I1: Western Succession 3D basin architecture & ore systems

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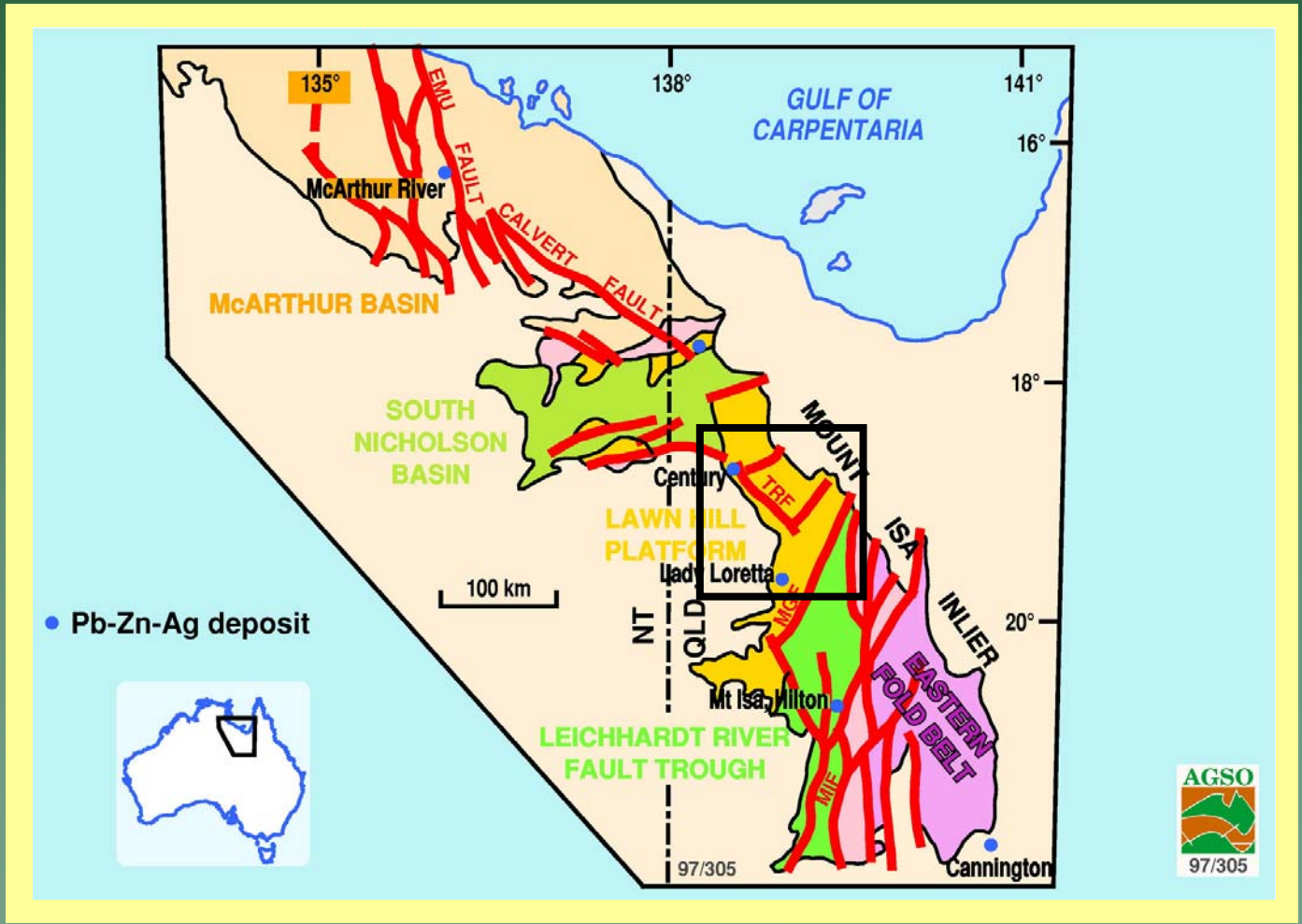
Mount Isa Pb-Zn-Ag Mineral Province



Needs of Exploration Industry

- **Basin architecture at time of fertile fluid generation & migration (F3 linkage)**
  - Nature & distribution of source rocks (origin of fertile fluids)
  - Fluid conduits & pathways
  - Mineralisation traps
- **Timing of Mineralisation (H4 linkage)**
  - Fluid development & migration
  - Entrapment
  - Relationship to regional alteration (e.g. Fe-Na)
  - Pb-Zn versus Cu

Western Succession 3D basin architecture & ore systems

1. Serial cross-sections & 3D architecture
2. Kinematic history of key structures/faults/shears
3. Metamorphism & P-T conditions
4. Upward continued wavelet analysis (mag & grav)
5. Sequence stratigraphy (depocentres; boundaries)
6. Zircon provenance studies & timing of key events
7. PIMA & Hyperspectral analysis (new program)
8. Gap analysis & deposit database

Integration & testing of previous research

NW Queensland Mineral Province report

- **Rift basin: 13 tectonic events (1800 Ma → Isa D3 event)**
- **Initial NE-SW rifting (ECV + Myally Gp.)**
- **Episodic NW-SE extension (Quilalar thro' McNamara time)**

Monash University Rift Model

- **Initial E-W (or SW-NE) trending half-graben; bounded by transfer faults (cf NW-SE half-graben favoured by NABRE)**

NABRE (P552) Sequence Stratigraphy

- **Strike-slip basins - convergent margin (NW-SE thickening wedge)**
- **Post-Quilalar (Myally) age for NE-SW half-graben**

Thrust Model (Bell, 1983)

