

Rock magnetism, geologic history and aeromagnetic anomalies: A case study of the Ulupa Siltstone, Adelaide Geosyncline

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Abstract

Marine siltstones and fine sandstones of the Brachina Formation and olive-green siltstones of its more distal equivalent, the Ulupa Siltstone, were deposited during the Marinoan in the Adelaide Geosyncline. These sediments have since been deformed and metamorphosed during the Ordovician Delamerian Orogeny.

In the Flinders Ranges, the relatively unmetamorphosed sediments, though iron-rich, are only weakly magnetic. In the Mount Lofty Ranges, where peak metamorphic grades were reached, the Brachina Formation and its equivalent, the Ulupa Siltstone, are extremely magnetic. Magnetic markers within these formations have been used to trace the macrostructure of the Southern Adelaide Foldbelt and have been especially useful where outcrop is limited.

While the magnetic markers are consistent with respect to their continuity and presence, the amplitude and character of the anomaly changes significantly along strike. This is basically a function of metamorphic grade as anomalies at lower grades can be successfully interpreted (since both depth and dip are often known) assuming induced magnetisation only. At the highest grade, where the rocks are andalusite schists, the magnetic anomalies are inconsistent with the direction of the present magnetic field, and remanence must represent the greater component of the anomaly.

The results of the rock magnetism study show a close correlation between metamorphic grade and the variation in magnetic mineralogy and natural remanent magnetisation. The rocks display multiple components of NRM including a weak primary detrital component acquired during deposition and a much stronger thermal or chemical component acquired during the Delamerian Orogeny. The secondary component has been related to the NRM direction indicated by the nearby Black Hill Norite which is believed to have intruded during the waning phases of the Delamerian Orogeny.

The results of the rock magnetism study have been interpreted in terms of the geologic history of the Ulupa Siltstone and have been used in the interpretation of the aeromagnetic anomalies it causes.

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