Eucalyptus camaldulensis (river red gum) Biogeochemistry: An Innovative Tool for Mineral Exploration in the Curnamona Province and Adjacent Regions

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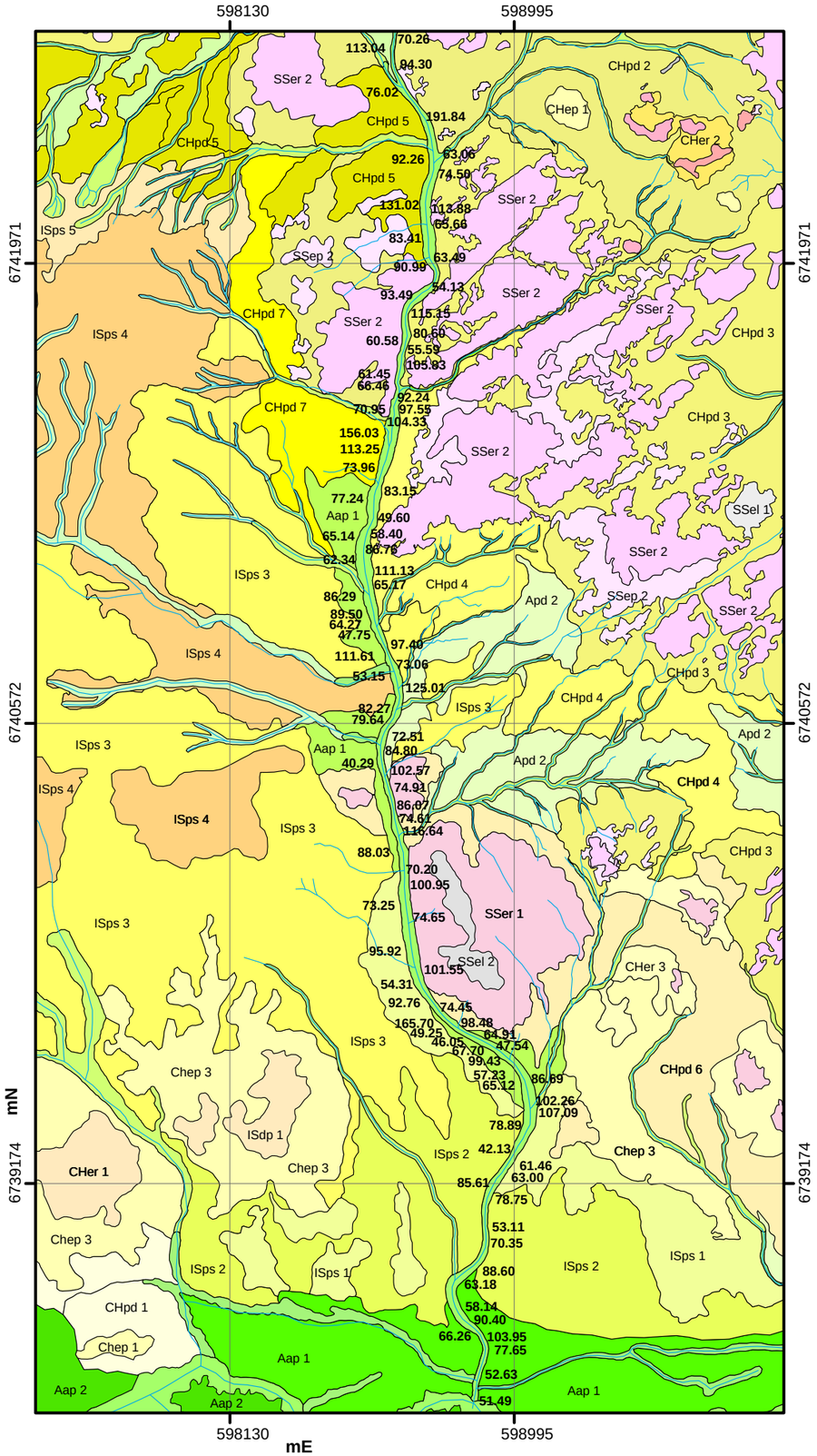
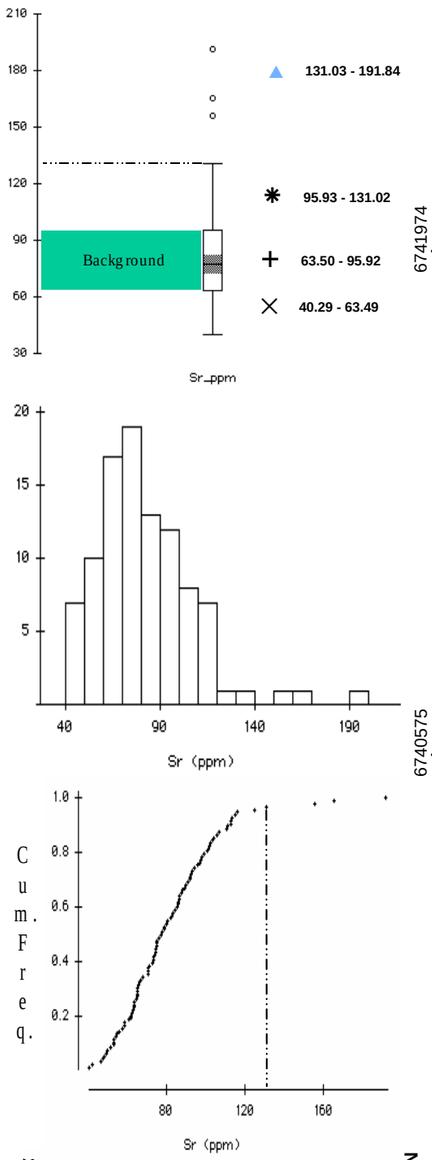
E. camaldulensis (leaves) Biogeochemistry
Racecourse Creek Tibooburra W/NSW - (Sr)

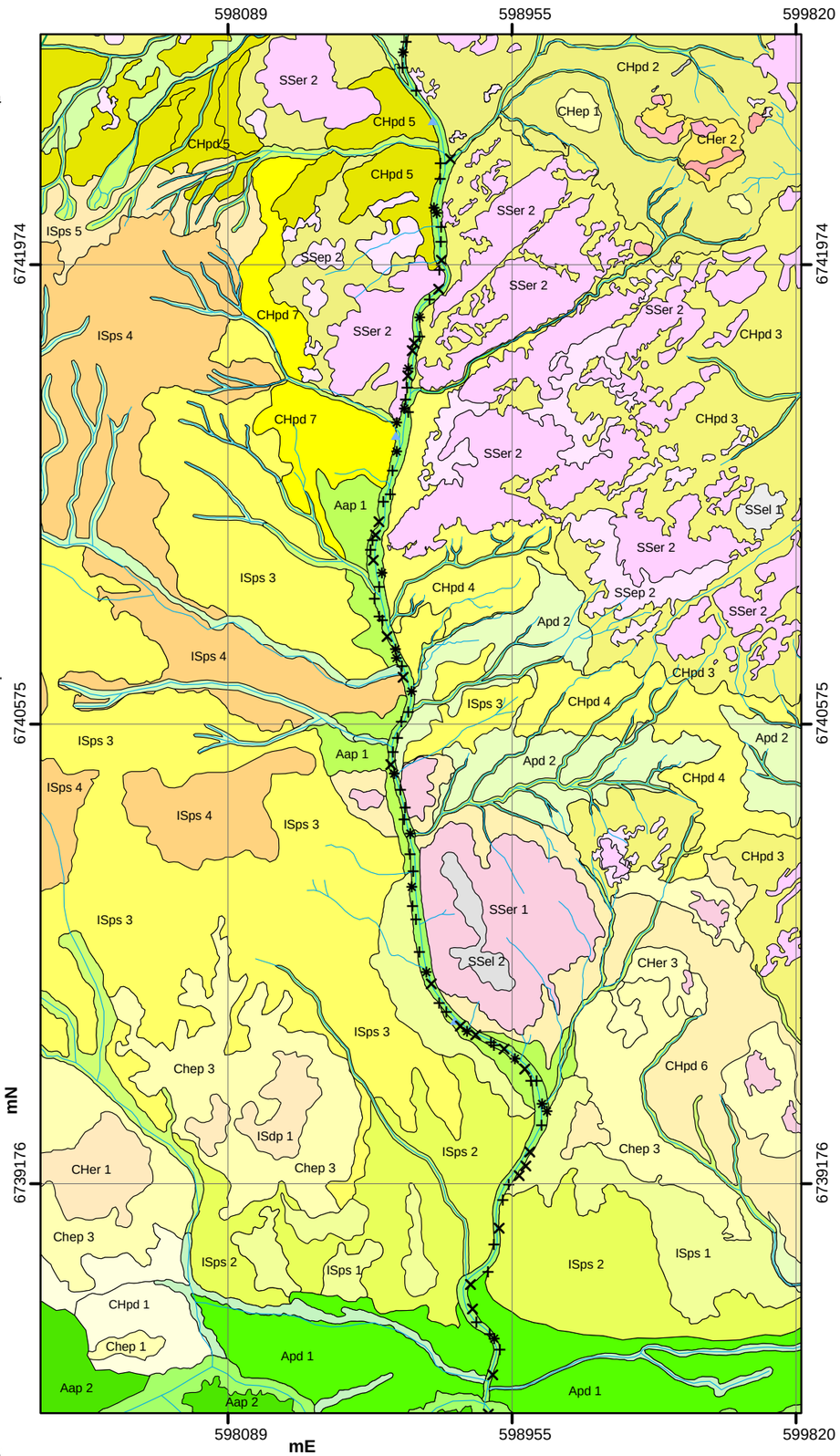




Sr ppm

Summary Statistics

Count	98
Max	191.84
Min	40.29
Mean	81.7931
Median	77.445
StdDev	25.9016
Range	151.55
Det Limit	0.05 ppm



HORIZONTAL DATUM: WGS84, UTM ZONE 54S

Figure 4.18: Raw data and spatial distribution of detectable Sr in *E. camaldulensis* (leaves) down Racecourse Creek with accompanying boxplots, histogram, cumulative frequency plot and summary statistics.

