

Book reviews

● *Economics of the mineral industries*. 4th Edition. Society of Mining Engineers (Caller No. D, Littleton, CO 80127, U.S.A.). 660 pp.

Reviewer: M.A. Ford

The Seeley W. Mudd Fund, which is administered by AIME, seeks to perpetuate Colonel Mudd's lifelong interest in newcomers to the mining fraternity by producing publications for the profession. This book is an example of one of these publications, and is divided into the following five parts.

Part 1. Entitled *Minerals and the Economy*, this section contains three chapters and is suitable for use by non-specialists, and as introductory material for students. Chapter 1.1 is an up-to-date presentation of the behaviour of mineral prices in real terms over the past 110 years, sustaining the hypothesis of no increase in mineral scarcity over that period. The effects of increases in the energy price flowing from market control, and of environmental regulation, are apparent in the 1970–1980 price behaviour. Chapter 1.2 develops the role of minerals in the developing economies of the world, and Chapter 1.3 stresses the international nature of the mineral industries.

Part 2. These chapters give the formal economic theory of mineral production and resource appraisal. The level here is much more rigorous, and requires a knowledge of economic theory and some mathematical background. This part is designed for reference by trained people and for instruction in the formal principles of mineral economics.

Part 3. Here the chapters deal with analysis applied to the mineral sectors. Chapter 3.7, which covers investment and financial analysis, is designed for reference by those concerned with the evaluation of mineral deposits for their economic viability, and for use in evaluation courses. Chapters 3.8 and 3.9 describe the current state-of-the-art in mineral and energy modelling.

Part 4. This section describes the major mineral sectors—metals, oil and gas, and solid fuels—with the emphasis on aspects that are of special importance to each sector.

Part 5. These chapters address the matter of public policy: Chapter 5.13 stresses the contribution of economic principles to the development of efficient public policy, Chapter 5.14 reviews the policy discussions during the 1970s on non-fuel minerals, and Chapter 5.15 covers environmental policy with respect to minerals in the U.S.A. This part is designed for reference by those interested in the issues of mineral policy and analyses.

The book deals with principles, trends, and interrelationships rather than with specific problems, and statistical data have been largely omitted. As the editor claims in his foreword, some of the best thinkers in the field have made contributions and, although the focus is on the U.S.A., it provides the foundation and models for theoreticians and practitioners to use in gaining a better understanding of the economics of the minerals industries.

● *Foundry technology*, by P.R. Beeley. Durban, Butterworth Scientific, 1982. R124 + GST.

Reviewer: A.P. van Wyk

This book was first published in 1972 and has since been reprinted three times. The text is aimed at the foundry engineer, and serves as a bridge between the basic principles of metal founding and their application in the producing industries.

The topics are arranged in three distinct sections. Phenomena involving metal and mould during the crucial stages of moulding and casting are dealt with in the first four chapters. These are followed by three chapters concerned with the cast product, and different casting processes are discussed in the final section, which is made up of three chapters.

Following a short introductory note on the history of castings, chapter one discusses the fluidity of liquid metals, as well as the gating of castings. The experimental determination of fluidity is highlighted, and various examples of gating systems are evaluated. The theoretical design of gating systems by means of the equation of continuity and Bernoulli's theorem is explained briefly.

The solidification of castings is dealt with more comprehensively in the second section. Crystallization from the melt and the significance of the practical control of cast structures are explained. The proper feeding of castings is always important, and Beeley devotes a large proportion to this aspect. The feeding characteristics of different alloys are discussed, the importance of the design and location of feeder heads (risers) being indicated. Wlodawer's techniques of feeder-head dimensioning are also described.

No textbook on foundry technology is complete without at least an outline of the properties of moulding materials. This comprehensive subject is neatly summarized, with a good combination of theory and practice. The more advanced reader might enjoy more information on the structural properties and binding mechanisms of the moulding material, but these are not included.

A whole chapter is devoted to undesirable defects in castings. Beeley discusses a large variety of defects like shaping faults, inclusions and sand defects, gas shrinkage, contraction, segregation, and dimensional and compositional errors. Their significance is mentioned, and some rectification techniques are shown.

As quality control is of prime importance in a foundry, the book includes some testing procedures for materials and products, which involve both destructive and non-destructive techniques. Indications are also given on ways and means of quality and process control in the foundry. A proper comprehension of statistics is a prerequisite to a full appreciation of this paragraph.

Chapter seven gives some useful guidelines on the engineering design of cast products—an essential but difficult subject that is usually neglected. Design philosophy has to be combined with technique in a successful approach, and the author's endeavour is appreciated, although more practical applications would have been useful.

The last part of the book, devoted to production techniques, outlines the more common casting processes. Sand castings are fully dealt with; shell, investment, and die-casting processes are discussed; and centrifugal casting is outlined with very helpful practical hints. Some other less common casting processes are also mentioned.

