

Book news

1. Reviews

● *Steel and its heat treatment*, by K-E Thelning. 2nd Edition. London, Butterworths, 1984. 678 pp. R201,60 (incl. GST).

Reviewer: J.P. Hoffman

This book has been thoroughly revised and updated, so that this second edition incorporates the developments that have taken place on this subject since the publication of the first edition in 1975. The English translation was carried out by Cecil N. Black.

SI units are used throughout, and ISO standard designations are adhered to. Depending on which types are being discussed in the text, steels are designated by BS standards as well as by the relevant AISI, DIN, or SS standard. In some instances, use is made of simplified designations, e.g. X5CrNi 18 9, which are commonly used on the Continent and indicate the approximate chemical composition of the steel.

The first chapter acts as a useful reference to such concepts as metallography, TTT and CCT diagrams, decomposition of martensite, diffusion, grain size, and hardening mechanisms in steel. These concepts are well presented.

The chapter on materials testing and the section on new steelmaking processes could well have been omitted. It stands to reason that such subjects cannot be reviewed comprehensively in a book on a specific topic such as heat treatment.

The section in chapter three dealing with the effects of alloying elements in steels is poor. Again, it must be realized that proper justice cannot be done to such a vast subject in a book of this nature. However, although the information is not comprehensive, it is useful.

Starting from chapter four, the author handles the topics of hardenability and heat treatment with authority. Much use is made of diagrams to illustrate and explain the concepts. The topic of hardenability is presented in a very practical manner and would prove useful to practising engineers.

The coverage of heat treatment in general and special heat treatments is deep and advanced. The sections on annealing, hardening, and tempering of carbon steels are comprehensive, as is the chapter on the hardening and tempering of alloy and tool steels (chapter six). Topics such as the heat treatment of martensitic stainless steels, spring steels, ultra high-strength steels, Hadfield manganese steels, boron steels, HSLA steels and dual-phase steels are all covered—some in depth and others very superficially.

Surface heat treatments such as case hardening, carbonitriding, and particularly nitriding are well described. Induction hardening and flame hardening are adequately covered.

In chapter seven the author discusses the problem of the dimensional changes that occur during hardening, tempering, and surface treatments. The topic is illustrated with a number of practical examples, and the aspect of designing for heat treatment is emphasized.

The book includes some useful tables and has a subject index to assist in the location of topics in the text.

Every chapter is followed by a comprehensive list of references, which would prove useful to the ardent researcher or student.

The book is not very helpful in the fields of welding and the heat treatment of welded fabrications, the latter topic not even being discussed. It is evident that the author's main interest (and probably experience) lies in special heat treatments and surface treatments.

The book can be regarded as a sound textbook at an advanced level, with good coverage of most topics. It is also a useful work of reference.

● *The Southern Queensland Conference 1985*. Parkville (Australia), The Australasian Institute of Mining and Metallurgy, 1986. A\$ 15.00.

Reviewer: R.B. McGillivray

A wide variety of papers were presented, ranging from marketing through to metalliferous and coal mining. The following gives a comment on each paper.

1. *Declining Markets—A Marketing Challenge*

This discusses the marketing of lead in broad and general terms. Mention is made of the research being done to reduce pollution or the dangerous aspects of lead usage. Research is being conducted into possible new uses for lead.

2. *Can World Commodity Markets be Regulated?*

Whether countries could regulate world markets is discussed. The conclusion reached is that national intervention impedes the marketing process and leads to losses of market share, and that a national marketing authority would lead to a serious loss of efficiency in any commodity industry.

3. *The Competitive Challenge in the Marketing of Olympic Dam Copper, Uranium, and Gold*

The successful development and marketing of a copper and uranium resource during the current period of oversupply and depressed prices for both these minerals pose a competitive challenge that will be met only if the technology, manpower, and management are of the highest quality.

4. *The Utah Acquisition*

This paper describes the acquisition of Utah by BHP.

5. *MIM Project Financing*

This paper describes MIM's experience in arranging and executing project financings for coal projects at Oaky Creek, Newlands, and Collinsville, and the port facility of Abbot Point.

6. *Commodity-linked Borrowing Opportunities for Resource-oriented Projects and Companies*

The concept of commodity-linked borrowing has added a new dimension to borrowing opportunities for resource-oriented projects and/or companies.

