WARBURTON RANGE 4245, section A–B, 1:100 000 geological map

(Bentley Basin, west Musgrave Province)

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Location

Maps: TALBOT (SG 52-9) and WARBURTON RANGE (4245)

Zone: MGA Zone 52

End coordinates: 260189E 7097398N to
282811E 7122205N

Length: 33.1 km

Scale of interpretation: 1:100 000

This is a southwest–northeast section on the western part of sheet WARBURTON RANGE (Howard et al., 2014) within the Talbot Sub-basin of the Bentley Basin (Fig. 1).

Tectonic units

The Bentley Basin was formed during the intracontinental Ngaanyatjarra Rift which took place within the 1085–1040 Ma Giles Event (Evins et al., 2010; Howard et al., 2011). The basin sequence of the Bentley Supergroup consists of felsic and mafic volcanic and volcaniclastic rocks, and interlayered sedimentary rocks that unconformably overlie the high-grade metamorphic basement rocks of the Musgrave Province, mainly in the Mamutjarra Zone. Several sub-basins constitute components of the larger Bentley Basin, including the Blackstone, Finlayson, and Talbot Sub-basins (Howard et al., 2011). The Blackstone and Finlayson Sub-basins are dominated by units of the lower part of the Bentley Supergroup (Kunmarnara Group and Tollu Group), whilst the Talbot Sub-basin is dominated by the upper part of the Bentley Supergroup (Mount Palgrave, Kaarnka, Pussy Cat, Cassidy and Mission Groups). To the south, the Bentley Supergroup is unconformably overlain by units that were deposited into the Officer Basin, namely the Buldya Group and Lupton Formation.

Structure

In the Talbot Sub-basin the volcanic succession generally shallowly dips (≤30°) south to southwest (in the western part of the sub-basin) and west (in the eastern part of the sub-basin). Locally the succession is steeply dipping (up to 85°) in the east of the sub-basin adjacent to the Barrow Range Anticline. The upper part of the Bentley Supergroup forms outcrops that extend east from the Warburton Community to the Barrow Range (approximately 40 km southwest of Jameson Community). This part of the sequence extends laterally for a distance of over 90 km.

In the northwest, the exposure in the Warburton Range strikes northwest to southeast and the range bends around to strike east to west in the east.

In the northern part of sheet WARBURTON RANGE, there is an open south-verging anticline with south-directed reverse faults in its northern limb through the Pussy Cat Group. Farther north, dolerite dykes intrude granite of the Warakurna Supersuite, which the authors regard to be the magma chamber from which the Talbot volcanic rocks were generated.

Geophysical data

A gravity profile was extracted from the 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 were taken from the Shuttle Radar Topography Mission (SRTM) at the same points.

Physical property data were estimated from global average values and are listed in Table 1.

Modelling

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

Results

The section A–B was modelled down to a depth of 4 km. The gravity profile shows moderate variations with a central peak including a lower amplitude peak on either side (Fig. 2b). The geology of the area comprises various low-density sedimentary and rhyolitic rocks layered with high-density basalts (Fig. 2a). As a consequence many ‘edge anomalies’ are seen in the error line. The central peak is generated by the basalts of the Glyde Formation.

In the northern end, the generally lower gravity is caused by the presence of rhyolites of the Mount Waugh and Scamp Formations (Fig. 2c), overlying a large body of Warakurna Supersuite granite. The slight rise in the gravity here is probably due to an increase in the volume of dolerite intrusions within the granite.

