

RICHENDA 3963, 1:100 000 geological map

(Lamboo Province, Speewah and Kimberley Basins, Kimberley)

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Location

Maps: LENNARD RIVER (SE 51-8) and RICHENDA (3963)

Zone: MGA Zone 51

End coordinates: 725141E 8063877N to
765861E 8094172N

Length: 50.7 km

Scale of interpretation: 1:100 000

This is a southwest- to northeast-oriented section that crosses from the Lamboo Province into the Kimberley Basin on the southwest edge of the Kimberley (Fig. 1).

Tectonic units

The Lamboo Province, comprising the Marboo Formation (tubiditic metasandstone) and the Ruins Dolerite, forms the basement of this section. The rocks were then deformed during the 1870–1850 Ma Hooper Orogeny (Griffin et al., 1993, 1994; Tyler and Griffin, 1993). They are intruded by felsic unit and overlain by the cogenetic White Water Volcanics of the Paperbark Suite during the Hooper Orogeny (Phillips et al., 2015).

Unconformably overlying the basement rocks is the 1835 Ma Speewah Basin. These sediments show a transgressive–regressive cycle from fluvial to shallow-marine and return to a fluvial setting in an interior continental basin (Phillips et al., 2015).

Unconformably overlying the Speewah Basin is the 1800 Ma Kimberley Basin. It is filled with the Kimberley Group shallow-marine sediments and basaltic lavas of the Carson Volcanics, which were laid down in a south-sloping basin (Gellatly et al., 1970).

The intrusive Hart Dolerite and extrusive Carson Volcanics form the Hart–Carson Large Igneous Province of 1797 ± 11 Ma. The Hart Dolerite is a massive mafic with lesser felsic granophyre layers and intruded into the Speewah and Kimberley Basins (Sheppard et al., 2012).

Structure

The 1835–1740 Ma Speewah and Kimberley Groups are situated within basins of the same names and are largely undeformed. The Hart Dolerite intrudes the Speewah and lower Kimberley Group as it is thought to be a product of a plume- or post-orogenic plate-margin reorganization (Griffin et al., 1994; Sheppard et al., 2012).

The Paperbark Suite is thought to have been formed from extensive magmatic reworking of the Archean and Palaeoproterozoic Kimberley Craton margin following northwesterly subduction (Griffin et al., 2000).

The Lamboo Province records the deformation and metamorphism of northwesterly directed subduction during the 1835–1810 Ma Halls Creek Orogeny (Tyler et al., 1995; Griffin et al., 2000; Sheppard et al., 2001; Page et al., 2001).

Geophysical data

Magnetic data were extracted along the same profile from the 80 m magnetic compilation of Western Australia (GSWA, 2014). Topographic data were taken from the Shuttle Radar Topography Mission (SRTM) at the same points.

Modelling

All modelling was performed in GM-SYS software run within the Oasis Montaj software. A 2D profile along the line of the cross-section of sheet RICHENDA was modelled (Phillips et al., 2015). Values of magnetic susceptibility used in the modelling are given in Table 1.

Only magnetic modelling was performed as there were too few gravity points along the section to create a profile.

Results

The section (Fig. 2a) shows sediments with relatively low magnetic susceptibility (Fig. 2b) against the nonmagnetic rocks of the Paperbark Suite and Marboo Formation.

The bands of Ruins Dolerite within the Marboo Formation form a large magnetic and negative peak, implying remanent magnetization of this part of the dolerite. The Ruins Dolerite also appears to have imparted a low magnetization to the rocks in its immediate vicinity.

The units of the Speewah Group shown in this section are nonmagnetic, except for a small syncline of the Landsdowne Arkose in the pop-up section at about 42 km along the profile (Fig. 2c), which may have a small susceptibility. This susceptibility fits the model at the eastern end of the syncline, but generates an unwanted peak at the western end. Alternatively, with no susceptibility, the western end has a better fit, but the eastern end is poorer.