7. *The Competitive Challenge—Women's Contribution to Employment*

The massive entry of women, especially married women, into the workforce in the past two decades

- has long-term implications for the Australian economy and those who participate in it. The ultimate impact on society of women's increased and increasing participation in all areas of economic, social, and political life will be far more widespread than is often perceived today, and managers need to be aware of their role in this social revolution. No matter what a manager's personal view may be on a woman's place, women in increasing numbers are working and influencing the economy.
8. *Mine Management—The Need for New Skills*
A case is made for broader commercial education of executive and operational managers in Australian mining companies. The competitive advantages and disadvantages of Australian miners are examined. Areas of opportunity are identified that could be exploited by broader applications of proven techniques to the commercial management of mining companies. The conclusion is reached that current management-education programmes have not brought these specific opportunities to the attention of many managers in the mining industry.
 9. *Management Education—The Need for Change*
The paper suggests that the increased complexity of management education today presents great dangers to management at senior and board levels. It suggests that there is a tendency for leadership to be educated out of managers and that the move should be halted. It suggests that management educators should recognize the distinction between management and leadership, with a plea that they focus on leadership as a key ingredient in meeting the competitive challenge.
 10. *The Logical Development of Longwall Mining in the Bowen Basin*
The paper outlines the philosophy adopted during the planning and development of the underground mining operation at German Creek, and deals with the logic and decision-making processes that led to the adoption of the longwall-retreat technique as a viable long-term method of operation.
 11. *Cost-ranking Studies in the Mining Industry*
While decisions to commit projects have traditionally been heavily influenced by hurdle rates for d.c.f. analysis, it is suggested that the evaluation of competitors' costs may be a desirable additional tool. The MICAS system, developed over the past four years, is described.
 12. *In-pit Crushing and Conveyor Transportation of Coal at Ulan*
Technical features and design parameters for the major items of equipment are outlined, as well as operating, manning, and performance assessments.
 13. *The Development of Hunter Valley Coal-preparation Plant*
The new plant and coal-handling system includes raw-coal stockpiles, a 900 t/h dense-medium/water-washing cyclone preparation plant, stockpiles of clean coal, a 7.8 km overland conveyor, large finished-product stockpiles, and a high-capacity train-loading plant.
 14. *Development of an Exploration Data-based Quality-control Programme*
The Curragh Mine has complex operating conditions. The Mine operates in four seams to produce two coal qualities, and is divided into five pits that have different qualities and coal-preparation characteristics. The combination of all the necessary controls to achieve maximum resource utilization has necessitated the development of suitable software to assist the quality-control engineering function.
 15. *Stripping Operations Using Belt-conveyor Systems*
As near-surface deposits are increasingly becoming mined out and pit widths begin to exceed the reach of practical direct-casting stripping machines, high haulage costs can make truck-shovel prestripping operations uneconomic. This is compounded because the rate of inflation for diesel fuel, lubricants, tyres, etc., exceeds the general rate of inflation.
 16. *Future Exploration Techniques for the Coal-mining Industry*
Long-hole in-seam drilling both from surface and underground is described, advantages over vertical-hole drilling being claimed.
 17. *The Development of Underground Belt-conveyor Systems from the Face to Surface*
Individual belt-conveyor systems and associated equipment are reviewed, and statistical information is presented to highlight the considerable developments that have been made in recent years, with an evaluation of the manpower and cost involved.
 18. *Reducing Costs by Going Underground*
Continuous loading and haulage caused underground costs to equal or fall below open-cut costs, with the added advantage of no waste, higher grades, and access to deep ore.
 19. *The Kidstone Gold Mine: A Development Challenge of a Low-grade Deposit*
If tradition had prevailed, the Kidstone project, which now produces 1 per cent of the world's gold, would never have been realized. A fresh alternative to the traditional approach was needed. The projected commodity prices were first assessed, and a determination was then made of what the mine needed to look like in order to make it economically feasible. A re-evaluation resulted in a reduction of capital costs, operating costs, and manpower costs, in a financially-based cost-effective mining/milling programme, in commuter mining instead of the building of a town, and in an effective labour-relations management programme.
 20. *Sampling to Gain the Competitive Edge*
Sampling criteria and the practical implementation of these criteria are discussed with a view to achieving and maintaining a high level of quality for minerals at their various stages of production through to their utilization.
 21. *Review of the Cut-and-fill Method of Underground Mining*
Cut-and-fill is used mostly where geological and ground conditions are unsuitable for open or caving methods. These conditions range from narrow, ir-

regular orebodies to wide, massive orebodies where pillars are retained in the ore. There is significant potential for improvement and further development of the method. It could then be used in a broader range of conditions and for orebodies that might not otherwise be mineable.

22. *E.A. Weinberg and the Australian Smelting Industry*
E.A. Weinberg, born and educated in Germany, worked in the American West for ten years as a mining engineer and metallurgist. He was the first head of the Queensland Smelting Co. and, from 1889 to 1915, was a prominent mining figure in Queensland. He was a competent manager at Aldershot, Dapto, and Chillagoe, but always lacked huge ore deposits for his smelters.

