BADJA 2240, section A–B, 1:100 000 geological map

(Yalgoo Dome, Murchison Domain, Yilgarn Craton)

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Location

Maps: YALGOO (SH 50-2) and BADJA (2240)

Zone: MGA Zone 50

End coordinates: 451212E 6741044N to
473331E 6820809N

Length: 30 km

Scale of interpretation: 1:100 000

The A–B section is a northwest–southeast section that crosses from the Edamurta greenstone belt and then across a series of granodiorites and tonalities of the BADJA geological map (Zibra et al., 2016; Fig. 1).

Tectonic units

Cross-section A–B cuts through the western margin of the Yalgoo Dome, a large elliptical structure (50 × 100 km), which includes a granite–migmatite core overlain by a greenstone envelope. The dome formed at c. 2750 Ma via multiple emplacements of diapir-like plutons into older greenstones. Within the dome, we identify four granitic suites, each with a distinctive geochemical signature and age of emplacement, which suggest a protracted tectono-magmatic history lasting >300 Ma. The main infrastructure of the Yalgoo Dome formed at c. 2750 Ma by the emplacement of voluminous granite (i.e. the Goonetarra Granodiorite) and is associated with remelting of the older (c. 2950 Ma) Kynea Tonalite. This main dome-forming event is responsible of the main geometry of the granite–greenstone contact, as described in the next section. A north-trending dyke swarm of granitic composition was emplaced near the core of the dome at c. 2700 Ma.

The last magmatic episode is marked by the intrusion of late-orogenic, low-Ca granitic bodies, not intersected by the cross-sections. These undated units are likely to be equivalent to the late-orogenic (2640–2600 Ma), low-Ca plutons, extensively exposed throughout the craton.

Structure

First-order structural features in the Yalgoo Dome include domal patterns of foliation and lithological boundaries, causing greenstone packages to dip mainly west along the western side of the dome (e.g. at Edamurta, section A–B) and to dip east along the eastern side of the dome. Another prominent feature is represented by the radial pattern of lineation and fold axes. The granite–greenstones contact represents a large-scale normal shear zone developed during the latest stages of emplacement of the c. 2750 Ma granite suite. The main foliation along this high-strain zone developed from near-solidus to low-amphibolite facies conditions. At c. 2700 Ma the dome recorded a minor overprint (north–south-trending regional foliation visible in the Edamurta area), associated with the emplacement of a granitic dyke swarm with transitional tonalite–trondhjemite–granite composition. This event can be temporally linked to the emplacement of the Lakeside Pluton along the eastern side of the dome.

The emplacement of the low-Ca suite was associated with the development of a narrow high-strain aureole in the host Goonetarra Granodiorite. This late magmatic event probably post-dated most of the regional structures.

Geophysical data

A gravity profile was extracted from the Geological Survey of Western Australia (GSWA, 2015) gravity merged grid of Western Australia (Fig. 2b). The magnetic profile was extracted at the same location from the GSWA 2014 merge of the total magnetic intensity of Western Australia (GSWA, 2014; Fig. 2d). Topographic data were taken from the Shuttle Radar Topography Mission (SRTM) at the same points. Physical property data were estimated from Yilgarn average values (Table 1).

Modelling

All modelling was performed in the GM-SYS software run within the Oasis Montaj software.

Results

The A–B section was modelled to a depth of 4 km (Fig. 2c,e).

Generally, the gravity profile reflected the slight difference in densities between the Goonetarra Granodiorite and the slightly denser Kynea Tonalite. The extent of the tonalite under the granodiorite is defined by the gravity high. The Edamurta greenstone belt shows as a high-density feature in the northwest of the profile (Fig. 2c).

