The HEILBRONN Rock Salt Mine – Salt Production for the New Century

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The HEILBRONN rock salt mine started mining in 1885 and there are identifiable reserves for a further approximate 80 years of extraction. Current salt production is about 3 million tons per year and is used principally as a raw material in the chemical industry and as road salt for de-icing. The geological conditions have always favoured mechanised rock salt extraction. Further technical improvements will focus on automatic drilling, hauling with electric loaders, processing and ventilation. Besides salt winning, the worked out areas of the mine are used as repositories for different kinds of industrial waste.

1 INTRODUCTION

Rock salt is a raw material which occurs in substantial quantities and can be mined economically in different mines in Germany. The HEILBRONN rock salt mine is situated in south-western Germany at the Neckar River (Fig. 1), which has been used to transport salt to customers since mining first started in 1885. The Heilbronn Mine, with current annual salt production of more than 3 million tons, 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: Location of the HEILBRONN mine in south-western Germany

2 GEOLOGICAL CONDITIONS

The HEILBRONN rock salt deposit belongs to the triassic formation, is horizontally bedded and lies at a depth of 170 – 230 m (Fig. 2). The deposit is protected by an anhydrite layer, impervious to water and over 50 metres thick. In the HEILBRONN area the salt bed has a thickness of about 40 metres, but only the lower 10 – 12 m is mined due to the higher purity of salt of about 95 % NaCl. The purity of salt and the geological and geomechanical conditions limit the commercial reserves of the mine. The deposit is laid down over a very large area but only those parts of at least 30 metres bed thickness are mined out. This operating regime results in commercial reserves of about 240 million tons that would last for a further 60 – 80 years of mining at current extraction rates.