● *Rock mechanics*, by A.R. Jumikis. 2nd edition. Clausthal-Zellerfeld (West Germany), Trans Tech Publications, 1983. US\$ 58.

Reviewer: R.W.O. Kersten

The term *rock mechanics* brings to mind various associations: to the practitioner concerned with deep-level gold mines, it means seismic activity, induced fractures, and support; the engineering geologist thinks of rock mass classification; and the civil engineer is reminded of the deformation of near-surface structures in a highly jointed medium. As all these associations are fundamentally different in emphasis, a book title such as 'Rock Mechanics' could be misleading. However, the foreword of this book clearly states that its object is the introduction of geotechnical engineering to students of civil engineering and engineering geology.

The book is divided into four parts, the first of which defines the subject. The second part deals extensively with methods of rock exploration and the recording of the results. Stress distribution round shallow excavations and the influence of lining are briefly discussed in the third part, while the stabilization of rock masses is dealt with in part four. Also included is a glossary of terms, which should be useful to the beginner. Case histories are given for selected subjects, and these the reviewer found very interesting.

The book achieves what the author set out to do: it is an introductory book, and offers good, if somewhat lengthy, reading for the civil engineer who comes into contact with the subject but does not have to carry out the work himself. The rock mechanics practitioner and the engineering geologist may find that additional reading is required since not all the generally accepted procedures and methods, especially those used outside the U.S.A., are dealt with. For rock mechanics practitioners on deep-level gold mines, this book is recommended only as an interesting book to read.

● *The XVIIth International Colloquium on Refractories*. Freiburg, West Germany, 1985. DM 80.

Reviewer: H.J. S. Kriek

The 25 papers in this issue were presented at a colloquium that was held in Aachen during October 1984.

They deal with the subject of refractories for oxygen converters, and address the problems arising from the development of BOF processes such as top-blowing, bottom-blowing, and combined blowing. The papers mainly reflect developments in the application of refractories in Japan and Europe, and emphasize the fact that, for cost-effective usage, the materials used are mostly those available at comparatively low cost in the specific geographical area of the user. In Europe, converter linings consist primarily of pitch-bonded magnesia, doloma, and magnesia-doloma bricks with a residual carbon content of up to 5 per cent. In Japan, linings consist predominantly of the recently developed resin-bonded magnesia-carbon bricks with carbon contents of up to 25 per cent and with up to half of the magnesia present as fused magnesia.

All papers are of a high standard, and reflect the advances made with the addition of graphite to magnesia to improve thermal shock, thermal conductivity, and corrosion resistance. The purity of the graphite and its effect on the properties of the brick, the addition of metals such as silicon, aluminium, magnesium, and their alloys to prevent oxidation and to improve mechanical strength at high temperatures, and flame-gunning repair—all receive attention. Most of what is described in the papers is known, and has already been applied by South African steelmakers and manufacturers of refractories.

● *Diamond drilling handbook*, by W.F. Heinz. Johannesburg, South African Drilling Association, 1985. 517 pp. R30.

Reviewer: S.A.G. Martins

This book, produced under the auspices of the South African Drilling Association (P.O. Box 1338, Johannesburg 2000), extensively reviews basic geology, down-the-hole diamond-drilling equipment, drilling machines, and associated hydraulics (pumps, motors, actuators, etc.). It is a rather specialized book aimed primarily at drilling-site engineers, geologists, and drilling technicians, who are assumed to be at least familiar with exploratory drilling. The author states his intention as being to bring order to the chaos in regard to the sizes, standards, and literature applicable to the South African drilling industry.

The first chapter deals with geological formations and structures, and their influence on the selection of the in-hole drilling equipment described in chapters 2, 3, and 4. The role played by drilling mud and its properties are highlighted in chapter 5, while chapter 6 discusses the causes for fishing operations, the action to be taken with the fishing tools selected, and the precautions for avoiding fishing situations.

Chapters worthy of special mention are 8 and 9. Well-illustrated diagrams on hydraulic circuits, followed by trouble-shooting hints, are exceptionally useful in the identification of hydraulic problems. The correct application of circulation pumps, so often misunderstood for its importance, is discussed in chapter 9. Graphs showing the lifting speed of flushing water in relation to the annular cross-section of the hole for various pump volumes are interesting. Some consideration is also given to derricks, hoisting equipment, and wire ropes (chapter 10).

The book appropriately concludes with a discussion of the general safety precautions to be taken on site (chapter 11), and first aid (chapter 12). A somewhat disappointing aspect of the book is its total lack of bibliographical references.

