

Book News

1. Book reviews

● *Underwater tools*, by Donald J. Hackman and Don W. Candy. Columbus (U.S.A.), Battelle Press, 1981. 152 pp. \$32,95.

Reviewer: B. Schmitz

The oceans are becoming increasingly important in providing food, minerals, and transportation. *Underwater Tools* describes ways and means of performing underwater construction and maintenance operations safely and efficiently. It also combines the practical knowledge gained over many years of experience in the field of underwater tools, their use, fabrication, and design. The content is particularly directed at managers, engineers, scientists, divers, and technicians involved in underwater work. Emphasis is placed on the pragmatic engineering application and not on abstract theory.

In brief, the main topics include

- (i) diver limitations, reaction forces, resistance to motion, and restrictions on visibility;
- (ii) manipulators (i.e. diver aids or remote-controlled arms) of various types, and their advantages, limitations, and availability;
- (iii) comprehensive details of hand and power tools, capacities, and advantages;
- (iv) underwater power sources for tools;
- (v) metal selection, protective coatings, pressure compensation, and cathodic protection for underwater structures.

The development of the underwater tools described has been undertaken primarily by the offshore oil industry and to a lesser extent by the mining industry.

With the increase of seabed mining, this book should prove to be a valuable reference to anyone interested and involved in accomplishing work underwater.

Comprehensive references are also given.

● *Uranium exploration case histories. Proceedings of Advisory Group Meeting Vienna, IAEA, 1981*. Price: Austrian schillings 630.

Reviewer: E. C. Köstlin

The book fulfils a long-felt need for exploration case histories covering a wide, albeit not complete, range of uranium deposits and a wide spectrum of exploration techniques. The types of deposit range from the sandstone-hosted types (Wyoming, Texas, New Mexico, Karoo), through those hosted by Proterozoic conglomerates (Westmoreland, Witwatersrand), unconformity-related types (Northern Territory, Saskatchewan), deposits of granitic and syenitic affiliations such as the Espinhaços occurrence in Brazil and the Bernadan deposit in France, deposits associated with alkali complexes (Pocos de Caldas, Brazil), and hosted by marbles (Itataia, Brazil), to those with volcanic affiliations such as the Kvanefjeld deposit in Greenland. Conspicuous by their absence are calcrete or other surficial deposits and two other deposits of interest: Rössing and Roxby Downs. The absence of the latter is particularly regrettable in view of the paucity of published information on it.

The detailed descriptions of exploration methods in many cases, and the frankness with which details regarding ore reserves and grades are revealed, are refreshing and stimulating. Lamentably, the South African contribution presents a marked exception to this.

An important fact that emerges from the presentations and subsequent discussions is that there is no specific technique with universal application, and explorationists with experience in the field can draw comfort from the numerous disappointments encountered by exploration companies using conventional as well as less-tried methods. There seem to be few, if any, effective alternatives to intensive drilling in discovering viable uranium deposits.

● *Jet cutting technology, a review and bibliography*, edited by Robin Brown. Published by BHRA Fluid Engineering, Cranfield, Bedford MK430AJ, England.

Reviewer: D. O'Beirne

Many engineers will be surprised that there is a technology of jet cutting. It has grown in the past two decades to the point where this publication can refer to 800 technical papers. Some of these papers are themselves status reviews, and there are several proceedings of international conferences.

The book was clearly produced for reference purposes. It is therefore a catalogue describing the literature. To relieve the tedium, a 20-page review is given at the front of the book. This review will startle most engineers, because jet cutting is now applied in many fields of engineering. In manufacturing industry, jets are used to cut precision profiles of paper, shoe components, and asbestos parts for the aircraft industry, where dust suppression is an important factor.

Coming more closely to the mining industry, jet cutting has been tested for hole drilling, including deep holes for oil wells. It is used to cut concrete, and to assist in sheet steel pile-driving. Jet cutting has been used on a limited scale for the mining of certain ores for a number of years. The required conditions were found only in one or two mines, mostly coal mines, in Canada, Germany, and the U.S.S.R. The applications seem to be extending as jet cutting is being applied to harder rock forms. These harder materials are not yet mined by jet, but some of the known hard rocks such as granite can be cut to shape by this means.

