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Compositional pattern of lignin derived phenols of sediments as a proxy of accumulation of terrestrial organic matter in coastal zone of the Laptev Sea

Alexander Ulyantsev¹, Svetlana Bratskaya², Nikolay Belyaev¹, Oleg Dudarev³, and Igor Semiletov³

¹Shirshov Institute of Oceanology, Russian Academy of Sciences, Moscow, Russia (uleg85@gmail.com)

²Institute of Chemistry, Far Eastern Branch of the Russian Academy of Sciences, Vladivostok, Russia

³Il'ichev Pacific Oceanological Institute, Far Eastern Branch of the Russian Academy of Sciences, Vladivostok, Russia

The modern East Siberian Arctic shelf represents a fascinating area with a vast expansion of subsea permafrost that holds a large pool of frozen immobilised organic carbon (OC). Amplified climate change at high latitudes has raised growing concerns about potential positive carbon–climate feedbacks. Degradation of permafrost in the Arctic could constitute a positive feedback to climate change due to activation of this OC stock, while recognizing the origin and peculiarities of organic matter (OM) is useful for predicting the potential for involving the ancient OC in modern carbon cycling. This paper emphasises the molecular composition of lignin-derived phenols (LDP) in bottom sediments and subsea permafrost from the Laptev Sea shelf as a proxy to describe the main sources, distribution, and preservation of terrestrial OM. The compositional pattern and concentration of LDP revealed irregular dynamics of terrigenous OM supply in the study area, that were governed primarily by continental flows. The OC concentration in the studied sediments varied from 0.04% to 23.1% (mean 1.74%, median 1.07%). The concentration of LDP in the studied 126 samples from five sediment cores obtained from Buor-Khaya Bay varied from 0.7 to 13191 (mean 539, median 63.5) µg/g of dry sediment as the sum of vanillyl, syringyl, and cinnamyl (VSC) compounds and from 0.03 to 27.6 (mean 1.61, median 0.76) mg/100 mg of OC content. All OC-rich samples showed higher concentrations of LDP and virtually non-oxidized lignin. Vegetation proxies suggested that vascular plant tissues account for a significant fraction of the lignin in the examined samples, with a strong share of gymnosperms. The concentration of LDP correlates to OC content, indicating a strong supply of terrestrial OC to the study area. Degradation proxies indicate a predominant supply of wood-rich non-oxidized terrestrial OM. The well-preserved lignin revealed in the studied deposits represents a specific feature of Quaternary lithodynamics of the Laptev Sea and is not typical for the majority of bottom sediments of the World Ocean. Good correlation between OC and lignin concentration suggests that terrigenous fluxes were the main contributor to OM supply. Distribution of specific lignin phenols and related ratios coupled with lithology and grain size revealed that fluvial processes have been leading here.

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