnification 60 ×. South of the Långban mines. (After N. H. Magnusson.)

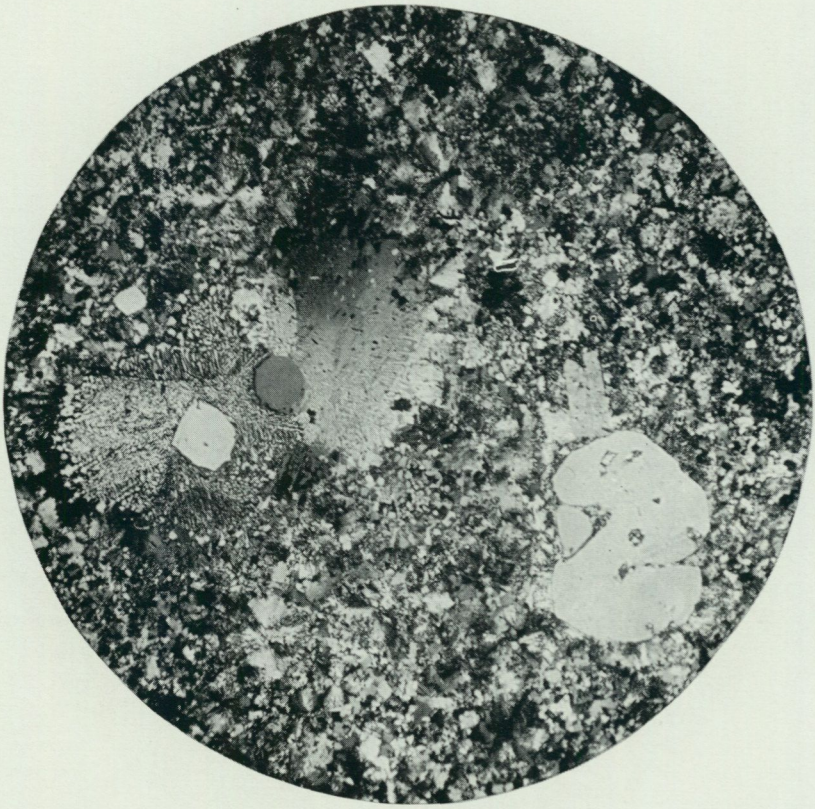


Fig. 24. Leptite, Nygruvan mine, east of the Persberg Odal field. Two phenocrysts of quartz are seen, as well as granophyric development of part of a groundmass rich in spherulites of feldspar. Thin section, + nic., magnification 16 ×. (After N. H. Magnusson.)

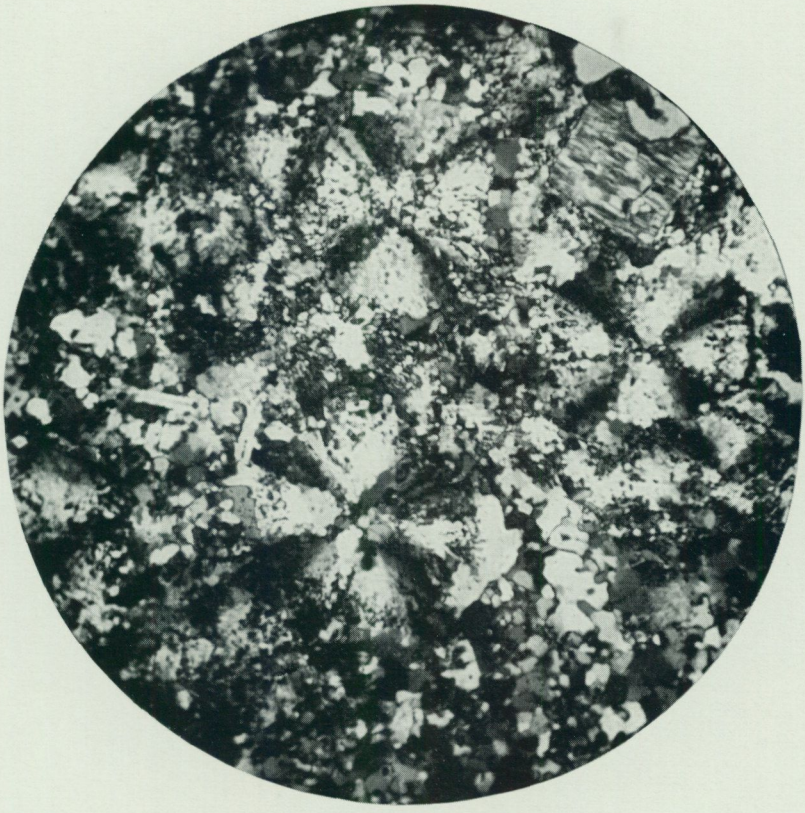


Fig. 25. Detail from the specimen of Fig. 24 showing groundmass rich in spherulites. Thin section, + nic., magnification 60 ×. (After N. H. Magnusson.)

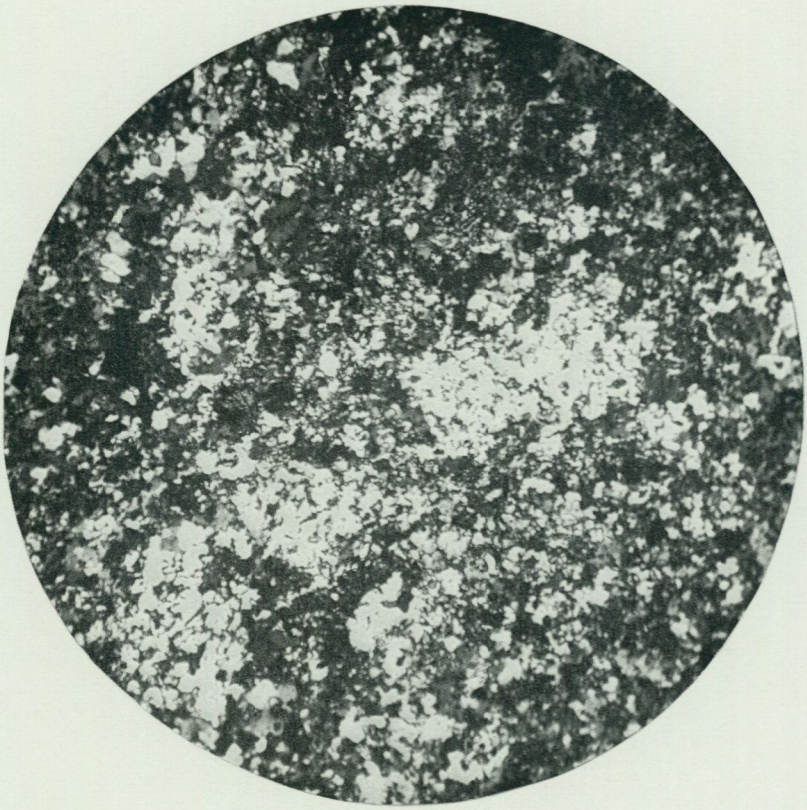


Fig. 26. Leptite from the Persberg Odal field showing micropoikilitic texture. Thin section, + nic., magnification 60 ×. (After N. H. Magnusson.)

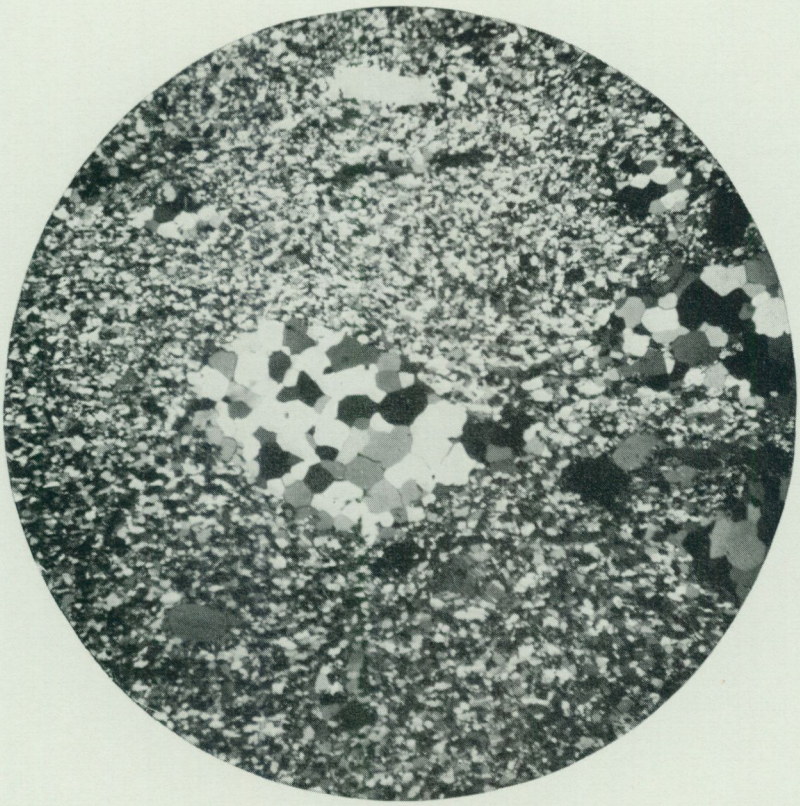


Fig. 27. Leptite in the Taberg mines, Nordmark district: a granulated quartz phenocryst in a groundmass showing typical pavement texture. Thin section, + nic., magnification 15 ×. (After N. H. Magnusson.)

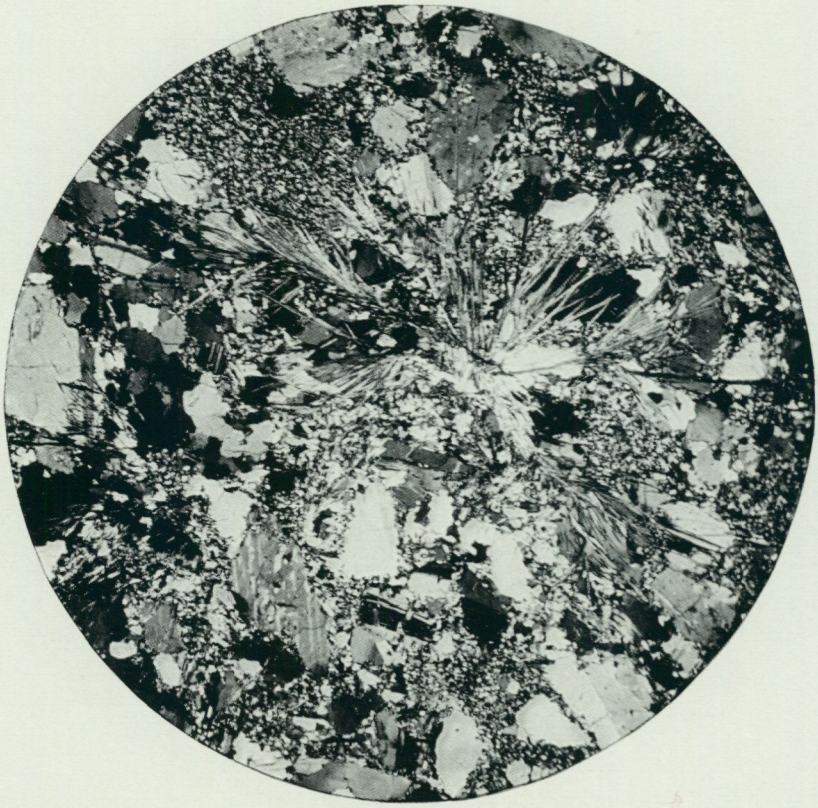


Fig. 28. Leptite from Storön, south of the Persberg Odal field, very rich in fragmental grains of quartz and albite. A bunch of gedrite needles is also seen. Thin section, + nic., magnification 12 ×. (After N. H. Magnusson.)

Fig. 29. Geological map of the Persberg peninsula. (After N. H. Magnusson.) Legend: 1. Skarn and iron ore; 2. Limestone and dolomite; 3. Leptite; 4. Svecofennian synorogenic granite.

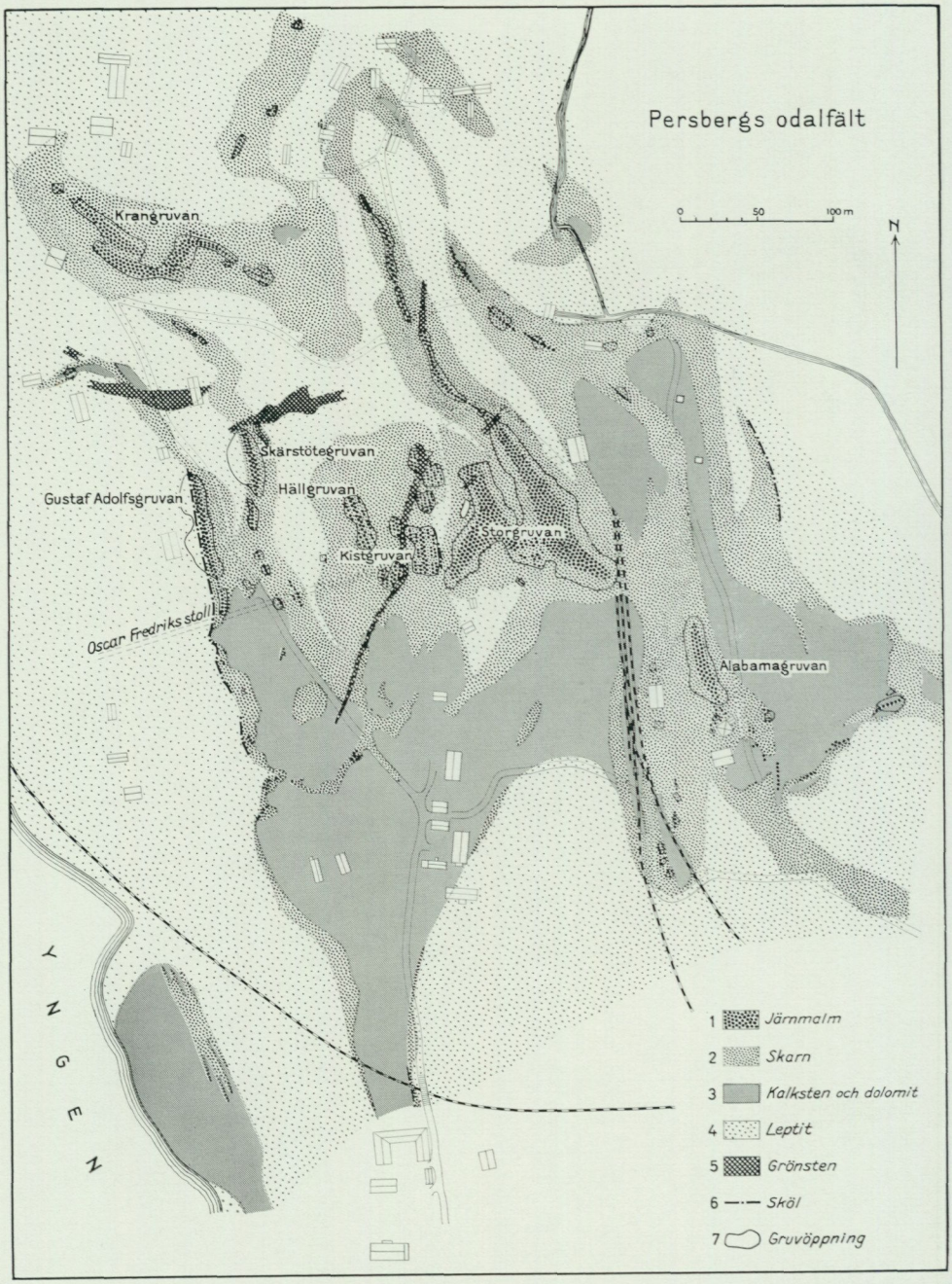


Fig. 30. Geological map of the Persberg Odal field. (After J. G. Jungner.) Legend: 1. Iron ore; 2. Skarn; 3. Limestone and dolomite; 4. Leptite; 5. Greenstone; 6. Sköl; 7. Mine.

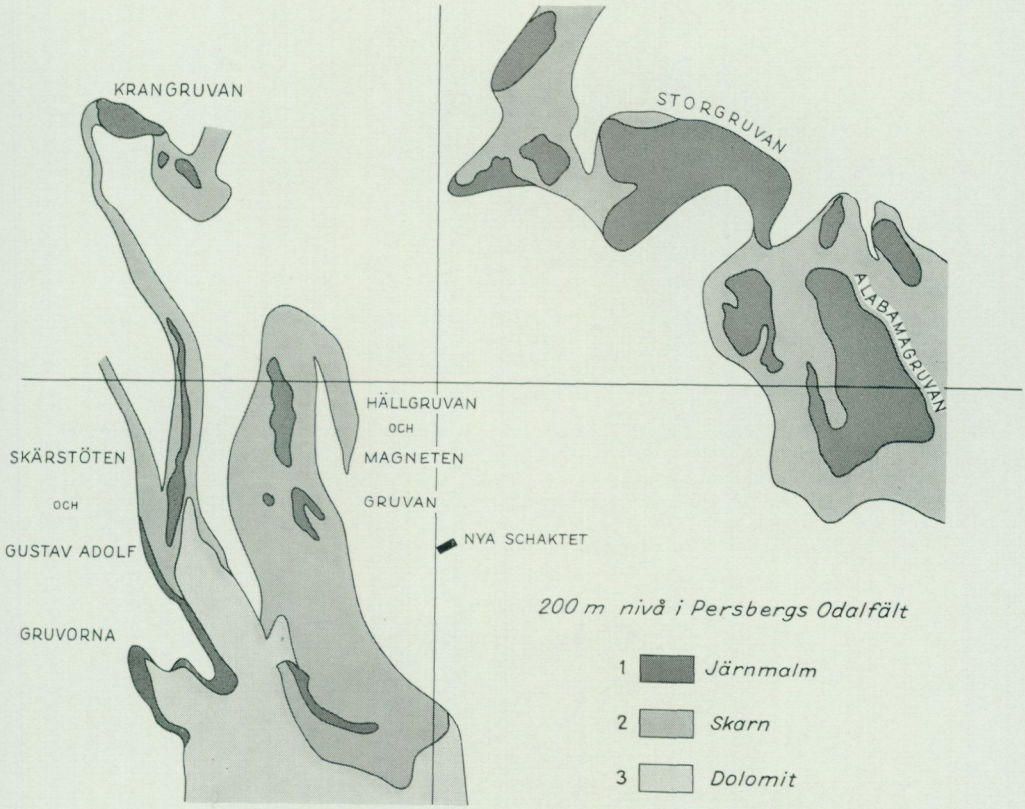


Fig. 31. 200 m. level, Persberg Odal field. Legend: 1. Iron ore; 2. Skarn; 3. Dolomite and limestone. When outcropping the bodies of iron ore, skarn, and dolomite-limestone are situated close together, whereas the bodies at 200 m level have been separated markedly from each others, and the leptite between them has consequently increased in volume.

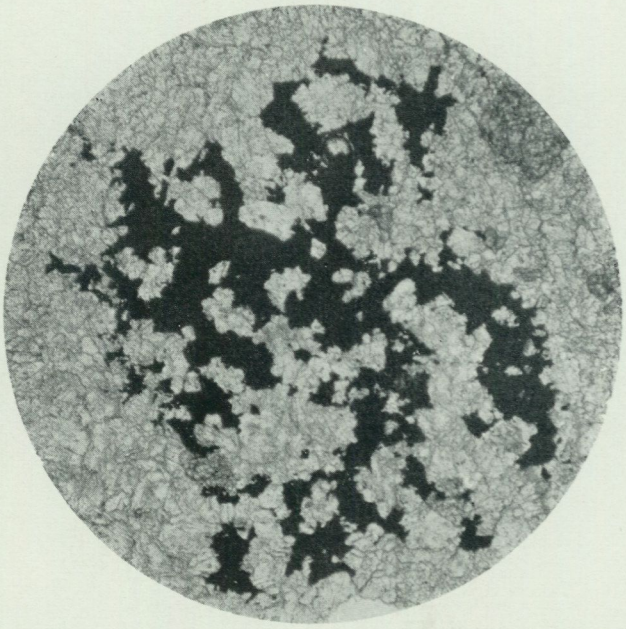


Fig. 32. Skarn-magnetite iron ore. Thin section, ord. light, magnification 20 ×. Magnetite in pyroxene skarn. Storgruvan. Persberg mines. In this so-called ore of Storgruvan type, actinolite and andradite often appear together with the pyroxene, which is a diopside with subordinate amounts of hedenbergite. Towards the leptite boundaries the garnet has often been replaced by epidote, and pyroxene + actinolite by hornblende. (After N. H. Magnusson.)

Fig. 33. Skarn-magnetite iron ore. Thin section, ord. light, magnification 20 ×, showing magnetite in anthophyllite skarn, Persberg mines. In this Alabama type of ore, the anthophyllite has often been altered to talc. Between this type and the Storgruvan type there often appear a zone characterized by tremolite and diopside. In the Alabama type there have also been found remnants of ores of the Storgruvan type, indicating that the anthophyllite ores are alteration products of the pyroxene ores. (After N. H. Magnusson.)

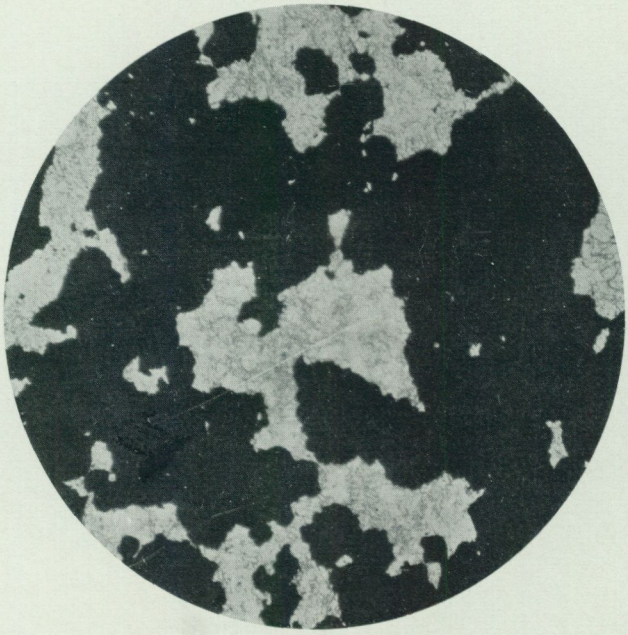


Fig. 34. Limestone-magnetite ore. Thin section, ord. light, magnification 20 ×, showing magnetite in a mass consisting of calcite, serpentine, tremolite, and pure diopside, Persberg mines. In this Skärstöten type of ore, the skarn minerals are subordinate in comparison with calcite and dolomite. The amount of silica in the original sediment was low, which explains the low amount of skarn in the ore type under consideration. (After N. H. Magnusson.)

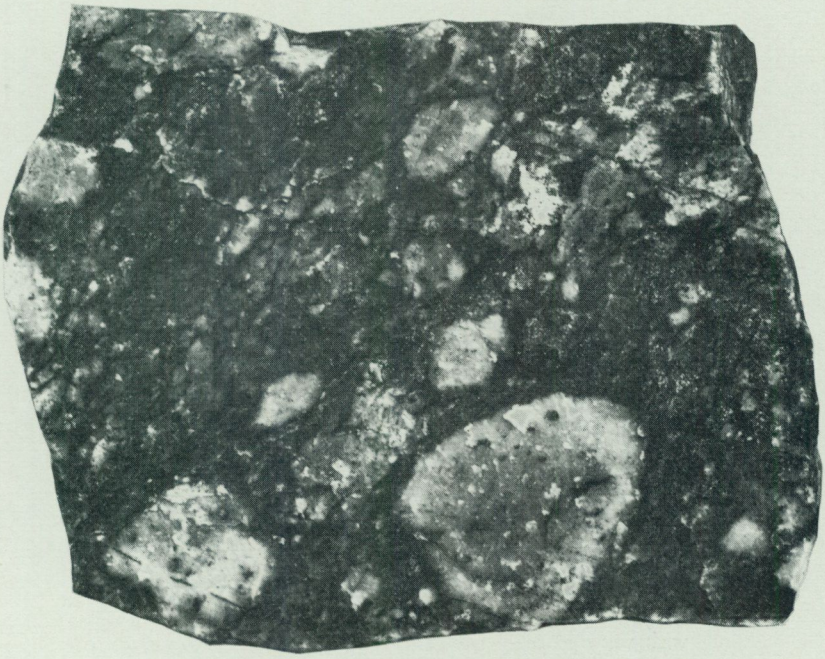


Fig. 35. Leptite as remnants in a sköl mass of cordierite, gedrite and biotite. 1/2 of nat. size. The Persberg Odal Field. (After N. H. Magnusson.)

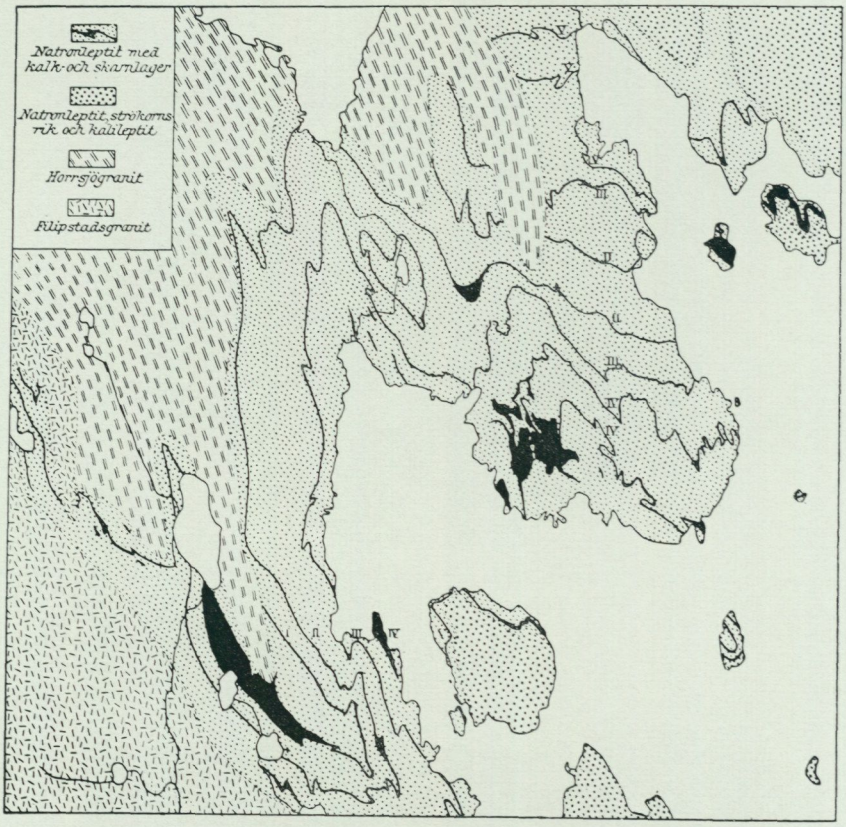
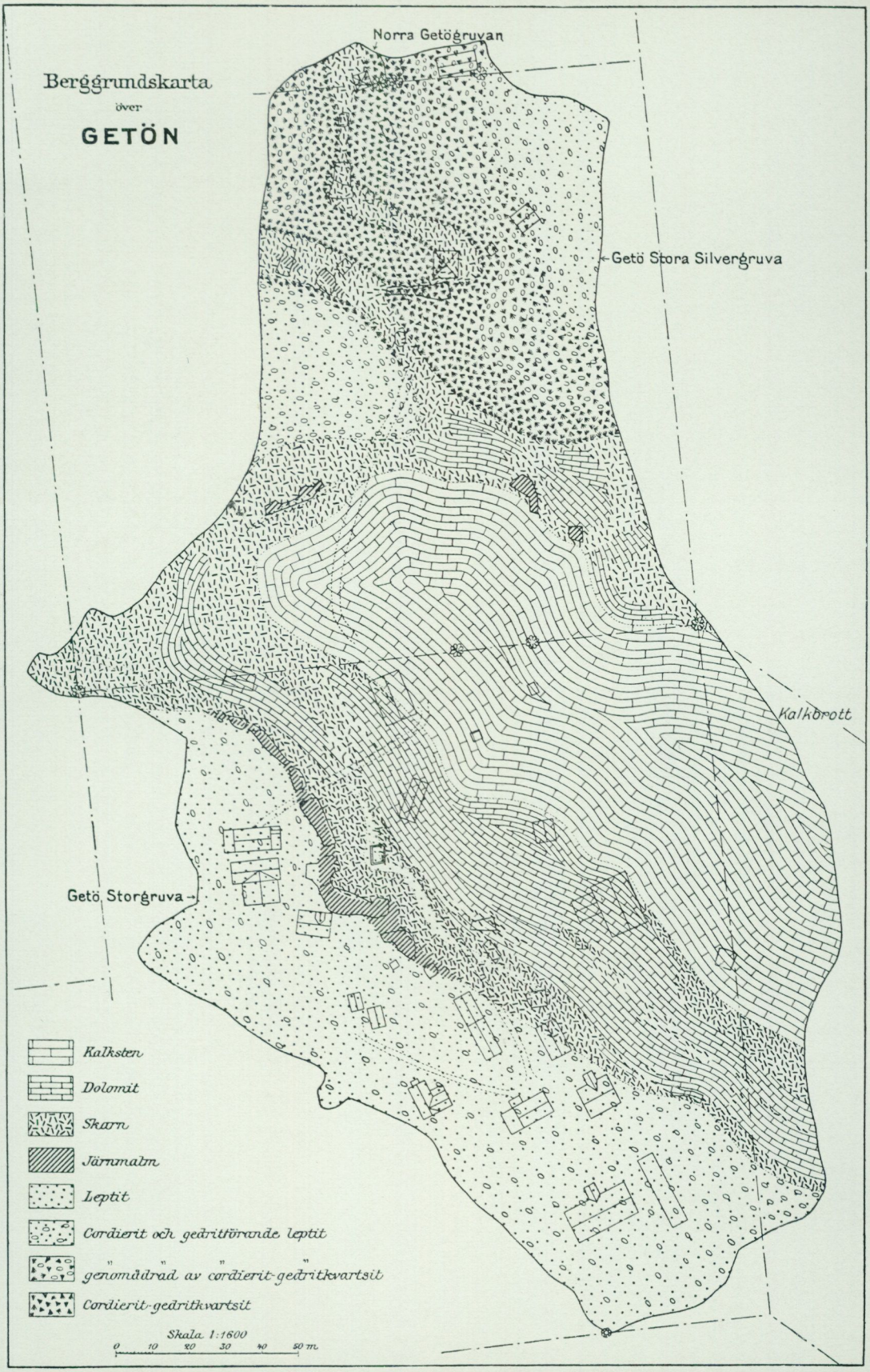


Fig. 36. Map showing the ore-, skarn-, and limestone-dolomite horizons in the central part of the Persberg district. (After N. H. Magnusson.)

Natronleptit med kalk- och skarnlager = Sodic leptite with intercalations of limestone and skarn. *Natronleptit, strökornsrik, och kalileptit* = Sodic leptite rich in phenocrysts, and potassic leptite. *Horrsjögranit* = Horrsjö granite. *Filipstadsgranit* = Filipstad granite.

Fig. 37. Geological map of Getön. (After N. H. Magnusson). Legend: 1. Limestone; 2. Dolomite; 3. Skarn; 4. Iron ore; 5. Leptite; 6. Cordierite- and gedrite-bearing leptite; 7. Leptite with veins of cordierite-gedrite quartzite; 8. Cordierite-gedrite-quartzite.


Berggrundskarta
över
GETÖN
Norra Getögruvan
Getö Stora Silvergruva
Kalkbrott
Getö Storgruva
Kalksten
Dolomit
Skarn
Järnmalm
Leptit
Cordierit och gedritförande leptit
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Cordierit-gedritkvartsit
Skala 1:1600
0 10 20 30 40 50 m

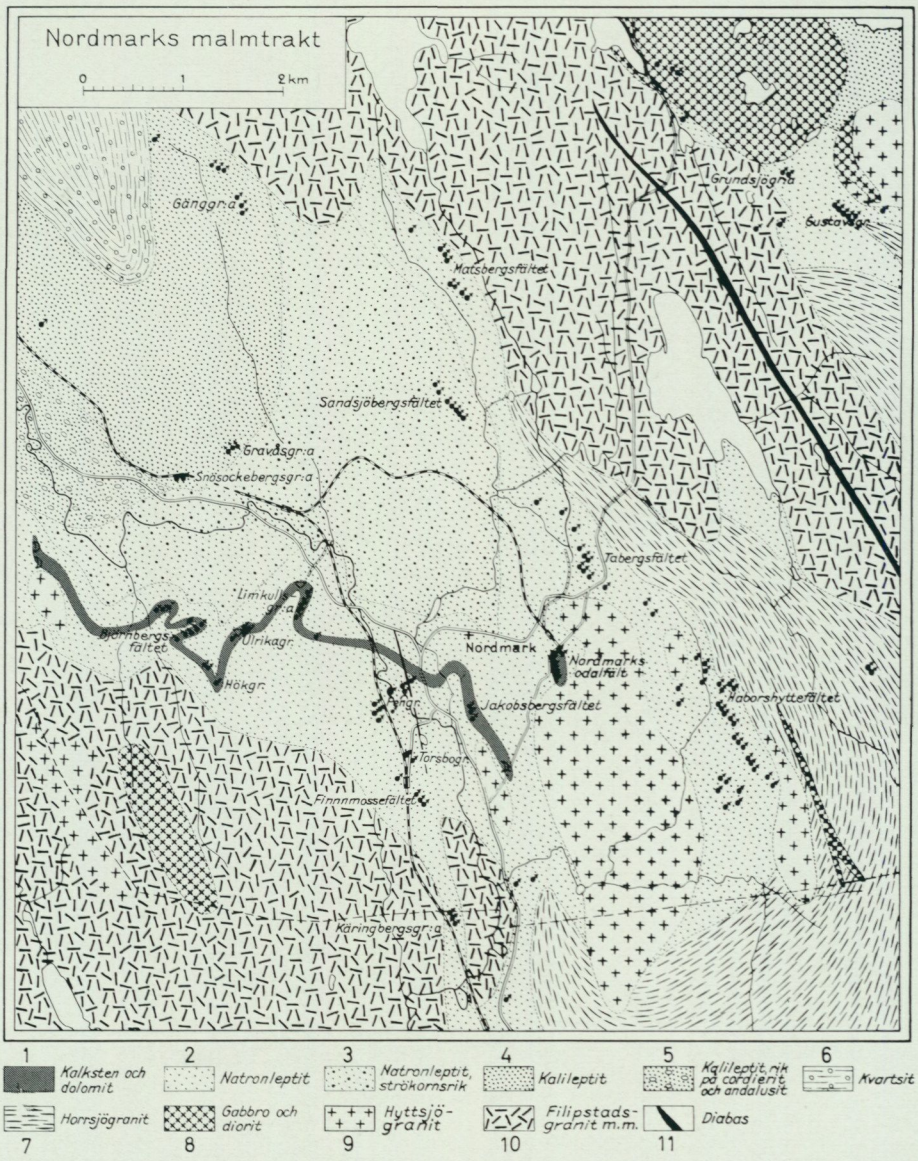


Fig. 38. Map of the central part of the Nordmark district. (After N. H. Magnusson.) Legend: 1. Limestone and dolomite; 2. Sodic leptite; 3. Sodic leptite rich in phenocrysts; 4. Potassic leptite; 5. Potassic leptite rich in cordierite and andalusite; 6. Gothian quartzite; 7. Svecofennian synorogenic granite; 8. Gabbro and diorite; 9. Late Svecofennian palingenic granite; 10. Gothian granite; 11. Diabase.

Fig. 39. Calcite-brucite rock. Thin section, + nic., magnification 35 ×. Bergmästaränggruvan mine, Persberg district. (After N. H. Magnusson.)

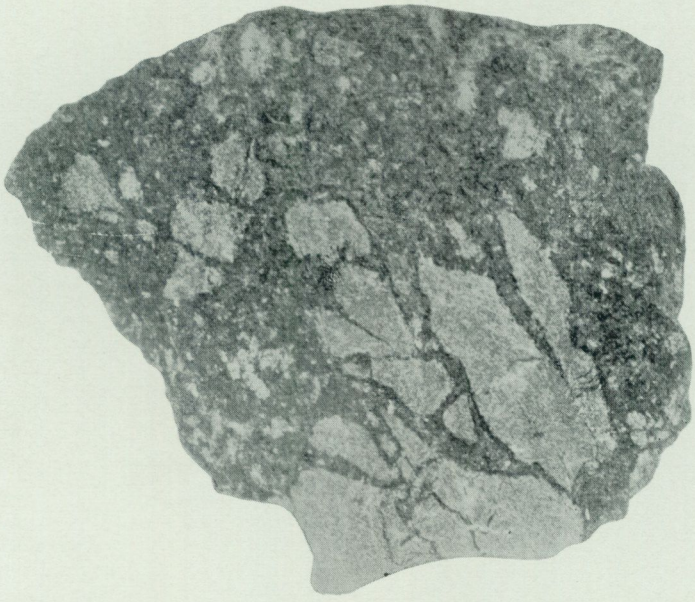


Fig. 40. Pyroxene skarn, partially transformed in hornblende skarn. Nat. size. Aggruvan mines, southern part of the Nordmark district. (After N. H. Magnusson.)

Fig. 41. Scapolite in pyroxene skarn. 1/2 of nat. size. Finnshytteberg field, southern part of the Nordmark district. (After N. H. Magnusson.)

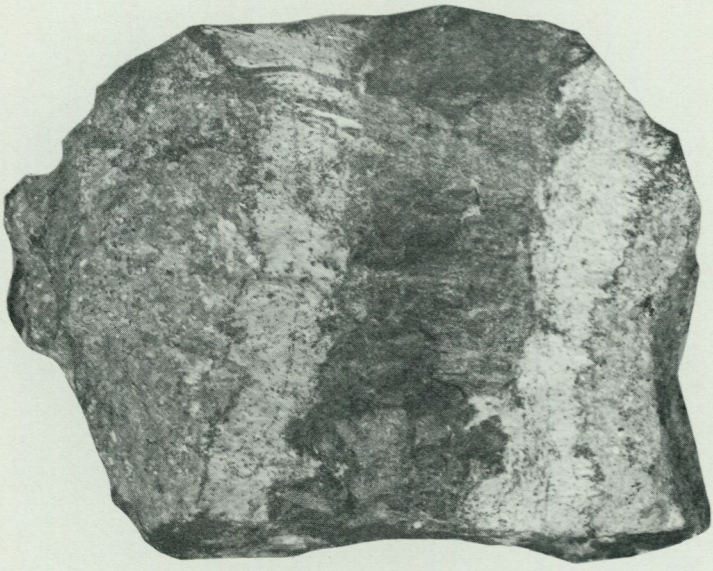


Fig. 42. Garnet-wollastonite dike in limestone. 1/2 of nat. size. Finnshytteberg field, southern part of the Nordmark district. (After N. H. Magnusson.)

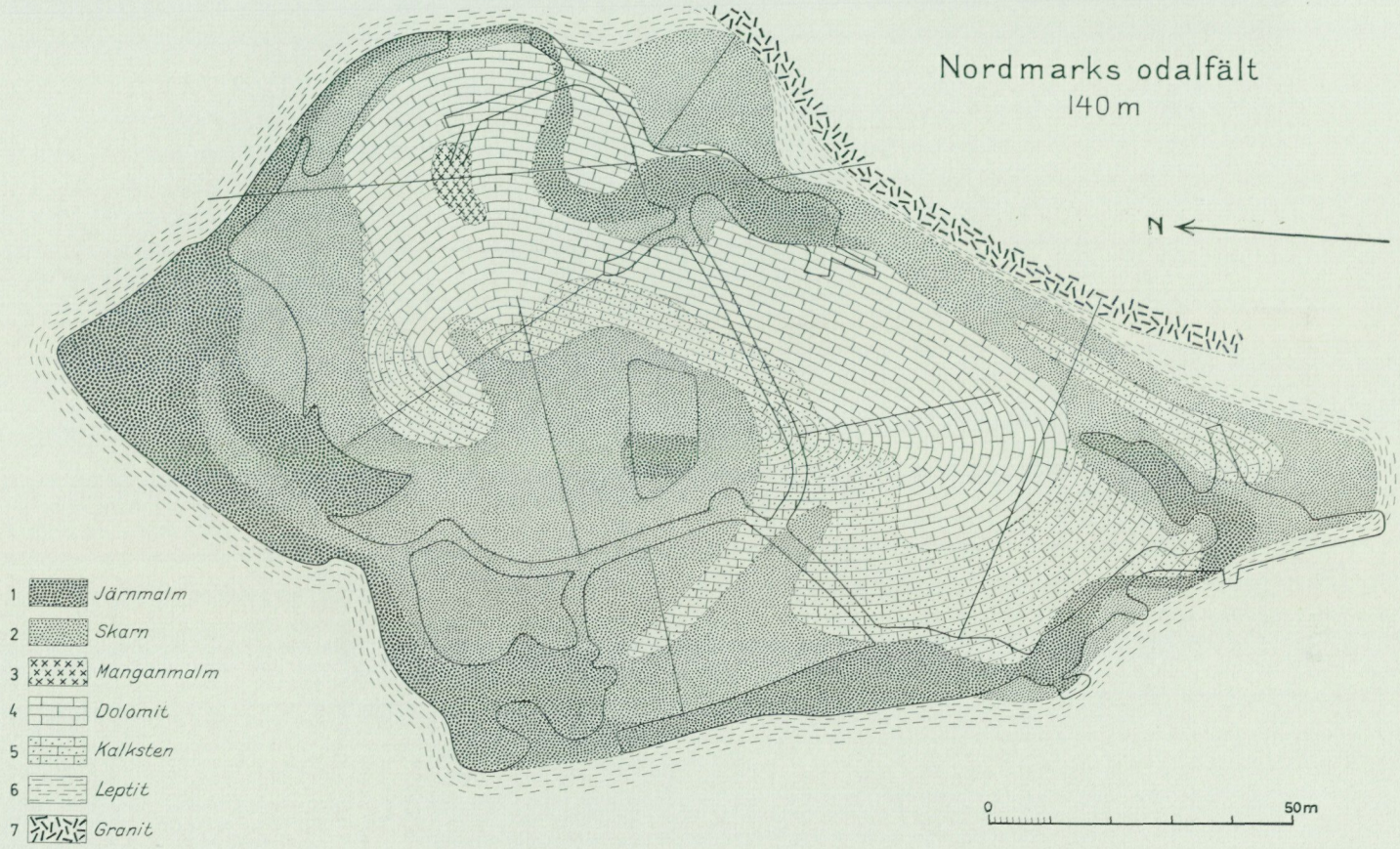


Fig. 43. 140 m level in the Nordmark Odal field. (After N. H. Magnusson.) Legend: 1. Iron ore; 2. Skarn; 3. Manganese ore; 4. Dolomite; 5. Limestone; 6. Leptite; 7. Late Svecofennian palingenic granite.

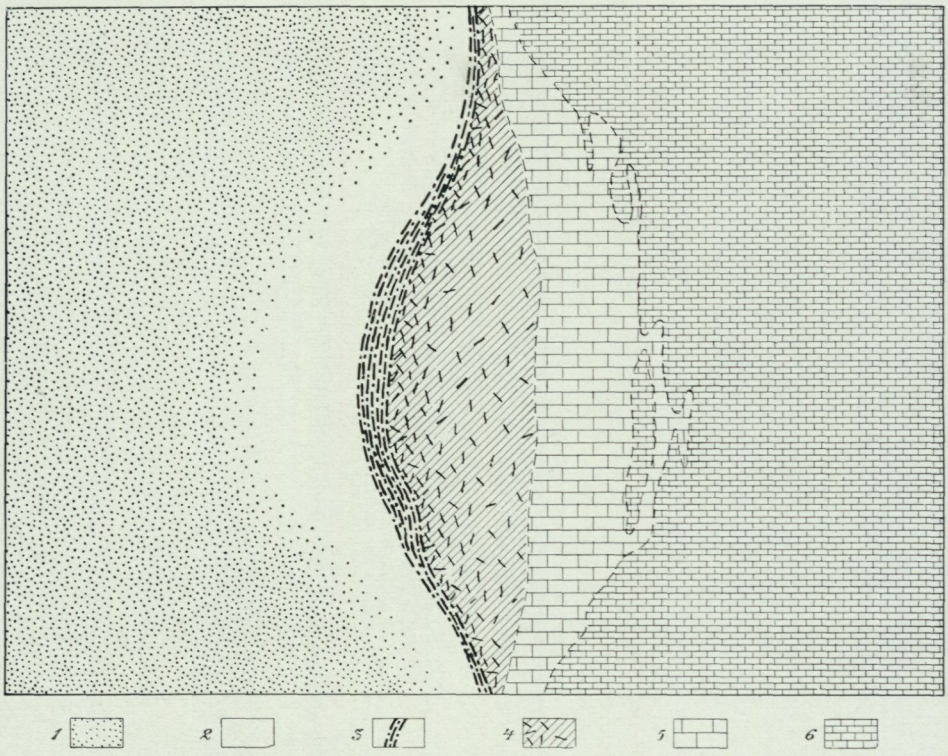


Fig. 44. Schematic section of a mica-bearing iron ore body, separated from the leptite by a broad mica sköl and from the dolomite by limestone. Nordmark Odal field. Legend: 1. Leptite, alkali-intermediate in character; 2. Sodic leptite; 3. Mica sköl; 4. Skarn iron ore with scattered scales of mica; 5. Limestone; 6. Dolomite. Here, the formation of the soda-extreme leptite on the one side and the limestone on the other was connected with the formation of the sköl. Material was taken from both sides. The scattered flakes of mica in the iron ore was formed at the same time. (After N. H. Magnusson.)

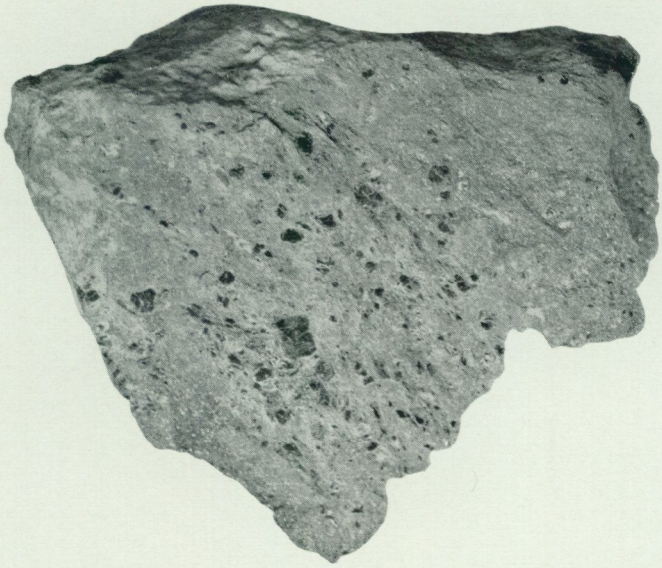


Fig. 45. Skarn consisting of pyroxene and scattered flakes of mica. 1/2 nat. size. Nordmark Odal field. The scattered mica has grown in connection with the formation of the sköl zone; see Fig. 44. (After N. H. Magnusson.)

Fig. 46. Linear structure in leptite. Near the Taberg mines, Nordmark ore district. (After N. H. Magnusson.)

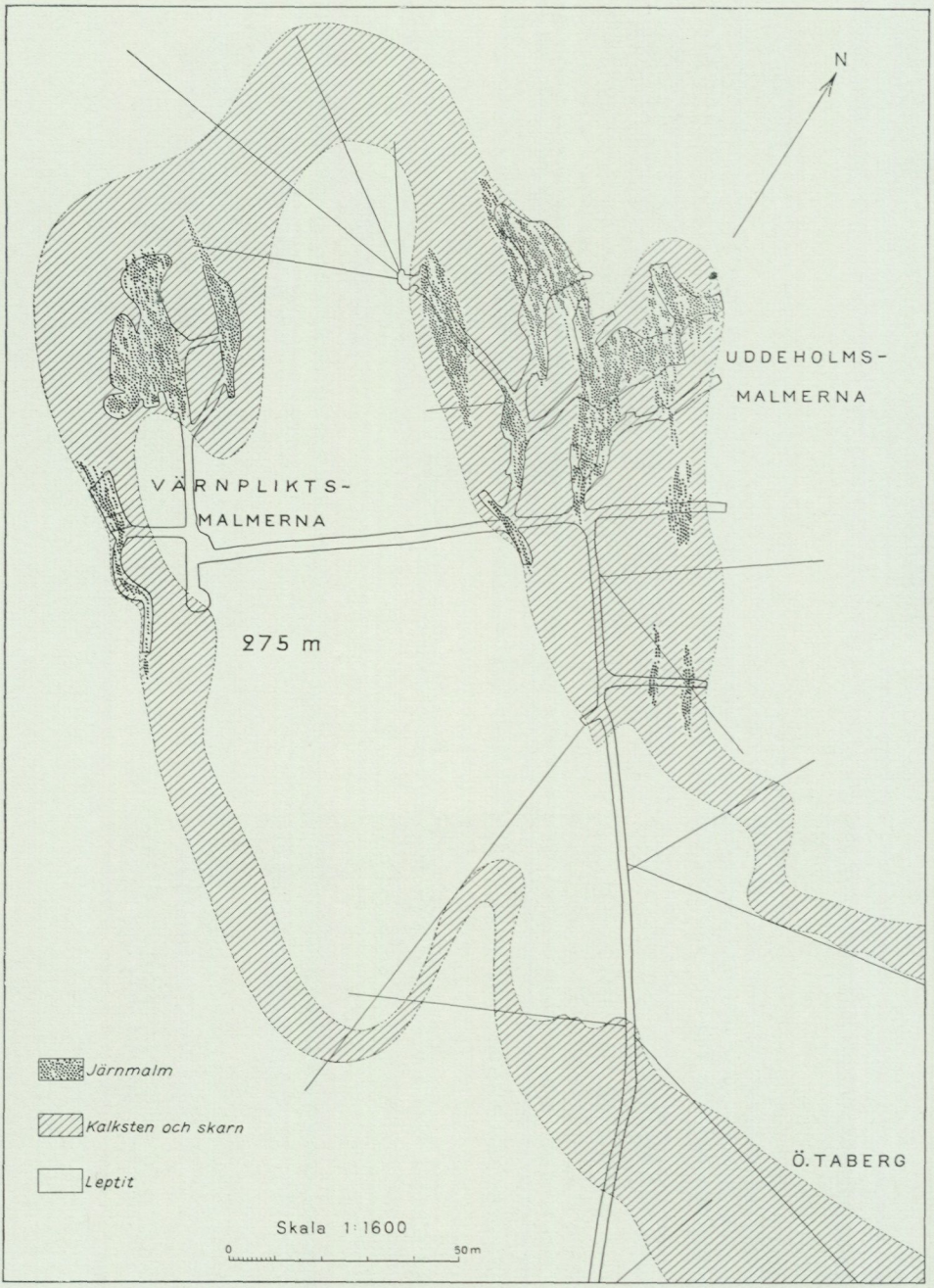


Fig. 47. 275 m. level in the Taberg mines. Legend: Järnmalm = Iron ore; Kalksten och Skarn = Limestone, Dolomite, and Skarn; Leptit = Leptite. The ore-bearing skarn-carbonate layer is strongly folded together. The best iron ores appear near the crest of the fold and dip parallel with the linear structure of the surrounding leptites. (After N. H. Magnusson.)

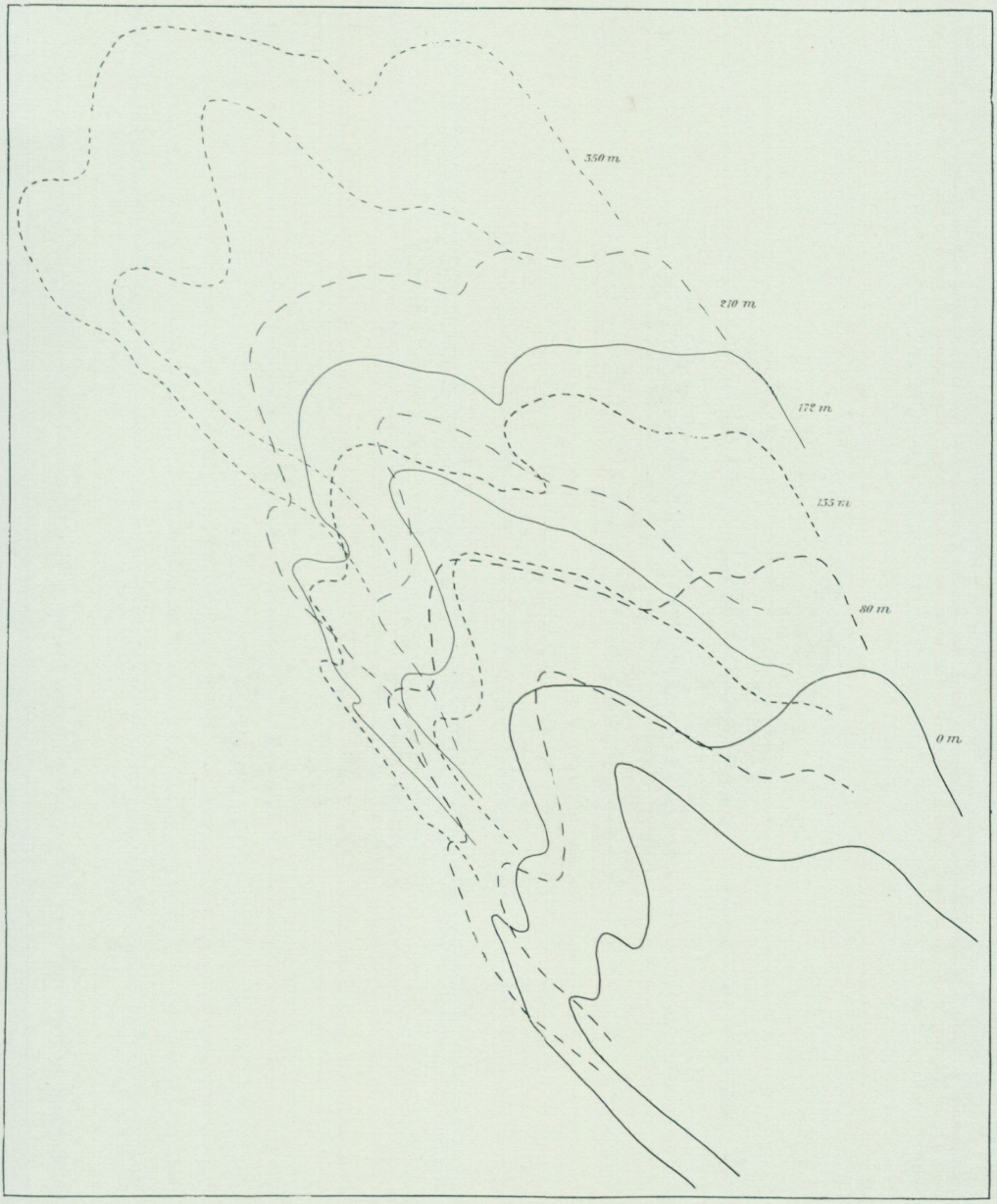


Fig. 48. The boundaries of the ore-bearing skarn layer in the Taberg mines when outeropping and at five underground levels. The dip of the folded layer is also displayed. Scale 1:2400. (After N. H. Magnusson.)

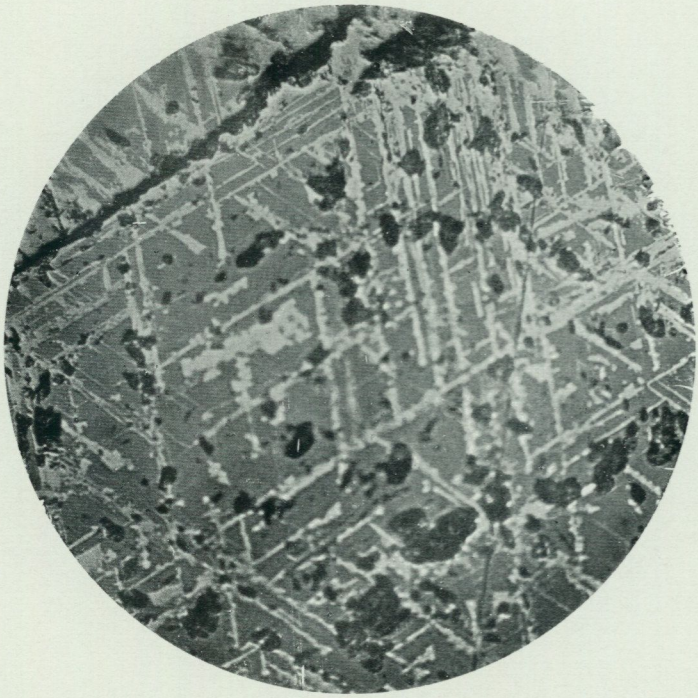


Fig. 49. Magnetite partly martitized along the octahedral faces. Polished section, magnification 200 ×. Taberg mines. One of the ores in the Taberg mines has been partly weathered as deep as to about 110 m. In the weathered ore magnetite grains more or less altered to martite occur in a mass of goethite and antigorite. Martite has been found near the surface of several iron ores in Central Sweden. Deep weathering has been observed only in a few occurrences, however. (After N. H. Magnusson.)

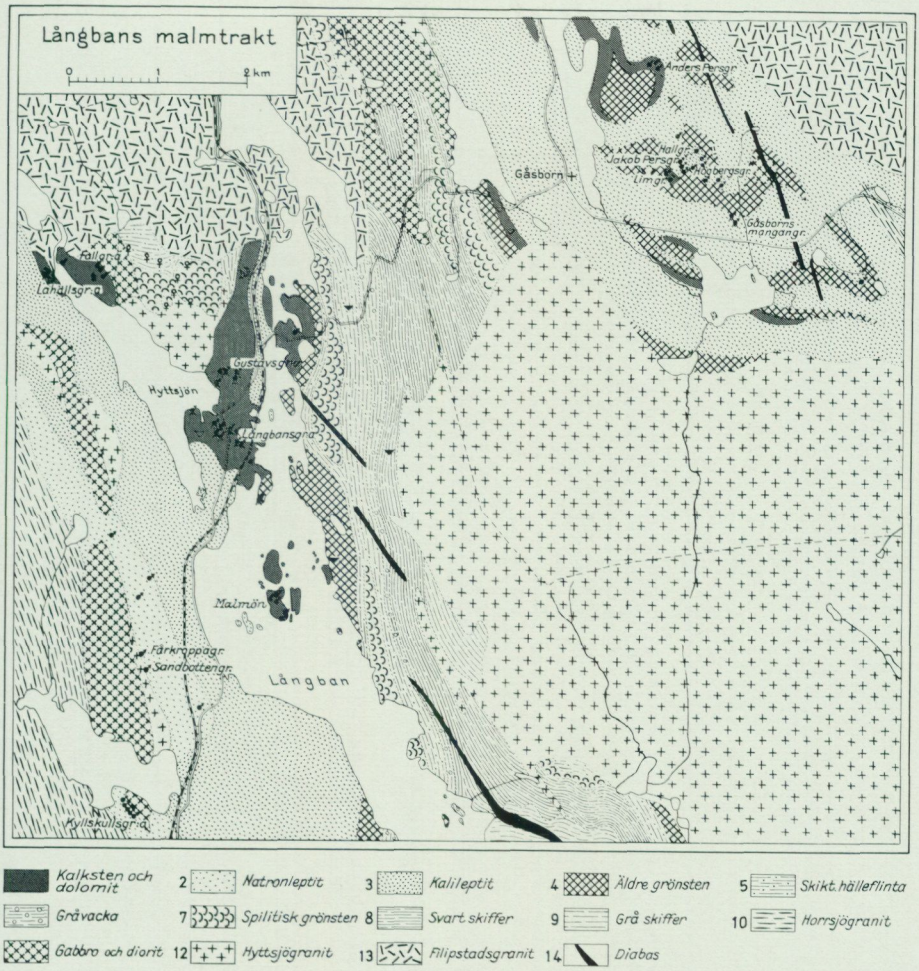


Fig. 50. Map of the Långban district. (After N. H. Magnusson.) Legend: 1. Limestone and dolomite; 2. Sodic leptite; 3. Potassic leptite; 4. Old greenstone; 5. Banded hälleflinta; 6. Greywacke; 7. Spilitic greenstone; 8. Black schist; 9. Grey schist; 10. Svecofennian synorogenic granite; 11. Gabbro and diorite; 12. Late Svecofennian palingenic granite; 13. Gothian granite; 14. Diabase.

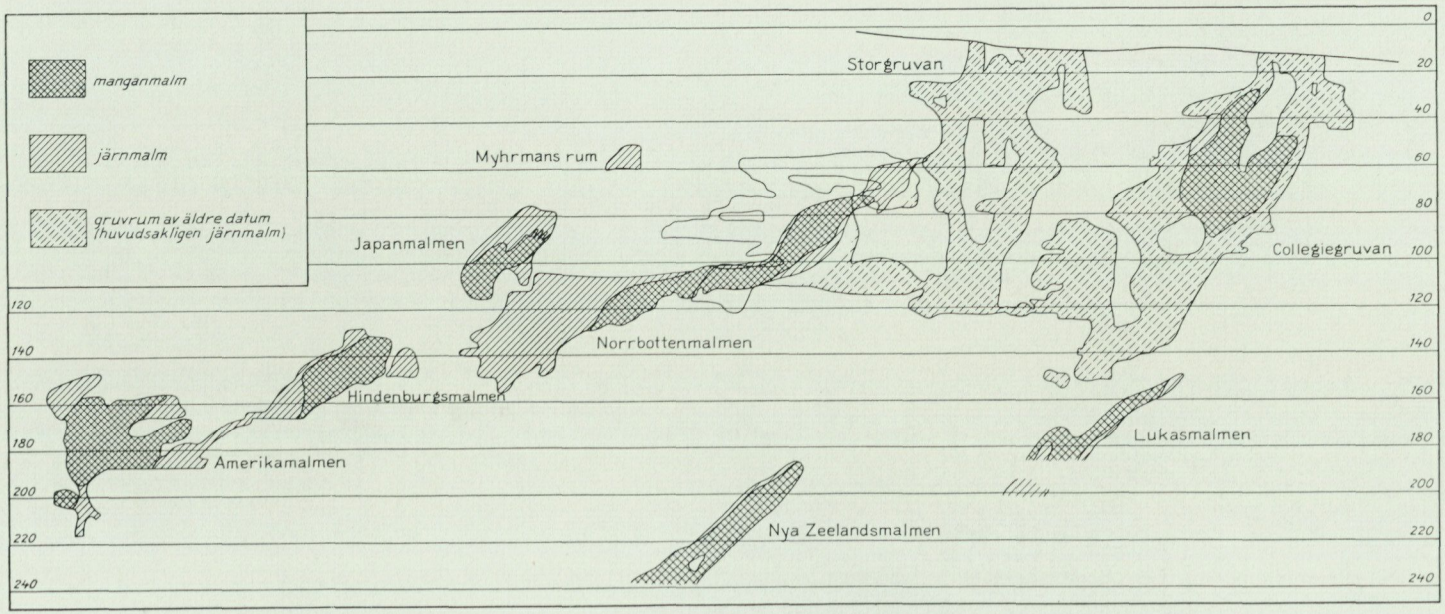


Fig. 51. Longitudinal section of the Långban mines. The symbols in the legend indicate manganese ore, iron ore, and old workings (mostly iron ore). (After N. H. Magnusson.)

Fig. 52. Ferruginous quartz, Långban mines. The recrystallization has sometimes followed the crystal faces of quartz. Thin section, ord. light, magnification 27 ×. (After N. H. Magnusson.)

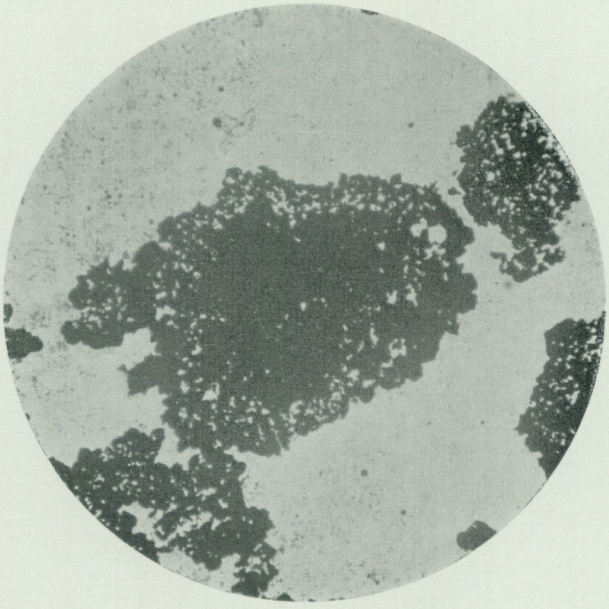


Fig. 53. Ferruginous quartz, Långban mines. Hematite concentrations have been developed in connection with the recrystallization. Thin section, ord. light, magnification 27 ×. (After N. H. Magnusson.)

Fig. 54. Braunite in dolomite, Långban mines. (After Hj. Sjögren.)

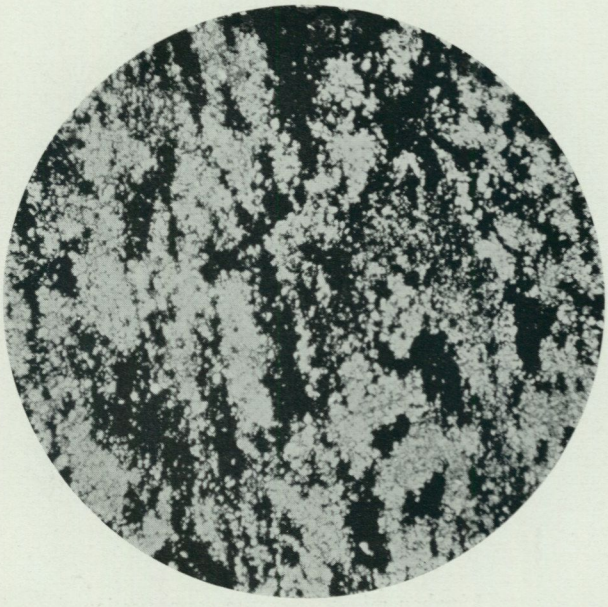


Fig. 55. Braunite in schefferite-rhodonite skarn, Långban mines. Thin section, ord. light, magnification 13 ×. (After N. H. Magnusson.)

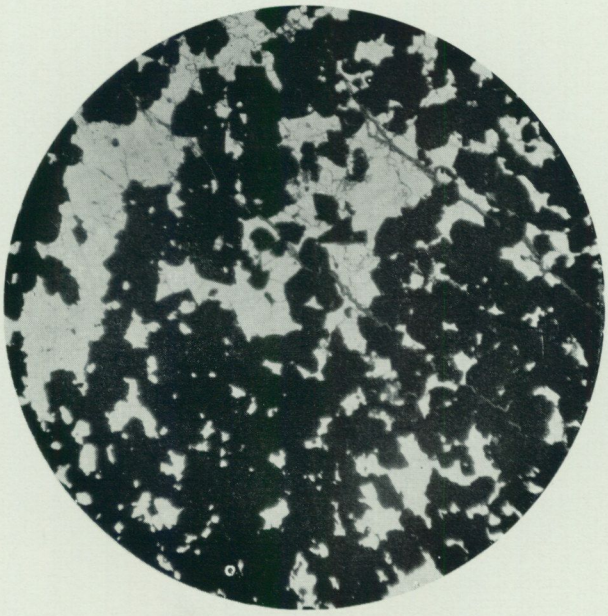


Fig. 56. Hausmannite in dolomite, Långban mines. Thin section, ord. light, magnification 30 ×. (After N. H. Magnusson.)

