GEOSTATISTICAL ASSOCIATION OF AUSTRALASIA

**Newsletter 23 April-2005**

Contact Addresses: PO Box 1719, West Perth WA, 6872.

Http:// www.gaa.org.au

## INCOMING PRESIDENT'S ADDRESS

Dear Colleagues

As incoming president I wish to add my thanks to those of Roussos for the efforts of the outgoing committee and to Jennette for her tireless efforts on the newsletter. I also wish to thank Roussos himself - he has done a great job of being president and has raised the profile of the GAA. Thanks go as well to the team at the Bryant Research Centre for their considerable assistance over the last year.

In the year ahead I have several basic objectives in mind. These are;

- To complete the incorporation process.
- To assist with the newsletter as it will become the primary communication tool of the association due to the dispersed nature of the membership.
- To consolidate the membership and membership documentation.
- To maintain the momentum of the bursary process already initiated.

I welcome aboard the new committee and Peter, our new VP. I thank Selena for her efforts as stand in treasurer after her term as treasurer expired and Michael for taking on the role. I look forward to a productive year.

Roger Cooper
president@gaa.org.au

## OUTGOING PRESIDENT'S ADDRESS AT THE AGM

Dear Colleagues,

Welcome to the 2005 AGM of the GAA!

I would like to thank you for the opportunity of being the president of a growing and active GAA; a great and exciting year with activities and progress for our members and our profession.

Let me start with our international symposium "Orebody Modelling and Strategic Mine Planning: Uncertainty and Risk Management" organized in collaboration major mining institutes and associations, namely, AusIMM, SME, CIM, SAIMM. With 260 participants and support from most major mining companies our symposium discussed focussed on the forefront of developments in mining geostatistics. Themes

included the modelling of geological uncertainty, risk analysis and the critical flow and integration of these to down stream mining, and in particular strategic mine planning. Our Symposium generated an incredible interest and enthusiasm internationally, and was, I think, unanimously proclaimed an outstanding success (Please see write up in this issue).

I am happy to announce that we have established with funds from the Symposium a post-graduate and/or fourth year Honours scholarship for study in Geostatistics to be awarded to outstanding young individuals. AusIMM will administer the scholarship, and we would like to thank them for that. However, to move things forward in the future I would like to appeal on behalf of the GAA, to mining companies and consulting groups to consider funding the continuation of the GAA scholarship after 2006. I hope that one of our goals in 2005 will be to actively solicit industry support for this initiative. Yes, *our 'young ones' do need your support and active encouragement!*

The GAA is nearly incorporated and I believe that the effort of Roger Cooper and Stella Searston on this front have been successful. The item 'Constitution' on today's agenda is a clear indication that we are 'almost there'.

The GAA supported the Mining Geology day in Brisbane last October and Ian Lipton was our member on the organizing committee. Geostatistics was clearly present in a day that attracted nearly 100 people, including several GAA members.

To that extent where possible we have tried to foster international links, particularly with the International Association for Mathematical Geology. Dr F. Agterberg, the 2004 IAMG Distinguished Lecturer of IAMG visited Australia and gave lectures in Brisbane and Townsville. As we do move ahead to the future, we hope to improve our web page, which will enable us to provide a better link to IAMG journals, events, and perhaps a joint GAA-IAMG meeting These are all under consideration.

We now look forward to the next 12 months aware that the GAA should continue on its path of a systematic growth, activities and initiatives that will meet the needs of our community in the present as well as the years to come. The GAA's executive committee is, as I have learned first hand over the past year, a group of passionate volunteers and with this passion for our profession, anything is possible. I am not sure who of the Executive committee members I should thank first, so I will start by acknowledging our amazing Jennette Binns who does it all when it comes to high quality newsletters, and will follow with thanks to Roger Cooper and Stella Searston for their persistent follow up of the Constitution and the GAA's incorporation, Ute Muller and Mark Nope who are always there to look after anything needed, Arja Jewbali particularly for organizing us (mostly the President) as well as looking for post graduate student members and links, Ian Lipton and Mike Andrews for trying to be there when needed in between their consulting assignments, and John Warner for always looking after members lists, the web page, e-mails, memberships and the lot. Last, grateful thanks to Selina Brown for helping out during "the year without a treasurer". As Always, Associations like GAA do well due to the dedication, time and effort of people like the Committee and we thank you all for your efforts and contribution.

Last, let me say in the same words as a year ago:

As a university professor today in Australia and tomorrow in Canada, I believe and would like to further support activities that enhance education in our field and in its broader sense. I believe that we would all like to see the continuation of activities which the GAA has started, excellent initiatives, more information dissemination, and even more encouragement of the younger generations to join the profession.

Please join us in our efforts for a further creative, constructive and rewarding 12 months to come!

Thank you for your presence in the GAM. Thank you for your support of the GAA.

Roussos Dimitrakopoulos
roussos@uq.edu.au

## CONTENTS

Roussos and family are re-learning their winter vocabulary (i.e." sub-zero", "freezing", "blizzard", "snow"...) and are moving to Montreal. Roussos will take on the Canada Research Chair in "Sustainable Mineral Resource Development and Optimization under Uncertainty" and the BHP Billiton Chair in "Mine Planning Optimization" at McGill University.

Roussos redefined today BRC since undertaking its directorship in 1996. BRC is considered a leader in mining geostatistics and mine planning. He attributes his success to the support of the University and the Chairman of the BRC board since 1996, Prof Greenfield, and the remarkable good will, support and collaboration from most mining companies, including many colleagues working in the industry, and the collaboration with the AusIMM.

Roussos' new address:

Dept. of Mining, Metals and Materials Engineering
McGill University
ADAMS Building, 1st floor, Room 107
3450 University Street
Montreal, Quebec H3A 2A7
Canada

## CONSTITUTION OF THE GEOSTATISTICAL ASSOCIATION

The Constitution of the Geostatistical Association of Australasia was presented at the Annual General Meeting in March 2005. The full Constitution is attached at the end of this Newsletter for perusal.

## NEW JORC CODE

The New JORC Code has been launched. Attached at the end of the Newsletter is a brief outline prepared by Peter Stoker, a JORC Committee member, of the most important differences between the old code and the 2004 version. To view and download the new code plus read other information related to the code go to www.jorc.com.

# OREBODY MODELLING AND STRATEGIC MINE PLANNING: UNCERTAINTY AND RISK MANAGEMENT

## *AN OUTSTANDING SUCCESS!*

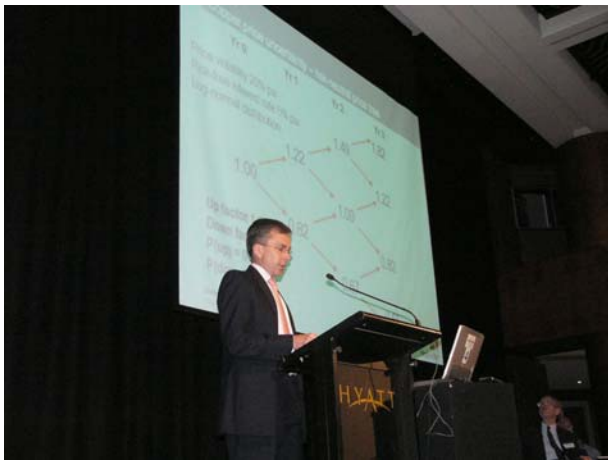
By Damon Frith and Tina Thornton

Perth, WA, November 22-24, 2004

The International Symposium on *Orebody Modelling and Strategic Mine Planning: Uncertainty and Risk Management* was held in Perth in November 2004 and attracted 260 delegates from Australia, the Americas, Europe, Africa and Asia. Symposium attendees included senior representation from the major mining companies, including BHP Billiton, Rio Tinto, AngloGold-Ashanti, De Beers, Newmont, Hamersley Iron, Xstrata, and Anglo American, as well as the leading academics in the field. Whittle Programming had a strong presence as co-sponsor of the symposium. The symposium was supported by leading mining professional organisations, namely the AusIMM, SME, CIM, SAIMM and GAA.

