3D DATA AND DENSITY MODEL EAST ALBANY–FRASER OROGEN

East Albany–Fraser Orogen 3D data

The GSWA has embarked on a statewide project to investigate the structure of cratonic margins and the association between structures and mineralisation. Recent GSWA mapping and geophysical data acquisition in the east Albany–Fraser Orogen, a Proterozoic orogen on the southern margin of the Archean Yilgarn Craton, has resulted in a multitude of 2D and 3D datasets (Fig. 1). These datasets have been compiled in 3D (Figs 2–6) to assist with the visualisation and interpretation of data and will be made available in GOCAD and free-viewer Geoscience Analyst. Several of these datasets, including the Moho topography and interpreted reflection seismic lines, have been used to constrain a regional 3D geological model of the margin. This model has been tested and modified using 3D gravity forward modelling.

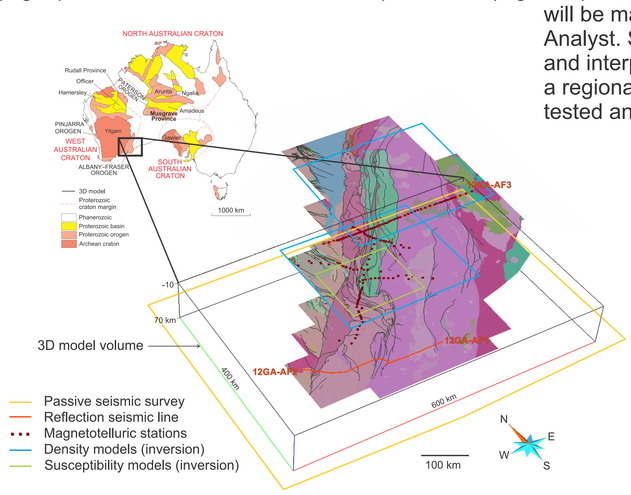

Figure 1. Interpreted bedrock geology of the east Albany-Fraser Orogen (Spaggiari et al., 2016) showing 3D model volume, and locations of geophysical data.

Passive Seismic

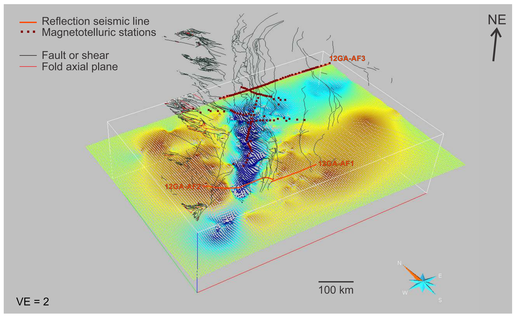

Figure 2. Moho topography from passive seismic data showing crustal thickening along the margin of the orogen.

Reflection and passive seismic profiles

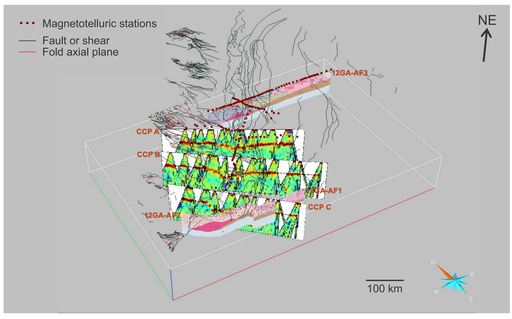

Figure 3. Reflection seismic lines (12GA-AF1, 2 and 3) and common conversion point profiles from passive seismci data (CCP A, B and C).

Density models

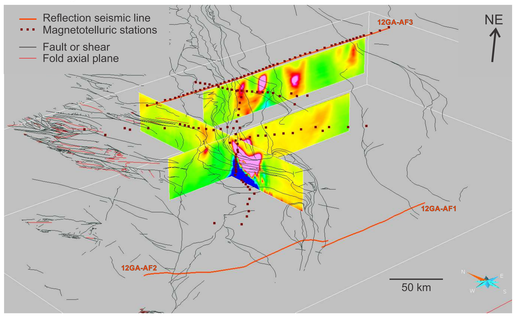

Figure 4. Sections through 3D density model (from inversion) and 1:500k structure showing the geometry of the Fraser Zone.