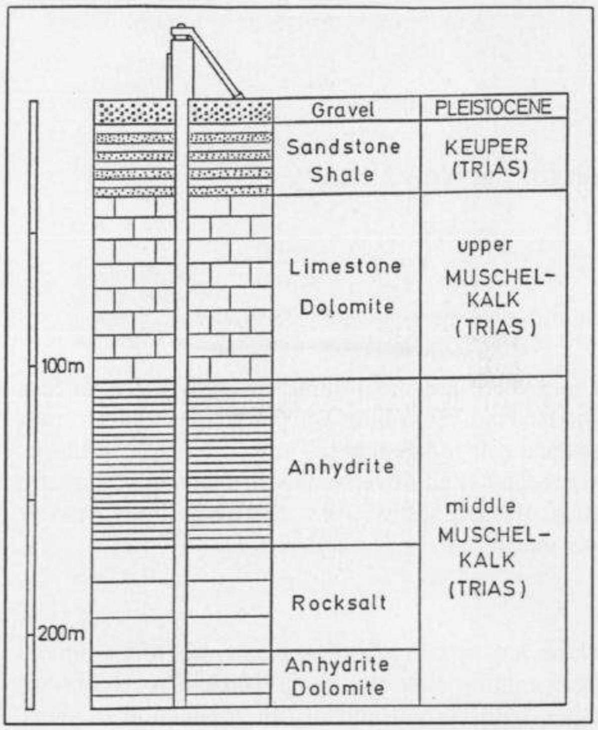

Fig. 2: Geological strata in the HEILBRONN area

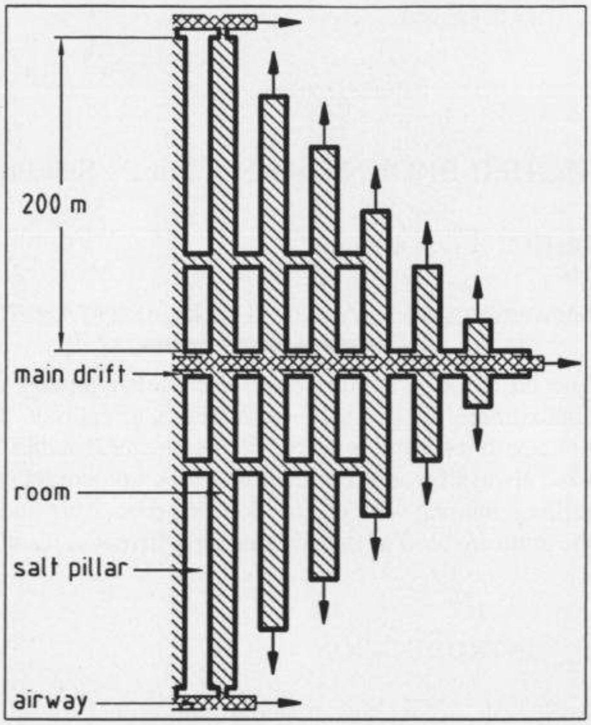

Fig. 3: working scheme in the HEILBRONN mine

3 MINING METHOD

The mining method (Fig. 3) is room and pillar with a recovery of 45 % by volume. The rooms are 15 m wide, 10 – 12 m high and 200 m long; they are driven parallel to each other and separated by 15 – 18 m wide salt pillars for support.

3.1 Drilling and blasting

The method to driving the headings is to undercut with Goodman undercutters, drill 4 metre deep blast holes with jumbos and fill the holes with ANFO explosive, primers and electric detonators. This process is to be changed by pre-splitting with one large hole, drilling of 7 metre deep blast holes and blasting without primers. The use of new generation Salzgitter BW 50 drilling jumbos (Fig. 4) with automatic borehole steering has improved productivity by reducing the number of boreholes and with it the quantity of explosive used, as well as the need to descale.

3.2 Haulage

The haulage had previously been done with diesel engine loaders of shovel capacity of 16 tons. A first step to reduce the exhaust gas emissions was the installation of particle filters. In 1997 electric loaders of GHH (Fig. 5) were introduced to eliminate exhaust gas emissions. The electric motor drive with 250 kW drive power is supplied by a 250 m long rope. The drive of the cable drum is steered by microprocessors. The drive speed of the loader is regulated by a hydrodynamic drive unit. The LF 17.2 GHH loaders work very successfully in the HEILBRONN mine with a reduction in diesel gas emissions, a bigger shovel capacity of 17 tons, more efficient loading of the blast rock, higher vehicle availability and by far lower noise emissions.

