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Report on Ørsdalen Tungsten-Molybdenum Area, Norway

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Råstoffgruppe	Råstofftype	
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Sammendrag, innholdsfortegnelse eller innholdsbeskrivelse

En historisk og geologisk gjennomgang gjøres. Vurdering av hva som hittil er gjort og av malmreservene.
Det anbefales et begrenset program for å sette i gang drift strak, istedet for en lengere periode med malmleting og undersøkelser.
Det gjøres overlegninger om mindre undersøkelser og finansiering av en driftstart.

B.S.

c/o American Embassy
7

3 July 1951

Mr. Charles E. Stott, Director
Strategic Materials Division
Economic Cooperation Administration
Washington, D.C.

Dear Mr. Stott:

We are transmitting herewith two copies of my report on the Ørsdalen Tungsten-Molybdenum Area, which is the result of my three-day visit to Norway early in June.

As mentioned in the abstract, the Ørsdalen district does not appear to have extraordinary potentiality, but it quite definitely has good possibilities for producing small but appreciable amounts of tungsten ore with a relatively minor investment of capital, material and time. For this reason I have recommended a program aimed at immediately developing of any possibility of obtaining tungsten ore, rather than a long-range exploration program to locate and block out ore reserves. I hope you agree with my thinking.

Additional distribution of this report is, besides your two copies:

OSR, Strategic Materials Section - one copy

ECA Mission to Norway - three copies

Yours very truly,

BKH:eh
Attachments as stated

B. K. Haffner
Industry Officer

REPORT

ON

ØRSDALEN TUNGSTEN-MOLYBDENUM AREA

NORWAY

BY

B. K. Haffner
Strategic Materials Officer
ECA Mission to The Netherlands

July 3, 1951

ABSTRACT

The tungsten-molybdenum deposits in the Ørsdalen district, Norway, were exploited on a small scale during the periods of high metal prices in World War I, and before World War II. In spite of a relatively uninteresting history, attention should be directed to these deposits again, because of the present world shortage of these metals and the high prices prevailing.

Geological information concerning the property is scanty, because of a lack of maps and records of previous operations, and the fact that no detailed investigation of the district has been made. In general, however, the deposits show a marked similarity to several fairly important tungsten deposits in the western United States. The deposits are associated with aplite and pegmatitic quarts in a granitic country rock. This type of mineralization does not usually form really large, important tungsten deposits, but does form smaller high grade ore bodies that are relatively important as tungsten producers.

A limited examination of the Ørsdalen deposits leads to the conclusion that a reasonably good possibility exists of developing additional ore that can be hand-cobbed and shipped as a high grade concentrate. No estimate can be made at present of the possible tonnage and grade of ore to be expected. The best possibilities for developing ore lie in reopening and extending one of the present workings, the Schaaning Mine, where it is assumed that ore similar to that produced in the previous operations may be expected to exist. At the same time this is the most practical method of exploring the ore deposits.

It is recommended that a limited development program be adopted. This would consist of a restricted but detailed survey of the old workings and the intervening areas, and include necessary sampling and assaying. At the same time the Schaaning Mine will have to be reopened to permit mapping, sampling, and a limited amount of development work to be done.

The cost of this program is estimated by local mining engineers at about 165,000 Norwegian Kroner. No U.S. equipment or dollar financing should be required. The project is recommended as a suitable instance for 5 ½ counterpart fund financing. If a loan were made as an advance against possible production, the recovery of only 8 or 10 tons of 65% tungsten concentrate would repay the entire advance.

REPORT

ON

ØRSDALEN TUNGSTEN-MOLYBDENUM AREA

NORWAY

Introduction

The Ørsdalen tungsten-molybdenum deposits have been worked intermittently and on a small scale of operation since about 1905, originally for molybdenum, and later for tungsten. The principal tungsten production has been from the Schaaning Mine, operated during 1937, 1938 and 1939, which was taken over by the Germans after the occupation. The German authorities planned to operate the mine, and to this end they built a power plant and housing facilities; started construction of a mill, and did a little underground exploration. The German operations were terminated by the capitulation of the German Army in 1945. There has been no activity since that time.

Information concerning the potentialities of the Ørsdalen district is very scanty. There are no records left of the early operations of the molybdenum deposits, and there is very little technical information available concerning the Schaaning Mine. Sampling in the mines and other works is very incomplete, and such assays as are available are unreliable. What geological mapping has been done is not practical for local mining and exploration work. No underground geological mapping has been done. The few production records that are available are not encouraging since they show only a small, intermittent and irregular production of molybdenum and tungsten concentrates.

Dr. Vanderwilt, acting as an ECA consultant, made studies of the Norwegian mining industry, either by personal examination of mines or reports and other data, and made certain recommendations to guide future development and exploration. In these recommendations, the Ørsdalen deposits are given a low priority, based on the reports and data available concerning the property.

