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BV 488

PRELIMINARY REPORT ON THE GEOLOGY OF THE SKRATTÅS AREA

by

Professor Brian A. Sturt

1. juli 1974

Bv 4 88

A/S SULFIDMALM

INTER-OFFICE MEMORANDUM

Date: 9. July, 1974

To: Falconbridge Nikkelverk A/S

cc: A. M. Clarke, H. T. Berry, R. Hovland, F. Nixon, T. H. Tan, B. A. Sturt.

From: J. B. Gammon

Subject:

904-24. Skratås area. Report nr. 328/74/24.

Please find attached Sturts preliminary notes on the geology of the Skratås area. His initial investigation has indicated an interesting pattern of folding which suggests stratigraphic connection for the known mineralised areas. This hypothesis will be evaluated further during the balance of the 1974 field season.

Preliminary note on the Geology of the Skrattås Area

This note is being written in advance of a report on the geology of the area to give an indication of the main results established during reconnaissance mapping 19 - 23 Juné 1974. The basis from which this reconnaissance study was built consists of reports 301- 73 - 24 (T.H. Tan) and 266 - 73 - 24 (R. Hovland), with the addition of the preliminary 1:100 000 geological map of Carstens (obtained by Tan from N.G.U. archives). The general pattern of the Geology of the Skrattås prospect according to Carstens' map and Tan's report is of a belt of greenschists (containing the known mineralization) striking ENE/WSW bounded to the north by limestones. The ore-body at the Skrattås Mine is indicated by Tan to be cut-off by faulting to the east, and the connection of the mine to the Bjønsaas mine, the Marken workings and the surface exposures with good Zn assays from Skrattås Farm were not obvious. The results of the current work to be amplified in detail later are as follows: -

(1) The interface between the limestone and the "greenschists" to the south is an interfolded junction, where the limestone forms antiforms and the "greenschists" synforms. From minor structure observations the folds plunge 30-40° westwards.

(2) The implications of this as far as the Skrattås mine is concerned are quite interesting, they indicate that the ore-zone closes out eastwards in a westerly plunging synform and is not limited by fault contact as indicated in the report (301 - 73 - 24).

(3) The sequence reading outwards from the limestone Stamvann is a sedimentary one almost completely devoid of "greenstone".

(4) The dominant lithologies are as follows: -

Grit (including thin conglomerate zones)

Sandstones

Quartzites rich in magnetite

Quartz-Schists

Phyllites

Phyllonites

The latter lithology is of considerable interest as many of the rocks between the grid-baseline and the Stamvann limestone have the appearance of green chloritic phyllites, however on broken surfaces it is possible to see that the rock has a phacoidal or lensoidal appearance with coarser material preserved between foliation planes felted with chlorite. It is usually possible by careful observation to trace a complete transition between grit, with well preserved sedimentary grain shapes, though sheared grit and eventually into the phyllonitic rocks described above. In the reconnaisance map presented a careful distinction between the various tectonic facies of the gritty rocks was not possible as indeed the transitions mentioned may occur over very small distances. However, the colour distribution on the map does give some indication of the types of patterns which occur.

Grits and Sandstones

These are the main element of the succession south of the limestone of Stamvann. They range from fairly thin conglomeratic horizons near the SW termination of Stamvann and at localities - (74) and (78) to grits (which is a more colloquial term for coarse sandstones with angular fragments), to the sandstones with fairly even grain showing good degrees of grain rounding. The grits and sandstones all have appreciable foldspar content

(mainly plagioclase) which in some instances may dominate over quartz. One fairly characteristic feature of the grits is the presence of sedimentary grains (not ubiquitous) of blue quartz- presumably derived from a basement complex of high metamorphic grade. As mentioned above the strong deformation of the area has produced a range of phyllonitic rock types from the grits and sandstones where secondary chlorite produces a dominating green colouration to the lithologies. Even in some of the most phyllonitic varieties, however, blue clastic quartz grains are often visible.

