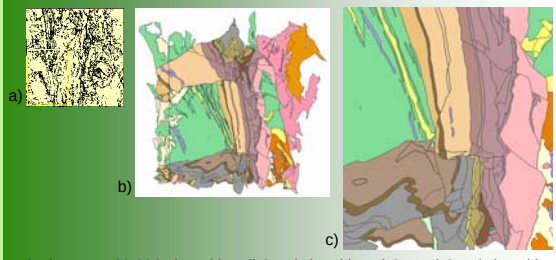
predictive mineral discovery
COOPERATIVE RESEARCH CENTRE

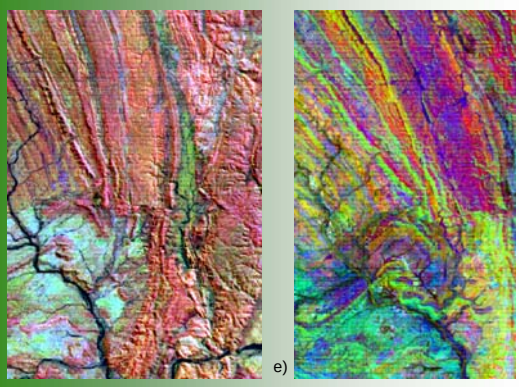
I1: Mt Isa Western Succession 3D Architecture and Ore Systems

G. Gibson, Michael Barlow, Simon Debenham, Paul Henson, Aleks Kalinowski, Lex Lambeck, Barry Murphy, Lucy Chapman, Leonardo Feltrin

Landsat, ASTER, Hyperion & PIMA



a) Alsace 1:100 000 sheet b) Bull Creek (north) and Crystal Creek (south) area c) close-up of Bull Creek Syncline, area currently under intense study due to prominent gossan within the Quilalar Fmn.



Images of the Bull Creek Syncline. d) Landsat 157 (rgb – clay, Fe-oxides, silica), e) Hyperion (raw), f) ASTER – Advanced Spaceborne Thermal Emission and Reflection (raw).

Landsat vs ASTER vs Hyperion

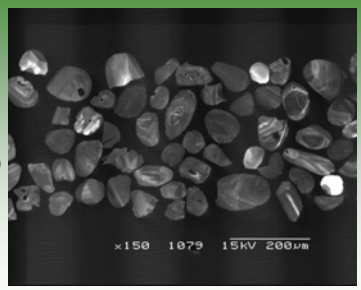
Landsat: 7 unique bands, 1 in SWIR
ASTER: 14 unique bands, 4 in SWIR
Hyperion: 196 unique bands, ~150 in SWIR

Example of K-spar & Hema-tite Alter-ation:

SHRIMP U-Pb Zircon Dating

Use zircon age populations to:

- Constrain (maximum) depositional ages for lithologies of the Haslingden Group, Quilalar Formation, and Bigie Formation.
- Describe sedimentary units from the Leichhardt (*ca* 1800 to 1750Ma), Calvert (*ca* 1730 to 1690Ma), and Isa (*ca* 1670 to 1575Ma) Superbasins. Can these age populations be used to characterise changes in provenance through time and help understand basin evolution?
- Compare sedimentary units across identified supersequence boundaries to test models describing unconformities vs structural repetition of stratigraphy.



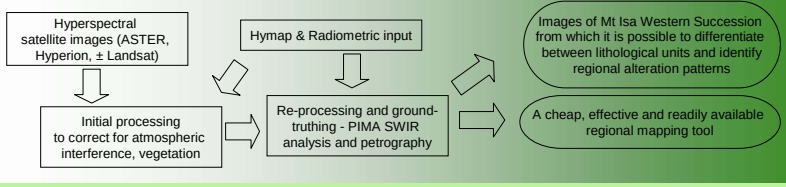
Cathodoluminescence image of zircons from the Haslingden group.

