Book news

1. New books

● *Extraction metallurgy '81.* London, Institution of Mining and Metallurgy, 1981. 441 pp. $40. 'The response of technology to the challenge of rising costs' is the central theme of this volume, which contains the 42 papers presented at the Extraction Metallurgy '81 Symposium, London, 21st to 23rd September, 1981, organized by the Institution of Mining and Metallurgy in collaboration with Gesellschaft Deutscher Metallhütten- und Bergleurte, Benelux Métallurgie, and the Société Francaise de Métallurgie. The papers, by authors from Australia, North and South America, Japan, the Philippines, and Europe, examine a range of current developments in metal extraction worldwide and show what operators and researchers are doing – often by entirely novel process routes – to lower costs in a number of key areas: capital plant and equipment, energy, control and techniques for process development, feedstock and products, and environmental protection. Specific subjects covered by the papers include copper production via the Dextec, AMAX, Noranda, and Outokumpu processes; coal gasification for reduction processes; recent developments in the extraction of alumina from shales and in Hall–Heroult aluminium cells; the low-contaminant jarosite process; the QSL lead process; and recent developments in the production of tin, gold, and steel.

● *Structures and properties of engineering alloys*, by W. F. Smith. London, McGraw-Hill, 1981. 512 pp. R39,65. This book examines major engineering alloy systems, including carbon and alloy steels, aluminium alloys, coppers and copper alloys, stainless steels, cast irons, tool steels, titanium alloys, nickel alloys, and cobalt alloys, as well as incorporating the most recent advances in various engineering fields. References are also made to the original journals for further investigation. This reference explores the behaviour of alloys in various fabricated and heat-treated conditions.

● *Rock and mineral analysis*, by W. M. Johnson and J. A. Maxwell (editors). 2nd ed. New York, Wiley, 1981. 424 pp. $40. A comprehensive guide to the determination of major, minor, and trace elements in rocks and minerals—from selection of sample to reporting of results of the analysis. Considers what elements should be determined, facilities needed, preparation of sample and methods for determination of individual constituents, and problems encountered along the way. Gives special attention to new advances in sampling theory, and expands previous discussions of standard reference materials and sample decomposition techniques.

● *Mining methods and equipment*, by Mining Information Services. London, McGraw–Hill, 1981. 218 pp. R23,40. This is a new edition of *Mining Methods and Equipment Illustrated*, which was published in 1967. Since then there have been a great many developments in the mining industry. The new book includes a number of the improvements and innovations in the industry since the first publication. It also includes sections on finding, evaluating, and opening a mineral deposit. Land reclamation, an important part of mining today, has also been included. The book is intended as an introduction to the concepts used and the application of those concepts in producing ore and coal.

● *International directory of acronyms in library, information and computer sciences*, by P. M. Vaillancourt. New York, Bowker Publishing Co., 1980. 516 pp.
This directory lists approximately 5500 international acronyms in the fields of library, information, and computer sciences (for the purposes of this publication the term acronym encompasses both true acronyms and initialisms). The acronyms are arranged alphabetically and include 9 categories: Associations, Meetings, Publications (Books and Journal), Library and Information Centres, Terms, Government Agencies, Projects and Systems, Commercial Firms, and Consortia. Each entry contains three parts: acronym, full name of acronym, and a brief annotation providing further identifying information. The information given in an annotation varies according to the category of acronym.

2. New journals

● *Trends in analytical chemistry (TRAC)*, Amsterdam, Elsevier, 12 issues per year. Subs. for Volume 1 (16 issues) D.fl 95.50.

Analytical chemistry has grown so rapidly and is applied to so many diverse problems that it is impossible for analytical chemists to have specialist knowledge of every available technique. However, it is important for them to be aware of techniques outside their own area and of what these techniques can achieve. They must also be in a position to select appropriate methods for solving the broad spectrum of problems encountered in practice. It is the aim of this journal to provide such information and so promote communication about methodology among all scientists involved in chemical analysis.

● *Engineering management international*, Amsterdam, Elsevier, 4 issues per year. U.S. $32.50, D.fl. 70.00.

This journal is devoted primarily to meeting the needs of practising managers of technical activities by publishing articles of vital concern to those seeking to manage their responsibilities more effectively. The articles, while encompassing a broad spectrum of interests, will concentrate mainly on ideas and practices that are relevant to obtaining results in organizations where technology is a significant component.

3. Mineral policy sector publications

The following are available from Printing and Publishing, Supply and Services Canada, Hull, Quebec K1A 059.

