empty bags should be permitted),
9. checking on and reporting wear and tear,
10. Indicating the time for change-over to fresh jackets,
11. cleaning the freezer,
12. locking up all facilities, and
13. reporting any breakdowns to miner and shift boss.

The microclimate suits should be issued at a site as close as possible to the working area. Men should not be required to walk long distances in order to change jackets. This can be accomplished by siting the freezing unit as near to the stope as possible or by transporting ice-jackets in *insulated* containers to the point of use. Only fully frozen jackets should be issued because those with unfrozen pockets have a low efficiency and are potentially dangerous.

As stated previously, a thick woollen or cotton vest should be worn underneath the ice-jacket in order to avoid skin damage. For reasons of comfort, additional clothing could be worn under the ice-jacket. The straps of the ice-jacket should be fastened tightly with a non-slip knot in order to bring the ice pocket into close contact with the surface of the skin. The over-jacket should be fastened similarly and the lamp belt worn around the skirt of the overjacket. If correctly fastened up, the ice-jacket will last for about 2,5 hours, even at an environmental wet-bulb temperature of 35,6 °C. If a six-hour shift is worked, the last hour can be completed easily without any need for microclimate protection. The wearing of a jacket in which the ice has melted is not only uncomfortable but could cause hyperpyrexia by interfering with natural heat-loss mechanisms. No jacket at all is better than a jacket in which the ice has melted.

ACKNOWLEDGMENT

The assistance and advice given by Dr Austin Whillier, of the Mining Research Laboratory of the Chamber of Mines of South Africa, in the development of the microclimate suit is highly appreciated.

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Book review

HOEK, E., and BRAY, J. *Rock slope engineering*. London, The Institution of Mining and Metallurgy, 1974. £5.

The last decade or so has seen a tremendous upsurge in publications relating to the stability of artificial and natural slopes in rock and soils. The publications on new developments appear in a wide variety of media: articles in technical journals (geology, civil, and mining engineering), proceedings of symposia and conferences, university theses and dissertations, translations, etc. A newcomer to the subject, or someone who has not followed the developments in detail, would find it extremely difficult to trace his way through this thick forest of literature without guidance.

The book by Professor Hoek and Dr Bray is, of course, by no means just a literature review; it is a fundamental up-to-date textbook on the subject of rock slope stability. In the development of the subject, the authors bring the reader to the level of the state-of-the-art and at the same time point out with ample literature references the direction of further or future developments that have not yet reached the level of practicality.

The authors are in an excellent position to follow the latest developments in the field by reason of being at the very core of the research activity carried out at Imperial College of Science and Technology (University of London), and being directly connected with the Rock Mechanics Information Service.

In addition to the academic aspect of research, the first author, in particular, has had wide-ranging practical consulting experience in rock slope problems. The best test-bed for newly developed results is, of course, the field. Thus, it can be expected that the methods presented in the book have stood the test of actual field application.

After making a case for the investigation of planning stability on the basis of economics (Chapter 1), the basic mechanics of slope failure is discussed (Chapter 2). The next two chapters are devoted to the presentation and collection of geological data. Chapter 5 deals with the shear strength determination of rock discontinuities and discusses the role of friction and cohesion in slope design. The importance of the influence of groundwater flow and pressure, and the method for the measurement of permeability and water pressure, form the subject of Chapter 6. In the following three chapters (7 to 9), the three main types of slope failure (i.e., plane, wedge, and circular failure) are presented in detail, each amply illustrated with examples drawn from practical situations. The concluding chapter covers some miscellaneous topics, including drainage of slopes, control of rock falls, and monitoring and interpretation of slope displacements.

The book is well presented, numerous sketches and line drawings helping in the understanding and elucidation of the subject material. In addition, a large number of design curves and charts are given that should give an easy initial assessment of the problems that may arise in a practical situation.

The method of production has certainly helped to keep the price of the book at a very acceptable figure, but a slightly larger typeface would have been preferable. The difference in typeface for the titles of sections

and the italization certainly make the book more readable, except when a different typeface is used for, apparently, corrections in the text.

The authors state that the book is intended to serve the non-specialist engineer who, after studying his problem by means of the techniques introduced in the book, will be in a position to appreciate whether a geotechnical specialist ought to be called in for a more detailed study and investigation. In such a case he will be able to communicate his requirements to the specialist and so obtain an economical and practical solution.

