REPORT ON THE PROSPECTING FOR ORE ON CLAVERING Ø, EAST GREENLAND, IN THE SUMMER OF 1932

Introduction.

During the Danish expeditions to East Greenland the geological surveys of the three last summers have located some occurrences of ore minerals. In 1929 and 1930 Professor BACKLUND, investigating geologically the eastern part of Clavering Ø, detected within the igneous metamorphic complex, along its eastern border, some areas of gossan (some of these are marked (♀) on map I)[1]). The present writer, investigating, in 1931, the Carboniferous sediments in the western part of the island, discovered a very pronounced rust-zone (marked x on map I) in the eastern part of the investigated area, whose sediment cover had to a great extent been removed, and the gneissic rocks of the basement partly exposed.

However, in the last-mentioned area the outcrops along the fault-zones traced as rust-bearing were mostly capped by heavy moving soil. Thus, the chance of finding some ore outcrops in this place was not very great. If expensive exploratory work was to be avoided, it would be necessary to employ any geophysical method for location of the more heavily mineralised part of the zones.

The Swedish Electrical Prospecting Company (Aktiebolaget Elektrisk Malmletning) at Stockholm had placed at the disposal of the expedition in 1932 an equipment for geoelectrical prospecting. The limited possibilities of getting a sufficient number of assistants and the transport difficulties did not allow a geoelectrical investigation of a large area. Moreover, within a limited area the potential and the electromagnetical methods had to be proved to find out the most convenient geoelectrical prospecting method in arctic regions, where these methods have scarcely been practised. In this sense the investigation should be considered rather an experiment, and the efficiency of the

1) This report was accompanied by various maps and sections, which, however, are not published here, as they may contain information of practic-geological value.

Fig. 164. Electrical prospecting equipment transported by ponies. Clavering Ø.

work can by no means be compared with the speed that would be reached by a systematical investigation for ore by means of these methods in regions of arctic climate.

The progress of the investigations.

On the 17th of July the s/s "Gustav Holm" arrived at the Danish scientific station at Eskimonæs on the south-coast of Clavering Ø. The following day the ship anchored off the shore about five kilometres northwest of the scientific station. The electrical equipment, provisions, tents, fuel, and two Icelandic ponies for transport were carried on to the shore, where a depot was established. For the following two days the prospecting team, of four menbers, was occupied with the transport of tents, provisions, fuel, and some instruments to the locality of the investigations planned, at a distance of about nine kilometres inland from the shore depôt and at a height of 700 m.

July 21st.—A geological reconnaissance was undertaken combined with erection of cairns for a topographical and geological mapping of the area.

July 22nd.—Prof. Backlund continued the geological reconnaissance of the area, and the writer with two other members of the team, Mr. Sørensen and Mr. Kamman, fetched the electrical prospecting equipment on the shore.

July 23th.—A base was measured, and a triangulation of the area by means of theodolites was made. Some other instruments and cables were fetched from the depôt.

July 24th.—A base-line and transverse lines for the electrical measurements were laid out. The cable was laid out and connected with grounded electrodes. The instruments were put in order for measurements.

From July 25th to Aug. 2nd.—Uninterrupted electrical measurements were carried out and the equipotential, the ratio compensator, and the two frame methods proved. Meanwhile Prof. BACKLUND was occupied with the geological survey, drawing a geological map of the area.

From Aug. 3rd to Aug. 7th all members were engaged in digging pits II and III, which caused much trouble on account of the moving soil, which was all the time threatening to slide down into the pit already prepared.

Aug. 8th.—The equipment was transported back to the shore.

The results of the investigations.

1) Geological evidence.

As will be seen on the geological map (map II), the district is built up of the following rocks from above downwards:

Basalts	Tertiary
Sediments (Conglomerate, sandstones, and sands)	Carboniferous?
Gneiss, granite, and pegmatite	Caledonian-Late Palaeozoic?

