BENEATH THE SAND OF THE TANAMI DESERT

The Ngururrpa regolith landform map was produced as part of GSWA's 2015 regional regolith geochemistry program (Fig. 1). The map has been compiled using remotely-sensed data (e.g. ASTER, Landsat), geophysics, Google Earth imagery, existing geological maps, and ground observations made during the regolith sampling part of the program, and from GSWA's WAROX database. The classification of regolith and approach to regolith-landform mapping has been discussed in Geological Survey of Western Australia (2013).

The Ngururrpa area is dominated by eolian dune fields and scattered outcrops, and lacustrine-playa terrain (Fig. 2). The major topographic features are the west-dipping sandstone and siltstone cuestas of the Canning Basin forming the Stansmore Range (Fig. 3). The range rises along the west side of the NW–SE trending Stansmore Fault, a major regional tectonic structure. The Stansmore Fault runs mostly through the Canning Basin. At the southern end of the ranges the fault separates the Phanerozoic Canning Basin in the west from the Neoproterozoic Murraba Basin in the east (Fig. 4). Two paleodrainage networks have been identified, a deeper network of broad calcrete infilled paleovalleys and a shallower network of palaeochannels infilled with magnetic material

Regolith in Ngururrpa is extensive (Table 1) and mostly depositional (Fig. 5 and Fig. 6), most of which is a thin cover of quartz-rich sand which varies in thickness from less than one metre near areas of outcrop or residual regolith to more than 90 m over paleovalleys and palaeochannels Residual/relict regolith is varied (Fig. 7), and ranges from ferruginized lag a few centimetres thick to 70 m of weathered rock underlying paleovalleys. Regolith and bedrock show broad compositional relationship. For example, Canning Basin rocks are ferruginized at the surface and the regolith formed from them is generally quartz-rich and ferruginous; regolith developed over the Murraba Basin is generally quartz-rich and calcareous, and characterized by playa-lacustrine terrain and longitudinal dune fields (Fig. 8).