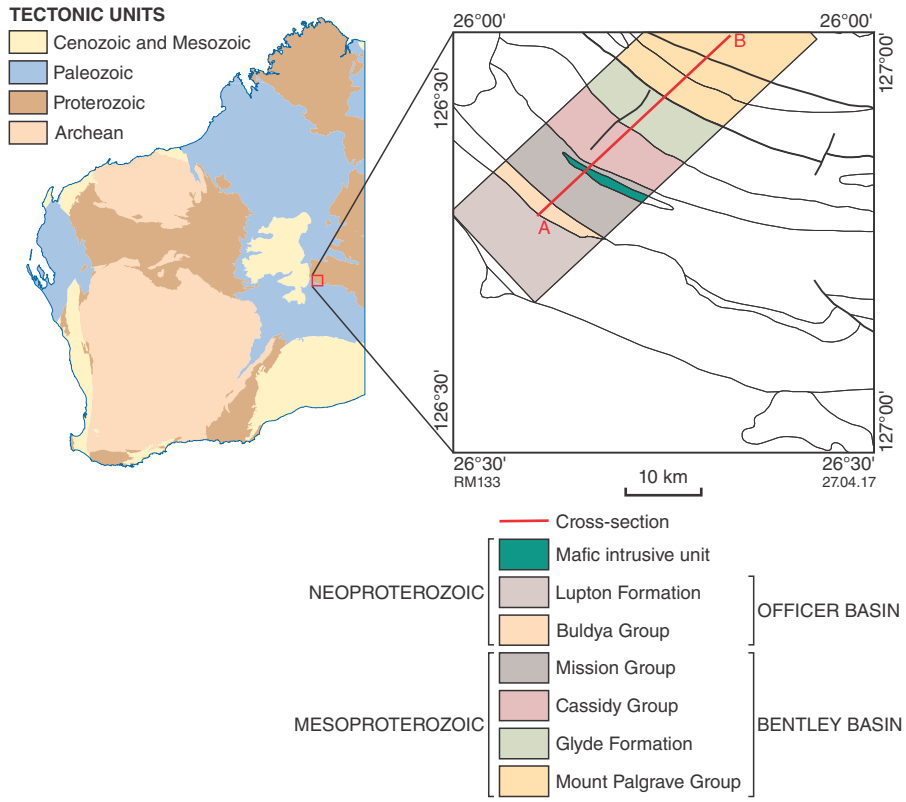

Figure 1. Location of WARBURTON RANGE map sheet with simplified interpreted bedrock geology within 8 km of cross-section A–B

The sedimentary rocks of the Lupton Formation, Buldya Group and Townsend Quartzite are slightly less dense than the sandstones and basalts of the Milesia Formation, which generates the slight rise in gravity at the southern extreme of the profile.

Generally, the sedimentary rocks have a low magnetic susceptibility (Fig. 2e), although one sandstone unit in the Milesia Formation has been modelled with an unusually high susceptibility. Nevertheless, this may be an artefact of the modelling close to the overlying basalt with strong susceptibility. Remanent magnetisation has not been accounted for in these models. There appears to be a low susceptibility within the rhyolites. The dykes within the rhyolites probably are the source of the high-frequency signal within the main rhyolite body.

The magnetic profile is poorly matched although the gross shape is coarsely fitted (Fig. 2d). A better fit could be obtained by more detailed modelling of the highly magnetic units, which are generating the peaks. Factors, such as the layering within rhyolite units, and the influence of the Warakurna dolerite and remanent magnetism should be considered.

References

Evins, PM, Smithies, RH, Howard, HM, Kirkland, CL, Wingate, MTD and Bodorkos, S 2010, Devil in the detail; the 1150–1000 Ma magmatic and structural evolution of the Ngaanyatjarra Rift, West Musgrave Province, Central Australia. Precambrian Research v. 183, p. 572–588.

Geological Survey of Western Australia 2013a, Gravity anomaly grid (400m) of Western Australia (2013 – version 2), 11 November 2013 update: Geological Survey of Western Australia, digital data layer.

Geological Survey of Western Australia 2013b, Magnetic anomaly grid (80 m) of Western Australia (2013 – version 2): Geological Survey of Western Australia, digital data layer.

Howard, HM, Quentin De Gromard, R and Smithies, RH 2014, Warburton Range, WA Sheet 4245: Geological Survey of Western Australia, 1:100 000 Geological Series.

Howard, HM, Werner, M, Smithies, RH, Evins, PM, Kirkland, CL, Kelsey, DE, Hand, M, Collins, AS, Pirajno, F, Wingate, MTD, Maier, WD and Raimondo, T 2011, The geology of the west Musgrave Province and the Bentley Supergroup — a field guide: Geological Survey of Western Australia, Record 2011/4, 116p.

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)*
	Proterozoic dyke	P_-WK-od	Dolerite	2900	0.010
	Lupton Formation	P_-lu-se	Diamictite	2600	0.037
	Buldya Group	P_-BU-xs-k	Mixed sedimentary	2600	0.036
	Townsend Quartzite	P_-BUw-stz	Quartzite	2600	0.038
	Mission Group				
	Milesia Formation	P_-MIm-xs-bb	Sandstone/basalt	2700	0.042
		P_-MIm-sp	Sandstone/conglomerate	2670	0.035
		P_-MIm-sti	Sandstone	2400	0.059
		P_-MIm-xst-bb	Sandstone/basalt	2500	0.045
		P_-MIm-bb	Basalt	2750–2850	0.041 – 0.081
		P_-MIm-st	Sandstone	2400	0.079
	Lilian Formation	P_-MIl-sh	Shale	2500	0.035
	Frank Scott Formation	P_-MIf-kds	Dolomite	2670	0.051
	Cassidy Group				
	Miller Basalt	P_-CAm-bb	Basalt	2850	0.096
	Hilda Rhyolite	P_-CAh-frp	Rhyolite	2450	0.049
		P_-CAh-frpa	Rhyolite	2450	0.050
	Warubuyu Basalt	P_-CAw-xbb-s	Basalt/sandstone	2850	0.050
	Thomas Rhyolite	P_-CAt-frp	Rhyolite	2450	0.045
	Gurgadi Basalt	P_-CAg-bbg	Basalt	2850	0.048
		P_-CA-sl	Siltstone/mudstone	2400	0.000
	Gombuggura Rhyolite	P_-CAo-frp	Rhyolite	2400	0.059
		P_-CA-sf	Siltstone/sandstone	2400	0.000
	Wururu Rhyolite	P_-CAu-frp	Rhyolite	2450	0.045
	Pussy Cat Group				
	Glyde Formation	P_-PUg-xbb-s	Basalt/sandstone	2850	0.077
		P_-PUg-bbg	Basalt	2900	0.068
		P_-PU-frp	Rhyolite	2450	0.000
	Mount Palgrave Group				
	Mount Waugh Formation	P_-PGw-fr	Rhyolite	2670	0.000
	Scamp Formation	P_-PGs-fr	Rhyolite	2500	0.000
		P_-PGs-frwp	Pumiceous rhyolite	2500	0.070
	Warakurna Supersuite	P_-WK-od	Intrusive mafic	2900	0.000
		P_-WK-ge	Quartz syenite	2670	0.000

