Fowlers Gap Regolith Mapping Report

I. Introduction

Fowlers Gap station is the main centre of the study area. The landscape consists of plains and medium to high hills and ridges. The characteristics of the surrounding landscape are highly reflective of the aridity of the region. The formation of the landscape has occured since the cretaceous period [Hill and Roach, 2003], with active landscape processes, such as erosion, resulting in numerous landform structures. Rivers, streams and drainage systems have been reworked and altered over time, resulting in a high range of regolith materials along the landscape of the study area [Hill and Roach, 2003]. The sparse coverage of the vegetation also reflects the aridity of the region. This report will attempt to interpret the evolution of the landscape around the study area.

Figure 1. Slightly weathered quartzite outcrop along the river channel.

II. Setting

The study area is part of the Fowlers Gap Research Station region at Broken Hill, south-eastern central Australia. The geology of the area consists of the Coco Range beds (Paleozioc: Carboniferous to late Devonian), Fowlers Gap formation (Precambrian), quartzite and Faraway Hills quartzite (Precambrian) [Roach, 2004]. The majority of these formations are quite weathered, which can be seen through a large range of regolith materials. One of the main features of the study area is the highly weathered quartzite ridge along the west end of the study paddock.

A. West End of the Mapping Site Paddock

The landform at this part of the study site is composed of plains, low rises and numerous depression channels along the low relief areas. The in situ outcrops are dominated by ferruginised and quartzite rock, as seen in Figure 1, although there was some evidence of in situ highly weathered dolomite out crop. The regolith materials along this part of the paddock is highly reflective of the in situ outcrops, such as the ferruginised and quartzite materials, with the exception of a high concentration of rounded quartzose gravels in a particular area of the paddock, as seen in Figure 2. The west end of the paddock has a high dominance of chenopod vegetation, including pearl blue-bush, bladder salt-bush and copper-burr, while the sparsely scattered medium trees, particularly casuarina, curly mallee and mulga, are the dominant trees along this arid wood land. A river channel with small drainage tributaries was also observed along this end of the paddock, and the vegetation along the riparian section of the river is mostly dominated by casuarina, curly mallee and eucalypts trees, as seen in Figure 2. Alluvial deposits, such as large boulders and highly weathered outcrops at the edge of the river channel, was observed during the mapping activities.

Figure 2. Eucalyptus and casuarina trees along riparian section.

Figure 3. Rounded quartzose gravels

Figure 4. Highly weathered dolomite in situ rocks and regolith materials associated with the curly mallee trees.

Figure 5. Weathered silcrete along the river channel.

B. Central Area of the Mapping Site

The landforms along the middle section of the study site are dominated by alluvial plains, colluvial depressions and river channels. These regolith materials highly reflect the landform including the dominance of the colluvial washed material. Highly weathered dolomite, shown in Figure 4, and green slate outcrops are amongst the main features along this area. The vegetation along the plains are dominated by curly mallee trees and salt bushes, while the large river gums occupy the riparian section of the river. Low rises were also observed along this section of the study site, with changing regolith materials such as silcrete. Paleodrainage was also observed along this landscape.

C. East End of the Mapping Site

The landform along the east side is dominated by alluvial plains and river channels. The regolith materials are now mainly of silcrete and quartzose. A highly weathered silcrete outcrop was observed along the main river channel, and the honey comb feature of this outcrop is possibly due to the fluctuation of the water level along the river channel resulting in the instability of some minerals, as seen in Figure 5. Salt bushes, such as pear blue bush, bladder salt-bush etc., still dominate this section of the study site. Large river gum trees dominate the main river system.

III. Regolith Units

A. Transported Regolith

1) Mapping of the Fowlers Gap paddock

Figure 6 details a map that was prepared for the area. The regolith-landform refered to in the following detailed analysis can be found on this map.

