

Book news

1. Journals

● *Marine Geotechnology*, edited by R.C. Chaney. London, Taylor & Francis (Rankine Road, Basingstoke, Hants RG24 OPR, UK), 1988. vol. 8, \$50. Published quarterly.

This journal publishes research devoted to all scientific and engineering aspects of seafloor sediments and rocks. With the goal of solving marine problems in civil engineering and the earth sciences, it includes the study of the acoustical, biological, chemical, mechanical, and physical properties affecting the electrolyte-gas-solid sedimentary system of the seafloor. The response of this system to applied static and dynamic loads is also included. Other topics covered include anchoring and mooring systems, bottom installations, coastal engineering structures, pipelines, transportation, and case studies.

● *Mineral Resources Engineering*, edited by C.T. Shaw. London, Taylor & Francis (address as above), 1988. vol. 1, \$99. Published quarterly.

This is a new international quarterly journal, which aims to be in the forefront of the management of change within the mining industry. It will promote newly developing technologies, and the application and introduction of those technologies, and will demonstrate the practicality and safety of new methods of exploration, extraction, and processing of surface and underground minerals. It will also publish review papers by experts in the various less-common technologies within the mining industry, as well as research reports and reviews of recent conferences. Regular features on mining education, developments, and the training of mining engineers are planned for future issues.

2. New publication

● *World mining map of non-ferrous metals* (with 4 regional maps and a booklet). Reinhard Ryborsch (Postfach 2105, D-6053 Obertshausen bei Frankfurt am Main, West Germany). International edition: bilingual, English and German. 7 colour-print: Size (unfolded) 138 × 100 cm. US\$ 19 (excl. mailing) for folded map with hard cover (Order No. 61-4); US\$ 25 (excl. mailing) for unfolded (flat) map with hanging strip (Order No. 62-2).

For the first time on a world map, this publication presents the major non-ferrous metal producers of copper, lead, zinc, tin, aluminium, and other metals, including those in centrally-planned-economy countries. Each individual mine is shown with its geographical coordinates, and is described according to its relative significance. The world mining map shows the locations of 481 active mines with an annual production (gross metal value) of at least DM 20 millions, or a metal output of at least 5000 t of nickel or 100 000 t of aluminium. The map was compiled from data for 1983, updated to a limited extent between 1984 and 1986. The four regional maps show in detail significant mining areas in the USA (copper), Peru (lead and zinc), Zaire and Zambia (copper), and Yugoslavia, Rumania, and Bulgaria (lead, zinc, and copper). Where the production of a particular metal exceeds 1 per cent of the world mining output, it is shown. The world map is accompanied by an index of mines

(booklet) in tabular form with explanatory notes (name, mine or mining district, location, mine operator, production, and geographical coordinates). The publication was edited and published in cooperation with the Metallgesellschaft, Frankfurt am Main, West Germany.

3. Mintek reports

The following reports are available from the Council for Mineral Technology, Private Bag X3015, Randburg, 2125 South Africa. They are free of charge to South African addressees, but there is a handling charge of US\$25 per copy for reports sent to overseas destinations.

● Report M326

Crevice corrosion and other localized corrosion behaviour of 3CR12 corrosion-resisting steel in synthetic minewaters, by D. Howarth. May 1988. 28 pp.

This report reviews the mechanism of localized corrosion, particularly crevice attack, in a passivable corrosion-resisting steel with a chromium content of 12 per cent, and examines the chemical and physical factors that contribute to such attack.

Various experimental techniques for the prediction of the initiation and propagation of crevice corrosion were considered, and two electrochemical methods that do not involve the stimulation of crevice attack by an applied current and therefore closely simulate service conditions were selected for use in the laboratory testwork.

A recently developed ferritic corrosion-resisting steel, 3CR12, was tested in a variety of synthetic minewaters, and its performance compared with that of mild steel and AISI 430 stainless steel. The effects of various physical and chemical factors were investigated, namely surface finish, crevice size and geometry, percentage martensite in the 3CR12, water flowrate, pH, and the concentrations of chloride, sulphate, and thiosulphate. In addition, the performance of 3CR12 was compared with that of AISI 304 and 316 stainless steels in simulated crevice solutions.

The results show that 3CR12 is susceptible to both the initiation and propagation of crevice corrosion in synthetic minewaters similar to those found in South African gold mines.

● Report M332

The carbon-regeneration furnaces at Mintek, by P.M. Cole and P.J. van Staden. Nov. 1987. 31 pp.

The concept of resistive heating has been applied in a practical device, the Rintoul furnace, in which an electrical potential is applied across a bed of activated carbon, resulting in a flow of current that generates the heat required for the regeneration of the carbon.

