



Report on the technical sessions by the chairmen of the XV CMMI Congress

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The theme of the Congress was 'Resources and Technology', the intention being to highlight those basic technical aspects in the disciplines of geology, mining, extractive metallurgy, and metals technology that are required for successful mineral-based operations. The technical programme covered a fairly broad field, as is appropriate for the CMMI Congress, and was generally considered to be of a high professional standard; informative and, with the exception of some minor hitches, well-run. Parallel sessions were held in the four disciplines. All were well attended, and despite tight presentation schedules, certain valuable discussions developed.

Geology

The geological contributions were all from South Africa, with the majority of papers being presented by delegates from industry rather than from academic institutions. The international Geocongress planned in South Africa for 1995 clearly had an influence on the papers submitted. Two major areas were covered—commodities, which included mining case studies, and exploration techniques. Not surprisingly, about half of the papers dealt with the Witwatersrand goldfields.

The origin of gold was reviewed, along with current Witwatersrand basin models, exploration approaches, and techniques for defining the distribution pattern of the significant accumulations of gold. The current theory of origin is the erosion of unusually fertile granites, with the detritus so produced being re-worked in the Witwatersrand basin.

Of particular interest were a number of well-presented Witwatersrand case histories, including those of the Ventersdorp Contact Reef at Vaal Reefs No. 10 shaft, South Deep, Lindum Reefs, and the Sun Project. The tenacity of the exploration programme in the latter case aroused much attention. Papers on orebody modelling emphasized the importance of geological and mining input, and the need for accurate and meticulous data capture.

Potgietersrust Platinum, the Premier kimberlite pipe, and various coal, industrial-mineral, and base-metal operations were discussed.

Most of the sessions devoted to geophysics featured the use of the vibroseis technique in exploration. Just as magnetic and gravity methods were of fundamental importance in identifying the West Witwatersrand, Free State, and Evander Goldfields, so too is the vibroseis technique, introduced in South Africa in 1993, providing new insights. Case studies demonstrated the importance of the two-dimensional format in regional work and the three-dimensional format in detailed work. Detailed work has been carried out at South Deep, Western Deep Levels, Vaal Reefs, and Oryx. The method, which has the ability to locate faults of less than 10 m displacement, is destined to play an important role in the planning of deeper mining areas in the future. A number of other geophysical methods being developed to assist in predicting faults, dykes, and geological features include radio tomography, ground-penetrating radar, and in-seam seismics.

More generally, the ability to display huge volumes of digital data graphically has revolutionized geological processing and interpretation.

Mining

The mining technical sessions aimed to focus on mining methods and were largely successful in this regard. A number of papers were presented by delegates from Africa and overseas. The increasing number of papers from Africa being presented at major conferences in which the SAIMM is involved, is most welcome, as exchange of technical information must be a high priority to all those involved in the mining industry in Africa.

The Witwatersrand gold-mining industry was featured in many presentations. Topics included stoping methods with planned and achieved improvements, rock mechanics, mechanized mining in narrow tabular orebodies, operating initiatives in non-explosive mining, vacuuming of high-grade fine material, planning of underground operations, and new initiatives in ultra-deep hoisting. An outstanding presentation describing a rescue operation at Kloof mine following a shaft accident, created significant interest. Papers were presented by a range of the major gold producers, and also by important producers of platinum from narrow tabular orebodies in South Africa.

Report on technical sessions

Papers on opencast and massive mining techniques included the base-metal mines of Namibia and the North-Western Cape, copper mines in Zambia, manganese mines in Ghana, kimberlite diamond operations, and small-scale but profitable opencast mines on shallow Witwatersrand gold reefs.

The day allocated to coal-mining operations produced an excellent range of papers which highlighted the high degree of mechanization and sophisticated planning employed on these mines. Certainly, as gold mines move deeper, more of the disciplined planning employed on coal and base-metal operations may well be appropriate. In this regard, the broad range of mining topics discussed was most useful, even though there was less focus than in some of the more specialized conference sessions.

Papers on mining education by the staff of the University of the Witwatersrand, Witwatersrand Technikon, and the Royal School of Mines rounded off the mining session. Clearly, in the deeper and necessarily much more competitive operations of today and the future, a much higher number of qualified engineers are required in the mining management structure.

