

SPOTLIGHT

on underground rock boring

by A. N. BROWN*

Underground rock boring was the topic of the mining vacation school held at the University of the Witwatersrand in the week 4th to 8th February, 1980. The School, which dealt with the management and economics of the subject, attracted 75 delegates from all sectors of the South African mining industry, in addition to two delegates from Germany and one from Zambia.

Steady progress has been made in underground rock boring in Southern Africa since its introduction in 1967. It is now a rollicking teenager and, like all teenagers, needs a firm hand and parental discipline. The staff responsible for operating rock-boring equipment have acquired a great deal of skill and experience over the years, so that they are able to conduct the operations effectively and efficiently. However, underground rock boring is an extremely complex operation, which generally involves the movement of a large quantity of heavy, bulky equipment through the mine, and depends for its success on the dovetailing of efforts from various mine departments. These include rock-boring staff, geologists, surveyors, and engineering, work-study, mine-planning and mine production personnel. The greatest need at the moment is better planning and management of underground rock-boring operations. It presents a challenge to mining management, because the techniques are cost effective only under conditions where the operations are well planned, the equipment is correctly selected, the personnel is properly trained and supervised, the equipment is effectively maintained, and the operations dovetail smoothly. The School was designed to cover these important aspects so as to be of value to senior and middle management, and to the technical staff concerned with the direct control, management, or planning of underground rock-boring operations. Such a course, by its very nature, is of interest to the suppliers of equipment as well as to the academic staff of our universities, and both groups of people were well represented.

The school was opened by Mr D. A. Viljoen, President of the South African Institute of Mining and Metallurgy. He welcomed all the delegates, and thanked the organizing committee for their efforts. The committee comprised Mr J. D. Austin (Chairman) and Messrs A. N. Brown, D. G. Malan, H. G. M. Rose, and G. C. Thompson, Dr H. Wagner, Professor S. Budavari, and Dr M. D. G. Salamon. Mr Viljoen stressed the objectives of the Institute's vacation-school programme, namely, to provide the opportunity for people engaged in industry and research to participate in short, intensive technical

programmes. The aim is to stimulate technical discussion and interaction, to provide a refresher course with particular emphasis on modern trends and new developments, and to encourage familiarity with relevant current literature. The President highlighted the important role of mechanical rock-boring techniques in modern underground mining, and briefly sketched the development of mechanized excavation from the painful and tedious working methods practised in Neolithic times. Research into the stoping of narrow, uniform reefs by boring was an exciting development that could have many advantages over conventional mining at great depth. A recent breakthrough was the use of a tunnel-boring machine at the Free State Geduld Mine to complete the first mechanically bored horizontal tunnel, which is some 1150 m long. Although costing substantially more than if it had been constructed by conventional means, and constructed at a very much slower rate because of the difficulties experienced, the achievement can be regarded as a significant technical advancement. Techniques of mining are at present undergoing a state of purposeful change. The stimulus has come from a number of forces, including a drive for environmental compatibility, the pressing need to increase productivity, the escalation of labour costs, the onerous conditions existing in deep mines, and an exponential increase in knowledge and communications.

Lecturers

The Institute's vacation schools are conducted on an educational level, and every effort is usually made to limit the number of lecturers in the interest of continuity, duplication, and lecturing competence. However, underground rock boring is a relatively new technology and very few people possess a sufficiently complete and broad background. A group of ten leading specialists was assembled from overseas as well as from local industry to give a balanced presentation of the subject. They are all highly regarded in the field of rock boring on the basis of their experience, and the many papers that they have published within their specialized field attest their competence.

The leading suppliers of rock-boring tools and equipment gave very valuable assistance in arranging for the visits of their staff (the overseas lecturers) to South Africa to coincide with the School. The three lecturers from the U.S.A. were Mr Dick Robbins, who is President of his own Company and a world authority on rock boring, Dr Euclid Worden, of Smith Tool, who has accumulated a wealth of experience in rock boring over the years, and Mr Neal McNabb, of Drillco International.