Magnetite Quartzites

These form a very interesting lighology and are virtually purely of quartz and magnetite, the magnetite often making up 20% of the total rock volume. A good example of this is seen near the eastern margin of the Skrataas mine called Kvartz in the cross-section after Støren (Fig. 4, report 301 - 73 - 24). This zone was followed in small outcrops around the Synform to the E of the mine (hereafter referred to as the Skrataas Synform). Tests with the Flux-gate magnetometer showed that immediately over this outcrop at the mine a marked positive in excess of 10.000 gammas was recorded. This lithology both because of its distinctive appearance and magmetic propoerties is liable to be a most important marker horizon and should be capable of accurate mapping by combining the few surface occurrences with magnetometric work. This could be significant because the various mineralogization types in this restricted area of Sulfidmalm's grid are apparently controlled by the original lithological junctions between the sedimentary rock types.

Quartz-Schists

These represent highly flattened rocks with quartz as the dominant component with muscovite along the foliation planes. In places these rocks grade into quartz-mylonites,

as indeed is the case in some of the surface exposures at the Skrataas Mine. In some instances the quartz-schists are strongly magnetite bearing and, there probably represent extreme deformation products of the magnetite quartzites. Much of the host rock at the Bjønsaas prospect is in fact a quartz schist with rather much mica.

Phyllites

True phyllites are developed in a number of localites, particularly near the limestone contacts where they are often calcareous and contain lenses of limestone. The phyllites vary from sivery micaceous rocks rich in fine-grained muscovites, to dark and greenish biotite/chlorite bearing rocks. It may also be that during the haste of locality logging in this short visit certain of the localities logged as phyllite are in fact phyllonite as described earlier.

Greenstone

Only one fairly narrow zone 10 - 15 m wide of greenstone was observed in the grid area to the south of the Marken Prospect. This is a chlorite-biotite-albite-epidote rock in which rounded aggregates of epidote have radial habit. Other varieties are amphibole bearing where the amphibole grows parallel to the westerly plunging stretching lineation.

Limestone

The contact of limestone with the surrounding schists is fairly abrupt, though usually marked by a transitional zone of calcareous phyllites. The limestone is extremely pure in this region and probably would be well-suited for quarrying purposes; a point which might perhaps be borne in mind should the Skartaas sulfide deposits prove of economic importance.

(5) The tectonic pattern of the area is both complex and interesting. The main features of the exposed rocks is of a penetrative E-W striking cleavage which has a general steep northerly dip. This is seen to be the axial planar structure to minor folds associated with the larger antiforms and synforms, mapped during this reconnaisance survey, and hence the axial planar structure to these larger folds. However, where good minor folds are preserved they are seen to refold isoclinal folds and a well developed foliation. It would thus appear that the obvious folds in the area are at least second-generation structures (and will be referred to as F_2) which affect a previously folded layering and foliation.

It was not possible however to establish any meaningful information regarding the styles, magnitude or regional implications of this earlier deformation.

Associated with the development of the F_2 folds is a strong stretching of the sedimentary grain shapes which in the more conglomeratic horizons e.g. loc (74) can be seen to produce at least a 3:1 extension of pebbles in the stretching direction. The stretching lineation is pervasively developed throughout the sequence and generally plunges between 25-50° towards the west. A certain amount of information on the age of mineralization is seen here as magnetite in the magnetite quartzites and phyllites often is surrounded by pressure-shadow haloes elongated in this stretching direction. This has also been observed in relation to pyrite cubes at some localities indicating an early origin for sulfide dissemination.

The interpretation of the major antiforms and synforms shown on the map is based on the outcrop patterns, the relationships of the few well-developed related minor folds and on the pervasive stretching and intersection lineation parallel to the axes of such folds. On the basis of the constant lineation it is assumed that these folds also plunge westerly. It will be seen also that the strike of foliation is usually oblique to lithological contacts, owing to it being an axial-planar structure relative to the larger folds. It was only possible to record original bedding in two localities and hence the form of fold structures can only be established from major lithologic markers. The most obvious of these are;

(i) The limestone contact.

