Atley 2741, 1:100 000 geological map

(Sandstone greenstone belt, Southern Cross Domain, Yilgarn Craton)

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Location

Maps: Youanmi (SH 50-4) and Atley (2741)

Zone: MGA Zone 50

End coordinates: 697164E 6891946N to 745243E 6891936N

Length: 48 km

Scale of interpretation: 1:100 000

This is an east–west section that crosses the southern part of the Sandstone greenstone belt (Fig. 1).

Tectonic units

The Sandstone greenstone belt is a refolded syncline of greenstone stratigraphy sitting on the edge of the Southern Cross Domain. No regional stratigraphy has been established across the domain, but the local stratigraphy has been determined from mapping and drillcore although lack of outcrop precludes correlation of the northern part of the greenstone with the better exposed northern part found on Sandstone.

The Sandstone greenstone belt in the south is a mafic-dominated succession, which at its base consists of a foliated basalt (Chen, 2005). Above the basalt are thin deposits of banded iron-formation (BIF) and cherts intercalated with clastic sedimentary rock and intruded by gabbroic sills. This is overlain by a tremolite–cholorite and then by a tholeiitic basalt and a thick layer of BIF intruded by gabbroic sills. Above this is another mafic layer with thin units of BIF. The top of the sequence is an ultramafic layer, but the stratigraphic relationship between this and the lower layers is not known.

The greenstone belt has fault-bounded contacts with the surrounding Archean granites, which are typically poorly exposed. They are dominated by monzogranites with subordinate granodiorites. Strongly deformed granitic rocks are mapped with, and adjacent to, the major shear zones (Chen, 2005).

Structure

The major fault in this area is the Youanmi Shear Zone, which forms the boundary between the Murchison Domain in the west and the Southern Cross Domain in the east. From the seismic reflection surveys of 2010 it was shown to be a trans-crustal fault going all the way to the mantle (Wyche et al., 2014). It dips to the east and, with the west-dipping Edale Fault, bounds the Sandstone greenstone belt.

The Sandstone greenstone belt is a refolded syncline. The original F1 east-trending syncline has been overprinted by the F2 syncline with box-fold geometry and disrupted by brittle faults (Chen, 2005).

Geophysical data

A gravity profile was extracted from the Geological Survey of Western Australia (GSWA) 2013 400 m gravity merged grid of Western Australia (GSWA, 2013a). Magnetic data were extracted along the same profile from the 80 m magnetic compilation of Western Australia (GSWA, 2013b). Topographic data was taken from the Shuttle Radar Topography Mission (SRTM) at the same points. Physical property data was compiled from Williams (2009) and Gessner et al. (2014; Table 1).

Modelling

All modelling was performed in the GM-SYS software run within the Oasis Montaj software. All models are 2.5D with the polygons extending for 100 km perpendicular either side of the viewed profile.

Initial conceptual models were compiled from the cross-section on the map sheet (Chen, 2003) and interpretation of the 10GA-YU2 seismic line (Wyche et al., 2014), which traverses close to section A–B (Fig. 2a).

Results

The section across the Sandstone greenstone belt was modelled down to a depth of 35 km (Fig. 2c) and is heavily based on the modelling of seismic line 10GA-YU2 (Wyche at al., 2014). The broad peak seen in the section can be attributed to the higher density of the Sandstone greenstone belt with the variations in the peak accounted for by the depth of the mafic rocks. The only unit modelled within the greenstone is the slightly higher density ultramafic unit in the centre (Fig. 2c). There are BIF throughout the greenstone as seen in the magnetic peaks and profile, but they are too narrow to be picked out in the gravity data.

