CHANGE OF MINING TECHNOLOGY IN A GERMAN ROCK-SALT MINE

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ABSTRACT

Since mining commenced in 1885 the mining method in the Heilbronn rock-salt mine has been drilling and blasting. In May 2006 a first Continuous Miner from Sandvik was put into operation. The introduction of continuous mining required changes in the working system, the haulage and the infrastructure. In the year 2008 the miner produced one million tonnes and replaced a blasting section. The positive results of the new mining method gave encouragement to order a second machine that was delivered in November 2008. The change of mining technology from blasting to cutting was successful and will be continued in the next years.

Keywords: salt production, rock-salt mining, drilling and blasting, continuous mining

1 INTRODUCTION

The Heilbronn rock-salt mine is situated in south-western Germany. The rock-salt deposit belongs to the Triassic formation, is horizontally bedded and lies at a depth of 170-230 m. The deposit is protected by an anhydrite layer, impervious to water and over 50 m thick. In the Heilbronn area the salt bed has a thickness of about 40 m, but only the lower 10-12 m is mined due to the higher purity of salt of about 95% NaCl. The salt is mined underground and hoisted by two shafts (Fig. 1), a third shaft is used for ventilation and material transport. The Heilbronn mine, with current annual salt production of more than three million tonnes a year, has the highest output of any rock-salt mine in Europe. The salt is mainly used as a raw material in the chemical industry and as road salt for de-icing. A small part of the production is refined to table salt at a vacuum salt plant.

Fig. 1: Hoisting shafts of the Heilbronn rock-salt mine

2 DRILLING AND BLASTING METHOD

Since mining commenced in 1885 the mining method in the Heilbronn rock-salt mine has been room and pillar with drilling and blasting. Rectangular drift rooms are driven parallel to each other and separated by 15-18 m wide salt pillars for support. The rooms are 15 m wide, 10-12 m high, 200 m long and mined in two steps: first the lower level is mined with 7 m deep blastings and a height of 5 m; then the roof is blasted down from the end of the room towards the main drift (Fig. 2).

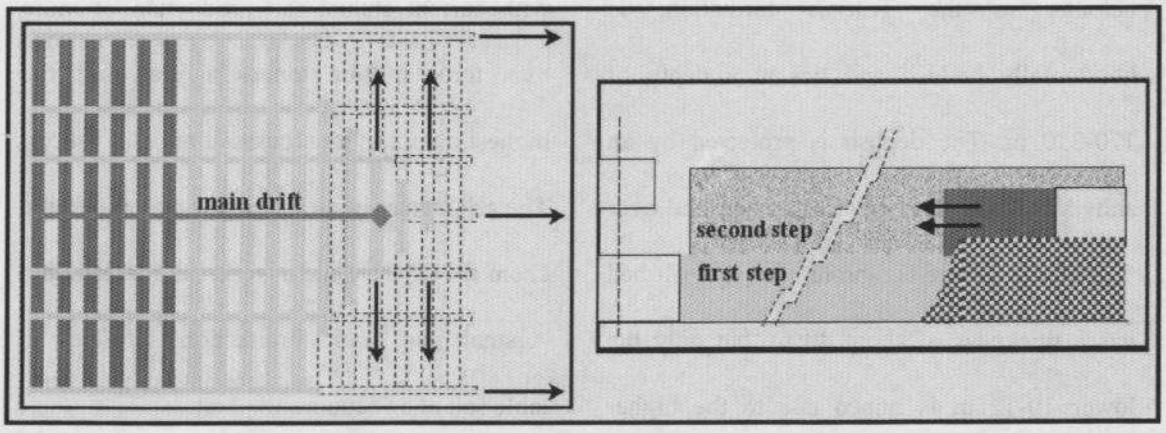


Fig. 2: Mining method in the drilling and blasting areas

During the last decades a number of technical improvements has been realized to optimize the drilling and blasting method. The most important steps were the use of ANFO explosive and electric detonators without primers, the drilling jumbos with automatic borehole steering (Fig. 3) and blasting vehicles with lifting platforms (Fig. 4). The drilling and blasting method has now been

optimized with only few options for further improvements.