The author has succeeded in his aim, which was to produce a general guide including a large selection of different subjects related to the foundry industry.

● *Underground Transport Symposium*. Johannesburg, The South African Institute of Mining and Metallurgy, *Special Publication SP 1*. 300 pp. R65 (Non-Member), R55 (Member), + GST.

Reviewer: C.L. Workman-Davies

The relevant government agencies and the mining industry have always been concerned about the well-being of the people working in the mines of South Africa. This is evident from a reading of the papers presented at the Underground Transport Symposium, which was held in August 1984. The Symposium had its origins in the mining industry's ongoing concern about the high rate of fatalities and injuries associated with underground transport. At meetings of the Management Committee of the Mine Safety Division of the Chamber of Mines of South Africa, which were held towards the end of 1981 and early in 1982, it was decided once again to investigate all safety and operational aspects of underground rail transport.

Following the distribution of a questionnaire to the mines, and discussions with the Association of Mine Managers of South Africa and the Association of Mine Resident Engineers, it was decided to achieve enlarged objectives by way of a symposium. The symposium would provide a forum that would stimulate a review of existing systems and promote discussion on future systems for the transportation of men, materials, and rock in the underground workings of South African mines.

So it is that we now have a book of 22 papers: ten papers written by operating personnel, and twelve papers written by specialists from the manufacturers and suppliers of equipment and from academic centres. The theme of the book is set by the first paper, which considers the government's concern for safe and healthy working by way of an explanation of certain of the appropriate regulations in the Mines and Works Act.

This theme is further developed in the paper entitled 'Underground Transport Accidents, Investigation and Recommendations'. The author of this paper spent some time seconded to the Mine Safety Division of the Chamber of Mines in order to conduct a periodic safety study, which was commissioned following concern at a change in the rate of fatalities and injuries associated with underground accidents. The study resulted in the establishment of a code of recommendations for the safe operation of underground transport. Four critical areas, causing 80 per cent of all fatal transport accidents underground, were identified for the two-year period July 1981 to June 1983. They are derailments (41 per cent), insufficient track clearance (16 per cent), collision with ventilation doors (12 per cent), and crushed between objects (11 per cent).

A major part of the book is devoted to various aspects of locomotive rail transport underground. In this regard, the paper dealing with a rock-tramming system at Driefontein Consolidated is noteworthy for the emphasis that it places on the integration of the various disciplines involved in the design of tramming layouts. The point is also made that, with the shortage of skilled electronic and computer technicians in the mining industry, the design and layout of underground systems should not require or include sophisticated electronic and computer-based traffic control and signalling equipment at this stage. Acknowledging the need for correct track installation, Driefontein demonstrated their commitment by obtaining the services of a track expert.

There are several short papers authored by specialists representing manufacturers and suppliers of equipment. They deal with rail-track specifications, fastenings for rail sleepers, underground rail switches, concrete sleepers, and couplers and drawgear for underground rolling stock. Two of the papers deal with the heavier, high-power locomotives as used by British Coal, and some interesting aspects of rack and adhesion locomotives are also covered. The author of the paper on the financial aspects of ore transport in gold mines suggests the use of a multi-load train consisting of a locomotive and a motorized battery brake car and fourteen hoppers. This proposal is adequately supported by an industrial engineering investigation.

Various aspects of the supply, installation, and operation of underground chairlifts are covered in three papers. One paper is devoted to an overview of freight pipeline transportation systems in the mining industry. Two papers refer to the coal mines specifically in terms of the transportation of personnel from surface to the work face in flame-proofed buses, and coal transport from the work face to surface.

With regard to future systems using trackless mining equipment, the paper emphasizing the criteria for success is certainly important in establishing the fundamentals to be considered. Another future system is the reciprocating flight conveyor for rockhandling in stopes. So far, this unit has received only ten years of research and development effort: one prototype after the other, making six units in all. The concept has shown that it can meet the objectives providing the mining conditions are favourable.

This hard-back volume (16 cm by 23 cm) is clearly printed with sufficient line drawings and some black-and-white photographs. It is very readable and will be of interest to many.

● *A summary of the Project Development Symposium as presented by The Australasian Institute of Mining and Metallurgy*. \$A 25.00.

Reviewer: D.J. van Niekerk

The Project Development Symposium, which was held in November 1983 and was organized by the Sydney Branch of the Institute, consisted of 46 presentations, which are arranged in various sections of this volume according to subject matter.

In their opening addresses, A.G. Raper and A.N. Whiting reviewed present world conditions and predicted

future trends. The other opening addresses dealt with financing and would have been better placed in that section of the volume.

