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## **Micromorphology and Clay Mineralogy of Lower Siwalik Paleosols: Implications for Landscape Stability and Climatic Fluctuations of 2.5 ka to 10 ka Intervals at 12 Ma in the Himalayan Foreland Basin**

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**Abstract:** *The paleosols preserved in fluvial sequences represent an important proxy to understand paleoenvironment, paleoweathering, and paleopedogenic processes of the Earth's geological history. Present study provides macro-, microscopic, and clay mineralogical details of the 9 paleosols from a 15 m section of the lowermost Siwalik Succession of the Himalaya that formed at about 12 Ma. The key paleopedofeatures such as pedality, mineral weathering, b-fabric, clay pedofeatures, rhizocretions, bioturbation, and pedogenic  $\text{CaCO}_3$  are well preserved in Bw, Bt, Bk, and Bss horizons in the 9 paleosols, that suggest moderate to strong degree of paleopedogenic development over an interval of 50 ka-60 ka with a dominance of moderately to well-developed paleopedofeatures.*

*Clay mineralogy of the total clay ( $<2 \mu\text{m}$ ) and fine clay fraction ( $< 0.2 \mu\text{m}$ ) of the 9 paleosols suggests weathering of silicate minerals and change of paleoclimatic conditions over a period of 50 ka to 60 ka during paleopedogenic activity in the lowermost part of the Siwalik sedimentation. Large amounts of smectite together with pedogenic carbonates in lower and upper parts of the 15 m section suggest arid to semiarid dry conditions. Whereas, the middle part of this section with dominance of kaolin, illuvial features, and dissolution of pedogenic carbonates suggests sub-humid to humid conditions. The degree of paleopedogenic development in these paleosols is similar to the modern soils of the Ganga Basin that formed during 2.5 ka to 10 ka. Dominance of moderate to strong paleopedogenic development in 9 paleosols in this 15 m section represents 50 ka–60 ka interval of sedimentation and subaerial weathering during initial phase of Siwalik sedimentation. This 15 m section of the paleosols provides the evidences of 2.5 ka to 10 ka periods of landscape stability and climatic changes of semiarid -sub-humid-semiarid phases during initial sedimentation in the Siwalik Group of the Kanga sub-basin.*

**Keywords:** Micromorphology; Clay Minerals; Paleoclimate; Paleosols; Siwalik