

express my gratitude to them. Although it will be obvious to you, I nevertheless want to admit having drawn freely on the ideas (sometimes written, sometimes expressed only verbally) of my immediate colleagues and friends in the team. While I have been unable to

acknowledge their contributions at the appropriate point, often because it is no longer clear who originated a particular idea, I wish to thank them all for the unselfish part they played in the work on which this address was based.

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## O.F.S. Branch

### Proceedings of the Annual General Meeting Held on Wednesday, 4th August, 1976

Mr G. J. C. Young (Chairman) was in the Chair. Also present was Dr R. E. Robinson, President of the South African Institute of Mining and Metallurgy.

*Four Fellows:* Messrs G. L. H. Diering, Z. J. Lombard (Committee Member), A. N. Shand (Vice-Chairman), D. A. Smith (Committee Member).

*Nine Members:* Messrs D. V. Baum, B. J. Drysdale (Committee Member), E. J. Dominy (Committee Member), A. H. Edwards, H. M. W. Eschenburg (Committee Member), R. W. Impey, F. W. Kleinschmidt, R. A. McCallum, L. C. Mather, R. G. B. Skirving.

*Six Associates:* Messrs W. F. de Lange, A. J. Johansen, P. Kraus, D. R. Lings, J. Scott, L. Vorster.

*Eight Graduates:* Messrs A. R. Godfrey, D. A. Holtum, A. P. S. Howard, A. M. Jones, A. N. Morris, D. J. Payne, S. P. Pienaar, G. S. Worthington.

*Two Students:* Messrs D. W. Butcher, D. B. Wait.

*Six Visitors.*

Numerous lady guests were also present.

Apologies for non-attendance were received from numerous members.

The Chairman declared the meeting open and extended a special welcome to Dr R. E. Robinson, President of Council, and Mrs Robinson, who had flown down from Johannesburg to be present.

### Minutes of Previous General Meeting

The Minutes of the General Meeting held on 2nd June, 1976, were taken as read, and their adoption, proposed by Mr A. N. Shand and seconded by Mr B. J. Drysdale, was carried.

### Matters Arising from the Minutes

There were no matters arising from the Minutes.

### Chairman's Annual Report for 1975/1976

The Chairman presented his Annual Report, which is included in the Annual Report and Accounts of the Institute on page 52.

### Declaration of Office Bearers and Committee Members for the Year 1976/1977

The Chairman announced that, in terms of the Constitution, the outgoing Committee had elected the following Office Bearers for the ensuing year:

Chairman: Mr A. N. Shand

Immediate Past Chairman: Mr G. J. C. Young.

Because so many Committee Members had been absent through illness from the last Committee Meeting, it had been decided that the election of a Vice-Chairman would be held over to the first Committee Meeting of the next season.

With regard to the incoming Committee, the number of nominees just equalled the vacancies on the Committee. Thus, no election was necessary, and the following members will serve on the Committee during the coming year: Messrs E. J. Dominy, B. J. Drysdale, H. M. W. Eschenburg, E. C. Hunter, Z. J. Lombard, D. A. Smith, and P. S. Wentworth.

### Induction of Chairman

Mr G. J. C. Young introduced Mr A. N. Shand by briefly outlining his past career and achievements, and, in calling upon him to take the Chair, wished him a very successful year of office.

Mr Shand thanked the Committee for having honoured him with the Chair for the coming year, and thanked Mr Young for his kind introduction. He congratulated Mr Young on a very successful year of office, with some most interesting general meetings that had culminated in the successful visit to VECOR in May. He added that he had been very impressed with the complexity of the organization at VECOR and with the treatment given to the visitors by VECOR officials. All who had been fortunate enough to be present on this visit would agree that Mr Young's organization had been outstanding. Mr Shand finally expressed his congratulations to his Committee on their election and felt that, with their assistance, the coming session would be as successful as those of the past.

### Address by the President, Dr R. E. Robinson

The Chairman introduced Dr Robinson by outlining his career and achievements, which had been many. After obtaining his Ph.D., Dr Robinson joined the Central Metallurgical Laboratory of Anglo American as head of the Chemical Engineering Section and, while still there, was seconded to the Atomic Energy Board, and to the Government Metallurgical Laboratory as its Director. He was intimately connected with the development of processes for the recovery and refining of uranium in South Africa, and was also the major influence in the building up of the old Government Metallurgical Laboratory to the status that the National Institute for Metallurgy (NIM) now holds as one of the foremost metallurgical research institutes in the world. In 1972 he became Director General of NIM.