- **N over S directed thrusting & duplex development**

Building the 3D Model

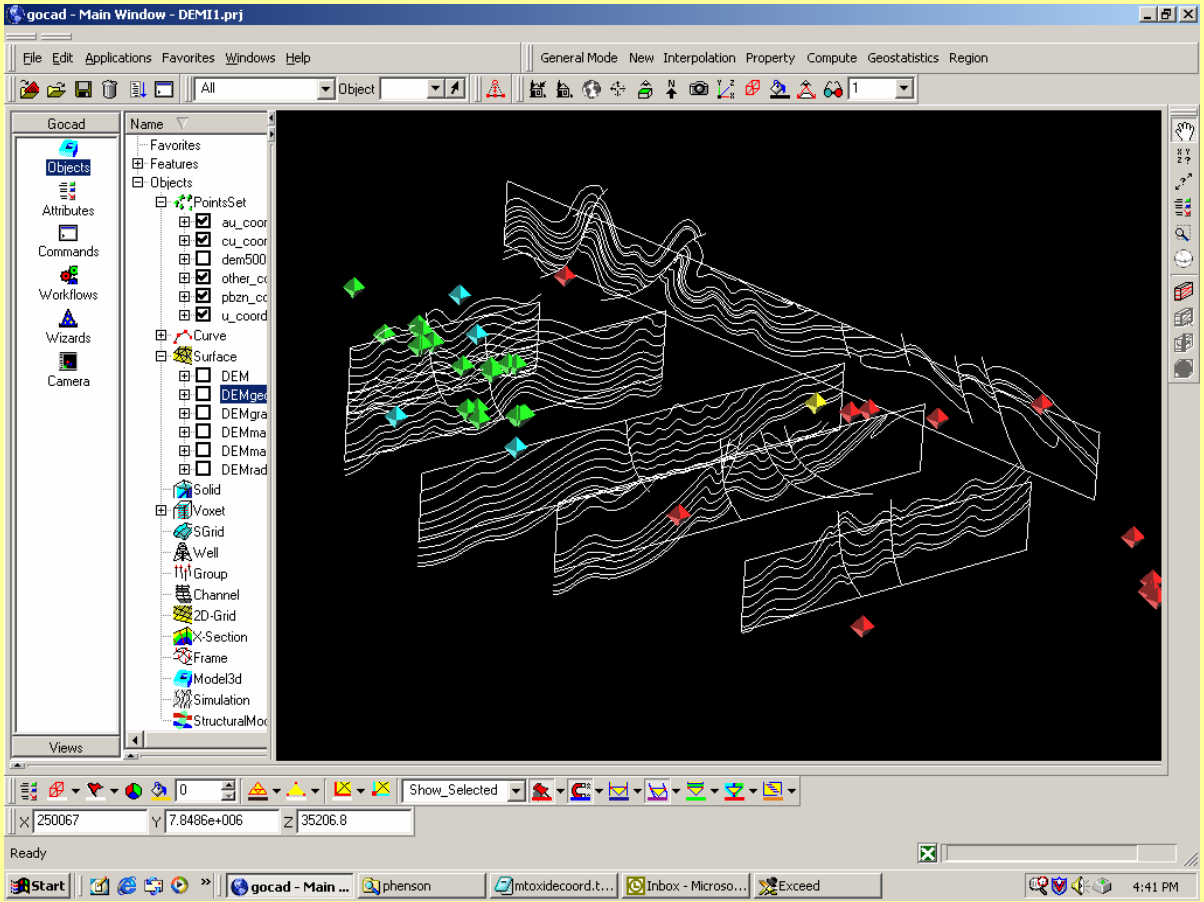
Integrating:

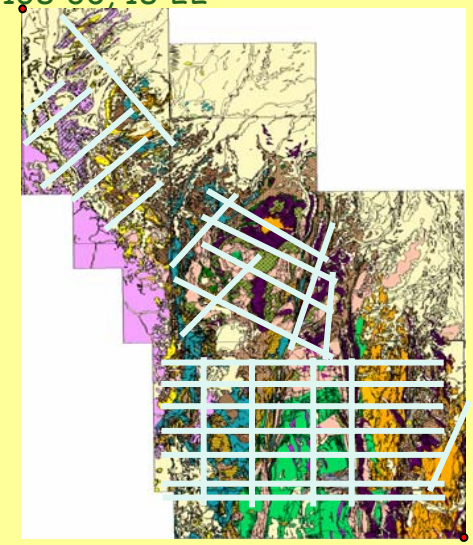
- Lithostratigraphic and/or chronostratigraphic (sequence) boundaries & unconformities
- Thickness variation in sedimentary packages
- Geometry of bounding structures & faults
- Basin topography (erosion vs non-deposition)

Deconstructing:

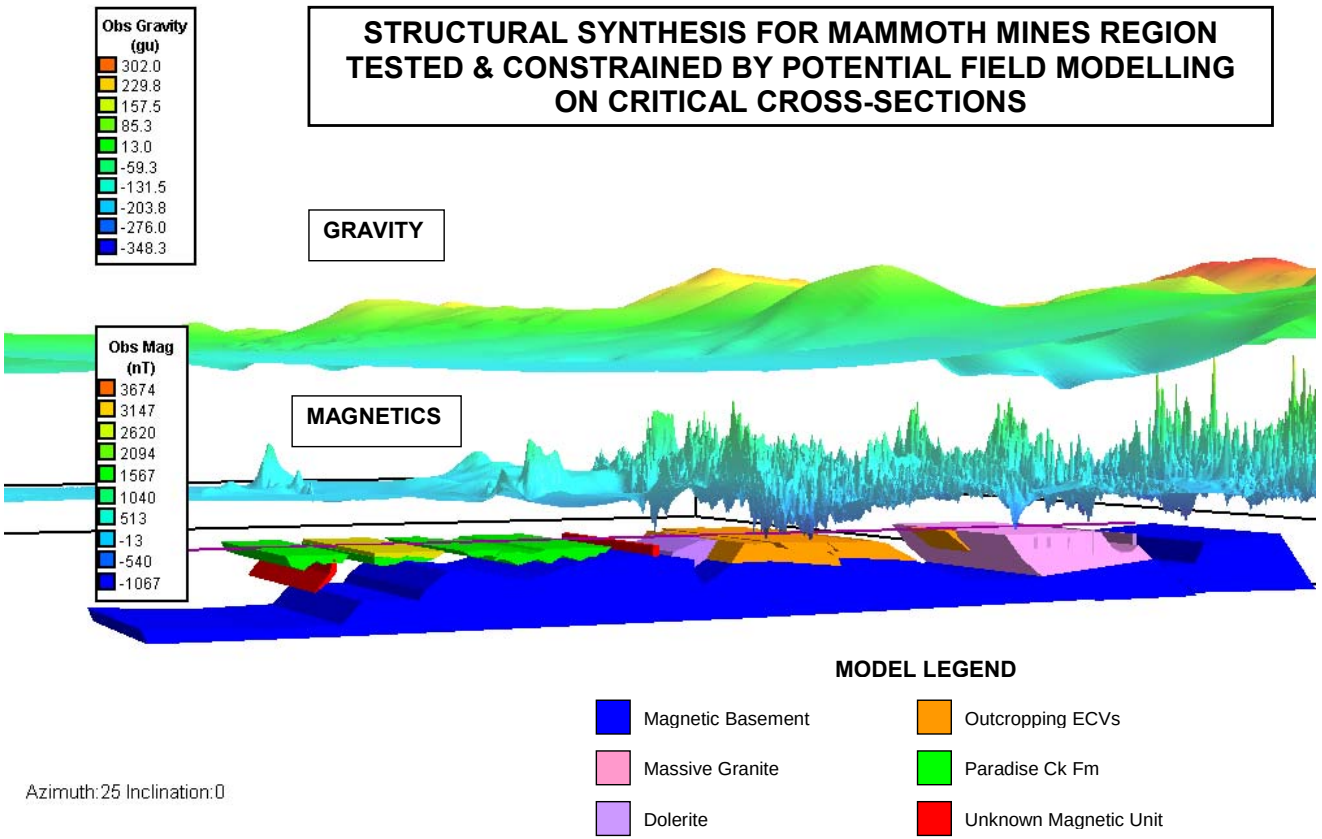
- Post-depositional structures (folds, faults)
- Tectonic excision vs structural repetition