Single-phase furnaces of 3 and 8 kg capacity, and a 100 kg capacity three-phase furnace, have been designed and installed at Mintek for research purposes.

This report describes these units and their operation.

● Report M344

The flotation of pyrite with amine collectors, by R.D. Hill, E.W. Giesekke, and P.J. Harris. Mar. 1988. 25 pp.

The interaction between a 'model' collector, *n*-dode-

cylamine (DDA), and a 'model' Witwatersrand-type mineral system consisting of pyrite and quartz was extensively investigated by means of adsorption and microflotation tests and the measurement of zeta potentials. It was found that the presence of 'foreign' ions e.g. calcium, magnesium, and ferric ions, strongly influences the selectivity for pyrite over quartz when DDA is used as the collector in alkaline media. The surface activities of commercial amine-type collectors compare favourably with that of DDA, although the former are more surface-active.

The pyrite results obtained in the present work correlate with the pyrite recoveries obtained on a gold plant using DDA as the collector, i.e. the selective recovery of pyrite from gangue (quartz) with amine-type collectors is brought about by the natural floatability of pyrite, and by the depression of the gangue by calcium and magnesium ions. Increased dosages of collector improve the floatability of the gangue, thus reducing the selectivity of the process.

● Report M345

The substitution for chromium in steels: Progress and trends, by M.B. Cortie. Mar. 1988. 14 pp.

The USA, Western Europe, and Japan are dependent on external sources of supply for many key minerals. This dependence has not passed unnoticed, and an extensive research effort is under way with the goal of finding potential substitutes for chromium. The aim of this report is the investigation of the use of chromium in iron-based alloys, and the progress that has been made in the finding of substitutes for this chromium.

The metallurgical, industrial, and economic basis of potential substitutes for chromium is also examined. Since about 25 per cent of all the chromium mined is used for the manufacture of AISI type 304 stainless steel, most research effort has been focused on the development of an alloy with similar properties that contains less chromium.

Success in this regard has been claimed by several workers. The proposed alloys generally contain from 9 to 12 per cent chromium in contrast to the 18 per cent chromium in type 304 stainless steel. The resistance to corrosion or oxidation that is lost by the reduction in the chromium content is supposedly compensated for by additions of elements such as molybdenum, silicon, aluminium, and vanadium. Nevertheless, the optimistic claims made by many of these workers are not supported by the data they present. In general, these alternative alloys have a markedly inferior resistance to corrosion, poorer mechanical properties, and a higher cost than type 304 stainless steel.

Several alloys have been developed that have resistance to oxidation superior to that of type 304. This is obtained by additions of aluminium and/or silicon in amounts of up to 4 per cent each, but a chromium content of at least 8 per cent is still necessary. These alloys appear to have considerable potential, although they are not as easy to fabricate as type 304 stainless steel.

● Report M346

The direct reduction of sulphur dioxide to elemental sulphur, by I. Henderson. Mar. 1988. 30 pp.

The reduction of sulphur dioxide to sulphur was car-

ried out on an industrial scale as early as 1928 in Norway and 1936 in Canada. A number of plants have been closed for economic reasons, mainly because of the preference for the production of sulphuric acid. However, the conditions in South Africa are favourable for the conversion of part of the locally produced sulphur dioxide to elemental sulphur; the remainder could be converted to sulphuric acid by existing processes.

A major problem with the reduction of sulphur dioxide is the simultaneous production, at high conversions of the gas, of significant quantities of contaminants such as hydrogen sulphide and carbonyl sulphide. Testwork is reported in which char from Rand Carbide was used to reduce a gas stream comprising 20 per cent sulphur dioxide in nitrogen. It was found that, under certain experimental conditions, conversions of up to 90 per cent could be attained without the production of contaminants. Passivation of the char appears to be a potential problem, and higher temperatures are required to achieve a high conversion of sulphur dioxide with char that has been partly utilized.

At temperatures up to 850°C, the reaction appears to be of zero order, with the rate controlled by chemical reaction.

● Report M349

The optimization of a process using weak-base resin for the recovery of gold from plant solutions and pulps, by A. Mehmet. Apr. 1988. 17 pp.

Laboratory testwork was carried out to provide additional information for a detailed cost-evaluation of a process using weak-base resin for the recovery of gold from pregnant solutions or pulps. The development of an eluant which, unlike sodium hydroxide solution, would achieve the satisfactory elution of silver, zinc, lead, and nickel, was also investigated.

The results show that a commercial weak-base resin maintains a satisfactory performance for at least 45 cycles of adsorption, elution (with sodium hydroxide), and regeneration (with sulphuric acid). This is equivalent to a period of 2 years' service in a production plant.