However, Dr. Adamson, a Norwegian geologist now acting indirectly for ECA, has some direct knowledge of the Ørsdalen district from previous examinations, and is of the opinion that the available literature does not give a proper picture of the potentiality of the Ørsdalen district, especially the Schaaning Mine. The writer agrees with Dr. Adamson in this respect. The operations during the first World War were possible because of high prices for metals, and were discontinued after the war, principally as a result of declining prices, rather than exhaustion of ore reserves.

The Schaaning operation was carried out under the most difficult of operating conditions, and the low production rate was not necessarily dueto limited ore reserves, low grade, or other geologic factors. The failure of the Germans to get into operation was a matter of administrative problem, and other similar factors, which are not a basis for judging the potentialities of the area. The lack of activity in the area since that time is probably primarily due to a lack of "risk capital" in Norway, and not because the project had been examined and found wanting, since no detailed examination or exploration has been done. In fact, during the whole history of the area, there has been no serious economic geological investigation.

General Remarks

The Grsdalen district was visited by the writer and Dr. Adamson on June 1 to June 3, 1951. Because of the short time available, the examination had to be limited to a general inspection of the underground workings and the Schaaning Mine, with a cursory examination of the immediate surface area, including the old workings of the Molybdenum companies.

The location, history, topography, and other information concerning the Grsdalen district is adequately covered in Dr. Adamson's reports. The tungsten deposits occur on the south side of a narrow, steep walled glacial valley which lies in an east-west direction. The valley walls are about 2000 feet high in the vicinity of the deposits, and for the most part are actual cliffs 1500 feet or more in height. The old molybdenum workings, mostly small open cuts, pits and trenches, lie on the plateau 300 or 400 meters back from the cliff face.

The Schaaning Mine actually is on the cliff face, some 400 feet below the edge, overlooking the valley floor 1500 feet below. At the base of the cliffs, under the Schaaning, and a hundred feet or so above the valley floor, are two adits which have been driven into the cliff face, which have a total length of something over 2000 feet.

Local Geology

The following observations, being the result of a two-day visit, must be recognized as tentative conclusions only, and applying solely to the immediate area of the deposits.

The mineralized area and the major workings are, in general, confined to a long narrow zone striking N30W. The principal rock in the vicinity of the ore deposits is a medium grained granite or quartz monzonite. In some places it has a moderate porphyritic structure, and in others, apparently nearer the mineralized zone, it has a definite gneissic structure, which also has a N30W strike direction. The granite contains a large amount of inclusions, generally classed as

Local Geology (Cont'd.)

"amphibolite". Practically all of these inclusions are small, with dimensions of only a few feet. The "amphibolite" contains an appreciable amount of light colored minerals, mostly feldspar, and is strongly banded, and may have been derived from an old metamorphosed sedimentary series. The inclusions show various degrees of resorption and alteration by the enclosing granite.

According to previous descriptions of the area, there are a number of "aplite" dikes intruded into the granite. Since the ground surface was largely covered by snow at the time of the writer's visit, this could not be checked. There is, however, at least one large aplite mass outcropping on the plateau above the cliffs. It is apparently an elongated lens or dike, striking roughly N30W, lying within the mineralized zone, and parallel to the general strike of the gneissic structure of the granite. No aplite was recognized on the face of the cliffs or in the lower tunnels, although it has been reported. There is some light colored rock in the tunnels but it is quite different than the aplite observed on the plateau. These light colored rocks may be a local differentiation phase of the granite, silicified or altered zones, rather than aplite.

There is a third distinct rock type present. It is a black rock composed principally of hornblende and biotite. The major exposures are in the tunnels at the base of the cliff where the black rock appears as irregular masses in the enclosing granite. Some material of this hornblend-biotite rock is seen in the waste dump from the Schaaning Mine, indicating the presence of this material within the mineralized zone. The writer suspects that it is not altered "amphibolite" inclusions, but may be a separate intrusion, probably related to the granite, and represents a diaschistic phase associated with the aplite intrusions.

Although the structural pattern is not clear, there is apparently some local structural control relating the various intrusions and the mineralization. The secondary intrusions and the ore bodies are confined in general to the long, narrow zone, exposed on the surface, trending W30W, and apparently dipping about 70° to the northeast. This main zone can be traced by means of aplitic outcrops and mineralization for over 1000 meters. A second "zone" has been postulated on the basis of one small prospect 300 meters west of the main zone, but the comparison is not yet warranted.