This handbook fulfils a long-neglected need by providing practical information on South African drilling conditions. In view of its wide coverage of drilling aspects, there is an understandable self-acknowledged lack of detail for some drilling techniques and procedures.

In summary, the book represents a creditable effort, covering a wide and useful spectrum of diamond-drilling aspects, which was desperately needed in such a vast and ever-increasing important industry. Being his first attempt in this field, the author is to be congratulated on his initiative, which, it is hoped, will lead to more substantial future editions. The book should constitute an integral part of the tools required for any exploration project.

● *Processing and utilization of high sulfur coals*, edited by Y.A. Attia. Amsterdam, Elsevier, 1985. 788 pp. Dfl. 385.

Reviewer: L.M. Falcon

This 9th Volume in the Series on Coal Science and Technology represents the proceedings of the First International Conference on the Processing and Utilization of High Sulfur Coal, which was held in Columbus (U.S.A.) during October 1985.

The problems facing the usage of high-sulphur coals are immense, and deserve the attention of scientists, engineers, public-policy makers, coal producers and users, and environmentalists.

Much of the blame for 'acid rain' is laid at the door of high-sulphur coals when used in industrial activities. Acid rain is considered to be a major threat to the survival of mankind, since it not only gradually destroys plant and animal life but also depletes the ozone layer in the atmosphere. Also of constant concern are the adverse economic impacts of inadequately utilized natural energy resources. Thus, the challenge is to develop technologies to enable cost-effective use to be made of these high-sulphur coals while still meeting the stringent environmental regulations promulgated to alleviate acid rain.

Altogether, 74 papers were presented at the Conference, but only 54 of these are included in this volume. The editor selected the papers to present a comprehensive coverage of the work in progress on such topics as the following: characteristics of sulphur in coal, environmental problems and the impact of high-sulphur content on coal utilization, selective mining and blending, coal desulphurization by physical and chemical cleaning techniques, biological desulphurization, handling of coal fines, sulphur captive during combustion, control of sulphur dioxide emissions, and new applications for high-sulphur coals. The topics of almost all the papers form the subject of university or institutional laboratory research, and very limited reference is made to full-scale commercial operations.

Although only northern-hemisphere coals are referred to, the book, because of its strong bias towards basic research, should be of considerable interest to researchers and coal users in South Africa. In particular, the section

on biological desulphurization of coal should be of interest since this is one of the few available methods for the reduction of organic sulphur in coal.

South African coal reserves are, in general, considered to be of low quality, but fortunately the sulphur content is also relatively low. However, this fact should not give rise to complacency, and every effort should be made to reduce the sulphur in the atmosphere. This book on high-sulphur coal should be of significant assistance in these endeavours.

● *Weighing and proportioning of bulk solids*, by Hendrik Colijn. 2nd edition. Rockport (U.S.A.), Trans Tech Publications, 1983. 398 pp. \$60.00.

Reviewer: G. Cunningham

This publication deals with the weighing of materials in bulk form and the control aspects of the proportioning of such bulk solids.

The first few chapters deal with the fundamentals of weighing, and the sensing and transmittance of the detected weight. A number of different types of lever systems and load cells are discussed. The application of weighing systems to weigh hoppers and batching operations is detailed, with emphasis on automatic systems. Motor and rail weighbridges are discussed in detail, accuracy and reliability being of paramount importance.

The last chapters are of interest to the mining and metallurgical industry. Belt scales of nuclear and mechanical-electronic design are described, with discussions of both theoretical and practical aspects. Weigh feeders of all types are detailed, and their design and operational limitations are explained. The control of a weighing system is discussed, and the basics of such a system are formulated.

As the accurate weighing of materials in bulk is an important aspect of a mining and metallurgical operation, this publication can be recommended as a most useful reference for operational and maintenance personnel.

● *Investment appraisal and economic evaluation of mining enterprise*, by S. von Wahl. Clausthal-Zellerfeld (West Germany), Trans Tech Publications, 1986. US\$ 40.

Reviewer: D.G. Krige

The book deals with the subject matter fairly comprehensively, and covers most aspects very well.

The pictorial presentation of processes such as amortization, depreciation, payback period, and growth rate are interesting and useful. Unfortunately, the book is difficult to follow—even to those who are familiar with the subject—because even the most simple arithmetic relationships are complicated by the excessive use of symbols. Given time, one becomes used to many of the symbols, but until then it is frustrating to keep referring to the back of the book, where a listing of 144 different symbols is given over five pages.

The last fifty pages of the book are filled with compound-interest and annuity tables to 9 decimals, which in these days of electronic hand calculators and personal computers are quite unnecessary.

However, in view of the limited coverage of this subject in modern textbooks, the book is a useful additional reference.