The results of the elution and regeneration tests indicate that the optimum consumption of reagents would be approximately 90 g of sodium hydroxide and 75,0 g of sulphuric acid per litre of resin.

It was established that silver, zinc, lead, and nickel can be satisfactorily eluted by the addition of free cyanide ions (added as sodium cyanide) to the caustic solution. Although the high consumption of cyanide (presumably due to its decomposition at the anodes of the gold electrowinning cell) makes this process far more expensive than caustic elution, the use of an eluant containing sodium hydroxide and cyanide may be justified in some circumstances, e.g. when the continuous elution of silver is required.

● Report M353

The determination, by ion-interaction chromatography, of sulphur species in cyanide solutions, by C. Pohlandt-Watson, M.J. Hemmings, D.E. Barnes, and G.W. Pansi. Jun. 1988. 7 pp.

This report describes a method for the determination of thiosulphate, thiocyanate, and tetrathionate in solu-

tions and effluents resulting from the cyanidation of gold. The procedure makes use of reverse-phase ion-interaction chromatography, an acetonitrile mobile phase containing tetrabutyl ammonium hydroxide being used as the pairing reagent. The sulphur species are separated from the copper cyanide complex, which can be determined simultaneously, and their concentrations are measured by means of an ultraviolet (UV) detector at 240 nm. Owing to the degree of separation, interference from other metal cyanide complexes is avoided.

The method is accurate and precise, with a relative standard deviation of 0,025 for thiosulphate (3 mg/l), 0,003 for thiocyanate (10 mg/l), and 0,045 for tetrathionate (30 mg/l). Sulphide, although detected by the proposed procedure, cannot be determined quantitatively because it is eluted close to the solvent front, and is therefore subject to interference.

● Report M355

A laboratory-scale continuous-feed resistance furnace, by K.P.D. Perry, A.S.E. Kleyenstüber, and C.T. Logan. May 1988. 9 pp.

A laboratory-scale continuous-feed furnace was constructed and its performance was evaluated. Heating in this type of furnace is effected by a current passing through a continuously flowing mixture of carbon and ore in an inert atmosphere. Theoretically, temperatures in excess of 3000°C are attainable, but the available materials of construction limit the maximum temperature to 1800°C.

During a limited number of experiments, temperatures of the order of 1300°C were easily achieved but, at temperatures above 1300°C, rapid fluctuations in temperature due to poor control resulted in cracking of the refractory. However, this problem can be overcome by the use of a superior type of controller. It is suggested that a laboratory-scale continuous-feed furnace of this type can be developed into a useful tool for high-temperature metallurgical and mineralogical studies.

● Report M357

The determination of minor and trace elements in activated charcoal, by B.T. Eddy and G.J. Wall. Jun. 1988. 14 pp.

A rapid method using X-ray-fluorescence spectroscopy for the direct analysis of charcoal samples obtained from the carbon-in-pulp process has been developed. The specimens were prepared for analysis from samples of dried charcoal mixed with a diluent containing cerium, which acts as a heavy absorber.

The mass-absorption coefficients of the specimens were calculated to show that the absorption effects occurring in the analysis of these samples are too small to account for the deviations in the results obtained. By and large,

the method is acceptable for purposes of plant control, but not for the accurate analysis of charcoal samples, which requires ashing, followed by complete dissolution, of the sample.

● Report M358

The sensitive determination of germanium by atomic-absorption spectrophotometry using electrothermal atomization, by G.D. Marshall. Jun. 1988. 11 pp.

Experimental work leading to the development of a method for the determination of low levels of germanium in zinc slag and related compounds is described. The sample is dissolved in a mixture of mineral acids, and the germanium is extracted from 9 M hydrochloric acid into carbon tetrachloride, and then back-extracted into water. The germanium is determined in this solution, after acidification with a dilute solution of nitric acid, by atomic-absorption spectrophotometry using electrothermal atomization (ETA-AAS).

The relative standard deviation, s_r , for the measurement step was 0,039 at a germanium concentration of 10 µg/l. The working range was 4 to 50 µg/l.

● Report M92D

The recovery of tin and tungsten from various zones of the Van Roois Vley deposit, including settling and filtration, by C.F.B. Coetzee. First issued Apr. 1983; reissued Apr. 1988. 40 pp.

Eight samples of tin-tungsten concentrates from various zones of the Van Roois Vley deposit were tested, by what was then regarded as a standard leach, in 10 M hydrochloric acid at 95°C under atmospheric pressure for 4 hours. The samples were milled to smaller than 106 µm before being leached.