Most of the mineralization has been confined to the narrow zone along which the intrusions occur. The ore minerals, molybdenite, wolframite and scheelite, are associated with quartz in small, irregular, discontinuous pegmatite or pegmatitic quartz veins and lenses. Most of the veins and lenses are only a few inches wide, although a few measure 16-18 inches in width. In the principal ore bodies, such as the Schaaning, a number of roughly parallel veins occur, separated by narrow streaks of altered and silicified wall rock. The altered wall rock between the quartz veins is also mineralized and has grains and patches of scheelite, wolframite and molybdmite along with biotite

Local Geology (Cont'd.)

hornblende, garnet, and a minor amount of pyrite. The "ore zone" is 15 to 18 feet wide at the Schaaning Mine. The granite wallrock outside the ore zone shows a weak mineralisation and a sparse dissemination of ore minerals.

The tunnels at the base of the cliff do not encounter a definite "mineralised zone" such as is seen at the Schaaning and molybdenum workings. Either the zone weakens and disappears at this depth, or it lies outside the explored area. No molybdenite was seen in these lower tunnels, but a considerable amount of weak tungsten mineralisation is present. Irregular scattered quartz veins contain scheelite and streaks and blebs of scheelite occur in the granite wall rock near the quartz veins. Comparatively large masses of the black hornblende rock exposed in the tunnels, and scheelite mineralisation is relatively stronger in the black hornblende-biotite rock than in the granite. The scheelite occurs as a fairly heavy dissemination throughout the black rock.

Ore Reserves

The lack of detailed mapping, and the scanty and unreliable assays, prevent any proper calculation of tonnage and grade figures. Even had time been available during the writer's visit to make a detailed examination, it would not have been very helpful, since the major part of the Schaaning workings are at present unaccessible and could not have been mapped. Certain observations on the probability of ore reserves are, however, valid.

The old molybdenum workings, which are mainly confined to the narrow mineralized zone, consist of eight or ten separate shallow excavations obviously sunk on scattered ore outcrops. None of them are more than a few feet deep. Very little, if any, underground exploration was done. The Schaaning Mine, on the same ore zone, and less than 1000 feet distant, is at a 350 foot lower elevation, and the mineralized zone is still very strongly developed. It is reasonable to assume that the same type of mineralization that is present on the surface should extend down to at least this depth below the molybdenum workings. Since the old workings undoubtedly represent small pods or shoots of ore rich enough for direct shipping (probably with hand cobbing), there should be an appreciable amount of this material below the old workings. An estimate of the possible tonnages could only be made after detailed mapping to show the distribution and volume of the old excavations. In addition, there is the possibility of developing reserves of lower grade milling ore.

Ore Reserves (Cont'd.)

At the Schaaning Mine, operations were stopped at the time production was at its highest. There are no records of any ore reserve, in fact, from the character of the operation it is unlikely any ore reserve was developed ahead of mining. The best possibilities for immediate production of ore are, nevertheless, at the Schaaning Mine, since it was in production at the time it was shut down. At the Schaaning Mine, too, former production was confined to high grade ore shoots, and the possibility of developing appreciable amounts of lower grade milling ore is attractive.

The mineralization in the lower tunnels does not yet show any direct relation with the ore occurrences at the top of the cliffs. No high grade ore is exposed, but several low grade mineralized areas are partiallyexplored. The largest of these is roughly 150-175 feet in diameter. Careful mapping and sampling may show this to be milling grade ore, at least in part. Properly directed exploration might develop additional low grade material, and possibly higher grade material, or even locate a continuation of the mineralized zone which is present 1000 feet higher. At the least, the amount of mineralization present in the tunnels suggests the presence of scheelite mineralization over a vertical extent of 1000 feet or so, and encourages underground exploration beneath the presently known ore occurrences.

Conclusions.

It will require a considerable amount of detailed mapping and geological investigation in order to develop a reasonably complete picture of the tungsten-molybdenum occurrences and the genetic and structural relationships between the ore and enclosing rocks. Even the present state of knowledge, however, indicates a strong parallel between the Grsdalen deposits and some of the important tungsten deposits of the western United States, in particular the Creana, Nevada, and to a lesser extent, the deposits of Benson, Arizona; and similar deposits in igneous rocks. The country rock is similar, and in both areas there is a close spatial relation between the tungsten deposits and aplitic intrusions. The aplite at Grsdalen, as elsewhere, does not seem to be directly related to the tungsten mineralization, but rather is the channel along which the mineralizing solutions rose. The tungsten minerals are associated with quartz and pegmatite veins, or the tungsten is deposited in some favorable host rock other than the granite and aplite, which are, for the most part, barren. The Grsdalen deposits are definitely similar in type to other well known tungsten deposits, and, even for this reason, are worthy of additional attention.

Conclusions (Cont'd.)