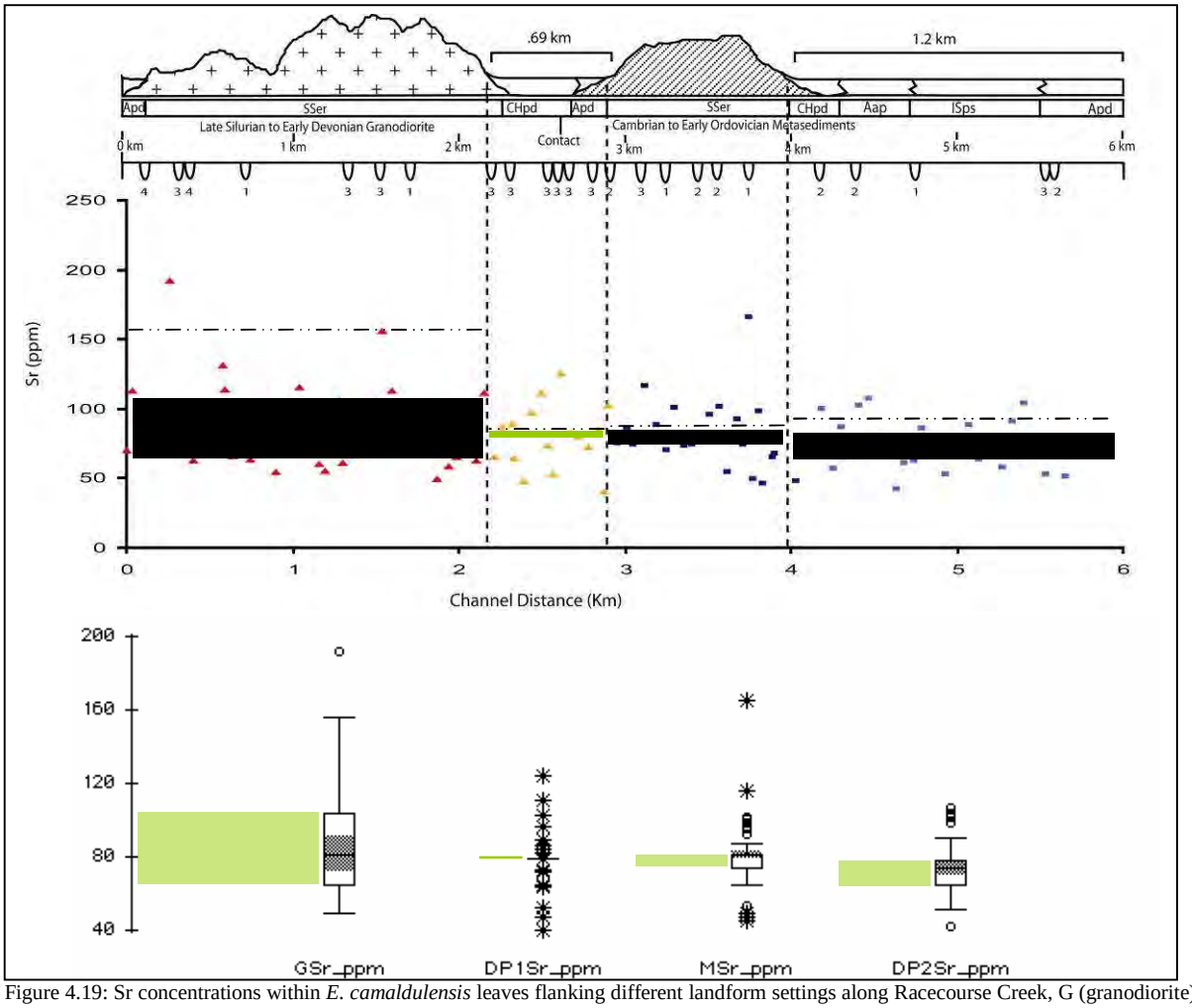
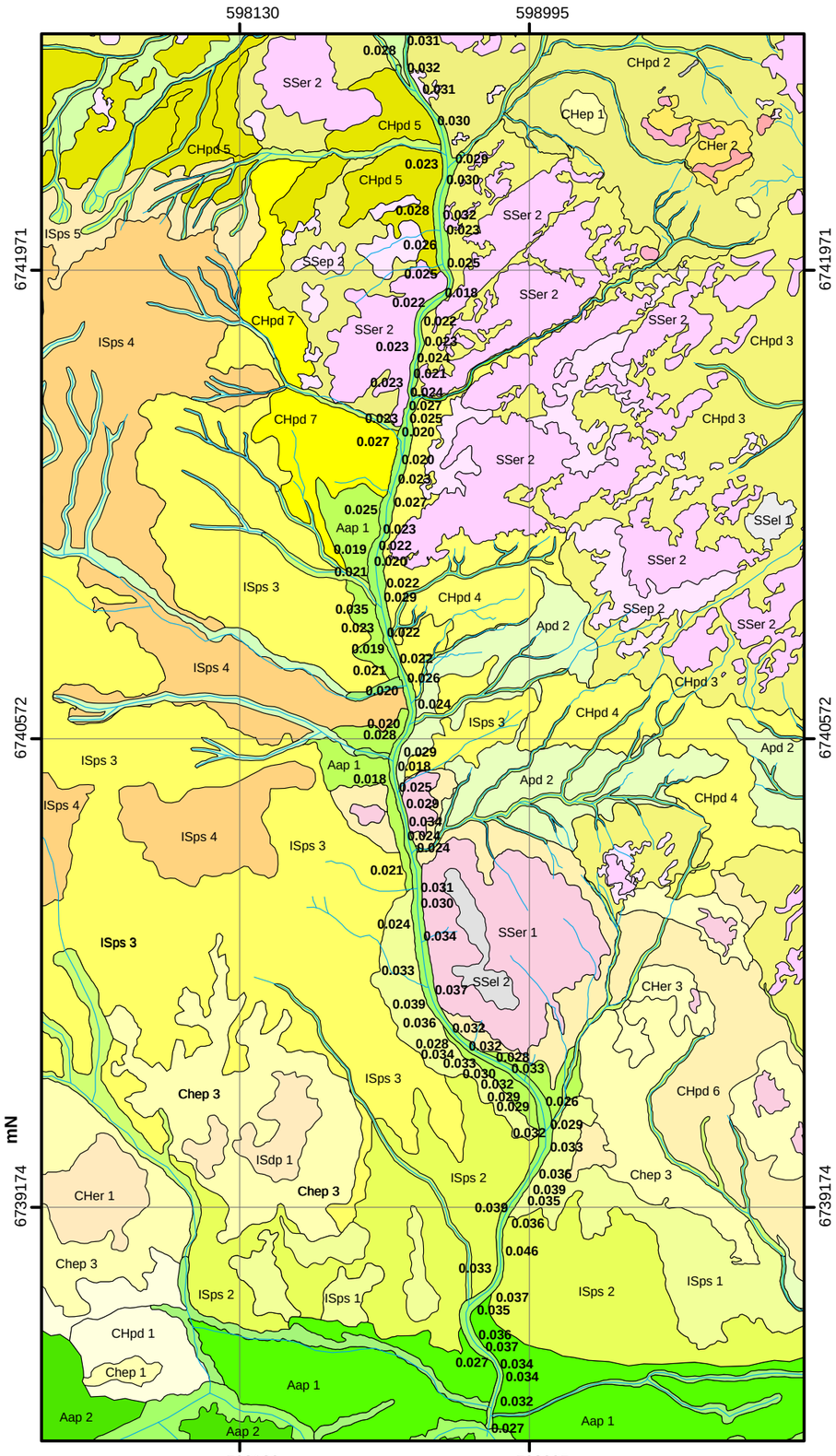


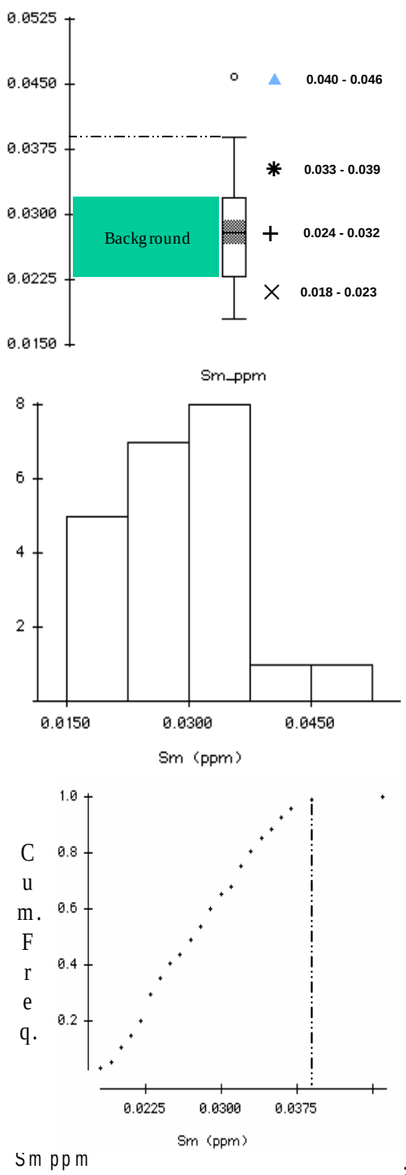
Figure 4.19: Sr concentrations within *E. camaldulensis* leaves flanking different landform settings along Racecourse Creek, G (granodiorite), DP1 (depositional 1), M (metasediment) and DP2 (depositional 2). Green region denotes 'values below the mean' and the dashed line indicates the 90th percentile.