This book will be warmly welcomed by practising mining and civil engineers, geologists, and rock mechanic specialists, as well as by those who are concerned with the teaching of rock mechanics. The Institution of Mining and Metallurgy is to be congratulated for having put its prestige and resources behind such an excellent publication.

K.I.O.

NIM reports

The following reports are available free of charge from the National Institute for Metallurgy, Private Bag 7, Auckland Park 2006.

Report no. 1625

The determination of uranium and thorium by the use of delayed neutrons.

The analytical method developed is based on the detection of the delayed neutrons emitted by some fission products. Limitations in the irradiation facilities at present available result in a limit of detection of 5 p.p.m. of uranium and 3000 p.p.m. of thorium in a 50 mg sample. Two hundred determinations per day can be made, and modifications are suggested to improve this figure.

Report no. 1626

Formation constants of zinc chloro-complexes in perchlorate medium.

The dearth of thermodynamic data describing the properties of complexes in aqueous solution for the conditions obtaining in hydrometallurgical processes led to the determination of the stability constants appropriate to these conditions.

The stability constants of zinc chlorocomplexes at temperatures of up to 60 °C and at high ionic strengths were determined by potentiometric measurements of the concentrations of free ions of both zinc and chloride species. Techniques for the preparation and use of the zinc-amalgam electrode to monitor the zinc concentration are described.

The stability constants for $ZnCl_n^{2-n}$, where $n=1$ to 4, were elucidated by graphical methods and by a computer programme employing non-linear search techniques. There was no evidence of polynuclear complexes.

The constants for the higher complexes increase sharply with increasing ionic strength, especially at 60 °C. The relevance of the new data to hydrometallurgical processes is discussed.

Report no. 1629

The thermodynamics of the formation of complexes of silver with some substituted pyridines.

The changes in free energy, enthalpy, and entropy for the reactions involved in the formation of complexes between the silver ion and various substituted pyridines in aqueous solution were measured by titration calorimetry.

The results show the enthalpy contribution to the free-energy change to be favourable and to become more favourable with increasing basicity of the ligand. This is similar to the situation encountered in the corresponding protonation reactions of the ligand. The entropy contribution, on the other hand, is unfavourable and becomes increasingly unfavourable with increasing basicity of the ligand, in contrast to the situation with the proton.

This behaviour can be rationalized in terms of the size of the ligand molecules and desolvation of the metal ion on complex formation.

Report no. 1630

An electrochemical investigation of the dissolution of copper, nickel, and copper-nickel alloys in ammonium carbonate solutions.

The dissolution of copper and nickel in ammonium carbonate solution was studied by techniques involving electrochemical anodic dissolution and ring-disc electrodes. The rate of oxidation of both copper and nickel by copper (II) was shown to be controlled by diffusion to the surface. Variations in rate with changes in copper (II) concentration, agitation, pH, ammonia concentration, temperature, and copper (I) concentration were investigated and rationalized in terms of their effects on the electrochemical half-reactions involved. Evidence was found for the passivation of nickel and nickel-copper alloys of more than 50 per cent nickel.

Report no. 1640

A semi-automatic titrimeter for cyanide analyses.

The titrimeter developed for the determination of the cyanide concentration in the filtrate from gold ore pulps is described. The system comprises a simple detecting electrode and an electronic endpoint sensor, which stops the flow of titrant once the endpoint has been reached. The use of this titrimeter will improve the consistency of results from routine titrations, and will enable an unskilled operator to achieve the same accuracy as that of an experienced analyst.

Report no. 1644

Prospects for the recovery of minerals from the sea.

The possibility of the recovery of manganese nodules from the ocean floor is assessed, special consideration being given to the distribution, properties, and contents of the nodules; to processes for the mining and extraction of metals from the nodules; to the costs of recovery and the potential effects of nodule mining on metal prices; to legal and political factors; and to effects on the ocean environment. Marine minerals other than manganese nodules are discussed, and specific mention is made

of those most likely to be of importance to South Africa.

The available information leads to the conclusion that ocean manganese nodules are likely to be mined by about 1978. The price of ferromanganese and manganese ores is not likely to be affected before 1990, but that of cobalt, and possibly also of manganese metal, will be sensitive to nodule mining. One of the main factors delaying the implementation of ocean mining is the lack of definition of legal rights to resources in the deep ocean.