(ii) The magnetite quartzites, which should be capable of tracing in badly exposed terrain by careful work using a magnetometer.

One of the features of the tectonics alluded to earlier is the strong flattening that produces phyllonites, quartz-schists etc. from the main grit/sandstone sequence. It was not possible in the time available to distinguish these in detail especially as the variation in fabric may be from outcrop to outcrop. However, it is obvious that some of the most strongly flattened rocks occur in the surface exposures at the main Skrataas prospect, where indeed the psammites in places become promimently banded mylonites. It is obvious also that the main prospect is also the site for late brittle deformation at relatively low temperatures. The entrance to the main inclined shaft and the tunnel to the west shows pronounced shear-plane development with strong brecciation; the main shears have a strike of approximately 020° and dip 50°W. Within the shear-zones there is an irregular lensoidal pattern of blocks including lens of sulfide ore. Within the shear (breccia)-zones at the mine entrance much talc is developed particularly in relation to limestone lenses. As indicated above the rocks from which the shear-zones developed were already strongly flattened and resemble mylonites in appearance. Many sulfides are concentrated along this "mylonitic" banding and indeed pressure-shadows about pyrite cubes are elongated in the general stretching direction.

The latest stage of regional deformation is seen in the development of a crenulation cleavage with related crumples on foliation planes, the lineation plunges gently westwards and the cleavage is flat-lying. No large scale structures associated with this deformation were located

6. Mineralization. It is true to say that most of the rocks in the area, with the exception of the limestones show evidence of mineralization. Indications of visible ore-minerals are shown on the accompanying map. Many of the rocks are strongly magnetite-bearing and this may account for the fairly high almost linear magnetic anomaly patterns.

One interesting feature was the location of a zone generally richer in sulfide inpregnation than usual, shown on map as strongly mineralized belt, in a number of locations good pyrite + chalcopyrite was observed and at loc. (127) sphalerite was also observed this belt is on strike to the Marken prospect and includes the drill-hole DDH-1. No surface lead mineralization was seen. In the time available it was not possible to delimit the southern limits of this belt, but the suggestion was made to Tan to extend his V.L.F. work south of his planned base-line in this particular area. As yet it is not possible to be categoric concerning the stratal relationships of the Bjφnas, Skrataas, Marken deposits and this belt of mineralization, except that the Marken deposit occurs within the belt. The area of mineralization is in fact very poorly exposed and it will obviously not be possible to make an assessment based upon surface geological features.

