Different ^{14}C age of terrestrial and marine organic carbon in sediments of New Britain Trench: Insight into carbon source and transport in hadal trenches

Wenjie Xiao [a,b,c], Timothy I. Eglinton [b], Negar Haghipour [b,d], Danial Montluçon [b], Zehua Jia [a], Yunping Xu [a*]

[a] *Shanghai Engineering Research Center of Hadal Science & Technology, College of Marine Sciences, Shanghai Ocean University, Shanghai 201306, China*

[b] *Geological Institute, Department of Earth Sciences, ETH Zürich, 8092 Zürich, Switzerland*

[c] *Key Laboratory for Earth Surface Processes of the Ministry of Education, College of Urban and Environmental Sciences, Peking University, Beijing 100871, China*

[d] *Laboratory of Ion Beam Physics, Department of Physics, ETH Zürich, 8093 Zürich, Switzerland*

**Corresponding author. Email: ypxu@shou.edu.cn (Y. Xu)*

Abstract

The biogeochemical characteristic of sediment organic matter (OM) in the hadal trenches (6000 to 11000 meter water depth) is sparsely studied due to high challenges in observation and sampling at extreme depths, although limited evidence suggests that the trench axis is a potential organic carbon depocenter. Here we collected four short sediment cores from the New Britain Trench (NBT) to study the source, translocation and deposition of OM by combining bulk geochemical properties, biomarker and compound-specific radiocarbon data. Our results reveal that sediments of the NBT deep (8225 m) comprise a large proportion of terrestrial OM that was attributed to the rapid delivery and efficient burial of terrestrial OM from adjacent Papua New Guiana. Despite less degraded (reflected by higher CPI value of *n*-alkanes, $\delta^{13}C^{*}C_{org}$/SA and presence of labile marine-derived C_{16} and C_{18} monoacylglycerols), bulk sediment OM of the trench axis was characterized by older ^{14}C age (2520 yr BP) than that of the flanks (592 yr BP). At the molecular level, terrestrial biomarkers (C_{26}-C_{30} *n*-fatty acids) are 3625 yr BP in the deep and 1424 yr BP in the slope, while marine biomarkers (C_{16} *n*-fatty acid) are 734 yr BP in the deep and 637 yr BP in the slope, respectively. The combination of radiocarbon data at the bulk and molecular level unambiguously demonstrate that substantial amount of pre-aged (e.g., soils) terrestrial OM could be preserved along the trench axis, and trench slope was more diluted by young marine OM. Frequently occurring earthquakes triggered resuspension-deposit processes of sediments, aiding in transporting more recent plant-derived OM from continental shelf

and slope into the trench deep. Therefore, hadal trenches, particularly those close to the landmass, and with frequent seismic activities, may act as a depocenter for effective carbon sequestration. Considering many hadal trenches are close to continental margins, the storage of terrestrial OM there may be helpful for explaining “terrestrial missing carbon”.