Element (ppm) [detection limit] Analytical Method	Parameters	Total data set (C) n=98	Setting				Data set comparison
			Granodiorite (SSer) (C) n=38	Upper catchment depositional (CHpd and Apd) (C) n=16	Metasediment (SSer) (C) n=25	Lower catchment depositional (CHpd, Aap, ISps and Apd) (C) n=19	
Sr [0.05] ICP-MS	Concentration range (Mean)	40-192 (81)	50-192 (87)	40-152 (79)	46-166 (81)	42-107 (74)	Regolith-landform units associated with the granodiorite, upper catchment depositional regolith-landform units & metasediment have similarities at the 5 % Sig level in their median conc^{n}.
	25th - 75th percentile	63-96	65-104.	65-93	75-82	65-79	
	95% confidence level	5	10	12	12	8	
	>90th percentile (outliers), # of samples	156-192 (3)	192 (1)	No outliers'	117-166 (1)	99-107 (3)	
	E. camaldulensis position with the greatest concentration.	adjacent to both the granodiorite and metasediment	northern margin of the granodiorite flanked by CHpd2 & CHpd6	northern margin & down stream of intersecting Aed unit	down stream of intersecting Aed unit	northern & southern margin of lower catchment depositional	While the lower catchment depositional regolith-landform units are similar at the 5 % Sig level, with the granodiorite but different between the other regolith-landforms.

Table 4.23: Variation of Sr concentrations within *E. camaldulensis* s (river red gums), flanking different land-form settings along Racecourse Creek. Initial values concentration range, 25th - 75th percentile concentration range, 95 % confidence level, >90th percentile (outliers) C= composite sample.

E. camaldulensis (leaves) Biogeochemistry
Racecourse Creek Tibooburra W/NSW - (Sm)

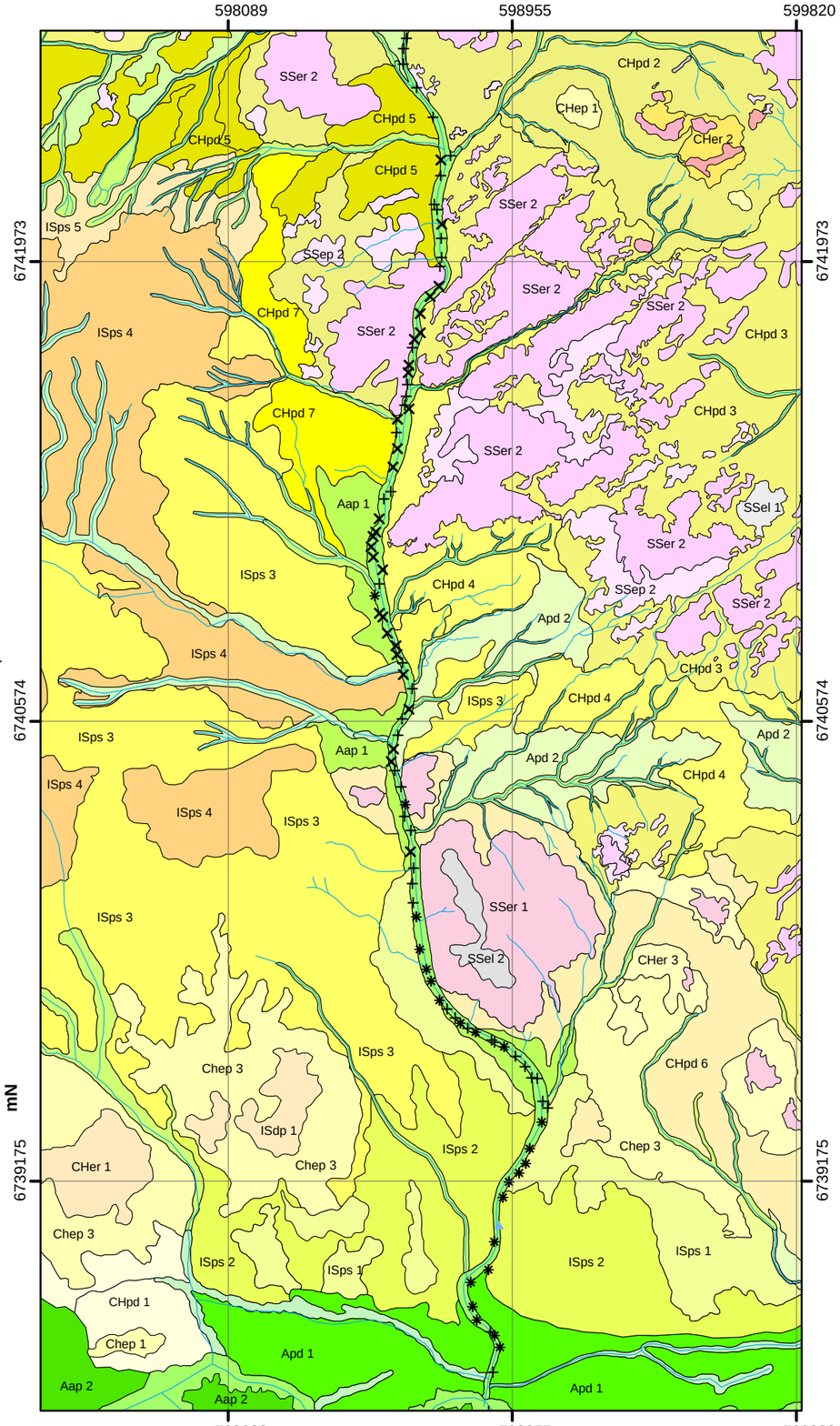




Sm ppm

Summary Statistics

Count	98
Max	0.046
Min	0.018
Mean	0.0279184
Median	0.028
StdDev	0.00590243
Range	0.028
Det Limit	0.01ppm



HORIZONTAL DATUM: WGS84, UTM ZONE 54S

Figure 4.22: Raw data and spatial distribution of detectable Sm in *E. camaldulensis* (leaves) down Racecourse Creek with accompanying boxplots, histogram, cumulative frequency plot and summary statistics.