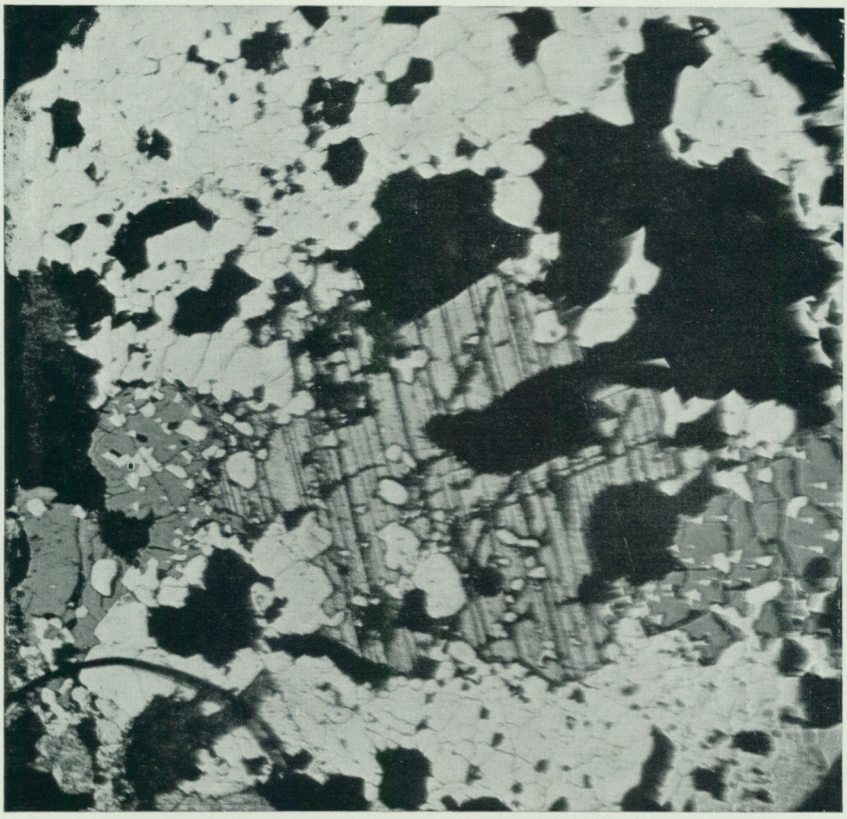


Fig. 57. Hausmannite porphyroblasts with polysynthetic twinning in braunite ore, Långban mines. Polished surface, etched with conc. HCl during half a minute. Refl. light, magnification 60 ×. In the hematite ores magnetite porphyroblasts have often been found. These have grown in the same way as the hausmannite porphyroblasts, i. e. in connection with the recrystallization processes. (After N. H. Magnusson.)

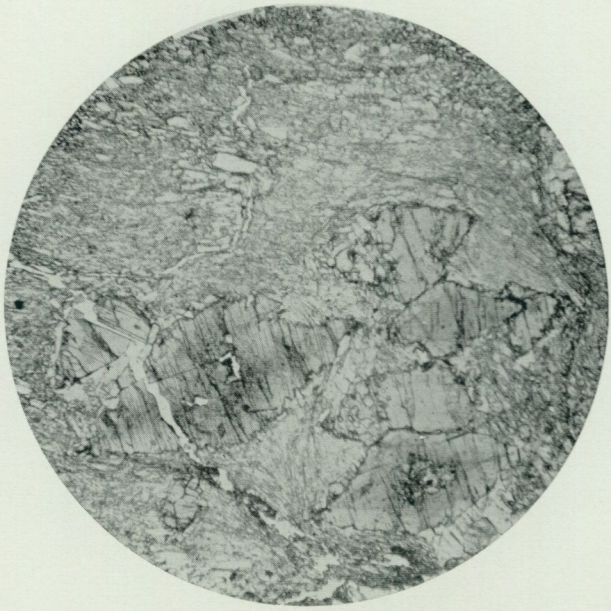


Fig. 58. Schefferite with zonal structure in richterite skarn. Thin section, ord. light, magnification 13 ×. Långban mines. (After N. H. Magnusson.)

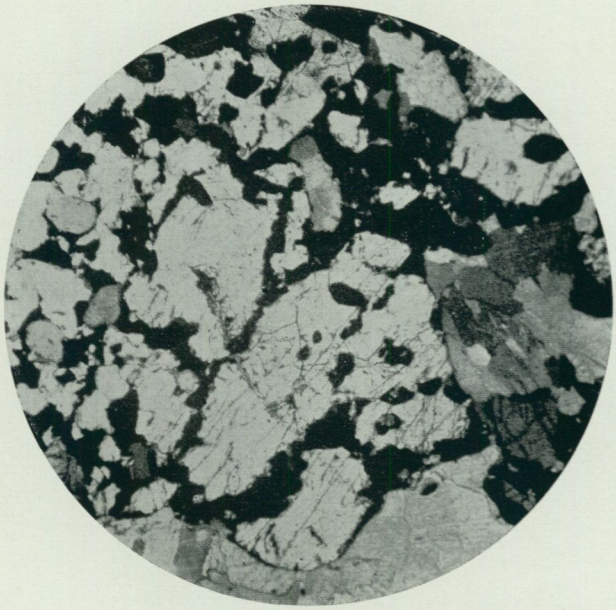


Fig. 59. Caryinite with rims of berzeliite (dark). Thin section, + nic., magnification 10 ×. Långban mines. (After N. H. Magnusson.)

Fig. 60. Pinakiolite and hausmannite in dolomite. Thin section, + nic., magnification 10 ×. Långban mines. (After N. H. Magnusson.)

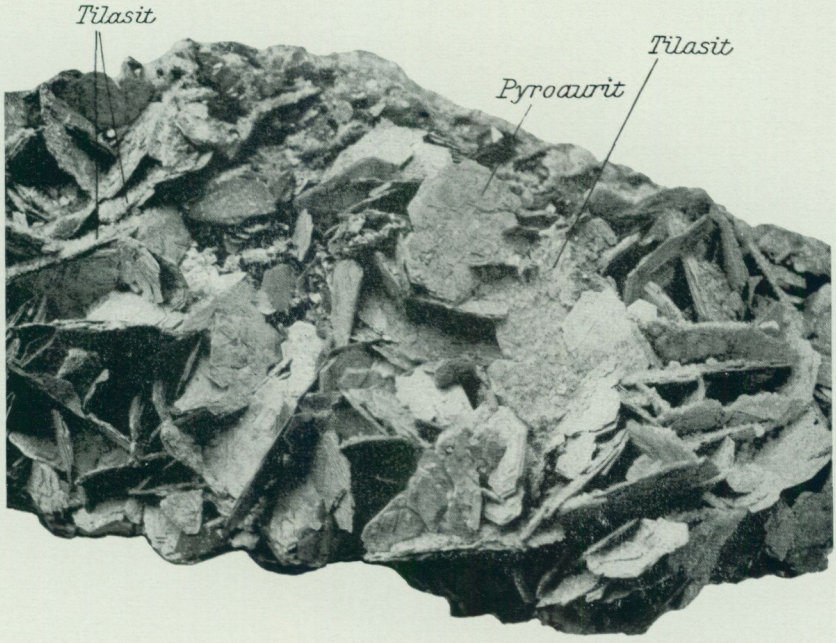


Fig. 61. Tilasite and pyroaurite in a calcite fissure in hematite ore, Långban mines. (After G. Aminoff.)

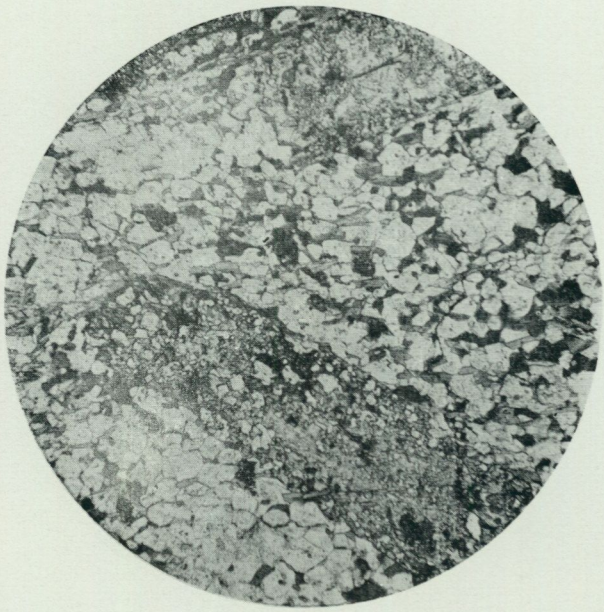


Fig. 62. Andalusite in leptite. Thin section, ord. light, magnification 13 ×. Långban mines. (After N. H. Magnusson.)

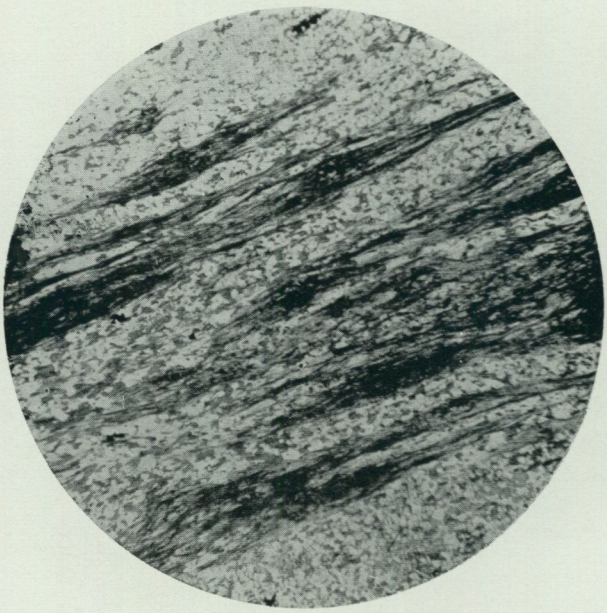


Fig. 63. Sillimannite in leptite. Thin section, ord. light, magnification 13 ×. Långban mines. (After N. H. Magnusson.)

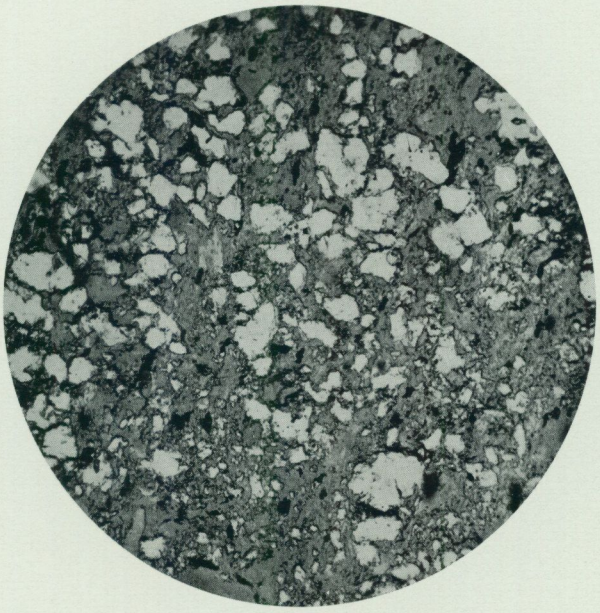


Fig. 64. Remnants of microcline and quartz in a sköl rock. Thin section, ord. light, magnification 50 ×. Långban mines. (After N. H. Magnusson.)

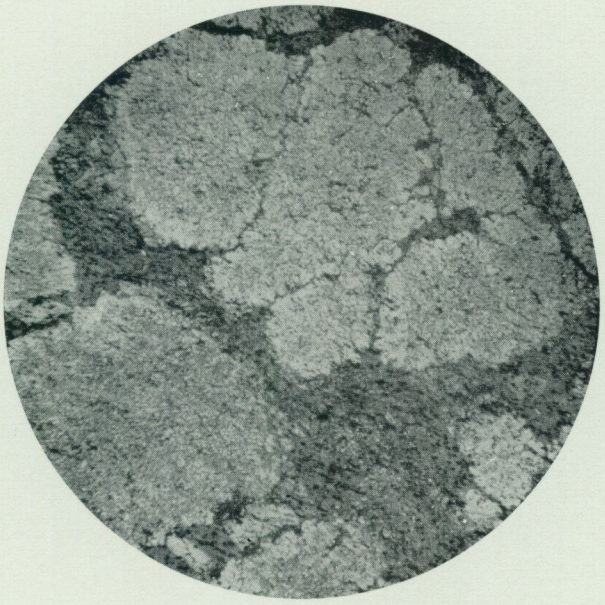


Fig. 65. Scapolite in a mica sköl. Thin section, ord. light, magnification 13 ×. Långban mines. (After N. H. Magnusson.)

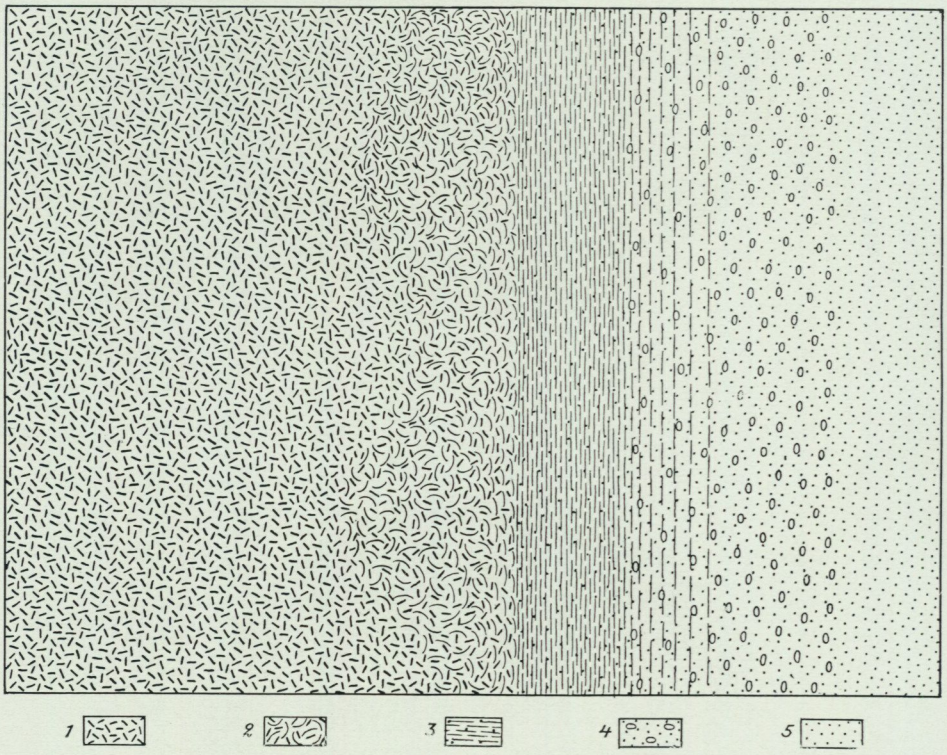


Fig. 66. Schematic section through a contact zone between leptite and skarn. (4 = cordierite-andalusite- and sillimanite-bearing transistional zone between sköl and leptite). Långban mines. The zones marked with nos. 1–5 are the same as in Fig. 67. (After N. H. Magnusson.)

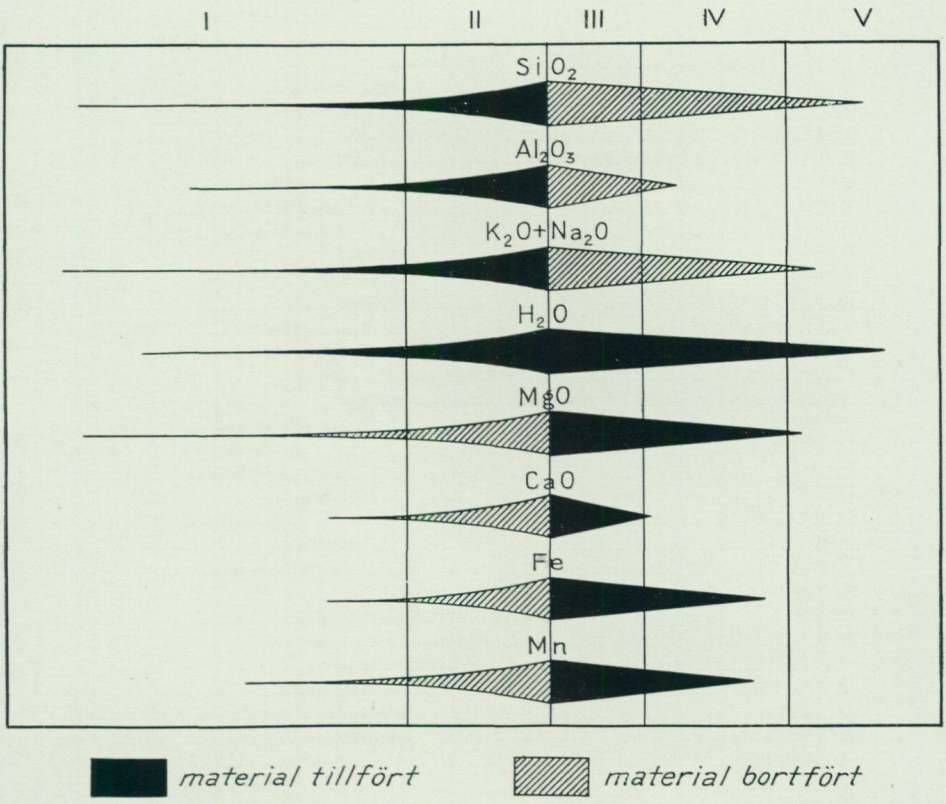


Fig. 67. Diagram illustrating transport of material in the contact zones between skarn and leptite during the sköl-forming process. Addition in black, subtraction hatched. Zone I skarn, Zone II sköl skarn, Zone III sköl, Zone IV cordierite- and andalusite-sillimanite-bearing, transitional zone, Zone V leptite. Långban mines. (After N. H. Magnusson.)

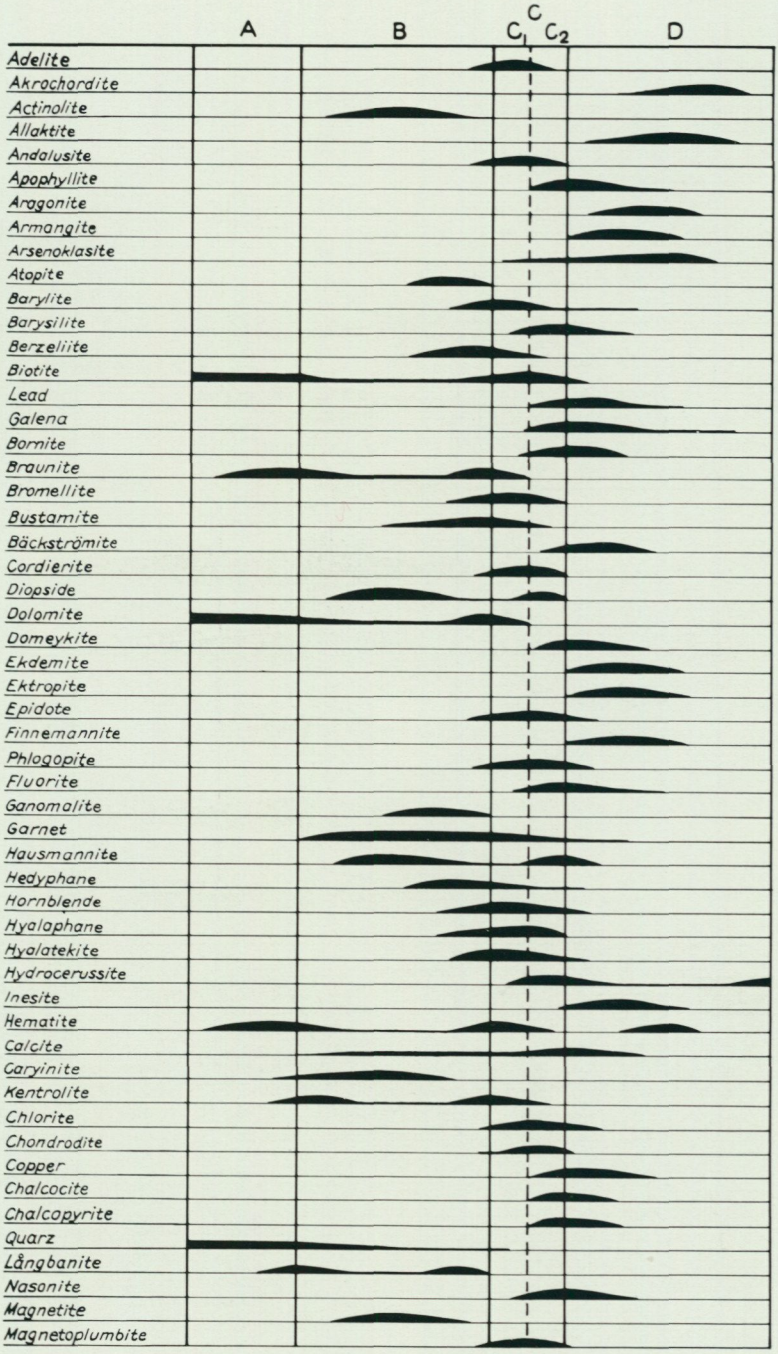


Fig. 68. Provisional paragenetic classification of the minerals in the Långban mines. Part I. (After N. H. Magnusson.)

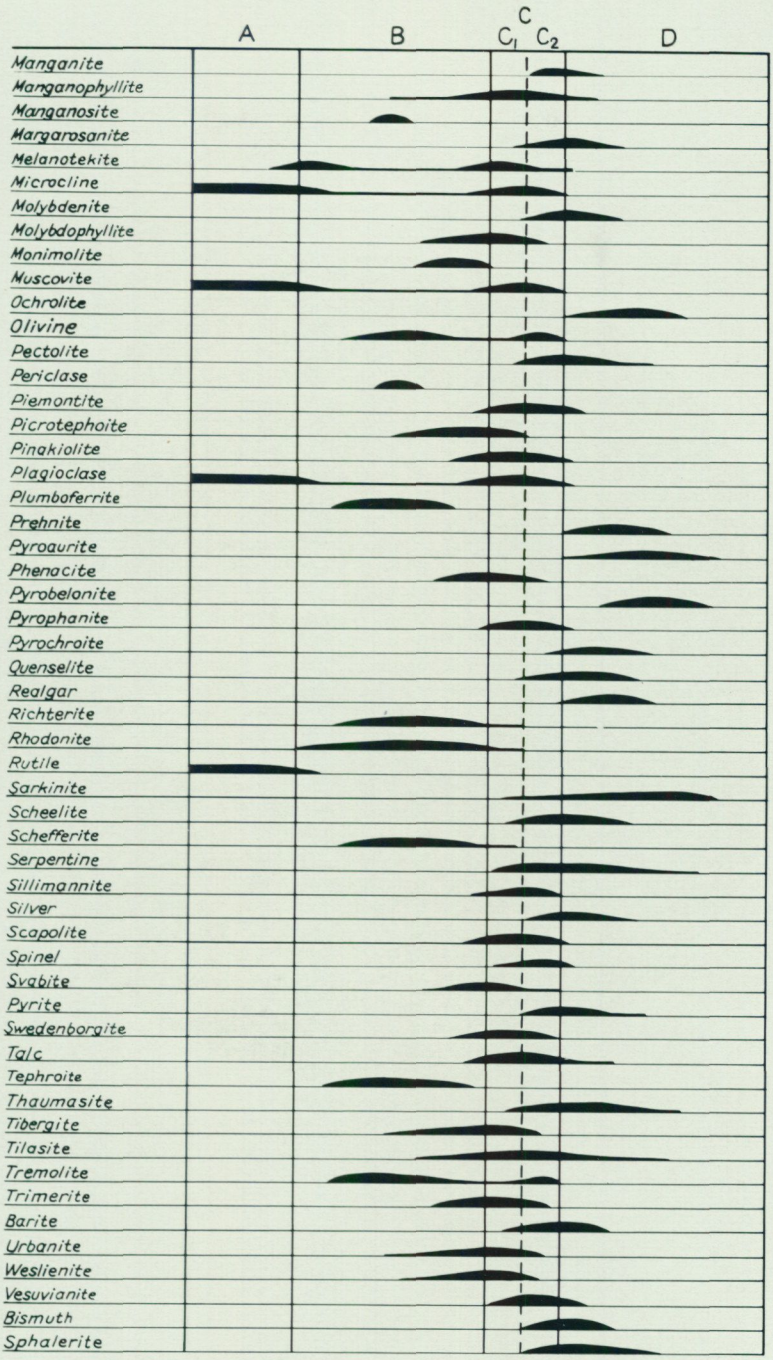


Fig. 69. Provisional paragenetic classification of the minerals in the Långban mines. Part II. (After N. H. Magnusson.)

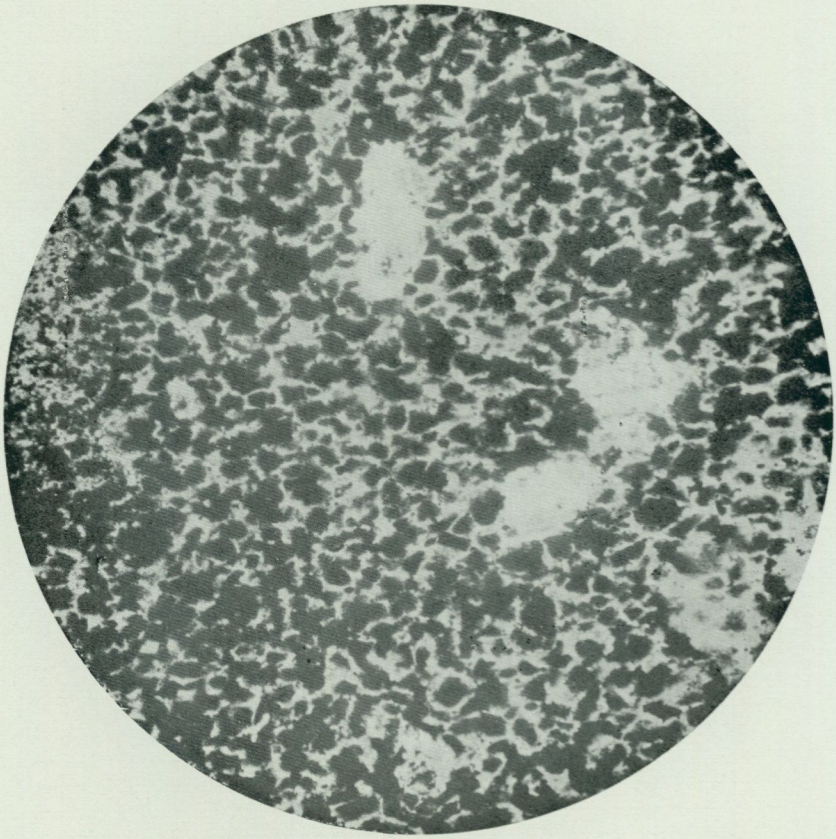


Fig. 70. Ferruginous quartz. The dark spots represent finely distributed hematite surrounded by quartz rims. The larger light areas are aggregates of quartz, free from hematite or poor in this substance. Thin section, ord. light, magnification 120 ×. Saxhyttan, Sångenn iron ore field west of Hällefors, Grythyttan region. (After N. Sundius.)

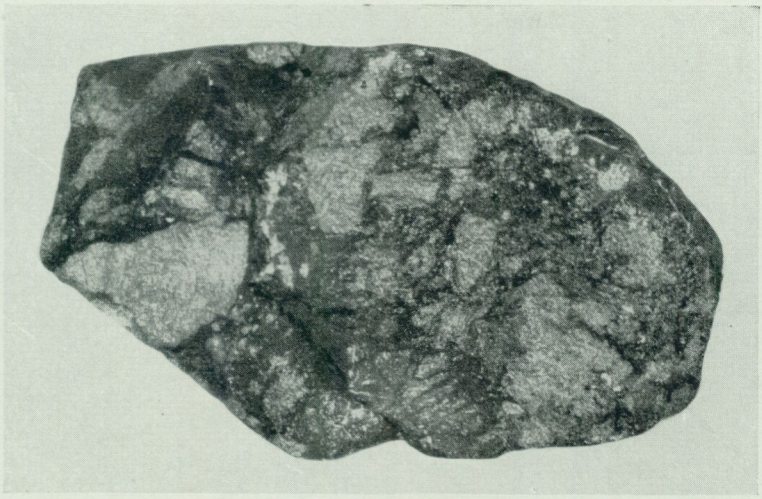


Fig. 71. Manganiferous iron ore as fragments in hälleflinta agglomerate. Half nat. size. Kextjärn mine, Grythyttan region. (After N. H. Magnusson.)

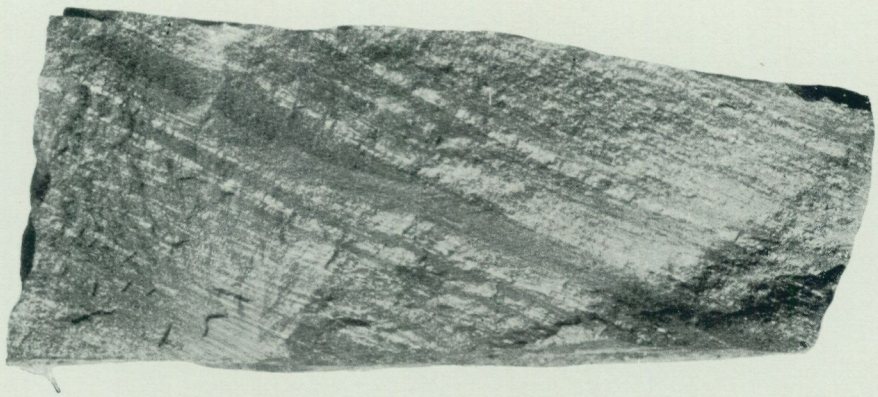


Fig. 72. Alternating layers of hälleflinta and hematite ore. The light layers consist of hematite ore. Saxå Mossgruvan mine, Sångenen iron ore field west of Hällefors, Grythyttan region. (After N. Sundius.)

Fig. 73. Skarn-banded hematite ore with subordinate quartz. Thin section, ord. light, magnification 15 ×. Hopakärrsgruvan mine, Sångenen iron ore field west of Hällefors, Grythyttan region. (After N. H. Magnusson.)

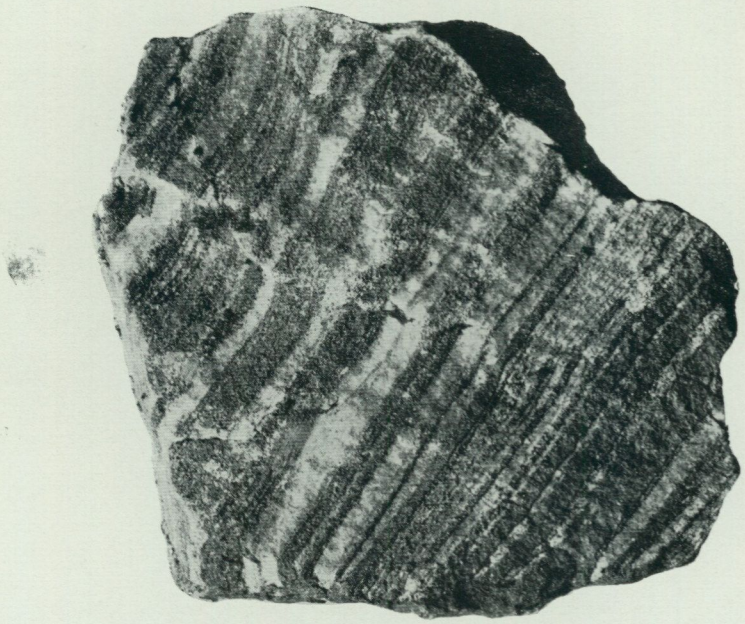


Fig. 74. Limestone-banded iron ore. Layers rich in hematite and with subordinate magnetite alternate with limestone poor in ore minerals. 5/6 of natural size. Klampåsgruvan mine, east of Hällefors, Grythyttan region. (After N. Sundius.)

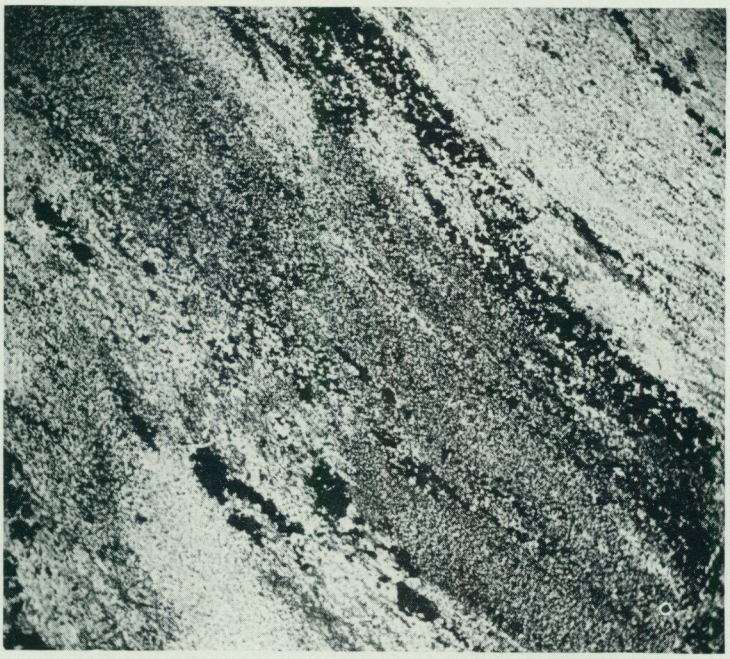


Fig. 75. Detail from a layer rich in quartz in skarn iron ore. Thin section, ord. light, magnification 15 ×. August-Andersgruvan mine southeast of Hällefors, Grythyttan region. (After N. H. Magnusson.)

Fig. 76. Large grains of quartz and magnetite in a skarn consisting essentially of amphiboles. Thin section, ord. light, magnification 15 ×. Björnkärrgruvan mine southeast of Hällefors, Grythyttan region. (After N. H. Magnusson.)

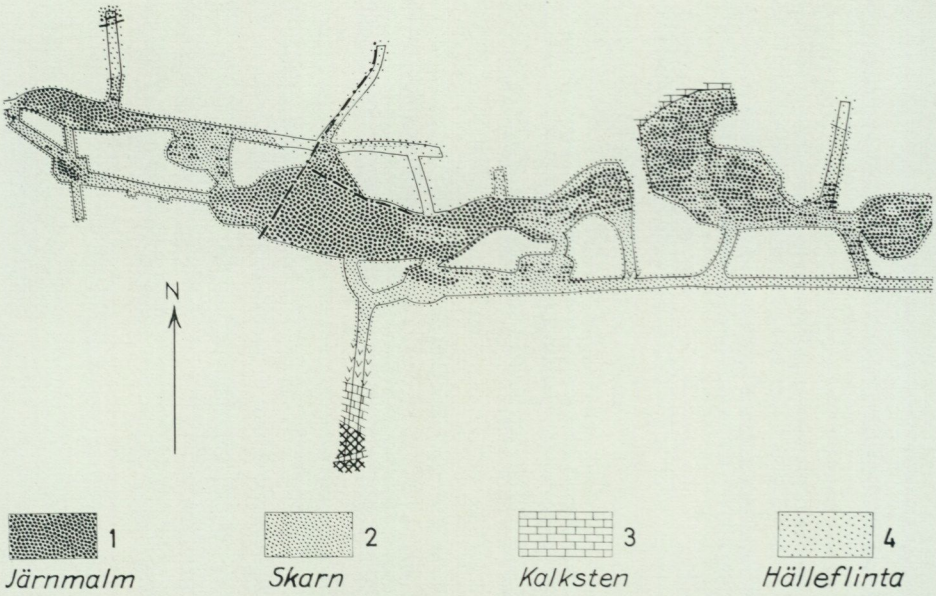
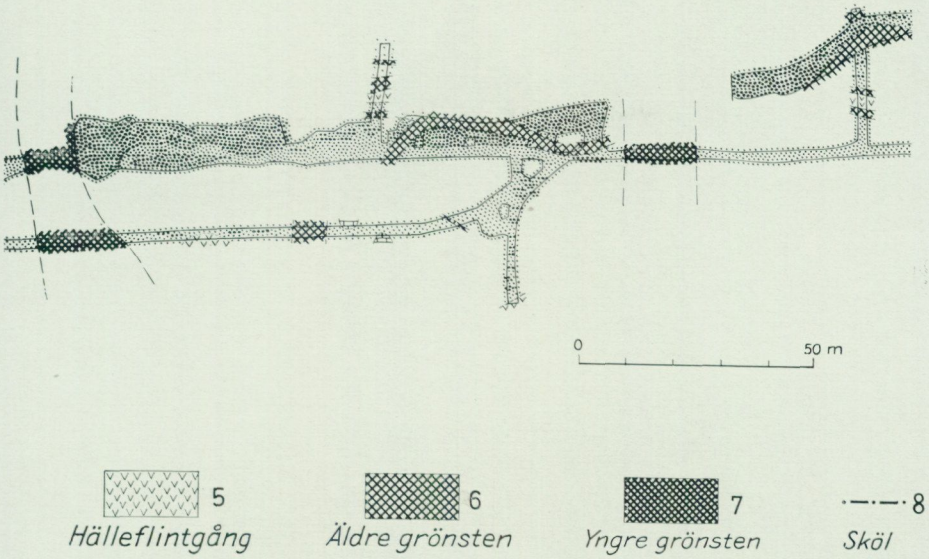


Fig. 77. Map of 135 m. level in the Sirsjöberg mines east of Hällefors, Grythyttan region. (After N. H. Magnusson). Legend: 1. Iron ore; 2. Skarn; 3. Limestone and dolo-

Fig. 78. Greenstone from the outer part of a composite dike in Sirsjöberg mines. Thin section, ord. light, magnification 15 ×. (After N. H. Magnusson.)



mite; 4. Hälleflinta; 5. Hälleflinta dike; 6. Old greenstone dike; 7. Younger greenstone (meta-diabase); 8. Sköl.

Fig. 79. Hälleflinta (keratophyre) from the inner part of a composite dike in Sirsjöberg mines. Thin section, + nic., magnification 15 ×. (After N. H. Magnusson.)

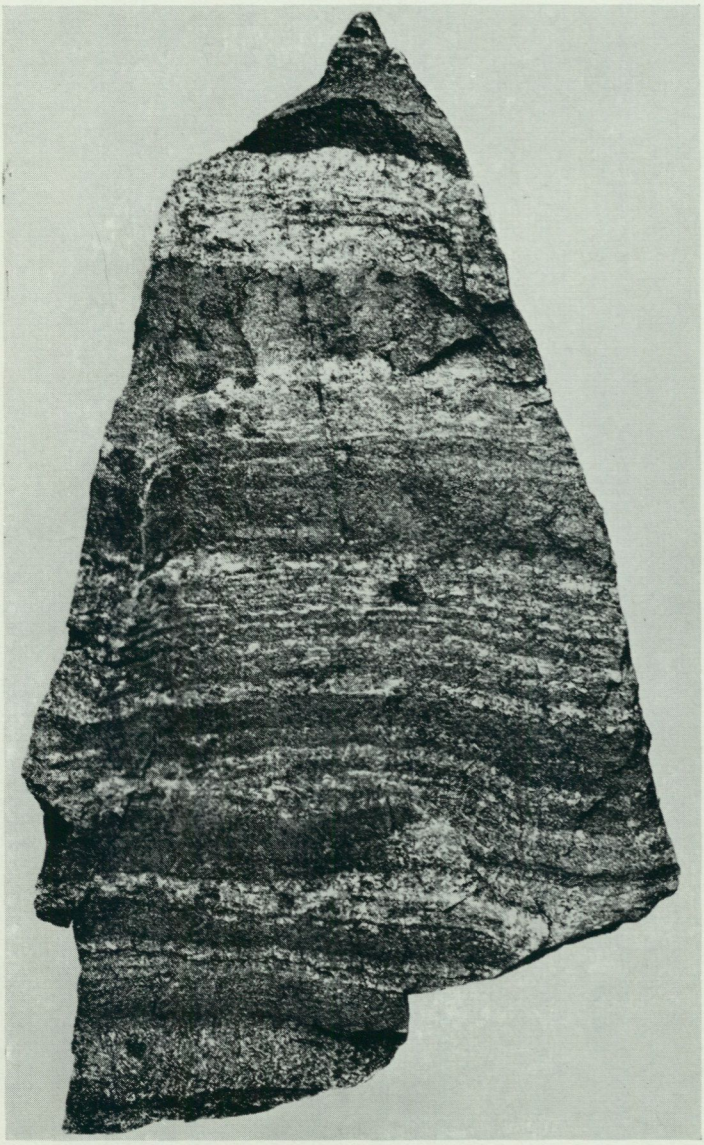


Fig. 80. The irregular skarn iron ores in the Haggruvan mine at Grönhult, east of Sirsjöberg, often contain quartz as bands and variform aggregates. The skarn consists of pyroxene, actinolite and hornblende. Locally there have been found types with alternating layers of magnetite ore, layers of skarn with magnetite, layers of quartz and layers of hälleflinta. Agglomeratic layers with pebbles of magnetite ore have also been observed in the vicinity. 3/4 of natural size. (After N. H. Magnusson.)

Fig. 81. In the iron ores in the Haggruvan mine at Grönhult the present author also have found pebbles of hälleflinta in the iron ores. Half nat. size. (After N. H. Magnusson.)

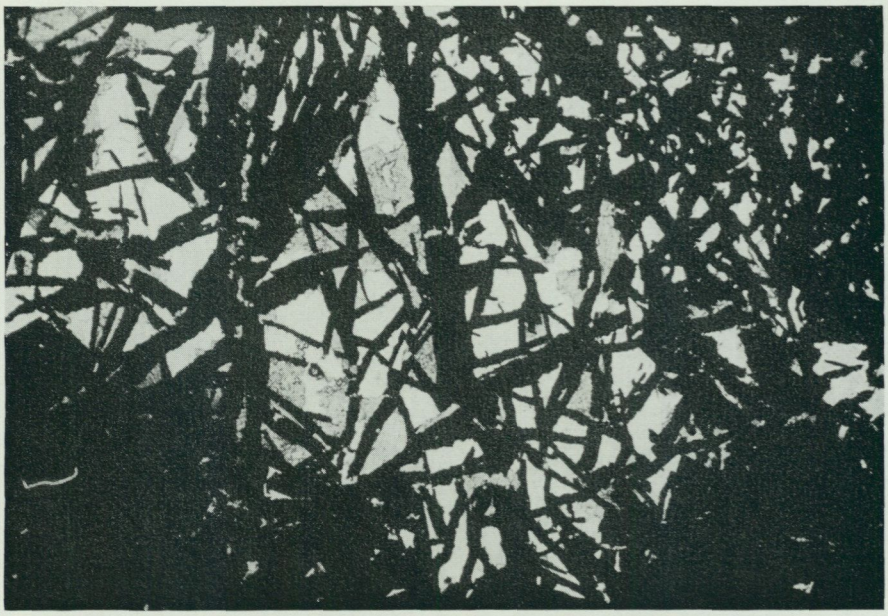


Fig. 82. Lamellar magnetite in the iron ores in the Haggruvan mines at Grönhult. Thin section, ord. light, magnification 15 ×. (After N. H. Magnusson.)

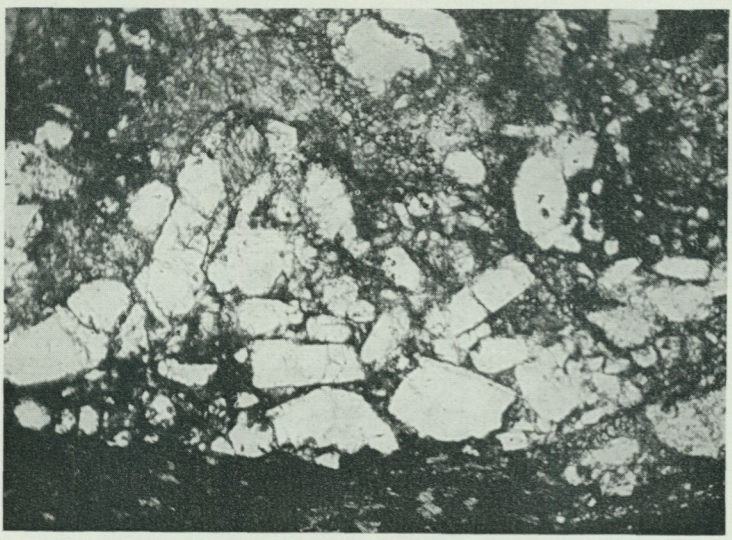


Fig. 83. Quartz layer broken into pieces and found in the skarn iron ores of Sirsjöberg mines. Thin section, ord. light, magnification 15 ×. (After N. H. Magnusson.)

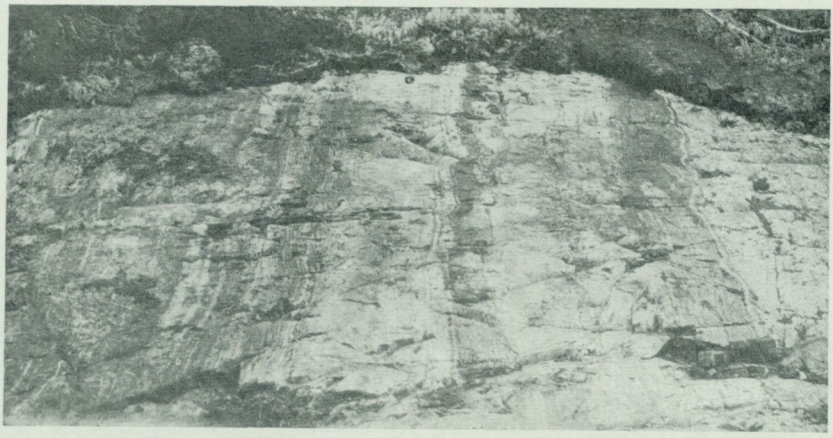


Fig. 84. Banded hälleflinta. The dark bands are rich in amphiboles. Finnberget mines, east of Grythyttan. (After N. Sundius.)

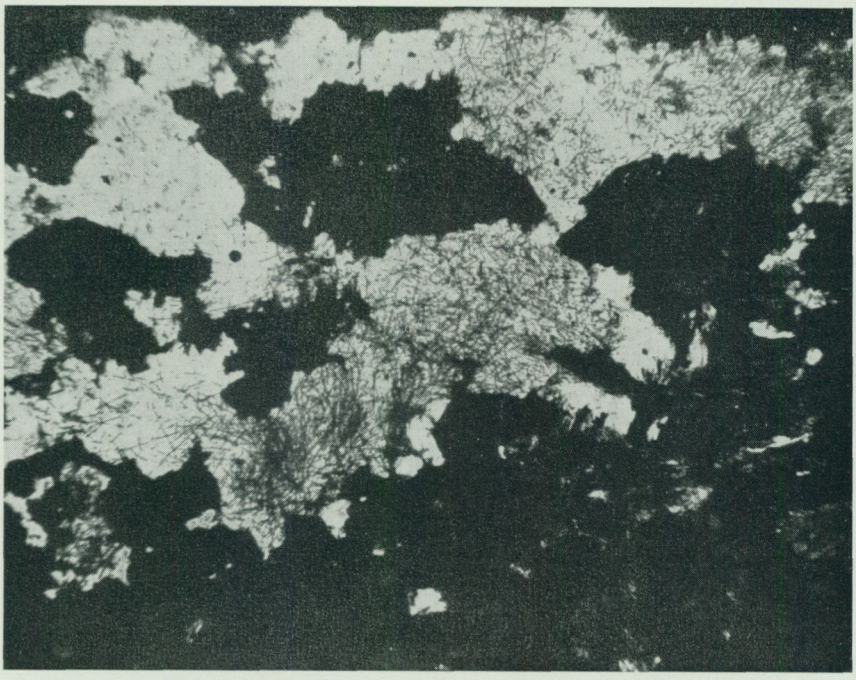


Fig. 85. Actinolite needles in a layer of quartz-magnetite ore. Thin section, ord. light, magnification 15 ×. Finnberget mines east of Grythyttan. (After N. H. Magnusson.)

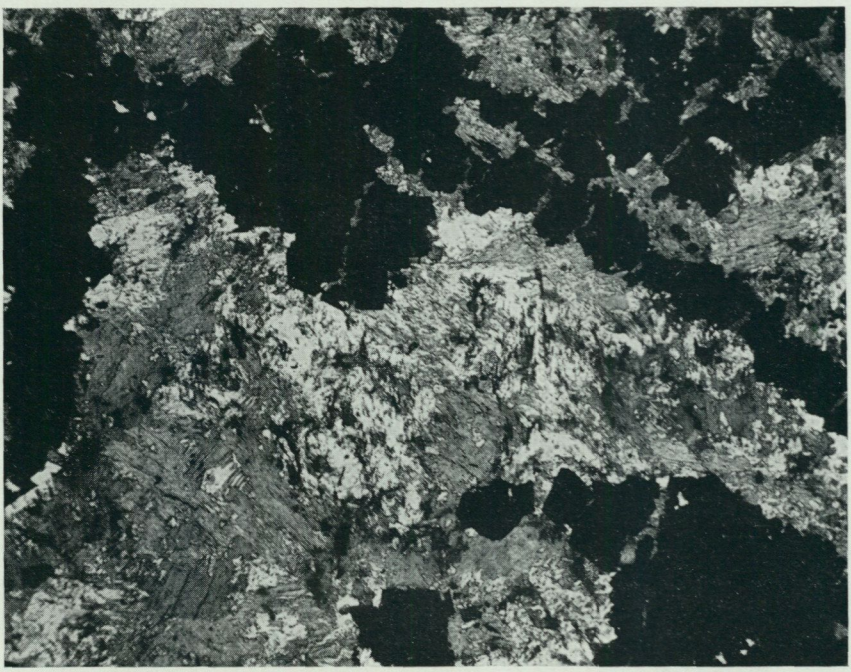


Fig. 86. Folded magnetite layer in amphibole skarn with limestone remnants. Thin section, ord. light, magnification 15 ×. Finnberget mines east of Grythyttan (After N. H. Magnusson.)

Fig. 87. The skarn iron ores in the Högborn mines south of Grythyttan are often banded (compare the photo above), and all transitions exist between banded ores and massive ores with irregular distributions of magnetite in the skarn masses, which consist of actinolite, tremolite, hornblende, garnet, epidote, biotite, chlorite, and talc. Together with skarn-banded types there also occur limestone-dolomite-banded and quartz-banded ores as remnants in the skarn masses. (After N. H. Magnusson.)

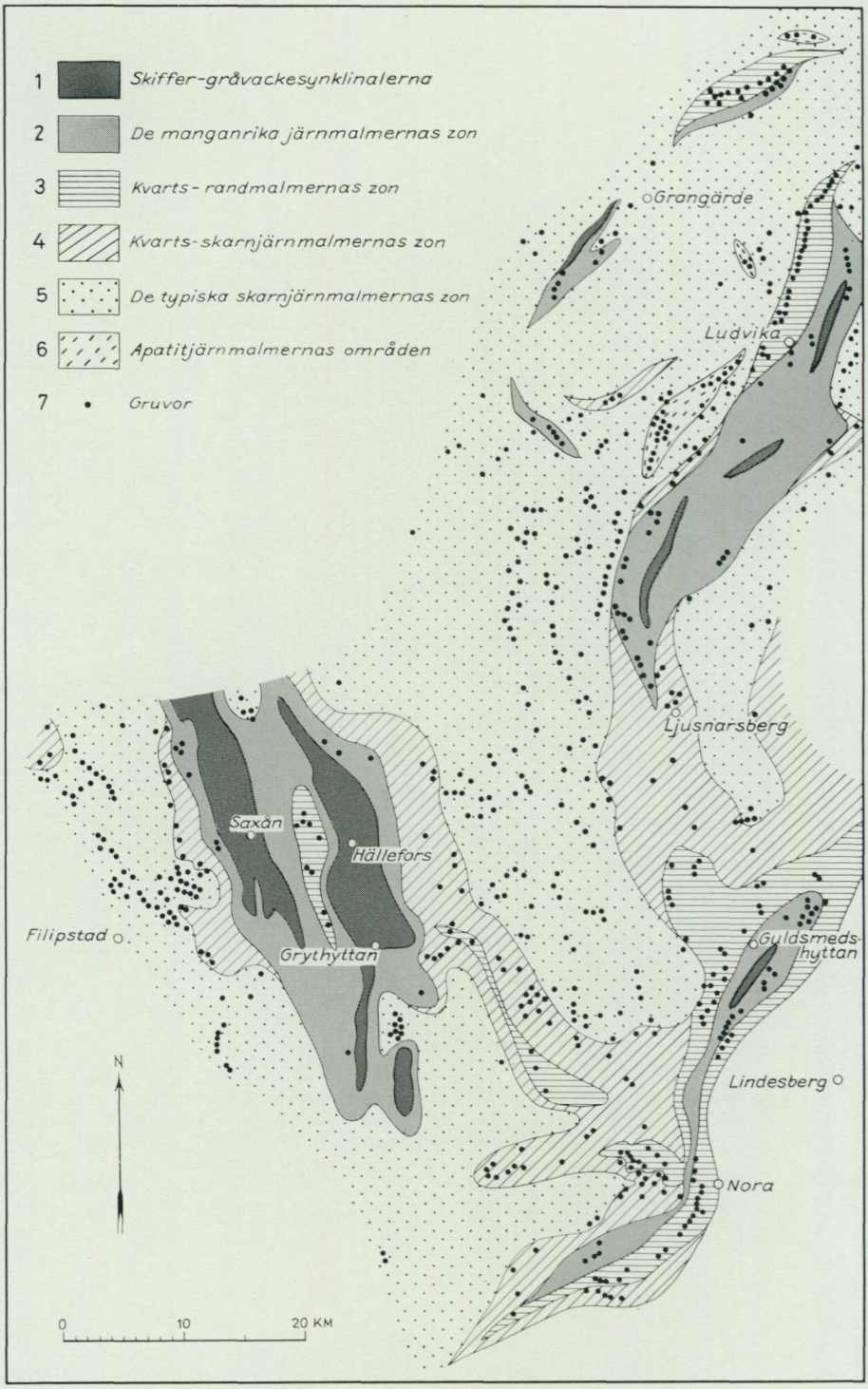


Fig. 88. Map of the stratigraphic zones. Legend: 1. Greywacke-schist syncline; 2. Zone with manganiferous iron ores and combined iron and manganese ores of the Långban type; 3. Zone with quartz-banded hematite (-magnetite) ores; 4. Zone with quartz-skarn iron ores; 5. Zone with skarn iron ores poor in or free from quartz; 6. Areas with apatite iron ores; 7. Mines. (After N. H. Magnusson.)

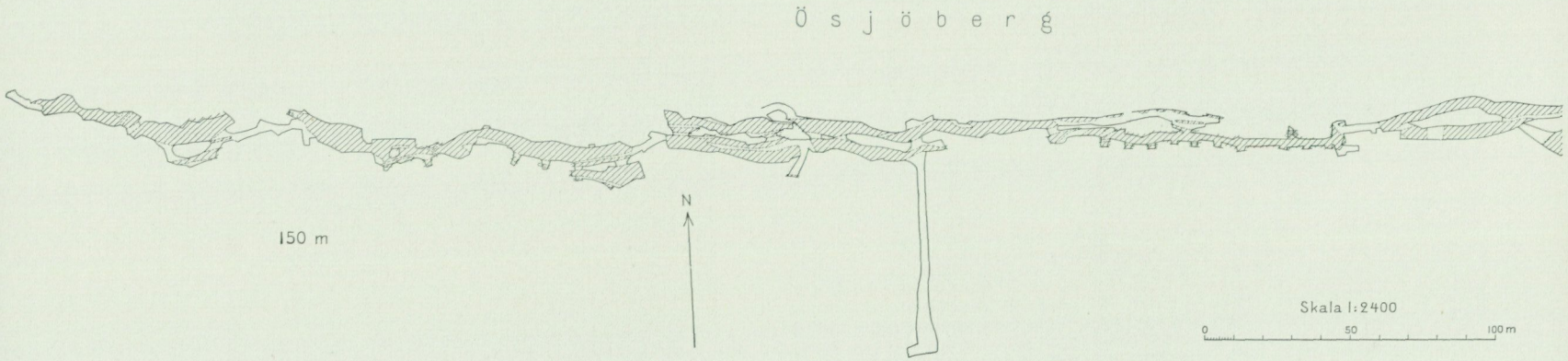


Fig. 89. Map of the 150 m. level in the Ösjöberg mines. The ore layer has been cut into pieces by older and younger greenstone dikes (without hatching on the map). Hjulsjö-Järnboås region. (After N. H. Magnusson.)

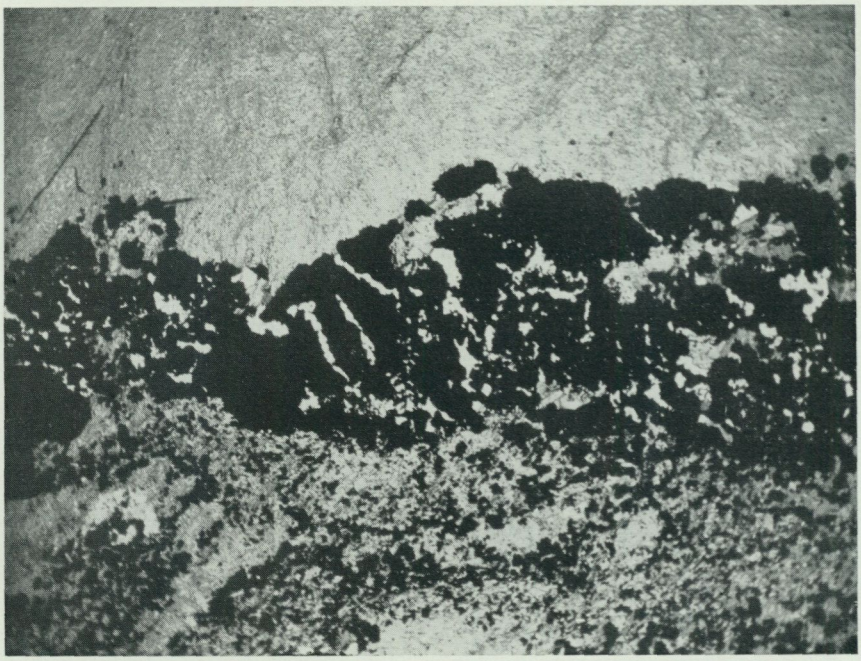


Fig. 90. Banded magnetite ore. The central magnetite ore layer is rich in quartz. Above this layer a limestone layer is seen, and below it a layer with magnetite, skarn minerals, and quartz. Thin section, ord. light, magnification 15 ×. Björksjö mines, Hjulsjö-Järnboås region. (After N. H. Magnusson.)

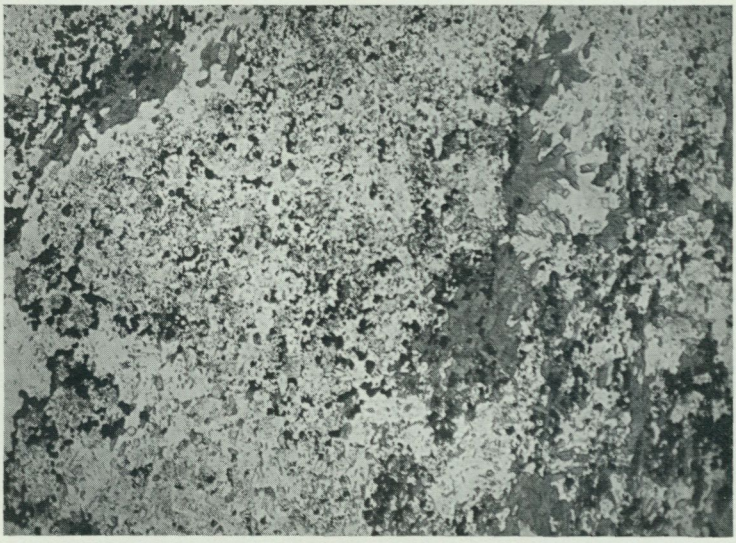


Fig. 91. A quartz layer with fine-grained magnetite, probably originally ferruginous quartz with hematite. Scattered skarn minerals are seen. Thin section, ord. light, magnification 15 ×. Björksjö mines, Hjulsjö-Järnboås region. (After N. H. Magnusson.)

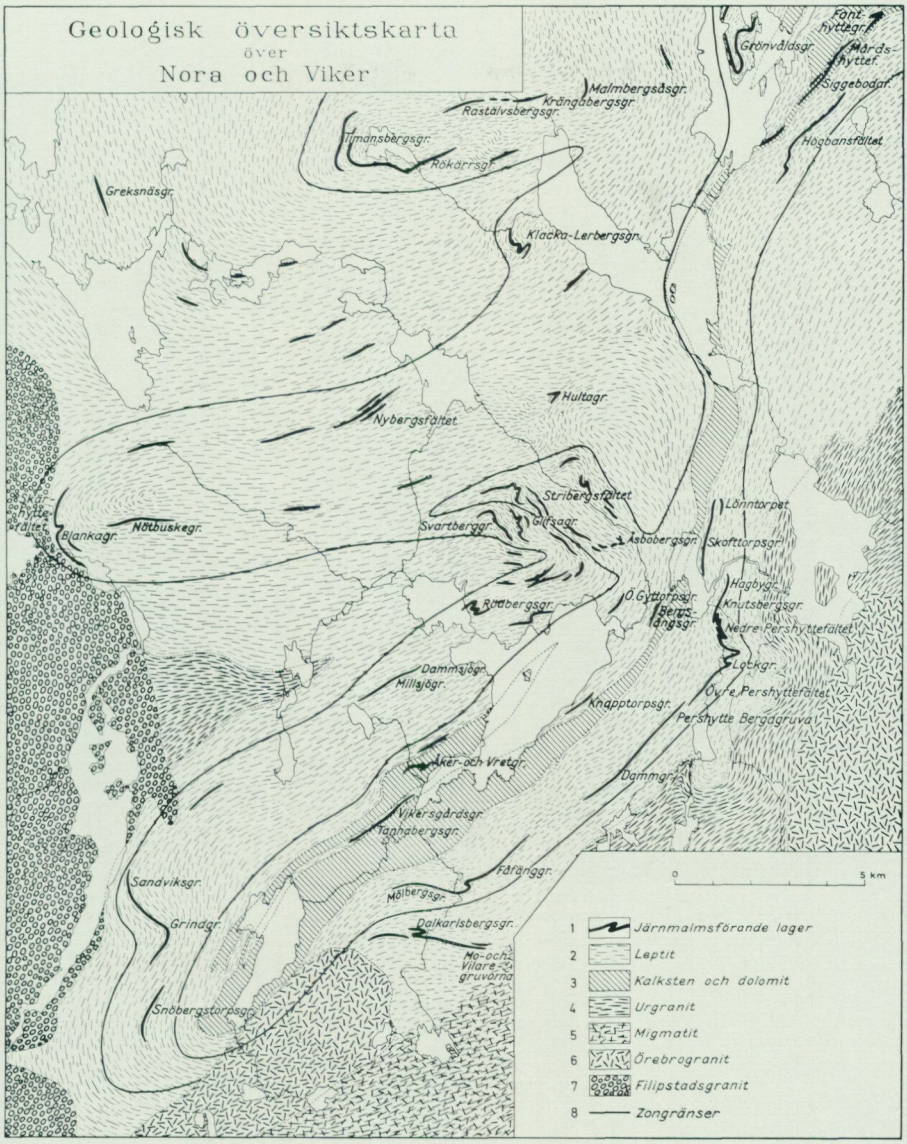


Fig. 92. Map of the Nora-Viker region. Legend: 1. Iron ore; 2. Leptite; 3. Limestone and dolomite; 4. Svecofennian synorogenic granite; 5. Late Svecofennian migmatite; 6. Late Svecofennian palingenic granite; 7. Gothian granite. The inner continuous black line separates the syncline with large limestone-dolomite bodies and manganiferous iron ores as well as the zone with quartz-banded iron ores from the zone with quartz-skarn iron ores. The outer continuous black line marks the downward limit of the last-named zone.

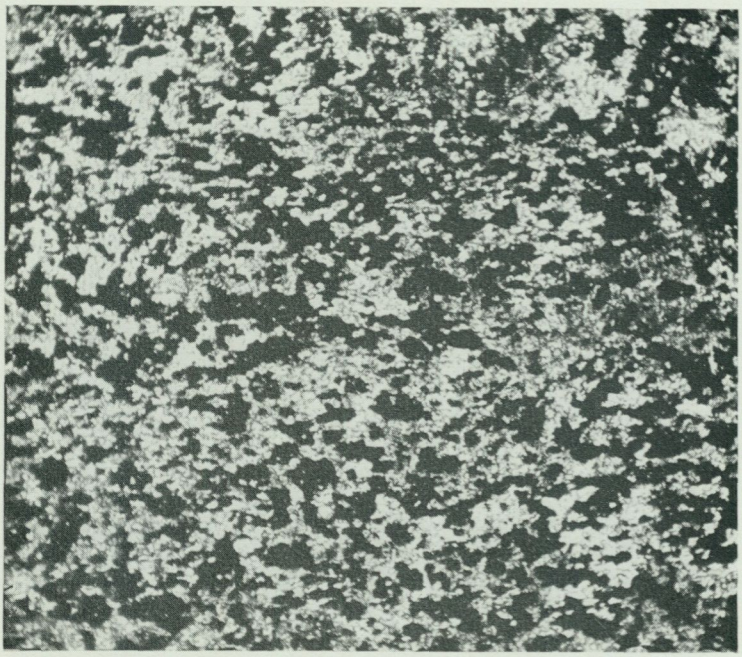


Fig. 93. Manganiferous skarn iron ore. Thin section, ord. light, magnification 15 ×. Magnetite (black) in knebelite- dannemorite skarn. Vikersgård mines southwest of Nora, in Nora-Viker region. (After N. H. Magnusson.)

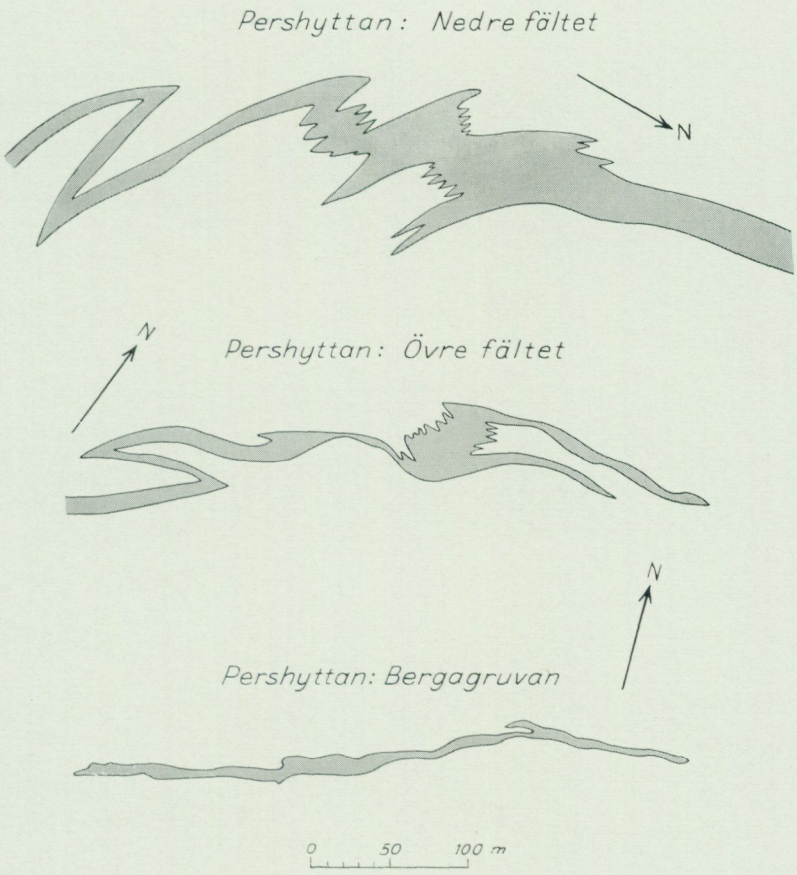


Fig. 94. Maps of three parts of the Pershyttan field, Nora-Viker region. (After N. H. Magnusson.)

