

# Rock-Cutting and its Potentialities as a New Method of Mining

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## Discussion

**R. E. Barnes (Member):** The original concepts and the pioneering work now brought to the practical test stage by the Mining Research Laboratory team deserve our highest praise. The authors of this comprehensive paper rightly stress the urgency of establishing the extent to which the apparent potential can profitably be realised in practice. It is to be hoped that adequate funds will be made available by individual mining companies, the Chamber of Mines and manufacturers to attract the necessary staff and maintain the high rate of achievement of the last two years.

From the Seventy-Eighth Annual Report of the Chamber of Mines and its members we see that, in 1967, with a Working Revenue of R759.8 million from gold and R54.6 million pit mouth coal sales and with profits from gold and uranium and pyrite of R307.9 million, only R1.9 million was spent by the Chamber on *all* forms of Research. It is considered unlikely that the associated mining companies and manufacturers exceeded this investment expenditure.

Assuming a total of R4 million spent by the industry on Research and Development, this is less than half of 1 per cent of sales of gold and coal. This percentage, so low in comparison to North America and Europe, is no worse than that of Exploration expenditure which, in 1967, with South Africa's total mineral production of R1,287 million, was estimated to have been R6 million (Pretorius 1968). In a primary industry with ever present depletion of ore deposits and with cost escalation, expenditure on Exploration and on Research and Development is not a risky luxury but a tactical obligation.

The potential rate of return on research expenditure into rock breaking is high. Stores consumed by gold and coal mines, members of the Chamber of Mines, totalled R316.2 million in 1967. Except for purchased power costing R42.2 million the highest cost group was explosives, drills and drill steel totalling R33.8 million or 10.7 per cent of the total stores consumed.

In the paper under discussion it is claimed that the low 'effective stoping width' should greatly reduce the likelihood of rock falls or rock bursts to the extent that permanent support can be dispensed with. Insofar as this narrow cut is only 12 in. in advance of the working area which, with a 10 in. channel, is unlikely to be much reduced in width from that achieved by current methods, this claim is not readily understandable. Were it to have been based upon the regional support gained from packed waste it would have been more acceptable.

Pre-developed stope drives may give serious trouble at depth and for this reason it is questioned whether a stoping area can avoid periodic sub-development blasting—the spoil and fumes from which will interfere

with the rock flow and continuous mining of the rock-cutter. If, in the mining method proposed by the authors, stope drives are cut as small as possible (6 ft by 6 ft) then 25 per cent of the total tons handled (excluding resued waste) and 5 per cent of the gold will be blasted conventionally in the stope. At this stage one cannot envisage tunnelling machines economically or practically capable of such work.

The various methods described by the authors and subsequent contributors for breaking waste are most interesting. It was noted that the 'bull wedge' and 'explosives' in Fig. 1 of the paper were no further from the ideal point 'A' than was 'cutting'.

The writer considers that the bold and imaginative steps taken by the Mining Research Laboratory Team, the mining companies and the manufacturers concerned will eventually lead to a successful rock cutting machine with universal application largely independent of rock type. This may take many years. In the meantime other methods of improving productivity of saleable metal by rock breaking teams should be investigated even if such methods have local applications only.

In 1955 the writer conducted tests with a wire saw similar to those used in quarries in the Northern Transvaal and elsewhere. Jeppestown shale, the immediate footwall of much of the East Rand gold field, was cut at the rate of 6 in. per hour using sand, water and a special endless rope driven by a low h.p. motor. A hypothesis on its application was submitted to the Office of the Government Mining Engineer in 1955 and to other mining institutions in 1966 after the writer returned to South Africa. By inference, rope sawing was classed as less promising than other methods tested in the Orange Free State Goldfields (Parker 1969). With highly resili-fied hanging and footwall quartzites this was not surprising and confirmed the writers findings when testing hanging wall quartzite from the East Rand in 1955. The relatively uniform conditions, the low strength, hardness, and silica content of the Merensky Reef platinum deposits (Gray and von Bardeleben 1969) and in particular, the existence of overlying Merensky pyroxenite (Cousins 1964) make this and the East Rand attractive areas for larger scale testing of wire saws.

It is envisaged that in suitable rock types the  $\frac{3}{8}$  in. slot would be advanced down dip or down a minor dip. In undisturbed areas 'faces' of up to 200 ft in length could be cut several feet in advance of breaking which could then consist of light blasting to the second free face or some of the methods now being tested for breaking waste in rock-cutting operations.