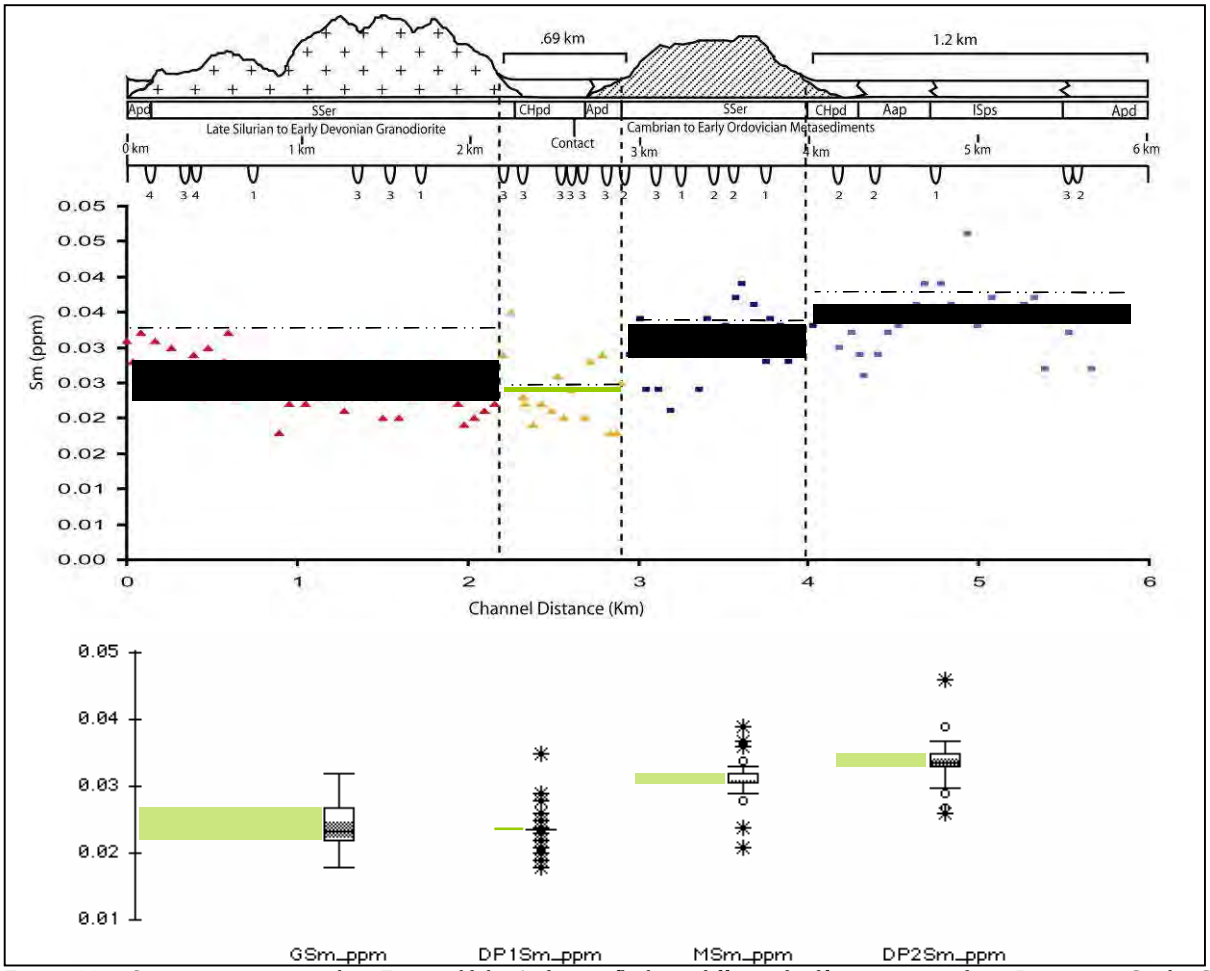
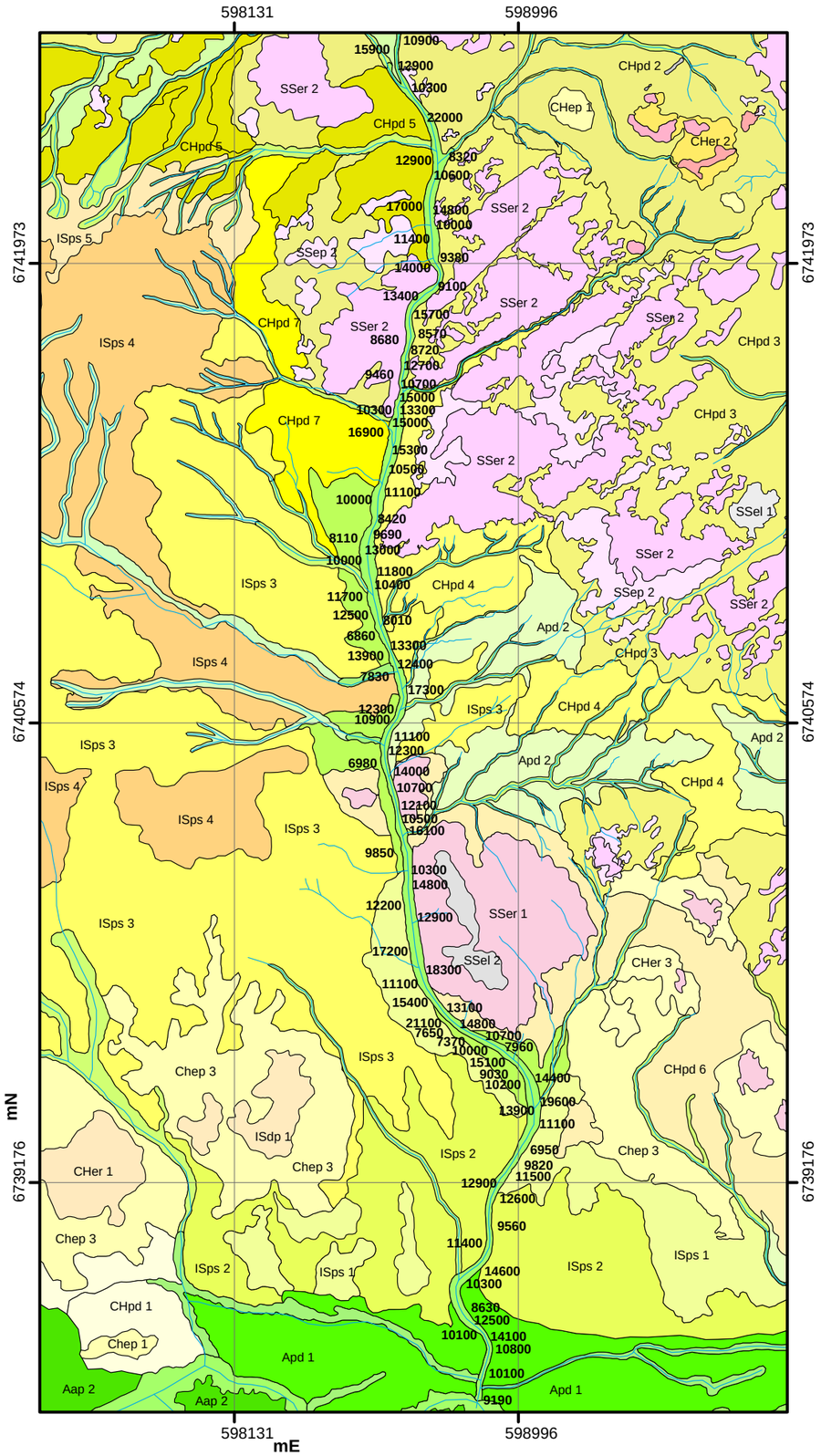


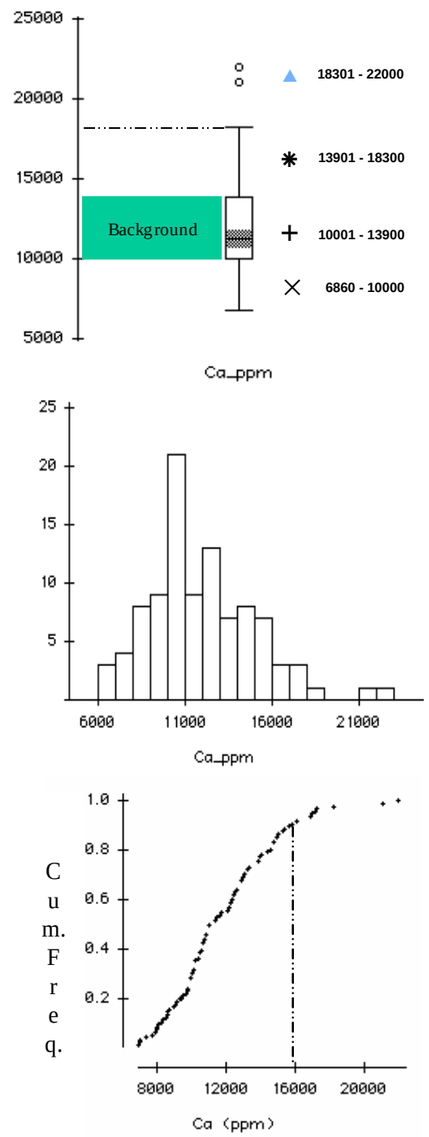
Figure 4.21: Sm concentrations within *E. camaldulensis* leaves flanking different landform settings along Racecourse Creek, G (granodiorite), DP1 (depositional 1), M (metasediment) and DP2 (depositional 2). Green region denotes 'values below the mean' and the dashed line indicates the 90th percentile.

Element (ppm) [detection limit] Analytical Method	Parameters	Total data set (C) n=98	Setting				Data set comparison
			Granodiorite (SSer) (C) n=38	Upper catchment depositional (CHpd and Apd) (C) n=16	Metasediment (SSer) (C) n=25	Lower catchment depositional (CHpd, Aap, ISps and Apd) (C) n=19	
Sm [0.01] INAA	Concentration range (Mean)	0.018-0.046 (0.03)	0.018-0.032 (0.03)	0.018-0.035 (0.02)	0.021-0.039 (0.03)	0.026-0.046 (0.03)	Regolith-landforms associated with granodiorite upper catchment depositional regolith-landforms are similar at the 5 % Sig level in their median conc^{n}.
	25th - 75th percentile	0.024-0.032	0.022-0.027	0.020-0.027	0.030-0.032	0.033-0.035	
	95% confidence level	0.001)	0.001	0.002	0.002	0.001	
	>90th percentile (outliers), # of samples	0.046 (1)	No outliers'	No outliers'	0.034-0.039 (6)	0.039-0.046 (3)	While the metasediment & lower catchment depositional regolith-landform units have major difference between each other and other associated regolith-landforms at the 5 % Sig level
	E. camaldulensis position with the greatest concentration.	northern part of Racecourse Ck	northern & southern margin of granodiorite	northern & southern margin of upper catchment depositional & down stream of intersecting Aed unit	northern & southern margin of metasediment & down stream of intersecting Aed unit	central & adjacent to flanking ISps1 & ISps2	

Table 4.24: Variation of Sm concentrations within *E. camaldulensis* s (river red gums), flanking different land-form settings along Racecourse Creek. Initial values concentration range, 25th - 75th percentile concentration range, 95 % confidence level, >90th percentile (outliers) C= composite sample.

