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## **Clay Mineralogical Diversity in Soil Systems: Insights from XRD Analyses Across Diverse Soil Orders**

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**Abstract:** *The objective of this investigation was characterization of clay minerals from soils of Vertisols, Alfisols, Inceptisols, and Entisols orders in India. X-ray diffractograms showed diverse mineralogical compositions in these soil orders. Vertisols were dominated by smectite, illite and kaolinite clay minerals. Alfisols presents a contrasting mineralogical array, with the dominant presence of kaolinite, vermiculite, and illite type clay mineral and these findings accentuate the distinct mineralogical identity characterizing the Alfisols, where smectite, illite, and kaolinite were prevalent. Mineralogical signatures unravel the prevalence composition within Inceptisols. Conversely, the Entisols manifests a distinctive mineralogy by the coexistence of chlorite, hydroxy interlayer chlorite, illite, and kaolinite clay minerals. The comprehensive insights into the distinct clay mineral compositions of diverse Indian soil orders, enhancing our understanding of their unique mineralogical characteristics.*

**Keywords:** igneous rock sourced clay minerals; mineral provenance; minerals in alluvial soils; parent materials on mineral occurrence; sedimentary rock sourced minerals; Soil Taxonomy and mineral occurrence.