Book news

1. Reviews

● *Mining with backfill,* by S. Granholm (ed.). Rotterdam, Balkema, 1986. US$37.50.

Reviewer: R.W.O. Kersten

This publication contains the proceedings of the International Symposium on Mining with Backfill, which was held in Lulea (Sweden) in June 1983. The Symposium was a sequel to a symposium of the same title that was held in 1980.

The papers are listed below in four categories.

Fill Properties

Engineering properties of cemented aggregate fill for Uludag Tungsten Mine of Turkey, by Ergin Arioglu

A study on the possible uses of waste calcium sulphate from chemical industry as a mine fill material, by B. Contini, G. Iabichino, R. Mancini, and S. Pelizza

Influence of tailings particles on physical and mechanical properties of fill, by Liu Keren and Sun Kainian

Strength of cemented rockfill from washery refuse—results from laboratory investigations, by Walter Knissel and Wolfgang Helms

Mill tailings and various binder mixtures for cemented backfill: analysis of properties related to mining problems, by P.P. Manca, G. Massacci, L. Massidda, and G. Rossi

The use of blast-furnace slag and other by-products as binding agents in consolidated backfilling at Outokumpu Oy's mines, by P. Nieminen and P. Seppanen

Characteristics of cemented deslimed mill tailing fill prepared from finely ground tailing, by E.G. Thomas

Technology

Cemented gravel fill for a small underground mine, by J.R. Barrett, J.E. Stewart, and J.G. Brock

Sub-level vs cut and fill stoping at the Funtana Raminosa Mine: an economic comparison, by C. Berlingieri, M. Congiu, A. Medda, L. Musso, C. Sancilio, and I. Trudu

Cut-and-fill mining at Boliden, methods and economy, by Bengt-Olov Centervarn, Birger Kolsrud, and Mati Sallert

Hydraulic filling—an effective way of ground control, by B.B. Dhar, K.V. Shanker, and V.R. Sastry

State-of-the-art of pneumatic backfilling and its application to a nuclear waste repository in salt, by F. Djahanguiri and M.A. Mahtab

Mining method with hydraulic stowing in the Austrian lead–zinc mine Bleiberg, by Erwin Eckhart

Some aspects of using cemented filling in the ore mining of the GDR, by H. Gerhardt

Usage of downward tailings-fill in the ore No. 5 of Xiang-II Mine, by Huang Wendian and Mei Renzhong

Consolidated backfilling at Outokumpu Oy's Vihanti, Keretti and Vammala mines, by V.A. Koskela

Mining with backfill at Kidd Creek No. 2 Mine, by D.L. McKay and J.D. Duke

A review of the backfill practices in the mines of the Noranda Group, by J.H. Nantel

Fill operating practices at Mount Isa Mines, by L.GB. Neindorf

Slinger belt stowing technique for cemented backfill at the Meggen Mine, by I. Rohlfing

Initial experience in the extraction of blasthole pillars between backfilled blasthole stopes, by D.A.J. Ross-Watt

Mining with backfill at Indian Copper Complex, by P.A.K. Shettigar

The development and introduction of LHD undercut-and-fill mining at Homestake's Bulldog Mountain Mine, by R.A. Simonson and G.C. Logsdon

Evolution of newer techniques of mining thick coal seams and wide orebodies with filling in India, by R.D. Singh and D.P. Singh

Mixed order slicing of 20 m thick moderately dipping coal seam in conjunction with stowing, by T.N. Singh, B. Singh, and R.D. Singh

Development of stope backfilling at Bor Copper Mine, by Radivoje Stankovic, Ante Glusevic, and Zoran Petkovic

Development of stoping methods with the application of backfills at Kilar Gold Field, by R.R. Tatiya

The state of development of pneumatic stowing in the hard coal industry of the Federal Republic of Germany, by K.H. Voss

The design and practice of cut-and-fill method at Fankou lead–zinc Mine, by Wu Liangduan.

Geomechanics

Design and properties of still fill for lateral support of pillars, by G.E. Blight and I.E. Clarke

The application of the finite element model of the Näsliden Mine to the prediction of future mining conditions, by T. Borg and N. Krauland

Investigation of an experimental sublevel stoping method utilizing a discrete cemented backfill in a vein-shaped orebody, by M. Carta, P.P. Manca, G. Massacci, S. Putzolu, and G. Rossi

Experience with cemented fill stability at Mount Isa Mines, by R. Cowling, G.J. Auld, and J.L. Meek

Evaluation of the stability of backfill faces, by J.P. Dixit and N.M. Raju

Supports of reinforced granular fill, by J.A. Hahn, G.E. Blight, and L. Dison

On several subjects in flat-back cut-and-fill stoping, by Huang Wendian and Mei Renzhong