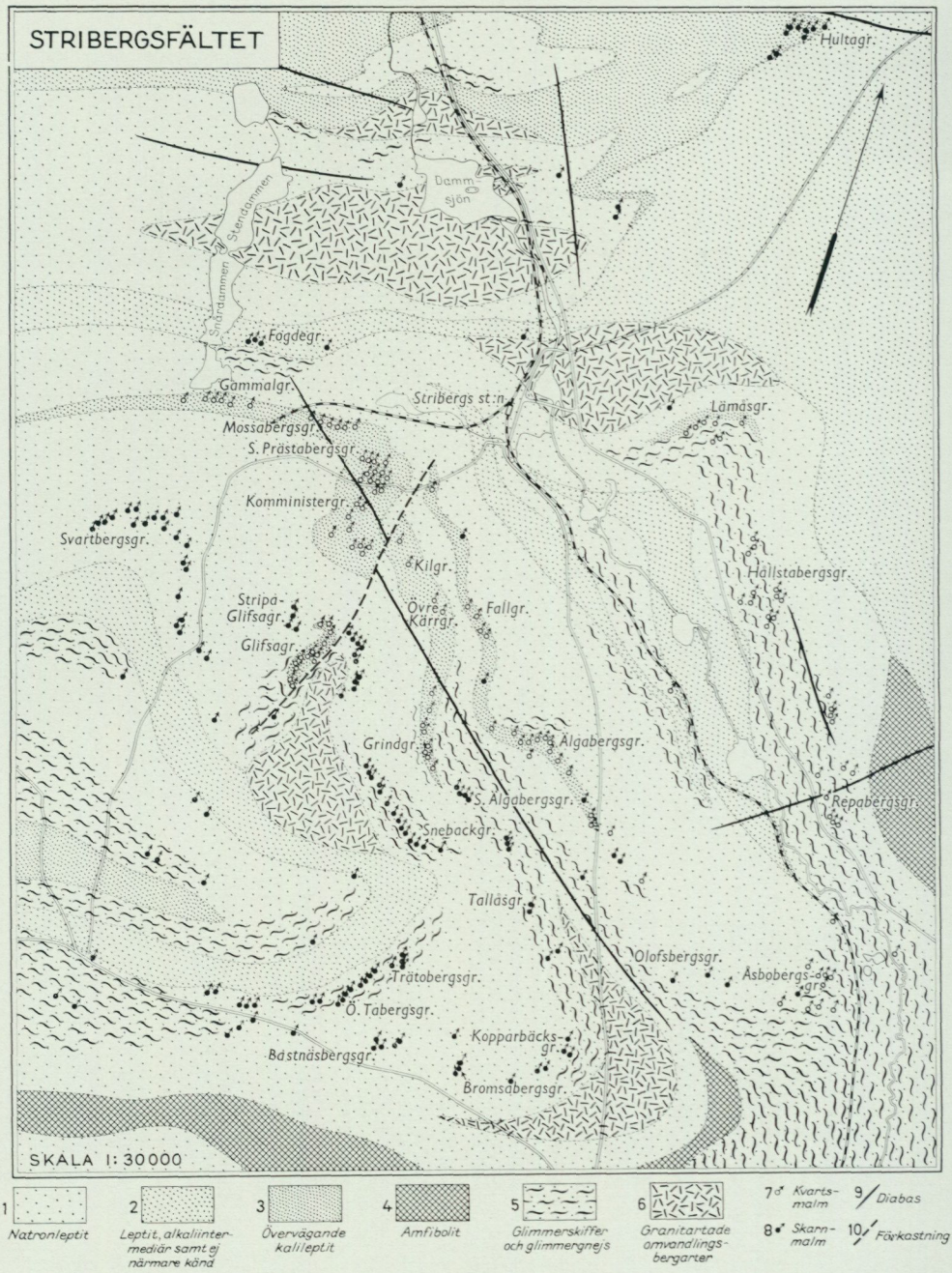


Fig. 95. Map of the Striberg field, Nora-Viker region. (After S. Hjelmqvist.) Legend: 1. Sodic leptite; 2. Leptite, intermediate regarding the contents of potash and soda; 3. Potassic leptite; 4. Amphibolite; 5. Mica schist and mica gneiss; 6. Palingenic granite-looking rocks; 7. Quartz-banded iron ores; 8. Quartz-skarn iron ores; 9. Diabase; 10. Dislocation.

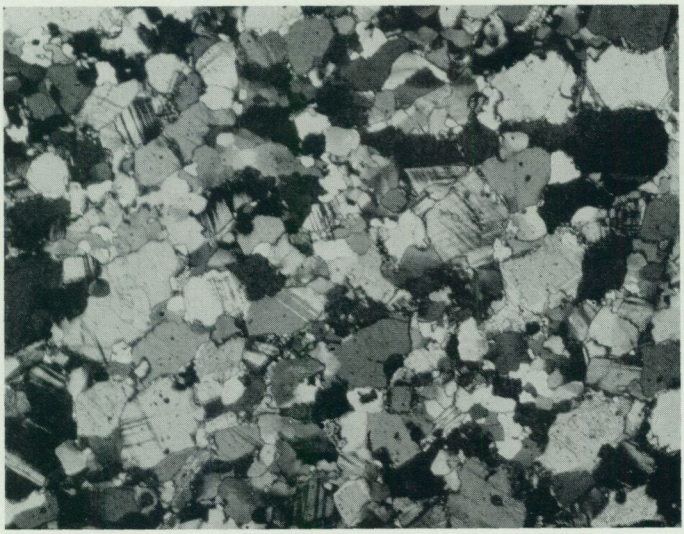


Fig. 96. Potassic leptite. Thin section, + nic., magnification 30 ×. Striberg field, Nora-Viker region. (After S. Hjelmqvist.)

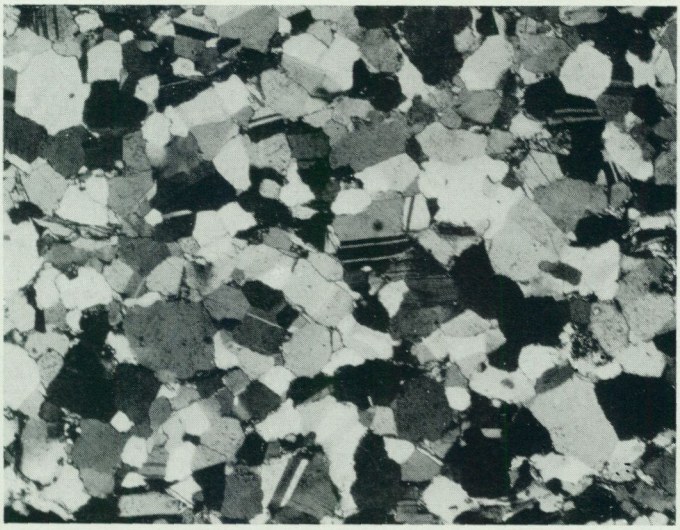


Fig. 97. Sodic leptite. Thin section, + nic., magnification 30 ×. Striberg field, Nora-Viker region. (After S. Hjelmqvist.)

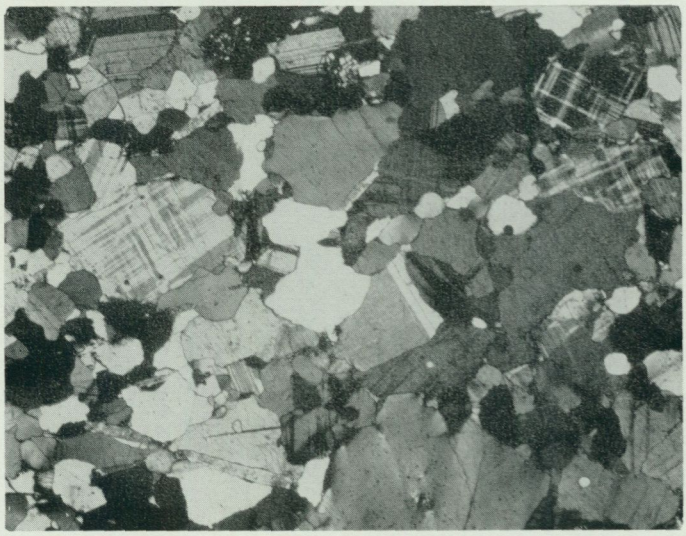


Fig. 98. Granite. Thin section, + nic., magnification 30 ×. Striberg field. (After S. Hjelmqvist.)

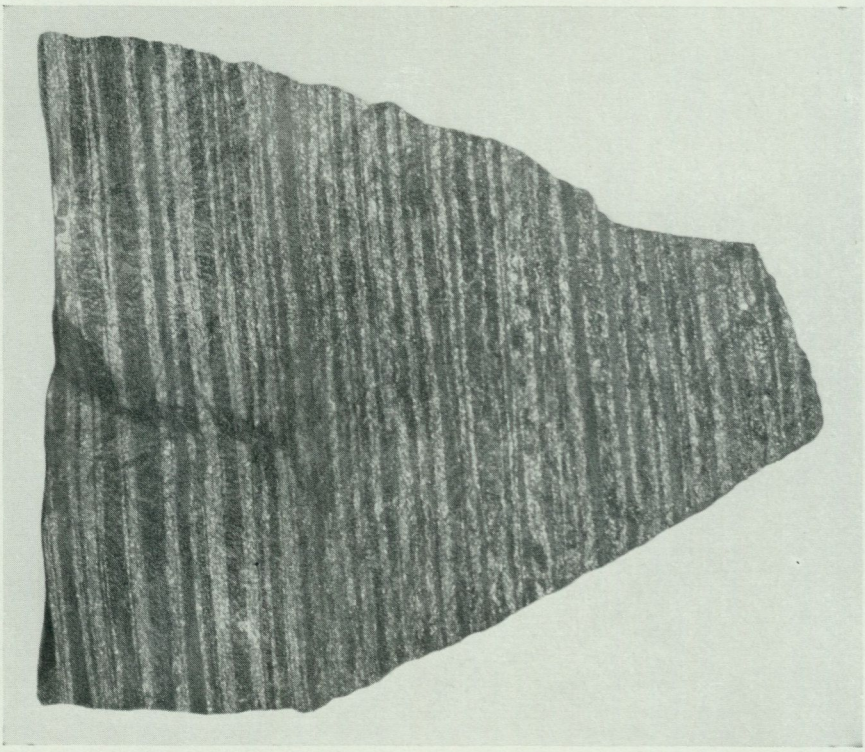


Fig. 99. Quartz-banded hematite ore, Striberg field. 2/3 of nat. size. (After S. Hjelmqvist.)

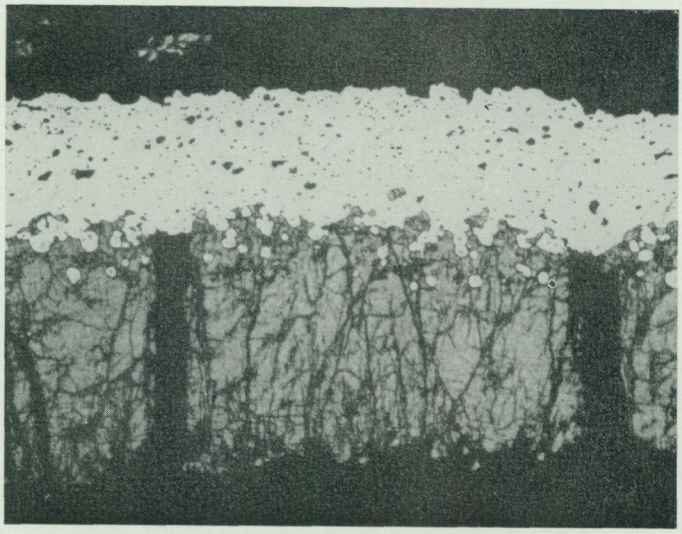


Fig. 100. Quartz-banded hematite ore with garnet. Thin section, ord. light, magnification 10 ×. Striberg field. (After S. Hjelmqvist.)

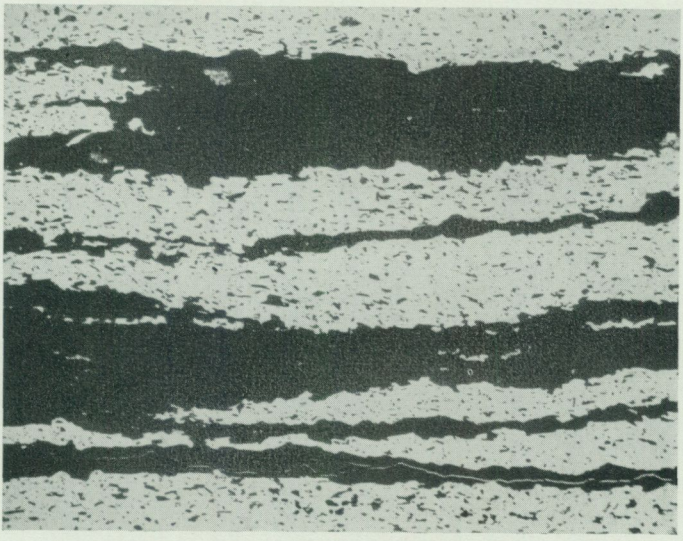


Fig. 101. Quartz-banded hematite ore, Striberg field. Thin section, ord. light, magnification 6 ×. (After S. Hjelmqvist.)

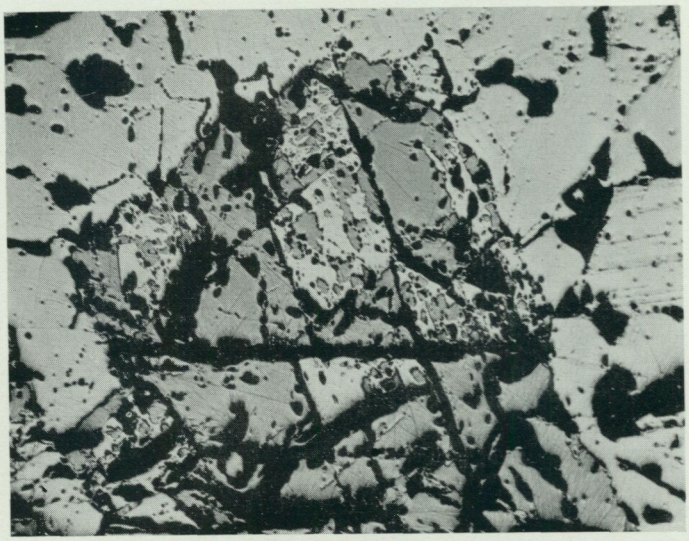


Fig. 102. Magnetite porphyroblast in quartz-banded hematite ore. Thin section, ord. light, magnification 50 ×. Striberg field. (After S. Hjelmqvist.)

Fig. 103. Quartz layer rich in hematite. Thin section, ord. light, magnification 50 ×. Striberg field. (After S. Hjelmqvist.)

Fig. 104. Folded, quartz-banded hematite ore with scaly hematite. Thin section, ord. light, magnification 6 ×. Åsboberg mine, Striberg field. (After S. Hjelmqvist.)

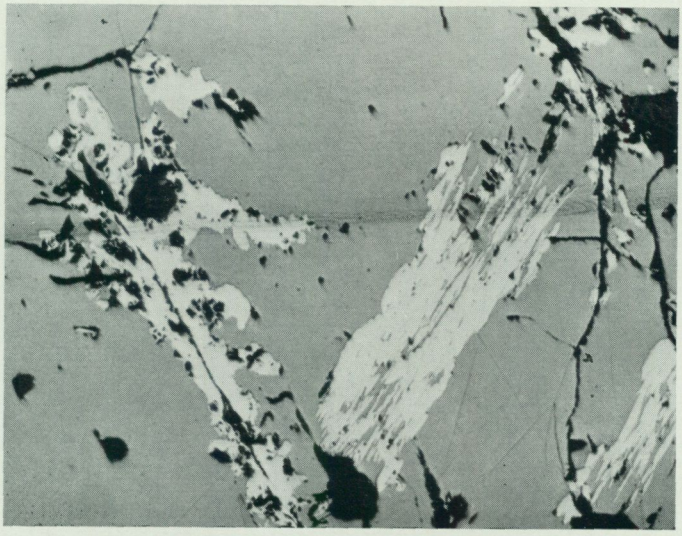


Fig. 105. Magnetite with remnants of hematite. Thin section, ord. light, magnification 200 ×. Åsboberg mine, Striberg field. (After S. Hjelmqvist.)

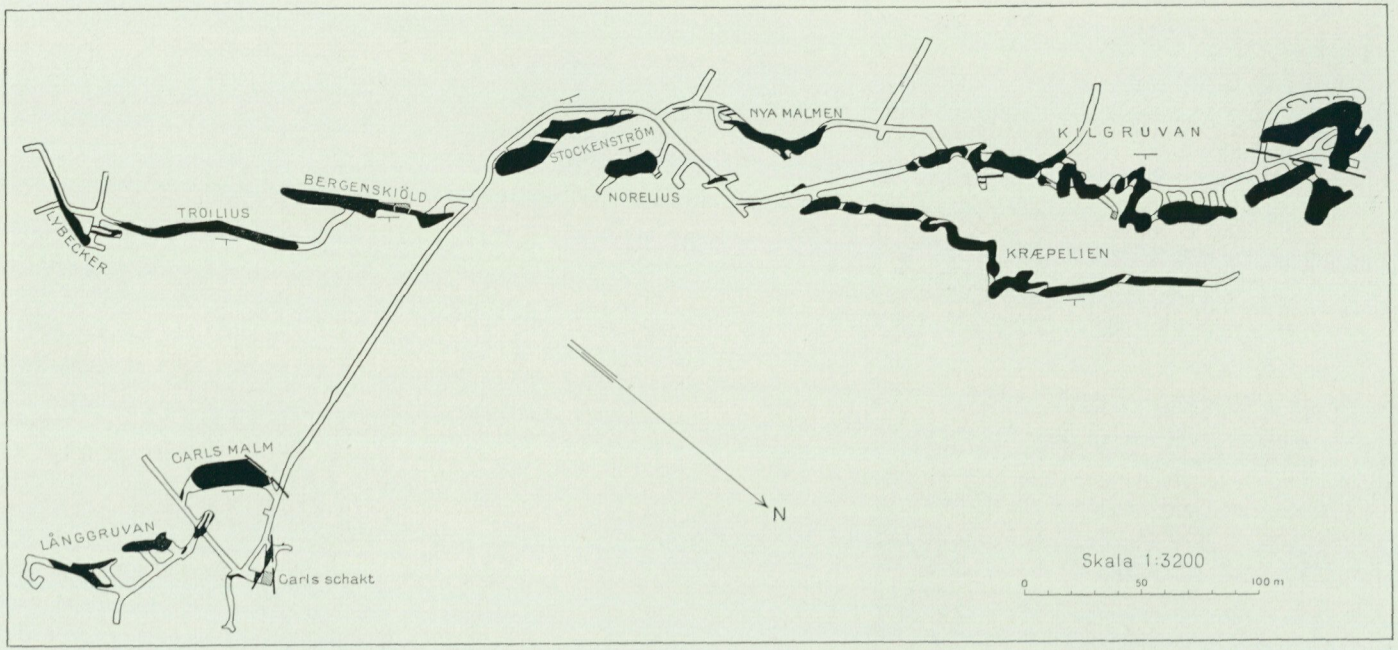


Fig. 106. 112 m. level in Övre Kärrgruvorna mines, Striberg field. (After S. Hjelmqvist.)

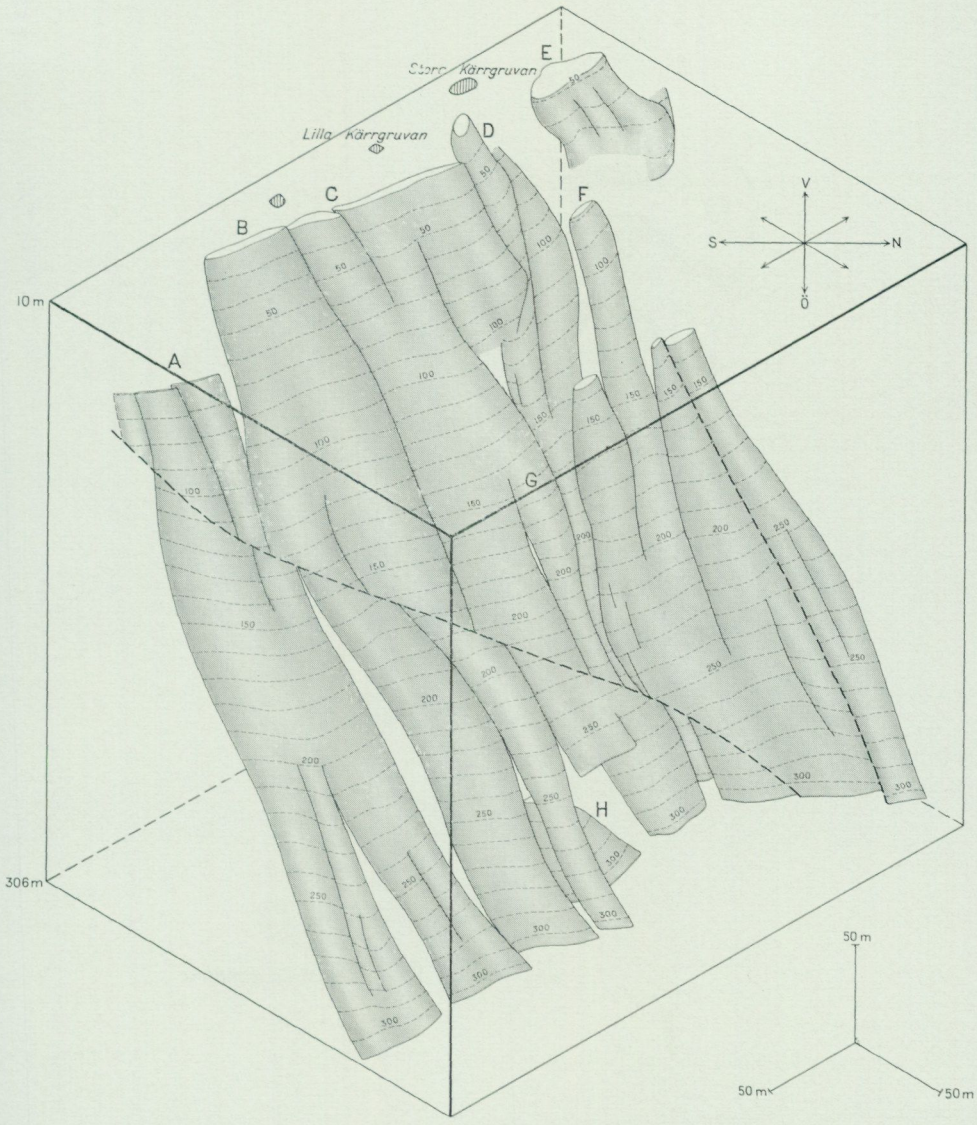


Fig. 107. The iron ores in the central part of the Övre Kärrgruvorna mines above 300 m. level. Striberg field. (After S. Hjelmqvist.)

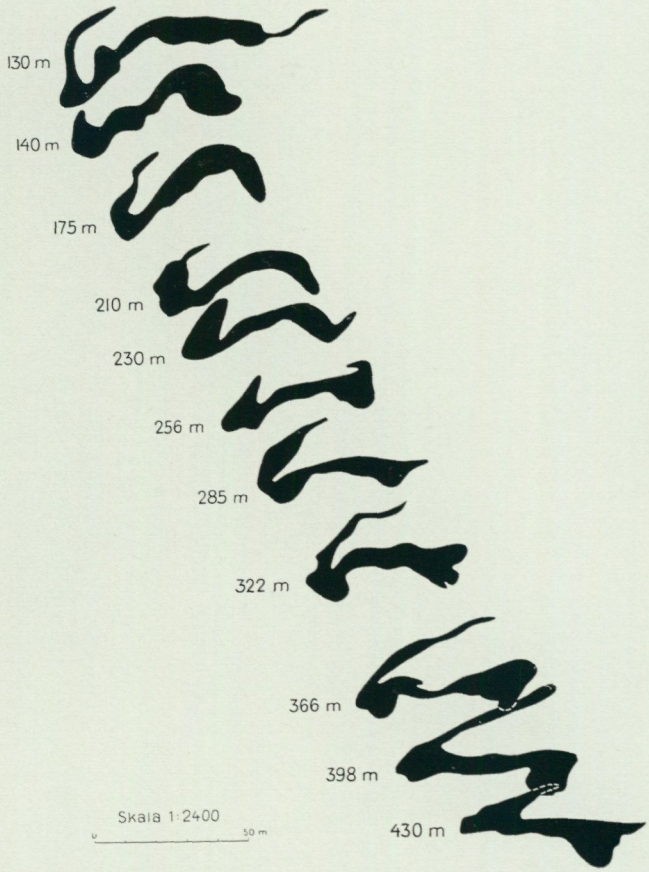


Fig. 108. The Åsboberg ores at 11 levels between 130 m. and 430 m. (After S. Hjelmqvist.)

Fig. 109. Quartz-skarn iron ore, Klacka-Lerberg mine, Nora-Viker region. Thin section, ord. light, magnification 15 ×. The ore mineral is magnetite together with subordinate hematite and skarn minerals (actinolite, hornblende, chlorite and biotite). The larger grains are concentration products developed during later recrysallization. The ores were surely precipitated in colloidal form. In the precipitate hematite originally formed as very small grains. The mineral later changed to magnetite grains which grew larger and larger the more temperature rised. (After N. H. Magnusson.)

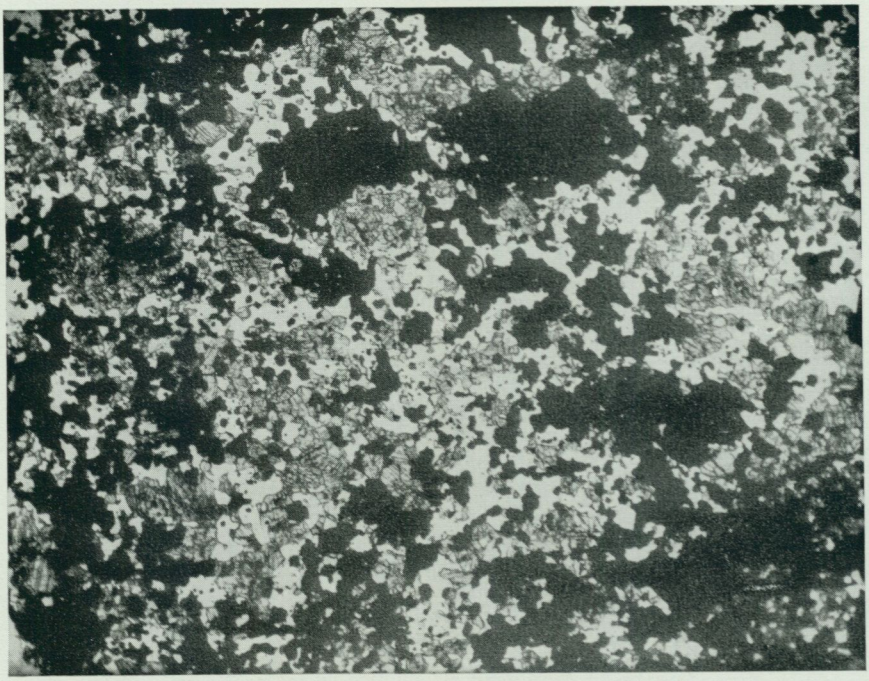


Fig. 110. Quartz-skarn iron ore. Thin section, ord. light, magnification 15 × Linsgruvan mine. The ore mineral is magnetite. The skarn minerals are pyroxene, garnet, and actinolite. The larger magnetite grains are concentration products developed during later recrystallization. Probably hematite was the original ore mineral occuring as very small grains. (After N. H. Magnusson.)

Fig. 111. Quartz-skarn iron ore with subordinate skarn minerals. Thin section, ord. light, magnification 15 ×. Rökärr mines north of Klacka-Lerberg. (After N. H. Magnusson.)

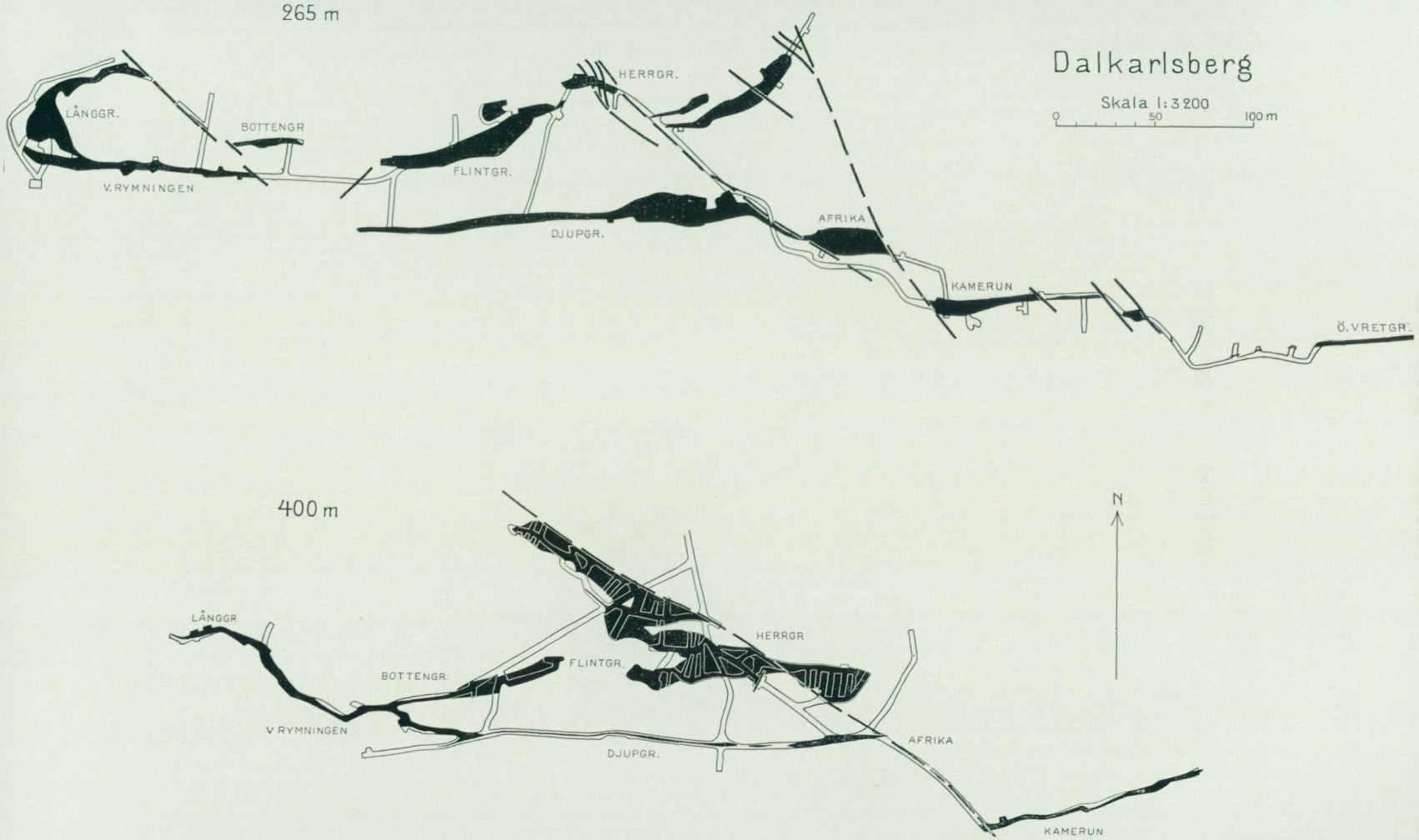


Fig. 112. 265 and 400 m. levels in the Dalkarlsberg mines southwest of Nora. A comparison between the ores at 400 m. level and the ores at 265 m. displays the strong deformation of the ores at the lower level. (After N. H. Magnusson.)

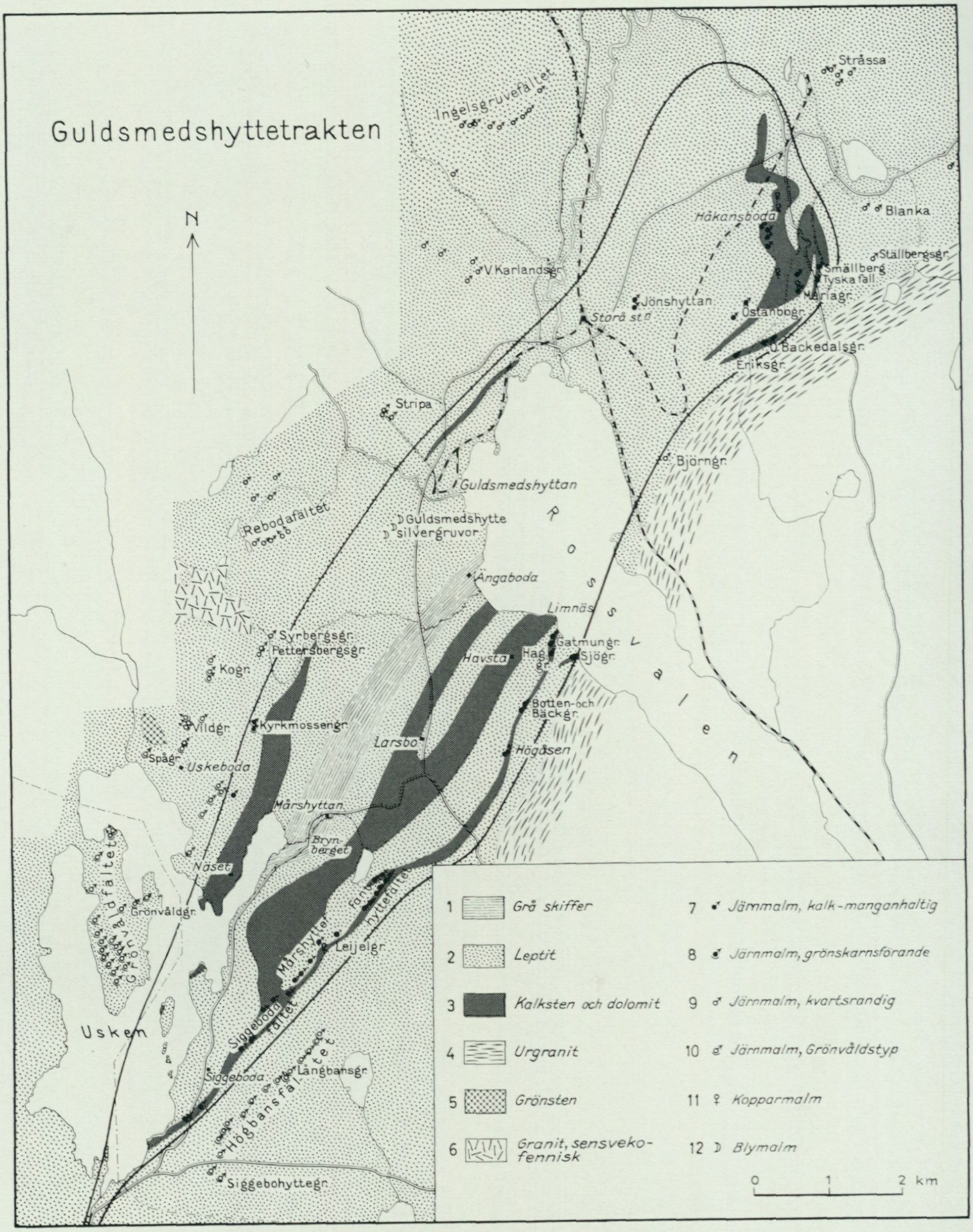


Fig. 113. Map of the Guldsmedshyttan syncline with the central schists and the manganiferous iron ores beneath them. Outside this syncline quartz-banded iron ores occur. Legend: 1. Grey schist; 2. Leptite; 3. Limestone and dolomite; 4. Svecofennian synorogenic granite; 5. Greenstone; 6. Late Svecofennian palingenic granite; 7. Manganiferous iron ore; 8. Skarn iron ore; 9. Quartz-banded iron ore; 10. Iron ore of the Grönvåld type; 11. Copper ore; 12. Lead ore. (After P. Geijer.)

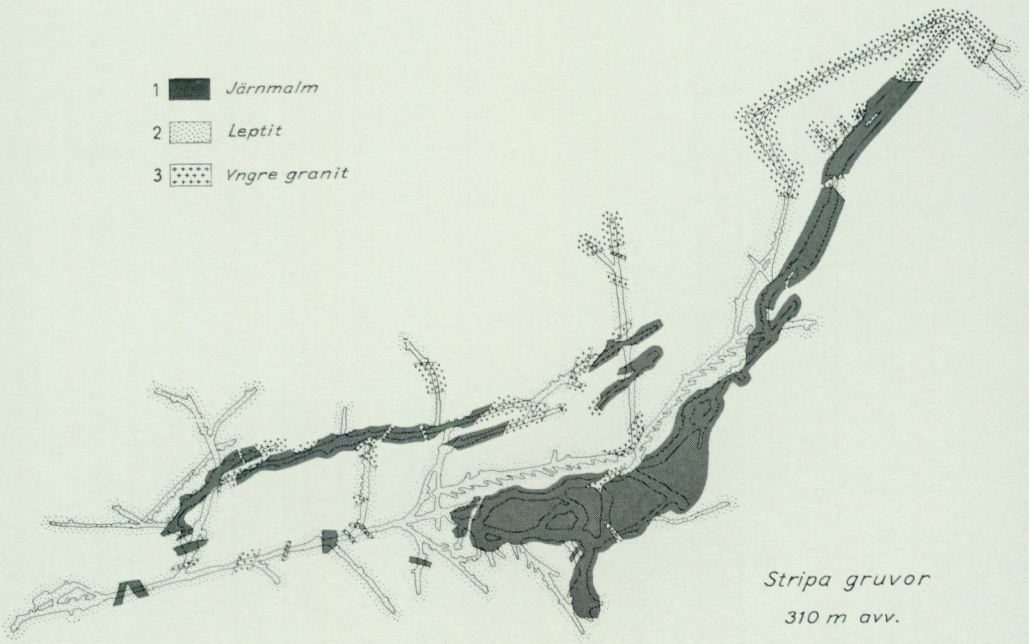


Fig. 114. The quartz-banded iron ores of the Stripa mines at 310 m. level. Legend: 1. Iron ore; 2. Leptite; 3. Granite.

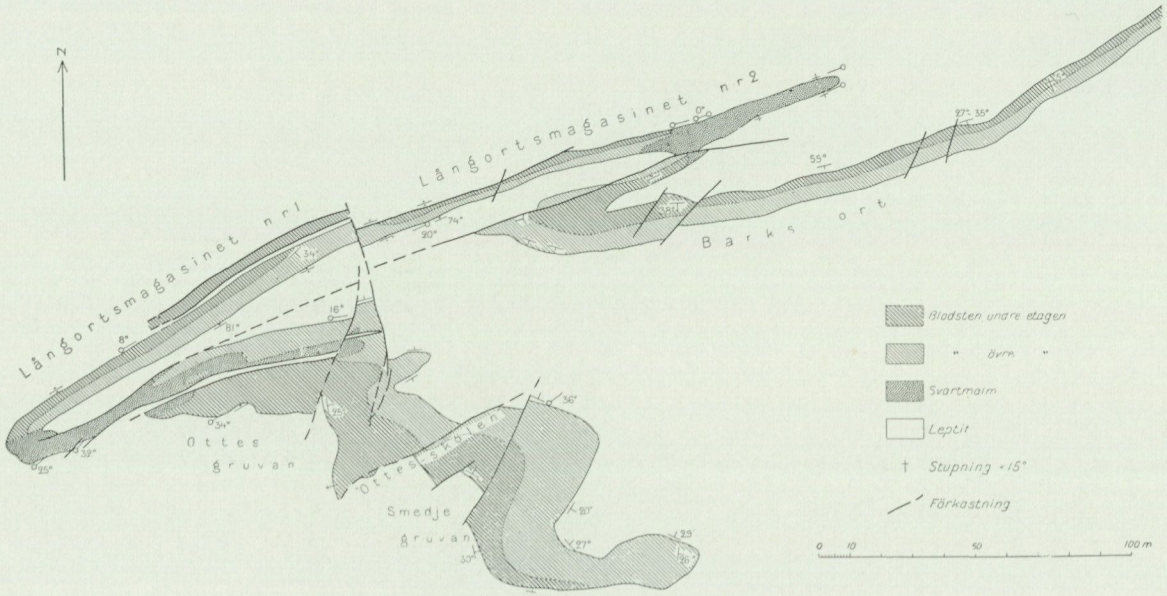


Fig. 115. Main ore body at 260 m. level in the Stripa mine. Light hatching applied to the upper etage with dominating simple-banded quartz-hematite ores, heavy hatching to the lower etage with double-banded quartz-hematite ores. Dark dotting marks the quartz-magnetite ores. Between the upper and the lower etage, is a thin leptite layer. (After P. Geijer.)

Fig. 116. In the Stripa mines two different types of quartz-banded iron ores appear in the main ore body. One of them may be characterized as double-banded, with comparatively thick bands, the other as simple-banded with thinner bands. The double-banded ores have hematite bands with thin layers of skarn and also often thin layers of quartz. These compound bands alternate with bands of quartz in which, besides a small amount of finely distributed hematite, there are thin layers of hematite. The photo reproduced above displays a double-banded iron ore from Stripa. (After P. Geijer.)

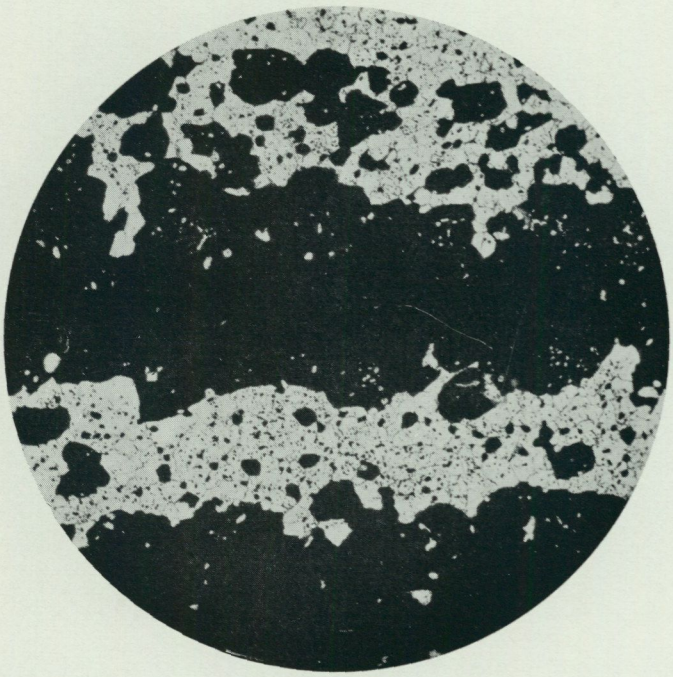


Fig. 117. Quartz-banded hematite iron ore, Stripa mines. Thin section, ord. light, magnification 22 ×. Hematite black, quartz white. The quartz grains have dimensions between 0.06 and 0.20 mm. As is shown in the figure, the amount of hematite in the quartz layers is not small. The dimensions of the hematite grains vary from 0.0005 mm to 0.3 mm. It is the smallest hematite grains that give the quartz its reddish colour. (After P. Geijer.)

Fig. 118. Folded simple-banded quartz-hematite ore at 310 m. level, Stripa mines. (After P. Geijer.)

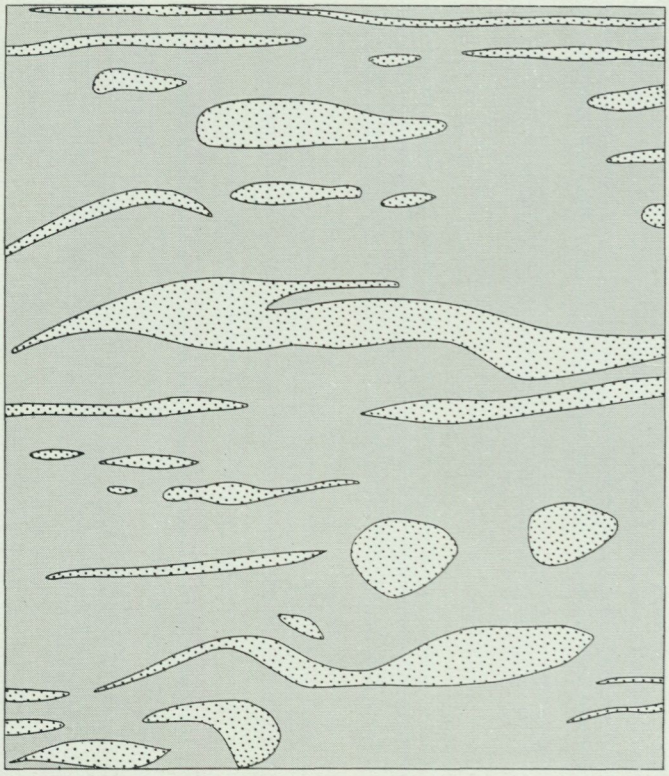


Fig. 119. Red jasper (dotted areas) in hematite (grey). 2/3 of nat. size, the surface of the specimen at right angles to the bedding. Stripa mines. (After P. Geijer.)

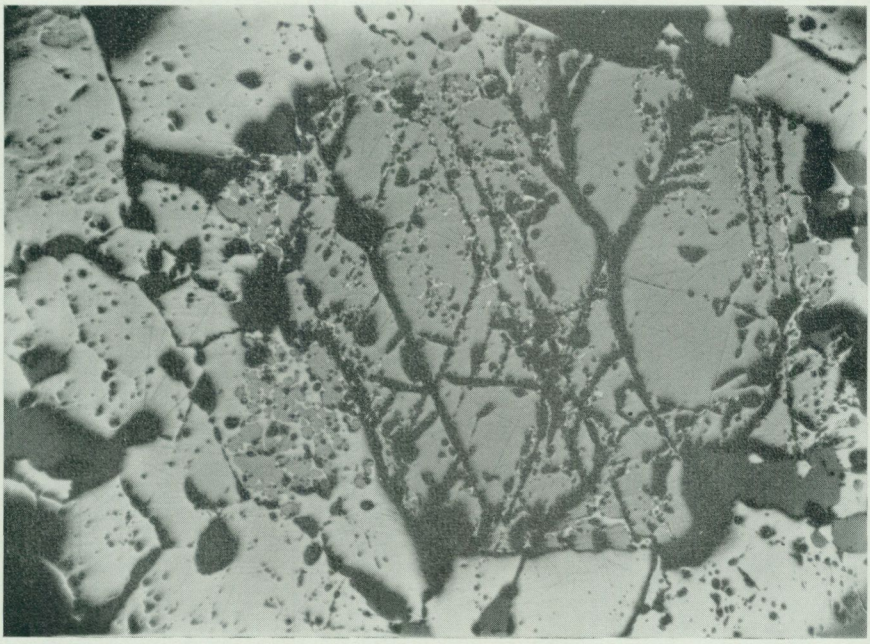


Fig. 120. Magnetite porphyroblast in hematite ore. Polished section, magnification 65 ×. Magnetite grey, hematite white, quartz and fissures black. Stripa mines. (After P. Geijer.)

Fig. 121. Typical hematite ore. Polished section, + nic., magnification 65 ×. Hematite twinned and containing small quartz inclusions (dark). Stripa mines. (After P. Geijer.)

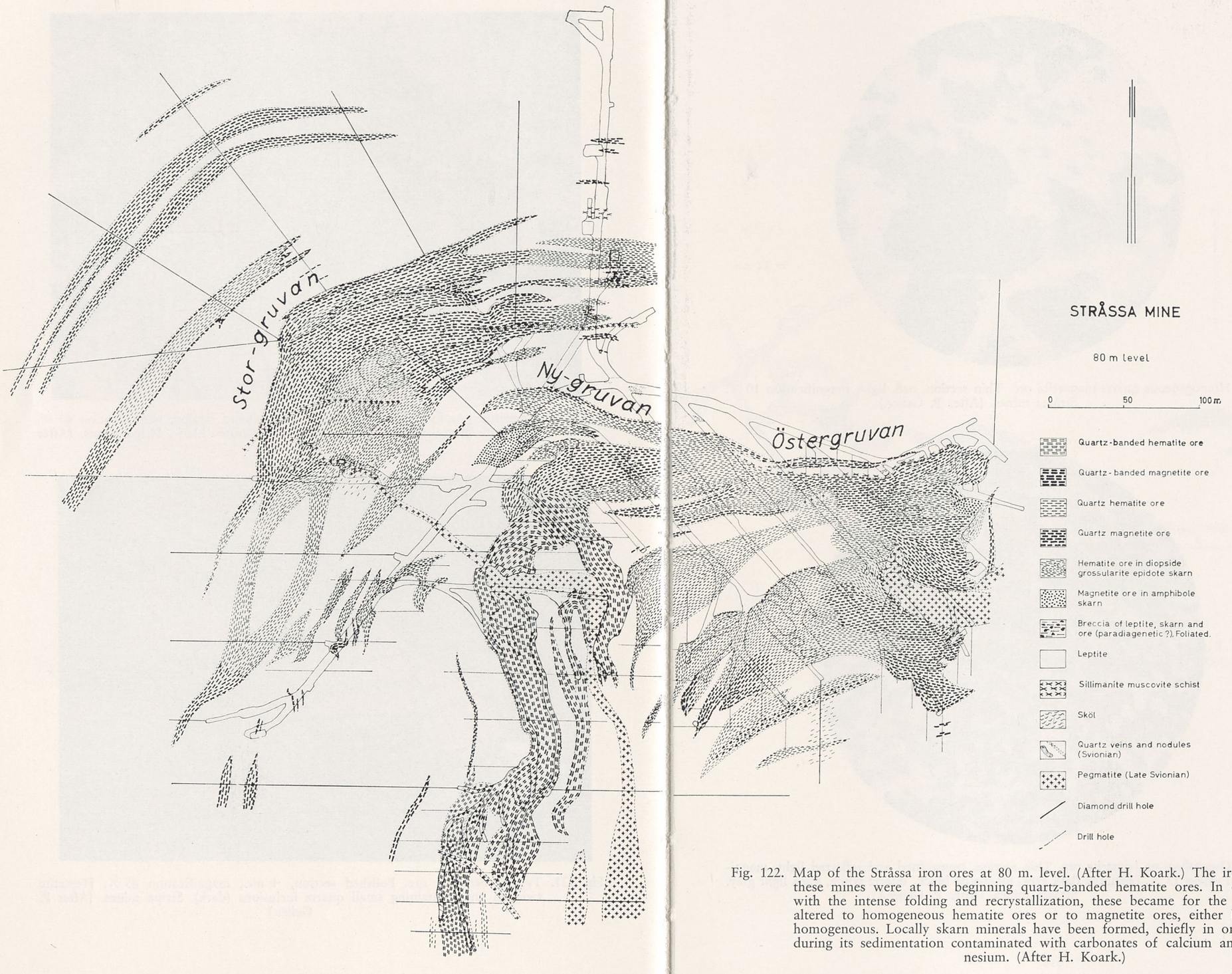


Fig. 122. Map of the Stråssa iron ores at 80 m. level. (After H. Koark.) The iron ores in these mines were at the beginning quartz-banded hematite ores. In connection with the intense folding and recrystallization, these became for the most part altered to homogeneous hematite ores or to magnetite ores, either banded or homogeneous. Locally skarn minerals have been formed, chiefly in ore material during its sedimentation contaminated with carbonates of calcium and/or magnesium. (After H. Koark.)

Fig. 123. Homogeneous quartz-magnetite ore. Thin section, ord. light, magnification 10 ×. Stråssa mines. (After P. Geijer.)

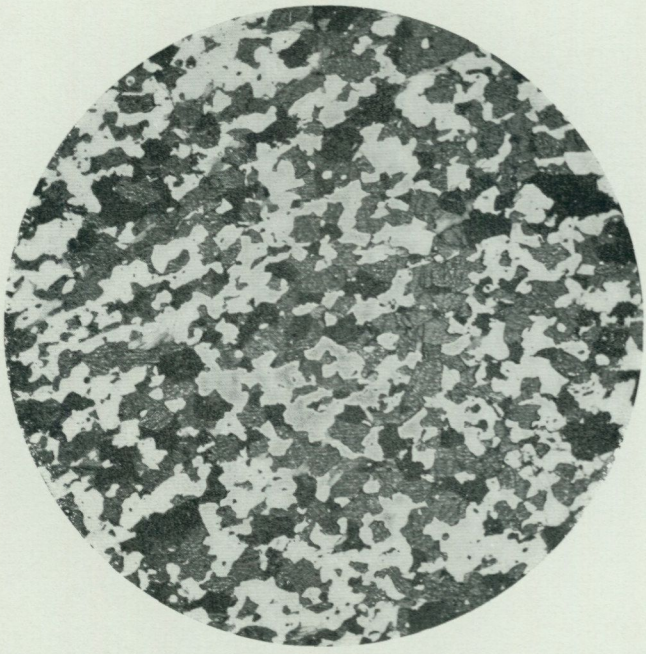


Fig. 124. Quartzbearing hematite ore. Thin section, transmitted and reflected light, magnification 13 ×. Hematite dark grey, magnetite black, quartz white, mica light grey. Stråssa mines. (After P. Geijer.)

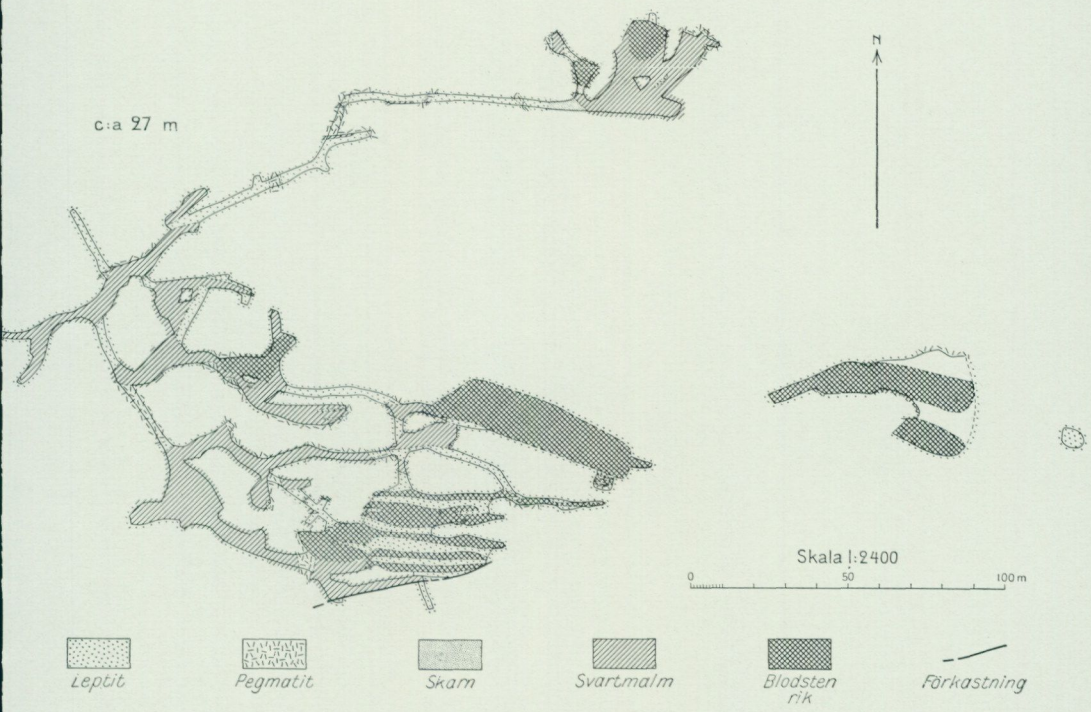


Fig. 125. 27 m. level in the Blanka mines. (After P. Geijer.) Legend: 1. Leptite, 2. Pegmatite; 3. Skarn; 4. Magnetite ore; 5. Hematite ore; 6. Dislocation.

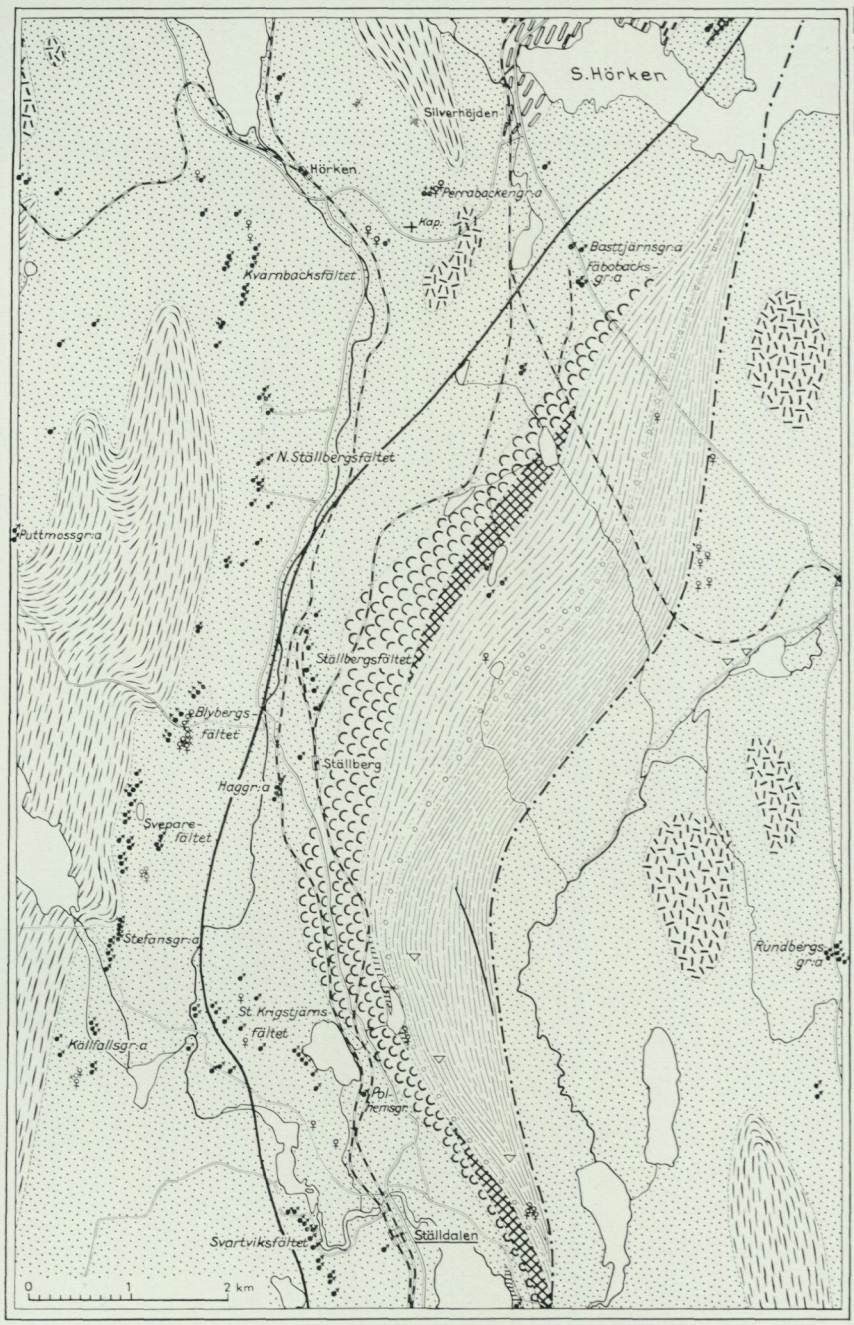


Fig. 126. Map of the Ställdalen syncline. (After N. H. Magnusson.) Legend: 1. Leptite; 2. Limestone and dolomite; 3. Zone rich in agglomerate and spilite; 4. Bedded leptite at the bottom of the greywacke; 5. Greywacke; 6. Grey schist; 7. Old greenstone; 8. Red Svecofennian granite; 9. Granodiorite (Svecofennian); 10. Tonalite (Svecofennian); 11. Late Svecofennian palingenic granite; 12. Diabase; 13. Dislocation (probably thrust zone). The continous black line separates the zone with manganiferous iron ores from the zone with skarn iron ores poor in manganese.

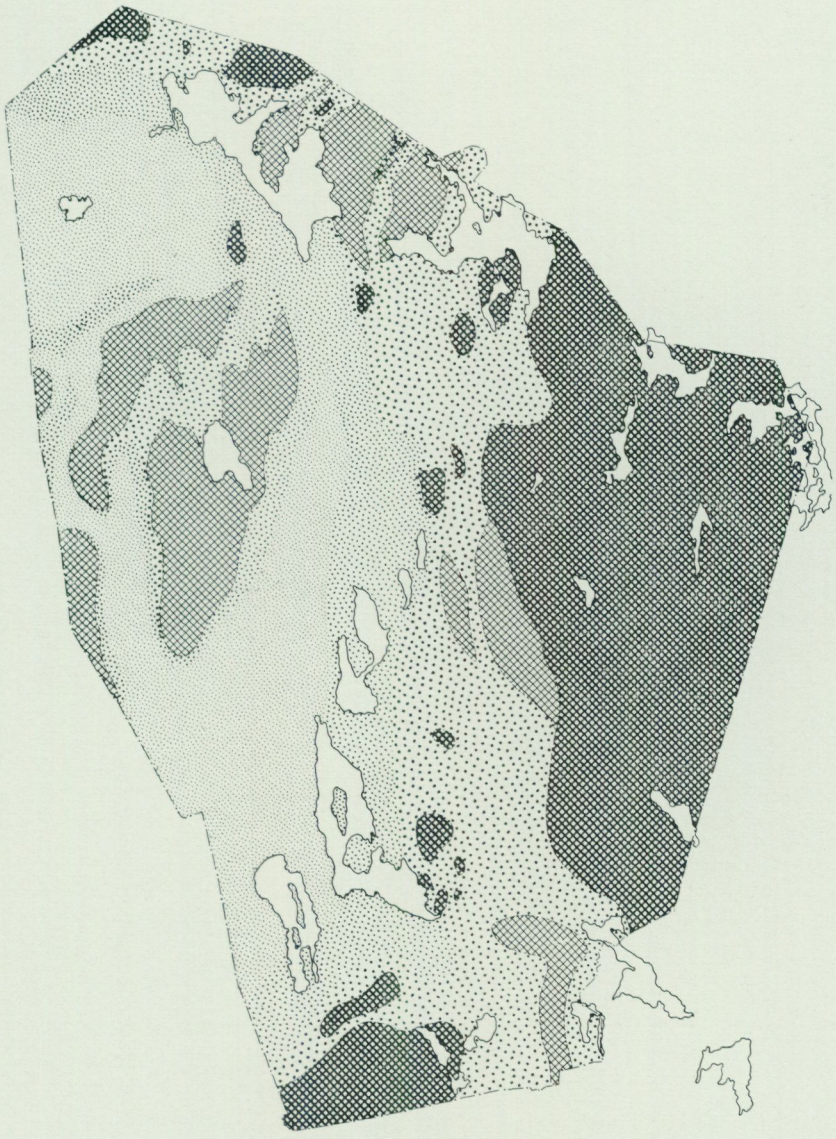


Fig. 127. Map showing the variations in grain size of the groundmasses of the Ljusnarsberg leptites and hälleflintas. Fine dots correspond to grains measuring 0.05–0.08 mm., medium dots to 0.08–0.1 mm., and large dots to more than 0.1 mm. The old Svecofennian synorogenic granites are displayed by thin diagonal pattern, the young, palingenic, late Svecofennian granites by dense diagonal pattern. (After N. H. Magnusson.)

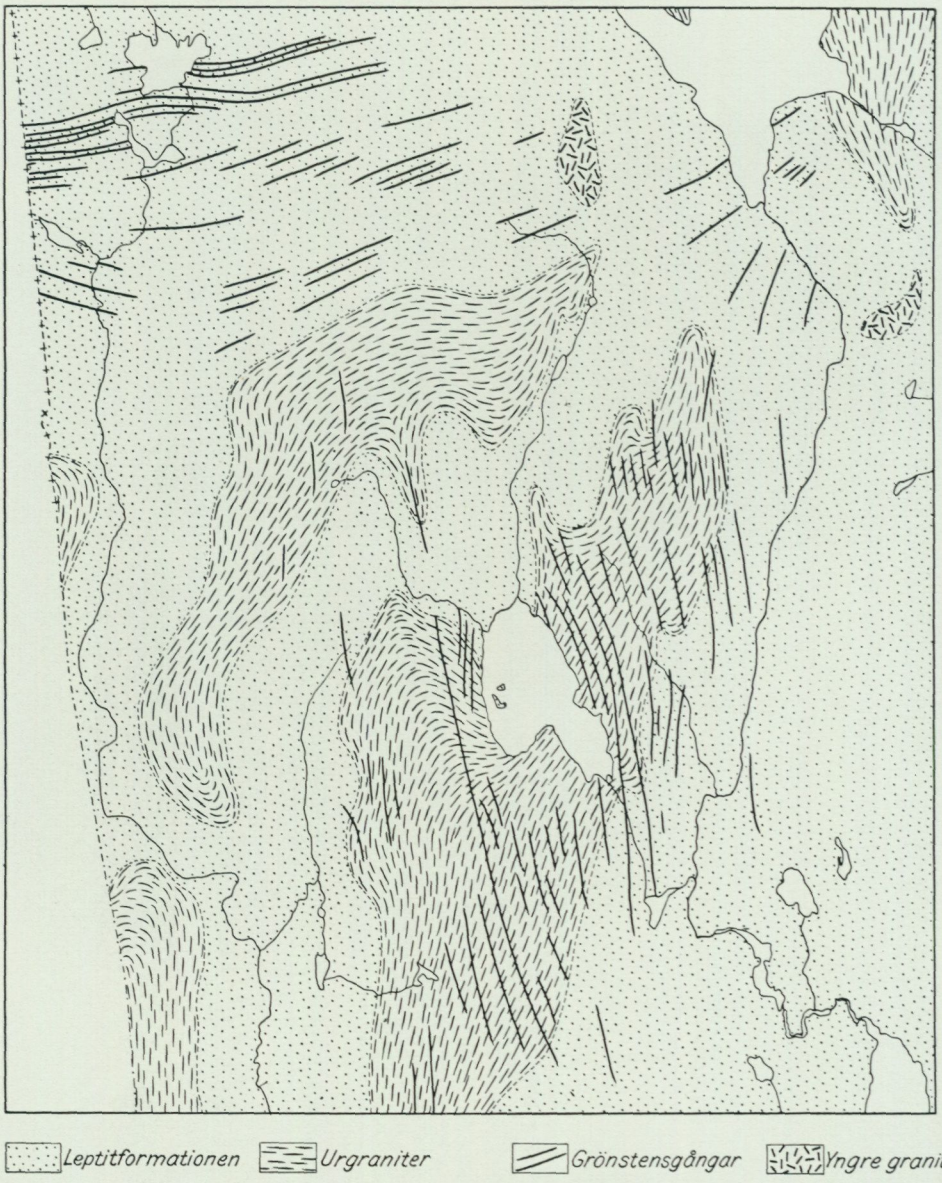


Fig. 128. Map of the younger greenstone dikes (meta-diabases) in the Ljusnarsberg region. Legend: *Leptitformationen* = Leptites and sediments; *Urgraniter* = Svecofennian synorogenic granites; *Grönstensgångar* = Greenstone dikes (meta-diabases); *Yngre graniter* = Late Svecofennian palingenic granites. (After N. H. Magnusson.)