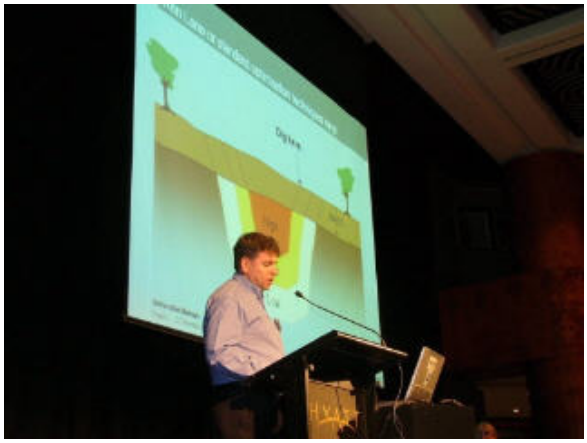
Mining is arguably a high risk/high reward business, and the aim of the symposium was to add value to the industry by demonstrating how quantification of uncertainty and risk management can be used to capture maximum upside potential while minimising downside risk. New trends in pit optimisation modelling and the international shortage of skilled labour in the workforce were among the many issues debated. In his introduction of the event, Symposium Chairperson, Professor Roussos Dimitrakopoulos, described it as "a remarkable assembly" of participants. The symposium sessions started with themes such as "Why strategic Risk Management?" continued with "Integrated large-scale applications" and concluded with "New concepts, technologies and directions". Parallel sessions focused on specific issues and techniques ranging from conditional simulation to mining operations research and optimisation, and global asset optimisation. Geotechnical risk in mine planning and optimisation was addressed in a special forum and the final forum session on new challenges addressed issues stemming from the symposium.

Symposium presenters used traditional thinking to improve the currently available tools within the mining community to optimise mine plans and designs. They combined this with attempts to challenge delegates with new concepts for radically changing how mine planners develop and optimise their mine plans in an uncertain, changing, and increasingly complex, global economic environment combined with the equally complex orebodies being mined.




In his keynote opening address, Peter Monkhouse, BHP Billiton Vice President Strategy for Carbon Steel Materials, highlighted that, when planning and developing an orebody, there was a need to look beyond the *Economic Definition of Ore* by Ken Lane, which has been used as the mining industry's 'bible' for the past 17 years. Monkhouse said the standard practice of taking a single set of assumptions—like a single orebody, mining costs, exchange rates, and metal prices and applying them to optimise mine designs and production schedules—is inherently wrong. The assumptions would undoubtedly be erroneous over the 20 or more years of mine-life typical for a large operation. He said that BHP Billiton was adapting its mine developments to incorporate "robust mine plans". These he described as flexible in absorbing changes in a mine plan or the underpinning assumptions with minimal impact, while optimising over a wide range of assumptions. The concept is to recognise the changing world economic environment and to manage risk, sensitivities and mine development using tools such as "real options", sensitivities and mine development. Real options was described as a valuation method used to calculate project net present value while accounting for uncertainty, risk and the time value of money

BHP Resource Evaluation Manager and co-speaker, Gavin Yeates, stressed the need to encapsulate a plan that covered all contingencies in the long-term development of a large-scale mine. While high-grading a deposit in the initial years of operation may lead to early profits, a lack of pre-stripping and other long-term goals could lead to "value destruction" for both the company and the host country. This is particularly evident if changing world conditions make the mine uneconomic to mine mid-grade or low-grade zones. According to Yeates, questions to be resolved in the pre-feasibility stage include what is waste and



what is ore? How much excess capacity should be built into the plant? Should the operation be selectively mined or use bulk mining? How much exposed ore should be carried? What level of stockpiles should be maintained? Mines had to work in the real world, which means shutting down production near the bottom of the metals cycle if required; and achieving mine flexibility through solutions such as early pre-stripping of the orebody, and not just the area that makes up the initial pit. A failure to recognize 'real world' impacts on a mining operation was an invitation to create "value destruction".

The perspective of the developer and consultant operating in the 'real world' came from Jeff Whittle, founder of Whittle Programming. He asserted that the value of a developer's and consultant's contribution was in providing a mining company with a competitive edge by using the mine planning and evaluation modelling and optimisation tools developed to meet each client's individual needs of their operations or systems, thus maximising their return on funds invested.

Symposium Chairperson Roussos Dimitrakopoulos continued this theme of optimisation of resources and summarised public statistics suggesting that about 70% of plants operate at less than 70% of planned capacity in their first year of operation, while 60% of mining operations operate at less than 70% of their planned rate. Dimitrakopoulos commented that given the risky nature of the mining business–the uncertain demand for raw materials and equally uncertain supply from partially known orebodies–we are better off accepting uncertainty and managing risk to our benefit. "Uncertainty is good for us", he stated, "uncertainty creates opportunities for strategic planning decisions". This leaves us with the goal of developing new frameworks and technologies for mine planning and design, technologies that accurately quantify risk in all key sources of information used.

Peter Ravenscroft, General Manager Resource Planning, Hamersley Iron, stressed some of these difficulties in orebody modelling and strategic mine planning. He calculated that the level of information available from drilling for the average mine plan and mine production forecasting is equivalent to generating a daily forecast for a month from looking out of the window once, and for a couple of seconds!

In his closing address, Allen Cockle, Corporate Director, Mining, Newmont Mining Corporation stressed issues on research and development from the angle of uncertainty and risk management. Cockle suggested that, despite the general improvements in the mining sector's productivity and conditions, the same cannot be said for the funding of mining research and development. In a business that is increasingly reliant on technology, rather than a technical work force, there will be fewer people conducting, producing, and being trained and reporting on research. In Australia, and internationally, there is a general downturn in business spending on research and development as a proportion of Gross Domestic Product and this is significantly more evident in the mining industry. Business expenditure on research and development (in current price terms) has decreased from 0.81% of GDP in 2001-02 to 0.79% of GDP in 2002-03; within the mining industry research and development expenditure decreased by 3% in current price terms (ABS, 2004). A number of issues that underpin this downturn are evident and include the segmented nature of the various mining operations, dwindling funds for university research and curricula, reduced opportunities for employee involvement in research and the failure of the industry to compensate for deficits in public funding.

Cockle emphasised that the fruits of research and development are the result of investment in people and a commitment of funds to them so that innovation will follow. Without investment in people and appropriate supportive funding for research and development there is a major risk that innovation in the mining industry will be limited. A recent statement on monetary policy by the Reserve Bank of Australia (2005, Feb) reports that overall mining investment in Australia has substantially increased since the downturn in the 1990s. A resurgence in global demand and world commodity prices from 2003 has also provided impetus for resource-led investment. The challenge for the mining industry will be to ensure that research and development attracts some of this investment.

Cockle's address was followed by a forum discussion led by Roussos Dimitrakopoulos, Allen Cockle (Newmont), Peter Ravenscroft (Hamersley Iron), Jeff Whittle, Gavin Yeates (BHP Billiton), Wynand Kleingeld (De Beers), and Martin Whitham (Rio Tinto).

