Bergvesenet

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Rapportarkivet

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Tittel

Remarks on the geophysics of the Tverrfjelle area

Forfatter	Dato	År	Bedrift (oppdragsgiver og/eller oppdragstaker)
Lakanen, Ensio	28.03	1988	Outokumpu Exploration

Kommune	Fylke	Bergdistrikt	1: 50 000 kartblad	1: 250 000 kartblad
Dovre	Oppland		15193	Røros

Fagområde	Dokument type	Forekomster (forekomst, gruvefelt, undersøkelsesfelt)
Geofysikk		Tverrfjellet

Råstofgruppe	Råstofftype
Malm/metall	Cu, Zn, S

Sammendrag, innholdsfortegnelse eller innholdsbeskrivelse

Rapporten som er på engelsk foreslår noen geofysiske målemetoder som ennå ikke er forsøkt ved Tverrfjellet for å eventuelt påvise mulige malmforekomster.

REMARKS ON THE GEOPHYSICS OF THE TVERRFJELLE AREA

INTRODUCTION

The visit to Norrsulfid's Tverrfjelle mine occured on the 15-17th of March, 1988. The participants of the main discussion were: Johan Heim, Ivar Killi and Frank Priesemann, Folldal Verk A/S, Ole Lile, Trondheim University and Ensio Lakanen, Outokumpu Exploration.

The area in question is some tens of square kilometres consisting of the Tverrfjelle ore deposit and also the exhausted Folldal ore horizon. There are old aeromagnetic and turam survey results available, undertaken by NGU in 1965-67. The immediate surroundings of the Tverrfjelle were carried out by ground magnetics, gravity, Mise-á-la-Masse and amt, amt being measured by Elkem 1979-80. Few profiles were surveyed with a new turam equipment and Syscal EM by SINTEF, quite recently. Other methods like IP, resistivity and VLF have been also tested, but with less importance. Petrophysical determinations, susceptibility and density are available, too.

Geology of the area consists of steeply dipping layers of sedimental and volcanite rocks. Garnet-mica schist is the main sedimental rock, quartzite with magnetite as intermediate layers. Greenstones, mainly amphibolites form also long intermediate layers. Ore horizon is situated in the contact of amphibolite and mica schist. The amphibolite layer is thicker, where the base metals are enriched, but along this many kilometres long horizon there are plenty of pyrite, too. Some graphite is known to cause turam anomalies.

The strike is in average east-west or northeast-southwest.The Folldal horizon is separately in the southeast, but a possible connection by folding is not known. A major fault is close to Tverrfjelle ore body intersecting the horizon with an estimated thrust of 1500 m down in the eastern side.

GEOPHYSICAL SETTING

The orebody is 1.8 km long massive, pyrite rich copper ore with a pyrrhotite rich part in the deeper section. It is a good conductor causing a clear turam anomaly, and Mise-á-la-Masse has been used successfully to delineate the different ore lenses. The whole pyrite rich zone has been clearly followed by turam anomalies. There are plenty of parallel anomaly zones, which are thought to be caused by magnetite rich quartzite and also graphite rich mica layers. The orebody is located at the western end of a long magnetic anomaly, caused by magnetite, but only the pyrrhotite (monoclinic) rich part is seemingly magnetic. Long magnetic anomalies follow the ore critical zone and parallel narrow anomalies are found all over the area.

Gravity is controlled mostly by the thickness of amphibolite, which is somewhat heavier than the surrounding rocks. The orebody exists in the southern flank of gravity maximum. There is another elongated anomaly in the eastern side. These together make gravity the most interesting method for direct base metal prospecting along the ore critical zone as well as towards the Folldal ore zone.

Amt soundings have been carried close to the Tverrfjelle ore deposit, where there unfortunately is electrified trailway crossing the area. This and other cultural disturbances are most probably the cause of unsuccess of amt survey to gain interpretable data.

Deep em soundings carried out by SINTEF were more successful. In the northeast of the Tverrfjelle area (Gåvåli) a conductor was located at some depth. Mise-á-la-Masse was used to map its extensions, which are still open to east. It is already drilled, but only pyrite was found. Syscal em multifrequency measurements were used here to show that it is only a weak conductor.It is thought by Frank Priesemann to be the northern flank of possible syncline, but it is not as ore critical as the better known southern one. In the middle of the syncline there may be up to 1000 m of sediments covering the ore critical layer. Anyway this was practically the only place, where the shallow conductors did not mask deeper em survey.

To the west of the ore deposit there is thicker overburden and anomalies (turam and gravity) seem to break starting again, where a minor mineralization was drilled (Vesleknatten). The deeper section here as well as the layers to north are stopped by a nappe, thought to dip to south.

RECOMMENDATIONS

The orebody is very conductive and can be located by electric and em methods. This is already done by the large turam survey, which has located the sulfide bearing horizons. Unfortunately all the sulfides does not include copper or any valuable base metals. There is no geophysical method known that could discriminate copper rich part from pyrite rich. Some indirect means might be found by making enough testing and interpretations. Any lithogeochemical halo is not known either or tectonic factor to be followed. The only clue at the moment seem to be the fact that the amphibolite layer is thicker where the base metals are found. Because amphibolite is heavier enough than the surrounding rocks, the gravity is the first method to get a closer look. The data available will be interpreted in detail to see, if the hypothesis is of any value.

The interpretation of ground magnetics is good to undertake at the same time for more structural information. After this it can be decided if the gravity survey should be extended to cover the whole prospecting area, which seems already quite tempting. It is suggested to measure profiles from south to north over the critical horizon at most with 500 m spacing rather than doing regional gravity.

To find possible petrophysical indicators or special characteristics, logging of selected drill holes is proposed. Particularly something new may show up from gamma logging with a scintillometer type sensor. It does not need to be any radioactive mineral, just some specific differences in the total radiation. For instance a slight change in the contents of some rare mineral in amphibolite might be observed specific to a closeness of ore. This has been applicable in greenstone environments elsewhere, when tried, and though the chances here may not be too good, it is so cheap to test that it is worth of doing at any rate.

Deep em sounding can be only used further east or west from the orebody, because of cultural disturbances. The many shallow conductors prevent a serious detailed survey to be very successful. Only an exceptionally huge massive conductor might be observed separately. To check this, two parallel long (about 10 km) test profiles with multifrequency dipole-dipole (Gefinex 400 Sampo) system could be carried out in the eastern part directed from south to north. If topography is too rough, then transient method is more recommendable. The same applies to the most western part of the area.

If the prospecting is going to be extended to the whole area from Tverrfjelle to Folldal and the belt, where the greenstones are met, then a basic helicopter or low altitude airborne survey should be done. Magnetics and em data would be processed with modern image processing techniques, and the stratigraphy as well as tectonic factors were more thoroughly interpreted to guide the coming more detailed ground investigations. This needs money and few more years to go.

SUMMARY

Most of the geophysical possibilities have been used already, only some minor things can still be suggested:

-gravity and ground magnetics data are interpreted in detail using all the available geological and petrophysical information.

-logging is carried out in 5-10 drill holes with susceptibility, resistivity, natural gamma and gamma-gamma sensors.

-deep em soundings are surveyed in couple of long profiles with either Gefinex EM 400 Sampo type equipment or time domain.

If the investigations are going to be spanned at least three more years:

-regional gravity or rather profiling with 500 m line spacing is highly recommended.

-a low altitude airborne survey with modern equipment and image processing of the data would be needed to update structural and tectonic interpretations.

Outokumpu 28th of March 1988

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