2) Alluvial Deposits

The alluvial deposits along the study site were characterised by quartz and silcrete material, especially along the eastern part of the area. The following are the main landform assemblages:

- **Aap** : Angular and sub-angular silcrete and quartzose gravels dominate this alluvial plain. The vegetation is dominated by pearl blue-bush and black blue bush. There was minimal presence of rose wood bush amongst the chenopod vegetation.
- **Aed** : Angular quartzose gravels and sub-rounded boulders dominate this alluvial depression area. Fragmented green slates were also amongst the deposited materials. The vegetation along the alluvial channel is dominated by small to medium size salt bush shrubs.
- **Aer** : Course sandy surface materials dominate this small alluvial rise area and it is dominated by chenopod vegetation.
- **Aaw** : Red sandy alluvial swamp surface materials are located across the landscape. Distinct alluvial activity can be seen by the clumping of vegetation as the result of periodic water flow during rain. The surface lag materials consist of fine to small gravel material typical of alluvial deposits.
- **Afa** : Small gravel material dominates this section of the study site, and the small angular and sub-angular deposited materials are typical of an alluvial process. Depression drainage and channelling are amongst the features of this landscape. The vegetation is dominated by salt bush, including pearl blue-bush and prickly wattle shrubs.

3) Colluvial Deposits

The majority of the regolith materials along the study area are colluvial sediments dominated by ferruginised and quartzose gravels. The following are the main landform assemblages:

- **CHep1** : This area has red brown fine silt and sandy soil, with low topographic land surface and accompanied by angular surface lag of lithic gravels (brown colours). The Chenopod shrubland is dominated by pear blue bush, bladder salt bush with minor casuarina and mulga. Copperburr shrubs are also present along the landscape. Erosional activity exists along the depression area with rabbit burrow features.