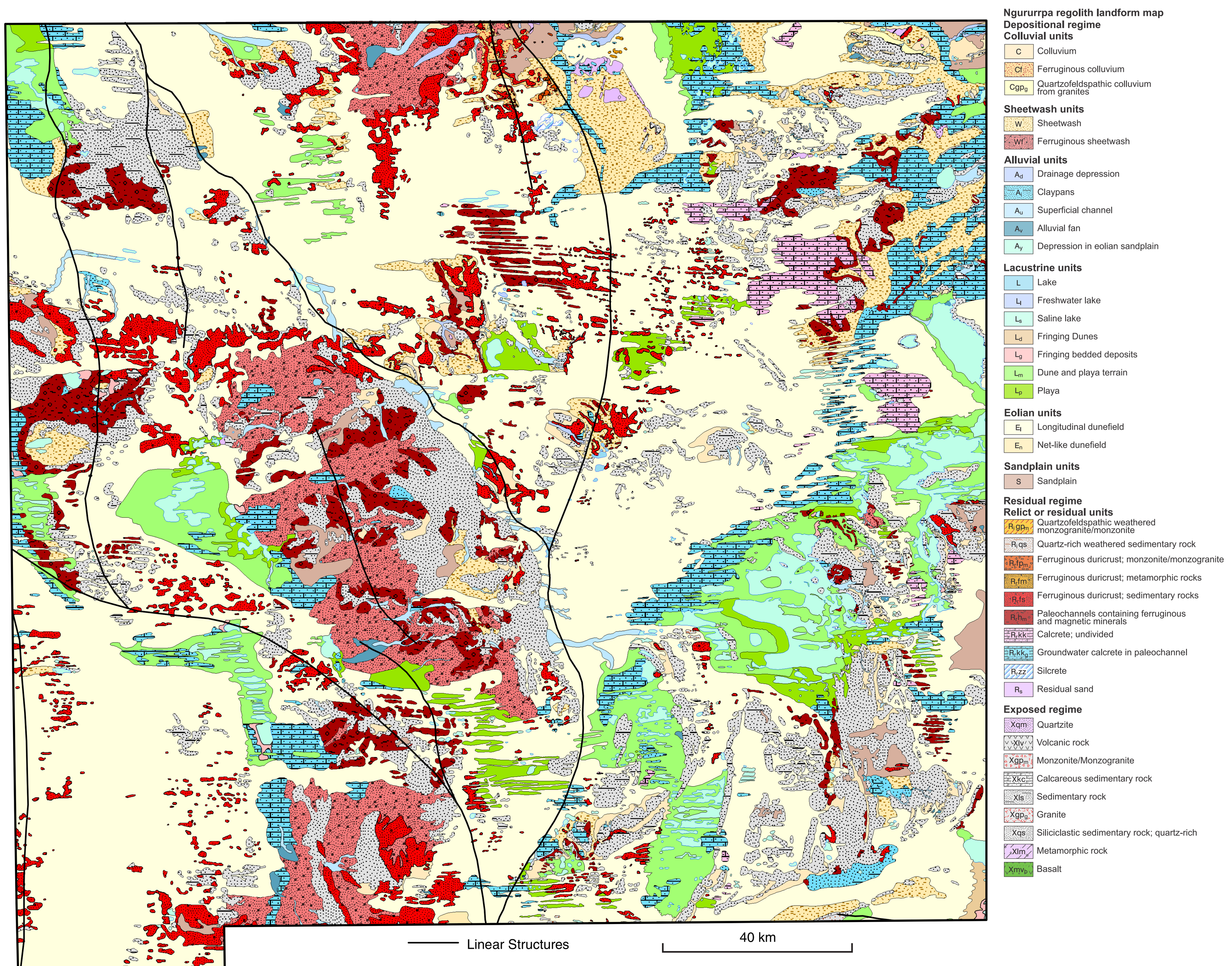

Figure 1. The Ngururrpa 1:250 000 scale interpreted regolith-landform map shows the distribution of different regolith-landform units according to GSWA's regolith classification scheme and approach to regolith mapping (Geological Survey of Western Australia, 2013).

Ngururrpa Bedrock Geology

- Phanerozoic Canning Basin
- Neoproterozoic Murraba Basin
- North Australian Craton
- Regional faults and linear structures

Figure 4. Simplified geological map of the Ngururrpa area showing the three tectonic units and regional structures. Source: Geological Survey of Western Australia; 1:500 000 Interpreted bedrock geology of Western Australia, 2016.

CODE	Regolith-Landform Unit Name	km^2	%
R$_i$gp$_m$	Quartzofeldspathic weathered monzogranite/monzonite	0.04	<0.1
R$_i$qs	Quartz-rich weathered sedimentary rock	9.78	<0.1
R$_r$fm	Ferruginous duricrust; metamorphic rock	3.05	<0.1
R$_r$fp$_m$	Ferruginous duricrust; monzogranite/monzonite	5.67	<0.1
R$_r$fs	Ferruginous duricrust; sedimentary rocks	1830.16	4.9
R$_r$h$_m$	Paleochannels containing ferruginous and magnetic minerals	1615.95	4.3
R$_r$kk	Calcrete; undivided	418.53	1.1
R$_r$kk$_g$	Groundwater calcrete in palaeochannel	1933.07	5.2
R$_r$zz	Silcrete unspecified	14.27	<0.1
R$_s$	Residual sand unspecified	34.32	0.1
	Total Residual/Relict	**5864.85**	**15.8**
Xgp$_g$	Granite	2.73	<0.1
Xgp$_m$	Monzogranite/monzonite	0.31	<0.1
Xkc	Calcareous sedimentary rock	2.15	<0.1
Xlm	Metamorphic rock	10.48	<0.1
Xls	Sedimentary rock	2512.74	6.8
Xlv	Volcanic rock	0.28	<0.1
Xmv$_b$	Basalt	0.09	<0.1
Xqm	Quartzite	9.29	<0.1
Xqs	Siliciclastic sedimentary rock; quartz rich	2227.13	6.0
	Total Exposed rock	**4765.2**	**12.8**
C	Colluvium	502.24	1.4
Cf	Ferruginous colluvium	67.2	0.2
Cgp$_g$	Quartzofeldspathic colluvium from granites	15.55	<0.1
	Total Colluvial	**584.99**	**1.6**
W	Sheetwash	1734.36	4.7
Wf	Ferruginous sheetwash	1791.72	4.8
	Total Sheetwash	**3526.08**	**9.5**
A$_d$	Drainage depression	44.77	0.1
A$_i$	Claypan	140.69	0.4
A$_u$	Superficial channel	303.15	0.8
A$_v$	Alluvial fan	68.21	0.2
A$_y$	Depression in eolian sandplain	22.35	0.1
	Total Alluvial	**579.17**	**1.6**
L	Lake unspecified	11.32	<0.1
L$_d$	Fringing dunes	31.21	0.1
L$_g$	Fringing bedded deposits	40.38	0.1
L$_l$	Freshwater lake	2.57	<0.1
L$_m$	Dune and playa terrain	2066.05	5.6
L$_p$	Playa	794.98	2.1
L$_s$	Saline lake	1240.24	3.3
	Total Lacustrine	**4186.76**	**11.3**
S	Sandplain	463.71	1.2
	Total Sandplain	**463.71**	**1.2**
E$_l$	Longitudinal dunefield	17194.64	46.3
E$_n$	Net-like dunefield	12.05	<0.1
	Total Eolian	**17206.68**	**46.3**
	TOTAL AREA	**37177.45**	**100**

