Bergvesenet

Postboks 3021, N-7441 Trondheim

Rapportarkivet

Bergvesenet rapport nr	Intern Journal nr	Internt arkiv nr	Rapport lokalisering	Gradering
6930				

Kommer fra ..arkiv	Ekstern rapport nr	Oversendt fra	Fortrolig pga	Fortrolig fra dato:
Orkla		Løkken		

Tittel

Gamble or Die: An experiment at Løkken Mine

Forfatter	Dato	År	Bedrift (Oppdragsgiver og/eller oppdragstaker)
Shillaber, J.H.		1966	Orkla Grube A/B

Kommune	Fylke	Bergdistrikt	1: 50 000 kartblad	1: 250 000 kartblad
Meldal	Sør-Trøndelag		15212 15213	Trondheim

Fagområde	Dokument type	Forekomster (forekomst, gruvefelt, undersøkelsesfelt)
Gruveteknisk		Løkkenfeltet

Råstoffgruppe	Råstofftype
Malm/metall	Cu,Zn

Sammendrag, innholdsfortegnelse eller innholdsbeskrivelse

Antagelig del av et studentarbeid. Årstall usikkert.Rapoort ikke datert, men etter 1962.
Tar for seg utvikling og innføring av ny gruveteknologi i Løkken grube, i en tid da det var økonomisk vanskelige tider samtidig med at malmreservene begynte å minske sterkt..
Det pekes på "vanskelig" gelogi, innsatsen for å utvikle dypmalmen, samtidig som en tok i bruk bergmekanikk for å kunne utvide strosse- og orttversnittene. Dessuten innføring av borrigger (Den Svenske Metoden".

Artikkelen har fått RTZ sin Essay Prize (?)

R. T. Z. ESSAY PRIZE

GAMBLE OR DIE ?

(An Experiment at Lökken Mine)

by

J. H. SHILLABEER

In 1904 the present company was formed with Norwegian and Swedish capital, diversatering began, and a power plant and railway were constructed. In spite of many false estimates, proved ore gradually increased in amount and soon the company felt justified in sinking the present main shaft. Labour disputes and lockouts followed and it was not until a sinking contract was signed with the Long Year Company of the U.S.A. that any substantial advance was made: their sixty-four man team sank to the 380m horizon in the sixteen months from August 1915. The way was then open for renewed mining activity which continued steadily until the present day when the mine is faced with final closure, unless substantial new ore reserves are soon disclosed.

Orkla Grube A/B is the large and well established Norwegian finance house which today owns and operates Løkken mine, having constructed both a hydro-electric scheme and an electric railway (the first in Norway), to serve its mining interests at Løkken. Until 1962 the mine was engaged in the production of a coarse lump ore from which copper matte and sulphur were obtained at the smelters operated by the company at nearby Thamshavn on the Trondheimsfjord. Exploitation of European natural gas reserves, however, made available a cheap new raw material for sulphuric acid manufacture and this led inevitably to a sharp decline in the sulphur market; continued operation of the Thamshavn smelters became no longer a viable proposition and they were closed down. From the fine grained cupriferous pyrite ore the mine now only produces a bulk concentrate, all of which is exported to Northern Germany. Except for the years of World War II, mine production had averaged about half-a-million tonnes annually from the early 1920's until 1962. Since the price for the concentrate has now fallen from around Kr. 250 to only Kr. 95 per tonne, production has been cut by 50 per cent. and now rests at 230,000 tonnes per year.

A closely knit community with a mining tradition, Løkken has little history of militant unionism. By Norwegian standards workers at Løkken have been well paid through the years and it would seem that the company has displayed a highly benevolent attitude towards them. When, in 1962, the rapidly con-

tracting sulphur market forced upon the company a radical programme of rationalisation, a large reduction in the labour force was achieved with remarkably little discord.

At the present time a reduced market is not the only problem facing Orkla Grube; depleted ore reserves are also a major cause of concern. Since mining began under the present company, the ore has been extracted by shrinkage stoping - conditions being eminently suitable for this method. Now, however, the mine has reached that stage when the only work remaining comprises removal of residual ore from the stopes together with pillar extraction. Thus life is assured for a few more years but new sources of ore are a vital necessity. One new ore body is known to exist nearby; its extent, however, is at present largely conjectural and its exploration, together with a re-appraisal of the mining methods currently in hand at the mine form the subject of the "experiment" to be described.

"Difficult" Geology increases Risks

At least a rudimentary understanding of the geology of the mine is necessary to appreciate fully what is involved in the proposed exploration programme. Like other pyrite deposits in Norway, the ore body at Lökken lies in a syncline of Caledonian age which now exists as a denuded mountain chain similar in appearance to parts of Northern Scotland. The country rock is greenstone (metamorphosed lava) and pillow lavae are common in the area. There are three ore bodies, the shape and position of which have been largely determined by tectonic folding - they are lens shaped and somewhat irregular but as a general rule tend to plunge to the west. Hovedgruben (trans: the main mine) is the largest of these and originally had proved ore reserves of about twenty million tonnes; the remaining two ore bodies, named India and Bakindia, run parallel to Hovedgruben but are much smaller and to all intents and purposes are worked out. All three peter out into stringers against a large and well-defined clay gouge to the west, but another ore body has been discovered still farther west about four hundred metres deeper than the present workings: it is around this that a major new development is centred. Geophysical methods of exploration have indicated the likely presence of an ore body but can give no reliable infor-

mation regarding its probable extent because of many misleading anomalies in the surrounding strata. Diamond drilling has confirmed the presence of ore but here again the extent will not be known until it is intersected by drives and crosscuts and at least partially developed.