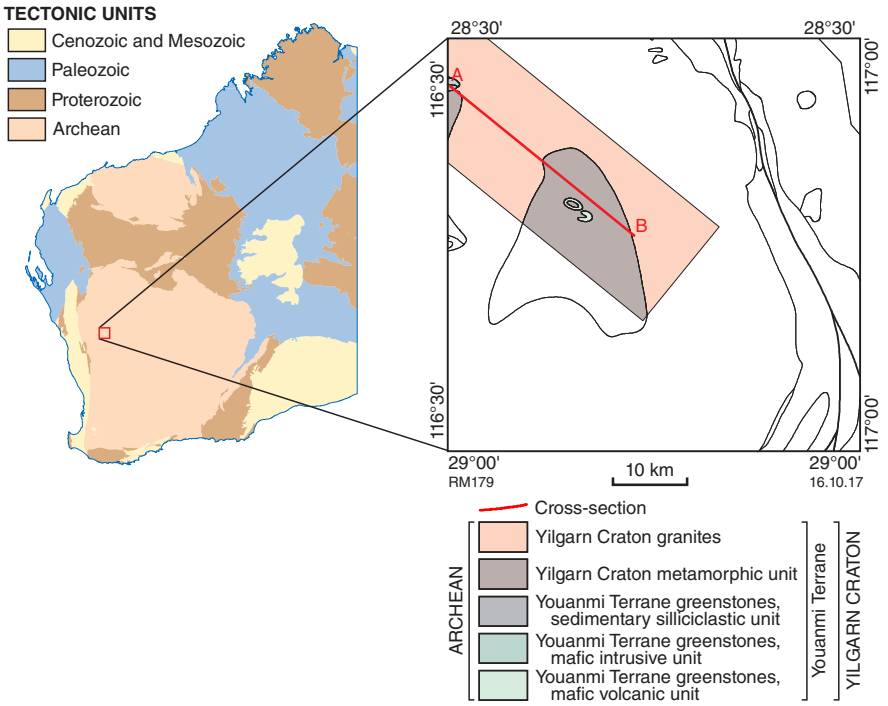

Figure 1. Location of BADJA map sheet with simplified interpreted bedrock geology within 8 km of cross-section A–B

Table 1. Petrophysical properties of modelled units and the corresponding map codes and lithologies. The colour column refers to colours used in Figure 2a

Colour	*Modelled unit*	*Map code*	*Density (g/cm³)*	*Magnetic susceptibility (SI)*
	Youanmi Terrane greenstones			
	BIF	A-mib-YYO	2.83	0.0170
	Migmatite inclusions	A-mwas-YYO	2.70 – 2.78	0.0150 – 0.0220
	General greenstone units	A-mls-YYO	2.83 – 2.85	0.0850 – 0.1260
	Gooneterra Granodiorite	A-ANgo-jgmfe-mgtn, A-ANgo-gmp, A-AMgo-mgmu	2.66 – 2.67	0.0050
	Edamurta Gabbro	A-ANed-oad, A-ANed-mog	2.85	0.0000
	Kynea Tonalite	A-THky-mgti	2.70 – 2.74	0.0000 – 0.0101