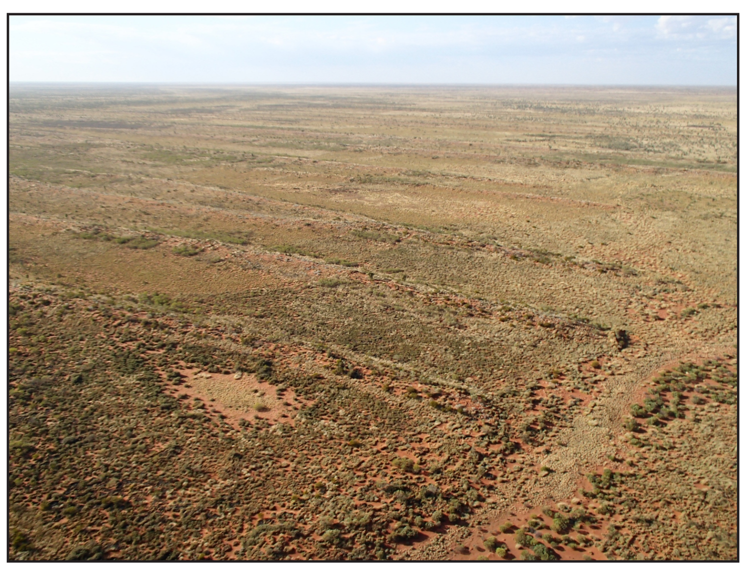

Figure 2. E–W longitudinal dunefield. Spinifex, and scattered shrubs and trees occupy the interdunes.

Figure 3. West dipping cuestas of the Stansmore Range are the major topographic features in the area reaching up to 510 meters a.s.l. The range rises along the west side of the NW–SE trending Stansmore Fault. At the southern end of the ranges the fault separates hills of the Phanerozoic Canning Basin in the west from eolian dunefields overlying the Neoproterozoic Murraba Basin in the east.

Figure 8. The landscape to the East over the Proterozoic Murraba Basin is characterised by ridges of Neoproterozoic sandstone covered by a silcrete veneer, and a series of salt lakes (Lakes Dennis, White, Willis and Hazlett).

Figure 9. Distribution of four inset paleovalleys as part of an internal drainage network into Lake Mackay, and shallow stratigraphic drilling conducted in the Granites-Tanami Region.

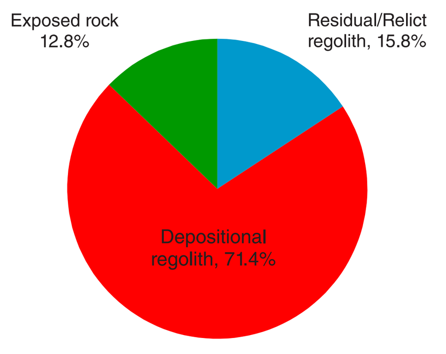

Figure 5. Percentage of residual/relict, depositional regolith and exposed rock in the Ngururrpa area.

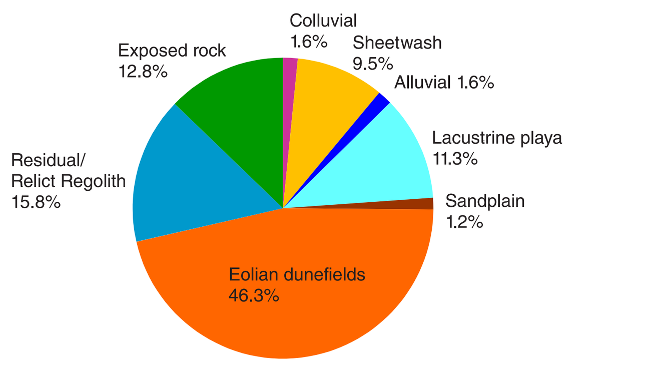

Figure 6. Depositional regolith is mainly composed of eolian, lacustrine and alluvial deposits, consisting of varying proportions of gravel, sand, silt, clay, and evaporate minerals.