The sediments rest directly upon the gneiss with a contact plane which dips some 10—15° to the SW. As all the different fault blocks have moved in relation to each other, the contact plane holds about the same dip, and in the overlying bedded sediments the stratification runs parallel to it. The sediments are capped by basalt sheets, reposing almost horisontally upon the sediments, thus crossing their bedding planes at low angles. In other words, the basalts are younger than the slight upturning of the older rocks.

a) Morphology of the area.

The Prospecting Valley owes its origin to two fault systems; one runs north—south from the Rustplateau to the Hidden Lake, the other, crossing the former at a nearly right angle, strikes west—east over the Rustplateau to the southern slope of the Gelting Plateau. The north-east area bounded by the two fault systems constitutes a down-faulted block in relation to the rest af the area. Thus, owing to the greater resistance to erosion of the basement gneisses compared with the covering sediments, these latter have been removed down to the basement surface of the outstanding blocks. Yet since the old gneiss surface dips pronouncedly to the SW., its boundaries northwards and northeast-wards towards the down-thrown block are well marked as rough crests of gneiss. Especially the crest that borders the structural Prospecting Valley to the West (The Western Hills), is well sculptured, for its gneissic terrain has been exposed, and its contiguous valley has been deepened by erosion in the sediments.

The loftier parts of the area are in some degree covered by ice caps. In the innermost part of the Prospecting Valley a typical cirque erosion has excavated the location of what is now the Hidden Lake.

The extent to which the district is covered by recent sediments is of special interest in this connection. Generally, the solid rock is well exposed, but on steeper slopes the outcrops have been overcapped by talus, and at the bottom of the valleys flowing soil has accumulated to very great thicknesses. In the western part of the Prospecting Valley, where the geoelectrical survey was made on the upper slope of the Western Hills, the talus is very abundant; its masses with occasional big boulders are further transported by the moving soil of the lower part of the valley (see fig. 2). In that part of the area, as generally along the fault systems, the exposures of solid rocks are rare, as seen on map III, where, except at the gneiss crests, nearly all rocks are covered by huge talus fans.

b) Characteristics of the rocks.

Gneisses and granites:

The oldest rock in the district is a brown biotite-bearing garnet-gneiss of Caledonian age, which generally strikes in a NNE. direction, and has a vertical or steep westerly dip. Conformably with, or cutting the schistosity of the garnet-gneiss at a slight angle, there occur some granitic and pegmatitic rocks with greater areal development than marked on the map, where only the greater dykes are shown. The granite or pegmatite south of the Prospecting Valley is a coarse pink microcline granite rich in quartz and poor in plagioclase. As accessories the granite contains sericite and some ore minerals as well as epidote and chlorite in the form of fissure fillings. The rock contains also fragments of the garnet-gneiss. Its boundaries towards the gneiss are, of course, very irregular, yet to some degree parallel to the gneissic schistosity. Farther southward, in the continuation of the strike of the pink pegmatite, a white microcline granite richer in plagioclase or a pegmatite containing garnet and biotite occurs as injections. This granite has possibly the same origin as the pink one. The granites and the pegmatites of the

Western Hills show a close resemblance to the white one. Their local abundance in garnet and two micas indicates a considerable assimilation of gneiss in connection with the intrusion. As accessories the rock contains sulphidic ore minerals, especially pyrite and molybdenite. Near the southern border of this body a big vein of milky quartz cuts the gneissic and probably also the pegmatitic rocks. The quartz shows no content of any sulphidic mineral, but its fissures are filled up with iron oxides.

Sedimentary rocks:

All the sedimentary rocks that occur in the area may be homotaxial with the lower horizons of the Carboniferous (Namurian) sediments, which are more completely preserved at the western end of Clavering Ø. Petrographically, they can be divided into the following groups:

	True thickness about
Upper arkose-sandstone, lightgrey-lightgreen	50 m
Middle violet brown arkose-sandstone	40—60 -
Lower grey arkose-sandstone	10—20 -
Lowermost quartzite or conglomerate	5—10 -

The distinction of these groups is not always sharp, especially when their members have undergone local alteration.

