REGOLITH MAPPING AND INTERPRETATION OF AIRBORNE HYPERSPECTRAL DATA FOR ZINC SILICATE/OXIDE MINERALISATION NEAR BELTANA IN THE NORTHERN FLINDERS RANGES OF SOUTH AUSTRALIA

Alexandria Pengelly & Patrick James

CRC LEME, School of Earth and Environmental Sciences, University of Adelaide, SA, 5006

The aims of this study were to map alteration of bedrock and determine if the overlying regolith could be successfully mapped using airborne hyperspectral data. The success of the mapping was intended to show the usefulness of hyperspectral data as a mineral exploration tool.

The Beltana area is 540 km north of Adelaide, South Australia, in the northern Flinders Ranges (Figure 1). The Beltana area was chosen for this study as the area has good bedrock exposure and also a variety of alteration and regolith systems. The Perilya mining and exploration company have produced detailed geologic maps available in digital format at up to 1:2,500 scale over 20 km of strike. The area also contains significant zinc ore bodies (e.g., Beltana, Aroona and Reliance), which makes it of interest for applications to exploration (Groves 2002).

Figure 1: Location of Beltana from Flinders Ranges Research website.

The geology of the Beltana region consists of Neoproterozoic Rawnsley Quartzite and early Cambrian Parachilna Formation, Woodendinna Dolomite, Wilkawillina Limestone and various other shales and limestones. Zinc mineralisation in the area is hosted within hematitic dolomite alteration and breccia of the surrounding Wilkawillina Limestone. The main ore mineral is willemite, with less abundant smithsonite. The zinc mineralisation is structurally controlled by the nearby Northwest Fault (Coates 1973).

In March 2002 a HyMap™ survey was flown over the Beltana area by HyVista Corporation. HyMap™ is a hyperspectral scanner that covers the spectrum continuously from 450-2500 nm over 126 bands at 10-15 nm bandwidth. Typical resolution of HyMap™ data is 5 m and swath width is generally 2.5 km. Three data runs were flown over the Beltana area: two trending NW were 26 km long; and one trending NNE was 10 km long (Figure 2). The data were atmospherically corrected and georeferenced by HyVista Corporation.

Data were processed using the ENVI proprietary software package. Various processing methods were used to map abundance and distribution of clay minerals and alteration. These included Spectral Angle Mapper (SAM), Spectral Feature Fitting (SFF), Linear Spectral Unmixing, Matched Filtering (MF) and Mixture Tuned Matched Filtering (MTMF). Simple classification methods were also used for lithology discrimination.

Regolith-landform mapping has been carried out to ground truth the spectral data. The area comprises one major E-W flowing creek (Emu Creek) in the north, which occupies an alluvial channel. The channel sits in a sandy alluvial floodplain, which is incised 2-3 m. To the south of the channel a shallowly dipping (2-4°) colluvial-sheetflow plain is covered mostly with lags of quartz, siltstones and carbonate, in varying proportions, and minor sandy plains, all with saltbush. Further south there are gently elevated undulating hills that contain exposed moderately to highly weathered bedrock.

Preliminary results suggest that airborne hyperspectral remote sensing is an effective method of mapping alteration and regolith. With appropriate image processing, different regolith units and alteration were distinguished. These correlated well with ground truthing in the field.

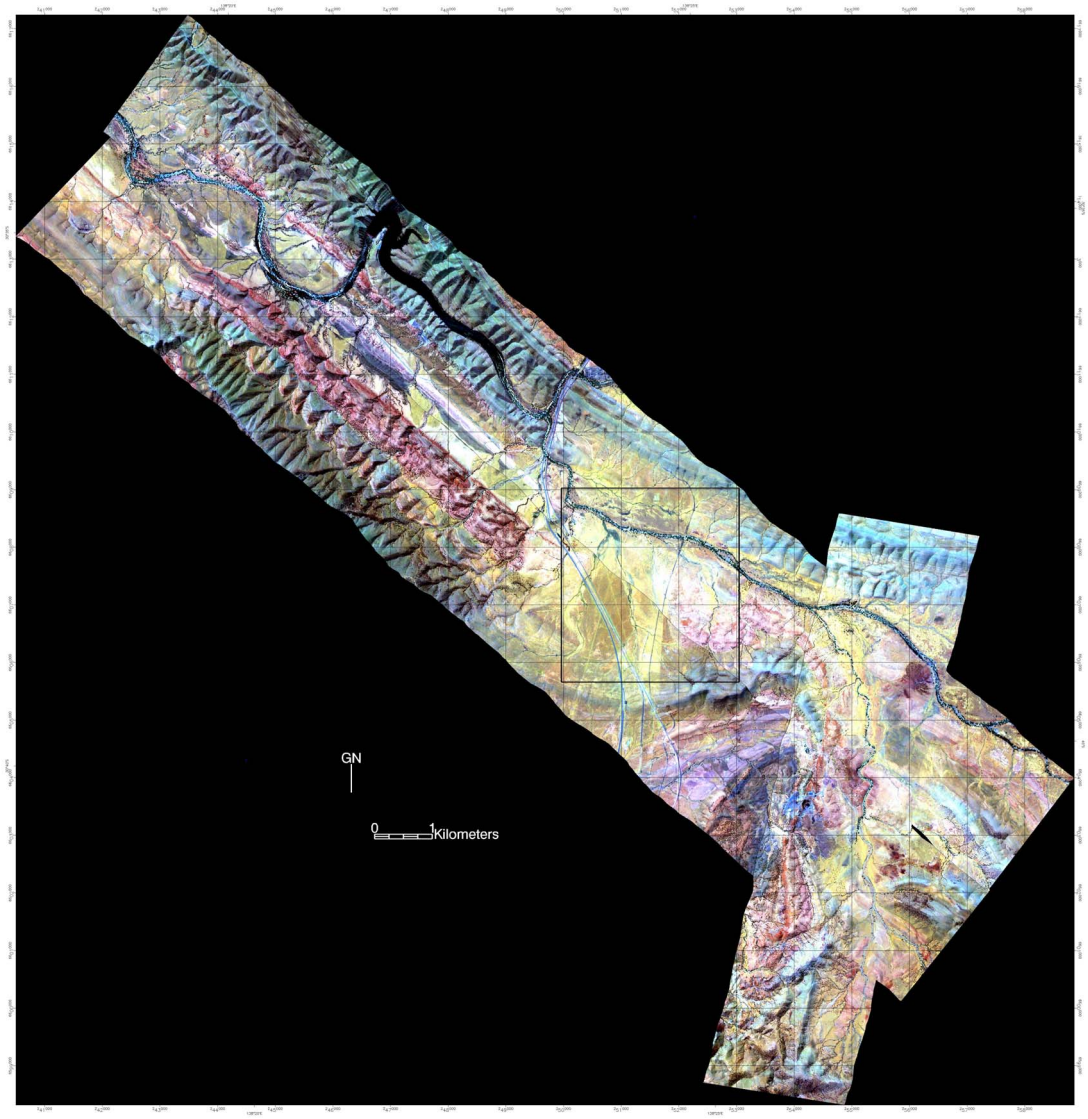

Figure 2: RGB image mosaic of the three HyMap™ data strips and regolith mapped area

REFERENCES

COATES R.P. 1973. *Copley 1: 250,000 geological explanatory notes*. Geological Survey of South Australia.

GROVES I., GREGORY I. & CARMAN C. 2002. Reliance – a new high-grade zinc silicate-oxide discovery in the Flinders Ranges. *MESA Journal* **25**, 6-10.

FLINDERS RANGES RESEARCH. http://www.southaustralianhistory.com.au/home.htm