Building the 3D Model

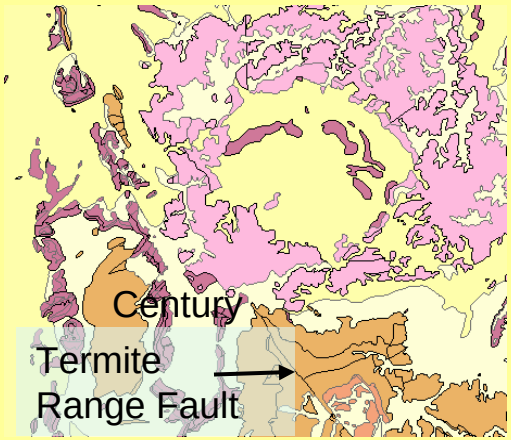




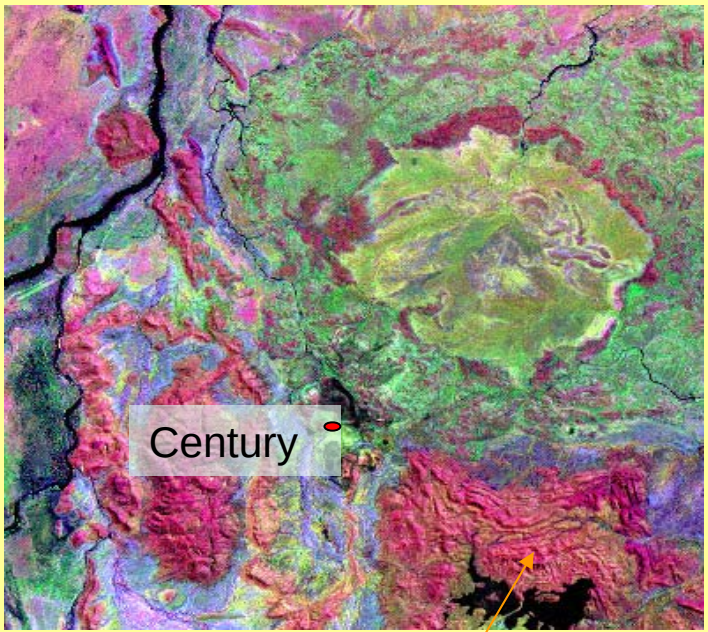
Potential Field Modelling



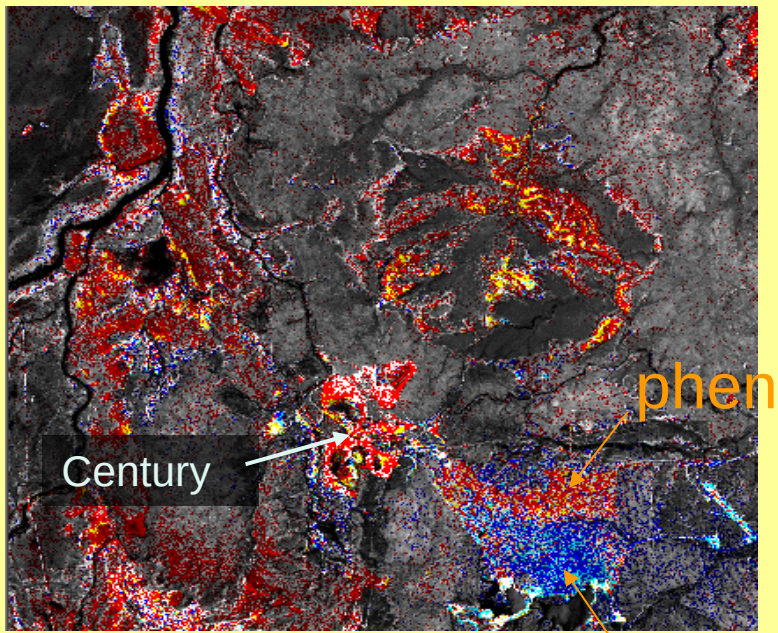
Hyperspectral Mapping



Landsat vs ASTER



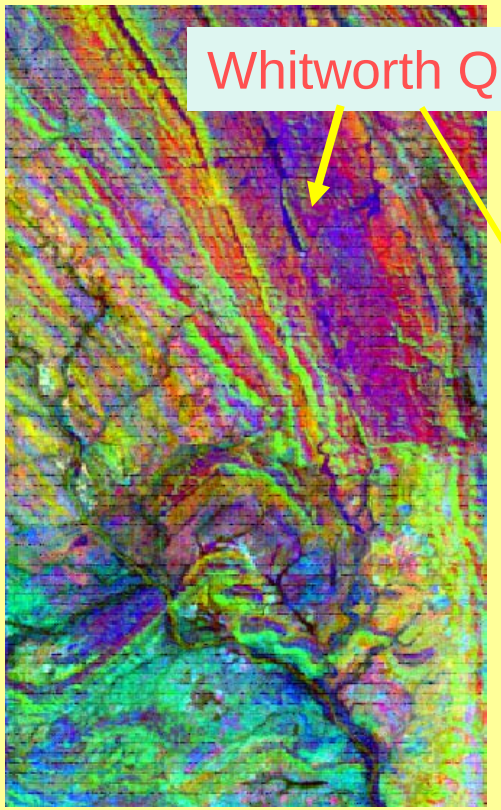
clay fraction



phengite

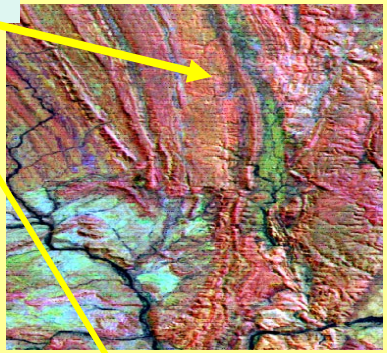
kaolinite

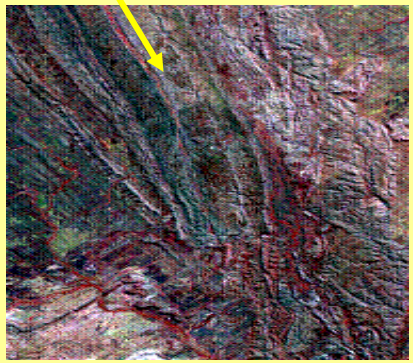
Ground-truthing Hyperspectral Imagery with PIMA



Whitworth Q.