A wire saw is an inexpensive and simple machine which, in some areas, could make significant and early gains in rock breaking efficiency as well as in ground and stoping width control.

## REFERENCES

1. The Seventy-Eighth Annual Report of the Chamber of Mines of South Africa.
2. PRETORIUS, D. A. 'Mineral exploration in Southern Africa: Problems and prognosis for the next 20 years.' Economic Geology Research Unit, Information Circular No. 50, October, 1968.
3. Contributions to discussions: M. J. Parker, p. 288; D. H. Gray and I. von Bardeleben, p. 276. *J. S.Afr. Inst. Min. Metall.*, January, 1969.
4. COUSINS, C. A. 'The platinum deposits of the Merensky Reef.' *The Geology of Some Ore Deposits in Southern Africa*, Vol. II, The Geological Society of South Africa, 1964.

## AUTHOR'S REPLY

Mr Barnes seems to have misunderstood the term 'effective stoping width' by which is meant the width of reef cut and trammed from the stope. Our claim concerning reduced problems of strata control is, as he points out, based on the regional support effected by the packed waste which effectively reduces the stoping width.

## Notices

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Transactions of the Seventh Commonwealth Mining and Metallurgical Congress

Requests are still being received by the Institute for sets of the above transactions. Members who wish to dispose of sets in good condition are requested to contact the Secretary, P.O. Box 1183, Johannesburg or 304 Kelvin House, Johannesburg. As these are for resale a price of not more than R10.00 can be offered per set of three volumes.

### INTERNATIONAL SOLVENT EXTRACTION CONFERENCE, 1971

The Society of Chemical Industry has agreed to sponsor an International Conference devoted to the science and technology of solvent extraction. This will be held in The Hague in the Netherlands during the week commencing 19th April, 1971. The organisation of the Conference will be in the hands of a Conference Committee under the chairmanship of Mr B. F. Warner.

The emphasis of the Conference will be on technical solvent extraction of both inorganic and organic substances, including basic principles and practical applications. Sessions are envisaged covering the chemistry of solvent extraction, industrial processes and economics, the performance of contacting equipment and the underlying phenomena involved, and the response characteristics and control of such units.

The Conference Committee will welcome offers of papers for presentation at the Conference. In the first instance, intending authors should submit a preliminary title and an indication of the scope of their contribution to the Conference Secretary: Dr. C. Hanson, University of Bradford 7, U.K. It is hoped to have available in

September a first circular giving further details of the Conference. Copies may be obtained from:

International Solvent Extraction Conference, 1971, 14, Belgrave Square, London, S.W.1.

### SOUTH AFRICAN TUNNELLING CONFERENCE TO BE HELD IN 1970

A South African Tunnelling Conference, to be known as TUNCON 70, is to be held in Johannesburg during the latter half of July, 1970.

South Africa, in common with other countries, has a vital and growing interest in tunnelling. Apart from the 800 kilometres of tunnel excavated annually in the gold mines, the 82 kilometre-long Orange-Fish Tunnel is being driven to carry water from the Orange River to the drier areas of the Eastern Cape Province. This and the realization that services such as water and transport are increasingly being carried underground in various parts of the world have emphasized the need for a forum at which the technology and potential of tunnelling can be discussed.

TUNCON 70 is being supported by three professional engineering societies representing some 6,000 engineers, namely, the South African Institute of Mining and Metallurgy, the South African Institute of Civil Engineers and the South African Institution of Mechanical Engineers, as well as by the Geological Society of South Africa.

The conference has three main purposes. Firstly, to pool and exchange expertise by authorities on tunnelling; secondly, to discuss future developments in tunnelling technology with the aim of making those concerned with long-term planning aware of the potentialities of tunnelling; thirdly, to propose standards for tunnel shapes and sizes. Adoption of standards for tunnelling equipment and accessories would be a major step forward in improving tunnelling efficiency.

The five themes of the conference will be: tunnel utilisation, exploration, design, construction and standards.

The conference will be held at the University of the Witwatersrand, Johannesburg, from 21st to 24th July, 1970. Arrangements will be made for visits to be paid to mines and tunnelling projects before the start of the conference.

Further information is obtainable from the Organising Committee, TUNCON 70, P.O. Box 1183, Johannesburg, South Africa.