Fig. 129. Map of the palingenic Ljusnarsberg granites and pegmatites. The Fellingsbro and Enkullen granites have been developed somewhat later than the Malingsbo granite. All three are Late Svecofennian palingenic rocks. In the Malingsbo granite have been found a large number of remnants of old Svecofennian rocks (swedish: *Malingsbo-granit med äldre brottstycken)*. In the western boundary zone the Malingsbo granite is rich in pegmatites (swedish: *Malingsbogranit med rikligt av pegmatit)*. Outside the large central Malingsbo granite the older bedrock has been cut by numerous pegmatite veins (swedish: *större pegmatiter och sliror och gångar av pegmatit)* and contains rounded masses of Malingsbo granite. (After N. H. Magnusson.)

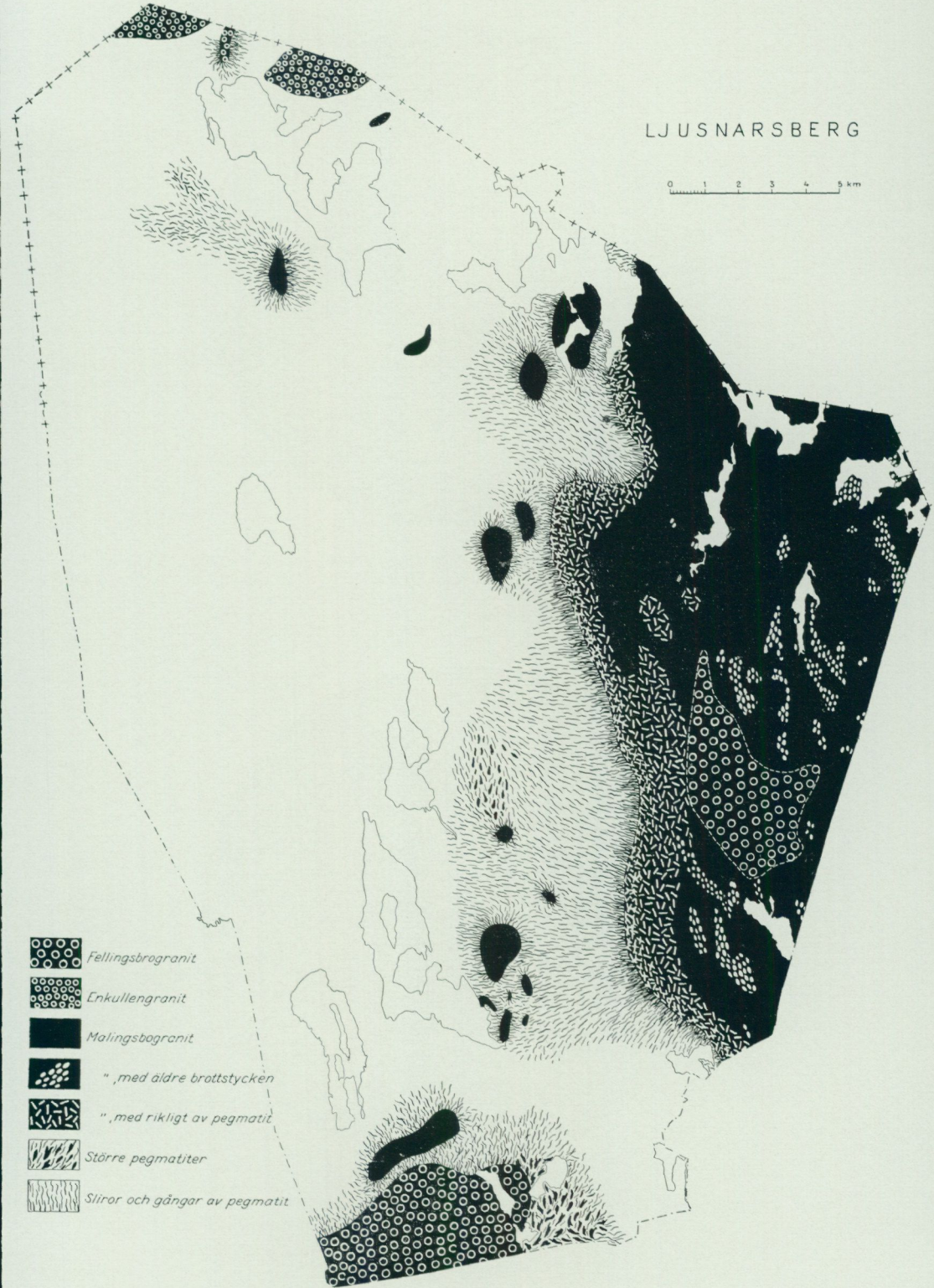

LJUSNARSBERG
0 1 2 3 4 5 km
Fellingsbrogranit
Enkullengranit
Malingsbogranit
" ,med äldre brottstycken
" ,med rikligt av pegmatit
Större pegmatiter
Sliror och gångar av pegmatit

Fig. 130. Leptite with phenocrysts of quartz. Thin section, + nic., magnification 13 ×. Ljusnarsberg region. (After N. H. Magnusson.)

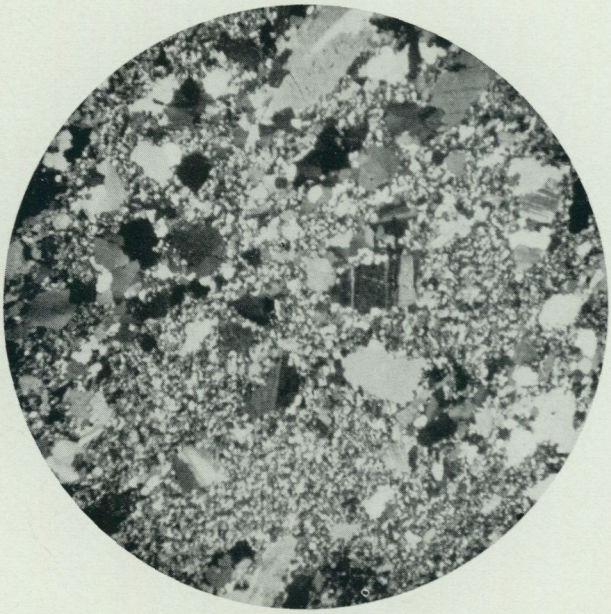


Fig. 131. Leptite rich in phenocrysts. Thin section, + nic., magnification 13 ×. Ljusnarsberg region. (After N. H. Magnusson.)

Fig. 132. Leptite agglomerate, 3/4 of nat. size. Near Finngruvan mines, Ljusnarsberg region. (After N. H. Magnusson.)

Fig. 133. Old Svecofennian synorogenic granite. Thin section, ord. light, magnification 13 ×. Ljusnarsberg region. (After N. H. Magnusson.)

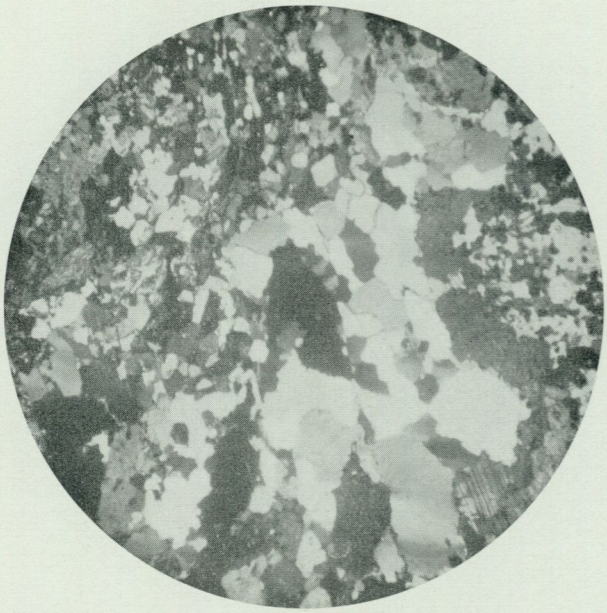


Fig. 134. Old Svecofennian synorogenic granite. The same section as in Fig. 133 though with crossed nicols. Ljusnarsberg region. (After N. H. Magnusson.)

Fig. 135. Late Svecofennian palingenic granite (Malingsbo granite). Thin section, + nic., magnification 13 ×. Eastern part of Ljusnarsberg region. (After N. H. Magnusson.)

Fig. 136. Late Svecofennian, palingenic granite (Malingsbo granite). Thin section, + nic., magnification 13 ×. Eastern part of Ljusnarsberg region. (After N. H. Magnusson.)

Fig. 137. Migmatite of Malingsbo granite and leptite. 3/4 of nat. size. Eastern part of Ljusnarsberg region. Great part of the Malingsbo granite is rich in remnants of leptites, old Svecofennian granites, and iron ores. (After N. H. Magnusson.)

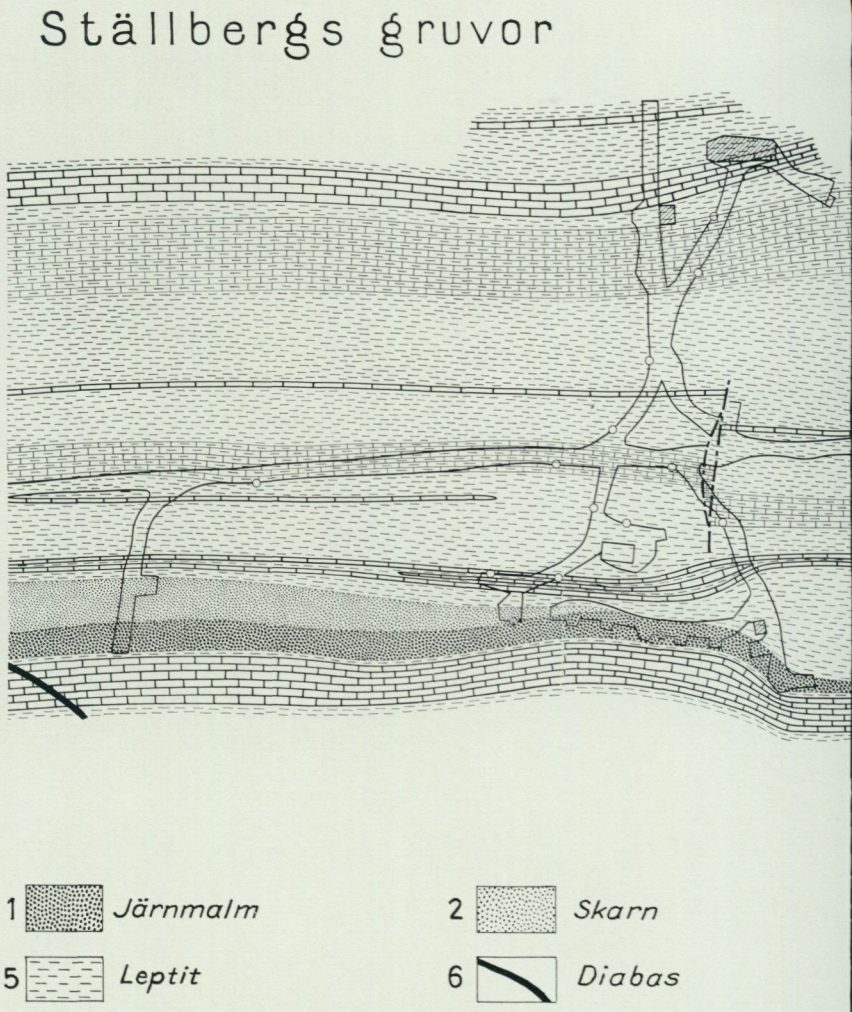
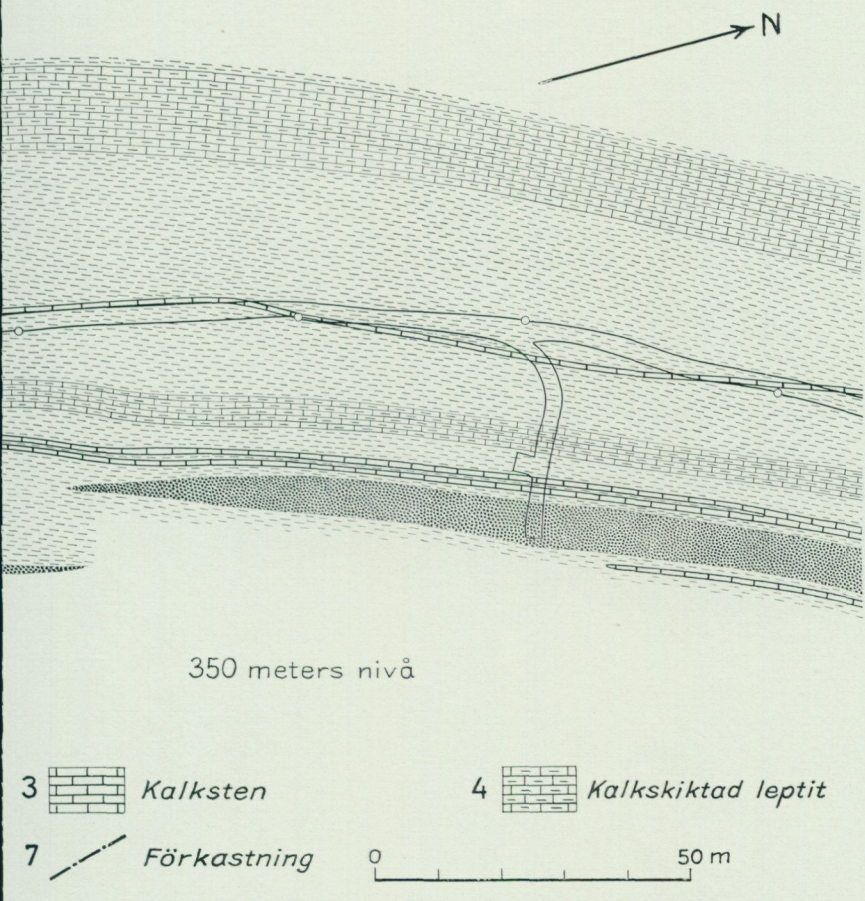


Fig. 138. Map of the central part of 350 m. level in the Ställberg mines, Ljusnarsberg region. Legend: 1. Iron ore; 2. Skarn; 3. Limestone and dolomite; 4. Alternating



leptite layers and limestone-dolomite layers; 5. Leptite; 6. Diabase; 7. Fault. After N. H. Magnusson.)

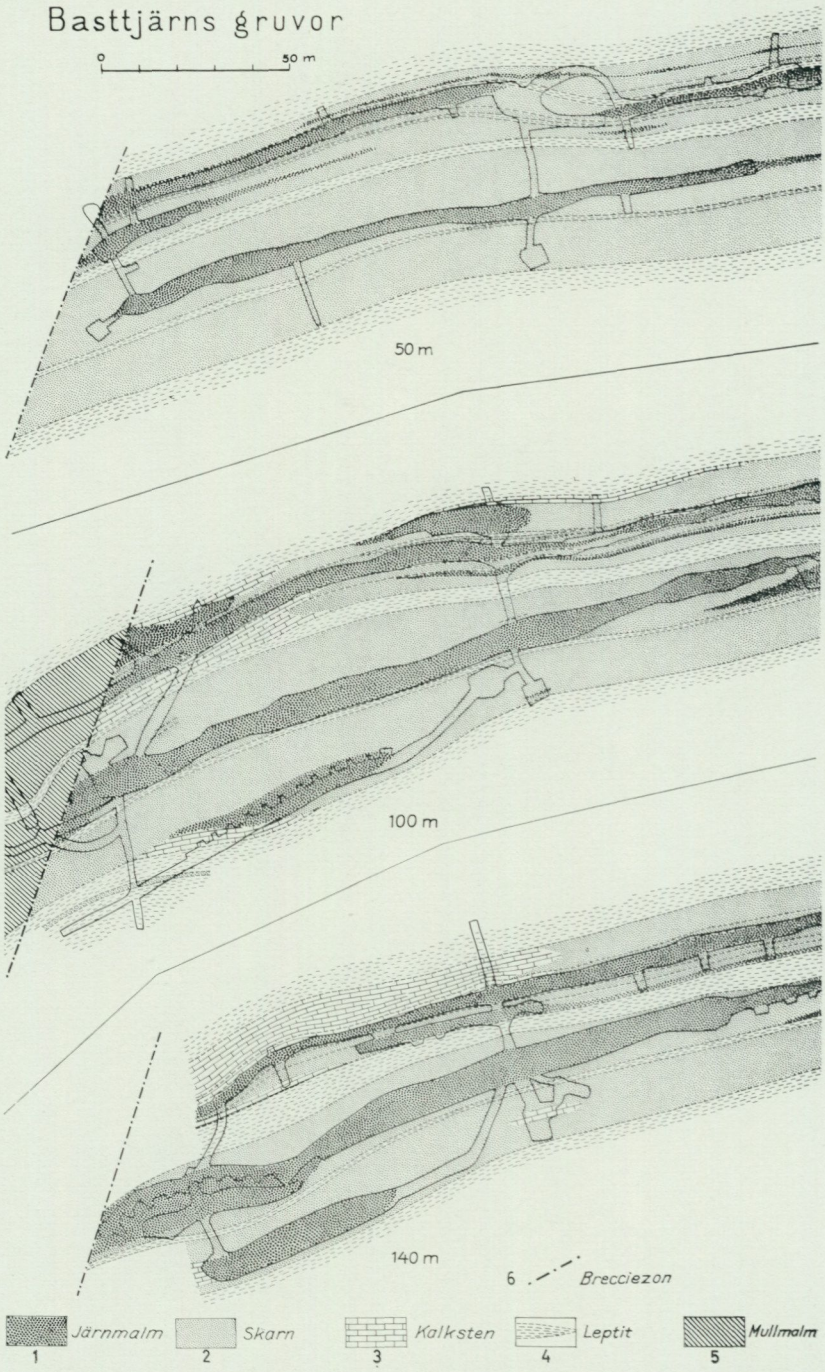


Fig. 139. Maps of three levels in the Basttjärn mines, Ljusnarsberg region. Legend: 1. Iron ore; 2. Skarn; 3. Limestone and dolomite; 4. Leptite; 5. Soft ore; 6. Fault zone. (After N. H. Magnusson.)

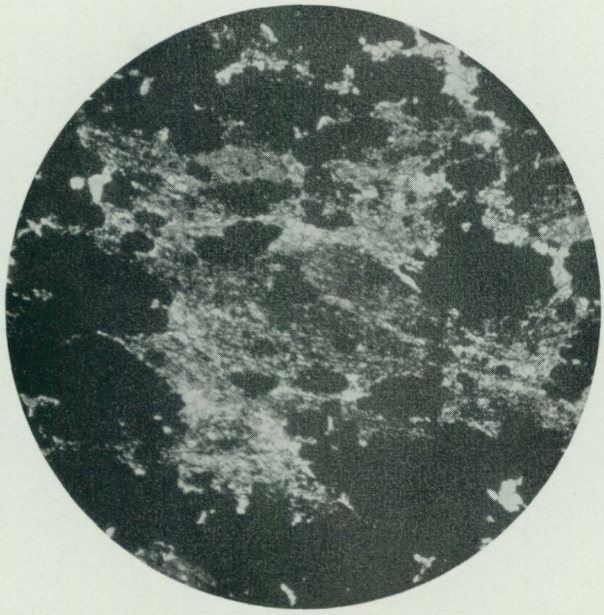


Fig. 140. Manganiferous iron ore rich in carbonate, Ställberg mines,Ljusnarsberg region. Thin section, ord. light, magnification 13 ×. The fine-grained banded parts have escaped stronger alteration. The larger magnetite grains have been developed by a concentration process working simultaneously with the recrystallization of the ore. The carbonates contain manganese, iron, calcium, and magnesium in varying proportions. The ore was surely precipitated as a colloid and has later become recrystallized. (After N. H. Magnusson.)

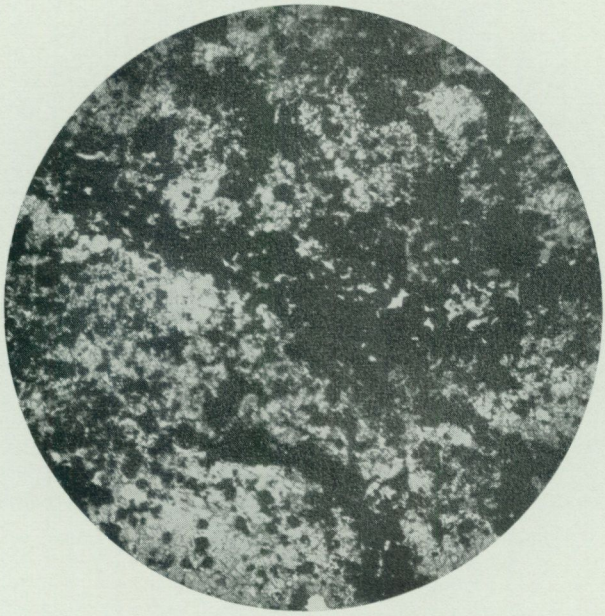


Fig. 141. Manganiferous iron ore rich in knebelite, Basttjärn mines, Ljusnarsberg region. Thin section, ord. light, magnification 13 ×. As in Fig. 140, the most fine-grained parts are nearest to the original state of the ore. The knebelite individuals often contain very small grains of magnetite. Larger magnetite grains are secondary concentrations products. The ore was probably precipitated as a colloid and has later become recrystalliced. (After N. H. Magnusson.)

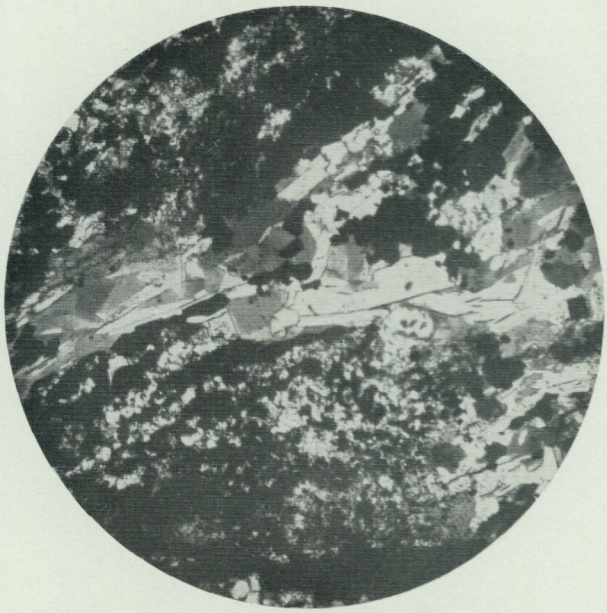


Fig. 142. Manganiferous iron ore rich in knebelite and containing veins of biotite injected from the neighbouring leptite, Basttjärn mines, Ljusnarsberg region. Thin section, ord. light, magnification 13 ×. (After N. H. Magnusson.)

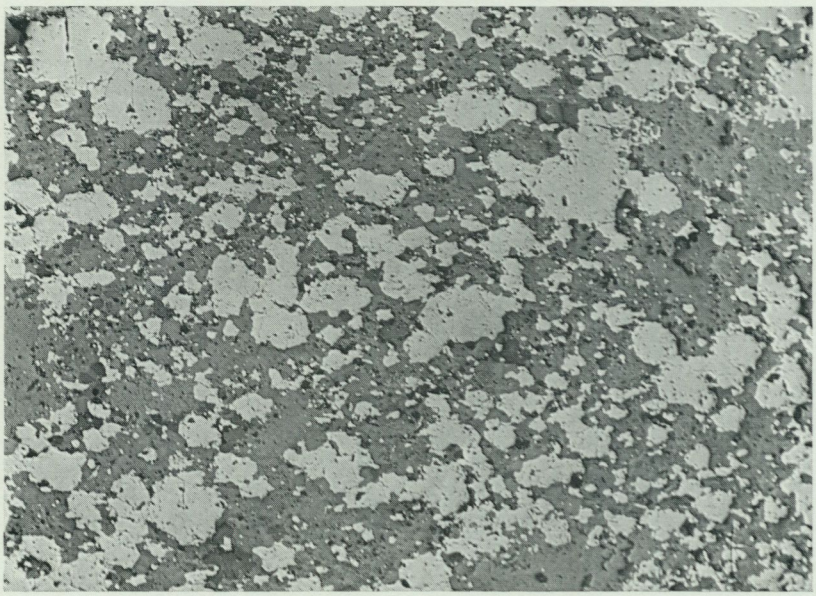


Fig. 143. Manganiferous iron ore consisting of magnetite in a carbonate rich in manganese accompanied by iron, magnesium, and calcium, Ställberg mines, Ljusnarsberg region. Polished section, ord. light, magnification 190 ×. The larger grains have formed in connection with the recrystallization of the ore. (After G. T. Lindroth.)

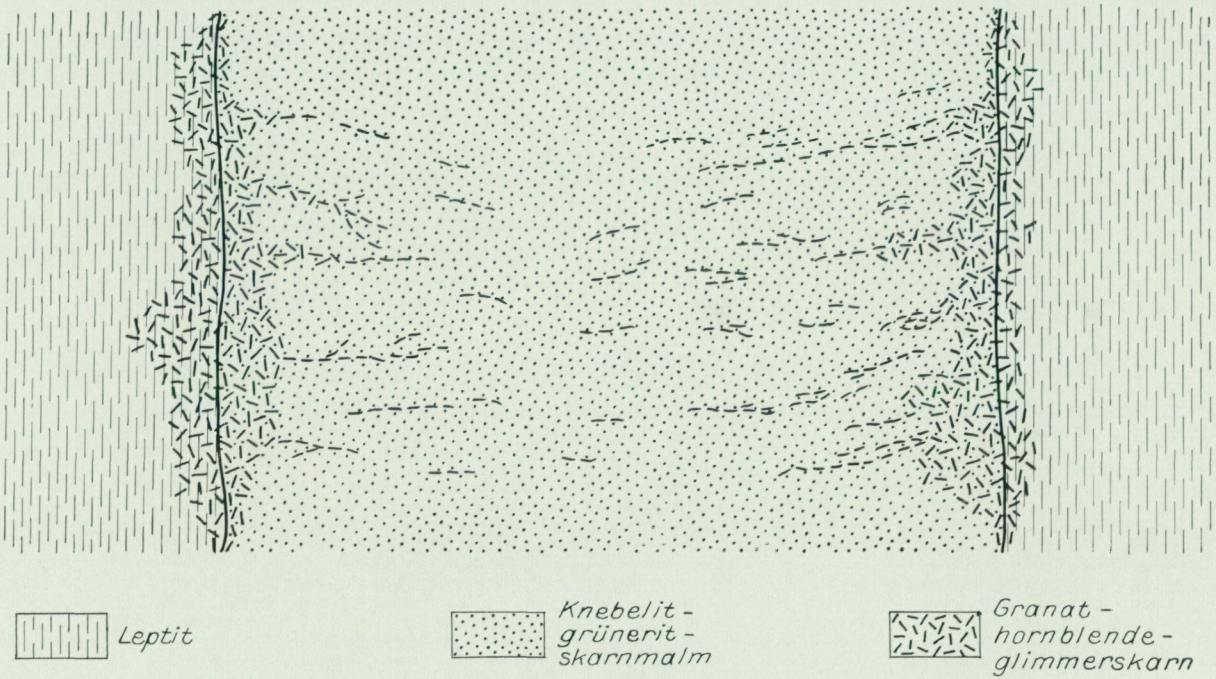


Fig. 144. Close to the leptites appear in the manganiferous iron ores a skarn consisting of garnet, hornblende, and biotite developed by reactions between ore and leptite. Schematic profile through an ore layer in the Basttjärn mines, Ljusnarsberg region. Legend: *Leptit* = Leptite; *Knebelit-grünerite-skarnmalm* = Knebelite-dannemorite-skarn ore; *Granat-hornblende-glimmerskarn* = Garnet-hornblende-mica skarn. (After N. H. Magnusson.)

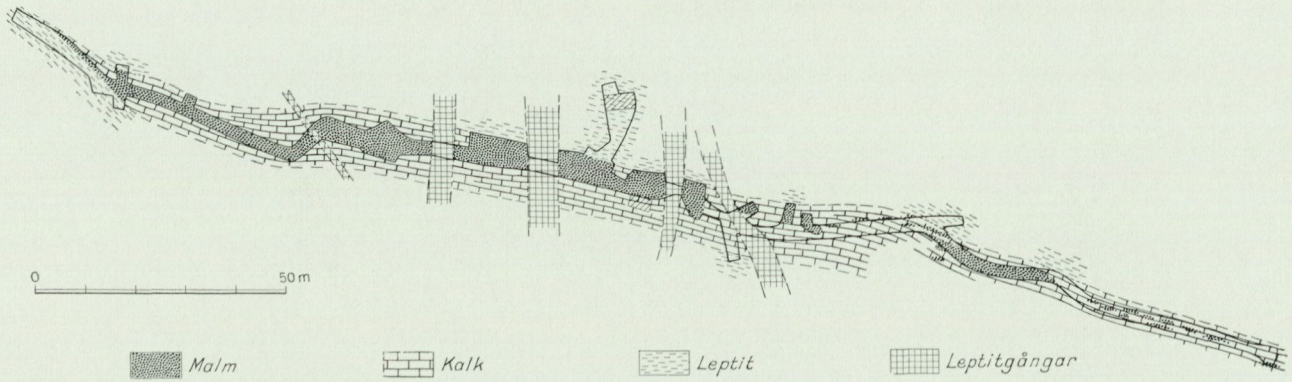


Fig. 145. Leptite dikes cutting the manganiferous iron ores. Garnet-hornblende-biotite skarn was formed even in marginal parts of the dikes when bordering upon the ores. 160 m. level in Haggruvan mines in the Ställberg field, Ljusnarsberg region. Legend: *Malm* = Iron ore; *Kalk* = Limestone and dolomite; *Leptit* = Leptite; *Leptitgångar* = Leptite dikes. (After N. H. Magnusson.)

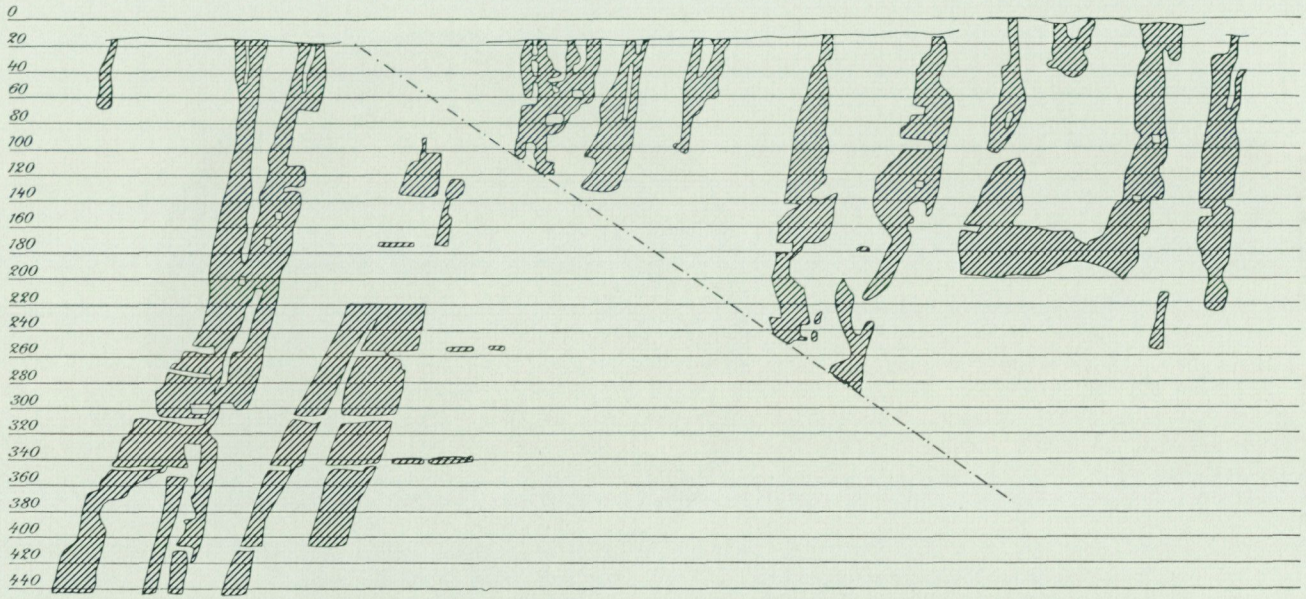


Fig. 146. Longitudinal section of the Svartvik mines showing stocklike ore bodies oriented parallel to the linear structure of the surrounding leptites. (After N. H. Magnusson.)

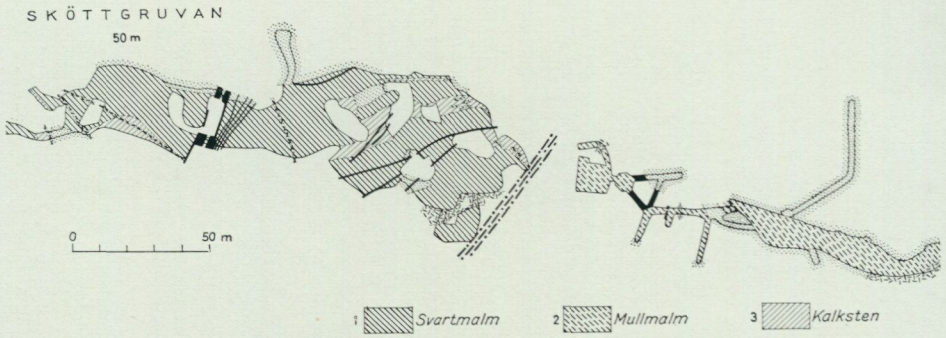


Fig. 147. 50 m. level in Sköttgruvan and Mossgruvan mines, Ljusnarsberg region. Between the mines is a broad sköl zone. The ores in Sköttgruvan are limestone-banded mag-

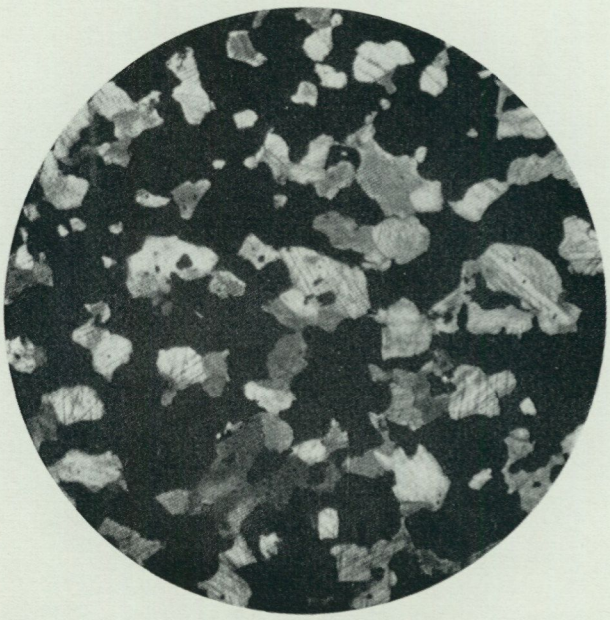
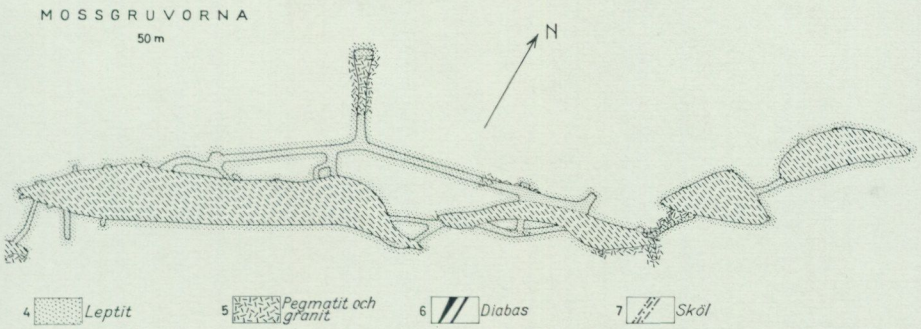


Fig. 148. Limestone-magnetite iron ore, Sköttgruvan mine, Ljusnarsberg region. Thin section, ord. light, magnification 13 ×. Magnetite (black) in a mass consisting of calcite. The structure of an ore layer is shown. The alternating limestone layers are composed of nearly pure calcium carbonate. Skarn appears only at the leptite boundaries. (After N. H. Magnusson.)



netite ores. The ores in Mossgruvan are soft ones. Legend: 1. Magnetite ore; 2. Soft ore; 3. Limestone; 4. Leptite; 5. Pegmatite and granite; 6. Diabase; 7. Sköl zone. (After N. H. Magnusson.)

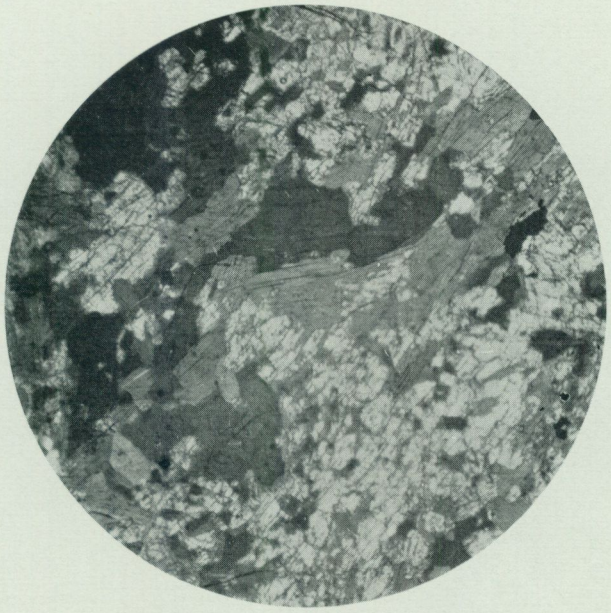


Fig. 149. Pyroxene-hornblende skarn appearing at the leptite boundaries in the Sköttgruvan mine, Ljusnarsberg region. Thin section, ord. light, magnification 13 ×. (After N. H. Magnusson.)

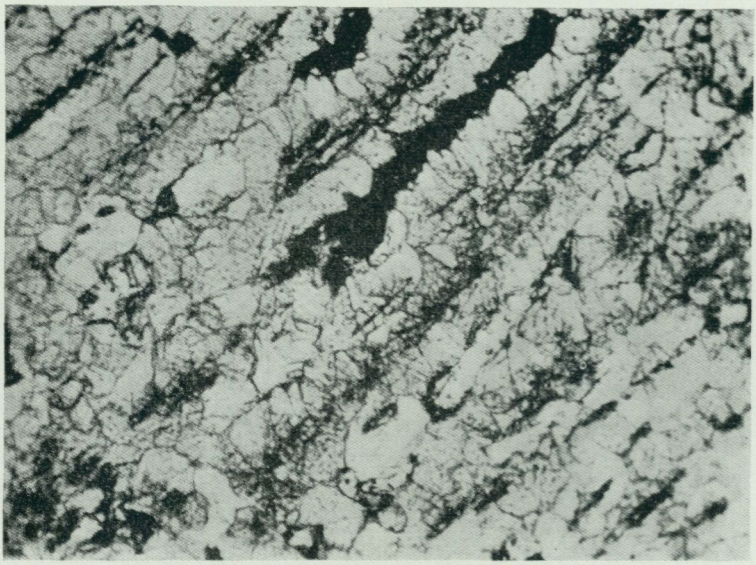


Fig. 150. Siderite from the soft ores in the Mossgruvan mine, Ljusnarsberg region. Thin section, ord. light, magnification 15 ×. (After L. Hedin, unpublished paper.)

Fig. 151. Chalcedony (white and black) in a magnetite-opal mass (black). From the soft ores of the Mossgruvan mine, Ljusnarsberg region. Thin section, + nic., magnification 15 ×. (After L. Hedin, unpublished paper.)

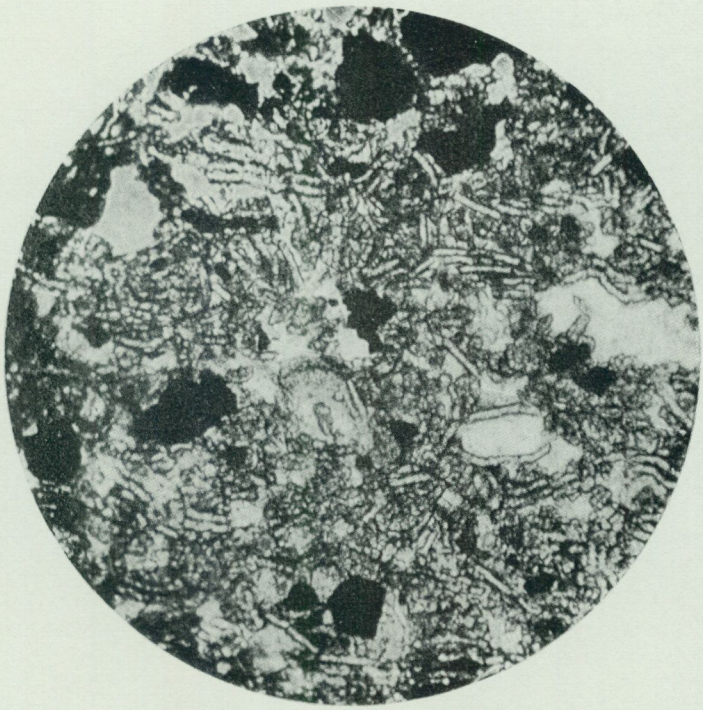


Fig. 152. Siderite ore, highly porous, with some magnetite grains, Mossgruvan mine, Ljusnarsberg region. Thin section, ord. light, magnification 36 ×. The magnetite grains have been more or less altered to martite. Both martite and siderite have to some extent been changed to limonite (goethite). Among the weathered ores of Central Sweden, only the soft ores in Mossgruvan contain considrable quantities of siderite. (After N. H. Magnusson.)

Fig. 153. Stratification in the quartziferous skarn-iron ores of the Salboberg mines, southern part of Ljusnarsberg region. (After N. H. Magnusson.)

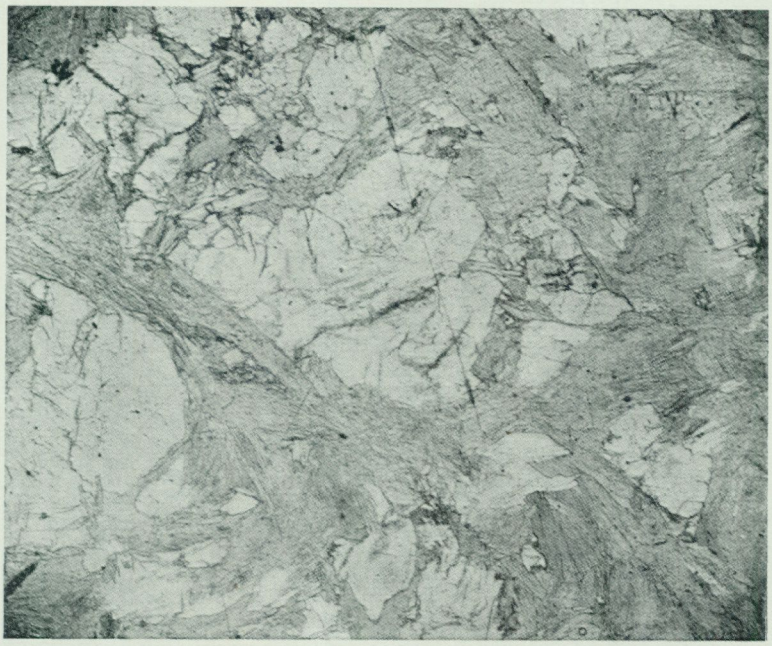


Fig. 154. Cordierite-gedrite-quartzite, Kaveltorp mines, Ljusnarsberg region. Thin section, ord. light, magnification 10 ×. The ores in these mines are zinc-lead ones of Falun type. Such quartzites often contain almandite and andalusite, sometimes also staurolite. Between the ore-quartzites and the unaltered leptite usually appear mica-schists with the same characteristic minerals. (After N. H. Magnusson.)

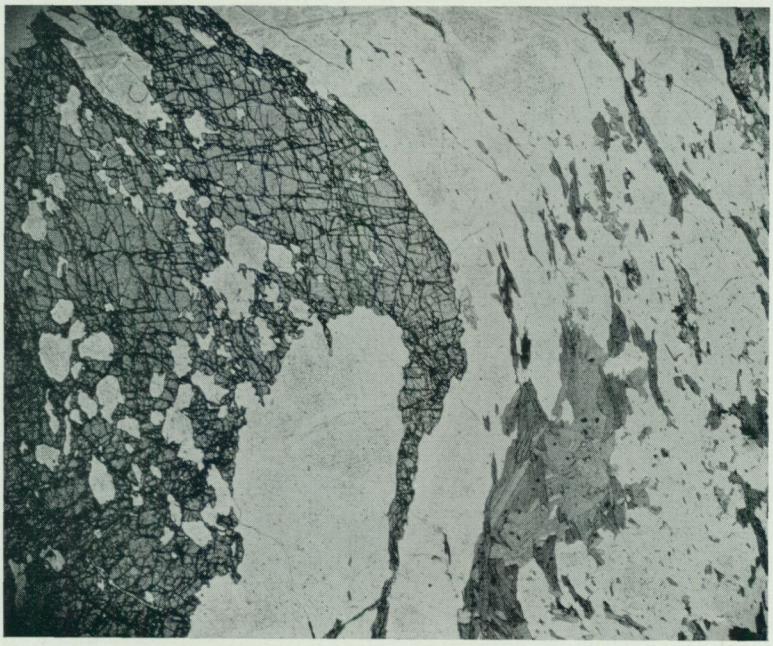


Fig. 155. Almandite-quartzite, Ljusnarsberg mines, Ljusnarsberg region. Thin section, ord. light, magnification 10 ×. (After N. H. Magnusson.)

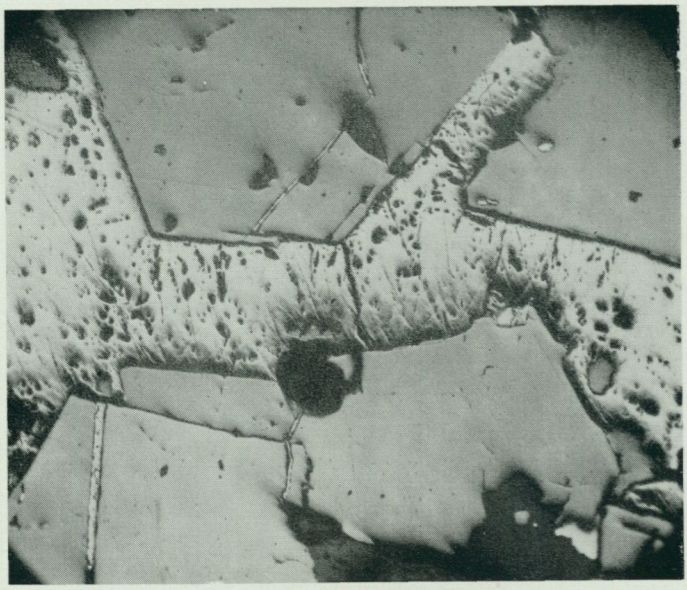


Fig. 156. Magnetite and interstitial pyrite, Ljusnarsberg mines, Ljusnarsberg region. Polished section, magnification 15 ×. (After N. H. Magnusson.)

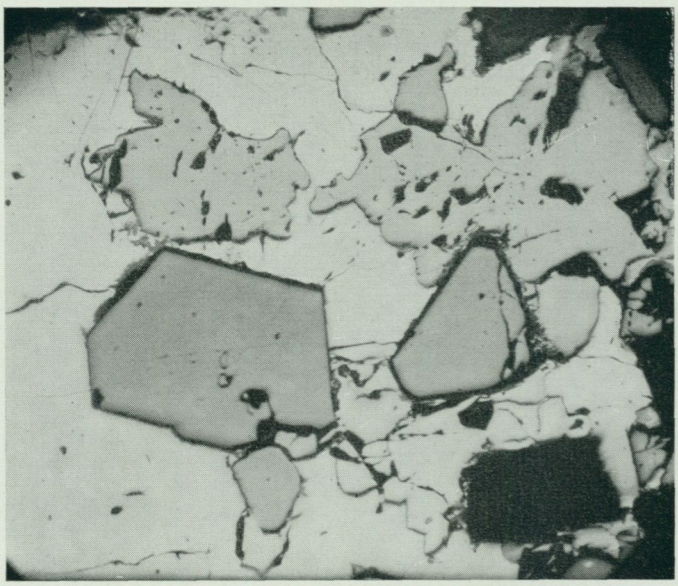


Fig. 157. Magnetite crystals in a groundmass of pyrrhotite (dark grey) and chalcopyrite (light grey), Ljusnarsberg mines, Ljusnarsberg region. Polished section, magnification 15 ×. The sulphide ores of these mines have been formed by metasomatic solutions which have penetrated a limestone-dolomite-body containing old skarn-magnetite iron ores In addition to pyrrhotite and chalcopyrite considerable quantities of sphalerite and galena occur in these sulphide ores. It is often difficult to decide wether the magnetite appearing in the sulphide ores of Falun type derives its origin from old preexisting iron ores or not. (After N. H. Magnusson.)

Fig. 158. Scheelite (the large white crystals in the lower part of the figure) in a hedenbergite-hornblende skarn rich in fluorite, Yxsjö mines, Ljusnarsberg region. 4/5 of nat. size. The ores of these mines can be characterized as a chaotic mixture of pegmatite minerals (quartz, plagioclase, microcline) and skarn minerals (garnet rich in grossularite, hedenbergite, hornblende rich in iron and alkali metals. In this mixture scheelite and some sulphide minerals such as chalcopyrite appear together with high amounts of fluorite. (After N. H. Magnusson.)

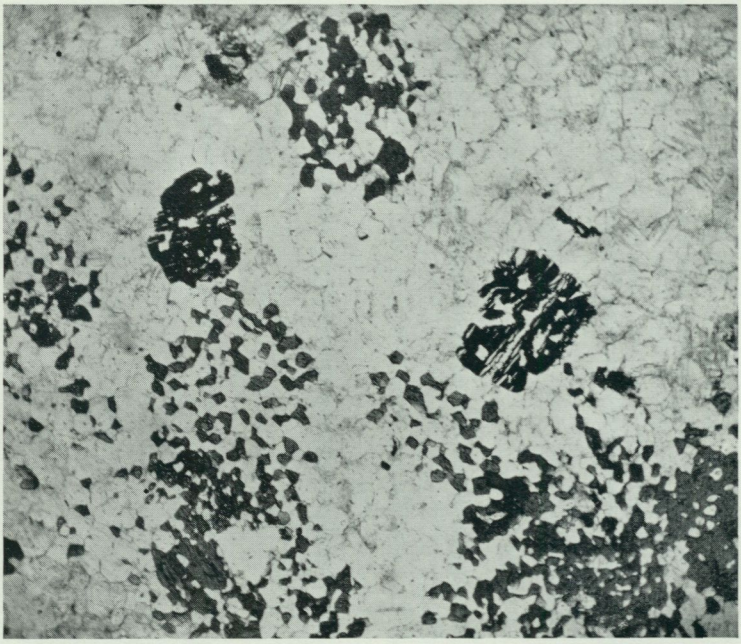


Fig. 159. Molybdenite in an aplitic granite with small grains of hornblende, Hörken mines, northern Ljusnarsberg region. Thin section, ord. light, magnification 10 ×. (After N. H. Magnusson.)

Fig. 160. Scheelite in a pegmatite rich in fluorite, Yxsjö mines, northern part of Ljusnarsberg region. Thin section, ord. light, magnification 10 ×. (After N. H. Magnusson.)

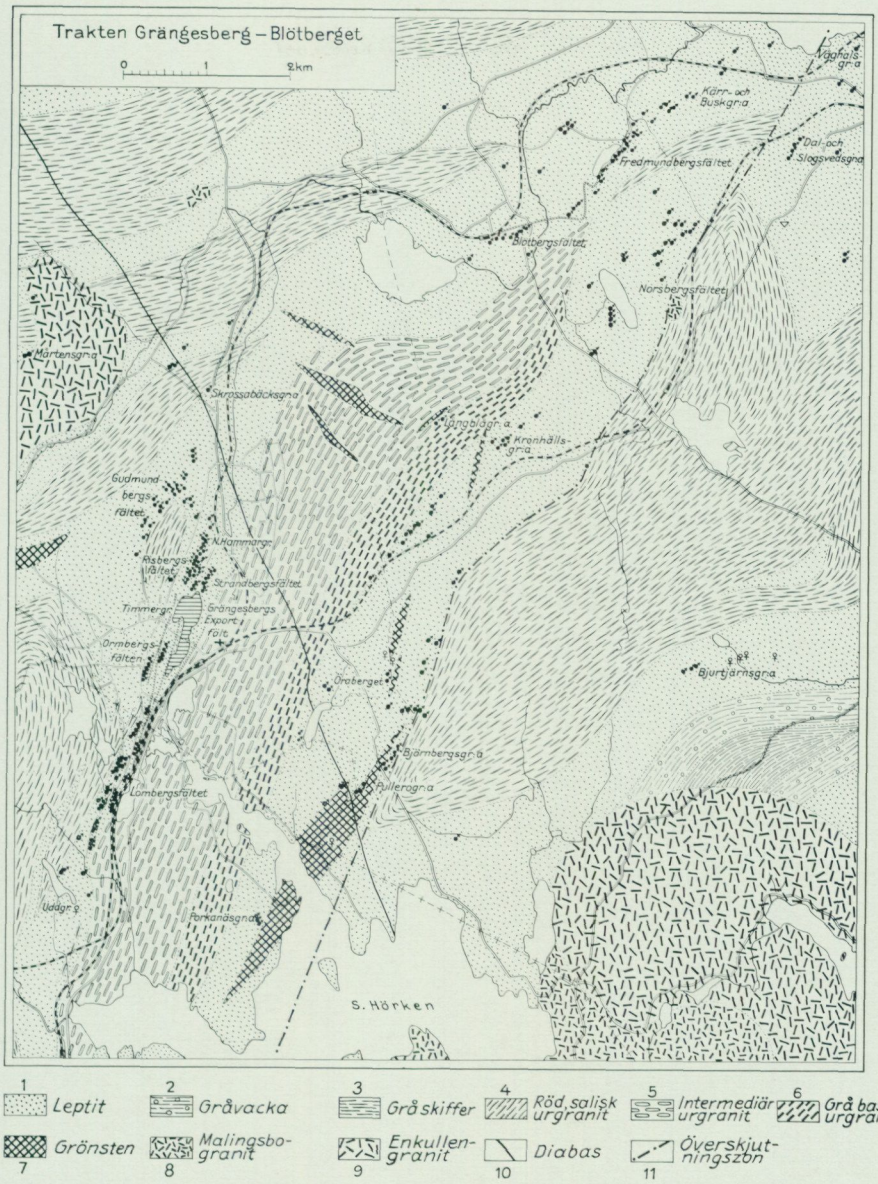


Fig. 161. Map of the Grängesberg and Blötberget fields. (After N. H. Magnusson.) Legend: 1. Leptite; 2. Greywacke; 3. Grey schist; 4. Red Svecofennian synorogenic granite; 5. Svecofennian granodiorite; 6. Svecofennian tonalite; 7. Svecofennian greenstone; 8 and 9. Late Svecofennian palingenic granites; 10. Diabase; 11. Fault.

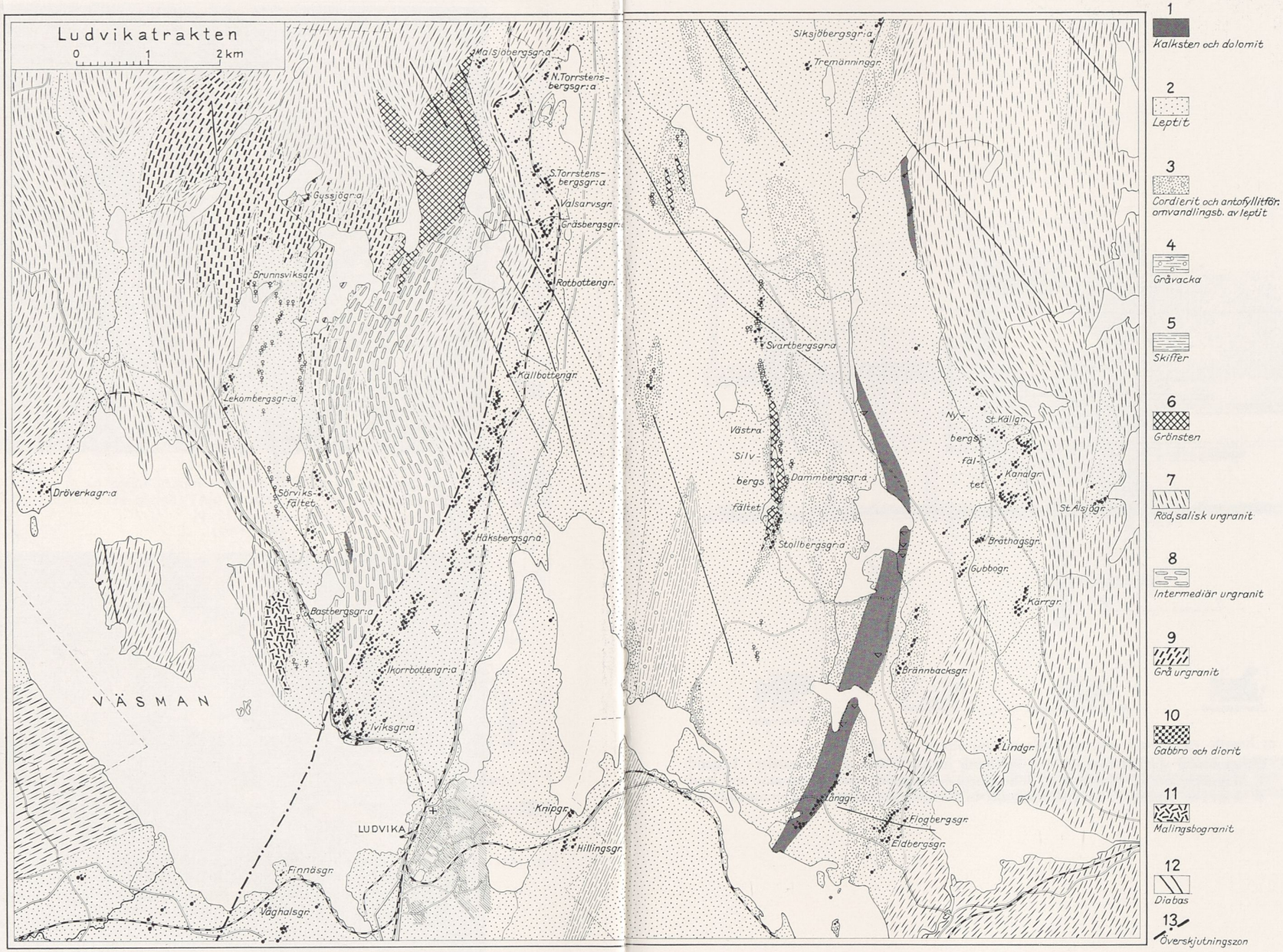


Fig. 162. Map of the Ludvika region. (After N. H. Magnusson and S. Hjelmqvist.) Legend: 1. Limestone and dolomite; 2. Leptite; 3. Leptite altered to a rock rich in cordierite and anthophyllite; 4. Greywacke; 5. Grey schist; 6. Greenstone; 7. Red Svecofennian synorogenic granite; 8. Svecofennian granodiorite; 9. Svecofennian tonalite; 10. Gabbro and diorite; 11. Late Svecofennian palingenic granite; 12. Diabase; 13. Fault.

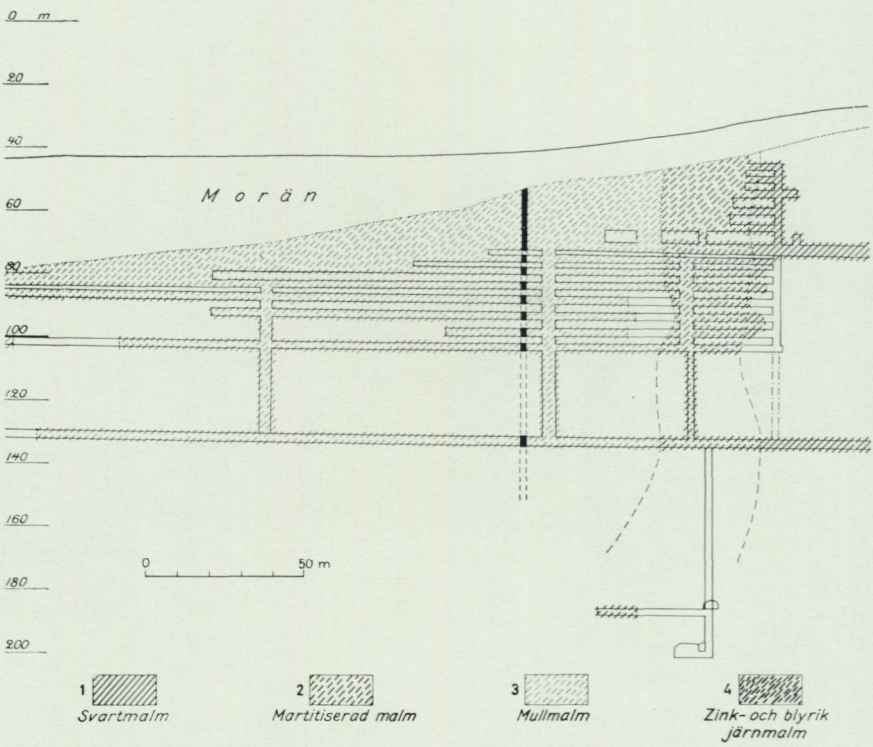
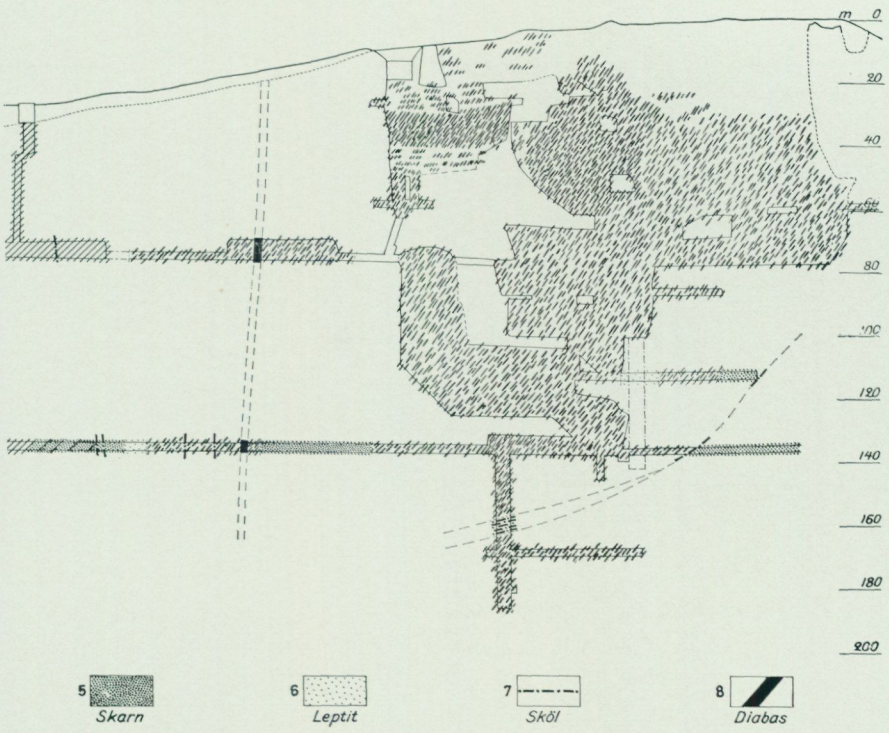


Fig. 163. Longitudinal section through the Stollberg mines. (After S. Hjelmqvist.) Legend: 1. Magnetite ore; 2. Martite ore; 3. Soft ore; 4. Magnetite ore rich in zinc and lead; 5. Skarn; 6. Leptite; 7. Sköl; 8. Diabase. In the central part occurs a manganiferous



iron ore. To the left in the section the iron ores have been altered to soft ores. Between the soft ores and the unaffected manganiferous ores is a narrow zone of magnetite altered to martite. To the right the manganiferous iron ores have become richly impregnated with sphalerite and galena. (After S. Hjelmqvist.)

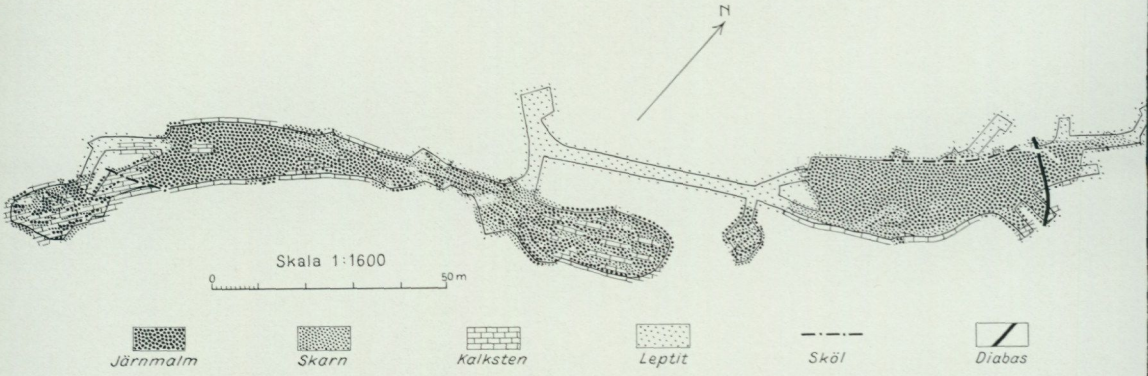


Fig. 164. 150 m. level in the Hilläng mines, east of Ludvika. (After N. H. Magnusson.) Järnmalm = Iron ore; Skarn = Skarn; Kalksten = Limestone and dolomite; Leptit = Leptite; Sköl = Sköl; Diabas = Diabase.