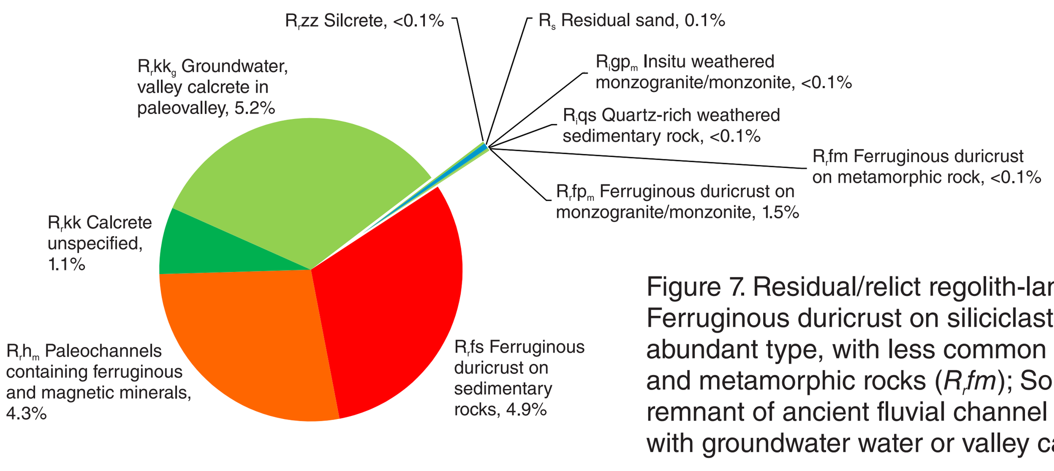

Figure 7. Residual/relict regolith-landform units in the Ngururrpa area. Ferruginous duricrust on siliciclastic sedimentary rocks (*R$_r$fs*) is the most abundant type, with less common occurrences on granitic rocks (*R$_r$fp$_m$*), and metamorphic rocks (*R$_r$fm*); Some Fe-rich residual/relict regolith is a remnant of ancient fluvial channel deposits (*R$_r$h$_m$*). Calcrete is extensive, with groundwater water or valley calcrete (*R$_r$kk$_g$*) the most abundant.

Paleodrainage Network

Two concealed paleodrainage networks are present at the Ngururrpa area composed of four broad and deeper calcrete infilled paleovalleys (Fig. 9), and a shallower and less extensive palaeochannel system infilled with magnetic material (Fig. 10).

The calcrete-filled paleovalleys, numbered 1 – 4 in Figure 9, occupy topographic depressions, as part of an internal drainage network into Lake Mackay (English, 2016). At the surface, paleovalleys are delineated by lacustrine-playa landforms. Shallow stratigraphic drilling conducted in the Granites–Tanami Region by the Bureau of Mineral Resources revealed these paleovalleys are filled with up to 15 m of calcrete and up to 90 m of unconsolidated alluvial sediments (Labouysse and Michoud, 1966, Blake, 1974).

A shallow network of dendritic buried palaeochannels is visible in the aeromagnetic RTP 1VD image (Mackey et al, 2000, Fig. 10). These paleochannels have minimal surface expression in areas of eolian cover (Fig. 11). Their aeromagnetic response can be attributed to a high content of magnetic minerals including maghemite-rich gravel lenses (Mackey et al, 2000, de Souza Kovacs, 2000). In parts of the Stansmore Range area, paleochannels appear to be continuous across the Stansmore Fault (Fig. 12), indicating the possibility of Cenozoic fault movement.

