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Mineralogical Characteristics and Some Physical Indices of Non-smectitic Vertisols from Iran

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Abstract:

Clay mineralogy and some physical indices including COLE, LL, PL and the ratio of fine clay/total clay have been investigated on four pedons of Vertisols from southern Iran. According to Soil Survey Staff, (1997) the shrink–swell classes are defined as: low (LEP 3%, COLE, 0.03); moderate (LEP 3–6%, COLE 0.03–0.06); high (6–9 %,COLE 0.06–0.09); and very high (LEP 9%, COLE 0.09). The studied soils show sufficient shrink- swell properties (COLE$>$0.07) and all morphological and physicochemical requirements of Vertisols, including; clay content, slickensides and/or wedge shape structure and cracks that open and close periodically in upper 100 cm of soil surface, and has been classified as Vertisols. However, mineralogical studies showed that they are not dominated by smectitic clays as is general believe regarding the mineralogical composition of these soils. Taking into account the clay content, the low clay CEC (25.46- 44.56 $cmol_c$/kg) and the results of XRD, TEM and SEM analysis, the probability of the presence of high amounts of vermiculite and smectite clays is very low, and the dominant clay minerals revealed to be chlorite (swelling and well crystallized), palygorskite, illite and minor amounts of smectite and kaolinite.

The measured Atterberg limits (LL (30-49 %) and PL (22-31 %)) as compared with the standard values for different clay types also showed that montmorillonite is not the dominant mineral in these soils.

Our study showed that the interparticle pores that are controlled by the size and arrangement of the primary particles, regardless of their nature, contributes to the shrink-swell potential in these soils. High clay content, mainly fine clay, and consequently plenty of interparticle spaces, together with many cycles of strong desiccation and

re-wetting are considered to be responsible for the genesis of these typical Vertisols.

Keywords:

Non Smectitic Vertisols, Clay Mineralogy, COLE, Atterberg Limits, XRD, TEM, SEM.