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Links between mineral prospectivity and tectonic models in the east Kimberley, Australia

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The geology of the east Kimberley region was investigated through integrated geophysical and geological interpretation. Emphasis was placed on identifying geological structures and features that may be important to include in assessing mineral potential of the region. Subsurface structure was constrained through combined gravity and magnetic modelling along three transects. Significant crustal-scale structures were interpreted and investigated to determine their potential influence on the development of regional structure and the emplacement of magma and the circulation of hydrothermal fluids. Some newly interpreted features include a north-trending structure that runs beneath Speewah Dome, and three orogen-normal structures. A metamorphic map was compiled that delineates a zone of high metamorphic grade which is bounded by two orogen-normal structures. For the co-located gravity high, we define a regionally extensive, west-dipping source in the mid-crust that is compatible with a large mafic-ultramafic intrusion, or, perhaps, a sliver of oceanic crust. We propose a model involving the accretion of a crustal fragment to the Kimberley Craton. Accretion of the fragment led to the propagation of orogen-normal and oblique structures. The structures represent weak zones in the crust, which may have led to differential exhumation of crust during the 1835-1810 Ma Halls Creek Orogeny. The coincidence of these geological features appear to predict the location of many mineral deposits and mines, and we discuss these observations within the framework of the proposed tectonic model.