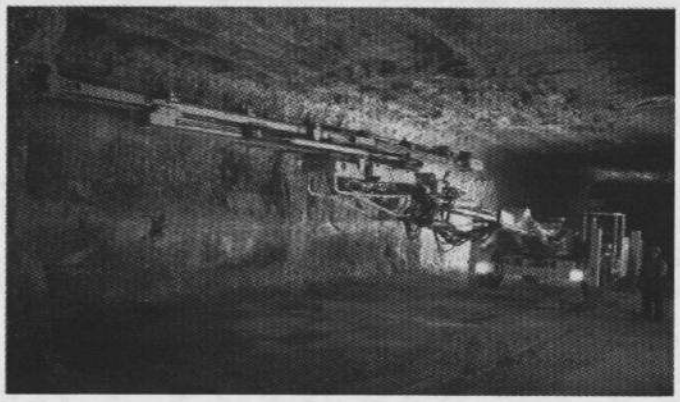


Fig. 3: Drilling jumbo with automatic borehole steering

Fig. 4: Blasting vehicle with lifting platform

3 REASONS FOR THE CHANGE OF TECHNOLOGY

There were three reasons for thinking about mining technologies others than drilling and blasting:

- The need to constantly look for ways to improve the productivity and economic efficiency in mining.
- During the recent years the mining area approached towards residential areas where the blasting can be perceived on the surface. Despite the fact that no damage to buildings can be caused by the blast vibrations, problems arose for the acceptance of the mining activities.

- The gases released by blasting are poisonous and require a waiting time for the ventilation to clear to protect the workers. European legislation intends to lower the existing limits for these gases although the current limits are absolutely sufficient for the health protection. The realization of this intention would complicate the mining by blasting heavily.

4 INTRODUCING OF CONTINUOUS MINING

The successful implementation of continuous mining in an English and an American rock-salt mine gave encouragement to examine the use of continuous mining at the Heilbronn mine. In May 2006 the first continuous miner was delivered by Sandvik Mining from Austria. It was an ABM 30-CM with a 7,2 m wide drum (Fig. 5).

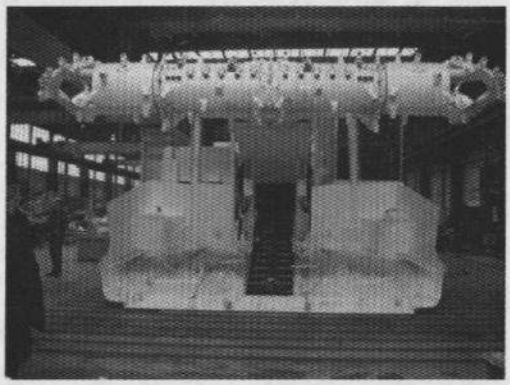


Fig. 5: Continuous Miner ABM 30-CM

The cutting height is 5,3 m and it is the largest Continuous Miner worldwide. To transport of the cut material teledump trucks were ordered from GHH Germany with a capacity of 30 tonnes (Fig.6). For this combination – continuous mining and discontinuous hauling by teledump trucks - a new mining system had to be designed. The upper level is mined first by driving five or seven 14 m wide headings (two cuts of 7 m) parallel to each other (Fig.7). The middle one is used for the main haulage with a conveyor belt, the two outer ones are used for ventilation.

After having reached the end of the mining field the conveyor belt is disassembled and the lower part is then mined.

Fig. 6: Teledump truck SK-A 30.1

During the first months the workers had to be trained and get used to the new technology and system of work. A number of technical and organizational improvements had to be made also. The success of these improvements and gained experiences was shown in an increase of productivity and reliability. The average daily extraction rate could be stabilized to more than 5.000 tonnes. The new mining system produced 760.000 tonnes in 2007 and nearly one million tonnes in 2008.