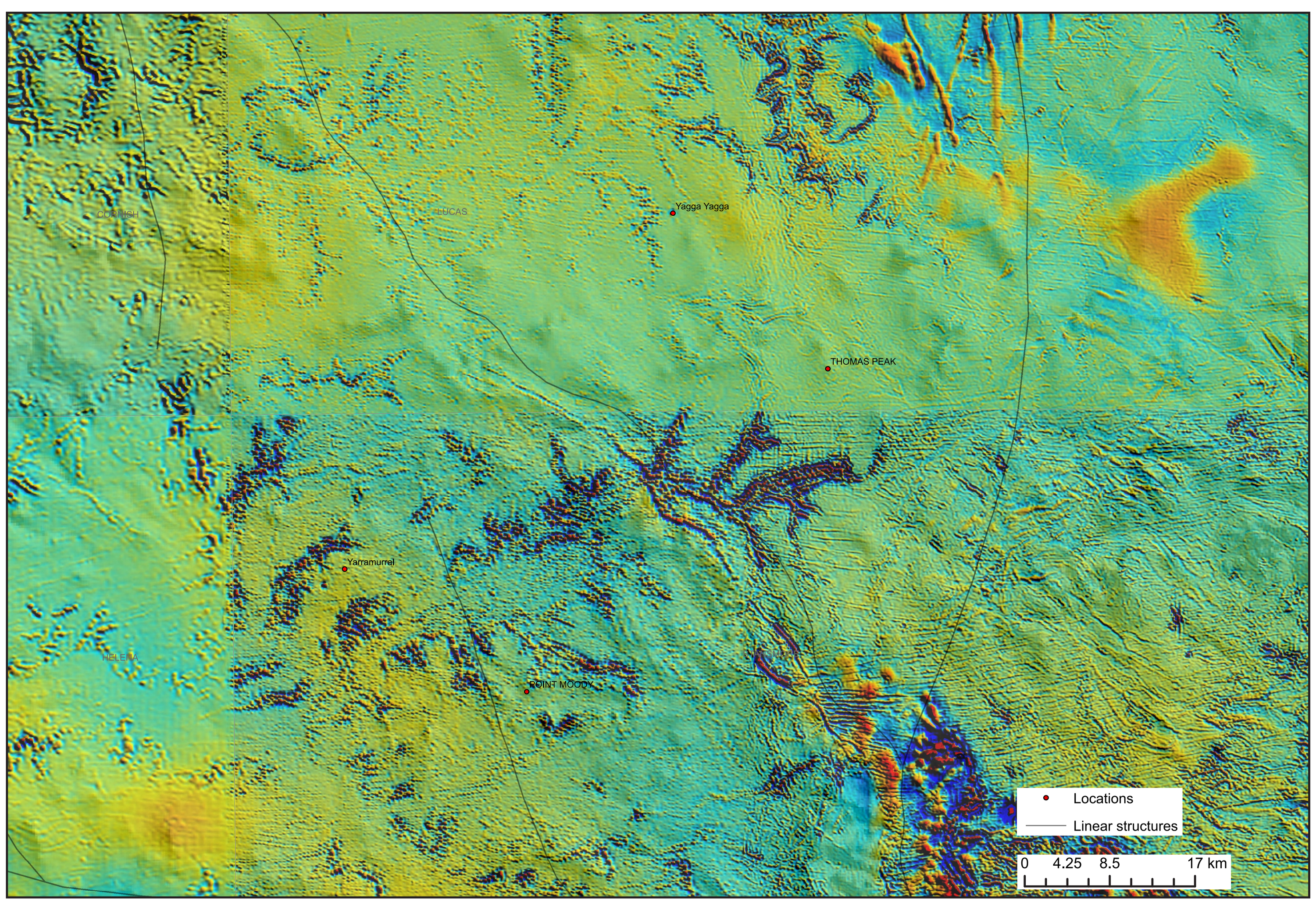

Figure 10. Magnetic RTP 1VD draped on Digital Elevation Model. Dendritic network of paleochannels is visible in purple-red colour on the Stansmore Range and surrounding area. A major palaeochannel appears to cross the Stansmore Fault. Source: Geological Survey of Western Australia.

Figure 11. Sheetwash on interdunes containing a veneer of magnetic ferruginous lag (0.1–1.0 cm). The lag is likely to have been derived from erosion and weathering of the ferruginous magnetic minerals in the paleochannels concealed beneath the eolian cover.

Figure 12. Stansmore Range to the west and dunefields to east. The Stansmore Fault runs in a NW–SE direction along the Range. A line of trees is visible delineating a modern alluvial stream that aligns with a paleochannel. The paleochannel continues to the west of the Stansmore Fault on the Range, and appears to have been displaced by fault movement in the Cenozoic.

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