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Loess derived soils evolution in Tajikistan, implications for paleoclimate reconstruction

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Loess deposits are the major parent materials in Tajikistan and modern soil development studies and understanding the formation processes especially in different climate regions could provide an insight to the paleosols which are important archives of environmental changes of late Pleistocene in central Asia. Ten soil profiles were investigated in a climate gradient with the mean annual precipitation and temperature range of 200-900 mm and 10-20 °C, respectively. The studied soils formed in the order of increasing precipitation were classified as Entisols, Aridisols, Inceptisols, Mollisols and Alfisols based on American Soil Taxonomy and Regosols, Cambisols, Calcisols, Kastanozems and Luvisols based on the World Reference Base for Soil Classification (WRB). The dominant soil forming processes in the more arid regions were calcium carbonate accumulation and redistribution, gypsum dissolution. In the steppe regions organic matter accumulation on the surface horizons were dominant process. With increasing water availability in more humid regions, carbonate dissolution and precipitation in the deeper horizons and subsequent clay dispersion and illuviation were dominant. Thin sections were prepared from each horizon and studied using polarizing microscope. The parent material loess has a massive microstructure with very little marks of biologic activity. The microstructure in the soils varied from massive and weakly separated subangular blocky in the arid regions to moderately to well separated blocky in the steppe and more humid regions. The b-fabric is calcitic crystallitic in the regions with lower precipitation and changes to speckled in the soils with higher moisture availability. This provides conditions for the formation of depletion pedofeatures of calcite and clay coatings in the moister areas. The features related to the biologic activity such as excrements, needle shaped calcite and cytomorphic calcite are also dominant in the soils with higher organic carbon in the steppe regions. Pedogenic features in the studied modern soils well correlate with the present climate and could be applied for the interpretations of the existing paleosols in the region. This

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