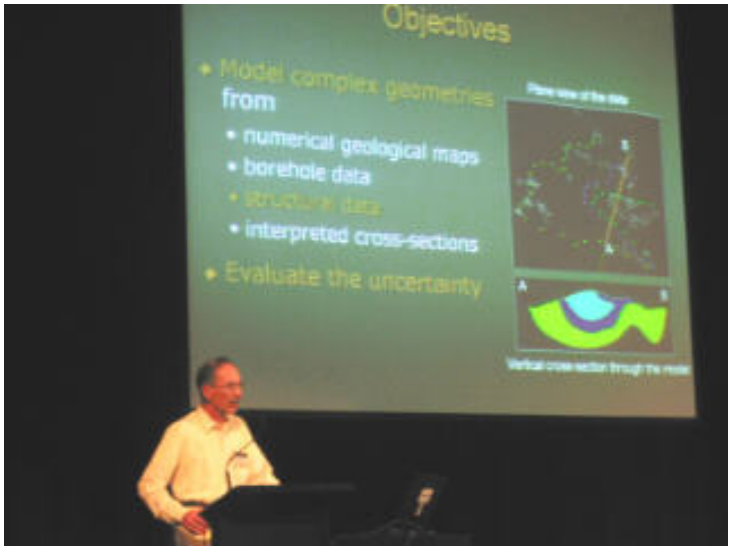
The open forum discussion tackled the growing problems of skills shortage, research ad development, as well as the transfer of technologies to practice in an environment whare a lack of skilled labour was a real threat to the growth of the industry, much as Newmont's Allen Cockle described how over 1200 person-hours were spent in research and development in Australia in 2001, but that in 2003 the figure had plummeted to 103 person-hours. He said governments were looking for short-term fixes but failed to contribute long-term funding to research. The industry was also fragmented and did not collaborate to help generate interest in the industry for young people or research programs. De Beer's Wynand Kleingeld added his voice to a call for collaboration and said the mining industry had a propensity to re-invent the wheel every time it brought in a new manager to an operation. Kleingeld also stressed the need for undergraduate and postgraduate training, as well as the need for internationally located Centres of Excellence in the field that are linked and collaborate. Industry, he said, must and will support these types of initiatives.

Dimitrakopoulos stated that there is a need for undergraduate studies in mining that reflect and are relevant to today's environment; the structure of engineering courses had changed little in the last decades. Allen Cockle also lamented the lack of a mentoring age group within the industry and noted its limited attraction to women, with a representation of only 2% of the workforce. Peter Ravenscroft and Martin Whitham stressed the need for transfer to, and application of, new technologies such as the developments presented at the conference. Whitham stressed that, to capitalise from minerals, new techniques need to be sufficiently demonstrated and proven to convince mine management of the benefits to their business; whilst the software currently available is often not adequately designed for ease of use by the user. He also stressed that we need to reduce the gap between development of new technology/techniques and their application–an excellent 'engagement model' needs to be developed to addresses technical robustness, ease of use, implementation training, and maintenance options.

Continuing the debate on new challenges, Yeates said that BHP Billiton is already putting a number of leading edge ideas raised at the conference into practice, including 'stochastic' methods for mine planning and optimisation. The world's leading mining company is seeking to introduce robust mining plans at all of its major operations with responses made to 'real world' changes in market conditions, uncertain orebodies, and other variables. Its operations are becoming a litmus test of how some of the new principles raised operate in a dynamic mining plan. Yeates stressed the need for more and focused research funding, as well as the effort and funding of development of tools after research. Whittle commented that development requires a different flair to research as much as different skills. The same person that developed a new method is not the seme person that will develop a commercial product, he stressed.

So where to from here? As the Chairperson, Dimitrakopoulos summarised that in time a collective group working in orebody modelling and strategic mine planning will form and collaborate to move the current state of discussions forward. While that may take months to achieve, a follow up conference is already being planned for 2007/08. This concluded a very successful conference, acknowledged by all attendees. Information on the symposium and photos are available on the symposium's website (http://www.ausimm.com/ommp2004 ).

In response to the success of this symposium and wide demand and requests from the mining industry, the AusIMM will publish a Spectrum Series Volume in *Uncertainty and Risk Management in Orebody Modelling and Strategic Mine Planning.* The Volume is due for release in April 2005.


Objectives
• Model complex geometries from
• numerical geological maps
• borehole data
• structural data
• interpreted cross-sections
• Evaluate the uncertainty

## NEW PUBLIC DOMAIN GEOSTATISTICAL SOFTWARE PACKAGE


In Dec 2004 S-GeMS (Stanford Geostatistical Modelling Software) was released by the Stanford Centre for Reservoir Forecasting. It is a user-friendly geostatistical package replacing the classic GSLIB.

Implemented algorithms

- Data analysis tools: histograms, variograms, cross-variograms, qq-/pp-/scatterplots;
- Estimation: kriging, indicator kriging, cokriging;
- Simulation: sgsim, cosgsim, sisim, cosisim, snesim;

Features

- Algorithms run on regular grids and on irregular shaped domains (e.g., block models);
- Display for 3D graphics;
- Organisation of data and outputs in projects;
- Automation of tasks by embedded scripting based on Python;
- Use of plug-ins to add further algorithms and filters;

Download

The code is distributed under the GNU General Public License. Downloads of the Windows executable, source code, and the manual are available on the S-GeMS website of Nicolas Remy at Stanford:
http://pangea.stanford.edu/~nremy/GEMS/index.html
http://sgems.sourceforge.net/

## 2ND WORLD CONFERENCE ON SAMPLING AND BLENDING

In August 2003, the First World Conference on Sampling and Blending (WCSB1) was held in honour of Dr Pierre Gy in Esbjerg, Denmark. The Conference was extremely successful and the Second World Conference on Sampling and Blending (WCSB2) will be held on 10-12 May 2005 in Queensland, Australia, jointly hosted by CSIRO and The Australasian Institute of Mining and Metallurgy (The AusIMM).

The venue will be the beautiful Novotel Twin Waters Resort on the Sunshine Coast just north of Brisbane. Twin Waters is a great location for a conference, with lots of facilities for guests to use, including a lagoon and a surf beach (a few minutes walk from the resort). The venue can be accessed by road from Brisbane (about a 90 min drive) or alternatively by air to the Sunshine Coast airport (a few minutes drive from the resort).