The quartzite and the conglomerate are formed of relatively porous quartz gravel with occasional felspar strongly kaolinised. Elsewhere the conglomerate prevails with well rounded pebbles of a milky quartz 1—2 cm in size. Occasionally carbonised plant remains are to be found in these rocks.

The lower arkose-sandstone is a felspar-bearing, parallel-bedded fine sand, with dark bands of biotite, of very slight cementation.

The middle violet-brown arkose-sandstone consists of a coarser material with abundant pink undecomposed felspar. The rock is hard, sometimes cross-bedded, with conglomeratic bands, poor in mica, and shows elsewhere a greenish pink colour.

Finally, the upper arkose-sandstone is again more fine-grained and poorer in felspatic material. The colour is generally light-grey or light-green, but sometimes yellow shades prevail.

Basalts:

In the basaltic sheets, beds of a dense plagioclase-basalt with columnar structure repeatedly alternate with beds of amygdaloid basaltic lava in which the amygdales are filled with zeolites. The lava shows flow structures.

c) Indications of ore minerals and some details of the geological conditions within the area geoelectrically prospected.

The marked zone of iron ochre can be distinctly followed for more than three kilometres along the fault system in a north-south direction. Elsewhere along the crossing fault system also brownish-red soils of ochre are easy to trace, but here of smaller extension. It is evident that the origin of the ore minerals may be connected with the dislocations of the district which have opened the way for intrusion of the ore-bearing solutions. Probably, these solutions have also caused the obvious alteration of the rocks along the faults, which first of all is prominent in the lowermost quartzites and conglomerates. As described above, they are generally porous and relatively rich in kaolinised felspar. Along the faults, however, they have been silicified and converted into very hard glassy quartzites with the felspatic material in some degree transformed to sericite. They are more or less impregnated with sulphidic ores, mostly iron pyrite, but also with a few grains of chalcopyrite, galena, and at random with bornite and chalcocite. Hereby these rocks, where exposed, are always coloured by a crust of iron ochre.

The precipitations of ochre are bound to the moving soil of the slope of the Western Hills, where they form great patches, from which tongues issue to the bottom of the valley.

Not only the ochre soils indicate the occurrence of sulphidic ores within the area, but also the local efflorescences of soluble sulphate-minerals, which owe their existence to the dry summer climate, point in the same direction. At pit I, there is a white sulphate of magnesium and aluminium, probably pickeringite, which forms pulverulent patches on the sand nearby. Chemical tests gave Al_2O_3, MgO, a little SaO and H_2O as constituents. The water loss at 105° (25 $^0/_0$ H_2O), however, is too low for pickeringite. Pit I was dug to a depth of about 1.5 m, where the frozen soil was encountered. To about 0.8 m depth, the cut ran through fine sand, on top of which followed a sand-mixed yellow heavy allophane clay with boulders of strongly silicified gneiss. The boulders, half a decimetre across, consisted to some extent of nearly pure marcasite with small grains of quartz and garnet; other boulders consisted of thin quartz-ribbons, with cavities up to some cm^3 between, whence the sulphidic ores have been dissolved and nearly totally removed. Except the secondary marcasite, no other ore minerals than some small crystals of chalcopyrite were found.

In the south-western corner of the investigated area, at the base of the hill with cairn I, a little outflow of water has precipitated sulphate of iron (analysed), coulouring some ten square metres light-green by crusts of this salt. The small water rill flows through a decomposed quartzitic rock with yellow clay containing allophane. These soils contain abundant crystals of pyrite and sparse quantities of chalcopyrite.

