WARBURTON RANGE 4245, section C–D, 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: 288764E 7084635N to 293791E 7100311N

Length: 16.5 km

Scale of interpretation: 1:100 000

This is a southwest to northeast section on the eastern 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°) between 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 outcrop that extends 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 the 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 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 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 platform.

Results

The section CD was modelled down to a depth of 4 km (Fig. 2a).

The gravity signal is generated from only seven data points, hence a detailed model could not be obtained. However, the slope of the Bouguer gravity anomaly reflects the consistently smooth and shallow dip of the succession to the south (Fig. 2b). Since there is no obvious difference in the densities between the basalts and sedimentary rocks of the Milesia Formation and the basalts and rhyolites of the Cassidy Group (Fig. 2c), the slope is probably the result of a regional trend.

The magnetic anomaly shows two distinct peaks (Fig. 2d), which can be associated with the Miller Basalt in the north and some sandstone and basalt layers in the Milesia Formation. Deposits such as the Thomas Rhyolite and Gurgardi Basalt also have low susceptibility signals (Fig. 2e).

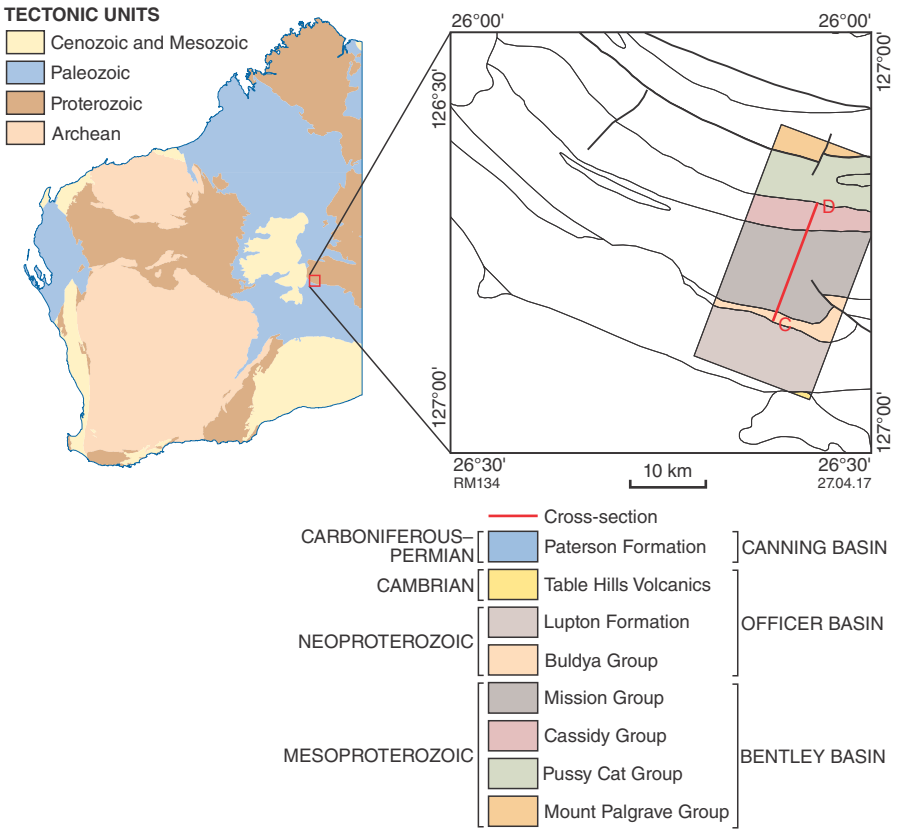

Figure 1. Simplified interpreted bedrock geology of WARBURTON RANGE map sheet showing the location of cross-section C–D

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)*
	Townsend Quartzite	P_-BUw-stz	Quartzite	2200	0.000
	Mission Group				
	Milesia Formation	P_-MIm-xs-bb	Sandstone/basalt	2550	0.000
		P_-MIm-sp	Sandstone/conglomerate	2670	0.000
		P_-MIm-sti	Sandstone	2300	0.064
		P_-MIm-xst-bb	Sandstone/basalt	2500	0.073
		P_-MIm-bb	Basalt	2750	0.005
		P_-MIm-st	Sandstone	2750	0.036
	Lilian Formation	P_-MIl-sh	Shale	2500	0.000
	Frank Scott Formation	P_-MIf-kds	Dolomite	2670	0.000
	Gamminah Conglomerate	P_-MIg-sg	Conglomerate	2200	0.021
	Cassidy Group				
	Miller Basalt	P_-CAm-bb	Basalt	2850	0.100
	Hilda Rhyolite	P_-CAh-frp	Rhyolite	2450	0.042
		P_-CAh-frpa	Rhyolite	2450	0.042
	Warubuyu Basalt	P_-CAw-xbb-s	Basalt/sandstone	2850	0.024
		P_-CAw-sf	Siltstone/sandstone	2400	0.021
	Thomas Rhyolite	P_-CAt-frp	Rhyolite	2450	0.038
	Gurgadi Basalt	P_-CAg-bbg	Basalt	2850	0.040
	Wururu Rhyolite	P_-CAu-frp	Rhyolite	2450	0.000
	Pussy Cat Group				
	Glyde Formation	P_-PUg-xbb-s	Basalt/sandstone	2700	0.000
		P_-PUg-bbg	Basalt	2800	0.000
		P_-PU-frp	Rhyolite	2670	0.000
	Warakurna Supersuite	P_-WK-od	Dolerite	2900	0.000