Assessment of support performance of consolidated backfills in different mining and geotechnical conditions, by Jun-Yan Chen, Di-Wen Chen, and Stefan H. Boshkov

Computer optimization and evaluation of cut-and-fill method, by Pan Jian

Some aspects of recovery of pillars adjacent to uncemented sandfilled stopes, by Y.V.A. Rao and V.S. Vutukari

A simple and convenient method for design of strength of cemented hydraulic fill, by Sijing Cai

Large scale model tests to determine backfill strength requirements for pillar recovery at the Black Mountain Mine, by J.D. Smith, C.L. de Jongh, and R.J. Mitchell

Design of post-pillar cut-and-fill mining system—rock mechanics investigations at Surda Mine, Singhbhum, by S.B. Srivastava and A.K. Ghose

Assessment on support ability of the fill mass, by Tong Guang-Xu and Han Mao-Yuan

A consideration on the effect of backfill for the ground stability, by U. Yamaguchi and J. Yamatomi.

New Development
Backfilling with ice, by Henning Fangel.

One very important feature emerging from these proceedings is the increased use of fly ash and pulverized slagment instead of cement. This promises to be of great significance for any cemented backfill currently using Portland cement, or for backfill that needs to have inherent strength.

Overall, the volume is a good summary of the state-of-the-art of backfilling, and forms a useful reference for anybody involved in the design of mining methods, as well as for engineers currently considering a cut-and-fill mining method, or for mining engineers who would like to update their system of backfilling.

● *The Carswell Structure uranium deposits, Saskatchewan, Canada,* edited by R. Lainé, D. Alonso, and M. Svab. Geological Society of Canada, *Special Paper* no. 29. 230 pp. 1 map in back pocket. Canadian $42, plus $3 postage and packing.

Reviewer: R.H. Ingram

The Carswell Structure is located in northern Saskatchewan in the western part of the Athabasca Basin. It is one of the most conspicuous large-diameter ring structures in Canada, and is also host to some of the best uranium deposits.

Today, Canada is the world's foremost producer of uranium. Most of this production is won from the prolific, high-grade deposits of the Athabasca Basin. This publication will therefore be of interest to any professional who is involved in the uranium industry either in exploration or in production.

The Carswell Structure comprises an inner core of basement gneisses 40 km in diameter surrounded by an 8 to 10 km wide ring of deformed Athabasca sediments.

The origin of the Carswell Structure is ascribed either to the impact of a meteorite or to a crypto-explosive event, and the reader must make up his own mind as to its origin from the evidence presented in this volume. The uranium deposits are clustered around the southern rim of the core, where the structural complexity is at its maximum. The uranium deposits are hosted by the basement gneisses and the overlying sandstones; strong lithological and structural controls are exerted by lithological contacts, mylonite zones, and abundant faulting. The main mineralizing event took place between 1150 and 1050 million years ago. However, several episodes of uranium mobilization were required to form these deposits.

The exploration history of the Carswell Structure is amply covered in this volume. Interest in the area was first aroused by the discovery of a mineralized boulder train. However, the facts that outcrop within the structure amounts to only 1 per cent and that the bedrock was obscured by 5 to 100 m of glacial till allowed the use of only indirect exploration methods. Radon surveys, seismic surveys, detailed aeromagnetics, geochemistry, overburden drilling, quarternary geology, geochronology, and magneto-telluric soundings were used in an integrated programme with great success.

This volume has been carefully edited, and the papers it contains are of the high standard that we have come to expect from the Geological Society of Canada. The papers are accompanied by well-produced and uncluttered maps and diagrams. The 1:50 000 scale map of the bedrock geology of the Carswell Structure provided with this volume is well produced, and gives a clear impression of the general geology of the area.

While the volume must be regarded as essential reading for uranium geologists, the price of approximately R90 for 230 pages may be a deterrent to personal acquisition. However, every company and institutional library would be well advised to purchase a copy.

● *Availability and cost of coal in South Africa,* by R. Long. London (14/15 Grosvenor Place SW1 OEX), IEA Coal Research, March 86. (ICEAS/C6). 74 pp. £75 (member countries), £150 (non-member countries).

Reviewer: Nuri Birtek

This is the third report in a series of reports in which the IEA examines the availability and cost of coal in the significant coal-exporting regions of the world. (The previous two were Colombia and the U.S.A.)

The report first studies the coal reserves and the coal-mining industry (well compiled in 25 pages of appendices), and then gives cost–supply curves for the major coalfields based on the data and assumptions made concerning future costs.

