

Unlocking Deep-Time Prospectivity: Integration of Multiple Paleogeographic Models with Geochemical, Geochronological, and Thermochronological Big Data

Fabian Kohlmann¹, Wayne Noble¹, Moritz Theile¹, Romain Beucher¹, Xiaodong Qin², Brent McInnes³, R. Dietmar Müller²

¹Lithodat Pty Ltd, Melbourne, Australia, ²The University of Sydney, Sydney, Australia, ³Curtin University, Perth, Australia

Effective mineral exploration increasingly depends on robust spatial and temporal understanding of Earth's dynamic geological processes. LithoPlates, an innovative and highly versatile geoscience platform, uniquely addresses this by providing rapid access to multiple, interchangeable global plate tectonic reconstructions extending back to approximately 1.8 billion years. Users can seamlessly switch between different published plate models, enabling immediate comparison and critical evaluation of geological scenarios.

By integrating these plate tectonic reconstructions with comprehensive standardised big datasets, including major and trace element geochemistry, geochronology, thermochronology, and mineral deposit occurrences, LithoPlates delivers a powerful, interactive environment for visualising and interrogating geoscience data through deep time. Advanced dashboards and built-in interpolation and analytical tools facilitate rapid identification of critical relationships between tectonic events, magmatism, sedimentary processes, and mineral deposit formation.

A significant innovation of LithoPlates is its capability to reconstruct geoscience datasets palinspastically, preserving original spatial relationships and ensuring accurate temporal and spatial context for geological interpretation. This functionality is crucial for exploring mineralisation patterns and predicting prospective regions historically influenced by tectonic events, basin evolution, magmatic episodes, and hydrothermal activity.

Moreover, LithoPlates provides integrated Open REST APIs, allowing reconstructed geospatial datasets and rich associated metadata to be seamlessly consumed by external software platforms. This connectivity enables direct integration into advanced prospectivity analyses, including cutting-edge machine learning workflows and automated mineral targeting systems, significantly enhancing exploration efficiency and success rates.

LithoPlates thus represents a critical step forward in deep-time mineral systems exploration, combining flexible multi-model plate reconstructions with robust geoscience data integration and advanced analytical capabilities. This integrated approach empowers explorers to rapidly develop new geological insights, optimise exploration strategies, and improve predictions of mineralisation processes through geological time.