Among his achievements has been the award of Honorary Professor of Chemical Metallurgy by his *alma mater* in 1969, and his appointment as a member of the Scientific Advisory Council to the Prime Minister.

The President commenced his address by saying how pleased he was to have the opportunity of visiting one of the local branches and meeting the members. He added that there was to be a change of policy regarding meetings of the Institute. While it was still necessary to provide a scientific forum for the presentation of technical papers, the social aspect of the meetings would be developed more fully.

The President went on to give a most interesting talk on research trends in extractive metallurgy. After the last war, when research activity had been at a peak, the attitude towards research was that any research was worth doing. Naturally, only the largest companies could support large research organizations, and the Government became responsible for the majority of research programmes. Even today about 75 per cent of all scientists are employed by the Government—a situation that has some advantages and some disadvantages.

After the initial period, when much research had been carried out without a real sense of direction, the thinking on research changed, and now, before the commencement of a project, a serious look is taken into what would be achieved by research in that field. Nowadays, industry pays 20 per cent of the cost of research, and there is a necessity to convince industry that research will be worth while. This is having a remarkable effect on the outlook of researchers.

Dr Robinson then enlarged on some of the exciting developments in mineral discovery in the north-western Cape, and the problems in extraction that would have to be overcome by research. Further east, a study was being undertaken to rationalize South Africa's requirements for coal, especially coal suitable for metallurgical use. Uranium had also become increasingly important with the development of a uranium-enrichment process, which increases the uranium value three times. However, should such a plant be built, it would require about twice the present annual production of uranium so that emphasis had to be placed on research into low-cost methods of uranium extraction.

Dr Robinson concluded by issuing an open invitation to all members to visit the NIM laboratories whenever they wished.

In proposing a vote of thanks to Dr Robinson, Mr E. J. Dominy said that Dr Robinson's reputation was matched by his ability to communicate his subject to lay people and generate enthusiasm. He felt that everybody present would agree that rarely had they listened to a more interesting speaker.

### Closure

Before declaring the meeting closed, the Chairman thanked Dr Robinson, and the members and visitors for their attendance.

Mr Drysdale thanked the hosts, Western Holdings Limited, for the hospitality accorded to the members on this occasion.

The meeting closed at 8.30 p.m., after which refreshments were served.

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## NIM reports

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

### Report no. 175

*Copper extraction by leaching magnetites from Palabora Mining Company.* (12th Apr., 1967; re-issued Jun. 1976)

It was found possible to reduce the copper content of the final magnetite concentrate to less than 0.03 per cent by leaching with solutions containing low concentrations of sulphuric acid and ferric ions. Samples derived from foskorite ore are not amenable to acid leaching, but can be leached with solutions containing sodium cyanide. A minimum addition of six pounds of sodium cyanide per ton would be required, but the value of the copper that could be recovered, as well as the possibility of recovering a large percentage of the cyanide addition, could make the process economically attractive.

### Report no. 1632

*A mineralogical examination of beach-sand concentrates from a pilot plant at Richards Bay.* (20th May, 1974; re-issued Jun. 1976.)

A series of beach-sand concentrates collected at various

points in the circuit of a pilot plant at Richards Bay were examined mineralogically.

Minerals identified in the concentrates include ilmenite, rutile, leucoxene, zircon, hematite, monazite, pyroxene, amphibole, garnet, goethite, staurolite, sillimanite, kyanite, tourmaline, quartz, and feldspar.

Excessive amounts of silica (detected by analysis) in the rutile final product were found to occur both as free grains of quartz and as composite leucoxene-quartz grains.

The presence of free rutile grains was found to account for the occurrence of undesirably large quantities of TiO<sub>2</sub> in the zircon final product. Some 70 per cent of the iron present in the same sample forms coatings preserved in concave hollows on the surface of the zircon grains, and can be removed by acid leaching.