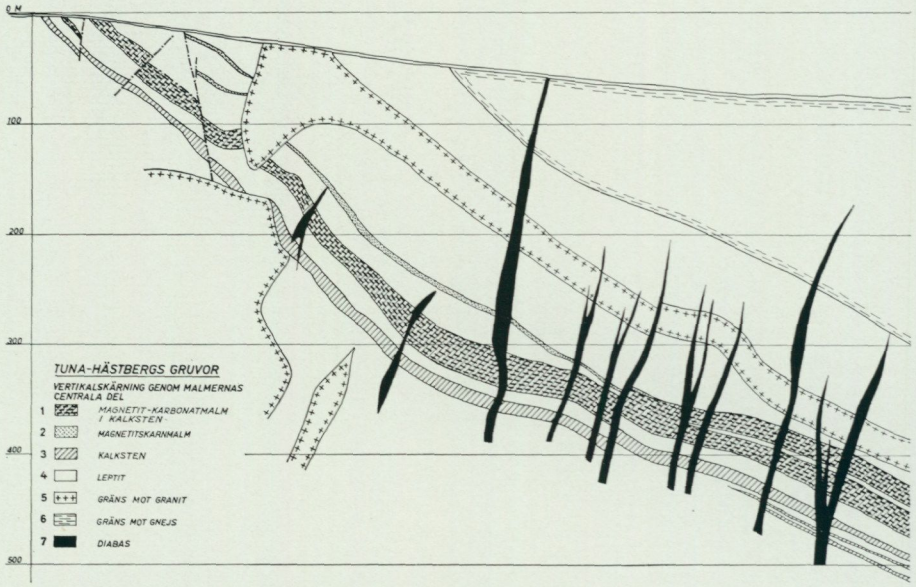


Fig. 165. Cross section through the manganiferous iron ores in the Tuna-Hästberg mines. Legend: 1. Magnetite-carbonate ores; 2. Magnetite-skarn ore; 3. Limestone and dolomite; 4. Leptite; 5. Boundary of intrusive granite; 6. Boundary of gneiss; 7. Diabase.

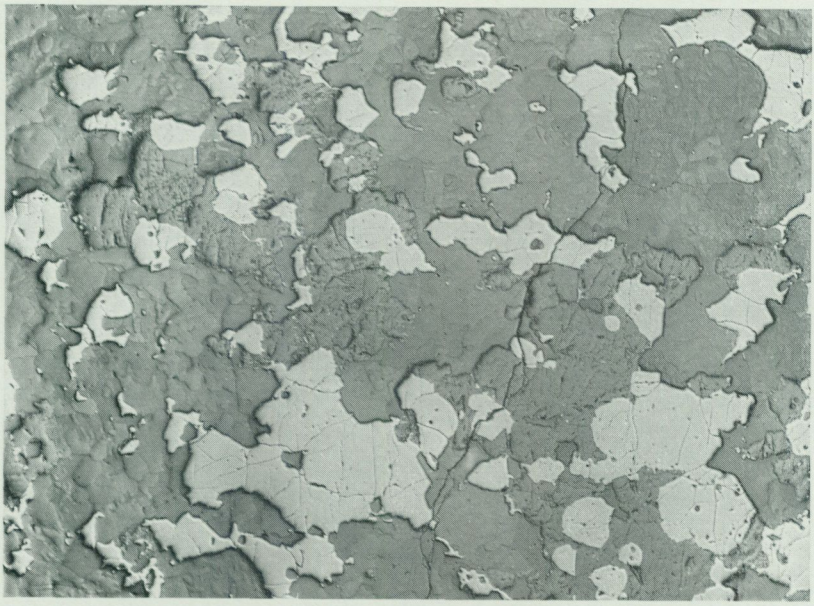
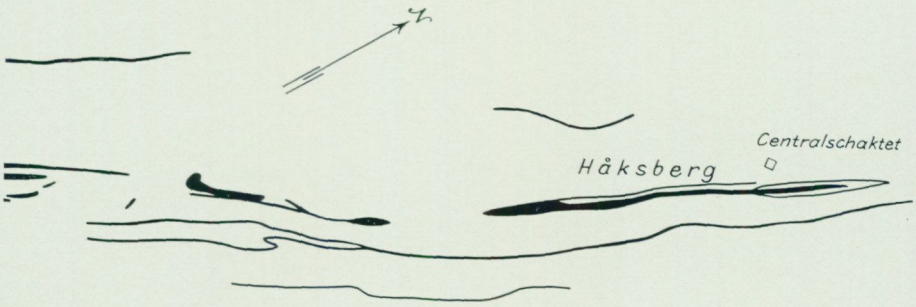


Fig. 166. Manganiferous iron ore consisting of magnetite in a carbonate rich in manganese together with iron, magnesium and calcium. Polished section, ord. light, × 190. Tuna-Hästberg mines, Ludvika region. (After G. T. Lindroth.)

Fig. 167. The iron ore layers in the Håksberg, Ickorrbotten and Iviken fields. These form the central part of a zone measuring 17 km. in length and containing primarily quartz-banded hematite iron ores with subordinate amounts of limestone and dolomite. These deposits have been more or less changed to magnetite ores, banded or



massive and with variable quantities of skarn minerals. The author has decided to reproduce here the central part mentioned in order to show that the zone contains several parallel thicker and thinner layers of ore. Only the thickest layers have been mined.

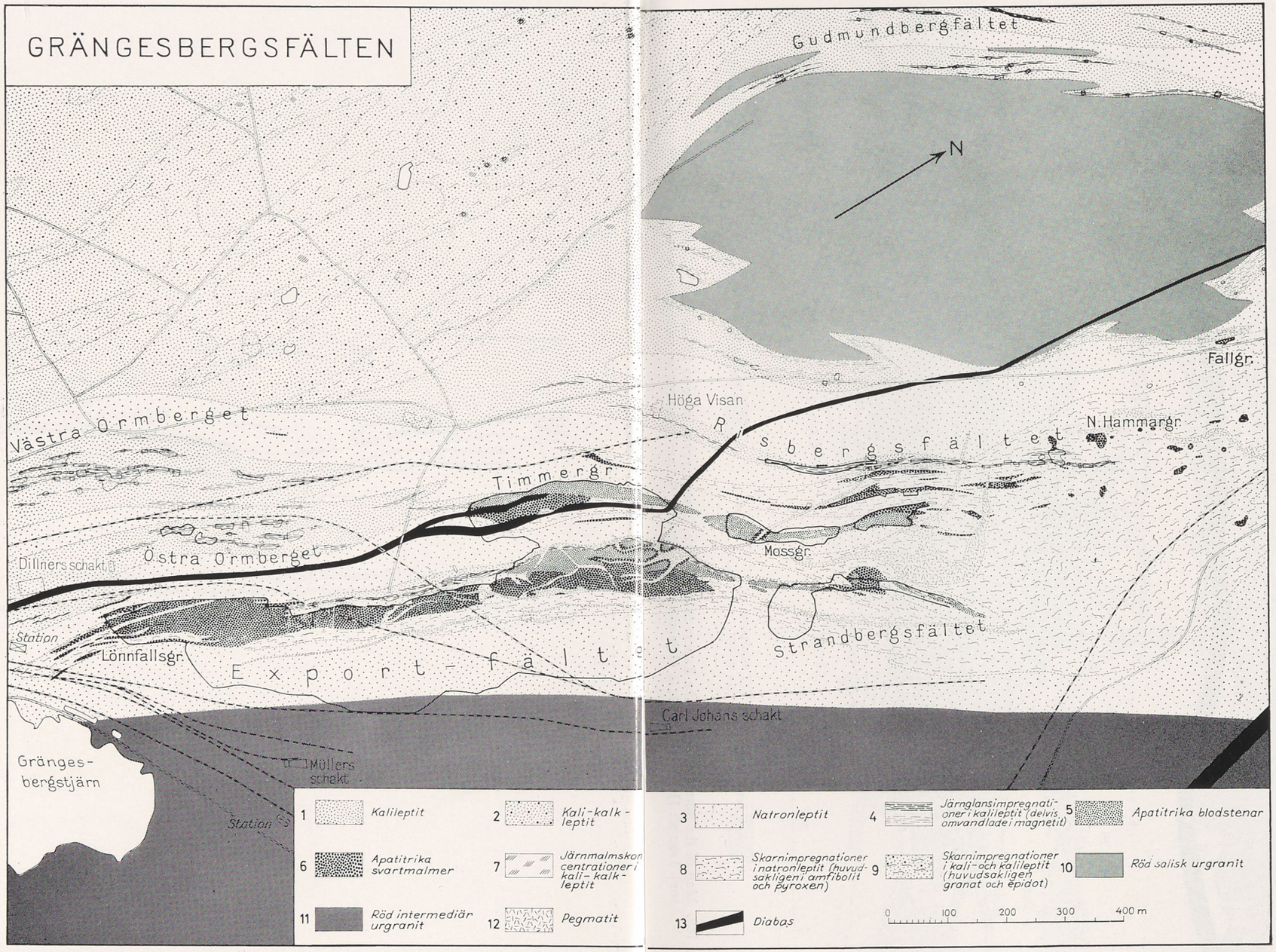


Fig. 168. Map of the central part of the Grängesberg field. (After N. H. Magnusson.) Legend: 1. Potassic leptite; 2. Potassic leptite rich in lime; 3. Sodic leptite; 4. Hematite impregnations in potassic leptite; 5. Hematite ore rich in apatite; 6. Magnetite ore rich in apatite; 7. Small hematite concentrations in potassic leptite rich in lime; 8. Skarn impregnations in sodic leptite essentially consisting of amphibole and pyroxene; 9. Skarn impregnations (especially garnet and epidote) in potassic leptite in part rich in lime; 10. Red Svecofennian granite; 11. Svecofennian granodiorite; 12. Late Svecofennian, palingenic pegmatite; 13. Diabase.

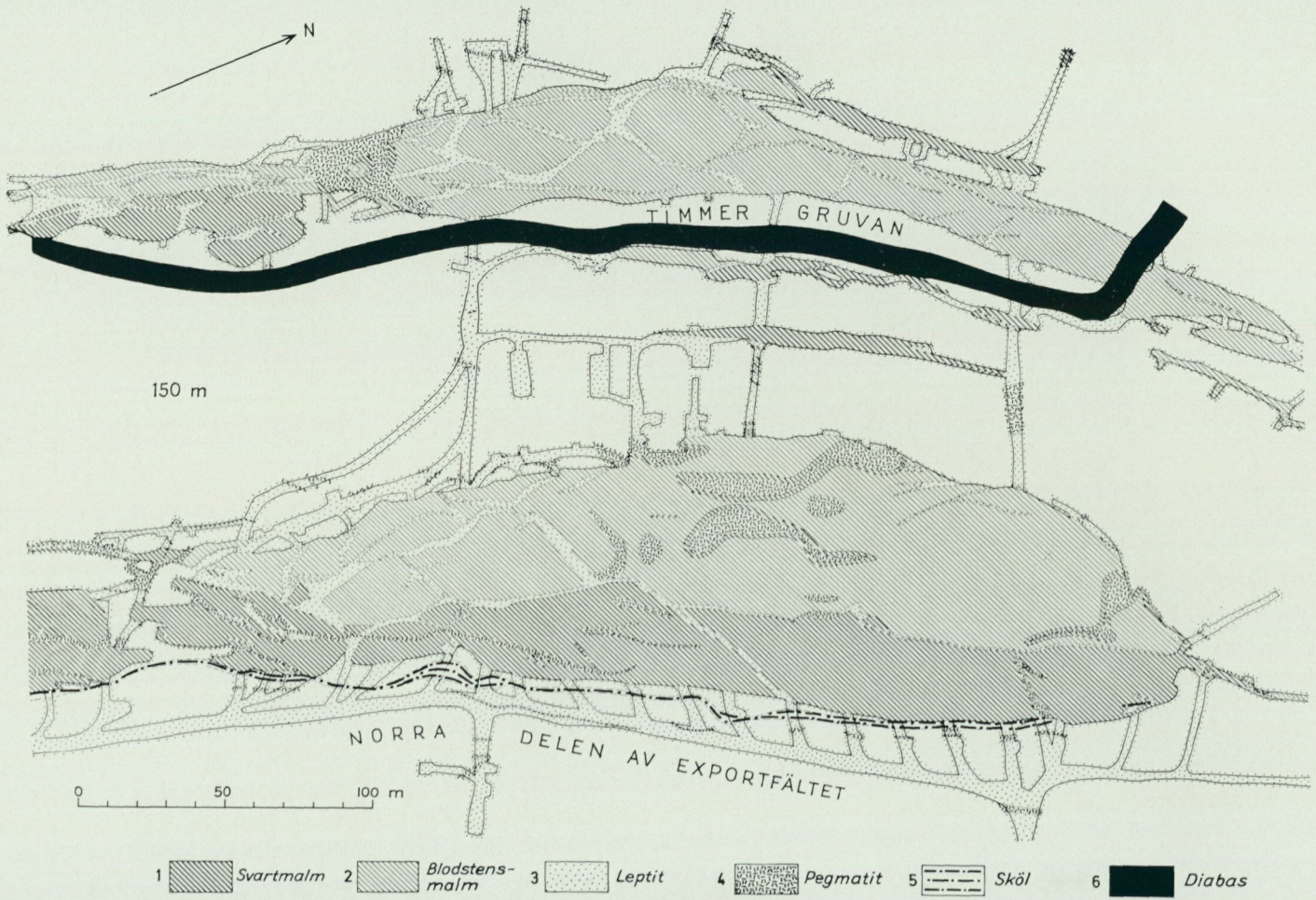


Fig. 169. Map of the northern part of the Export field and the Timmergruvan mine at 150 m. level, Grängesberg. (After N. H. Magnusson). Legend: 1) Magnetite ore; 2. Hematite ore; 3. Leptite; 4. Late Svecofennian palingenic pegmatite; 5. Sköl; 6. Diabase.

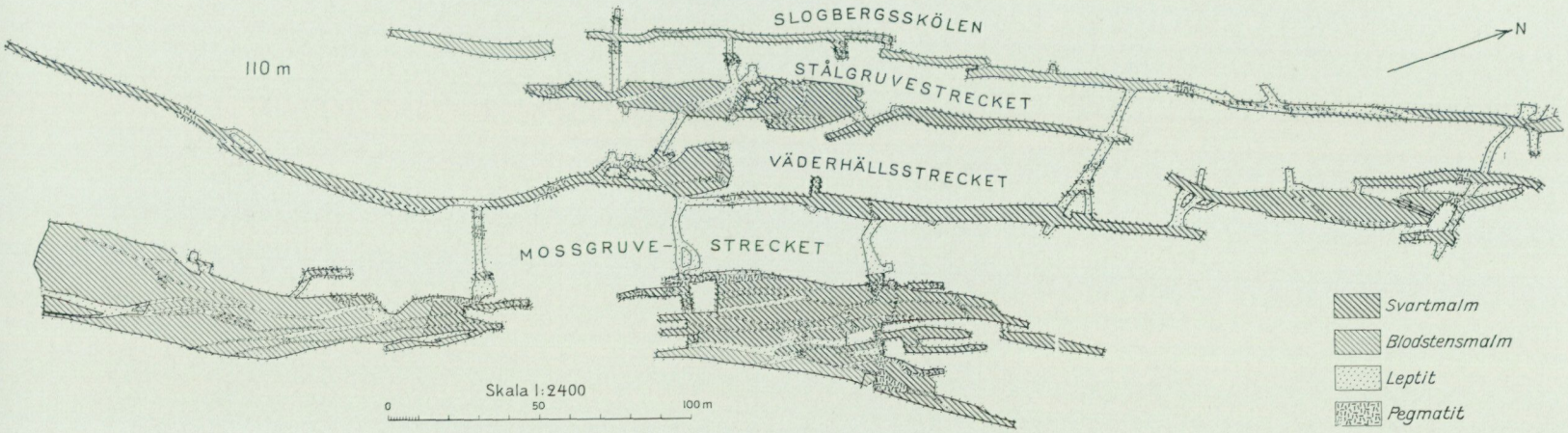


Fig. 170. Map of the Risberg field at 110 m. level, Grängesberg. Legend: *Svartmalm* = Magnetite iron ore; *Blodstensmalm* = Hematite iron ore; *Leptit* = Leptite; *Pegmatit* = Pegmatite.

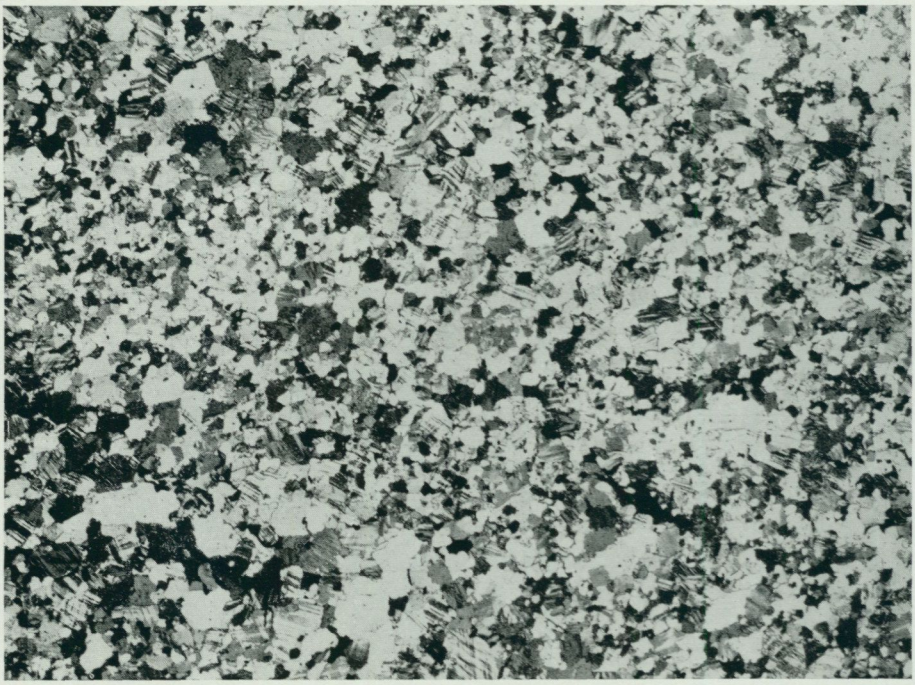


Fig. 171. Potassic leptite to the west of the Export field in Grängesberg. Thin section, + nic., magnification 10 ×. The potassic leptites in the Grängesberg region consist of quartz, microcline-perthite, oligoclase, and biotite. Some muscovite also occurs, but never hornblende. (After N. H. Magnusson.)

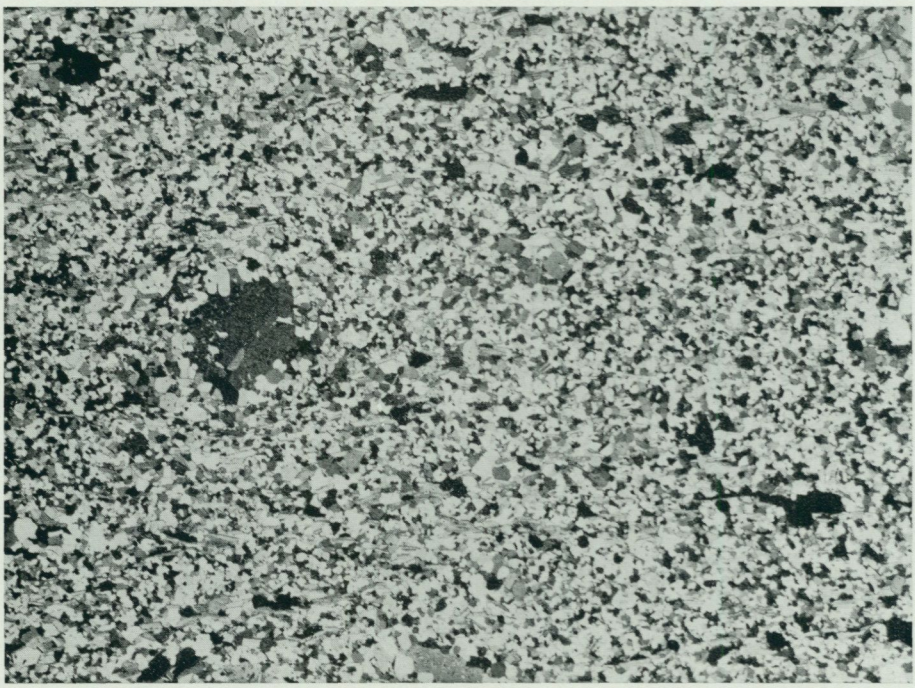


Fig. 172. Sodic leptite, the Export field, Grängesberg. Thin section, + nic., magnification 10 ×. The sodic leptites in the Grängesberg region consist of quartz, oligoclase or oligoclase-albite, and biotite. This is the ordinary leptite found around the apatite iron ores. (After N. H. Magnusson.)

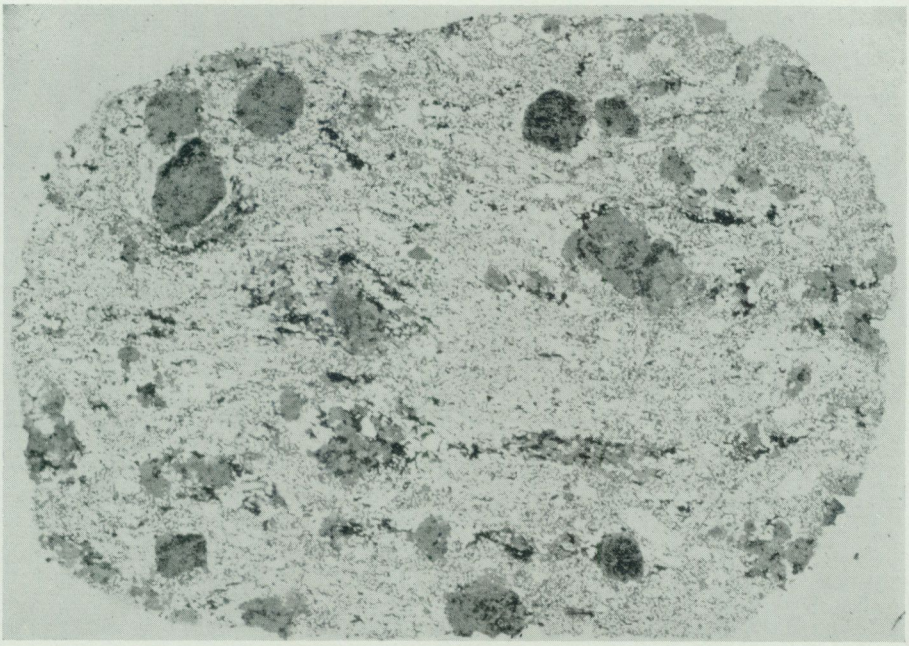


Fig. 173. Potassic leptite rich in calcium. Magnification 4 ×. This leptite consists of quartz, microcline-perthite, oligoclase, hornblende, and subordinate biotite. Phenocrysts of andesine or oligoclase are found here and there. These rocks are as a rule rich in skarn minerals such as garnet dominated by the grossularite molecule and epidote developed in connection with the regional processes producing skarn. Limestone and dolomite appear as small remnants and account for the plenitude of garnet, epidote, and hornblende. These leptites appear west of the Ormberg and Lomberg impregnation ores. (After H. E. Johansson.)

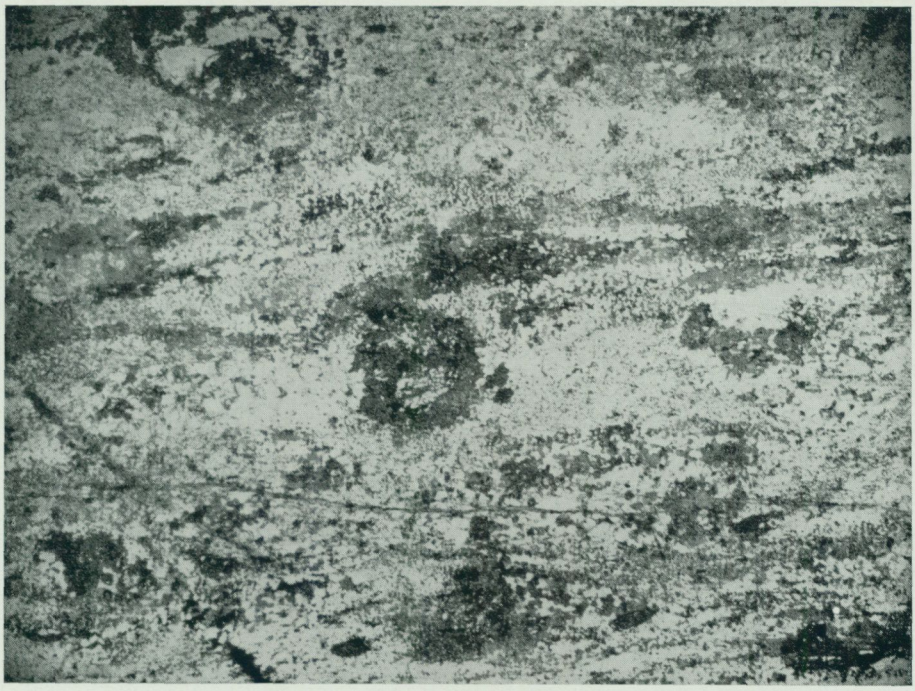


Fig. 174. Potassic leptite containing much calcium and accordingly very rich in skarn minerals, hornblende essentially. This potassic leptite appears to the west of the Ormberg and Lomberg ores. (After H. E. Johansson.)

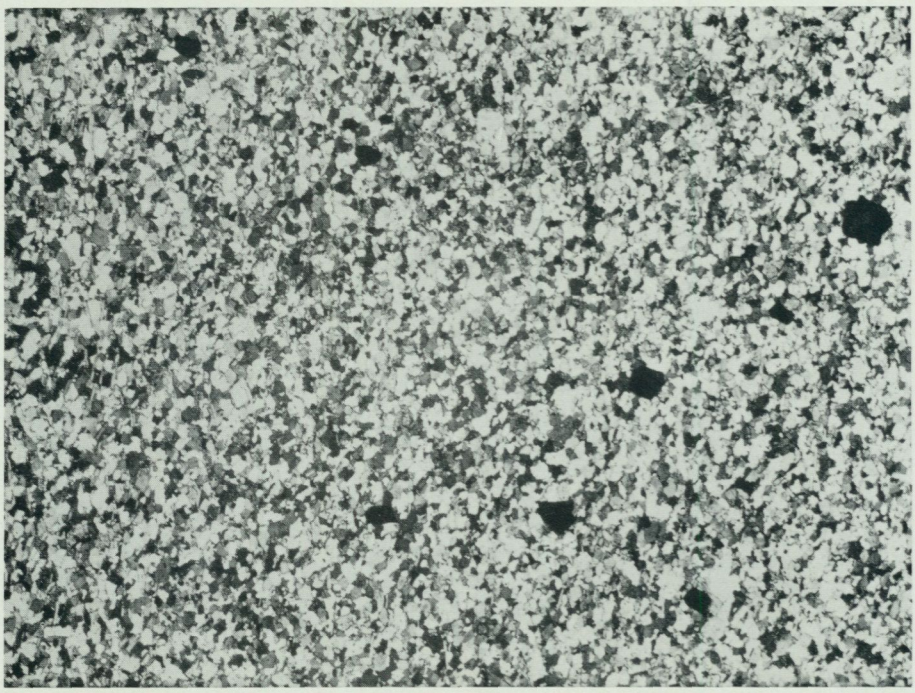


Fig. 175. Dacitic to andesitic dikes cut the leptites and iron ores of the Grängesberg region. Owing to recrystallization these rocks have got a granoblastic texture at the same time and of the same type as the leptites. The dacite and andesite consist of plagioclase, hornblende, and biotite. The plagioclase varies from basic andesine or acid labradorite in the andesite to oligoclase in the dacite. Accessoric minerals are apatite, magnetite, and titanite. The so-called porphyrites have phenocrysts of labradorite in a groundmass of hornblende and andesine.

The dikes now considered are younger than the ores and associated skarn impregnations but older than the Svecofennian synorogenic granites. The photo shows a dacite. Thin section, + nic., magnification 10 ×. (After N. H. Magnusson.)

Fig. 176. The leptites in the Grängesberg region usually display a good lineation, such as the rock in the photo from an outcrop to the north of the Risberg field. (After N. H. Magnusson.)

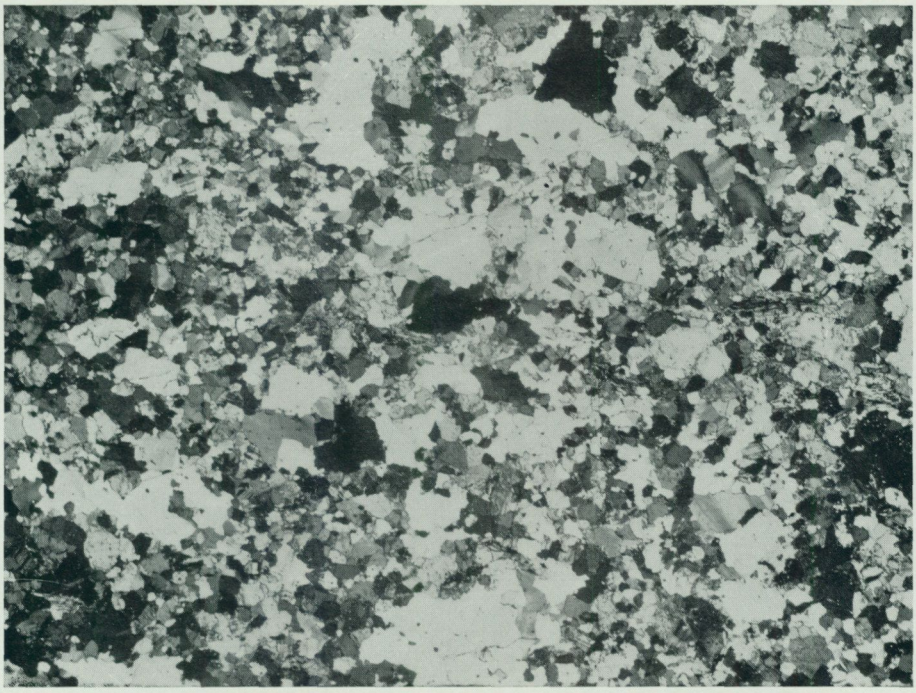


Fig. 177. Red granite, northwest of the Risberg field, Grängesberg. Thin section, + nic., magnification 10 ×. This granite consists of quartz, microcline-perthite, albite-oligoclase, and a little biotite. The granite borders with sharp contacts on the leptites, the ores, and the dacitic-andesitic dikes. (After N. H. Magnusson.)

Fig. 178. Photo of a young palingenic pegmatite dike in the foot-wall of the Export field, Grängesberg. The pegmatite cuts the linear structure. (After N. H. Magnusson.)

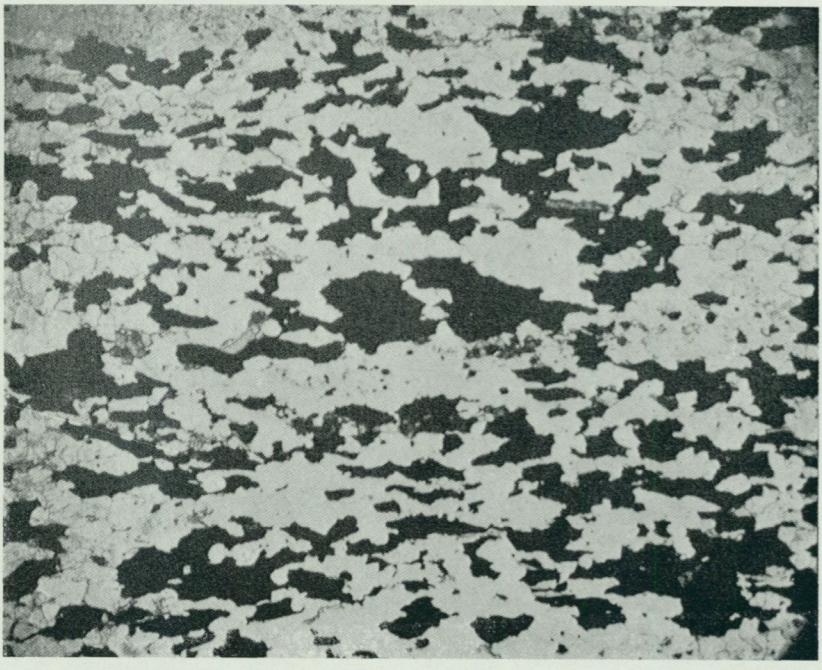


Fig. 179. Impregnation-ore of the Lomberg-Ormberg type, Grängesberg. Thin section, ord. light, magnification 10 ×. This kind of iron ore has been developed by impregnations of hematite and subordinate magnetite in potassic leptite. The minerals appearing together with the ore minerals are chiefly quartz, feldspar, muscovite, and biotite. Inferior constituents are garnet and epidote. The magnetite has been interpreted as an alteration product of hematite. This ore is closely associated with the apatite-iron ore of the Export field and contains between 0.30 and 0.06 % P. The amount of phosphorus is highest in the near vicinity of the apatite iron ores. (After N. H. Magnusson.)

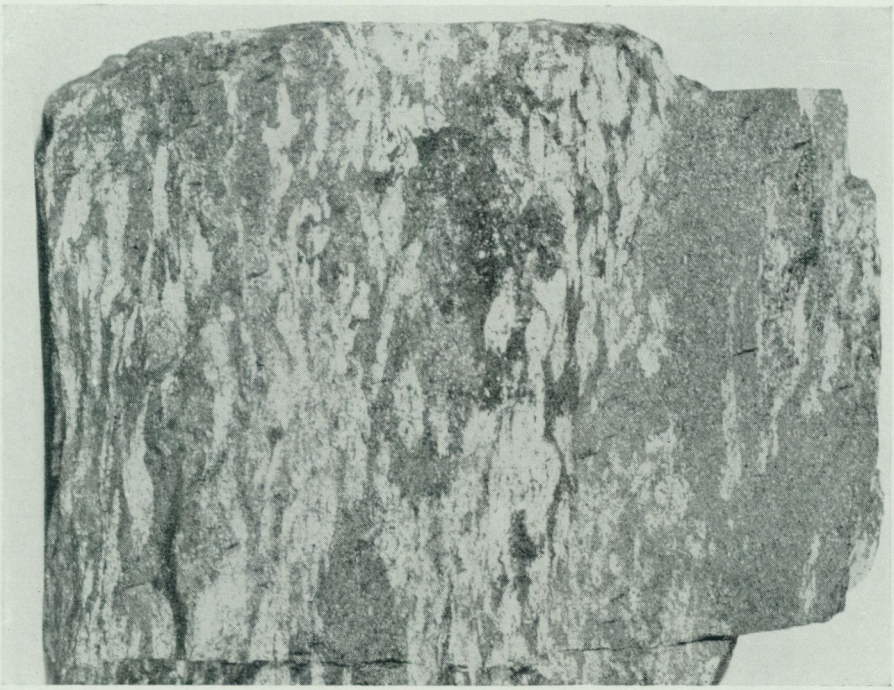


Fig. 180. Apatite iron ore, Hammargruvan mine, Grängesberg. 2/3 of nat. size. Hammargruvan is an abandoned small mine to the north of the Risberg field. The ore mined had an extremely high concentration of apatite: white in the figure (9% P). In the larger apatite iron ores of the region the amount of phosphorus only locally reaches the same height. In the Export field such concentrations of apatite are found nearly exclusively along the hanging wall. (After N. H. Magnusson.)

Fig. 181. Ore-bearing agglomeratic leptite. Horizontal surface, Risberg field, Grängesberg. (After R. Looström.)

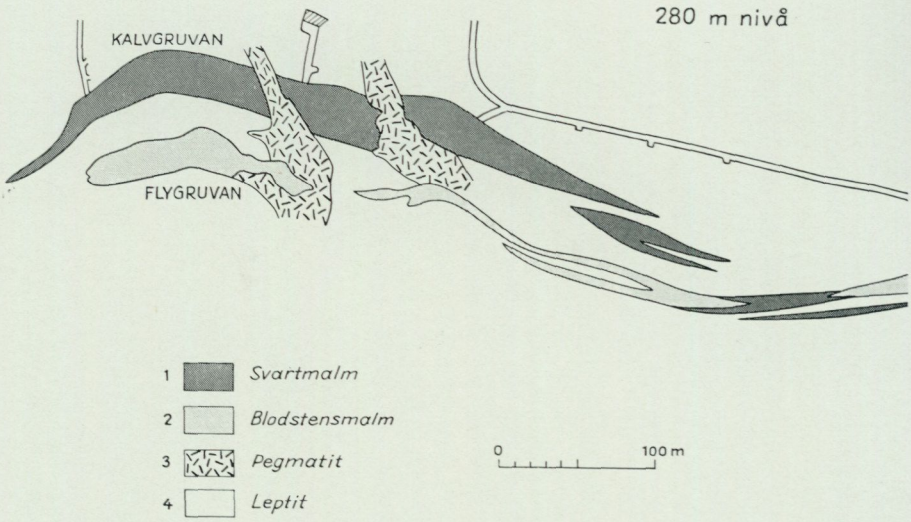


Fig. 182. 280 m. level in the Blötberget field. Legend: 1. Magnetite-apatite iron ore; 2. He-

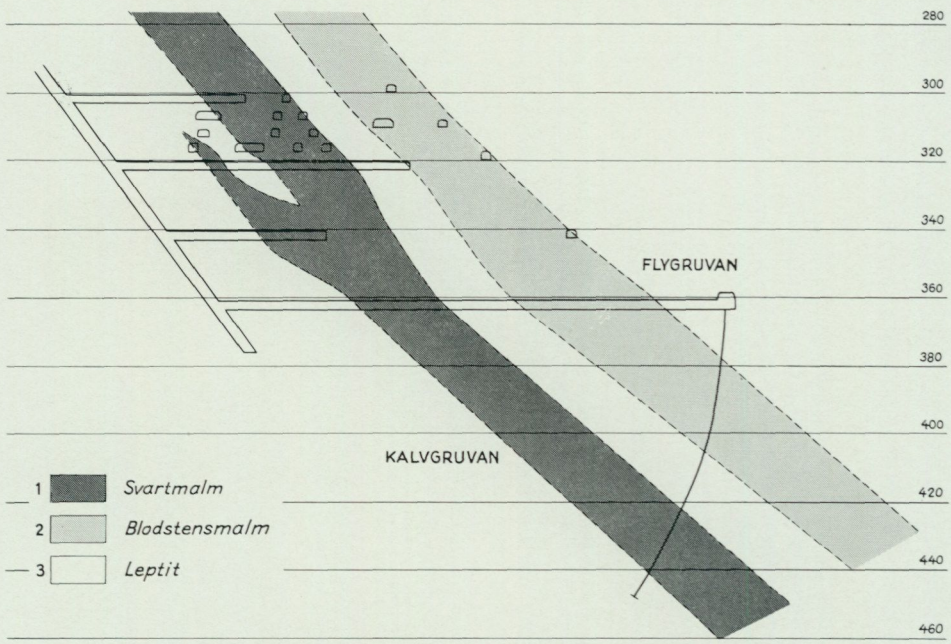
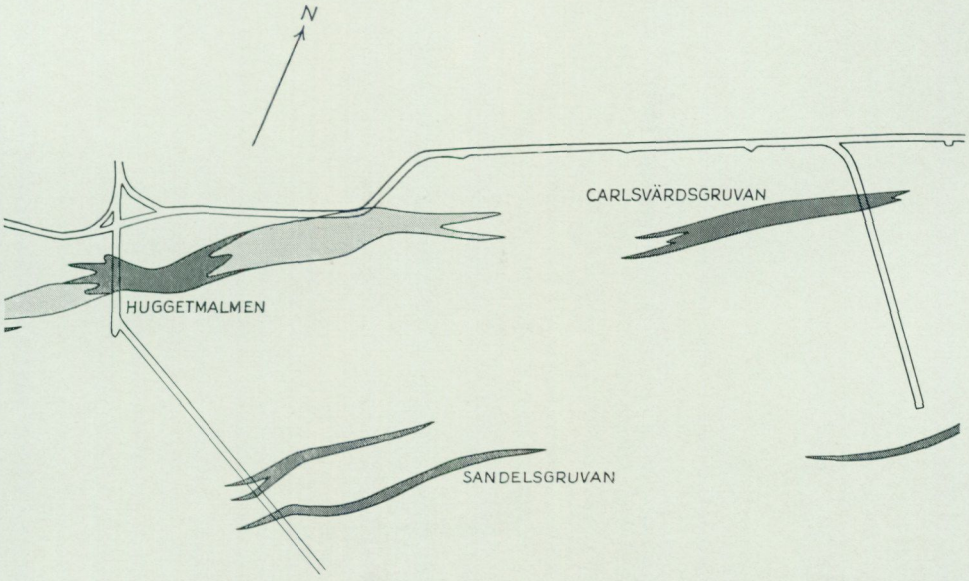


Fig. 183. Cross section through the Fly- and Kalvgruvan apatite-iron ores at the old Blötberget shaft, between 300 and 440 m. levels. Legend: 1. Magnetite-apatite iron ore; 2. Hematite-apatite iron ore. The large Hugget ore (Fig. 182) displays a continuation of the Flygruvan ores and is as well as these composed essentially of hematite.



matite-apatite iron ore; 3. Late Svecofennian palingenic pegmatite. Before 1940 only the Kalvgruvan and Flygruvan ores were mined. At that time the large Hugget ore was found. Mining operations started immediately, and it is now the central ore in the Blötberget field.

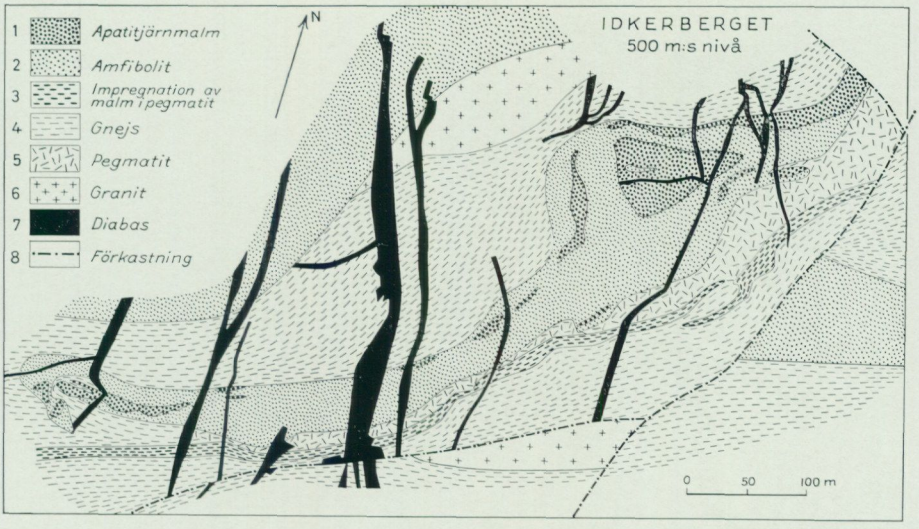


Fig. 184. 500 m. level in the Idkerberget apatite-iron ore field (A. Wesslén). Legend: 1. Apatite-magnetite iron ore; 2. Amphibolite; 3. Impregnation of magnetite and apatite; 4. Gneiss; 5. Late svecofennian palingenic pegmatite; 6. Late svecofennian palingenic granite; 7. Diabase; 8. Fault. In Idkerberget the intricate relations between the apatite-iron ores and the amphibolites have attracted special attention.

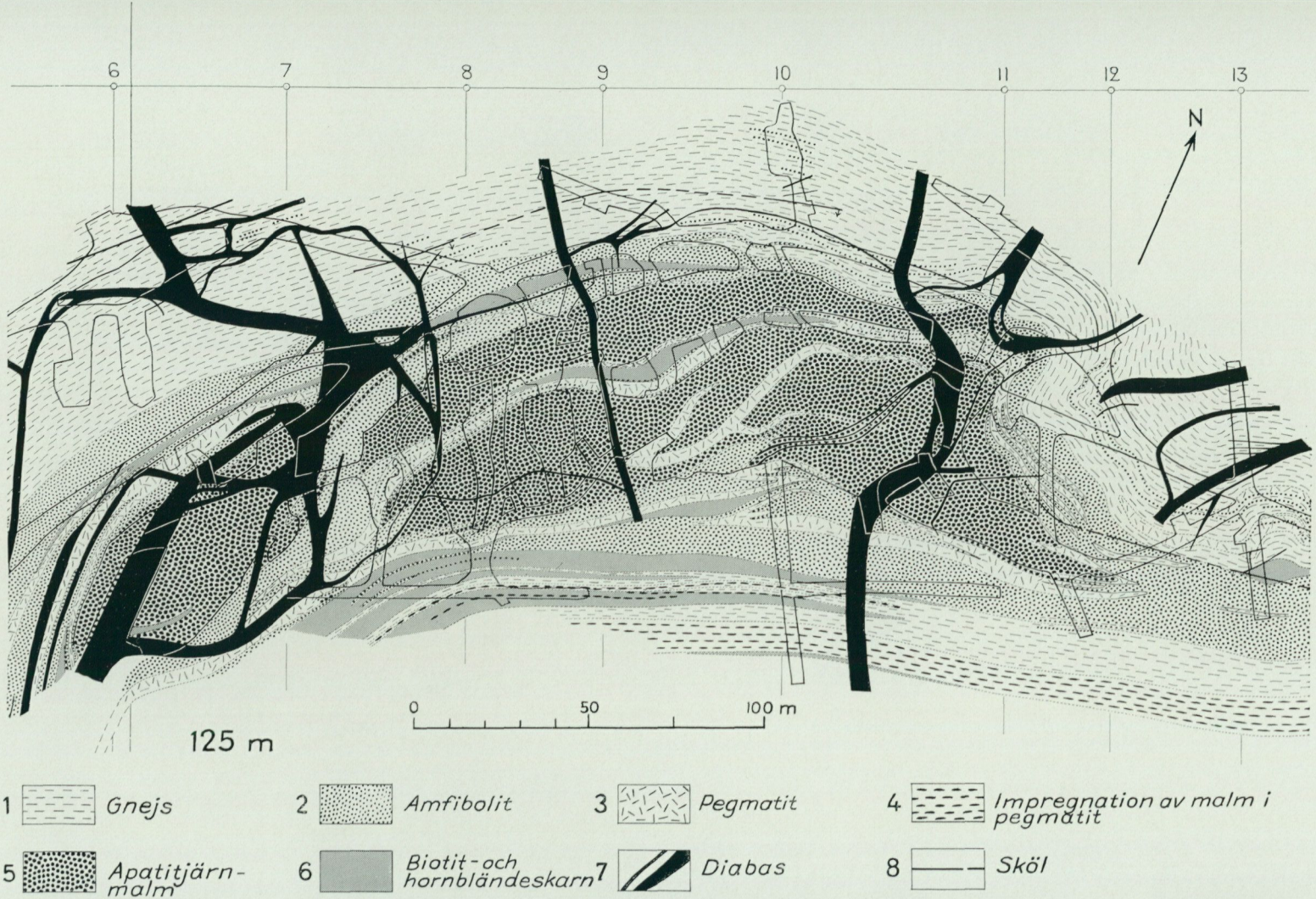


Fig. 185. Detail from 125 m. level in the Idkerberget apatite-iron ore field. (After N. Sundius.) Legend: 1. Gneiss; 2. Amphibolite; 3. Late svecofennian palingenic pegmatite; 4. Impregnations of magnetite and apatite in pegmatite; 5. Apatite-magnetite iron ore; 6. Biotite and hornblende skarn; 7. Diabase.

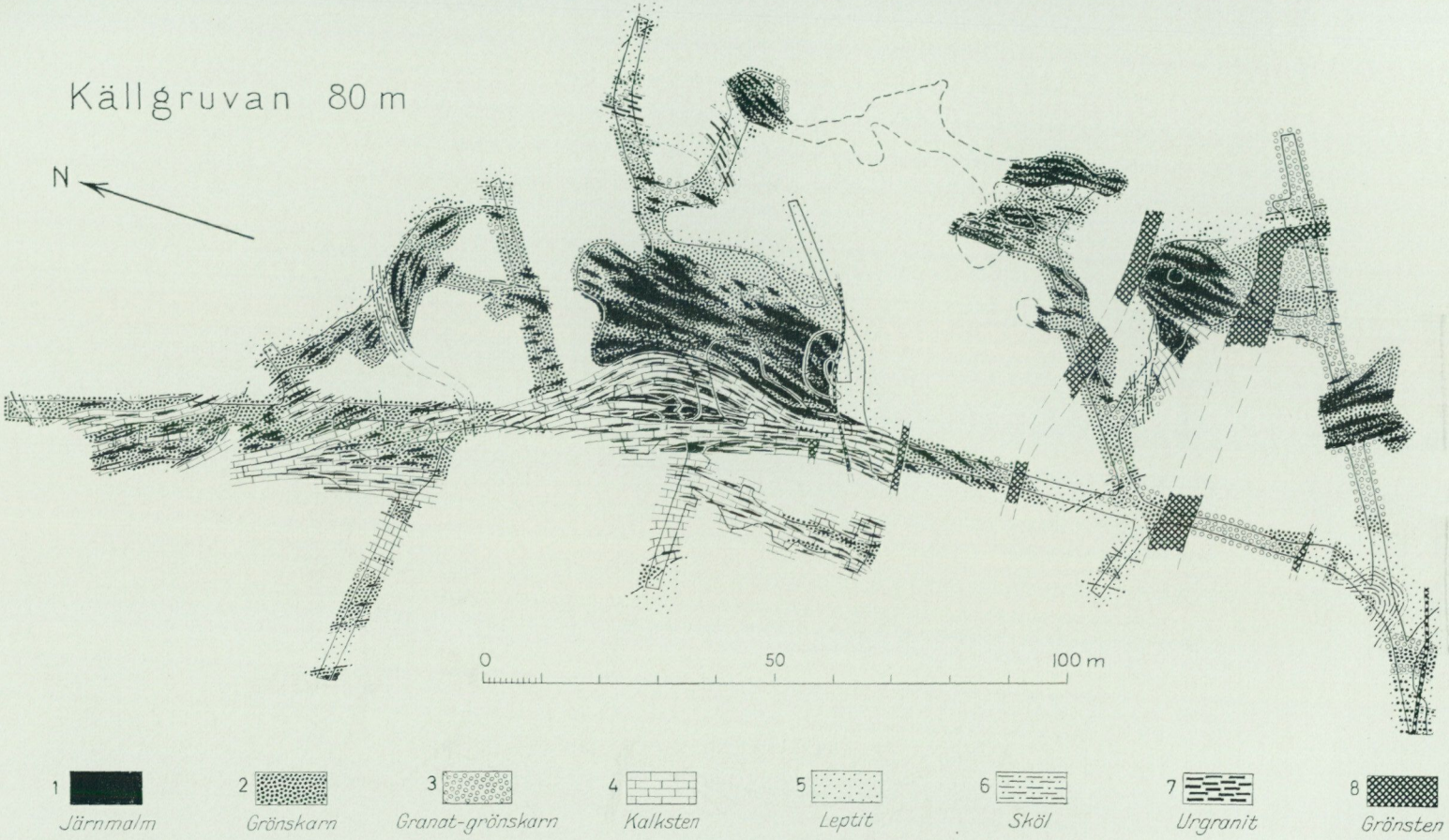


Fig. 186. 80 m. level in the Källgruvan mine in the Nyberg field. (After S. Hjelmqvist.) Legend: 1. Iron ore; 2. Greenskarn; 3. Greenskarn rich in garnet; 4. Limestone and dolomite; 5. Leptite; 6. Sköl; 7. Svecofennian synorogenic granite; 8. Greenstone dike.

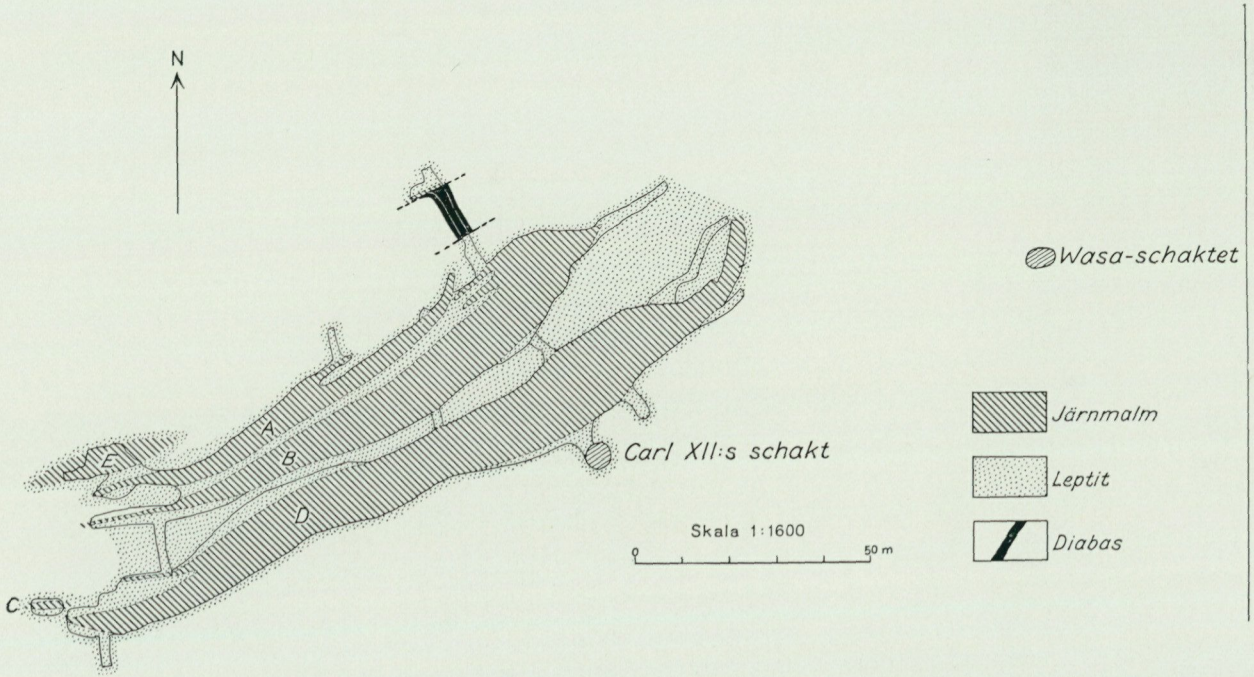


Fig. 187. 50 m. level in Bispberg-Storgruvan mine. (After G. T. Lindroth.) Legend: Järnmalm = Iron ore; Leptit = Leptite; Diabas = Diabase. The four ore bodies, A, B, C, and D, form parts of one ore layer, which has been folded and compressed.

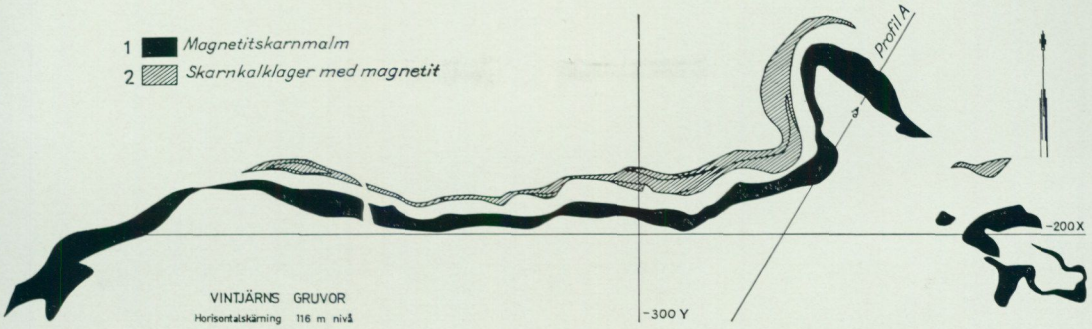


Fig. 188. 116 m. level in the Vintjärn mines, situated northeast of Falun in a leptite zone surrounded by svecofennian synorogenic granites. Both leptites and granites have been altered to veined gneisses as a result of the late svecofennian palingenesis, which has been strong in this region. The ore layers have been plastically deformed. Legend: 1. Magnetite-skarn iron ore; 2. Skarn-limestone-dolomite layer containing magnetite.

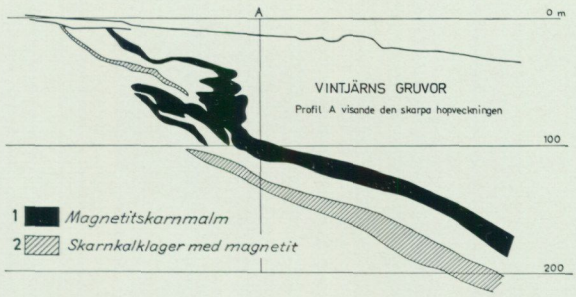


Fig. 189. Cross section through the iron ore layers in the Vintjärn mines. The plastic deformation is displayed in the upper part of this section. Legend: 1. Magnetite-skarn iron ore; 2. Skarn-limestone-dolomite layer containing magnetite.

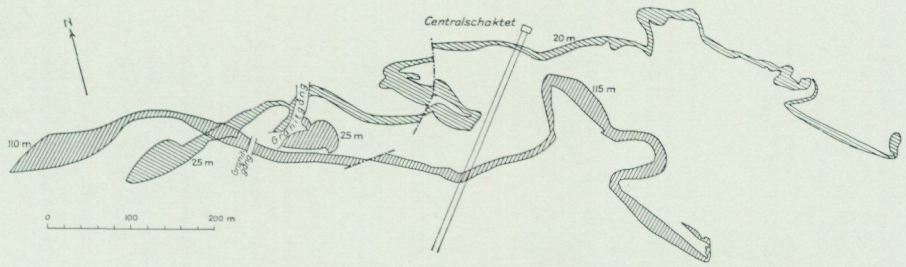


Fig. 190. Two levels: 20–25 m. and 110–115 m. in the main ore layer of the Vintjärn mines, showing the plastic deformation caused by the late svecofennian palingenic alteration of the ores and the surrounding rocks.

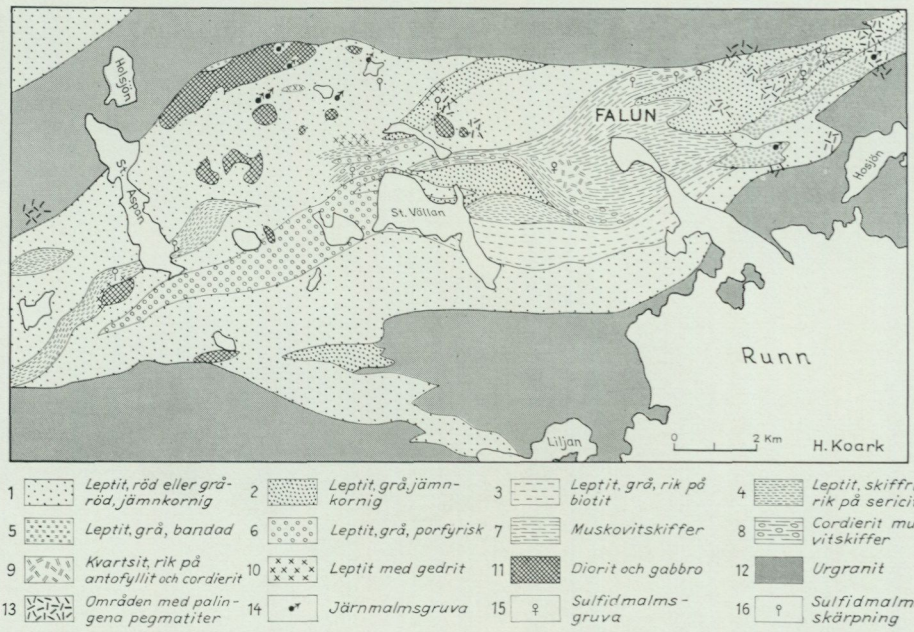


Fig. 191. Map of the Falun field. (After H. Koark.) Legend: 1. Leptite, red or greyish red, even-grained or porphyritic; 2. Leptite, grey, even-grained; 3. Leptite, grey, rich in biotite; 4. Leptite, schistose, rich in sericite; 5. Leptite, grey, bedded; 6. Leptite, grey, porphyritic; 7. Muscovite schist; 8. Cordierite-muscovite-schist; 9. Quartzite rich in anthophyllite and cordierite; 10. Leptite with gedrite; 11. Diorite and gabbro; 12. Svecofennian synorogenic granite; 13. Regions rich in late svecofennian palingenic pegmatites. 7, 8 and 9 are magnesia-metasomatic alteration products, as well as the gedrite in 10. The sulphide ores mined (Falun, Skyttåsen, and Näverberget are situated in anthophyllite- and cordierite-bearing quartzite.)

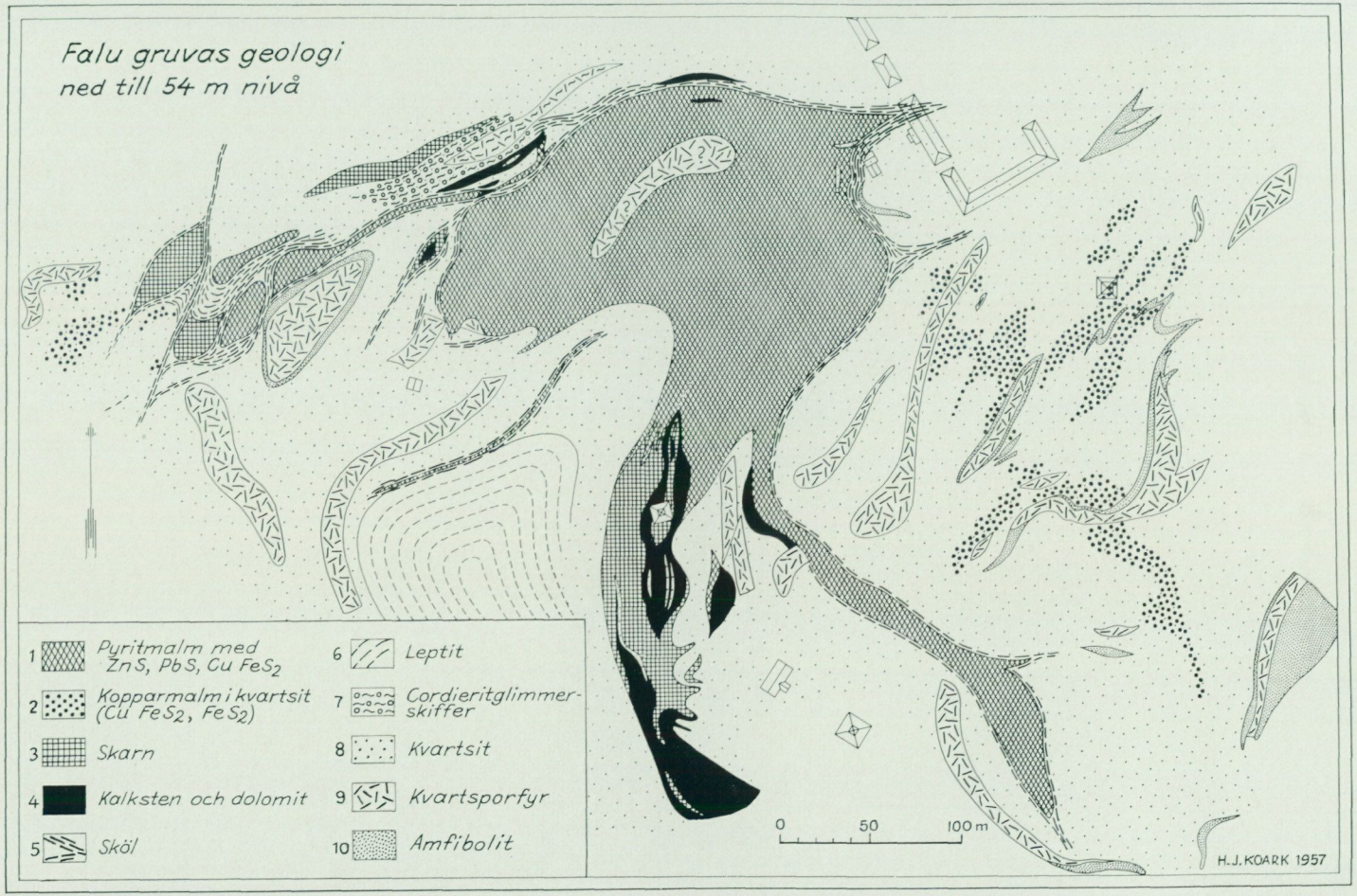


Fig. 192. Reconstruction of the geology of the Falun mine between the surface and 54 m. level. (After H. Koark.) Legend: 1. Pyrite ore with ZnS, PbS and $CuFeS_2$; 2. Copper ore in quartzite ($CuFeS_2$, FeS_2); 3. Skarn; 4. Limestone and dolomite; 5. Sköl; 6. Leptite; 7. Cordierite-micaschist; 8. Quartzite; 9. Quartzporphyry; 10. Amphibolite.

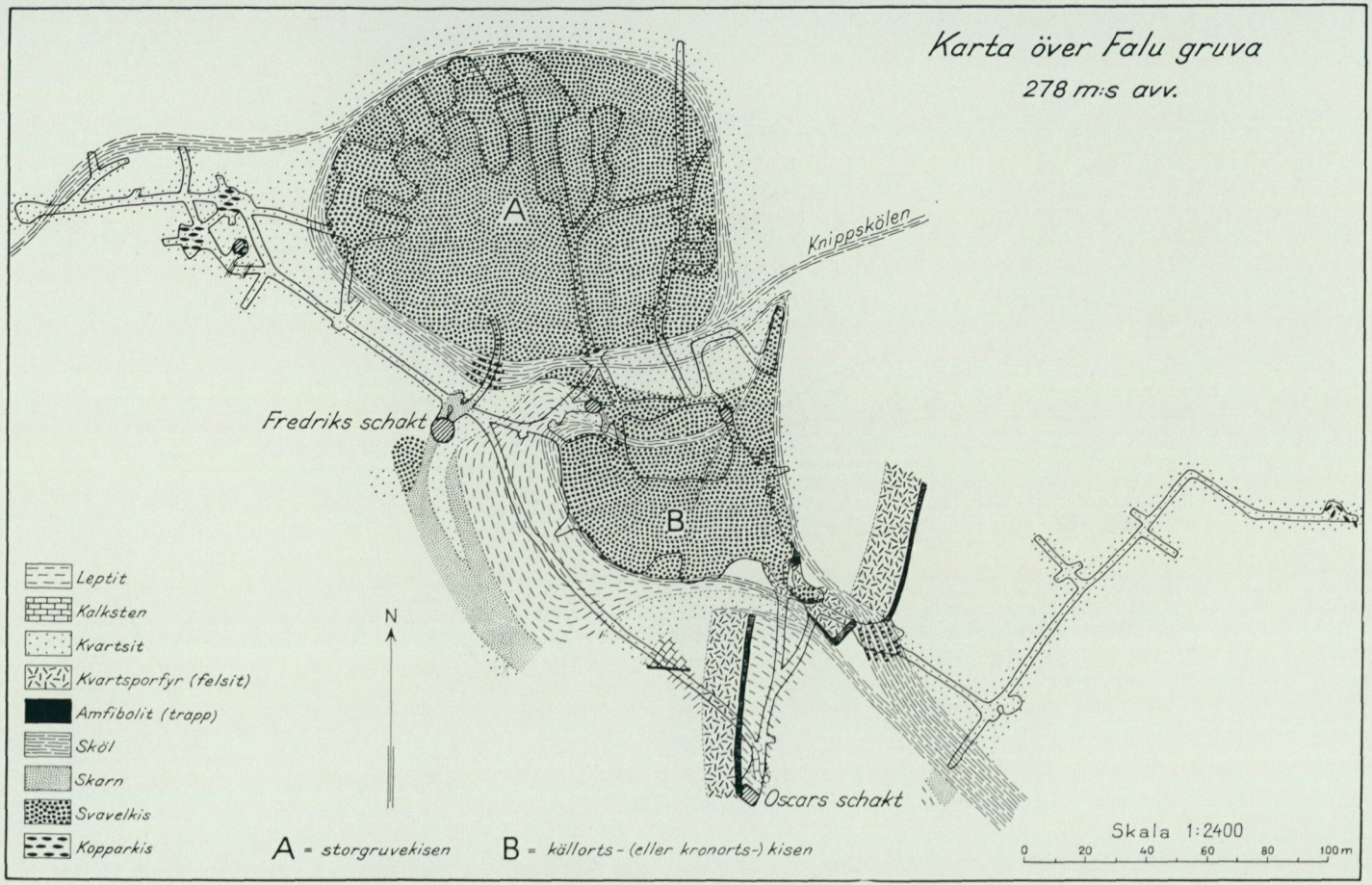


Fig. 193. 278 m. level in the Falun mine. (After S. Hjelmqvist.) Legend: Leptit = Leptite; Kalksten = Limestone and dolomite; Kvartsit = Quartzite; Kvartsporfyr (felsit) = Quartz porphyry; Amfibolit = Amphibolite; Sköl = Sköl; Skarn; = Skarn; Svavelkis = Pyrite; Kopparkis = Chalcopyrite. In order to find new sulphide ores beneath the Storgruvan and Källort ores, which stopped at 330 and 360 m., through prospecting investigations have been made on 440 and 600 m. levels. Only quartzites of metasomatic origin and containing very small concentrations of sulphide minerals were found, however.

