

## REVIEWS

---

---

**Orebody Modelling and Strategic Mine Planning.** R. DIMITRAKOPOULOS, Editor. Pp 402. The Australasian Institute of Mining and Metallurgy Spectrum Series 14. Second edition. 2007. ISBN 978-1-920806-76-7. Price (outside Australia) hardcopy A\$80.00, CD-ROM A\$60.00.

This volume follows the eponymous conference held in Perth, Western Australia, in November 2004. This second edition “includes new developments.” One-half of the case studies named in the title apply to Western Australia, with the remainder being scattered over other continents. The majority of articles discuss principles, so the value of the book is not impaired by a parochial focus. Authors are similarly distributed, and all regions have their champions. Authors include academics, senior managers, consultants, but few at operational level.

The printed text is very crisp and eminently legible. There is abundant illustration, all in black and white. The quality of figures and photos is variable, generally fair, but some line work is quite pixelated. Some diagrams are formerly color slides from the conference and so have unintelligible black-and-white scales. Some are too small. References are listed for each paper and appear to be adequately modern. There is no subject index.

The volume contains 8 chapters and 50 articles. The chapters are summarized as follows:

*Risk Management:* Mine optimization incorporates the certainty that variables are uncertain. A secondary product represented as primary-product equivalent is treated by a risk valuation method from the finance industry. The inherently limited and uncertain data on which management decisions are based leads to an understanding of the scale (time, space, number of samples) needed to comprehend variables. Conditional simulation methods on the dichotomy of local accuracy-global representation and other variable conditions are examined. Methods for evaluating variables not accommodated by commercial software are presented.

*New Conditional Simulation:* Techniques, principles, and practice of conditional simulation of orebodies and their inherent uncertainties are discussed, including multiple-point geostatistics; computational efficiency and data management in large models using sequential Gaussian, direct block simulation; and model updating by conditional simulation by successive residuals. Stochastic modelling of the probability of occurrence of geological boundaries and of faults is introduced. Conditional simulation of an ilmenite deposit demonstrates risk management in the resource model.

*Conventional Mine Optimisation:* New developments of the Lechs-Grossmann pit design optimization algorithm aim at increased computational efficiency, by aggregating mining blocks. The complexity of mine scheduling and sharing of infrastructure between several mines is discussed. New software tools, some in-house, used in mine optimization (pit planning, blending, in-pit dumping, mineral processing) are introduced. The benefit of optimization to Chuquicamata

open pit is demonstrated. Underground mining is also served by new software for development optimization.

*Large-Scale Applications:* Grade interpolation is compared with conditional simulation for estimating unknown short-scale variability in grade. Examples from a laterite mine discuss optimization using Net Value cutoffs in waste in place of individual cutoffs for grades of Ni, Co, and penalty elements, and in a gold mine of multi-pit scheduling. In underground operations, stope designing and exploration drilling can be optimized for grade uncertainty and variability. Other approaches to geologic-grade uncertainty and pit design are treated in terms of minimum requirements of the mine and decision-making criteria.

*Uncertainty and Reserves:* The regulatory situation surrounding reserves and resources requires rigorous presentation to investors. A Competent Person coordinates resource and reserves estimates, incorporating her evaluation of risks and uncertainty in sampling, models, sale, and revenue estimates, and tenure. For the Koniombo Ni-Co laterite-hosted deposit, feasibility study and resource classification are described in terms of sampling protocol, reconciling low-density data with local close-spaced data, 3-D geologic models, and risks in ore continuity. The balance is evaluated between greater confidence in block models and the costs of drilling. Stochastic modelling of risk is introduced to coal mining by case studies.

*Geotechnical Risk:* Hazard and likelihood in mine design include geomechanical factors such as rock fall, dilution, rock burst, and slope failure. This ‘data limited’ work is a key feature of geotechnical risk management. Failures of mine design within WA’s regulatory framework are illustrated by examples. Prototype economic optimization enhances strategic planning in South Africa.

*Blending Optimisation:* Ore blending can enhance performance and lower costs through managing contaminants, by pit designs that avoid contaminants, and managing ore supply to different mills. Increasing net present value (NPV) and satisfying various corporate goals by optimization to higher cutoffs carry the possibility of increasing downside risks. Commercial Optimal Mine Exploitation Technology (COMET) optimizer software, which analyzes cutoff, mine schedules, mill throughput, and recovery, is presented. The effect on financial return of grade uncertainty, dilution, and ore model block size is discussed. Hybrid or nested pits derived from conditionally simulated models can manage risk by taking advantage of the increase in knowledge and decrease in uncertainty as mining advances.

*New Technologies:* Integrated optimization techniques apply to different parts of the mining process and identify the main drivers in increasing NPV. Advances in schedule optimization and open-pit mining rates are discussed. A computationally efficient method is presented on joint conditional simulation of several variables (minerals-metals). New 3-D models of geologic structures that incorporate uncertainty in interpretation utilize the potential-field method.

Geostatistical simulation is applied to blasting, ore loss-dilution, excavating, and loading. Other new models of simulation and optimization apply to extraction sequence and cutoff grades. Multiple simulated ore models may improve production scheduling. Finally, a call is made to sustain research and development in the mining industry.

The book focuses on the modelling and statistics of ore grade and, to a lesser extent, financial modelling in mine planning. Other aspects—milling, metallurgy, and dewatering—are not discussed. The former are the aspects of mining closest to the concerns of explorers. One value of this volume to the exploration geologist or researcher is that it can remedy the ignorance of what constitutes a mineable resource. Understanding how a resource modeller thinks can aid in the way advanced exploration prospects are brought to the production stage. Its value is, therefore, substantial to SEG members concerned with exploration as a prospect approaches production, but much less for those concerned with geology and genesis alone.

ROGER BATEMAN

DEMPERS & SEYMOUR PTY LTD  
P.O. BOX 2323  
WARWICK, WA 6024  
AUSTRALIA  
*February 28, 2008*