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The Critical Mineral endowment of Large Igneous Provinces; Key Processes and Implications for Exploration

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Critical mineral resources are crucial for the energy transition, maintaining modern standards of living and climate change mitigation. These mineral resources are vital for national and economic security in addition to low- and zero-CO_2 transport, energy generation and energy storage yet have insecure supply chains, often reflecting uncertainties over the supply of these minerals from mining operations. Ensuring we have the critical mineral resources we need requires both discovery of new mineral deposits and systems as well as ensuring we make the most of the systems we have already discovered and are mining.

Understanding of the metallogenic processes linked with Large Igneous Province (LIP) events is a vital step in the discovery of new LIP-related critical mineral resources. These links can be split into those associated directly with LIP events, such as the formation of Ni-Cu-platinum group element (PGE) magmatic sulphide systems, and those that involve post-LIP event processes where LIP units can act as source rocks or reaction zones for mineralizing systems. Critical mineral resources associated with LIPs are not just limited to mafic-ultramafic LIP events but are also associated with siliceous LIPs, or SLIPs. The co- and by-product endowment of mineral systems associated with LIP events also represents a crucial yet unrealised source of critical minerals and requires further knowledge of the mineralising processes associated with LIPs. This keynote will provide an overview of key LIP-related mineralising processes and drivers, the important relationships between LIP magmatism and the associated LIP units formed during these events and critical metal metallogenesis, and the implications for exploration for critical minerals associated with LIPs.