An annual growth rate of 4,5 per cent (as opposed to 3,5 per cent in an economy without foreign finance) is expected in the coal industry, which translates into an annual demand of 317 Mt of coal by the year 2000, of which 80 Mt will be exported. This will not commit South Africa to imminent reserve exhaustion early in the 21st century.

Costwise, while general inflationary and exchange rates will push up the local costs of equipment, Black wages will increase by 2 to 3 per cent per annum in real terms. Although other operating costs and White wages will remain stagnant, in real terms mining and washing costs will increase by 30 per cent by the year 2000. Even with all these increases, the f.o.b. price will be in the range of US$29 to 32 per tce, which will maintain South Africa's strong position in international markets.

The message of the report is that there are no bottlenecks in regard to costs or reserves to prevent South Africa from remaining an important supplier of coal. Whether the country succeeds in achieving its potential as a growing coal exporter, or whether it is gradually pushed off the export market by a growing reluctance to buy South African coal, depends crucially on the nature of the political and social developments in the country over the next few years.

The report is a very useful guide to all who are interested in the availability and cost of coal in South Africa.

● *Process selection in extractive metallurgy,* by P.C. Hayes. Brisbane, Haynes Publishing Co., 1985. 460 pp. A$70 (hard cover), A$30 (cloth cover).

Reviewer: A.L. Hannaford

This book encompasses, fairly comprehensively and interestingly, the various steps involved in process selection. It is pitched primarily at university students but, as it is liberally strewn with meaningful practical examples, figures, and tabulations relating to all aspects of extractive metallurgy, it would also be of value to operating metallurgists.

The book does not describe in detail the hardware used in extractive metallurgy; nor does it get bogged down in lengthy descriptions of current commercial practices. It emphasizes, rather, the approaches to the solving of problems, and is the more valuable for it.

● *Materials in world perspective,* by D.G. Altenpohl. Ijmuiden (Netherlands), Springer Verlag, 1980. DM 72.

Reviewer: J.H. Dalton

This book represents the initial volume of a series on materials research and engineering that is intended to present up-to-date information about scientific and technological progress on materials, as well as on issues of general relevance within the engineering field and industrial society.

It covers the present status and ongoing developments in the materials industry in both highly developed countries and resource-rich developing countries. For the first time, resources, technologies, innovations, and trends in key industries producing or using materials of construction are interrelated. The book deals with the entire materials cycle, from extraction or harvesting to processing, manufacture, use, and re-use or disposal.

The opening chapter sets the scenario for the rest of the book, dealing with the role of materials of construction in the world economy and the question of resource constraint for the key materials industries. Here the involved materials are defined, and the concepts of the total materials cycle, the 'problem triangle' of the materials industry (raw materials, energy, and ecology), and the 'limits to growth' syndrome are discussed.

The second chapter deals with the present structure and future trends in key materials industries and poses the question 'Where are the basic materials heading?' The first part of this chapter presents the actual resource situation and an overview of the most important industrial metals. This is followed by an outline of the structure and future trends of six key materials industries, briefly covering their materials flow from feed stock to final uses, together with a discussion of current and future technologies. The industries reviewed are iron and steel, aluminium, copper, cement and concrete, plastics, and wood and wood products. A brief overview of advanced materials, covering fibre-reinforced materials, ceramics, and the advanced use of metals and alloys, is also included.

The materials covered in the second chapter provide a springboard to the explanation of the methodology of technology planning and assessment dealt with in chapters three and four. Chapter three outlines the main criteria and sequence required for technology planning and assessment, and chapter four uses these criteria, together with the message that the materials industries are clearly subjected to increasing pressures and key regulations from the socio-political arena, to explain the key issues of energy accounting and the substitution and conservation of materials. This message is brought home by consideration and assessment of the materials usage in the automobile and packaging industries.

In the light of the discussions in the preceding chapters, chapter five surveys the opportunities available in the materials industries for future research and development. This briefly covers the full R and D spectrum, from exploration and discovery of new resources; their mining, extraction, and mineral processing; to the manufacturing processes, materials design and production, and product design.

The concluding chapter of the book outlines a few of the problems facing the materials industries in the years ahead, and uses the main trends in ecology and energy as a basis for integration into the technology planning for further healthy development of the materials industries.

This slim volume deals with the subject succinctly, in a logical sequence, and is easily understandable. It admirably achieves its stated aim of serving as an introduction for a wide range of readers with quite different backgrounds. It is well worth reading by those concerned with the future of materials and the materials industries. It should not be looked upon as a textbook but as a good introduction to technology planning and assessment. However, most readers will probably find it unfortunate that this book is only now being reviewed, having been published six years ago. Most of the data used were generated in the mid-seventies and many of the predictions deal with the mid-eighties. It would be interesting to have a review of the intervening years.