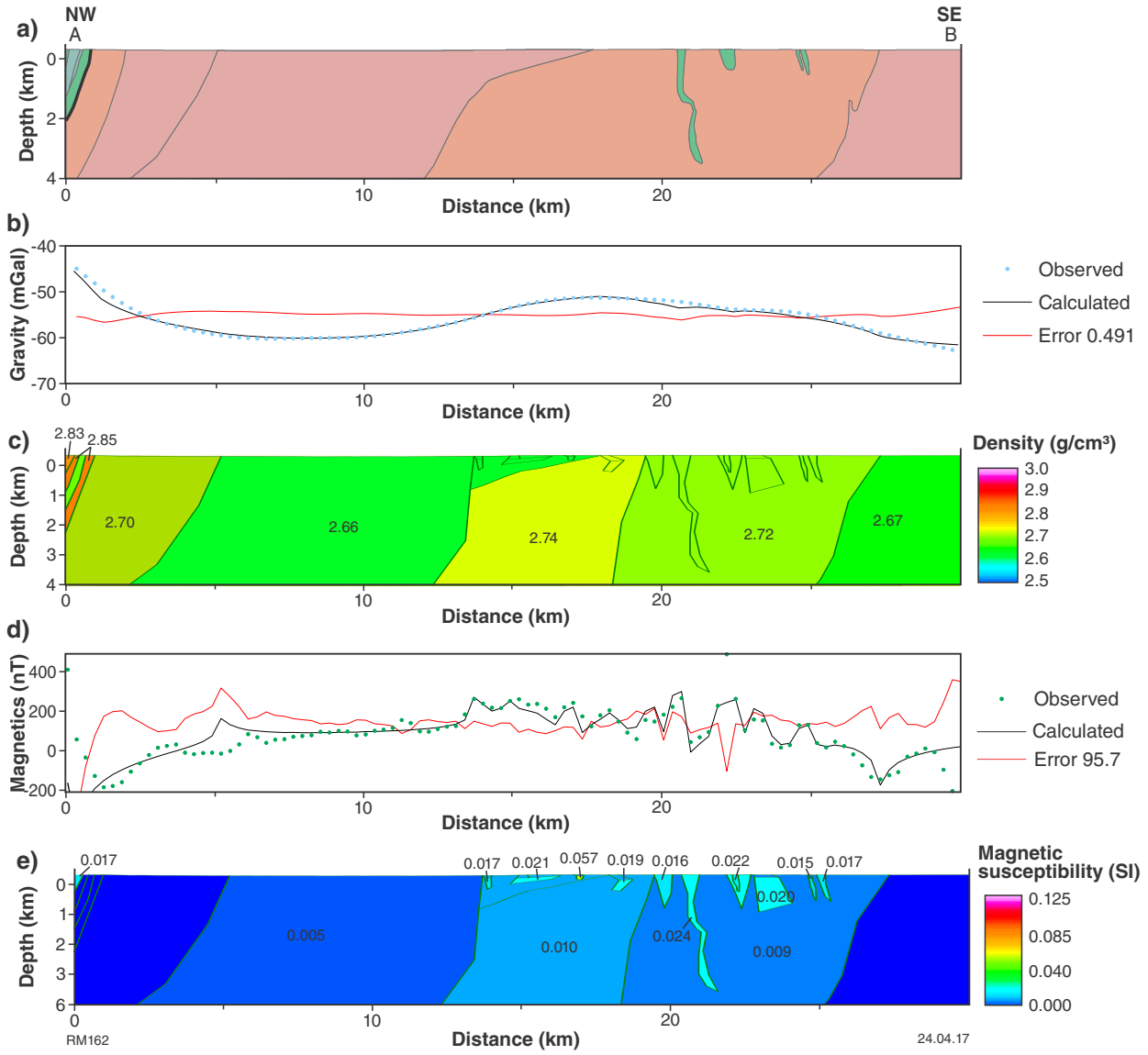

Figure 2. **Profiles along cross-section A–B showing: a) lithological section on BADJA map sheet; b) observed and calculated gravity anomaly profile with error line; c) section of density per lithology; d) observed and calculated magnetic anomaly profile with error line; e) section of magnetic susceptibility per lithology**

The banded iron-formation within the Edamurta greenstone belt accounts for the magnetic peak in the northwest. The granodiorite has a very low smooth magnetic signal, although closer to the tonalite, there are some magnetic spikes. These are probably migmatite inclusions. They are mapped in the field and seen in the magnetic signature over the Kynea Tonalite in the central part of the section (Fig. 2d). The Kynea Tonalite itself has a low magnetic susceptibility (Fig. 2e), but this varies slightly, as does the density along the profile (Fig. 2c).

References

Geological Survey of Western Australia 2014, Magnetic anomaly grid (80 m) of Western Australia (2014 – version 1), 16 September 2014 update: Geological Survey of Western Australia, digital data layer.

Geological Survey of Western Australia 2015, Gravity anomaly grid (400 m) of Western Australia (2015): Geological Survey of Western Australia, digital data layer.

Zibra, I, Ivanic, TJ, Chen, SF, Clos, F, Li, J, Gu, P, Meng, Y and Wang, C 2016, Badja, WA Sheet 2240: Geological Survey of Western Australia, 1:100 000 Geological Series.