Mechanism of Sediment Incorporation into Lake Ice Using ^{7}Be, ^{210}Po and ^{210}Pb as Tracer

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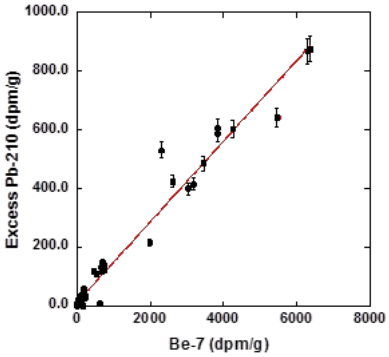
Extreme cold weather conditions in Lake St. Clair, SE Michigan (1114 km^2 area, 3.6 m depth) in February 2019 provided a unique opportunity to investigate mechanism of scavenging of atmospherically delivered ^{7}Be, ^{210}Pb and ^{210}Po on to fine sedimentary material and their eventual fate. From collection and analysis of these radionuclides in a suite of sediment extracted from dirty ice, pure ice and precipitation samples, we report the activities of ^{7}Be and ^{210}Pb in sediment in ice varied between below detection limit to >6,000 dpm/g and excess ^{210}Pb varied between 4 to >800 dpm/g, 2-3 orders of magnitude higher than bottom sediments in the lake and rivers in the study area. Most of the atmospherically-delivered radionuclides are scavenged by resuspeded particulate matter and subsequently incorporated into ice during frazil ice formation.



This implies that sediment entrained in ice serves as a '*cryo-concentrator*' of heavy metals and other pollutants delivered primarily from atmospheric deposition. The ^{210}Po/^{210}Pb activity ratio in different size-fractions of the ice-sediment varied between 0.08 to 0.68 and provides insights on the sources of these nuclides and their mechanism of incorporation in the sedimentary particulate matter. Detectable ^{137}Cs activity was found in many sediment samples.

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