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Interpretation of Airborne Geophysical Data Over the Petermann Ranges Area, Southwestern Northern Territory

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Abstract

Semidetailed airborne magnetic and radiometric data from the Petermann Ranges have been processed and a geological interpretation carried out. The Petermann study area lies within an aboriginal reserve and covers the Precambrian crystalline basement of the northern Musgrave Block and the southwest margin of the Amadeus Basin and associated infolded sediments and metasediments. Geological detail is severely limited by extensive sand and alluvial cover, and airborne geophysics is the only practical method for mapping the solid geology over much of the area.

The geophysical data have been reprocessed and presented as greyscale digital pixel maps. Interpretation of these maps using a textural interpretation scheme has delineated two major magnetic domains. Each Domain consists of smaller textural zones based on magnetic characteristics such as amplitude, frequency and linearity of anomalies which reflect lithological variations. The magnetic data is consistent with the regional scale fold nappe structure which dominates the north of the study area and much of the southwestern margin of the Amadeus Basin. The interpreted Northern Magnetic Domain includes the sediments of the Amadeus Basin, the Petermann nappe as well as original gneissic and granitic basement rocks. Large scale east–west basement shearing has been delineated within the basement of the Northern Domain. A two stage model for the emplacement of the Pottoyu Granite Complex of the Musgrave Block is proposed, with components both pre and post basement shearing, and a further deep seated granitic intrusion is interpreted as the major source of the Cobb Gravity Depression within the study area.

The Southern Magnetic Domain correlates with the high grade granulite gneisses of the Musgrave Block and has been subdivided into two lithomagnetic units which reflect large scale basement structure. The boundary between the Northern and Southern Domains is interpreted as the geophysical response of the Woodroffe Thrust, a major crustal dislocation in Central Australia. Current geological information only provides an approximate position for the Thrust whereas the geophysical data has been used to trace the feature more accurately than previously possible in the study area. The extension of the Mann Fault Zone from South Australia into the Northern Territory is confirmed and local to semiregional scale faulting and folding is defined in both Domains.

This research has shown that by detailed reprocessing and interpretation the geophysical data can be a useful aid to geological mapping in areas where access is limited and geological control is sparse. The results of this project provide the starting point for detailed geological mapping in sections of the aboriginal land in central Australia.