Sedimentary mercury in East Asian marginal seas: A comprehensive study in the Yellow and East China Seas

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The East Asian marginal seas, in particular the Yellow and East China Seas (YECSs) around China and Korea, are the potentially important sinks of anthropogenic mercury (Hg) emission from Asian countries (mostly China), which contribute 54% to the global anthropogenic emission. However, few studies have investigated sedimentary Hg levels in these seas. This study filled this knowledge gap, based on a large dataset of total Hg (THg), aluminum (Al), and total organic carbon (TOC) in 516 surface and 4 core sediment samples. The THg concentration varied from 1.1 to 215.7 ng/g, with a significant spatial distribution, which was largely controlled by Hg sources, organic carbon content coupled with sediment grain size and complex current systems. The Hg deposition flux was highest in areas influenced by the Changjiang and Huanghe (average 23.16 and 8.28×10^{-5} g/m^2/yr, respectively), followed by an ocean waste-disposal site (average 5.67×10^{-5} g/m^2/yr), but was relatively low (average $1.22\sim4.52\times10^{-5}$ g/m^2/yr) in shelf areas away from direct riverine sources. The net atmospheric Hg flux to the sediments was estimated to be about 1.3×10^{-5} g/m^2/yr, which coincided reasonably well with that calculated using a box model. On the basis of Hg inventories, about 21.2 tons, accounting for approximately ~4% of total anthropogenic atmospheric Hg emissions from China, were buried annually in the YECS basins by particulate scavenging processes from the seawater. It implies that most of atmospheric Hg from China is transferred to the surface of the Pacific including East/Japan Sea, and consequently can play a critical role in aquatic ecosystems of open sea. Atmospheric Hg deposition in the YECSs has nearly doubled since the 1900s, which is comparable to the increase (about three times) in atmospheric Hg concentration during the same period. The present study could yield new information about the behavior and biogeochemical cycling of anthropogenic Hg, particularly for emissions from China, as well as the role of the marginal seas in the global Hg cycle.