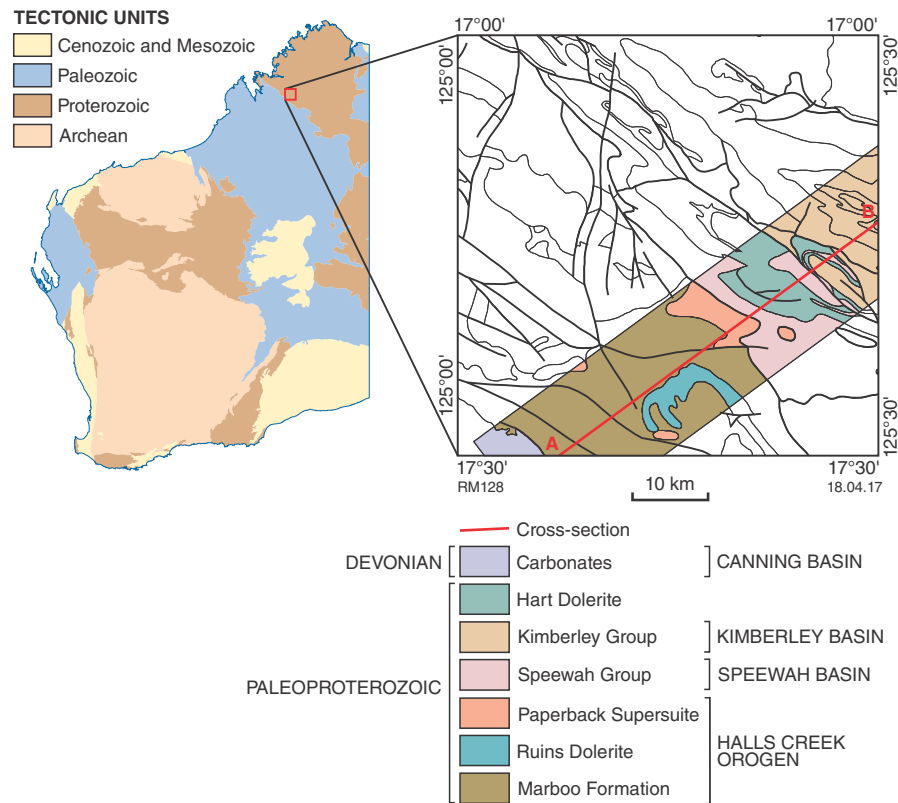


Figure 1. Location of sheet RICHENDA with simplified interpreted bedrock geology within 8 km of cross-section A–B

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	Magnetic susceptibility (SI)
	Milliwindi Dolerite	E_-KJM-od	0.013
	Hart Dolerite and granophyre	P_-ha-od, P_-ha-gv	0.009 – 0.037
	Kimberley Group		
	<i>Pentecost Sandstone</i>	P_-KMp-st	—
	<i>Elgee Siltstone</i>	P_-KMe-xsl-kd	—
	<i>Warton Sandstone</i>	P_-KMw-st	—
	<i>Carson Volcanics</i>	P_-KMc-bb, P_-KMc-sta	0.010
	<i>King Leopold Sandstone</i>	P_-KMI-st	0.080
	Speewah Group		
	<i>Lansdowne Arkose</i>	P_-SPo-sta	—
	<i>Tunganary Formation</i>	P_-SPt-st	—
	<i>O'Donnell Formation</i>	P_-SPn-stq	—
	Ruins Dolerite	P_-ru-mod	—
	Paperbark Supersuite		
	<i>Felsic unit</i>	P_-PB-xg-o	—
	<i>White Water Volcanics</i>	P_-PBww-f	—
	Marboo Formation	P_-mr-mh	—