The keystone of this project is that the management, recognizing the nature of the gamble involved in developing this ore body, reduced the odds against them to a minimum. By careful engineering design and a programme of diamond drilling from existing workings sufficient ore has been proved to cover the capital expenditure required in development.

A satisfactory theory for the origin of the ore at Ökken has never been produced and so little weight can be given to arguments about the possible extent of the new deposit. Speculation regarding ore genesis has continued for some years but now seems to feature little in conversation, the situation having reached an impasse which may or may not be settled when more is known about this new area.

Ökken, at best, only a medium-sized mine is, nevertheless, the only major producer of its type in the country. In addition to the geological difficulties there are several other factors all with important bearing on the situation which would probably be of smaller significance if taken out of context. Ökken is the only mine of any significance remaining within the company - Orkla Grube no longer has its interests closely centred around the mining industry and has diversified into shipping and manufacturing. To a large and prosperous mine operating in a well-established area this would be an operation of no great importance but here it is highly magnified in proportion. The risky nature of the project taken together with the size of the capital investment which must be drawn from a limited source make this a rather interesting proposition. However, one can only speculate upon this aspect since the company is understandably reticent about its more involved financial policy.

Older Workers Must Acquire New Skills

The "human" aspects of this problem are probably just as important, and here one may draw some valid conclusions.

Some of the newer departures in metal mining practice have been included in the project which otherwise might well have proved unworkable. For example, before excavation began work was carried out to define the planes of principle stress and to obtain some forecast of the rock pressures to be encountered. From these investigations it proved possible to design and orientate the shaft to give the best resistance to stress, minimise scaling from the sides, and aid blasting to some extent. The shape selected was an elipse which has now increased by natural scaling from 4.30 metres x 2.76 m to 4.90 m x 2.90 m at which size it appears to have reached a stable condition. The sinking method was chosen to give an acceptable cost per metre of advance. No great speed was called for and, in fact, only a four-man team comprised of personnel drawn from the mine was found necessary. A simple single stage drilling platform was designed and built at Løkken similar to the type known as the "Boliden Ring". Primarily for drilling purposes, this incorporated four drilling machines suspended by their air legs from a peripheral ring. The size of the ring, length of the air legs and the round of holes were also designed so that in positioning each drill the correct angle was obtained automatically. This sinking stage was also used for rock bolting purposes - the only form of support thought necessary.

Blasting the greenstone, which contained an abundance of pillow lavae, proved difficult using the generally accepted "cone cut" type of sinking round and a "Vannkut" was soon adopted instead. Basically this comprised a double slipping round, one half of the shaft being blasted and cleaned out before drilling on the second was commenced. A tendency on the part of the greenstone to reconsolidate after blasting might have caused difficulties, especially in cleaning. This was anticipated from experience elsewhere in the mine, so that due consideration could be given to the method of loading to be employed. A Cryderman Shaft Mucker was eventually selected as being most suitable after sifting information gained from mines in many parts of the world. This provided the very necessary positive digging action and was at the same time sufficiently manoevreable to cope with an uneven floor profile.

Modern but well-proved equipment can also be found in the permanent hoisting installation which was nearing completion at the end of the author's visit. This incorporates a small single skip and cage sheave winder and like many hoists today is to be fully automatic when raising ore. Pushbutton selection is available for man riding and supplies transport duties.

Modern Tunnelling Methods

Since so much of the future of Ldkken depends on the success or failure of this project it is fairly obvious that development must be pressed forward steadily. With this aim in view, one high speed drilling rig has already been purchased and men are now being trained in its use as a matter of urgency; a second is likely to be obtained in due course. A system of tunnelling to be implemented is based on what has become known as the "Swedish" method. The rig incorporates four percussive drilling machines with auto-feed attachments mounted on horizontal arms to the left and right of a central winch pillar. Each machine is positioned laterally by simply moving it by hand along the supporting arms, whilst vertical movement is by hand and air operated winches. The rig is rail-mounted and is anchored to the roof by two compressed air operated pistons. It combines high drilling capacity with simplicity and thus in this application has many advantages over the more flexible, but rather more complex rigs also available today. Results already obtained with the new drilling rig have been a source of great encouragement. With two operators (probably one in the future) working in a trial end similar in size to the new development work a total of 74.3 m drilling was completed in well under two hours.

Efficient cleaning must also be employed if the drilling machines are to be utilised to the full. This presents something of a problem as a tunnel becomes longer and transport more time-consuming. This particular aspect of the problem has been at least partially overcome by the construction of a modified "Boliden" scraper train. Being both rugged and unsophisticated in design, this combination could be an attractive proposition for use in many other mines. Here again is an example of modern but popular equipment being selected in order that some of the

unknowns may be eliminated.

In presenting a general outline of this crucial project and describing some of the ways in which Orkla Grube is tackling the problem of a depleting ore reserve, it is hoped that some insight may have been given into the risks involved in mining even today. It is also hoped that any doubts which might have existed concerning the value of a vacation visit to a smaller mine have been well and truly dispelled.

Signed: J. H. Shillabeer

J. H. Shillabeer