

**Role of climate and fluvial
architecture on temporal and
spatial variation in C₄
abundance: A compound specific
isotopic evidences from the late
Miocene Siwalik deposit of NW
India**

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The appearance of C₄ plant during the late Miocene time was considered as major ecological change which attracted attention of workers for the past few decades. The existence of C₄ plant was first documented from different Siwalik sections of Indian sub-continent using $\delta^{13}\text{C}$ values of soil carbonate, soil organic matter and fossil tooth enamel. Initially the appearance and expansion of C₄ plant during the late Miocene time was linked to low atmospheric pCO₂ and strengthening of Asian Monsoon intensity. However, the appearance and expansion of C₄ plant was asynchronous globally as well as regionally which suggest regional factors controlling the C₄ plant abundance.

In this study, NW Indian Siwalik paleosol derived long chain *n*-alkane $\delta^{13}\text{C}$ and δD values along with fluvial architectural analysis has been used to understand the triggering factors for appearance and expansion of C₄ plant during the late Miocene time. Considering the end member $\delta^{13}\text{C}$ values of modern C₃-C₄ plant surviving in the Gangetic floodplain, paleosol derived *n*-alkane $\delta^{13}\text{C}$ values from Naladkhad and Ranital sections of Kangra sub-basin indicate presence of ~ 20 % C₄ plants at ~11 Ma suggest early appearance of C₄ plants compared to the previously published data. In Kangra sub-basin, Jabbarkhad section showed a gradual increase in C₄ plant abundance whereas Ranital section showed patchy occurrence of C₄ plant. The C₄ plants abundance showed large fluctuation in Haripur Khol section of Subathu sub-basin. The *n*-alkane δD measured from the same samples indicate two episodes of summer monsoon intensification at ~9 Ma and ~3.5 Ma. The co-relation between *n*-alkane δD and $\delta^{13}\text{C}$ values varies in different sections. It has been observed that the C₄ plant abundance variation can be linked to the variable channel/overbank of different studied section. The variable response of C₄ plant abundance with monsoonal intensity along with fluvial architectural relationship in different sections of Kangra and Subathu sub-basin suggest along with summer rainfall nature of substrate played important role in controlling C₄ plant abundance in Siwalik floodplain during the late Miocene time.