Analysing Metamorphic Grade

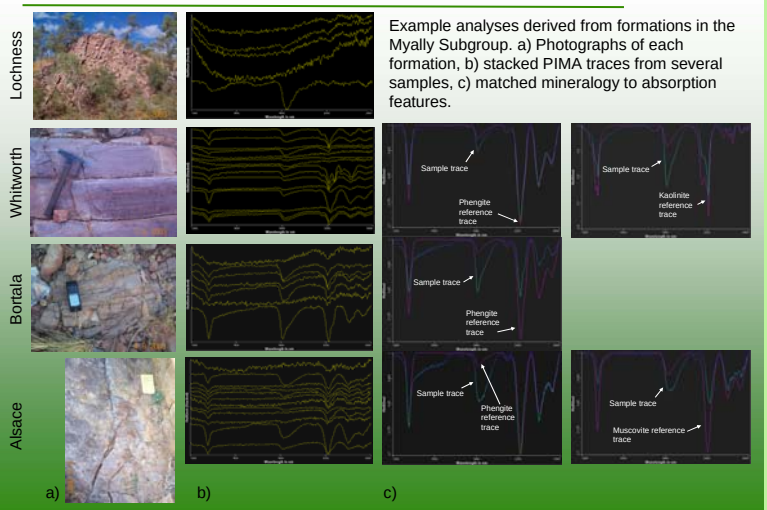
Estimates of metamorphic grade, that is, the P-T conditions to which the rocks were subjected, can be made through illite crystallinity and b_0 cell dimension analysis in low grade (subgreenschist facies) terranes. Although this method has been questioned, it is the only way to obtain P-T information for subgreenschist facies rocks such as those of the Western Succession. We are in the process of analysing 36 samples from the Mt Isa Western Succession. This data will enable us to understand the metamorphic setting of the study area.

Ground-truthing With PIMA

The Portable Infra-red Mineral Analyser is being used to ground-truth satellite-borne hyperspectral imagery through SWIR analysis. Processing satellite imagery (e.g. ASTER) produces threshold mineralogical maps that indicate probable mineralogy. However, this needs to be constrained by SWIR analysis of samples.

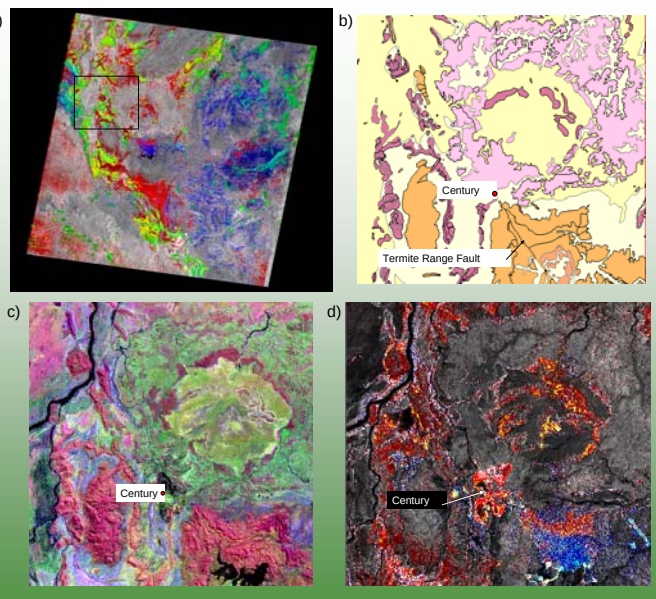


PIMA Analyses of the Myally Subgroup



Example analyses derived from formations in the Myally Subgroup. a) Photographs of each formation, b) stacked PIMA traces from several samples, c) matched mineralogy to absorption features.

ASTER and Landsat



a) ASTER image of Century / Termite Range Fault region. Clay fraction has been subdivided into phengite (red), muscovite (green) and kaolinite (blue). b) Solid geology for Century region. c) Landsat image of Century area showing clay (red), iron oxides (green) and silica (blue) compared to d) ASTER scene of Century area processed to show phengite (red), muscovite (green) and kaolinite (blue).