Examination of ilmenite concentrates produced by the plant shows chromium to be present for the most part as free chromite grains and composite chromite-magnetite grains. An electron-microprobe analysis of fifty ilmenite grains suggests that this mineral has a chromium content of about 0.03 per cent. Careful magnetic separations produced ilmenite concentrates

with chromium contents of about 0,06 per cent.

In addition, ilmenite concentrates prepared from samples collected from six boreholes drilled at intervals across the Richards Bay beach-sand deposit were examined mineralogically. These concentrates show only small variations in mineralogy, chromium content, and distribution of chromium between fractions of different magnetic susceptibility.

#### Report no. 1825

*The full automation of a Philips 1220 X-ray spectrometer.*

A Philips 1220 X-ray spectrometer (semi-automatic) was fully automated by the addition of a custom-built automatic sample-loader constructed at the National Institute for Metallurgy and a Texas 980A mini-computer. The mini-computer was interfaced to the existing control circuits of the X-ray spectrometer through a custom-built logic-circuit unit that controls the automatic sample-loader and X-ray spectrometer on instructions received from the mini-computer. The controlling software is written in BASIC.

#### Report no. 1840

*The spectrophotometric determination of total uranium in silicate ores and leach liquors by use of bromo-PADAP.*

An extractive-spectrophotometric method using tri-octylphosphine oxide (TOPO) and 2-(5-bromo-2-pyridylazo)-5-diethylaminophenol (bromo-PADAP) for the determination of total uranium in silicate materials and aqueous solutions is described. The method is adapted from a published procedure and has a coefficient of variation of 5,7 per cent at 30 p.p.m. of  $U_3O_8$ . Zirconium in amounts up to 10 mg does not interfere, and up to 20 mg of most other cations can be tolerated when 100  $\mu$ g of uranium are determined. The limit of determination is 4 p.p.m. of  $U_3O_8$  in solids and 0,2 p.p.m. in solutions.

This method replaces that using PADAP as the chromogenic reagent.

#### Report no. 1841

*The determination of acid-soluble uranium in silicate ores and solutions.*

A method is described for the determination of acid-soluble uranium in silicate ores and uranium in leach liquors, 2-(5-bromo-2-pyridylazo)-5-diethylaminophenol (bromo-PADAP) being used to produce an absorbing complex with uranium. Bromo-PADAP is used instead of PADAP, which was used in a previous method developed at the National Institute for Metallurgy, because it is more sensitive, has a greater tolerance to iron, and is easier to prepare in a pure state.

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## AS & TS National Award

The Associated Scientific and Technical Societies of South Africa has decided to make two National Awards this year. These awards, given in recognition of outstanding contributions to science and the application of science, will be made to Dr T. L. Wadley for his invention of the Tellurometer system of distance measurement and to Mr H. Scheffel for his design of the High Stability Bogie. The awards, in the form of gold medals, will be presented at the Annual General Meeting of AS & TS to be held in Kelvin House, Johannesburg, on Wednesday, 24th November, 1976.

At the time of his invention, Dr Wadley was employed by the National Institute for Telecommunications Research, of the C S I R. He has since 'retired' to the South Coast of Natal but is still actively promoting a number of special projects.

Mr Scheffel is employed in the Chief Mechanical Engineer's Department of the S.A.R.&H. and lives in Pretoria.

These two inventions are similar in that the personal contribution of the inventor was quite indispensable. Both were obviously given strong technical support, but the contribution to knowledge in each case came virtually entirely from the inventor. Both inventions were made in a field of application where the need for improvement, or indeed a breakthrough, had long been recognized and much effort had been devoted throughout the world without conspicuous success. Both inventions were quickly acclaimed by the engineering field concerned and put to practical use. The one major difference

in principle is that, whereas the invention of the Tellurometer was made some twenty years ago and has stood the test of time, being still unrivalled in its particular field, the invention of the High Stability Bogie is recent and is only now in the process of being put into use on a considerable scale.

To be more specific, Dr Wadley's invention achieved, and in some case surpassed, all the design objectives and was eagerly taken up by surveyors all over the world. Within a few years, it had brought about radical changes in survey methods. In countries where precise geodetic control did not exist, the ability to measure distance directly was of particular value in that it made possible the establishment in a few months of geodetic control over vast areas in terms of long traverses, which would have required many years by conventional triangulation and reference to a standard baseline. In countries with well-established geodetic control, the Tellurometer made it possible to determine scale errors that had arisen from triangulation measurements remote from accurate baselines. Such networks could now be re-computed with greatly improved accuracy.