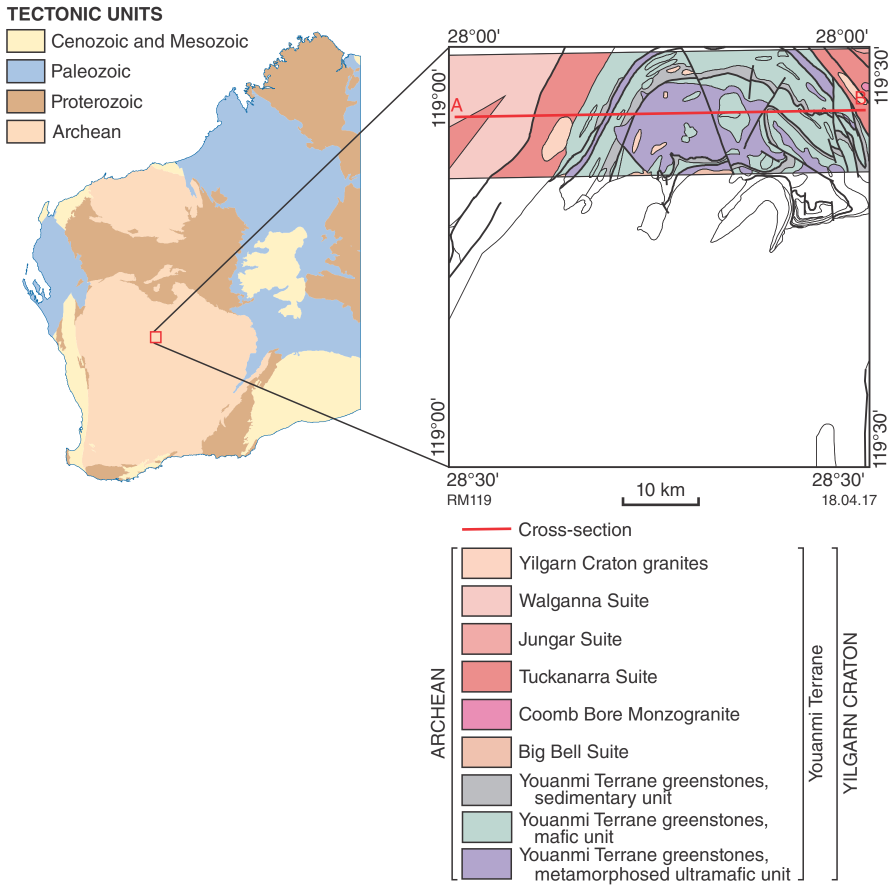

Figure 1. Location of sheet Atley with simplified interpreted bedrock geology within 8 km of cross-section A–B

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*	*Rock type*	*Density (g/cm³)*	*Magnetic susceptibility (SI)*
	Post-tectonic granite	A-g, A-gn	Granite	2.61	
	Youanmi Terrane greenstone (Unaly Hill greenstone belt)		Mafic, undivided	2.88	
	Youanmi Terrane greenstone (Sandstone greenstone belt)	A-b, A-o, A-og, A-bv, A-bf, A-bk, A-ba	Mafic	2.85	
		A-ci	BIF*		0.07 — very high
		A-s	Schist		
		A-u	Ultramafic	2.89	
	Sheared and foliated granite	A-gmf	Foliated granite	2.56	
	Murchison granites		Granite	2.55	
	Southern Cross granites		Granite	2.50	
	Yarraquin Seismic Province			2.85	
	Lower crust			2.90	