The two sections on project evaluation are very comprehensive, dealing with everything from reserve estimation (Bujtor), through feasibility studies (Ballard), to sensitivity analysis (Lee). Brennan's papers on the use and abuse of geological data are particularly useful.

Interesting discussions are included in the marketing section on both metal and coal, while Etheridges' papers are concerned with market uncertainties.

In the 'Government/Environment' section, Robinson and Hughes describe an excellent demonstration of interaction with government by the use of network analysis. Also included in this section are reviews of environmental legislation for New South Wales (Epps) and for Australia generally (Croft).

Of the several aspects of planning and management covered, the most interesting are those by Rose and Conway on the expanding role of consultants with a review of their management, and Kingsnorth's essay on management with a contractor.

Each of the sections on infrastructure and industrial relations includes both general descriptions of the subject and specific case studies.

Finance is, perhaps, the most comprehensively covered subject. Taxes (Sawyer), costs of capital (Rudenno and Seshold), trends (Palethorpe), audits (Dun and Bell), cost control (McGregor), and case studies (Hodge and Miskelly, and Spinks) are all included. The wide coverage of this subject is indicative of the importance of finance to project development.

Unfortunately, the three papers on legal matters all deal with joint ventures. The book would have been more useful if some other legal aspects had also been included.

Although the papers on new technologies are informative, especially the papers on pre-assembly concepts (Thitchenen, Kruse and Kjar), many other technologies could also have been dealt with.

In addition to the various individual aspects of development mentioned above, many general case studies of development projects are included. Most of them concern coal mines, but some examples of copper, uranium, and industrial minerals are also given.

● *Geology of uranium deposits. Proceedings of the CIM-SEG Uranium Symposium, September 1981*, edited by T.I.I. Sibbald and W. Petruk. Quebec, The Canadian Institute of Mining and Metallurgy, Special Volume 32, 1985. 268 pp. Canadian \$40 members, \$50 non-members (plus \$3 for postage and packaging).

Reviewer: M.S. Toros

The papers in this special volume—the fourth in a series of proceedings of symposia on special topics—were selected from contributions presented at a symposium held at Saskatoon, Saskatchewan, in September 1981. Twenty-two articles are grouped into six chapters: Canadian and Saskatchewan uranium industry (2 papers); unconformity-type deposits in Saskatchewan (13); other Canadian deposits (2); uranium in Proterozoic igneous rocks in Texas (1); Australian deposits (3); and the use of radiometric analyses (1). Although it is not readily apparent,

eighteen of these papers are entirely or mainly dedicated to unconformity-type deposits, and only three to other types; the last paper does not really fit in with the scheme of the volume, the book being devoted to this most important and challenging type of deposit. Yet the title heralds a much broader subject and is therefore misleading.

In the lead article, Saskatchewan occurrences are examined in an attempt to characterize the unconformity-type deposits of the Athabasca Basin, and suggestions are offered regarding metallogeny and exploration models and strategies. In the subsequent papers, a wealth of geological information and valuable data on the mineralogy, geochemistry, and geochronology of the Key Lake, Midwest Lake, McClean, Dawn Lake, and Maurice Bay deposits are presented. However, some of this material has been published previously. The metallogenic models suggested range from exclusively hydrothermal (Key Lake), through diagenetic hydrothermal (Maurice Bay) and diagenetic supergene (Dawn Lake), to exclusively supergene (Midwest Lake). This chapter ends with an interesting contribution from E.S. Cheney stressing the similar characteristics of roll-type sandstone uranium deposits and unconformity-type deposits, and speculating on a possible similar origin, i.e. the precipitation of tetravalent uranium minerals by bisulphide ions generated by the oxidation of pre-ore sulphide minerals. The three papers on Australian deposits are also dedicated to unconformity-type deposits. New data on the Ranger orebodies are proposed, whilst distribution and controls of mineralization in the Alligator Rivers uranium field are reviewed in an informative paper by R.S. Needham. The Post-Kombolgie alteration at Jabiluka II and its significance with regards to a comparison of the Athabasca-Alligator Rivers is discussed by L. Curtis.

The book is abundantly illustrated and would be a significant addition to a library on uranium geology, although the codings on many of the photographs suffer from frustratingly bad reproduction.

● *Crushing and grinding process handbook*. Chichester (England), Wiley, 1986. £49.

Reviewer: M.P. Hay

This book gives a mathematical description of the various processes of comminution, including classifier performance, and progresses logically to deal with scale-up and simulation. Within this context, the author provides an overview of a wide spectrum of size-reduction methods from those used in road construction, through mining, to the manufacture of pharmaceuticals. Each chapter is preceded by its own notation and concluded by its own reference list.

The first two chapters provide a survey of industrial comminution with an outline of the state-of-the art. A summary of recent progress in this field is made by the highlighting of selected facets, and various areas are exposed where research is lacking.

