

## Hyperspectral Mapping of Mineral Assemblages Associated with Gold Mineralization in the Central Pilbara, Western Australia

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### Abstract

The Indee district, located in the Central Pilbara tectonic zone of the North Pilbara terrain in Western Australia, contains Archean lode gold deposits and epithermal gold systems. Hydrothermal alteration assemblages associated with these deposits contain the minerals pyrophyllite, white mica, chlorite, and tourmaline. Known prospects are surrounded by flat areas of poorly exposed calcretized bedrock, calcretes, rock float, and sandy soils. Two adjacent lines of airborne hyperspectral data (HyMap®) were acquired. To produce mineral abundance maps, these data were processed to correct for atmospheric and illumination conditions and then calibrated to reflectance data using field spectra. This analysis successfully mapped the distribution of pyrophyllite, white mica, Mg chlorite, Fe chlorite, calcite, dolomite, kaolinite, tourmaline, hematite, and goethite. Alteration assemblages associated with the Camel 2 deposit, which is located along the Mallina shear zone, were found to be characterized by pyrophyllite and Al-rich white mica, the latter having an ALOH absorption feature at 2.194  $\mu\text{m}$ . In contrast, alteration assemblages associated with epithermal deposits south of the Mallina shear zone are characterized by Al-poor white mica with a longer wavelength absorption feature at 2.210  $\mu\text{m}$ , the shift reflecting the change in Al chemistry (Tschermak substitution). Tourmaline is also present near the epithermal-like deposits, suggesting that it may be an integral part of these systems. Fe chlorite is associated with both the mesothermal and epithermal systems but is also pervasive as a regional metamorphic mineral. Regolith-related carbonates are common throughout the area and their compositions are determined by the hyperspectral processing. Mineral abundance images were verified by PIMA® (portable infrared mineral analyser) analysis of ground samples, and assays of rocks in previously unknown areas of pyrophyllite and white mica confirmed the presence of anomalous gold. These results show that mineral maps and compositional information derived from hyperspectral analysis are extremely valuable for exploration, even in poorly exposed, regolith-dominated districts such as Indee.