E. camaldulensis (leaves) Biogeochemistry
Racecourse Creek Tibooburra W/NSW - (Ca)

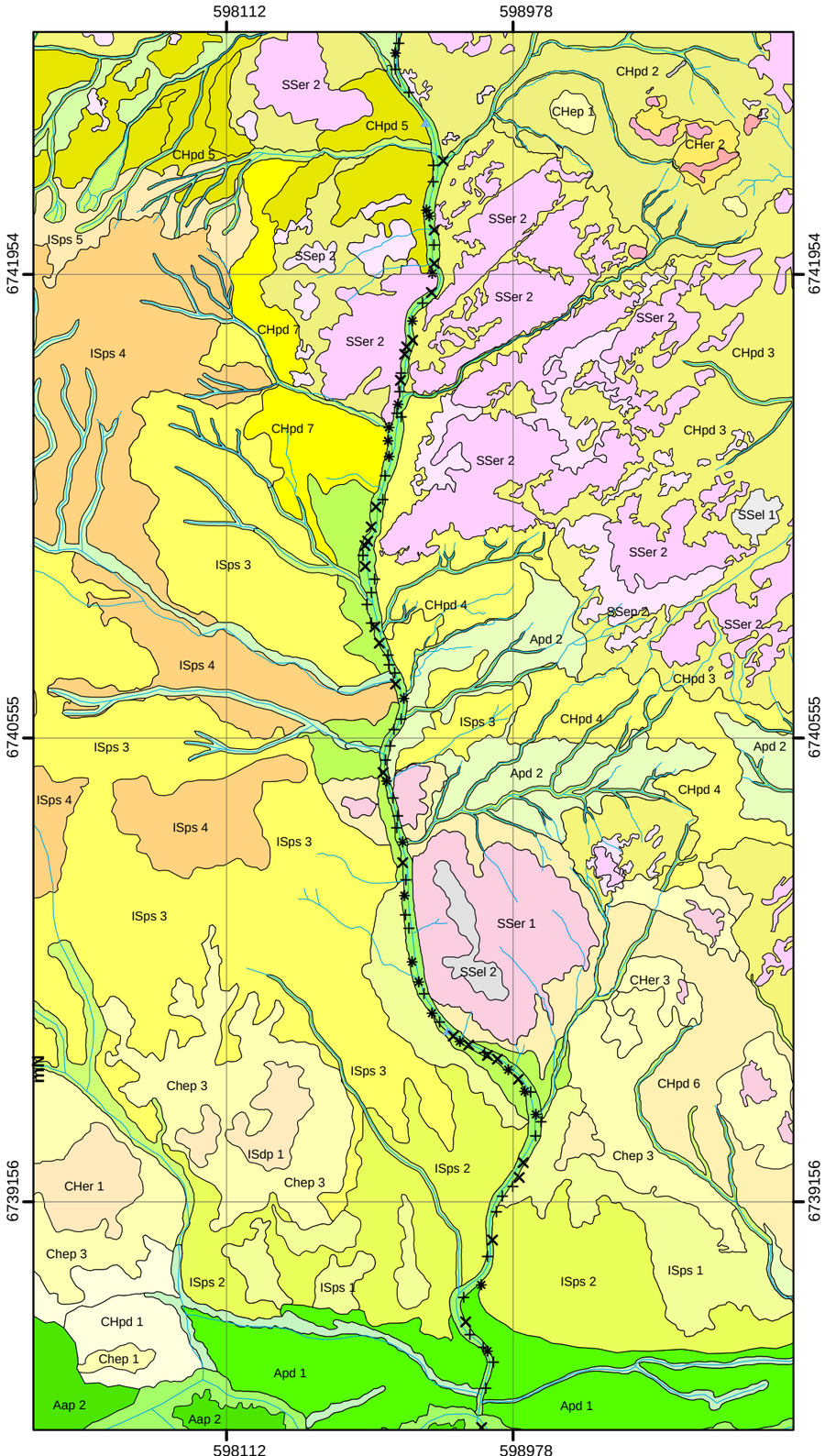




Capm

Summary Statistics

Count	98
Max	22000
Min	6860
Mean	11912.7
Median	11250
StdDev	3023.61
Range	15140
Det Limit	500ppm



HORIZONTAL DATUM: WGS84, UTM ZONE 54S

Figure 4.20: Raw data and spatial distribution of detectable Ca in *E. camaldulensis* (leaves) down Racecourse Creek with accompanying boxplots, histogram, cumulative frequency plot and summary statistics.

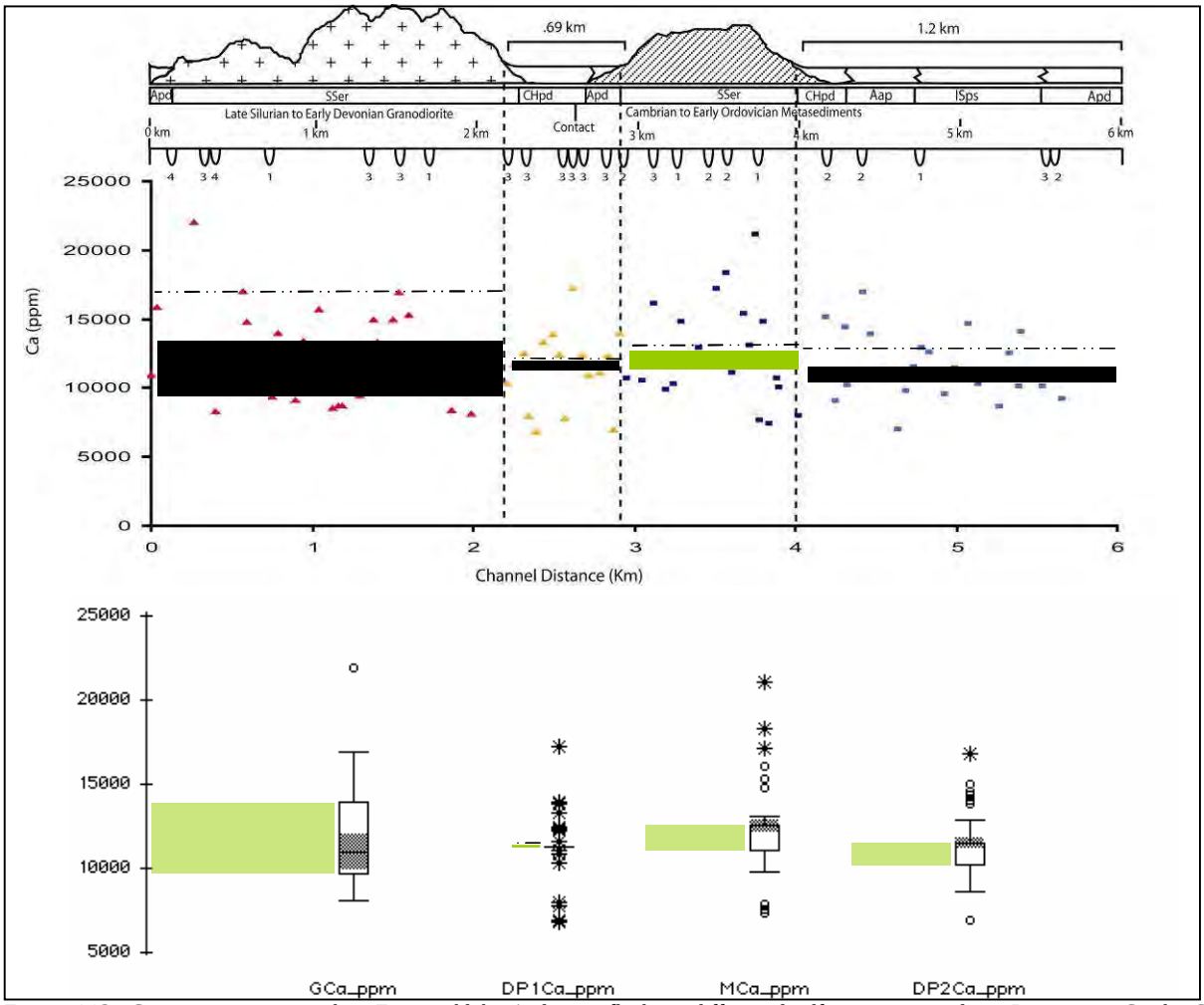


Figure 4.23: Ca concentrations within *E. camaldulensis* leaves flanking different landform settings along Racecourse Creek, G (granodiorite), DP1 (depositional 1), M (metasediment) and DP2 (depositional 2). Green region denotes 'values below the mean' and the dashed line indicates the 90th percentile.

Element (ppm) [detection limit] Analytical Method	Parameters	Total data set (C) n=98	Setting				Data set comparison
			Granodiorite (SSer) (C) n=38	Upper catchment depositional (CHpd and Apd) (C) n=16	Metasediment (SSer) (C) n=25	Lower catchment depositional (CHpd, Aap, ISps and Apd) (C) n=19	
Ca [500] INAA	Concentration range (Mean)	6860-22000 (11912)	8110-22000 (11996)	6860-17300 (11361)	7370-21100 (12577)	6950-16900 (11551)	Regolith-landforms units associated with granodiorite, upper catchment depositional and lower catchment depositional regolith-landforms all have similarities at the 5% Sig Level, compared to the regolith-landform units associated with the metasediment.
	25th - 75th percentile	10000-22000	9690-14000	9205-12900	11100-12577	10300-11551	
	95% confidence level	606	1016	1514	1652	1057	
	>90th percentile (outliers), # of samples	21100-22000 (2)	22000 (1)	No outliers'	17200-21100 (3)	19600 (1)	
	E. camaldulensis position with the greatest concentration.	northern & southern parts of Racecourse Ck	northern margin of granodiorite, flanked by CHpd2 & CHpd5	down stream of intersecting Aed unit	southern margin & down stream of intersecting Aed units	northern margin & down stream of intersecting Aed unit	

Table 4.25: Variation of Ca concentrations within *E. camaldulensis* s (river red gums), flanking different land-form settings along Racecourse Creek. Initial values concentration range, 25th - 75th percentile concentration range, 95 % confidence level, >90th percentile (outliers) C= composite sample.