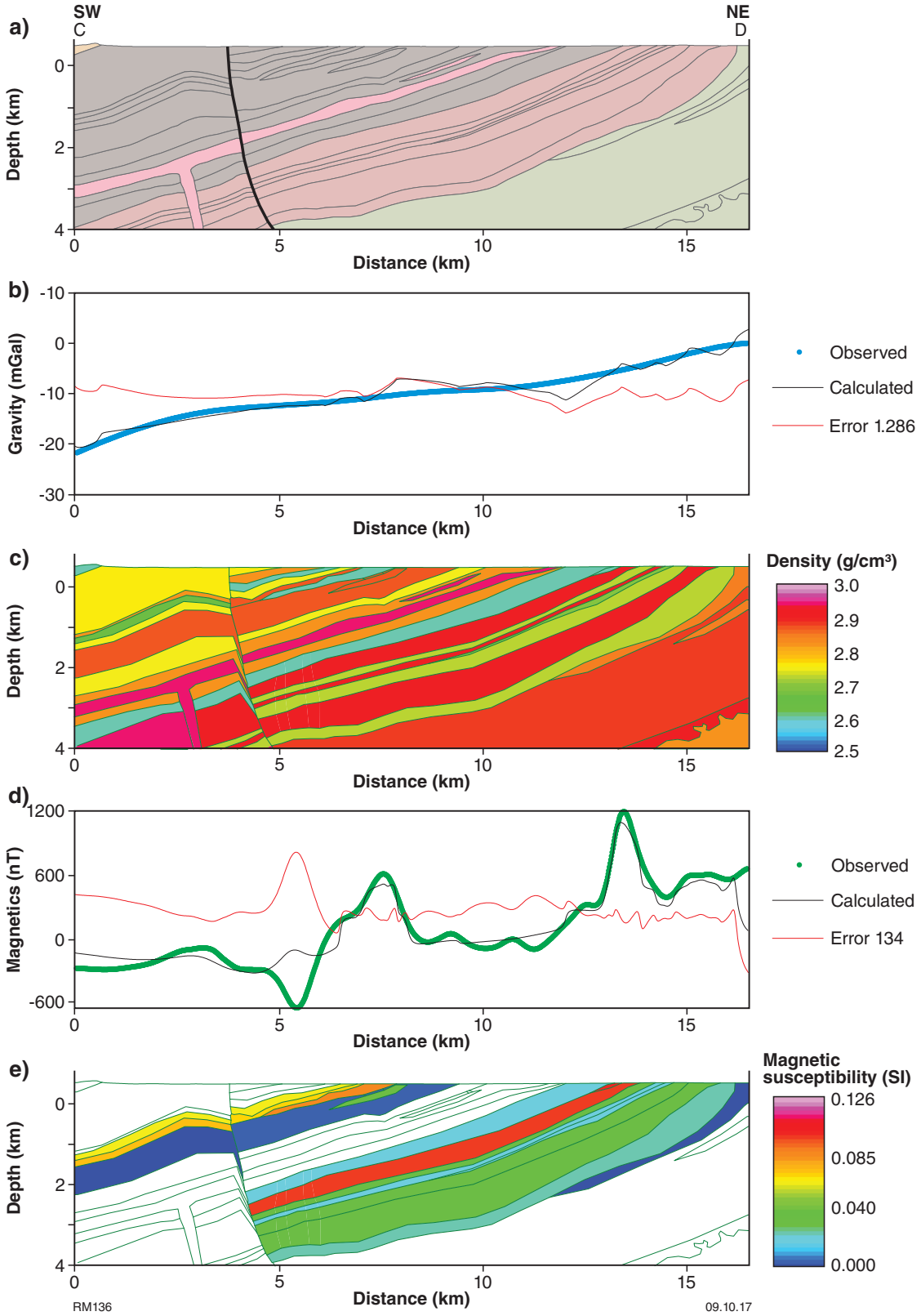

Figure 2. **Profile of section C–D showing: a) lithological section from sheet Warburton Range; b) observed and calculated Bouguer anomaly profile with error line; c) section of density per lithology; d) observed and calculated magnetic anomaly profile with error line; e) section of magnetic susceptibility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