Landsat

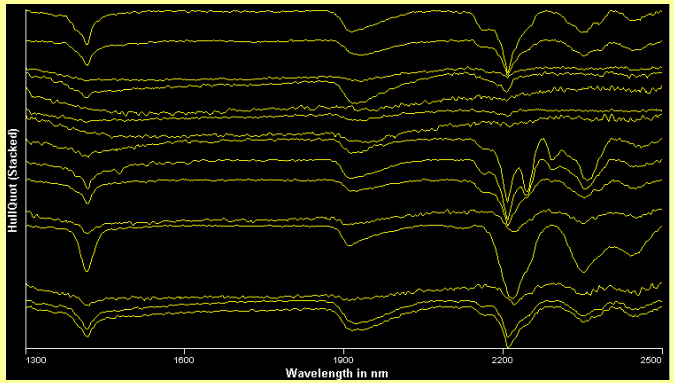


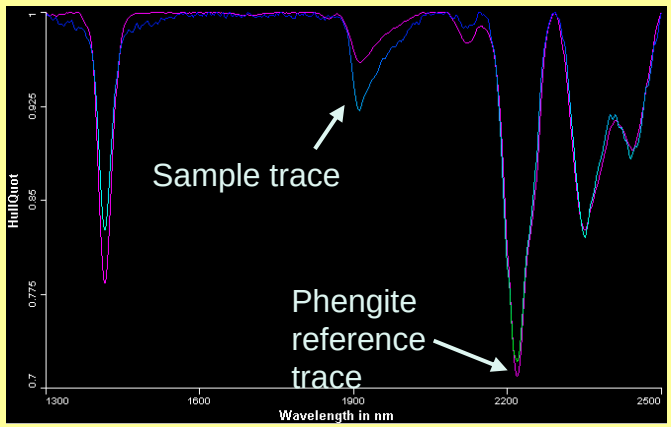


Hyperion

ASTER

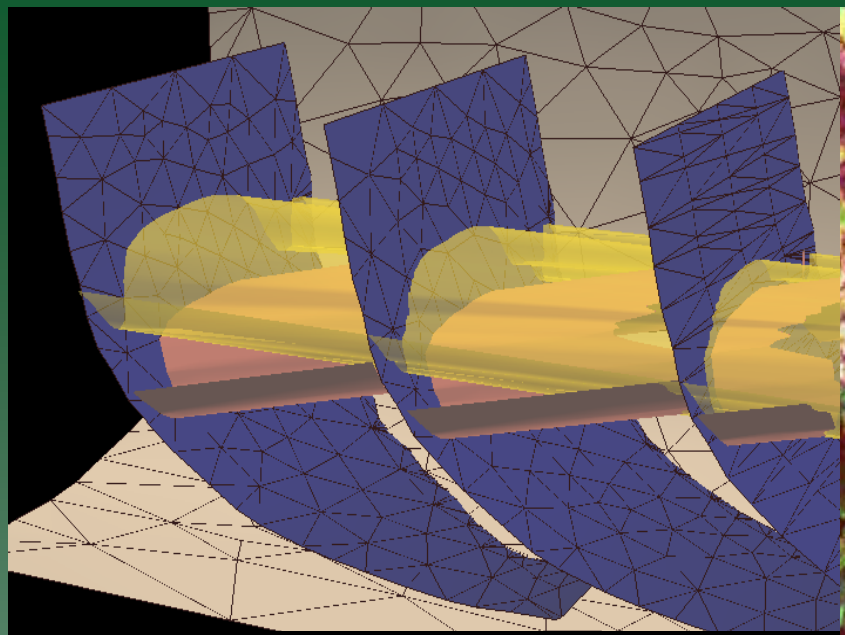
PIMA – analysis of Whitworth Quartzite

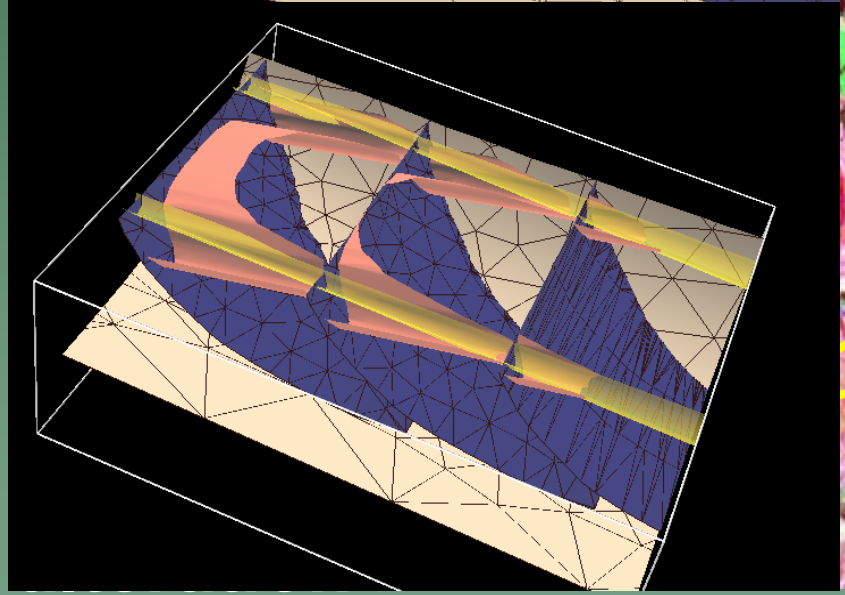


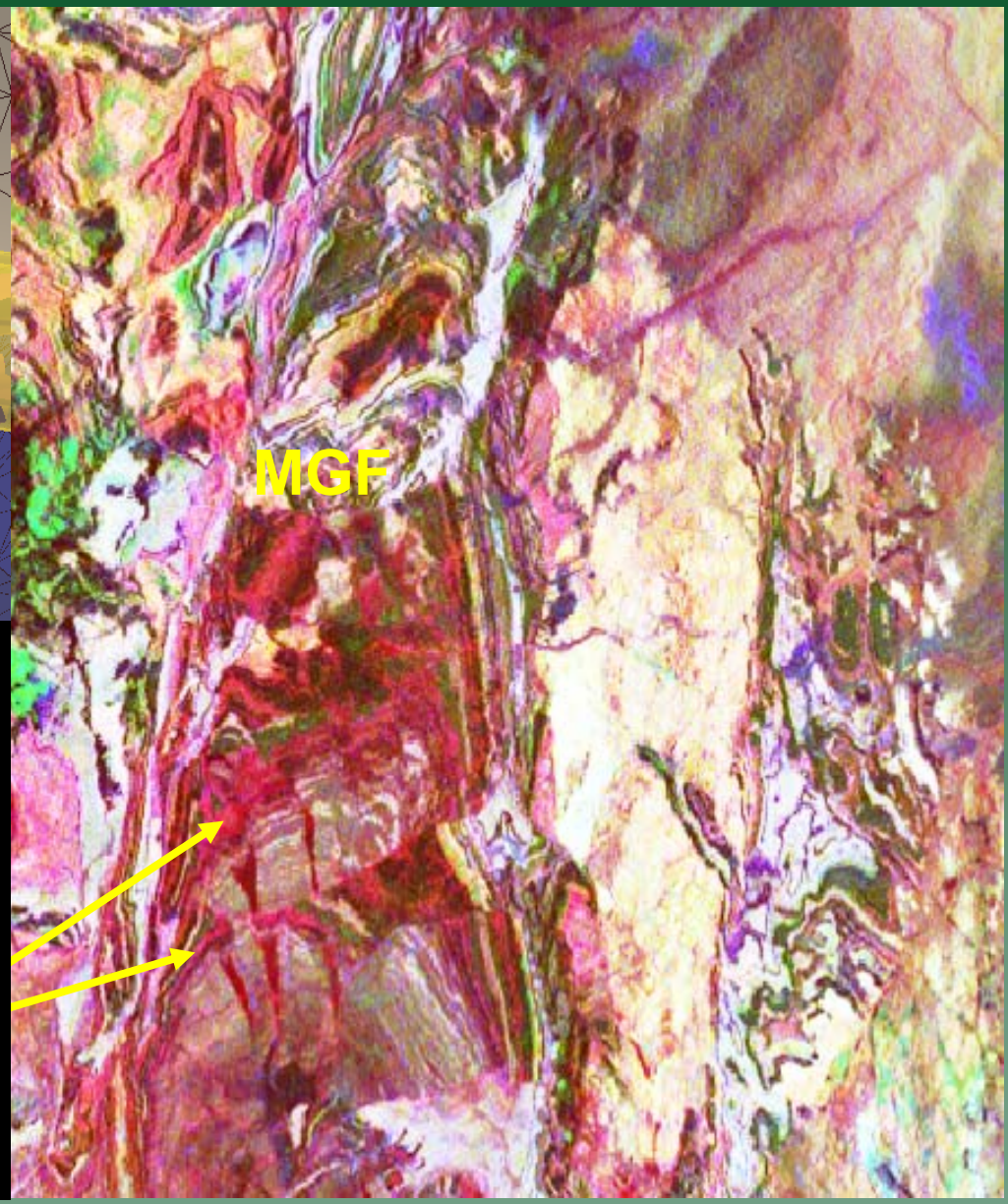


