Geophysical Research Abstracts
Vol. 19, EGU2017-1232, 2017
EGU General Assembly 2017

Relative contribution of C3 and C4 type terrestrial organic matter in the Mahanadi offshore (Bay of Bengal) sediments and climatic implication.

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C3 and C4 are dominant vegetation in terrestrial environment. The primary product of photosynthesis of C3 plants is a 3 carbon bearing compound called phosphoglycerate (PGA). In contrast, CO_2 is transferred to bundle sheath cells via 4 carbon bearing compound oxaloacetate/mallate and fixed by RuBiSCO in C4 plants. This marked variation in CO_2 diffusion across stomata and enzymatic pathways lead to differences in stable carbon isotope ratios. Factors that control relative abundance of these vegetation types are concentration of p-CO_2, temperature and humidity. Low p-CO_2, air temperature below cross over temperature and aridity are the climatic parameters favoring expansion of C4 type vegetation, whereas higher extreme conditions promote greater C3 type production (Ehleringer, J. R, 2005). In marine sediment n-alkane (lipid fraction) distribution and compound specific isotope ratios are ideal markers to characterize nature of terrestrial organic flux owing to high diagenetic stability and near 100% extraction efficiency. We report here the relative abundance of C3-C4 vegetation over 8 marine isotope stages covering 300kyr. A 39.08 m long core (MD 161-19) was collected onboard ORV Marion Dufresne, at a water depth of 1480 m (Lat: 18 59.1092N Long: 85 41.1669E) (Mazumdar., et. al. 2014) for the study of sediment physico chemical properties and their link to paleoclimatic variation. The carbon isotope ratios of C-27 n-alkane range from -35.3‰ to -23.6‰ VPDB. 13C enrichment trends indicate a greater contribution from C4 vegetation type and 13C depletion trends are attributed to greater flux of C3 type vegetation. Mass balance calculation to reconstruct the temporal variation in C3/ C4 ratios is carried out using the end member values of -34.5‰ and -19.8‰ respectively (Collister.,et. al. 1994). The calculated C3/C4 ratio is 27:73 at LGM and shifts to 71:29 around 6 kyr BP. Based on results, we observe that colder isotope substages characterized by lower pCO_2 saw relative expansion of C4 vegetation while warmer, high pCO_2 periods supported C3 expansion. A high resolution work is being carried out to get better understanding on actual limiting factors across the last 300 ky responsible for changes in C3 vs C4 expansion. Our data may help in understanding how vegetation may respond to future global warming and climate change including pCO_2 build up, change in air temperature and monsoonal rainfall.
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