Among the boulders of the moving soils hardly any containing important sulphidic ores are seen. The explanation of this is, no doubt, that boulders from the substratum covered by frozen soil have at present very little possibility of reaching the surface. Boulders that have reached the surface through the moving soils must be very old, however, the ore minerals have been dissolved by the water circulating above the permanently frozen soil. Probably the aforementioned boulders of thin quartz ribbons, which are fairly frequent within the moving soils, represent the remnants of ore-boulders. The bulk of the boulders within the moving soils, however, consists of rocks still exposed, the material of which slides upon the permanently frozen soil. The conclusion come to above is based on the assumption that deeply weathered ores existed before the establishment of the present climatic regimen.

The north-south fault system may be more complex than can be concluded from the morphology and the distribution of sediments; therefore it is possible to locate two different step-faults (map III, 250 W. and 50—100 W.). From the electrical measurements it became evident that two distinct dislocations between the aforementioned ones had to be located at 180—200 W. and 210—230 W. (L.O.). In order to examine one of these, pits II and III were dug, the former at 182 W., the latter at 197 W. In the former an upper section of moving soil was crossed to a depth of about 0.6 m, after which a nearly horisontally stratified violet sand continued to be frozen at a depth of a little over 1 m. At about 2 m the solid rock was probably reached, it was a grey sandstone rich in mica. In the section there were thus two groups of the sediments represented, namely 1) the middle violet brown sandstone, and 2) the lower grey sandstone. In pit III, from about 1 m down, a porous quartzite sand was cut; it was frozen, strongly kaolinised, conglomeratic, and to some extent impregnated with pyrite, chalcopyrite, chalcocite, and galena. At a depth of 2 m in this section a lenticle of black micaceous clay was met with which may very likely be identical with an "argile de frottement" (Verwerfungston). Evidently a fault, the throw of which may be at least 10 m, runs between these two points. The location of this fault makes it very likely that another fault runs at about 220 W., since at a higher level, at 230—240 W., the quartzite crops out again. The fault system thus consists of at least four different step-faults within the area. The perpendicular displacement of all the faults together amounts to more than 80 m.

Another peculiarity becomes clear from a more detailed structure survey of the area, partly from a topographical, partly from a geoelectrical point of view; the faults do not strike the terrain straight-lined. On the contrary, the faults are probably very often cut off by small transverse faults, meeting the main direction of the faults at obtuse angles and causing an en-échelon-distribution of the principal faults. The cross fault areas may be complex crush zones. These features are to some extent marked on map III, where, however, only the definitely located dislocations are shown. This matter will be considered once more later on in the course of the discussion of the geoelectrical results.

d) On the age of the ore-forming processes.

The question of the time of the ore-forming processes is first of all connected with the age determination of the faults within the area, since the ore solutions must have intruded at the same time as, or later than, these were formed. The age determination of the faults rests, indeed, upon very few premises, and must be regarded as rather uncertain. On account of the great resemblance of the sediments to those which crop out at the western point of Clavering Ø, it has been supposed that the sedimentary rocks of the district are of an Upper Carboniferous age (Namurian). If this be correct, the dislocations are younger than Carboniferous, because the sediments of this age have taken part in the block movements. However, the upper limit is very difficult to draw exactly; it can only with certainty be fixed as pre-basaltic, since the E.—W. directed fault is covered by basaltic sheets (not seen on the map). In addition, it is not probable that any Tertiary movements (older than the basalts) can at all have influenced the faults here discussed. For under such circumstances the solutions that have brought the ore minerals, must be connected to the Tertiary eruptives; this possibility is a very slight one. During the interval between the Carboniferous and the Tertiary, movements of late Paleozoic age, which in other districts of East Greenland have played an important rôle, may with a great degree of certainty also have caused the dislocations discussed above. In this connection the question arises whether the intrusives with which the ore-bringing solutions may be connected, are exposed in the present area. The only parent rock magma in the area, from which the mineralisers may perhaps have originated, is represented by the granitic, pegmatitic, or quartz veins which have crossed the Caledonian gneisses. Some of them, as already stated, are bearers of ore minerals (pyrite, molybdenite). But no proofs are given that these rocks belong to a late Palaeozoic magmatic cycle. Possibly only a definite representative of them may be considered the parent rock, or the ore solutions are associated with deeper intrusives not exposed in the area.