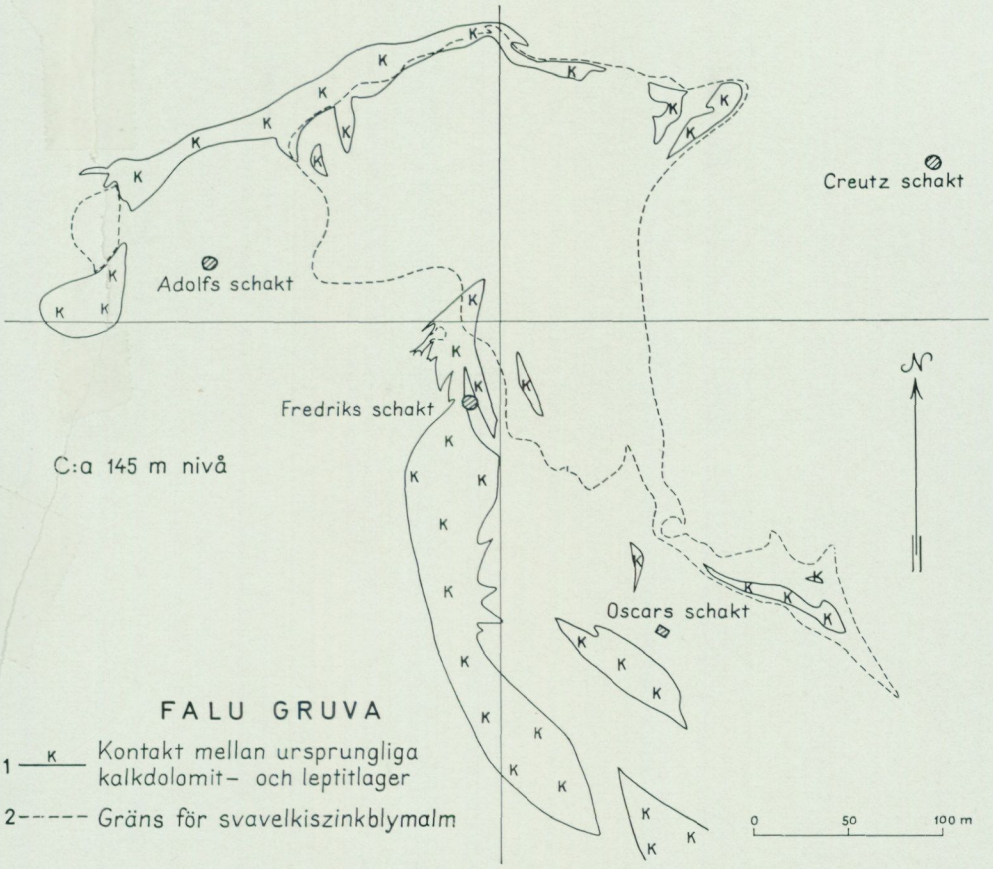


Fig. 194. The original limestone-dolomite bodies and the large concentrated sulphide ores on 145 m. level, Falun mine. (According to Elver Carlsson.) This figure gives an impression of the predominance of leptite over limestone-dolomite at the beginning of the magnesia-metasomatic alteration and the formation of the sulphide ores. Legend: 1. Contact between the original limestone-dolomite bodies and the surrounding leptite; 2. Limit of the compact zinc- and lead-bearing pyrite ore.

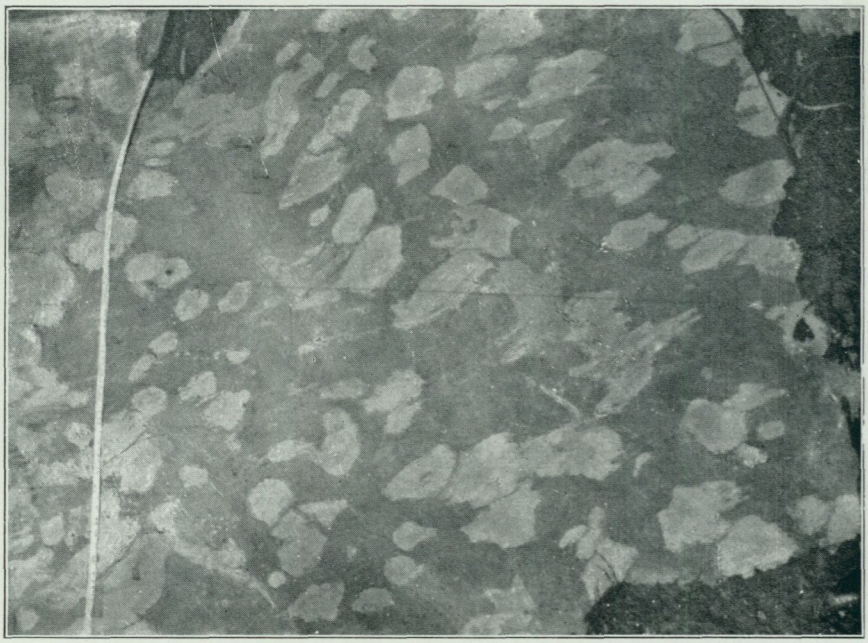


Fig. 195. Cordierite-mica-schist, Skyttgruvan mine west of Falun mine. Cordierite pale grey. (After P. Geijer.)

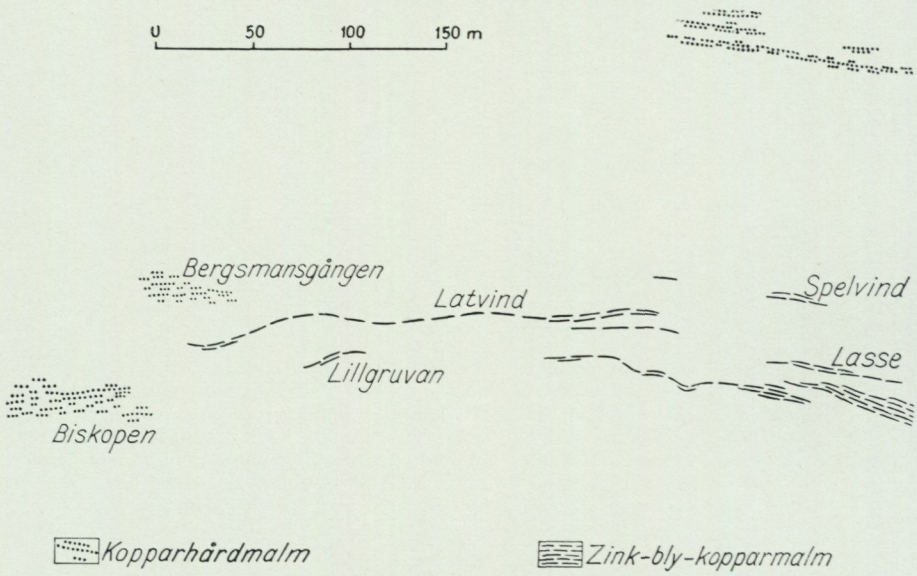


Fig. 197. The Garpenberg sulphide ores on 100 m. level, showing the copper ores in the quartzites of Överberget, Bergsmansgången, and Biskopen as well as the zinc-lead-copper ores in mica schists, quartzites, skarn, ophicalcite, or dolomite, and the weathered zinc-lead-copper ores. In Nya Kupp-gruvan and Rödgruvan more complex ores containing pyrrhotite and pyrite as well as zinc, lead, and copper

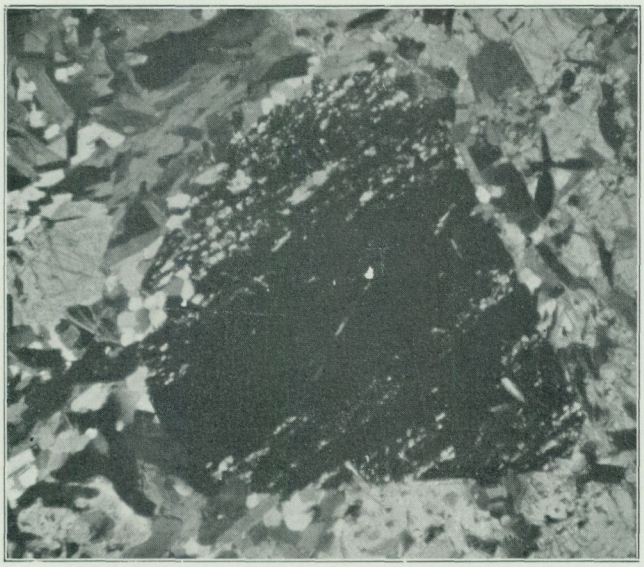
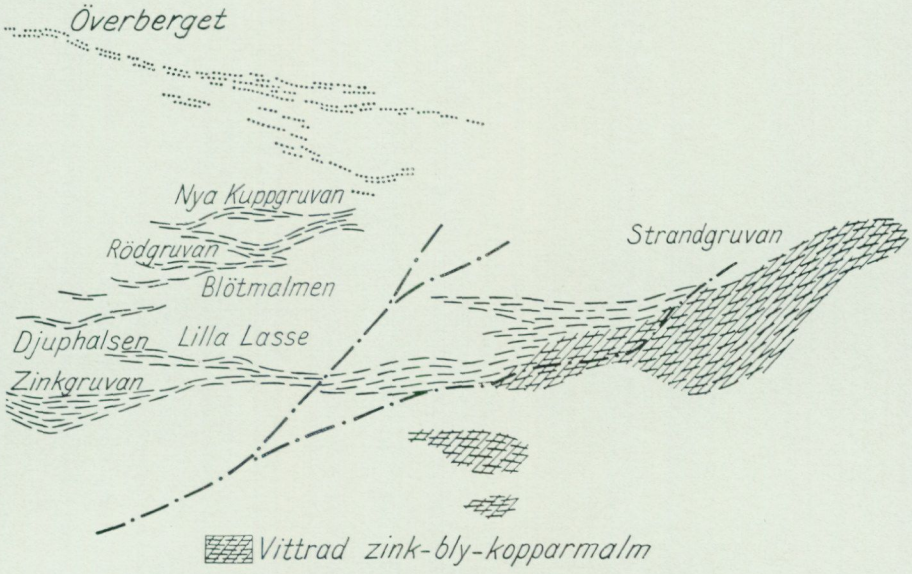


Fig. 196. Gahnite in cordierite and biotite. Näverberget west of Falun mine. Thin section + nic., magnification 16 ×. (After P. Geijer.)



sulphides have been mined. Several iron ores in a broad zone around the central sulphide deposits have been richly impregnated with sulphides. Legend: Koppar-hårdmalm = Copper ore in quartzite; Zink-bly-koppar-malm = Zinc-lead-copper ore; Vittrad zink-bly-kopparmalm = Weathered zinc-lead-copper ore. (After N. H. Magnusson.)

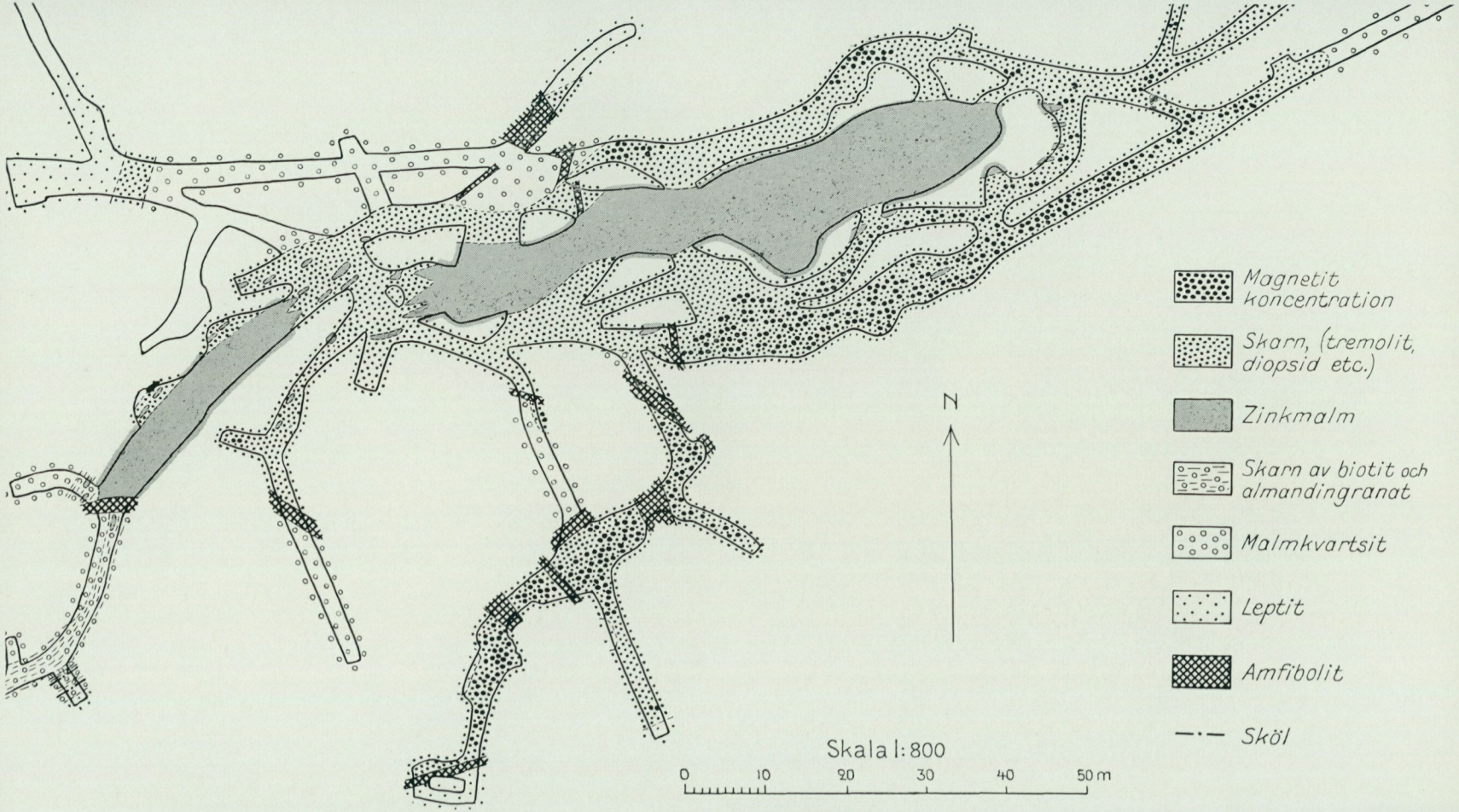


Fig. 198. 126 m. level in the Ryllshyttan mine. (After P. Geijer.) Legend: Magnetitkoncentration = Concentration of magnetite; Skarn (tremolit, diopsid etc.) = Skarn (tremolite, diopside); Zinkmalm = Zinc ore; Skarn av biotit och almandingranat = Skarn of biotite and almandite; Malmkvartsit = Ore quartzite; Leptit = Leptite; Amfibolit = Amphibolite; Sköl = Sköl. It seems clear to the author that the magnetite ores and their skarn (pyroxene, actinolite, and garnet) already existed when the sulphides invaded the central dolomite and altered the leptite to quartzites and to sköl zones rich in biotite and almandite. Simultaneously with these magnesia-metasomatic alterations much of the older iron ore skarn was changed to tremolite and diopside.

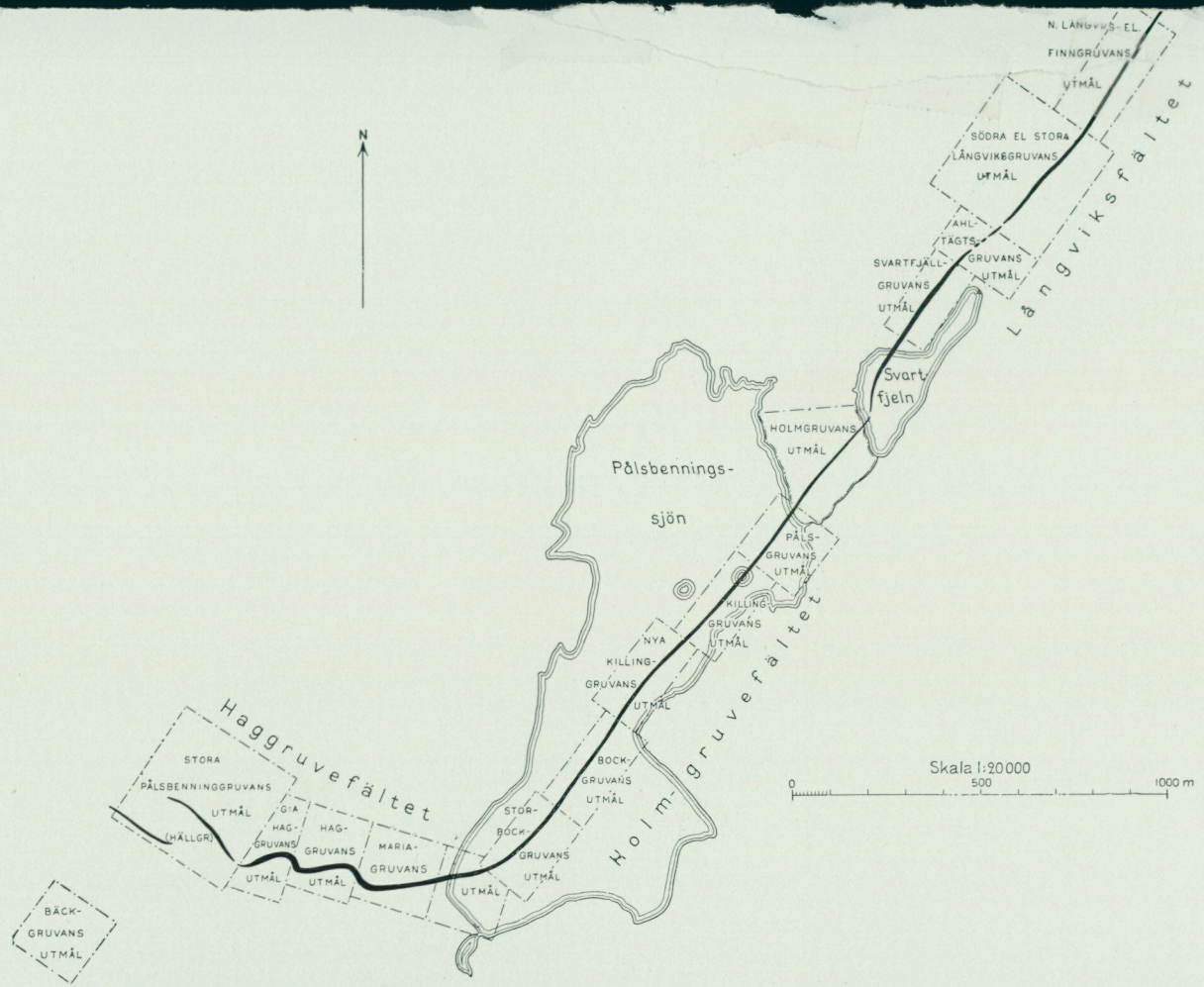


Fig. 199. Map of the manganiferous iron ores in the Långvik, Holmgruvan and Haggruvan fields in the Garpenberg region. The ores in Lake Pålsbenningssjön have been located by several drill holes but are not mined. The leptite nearest to the ore layer alternates with limestone-dolomite layers often rich in skarn minerals of the same type as in the central part of the Haggruvan field (Fig. 200). (After G. T. Lindroth.)

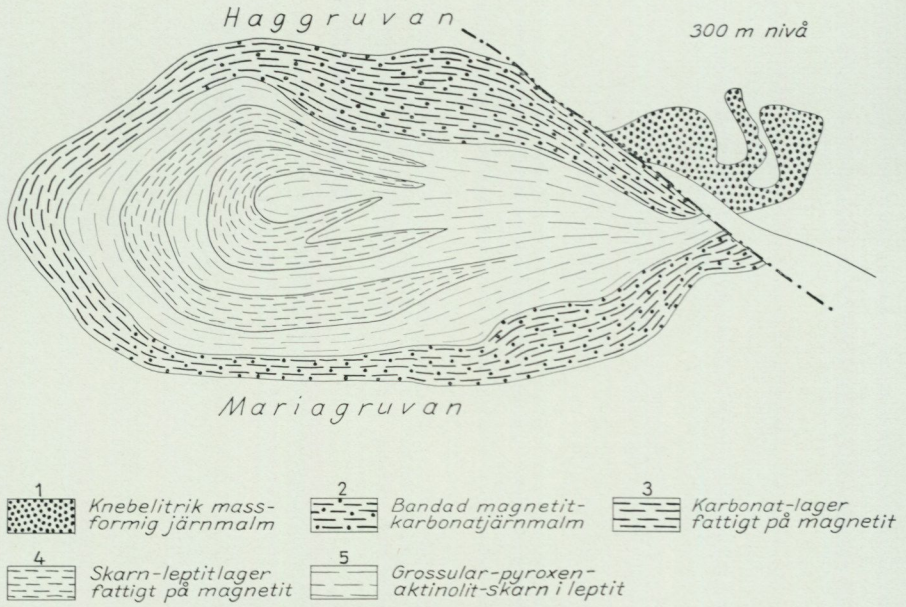


Fig. 200. 300 m. level in the Haggruvan and Mariagruvan mines in the Haggruvan field, Garpenberg region. (After N. H. Magnusson.) Manganiferous magnetite-carbonate ores with small amounts of knebelite predominate. In addition are found more concentrated magnetite ores rich in knebelite. The magnetite-carbonate ore layer has been folded to a U with parallel legs. The ores mined occur in the legs. In the knee the folded ore layer is poor and not worth mining. Inside the ore layer are situated two skarn-leptite layers very poor in magnetite layers and around them a leptite with grossularite-diopside-tremolite skarn predominates. Legend: 1. Manganiferous magnetite ore rich in knebelite; 2. Magnetite-carbonate iron ore rich in manganese; 3. Carbonate-leptite layer poor in magnetite; 4. Skarn-leptite layer poor in magnetite; 5. Grossularite-diopside-tremolite-skarn in leptite.

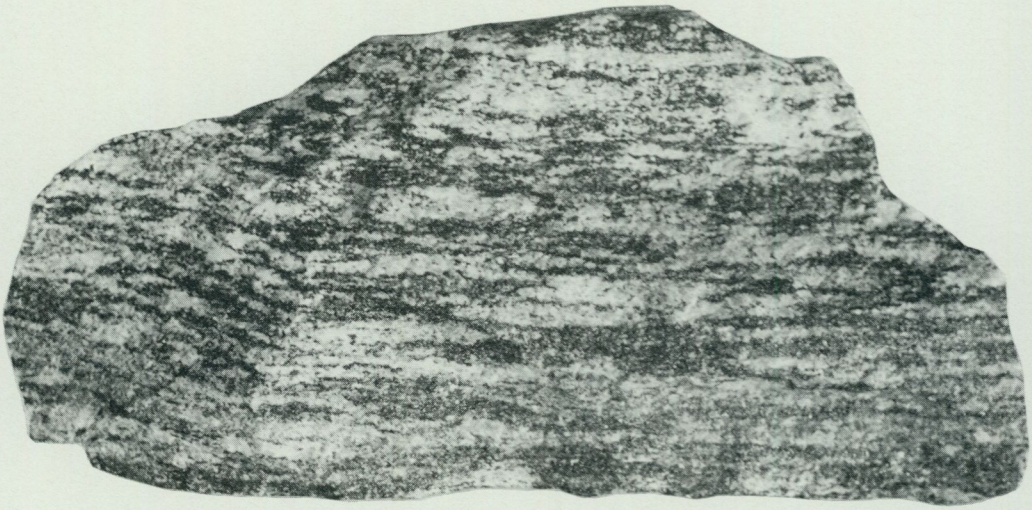


Fig. 201. The photo shows that the magnetite-carbonate ores in the Haggruvan and Mariagruvan mines in the Haggruvan field have a good parallel orientation of the magnetite grains. (After G. T. Lindroth.)

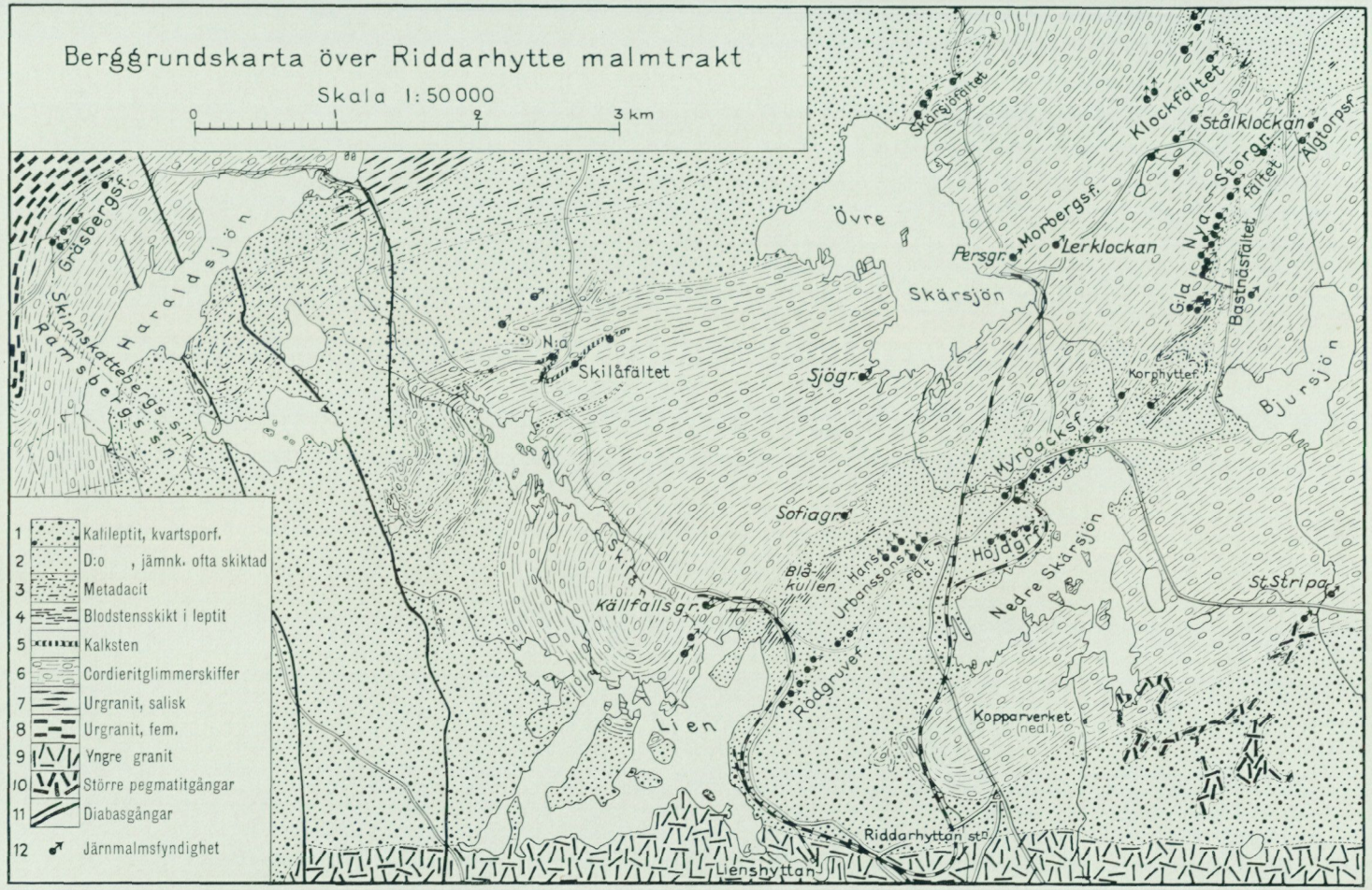


Fig. 202 Geological map of the Riddarhyttan region. (After P. Geijer.) Legend: 1. Potassic leptite (quartz-porphyry); 2. Potassic leptite, evengrained, often bedded; 3. Metadacite; 4. Hematite layers in leptite; 5. Limestone and dolomite; 6. Cordierite-mica schist; 7. Svecofennian synorogenic granite, salic; 8. Svecofennian synorogenic granite, femic; 9. Late svecofennian palingenic granite; 10. Late svecofennian palingenic pegmatite; 11. Diabase dike; 12. Iron mine.

Fig. 203. Mica schist with cordierite individuals (weathered and dark in the photo), Riddarhyttan region. (After P. Geijer.) In this region the cordierite- and locally almandite-bearing mica schists have got an extensive areal distribution, and large parts of the already existing sedimentary iron ores have been subjected to metasomatic alterations implying the formation of new minerals, among these sulphides such as chalcopyrite and cobaltite.

Fig. 204. Ophicalcite: serpentine pseudomorphs after humite minerals in dolomitic limestone. Natural size. Riddarhyttan region. (After P. Geijer.) Ophicalcite is common in the limestone-dolomite remnants in the sulphide ores of the Falun type and also frequent where older iron ores associated with limestone and dolomite have been subjected to metasomatic alterations caused by the invasion of sulphides.

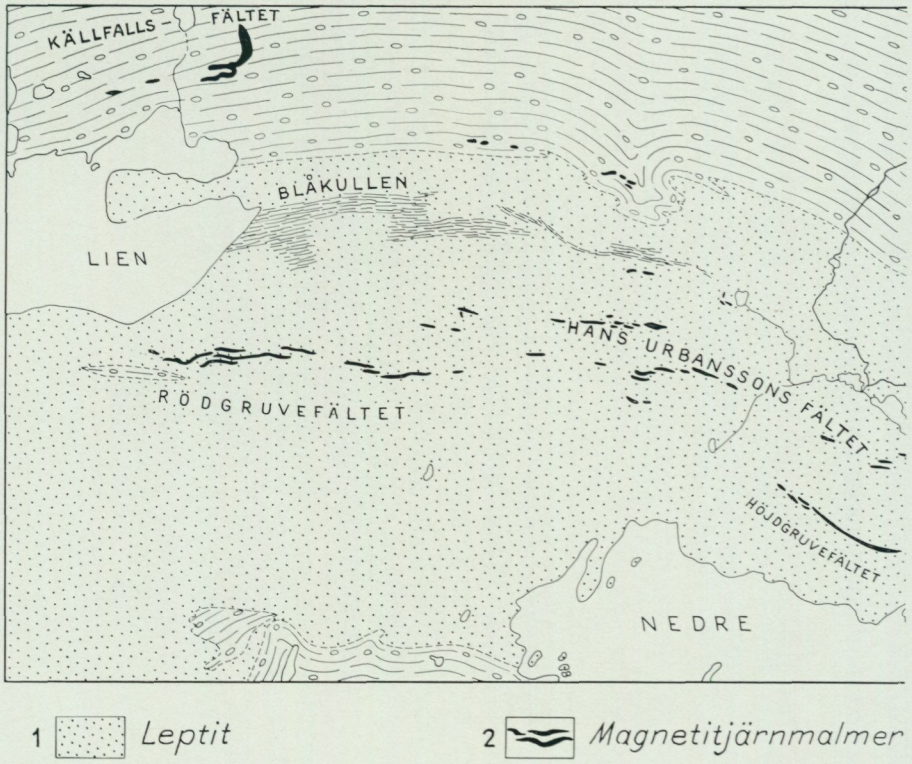


Fig. 205. Map of the western part of the central iron ore zone in the Riddarhyttan region including the skarn-magnetite ores in the Rödgruvan and Höjdgruvan fields, which show low percentages of manganese, further the skarn magnetite ores in the Hans Urbansson field, the leptite with interstratified layers of quartz-hematite ores in the Blåkullen area, and the talc-anthophyllite magnetite ores in the Källfallet field. (After P. Geijer.) Legend: 1. Leptite; 2. Magnetite iron ore; 3. Hematite iron ore; 4. Cordierite-mica schist.

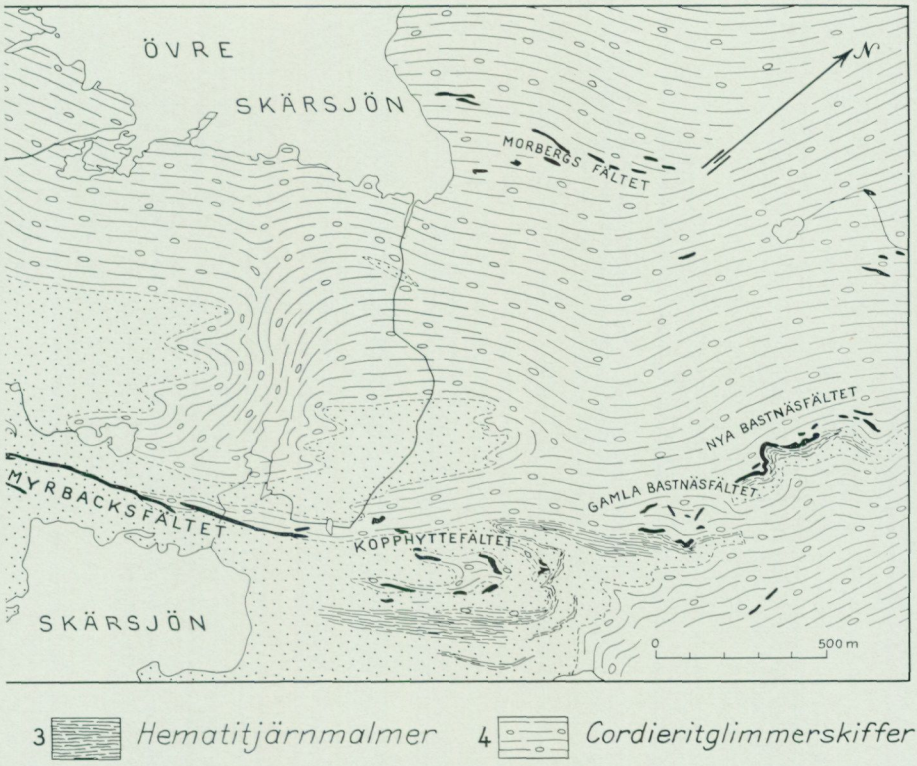


Fig. 206. Map of the eastern part of the central iron ore zone in the Riddarhyttan region including the metasomatically altered quartz-banded ores in the Myrback field, the skarn-magnetite ores, and the quartz-hematite ores of the Blåkullen type in leptite. (After P. Geijer.) Legend: see Fig. 205.

Fig. 207. Iron ore of the Myrback type: siliceous magnetite ore. Riddarhyttan region. 2/3 of nat. size. (After P. Geijer.) The original quartz banding has been disturbed during the period of intense metasomatic alteration.

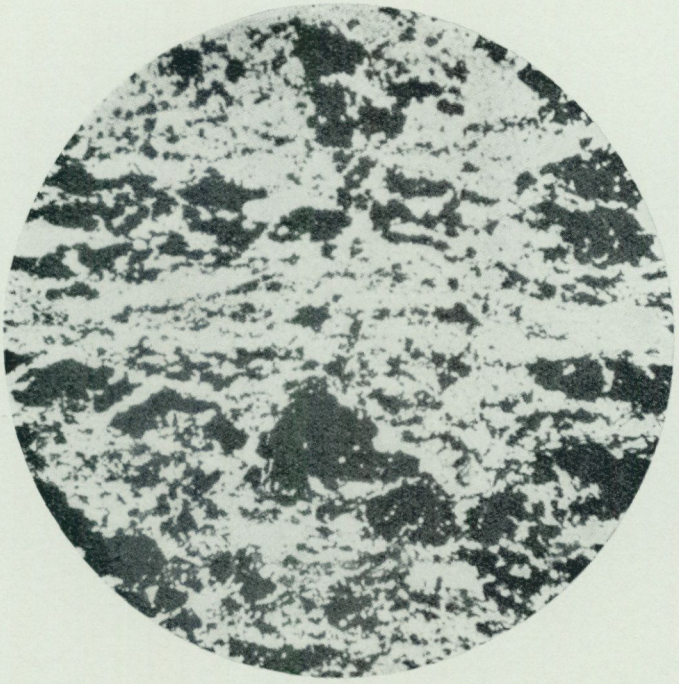


Fig. 208. Very poor ore of the Myrback type. Riddarhyttan region. Thin section, ord. light, magnification 20 ×. Magnetite black, quartz and occasional almandite white. (After P. Geijer.)

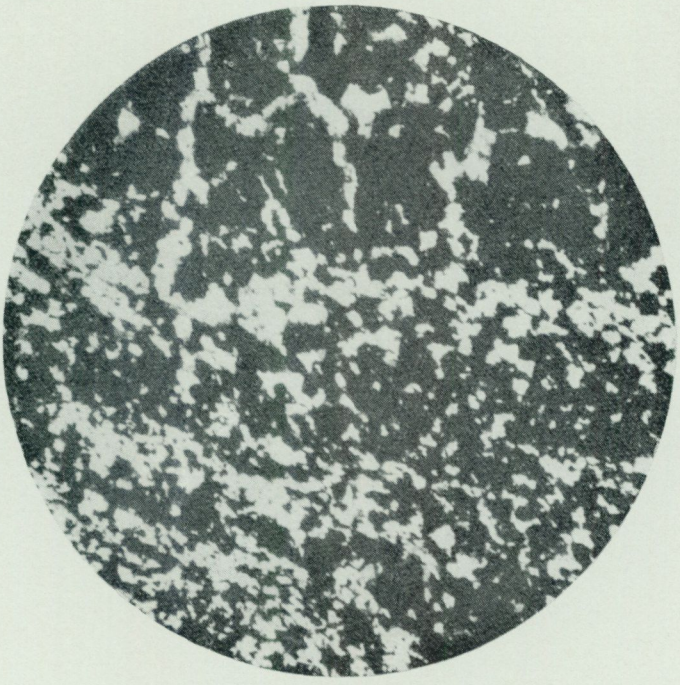


Fig. 209. Iron ore of the Myrback type, Riddarhyttan region. Thin section, ord. light, magnification 20 ×. Magnetite black, quartz white. (After P. Geijer.)

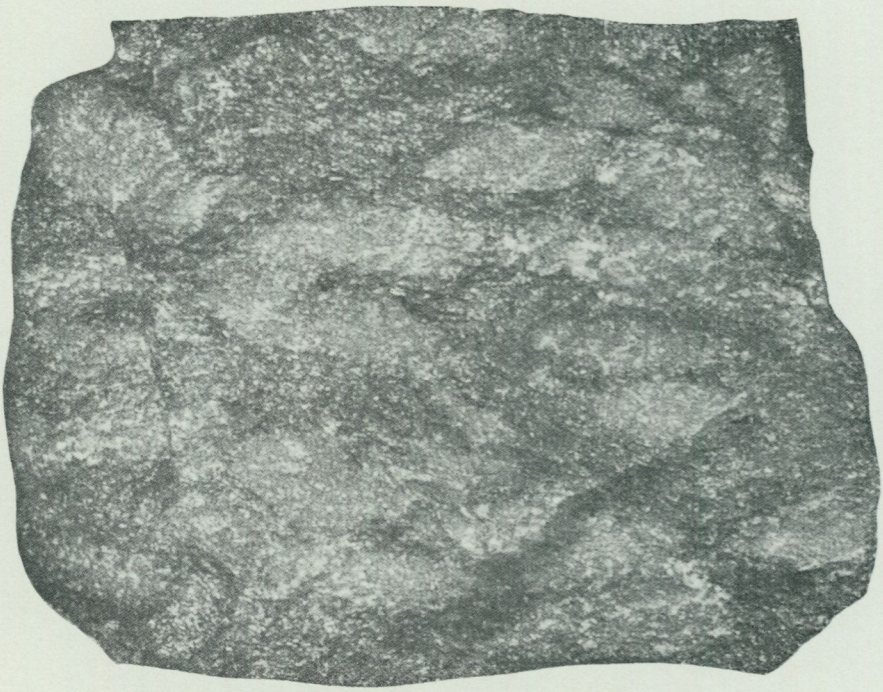


Fig. 210. Quartzite with large spots (lighter in the photo) of almandite. Myrback mines. Riddarhyttan region. (After P. Geijer.)

Fig. 211. Ore of the Källfallet type. Nat. size. Magnetite ore with sun-like spots of anthophyllite. Riddarhyttan region. (After P. Geijer.)

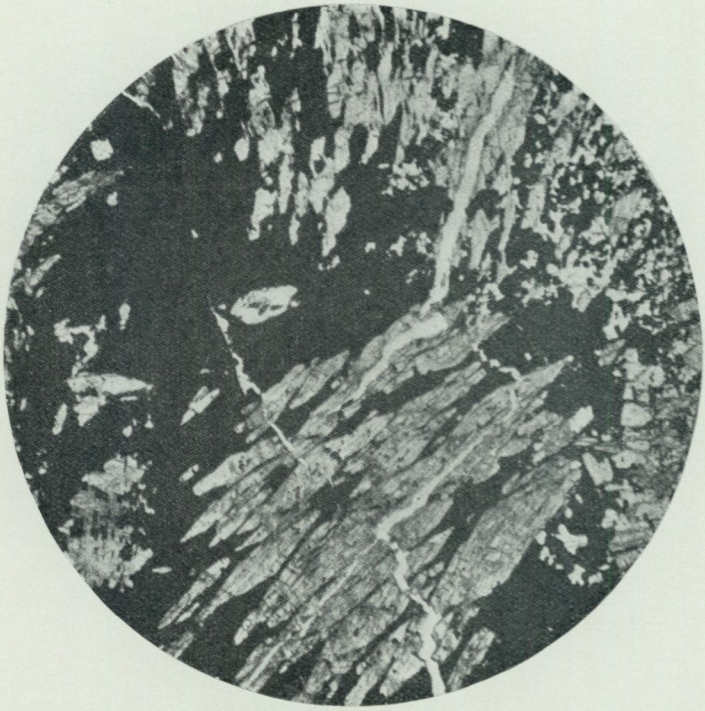


Fig. 212. Ore of the Källfallet type. Källfallet mine. Thin section, ord. light, magnification 20 ×. Magnetite black, anthophyllite pale grey. Riddarhyttan region. (After P. Geijer.)

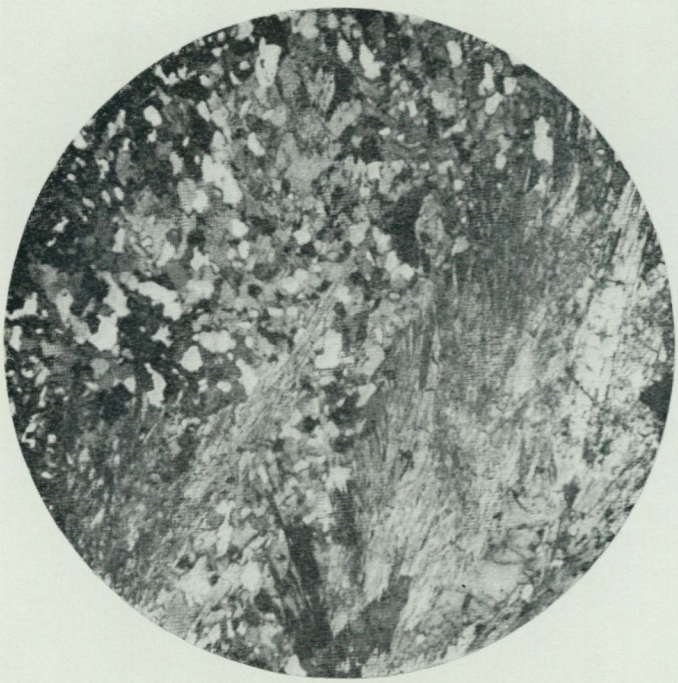


Fig. 213. Cordierite-anthophyllite-quartzite, Källfallet mine. Thin section, + nic, magnification 20 ×. Riddarhyttan region. (After P. Geijer.)

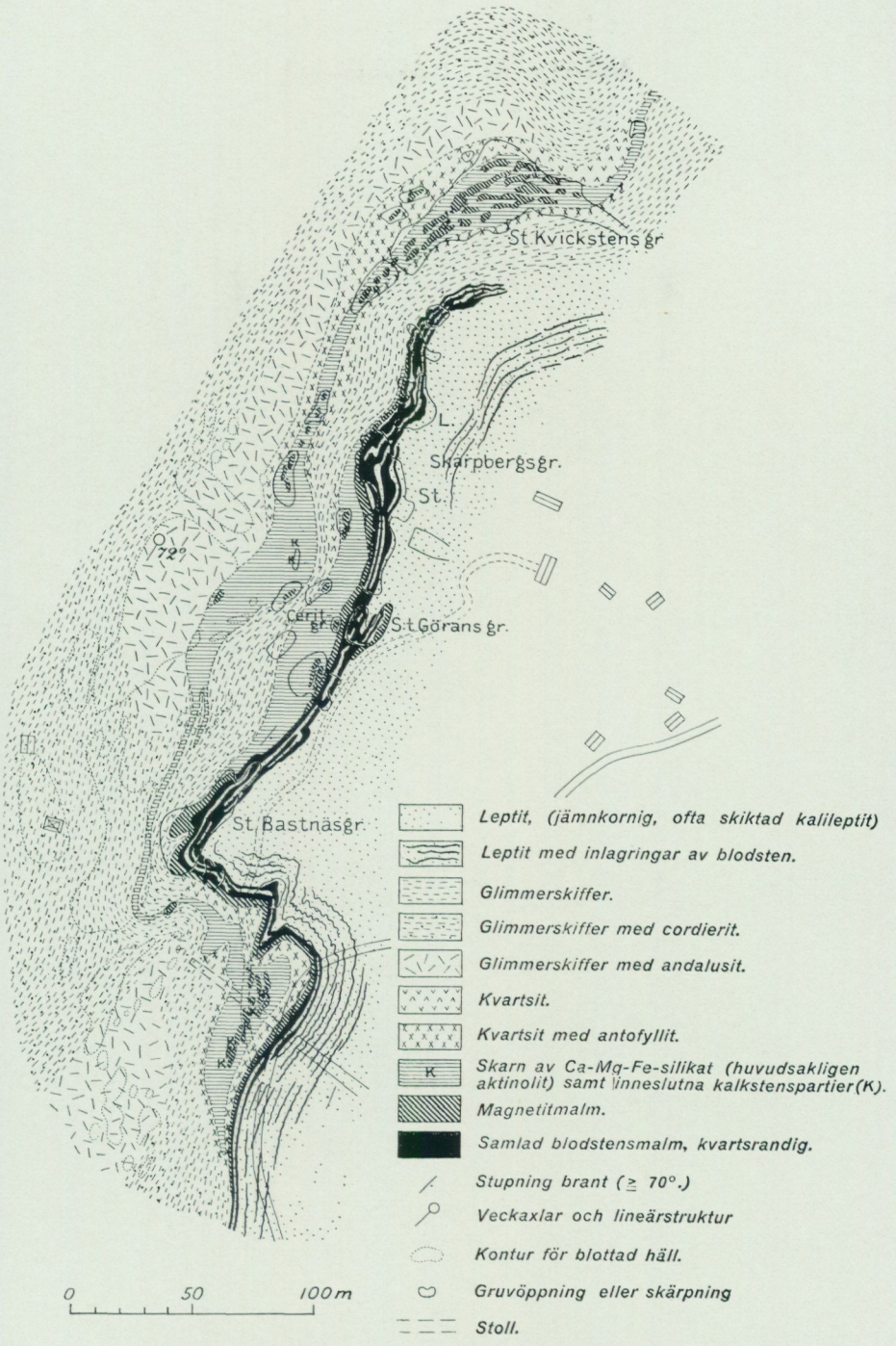


Fig. 214. Geological map of Nya Bastnäs field. Riddarhyttan region. (After P. Geijer.) Legend: Leptit (jämnkornig, ofta skiktad kalileptit) = Leptite (even-grained, often bedded potassic leptite); Leptit med inlagringar av blodsten = Leptite with interstratifications of hematite; Glimmerskiffer = Mica schist; Glimmerskiffer med cordierit = Mica schist with cordierite; Glimmerskiffer med andalusit = Mica schist with andalusite; Kvartsit = Quartzite; Kvartsit med antofyllit = Quartzite with anthophyllite; Skarn med Ca-Mg-Fe-silikat (huvudsakligen aktinolit) samt inneslutna kalkstenspartier (K) = skarn of Ca-Mg-Fe-silicates (essentially actinolite) and remnants of limestone and dolomite (K); Magnetitmalm = Magnetite ore; Samlad blodstensmalm, kvartsrandig = Rich hematite ore, quartsbanded.

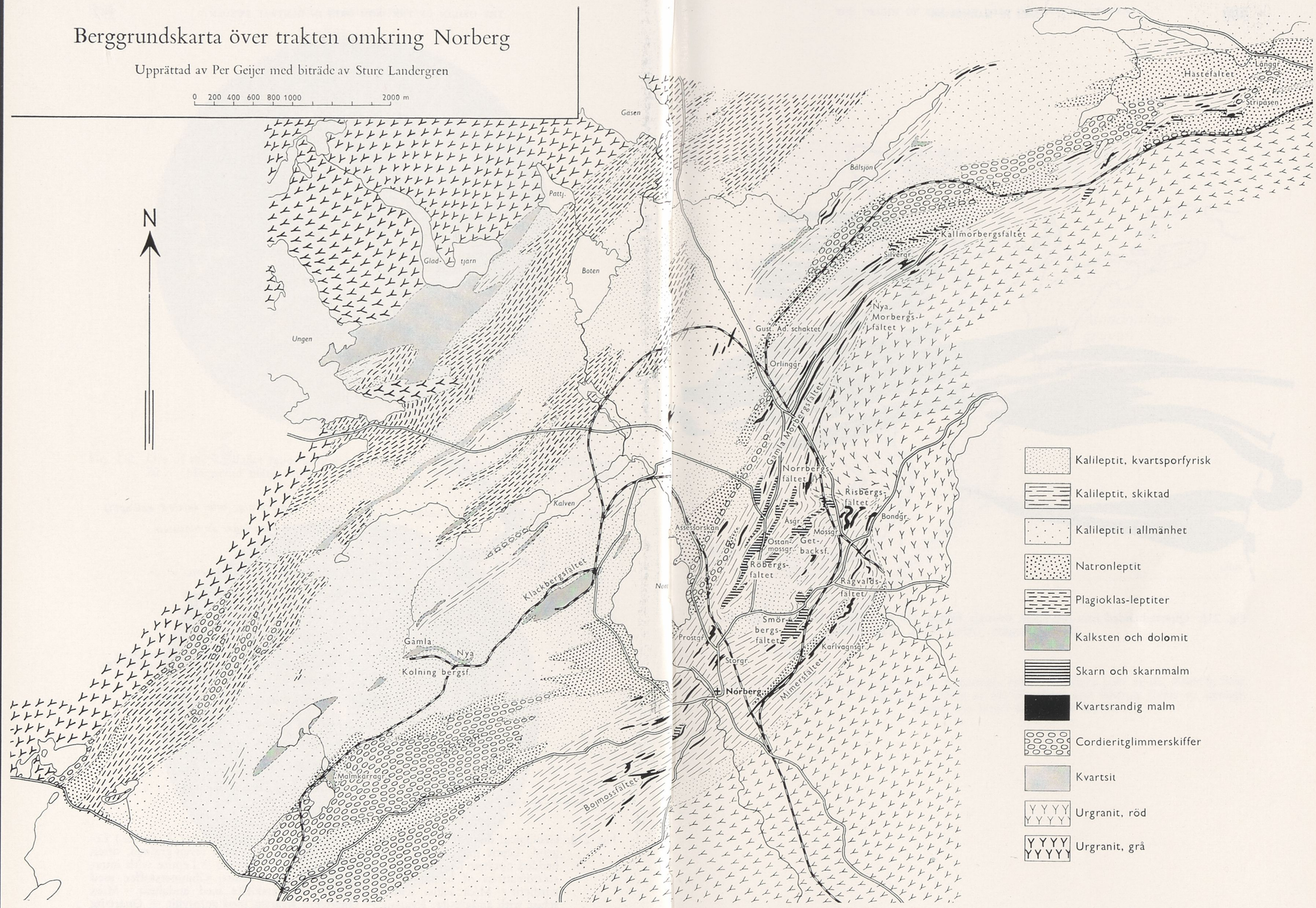


Fig. 215. Geological map of the Norberg region. (After P. Geijer.) Legend: Kalileptit, kvartsporfyrisk = Potassic leptite, originally quartz porphyry; Kalileptit, skiktad = Potassic leptite, bedded; Kalileptit i allmänhet = Potassic leptite in general; Natronleptit = Sodic leptite; Plagioklasleptiter = Plagioclase leptites; Kalksten och dolomit = Limestone and dolomite; Skarn och skarnmalm = Skarn and skarn iron ore; Kvartsrandig malm = Quartz-banded iron ore; Cordieritglimmerskiffer = Cordierite-mica schist; Kvartsit = Quartzite; Urgranit, röd = Red Svecofennian synorogenic granite; Urgranit, grå = Grey Svecofennian synorogenic granite.

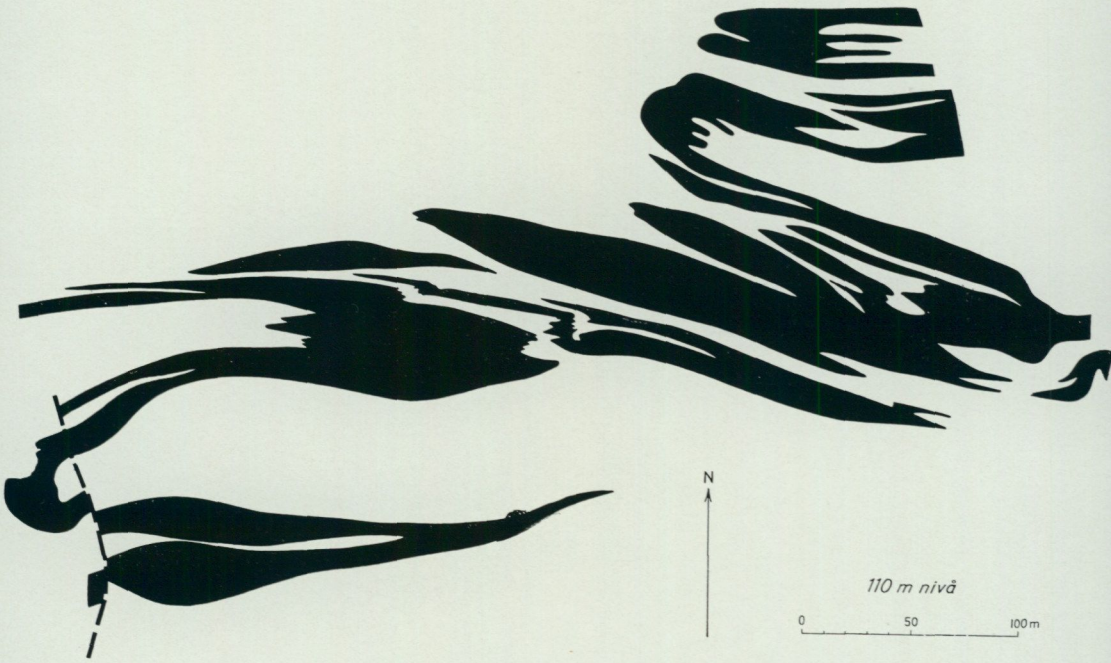


Fig. 216. Quartz-banded iron ore layer, strongly folded. 110 m. level in the Norrberg field, Norberg region. (After N. H. Magnusson.)

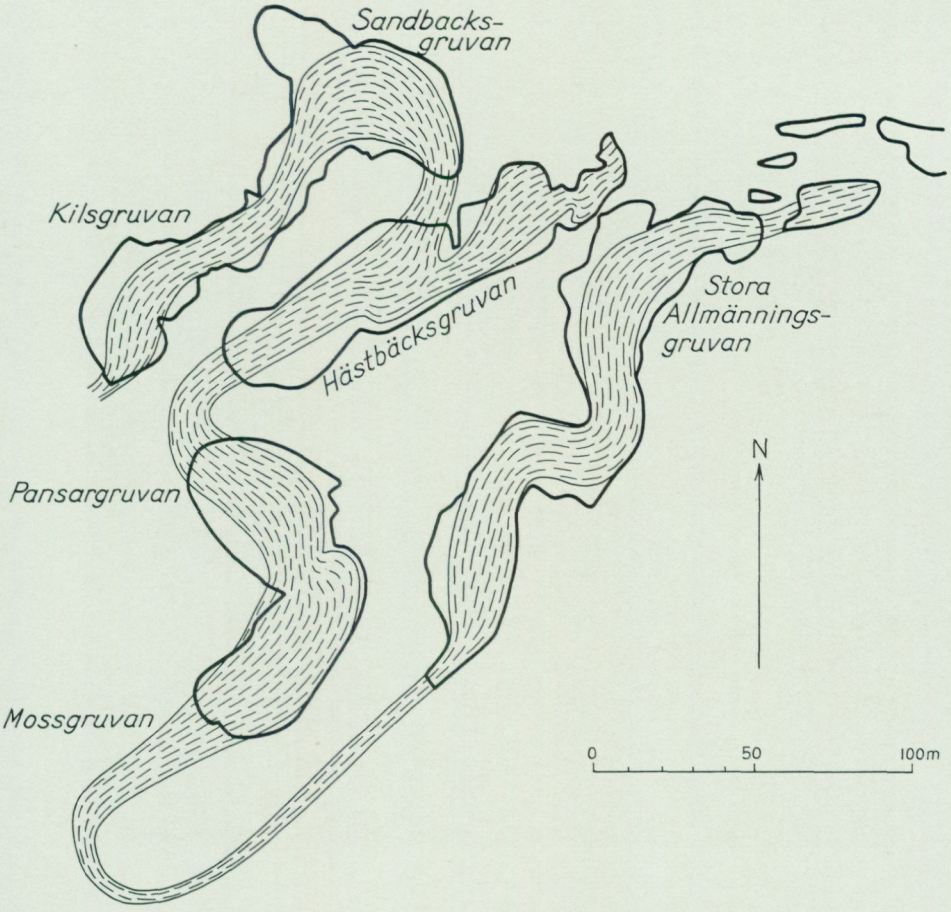


Fig. 217. Quartz-banded iron ore layer, strongly folded. Western part of the Risberg field. (After N. H. Magnusson.) Only in the Norrberg and Risberg fields so strongly folded ore layers have been found.

Fig. 218. The ores of the Nygruvan mine in the Norrberg field, Norberg region, are typical quartz-banded iron ores with narrow interlayering of hematite and quartz, as shown by the photo. The quartz has often a reddish colour produced by small scales of hematite. Occasional skarn minerals are garnet and epidote. Locally and especially towards the ore boundaries the hematite has been altered to magnetite. The quartz has locally assembled to irregular aggregates of coarse-grained white masses containing isolated larger flakes of hematite. (After N. H. Magnusson.)

Fig. 219. The ores of the Bondgruvan mine in the Risberg field, Norberg region, are principally of the same quartz-banded types as in the Nygruvan mine (Fig. 218). Locally the Bondgruvan ore has been magnesia-metasomatically altered to a skarn-magnetite ore and a skarn rich in talc. The banding has often been preserved, and remnants of the original quartz-banded ore have, also been found in the skarn ore. The photo above shows a sample of quartz-banded iron ore in which the quartz layers have been replaced by talc. (After N. H. Magnusson.)

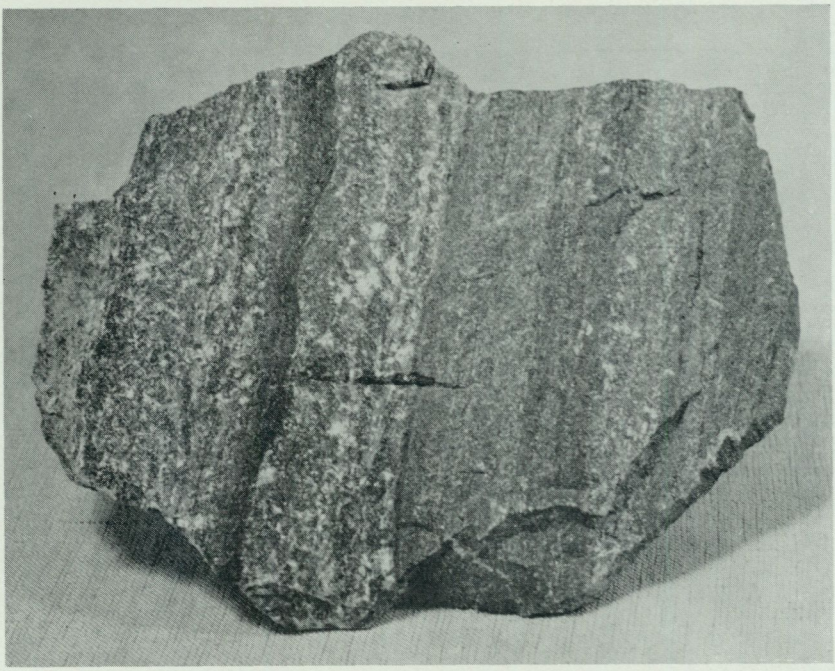


Fig. 220. The ores of the Kallmorberg mines in the Norberg region graduate from magnetite iron ores with magnetite irregularly distributed in dolomite or in skarn masses to banded types. The latter vary from quartz-banded hematite ores of the usual type to dolomite with layers of skarn, quartz, and magnetite. The magnetite is often accompanied by hematite, and the quartz has sometimes a reddish colour. In the dominating magnetite-skarn iron ores small remnants of quartz-banded iron ores have been frequently found. These mines give good evidence of the opinion that the iron content in the skarn iron ores have been derived from original sedimentary ores. The photo shows a sample of the banded dolomite-skarn iron ore, which in one direction passes into massive skarn iron ore, and in another direction into ore rich in hematite and quartz. (Photo N. H. Magnusson.)

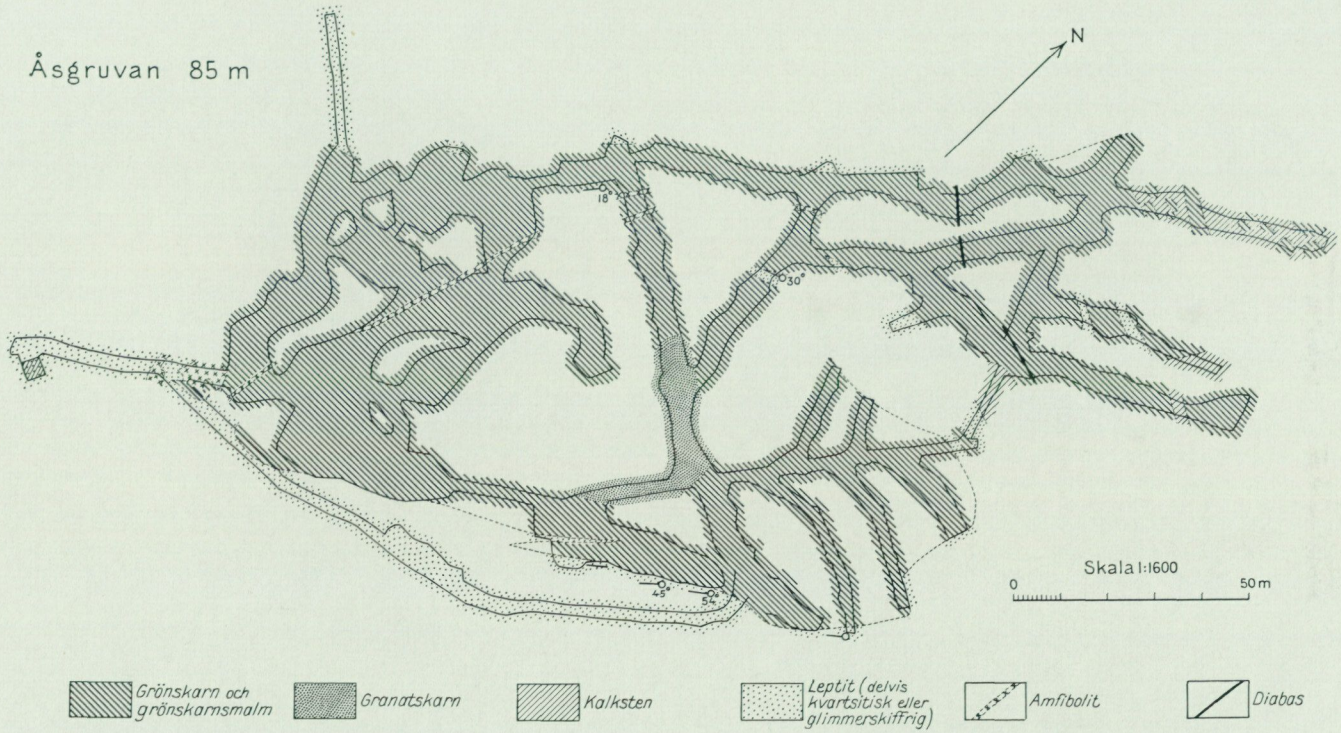


Fig. 221. Map of 85 m. level in the Åsgruvan mine in the Getback field, Norberg region. Legend: Grönskarn och grönskarnmalm = Skarn and magnetite ore with skarn; Granatskarn = Skarn with garnet; Kalksten = Limestone and dolomite; Leptit (delvis kvartsitisk eller glimmerskiffrig) = Leptite, in part altered to quartzite or mica schist; Amfibolit = Amphibolite; Diabas = Diabase. (After P. Geijer.)

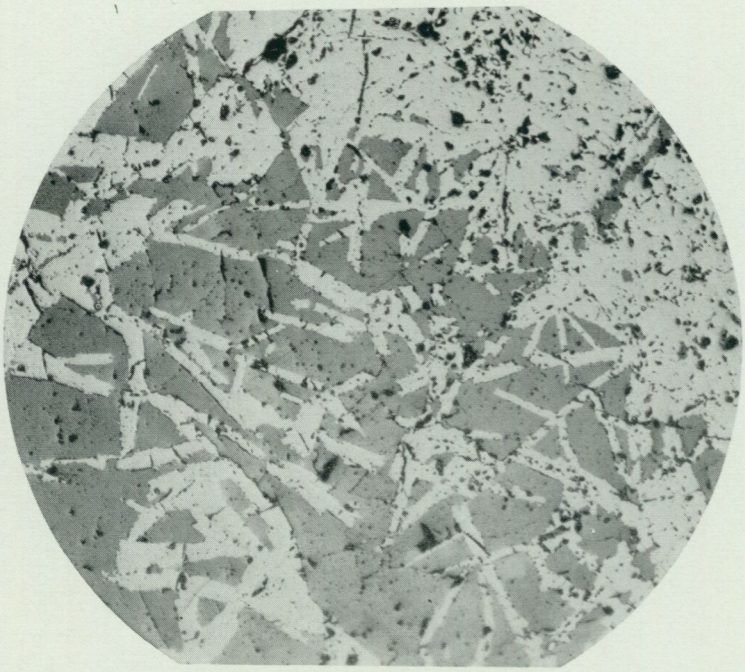


Fig. 222. Polished section of lamellar magnetite in skarn. Magnification 70 ×. Åsgruvan mine in the Getback field, Norberg region. The lamellar magnetite has been developed by alteration of original hematite. (After P. Geijer.)

