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Palygorskite in a Paleosol from Zagros mountain belt, NE Iraq

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In the semi-arid region south of Sulaimani city, paleosols can be found. The genesis of these paleosols needs to be elucidated. Here, we investigated a section of an Oligocene paleosol from that region. The section is about 7m thick with lower, middle and upper horizons, which consisted of partially weathered dolomitic limestone; conglomerate or lithified pebbly paleosol; and sandy-silty claystone or lithified clayey paleosol, respectively. These horizons were studied mineralogically and stratigraphically using X-ray diffraction, scanning electron microscopy, Simultaneous Thermal Analysis (STA) and granulometric analysis. Palygorskite content was higher in the conglomerate (lithified gravelly paleosol) and in the partially weathered dolomitic limestone than in clayey paleosol.

Palygorskite is a trace mineral that allows to estimate climatic conditions during soil genesis. In hand specimen, palygorskite occurs as green patches of crystalline coating that covers pores and cavities on limestone and dolostone. Under scanning electron microscope, it appears as linear and fibrous loose bundles that occupy the interstice between the dolomite crystals and is mainly associated with dolostone and limestone facies.

We thus conclude that the climate was arid, and that the terrestrial land cover in this part of the Oligocene Basin in Northern Iraq was limestone and dolostone.

On this land, soil genesis and intermittent stream and sheet erosion was occurring during the entire Oligocene and it is well known, stratigraphically, as Oligocene Unconformity.

The possible origin of the palygorskite was the development during Oligocene by upward accumulation under hydrothermal condition in partially high weathered dolomitic limestone of Pila Spi formation during burial. Palygorskite occurs in marine, lacustrine and soil environments. Limited occurrences are associated with hydrothermal activity, in both marine and continental environments. Palygorskite-containing soils are limited almost exclusively to arid and semiarid

areas of the world and are rather unstable in humid conditions.

The present paleosol was developed on Oligocene terrestrial land that bordered the sea covering Middle and Southern Iraq. Due to non-deposition weathering and mass wasting, calcareous gravelly soil (limestone conglomerate) was generated. Sandy and clay soil were developed on the terrestrial land which stratigraphically formed an unconformity. This land was covered by water of a closed lagoon. Limestones are deposited as Lower Fars Formation.

These occurrences are associated with aquatic conditions characterized by alkaline solutions with high activities of Si and Mg. The most common setting for lacustrine palygorskite genesis are playa deposits, ancient lacustrine terraces, or closed-basin deposits of other types. While traces of palygorskite can be identified in a wide variety of soils, significant amounts of the pedogenically formed mineral are commonly associated with one specific situation of soil genesis like soils have been affected by fluctuating ground water, soil morphology that includes distinct and sharp textural transitions. This groups includes many paleosols. Most of these Paleosols are non-saline or only slightly saline.