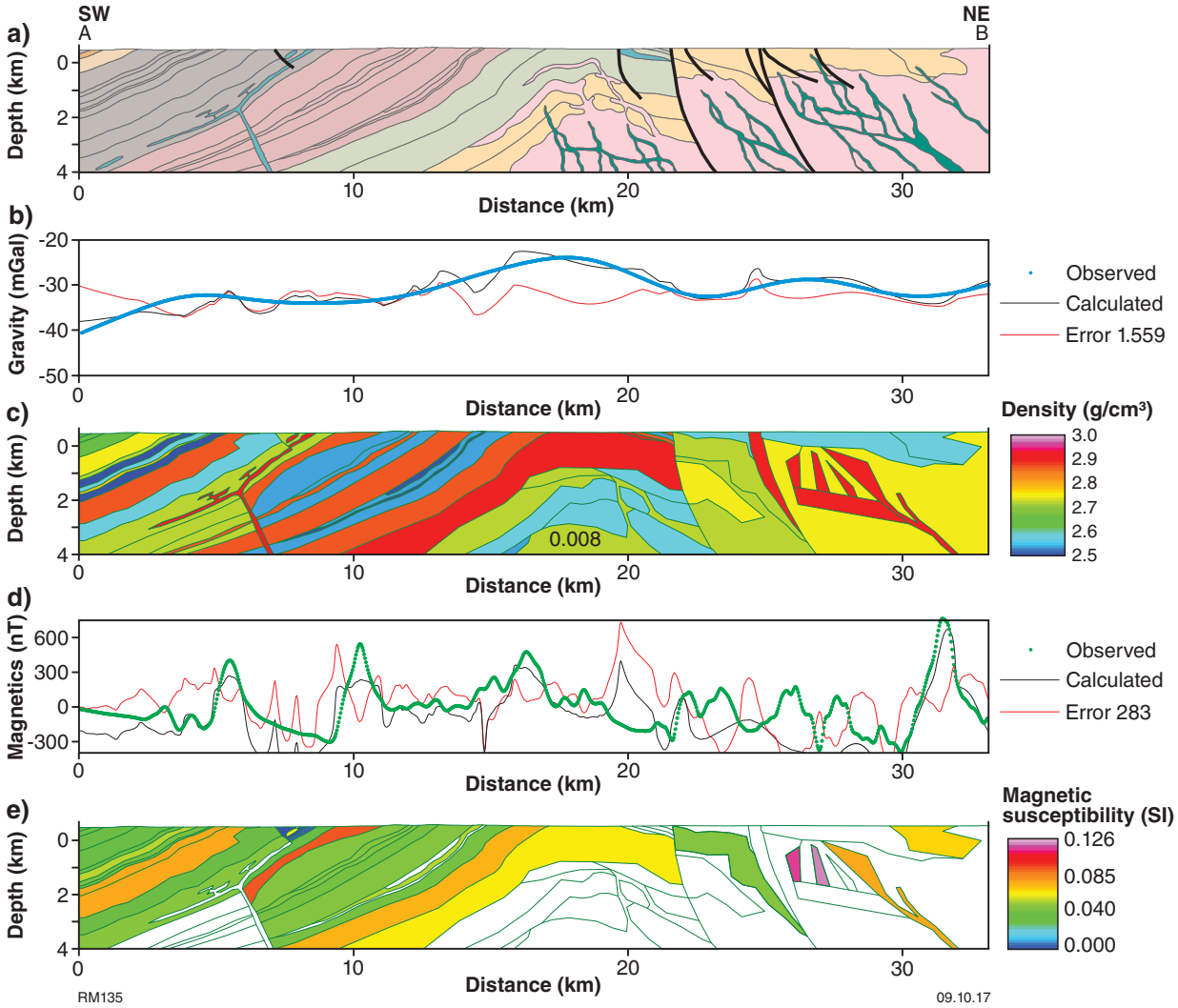

Figure 2. **Profile of section A–B showing: a) lithological section from sheet WARBURTON RANGE; b) observed and calculated Bouguer anomaly profile with error line; c) section of density per lithology; d) observed and calculated magnetic anomaly profile with error line; e) section of magnetic susceptibility per lithology**