After the initial and sensational impact of the Tellurometer, it became generally accepted as an indispensable tool for many survey purposes. The South African firm producing Tellurometer systems has maintained its position as the principal suppliers of this type of equipment.

The main features of the High Stability Bogie are its excellent curving ability and hunting stability, offering,

among other practical advantages, sensational reduction of wheel wear and the use of very much higher axle loads under certain conditions of operation. On an ore train running between Postmasburg and Port Elizabeth, wheels on the Scheffel bogie showed no measureable wear after 100 000 km, while the wheels on conventional bogies had to be re-machined after less than 50 000 km in service.

The prototype bogie for goods vehicles was extensively tested on the S.A.R., and the conversion of the S.A.R.'s fleet of approximately 3000 ore wagons will commence in September 1976. All new goods trucks to be acquired by the S.A.R. from April 1977 will be equipped with this type of bogie. Iscor's fleet of 1750 ore wagons to be used on the Sishen-Saldanha line will all be so equipped.

The development and testing of this invention received

extensive coverage in the international technical press. One American company has fully completed its test programme and is seeking a licence to manufacture. The design was preceded by a mathematical investigation and the development of a mathematical model. The required design parameters were then established by computer analysis of various configurations.

A passenger coach has been fitted with experimental bogies employing the High Stability suspension principles. The testing of this vehicle on 1065 m of single track at speeds considerably higher than hitherto considered possible is being contemplated. The principle has also successfully been applied experimentally to two-axle vehicles, which in the past were particularly prone to derailment.

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## Treatment of waste water

A major international symposium, organized jointly by the Water and Environment Group of the Society of Chemical Industry and the Environment Group of The Chemical Society of London, will be held in London in 1977. The event will be held over three days, papers being presented during 6th to 8th September, and will be held in the new Lecture Theatre of the Society of Chemical Industry, 14 Belgrave Square, London, which is equipped with all modern facilities. The subject of the symposium, is 'New Processes of Waste Water Treatment and Recovery'.

Original papers are invited for presentation to this meeting. It is emphasized that reviews will not be acceptable, since the orientation is entirely towards original research and development. Authors are reminded that the highest quality of papers will be expected, and that final acceptance will be subject to the reports of independent referees.

Notification of intention to submit papers along with provisional titles and 300-word abstracts will be required before 31st December, 1976, for initial referee examination, and the full papers will be required, following

provisional acceptance, by 31st March, 1977. The language of the papers and of the symposium will be English (although interpreting facilities in Russian, Japanese, German, and French will be available as necessary).

No formal sub-divisions have been defined within the overall symposium theme, but typical areas of interest would be, for example, biological and physicochemical treatment of sewage and of industrial and mining wastewaters; methods for recovery and re-use of food values, chemicals (including metals), and water; the achievement of high quality discharges; analytical monitoring and automatic control of treatment and recovery processes; and contributions towards the technical solution of new and/or difficult problems in waste water treatment. While research on methodology will be apposite, fundamental examinations and exploratory studies will also be of particular relevance to the meeting. Technologies will not need to have been fully realized, but potential practicality must be evident.

Further information is obtainable from Dr D. H. Sharp, General Secretary, Society of Chemical Industry, 14 Belgrave Square, London SW1X 8PS, England.

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## Down-the-hole drilling

Atlas Copco announces the publication of a revised and enlarged version of one of the booklets in their series 'Mining and Construction Methods'. This 40-page booklet is entitled 'Down-the-hole drilling with COP drills'. Major sections are applications, preparations and drilling, procedures to prevent and deal with stuck equipment, assembly and handling of component parts such as bits and drill tubes, lubrication, and standard

drilling units. The booklet is generously illustrated and will be a practical, easily read guide to DTH techniques in the drilling of water wells, post holes, pilot or other large-diameter holes, above and underground. The booklet is available from the PR and Publicity Department, Delfos & Atlas Copco (Pty) Ltd, P.O. Box 504, Benoni 1500.