Fig. 4: Salzgitter BW 50 drilling jumbo

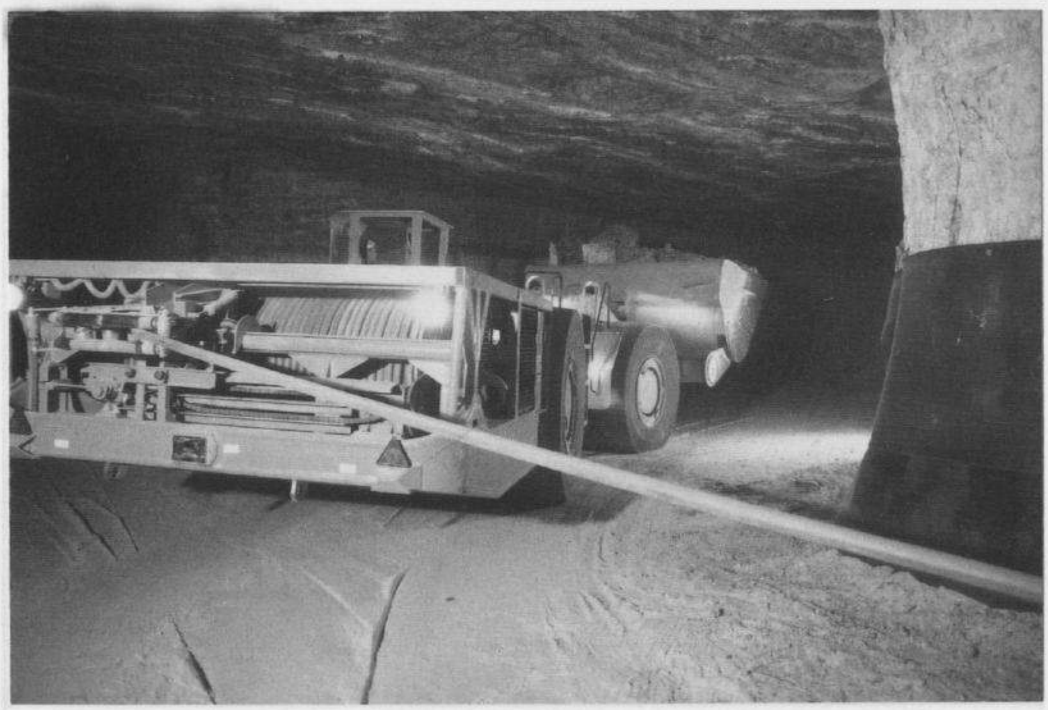

Fig. 5: LF 17.2 E GHH loader

3.3 Mineral processing

The rock salt is broken by crushers in the mining area and transported to the shafts on conveyor belts. Before hoisting, mineral processing takes place underground by a selective crushing and screening process which separates the rock salt from the anhydrite in a selective crushing mill. The tailings are used for backfilling mined-out areas. A new underground processing plant is being installed to improve product quality by selective crushing. An option is to install an optoelectronic cleaning system to reduce the quantity of tailings.

The salt is hoisted by two shafts from which one is used mainly for industrial salt and the other for de-icing salt.

The industrial salt is cleaned up to a quality significant above 99 % before it is transported to the clients.

3.4 Ventilation

As mining progresses the distance between the shafts and the mining area has increased and put pressure on the ventilation air supply. In order to meet air quality needs of men and machines two new ventilation fans (Fig. 6) were installed in 1996 with a capacity of 18.000 cubic metres of air per minute. In order to cope with the future demands of ventilation and to avoid the high energy costs for additional ventilation systems a new air shaft in the centre of the future mining area is planned. This shaft will then be used also for current supply and material transport.

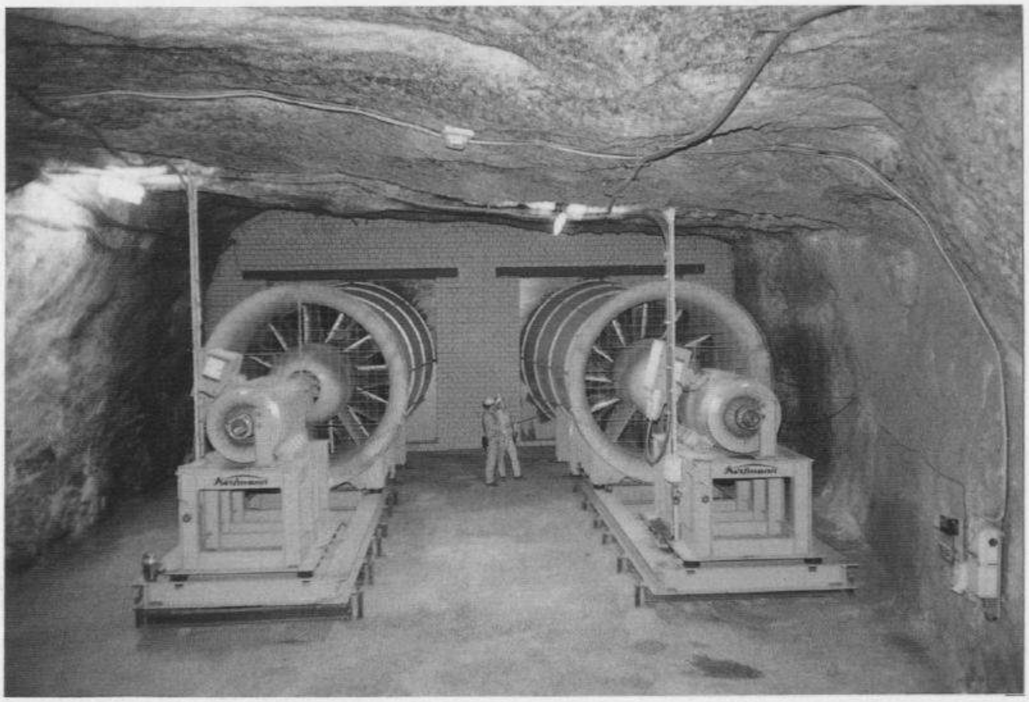

Fig. 6: Korfmann main ventilation fans

4 WASTE REPOSITORY

With an annual output of about 3 million tons a cavity of more than 1 million m^3 is created each year. The total volume after 115 years of mining is more than 30 million m^3. Part of this void space is backfilled with tailings and some rooms are used for workshops, stores and other operating purposes. There still remains considerable space for activities other than mining. In 1987 the HEILBRONN mine started to accept waste from incineration plants for disposal in the worked-out areas. Incinerator fly-ash together with associated flue-gas-cleaning residues are delivered to the mine in packages (big bags, containers or barrels). The packages are handled on the surface and at the shaft bottom using fork lifts. Trucks with a payload of 18 mt haul the packages to the repository area 4 km away.