**Organising Committee**

- Dr Ralph Holmes - Conference Chair
- Jim Docherty
- Antonia Riley
- Geoff Robinson
- John Vann

**Event Management**
Miriam Way - Publications, Conference & Events Manager
Alison McKenzie - Senior Conference & Events Coordinator
The Australasian Institute of Mining and Metallurgy
PO Box 660, Carlton South Vic 3053
Telephone: (03) 9662 3166
Facsimile: (03) 9662 3662
Email: conference@ausimm.com.au
Website: www.ausimm.com

## PROVISIONAL LIST OF PAPERS

Heterogeneity and Ingamells's Tests of Some Chilean Porphyry Ores – P Carrasco, P Carrasco, M Campos, J Tapia and E Menichetti

Benchmarking Sampling for Grade Control at the Lihir Gold Mine – Z Casley, J Kopana and D François-Bongarçon

Variograms of a Continuous Flow - A Tool for Proper Design of Sampling Increments – A Grigorieff, J F Costa and J Koppe

Mechanical Sampling Plants – J Docherty

Sampling of Coarse Gold Deposits - Case Studies From Australia, the CIS and Greenland – S C Dominy, G F Johansen and J S Petersen

The Approach to Sampling at the New Bendigo Gold Project, Victoria, Australia – G F Johansen and S C Dominy

Sampling for Grain Quality in the Co-operative Bulk Handling Supply Chain – G Elliott, D Capper and W Rubery

A Multivariate Perspective on Pierre Gy's Theory of Sampling - A First Foray – K H Esbensen In SituSampling for Sampling of Primary Diamond Deposits – J Ferreira

The Modelling of the Liberation Factor and its Calibration – D François-Bongarçon

A Fundamental Principle for Automatic Sampler Correctness – D François-Bongarçon

Theory and Optimal Use of Rotary Splitters – D François-Bongarçon

The Philosophy of Statistical Bias Testing Revisited and Applied to Automatic Samplers – D François-Bongarçon

Uncertainties in Soil Sampling - A Case Study – B Gustavsson, K Luthbom and A Lagerkvist

A New Approach for Determination of the Minimum Sample Mass During the Sampling of Random Mixtures of Particles – B Geelhoed

Design of Sample Plants - Getting it Right First Time – R J Holmes

The Application of Gy's Formula and Sampling Best Practice at the Snap Lake Diamond Sampling Plant – J J Langenhoven

Sampling Challenges in Highly Dispersed Types of Mineralisation – W Kleingeld and C Lantuejoul

Uncertainty About Uncertainty in Material Sampling - A Crucial Part of Risk Assessment – T Lwin

Sampling, Metallurgical Accounting and Reduction of Balance Estimation Variance – G J Lyman

Direct Estimation of Sampling Variance From Time Series Measurements - Comparison to Variographic Analysis – P Minkkinen and M Paakkunainen

Sampling and Interpolation Errors of the Ash and Sulfur Contents in Polish Hard Coal Deposits (Upper Silesian Coal Basin) – J Mucha and M Wasilewska

Investigation of Alternative Drawpoint Sampling at Ridgeway Mine, NSW – G Smart, J Rutter and M Noppé

Optimisation of an Image Analytical System for Bulk Materials Using the Theory of Sampling (TOS) – P P Mortensen and K H Esbensen

Use of Granular Flow Modelling to Investigate Possible Bias of Sample Cutters – P Cleary, G Robinson and M Sinnott

Sampling Correctness - A Comprehensive Guideline – F F Pitard

Representative Sampling of Grain and Mixtures - Experimental Validation of Spears, Augers and Thief Probes – L Petersen, K H Esbensen and P Downey

Leveraging Accuracy and Precision - Multi-Phase Mass Balancing and Reconciliation as a Tool for Quality Data Management – P Guerney, M Dunglison and P Cameron

Size Segregation on the Blasthole Pile - The Impact on Sampling and Mine to Mill Grade Reconciliation at the Batu Hijau Porphyry Cu-Au Deposit, Sumbawa-Indonesia – R Kresna and A Prihananto

Economic Justifications for Capital Expenditure on Sampling and Blending – G Robinson Assessment of Mill-Feed Sampling Strategies Based on a Variographic Experiment – H J Sans and K L Olzard

Principles of 'Good Sampling Practices' - Scope and Field of Confidence – D Thirouin

Sampling of Chemicals for the Production of Pharmaceutical Drugs – D Thirouin and M Bouchet

Identification and Management of Risks on Resource Evaluation Associated with Sampling and Analysis – J Vann

Parameters Calibration for Estimating Sampling Variance – M V de Castilho, P K M Mazzoni and D François-Bongarçon

Chemical Measurement System Analysis for a Manganese Metal Production Process – T Glück, R C A Minnitt, P V Savage and C Bothma

# EVALUATION OF MINERAL RESERVES – A SIMULATION APPROACH,

*By: Andre G. Journel and Phaedon C. Kyriakidis,*
*Applied Geostatistics Series, Oxford University Press 2004.*

In the preface the authors declare the book to be born out of the belief that methodology needs to be communicated rather than hidden in patents or confidential reports. In this particular case the objective is to develop a method for the use of simulation in the evaluation of mineral reserves, where it would appear that to date estimation methods are still the preferred tools for this purpose. In particular, they regard stochastic simulation as the toolkit that provides a numerical framework for estimating the factors affecting mining dilution and reserves recovery. The effects of particular interest in this work are the support and the information effect. The simulation approach is bench-marked against the more commonly used method of volume-variance correction (VVC) and the methodology is demonstrated via a case study based on a 2D data set taken from a digital elevation model. This choice was made to avoid having to make use of a synthetic set, as it is according to them impossible to obtain a real mining data set of the required quality as an exemplar. The study area of interest is one mining panel.

The book consists of a total of seven chapters. The first chapter introduces the problem and provides an outline of the material to be discussed. In the second chapter the methodology is described. There are five steps: Given the sample data, the variable of interest is simulated at the same support as the sample data. For each realisation at point support level construct the true SMU grade through averaging. Then generate future data from the realisation. If the future selection data are of the same type, then this averaging will be adequate, however, if, as is often the case, the future data are of a different type add a simulated heteroscedastic error. As a fourth step compute recovery functions. In the text ore tonnage, quantity of metal, mean ore grade and profit are used. The last step then consists of assessing the uncertainty about the unknown recovery values and this involves a statistical analysis of the recovery functions across the realisations that were generated in the first step and then used to construct SMUs and future selection data. In Chapter 3, VVC is recalled. The authors note at this stage that VVC (of course) only addresses the support effect, but not the information effect which they regard as a severe draw-back of VVC. In Chapter 4 two exhaustive reference data sets are introduced, both based on the digital elevation model taken from the USGS quadrangle Ely West in Nevada. The original data were transformed to have a grade distribution similar to the Walker Lake data set and in addition a second set Ely2 was constructed to have a two-population distribution. The details of its construction are given in Section 4.4. For both data sets reference SMU data are generated and recovery functions under perfect selection are computed. The future data are assumed to be blasthole data and their generation is carefully described. They are then used in block-kriging to obtain values for the recovery functions under actual selection. In Chapter 5 the approach outlined in Chapter 2 is applied, in each case starting with a sample of 30 point support data from the exhaustive reference set. In Chapter 6, VVC is applied using median IK as the base estimation method. The results from the simulation and VVC are then compared with the reference values generated in Chapter 4. The last chapter provides a summary of all those aspects that cannot be covered by a simulation or estimation study and present some arguments why simulation at an early stage in the evaluation of reserves is superior to estimation and present a series of general comments on information effect, accessibility, uncertainty and the like. They conclude with an outline of workflow and some recommendations.

According to the authors the book is addressed at geostatisticians, familiarity with simulation and estimation techniques is assumed. The software suite used is GSLIB, and the parameter files for running the algorithms are supplied. The data sets for the case studies can be downloaded from the SCRF website (along with GSLIB if one does not have it already), a testimony to their belief in the need for open and frank discussion about methodology. The provision of the data enables the reader to actively engage with the material presented and judge for themselves how the ease of implementation of VVC compares with the additional output and access to evaluation available through a simulation study. Overall this text makes a valuable addition to the library of any working geostatistician.

