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**Isotopic evidence for ecological and climate change in the richly fossiliferous Plio-Pleistocene Upper Siwalik deposits exposed around Chandigarh, India**

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**Abstract**

The Plio-Pleistocene Siwalik deposits around Chandigarh, well known for their great wealth of mammalian fossils, preserve a continuous record of calcareous paleosols ranging in age from ~2.7 to ~0.6 Ma. The carbon isotope composition ( $\delta^{13}\text{C}$  relative to Vienna Pee Dee belemnite [VPDB]) of 140 pedogenic carbonates from Ghaggar and Nadah sections and 13 gastropod samples from Nadah section record a landscape primarily occupied by C4 grasses during this interval. However, a mixed C3-C4 vegetation between 2.15 and 1.7 Ma and a progressive increase in the percentage of C3 plants from ~1.1 to ~.6 Ma has been recorded. Most of the pedogenic carbonate  $\delta^{18}\text{O}$  values (VPDB) in the Ghaggar River Section range between -5.29 to -8.93 ‰ indicating the dominance of monsoon climate. These  $\delta^{18}\text{O}$  values exhibit somewhat consistent trend in relation to  $\delta^{13}\text{C}$  values suggesting influence of climate on the vegetation. At two instances ~1.07 and ~.66 Ma, there is significant depletion in carbonate  $\delta^{18}\text{O}$  and  $\delta^{13}\text{C}$  values, suggesting monsoon intensification and a synchronous development of C3 vegetation. Pedogenic carbonate and gastropod  $\delta^{18}\text{O}$  values (VPDB) in the Nadah paleoswamp, also exhibit consistent trends in relation to  $\delta^{13}\text{C}$  values, indicating steady relationship between short-term climatic fluctuations in terms of warm-humid and

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