

Critique Of Mineral Resource Estimation Techniques: Unveiling the Flaws and Advancing Exploration Strategies

Mineral resource estimation serves as the foundation of any mining project, providing critical data on the quantity, quality, and location of valuable minerals within a deposit. Accuracy in estimation is of paramount importance to ensure efficient planning, cost-effective operations, and successful decision-making. However, the techniques employed in mineral resource estimation are not without limitations and critiques. In this article, we will explore the flaws in current estimation practices and discuss strategies for improvement.

Understanding Mineral Resource Estimation

Mineral resource estimation involves the use of geological and statistical methods to determine the mineral content and its spatial distribution within a deposit. This process heavily relies on data collected from drilling, sampling, and geological mapping. Using statistical algorithms and interpolation methods, estimates of tonnage and grade are generated for different parts of the deposit, allowing mining companies to evaluate the economic viability of a project.

The Limitations of Traditional Estimation Techniques

Traditional mineral resource estimation techniques often rely on the assumption of geological continuity, assuming that mineralization within a deposit occurs in continuous bodies. However, this assumption can lead to overlooking the presence of discontinuities or high-grade pockets within a deposit, resulting in inaccurate estimates. Additionally, reliance on historical data and the use of rigid

interpolation methods might not capture the complex geometries and variability of mineral deposits, further compromising the accuracy of the estimations.



I'D like to be OK with MIK, UC?: A Critique of Mineral Resource Estimation Techniques

by Ethan Tussey (Kindle Edition)

★★★★★ 5 out of 5

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X-Ray for textbooks : Enabled

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Advancements in Geostatistical Approaches

To address the limitations in traditional estimation techniques, geostatistical approaches have emerged as alternative methodologies. Geostatistics incorporates advanced statistical tools and spatial analysis techniques to model and predict the distribution of mineralization within a deposit more accurately. By considering the spatial relationship between drill hole samples, geostatistical methods have the potential to provide more reliable and realistic estimations.

Leveraging Machine Learning in Resource Estimation

Machine learning algorithms have gained popularity in the mining industry due to their ability to process large and complex datasets. By analyzing a wealth of geological and geophysical data, machine learning models can learn intricate patterns and relationships, subsequently improving the accuracy of mineral

resource estimates. These models can also identify unconventional mineralization patterns, improving detection capabilities and reducing the risk of oversights or biases in traditional estimation techniques.

Challenges in Implementing New Techniques

Despite the potential benefits offered by geostatistical and machine learning approaches, their implementation in the mining industry presents several challenges. Limited availability of high-quality data, lack of expertise, and resistance to change within the industry are common obstacles faced when transitioning from traditional methods to advanced ones. Overcoming these challenges requires collaborative efforts between mining companies, technology providers, and academic institutions to facilitate knowledge sharing and the development of robust estimation frameworks.

Future Outlook: Improving Estimation Accuracy

The future of mineral resource estimation lies in the integration of various data sources and advanced technologies. By combining geological, geochemical, and geophysical data with high-resolution imaging techniques, mining companies can gain a comprehensive understanding of the mineralization process, leading to more accurate and reliable estimations. Furthermore, advancements in automated data collection, data processing, and artificial intelligence will revolutionize the estimation process, greatly enhancing efficiency and accuracy throughout the mining industry.

Critiquing the current mineral resource estimation techniques is crucial to identify their limitations and explore avenues for improvement. By adopting geostatistical approaches and leveraging the power of machine learning algorithms, mining companies can enhance the accuracy of estimations, reduce risks, and make more informed decisions. Embracing new technologies and fostering

collaboration will be essential in advancing mineral resource estimation practices, ultimately contributing to the sustainable development of the mining industry.



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This is a book for Resource Geologists and Mining Engineers in the mining industry who regularly face the challenge of which estimation technique to use, how to use it and why to use it, and then what parameters to choose. This book builds on the resource estimation provided in Jacquie's first book, "The Art and Science of Resource Estimation". The style is similarly pragmatic and accessible.

Selecting an estimation method for modelling Mineral Resources is a challenge for many Resource Geologists, especially when they have to justify their choices, ensure the best possible parameters are selected and go on to classify the risks in accordance with a public reporting code.

The purpose of this book is to help practitioners develop their understanding in a way that enables them to clarify their selections and decision making in the resource estimation process. This is not an introductory text, yet it is written with

pragmatic users in mind. This book is not full of mathematical equations (there are a few, but only where necessary and invariably supplemented with explanations). Instead the focus is on exploring concepts, testing assumptions, and developing an appreciation for the thinking and scientific reasoning required at various milestones along the estimation journey.

Estimation methods explored include Inverse Distance, Simple and Ordinary Kriging, Multiple Indicator Kriging. This book also takes a pragmatic and in depth assessment of Recoverable Resource Estimation methods such as Uniform Conditioning, Local Uniform Conditioning and various MIK approaches. This book includes numerous discussions and evaluations of effects of parameter selections that apply to specific methods, as well as the general decisions and parameters that apply broadly across all techniques.

Ultimately as a Resource Geologist you need to formulate your own estimation strategy in accordance with the context and the purpose. This book is designed to help you develop an ability to critique the context, the methods and the associated parameters, so that you can develop your ability to make informed and reasoned choices.

I hope this book contributes as a catalyst in your learning journey, guiding you as you develop your critical reasoning through the types of questions and evaluations that are possible. Mostly, my wish is that the book facilitates discussion and debate, valuable processes for forming reasoning and reasonable basis that contribute to good quality resource estimates and subsequent mining and investment decisions.



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