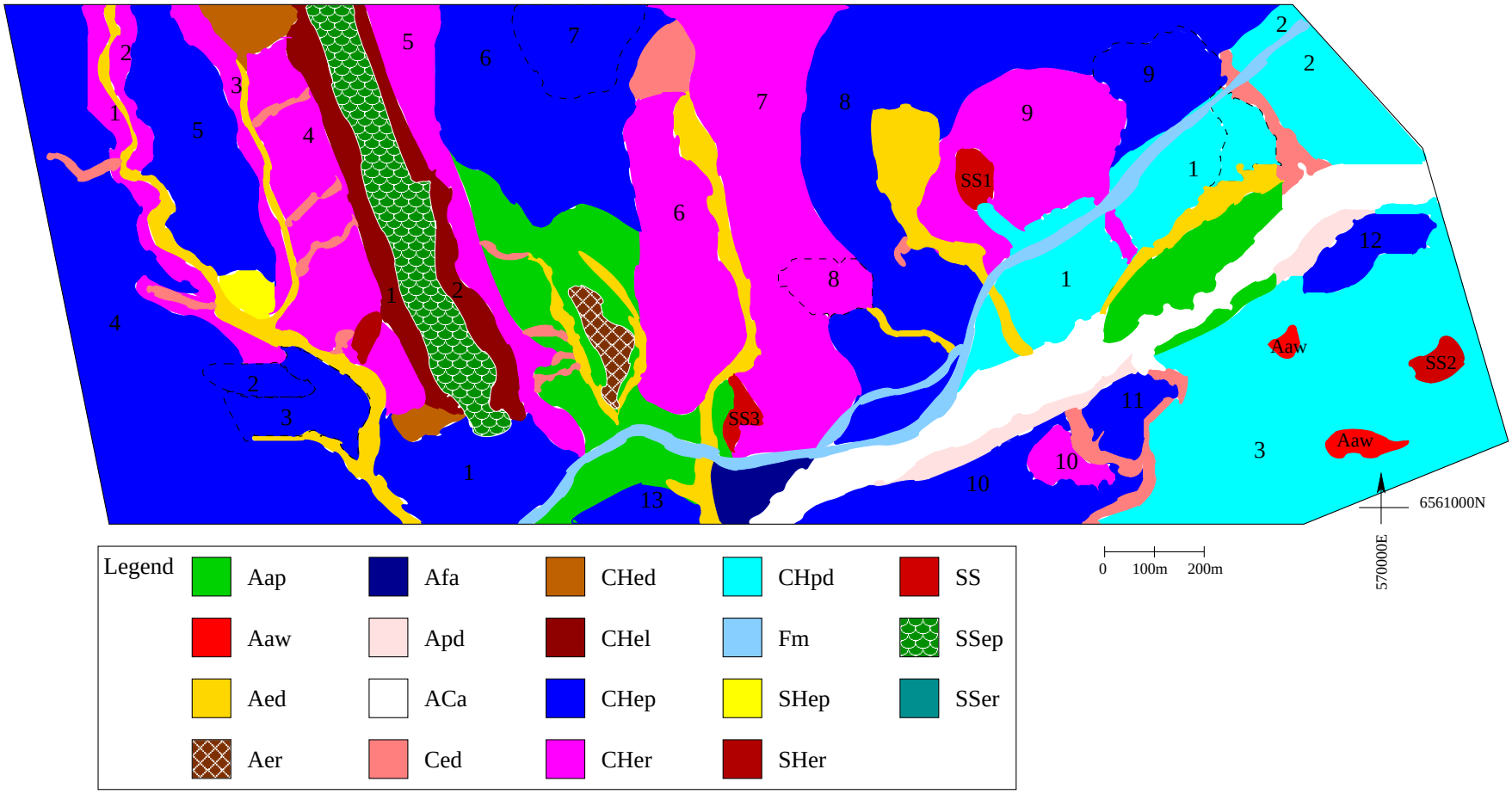

Figure 6. Regolith-Landform Unit map of the paddock under examination

- **CHep2** : The area has red brown fine sandy soil. Quartz rounded gravels dominate this part of the land surface with minor dolomitic slate components. Vegetation such as salt bush is very minimal.
- **CHep3** : A Ferruginised outcrop and surface lag gravels dominate the area. The outcrop is moderately weathered. The gravels are a mixture of angular and sub-angular gravel. Vegetation is dominated by salt bush.
- **CHep4** : This area has red brown fine sandy land surface soil with angular and sub-angular surface gravels. Chenopod shrubland is dominated by salt bushes with medium size casuarina trees.
- **CHep5** : This area has a red brown fine sandy silty soil surface with ferruginised lag materials. It is dominated by salt bush vegetation.
- **CHep6** : This area has yellowish soil with dolomitic characteristics. Curly Mallees dominate the land surface. Salt bushes are also present.
- **CHep7** : This area was identified as a palaeovalley due to the type and characteristics of the surface lag materials, namely rounded quartz, which indicates transported materials. Chenopod shrubland, such as salt bush, dominates the vegetation.
- **CHep8** : The land surface along this landscape is dominated by angular quartz and silcrete gravels, and apart from silcrete surface gravels, an in situ slightly weathered silcrete out crop was identified along this area. The vegetation is dominated by black bluebush, pearl bluebush, copperburr, and pop saltbush and medium size casuarina trees are also present along this area. Vegetation patterns in particular contour banding, was observed as one of the landscape features of the area.
- **CHep9** : This area consists of angular and sub-angular silcrete surface lag materials.
- **CHep10** : Apart from a silcrete outcrop, the main component of the surface lag materials are angular quartzites and silcrete gravels. The vegetation is dominated by chenopod vegetation.
- **CHep11** : Containing round quartzites indicating transported materials, this area was classified as paleovalley due to the characteristics of the regolith materials. Chenopod vegetation (salt bushes) dominates the area.
- **CHep12 and CHep13** : These areas have angular quartzite surface lag materials with chenopod vegetation.
- **CHel1& CHel2** : Covered with red brown fine sandy soil with angular quartzite gravels, depression drainages are amongst the surface structures of this low hill area of the landscape. The chenopod shrubland is dominated by pearl bluebush and a minimal number of casuarina trees.
- **Cher1 to Cher5** : These are colluvial erosional rises, with angular and sub-angular Ferruginised and quartzite surface lag materials. Salt bush vegetation dominates the area. Indication of a paleodrainage feature through a drainage depression at Cher2 was observed during the mapping exercise.
- **CHer6** : This area contains sub-angular silcrete and quartz surface lag materials.
- **CHer7** : Mixed surface lag materials with rounded quartzites and some minor pegmatite are found at the southern end of the area, and silcrete surface lag materials were progressively found towards the northern end of the area.
- **CHer8** : Mixed surface lag materials of angular, sub-angular and rounded quartzite and silcrete and distinctive slaty graded beddings were observed along the area. The vegetation is dominated by copperburr and curly mallee trees.
- **CHer9** : The surface lag materials along this area are poorly sorted and consist of rounded quartz, quartzite, ferugenized gravel, maghemite and saprolite. The vegetation is dominated by chenopods, including pearl blue bush.
- **CHer10** : A moderately weathered silcrete outcrop dominates this erosional rise. Pearl bluebush dominate the land surface area.
- **CHpd1** : Poorly sorted angular quartzite materials cover this location. The vegetation is dominated by chenopods.
- **CHpd2** : Angular and sub-angular quartzite and silcrete lag materials with chenopod vegetation cover this location.
- **CHpd3** : This area is covered with red brown fine sands with minor components of quartz pebbles. There is a slightly weathered silcrete outcrop along the southeast corner of the area. Chenopod vegetation dominates the area.