NOTE: *Not shown on section

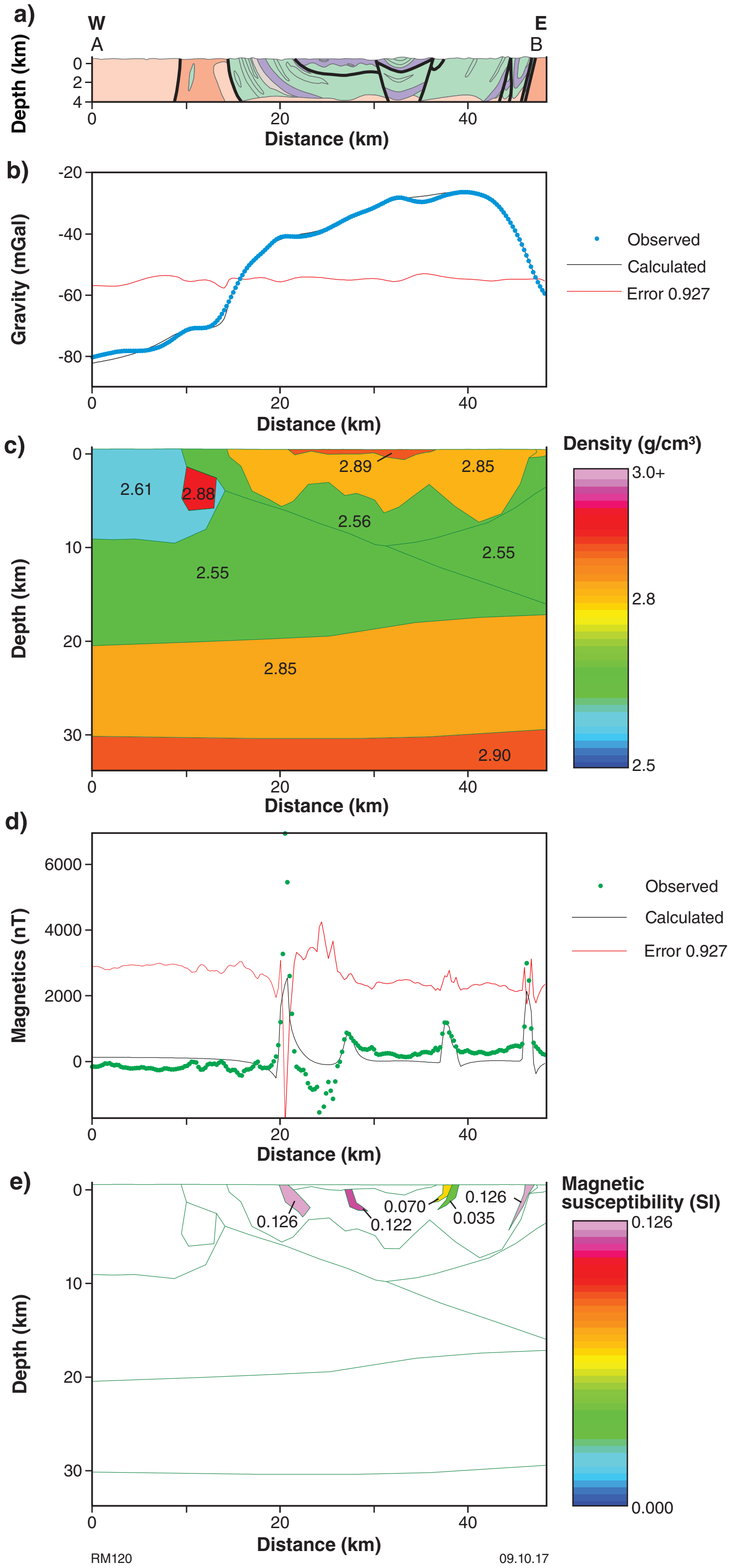

Figure 2. Profiles of cross-section A–B showing: a) lithological section from sheet Atley; b) observed and calculated gravity anomaly profile with error line, modelled down to 35 km for later use within a 3D regional model; c) section of density per lithology; d) observed and calculated magnetic anomaly profile with error line, modelled down to 35 km for later use within a 3D regional model; e) section of magnetic susceptibility per lithology

The Unaly Hill greenstone belt outcrops just on the edge of the map and is seen in this section as a small gravity high in the west of the section and modelled as a blind body of mafic density. However, in this section (as opposed to section A–B of SANDSTONE) it has a zero magnetic susceptibility (Fig. 2b,c).

Although this section contains the Youanmi Shear Zone, which divides the Murchison Domain from the Southern Cross Domain, both domains are largely composed of granites and hence there is negligible density contrast between them. However, it appears that the Southern Cross granitic rocks have a stronger magnetic signal than the Murchison rocks (Fig. 2d).

References

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