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Technical Programme

The technical programme consisted of twenty lecture sessions, each of one hour's duration. Mr Robbins outlined the history of rock boring, fundamental types of rock-boring machines, tunnel-boring machines, and the borability of rocks. Mr C. L. de Jongh, of Gold Fields of South Africa, spoke on rock mechanics aspects of the use of bored holes, design criteria, stress effects, and securing holes that had deteriorated through scaling effects. Dr Worden dealt with the all-important topic of pilot-hole boring and the factors affecting its accuracy. Mr N. M. Roberts, of Strata Boring Services, spoke on the maintenance of machines and equipment, and Mr McNabb covered the subject of the design, limitations, care, and use of drill strings. Mr E. N. Chur, of Reed Tool, who has been involved with rock boring since its inception in Southern Africa, spoke on the subject of reaming practice, tool design, and tool selection. The practical aspects of pilot-hole boring and reaming under difficult conditions of stress or flat inclination were handled by Mr P. C. Graham, of the Robbins Co. Mr W. van der Berg, formerly of the Anglo American Corporation, dealt with the more practical aspects of underground rock boring concerning the organization of operations, supervision, and the selection and training of personnel. Mr D. C. Brink, of R.U.C. Mining Construction Co., in an amusing and convincing manner, talked on the subject of contract rock boring. The economics of rock-boring operations and tool purchase or hire was adequately covered by Mr A. N. Brown, of Gold Fields of South Africa.

The final session consisted of a general discussion on 'Rock Boring in the Future' under the guidance of a panel made up of the lecturers. The discussion, which was both stimulating and interesting, accentuated the future potential of mechanical rock boring in mining in Southern Africa. The limitations of materials under extreme stress conditions were mentioned, and productivity problems and the potential use of the Dyna or Turbo drill for great accuracy of pilot-hole boring featured in the discussion.

Film Evening

A technical film session of approximately 1½ hour's duration was held on one evening. In all, four short technical films that had been obtained from various suppliers of equipment were shown. The films covered the topics of raise boring, shaft boring, and tunnel boring.

The raise-boring film covered the boring of a 3,66 m-diameter vertical raise 701 m long from the surface at the Caynga Rock Salt Mine in New York state. Shaft boring was covered by an excellent animated film, which

also showed the modern technique of boring shafts from surface in the city of Chicago. The tunnel-boring films dealt with an array of tunnel-boring applications in both soft- and hard-rock conditions. These films proved to be of great value to delegates in that they showed machines in operation and focused attention on recent developments.

Technical Visits

Practical exercises and technical visits were held in three afternoon sessions. The delegates were divided into four groups so that each delegate was able to visit three of the four centres during the School.

The visit to the Robbins factory at Roodepoort was mainly for the purpose of viewing various rock-boring machines in the process of assembly and overhaul, as well as rock-engagement tools. At the plant of the Reed Tool Company in Benrose, the accent was placed on reaming heads, pilot bits, and cutters. At the Smith Boart factory at Spartan, delegates were shown drill-pipe and stabilizer testing and repair, and the local manufacture of rock-engagement tools and an automatic machine control system. At the Chamber of Mines Research Laboratories at Richmond, the accent was placed on research into rock-cutting tools, telemetry, and rock-testing and cuttings analysis.

The technical visits proved to be a vital part of the School, enabling the delegates to get to grips with practical aspects of rock boring and also to enter into detailed discussion with specialists at the various centres. Great strides have been made by local suppliers of equipment in the manufacture of rock-boring machines, tools, and accessories. During the visits, delegates were made fully aware of just how far the local manufacturing programme had advanced.

Social Events

A cocktail party was held at the Chamber of Mines Sports Club on the first evening of the School. It was well attended by the delegates, lecturers, members of Council of the Institute, and senior representatives of the mining houses. The purpose of the party was to provide an opportunity for delegates to meet the lecturers, and officials from industry and the Institute. It is remarkable how a cold, and sometimes unresponsive, group of people, judged by the first day's proceedings, take on a completely different character after the social contacts made at a party, and this group was no exception.

A dinner, also held at the Chamber of Mines Sports Club, was held on the Thursday evening. The event was well attended by the delegates, the lecturers, and members of Council. Mr D. A. Viljoen, the President, was the official host, and addressed the gathering briefly during the course of the evening, which was enjoyed by all.