In its present state of development, and with the lack of adequate records on former operations, it is not possible to make any reasonable determination of possible ore reserves at the Ørsdalen prospects. On the other hand, it is quite probable that there is some pre present, at least in the Schaaning Mine, and if so, it is readily available. Unfortunately, the Schaaning workings are not accessible at the present and the presence of the ore cannot be stated as a fact. Further investigation is, however, clearly warranted.

There is a reasonably good possibility that a relatively small amoun of properly directed work at the Ørsdalen properties will result in the recovery of some urgently needed tungsten ore. At this stage in the development of the Ørsdalen district, it would be unwise to undertake a long term exploration and development program, with the object of developing sufficient reserves of milling grade ore, and rehabilitating the concentrator, and major efforts should be confined to obtaining smaller amounts of higher grade ore which can be hand-cobbed and shipped directly as a high grade concentrate. The immediate possibility lies in reopening and extending the operations at the Schaaning Mine. Fortunately, opening upand extending the Schaaning Mine is also the best practical method of exploring and developing the ore zone.

A necessary step in the investigation of the Ørsdalen deposits will be a detailed engineering and geological survey, including sampling and assaying. This, however, should be confined at this time to a small restricted area covering only the mineralized zone between the old molybdenum workings, the Schaaning Mine, and the lower tunnels. A wider more regional, geological investigation may eventually be warranted, but presently major efforts should be directed at a short term program of developing and exploiting any immediately available ore.

Recommendations.

The known ore zone and the area covering the present workings should be accurately surveyed on a scale of at least 1:1000 or larger if practical. Since the main purpose of this map would be to direct further development, the degree of accuracy necessary would require a transit survey or at least a plane table (alidade) survey. The existing workings should be accurately located and mapped separately (or continuous groups) on a scale of not less than 1:200.

At the same time, the Schaaning Mine should be reopened. Former access to the mine was by means of a steep, narrow trail and an exposed ladder down the face of the cliff. The ladder is no longer serviceable and will have to be repaired and enclosed. This will have to be done even to permit the surveying and sampling recommended above

Recommendations (Cont'd.)

Once access to the Schaaning Mine has been obtained, development work should be initiated. There is a short tunnel, which has been driven from the main Schaaning workings back into the cliff, along the ore zone. This tunnel should be extended 100 or 150 meters along the ore zone until the heading is well underneath the surface of the plateau.

This work will serve several purposes.

1. It is quite possible that appreciable amounts of tungsten-molybdenum ore will be produced. It is reported that the present tunnel has ore at the face and in places along the walls. Any ore encountered can be hand-cobbed and shipped.

2. This work offers what seems to be the quickest and most practical method of exploring the ore zone.

3. If results are satisfactory, and more work at the Schaaning Mine is warranted, it will be possible to drive a raise through the ore zone to the surface and establish a new mine entrance. The old cliff-face adit should not be used any longer than necessary, as it is dangerous, uneconomical and very difficult mining practice to supply men and supplies through this adit. Further, the new entrance would permit year-round operation, which is impossible or extremely difficult with the present adit. The present adit can be used to dispose of waste or low grade ore, obviating the need for extensive facilities at the new entrance.

4. Further development work can be done by extending the tunnel beneath the old molybdenum workings.

It will be noted that these recommendations agree in general with the recommendations in Dr. Adamson's report (Welke-Strand and Espeland, March 5, 1951). The writer agrees with the development program outlined under "Cost Estimate Phase I", but is not competent to judge the cost estimates without considerable study of local wage scales, material costs, and other factors.

Item 1, rehabilitating living quarters, ropeway and ladder way, is satisfactory. The cost estimate, N.Kr. 37,000 (U.S. $ 5,300) seems a trifle high.

Item 2, equipment, should of course be kept at a minimum until development work warrants increased efforts. Cost, N.Kr. 65,000 (U.S. $9,300) seems satisfactory.

Recommendations (Cont'd.)

Item 3, 150 meters of drifting, raising, and cross-cutting is satisfactory. Raising and cross-cutting should be kept to a minimum unless dictated by local geology. Most of the lateral and vertical exploration should be delayed until a later "Phase II" development program, after completion of a new mine entrance. Actual rock excavation should be kept to the minimum necessary as long as the old cliff-face adit is being used. Cost estimates (equivalent of U.S. $17 per foot) seem a little high for this work, but is admitted that operations through the present adit will be expensive.

Item 4, sampling, assaying, and mapping should be increased sufficiently to permit the recommended transit survey and assayings of the total present workings, not the Schaaning Mine alone.

The above program can be implemented without the necessity of importing U.S. equipment, and without providing dollar financing. The project is recommended as a suitable instance for counterpart fund financing.

BKH:eh
July 5, 1951

B. K. Haffner (sign.)

B. K. Haffner,
Strategic Materials Officer
ECA Mission to The Netherlands