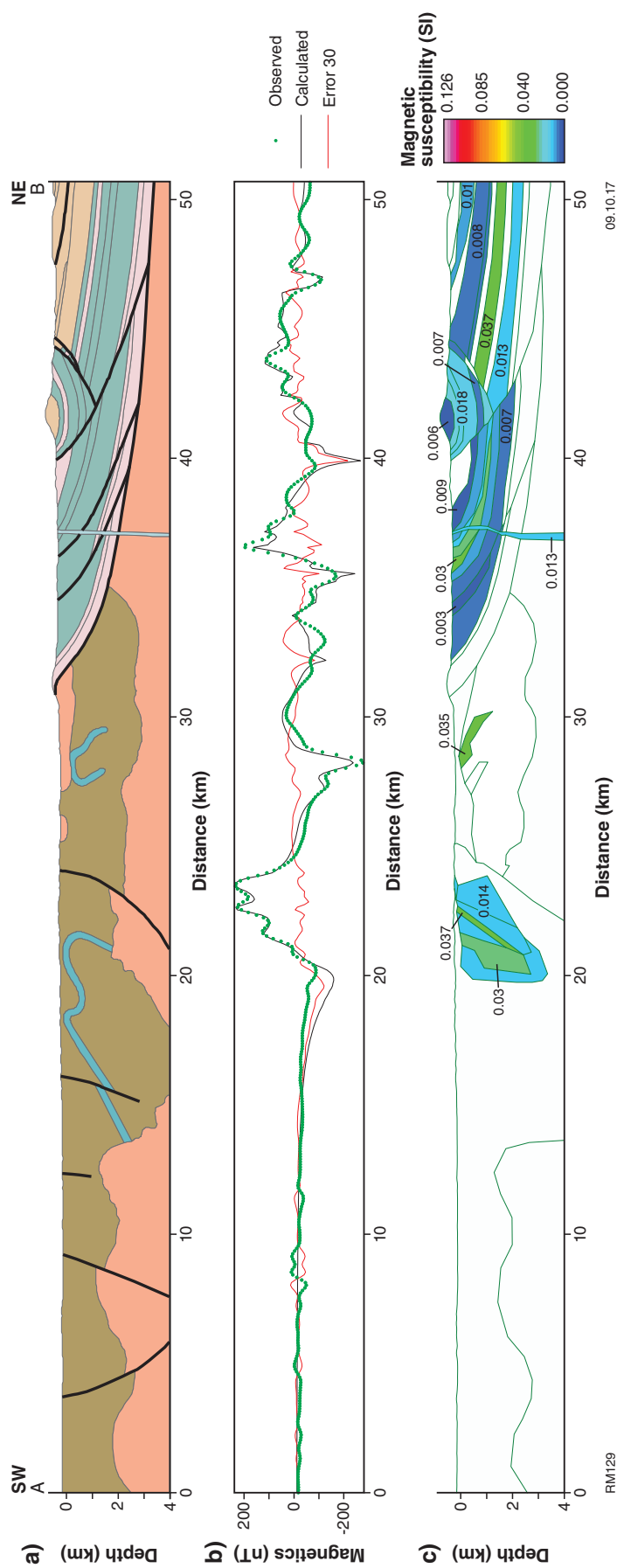


Figure 2. Profiles across section A–B from sheet RICHENDA showing: a) lithological section; b) observed and calculated magnetic anomaly profile with error line; c) section of magnetic susceptibility per lithology

This may indicate that some alteration may have affected it along one of the limbs or bounding faults of the syncline.

The Hart Dolerite has a high susceptibility with the granophyre layer in the middle having a relatively higher susceptibility than the dolerite/gabbro layers.

The King Leopold Sandstone, and one band within the Carlson Volcanics, displays a low susceptibility. Other units within the Kimberley Group do not show any magnetization, although they are only represented by small volumes within the section.

The Milliwindi Dolerite dyke provides a minor peak in the magnetic profile.

References

- Gellatly, DC, Derrick, GM and Plumb, KA 1970, Proterozoic palaeocurrent directions in the Kimberley region, northwestern Australia: *Geological Magazine*, v. 107, p. 249–257.
- 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.
- Griffin, TJ, Page, RW, Sheppard, S and Tyler, IM 2000, Tectonic implications of Palaeoproterozoic post-collisional, high-K felsic igneous rocks from the Kimberley region of northwestern Australia: *Precambrian Research*, v. 101, p. 1–23.
- Griffin, TJ, Tyler, IM and Playford, PE 1993, Explanatory notes on the Lennard River 1:250 000 geological sheet SE/51-8, Western Australia (3rd edition): Geological Survey of Western Australia, Record 1992/5, 85p.
- Griffin, TJ, Tyler, IM and Playford, PE 1994, Lennard River, Western Australia (3rd edition): Geological Survey of Western Australia, 1:250 000 Geological Series Explanatory Notes, 56p.
- Page, RW, Griffin, TJ, Tyler, IM and Sheppard, S 2001, Geochronological constraints on tectonic models for Australian Palaeoproterozoic high-K granites: *Journal of the Geological Society*, v. 158, p. 535–545.
- Phillips, C, de Souza Kovacs, N and Hollis, JA 2015, Richenda, WA Sheet 3963: Geological Survey of Western Australia, 1:100 000 Geological Series.
- Sheppard, S, Griffin, TJ, Tyler, IM and Page, RW 2001, High- and low-K granites and adakites at a Palaeoproterozoic plate boundary in northwestern Australia: *Journal of the Geological Society*, v. 158, p. 547–560.
- Sheppard, S, Page, RW, Griffin, TJ, Rasmussen, B, Fletcher, IR, Tyler, IM, Kirkland, CL, Wingate, MTD, Hollis, J and Thorne, AM 2012, Geochronological and isotopic constraints on the tectonic setting of the c. 1800 Ma Hart Dolerite and the Kimberley and Speewah Basins, northern Western Australia: Geological Survey of Western Australia, Record 2012/7, 28p.
- Tyler, IM and Griffin, TJ 1993, Yampi, Western Australia (2nd edition): Geological Survey of Western Australia, 1:250 000 Geological Series Explanatory Notes, 32p.
- Tyler, IM, Griffin, TJ, Page, RW and Shaw, RD 1995, Are there terranes within the Lamboo Complex of the Halls Creek Orogen?, *in* Geological Survey of Western Australia Annual Review 1993–94: Geological Survey of Western Australia, p. 37–46.