

Multi-proxy evidence of role of tectonics on C₃- C₄ plants abundance from the Mio-Pliocene Siwalik deposits of Central Himalaya

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Upliftment and denudation of the Himalayas continuously supplied sediments into its foreland basin. Over a period of time, the sediment accumulation resulted in the development of large alluvial megafans deposits known as Siwalik group of rocks. This Neogene foreland deposits recorded the effect of Himalayan orogeny in controlling the past climate, CO₂ concentration in the atmosphere and flora and fauna of the Indian subcontinents. One of the important floral changes documented from the Siwalik sediments is the appearance C₄ plants. Although timing, as well as the causes of the appearance and expansion of C₄ vegetation, is well debated. The reconstruction of C₄ plants abundance was believed to be done from paleosols developed on the floodplain of low lying river. However, the southward propagation of fault system into the Himalayan foreland basin resulted in exhumation while sedimentation was still going on. The topographic difference as a response of foreland exhumation would impart a change in climatic and environmental condition for the vegetation to thrive. Throughout the foreland basin, the exhumation rate was also not uniform which would have resulted in lateral variation in elevation and climate which in turn would have controlled vegetation. In order to track the vegetation distribution as a result of surface exhumation, reconstruction of paleovegetation and climate was done from the Siwaliks of Central Himalayas. The carbon isotopic composition of bulk OM along with long chain n-alkane and n-alkanoic acid showed enrichment in $\delta^{13}\text{C}$ values around ca. 7.5 Ma implying C₄ plants expansion. However, from ca. 4 to <1 Ma, the $\delta^{13}\text{C}$ values showed depletion indicating an increase in the abundance of C₃ plants. Previously, it was interpreted that variation in C₃-C₄ plant abundance was controlled by seasonality in Indian summer monsoon. In contrast, the rainfall intensity measured from hydrogen isotopic composition of molecular proxies (δD) does not show any direct control in the distribution of vegetation type. The higher rate of exhumation during post 4 Ma as evident from the Sr and Nd isotopic records probably controlled the abundance of C₃-C₄ plants. The topographic elevation gave rise to a cool and arid climatic condition which favoured C₃ vegetation growth. The distal part of the Bengal fan sediments also showed the signature of the increased C₃ vegetation during this time.

Keywords: C₃-C₄ variation, Siwalik exhumation, Stable Isotope (C and H), n-alkane, n-alkanoic acids, Bulk OM

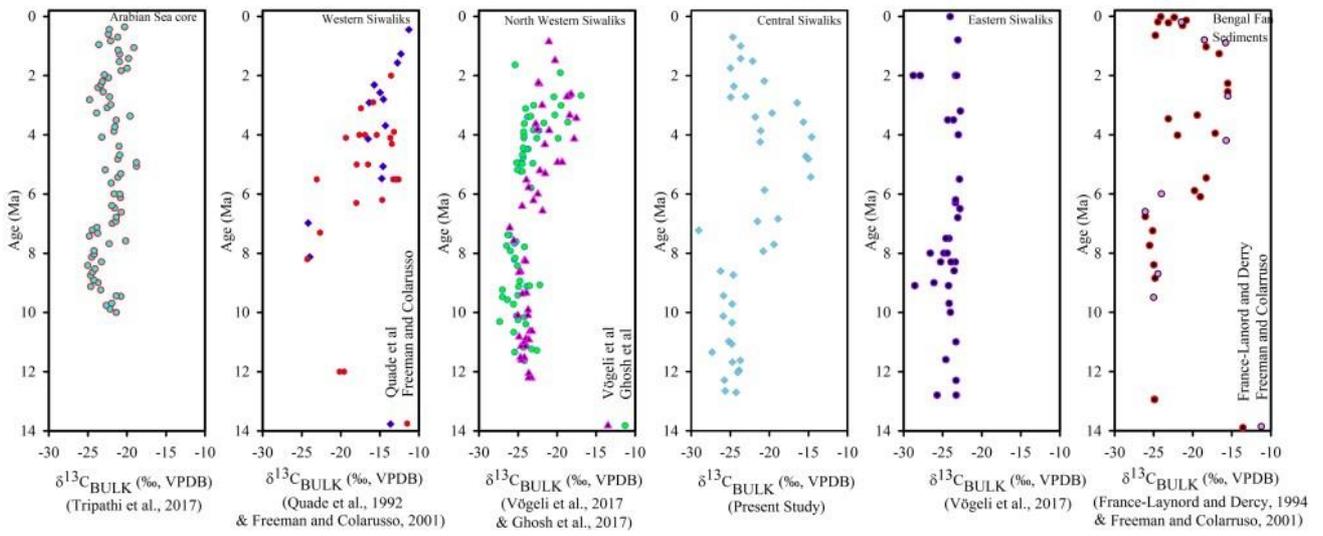


Fig. The variation in the $\delta^{13}\text{C}$ value in west-east lateral extent of the Siwaliks and time equivalent records from Arabian sea and Bay of Bengal sediments.