● *Modern physical metallurgy,* by R.E. Smallman (4th edition). Durban, Butterworths, 1986. R120 (hard cover) and R75 (soft cover).

Reviewer: D. Rümelin

This latest edition by Smallman contains an up-to-date account of the technological developments that have taken place since the last revision fifteen years ago. The text in this volume is approximately a third longer and

has been restructured to include fifteen chapters.

A number of microchemical analytical techniques such as SEM, TEM, HVEM, STEM, and Auger spectroscopy, which were developed since the previous revision, are discussed. Other subjects that have been added to the text include the following: an introduction to ternary phase diagrams, dislocations in ordered structures, and the yielding behaviour of ordered alloys.

A significant portion of the previous text has also been altered to include new features or to give a better explanation.

In all, this book gives a concise presentation of subjects that would be useful, not only to students as an introductory text to metallurgy both at university and technikon, but also to experienced personnel in industry.

● *Economic potential of coal–water mixtures,* by J.R. Sieman. London (14/15 Lower Grosvenor Place, SW1W OEX), IEA Coal Research Report, September 1985. ICEAS/E8. 100 pp. £50 (member countries), £100 (non-member countries).

Reviewer: Nuri Birtek

This report discusses the possible replacement of residual fuel oil (RFO) by mixtures of coal and water (CWM) in utility and industrial boilers, gas turbines, diesel engines, blast furnaces, kilns, and the like.

CWM is a coal slurry with a solids content of 60 to 80 per cent (by mass), a specific size distribution to allow optimum packing, and certain additives (0,3 to 1,0 per cent) to reduce viscosity. The top size is usually 250 mm and the ash content ideally between 1 and 4 per cent.

Based on data from the prototypes of CWM plants in operation, the report estimates that a plant with a capacity of 1 Mt/a will cost $67,5 million and $20 per ton to operate (the cost being in U.S. dollars).

Based on a crude-oil price of $29 per barrel for the period 1985 to 1990 and $34 per barrel for 1990 to 1995, CWM will have a price advantage over RFO of $0 to 2,4 per gigajoule. (Projected average coal prices of $55 and $63 per ton were taken for the corresponding periods.)

The conversion costs of existing plants are examined, and a total of 10 per cent of the RFO consumption is found replaceable, which amounts to 60 Mt of CWM per annum (50 per cent in power generation and 40 per cent in steam generation), the main customers being the U.S.A., Italy, and Japan.

2. Recent publications

● *Mining annual review 1986.* London, Mining Journal, Jun. 1986. 546 pp. Issued as part of a combined subscription service: with *Mining Journal* (by airmail) £100; with *Mining Magazine* (by surface) £100.

This publication includes reviews on metals and minerals; technical progress reports on exploration, mining, and mineral processing; and reviews of mineral production by countries. The indexes include a professional directory, a catalogue/brochure review, a buyers' guide, manufacturers' addresses, an index to mines and companies, and an index to advertisers.

● *Damage research in the service of technology and insurance,* by H.J. Schüller. Munich, Allianz Versicherungs-AG, 1986. 16 pp. DM 10.

Technical damage research has been carried out by Allianz Versicherungs-AG for more than fifty years, and this has contributed to restraining the sometimes threatening increase in losses incurred in various technological fields. The results of the research are equally applicable to the design, material selection, manufacture, and operation of machines and installations. This reprint gives an informative survey of the activities of the organization. The English edition (Ordering Ref. TI-E6-189) has now been published and is available from the Allianz Versicherungs-AG Vertrieb, Redaktion/TI, Postfach 44 01 24, D-8000, München 44, West Germany.

● *Precious Metals 1986,* edited by U.V. Rao. Allentown (U.S.A.), International Precious Metals Institute, 1986. 465 pp.

This volume represents the proceedings of the Tenth International Precious Metals Technical Conference and Exhibition held at Lake Tahoe, Nevada, in June 1986. It contains the technical information presented during the twelve sessions of the Conference by acknowledged experts in precious-metals technology. Some of the topics covered are Chemical Catalysts, Fuel Cells, Environmental Considerations for Precious Metals, and Precious Metals in Space and Related Industries.

● *Proceedings, FSPE National Engineering Congress.* Johannesburg, The Federation of Societies of Professional Engineers, 1986. R30 (incl. GST).