● *Flotation of sulphide minerals*, edited by K.S. Eric Forsberg. New York, Elsevier Science Publishers, 1985. 480 pp. US\$101.75.

Reviewer: T.R. Twidle

This volume is the sixth in the series entitled *Developments in Mineral Processing*, of which Professor D.W. Fuerstenau, Department of Materials Science and Mining Engineering, University of California, is the advisory editor.

The book is a record of the presentations made at a two-day workshop to discuss recent progress in the flotation of sulphide minerals that was held at the Lulea University of Technology in Sweden during June 1984. The workshop was divided into four sessions and the book is arranged in the same manner:

- Flotation Chemistry
- Process Development
- Plant Design and Equipment
- Modelling and Process Control.

A most cogent review of the theme is given by Professor G.A. Barberry of the Université Laval, Canada, under the heading 'Recent Progress in the Flotation and Hydrometallurgy of Sulphide Ores'. He makes the point that flotation is still the most effective means, in every sense of the word, by which an intermediate upgrading stage is achieved between the winning of ore and the production of finished metal. Because of the complexity of the many chemical reactions and physical phenomena that occur simultaneously and continuously during flotation, there are still large gaps in our knowledge of micro-process effects. Conversely, the macro-flotation parameters such as power input, air flowrate, and cell size are readily measured. There are grey areas between these two extremes, so that the flotation metallurgist has before him a range of factors over which he has little or no control, partial control, and full control, and it is this mixture and range of knowledge that pose the greatest dilemma to the practising flotation metallurgist at present. In some areas, hydrometallurgy is competing with and challenging flotation, and these are described together with relevant examples.

The first section, that on flotation chemistry, contains nine papers, three of which are concerned with the effect of the oxidation state of mineral surfaces on their response to flotation. This is an aspect of flotation chemistry that has been shown to be of paramount importance in recent years, and has received, and is continuing to receive, a considerable amount of attention. In practical applications, the net result of the reduction and oxidation states of the constituents of a pulp is expressed by measurements of the hydrogen-ion concentration (pH) and redox potential (Eh).

Two papers are devoted to the mechanism of sphalerite activation, a subject of enduring interest to flotation metallurgists.

Other subjects that are presented in this section investigate collector attachment, the effect of colloidal particles on the flotation of galena, the use of sulphur dioxide for the depression and activation respectively of sphalerite and chalcopyrite, and the recycling of process water to a complex sulphide-flotation circuit.

In the section on process development, there are six presentations, two of which focus on the often very valuable inclusion of precious metals with base metal sulphides and their co-recovery in flotation. The effect of sulphur dioxide is again examined, this time from the results of plant investigational work.

Three papers deal with the development of process flowsheets from initial tests, through the pilot plant phase, to plant design. An appendix to one of the papers gives very useful examples of the evolution of the process design for three recent projects: Kidd Creek in Canada, Woodlawn in Australia, and Aznalcollar in Spain.

The four titles presented in the section on plant design and equipment contain two valuable expositions. One is by H. Schubert, of the Bergakademie Freiberg in West Germany, on the hydrodynamics of the flotation process, and this is part of a series of papers by this author that probably represents the best work currently being done on the design of flotation cells. The other is by G. Von Wachterfeldt of Sala International, who maps out with great clarity the steps to be followed in the translation of laboratory and pilot-plant test results into the selection of plant equipment.

The final section, that on modelling and process control, consists of six papers, the most enlightening being the discussion by Professor K.L. Sandvik of the University of Trondheim, Norway, on some of the limitations to process control in complex sulphide flotation. Other presentations are concerned more specifically with modelling, and the application of such work to the control of the flotation circuits at the Pyhäsalmi concentrator in Finland is described.

This book contains a great deal of the most recent work in the field of sulphide flotation, and it is well presented and laid out. It is recommended as an addition to the technical libraries of all flotation metallurgists.

● *5th Meeting of the European Clay Groups (5th Euroclay Meeting)*, Prague, edited by J. Konta. Praha (Prague), Univerzita Karlova, 1985.

Reviewer: D. Bühmann

This volume contains the published versions of 80 of the 196 papers that were presented orally or as posters at the 5th Euroclay Meeting, which was held in Prague in August–September 1983. Seventy-three of the papers are in English, 5 in German (one with an English abstract), and 2 in French (both with abstracts in English).

The book opens with 2 Plenary lectures: 'Man and Clay' and 'Soil Clays: Subjects for Chemistry, Mineralogy or Physics?', given by J. Konta and R.C. Mackenzie, respectively. The review by J. Konta covers topics from crystal structure, classification, zonalities of formations, and surficial alteration of clay minerals. R.C. Mackenzie's account of soil clays concentrates on the effect of sampling and sample preparations on the physics and chemistry of soil clays.