B. In Situ Regolith

The highly weathered dolomite bedrock is characterised by the slightly coloured yellowish regolith materials, while the slightly weathered ferruginised bed rock is characterised by its reddish brown iron stained regolith materials. Angular gavels occupy the surrounding ferruginised outcrop in abundance. The following are some of the components that make up the regolith-landform assemblage units:

- **SSep :** This area has a red brown fine and sandy soil surface. Angular lithic quartzite gravels are scattered on the top plain surfaces of this quartzite ridge.
- **SHep** : Highly weathered dolomite bedrock reflects a change of soil surface colour (from red brown to creamy yellow) at this location. The vegetation is dominated by curly mallee with some Casuarina. Salt bushes are still the dominant shrub. The curly mallee is strongly associated with the dolomitic materials along this land surface.
- **SS1-to-SS3** : These are slightly weathered silcrete outcrops.

IV. Discussion

The morphology of the landscape along with its regolith components hold some significant geological events along the study area. The outcome of the mapping exercise can aid the reconstruction of the area's paleoenvironmental condition in relation to the current landscape morphology and its formation processes.

A. Landscape Formation Processes

1) Weathering and Erosional Processes

One of the main features on this study site is the very resistive quartzite ridge at the western end of the area. Erosional, chemical and physical weathering processes seem to be the main driver of the landscape formation in this area. The dominance of the colluvial materials that are deposited along the low hills, rises and plains are related to the active physical weathering of the most resistive rock beds, such as the quartzite ridge and the ferruginised outcrops along the area, and in particular at the west section of the study area. The erosional processes also play a main role in the landscape formation along the study area, although the most obvious active erosional processes can be seen through the depression and along river channel areas. The change in vegetation type (to curly mallee) and regolith surface colour in some of the landscape areas were reflective of the highly weathered rock bed, such as the dolomite.

2) Paleovalley

Paleovalley regolith materials were identified during the mapping exercise, and these materials consist of rounded quartz and silcrete pebbles. Previous studies that were conducted along this area claim that the silcrete is older than the quartzite materials (S. Hill, pers. comm., 2004). It was recognised that the silcrete materials were deposited first, and tectonic activities have resulted some uplifting and formation of some paleodrainage. Water flow along the paleodrainage has resulted in the deposition of the quartz materials. Active erosion over time has resulted in the morphology of the current landscape, in particular the drainage channels. These active erosion processes have also led to the exposure of the old regolith materials.

3) Alluvial Processes

Alluvial processes seem to be the dominant processes for the current landscape structure along the eastern section of the study site. The outcrops along this area are mainly of silcrete with some quartzose materials. The surface lag materials consist of fine to small sediments. Periodic rain events can be seen through the vegetation pattern, namely the clumping and contour banding. Active erosion were also identified in some of the alluvial plains through their large gullies.

V. Conclusion

The majority of this landscape is alluvial or erosional and is dominated by chenopod shrubland. Current landscape features were formed as result of tectonic activity, erosion and weathering processes over time. A strong correlation between curly mallee and dolomite was observed, with the curly mallee not being observed at any other locations at this study site.

References

[Hill and Roach, 2003] Hill, S.M. and Roach, I.C. 2003. The Regolith-Landforms of Sandstone Paddock, Fowlers Gap, Western NSW. Advance in Regolith, pp. 193-200. CRC LEME.

[Brooke and McGarva, 1998] Brooke, G. and McGarva, L. 1998. The Glove Box Guide to plants of the NSW Rangelands. NSW Agriculture.

[Roach, 2004] Roach, I. 2004. Fowlers Gap Map Lecture Handout, Stratigraphic Formation. CRC LEME/MTEC, ANU.