This is followed by two chapters on physical breakage and particle shape, size, and surface. An account is given of the various weaknesses in the structure of particle matter that give rise to degradation, with the emphasis on crack propagation, and a study is made of their rela-

tionships, culminating in a brief section on grinding additives. The measurement, representation, analysis, and application of particle shape, size, and surface is explored in some depth, and a comprehensive survey is made of various instruments on the market.

Since the majority of circuits have a classification loop, the types of classifier and their operation are considered, as are methods for measuring the effectiveness of separation. Mathematical simulation of classification is used to introduce the reader to the advantages associated with modelling, particularly in the assessment of classifier options. The concepts expressed here are extended in Chapter 10 with examples of the simulation of closed grinding circuits. These are divided according to mill type, subdivisions being made according to the level of sophistication introduced into the models.

Grinding energy and efficiency are dealt with in a chapter on the energy required for size reduction, and selected design procedures are worked through using grindability as a base.

A chapter on the scaling of capacity and energy provides a solid introduction to the next four chapters, which bring the book to a close with a comprehensive thesaurus on modelling and simulation.

The book will have a limited appeal because of the specialized subject matter and the highly theoretical way in which the material is presented. It will find readership among lecturers and engineers within a university environment, since there is little of practical interest that can be utilized directly by operating personnel without the use of sophisticated equipment.

O'okiep's 50th birthday

The O'okiep Copper Company Limited, situated at NababEEP some 35 km from Springbok, recently celebrated its fiftieth anniversary.

This Company was established on 25th May, 1937—eighteen years after the termination of the original Cape Copper Company in 1919—by the Newmont Mining Corporation. By a special Act of Parliament, the Company was granted substantial financial assistance, with the result that production started again in April 1940. The advent of the O'okiep Copper Company meant that many of the inhabitants of Namaqualand were able, not only to survive, but to prosper over the ensuing fifty years.

The decline of the copper price in 1975 and the near-disaster of 1980 called for courage from the then management and staff, and the Company did not emerge unscathed. In practice, this involved a number of cutbacks, including retrenchments. Despite the dull future of the copper price at that stage, the Company survived by obtaining substantial loans from the National Finance Corporation and Barclays National Bank Limited.

Instead of the copper price improving to viable levels during the early eighties, it deteriorated. Government backing averted the calamitous effect that closure of the mine would have had on the economy of the region.

Following the purchase of shares and subsequent rights issues in 1982 and again in 1984, Gold Fields acquired 41 per cent interest in the Company, and was appointed administrative and technical advisors and secretaries to O'okiep Copper Company in October 1984. Since the Company's affiliation to Gold Fields, the annual production of ore has been successfully increased. Financially, the position was reversed from a net loss of R18,4 million in 1984 to a net profit of R8,5 million in 1985 and R11,7 million in 1986.

Major features of the Company's anniversary celebrations included the opening of the new mining and historical museum complex at NababEEP, the Company's donation of some 379 hectares of development land, which was accepted by the Rev. Allan Hendrickse on behalf of the local Coloured community, and a variety of social events.

New Museum

The new museum complex is a birthday gift from O'okiep Copper Company, not only to the community

of NababEEP, but to Namaqualand as a whole. From the time of Van der Stel, there have been many legends about this part of Southern Africa, and the region is rich in a history that should be acknowledged and preserved.

The potential of the museum at NababEEP—established in the late 1970s—was greatly enhanced when Barclays National Bank Limited recently donated the adjacent house. Both these buildings are among the oldest in the community and therefore of historical significance.

The museum now houses a series of displays that range from the socio-historical to the techniques of mining, including a perfect scale representation of underground workings for the extraction of copper. The displays illustrate the romantic story of the last century and the early part of the present one, and the transition from wagon to mule train to steam train. These exemplify man's progress in fighting the elements and winning.

Land for Development

Historically, O'okiep Copper Company inherited the rights to a vast area of arid, semi-desert land. Owing to the availability of work, the company's settlements attracted greater numbers from the unemployed of the surrounding districts. As all the land was privately owned, the newcomers could do nothing more than set up squatter's camps.

O'okiep Copper Company was not averse to relinquishing its rights to the land, provided there was a guarantee of proper administration and private ownership. In 1983 the Board of the Company passed the first resolution to donate the land to the community. It took four years for the donation to be evaluated and accepted before final ratification of the donation.

Mr Dru Gnodde, Chairman of the O'okiep Copper Company, pointed out at the presentation ceremony that, although the land is no longer the property of O'okiep Copper Company, the services that have been provided by the Company will continue to serve the community. The provision of future serviced stands and other facilities will be dictated by the ability of the local community to afford the expenditure that may be involved. The Gold Fields Foundation has already agreed to assist with this development, and additional sources of financial support will be sought to enable the community to develop these housing projects.