2) Geoelectrical results.

a) Potential methods.

At the beginning of the geoelectrical experiments two potential methods were tested. The first of them, the equipotential method, proved to work unsatisfactorily in the terrain, as it was not possible to get sufficient grounding of the searching rods in the moving soils, especially in the places where they were covered by concentrated pavements. In addition, it proved difficult to get a distinct minimum sound in the measuring telephone by going up the potential lines on account of the phase differences of the distributed alternating current in the ground.

By means of the ratio compensator method the most detailed measurements were executed and the transversing lines 300 S., 200 S., 100 S., 0, 100 N., 150 N., 200 N. and 250 N. were measured from 0—250 W. For a more detailed account of this relatively new method, theoretically as well as practically, reference is made to the Electrical Prospecting Company's publications, especially: 1) H. LUNDBERG and T. ZUSCHLAG: A new Development in Electrical Prospecting. The American Institute of Mining and Metallurgical Engineers. Techn. Publ. No. 415, New York 1931; K. SUNDBERG, Principles of the Swedish Geoelectrical Methods, Ergänzungs-Hefte für angewandte Geophysik, Vol.1, pp. 298—361, Leipzig 1931, and H. HEDSTRÖM: Electrical Prospecting for Auriferous Quarz Veins and Reefs, The Mining Magazine, 1932. Only the main principles of the method will be briefly dealt with below. A 500 cycles alternating current from a generator is conveyed to the earth by means of two point electrodes. From one of these the potential gradient in definite intervals (10 m:s) is measured by means of the ratio compensator along a straight line. The other electrode lies at such a distance (1—2 km) perpendicular to the measuring line that it has no influence on the potential distribution from the first electrode in the direction measured. With such an arrangement it is possible to calculate the potential distribution from the point electrode if, along the measuring line, there is 1) a homogeneous medium, 2) a vertical fault plane with different electrical conductivity of the two blocks, or 3) a vein the conductivity of which differs from that of the country rock. These calculations are the theoretical basis upon which the method of "electrical trenching" is built. This method which was used in the area in question, differs from the "electrical drilling" method, where the object is the determination of the depth to a horizontal boundary plane between rocks of different electrical conductivities.

The arrangement of the ratio compensator is shown in fig. 3. A is the power electrode, P_1, P_2, and P_3 are three grounded electrodes connected with the measuring instrument. Through the bridge arrangement of the instrument, it is possible to vary the variable resistances R_1 and R_2 until the potentials G and P_2 have the same magnitude, in which case no sound will be heard in the telephone. A little phase difference between the two voltages of P_2 and G can be compensated by an out of phase voltage supplied from a variable inductance in the telephone circuit. After at least two different values of R_1, resp. R_2 have been obtained in this way, the ratio of the potential-gradient $\frac{P_1-P_2}{P_2-P_3}$ can be calculated, being directly proportional to the differences between the two readings on the resistances R_1, resp. R_2. If the measurements are going on continuously, the relative potential gradients between all the 10 m intervals are fixed along the profile line, and the relative potential of P_1, P_2, P_3, etc., can also be calculated.