The book offers a well-presented summary of a young but interesting technology that is bound to have at least some side benefits of application to the mining industry.

2. New Books

● *Proceedings, Twelfth Congress of the Council of Mining and Metallurgical Institutions*, by H. W. Glen (editor.) Johannesburg, The South African Institute of Mining and Metallurgy, 1982. 2 vols., 1060 pp. R78,85 (air-mail R153,85).

These 2 volumes contain the proceedings of the Twelfth Congress of the Council of Mining and Metallurgical Institutions, which was held in Johannesburg, South Africa, from the 3rd to the 7th of May, 1982, and was attended by over 1000 delegates from 29 countries. The Congress was hosted by The South African Institute of Mining and Metallurgy and the Geological Society of South Africa. As the previous CMMI Congress held in Southern Africa had been in 1961, the general theme of the Twelfth Congress was 'Southern Africa twenty-one years on'. Particular emphasis was therefore placed on the mining, metallurgical, and geological developments that have been of particular relevance to Southern Africa over the past twenty-one years. The two volumes of proceedings contain 82 technical papers together with the discussions that followed their presentation. Of the 37 poster presentations that were on display during the course of the Congress, 15 are reported in full and abstracts are given for the remaining 22. Also included are the speeches made at the opening and closing ceremonies and at the Congress banquet, and the plenary addresses on various mineral topics delivered by 11 notable personalities. The topics vary from the geology and exploitation of various mineral deposits, through mining practices and techniques, to the beneficiation of various minerals and the control of mineral-processing plant.

● *Amborite*. Johannesburg, De Beers Industrial Diamond Division (P.O. Box 916), 1982. 6 pp. Free of charge.

A well-established cutting tool material developed by De Beers in South Africa, Amborite provides excellent performance in the turning and milling of many ferrous workpiece materials, particularly in the range 45–65 HRC (60–92 Shore) and including white-case iron and tool steels. Amborite is also used in the machining of hard-facing alloys and grey-case iron. It consists of a tough polycrystalline mass of abrasive boron nitride particles, and is significantly harder than either cemented carbide or conventional ceramic cutting-tool materials. It is the only material of the three that combines a high degree of toughness with exceptional hot hardness.

3. New Journal

● BHRA Fluid Engineering has announced its new journal *World Ports and Harbour Abstracts* and the associated newsletter *World Ports and Harbour News*, which are issued from January 1983. The *Abstracts* is published bi-monthly and costs £60 in the U.K. and E.E.C., and £72 elsewhere.

There is a huge market available at home and abroad for contractors and designers of plant and machinery, and a corresponding demand for research and development to support the large-scale projects on dock and harbour improvement now being undertaken or planned, especially in Developing Countries. The *Abstracts* covers port and harbour management, design, commerce, shipping construction, and maintenance; mining and dredging technology and theory; and other aspects of coastal development and conservation. It is expected that the journal, containing about 1200 abstracts, will replace the *International Dredging Abstracts*, which was published

jointly by BHRA Fluid Engineering and the International Association of Dredging Companies, with whom BHRA will remain in partnership to produce this latest service for dredging companies and port authorities.

The *News* is free to subscribers of the *Abstracts* and will provide information on finance, legislation, contracting, commissioning, and launching of new products. It is hoped that it will become a focal point for company news. Further information is available from Publications Sales, BHRA Fluid Engineering, Cranfield, Bedford MK43 OAJ, England. Telephone: (0234) 750422, Telex: 825059.

4. Mintek reports

The following reports are available free of charge from the Council for Mineral Technology, Private Bag X3015, Randburg 2125, South Africa.

● Report 2134D

On-line analysis, by X-ray diffraction, of fluorspar-containing slurries. (First published 30th Sep., 1981.)

An on-line instrument developed by the Council for Mineral Technology was used in a feasibility study on the applicability of X-ray diffraction to the analysis of fluorspar-containing slurries.

The instrument is shown to have adequate sensitivity and resolution for the purpose, and further testwork is recommended.

● Report 2135D

A preliminary on-line analysis, by X-ray diffraction, of pyrite-containing slurries. (First published 30th Sep., 1981.)

An on-line instrument, which was developed by the Council for Mineral Technology, was used in a feasibility study on the applicability of X-ray diffraction to the analysis of the pyrite content of flotation concentrates from the gold-mining industry.