predictive mineral discovery

pmd*CRC

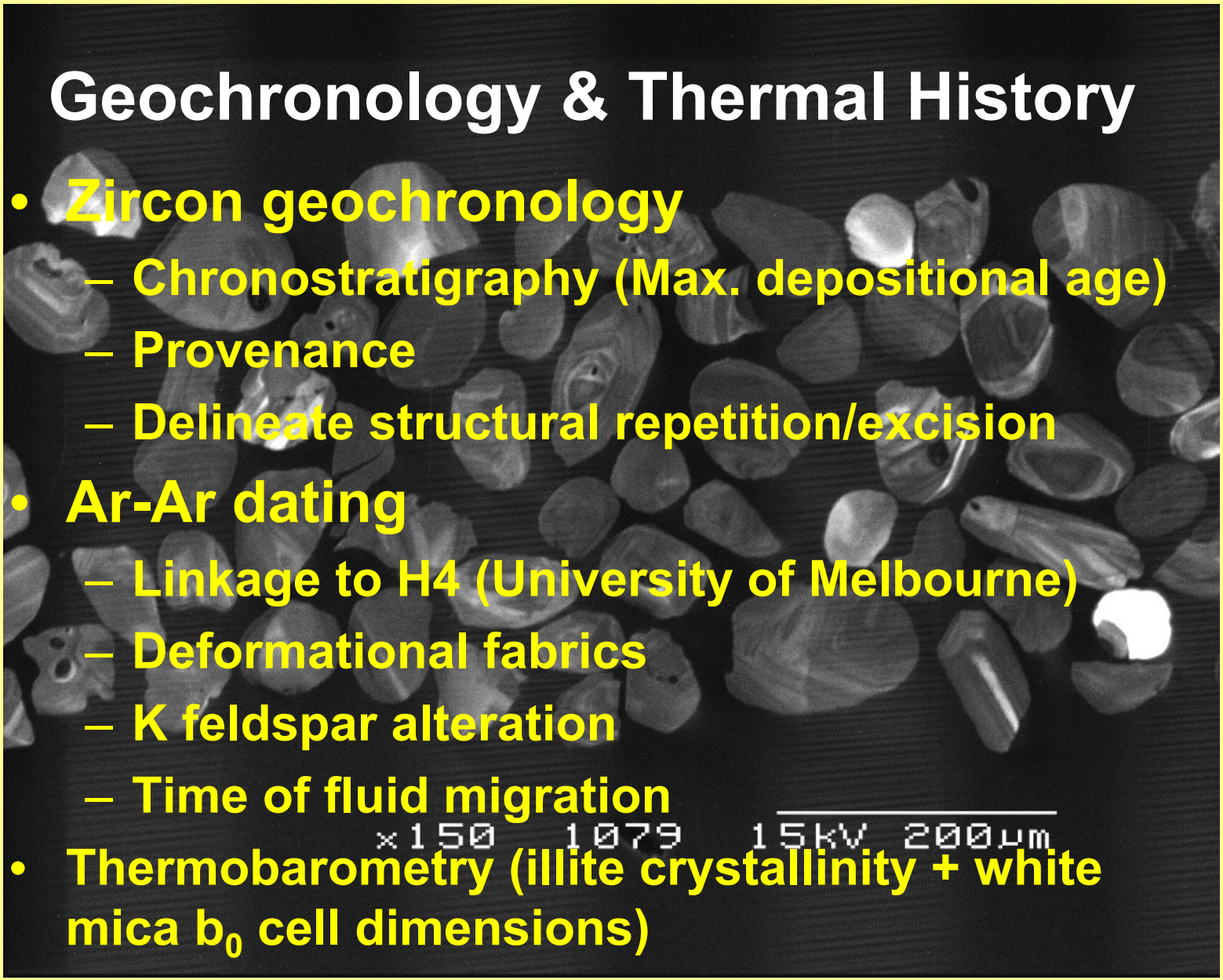




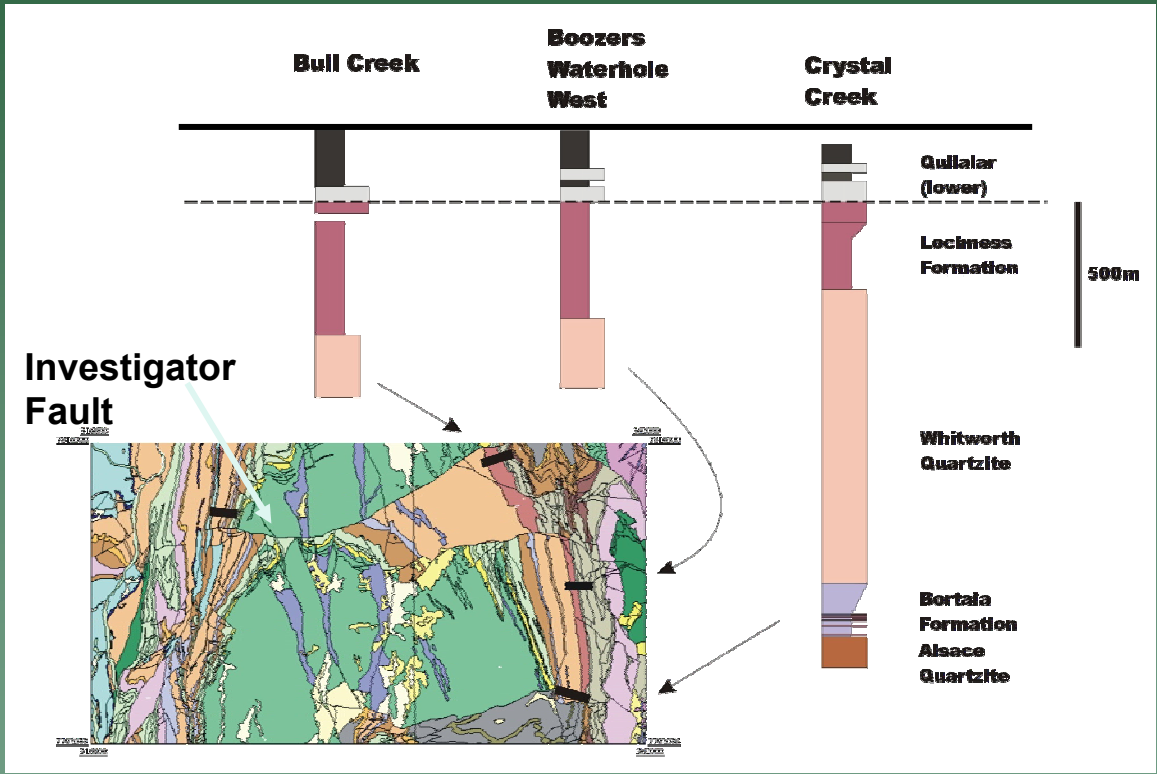

MGF

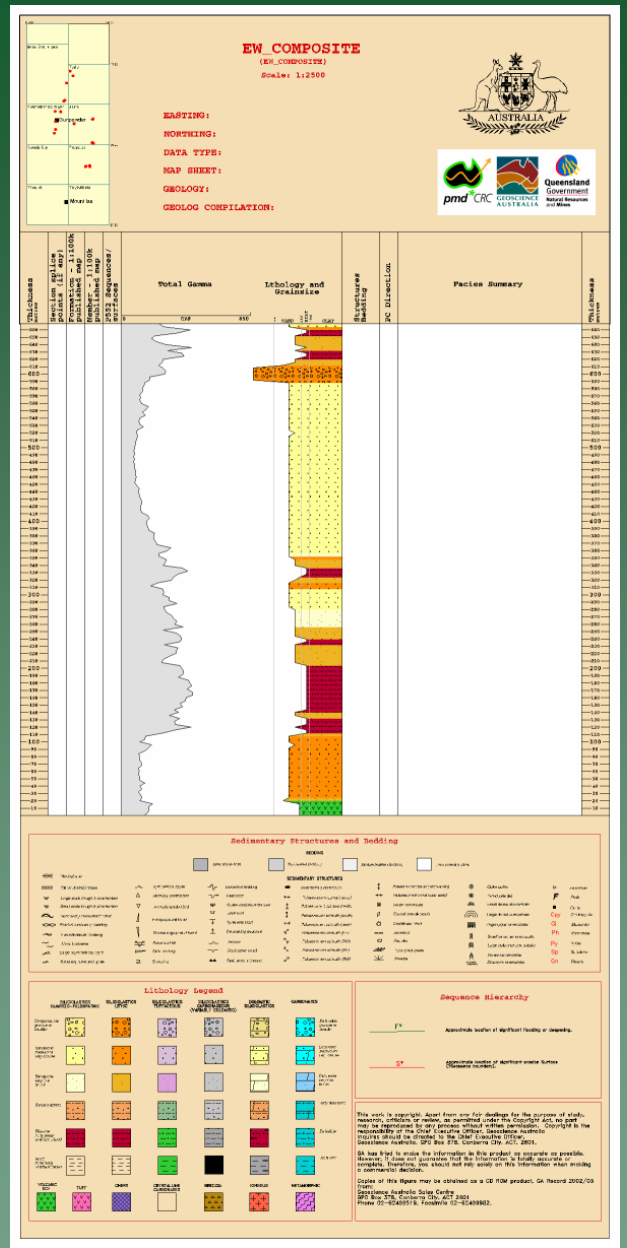
Geochronology & Thermal History

- **Zircon geochronology**
  - Chronostratigraphy (Max. depositional age)
  - Provenance
  - Delineate structural repetition/excision
- **Ar-Ar dating**
  - Linkage to H4 (University of Melbourne)
  - Deformational fabrics
  - K feldspar alteration
  - Time of fluid migration
- **Thermobarometry (illite crystallinity + white mica b_0 cell dimensions)**

