STABILITY OF CLAY MICROAGGREGATES IN AEOLIAN SEDIMENTS

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Parna, an aeolian sediment consisting largely of silt-and sand-size clay microaggregates as well as silt-size quartz grains, forms significant components of the regolith in Australia. These sediments can occur in the contemporary landscape as either (i) discrete deposits e.g. dunes, or (ii) widespread sheets of material of varying thickness. The properties of these sediments, in particular the stability of their clay microaggregates, can have significant effects on a range of landscape processes and hence have major implications for management. For example, if the clay microaggregates present in these sediments are highly unstable and disperse into < 2 µm particles, the soil profiles containing these materials will be highly prone to land degradation such as soil erosion (gullying, piping and rilling), poor air quality and surface sealing, crusting and hardsetting problems (Greene *et al.* 2001).

In this paper we discuss how a number of techniques are used to investigate the nature and the stability of the clay microaggregates in three soil profiles of parna sediments. One profile was from a dune (near Lake Corop in N. Victoria), and the other two profiles were sheet deposits (at Tiltagoona (Greene & Nettleton 1995) and El Capitan (Gonzalez 2001), near Cobar in N. NSW). The techniques include: (i) micromorphological (plain polarised light) and scanning electron microscope (SEM) studies (ii) XRD analysis, (iii) the effects of different dispersion treatments (such as water alone, and water followed by ultrasonics), on the particle size distribution, as measured using a Coulter Counter, (iv) measurement of the ratio of the 15 bar water content to clay content, and (v) the role of the exchangeable cation/soluble cation balance of clay particles on their physico-chemical dispersion (Rengasamy *et al.* 1984).

Results indicate that clay microaggregates occurring in parna sediments are very stable, i.e. resist breakdown in water (Mason *et al.* 2002) (Figure 1). These microaggregates, that originated from deserts and formed slowly under hot dry environments, have clay particles that are strongly bound in a face-to-face orientation. SEM shows well rounded clay microaggregates up to fine-sand in size (Greene *et al.* 2002) (Figure 2). This is in marked contrast to those microaggregates occurring in loess deposits in mid-western USA. It is probable that the glacial, or cold, environments of the loess source areas were not conducive to the formation of stable microaggregates and the clay particles only exist in an unstable face to edge orientation and readily disperse in water (Mays *et al.* 2003) (Figure 3).

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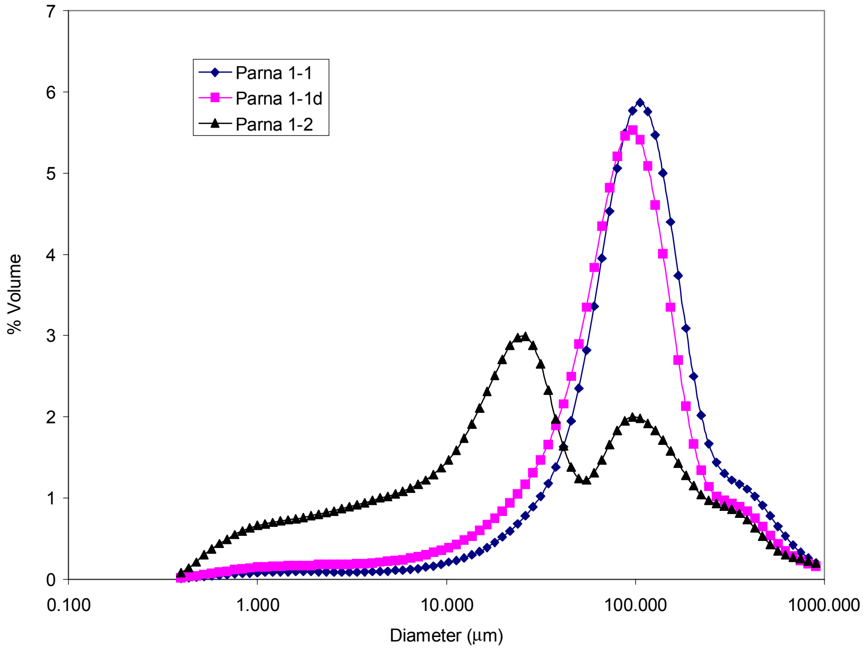

Figure 1: Particle size distribution (Coulter Counter) of parna sample from swale at Tiltagoona; 1-1 (Water for 5 minutes), 1-1d (Water for one hour), 1-2 (Water + Ultrasonics).