The succeeding papers are grouped in the following 8 sections, which correspond to the conference sessions:

- Crystal structure and crystallochemistry of clay minerals (8 papers)

- Mineralogy and geochemistry of the argillosphere (11 papers)
- Clay substance and recent environments (7 papers)
- Interaction of clay and organic substance (6 papers)
- Deposits of clay raw materials (11 papers, 1 abstract)
- Investigation methods of clay substance (5 papers)
- Clay substance in soils (9 papers)
- Applied argillology (8 papers).

The book closes with a poster section (10 papers, and 2 abstracts).

A wide range of topics is presented within each section, so that it is impossible to briefly review even the sections. The text is remarkably well written, and the volume benefits from a high standard of printing and binding. The quality of paper, tables, and figures is excellent, and the reproduction of the photomicrographs is generally adequate.

The book is invaluable in putting together information on research conducted in countries of the Soviet Bloc. Forty-nine of the papers are from scientists in Eastern Bloc countries, the host country Czechoslovakia contributing 19 articles. The broad range of topics will appeal both to the post-graduate student of phyllosilicate mineralogy and to the clay specialist who wishes to catch up on the advances made in other facets of the science. The volume can truly be recommended.

The book does have two disappointments, however. Its publication in 1985 (I received the copy in March 1986) was late, and its availability prior to the International Clay Conference in Denver, Colorado, would have been an advantage. There are also a number of typing errors, e.g. six on page 314, which could have been eliminated by efficient proofreading.

2. Recent publications

● CSIRO. *Research review 1982-84: CSIRO Division of Mineral Engineering*. Melbourne, Commonwealth Scientific and Industrial Research Organization, 1985. 77 pp.

The Division of Mineral Engineering conducts theoretical, experimental, and application studies aimed at developing, improving, and controlling processes in the minerals, energy, and basic-metals industries. Particular emphasis is placed on the handling, treatment, and smelting of ore and mineral products. This range of work is carried out by direct studies on industrial processes, pilot-plant studies at the Division or at industrial sites, experimental laboratory studies on process phenomena and on the fundamental science associated with such phenomena, and mathematical modelling of industrial processes in order to provide control strategies for such processes, to improve their performance, and to obtain a better understanding of how they function. In all areas of its research work, the Division enjoys close relationships with mining and mineral-processing companies throughout Australia. The Division is involved in a large number of projects carried out in collaboration with many companies. Results of this collaboration have been operational improvements that have benefited industry by millions of dollars. Following the transfer in July 1985 of 57 staff from the Division of Mineral Physics, the remit of the Division of Mineral Engineering has expanded. It

now includes emphasis on instrumentation and control, as well as on the winning, handling, treatment, and smelting of metalliferous ores, coal, oil shale, and basic metals.

● *The world copper market: structure and econometric model*, by Gerhard Wagenhals. Berlin, Springer-Verlag, 1984. 202 pp. DM 37,00.

This book is volume 233 in the series *Lecture Notes in Economics and Mathematical Systems*, M. Beckmann and W. Krelle being the Managing Editors of the series. The book is divided into two parts. Part I gives a general account of copper production and the market for copper. As the author's native tongue is German, to cover this subject in English is quite an achievement. In view of that, it would be rather unfair to quibble about some of his usages, e.g. the word *concentration* (upgrading of a dense collection?), or *mine production* (ore or copper?), which call for pause and some interpretation on the part of the reader. He is very comprehensive, mentioning seabed nodules and deposits on the moon and asteroids as possible future sources. The subject has been very thoroughly researched, and the material is well organized.

Part II, which relies on mathematical economics and econometric theory, is the most important part of the book, to which Part I serves as the foundation.

● *Materials data of high-strength aluminium alloys for durability evaluation of structures*, edited by L. Schwarzmänn. Düsseldorf (West Germany), Aluminium-Verlag GmbH, 1985.

This book, in the main, consists of a collection of data and graphs relating to the properties of certain high-strength aluminium alloys. This compilation of data would be of interest to those concerned with the design of dynamically loaded aluminium structures, where properties, such as the fatigue strength, crack propagation, and fracture toughness of aluminium alloys would be an essential prerequisite.

● BRITISH GEOLOGICAL SURVEY. *United Kingdom mineral statistics 1985*, compiled by H.C. Squirrel, A. Jones, N.E. Sharp, M. Lowe, and D. Slater. Keyworth (U.K.), the Survey, 1986. 175 pp.