4.4 PINE CREEK

4.4.1 Setting

Pine Creek catchment is about 10 km southwest of Broken Hill, western New South Wales, approximately 500 km north of Adelaide (Figure 4.24). The study area is approximately 6 km by 8.5 km. It is on the Broken Hill 1:250 000 topographic mapsheet (SH54-15).

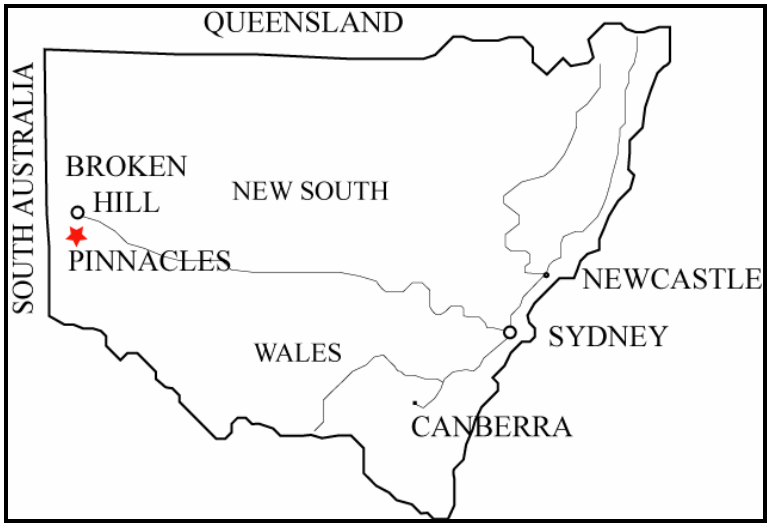


Figure 4.24: Location of the Pinnacles (Barrier Pinnacles Mine), western New South Wales.

The area presently experiences a semi-arid to arid climate, with an average annual rainfall of 253 mm, mainly falling in the summer. Temperatures range from an average summer maximum of 32.1°C to an average winter minimum of 5.9°C (Bureau of Meteorology, 2005c). Pine Creek generally flows from north to south, from the Barrier Ranges, past the eastern margins of the Pinnacles Mine, and then into the Murray-Darling drainage basin, where it terminates within a series of ephemeral floodout fans and swamps. The northern parts of the study area are within the Barrier-Pinnacles Mine lease, whereas the southern parts are within 'Balaclava' station. The northern area is currently host to Pb-Zn-Ag mineralisation/lodes. Wilkinson (1883-4 cited in Andrews, 1922) initially described the mineralised outcrop as a large black craggy mass (porous gossan), originally thought to extend from Round Hill to the north-east of Broken Hill to the Pinnacles in the south-west, and therefore part of continuations of the Broken Hill Lode. The lodes have since been shown to be discrete. The discovery of the Pinnacles mineralisation has been attributed to Maiden and Pretty in 1884 (Andrews, 1922 and Dickson, 1972) and derived from recognition of mineralised subcrop.

4.4.2 Geology

The Pinnacles mineralisation is set within the Early to Middle Proterozoic Willyama Supergroup (Stevens, 1971; Brown, 1978; Parr, 1994; Leyh, 2003), which includes composite gneisses, and migmatites, quartzo-feldspathic gneisses, amphibolite, and mafic granulites and mafic and ultramafic intrusives.

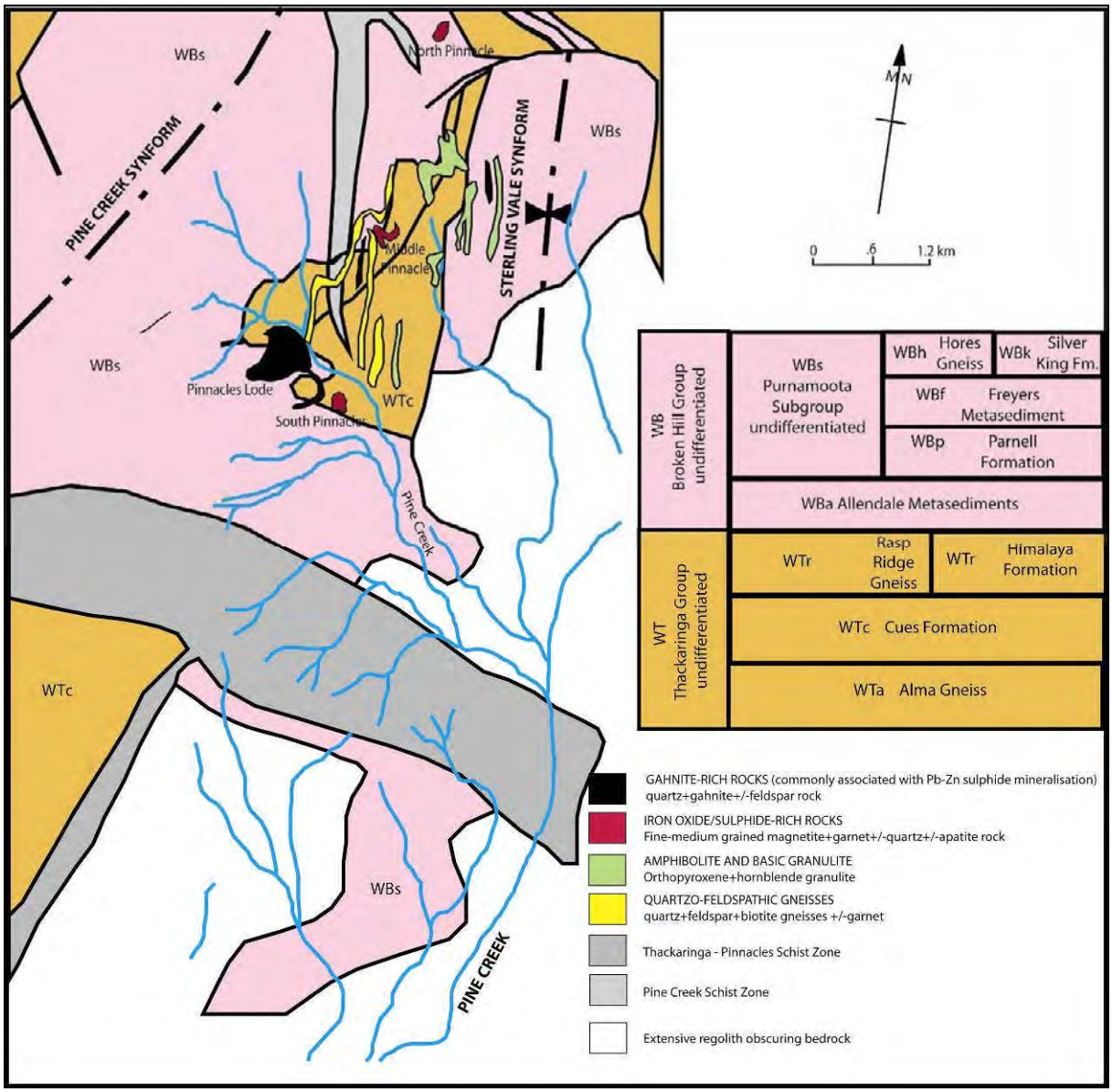


Figure 4.25: A section of the Willyama Supergroup stratigraphy, interpretative geology and known geology and associated mineralisation within the Thackaringa and Broken Hill Group. (Compiled from Brown, 1984; Rugless & Govett, 1984; and Parr, 1994) including upper Pine Creek catchment and Barrier Pinnacles mine area.

The exposed rock sequence at the Pinnacles is interpreted as being within the Cues Formation (stratiform Pb-Zn-Ag mineralisation) in the Thackaringa Group (Ruggless & Govett, 1984; Barnes, 1988; Parr, 1994), which is stratigraphically overlain by the Himalaya Formation (Ruggless & Govett, 1984; Lehy, 2003). The bedrock lithologies in the Pinnacles area (Figure 4.25) include psammitic to pelitic metasediments, composite quartzo-feldspathic and leucocratic quartzo-feldspathic gneiss and rocks, pegmatites, basic granulites and amphibolites, basic to ultrabasic intrusive, calc-silicates and numerous lode rocks (quartz gahnite, garnet sandstone, garnet quartzite and banded iron formation) with minor occurrences of quartz magnetite (Stevens, 1971; Brown, 1978 and Brown, 1984).

4.4.3 Mineralisation

The Barrier-Pinnacles mineralisation is the largest known Broken Hill Type deposit in the region, other than the Broken Hill line of lode. Since 1885, the deposit has been worked sporadically with approximately 0.2 Mt of ore extracted.

