

## Two step expansion of C4 plants in northwestern India at 10 Ma and 7.5 Ma: Evidence of leaf wax carbon isotopes in IODP Site U1457 sediments

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Earlier studies indicated that C4 plants started to expand globally around 8 Ma (e.g., Cerling et al., 1997). This phenomenon is attributed to the decrease of atmospheric CO<sub>2</sub> (Cerling et al., 1997), cooling (Zhang et al., 2003) and aridification (Huang et al., 2001).

In this study, we generated a record of the stable carbon isotope ( $\delta^{13}\text{C}$ ) of higher plants during the last 10.6 m.y. Long-chain fatty acids (>26 carbons) were analyzed for 90 samples between 0 to 1000 m in Site U1457, Laxmi Basin, Arabian Sea.

The  $\delta^{13}\text{C}$  of C<sub>26,28,30</sub> fatty acids was -29 ‰ at 10.5 Ma, dropped at 10 Ma to -34 ‰, recovered to -28 ‰ by 9 Ma, dropped again at 8 Ma to -33 ‰, abruptly increased to -26 ‰ at 7.5 Ma, gradually increased to -23 ‰ by ~6 Ma, and constantly high after 6 Ma. This result indicates that the proportion of C4 plants around 10 Ma and 8 Ma was significantly low, and C4 plants expanded two times at 10 Ma and 7.5 Ma. The first retreat of C4 plants around 10 Ma corresponded to a wet period in eastern Europe (Böhme et al., 2007), suggesting that higher precipitation increased C3 plants. The second retreat of C4 plants around 8 Ma is unexplained, but the recovery of C4 plants at 7.5 Ma coincided with global cooling, suggesting a drastic decrease of atmospheric carbon dioxide concentration may have induced C4 plant expansion.

キーワード : C4植物、中新世、インド

Keywords: C-4 plants, Miocene, India