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Titel
Report on the Esna Mine

Forfatter Bachke A S	Dato År 25 7. 1893	Bedrift (oppdragsgiver og/eller oppdragstaker) The Esna Mining Company
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Kommune Tydal	Fylke Sør-Trøndelag	Bergdistrikt	1: 50 000 kartblad 17212	1: 250 000 kartblad Trondheim
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Fagområde Geologi Boring	Dokument type	Forekomster (forekomst, gruvefelt, undersøkelsesfelt) Tilhører kisforekomstene i Tydal.
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Råstoffgruppe Malm/metall	Råstofftype Cu
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Sammendrag, innholdsfortegnelse eller innholdsbeskrivelse
Forfatteren gir en vurdering av gruen i forbindelse med utførte diamantboringer.

A. S. Bachke
1893

Norges Geologiske Undersøkelse
Bergens liva:
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Report on the Esna Mine

(Translated).

To The Directors of "The Esna Mining Company".

Gentlemen.

In accordance with the request contained in your letter of 30th May last I have pleasure in handing you the following description of The Esna Mining Field, together with my reports of the results obtained from the Diamond borings performed there last winter. Owing to various official journeys in the district of Bergen and Roraas, I have been unable to take up this work at an earlier date.

The Esna Mining field is situated in Tydal, N. W. of the Syltopper, 2 Kilometres ($1\frac{1}{4}$ English Miles) S of the Essand Lake, 18-20 kilometres (11-12 English Miles) from Østby the nearest farm, 36 kilometres (22 English miles) W of the Enafors railway station in Sweden, about 30 kilometres ($18\frac{1}{2}$ miles) S. S. E Gilsaa Smelting Works in Meraker, in elevation about 720 metres (2360 English Feet) above the level of the Sea. If one casts ones eye over the map of the Trondhjem District one will find that the above field belongs to a very rich and extensive zone running at about the same height above the sea level from the mines of Roraas on the South, in the direction of the Kjølvi, Killingdal, Grønkalet and other mines. Looking further still in the direction of Selbo, Meraker, Vardal the mineral fields of Malsaa and Skjaker-dal as far even as Gulstad and Mok old mines in Sparbu, where an important mining industry has been carried on for centuries, one finds this remarkable mineral zone associated with various upheavals, most frequently the soft (so called) Trondhjem schists belonging to the silurian formation whilst the tracts around Esna consist of Amphibolic and quartz rocks the geological position of which does not seem as yet to be fully ascertained.

The mineral ore before referred to consisting of magnetic Pyrites and Copper Pyrites resembles in occurrence the other copper ore deposits in the Trondhjem District by presenting itself in masses more or less solid, sometimes separately, sometimes parallel, with constant intervals in the strike where the ore occurs impregnated richer or poorer in the rock and frequently disturbed by dislocation in different levels both in dip and strike. One must therefore not be surprised that it presents a very different appearance at places where prospecting has been carried on. For example, The Esna Main Mine exhibits rich parts of the purest copper Pyrites, The Irmann claims chiefly magnetic Pyrites mixed with copper Pyrites affording a chance of profitable operations only in connection with richer openings at other places. But as Mr. Holmsen the Royal Inspector of Mines has observed, "Ore is found in every piece of stone picked up where workings have been carried on".

The lodes of Ore run in rather indefinite layers of various thickness dipping slightly to the

N. W. the dimensions of which are in reality as yet unascertained in spite of the amount of work performed; Impregnations of Copper having been observed during the recent diamond borings even at places supposed to be situated beyond the limits of the deposit.

The mining Engineers who have visited the spot. Sinding, Winsnes, Holmsen and others, all expressed themselves favourably as to the importance of the Esna mineral deposit.

According to the particulars given by Mr. Huitfeldt the Esna mine was opened in the year 1853 and worked to the year 1865 by The Tydal Company who relying on the assurances of Mr. A. AAS, a young mining Engineer, of the advantages to be derived from working the Pyrites of the Kjølil and Killingdal Mines (belonging to the same Company) by the wet process resolved to cease working the Esna Mine in order to devote all their efforts to those mines which promised quicker returns owing to their more favourable situation and proximity to a cheap supply of raw material for carrying out this process.