Ute Mueller u.mueller@ecu.edu.au

ASB MARKETING
ARTWORK APPROVAL
Ph 08 9474 3067 Fax 08 9474 3080

Polo shirt - Light Grey Marle
Embroidered on left chest in red, black & white


Actual embroidery size below

GAA
Geostatistical Association of Australasia

ARTWORK APPROVAL

☐ Artwork approved

☐ Changes required

Signature:_____

Date:_____

## CALENDAR OF EVENTS

**2005 MAY 10-12**
**SECOND WORLD CONFERENCE ON SAMPLING AND BLENDING**, Novotel Twin Waters Resort, Sunshine Coast, QLD **For Details**: www.ausimm.com

**2005 May 15 - 18**
**Geological Society of Nevada Symposium 2005** "Window to the World"
www.gsn2005.org

**2005 May 20-25**
**15th Annual Goldschmidt Conference - A Voyage of Discovery** University of Idaho, Moscow, Idaho, USA
website: www.uidaho.edu/gold2005
e-mail: gold2005@uidaho.edu

**2005 23-May**
**The Estimation and Reporting of Resources and JORC: The Role of Structural Geology** Perth WA

**2005 27 May**
**The Estimation and Reporting of Resources and JORC: The Role of Structural Geology,** Brisbane QLD

**2005 May 23 - 25**
**GEM2005 - PNG'S PREMIER MINING CONFERENCE**
Lae, Papua New Guinea, Contact: PNG Chamber of Mines and Petroleum
Telephone: + 675 321 2988

**2005 August 21-26**
**GIS and Spatial Analysis 2005 Annual Conference of the International Association for Mathematical Geology (IAMG)**
Toronto, Canada, www.iamg.org

**2005 September 19 - 21**
Iron Ore 2005 Western Australia Contact: The AusIMM Events Department
Telephone: 03 9662 3166; Facsimile: 03 9662 3662

**2005 19-23 September**
**22nd IGES** Perth Western Australia

**2005 September 20-23**
**XVI Congreso Geologico Argentino**
www.congresogeologico.org.ar

**2005 October 12-14**
**Bowen Basin Symposium 2005 - The Future for Coal-Fuel for Thought** See www.aig.asn.net.au

**2005 November 13 - 16**
**Joint Conference - New Zealand Branch/Crown Minerals** New Zealand
Contact: Roger Gregg

**2006 May 1-7**
**"OUTCROP TO OREBODY- APPLIED GEOSCIENCE IN EXPLORATION AND MINING"** Kalgoorlie WA AIG Conference

**2006 August 21 - 23**
**International Mining Geology Conference**
Contact: AusIMM Events Department
Telephone: (03) 9662 3166; Facsimile: (03) 9662 3662

## GAA COMMITTEE 2003 - 2004

| | Phone | FAX | Email |
|---|---|---|---|
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## FROM THE EDITOR

# CONSTITUTION
# GEOSTATISTICAL ASSOCIATION OF AUSTRALASIA

## 1. ASSOCIATION

1.1 The name of the Association shall be the "Geostatistical Association of Australasia", (abbreviated to GAA), hereafter referred to as "the Association".

1.2 The administrative office of the Association shall be any convenient place decided on, from time to time, by the Executive Committee of the Association.

1.3 The objectives of the Association are to —

1.3.1 Promote the good practice, development, study and application of geostatistics in the mining, petroleum, environment and related fields.

1.3.2 Increase the awareness and status of geostatistics in its various fields of application.

1.3.3 Promote co-operation and fellowship among the geostatistical community in Australasia.

1.3.4 Provide a forum for the exchange of ideas among membership of the Association on technical and professional matters.

1.3.5 Print or publish (including by electronic means) any periodicals, newsletters, journals, books or leaflets that the Association may think desirable for the promotion of its objectives.

1.3.6 Organise and promote lectures, meetings, symposia and other activities to further the professional development of membership.

1.3.7 Promote liaison of the Association and its membership with their colleagues internationally.

1.3.8 Foster and develop good relations and cooperative efforts with other relevant professional and industry bodies — both locally and internationally — in order to further the objectives of the Association.

1.3.9 Foster and develop good relations and cooperative efforts with universities currently teaching or having research efforts in the field of geostatistics (or closely related fields) — both locally and internationally — in order to further the objectives of the Association.

1.3.10 Recognise outstanding contributions to the Association or to the promotion or development of geostatistics by granting awards.

## 2. MEMBERSHIP

### 2.1 Grades of Membership

The Executive Committee has discretion to accept or reject applications for membership of the Association.

2.1.1 Member

Individuals may become *Members* of the Association on application, subject to approval being granted by the Executive Committee. Members of the Association shall normally have professional qualifications in mathematics, geosciences, engineering, environmental sciences or other relevant discipline and have a significant portion of their professional activity related to geostatistics, but not necessarily be specialised geostatisticians. In this constitution, "Member" specifically denotes this grade of membership, whereas "member" is a generic term covering any or all grades defined herein.

2.1.2 Associate Member

Individuals may become an *Associate Member* of the Association on application, subject to approval being granted by the Executive Committee. Associate

Members of the Association may not have a significant portion of their professional activity related to geostatistics, as stipulated for Member status.

2.1.3 Student Member

Individuals may become a *Student Member* of the Association on application, subject to approval being granted by the Executive Committee. Student Members of the Association must annually provide documentary proof of full-time enrolment in a recognised undergraduate or graduate program in a discipline within which geostatistics has application.

2.1.4 Honorary Life Member

Members may become an *Honorary Life Member* of the Association by invitation of the Executive Committee. Honorary Life Members of the Association shall normally be persons who have made significant contributions to geostatistics.

2.1.5 Corporate Member

Companies and other organisations may become a *Corporate Member* of the Association on application, subject to approval being granted by the Executive Committee.

**2.2 Fees**

2.2.1 The Executive Committee shall determine annual membership fees and the date of renewal of membership from time to time.

2.2.2 Fees may vary between different grades of membership.

2.2.3 If the membership fee shall remain unpaid for a period of two calendar months after it becomes due then the member may, after written notice of the default, be debarred by resolution of the Executive Committee from membership of

the Association. The Executive Committee may restore membership on payment of all arrears if it thinks fit to do so.

2.2.4 All income of the Association (including but not limited to membership fees) shall be applied towards the benefit of the Association and its membership in general and towards the achievements of its objectives in particular.

2.2.5 The financial records of the association are to be available to any member to scrutinise at the annual AGM or at any other time that is convenient to the Treasurer.

## 3. VOTING POWERS

3.1 *Members* shall be entitled to vote at meetings (in person or by proxy) or in ballots of the Association. Each vote shall carry equal weight.

3.2 All other membership grades (Associate, Student, Honorary, and Corporate) shall not be entitled to vote at meetings (in person or by proxy) nor in ballots of the Association.

## 4. GUESTS

4.1 Members shall be entitled to invite guests to meetings of the Association.

4.2 No person shall be a guest at more than two meetings of the Association in each calendar year, except at the invitation of the Executive Committee.

## 5. EXECUTIVE COMMITTEE

### 5.1 Definition

The Executive Committee of the Association (hereafter referred to as the "Executive Committee") shall manage the affairs of the Association in the interests of its membership and in accordance with the Constitution of the Association.

## 5.2 Structure

5.2.1 Only paid-up Members of the Association shall be eligible for election to the Executive Committee.

5.2.2 The Executive Committee shall consist of four office bearers: a President, a Vice-President, a Secretary, a Treasurer and at least two additional committee members.