Fig. 223. Polished section of skarn iron ore etched with conc. HCl. Magnification 70 ×. Åsgruvan mine in the Getback field, Norberg region. Magnetite aggregates, composed of lamellar crystals the mineral of which have originally been hematite. (After P. Geijer.)

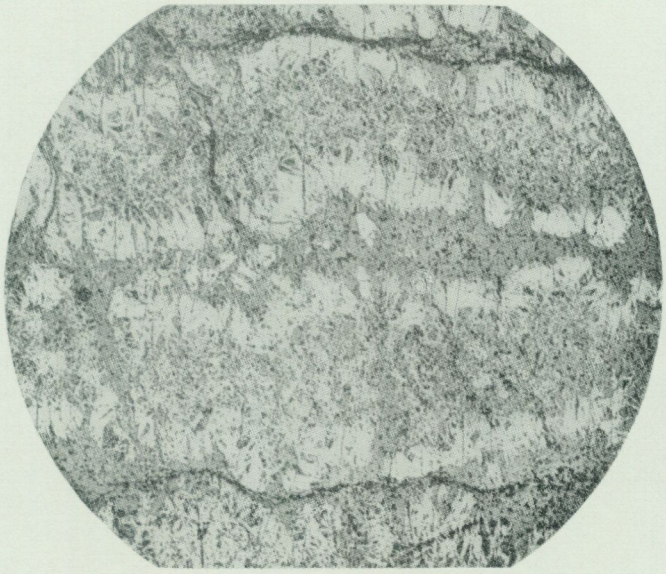


Fig. 224. Polished section of banded skarn iron ore from Åsgruvan mine in the Getback field, Norberg. Magnification 10 ×. The ore is composed of lamellar magnetite, compact in the margins of the ore bands and mixed with skarn silicates along their central parts. (After P. Geijer.) The author has locally found banding in the skarn iron ores in the Åsgruvan mine, even where lamellar magnetite is lacking.

Fig. 225. Skarn-banded magnetite iron ore. Thin section, ord. light, magnification 20 ×. Magnetite black and actinolite skarn white. Långgruvan mine in the Häste field, Norberg region. (After P. Geijer.) There has been, as found by the author all transitions between such banded skarn ores and more massive types. Here and there quartz-banded ores have also been found, locally with hematite, and in the Springa mine in the neighbourhood a quartz-banded hematite ore of the usual type has been mined. The author has got the impression that the larger skarn iron ores in this mine have been derived from sedimentary ores with lower contents of iron. There has occurred a rearrangement of iron material. Magnesia-metasomatic processes have also contributed to the concentration of the ore material.

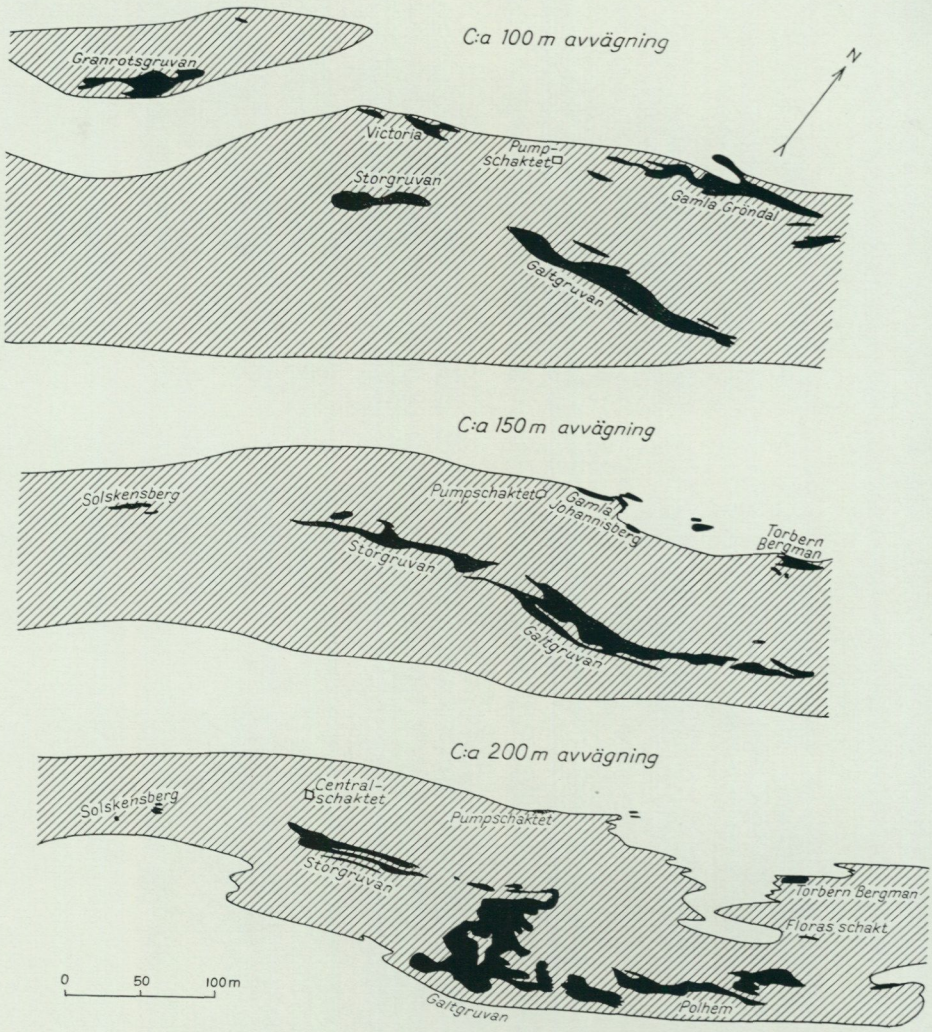


Fig. 226. 100, 150 and 200 m. levels in the Klackberg field, Norberg region. Manganiferous iron ores (black) in dolomite (hatching). The original ore layers have been deformed in the more plastic dolomite. (After P. Geijer.)

Fig. 227. Manganiferous iron ore. Thin section, ord. light, magnification 20 ×. Magnetite (black) in iron-manganese-carbonate with magnesium and calcium. Gamla Kolningberg mines in the Kolningberg field, Norberg region. (After P. Geijer.)

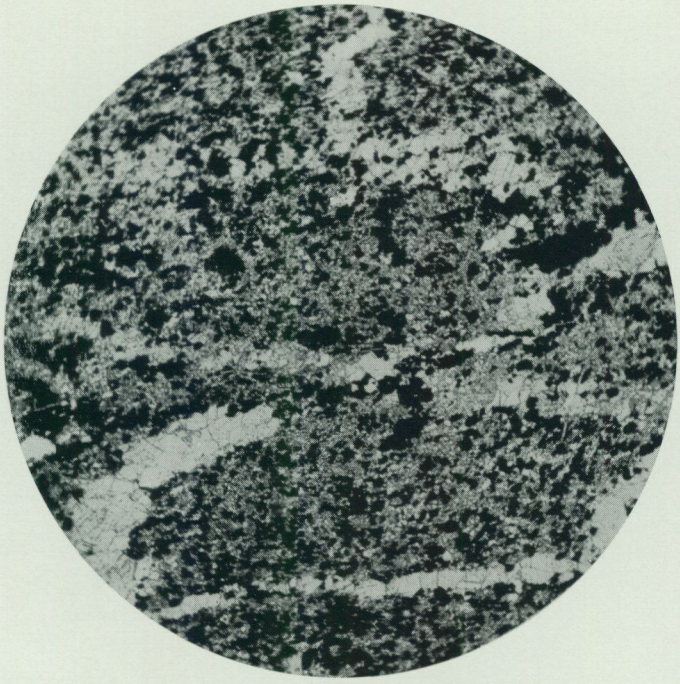


Fig. 228. Manganiferous iron ore. Thin section, ord. light, magnification 20 ×. Magnetite (black) in iron-manganese-carbonate with magnesium and calcium (grey) and veinlets of dolomite (white). Nya Kolningberg mines in the Kolningberg field, Norberg region. (After P. Geijer.)

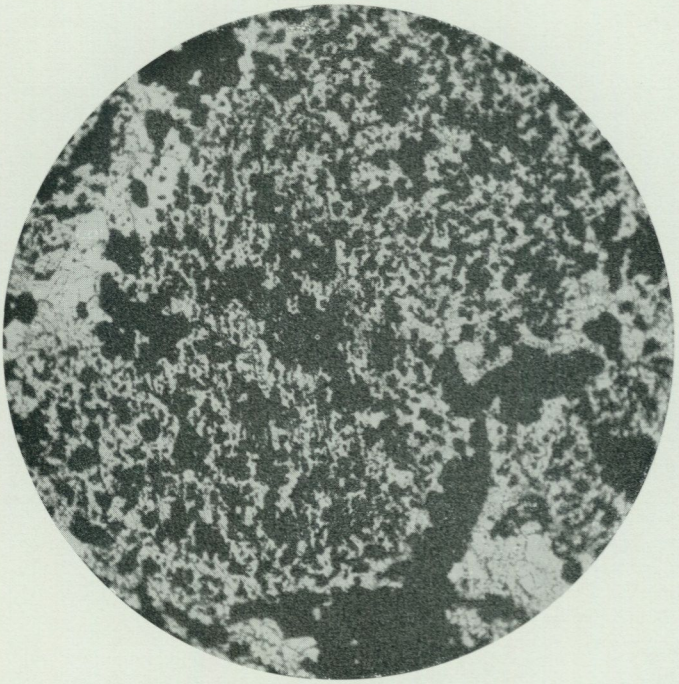


Fig. 229. Manganiferous iron ore. Thin section, ord. light, magnification 40 ×. The photo shows the development of magnetite (black) along structural faces in large grains of iron-manganese carbonate with magnesium and calcium. Klackberg mines in the Klackberg field, Norberg region. (After P. Geijer.)

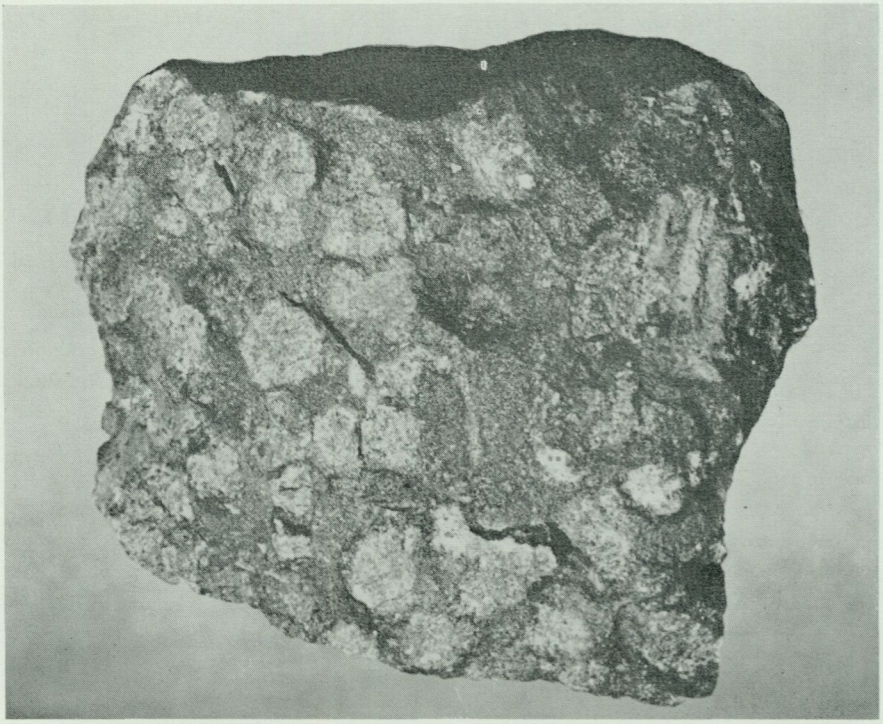


Fig. 230. At the boundaries between the manganiferous iron ores and the adjoining leptite a peculiar skarn consisting of garnet, hornblende and black mica has been developed by reactions between the ores and the leptite. The photo shows a sample of such a skarn from the Kolningberg ore field in the Norberg region. (After N. H. Magnusson.)

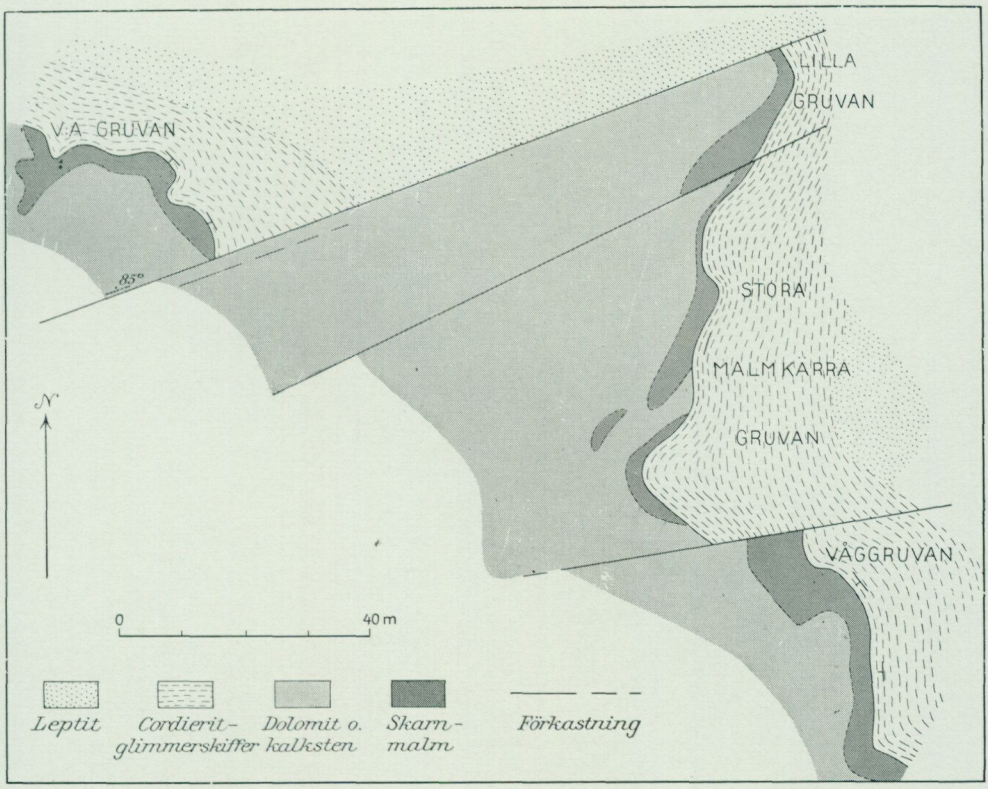


Fig. 231. Geological map of the Malmkärra mine, southwest of the Kolningberg field, Norberg region. (After P. Geijer.) The iron ores in this mine have undergone intense magnesia-metasomatism resulting in the development of magnesium-rich skarn minerals (tremolite and pure diopside), minerals rich in fluorine (humite minerals and fluorite), minerals rich in cerium (cerite and orthite), and sulphide minerals (pyrite, chalcopyrite, and molybdenite). Legend: Leptit = Leptite; Cordieritglimmerskiffer = Cordierite-mica schist; Dolomit och kalksten = Dolomite and limestone; Skarnmalm = Skarn iron ore; Förkastning = Fault.

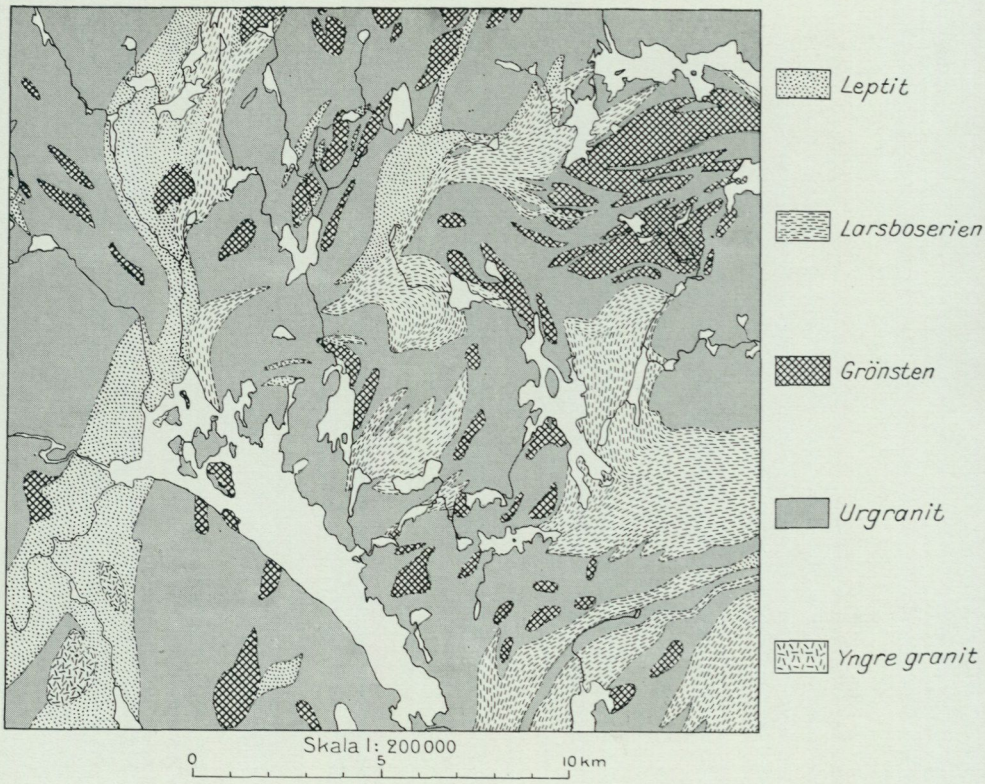


Fig. 232. Map of the central part of the Larsbo series. (After S. Hjelmqvist.) The legend runs as follows. Leptit = Leptite (older than the Larsbo series); Larsbo serien = Larsbo series; Grönsten = Gabbro and diorite; Urgranit = Svecofennian synorogenic granite; Yngre granit = Late Svecofennian palingenic granite.

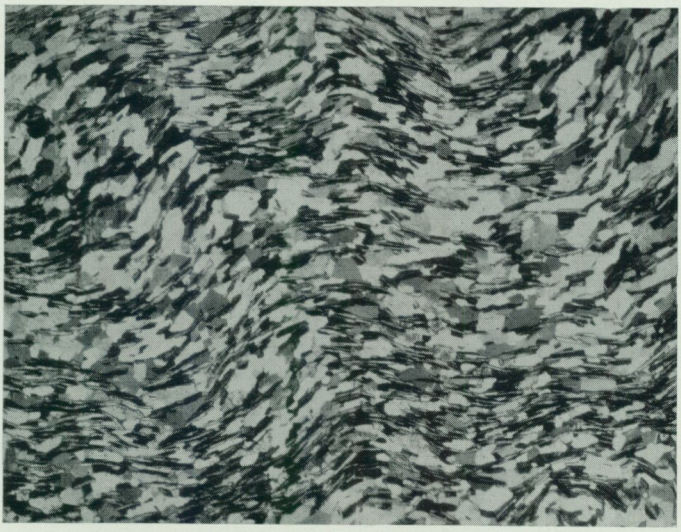


Fig. 233. Mica schist. Thin section + nic., magnification 13 ×. Larsbo series. (After S. Hjelmqvist.)

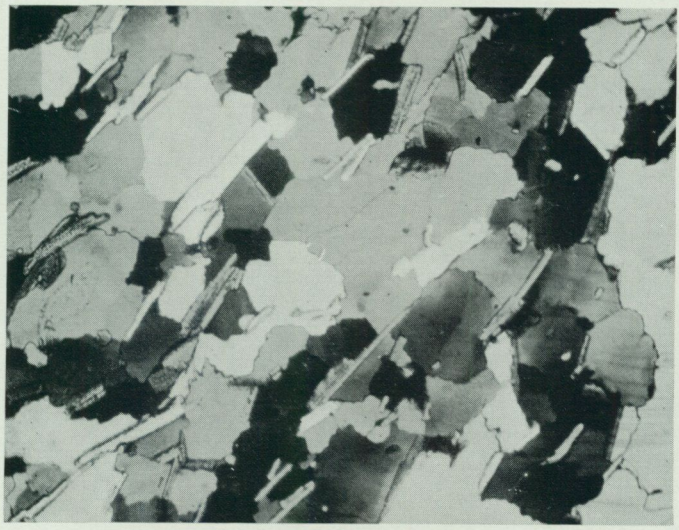


Fig. 234. Mica quartzite. Thin section, + nic., magnification 13 ×. Larsbo series. (After S. Hjelmqvist.)

Fig. 235. Bedded mica schist. Larsbo series. (Photo G. Lundqvist.)

Fig. 236. Conglomerate. Most of the pebbles are composed of hornblende porphyrites, Larsbo series. (Photo G. Lundqvist.)

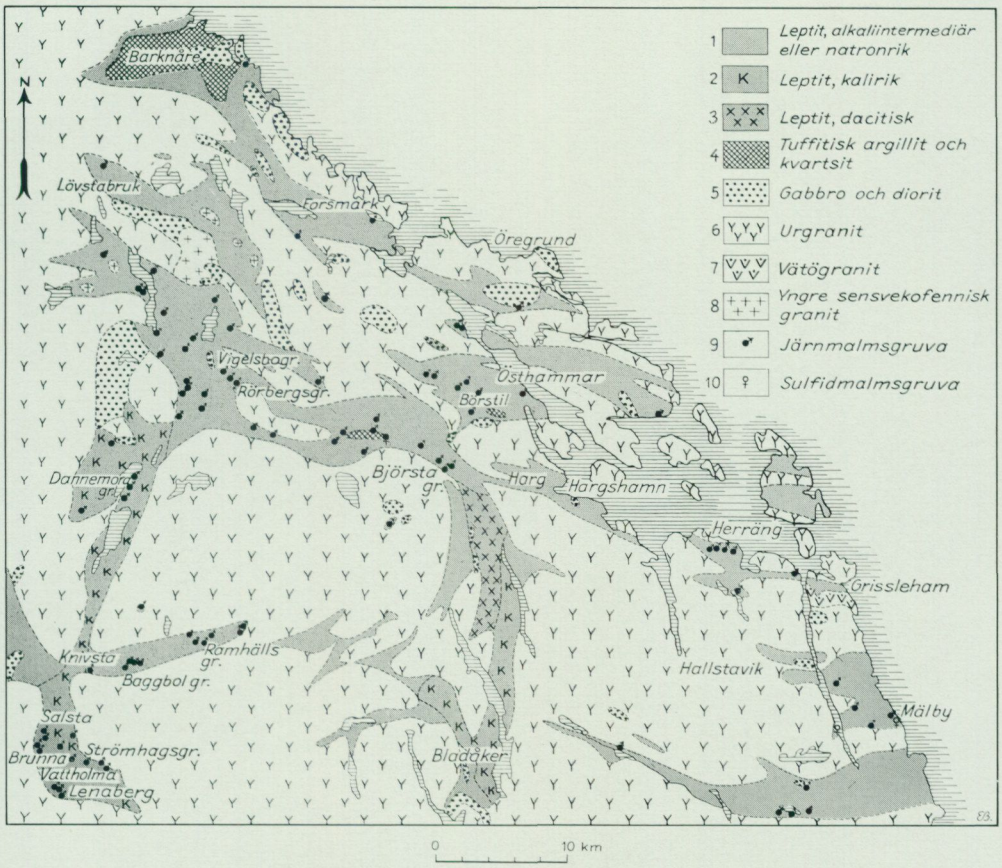


Fig. 237. Geological map of northern Uppland. (After B. Sund.) Legend: 1. Leptite, intermediate regarding alkali metals or sodic; 2. Leptite, preferentially potassic; 3. Leptite, dacitic; 4. Tuffitic argillite and quartzite; 5. Diorite and gabbro; 6. Svecofennian synorogenic granite; 7. Vätö granite; 8. Late svecofennian palingenic granite; 9. Iron mine; 10. Sulphide mine.

Fig. 238. Skarn-banded hälleflinta. Dannemora iron ore field. (Photo G. T. Lindroth.)

Fig. 239. Hälleflinta with well-developed clastic texture. Ramhäll iron ore field. (Photo G. T. Lindroth.)

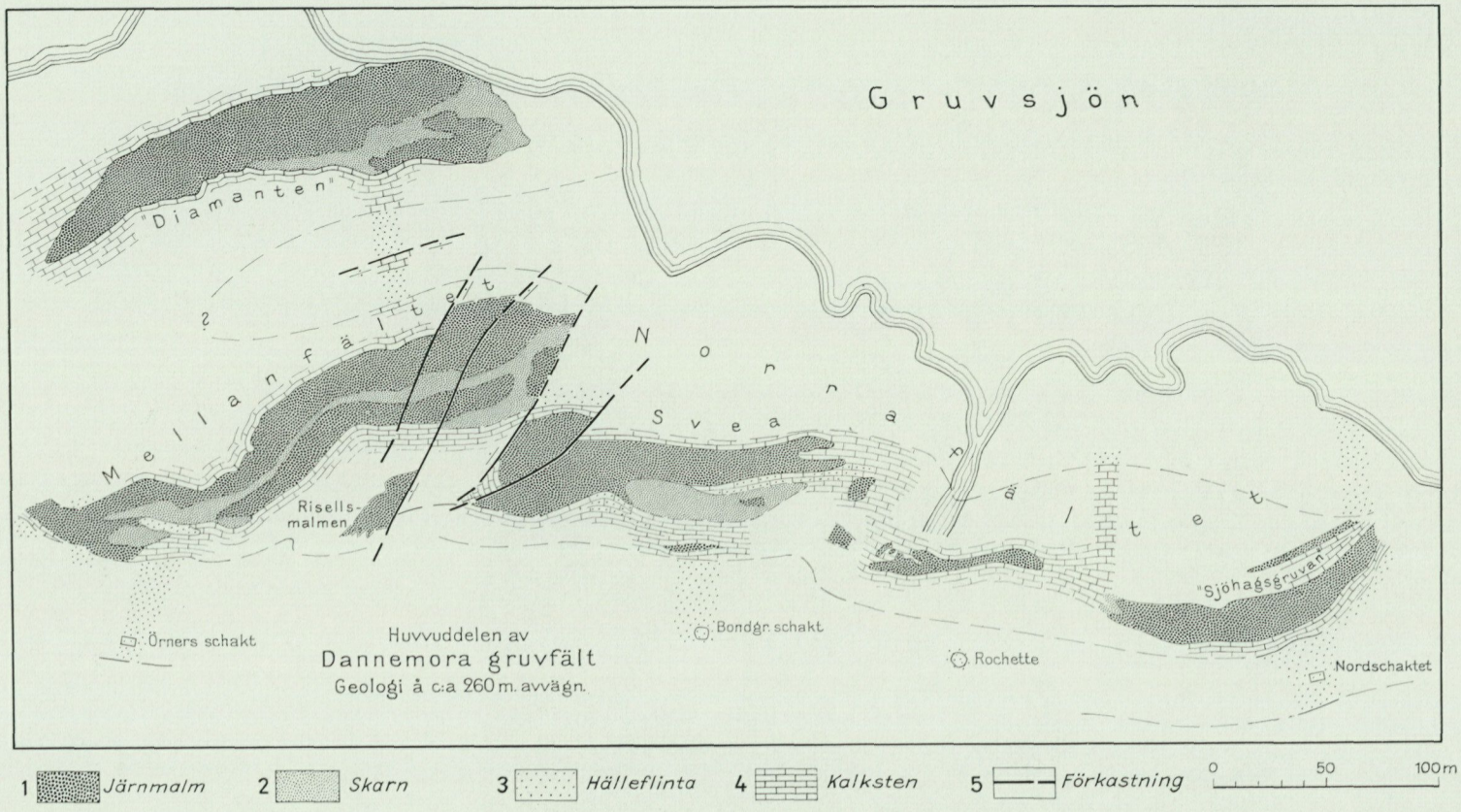


Fig. 240. 260 m. level in the Dannemora mines. (After P. Geijer.) Legend: 1. Iron ore; 2. Skarn; 3. Hälleflinta; 4. Limestone and dolomite.

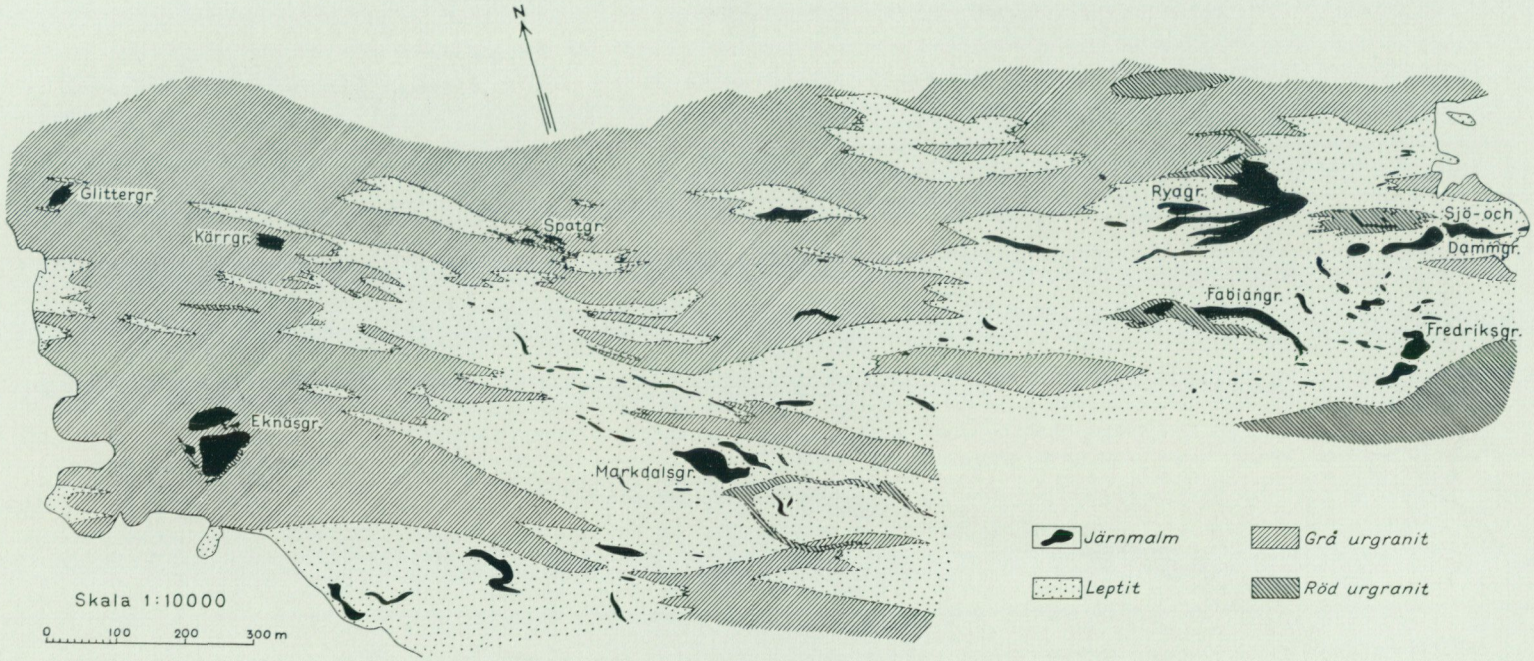


Fig. 241. Map of the Herräng iron ore field. (After N. H. Magnusson.) Legend: Järnmalm = Iron ore; Leptit = Leptite; Grå urgranit = Grey Svecofennian synorogenic granite; Röd urgranit = Red Svecofennian synorogenic granite. Further there occur in the Herräng field a large number of greenstone dikes, which are younger than the synorogenic granites and strike WNW–ESE, following the nearly vertical schistosity planes of the bedrock. These greenstone dikes have been removed from the above map.

Fig. 242. Map of a part of the ore-bearing body of the Spat mine (Spatgruvan) in the Herräng field showing that the iron ores have been intruded by the grey Svecofennian synorogenic granite and now appear as elongated remnants in this granite, which has been later intruded by the somewhat younger red Svecofennian synorogenic granite. Finally the greenstone dikes, mentioned in the text of Fig. 241, appeared along the vertical schistosity planes. (After N. H. Magnusson.) Legend: 1. Leptite; 2. Iron ore; 3. Skarn; 4. Gabbro and diorite; 5. Iron ore with elongated intrusions of grey granite; 6. Grey granite with elonged remnants of iron ore; 7. Grey granite; 8. Red granite; 9. Greenstone dike.

Fig. 243. Remnants of leptite in skarn-bearing Svecofennian synorogenic granite, Herräng field. 2/3 nat. size. (After N. H. Magnusson.)

Fig. 244. Remnants of leptite in grey Svecofennian synorogenic granite, Herräng field. Half nat. size. (After N. H. Magnusson.)

Fig. 245. Leptite with spots of mica, Herräng field. 2/3 nat. size. (After N. H. Magnusson.)

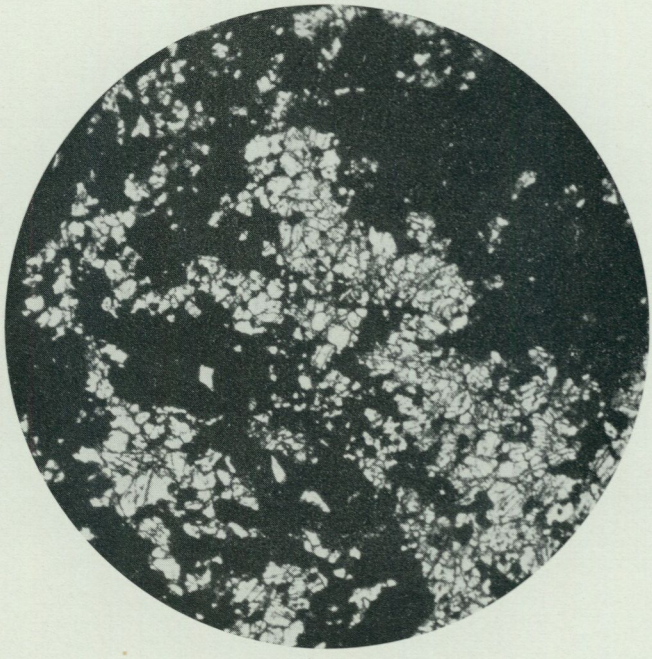


Fig. 246. Pyroxene-magnetite iron ore. Thin section, ord. light, magnification 30 ×. Herräng field. (After N. H. Magnusson.)

Fig. 247. Lamellar magnetite in tremolite skarn. Thin section, ord. light, magnification 30×. Herräng field. (After N. H. Magnusson.)

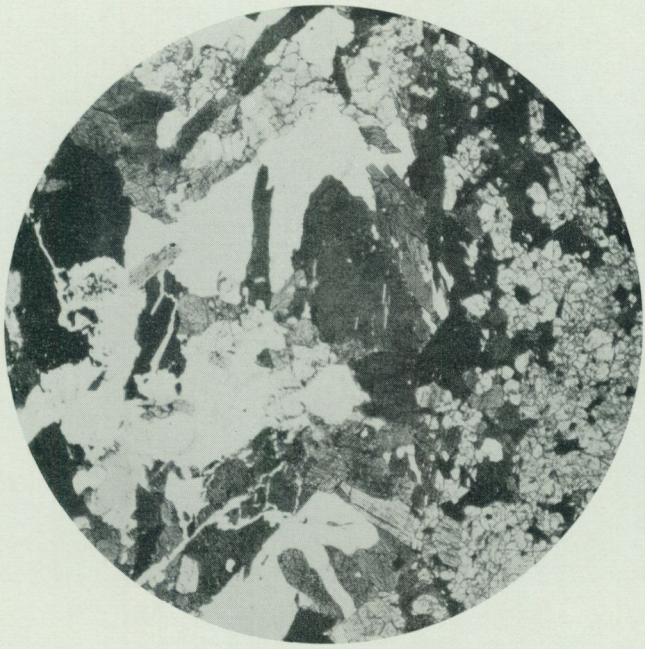


Fig. 248. Iron ore with pyroxene in a grey granite rich in hornblende. Thin section ord. light, magnification 10 ×. Herräng field. (After N. H. Magnusson.)

Fig. 249. Metasomatically altered leptite with spots of mica and anthophyllite. Sjö and Damm mines, Herräng field. (Photo S. Hjelmqvist.)

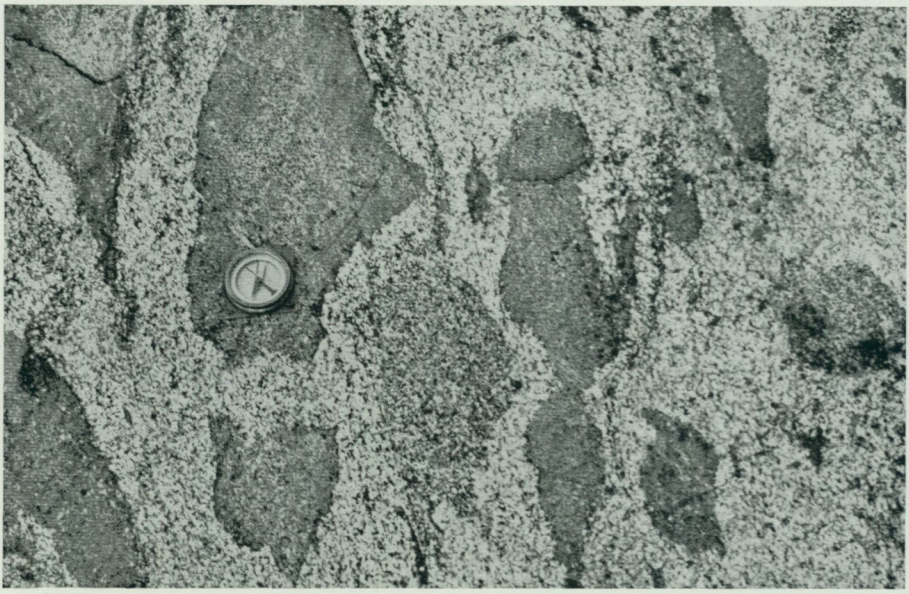


Fig. 250. Grey Svecofennian synorogenic granite with more or less assimilated inclusions of diorite. Road cutting, Hensvik west of Herräng. (Photo S. Hjelmqvist.)

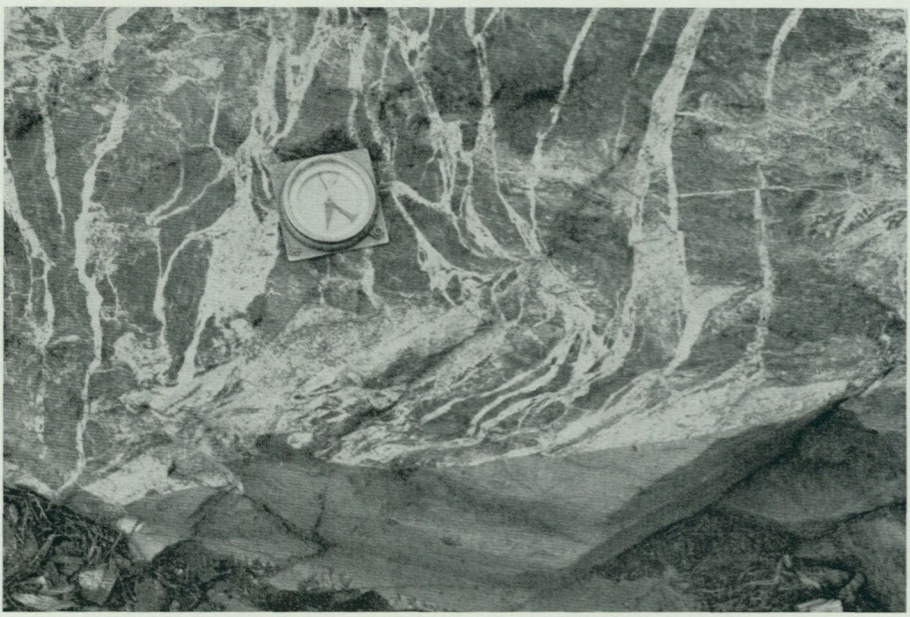


Fig. 251. Skarn cut by veins of granite, which have been intersected by a greenstone dike (below). Fredrik mine, Herräng field. (Photo S. Hjelmqvist.)

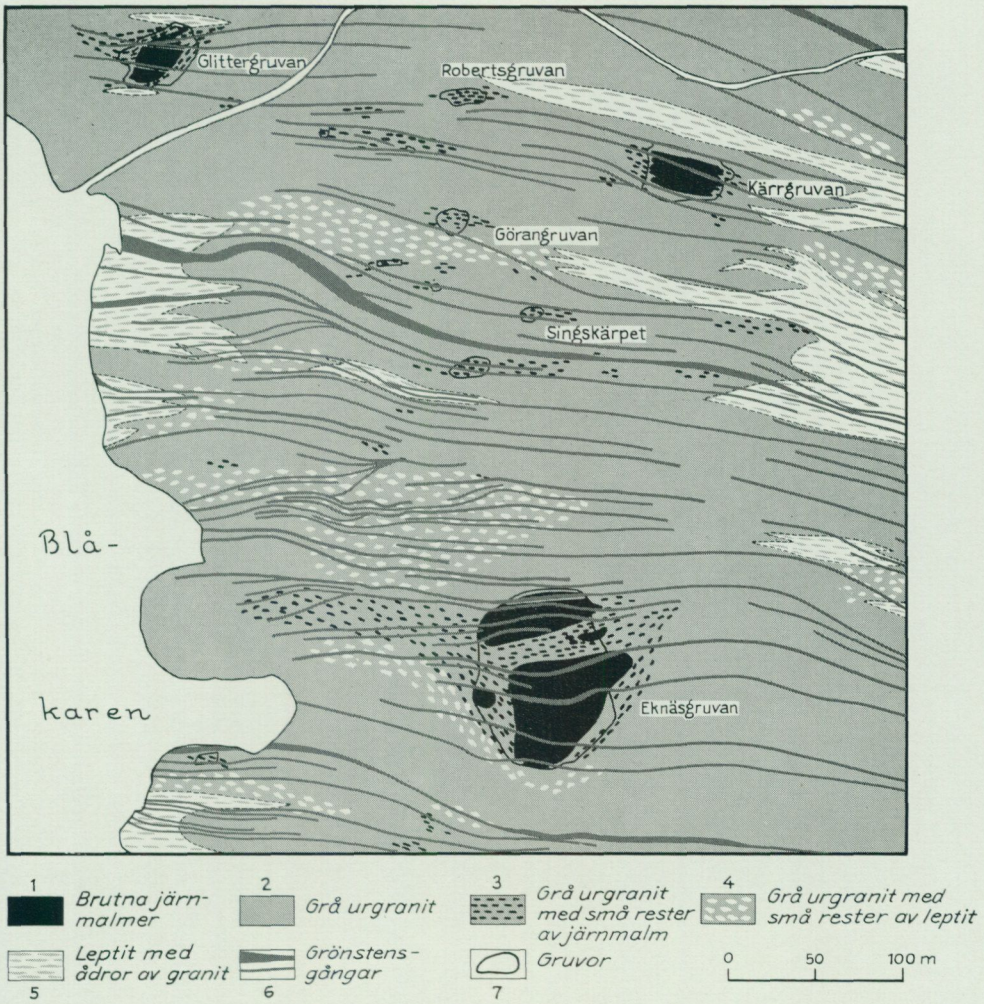
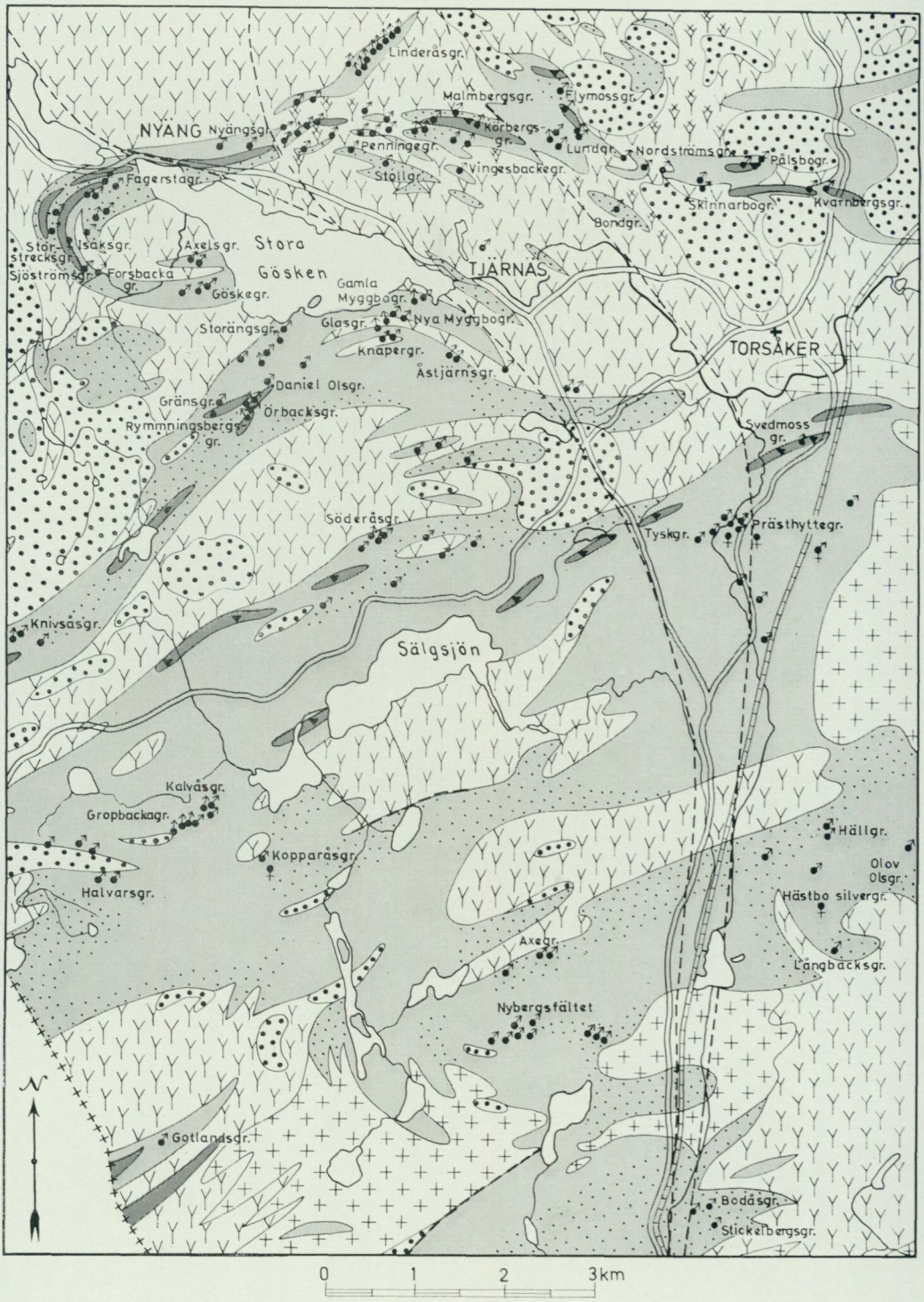


Fig. 252. The Eknäs iron ores before and after the granite intrusion. Legend: 1. Iron ores mined; 2. Grey Svecofennian granite; 3. Grey Svecofennian granite with small remnants of iron ore; 4. Grey Svecofennian granite with small remnants of leptite; 5. Leptite with veins of granite; 6. Greenstone dike; 7. Mine. (After N. H. Magnusson.)


Linderåsgr.
Malmbergsgr.
Flymossgr.
NYÄNG
Nyängsgr.
Korbergs gr.
Lundgr.
Nordströmsgr.
Pälsbogr.
Penningegr.
Vingesbackegr.
Fagerstagr.
Stöllgr.
Skinnarbogr.
Kvarnbergsgr.
Bondgr.
Stor-Strecksgr.
Nsäksgr.
Axelsgr.
Stora Gösken
TJÄRNÅS
Sjöströmsgr.
Forsbacka gr.
Göskegr.
Gamla Myggbogr.
Nya Myggbogr.
Glasgr.
Storängsgr.
Knapergr.
Åstjärnsgr.
TORSÅKER
Daniel Olsgr.
Gränsgr.
Örbacksgr.
Rymmningsbergs gr.
Svedmoss gr.
Söderåsgr.
Tyskgr.
Prästhyttegr.
Knivsåsgr.
Sälgsjön
Kalvåsgr.
Gropbackagr.
Hällgr.
Olov Olsgr.
Kopparåsgr.
Halvarsgr.
Hästbo silvergr.
Axegr.
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Nybergsfältet
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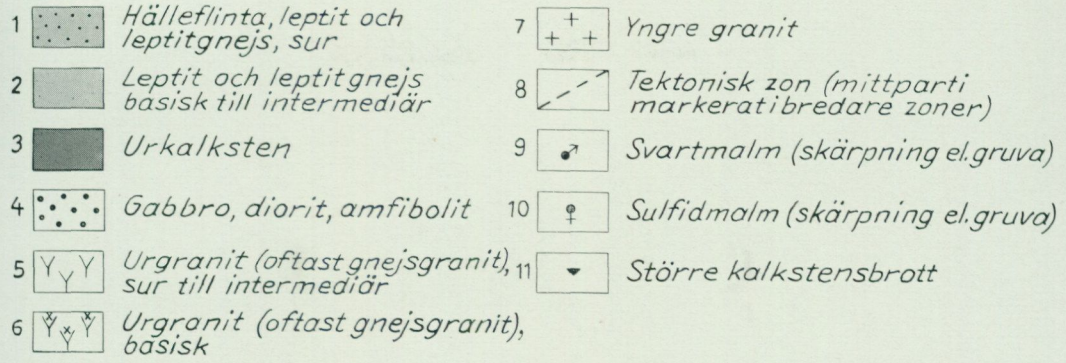

Fig. 253. Map of the Hofors-Torsåker region. (After P. H. Lundegårdh.) Legend: 1. Hälleflinta, leptite and leptite-gneiss, acid; 2. Leptite and leptite gneiss, basic to intermediate; 3. Limestone and dolomite; 4. Gabbro, diorite, amphibolite; 5. Svecofennian synorogenic granite and granodiorite; 6. Quartz-diorite; 7. Late Svecofennian palingenic granite; 8. Tectonic zone (in broad zones position of the central part); 9. Magnetite ore (mine); 10. Sulphide ore (mine); 11. Limestone quarry of considerable size.

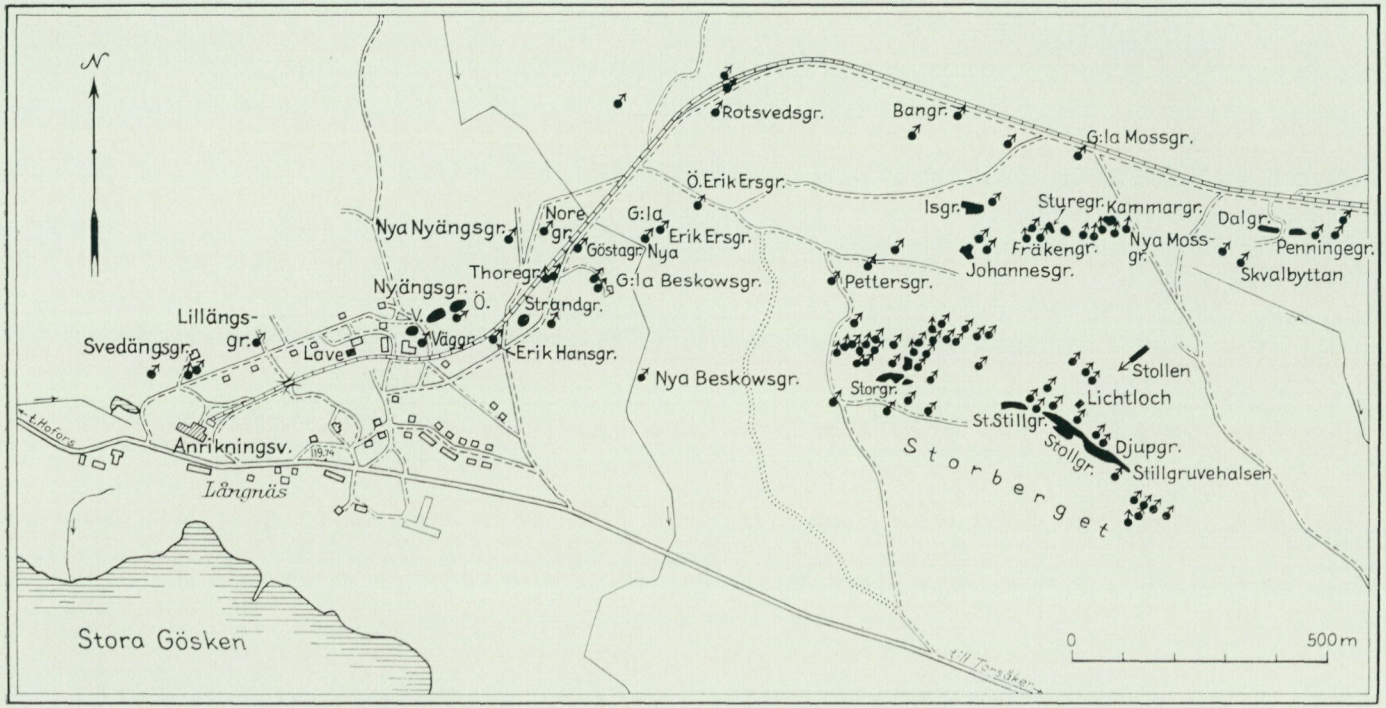

Fig. 254. The iron mines in the northern vicinity of Lake Stora Gösken, ESE of Hofors in western Gästrikland. (After P. H. Lundegårdh.) Predominant rocks in the area of this map are Svecofennian synorogenic granites. The leptites and the iron ores appear as remnants in the granites. The largest ores have been the ores in the Nyäng field, mined down to 663 m. level. From this mine two drifts on 290 and 550 m. levels stretch in the direction of Storberget and Vingesbacke and several diamond drill holes have been made at right angles to the drifts. The same granites as in the outcrops occur there. The granites contain several small remnants of ore and leptite, but no iron ores worth mining have been found.

Fig. 255. Bedded dolomitic limestone. 290 m. level, near the shaft, Vingesbacke mine, Hofors-Torsåker region. In the dolomitic limestone on this level the author has found grossularite-diopside skarn both bedded and massive. Near the iron ores this skarn passes over to skarn of andradite and green pyroxene. (Photo G. T. Lindroth.)

Fig. 256. Amphibolite dike in dolomitic limestone. The dike has been folded and broken into pieces in the plastic limestone. 230 m. level, Vingesbacke mines, Hofors-Torsåker region. (Photo G. T. Lindroth.)

Fig. 257. Remnants of leptite in a Svecofennian synorogenic granite, Vingesbacke mines, Hofors-Torsåker region. (Photo G. T. Lindroth.) Around the Vingesbacke mines and between these mines and the Nyäng mines both the leptites and the skarn iron ores have been more, or less assimilated by the synorogenic granite. The leptites and the iron ores therefore appear as remnants with transitional zones towards the surrounding granite, which contains scattered grains of magnetite, hornblende, epidote, and chlorite. (After N. H. Magnusson.)

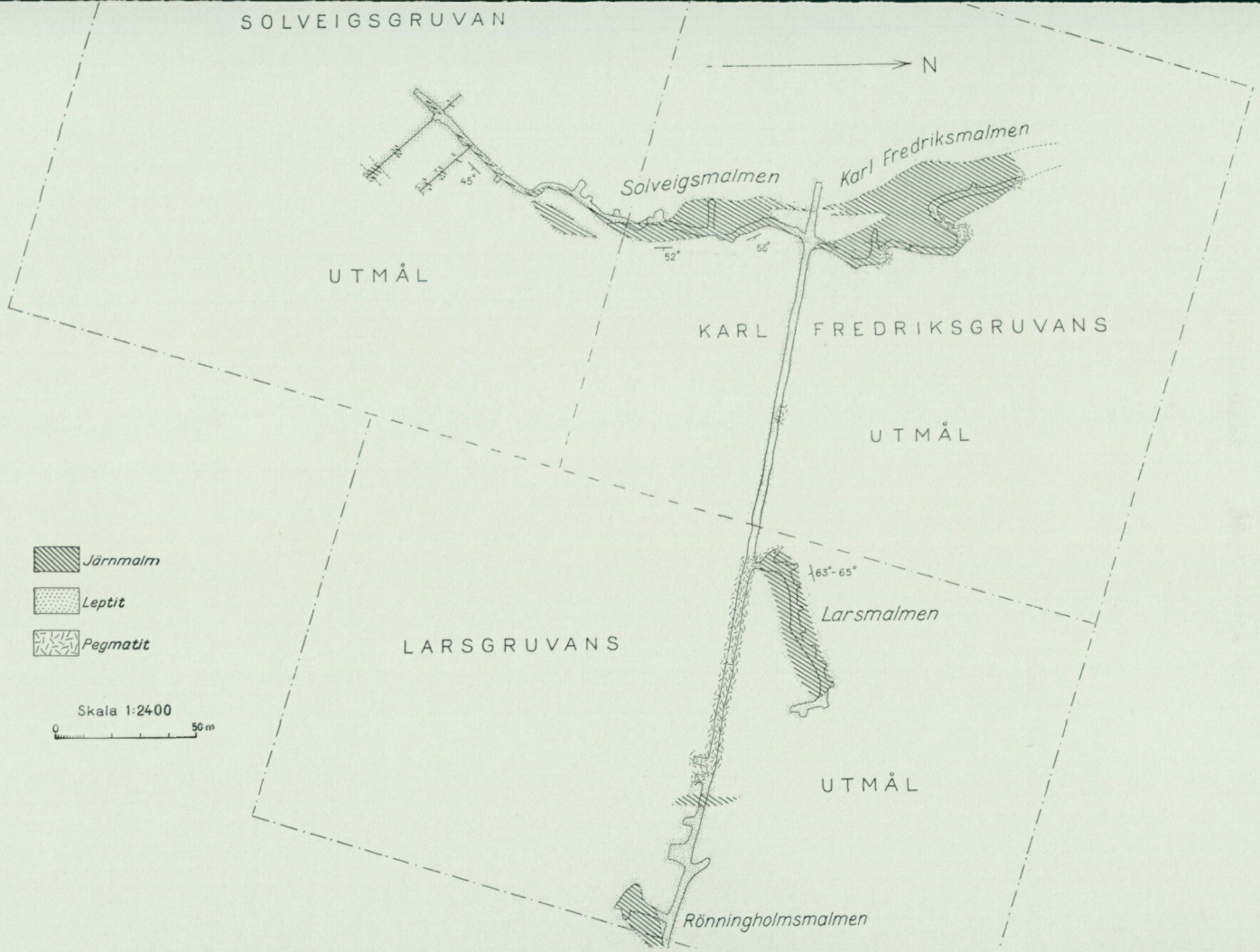

Fig. 258. Bodås mines on 105 m. level. The ores (*Järnmalm* in the map) all belong to one single, strongly folded horizon. (After N. H. Magnusson.)

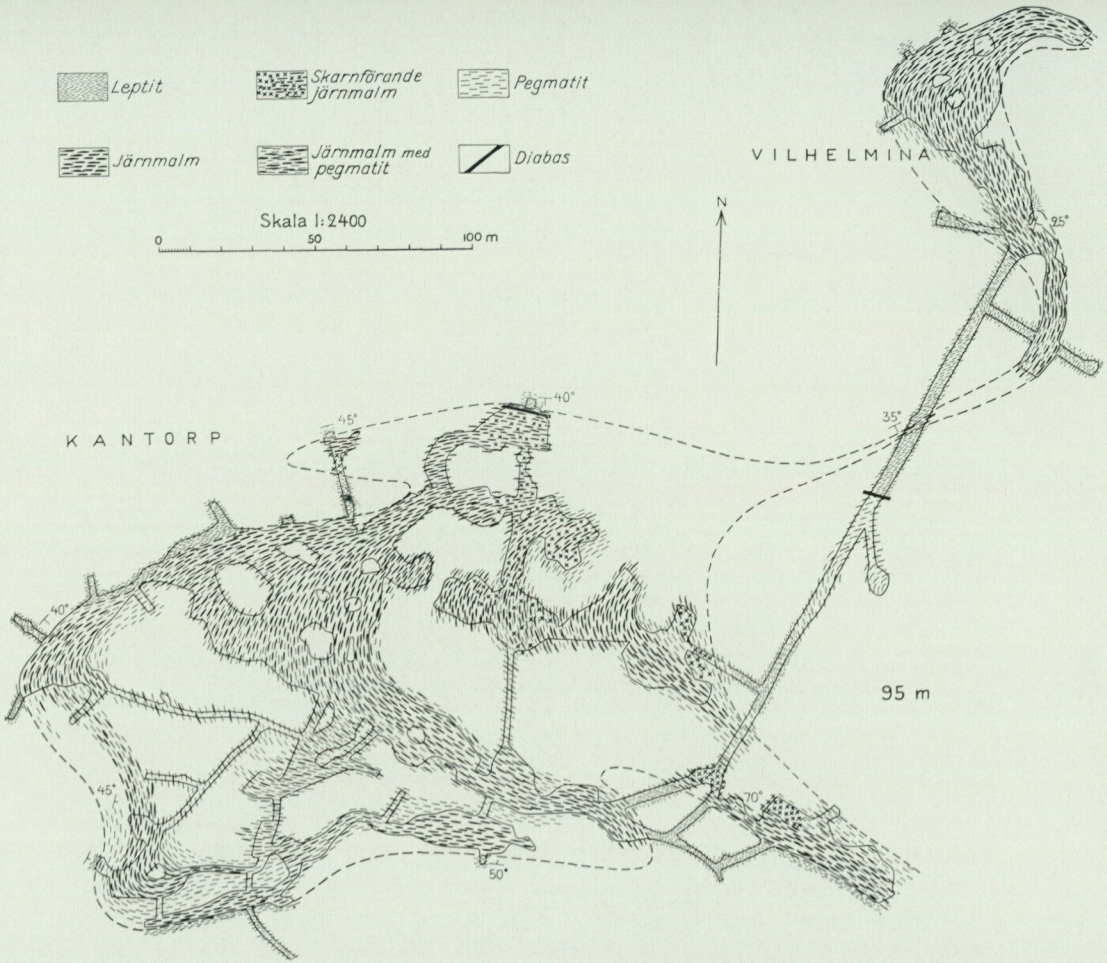

Fig. 259. 95 m. level, Kantorp mines, Kantorp-Askö region. (After N. H. Magnusson.) Legend: Leptit = Leptite; Järnmalm = Iron ore; Skarnförande järnmalm = Iron ore rich in skarn; Järnmalm med pegmatit = Iron ore rich in pegmatitic material; Pegmatit = Pegmatite; Diabas = Diabase. This geological map shows the areas, which were mined till 1940. The remaining areas were considered too rich in pegmatite-material to be operated. Later on, large parts of these pillars have been mined, but smaller pilars still remain.

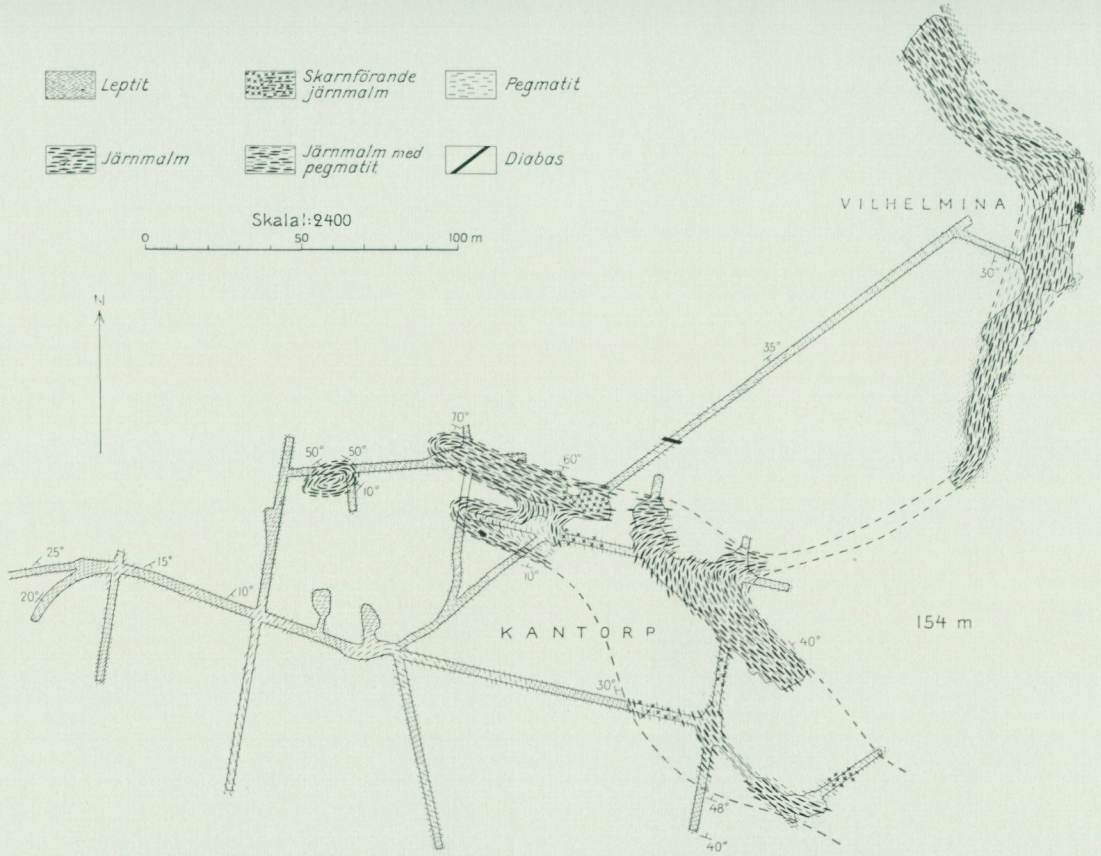

Fig. 260. 145 m. level in the Kantorp mines, Kantorp-Askö region. (After N. H. Magnusson.) A comparison between this level and 95 m. level indicates that the large area on the upper level diminishes very much when approaching the lower level. The ores at the ground and on 95 m. level are situated in a shallow, rounded basin formed simultaneously with the pegmatite invasion, which made the ores and the surrounding rocks plastic.

Fig. 261. Greywacke-gneiss with pegmatitic veins. West of the Kantorp mines. (After N. H. Magnusson.)

Fig. 262. Svecofennian synorogenic granite altered to veined gneiss. South of the Kantorp mines. (After N. H. Magnusson.)

Fig. 263. Homogeneous remnants of leptite in veined leptite gneiss. West of the Kantorp mines. (After N. H. Magnusson.)

Fig. 264. Homogeneous remnants of granite-gneiss in a pegmatized part of the same rock. South of the Kantorp mines. (After N. H. Magnusson.)

Fig. 265. Homogeneous leptite-gneiss with pegmatitic parts developed along fissures in the rock. West of the Kantorp mines. (After N. H. Magnusson.)