This edition is the twelfth in the annual series of 'United Kingdom Mineral Statistics', which was first published in 1973. In one volume it presents minerals production, consumption, and import and export data obtained from a wide variety of published and unpublished sources. Compared with the preceding edition, all the contents have been systematically updated by one year, and revisions for earlier years have been made wherever more up-to-date information has become available. A new table has been introduced, with an accompanying graph, which demonstrate the rapidly changing pattern of primary fuel production, especially the effect of increasing oil output upon the United Kingdom's progress to self-sufficiency in primary fuels since 1980. Numerous minor improvements and additions have been made to tables in the Commodity Summaries section and, for the first time, estimates of apparent consumption are given for three metals for which there are no reported statistics: chromium, manganese, and titanium.

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 M166D

The effect of calcining on the recovery of gold in a sand residue. (1st issued Sep. 1984.)

Calcining tests on a composited sand sample from the Sheba II dump in the Barberton district are reported. It is shown that, if the sand, which has a gold content of 1,89 g/t, is treated in an electrically heated muffle furnace at 700°C for 10 minutes before milling and cyanidation, a gold extraction of 74 per cent can be obtained. In calcining tests done on a continuous basis with coal as the fuel, it was found that partially unburnt coal remaining in the calcine had a deleterious effect on the extraction of gold when the calcine was subsequently leached with cyanide, but that the addition of paraffin before leaching or of activated carbon or ion-exchange resin during leaching improved the gold extraction.

Tests in a specially designed continuous calciner using coal showed that an overall gold extraction of 55 per cent could be obtained. This is still 19 per cent lower than that obtained when the sand was calcined batchwise in an electrically heated muffle furnace.

It is considered unlikely that substantially higher extractions will be obtained, even with further improvement in the calcining procedure, while coal is used as the fuel. It is suggested that the use of other types of fuel should be investigated, as well as external heating of the calciner with coal.

● Report M168D

The treatment of Uitkomst concentrate. (1st issued Oct. 1984; reissued Mar. 1986.)

Various methods for the treatment of a low-grade nickel-copper-cobalt concentrate from Uitkomst are described. It is shown that, owing to the nature of the mineralogical composition of the concentrate, direct leaching does not dissolve all the base metals. However, the mineralogical composition can be changed by a variety of heat-treatment processes, and the concentrate then becomes amenable to leaching.

The favoured process route is electric-furnace smelting to produce a low-grade matte in which more than 90 per cent of the sulphur in the concentrate is retained as sulphide sulphur. This is achieved by the use of ferric oxide and coal char as fluxes. Leaching of the low-grade matte is shown to result in good extraction of the base metals into solution and oxidation of the sulphide to sulphur.

Attempts to recover the platinum-group metals as an upgraded residue are also described.

Report M175D

Supergene alteration at the Pering zinc-lead deposit: The nature and extent of the oxidation zone. (1st issued Oct. 1984.)

At Pering, the disseminated sphalerite mineralization with only a trace of galena is of syngenetic or, more like-

ly, diagenetic origin. Later differential remobilization has resulted in semi-massive, epigenetic sulphide concentrations with higher ratios of lead to zinc. Supergene alteration has occurred in the upper few metres of the ore-body, and an empirical relationship between the sulphide abundance and the degree and extent of surface alteration is recognized. Supergene galena, anglesite, cerussite, descloizite, smithsonite, calcite, iron oxides, and an unknown lead-manganese-iron mineral occur in the altered zone. The major factors controlling the supergene mineral assemblage are pH and E_h , while groundwater availability and flowrates strongly influence the mineral composition and textural development.

In general, only the upper 5 metres of the deposit show sufficient alteration to affect the beneficiation of the ore.

● Report M176D

Bench-scale tests on the extraction of cobalt and nickel from COMAT leach liquors. (1st issued Nov. 1984; reissued Mar. 1986.)

This report describes testwork aimed at the removal of cobalt and nickel from COMAT leach liquors by the use of a laboratory-scale solvent-extraction apparatus. These leach liquors are pregnant liquors from the leaching, with sulphuric acid and oxygen, of a nickel-copper-cobalt matte obtained from converter slag.

It is demonstrated that equilibrium loading of cobalt can be achieved at pH values of 4,5 and 5,5 by the use of SME 418 (an alkyl phosphonic acid) as the extractant in ESCAID 110. The results of the experiments show that a raffinate with a cobalt content of 15 mg/l and a loaded solvent with a nickel content as low as 11 mg/l can be obtained from a feed with a cobalt content of 2,16 g/l and a nickel content of 10,8 g/l by the use of five extraction stages and by the addition of ammonia solution to control pH in each extraction stage. Furthermore, a 60 per cent saving of ammonia can be achieved if the ammonia is added stagewise instead of being preloaded into the solvent.