5.2.3 The immediate past President shall automatically remain a committee member in the following year.

5.2.4 The President shall chair all meetings of the Executive Committee and committees at which he or she is present.

5.2.5 The Vice-President shall act for the President in his or her absence.

5.2.6 The Secretary shall, under the direction of the Executive Committee, conduct the correspondence of the Executive Committee, record the proceedings of all meetings of the Executive Committee, issue and receive all requisite notices, and maintain a centralised listing of Members, Associate Members, Student Members, Honorary Members and Corporate Members.

5.2.7 The Treasurer shall —

5.2.7.1. Receive all moneys due to the Association and deposit them in a bank or banks approved by the Executive Committee.

5.2.7.2. Pay all moneys owed by the Association.

5.2.7.3. Invest moneys of the Association in such manner as the Executive Committee shall from time to time direct.

5.2.7.4. Keep proper records of account of the Association's receipts, payments and financial status, and prepare a summary of accounts for each financial year for reporting to the membership of the Association.

5.3.1 The office bearers and other members of the Executive Committee shall hold office for one year from the first day of March each year and are eligible for re-election in the following year.

5.3.2 A person is not eligible to simultaneously hold more than one position on the Executive Committee.

5.3.3 The Association, in general meeting, may move a special resolution to remove any member of the Executive Committee from office before the expiration of the Executive Committee member's term of office. A postal ballot must be conducted. The resolution shall only be acted upon if at least 75% Members casting a ballot are in favour of it.

5.3.4 A quorum of the Executive Committee shall consist of four members. In the absence of both the President and Vice-President, those members present shall elect a chair for the meeting in question.

5.3.5 The Executive Committee shall have the right to appoint Members to fill vacancies that arise on the Executive Committee during its annual term.

5.3.6 The Executive Committee shall have the right to co-opt additional Committee members.

5.3.7 The Executive Committee shall be able to establish sub-committees with such terms of reference as it sees fit and have the right to appoint Members to fill vacancies on any such sub-committees. All such committees shall report their proceedings to the Executive Committee.

5.3.8 The Executive Committee shall also be able to form joint committees with other organisations under such terms of reference as it sees fit and have the right to appoint Members to fill vacancies on any such joint committees.

All such committees shall report their proceedings to the Executive Committee.

5.3.9 Subject to the provisions of this constitution, the Executive Committee shall have the power to do all things necessary to promote the objectives of the Association. The powers of the Executive Committee shall specifically include —

5.3.9.1 The expenditure and investment of funds for the purposes of the Association.

5.3.9.2 The consideration of matters referred to it by membership or Branches of the Association.

5.3.9.3 The preparation of a newsletter and other communications (including by electronic means) with membership or Branches.

5.3.9.4 The approval or rejection of membership applications.

5.4 Voting Procedure

5.4.1 Written nominations for the positions of President, Vice-President, Treasurer, Secretary, and four Executive Committee members for the coming year shall be invited from Members of the Association and shall be submitted to the Secretary of the current Executive Committee on or before December 31st each year. Each nomination must be seconded.

5.4.2 The Executive Committee shall prepare a list of nominees for positions on the new Executive Committee. This shall be advertised to members at least one (1) month before the election is due.

5.4.3 Election of each position on the new Executive Committee shall then proceed by ballot at the Annual General Meeting. Election shall require a majority of votes and proxies.

5.4.4 In the case of only one nomination for any given position on the new Executive Committee, a ballot may be deemed unnecessary by the existing Executive Committee, *or* the existing Executive Committee may deem it appropriate to call for further nominations.

## 6. ANNUAL GENERAL MEETING

6.1 The Executive Committee shall organise an Annual General Meeting each year to present to members:

6.1.1 The annual report by the President.

6.1.2 A financial statement signed by the President and the Treasurer.

6.1.3 The nominations for election to the Executive Committee.

6.2. The quorum at the Annual General Meeting shall be 20% of existing Members. If a quorum is not achieved at the Annual General Meeting, the proceedings will be validated at a further General Meeting of the Association, at which a quorum is achieved.

6.3. At least 14 days notice to the GAA membership of the Annual General Meeting shall be given by the Secretary of the Association.

## 7. EXTRAORDINARY GENERAL MEETINGS

Extraordinary General Meetings may be called by the Executive Committee at any time on 14 days notice. Further, Extraordinary General Meetings may also be called by the Executive Committee upon receipt of a petition signed by not less than 15% of paid-up Members of the Association, again on 14 days notice.

## 8. AWARDS

8.1 At the discretion of the Executive Committee, annual awards may be presented.

8.2 At the discretion of the Executive Committee, special awards may be presented.

## 9. FINANCES

9.1 Any funds raised shall be used in the interests of the Association.

9.2 In the event of dissolution of the Association, all financial assets, over and above any liabilities and debts, shall be placed under trust to be available if and when the Association is resurrected. The Executive Committee shall decide upon the institution where the funds are to be placed in trust and the nature of this trust.

9.3 In the event of dissolution of the Association for a period of more than one (1) year, the Members shall be balloted by mail in order to determine the use of residual funds. Funds must be distributed in accordance with legislation relation to incorporated bodies such that funds may only be transferred to either a similarly incorporated body or to a registered charity..

## 10. GENERAL

10.1 Alterations or additions to this Constitution shall be made only if at least 75% of Members casting a vote are in favour of the proposed amendments.

10.2 Voting on amendments to the Constitution may only occur at an Annual General Meeting or Extraordinary General Meeting of the Association.

10.3 The Association may seek affiliation to other associations or societies.

10.4 The Executive Committee of the Association may accredit regional branches of the Association within Australasia.

The common seal of the Association shall reside with either the President, a member of the executive with the approval of the executive or if the association has an accountant, the accountant.

# AUSTRALASIAN JOINT ORE RESERVES COMMITTEE (JORC)


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A/Secretary: Mr P T Stoker — Phone (07) 3376 1007 Fax (07) 3279 1565
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## THE 2004 JORC CODE - COMPARISON WITH THE 1999 JORC CODE

After a three-year revision process, the ASX has incorporated the 2004 JORC Code into the ASX Listing Rules, from 17 December 2004 (see ASX Companies Update no 16/04) replacing the 1999 JORC Code as Appendix 5A. Appendix 5A can be accessed at http://www.asx.com.au/ListingRules/appendices/App5a.doc. The 2004 JORC Code is also available on the JORC web site www.jorc.org. This revision of the JORC Code follows a call for submission in December 2001 and the publication of several exposure drafts from late 2002.

Whilst there are differences between the 1999 Code and the 2004 Code, most of the changes are in the guidelines. The Code definitions, which are largely in accord with agreed international definitions, remain substantially unchanged. The two main changes in the 2004 Code are the requirement for a Competent Person to be responsible for the documentation supporting the reporting of Exploration Results, and the introduction of 'Recognised Overseas Professional Organisations' as overseas organisations to which Competent Persons may belong.

Other changes include:

- clarification of the reporting of exploration targets or potential;
- the rearrangement of the diamond reporting clauses;
- the introduction of guidelines for the reporting of Industrial Minerals;
- modification of the coal clauses and recognition of the new Coal Guidelines; and
- the introduction of a guideline encouraging the discussion of relative accuracy and confidence in resource/reserve estimates.

Other lesser changes to the Code include are listed and discussed briefly.

### Differences in Mineral Resource and Ore Reserve definitions

The Code definitions for Mineral Resources, Ore Reserves and the resource/reserve categories remain unchanged with the exception of one minor modification to the definition of a Measured Resource, the removal of "/or" after "and", correcting a previous typographical error, and the addition of the word "quality" in the definition of a Mineral Resource. These definitions are largely in accord with the "Denver Accord" international definitions.