Magnetotelluric profiles

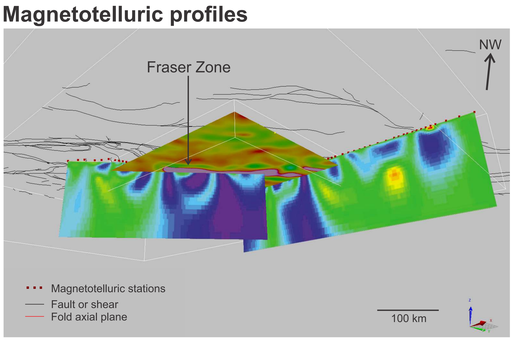

Figure 5. MT sections and depth slice through 3D density model (from inversion) showing the southern Fraser Zone.

Magnetotelluric profiles and density model

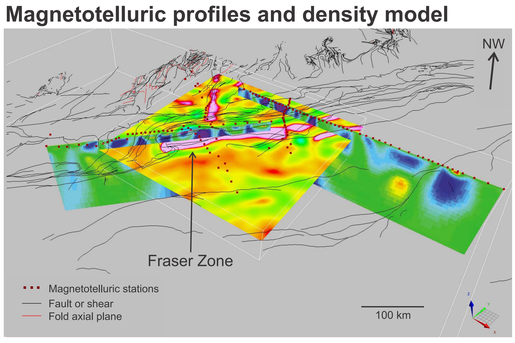

Figure 6. Depth slice through 3D density model (from inversion) and MT sections (same data as Fig. 7 but view from top).

Results of 3D density modelling

The east Albany–Fraser Orogen 3D model has been constructed from interpreted reflection seismic lines (12GA-AF1, 2 and 3), a series of 2D density models and the Moho topography (from the ALFREX passive seismic survey) which is an important constraint on long wavelength gravity anomalies.

Bouguer gravity data show a long wavelength gravity low along the margin of the Albany–Fraser Orogen and Yilgarn Craton. The minima of this gravity low is located to the northwest of an orogen parallel zone of thickened crust that extends along the margin (Fig. 7; Sippl et al., 2017). This suggests that dense material is required within this zone of thickened crust to shift the gravity minima produced by the trough, to the northwest.

3D gravity forward modelling show that this dense material is most likely a voluminous lower crustal body coincident with a non-reflective zone in deep reflection seismic surveys (Fig. 8; Spaggiari et al., 2015). This body may have formed as the Gunnadorrah Seismic Province, in the lower crust of the Albany–Fraser Orogen, was thrust beneath the Yilgarn Craton. Lower crustal underthrusting is interpreted to have produced crustal thickening, possibly during Stage I/II of the Albany–Fraser Orogen (Sippl et al., 2017). Alternatively it may have formed as an underplate along the margin during long-lived Paleoproterozoic extension.

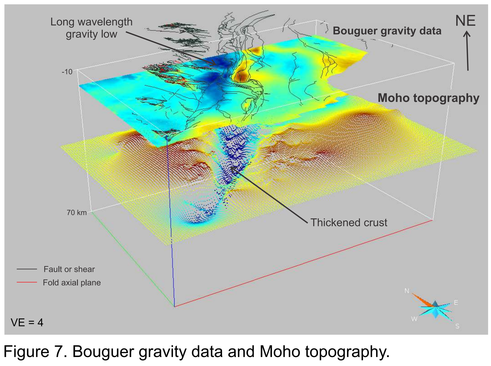

Figure 7. Bouguer gravity data and Moho topography.

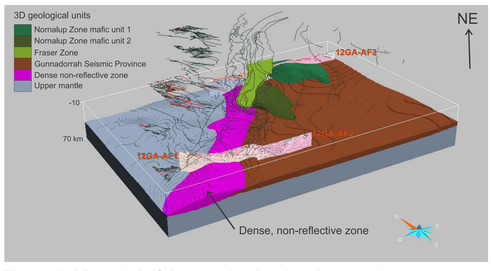

Figure 8. 3D model of the margin showing dense units.

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