

Exploring the use of Biomarkers to understand the paradox of the depository settings in Eastern Siwaliks of Himalayan foreland Basin

The Siwalik group of rocks archive an essential part of Himalayan foreland basin evolution. However, depositional setting of the Eastern Siwalik Miocene-Pliocene sediments have long been debated, with works based on ichnofossils, leaf macrofossils, pollens, and sedimentary architectures providing contradicting evidences of an exclusively terrestrial or marine dominated environment. To abate the existing confusion and provide an alternate perspective, molecular level characterization of an Eastern Siwalik sedimentary sequence have been attempted to re-evaluate the organic matter (OM) origin and paleo-depositional conditions. The *n*-alkane profiles show a bimodal distribution, with relatively higher abundance of long-chain *n*-alkanes, Pristane/*n*-C₁₇ and Phytane/*n*-C₁₈ cross-plot, and relative abundance of C₂₇–C₂₈–C₂₉ steranes suggesting major OM contributions from terrigenous source. Temporal increase in the oleanane index also demarcates an increase in contribution from higher-plants with age. Redox-sensitive parameters like Pristane/Phytane and C₃₀-norhopane/C₃₀-hopane ratios indicate fluctuations between highly oxic to suboxic conditions typical for terrestrial dominated environment. Interestingly, increased abundance of gammacerane, high regular sterane/17a-hopane ratios, and high d¹³C values of bulk OM during the suboxic phases suggests water-column stratification and deposition in hyper-saline/brackish water or marine conditions. Our data therefore indicates a mixture of terrestrial, lacustrine and open bay/eustarine type, suggesting a fluctuating near-shore depositional condition during Siwalik deposition. An increase in maturation of OM in the profile is also observed, with increasing Ts/Tm ratio with depth and higher abundance of diasteranes compared to regular steranes reflecting effects of OM diagenesis due to burial.