### Main Changes in the 2004 JORC Code

The two main changes in the 2004 Code are the requirement for a Competent Person to be responsible for the documentation relating to the reporting of Exploration Results, and the incorporation into the Code of 'Recognised Overseas Professional Organisations' as overseas organisations to which Competent Persons may belong.

## Involvement of a Competent Person in the Public Reporting of Exploration Results

Until now, the Code has not required the involvement of a Competent Person in the preparation of the documentation on which a company's Public Report of Exploration Results is based. Other overseas codes (the Reporting Code and the SAMREC Code) require the Competent Person, who prepared the documentation, on which the Public Report is based, to be named. In Canada, National Instrument NI 43-101 and the CIM Standards require the involvement and naming of a Qualified Person (effectively equivalent to a Competent Person). In Australia it has become increasingly common for companies reporting results of exploration to also report the name of the Competent Person who accepts responsibility for the preparation of the documentation on which the Public Report is based, and state that the report fairly reflects the work of the Competent Person. JORC believes it is now appropriate to formalise this reporting responsibility in the JORC Code.

Clause 8 of the Code, which defines the role of the Competent Person, has been amended to include Public Reports of Exploration Results, along with Mineral Resources and Ore Reserves. All these reports will be required to "be based on and fairly reflect the information and supporting documentation prepared by the Competent Person".

The term Exploration Results has been defined in Clause 16 as including "data and information generated by exploration programmes that may be of use to investors". The clause also states that "Exploration Results may or may not be part of a formal reporting of Mineral Resources or Ore Reserves", and additional guidance is included on when it is appropriate to report Exploration Results.

The definition of a Competent Person in Clause 10 has been amended slightly to cover this extension by including the words "If the Competent Person is preparing a report on Exploration Results, the relevant experience must be in exploration".

## Inclusion of Recognised Overseas Professional Organisations

Since the first JORC Code in 1989, Competent Persons have had to belong to either The Australasian Institute of Mining and Metallurgy ("The AusIMM") or the Australian Institute of Geoscientists ("AIG"). These are the Australasian professional organisations that have adopted the JORC Code and that have codes of ethics to allow disciplining of Competent Persons for breaches of the JORC Code. With the globalisation of the mining industry, and the worldwide adoption of reporting standards based on the JORC Code, this requirement has been recognised as somewhat restrictive.

- During 2003, the ASX promulgated a list of Recognised Overseas Professional Organisations (ROPO's) to which Competent Persons may belong for the purpose of preparing reports on Exploration Results, Mineral Resources and Ore Reserves for submission to the ASX. The ROPO process applies in respect of reports prepared under the JORC Code. The published list, prepared on the advice of JORC and its parent organisations, is available on the ASX website, at http://www.asx.com.au/about/pdf/JORC.pdf and is updated periodically.

Each of these organisations has satisfied the following qualification criteria agreed between JORC, its parent organisations and the ASX:

- *is a self-regulatory organisation covering professionals in the mining and/or exploration industry;*
- *admits members primarily on the basis of their academic qualifications and experience;*
- *requires compliance with the professional standards of competence and ethics established by the organisation; and*
- *has disciplinary powers, including the power to suspend or expel a member.*

It will, of course, be a prerequisite that any members of ROPO's wishing to take advantage of this recognition must meet the requirement for relevant experience set out in the applicable clauses of the JORC Code.

This ROPO initiative will replace the current ASX listing rules provision for a "recognised mining professional", which was a strict and temporary solution to the globalisation issue. The ROPO initiative is complementary to a similar arrangement introduced in Canada in 2001. The Canadian Securities Administrators ("CSA") published a list of overseas professional organisations that it recognised as fulfilling the requirements for a "Professional Association" as defined in Canada's National Instrument NI 43-101, included in which were The AusIMM and the AIG.

## OTHER CHANGES IN THE 2004 CODE

### Clarification of the reporting of exploration targets

In order for companies to clearly communicate the potential value of projects to investors and their advisors, there is a need for company boards to be able to discuss their exploration targets and possible outcomes of exploration programs. In the 1999 JORC Code there is an apparent contradiction between Clause 17 (1999 Code) which read as follows:

"A company may choose, or be required under stock exchange listing rules, to report exploration results. If a company reports exploration results in relation to mineralisation not classified as a Mineral Resource or an Ore Reserve, then estimates of tonnage and average grade must not be assigned to the mineralisation."

and its guideline, which read:

*"Where descriptions of exploration targets or exploration potential are given in Public Reports, any tonnage/grade figures mentioned must be clearly order-of-magnitude and conceptual in nature and expressed so as not to misrepresent them as an estimate of Mineral Resources or Ore Reserves."*

This section of the Code has been expanded and clarified in the 2004 Exposure Draft. The reporting of Exploration Results, which may not include estimates of tonnage and grade, is covered in Clauses 16 and 17. The reporting of exploration targets is covered in Clause 18 which permits the reporting of exploration target size and type with strict conditions, these being:

"Any such information relating to exploration targets must be expressed so that it cannot be misrepresented or misconstrued as an estimate of Mineral Resources or Ore Reserves. The terms Resource(s) or Reserve(s) must not be used in this context. Any statement referring to potential quantity and grade of the target must be expressed as ranges and must include (1) a detailed explanation of the basis for the statement, and (2) a proximate statement that the potential quantity and grade is conceptual in nature, that there has been insufficient exploration to define a Mineral Resource on the property and that it is uncertain if further exploration will result in discovery of a Mineral Resource on the property."

The cautionary statement, (2) above, is similar to one contained in the Canadian National Instrument NI 43-101, and emphasises to investors and their advisors that such statements should not be confused with Mineral Resources or Ore Reserves.

### Consolidation of information on reporting of Exploration Results

To report exploration results under the 1999 reporting conditions, it has been necessary to consult both the Code, including the guideline Table 1, and the ASX listing rules. Under the heading "Content of reports", the ASX listing rules 5.7 and 5.8, contain specific requirements for reporting of the results of mineral exploration, including the method of reporting assay results.

The 2004 JORC Code contains all this information instead of it being distributed between the Code and the ASX listing rules, as is currently the case.

### The rearrangement of the diamond reporting clauses

A diamonds (and other gemstones) section was included in the 1996 JORC Code having been derived from a diamond appendix issued after the release of the 1992 JORC Code.

During the preparation of the 1999 JORC Code, matters dealing with diamonds (and other gemstones) were integrated into the relevant clauses and guidelines of the Code. As a result there was an inconsistency in the treatment of diamonds and coal, which logically remained a separate section. Following a number of submissions from diamond specialists, and with recognition that a separate section on the reporting of Industrial Minerals was to be introduced into the 2004 JORC Code, the material relating specifically to diamonds has been aggregated into a group of clauses, Clauses 40 to 43. A complete review of the guideline material relating to diamonds in Table 1 has been undertaken, again with assistance from diamond specialists and with reference to the Canadian Guidelines for the Reporting of Diamond Exploration Results.

As with other commodities covered by specific sections of the Code, all the general sections of the Code are applicable.

### Naming of the diamond valuer no longer required

In line with common practice and the position adopted by other overseas codes and the Canadian guidelines, the requirement for the valuer of diamonds to be named has been deleted from the Code and replaced with a requirement that "any reported valuation of a parcel of diamonds or gemstones be accompanied by a statement verifying the independence of the valuation. The valuation must be based on a report from a demonstrably reputable and qualified expert".