On map IV, the boundaries between areas of different electrical conductivity are indicated, as they have been located from the measurements by means of the ratio compensator. The parts of the different profile lines of about the same electrical conductivity are connected with each other, and areas with relatively very high, high, moderate, and low conductivity have been outlined in this way. Between about 100—190 W., there is an area with a relatively normal potential drop, which to the West and East is interrupted by areas in which the potential ratio is highly variable. In the western part this fact may be very comprehensible, because here the area has been strongly dislocated, as is shown above. In the eastern part, however, the area of relatively low resistivity along the Camp River has, no doubt, nothing to do with the structure of the underground. The high conductivity along the river is probably due to the deeper thawing of frozen soils. Generally, it can be said that the method is too sensitive to the geological condition in the investigated area. Owing to this fact, the boundaries between blocks of different conductivity have been strongly indicated. At the same time it is difficult to distinguish the indications that have been caused by block boundaries and by mineralised veins. If we are to study a fault structure, the method may have some importance, but it cannot be very valuable for an exact location of mineral veins in the area. In addition, it is evident that frozen soils have had an unfavourable influence on the results of the measurements. Owing to the insulating sheet that is created by frozen soils, the current from the power electrode followed the moving soils above the frozen sheet, and had no opportunity of reaching the underground to the degree that would have been desirable. In consequence, the indications have also been influenced by superficial irregularities, which have been especially considerable in the north-western corner of the area, where outcropping gneiss and moving soils continually alternate.

b) Electromagnetic measurements.

Under the conditions that are met with in the area, the disadvantages of the ratio compensator method lie in the great sensitiveness of the method for variations of the conductivities of the rocks, also, when these changes are not very great. As an example a fault plane where the ratio between the conductivities of two adjacent rocks is 10:1, is indicated nearly as strongly as if this ratio had been ∞:1. With the electromagnetic or inductive two-frame method, however, the ratio mentioned must be greater before an indication is obtained.

Concerning this method, reference is made to the above-mentioned papers, K. SUNDBERG, Principles of the Swedish geoelectrical Methods, or to K. SUNDBERG, H. LUNDBERG and J. EKLUND, Electrical Prospecting in Sweden, Sveriges Geologiska Undersökning, Årsbok 17 (1923) No. 8, Stockholm 1925.

By this method the alternating current is almost exclusively supplied to the ground by electromagnetic induction. An insulated cable, connected with a generator, is laid out in a straight line along the area to be investigated, and grounded on to one half-kilometre outside the two opposite sides of the area. By this arrangement, the primary alternating current is surrounded by an electromagnetic field, the primary field, where points of the same field strength occupy a cylindric shell with the cable as an axis.

In bodies of good conductivity, however, this primary alternating electromagnetic field will induce an alternating current, which in turn originates a secondary electromagnetic field. It is the resultant of the primary and secondary fields, or the resultant field, that can be measured. By this arrangement the secondary current of the conductor is not only due to induction but also in some degree to concentration in the conductor of the return current travelling through the ground between the two ends of the primary cable. Generally that part of the secondary current is not great.

The instruments used for these measurements consist of movable coils of insulated wire, the so-called frames, in which a voltage is induced when the coil is exposed to the alternating electromagnetic field. The frame is connected to an amplifier with a telephone, in which the sound, corresponding to the frequency of the generator, will be heard. The investigation of the electromagnetic field can be executed by determining the field direction by means of one frame, and by determining the ratio between the fields at two different points by means of two frames. In the first case the frame, movable around a horisontal and a vertical axis, is turned until no sound is heard in the telephone. In this position the plane of the frame is parallel to the axis of the field. In the second case the two frames are connected with each other, and the amplifier and telephone are coupled in series to the circuit. The frame at the one point is kept horizontally, the other frame, movable around a horizontal axis, is turned until the voltage of the first frame is balanced. The angle then turned is a measure of the ratio of the vertical field components at the two points. The measurements are going on continuously along a profile line perpendicular to the cable, at every 10 m points of the line. If the field direction at the measuring points and the ratios between adjacent points are determined, it is possible to calculate the horizontal as well as the vertical components of the secondary field in relation to the primary. From these data, the position and the depth to the secondary current, and accordingly to the conductor or the ore body, can be calculated.

In the investigated area only three lines, namely 100 S., 0 and, 100 N., were measured by this method. The short time did not permit any other measurements although the method worked fairly well. By this method apparently no indications were obtained from block boundaries. Six indications have been received, namely at:

L.O.	185 W., 220 W.
L. 100 S.	180 W., 210 W.
L. 100 N.	70 W., 240 W.

