

## Conference Report

### Mineral Resource Evaluation 93

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*Report of a joint Mineral Deposit Studies Group and Geosciences Information Group meeting in association with the Institution of Mining and Metallurgy (Midlands Section), held on 6 and 7 April 1993 in the Geology Department at Leicester University. The meeting was organized by Michael K.G. Whateley and Peter K. Harvey.*

After the first Mineral Resource Evaluation meeting held in Cardiff in March 1991, it became clear that there was a large, interested group of geologists, engineers and financial experts who have a common interest in mineral resource evaluation. It appeared timely to repeat the conference; this second meeting therefore was convened to discuss methods in mineral resource evaluation and describe case histories. This successful international meeting brought together all those who are involved in the day to day exploration and evaluation of mineral deposits in addition to those who are responsible for their economic evaluation and for mine feasibility and design studies. The two-day meeting included 31 papers, six posters and commercial displays by nine companies. A Special Publication of the Geological Society will be published within about a year from the date of the meeting. The meeting attracted over 100 speakers and delegates from Ireland, the Netherlands, USA, Portugal, Germany, Malawi, Canada, Ghana, Sweden, Bulgaria, Belgium, England, Scotland and even Wales.

The theme of the conference was to discuss methods of mineral deposit evaluation, and to follow this with case histories from around the world. The conference started with a keynote address by **G. Riddler** (British Geological Survey) on the definition of mineral resource. This topic was continued in by two further papers by **M. Armitage**, **A. McCracken & M. Potts** (SRK Ltd), and **Z. Jakubiak & T. Smakowski** (Mackay and Schnellman) who explained the terms defined in various parts of the world. The latter authors had the advantage of being able to understand the languages used in the former Comecon countries and were able to pass on their knowledge to us. There was a call for a world standard to be adopted, but as **B. Scott** in his closing address asked, 'who would enforce the proposed world standard, the banks, or the UN?'

**S. Henley** (Datamine International) gave an interesting account of a joint European project to develop an industry standard for a new relational database call DEEP. This was followed by a series of six papers which all developed part of the theme of how to define the shape, grade or tonnage of an unknown deposit from limited exploration data. **J. Arthur** (University Wales, College Cardiff) described the application of geostatistical techniques to in-situ resource estimation in the sand and gravel industry. **T. Bell & M.K.G. Whateley** (CP Holdings and University of Leicester

respectively) gave a paper on the accuracy of numerous estimation techniques using the same simulated set of exploratory boreholes. Their results were compared to the ground truth derived from a dense pattern of blast holes. **W. Hatton** (British Coal Corporation) described a moving windows program developed to analyse spatial data and to help quantify the error of estimation spatially. **M. Scoble & A. Moss** (McGill University and Golder Associates, Vancouver respectively) described the problems of grade control in underground long-hole stoping, when geological uncertainty makes delineation of the mineral body difficult. **R. Cameron & H. Middlemis** (Water Management Consultants Ltd) gave a fascinating description of the need for accurately modelling the ground water table for an open pit gold mine in Nevada. The problem of defining shape was discussed in detail by **E. Sides** (ITC, Delft) in his paper on the accuracy of orebody shape using computer models. The final paper on this theme was delivered by **M. Brooker** for **P. Dowd** (University of Leeds) on the sensitivity of an open pit design to estimated block values.

The first days proceedings was completed with a set of three papers on various aspects of mineral resource estimation. **P. Gorman** (Mineral Resources Development Ltd) gave a most interesting review and evaluation of the costs of exploration, acquisition and development of copper and gold projects in Chile. **R. Allington & P. Carr** (Geoffrey Walton Practice) explained how evaluation, scheduling and quarry planning is important to maximize the life of cement making raw materials, and **A. Notholt** (Mineral Resource Consultant) gave us the benefit of his considerable wisdom with a discussion of some of the factors in economic and technical evaluation of phosphate rock. He pointed out that grade estimation is only one aspect of resource evaluation.

The theme of the second day's proceedings was that of case histories. **J. O'Leary & J. Forkes** (Montagu Mining Finance and RTZ Technical Services respectively) gave a fascinating insight into the development of Los Pelambres copper project in Chile. This was followed by a talk on the geostatistical estimation of manganese oxide resources at the Nsuta mine in Ghana, given by **S. Al Hassan** (University of Wales, College Cardiff). **B. Vidales**, **A. Jha & C. Bodsworth** (Brunel University) gave a talk on the removal of copper from molten steel by sulphide slags. **L. Crump & R. Donnelly** (ARC Central Ltd) explained how Clee Hill quarry has an extended life because of the exploitation of coal overlying the dolerite. **J. O'Leary** (Montagu Mining Finance) gave a second contribution when he discussed mining project finance and the assessment of ore reserves, from a merchant banking perspective. This was followed by a talk by **P. Nathanail** (Imperial College) who gave a thorough account of the steps required when completing a

tender for a coal extraction site. He summarized his talk by saying that each site must be treated as a unique entity, as a general approach may lead to inaccurate estimations. **P. Gribble** (Surpac Software Ltd) explained a computerized method which could be used to define more accurately the location of faults. The final talk of the morning was given by **W. Gwosdz & A. Mwafurwa** (German Geological Advisory Group and Malawi Geological Survey respectively) on the exploration for cement-grade limestones in Malawi.

The final session was started by **C. Mitchell** (BGS) who explained the laboratory evaluation of kaolin undertaken in Zambia. **J. Barry, J. Guard** (Crowe, Schaffalitzky & Associates) & **G. Walton** (Chevron Mineral Corporation of Ireland) gave two talks on a project associated with the Lisheen Zn-Pb-Ag deposit in Ireland. The first paper described the database management system that they developed for the project and they then described the various resource calculations undertaken on the deposit and explained the variability in the results. The Irish theme was continued in the talk by **R. Young** (Cambridge Mineral Consultants Ltd) who described the exploration and evaluation of the gold deposits in western Ireland. The final session of the conference was initiated by **D. Pelham** (Consultant) who went into the vexed question of evaluating vein gold deposits. **A. Annels, S. Ingram** (University of Wales, College Cardiff) & **L. Malmstrom** (Vieille-Montagne Sverige) gave an account of attempts to unravel (literally) the complex structure at Zinkgruvan mine in Sweden using palinspastic reconstructions, before attempting geostatistical

estimations. The final paper by **C. Wang & C. Moon** (University of Leicester) described the application of GIS (Geographical Information System) in geochemical data interpretation and mineral resource evaluation in south Devon.

One notable aspect of the meeting was the debate on the meaning of mineral resource definitions. A mineral resource is a means to an end not an end in itself. The aim is to develop a mine which will maximize the Net Present Value (NPV) for the present shareholders. It is therefore important to define resources sufficiently accurately to convince the banks to lend the necessary 75–80% of the money required for the capital expenditure to develop the mine. It would appear that the banks are the final arbiters and maybe it is they who should be telling the mining companies how they should be describing their resources. Perhaps the mining industry, through their various institutions, in conjunction with the financial organizations should set up an international commission to recommend a standard nomenclature with recognized definitions. As recommendations they would not be enforceable, but companies, Governmental organizations and individuals could then compare their preferred way of describing resources to the recommended nomenclature and at least sensible and meaningful comparisons could then be made.

The conference convenors are particularly grateful to those companies and organizations who provided support for the conference either directly or indirectly through their demonstrations of software, publications or services.