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Provenance and Transport Dynamics of Terrestrial Organic Carbon in the Godavari Basin

Muhammed Usman (1), Camilo Ponton (2), Maarten Lupker (1), Negar Haghipour (1,3), Liviu Giosan (4), and Timothy Eglinton (1)

(1) Geological institute, ETH Zürich, Zürich, Switzerland. (muhammed.usman@erdw.ethz.ch), (2) Division of Geological and Planetary Science, California Institute of Technology, Pasadena, USA. (camilo.ponton@gmail.com), (3) Laboratory of Ion Beam Physics, ETH Zürich, Zürich, Switzerland. (Negar.haghipour@erdw.ethz.ch), (4) Geology and Geophysics Department, Woods Hole Oceanographic Institution, Woods Hole, USA (lgiosan@whoi.edu)

Continental margins are estimated to account for about 90% of organic carbon (OC) burial in marine sediments and the nature and composition of sedimentary organic matter (OM) accumulating on margins are strongly influenced the continental delivery of siliciclastic sediments as well as the composition of the exported terrestrial-derived OM. This study assesses OC export from the Godavari and delivery to the Bay of Bengal with a view to understanding key facets of sediment translocation and deposition in continental margins.

The OM contents of a sediment core collected at the mouth of the Godavari River was investigated by integrating bulk OM measurements, such as total organic carbon (TOC), carbon stable isotope (δ13C) and radiocarbon contents of TOC (Δ14C), with lipid biomarker analysis. Coupled radiocarbon measurements on lipid biomarkers (long-chain fatty acid) and co-eval shells of planktic foraminifera (G. bulloides and G. ruber) indicate addition of pre-aged terrestrial OC. The higher temporal offset between long-chain fatty acid, TOC and foraminifera in the late Holocene implies increased proportions of aged terrigenous materials.

A coupled three-component isotopic mixing model, based on bulk and compound-specific biomarker 13C and 14C, was used to estimate the fractional abundances of the three OC components that reflects OC provenance and transport dynamics. About 60% is modern OC, 30% is fossil OC, and 10% is pre-aged terrestrial OC. The latter two reflecting erosion of ancient sedimentary rocks and OC residence times in terrestrial reservoir (e.g. soils), respectively. This study reinforces the notion that OC residence times within major reservoirs during transport strongly influence the composition and nature of exported OM which in turn play a crucial role in global carbon cycle.