Some of these samples were of a more refractory nature than the others, and gave poor recoveries of tungsten (one as low as 34 per cent). However, when the samples were milled to finer than 38 µm, all except sample VRC-2 gave optimum recoveries. An extended leach of up to 10 hours brought the recovery from VRC-2 to 99,9 per cent.

Larger composite samples (of 1,5 kg each) were leached under a pressure of 200 to 300 kPa at 120°C for 5 hours. The object was to produce some design parameters with regard to leaching, settling, filtration, and precipitation of synthetic scheelite.

Leaching yielded extractions of 99 per cent. Leaching under pressure caused dissolution of the calcium fluoride impurity in the concentrate and severe attack of the glass lining of the leaching vessel by the hydrofluoric acid thus formed.

The overall recovery of tungsten as calcium tungstate was 98,6 per cent at a grade of 94 to 97 per cent calcium tungstate, with impurity levels well below the limits set by industry.

World Environment Day Symposium*

Mintek auditorium in Randburg was the venue on Thursday, 2nd June, 1988, for more than 200 interested delegates at the annual World Environment Day Symposium, organized jointly by the Federation of Societies of Professional Engineers (FSPE), The Environmental Planning Professions Inter-disciplinary Committee (EPPIC), The Habitat Council, and The Associated Scientific and Technical Societies of South Africa (AS&TS). The theme 'Cultural and Historical Conservation' was adapted from the theme of the Department of Environment Affairs for the 1988 Environment Week.

The opening speaker, the well-known archaeologist, Professor Revel Mason, drew attention to the appalling lack of interest by the average South African in the preservation of our archaeological sites, which are frequently vandalized after excavation. He outlined efforts that were being made to promote this neglected subject, and illustrated his lecture with encouraging pictures of groups of young people from all sections of the community who were tackling the problem with youthful enthusiasm.

Architect Professor Dennis Radford of the University of the Witwatersrand illustrated the concept of rehabilitation of several important historical buildings with excellent slides. He listed various factors that give rise to consideration of rehabilitation, not only of single buildings but of whole ranges or groups of buildings; not only aesthetically beautiful buildings, but even simple homes from the early days of Johannesburg. He stressed the need for compatibility of the new use with the major existing qualities of the building, and cited the old market complex in Johannesburg in this context. He also cited bad or unsuccessful attempts at rehabilitation and stressed the social importance, in terms of the well-being of people, of the retention of a known environment.

Derek Stedall, an architect who has been involved in the conversion of the old power station at Mossel Bay into an information centre for Mossgas, was the next speaker. He pointed out that the traditionally quiet town of Mossel Bay is in the process of dramatic change, which could have disastrous effects on the environment and the

existing socio-economic structure if not properly controlled. He illustrated how historical buildings worthy of consideration for recycling and for conversion could be identified and stressed the need for the structure plan to incorporate the cultural historical conservation ethos into the scheme.

Consulting Engineer Rob Pullen illustrated the international nature of our water resources, showing that the cultural and historical environment is no respecter of political boundaries and that man's cultural and historical activities have had and continue to have major effects on riverine ecology. He stressed the need for a multi-disciplinary approach to the management of the country's water resources.

Ben Alberts, Senior General Manager, Mining, of Iscor, referred to the need for good management of mining activities, not only to prevent air, water, noise, and visual pollution, but to prevent irreparable damage to our natural, archaeological, and cultural-historical heritage. Iscor approaches the problem in its totality, and ensures that relevant departments or sections are fully informed of the Corporation's aims, strategies, guidelines, and standards to promote environmental conservation. He referred specifically to the work done to preserve the crystal cave at the Thabazimbi Mine, the archaeological evidence at the Sishen Mine, and historical graves at the Hlobane Mine.

At this function EPPIC introduced its Award Scheme, which is designed to promote the concept of integrated Environmental Management. The National Premium Award was won by the Palmiet Pumped Storage Scheme. The Best Paper Award was won by Mr Ron Couling for his paper entitled 'Protection and Reinstatement of the Environment at Matimba Power Station' (*The Civil Engineer in South Africa*, July 1987). The National Student Award for 1987 was won by Martin Harvey for his dissertation entitled 'Affecting people/nature relationships through interpretive publications'.

Before the Symposium, delegates had the opportunity to view topical exhibits ranging from Iscor's presentation of prehistoric sites and artifacts to the 'Keep Johannesburg Beautiful' exhibit with the well-known Zibi. An excellent finger supper followed the Symposium.

* Released by The Federation of Societies of Professional Engineers (FSPE), P.O. Box 61019, Marshalltown, 2107 Transvaal.