Extractive Metallurgy

The extractive metallurgy session focused on two sub-themes, cost control and beneficiation. The link between the disciplines of geology, mining, and extractive metallurgy is becoming increasingly important for optimal exploitation of scarce ore deposits. Certainly, the cooperation and interchange of ideas that took place at the CMMI Congress needs to be repeated at future mineral-based conferences. This discipline was fortunate in that it drew papers on a broad range of topics, and attracted some forty per cent of the presenters from outside South Africa.

Virtually all of the presentations featured the innovative technology and thinking that has developed in recent years to reduce unit costs and improve recoveries and product qualities. The topics addressed covered a broad area, ranging from crushing and milling technology to gold recovery by resin-in-pulp, heavy-medium separation, flotation, pressure leaching, bacterial oxidation, smelting, and comprehensive platinum-recovery processes. Cost control tended to be covered in general terms, due to the sensitivity of detailed cost information.

Mintek, as part of its sixtieth anniversary, jointly coordinated the second day's proceedings. A particularly interesting set of presentations started with an overview of the role of technology in the development of South Africa's mineral industry, and continued into minerals processing, beneficiation, and environmental aspects.

Attendance was good throughout the three days, and a great deal of interest was generated. A highlight was Professor R.E. Robinson's presentation on 'The economic evaluation of research projects'. This effective presentation, using computer-generated visuals, evoked widespread discussion.

Metals Technology

The papers on metals technology were selected for their contribution to the advancement and understanding of more efficient, safer, and less costly processes. The discipline covers a wide spectrum of metallurgy, sometimes overlapping the boundaries of extractive metallurgy and mechanical and electrical engineering.

Major emphases in the presentations were on mathematical modelling and simulation, physical metallurgy, corrosion, pyrometallurgy, new processes, and also environmental control highlighting the recycling of by-products. There was a reasonable level of foreign participation, and the audience, while limited in the case of various specialist topics, proved to be discerning, and in-depth discussions often followed the presentations.

Presentations of a general nature covered electroforming for industrial and jewellery applications, vanadium carbide as a replacement for tungsten carbide in hand-facing, and materials for aggressive conditions in a platinum refinery.

Mathematical modelling and simulation covered the carbothermic reduction of pelletized electric-arc-furnace dusts, mass and heat transfer in steelmaking oxygen converters, two-phase fluid flow in bottom-gas-stirred ladles, the thermal analysis of liquid pool, purification of zirconium metal, the Midrex DRI process, and shaft furnaces.

New processes such as Isasmelt, Cirofer, and Ausmelt raised considerable discussion.

The presentations on physical metallurgy, welding, and corrosion drew a specialist audience. Of particular interest were those on the thermomechanical treatment on low-carbon 11%Cr steel, the empirical model for tempering of HR3CR12 plate, and the toughness of welds in 12% Cr steels. Other presentations in this area covered PGM-modified stainless steel, copper as an austenizing addition to stainless steel, hot-dip galvanizing and abrasion-resistant steels, and the use of Gleeble simulation in steel processing.

The pyrometallurgy session, with its bias towards ferrochromium, again appealed to a specialist audience. The keynote address by Columbus Stainless, as well as Iscor's possible conversion of its Pretoria works to stainless-steel production, resulted in interesting discussions.

Presentations on the recycling of waste products were well received at a time when environmental legislation is becoming more stringent and the dumping of wastes more costly. Certainly, waste recycling need not lead to additional costs. Other presentations in this area featured the Technored process and the reduction of chromites; the latter paper contributed considerably to the understanding of this reduction process.

General Comments

This brief note does no more than touch on the range and highlights of the presentations. The collections of papers in the CMMI Proceedings, however, constitute an excellent and detailed coverage of a range of operating methods in the mineral industry. These volumes should provide good instructional and reference material for some years to come, thus fulfilling one of the important objectives of the Congress.

Safety and health, as well as responsible environmental attitudes, are of paramount importance in the mineral industry. The organizers believe strongly that good minerals engineering is one of the most important priorities in these areas, and that the Congress made a significant contribution to safety and health and to environmental management.

Sincere thanks go to all authors, presenters, organizers, and delegates who contributed to a most successful technical programme at the XV CMMI Congress. ♦