The Pinnacles deposit includes both Pb and Zn lodes, which are identified based on their metal grades (Barnes, 1988). Ayres (1962) describes the ores as:

- Lead lode: galena is the most abundant mineral of the lead lode horizon; however pyrite is typically also a major mineral. Minor minerals are arsenopyrite, sphalerite, ilmenite, pyrrhotite, chalcopyrite and jamesonite.
- Zinc lode: major minerals in these horizons are sphalerite and pyrite, with minor arsenopyrite, galena, pyrrhotite, chalcopyrite and ilmenite.

Average ore grades are 6-11 % Pb, 2.5 % Zn and 300-500 g/t Ag from the main strata Pb lodes, and 1 % Pb, 10-15 % Zn and 30 g/t Ag from the less persistent Zn lode (King, 1953; Barnes, 1988; Parr, 1994). The Pinnacles Mine also has a substantial Au content of 1-7 g/t (Williams, pers comm., 2005). Recent drilling by Pinnacles Mines resulted in the intersection of mineralisation with an apparent width of 6.4 m which revealed 11.6% Zn, 1.38 % Pb and 0.63 g/t Au, and 2.5 m at 12.58 g/t Au.

The Pinnacles deposit is similar to the Broken Hill ore, except that contains larger proportions of Fe, As Sb (Barnes, 1988) and with less Mn, Ca, F and P (Plimer, 1994). The Pinnacles deposit is associated with rocks of interpreted exhalative origin formed as chemical precipitates in the silicate, oxide, carbonate and sulphide facies (Ruggless & Govett, 1984; Parr, 1994). The deposit is characterised by a series of stacked, strata-bound Pb-rich and Zn-rich lenses (Rugless & Govett, 1984; Barnes, 1988; Parr, 1994), hosted in a thick succession of clastic and chemical sedimentary rock, which have undergone multiphase deformation and metamorphism.

Most of the prospective bedrock in the Pinnacles region is concealed by transported colluvial, alluvial and/or aeolian regolith material, which has been a major impediment for exploration in the region. In order to optimise future mineral exploration programs within the region it is important to understand the regolith materials and processes.

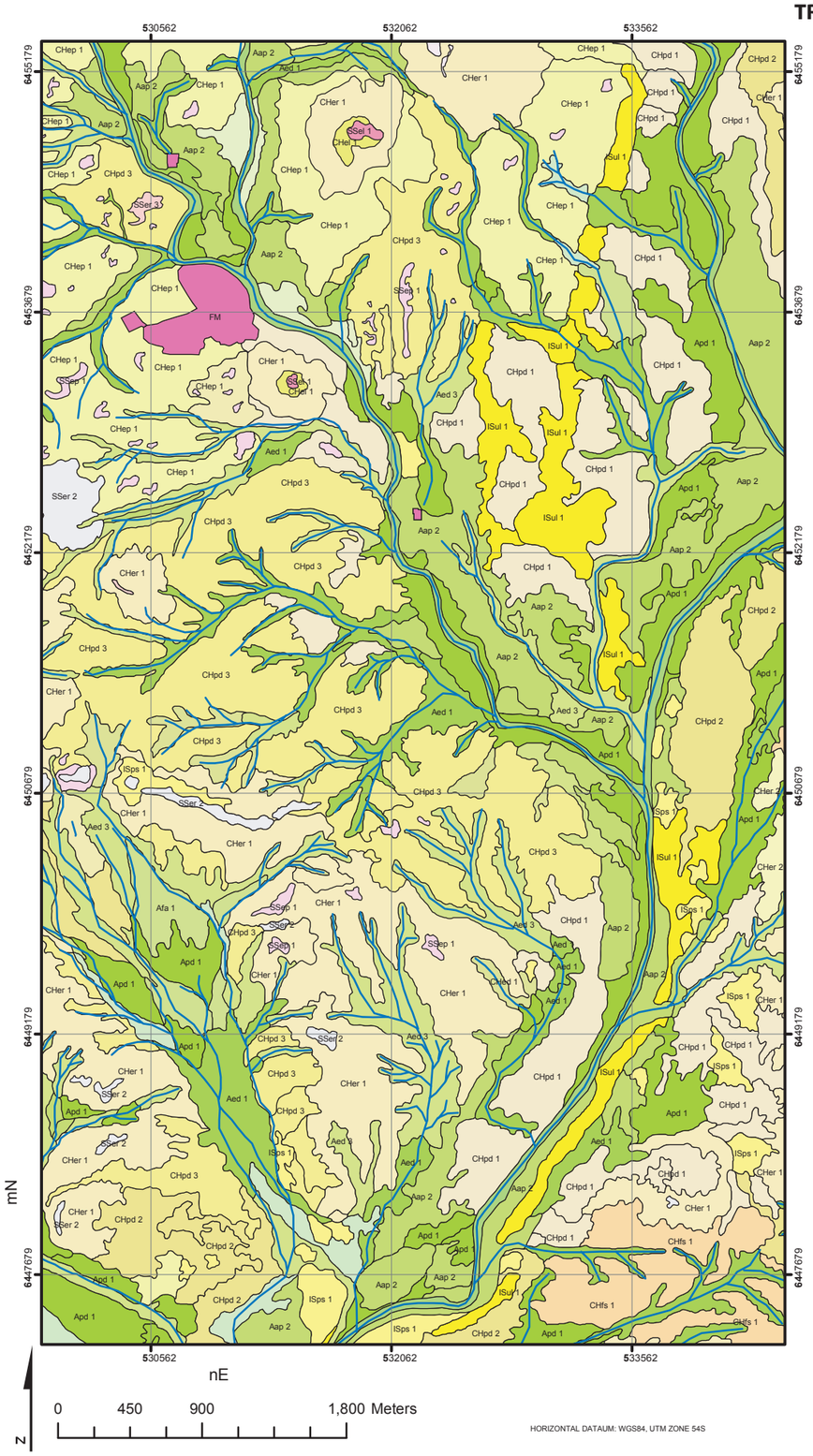
4.5 REGOLITH-LANDFORM UNITS

The regolith and landforms of the Pinnacles area have been mapped and characterised at both the regional (Gibson & Wilford, 1996; Hill, 2001) and local (Senior *et al*., 2002; Senior & Hill, 2002) scales. To aid in the understanding of *E. camaldulensis* biogeochemistry within the Pine Creek catchment, further, more detailed (1:10 000) regolith-landform mapping was undertaken across the catchment, focussing on the context and associated surficial dispersion processes and pathways for the biogeochemical sampling sites.

The Pinnacles catchment broadly consists of a series of erosional hills, rises and plains consisting of variably weathered (mostly slightly weathered) bedrock surrounded by depositional plains consisting of transported regolith derived from alluvial, colluvial, sheetwash and aeolian processes. The transported regolith thickness is variable and ranges up to 10 m, particularly towards the south of the catchment. A total of 26 regolith-landform units

have been identified within the 1:10 000 map area. The accompanying regolith-landform map (Figure 4.26) and the following section provide a description of the attributes of each regolith-landform unit.

PINNACLES (PINE CREEK) REGOLITH-LANDFORM MAP (1:10 000)



TRANSPORTED REGOLITH

ALLUVIAL SEDIMENTS — *ALLUVIAL SEDIMENTS*

Aap 1 — Sub-rounded to rounded fine-grained red-brown sands, silts with minor clays and gravels comprised mostly of quartz and lithic fragments (5-15 mm), on a very low landsurface. Includes sub-angular to sub-rounded coarse quartz sand and minor quartzose lithic gravel surface lag. Vegetation dominated by *Acacia victoriae* with minor chenopod shrubs such as *Maireana pyramidata*, and *Atriplex vesicaria*.

Aap 2 — Sub-rounded to rounded fine-grained red-brown sands, silts with minor clays and gravels comprised mostly of quartz and lithic fragments (5-15 mm), on a very low landsurface. Includes sub-angular to sub-rounded coarse quartz sand and minor quartzose lithic gravel surface lag. Vegetation dominated by chenopod shrubs including *Maireana pyramidata*, and *Atriplex vesicaria* with minor *Acacia victoriae*.

