ADVANCES IN HYPERSPECTRAL PROCESSING FOR PROVINCE- AND CONTINENTAL- WIDE MINERAL MAPPING

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Comprehensive mapping of the mineral composition of the Earth's surface, at province to continent scales is of value for a range of geoscience applications from mineral and petroleum exploration through to soil characterization. One vision for Australia is the generation of a complete suite of web-accessible, seamless, accurate maps of the Australian continent for mineral abundances and physicochemistries, at high spatial resolution, made available to geoscientists through the government geoscience agencies. A recent two year project with the Queensland Geological Survey, as part of the "*Smart Exploration*" and *Smart Mining"* initiatives of the Department of Mines and Energy Queensland, has been a significant milestone towards making this vision a reality. In particular, 25000 km^2 of hyperspectral mineral and compositional map products, at 4.5 m spatial resolution, have been generated and made available via the internet (http://www.em.csiro.au/NGMM/; http://www.dme.qld.gov.au/mines/hyperspectral.cfm). Ultimately, such data sets are designed to provide explorers and soil scientists with a window for understanding sub-surface processes over a wide variety of geological and environmental landscapes.

The recent Queensland hyperspectral mapping project demonstrated the successful use of spectral indices to target diagnostic reflectance absorption properties and features associated with mineral composition. In addition, the application of a multi-level series of masks, in a logical sequence, reduced possible ambiguities in the quest to extract unique solutions for each mineral species, compositional variation, crystalline or water bonding state. Several significant issues had to be addressed including the choice of appropriate consistent thresholds, applied across large scale survey areas encompassing diverse environments. This approach was applied to the 25000 km^2 of hyperspectral data acquired as part of this Queensland Project. A new technique was also developed to compensate for variable vegetation cover, enabling the extraction of purely geological information (*e.g.* soil, outcrop, colluvium). The resulting map products were no longer dominated by anomalously high mineral contents associated with exposed watercourses, roads, earthworks and topographic related vegetation patterns. Such maps enabled an improved geological interpretation for mineralogy related to stratigraphy, and possible mineralized alteration trends. The application of this Vegetation Compensation Continuum Depth (VCCD) algorithm is therefore a significant step to assist high spatial resolution hyperspectral mineral mapping, at continental scales over diverse landscapes and environments.