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The Critical Role of Sediment Nutrient Cycling for the Nutrient Budget of the Laptev and East Siberian Shelf Sea

XIAOLE SUN, CHRISTOPH HUMBORG, CARL-MAGNUS MÖRTH AND VOLKER BRÜCHERT

Stockholm University

Presenting Author: xiaole.sun@su.se

This study presents a shelf-wide assessment of benthic nutrient regeneration and its role for the nutrient budget in the Laptev and East Siberian shelf Seas. Porewater profiles of major nutrients and total dissolved iron were modeled with a one-dimensional reaction transport model to derive net reaction rates and benthic nutrient fluxes from 16 stations. Integrated over the shelf area, the benthic fluxes of DSi, DIN, and DIP in the Laptev Sea were found to be 7.1, 1.2, 0.5 Gmol/yr, respectively. A comparison of the ratios of the benthic nutrient fluxes with marine and riverine inputs and Arctic plankton stoichiometry indicate substantial benthic nitrogen loss due to denitrification relative to DIP and DSi . Biogeochemical reactions and processes in sediments including organic carbon minerlization, nutrient adsorption/desorption and biogenic silica recycling regenerate nutrients from land- and marine- derived organic and detrital materials. Our benthic flux estimation suggests the pronounced role of benthic nutrient fluxes by returning nutrients to water with a fundamentally different stoichiometry from that of Arctic marine phytoplankton, riverine sources, and open water inflow. With a simple box model, we provide a snapshot of today's nutrient budget in the two seas and reveal about 10-20% of nutrients required by primary productivity is derived from sediments, which will continue to incline in the warmer Arctic continental shelf in response to increasing primary production.