● *Mineral Bulletin* MR 188. Vanadium: an imported mineral commodity. $3.60.

This report, the first of a series on imported mineral commodities, examines Canada's position in regard to the principal vanadium materials: vanadium oxide, ferrovanadium, other vanadium-bearing alloys, and vanadium chemicals.

● *Mineral Bulletin* MR 190. Canadian mines: 1980 perspective. $3.00.

This bulletin reports on the results of a joint federal–provincial undertaking aimed at monitoring, on an annual basis, the supply systems for the most important mineral commodities being mined in Canada. Concise overviews are presented of the Canadian reserves situation, of the supply capability on the basis of current reserves alone, of recent commitments for bringing new mines on-stream, and of the level of exploration and discovery.

● *Canadian mineral survey 1980*, by the staff of Mineral Policy and Energy Sectors. $1.00.

The preliminary survey of the Canadian mineral industry, as published in the February 1980 issue of the *Canadian Mining Journal*. These are the most up-to-date mineral industry statistics covering the leading metals, minerals, and mineral products produced in Canada.

4. NIM reports

The following reports are available free of charge from the Council for Mineral Technology (formerly the National Institute for Metallurgy), Private Bag X3015, Randburg, 2125 South Africa.

● Report 2090

Observations made during the dig-out of a 48 MVA ferrochromium furnace.

The no. 4 furnace at Ferrometals, Witbank, was excavated in June 1977, and samples were taken for chemical analysis and mineralogical examination. Various zones were observed, including a large metal bath that had eroded the carbon blocks, a slag layer containing coke in some places, and loosely sintered burden at the top of the furnace.

The major slag phases identified included forsterite, plagioclase, pyroxenes, and spinel. Chrome spinel, which had undergone varying degrees of incipient fusion and reduction, was observed in different localities. The major metallic phases were carbides of chromium and iron, usually $(Cr, Fe)_7C_3$, although other iron-rich phases and chromium-rich phases were also identified.

Oxides of chromium and iron had been reduced at the interface between the particles of coke and the slag, within particles of partly altered chrome spinel, and from the slag phase (presumably from dissolved oxides).

The observations are illustrated with numerous photographic plates and photomicrographs, and a detailed discussion of the mineralogy is included.

● Report 2110

The investigation of a fracture on one side of a skip bridle in a mine shaft.

Component sections from the fractured side of a skip bridle were submitted to the National Institute for Metallurgy for examination. The fracture had occurred at the junction of the side of the bridle with the top crosshead. Examination indicated that the fracture had resulted from the combined effect of impact on the side of the bridle by the base of the hook and severe corrosion by acid mine water. Certain aspects of the design are commented upon, and suggestions are made as to modifications that might prevent the recurrence of such a fracture. Modifications to the design of the skip bridle, as proposed by the Resident Engineer of the mine, are described in an Appendix.

● Report 2111

Pilot-plant tests for the recovery of chromite and the noble metals from the UG-2 Reef at Maandagshoek.

A series of pilot-plant tests was carried out on samples from the UG-2 Reef at Maandagshoek so that the optimum conditions for the recovery of chromite and the noble metals could be determined.

Gravity-concentration tests on ore that had been ground to the approximate liberation size for chromite showed that concentrates with grades of about 40 per cent Cr_2O_3 and recoveries of up to 75 per cent can be produced. The chromite concentrate contained over 30 per cent of the noble metals present in the ore. The noble-metal content of the chromite concentrates can be reduced substantially by the use of a unit cell for flotation prior to gravity concentration and the removal, for retreatment, of a fraction rich in the noble metals from the cleaner-tabling stage. However, this procedure resulted in reduced chromite recoveries.

The flotation of gravity tailings gave overall recoveries of the noble metals from 47,0 per cent when no unit cell was used, to 74,0 per cent for a procedure involving preconcentration in a unit cell.

The chromite content of the noble-metal concentrates in these tests ranged from 0,8 per cent Cr_2O_3 to 1,3 per cent Cr_2O_3.

The optimum conditions for the recovery of the noble metals and chromite were obtained in a test in which rougher flotation for the recovery of noble metals was followed by the recovery of chromite from the flotation tailings, a second stage of rougher flotation of the gravity tailings, scavenger flotation, and three stages of cleaner flotation. With this procedure, 88,0 per cent of the noble metals were recovered at a concentrate grade of 387 g/t. The Cr_2O_3 content of the noble-metal concentrate was 2,0 per cent, and the chromite recovery was 56,7 per cent at a grade of 40,7 per cent Cr_2O_3.

