Regional architectural modelling of the Tasmanides: The story so far

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Where we have been & where we are going
(and a what we were thinking on the way)

- T5 scope and objectives
- Progress
  - 3D modelling (Vic)
- Flexible modelling strategies
- Data custodianship
T5 objectives

• construct a seamless 3D map of the Tasmanides (that is, a regionally consistent structural, stratigraphic and intrusion architecture of the Tasmanides Orogen)

• help understand the fundamental controls on location of major ore deposits (gold and base metals) and to assist the mineral exploration industry to predict and discover new world class ore bodies in Southeast Australia
Year 1

**Objective:** Develop coherent structural template for NSW and Victoria as input to 3D modelling of the crustal architecture of the region, with application to mineral exploration

**Methods:**
- **Compile** – Geology, Geophysics, Mineral Occurrences
- **Process** – potential field data, targeted inversion
- **Interpret** – geological data wrt potential field worms

**Products:** GIS database (MapInfo/FRACSSIS)
- 2D and 2.5D interpretive maps
Years 2 & 3

Objective: Build a 3D model (map) of the major architectural and stratigraphic elements in the Tasmanides and investigate relationships between these and major ore systems.

Methods:
- Develop standard geological legend
- 1:250000 serial sections for key regions
- 2.75D forward model sections against available PF data
- Model architectural then stratigraphic elements
- Constrained 3D inversions to check and modify geometries as required
- Integration of various models and infill modelling of rest of project region
- Analyse and interpret regional spatial relationships
  - Selwyn Block
  - Mineral systems

Products: 3D model and database (FRACSIS/GOCAD)
- Volumes attributed with petrophysical data
- Series of model mineralisation geometries as basis for regional numerical simulations
Gravity worms

GA Worms 800m-90km

FracWorms

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Gravity Worms
Magnetic Worms

GA worms 500m-44km

Fracworms
Magnetic Worms

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Derived PF worm maps

Magnetic Worms
Length Distributions
Modelling - scope

T5 serial sections
- Vic - d.green
- NSW – l.green

T1 Western Vic model
- section loc. – blue

T11 Cobar Model
- section loc. – mauve

T13 seismic traverse
- line location – red

GA Lachlan Model
- Geoinformatics - grey

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Methodology - sections

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Methodology – forward modelling

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Modelling - progress
Modelling - progress

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Modelling - progress

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Seismic interpretation

Avoca Fault

Muckleford Fault

Mt William Fault

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Modelling flexibility

• Why is flexibility important?
  – Models should be dynamic – evolving
  – New datasets should be easily accommodated
    • Seismic – drilling – etc
  – We don’t want to get stuck back in the release mentality
3D Modelling techniques

• Traditional CAD approach
  – GOCAD
  – Serial section, 2D linework, geophysics, integration
  – Mesh, Tsurf, TIN, etc

• Algorithmic approach
  – 3D geomodeller
  – Data driven models

• Geostatistical approach
  – Mine-scale grade modelling
  – Leapfrog
**Flexible 3D modelling**

- Integrate CAD with nurbs and inversions
  - **NURBS - Non-Uniform Rational B-Splines**
    - mathematical representations of 3-D geometry that can accurately describe any shape including complex 3-D organic free-form surface or solid
    - Mira Geoscience Sparse package
  - **Constrained 3D Inversions**
    - Allows geometry of modelled surfaces (volumes) to be easily modified based on
    - VPmg
Data custodianship

- Multiple partners
- 3D model delivery
- Divergent model development post pmdCRC

- Single custodian
  - GA?
  - Check out data for modification
T5 progress

- GIS compilation and prospectivity analysis is complete
- Victorian Phase 1 modelling underway
  - Faults, granites and major architectural elements – completed
  - Stratigraphic modelling – started (completed by Aug 2006)
- NSW Phase 1 modelling started
  - Currently constructing ~30 sections covering the southern Lachlan region and integrating with the GA North Lachlan model and the T11 Cobar model region
  - Modelling to be started mid-year
**T5 next steps**

- **Victoria**
  - Complete stratigraphic modelling in Central Vic region
  - Extend modelled volume to the south (coast)
  - Check integration with T1 modelling to the west
  - Run multiscale constrained inversions
    - VPmg
    - Test theory and modify model geometry where appropriate
  - Develop simplified model geometries based on 3D model and prospectivity analysis results for numerical simulation
  - Infill modelling of poorly covered regions (e.g., eastern Vic)
  - Integration with NSW modelling to the north
T5 next steps

• NSW
  – Complete architectural and stratigraphic modelling South Lachlan region
  – Integrate with existing models (North Lachlan and Cobar)
  – Attribute rock volumes with petrophysical data
  – Run multiscale constrained inversions
    • VPmg
    • Test theory and modify model geometry where appropriate
  – Infill modelling of poorly covered regions (e.g., extensions of the potential Delamarian Stawell Belt into western NSW)
  – Integration with Victorian model
T5 model outcomes

• Long lived repository for 3D data in the NSW and Victorian Surveys

• Rock volumes will be attributed with available petrophysical data
  – Easy for stakeholders to extract volumes of interest and use these for their own inversions or numerical simulations

• A series of simplified geometries of key mineralised zones will be constructed
  – based on the 3D model and prospectivity analysis
  – simple crustal numerical simulation
Regional numerical simulation geometries