### The introduction of guidelines for the reporting of Industrial Minerals

The JORC Code has always implicitly been applicable to the reporting of Industrial Minerals although it has not previously supplied specific guidance. JORC has conducted a process of industry consultation over several years, including approaches to The Institute of Quarrying Australia, and the presentation of a paper (Stephenson and Lee, 2003) at the AIG Industrial Minerals Conference in Brisbane during March 2003. At this conference a new section containing a single draft Industrial Minerals clause (Clause 44) and guideline was circulated, which has subsequently been included in the draft 2004 Code. The guidelines refer to the importance of matters not normally considered quite so material for other commodities, such as deleterious minerals or physical properties, likely product specifications, proximity to markets and general product marketability. Note that this clause and guideline does not specifically refer to the extractive industries, however a dialogue on the appropriate manner to handle this industry sector has been established with Cement, Concrete & Aggregates Australia, the extractive industry association.

### Modification of the coal clauses and recognition of the new Coal Guidelines

As a result of the revision of the Australian Coal Guidelines to coincide with the release of the 2004 JORC Code, a revised reference to these new guidelines, the "Australian Guidelines for Estimating and Reporting of Inventory Coal, Coal Resources and Coal Reserves, 2003 Edition" is included in the coal section of the Code. With the agreement of the Coal Guidelines Committee, the provision in the 1999 JORC Code permitting combined reporting of Proved and Probable Coal Reserves as Recoverable Reserves has been removed. Otherwise the coal specific sections of the Code remain unchanged in intent.

### Guideline encouraging discussion of relative accuracy and confidence in estimates

The classification of Mineral Resources and Ore Reserves involves the Competent Person in expressing a view on the relative confidence that investors and their advisors should place on the resources or reserves. Increasingly it is common practice during mining project studies to attempt to quantify the confidence levels that are applicable to the resources or reserves being considered as the basis for the study.

During committee debate on the Code revision, there was considerable discussion on the manner in which any confidence levels, which may supplement those inherent in the classification, might be developed. This led to the realisation that it was inappropriate, at least at this point in time, to specify a single method of discussing confidence levels for resources and reserves. Instead, a guideline has been introduced which encourages, but does not require, the discussion of relative accuracy and confidence in resource/reserve estimates. It

does not specify the manner in which that is done, leaving the selection of an appropriate method to the judgement of the Competent Person.

### Naming of the Competent Person

The requirement for the Competent Person to be named, previously in section 5.12 of the ASX Listing Rules, has been moved to Clause 8 of the Code. The guidance previously included in Appendix 1 of the Code, which discussed the JORC Code and stock exchanges, has been moved to become a guideline to Clause 8.

### Fair Representation

In Clause 9 of the 2004 revision a sentence has been added to the clause stating that the documentation must provide a "fair representation" of the material being reported. So there is now explicit recognition of the obligation for the Competent Person to provide balanced documentation and, in Clause 8, for the Public Report to fairly reflect that documentation.

### What is a Public Report and Summary Reports

An updated guideline has been included with Clause 5 indicating more fully the nature and type of reports which are regarded for the purposes of the Code as Public Reports, the main additions being postings on company web sites and briefings for shareholders, stockbrokers and investment analysts.

The 2004 Code includes guidelines covering the issuing of concise reports or other summary reports. The guidelines to Clause 5 include advice that, for companies issuing concise annual reports or other summary reports, inclusion of all material information relating to Exploration Results, Mineral Resources and Ore Reserves is recommended. In cases where summary information is presented, the guideline suggests that it should be clearly stated that it is a summary, and that a reference should be attached giving the location of the Code-compliant Public Reports or Public Reporting on which the summary is based.

### Inclusion of Generic Terms Table

The new Appendix 1 in the 2004 JORC Code is a table of generic terms, modelled on a similar table in the Reporting Code. In the Code certain words are used in a general sense when particular commodity groups within the industry might attach a more specific meaning to them. In order to avoid unnecessary duplication, a non-exclusive list of generic terms has been prepared, together with other terms that may be regarded as synonymous for the purposes of the Code.

### Guideline on level of study required for the reporting of an Ore Reserve

There is a variation in the level of studies required for the reporting of an Ore Reserve between a number of the overseas Codes. The United States Securities and Exchange Commission is also quite prescriptive on the acceptable inputs to a mandatory feasibility study for the declaration of Ore Reserves. The JORC Code has implicitly recognised that the level and timing of appropriate studies will vary according to circumstances. The definition of an Ore Reserve in the Code includes the following: "Appropriate assessments, which may include feasibility studies, have been carried out, and include consideration of and modification by realistically assumed mining, metallurgical, economic, marketing, legal, environmental, social and governmental factors. These assessments demonstrate at the time of reporting that extraction could reasonably be justified."

The 2004 Code includes a guideline that expands on the intent of these sentences by stating that the studies will have determined a mine plan that is technically achievable and economically viable and from which the Ore Reserves can be derived. It further advises that it may not be necessary for these studies to be at the level of a final feasibility study.

In this matter, as in other areas, the JORC Code allows the decision as to what is an appropriate study to be made by the Competent Person.

## Reference to the VALMIN Code And Valuations

There has been some confusion between certain terms used in the JORC Code and certain terms used and defined in the VALMIN Code. In order to clarify the situation, a guideline has been added to Clause 6 to emphasise that the terms 'technical and economic studies' and 'feasibility studies' in the JORC Code are not intended as references to "Technical Assessments" or "Valuations" as they are specifically defined in the VALMIN Code.

## Definition of "Modifying Factors" added

For clarity a definition of the term modifying factors has been added in Clause 11 as follows: "The term 'Modifying Factors' is defined to include mining, metallurgical, economic, marketing, legal, environmental, social and governmental considerations".

## Additions to guideline Table 1

Several additional topics have been included in Table 1 in the 2004 Exposure draft:

- Orientation of data in relation to geological structure, in the sampling section,
- Dimensions and moisture in the Mineral Resource section,
- Study status in the Ore Reserves section.

## REFERENCES:


Australian Guidelines for Estimating and Reporting of Inventory Coal, Coal Resources and Coal Reserves, 2003 Edition. Prepared by the Coalfields Geology Council of New South Wales and the Queensland Mining Council, 2003.

Australian Stock Exchange, Companies Update 6 December 2004, Update no 16/04.

Australian Stock Exchange, Appendix 5a Listing Rules.

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Joint Committee of The Australasian Institute of Mining and Metallurgy, Australian Institute of Geoscientists and Minerals Council of Australia, 1999. Australasian Code for Reporting of Mineral Resources and Ore Reserves.

National Instrument NI 43 - 101 Standards of Disclosure for Mineral Projects, 02/01/2001.

South African Mineral Resource Committee (SAMREC) Under the Auspices of The South African Institute of Mining and Metallurgy. South African Code for Reporting of Mineral Resources and Mineral Reserves (the SAMREC Code), March 2000.

Stephenson, P R, and Lee, G, 2003. The Application of the JORC Code to the Public Reporting of Industrial Minerals, *Proceedings of the AIG Industrial Minerals Conference*, pp 61-64 (The Australian Institute of Geoscientists, Brisbane, March 2003).

The CIM Standing Committee On Reserve Definitions Adopted by CIM Council. CIM Standards on Mineral Resources and Reserves Definitions and Guidelines, August 2000.


**P T Stoker**

**Acting Secretary - JORC**