If the ore is treated by flotation for the recovery of the noble metals alone, a procedure involving the use of a regrinding stage for the scavenger concentrate and cleaner tailing will result in the recovery of 86,0 per cent at a concentrate grade of 506 g/t. Fine grinding was required for this result to be achieved, and the Cr_2O_3 content of the noble-metal concentrate was 3,1 per cent. Most of the chromite in this concentrate was present as fines smaller than 7 μm in size.

It is concluded that either of these procedures will yield noble-metal concentrates with grades exceeding 400 g/t and recoveries exceeding 86,0 per cent. However, the efficacy of the first method will need to be confirmed by additional testwork, as will the use of autogenous milling, since only single tests involving these procedures were conducted.

Finally, a feasibility study should be carried out to show which of these two procedures would be better suited to the beneficiation of the ore deposit.

● **Report 2112**

The behaviour of UG-2 chromite concentrates during smelting.

It was found that good recoveries of chromium and iron were obtained over a wide range of slag compositions, the grade of the alloy being between 48 and 52 per cent chromium. Silicon control was difficult under the conditions prevailing in the induction furnace used, but prereduced pellets of UG-2 chromite were successfully smelted, chromium recoveries of 99 per cent being achieved. Theoretical heat balances showed that the power requirements for the smelting of preheated, prereduced UG-2 chromites were less than 1500 kW-h per ton of alloy produced.

● **Report 2113**

Multivariable control of a milling circuit at East Driefontein Gold Mine.

In an investigation into the control of an industrial milling circuit, a preliminary study was made with the use of a computer simulation. Step tests were then carried out on the plant, and the data obtained were used for the derivation of a linear dynamic model. A multivariable controller was designed for the plant by a suite of interactive computer programmes that included the use of techniques involving the inverse Nyquist array. This controller was successfully applied to the plant by digital computer, and there was very good agreement between the theoretical predictions and the practical application of the controller. The quality of control was also good. While the control scheme involves local control of sump levels and cascade control of feed rates, the most important of the variables that can be controlled to any practically feasible operating points are the flow and density of the feed to the primary cyclones, and the product size, which can be measured on-line.

● **Report 2115**

Estimation of material variation in powdered materials

Measures of material variation (state of homogeneity) for reference materials of powdered rocks, minerals, and ores are examined critically.

It is shown that the customary analysis of variance concluding with the F-test is not a satisfactory method for the analysis of the analytical data obtained in a homogeneity experiment. It is argued that an estimation approach is more appropriate.

Examples are given of values calculated from reference-material data, together with an explanation of how the results can be interpreted.

● **Report 2116**

Optimum operation of a direct-reading spectrometer with excitation by a 5 kW inductively coupled plasma torch.

An examination was made of the optimum operating conditions, degree of interference from sodium ionization, and spectral interferences in a simultaneous 40-channel spectrometer having a data-reduction system controlled by a microprocesser. Excitation is provided by an inductively coupled plasma (ICP) source of medium power, i.e., with a nominal maximum of 5 kW.

The optimum conditions were ascertained for atomic lines, for ionic lines, and for compromise multi-element analysis in aqueous solutions and in sodium solutions at concentrations up to 30 g/l, the detection limits for 37 elements being determined.

It was found that an increase of approximately 30 per cent in the power input under the optimum conditions for multi-element operation reduced the interference from ionization caused by up to 30 g of sodium per litre to less than 5 per cent relative.

It was found that there is a correlation between the extent of the interference from ionization and the ionization potential of an element.

Although the great majority of the lines in the spectral array were generally free of significant spectral overlap, several serious spectral interferences were observed and were determined quantitatively.

● **Report 2121**

Five robust indicators of central value.

The presence of outliers and the statistical noise that affects the data for reference materials have undesirable effects on the mean and on other indicators of the central value. Five robust indicators of the central value, which are resistant to obvious outliers and less obvious contamination (spurious data), were investigated: the dominant cluster mode, the modian, the Gastwirth median, the trimean, and the trimmed mean. The mean and the median were investigated for purposes of comparison

The results confirm that the mean is very unreliable, and that the Gastwirth median and the dominant cluster mode are strong indicators of the central value.

● **Report 2124**

The direct determination, by differential pulse anodic-stripping voltammetry at the thin mercury-film electrode, of cadmium, lead, and copper.

