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Pedogenesis of spatially associated red and black soils in Purna valley from semi-arid region of Central India

P. Raja^{a,*}, B.P. Bhaskar^a, U. Surendran^b, K. Rajan^c, Santosh Kumar Sarkar^d, D.B. Malpe^e,
M.S.S. Nagaraju^a^a National Bureau of Soil Survey and Land Use Planning, Amravati Road, Nagpur, Maharashtra, 440033, India^b Centre for Water Resource Development and Management (CWRDM), Calicut, Kerala, India^c Indian Institute of Soil and Water Conservation, Research Centre, Udhamandalam, Tamil Nadu 643 004, India^d Department of Marine Science, University of Calcutta, 35, Ballygunge Circular Road, Calcutta 700019, West Bengal, India^e Department of Geology, RTM Nagpur University, Law College Square, Nagpur, Maharashtra 44 00 01, India

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ABSTRACT

Eight representatives spatially associated red and black soils in Purna valley from the semi-arid region of Central India were studied through mineralogical, micromorphological and geochemical investigations to infer pedogenic transformations during changing climatic phase. The morphology of soils showed that dissected alluvial plains over the basaltic landforms consists predominantly of dark reddish brown to dark yellowish brown soils with iron/calcium carbonate nodules (Typic Haplustepts), and lithological discontinuities (Typic Ustifluvents) whereas, pediplains and alluvial plains have clayey, dark brown, sodic, slickensided (Bss) horizons enriched with CaCO_3 nodules (Typic Haplusterts). Buried Natrustalf on alluvial fans and floodplains has strong brown, natric (Btn) horizons with distinct ferriargillans and abundant CaCO_3 nodules. Ferriargillans in Alfisols indicates prevalence of humid climatic phase in the past during which alteration of plagioclase feldspars to smectites could have occurred, thereafter termination of humid phase and an onset of semi-arid climatic phase had favored drier non-leaching environment which has resulted in the preservation of smectites in Vertisols. The randomness in soils are expressed as entropy index which showed that physical mixing in subgroups of Vertisols and sodium enriched argillic horizons in Alfisols were the indicators of altered pedogenesis at steady state. The formation of CaCO_3 (pedogenic carbonates) and the concomitant development of sodicity during arid climatic phase were indicators of strong alkalinity and base accumulation in soils as a mark of aridity in red and black soils of the valley. The chemical index of alteration, weathering index, and entropy index were served as good indicators for assessing intensity of chemical weathering rate with respect to hydrology and topography. The study demonstrates that how the morphological, physical, chemical, mineralogical and micromorphological data were useful in assessing pedogenetic processes in spatially associated red and black soils of Purna valley.