THE EFFECT OF MINERALOGY AND EXCHANGEABLE MAGNESIUM ON THE DISPERSIVE BEHAVIOUR OF WEAKLY SODIC SOILS.

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ABSTRACT

The influence of soil stability of interactions between exchangeable magnesium, calcium and sodium, where all three cations are present, has rarely been investigated. Therefore, the effect of mineralogy and exchangeable magnesium on the dispersive behaviour of weakly sodic Australian soils was investigated. Soils were subjected to spontaneous and mechanical dispersion, and the percentage of dispersed clay was measured.

The extent of clay dispersion from soils bearing group II exchangeable (Mg, Ca, Sr, Ba) cations was also measured. The six soils studied generally dispersed more clay when saturated with exchangeable magnesium. The amount of clay dispersed from each soil with calcium, strontium or barium as the dominant exchangeable cation was similar. This shows that Group II cations do not produce effects on the dispersion of soil which are reflected in the chemical trends within the series.

In mixed magnesium calcium systems the dispersive effects of exchangeable magnesium generally occurred when magnesium dominated the exchange phase. Soils which were more susceptible to the effects of sodium also exhibited significant increases in the amount of clay dispersed, as exchangeable magnesium increased. This result indicated that these soils may be more susceptible to the presence of exchangeable magnesium and require amelioration even when only weakly sodic.

It was evident that soils containing significant amounts of smectitic Randomly Interstratified Minerals (RIM) were particularly susceptible to the effects of
exchangeable magnesium. There were also some similarities in the response of soils with similar dominant clay minerals. The clay mineralogy clearly played a very important role in soil behaviour. However, classification by dominant minerals only, could not be used to explain the results observed. More detailed mineralogical information, as well as surface charge density and pore size distribution all contributed to the response of a soil to various conditions. Thus the nature of the dominant mineral alone is not indicative of potential soil dispersivity, and further details about silt/clay properties are required before possible predictions can be made.

A method for inducing sodicity in soils without disturbing the aggregate structure was developed. The undisturbed aggregates prepared using this method were subjected to the same mechanical dispersion regime as the samples studied for the effects of magnesium and mineralogy. Comparisons of the amount of dispersed clay were made. Unexpectedly, the undisturbed samples generally dispersed to give more clay. This implies that clay dispersion may be underestimated in soils where the structure is disturbed during preparation. Further work on the method is required.