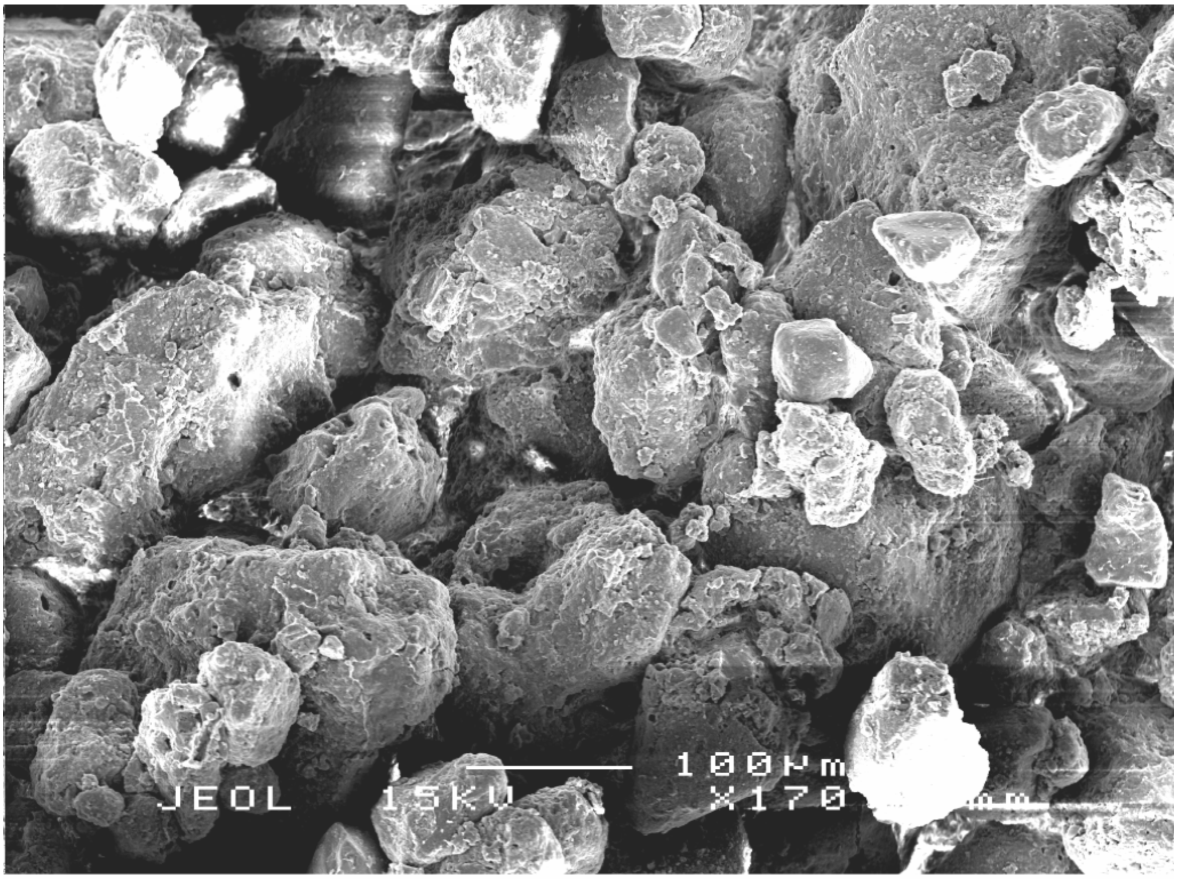

Figure 2: Scanning Electron Micrograph of well rounded, parna clay microaggregates from dune at Lake Corop. Scale bar 0.1 mm.

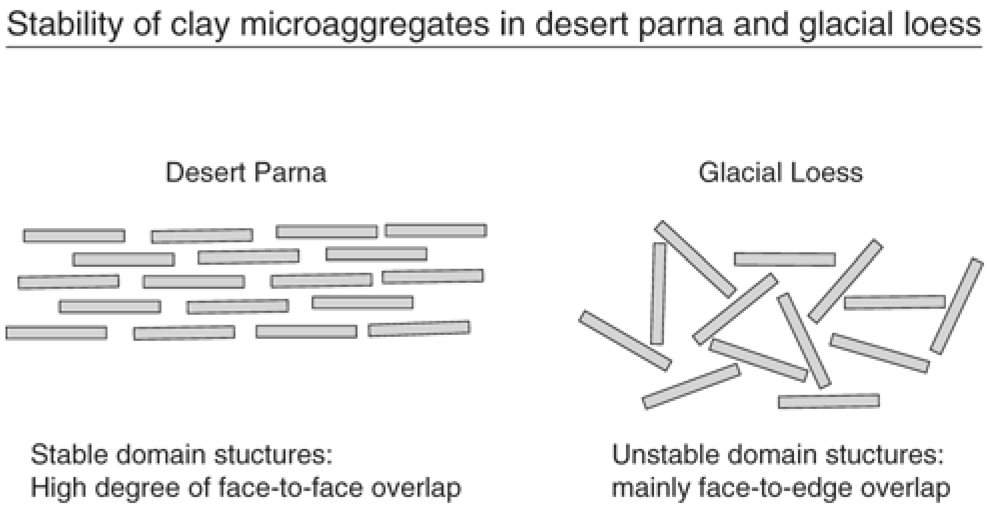

Figure 3: Stability of clay microaggregates in desert parna and glacial loess (adapted from Mays *et al.* 2003).