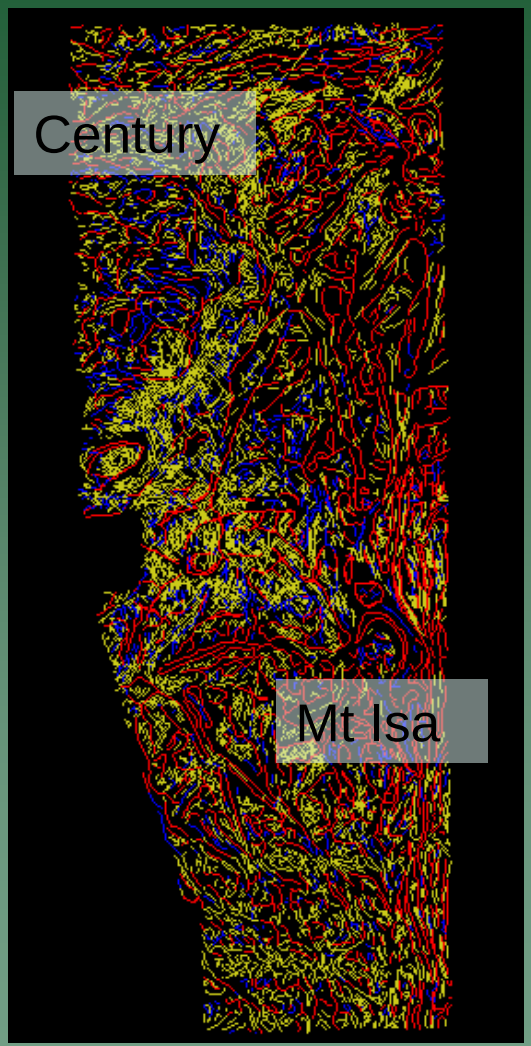


Sequence Stratigraphy



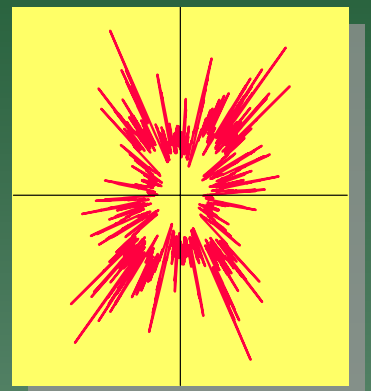


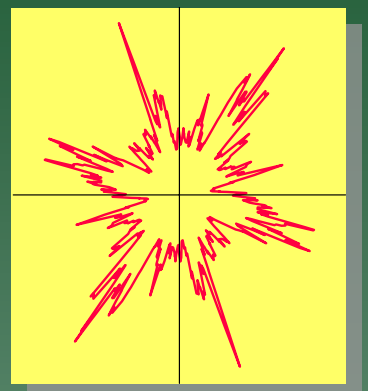
Statistical Analysis of Worms

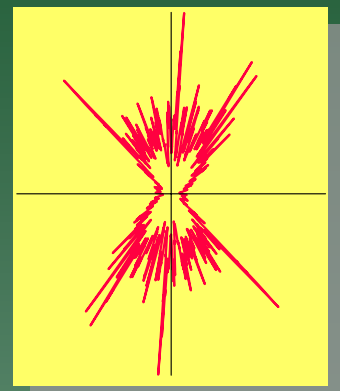


Sheet 1 (north)

Northern sheet

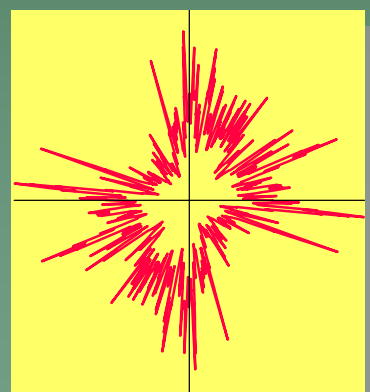


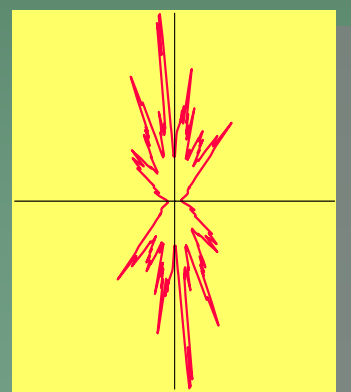


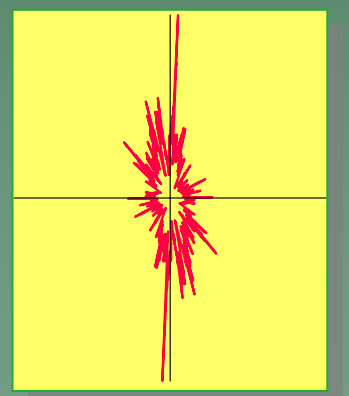


Sheet 2 (south)