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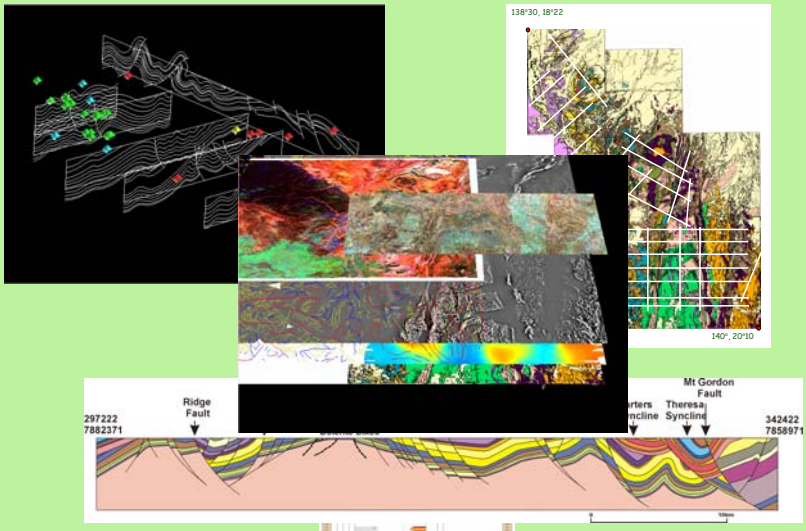
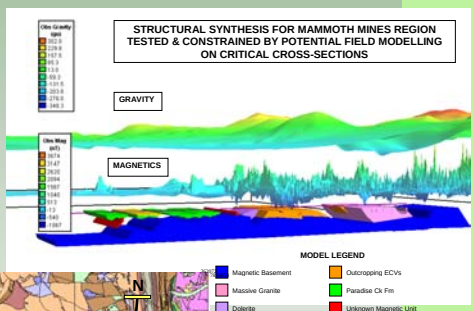
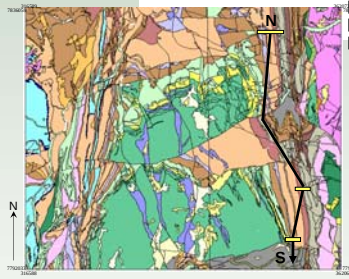
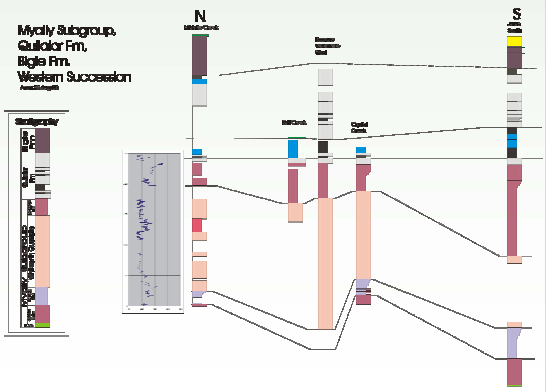
Sequence Stratigraphic Approach

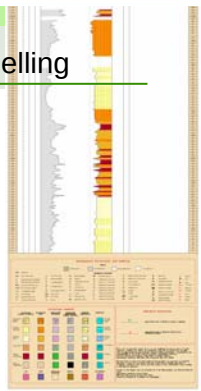








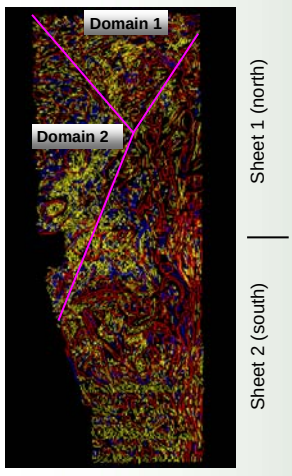
Geophysical Modelling

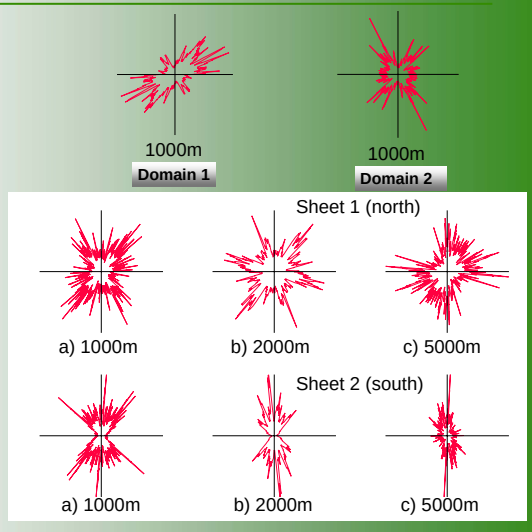


As an integral component of the 3D map construction, critical model components are validated with potential field data (gravity and high resolution airborne magnetics).
Shown here is E-W section 7816000N, crossing the Mount Gordon Fault Zone near Mammoth Mines (Camooweal, NQ).

Using an interpreted cross-section as a basic structural framework (not shown), key magnetic and contrasting-density blocks are fitted to the cross-section and the resultant response compared against field data.

Wavelet-based multiscale edge analysis ('worms')





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