After stacking the big bags by mobile crane (Fig. 7), a ramp is made with the tailings from the salt processing and the bags are covered with tailings (Fig. 8). On this new platform the next layers of bags are stacked until the worked-out chamber is virtually filled up. The remaining space is infilled by tailings catapulted in.

The underground disposal of waste in the HEILBRONN mine has been succesfully and safely undertaken for many years. As a result of this success an application was made to increase the area for waste disposal as well as extend the types of wastes. In 1999 approval was granted for approximately 240 different kinds of waste in a mined out area of the mine of more than 9 million cubic metres.

Fig. 7: Stacking of big bags by a mobile crane

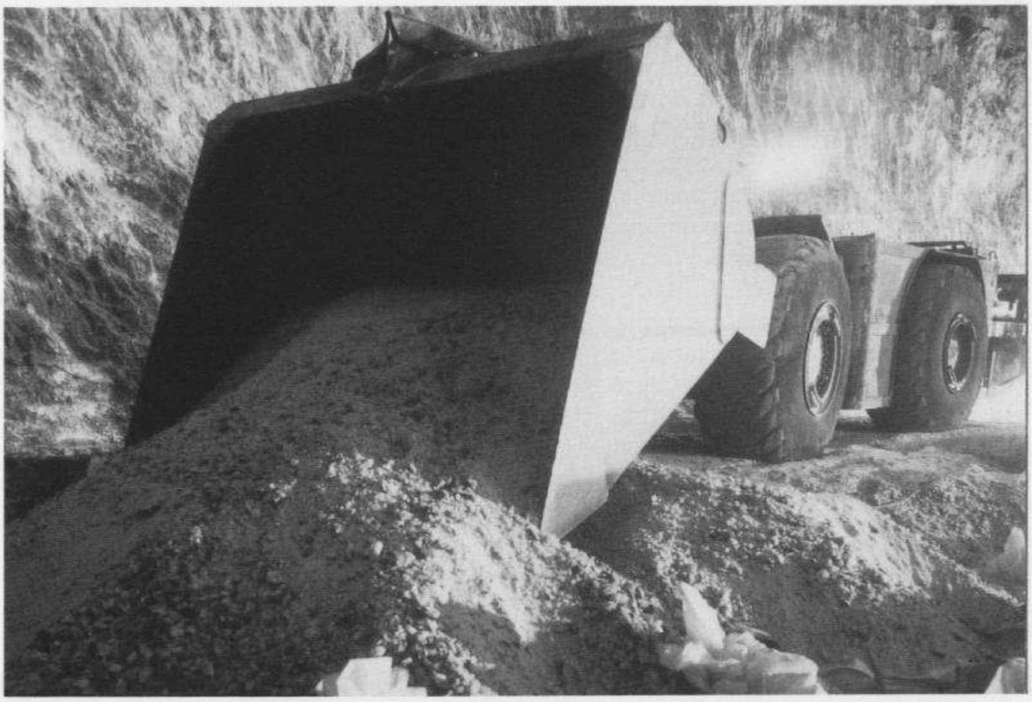

Fig. 8: Covering the big bags with tailings

5 CONCLUSIONS

The HEILBRONN rock salt mine is well prepared for the new century. The commercial reserves identified will allow for a further approximate 80 years of extraction. The geological conditions favour mechanisation that is on a high standard and will be continued in order to cope with the demands of the salt market. The use of the worked out areas of the mine as waste repositories meets an environmental need as well as supports the economic viability of the mine. The Südwestdeutsche Salzwerke AG will stay a powerful and reliable partner for the clients in the future.

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