The instrument is shown to have adequate sensitivity and resolution for the purpose, provided that the slurries are diluted. Further testwork is recommended, particularly if the analysis of layer silicates such as pyrophyllite is intended. Problems due to blockages in the transport of samples also require attention.

● Report M28

The measurement of flow velocity distribution in fluids.

A method for the ultimate improvement, in range and accuracy, of the cross-correlation flowmeter was investigated. The principles on which the flowmeter operates and fundamental digital signal-processing techniques are reviewed, and the process of the Fourier-transform deconvolution of the auto-correlation and cross-correlation functions were studied. Simulation of the flow system on a computer was shown to require impracticable amounts of computer time to achieve the necessary convergence of the correlation functions. Consequently, correlations and measurements of velocity profiles were made on an experimental flow rig. A programme for waveform analysis was used in the analysis of these measurements. The Fourier-transform deconvolution was shown to have poor immunity to noise and, for this

reason, an alternative method of Bayesian deconvolution was investigated. The correlation functions measured from the experimental flow rig were deconvolved by use of the Bayesian-deconvolution algorithm. The transit-time distribution obtained from the deconvolution and that obtained from measurement of the velocity profile were found to converge. It is therefore clear that the velocity distribution of the flow can be determined from an analysis of the flow signals.

● Report M34

The determination, by atomic-absorption spectrophotometry using electrothermal atomization, of platinum, palladium, rhodium, ruthenium, and iridium.

A method that involves measurement by atomic-absorption spectrophotometry using electrothermal atomization has been developed for the determination of trace quantities of platinum, palladium, rhodium, ruthenium, and iridium in mineralogical samples.

The elements are separated and concentrated by fusion, nickel sulphide being used as the collector, and the analyte elements are measured in the resulting acid solution. An organic extraction procedure was found to offer no advantages over the proposed method. Mutual interferences between the five platinum-group metals examined, as well as interferences from gold, silver, and nickel, were determined. The accuracy of the measurement was established by the analysis of a platinum-ore reference material.

The lower limits of determination of each of the analyte elements in a sample material are as follows: platinum 1,6 $\mu\text{g/l}$, palladium 0,2 $\mu\text{g/l}$, rhodium 0,5 $\mu\text{g/l}$, ruthenium 3 $\mu\text{g/l}$, and iridium 2,5 $\mu\text{g/l}$. The relative standard deviations range from 0,05 for rhodium to 0,08 for iridium.

The method, which is described in detail in the Appendix, is applicable to the determination of these elements in ores, tailings, and geological materials in which the total concentration of the noble metals is less than 1 g/t.

● Report M45

Two computer programmes for the calculation of mass and heat balances in the production of high-carbon ferromanganese.

Two new and comprehensive computer programmes that calculate mass and heat balances for high-carbon ferromanganese furnaces are presented. The first of these, NMASBAL, which was originally written and tested for Metalloys, Meyerton, and subsequently extended for more general use, designs and specifies the proportioning (by mass) of the streams of raw materials to the furnace. The calculation of the heat balance is done by conversion of the chemical analysis of each stream of raw materials to its mineralogical composition, which then forms the basis for the calculation. In the calculation of the mineralogical composition, the chemical analyses of the raw materials are used, as well as the knowledge of their mineral constituents, for which thermodynamic data are available.

The second programme, NPMASBAL, calculates the mass and heat balances on operating furnaces for the production of high-carbon ferromanganese. These results can then be compared with the design specifications of NMASBAL in an evaluation of the performance of the furnace.

Both computer programmes permit the interactive input of data by the user, and produce very readable tabulated results.

● Report M50

The development of an on-line gold analyser.

An on-line analyser to monitor the gold in solutions from the carbon-in-pulp process is described. The automatic system is based on the delivery of filtered samples of the solutions to a distribution valve for measurement by flameless atomic-absorption spectrophotometry. The sample is introduced by the aerosol-deposition method.

Operation of the analyser on a pilot plant and on a full-scale carbon-in-pulp plant has shown that the system is economically feasible and capable of providing a continuous indication of the efficiency of the extraction process.