1974 A.S. & T.S. National Award

Professor D. C. Midgley, President of the Associated Scientific and Technical Societies of South Africa, today announced the winner of the 1974 A.S. & T.S. National Award. This award, which takes the form of a gold medal, is given in recognition of outstanding contribution to science or the application of science.

This year's award has been given to the SAPPI Research and Development team, under the original leadership of the late L. A. Job and subsequently that of C. J. Myburgh, for its contribution to the technical development of the SAPOXAL oxygen bleaching process. The SAPOXAL process and plant were developed by an international group of research teams from SAPPI, L'Air Liquide (France), and Kamyr (Sweden) under the joint direction of the participating companies. It is now in full-scale operation in South Africa, France, and Sweden. The technology has been made available to Russia, and further licences should shortly be concluded in the U.S.A. and Japan.

The achievements of this team were summarized as follows:

(1) they made a significant contribution to the science and technology of bleached paper-pulp manufacture;

(2) they made a major contribution to the reduction of pollution associated with the pulp-bleaching process;

(3) they demonstrated the ability of the South African pulp and paper industry to play a leading part in an international research and development programme; and

(4) they pioneered the establishment of a full-scale industrial plant using the newly developed technology with commercial success.

Professor Midgley referred to some of the previous National Awards that were given to the Groote Schuur Hospital Heart Transplant Team, The West Driefontein Team that saved the mine in 1968, and recently the Vaccine Research and Production Team of the Veterinary Research Institute at Onderstepoort. The Associated Scientific and Technical Societies' National Award is recognized as one of the most significant awards of its kind in the Republic.

1974 G.W. en T.V. Nasionale Toekenning

Professor D. C. Midgley, President van die Geassosieerde Wetenskaplike en Tegniese Verenigings van Suid-Afrika het vandag die wenner van die 1974 G.W. & T.V. Nasionale Toekenning aangekondig. Hierdie toekenning, in die vorm van 'n goue medalje, word uit erkentlikheid vir voortreflike bydrae tot die natuurwetenskap of die toepassing daarvan gedoen.

Vanjaar se toekenning gaan aan die SAPPI Navorsing- en ontwikkelingspan onder die aanvanklike leiding van wyle L. A. Job, en later mnr. C. J. Myburgh, vir hulle bydrae tot die tegniese ontwikkeling van die SAPOXAL suurstofbleikproses. Die SAPOXAL -proses en -aanleg is deur 'n internasionale groep navorsingspanne van SAPPI, L'Air Liquide (Frankryk) en Kamyr (Swede) onder die gesamentlike bestuur van die deelnemende maatskappye ontwikkel. Dit is nou ten volle in werking in Suid-Afrika, Frankryk en Swede. Die tegnologie is aan Rusland beskikbaar gestel en die toekenning van lisensies aan die V.S.A. en Japan sal binnekort afgehandel word.

Die prestasies van hierdie span is soos volg saamgevat:

(1) hulle het 'n betekenisvolle bydrae tot die wetenskap en tegnologie van pulpvervaardiging gelewer;

(2) hulle het 'n groot bydrae tot die vermindering van die besoedeling wat met die pulpbleikproses geassosieer word, gelewer;

(3) hulle het die vermoë van die Suid-Afrikaanse pulp- en papiernywerheid om 'n vername rol in 'n internasionale navorsings- en ontwikkelingsprogam te speel, bewys; en

(4) hulle het die weg berei vir die instelling van 'n nywerheidsaanleg van volle omvang wat met kommersiële welslae van die nuutontwikkelde tegnologie gebruik maak.

Professor Midgley het verwys na sommige van die vorige Nasionale Toekennings aan die Hartoorplantingspan van die Groote Schuur-hospitaal, Die Wes Driefonteinspan wat in 1968 die myn gered het en die onlangse Entstofnavorsing en -produksiespan van die Navorsingsinstituut vir Veeaartsenykunde op Onderstepoort.

Die Geassosieerde Wetenskap en Tegniese Verenigings se Nasionale Toekenning word erken as een van die betekenisvolste toekennings van sy soort in die Republiek.

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