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Finding mineral potential in greenfields regions with structural geophysical interpretation, west Kimberley, Australia.

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The mineral potential of the greenfields west Kimberley region is investigated following structural interpretation of gravity and magnetic data. Special attention is given to identifying geological structures that reveal aspects of the regional geodynamic history. Structural domains have been delineated and related interpreted structures sorted into discrete events assigned to tectonic activity thought to have occurred within the study area. The interpreted structures characterise the spatial extent of tectonic activity and support an expanded view of the regional tectonic framework. Geophysical interpretation is depth constrained through joint forward modelling of gravity and magnetic modelling of three sections intersecting the area. Mantle-tapping structures critical to mineral potential mapping, such as those potentially reaching the Moho, are identified through structural interpretation and supported with section forward modelling. Crustal-scale structures are identified that separate regions of different geological and geophysical character and also control the formation of the oldest geological units. Mineral potential analysis of the west Kimberley has been undertaken using the results of regional-scale structural interpretation and modelling with a mineral systems approach. Several mineral systems are considered: 1) nickel-sulphide, 2) carbonate-hosted base metals, 3) orogenic gold, 4) stratiform-hosted base metals, 5) intrusion-related base metals (including tin-tungsten, iron-oxide-copper-gold and porphyry deposits). The resulting mineral potential maps reveal that spatial variations in geological characteristics considered favourable for each mineral system also indicate relative variations in prospectivity. Potential field geophysical data are shown to be effective for generating inputs for mineral potential modelling in greenfields regions through a combination of constrained structural geophysical interpretation and joint forward modelling. Importantly, potential field geophysical data allows the identification of deeper structures, and deeper mineral potential, that may otherwise not be observable at the surface