CONCLUSIONS

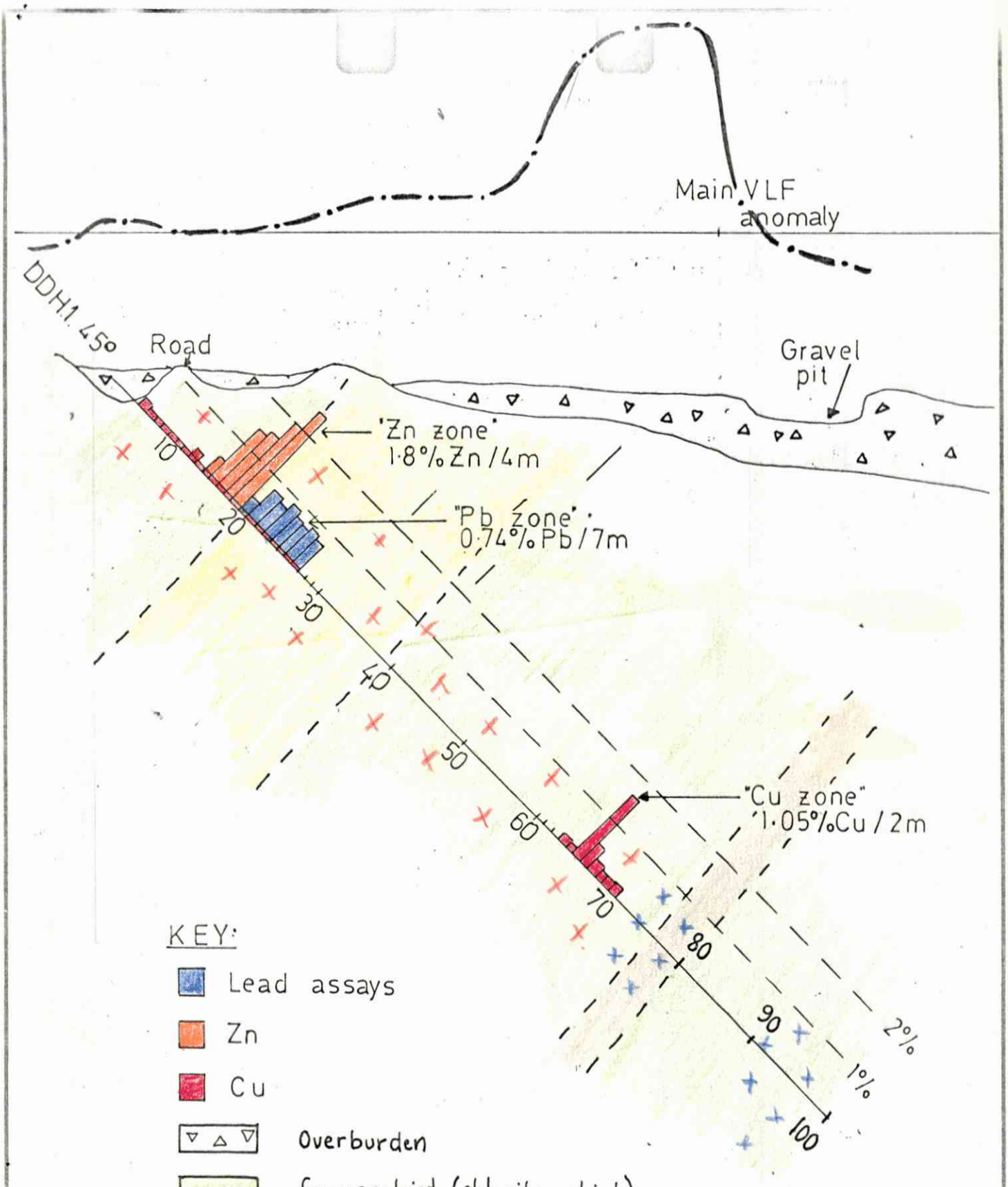
The area as a whole appears to be interesting in terms of both the known mineralization and that observed during this quick study. The differences in mineralization are apparently related to differences in the original lithology of a sedimentary sequence dominated by clastic rocks of the girt/sandstone type. This is certainly indicated by the presence of magnetite quartzite and magnetite bearing phyllites in the area. In some sandsontes lines of fine-grained sulfide minerals occur oblique to the cleavage and may event represent original bedding. The sulfide mineralization appears to have undergone secondary migration and concentration during strong flattening deformation (probably F_2) which produces the main fold structures shown on the map. In both the case of the main Skrattås prospect and the mineralized zone shown on the map the rocks have strong flattening fabrics with the widespread development of phyllonitic and mylonitic rocks.

The information contained in this preliminary report may cast different light on the type of mineralization of the region as a whole. It indicates that the mineralization is related to original lithologic stratigraphic differences and not a greenstone belt mineralization in the typical sense. The report by Tan discuss a number of old magnetite prospects in the general region, which may probably relate to the magnetite bearing sediments described in the current report. It may well be that sulfide mineralization of the Skrattås type may be found in other poorly exposed areas of deformed sediments around such old prospects, but only investigation will tell!

In conclusion it is only right to say that this must be taken as a very preliminary report based only on four days full mapping, and obviously more time is required on the whole prospect before the intricacies of the geology can be unravelled.

B. A. Stanley

1.7.74.



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