During this period 8,534 Miners barrels (4,460 English Tons) of ore were extracted besides 1,490 Mimers barrels (650 English Tons) of inferior ore requiring concentration before being smelted. The total cost of smelting ore with $6\frac{1}{2}$ per cent of copper amounted to Kr. 19,22 (£ 1:1:6) per ton a result which may be regarded very satisfactory for a new enterprise.

According to Mr. Holmsen the Inspector of Mines, each ton of rock mined yielded an average of

0.43 ton of smelting ore at 6.50 per cent Cu.
 0.45 ton of inferior ore. - 1.36 per cent -
 0.12 ton of steril rock.

by which one finds the average per centage of the gangues should be 3.407 per cent of Copper. The mine then remained in a state of suspension for 30 years and was resumed afresh in the winter of 1890-1. It was drained and a test working carried on under the supervision of Mr. Holmsen 400 m.³ (65 Cubic fathoms) of gangue were extracted yielding an average of 5.38 per cent of copper.

On the basis of these results one can certainly reckon upon an average of the Matt of 4 per cent Cu. at least.

It was upon this second period of working the Esna Mine when it had reached a depth of about 22 metres (72 feet) and a length of 50 metres (164 feet) in a North Westerly direction and when ore more or less rich was met with everywhere in the mine that Mr. Holmsen worked out a scheme for working the deposit in a rational way, concentrating the produce by means of suitable apparatus and plant. At the same time that the Main mine was examined by driving and sinking the neighbouring claims (Irmans and the Essand claims) were also to be tested.

The main mine being much exposed to water owing to its situation on boggy land it was necessary to procure a powerful engine for winding and pumping. To treat the ore there should be erected a complete concentration plant with necessary stamps and melting furnaces after the Roros pattern arranged with an American Water jacket furnace which arrangements ought to be supplied with driving power by building a dam at the outlet of the Essand Lake.

From these arrangements one thinks a result would be a rich regulus containing 35 to 40 per cent of copper which would without difficulty meet with a ready sale on the English Market.

Based upon the treatment of 9000 tons yearly of unsorted Matt it is calculated:

Outlay on plant, about	Kr. 72,000	(£ 4,000)
The Working expenses etc.	" 154,000	(£ 8,555)
total	Kr. 226,999	(£ 12,555)

which is the capital requisite.

At a price of 9 Kr. (10 sh) per unit, Mr. Holmsen calculated the annual profit Kr. 53,000 (£ 2,950). Upon this estimate by the Mining Inspector of the District with his long experience, there could not be any idea of abandoning a field which offers such chances; after the result of the above authority

even in spite of the reduction since experienced in the price per unit of copper (from financial reasons) it was thought necessary to submit the character of the mine to a clear examination prior to, laying out further capital on such a field.

In order to arrive at a speedy and cheap result, it was resolved after the mine had been visited again in the Autumn 1892 to have the deposit in the Main Mine and its immediate vicinity, tested by a series of diamond borings for which the requisite capital was provided. At a meeting with the District Inspector of the Mines the places considered most important to have tested by borings, were agreed upon with a proviso to make alternations if found expedient by the results obtained during the course of the borings.

A contract was then concluded with the Swedish Diamond borings Company for carrying out the work. It began in November 1892 and terminated in March 1893 during which period 77 m (254 English feet) were bored in the Esna Mine and 220 m (720 English feet) from the surface. In this way the foot wall of the Main mine was examined by two holes, of which No. 1 in the inmost westerly drift intersected the strata in the following order:

5.00 m	=	16	English ft.	5	inches	Copper ore
2.10 m	=	6	"	"	10	" Hornblende
2.00 m	=	6	"	"	6	" Copper Ore
4.40 m		=	25	"	"	9 " Quartzzy Rock
3.50 m	\					
15.00 m	=	49	"	"	6	" Chloritic soft rock.
32.00 m	=	105	"	"	0	"

And No. 2 in the adit, penetrated:

1.00 m	=	3	feet	3	inches	Honblende.
3.20 m	=	30	"	2	"	Good copper ore.
9.80 m	=	32	"	2	"	Sterile rock partly impregnated with copper ore.
20.00 m	=	65	"	7	"	

Thus it was proved that a deposit of copper ore 8-9 m (English, 30 feet) thick and partly very rich, existed under the present level of the mines.