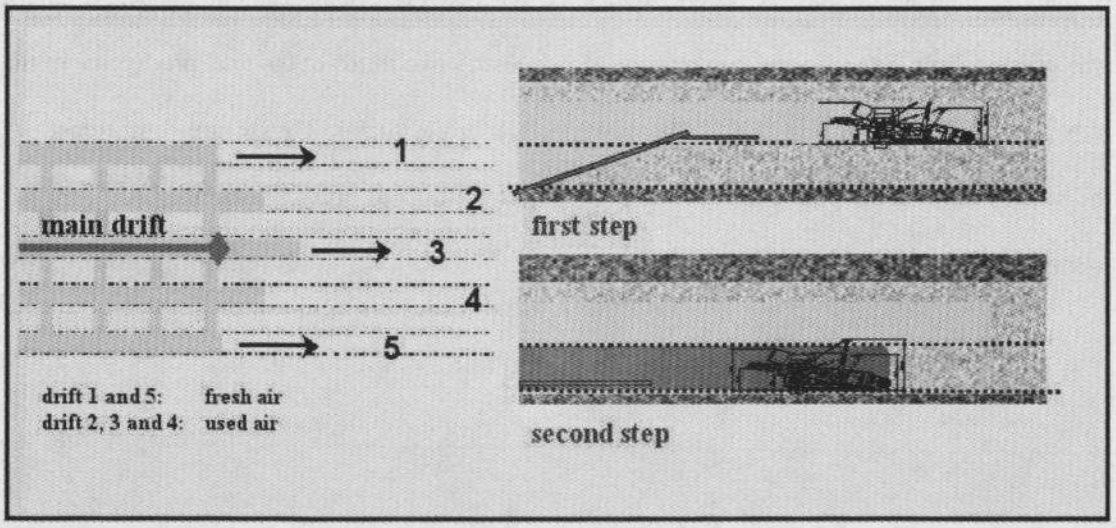


Fig. 7: Mining method in the continuous mining areas

5 CONTINUATION OF CONTINUOUS MINING

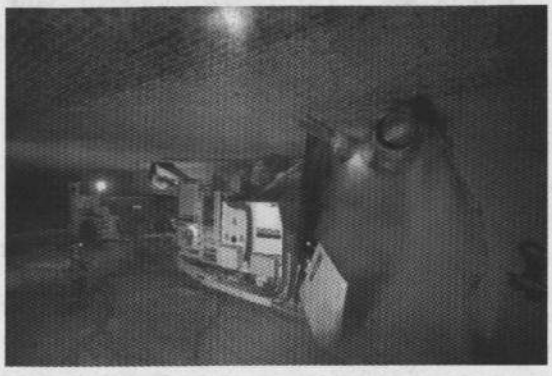
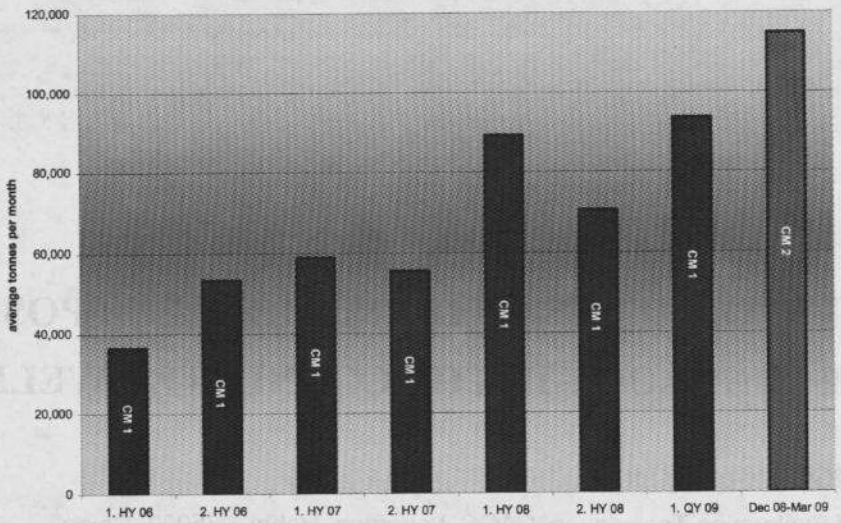


Fig. 8: Continucus Miner MB 770

When compared to drilling and blasting not only the production figures, but also the economic figures showed that the change of technology had succeeded. A second miner was ordered from Sandvik and commissioned in November 2008 (Fig. 8). The equipments of the second continuous mining area are similar to that of the first but have included a number of further technical improvements. In the first months of operation the average monthly production rate of the second miner has reached more than 100.000 tonnes (Fig. 9). Nearly two thirds of the total production of the Heilbronn rock-salt mine are now mined by the continuous mining system.



6 CONCLUSIONS

The change of technology in the Heilbronn rock-salt mine was successful. Geological conditions in this south-west German rock-salt layer are well suited to continuous mining. The mining machinery available offers a range of powerful equipment that makes it possible to get high mining rates. Training and education of the workers is a further important factor for a successful implementation of the new technology. The avoidance of blasting prevents the release of poisonous gases and offers the chance for mining sections under residential areas without blasting vibration concerns. Finally the economic conditions for salt production can be improved by continuous mining.

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