

ANALYSIS OF LANDSAT TM AND GAMMA-RAY SPECTROMETRY DATASETS FOR VHMS EXPLORATION, WESTERN AUSTRALIA

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Abstract

Previous studies in the Panorama district (East Pilbara Granite-Greenstone Terrain (EPGGT), Western Australia) indicate that spatial distributions of white mica and K concentrations are diagnostic of paleo-fluid paths that resulted in hydrothermal alteration systems associated with volcanic-hosted massive sulphide (VhMS) deposits. Paleo-fluid recharge zones are characterised by hydrothermal alteration enriched in white mica and K whilst paleo-fluid discharge zones, which are spatially associated with VhMS deposits, are characterised by hydrothermal alteration depleted in white mica and K. Based on this knowledge, Landsat TM and gamma-ray spectrometry datasets were analysed to map spatial patterns indicative of paleo-fluid paths, which could guide regional exploration for VhMS deposits. Band ratio (5:7) images of Landsat TM data and K-channel of gamma-ray spectrometry data were used to interpret paleo-fluid recharge and discharge zones in a test area in the Panorama district containing the Kangaroo Caves deposit. Initially, the raw band ratio and K images were found not satisfactory in recognising spatial patterns indicative of known hydrothermal alteration suites. The band ratio and K images were then enhanced by a simple normalisation technique using average and standard deviation of image values per lithologic unit. The normalised band ratio and K images represent, respectively, relative abundance of white mica and K. Spatial patterns associated with known hydrothermal alteration suites are clearly enhanced in the normalised images, which facilitate interpretation of paleo-fluid recharge and discharge zones. The technique was further tested in the whole of Panorama district resulting in recognition of sets of recharge and discharge zones associated with known VhMS deposits. The results show usefulness of the normalisation technique, which is scene-dependent, in analysing Landsat TM and gamma-ray spectrometry data to infer paleo-fluid paths in order to guide regional exploration for VhMS deposits in other terrains with geologic settings similar to Panorama district.