

# SEG 2024 Conference: Sustainable Mineral Exploration and Development

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## Mineral Systems: A Discussion on the Continuing Challenges and Emerging Opportunities

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Application of mineral systems in the exploration industry continues to expand, improving the understanding of how mineral deposits are formed, however, after years of application their full adoption and value have been hampered by some continuing challenges. Mineral systems are often only applied at the earliest stages of exploration, the systems approach though is most effective across scale, as conceptual assumptions are replaced with knowledge and proxies to critical processes are verified with direct evidence. Throughout exploration mineral systems provides the framework for understanding knowledge gaps and what data will improve this knowledge. The acquisition of knowledge identified in this gap analysis defines the exploration program needed to confirm critical processes and vector towards areas of highest prospectivity.

Continuing challenges in identifying and understanding of the critical processes, specifically which are truly essential for the formation of a mineral deposit while others may be absent or simply modifying factors. In addition to criticality, the interdependence, timing, and efficacy of processes must be evaluated to confirm their relevance. Although challenging to constrain, inclusion of these factors into systems thinking represents an emerging opportunity for understanding how and why ore deposits form. Further opportunities include improving our understanding what data is effective at what resolution and scale, improving our ability to predict and detect mineral systems, also promoting targeted research and development in deliberately designed geoscience research.

Our ability to compare geological or political regions and prioritise effort including opportunities at all scales from global prospectivity to potential acquisitions is greatly enhanced by mineral systems. The most important opportunity in the application of mineral systems to the mining industry is as the foundation for commodity supply evaluation and forecasting future production. The systems approach to supply, costs and products produced can then be integrated with other market fundamentals to formulate growth strategy.