Paleoclimate and Paleoecology of the Neogene Siwalik Group, Muksar Khola Area, Nepalese Himalaya

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ABSTRACT

The Miocene to lower Pliocene Siwalik Group lie at the base of the Himalayan orogenic belt and are composed of continental sedimentary fill of one of the world's largest foreland basins, being derived from uplift and subsequent erosion of the Himalayan fold and thrust belt. This study focuses on the Muksar Khola area of southeastern Nepal where a perennial river has cut down through the rocks exposing outcrops of the entire Siwalik group in this locality.

The global expansion of C_4 grasses replacing C_3 trees during the late Miocene has been well documented and is generally attributed to a global drop in atmospheric pCO_2. However, recent studies have argued for differing catalysts for this vegetation change including an increase in monsoonal activity, aridity, and seasonality. To further investigate the vegetation shift, this study will use compound-specific isotope analysis of $\delta^{13}C$ and δD of leaf lipids and microbially derived soil tetraethers (GDGTs), using cutting-edge techniques of isolating leaf lipids, which are largely resistant to diagenesis. Individual compounds of a carbon chain can be analyzed and interpreted using spatiotemporal changes of isotopic values in the Siwalik. For instance, increases in δD values indicate a decrease in precipitation, while increases in $\delta^{13}C$ indicate an expansion of C4 grasses. Additionally, analysis of the GDGT data offers a valuable proxy for paleotemperature. This study seeks to perform a chronostratigraphic correlation of $\delta^{13}C$, δD, and GDGT temperature data to investigate whether there is a link between the vegetation change and changes in paleoprecipitation and paleotemperature.

Analysis of the reconstructed climate data reveals a step-wise change from C_3 forests to C_4 grasslands starting at 6.7 Ma, with C_3 grasses dominating by 5.4 Ma. Additionally, this coincides with an increase in temperature from δD values and a reversal of negative correlation of temperature and precipitation.

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