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The orbital vs sedimentological tuning of ^{230}Th-excesses in the Arctic Ocean sediments

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Thorium-230 excesses ($^{230}Th_{xs}$) in Arctic Ocean sediments have been used for the documenting of paleoceanographic and sedimentological changes during the last few climatic cycles. So far, the $^{230}Th_{xs}$ burial vs its production, especially its linkage to ice cover conditions, has not been fully elucidated. The compilation of available U-Th datasets, mostly from the Lomonosov and Mendeleev ridges, sheds new light on the cycling and behavior of ^{230}Th in this ocean, particularly about its response to sea level oscillations and summer season insolation changes. In comparison with the peaking $^{230}Th_{xs}$-values during interglacials/interstadials, the low even nil $^{230}Th_{xs}$-values of glacial layers are associated with i) an ~40% reduction of ^{230}Th production linked to up to 1 km-thick ice shelf and low sea level conditions; ii) very low, sporadic fluxes of relatively coarse sediments, iii) some ^{230}Th export toward the Nordic Seas; and iv) potential ^{230}Th build-up in the deep Arctic Ocean. $^{230}Th_{xs}$ inventories in sediments accumulated since the Last Glacial Maximum suggest that $^{230}Th_{xs}$ fluxes and burials are closely linked to i) the sea-ice regime, ii) the organic carbon fluxes, iii) brine production rate and sinking, and iv) deep current winnowing processes. Conventionally, the dissolved organic carbon (DOC) is the most effective scavenger of ^{230}Th in the sediment-starved Arctic Ocean. A widely documented $^{230}Th_{xs}$ peak marks the MIS 3, likely related to enhanced DOC fluxes from the Lena River, a high summer insolation, a relatively high sea level (~ -40 m?), and some build-up of ^{230}Th during the preceding MIS 5d–4 interval. The relatively low $^{230}Th_{xs}$ content of MIS 5e and MIS 1 interval sediments are linked to a relatively short time window with optimal conditions (i.e., seasonal sea-ice opening) and the winnowing of fine fractions and brines-related compounds by deep currents from the Canada Basin towards the Eurasian Basin. Altogether, the submergence of continental shelves and seasonal sea ice production governed by sea level rise and peaking summer insolation, partly control the ^{230}Th production and scavenging in the central Arctic Ocean, whereas aside from radioactive decay, sedimentological and diagenetic processes modify $^{230}Th_{xs}$ burial rates and evolution in the sedimentary column.