Along L.O. and L. 100 S. the indications lie in the same fault-zones, and follow the block indications that have been obtained from the ratio-compensator measurements. At L. 100 N. 180 W. no corresponding indicationes appear, although the fault probably follows the strike in that direction, which can be explained by the fact that the mineralisation here has ceased. The westerly indication at 240 W. does not lie in the same strike as the indications on L.O.; this is probably due to the transverse fault disturbances, which can be seen from the conductivity measurements. Finally, a weak indication has been obtained at 70 W., which is of some interest, because the position lies in the same strike as the sulphate efflorescences at pit I. All the indications obtained are weak, however, those of L.O. being the most pronounced. It is not possible, in the present state, to decide whether the weakness of the electrical indications is due to the relatively small conductivity of the bodies, or whether it is due to the moderating effect of the insulating sheet of frozen soils. It would be very difficult to understand these indications if they did not depend on mineralised bodies. In other regions one might fear that they were the result of water-filled fissures of great conductivity, but in this area where the subsoil is frozen this possibility is excluded.

From the results of the electrical measurements it can be estimated that the depth to the conductor at L.O., 185 W., must be less than 6 m. The dip of the conductor may be directed a little to the east.

The arrangement just described has some disadvantages, which, however, can easily be remedied. When the cable is grounded by two electrodes, the return current through the ground between these electrodes will travel almost exclusively through a rather thin layer of thawed soil at the very surface of the ground, as already discussed above. In consequence, that part of the secondary electromagnetic field which is due to this return current, will be rather strongly disturbed by superficial irregularities. Such disturbances also occur in the area investigated, but they are rather weak and can therefore easily be corrected for. However, the arrangement may be ideal if the current is supplied to the ground solely by induction from a large circular or rectangular loop of insulated wire which is nowhere in electrical connection with the ground. In addition to this, it must be considered desirable that the phase differences of the electromagnetic field, also, could be determined, which, however, is not possible by means of the two frame methods. For this purpose the so-called "Turam" method, recently devised by the Aktiebolaget Elektrisk Malmletning, may be the most convenient.

In further geoelectrical investigations for ore in Greenland, therefore, the "Turam" method is recommended, whereby the current should be supplied to the ground inductively by means of large rectangular loops. By this method it would be possible, by a team of 6—8 persons, to investigate an area of 1—2 sq. kilometres in about a week. The team would then consist of two measuring engineers with 2—3 assistants each. The transports of provisions and instruments, as well as the continuous laying out of wire for new loops can be made by 2 or 3 assistants.

Summary of the results.

To sum up the more important results of the ore prospecting in the area, it has been proved that ore-forming processes have taken place along fault zones. The ore-bearing solutions were probably associated with granites and molybdenite-bearing pegmatites somewhat younger than the Caledonian gneisses, or with later intrusives not exposed in the area. The fault system more closely investigated consists of at least four different step-faults, which all seem to be more or less mineralised. Outcrops of ore as well as primary ore boulders have not been found in the area. But indirectly the electromagnetic indications furnish evidence of the occurrence of veins with a relatively concentrated mineralisation of good electrical conductivity. The ore minerals disseminated within the rocks show that not only pyrite is represented but also galena, chalcopyrite, and probably some other copper minerals.

The geology dealt with in this report is to the greater extent founded on observations made by Prof. BACKLUND. I have also had the opportunity of discussing the geological conditions with him, and he has looked through the geological part of the text. With Mr. H. HEDSTRÖM, Mining Engineer of the Swedish Electrical Prospecting Company, I have discussed the geoelectrical results, and he has looked through the geoelectrical part of the text. For advice and assistance in these connections, I wish to express to them my sincere thanks.

April 1933. Mineralogical and Geological Institution of Upsala.

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