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Tracing terrestrial organic matter in surface sediments in Laptev Sea and East Siberian Sea: a Rock-Eval pyrolysis approach

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The East Siberian Arctic shelf (ESAS), the world's largest continental shelf, receives substantial input of terrestrial organic carbon (TerrOC) both from increasing river discharge and from amplifying coastal erosion. Increasing TerrOC supply directly affects the Arctic marine carbon cycle, and, therefore, the fate of TerrOC upon its translocation to the Arctic continental margin has been the subject of growing interest in recent decades. Previous studies reported a strong decrease in sedimentary bulk TerrOC and terrestrial biomarkers with increasing distance from the coast during cross-shelf transport with much higher extent of degradation in the ESAS nearshore zone. Despite major progress has been made in estimating TerrOC inputs and quantifying its degradation rates in the Arctic land-shelf system, there are still important pieces insufficiently understood. Rock-Eval (RE) pyrolysis contributes to the traditional geochemical interpretations, based on elemental, isotopic and biomarker analyses and provides additional insight into the distribution, source and degradation state of organic carbon compounds of sedimentary organic matter.

In this study, the analytical approach included the characterization of marine and terrestrial carbon compounds using RE data coupled with organic carbon stable isotope composition. Rock-Eval analyses was performed on over 80 surface sediments samples from the Laptev Sea and western part of the East Siberian Sea collected during Arctic expeditions in 2011-2019. A track of rapidly degrading terrOC in shallow deposits may be traced using the ratios between hydrogen and oxygen indices and from the distribution of labile organic carbon fraction. Our results indicated high content of heavily degraded material with low hydrogen index, high oxygen index and a high content of residual carbon in sediments on the outer shelf of the western Laptev Sea and on the continental slope. Sharp decreasing of oxygen content in the eastern part of Laptev Sea and the western East Siberian Sea marked intensive dilution of degraded carbon with fresher material exported from New Siberian Islands. Furthermore, the RE data indicated a relatively high content of residual carbon (up to 87 %) stored in the studied surface sediments.

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