This result was alone sufficient to cover more than the total cost of the diamond borings, in so much that about 7,000 tons of copper ore existed under the foot wall of the mine, when one calculates the before named magnitude and the width of the inmost level its distance from the entrance of the adit, and the thickness of the deposit.

The boring in the foot wall having given such satisfactory results, the side walls were bored by two horizontal holes. The first hole No. 3 to S. S. W. $12\frac{1}{2}$ m (41 English feet) long and afterwards No. 4 to N. N. E. 13 m (42 feet, 7 inches). In southerly direction only 0.80 m (2 feet, 7 inches) of copper ore were met with besides some impregnations whilst the hole in the Northerly direction, traversed a lode of copper ore $6\frac{1}{2}$ m (21 feet, 4 inches) wide besides traces of ore in its inmost part. The dip being N. W. it was doubtful whether it was correct to bore horizontal holes, but at any rate they proved the existence in northerly direction of a similar lode of copper ore as the one substantiated in the mine most properly separated from this by impregnations frequently occurring in the strata. By boring these holes in the mine it has been proved about 15,000 tons of good Copper ore exist besides what can be extracted from the impregnated parts and this alone considering the small length from E. to W. which is the present extent of the mine.

I shall now pass to the holes which during an unfavourable period of the year were bored from the surface. I pass the two first holes because I have no reliable account, but in which a little ore was met with. I may remark in reference to the hole:

- No. 3 in the surface which was bored altogether 60 m (196 English feet) deep through schists and a quartz rock with traces of ore at a depth of 5 m (16 English feet 5 inches) and now and then later, it was situated 100 m (328 English feet) S. of the shaft and about 100 m (328 English feet) E. S. E. of the Irmans claim.
- " 4 " " — about 40 m (132 English feet) deep and distant about 80 m (263 English feet) N. E. from the shaft intersected at a depth of 28.50 m (95 English feet) a layer bearing ore about 1 m (3 English feet) altogether.
- " 5 " " — Situated about 40 m (132 English feet) N. of the shaft and altogether 40 m (132 English feet) deep presented ore at a depth of 15 m (49 English feet) of an inferior quality and then impregnations of ore at a depth of 28 m. (92 English feet).
- " 6 " " — Situated 220 m (722 English feet) N. E. of the shaft and 40 m (132 English feet) deep with impregnations of ore at a depth from 6—9½ m (20 to 21 English feet) and at 25 m. (80 English feet). At a depth of 39 m (128 English feet) it also intersected some superior and second quality ore in amphibolic and quartz rock measuring respectively 27½ m (40 English feet) and 12½ (30 English feet) in thickness.

Above borings executed in the surface have proved that ore is found everywhere although unfortunately no larger accumulation was met with. The reason for this may partly be that the holes were not bored deep enough or that the choice of the places where the holes were set was not the best one for the object of coming across the layers occurring no doubt beyond the limits of the mine proper and which layer will only be found by ordinary workings.

It will therefore be premature and misleading to make up an estimate as to the returns of ore existing around the mine from these surface borings. If however, a quantity is absolutely to be named, I may put it down for the present to 30,000 tons, adding as much to the returns visible in the mine. No professional man will object to this, although it is best to adhere to the fact that ore is proved to exist in larger and smaller quantities in and around the Esna Mine sufficient for continuous working with a proper concentrating plant.

My report being now at an end, I will refrain from entering into the question as to the most suitable plan for working this deposit of ore, the more so as Mr. Holmsen the Inspector of mines, has delivered a complete plan in this respect with the view of a concentration and a subsequent reduction of the ore by smelting it to regulus either at the mine itself or at the Gilsaa Smelting Works in Meraker in connexion with ore from the Lillefeld Mine in the same district. I may however call your attention to a third alternative for smelting the ore at Enafors, where water power and cheap charcoal can be supplied.

Ringved pr. Trondhjem 25th July 1893.

Yours respectfully,

A. S. Bachke