

Palygorskite Bearing Calcic-Soils from Western Thar Desert: Implications for Late Quaternary Monsoonal Fluctuations

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Abstract : Main objective the present study is to investigate microscopic, sub-microscopic, clay mineralogical and geochemical characteristics of three calcic soil profiles from the western Thar Desert for the last 30 ka paleoclimatic information. Thin-sections of the soils show weakly to moderately developed pedofeatures dominated by powdery to well-indurated pedogenic calcium carbonate. Sub-microscopy of the representative calcretes show extensive growth of fibrous palygorskite in pore spaces of micritic and sparitic nodules. XRD of the total clay ($< 2 \mu\text{m}$) and fine clay ($< 0.2 \mu\text{m}$) fractions of the soils show dominance of smectite, palygorskite, chlorite, mica, kaolinite and small amounts of quartz and feldspar. Formation of the palygorskite is attributed to pedogenic processes associated with Bw, Bss and Bwk horizons during drier conditions over the last 30 ka. Formation of palygorskite was mainly favoured by strongly evaporating percolating water and precipitation of secondary calcite, high pH (9-10), high Mg, Si and low Al activities during pedogenesis. Age estimate and distribution of calcretes, palygorskite, and illuvial features indicate fluctuating monsoonal strength during MIS3-MIS1 stages. The pedogenic features in calcic soils of western Thar suggest relatively arid conditions during MIS3-MIS2 transition and LGM time that changed to relatively wetter conditions during post LGM time and again returned to dry conditions at ~ 4 ka in MIS1.

Keywords : palygorskite, clay minerals, Thar, aridisol, late quaternary

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