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Lipid biomarkers as tracers of organic matter dynamics in a hydrodynamically complex continental margin: insights from the Santos Bifurcation (SW Atlantic)

SATIE TANIGUCHI, FELIPE RODRIGUES DOS SANTOS, LUCAS COSTA PEREIRA, GIOVANNA LIMA PICCINI, MARCIA CARUSO BÍCEGO, RAFAEL ANDRE LOURENÇO, CESAR CASTRO MARTINS, RUBENS CÉSAR LOPES FIGUEIRA AND MICHEL MICHAELOVITCH DE MAHIQUES

University of São Paulo

The South Atlantic Subtropical Gyre intersects the western South American continental margin between 25°S and 27°S, where it splits at intermediate depths into northward and southward branches, a feature known as the Santos Bifurcation (SBF, Figure 1). This hydrodynamically complex setting is characterized by flow reversals between the Brazil Current, the Intermediate Western Boundary Current, and deeper boundary currents, generating depth intervals with reduced near-bottom velocities that favour particle retention, sediment accumulation, and organic matter (OM) preservation along the continental slope. The sources, distribution and transport pathways of sedimentary OM were assessed using lipid biomarkers in surface sediments. Total n-alkane and fatty acid contents ranged from 0.17–0.71 μg g^{-1} and 0.61–3.41 μg g^{-1}, respectively. Alkane distributions were dominated by long-chain homologues (n-C27, n-C29, n-C31), indicative of terrigenous higher-plant inputs as corroborated by molecular carbon isotope ratio, $d^{13}C$, whereas fatty acids were dominated by short-chain compounds, followed by monounsaturated and long-chain homologues, reflecting mixed marine and continental sources. Fatty alcohols and sterols also confirmed mixed marine-terrigenous influence. The measured proxies contents were systematically higher in the northern and southern sectors of the SBF and lower in the central of that divergence, highlighting spatial heterogeneity linked to hydrodynamic sorting and depositional focusing. Although no statistically significant differences among depth intervals were detected, contents consistently increased at 1000–1500 m relative to 500 m, suggesting preferential OM accumulation at intermediate to deep slope depths. Carbon Preference Index (CPI_{alk} = 1.77–3.63) values indicate a predominance of higher-plant-derived n-alkanes subjected to variable degrees of degradation, reflecting early diagenetic alteration and hydrodynamic reworking. Alkane Index values (AI = 0.50–0.66) point to a dominant C_4 vegetation signal, consistent with terrigenous inputs from the La Plata River basin transported northward by the Brazilian Coastal Current. The lipid biomarkers results demonstrate that off-shelf transport and lateral advection by intermediate boundary currents exert first-order control on OM distribution and preservation. The SBF can be considered an efficient depositional sink for particle-bound organic matter and a key zone of carbon accumulation on the southwestern Atlantic margin. Funded by FAPESP 20/14356-5.

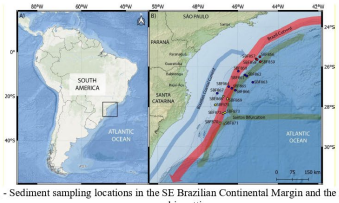

Figure 1 - Sediment sampling locations in the SE Brazilian Continental Margin and the regional oceanographic settings.