● Report M54

Major amounts of mercury in native gold from upper Witwatersrand sediments.

This report describes instrumental neutron-activation techniques developed for the analysis of samples of South African native gold. The application of these techniques has resulted in the discovery that mercury is a major constituent of native gold from the Witwatersrand.

Physically and chemically undisturbed gold grains were obtained for analysis by the decomposition of auriferous rocks in cold hydrofluoric acid.

Quantitative results are presented for the mercury content of 46 different samples of native gold. The samples represent eight conglomerate reefs from different regions of the Precambrian Witwatersrand Basin. A limited number of samples were included from Archaean deposits in the Barberton area, Murchison Range, and near Pietersburg in the northern Transvaal.

The results suggest that all the native gold in South Africa contains mercury. A remarkable feature is that the concentration of mercury in detrital native gold in Witwatersrand sediments was found to be between 1,2 and 4,6 per cent, whereas gold grains from the Barberton deposits contained part-per-million concentrations of mercury.

● Report M55

A new robust method for the treatment of analytical data.

A new robust method is proposed for the calculation of the median and the relative standard deviation for a set of data containing unsymmetrically placed outliers. Examples of the advantages of the new method are given, the findings being confirmed by Monte Carlo tests.

● Report M57

The hydrometallurgical treatment of liquors generated by the leaching of a low-grade matte.

This report describes the laboratory tests aimed at the optimization of a solvent-extraction process for the recovery of cobalt from a sulphate medium in the presence of nickel. The process uses Aliquat 336 in the thiocyanate form in Solvesso 150.

The results show that four extraction stages are needed to recover more than 99 per cent of the cobalt in the low-grade matte tested and to load the solvent to approximately 14 g of cobalt per litre.

Awards for inventions

For inventing devices of exceptional value to the mining industry, two mining men were presented with awards in Johannesburg on 25th November, 1982, under the Chamber of Mines' Ideas and Suggestions Scheme. Mr W. W. Malan, President of the Chamber of Mines, made the presentations.

The winners of the awards are Mr Piet van Vuuren (Manager, Technical Services, Coal Division, Gencor) and Mr Fred Cartwright (Pollution Control Officer, Chamber of Mines).

Mr Van Vuuren designed the 'pipe stick', which is now being used by most gold mines as a means of supporting underground workings. Pipe-stick supports combine to an acceptable degree the strength of mine poles, the compressibility of matt packs, and the immediate support offered by hydraulic props.

The pipe stick brings to South African gold mining an old mining concept that the centre of a support should be stronger than the ends, so that, under increasing compression, the support will not snap or splinter but the ends will mushroom. The pipe stick consists of a smoothly fitting stick in a standard steel pipe with no more than 10 cm of the stick exposed at either end. The exposed wood is sawn off on site to ensure that the support fits exactly.

The advantages of the pipe-stick support can be summed up as immediate support, adaptability to variations in stoping width, substantial savings in transport and installation labour, effectiveness under rockburst conditions, reduction in stope fire hazard because of the smaller amount of wood used, a reduction in the loss of gold (formerly absorbed in the packs), and the possible use of second-hand and reject pipes.

When making the presentation, Mr Malan said that Mr Van Vuuren's contribution had had a major impact on mining.

Mr Cartwright's Comet index makes it possible to test whether a particular mine residue really poses an environmental problem. Before he perfected the device, there was a tendency to vegetate or otherwise treat all dumps because there was no acceptable way of assessing whether a particular deposit would erode or not.

The Government Mining Engineer, who is the Air Pollution Control Officer in terms of the Atmospheric Pollution Prevention Act, has accepted the Comet index as a means of establishing whether a particular tailings deposit is sufficiently cohesive not to require shrouding of any sort for pollution-control purposes.

The Comet index is determined by a water or air jet with a measuring device, which together measure the cohesion of the particles making up a residue deposit.

The device can also be used in agriculture to test the ability of soils to resist wind and water erosion, and in the construction industry to assess the quality of concrete.

Mr Malan congratulated Mr Cartwright on an invention that has such varied and valuable uses.



Mr Fred Cartwright (left), standing next to his Comet for testing whether any particular tailings deposit is a pollution hazard, and Mr Piet van Vuuren with the pipe stick he devised to improve underground support in gold mines.