This report describes the development and application of a voltammetric procedure for the direct, simultaneous determination of cadmium, lead, and copper in three SAROC reference materials (carbonatite, magnesite, and quartz). The electrolyte was a mixture of 1 M ammonium chloride, 0,1 M citric acid, and 0,025 M ascorbic acid. No interferences were encountered from Fe(III), As(III), Sb(V), Tl(I), or In(III) at the concentrations present in the samples. Intermetallic interferences were eliminated by the use of thin mercury-film electrodes not less than 80 mm thick. Limits of detection were determined by the degree to which the supporting electrolyte could be purified, and were estimated to be 10 ng/g, 250 ng/g, and 150 ng/g for cadmium, lead, and copper respectively.

● **Report 2127**

The preparation of a reference material of South African zirconium concentrate from Richards Bay.

This report describes the preparation of a South African zirconium concentrate as an international reference material. The procedure for the selection of preferred values is outlined. Eleven laboratories contributed to the analytical programme, and 7 elements have been assigned preferred values.

● **Report 2128**

The determination, by differential pulse anodic-stripping voltammetry at the thin mercury-film electrode, of cadmium and thallium in six NIMROC reference materials

A previously reported procedure has been extended to include the determination of thallium. In samples where thallium occurred in the presence of relatively high concentrations of cadmium, the stripping peak for cadmium was first suppressed with a non-ionic surface-active agent, Triton X-100. Cadmium and thallium were determined directly in six NIMROC reference materials, without interference from iron(III), in a reducing electrolyte, which is also a complexing agent, consisting of 1 M ammonium chloride, 0,1 M citric acid, and 0,025 M ascorbic acid. Interelement interferences were eliminated by the use of a mercury-film electrode of adequate thickness. The limit of detection for cadmium was 10 ng/g and that for thallium 20 ng/g.

● **Report 2130**

The organizing of conferences.

The National Institute for Metallurgy has gathered a fair amount of expertise in arranging conferences and has developed a successful course of action. This report gives details of that course of action.

Research grant

The Board of Directors of International Precious Metals Institute in conjunction with Gemini Industries, Inc., a California-based refiner of precious metals, recently announced a Gemini Research Grant of $3000 will be awarded annually to a graduate student who is pursuing studies in metallurgy, chemical processes as it pertains to precious metals, or materials sciences, and who is performing or planning research studies in the precious metals.

Mr Sebastian Musco, President of Gemini Industries, Inc., and also on the Board of Directors of IPMI, stated that the purpose of the award is to encourage young persons to pursue their education in the field of precious metals.

The 1981 recipient is Ms Aphrodite Economedes, a graduate student at Polytechnic Institute of New York, who is performing research in micro-structures of gold–copper–zinc alloys in and near the beta phase region. She was present at the 5th International Precious Metals Conference, held in Providence, U.S.A., on 1st to 5th June, 1981, to receive her grant from Mr Musco.

To be eligible for the 1982 Award, any qualified student at present enrolled in an approved course of study leading to an advanced degree may apply directly to IPMI, Polytechnic Institute of New York, 333 Jay Street, New York, New York 11201, before 1st February, 1982. Applications must be submitted with an accompanying endorsement from a supervising faculty member of the applicant's college. . . . . .

The 1982 Award will be presented at the 6th International Precious Metals Conference, which is to be held in Newport Beach, CA, from 6th to 11th June, 1982.

Accidents and diseases

The Third International Colloquium for the Prevention of Occupational Accidents and Diseases in the Iron and Metal Industry is to be held on 15th and 16th June, 1982, in Palma de Mallorca, Spain.

The main object of the Colloquium is to provide an opportunity for the exchange of experience and knowledge among experts from different countries in the fields of Industrial Safety, Hygiene, and Occupational Medicine.

The preliminary programme of the Colloquium consists of the following themes:

- Measures of risk control in the iron and metal manufacturing industry
- Working with dangerous substances
- Measures of protection against heat in the workplace in the metallurgical industry.

The official languages of the Colloquium will be German, French, English, and Spanish. All the working papers of the conference will be available in these four languages. Simultaneous translation will be available in the four official languages.

Those attending the Colloquium who wish to present a paper on any of the themes outlined, should send their papers to the Colloquium Office before 1st February, 1982. The paper should consist of not more than 750 words and should be accompanied by a summary of a maximum of 100 words. The original and seven copies of the paper and summary should be submitted in any one of the four official languages.

Further information is available from the Colloquium Office: Asociacion Para la Precencion de Accidentes, Echaide 4, San Sebastian, Spain. Telephone: 425645 — 425647.