Tests were conducted on the suitability of a solvent system containing ESCAID 110, di-(2-ethylhexyl) phosphoric acid (D2EHPA), and 2-ethylhexanal oxime (2EHO) for the extraction of nickel in the cobalt barren solution; equilibrium curves for pH values of 2,0, 2,5, and 3,0 and stripping curves for varying nickel and sulphuric acid concentrations are presented. The results of solubility and phase-disengagement tests are given, together with the results obtained by countercurrent operation in a laboratory-scale mixer-settler unit.

Countercurrent operation is shown to require four extraction stages and six stripping stages to reduce the nickel in the raffinate to less than 10 mg/l. This is achieved for aqueous-to-organic ratios of 1:3,75 and 1:7,8 in the extraction and stripping circuits respectively.

The solubility of the mixed solvent in a nickel sulphate solution is greater than 37 mg/l owing to the presence of the oxime of low molecular mass. Phase-disengagement characteristics are shown to improve with the addition of the oxime.

● Report M241

PLATO at Mintek.

This report describes how the PLATO computer-based educational system, which is being used at Mintek, was

evaluated. The aspects that were investigated include the complete usage of such a system, the education it provides in new skills, its improvement of present levels of education, and its present and potential educational levels.

In addition, an account is given of the construction and implementation of 'in-house' courseware.

● Report M243

The performance and wear characteristics of grinding media as affected by metallurgical and dimensional factors.

Different types of chromium-white iron grinding balls produced markedly differing results in the grinding of ore from the Merensky Reef: differences that could not be easily correlated with changes in chemical composition, structure, or hardness. One of the best of these balls showed a drastic reduction in performance in the treat-

ment of ore from the UG-2 Reef, probably because of the much higher chromite content of that ore.

Despite claims that the shape of the units in a grinding medium has very little effect on grinding efficiency, testwork showed that, for equal masses of charge, non-spherical media give a slightly coarser product than spheres, a fact that may be partly offset by the lower production costs of non-spherical media.

A higher total surface area in a grinding charge tends to give a finer product, but the shape of the different media plays an important part. However, even when the shape of different media is the same, an increased surface area does not bring about a commensurate increase in the new surface area of the product.

The consumption of grinding media, expressed in kilograms per ton milled, rises very rapidly with an increased fineness of grind.

Project development

The Second Project Development Symposium on Planning, Construction and Commissioning will be held in Sydney, Australia, from 7th to 10th October, 1986. Hosted by the Sydney Branch of The Australasian Institute of Mining and Metallurgy, the Conference aims to bring together a team of practitioners to promote discussion and disseminate the wealth of knowledge that has accumulated during the planning, construction, and commissioning of a large number of recent mining projects in Australia, Indonesia, Thailand, Papua New Guinea, and the Philippines.

The preliminary programme is as follows:

Commercial

- Bankers Acceptance Criteria
- Assessment of Risk for Long-term Mining Contracts, a Case Study
- Project Development: The Lump Sum Alternative
- Working-capital Requirements for Resource Projects
- Maintenance Inventory Planning

Mine Design

- The Integrated Planning of Geotechnical Investigations for New Mining Projects
- Mining Geotechnical and Groundwater Risk Analysis
- Strategic Planning, Mining Method Selection, and Mine Design—Mae Moh Lignite Project, Thailand
- Pre-commitment Phase, Geotechnical Investigation Planning for Lochiel Coal Deposit

Process Design

- The Olympic Dam Copper-Gold-Uranium Pilot Plant
- Control System of the Process Plant at the Argyle Diamond Project
- Continuous Assaying in a Copper-Lead-Zinc Mineral-flotation Pilot Plant Using Instrumentation for In-stream Analysis

Project Planning and Management

- Recent Case Studies—Lessons and Potential
- Blair Athol Coal-mine Project: A Case History in Project Planning and Management
- Power Supply for Resource Projects

- Project Planning and Management with Regard to the Environmental Programme

Project Construction

- Construction Methods for Remote Locations
- Construction of The Cooper Basin Natural-gas-Liquids Project
- Development of the Argo Gold Mine, Tennant Creek
- Rapid Implementation and Commissioning in a Remote Location
- Amacan Copper Project, Philippines

Project Commissioning

- Operations and Maintenance Training in Project Development
- Commissioning of the Coal-preparation Plant at Newlands Coal Mine
- Commissioning from a Project Manager's Point of View
- Commissioning of New Equipment in Continuously Operating Plants
- Commissioning of a Large Coal-blending and Preparation Plant: Curragh, Queensland

Case Studies

- Baal Bone Coal Washery
- Installation and Commissioning of the Liddell Coal Longwall System
- Construction and Commissioning of the Leborg Tandai Gold Project, Indonesia
- The Paddington Gold Project.

Registration forms and further information are available from

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