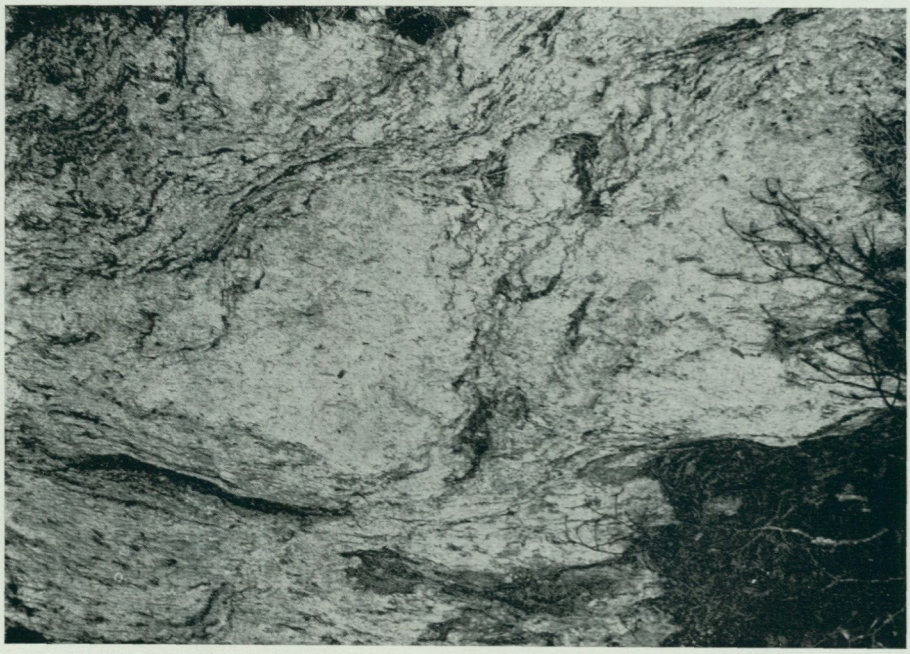

Fig. 266. Strongly pegmatized granite-gneiss. East of the Kantorp mines. (After N. H. Magnusson.)

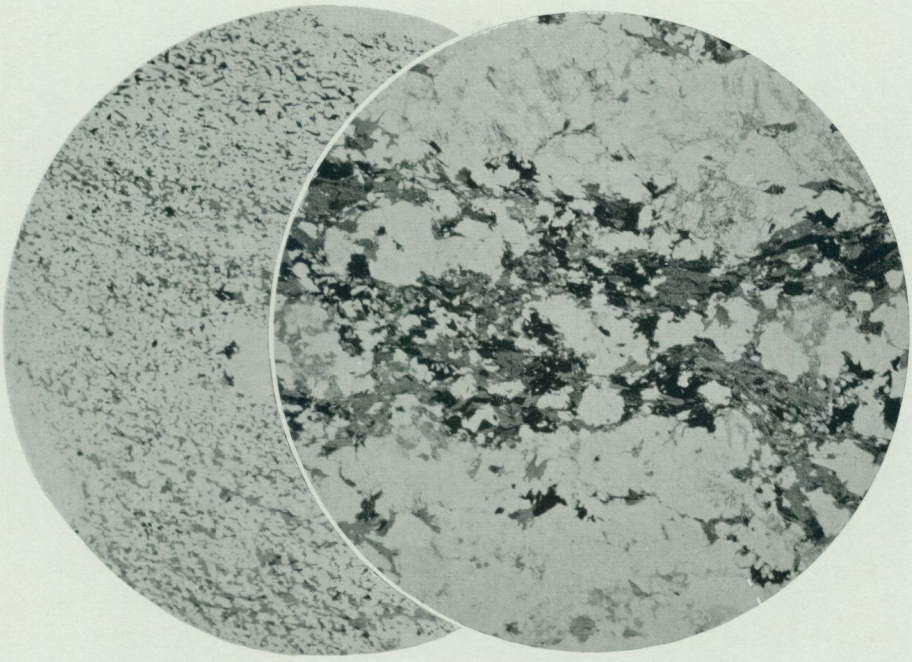

Fig. 267. Homogeneous leptite-gneiss from the western (to the left) and eastern (to the right) parts of the Kantorp ore district. Thin sections, + nic., magnification 13 ×. (After N. H. Magnusson.) The figure shows the increase in grain size from the western part of the Kantorp district to the eastern part.

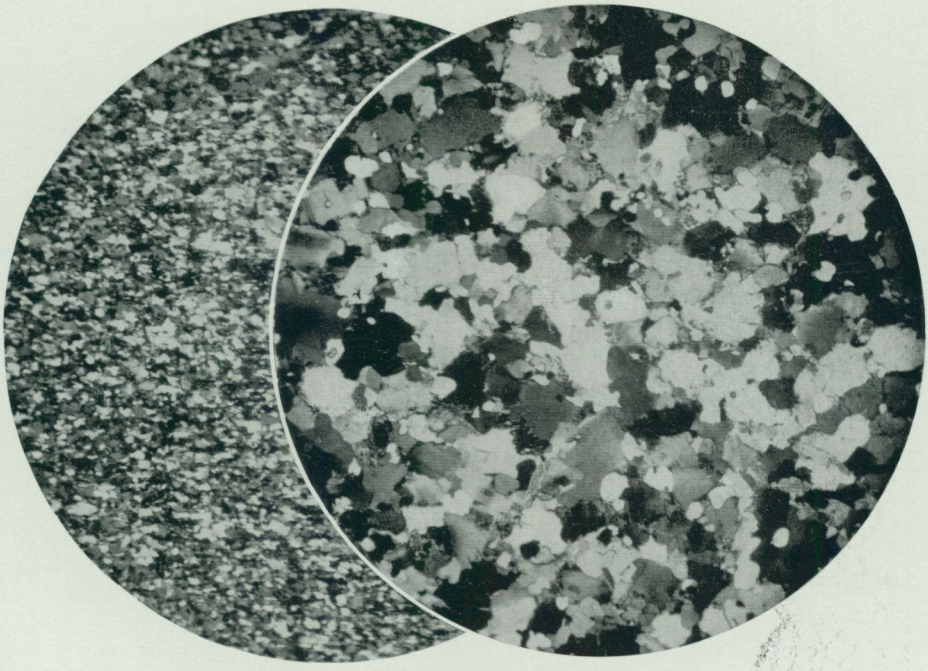

Fig. 268. Homogeneous leptite-gneiss (to the left) and the same rock as a veined, pegmatitic gneiss (to the right). Thin sections, ord. light, magnification 13 ×. Both specimens taken north of the Kantorp mines. (After N. H. Magnusson.)

Fig. 269. Veined, pegmatitic slate-gneiss rich in mica and cordierite. SSE of the Kantorp mines. Thin section, ord. light, magnification 13 ×. (After N. H. Magnusson.)

Fig. 270. Younger palingenic granite. WSW of the Kantorp mines. Thin section, + nic., magnification 13 ×. (After N. H. Magnusson.)

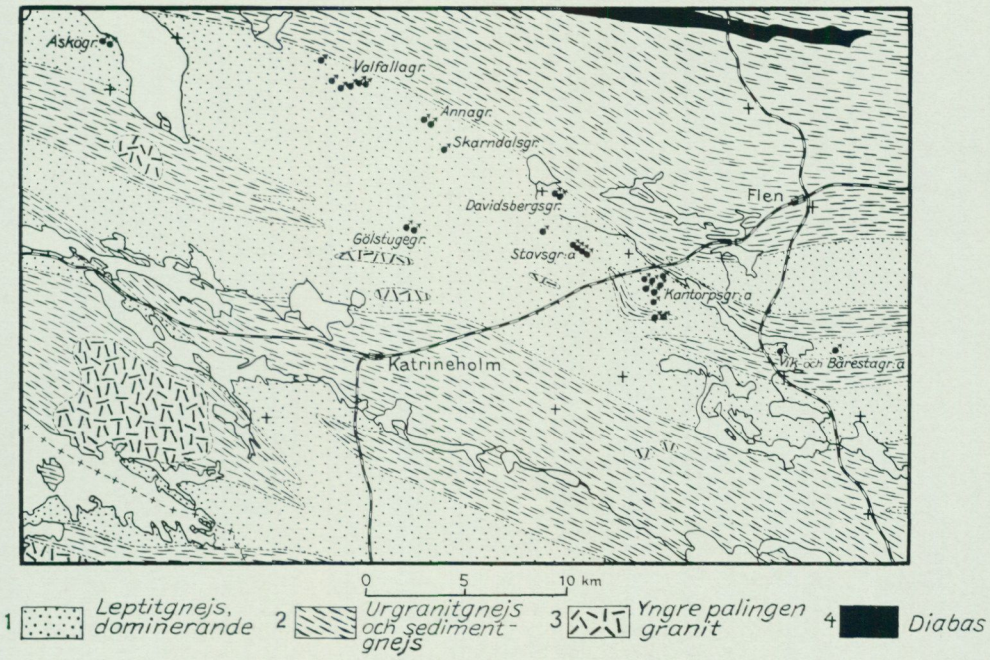

Fig. 271. Kantorp-Askö iron ore zone. (After A. E. Törnebohm.) Legend: 1. Leptite gneiss and greywacke gneiss, most frequently changed to veined gneisses; 2. Granite-gneiss end sedimentary gneiss, usually changed to veined gneisses; 3. Late Svecofennian palingenic granite; 4. Diabase.

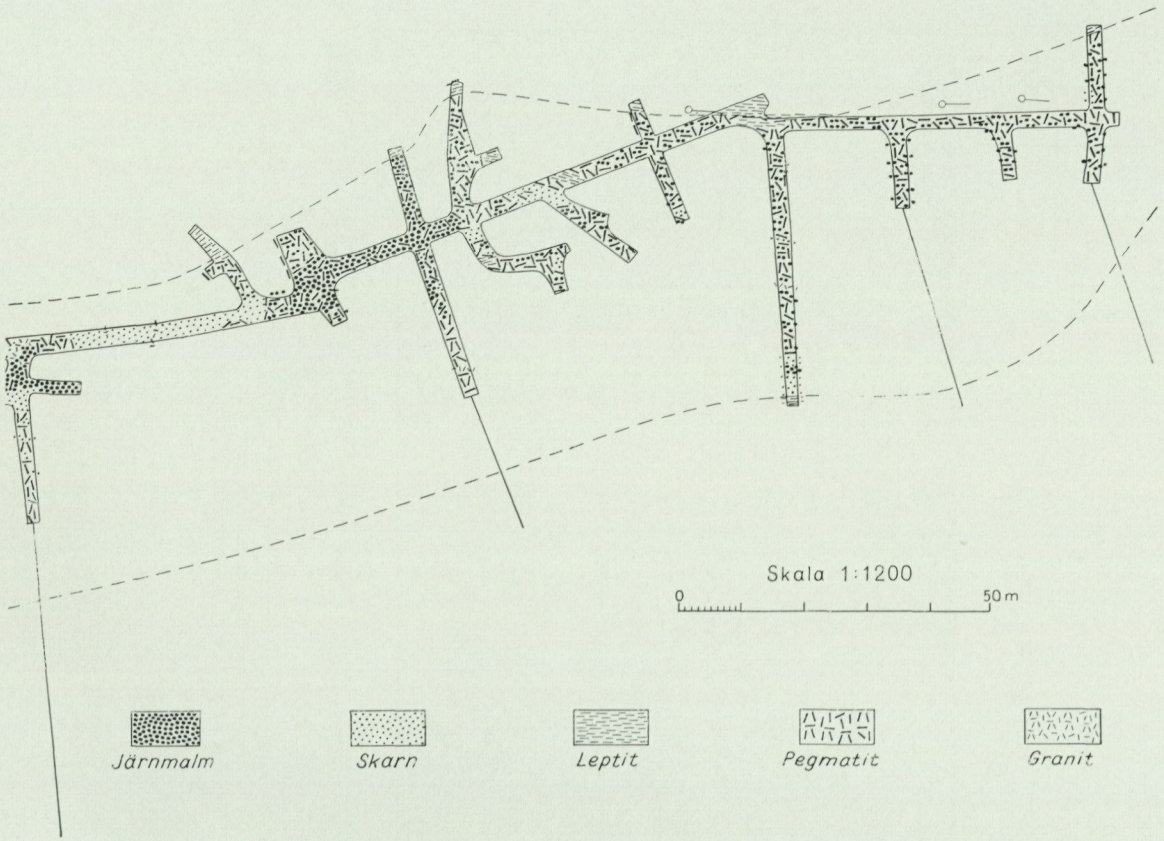

Fig. 272. Map of the Askö mines on 45 level. (After N. H. Magnusson.) Legend: Järnmalm = Iron ore; Skarn; Leptit = Leptite; Pegmatit = Pegmatite; Granit = Granite.

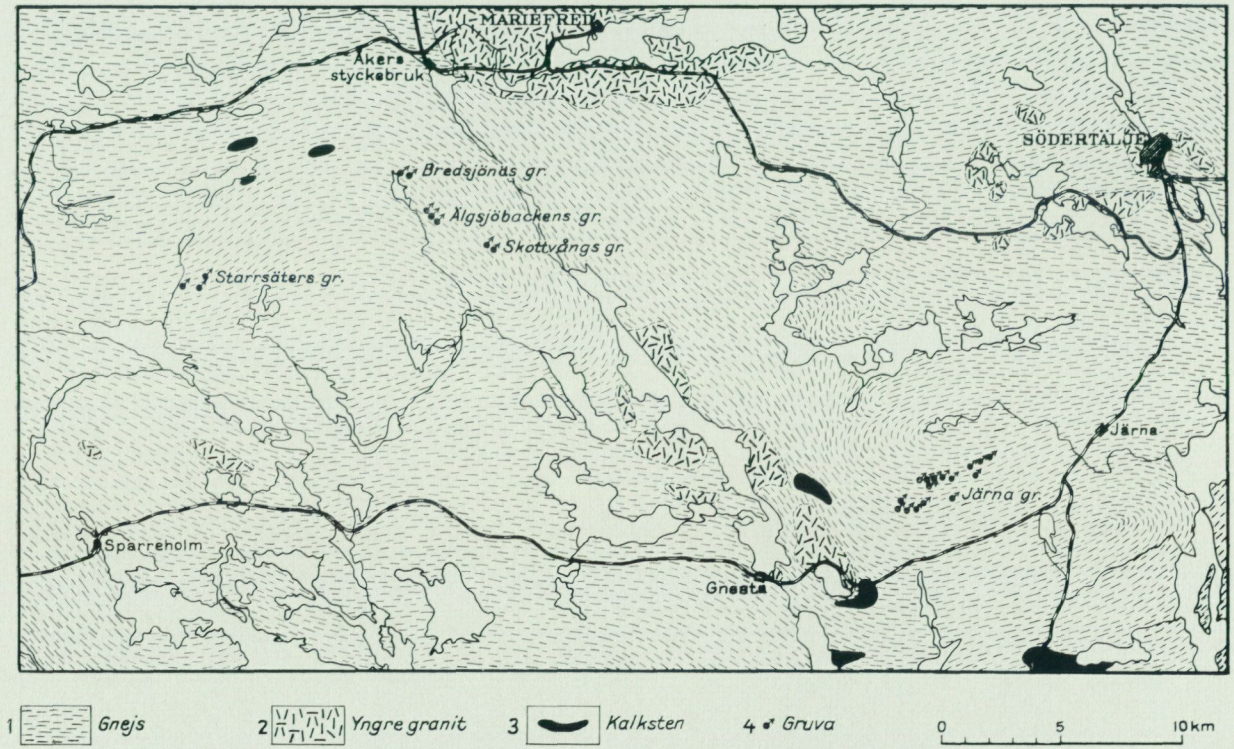

Fig. 273. Map of the Åker and Järna iron ore zones. (After A. E. Törnebohm.) Legend: Gneis = Supracrustal rocks, viz. leptites and clastic sediments, altered to veined gneisses; Yngre granit = Late Svecofennian palingenic granite; Kalksten = Limestone and dolomite; Gruva = (Iron ore) mine.

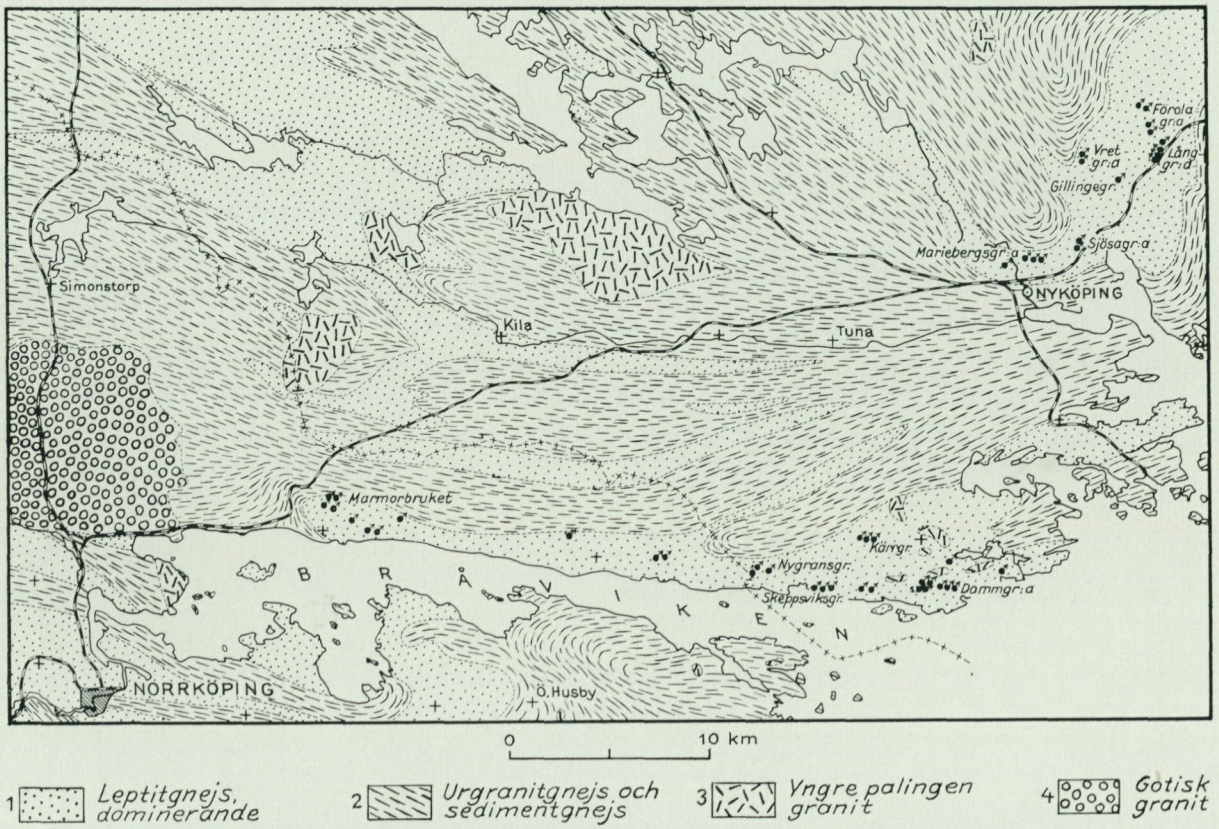

Fig. 274. Map of the iron ore zones north of Nyköping and north of Bråviken. Legend: 1. Leptites and greywackes more or less altered to veined gneisses. 2. Svecofennian synorogenic granites and sediments of the Mälar series more or less altered to veined gneisses; 3. Late Svecofennian palingenic granites; 4. Gothian granite. (After A.E. Törnebohm.)

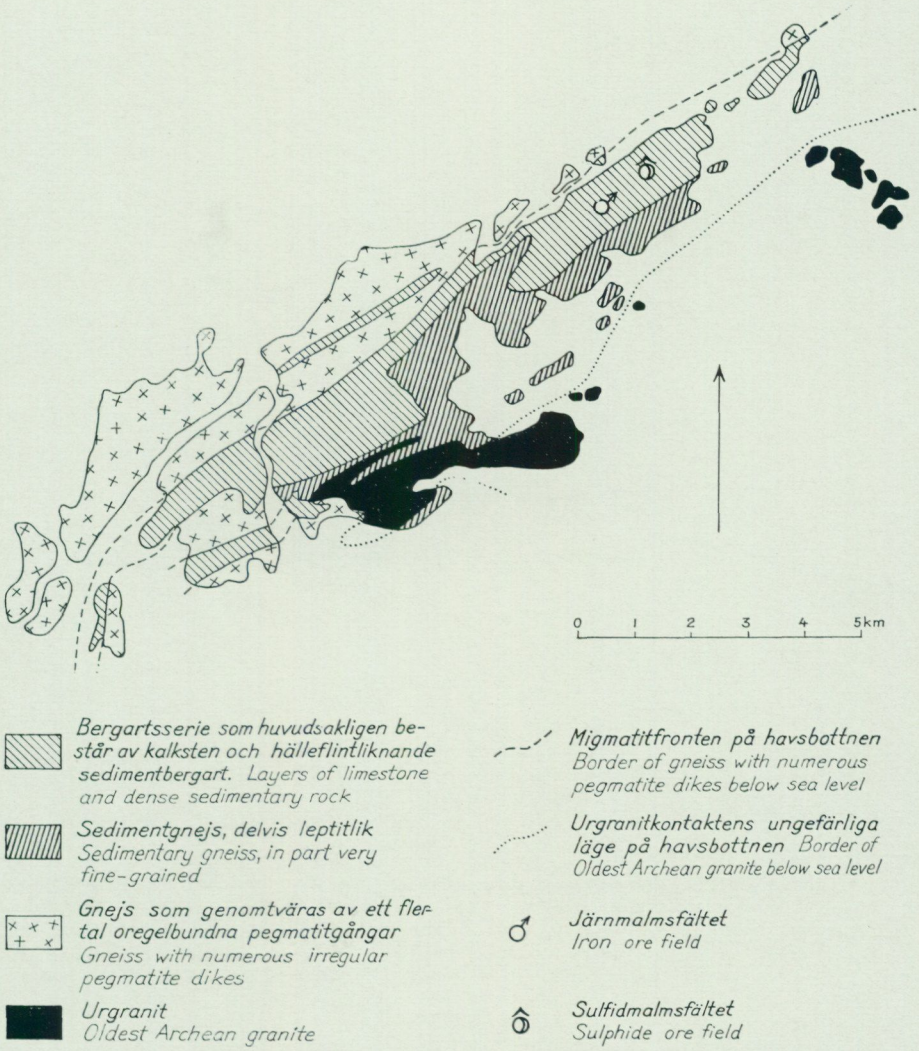

Fig. 275. Petrological map of Utö Island in the southernmost part of the Stockholm Skerries. (N. Pilava-Podgurski; after P. J. Holmquist). The iron and sulphide ore fields are situated in a series consisting of alternating layers more or less dolomitic limestone and a dense "hälleflinta", which in part may be a volcanic rock and in part a dense sedimentary rock. Southeast of this zone there is another containing sedimentary rocks, greywackes and schists. In the southeast the latter has been intruded by Svecofennian synorogenic granites. What Pilava-Podgurski has called gneiss with numerous irregular pegmatite dikes belongs to the Mälar series and consists of greywackes and slates altered to veined gneisses rich in pegmatite. The southeastern limit of these rocks, the "migmatite front", is distinct. From the migmatite front solutions have been pushed into the "hälleflinta"-carbonatite series with its iron ores and has there caused intense alterations and impregnation with sulphides.

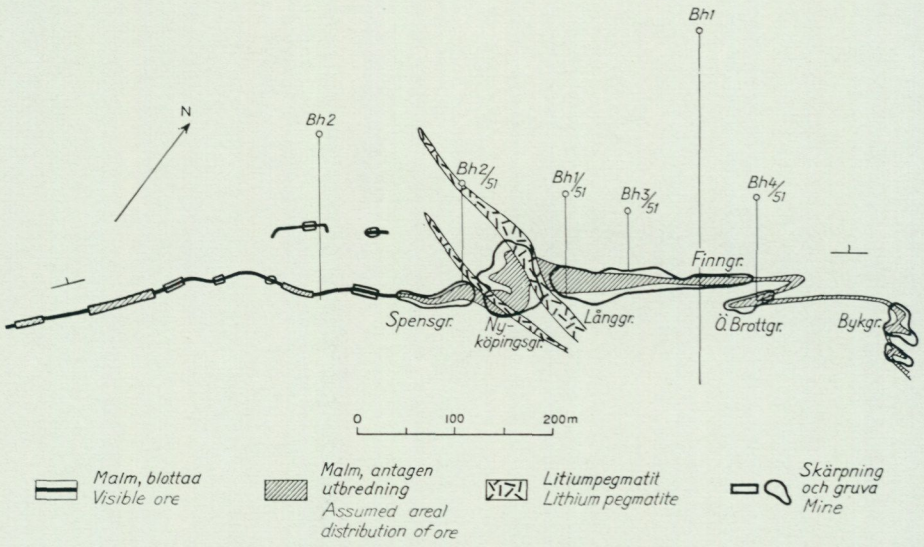

Fig. 276. Utö iron ore field. (After P. Geijer. Revised by Pilava-Podgurski.) The map shows the position of the diamond drill holes and the two renowned litium pegmatite dikes with amblygonite, petalite, and spodumene. In the vicinity of these dikes some bornite and chalcocite occur. Pilava-Podgurski has also found that magnetite has altered to martite in the neighbourhood of the pegmatites. Tourmaline and some apatite seems to be bound to aplite and pegmatite dikes.

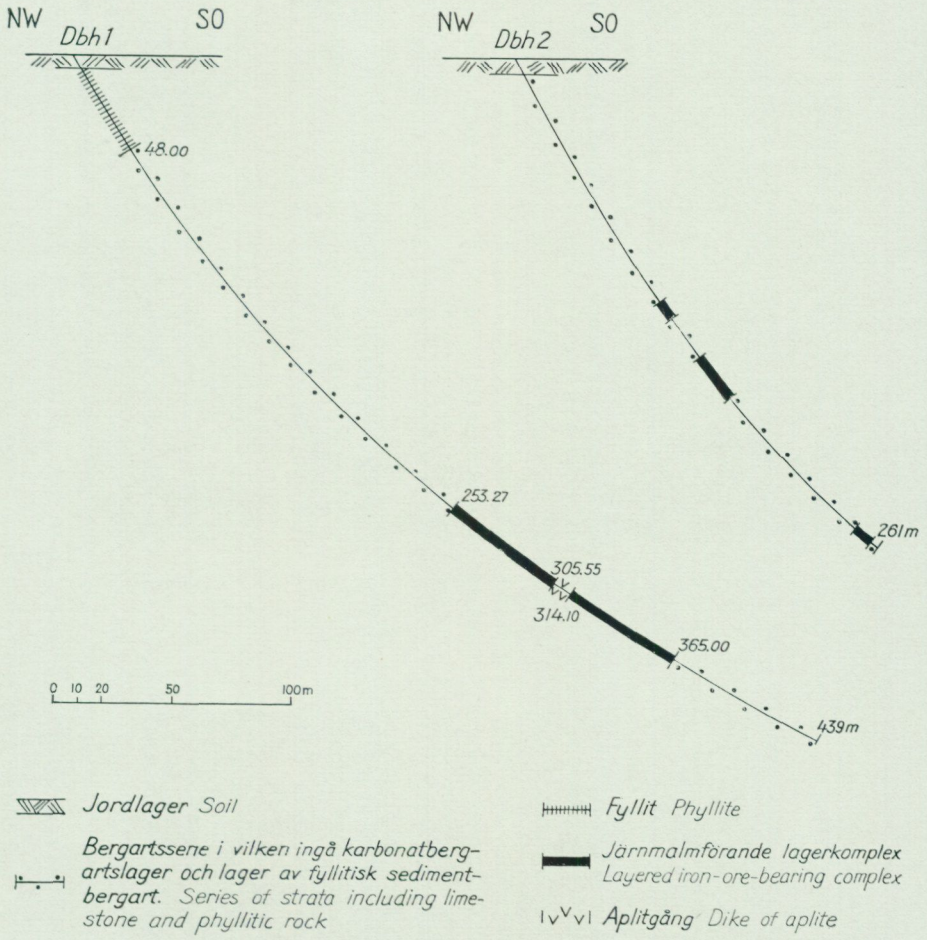

Fig. 277. Diamond drill holes nos. 1. and 2. (Cf. Fig. 276.) Pilava-Podgurski has given a detailed description of the iron-ore-bearing part of drill hole no. 1. The part above the dike of aplite shows a skarn-banded magnetite ore here and there also containing quartz layers. The skarn layers are variform containing one or more of the following components: actinolite and tremolite, pyroxene, including diopside, garnet, hornblende, epidote, and serpentine. The "hälleflinta" layers have usually changed to garnet-bearing biotite-schists frequently containing hornblende and epidote. In the skarn layers both quartz and microcline have been found. Impregnations with galena appear here and there in all rocks mentioned above. Below the aplite the best iron ores appear. These are quartz-banded hematite or magnetite ores with red grey to red quartz layers. Skarn minerals play a very subordinate rôle. It seems quite clear that the quartz-banded ores have been originally developed as hematite ore. The best ores continue c. 30 m. in the drill hole. In the lowest part of the hole there is again found more of thin skarn and "hälleflinta" (phyllite) layers free from magnetite and hematite. Magnetite here predominants over hematite, which appears only as remnants.

Fig. 278. Part of a layer of jasper with visible grains of hematite. Thin section of hematite ore with narrow layers of red jasper. Ord. light, magnification 12 ×. Utö mines. (After N. Pilava-Podgurski.)

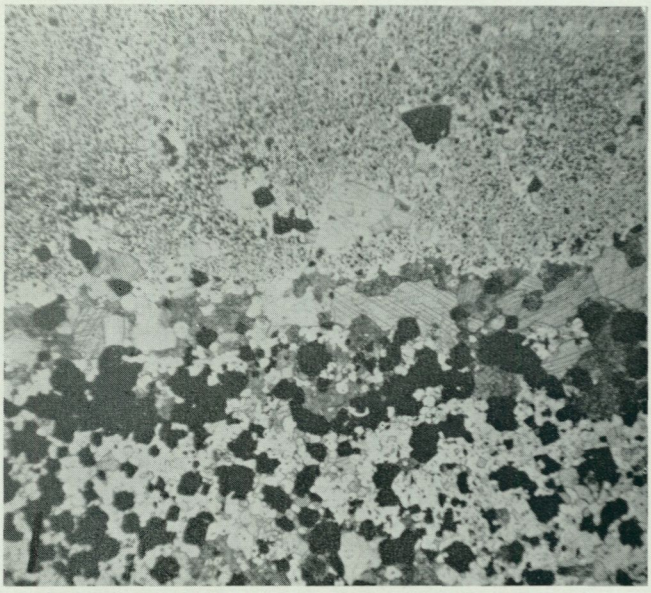

Fig. 279. Magnetite ore with narrow layers rich in quartz. Upper part: layer of very fine-grained quartz impregnated with magnetite. Lower part: layer of magnetite and carbonate. Thin section, ord. light, magnification 12 ×. Utö mines. (After N. Pilava-Podgurski.)

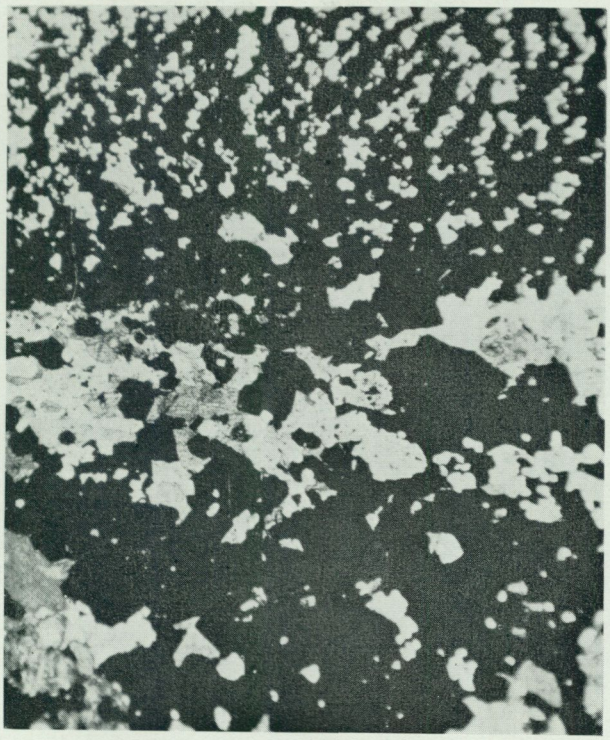

Fig. 280. Magnetite ore with narrow layers rich in quartz. Upper part: layer of quartz and magnetite. Lower part: layer of octahedral magnetite with carbonate. Thin section, ord. light, magnification 20 ×. Utö mines. (After N. Pilava-Podgurski.)

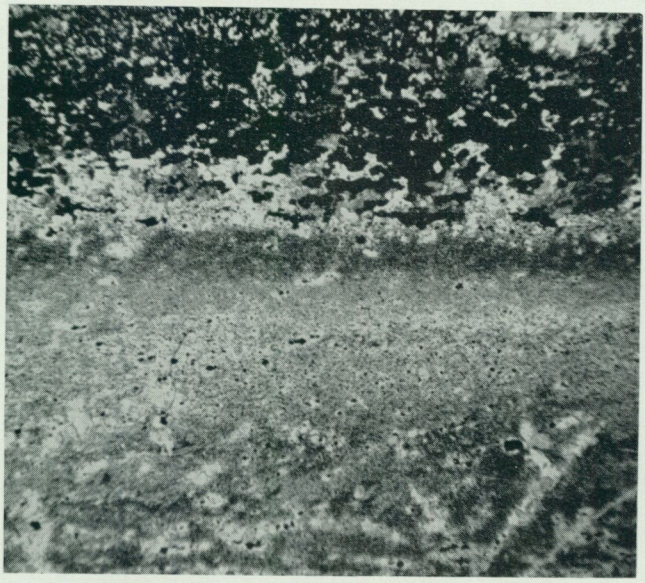

Fig. 281. Hematite ore with narrow layers of red jasper. Upper part: ore with diopside and carbonate. Lower part: recrystallized jasper with visible hematite grains. Thin section, ord. light, magnification 12 ×. Utö mines. (After N. Pilava-Podgurski.)

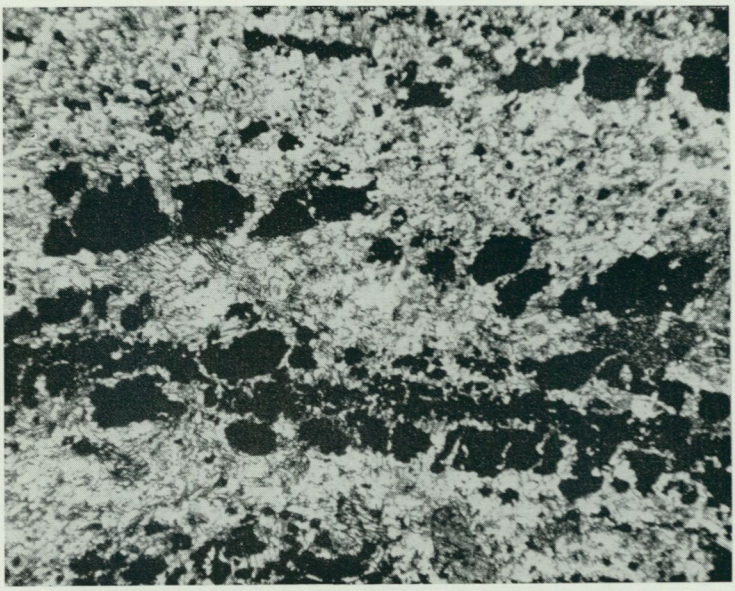

Fig. 282. Remnants of layers of iron ore (black) in skarn consisting of tremolite and diopside. Thin section, ord. light, magnification 12 ×. Utö mines. (After N. Pilava-Podgurski.)

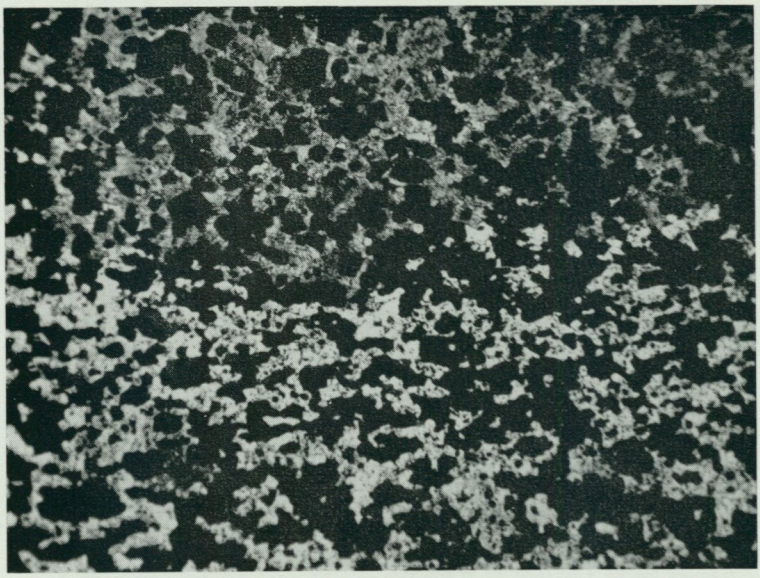

Fig. 283. Magnetite ore with narrow layers rich in quartz. Upper part: magnetite and skarn (diopside). Lower part: quartz and magnetite. Thin section, ord. light, magnification 28 ×. Utö mines. (After N. Pilava-Podgurski.)

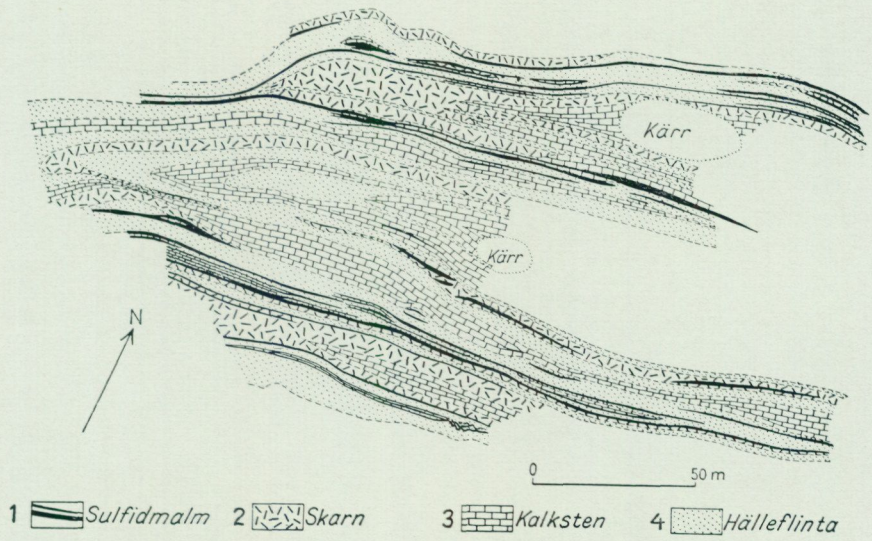

Fig. 284. Map of the central part of the Utö zinc-lead ore field. (After B. Astlind.) Legend: Sulphide ore – Skarn – Dolomitic limestone and "hälleflinta". The zinc-lead ores in this field appear as layers of impregnations in a banded complex of dolomitic limestone and hälleflinta with more or less carbonate material. The sulphides are sphalerite, galena, and pyrrhotite in varying proportions. Complete transitions exist between rich ores and poor impregnations.

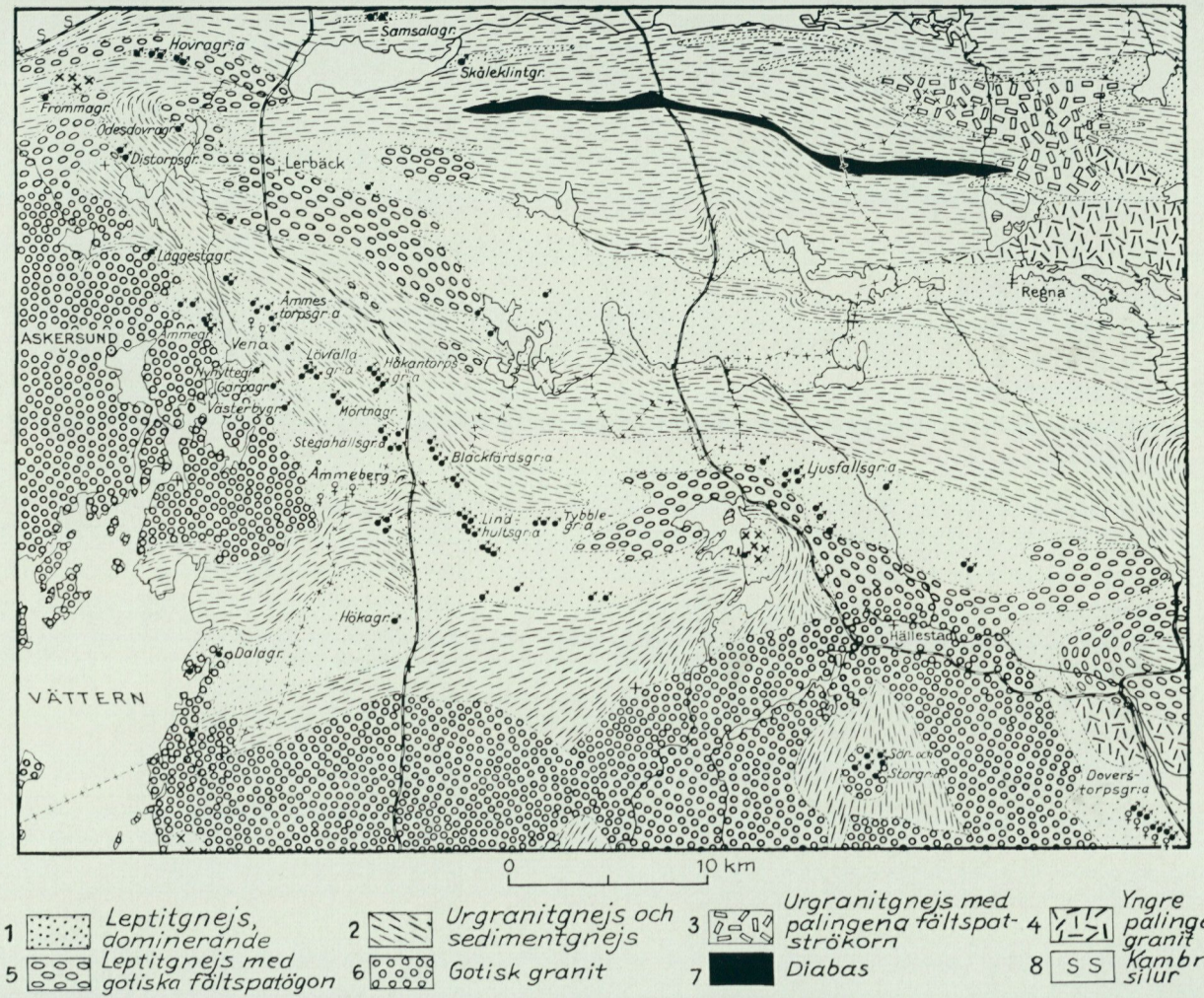

Fig. 285. Geological map of the Åmmeberg-Doverstorp region .(After A. E. Törnebohm.) Legend: 1. Predominant leptite gneiss; 2. Svecofennian synorogenic granites altered to gneisses and sedimentary gneisses; 3. Svecofennian synorogenic granite-gneiss with palingenic feldspar porphyroblasts; 4. Late svecofennian palingenic granite; 5. Leptite gneiss with Gothian feldspar porphyroblasts; 6. Gothian granite; 7. Diabase; 8. Cambro-Silurian rocks.

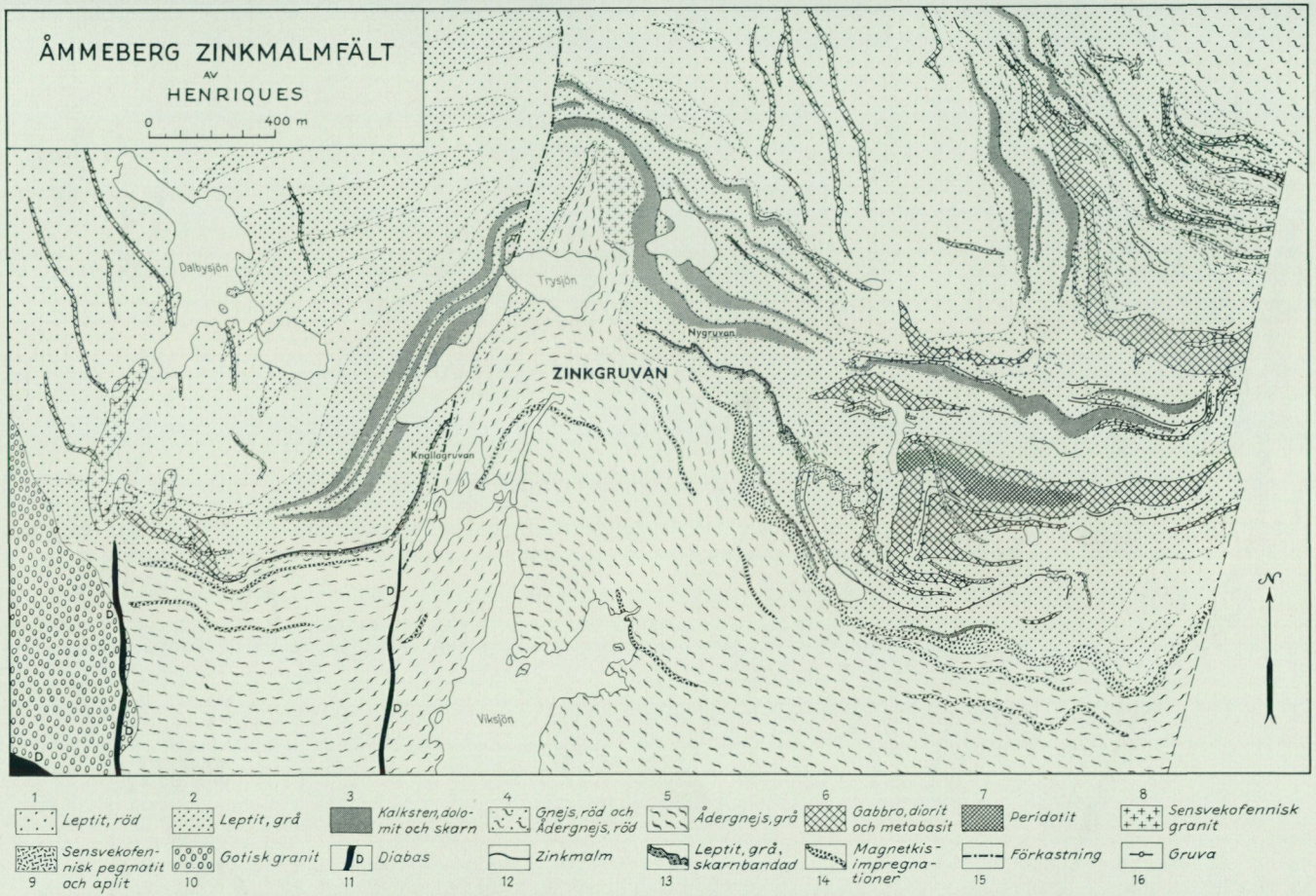

Fig. 286. Map of the Åmmeberg field. (After Å. Henriques.) Legend: 1. Leptite, red; 2. Leptite, grey; 3. Limestone, dolomite and skarn; 4. Gneiss, red, and veined gneiss, red; 5. Veined gneiss, grey; 6. Gabbro, diorite, and metabasite; 7. Peridotite; 8. Late Svecofennian palingenic granite; 9. Late Svecofennian pegmatite and aplite; 10. Gothian granite, porphyritic; 11. Diabase; 12. Zinc ore; 13. Leptite, grey, skarnbanded; 14. Disseminations of pyrrhotite; 15. Fault.

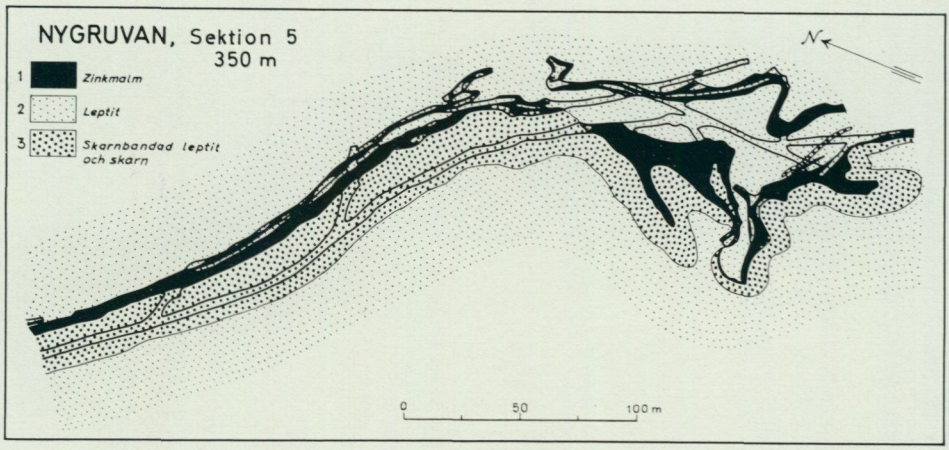

Fig. 287. Detail from 350 m. level in Nygruvan, Åmmeberg field. (After Å. Henriques.) Legend: 1. Zinc ore; 2. Leptite, grey; 3. Skarn-banded leptite and skarn.

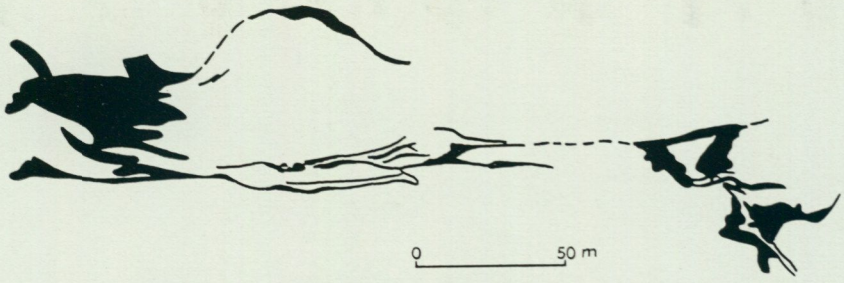

Fig. 288. Strongly folded sphalerite ore on 200 m. level in the Knalla mine, Åmmeberg. (After N. H. Magnusson.)

Fig. 289. Skarn-banded leptite in the foot-wall of the Zinc ore layer. Nygruvan mine. Ammeberg. (After Å. Henriques.) Leptite is here dark grey to black, skarn and limestone white to light grey. Scale 1:10.

Fig. 290. Strongly folded sphalerite ore resulting from replacement of fine-bedded leptite of which occassional beds still remain. Ore grey, leptite dark grey to black, skarn and limestone white to light-grey. Scale 1:16. Nygruvan mine, Åmmeberg. (After A. Henriques.)

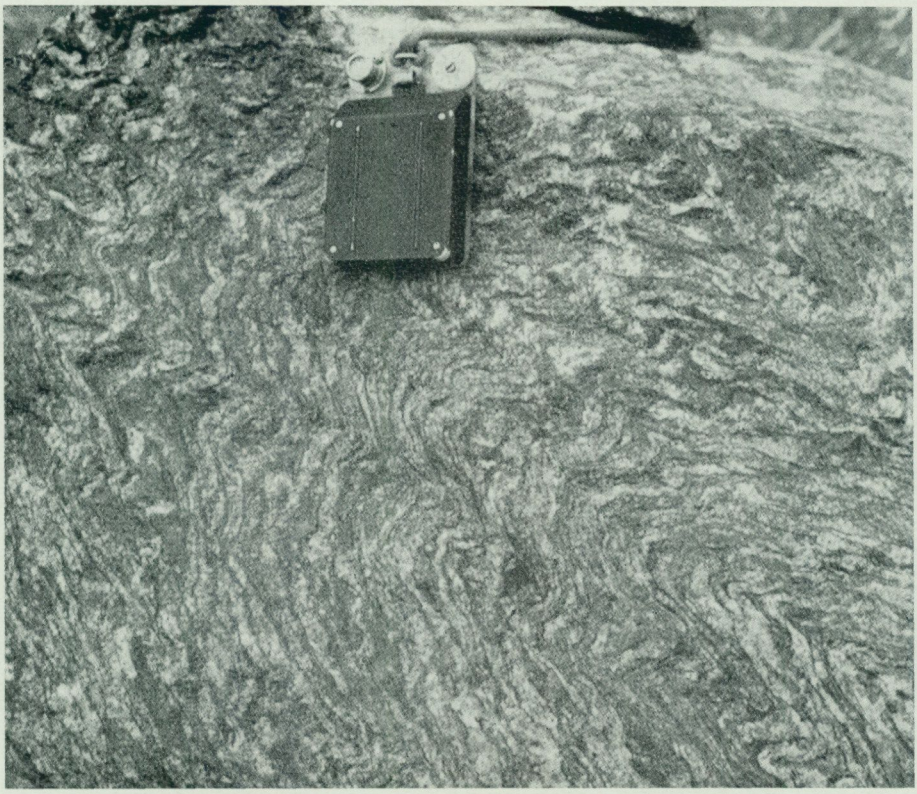

Fig. 291. Folded veined gneiss of grey colour. Quarry about 575 m. southeast of Nygruvan, Åmmeberg. In this gneiss appear several thin zones with disseminations of pyrrhotite, and in the Nygruvan region such a zone marks the boundary between the veined gneisses in the south and the zinc-ore-bearing grey leptites in the north. (After Å. Henriques.)

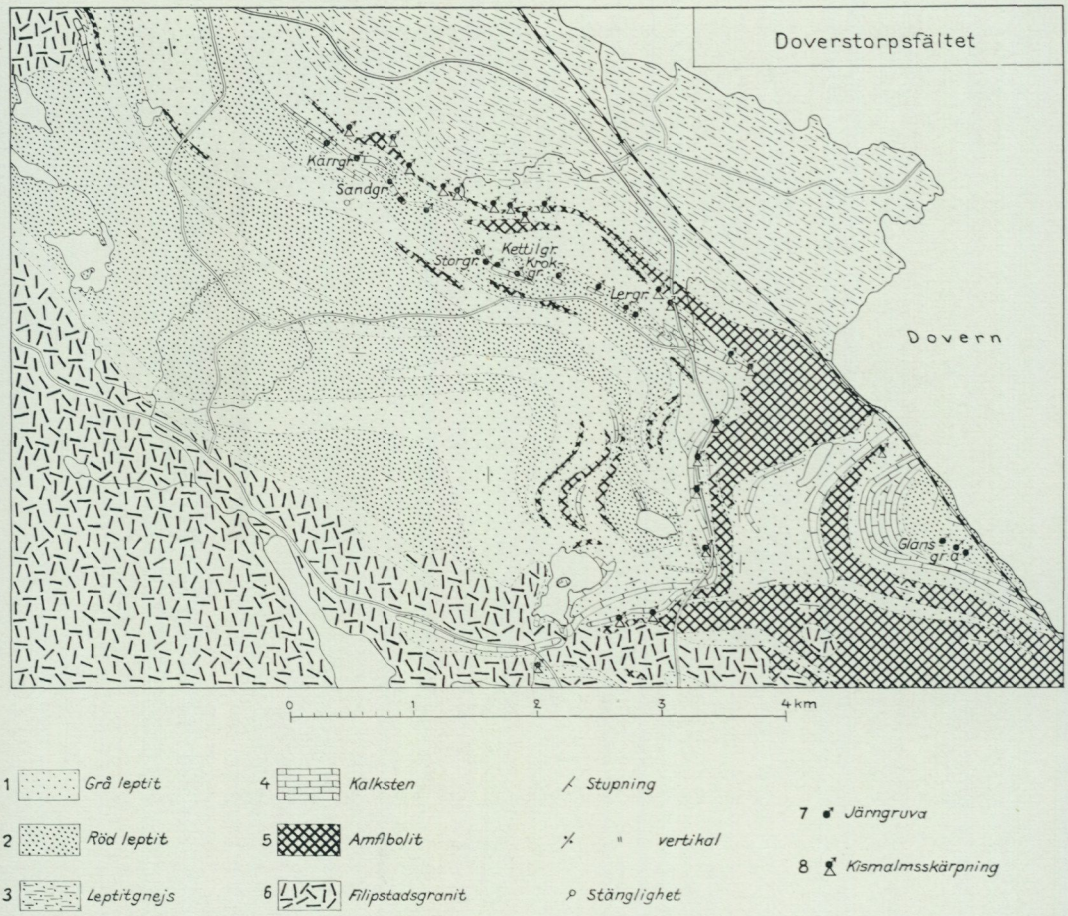

Fig. 292. Map of the Doverstorp field. (After B. Asklund.) Legend: 1. Grey leptite; 2. Red leptite; 3. Leptite gneiss; 4. Limestone and dolomite; 5. Amphibolite; 6. Gothian granite; 7. Iron ore mine; 8. Sulphide impregnation.

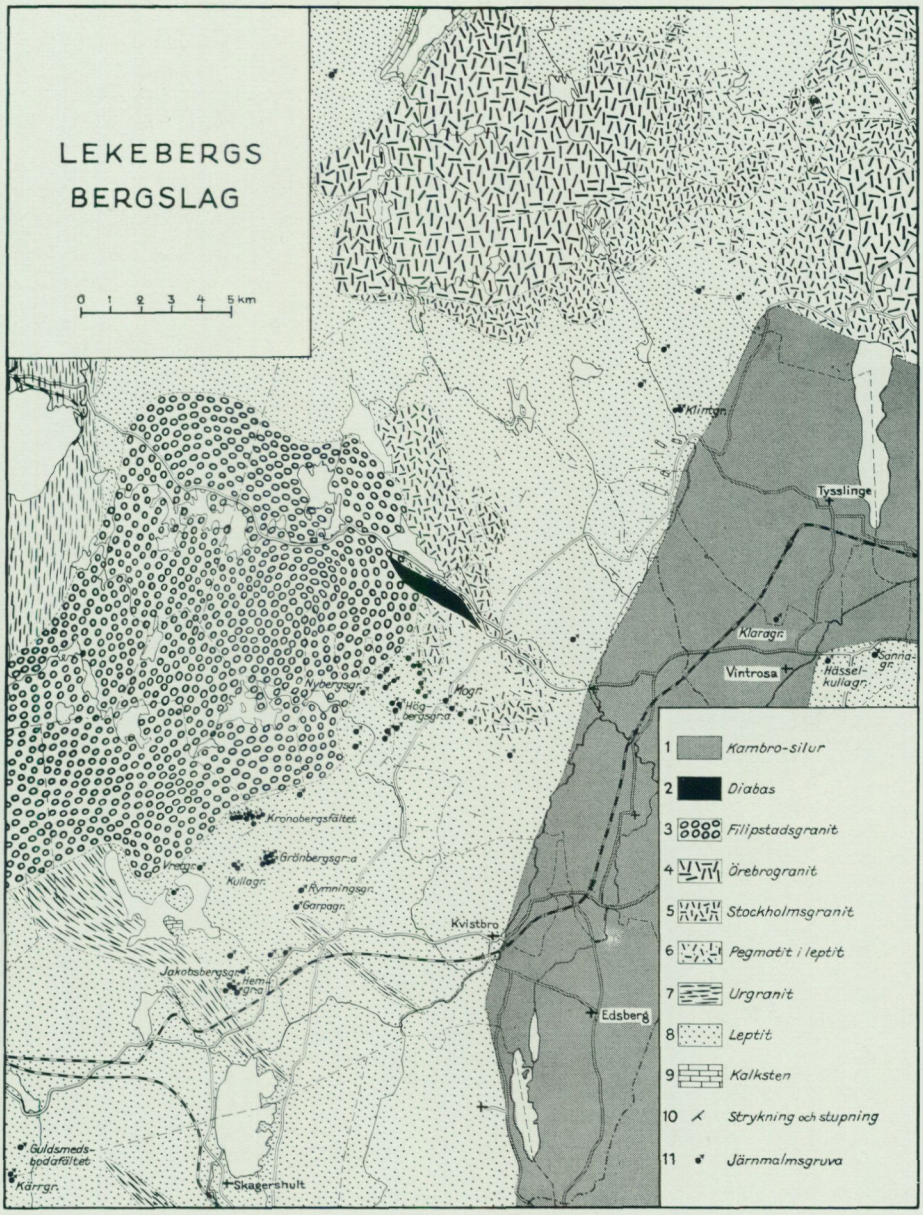

Fig. 293. Map of the Lekeberg region. (After N. H. Magnusson.) Legend: 1. Cambro-Silurian; 2. Diabase; 3. Gothian granite; 4. Late Svecofennian palingenic granite, porphyritic; 5. Late Svecofennian palingenic granite, evengrained; 6. Late Svecofennian pegmatite in leptite (migmatite); 7. Svecofennian synorogenic granite; 8. Leptite;9. Limestone and dolomite.

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(Maps and diagrams marked with italics)

Index compiled by Dagmar Lundegårdh.

MAP OF THE IRON MINES OF CENTRAL BERGSLAGEN

COMPILED BY NILS H. MAGNUSSON

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3 Svecofennian synorogenic granites

4 Svecofennian palingenic granites

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Fagerbergsgr.
Sjögr.
Yxsjögr.
Barnfallsgr.
Smaltjärnsf.
Älvhöjdsf.
Kvarnbacken
Hembäcksf.
Blyberget
Stefansgr.
Porkanäsgr.
Perrabäcksgr.
Bastkärnsgr.
Fäbobäcksgr.
Hörken
N. Ställbergsf.
Ställ-bergsgr.
Haggr.
Lyepargr.
St. Krigstj.
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Ställdalen
Finngr.
Sundsgr.
Dianagr.
Björkbergsgr.
Östenstorp
Ljusnarsberg
Kaveltorp
Långblågr.
Havsjöberg
Gåsborn
Myssberget
Getberget
Långban
Långbansgr.
Järnåsgr.
Silvergr.
Kextjärnsgr.
Klampasen
Haggr.
Fallagr.
Björksjögr.
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Salbobergsgr.
Sirsjöberg
Grönåsgr.
Ösjöbergsgr.
Rishöjdsbergsgr.
Rällsgr.
Dammängsgr.
Gränshyttef.
Gladtjärnsgr.
Gullblankagr.
Nybergsf.
Ingelsgr
Strässa
Bergsgr.
V. Karlandsgr.
Håkans-boda
Blankagr.
Smällberg
Tyskafallsgr.
Slotterbergsgr.
Stripa oddlf.
Rebodaf.
Guldsmedshyttan
Guldsmedshyttegr.
St. Svartbergsgr.
Rösbergsgr.
Kampagr.
Sångesgr.
Sjögr.
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Grönvätsf.
Vildgr.
Fanthyttef.
Mårdshyttef.
Högbansf.
Siggebohyttegr.
Siggebodaf.
Linsgr.
Timansbergsgr.
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Borsbergsgr.
Grekenäsgr.
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Berg-sängsgr.
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Övre Pershyttef.
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Pellegr.
Stripa
Källfallsgr.
Höjdgr.
Rödgr.
Riddarhyttan
Glittragr.
Bäckgr.
Oxgr.
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Svartviksgr.
Gustavsbergsgr.
Nordmark
Tabergsgr.
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Jakobsbergsgr.
Finnmossen
Saxå
Aggruvan
Harstigen
Pajsberg
Ormbergsgr.
Finnshytte-berg
Skribrogr.
Limtjärn
Getön
Högberget
Gruvåsen
Persberg
Storön
Sångs-fältet
FILIPSTAD
Gås-gruvef.
Koberg
Ansviksf.
Hornkullen
Nykroppaf.
Kroppa
Brunsjögr.
Malingsbograniten

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EB.

För spridning godkänd i Rikets allmänna kartverk 17/11 1969

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SVERIGES GEOLOGISKA UNDERSÖKNING SER. C. NR. 643

Översiktskarta över Centrala Bergslagens Järnmalmsgruvor

Sammanställd av
Nils H. Magnusson

0 5 10 km

Våtångsgr. Rolandsgr. Vargbergsgr. Digerbergsgr. Gryssgr. Digertäkt Djura Kuså Skyttgr. Grönbo Falugr. FALUN Domängr. Korsnäsgr. Gruvberget Aspeboda Råbergsgr. Malmbergsåsgr. Örlaxgr. Hofors Linderåsf. Penninggr. Nyängsgr. Vingesbackegr. Fagerstagr. Kvarnbergsgr. Storstrecksgr. Sjöströmsgr. Stallgr. Myggbogr. Tors-åker Göskegr. Storsängsgr. Örbäcksgr. Prästhyttef. Runn Vika Skinnarängsgr. Kråknäsgr. Kalvbäcken Söderåsgr. Knivsåsgr. BORLÄNGE Strandgr. Lövåsgr. Kalkbergsgr. Rällingsbergsgr. Skällingsbergsgr. Hällsjögr. St. Tuna Nybergsgr. Romme gruvor Forsängsgr. Tomtebogr. Svedgr. Bodåsgr. Gustafs Dalälven Fjägeråsgr. Husby Idkerberget Finnåsgr. Haggr. Skvatterbergsgr. Kalkbergsgr. Silvberg Ö. Silvberg SÄTER Bispbergsgr. Gångstigsgr. Laxsjöfältet Tuna-Hästberg Vallberget Gransjögr. Bensåsgr. Intrångsf. Jälkengr. Smältarmossgr. Garpenbergsgr. Ryttshyttegr. Garpenberg Hovran Haggr. Långviksf. Holmgr. Jönviksgr. Tallbottengr. Hästhagsberg Korstäppsgr. Bondhyttef. Broddgruvef. HEDEMORA Ställbergsgr. Tyskgr. Torrstensberg Bråfallsberg Gässbergsgr. Grangärde Siksjöbergsgr. Malsjöberg Mällsjögr. Hedtjärnsgr. Märrhagsgr. Gussjögr. Furbobergsgr. Östanbergsgr. Bäckbergsgr. Norbergsgr. Tysktorpsgr. Lekombergsgr. N. Nybergsf. Sljärngr. Fjäterbäcksgr. Björndalsgr. Väsman Sörvik Kanalgr. S. Nybergsf. Burängsbergsf. Gubbogr. Kärrgr. Grytnäs Folkärna Lövsvedsgr. Sjögr. Klintgr. AVESTA LUDVIKA Saxberget Kärr- och Buskgr. Väsmanf. Bybergsgr. Högbergsgr. Fredmundberg Blötberget Dal- och Slogsvedsgr. Skepparbäktgr. Norsbergsgr. Kronhällsgr. Källmossgr. Gudmundbergsf. Långblågr. Risbergsf. Gränges-berg Ormbergsf. Lombergsf. Bromossgr. Uddgr. Silkesbergsf. Björnbergsgr. Snöägr. Björkarnsgr. Norrbärke Smedjebacken Flatenbergsgr. Humbobergsgr. Holängsgr. Larsbo N. Barken Söderbärke Närsjögr. Tombogr. Röjningsgr. Johannisbergsgr. Långgr. Kärrgr. Stripåsen Bälsjöbergsf. Kallmora Morbergsf. Mossgr. Bondgr. Karlvagnsf. Åsgr.-Östanmossa Assessorskan Klackbergsr. Kolningsbergsf. Norberg Bojmossf. Aspgr. Malmkärragr. Klingbogr. Källgr. Svensbogr. Knutsbogr.

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