Apd 1 — Sub-rounded to rounded quartz sands and minor quartzose and lithic fragments (5-15 mm), with fine-grained red-brown sands and silts with minor clays. Vegetation dominated by chenopod shrubs including *Maireana pyramidata* with mior *Atriplex vesicaria*, and *Bassia ssp.*

Aed 1 — Sub-angular to sub-rounded red-brown quartzose lithic sands and silts, with minor lithic clasts (10-40 mm), elongated drainage depression including narrow incised channel and lower valley margins. Gullying from surrounding landforms and minor melon holes. Vegetation dominated by *Acacia aneura* with minor chenopod shrubs including *Maireana pyramidata* and *Atriplex vesicaria.*

Aed 2 — Sub-angular to sub-rounded red-brown quartzose lithic sands and silts, with minor lithic clasts (10-40 mm), elongated drainage depression including narrow incised channel and lower valley margins. Gullying from surrounding landforms and minor melon holes. Vegetation dominated by *Acacia victoriae* with minor chenopod shrubs including *Maireana pyramidata* and *Atriplex vesicaria.*

Aed 3 — Sub-angular to sub-rounded red-brown quartzose lithic sands and silts, with minor lithic clasts (10-40 mm), elongated drainage depression including narrow incised channel and lower valley margins. Gullying from surrounding landforms and minor melon holes. Vegetation dominated by *Acacia victoriae* with minor chenopod shrubs including *Maireana pyramidata* and *Atriplex vesicaria.*

Afa 1 — Sub-rounded to rounded fine-grained red-brown sands, silts and clays, with minor gravels comprised mostly of quartz and lithic fragments (5-15 mm), on a very subtle relief. Vegetation dominated by *Acacia victoriae* with minor chenopod shrubs including *Maireana pyramidata*, with minor *Atriplex vesicaria*, and *Bassia ssp.*

CHANNEL DEPOSITS

ACar 1 — Major ephemeral meandering channel approximately 50-80 m wide, consisting of minor braided channels with ocassional levees. Sub-angular to sub-rounded red-brown quartzose sands, red-brown silts, and sub-angula to sub-rounded lith fragments with minor heavy minerals. Imbricated gravesl (5-30 mm). Minor exposures of slightly weathered bedrock. Vegetation dominated by open woodland *Eucalyptus camaldulensis* with minor *Acacia victoriae* and scattered chenopod shrubs such as *Atriplex vesicaria* and *Maireana pyramidata.*

AEOLIAN SEDIMENTS — *AEOLIAN SANDS*

ISps 1 — Rounded to well rounded fine-grained quartzose sands and silts, with coarse grains quartzose sands and minor lithic fragments exposed within the swales, with irregular hummocky dunnes on a low landsurface. Vegetation grassland dominated by *Stipa ssp.* and *Astrebla ssp.* with minor chenopod shrubs including *Maireana pyramidata* and *Atriplex vesicaria.*

ISul 1 — Rounded and spherical fine-grained quartzose sands and silts, with coarse grains quartzose sands and minor lithic fragments exposed within the swales, on a low long narrow landsurface. Vegetation dominated by chenopod shrubs including *Maireana pyramidata* and minor *Atriplex vesicaria*, and grasses *Stipa ssp.* and *Astrebla ssp.*

COLLUVIAL SEDIMENTS — *SHEET FLOW DEPOSITS*

CHel 1 — Angular to sub-angular lithic and quartzose gravels (10-150 mm), with silts and sands. Angular to sub-rounded red-brown sands with minor silts and clays. Minor powdery, nodular and hardpan regolith carbonate accumulations. Geohazard: talus deposit. Vegetation dominated by chenopod shrubs such as *Maireana pyramidata* and *Maireana sedifolia* with minor *Atriplex vesicaria* and scattered *Sida petrophila* and *Bassia ssp.*

CHer 1 — Angular to sub-rounded red-brown sands with minor silts and clays, angular to sub-rounded lithic and quartzose gravels (5-30 mm). Minor powdery, nodular and hardpan regolith carbonate accumulations. Vegetation dominated by chenopod shrubs such as *Maireana pyramidata* and *Maireana sedifolia* with minor *Atriplex vesicaria* and scattered *Sida petrophila* and *Bassia ssp.*

CHer 2 — Angular to sub-rounded red-brown sands with minor silts and clays, angular to sub-rounded lithic and quartzose gravels (10-150mm). Minor powdery, nodular and hardpan regolith carbonate accumulations. Vegetation dominated by chenopod shrubs such as *Maireana pyramidata* and *Maireana sedifolia* with minor *Atriplex vesicaria* and scattered *Sida petrophila* and *Bassia ssp.*

CHep 1 — Angular to sub-rounded red-brown sands with minor silts and clays, angular to sub-rounded lithic and quartzose gravels (5-30mm). Minor powdery, nodular and hardpan regolith carbonate accumulations. Vegetation dominated by chenopod shrubs such as *Maireana sedifolia* and *Maireana pyramidata* with minor *Atriplex vesicaria* and scattered *Acacia aneura, Sida petrophila* and *Bassia ssp.*

CHep 2 — Angular to sub-rounded red-brown sands with minor silts and clays, angular to sub-rounded lithic and quartzose gravels (5-10 mm). Minor powdery, nodular and hardpan regolith carbonate accumulations. Vegetation dominated by chenopod shrubs such as *Maireana pyramidata* and *Maireana sedifolia* with minor *Atriplex vesicaria* and *Acacia aneura* and *Bassia ssp.*

CHpd 1 — Sub-angular to sub-rounded coarse lithic and quartzose sands, sub-rounded red-brown sands and silts, with sub-angular to sub-rounded lithic quartzose gravels (5-15 mm), with minor fragments of regolith carbonate accumulations on a low topographical relief. Vegetation dominated by chenopod shrubland such as *Maireana sedifolia* and *Maireana pyramidata* with scattered *Bassia ssp.*

CHpd 2 — Sub-angular to sub-rounded coarse lithic and quartzose sands, sub-rounded red-brown sands and silts, with sub-angular to sub-rounded lithic quartzose gravels (5-10 mm), with minor fragments of regolith carbonate accumulations and maghemite (*y*-Fe2O3) on a low topographical relief. Vegetation dominated by chenopod shrubland such as *Maireana sedifolia* and *Maireana pyramidata* with scattered *Bassia ssp.*

CHpd 3 — Sub-angular to sub-rounded coarse lithic and quartzose sands, sub-rounded red-brown sands and silts, with sub-angular to sub-rounded lithic quartzose gravels (5-15 mm), with minor fragments of regolith carbonate accumulations on a low topographical relief. Vegetation dominated by chenopod shrubland such as *Maireana sedifolia* and *Maireana pyramidata* with scattered *Bassia ssp.*

CHed 1 — Sub-angular to sub-rounded red-brown quartzose lithic sands and silts, with sub-angular to sub-rounded lithic fragments and gravel lags (10-40 mm). Vegetation dominated by *Acacia aneura* with minor chenopod such as *Maireana pyramidata* and *Atriplex vesicaria.*

CHfs 1 — Angular to sub-rounded lithic and quartzose gravel within red-brown fine sands and silts, seperated by dense vegetation dominated by chenopod shrubs such as *Maireana pyramidata, Maireana sedifolia* and minor *Atriplex vesicaria*, colonising the fine sand and silts.

FILL — *FILL*

FM — Urban/Barrier Pinnacles Mine, surface lags are highly variable. Vegetation is variable and includes abundant exotic species.

IN-SITU REGOLITH

SAPROLITH — *SAPROCK*

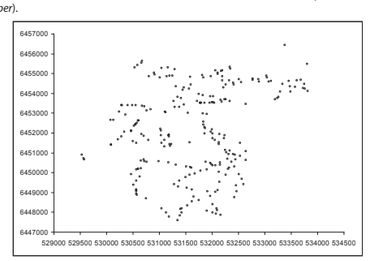
SSel 1 — Slightly weathered bedrock, with minor ferruginous staining and fractures. Comprised of coarse angular lithic, and quartzose gravels with minor regolith carbonate accumulations on a moderate relief (30-90 m) land surface, with red-brown sands and minor clays. Vegetation dominated by chenopod shrubs *Maireana pyramidata, Maireana sedifolia* and *Atriplex vesicaria* with scattered *Acacia aneura*, minor *Sida petrophila* and *Casurina cristata* (*ssp. pauper*).

SSer 1 — Slightly weathered bedrock, with minor ferruginous staining and fractures. Comprised of coarse angular lithic, and quartzose gravels with minor regolith carbonate accumulations on a slight relief (9-30 m) land surface, with red-brown sands and minor clays. Vegetation dominated by chenopod shrubs *Maireana pyramidata, Maireana sedifolia* and *Atriplex vesicaria* with scattered *Acacia aneura*, minor *Sida petrophila* and *Casurina cristata* (*ssp. pauper*).

SSer 2 — Slightly weathered bedrock, with minor ferruginous staining and fractures. Comprised of coarse angular lithic, and quartzose gravels with minor regolith carbonate accumulations on a slight relief (9-30 m) land surface, with red-brown sands and minor clays. Vegetation dominated by chenopod shrubs *Maireana pyramidata, Atriplex vesicaria* with scattered *Acacia aneura* and minor *Sida petrophila.*

SSer 3 — Slightly weathered bedrock, with minor ferruginous staining and fractures. Comprised of coarse angular lithic, and quartzose gravels with minor regolith carbonate accumulations on a slight relief (9-30 m) land surface, with red-brown sands and minor clays. Vegetation dominated by chenopod shrubs *Maireana pyramidata, Atriplex vesicaria* with minor *Sida petrophila.*

SSep 1 — Slightly weathered bedrock, with minor ferruginous staining and fractures. Comprised of coarse angular lithic, and quartzose gravels with minor regolith carbonate accumulations on a low relief (0-9 m) land surface, with red-brown sands and minor clays. Vegetation dominated by chenopod shrubs *Maireana pyramidata, Atriplex vesicaria* with minor *Sida petrophila.*



FIELD SITE LOCATIONS

LANDFORMS

a - Alluvial landforms
ap - alluvial plain
pd - depositional plain

ed - drainage depression
ar - alluvial channel
fa - alluvial fan

fs - sheetflood fan
ep - erosional plain (0<9 m)
er - erosional risel (9<30 m)

el - erosional low hill (30<90 m)
ps - sandplain
ul - logitudinal dunefield

m - man made

Figure 4.26: Pinnacles (Pine Creek) Regolith-landform 1:10 000 map and legend.