Southern sheet

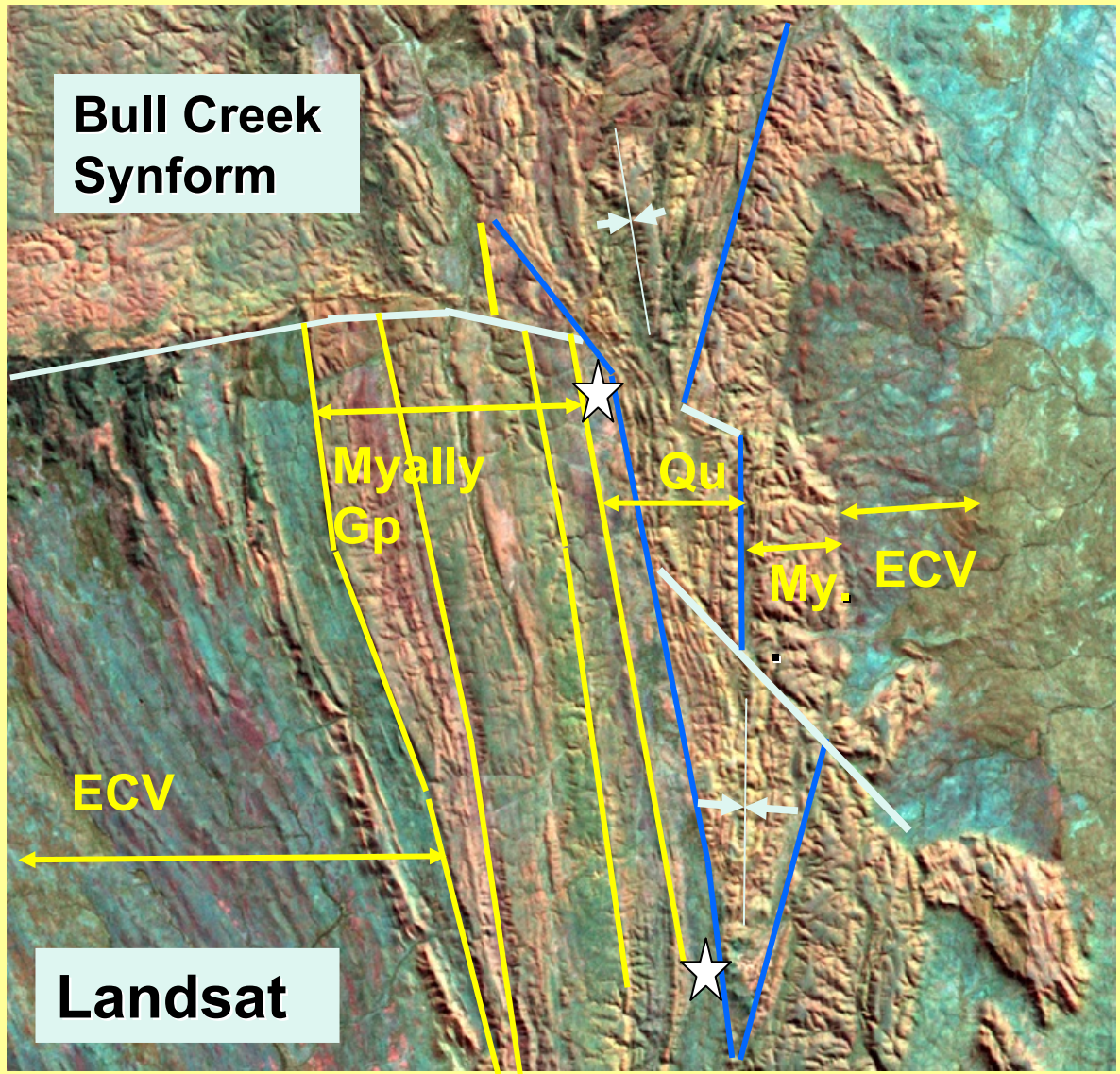


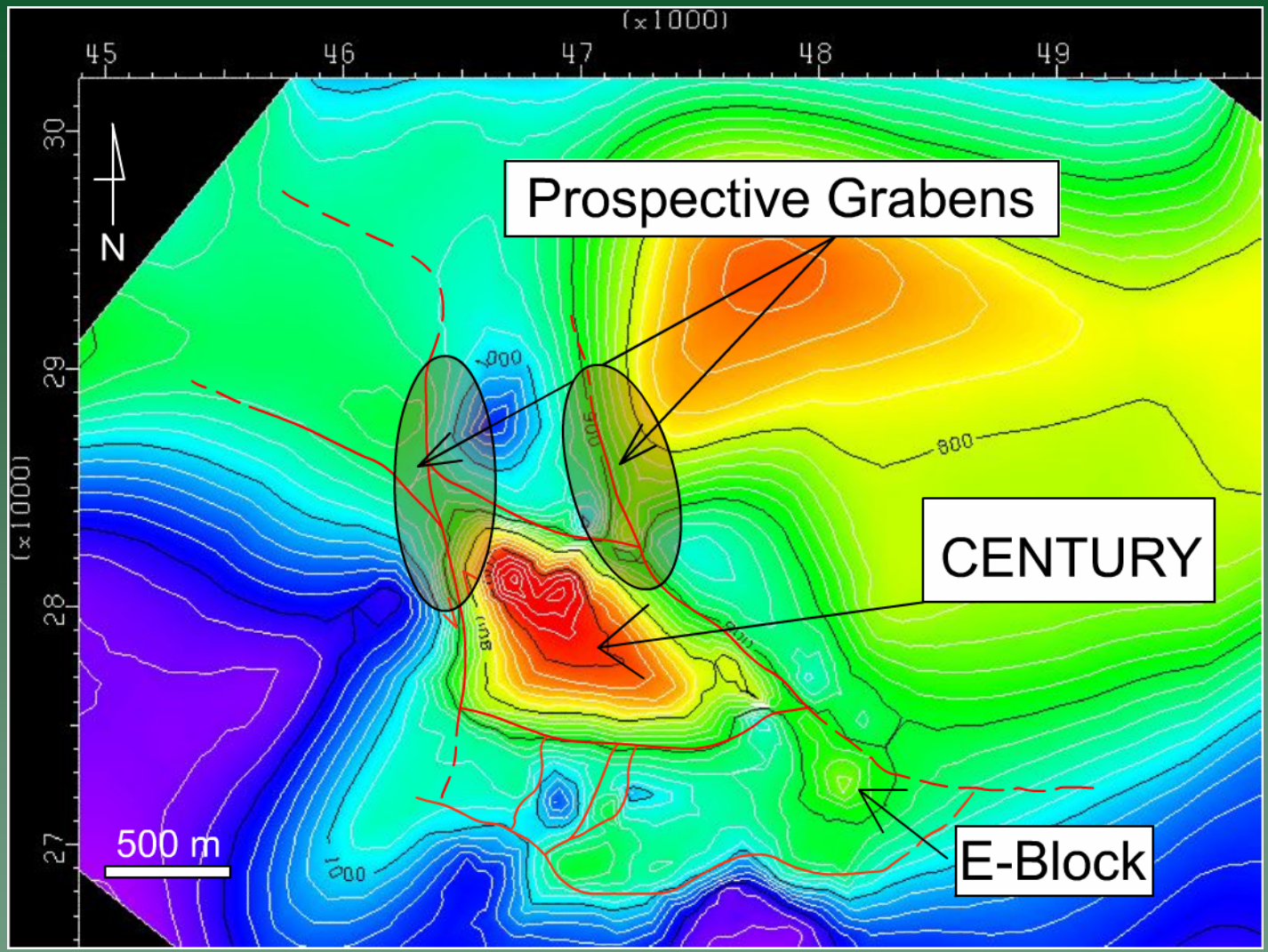




Mineralisation

- Not simple wedge geometry
- E-W shears post-date Myally Gp?
- Loss of stratigraphy across synform - erosion or tectonic excision
- Truncation in upper Quilalar Fm- Unrecognised U/C or structure
- Mineralisation in carbonates (lower Quilalar Formation)





Horizon reconstruction helps to identify graben structures that might preserve ore units, as the two Century grabens (Fig. 3). We interpret 2 potential targets based on the grabens identified and considering also the location of NW striking structures that are inferred to be the primary pathways of brines.

Heading towards…

1. A multi-disciplinary approach and understanding of the 3D architecture and mineralising systems in the Western Succession of the Mt Isa Inlier.
2. Template to address tyranny of depth through understanding size and characteristics of hydrothermal cells and structural/stratigraphic framework that supports them
3. Greater emphasis on understanding processes and predictive mineral system analysis