This volume, available from FSPE (P.O. Box 61019, Marshalltown, 2107) contains the proceedings of a congress held in May 1986 to highlight the key role played by engineering in the development and prosperity of Southern Africa. The themes were 'Technological and economic strategies related to the provision of an adequate infrastructure for the development of the Southern Africa economy and its export potential', 'Innovation—creation of the necessary incentives', and 'Human resources—productivity, education, training, and recruitment'.

3. Mintek reports

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

● **Report M251**

Cost implications of metallic corrosion for the South African economy in the sectors of mining, power generation, shipping, and transportation.

Costs related to corrosion were assessed for various South African industries in 1984–1985 so that the possible wastage of resources under current conditions could be evaluated.

According to research that was conducted overseas, corrosion is responsible for an economic loss equivalent to between 3,5 and 5 per cent of the Gross National Product (GNP) in an industrialized economy. A significant proportion of this loss could be avoided by the use

of adequate training and control, even with the existing technology.

The current investigation was based on the major national surveys carried out in the 1970s in Britain and America, with necessary modifications. It featured four main industrial sectors in South Africa: mining, power, shipping and marine transportation, and other transportation.

Generally, the results were similar to those obtained overseas. Corrosion control was adequate in areas where safety during operations was a crucial factor; otherwise, the extent of the damage caused by corrosion was neither widely realized nor accepted. Estimates obtained for corrosion costs during the period 1979 to 1983 (R1250 million for these four sectors) indicated that the total corrosion costs to the economy are well over 4 per cent.

- **Report M259**

The carbon-in-pulp plant at Rand Mines Milling & Mining Company: Problems encountered and developments introduced.

The carbon-in-pulp (CIP) plant of the Rand Mines Milling & Mining Company (RM3) treats 370 kt of reclaimed sand and slime per month, and is at this stage the largest CIP plant in the world. The plant was commissioned in September 1982, and encountered many problems during the initial period of operation.

Mintek provided advice and assistance under various projects related to the RM3 plant, including the operation of a pilot adsorption plant alongside the main CIP plant. The developments at RM3 during this initial period are described, including the installation of a novel resistive-heating reactivation furnace. Results from the Mintek CIP pilot plant are also included.

- **Report M269**

The determination, by X-ray fluorescence, of platinum, palladium, ruthenium, iron, and chromium in special steels.

This report describes the analysis of special corrosion-resistant steels for ruthenium, palladium, and platinum by X-ray-fluorescence spectrometry (XRFS) and a thin-film technique. The precision of this method varies from 1 to 7 per cent, depending upon the analyte and its concentration. The accuracy is good and compares favourably with that of other methods.

The direct determination of these elements on solid samples with the use of scattered radiation as a matrix correction is only partly successful and is not recommended.

The three platinum-group elements, iron, and chromium can be determined successfully in solid samples by XRFS if an empirical interelement correction method is used. The correction factors are determined by a multiple-regression method. The precision of the determination of the platinum-group elements is about 1 per cent and that of iron and chromium about 0,2 per cent. The accuracy is in most cases better than 2 per cent for all the elements determined. The method can be implemented with the use of available computer software and a small microcomputer.

The two recommended laboratory methods are given as appendices to the report.

- **Report M270**

A literature review of the properties and uses of vanadium in engineering alloys and of vanadium carbide.

The main use of vanadium is in the manufacture of alloy steels, particularly the high-strength low-alloy types. Apart from its use in non-ferrous alloys, the consumption of vanadium outside the steel industry is very limited.

Vanadium is little used in stainless steels, and it is recommended that research should be undertaken towards the development of a general-purpose ferritic stainless steel containing both molybdenum and vanadium.

Vanadium-based cemented carbides can replace alloys based on tungsten carbide in applications where resistance to mechanical and thermal shock is not an important criterion. Research should be started in South Africa in the field of vanadium carbide coatings.

Hydraulic fill structures

A specialty conference on hydraulic fill structures is to be held at Colorado State University, Fort Collins, U.S.A., from 7th to 10th August, 1988.

The purpose of the Conference, sponsored by the Geotechnical Division of the American Society of Civil Engineers, is to review experience and to promote the use of hydraulic-fill methods for engineering purposes such as water-retention dams, tailings dams, offshore artificial islands, reclaimed lands, airports, and the use of dredged materials.

The topics will include the following:

- Static and dynamic material properties
- Construction and management techniques
- Seepage, settlement, and stability analyses
- *In situ* testing
- Instrumentation
- Slurry-transportation systems and material beneficiation
- An overview of past, present, and future trends in hydraulic-fill structures.

A call for papers will be issued later this year; for further information contact

W. David Carrier III
Bromwell & Carrier, Inc.
P.O. Box 5467
Lakeland, FL 33807-5467
U.S.A.
Telephone: (813) 646-8591.