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Atmospheric Mercury Deposition Inferred from Glacial Records in the Tibetan Plateau: Modern Process and History

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Mercury (Hg) has been recognized as a global contaminant due to its intrinsic toxicity, biomagnifications in ecosystems, and long-range transport via the atmosphere. Atmospheric Hg deposition was evaluated using snowpits and an ice core retrieved from glaciers over the Tibetan Plateau (TP). Results revealed a wide range of total Hg (THg) concentrations (<1 to 43.6 ng L-1) in glacier snow and a clear seasonal variations with higher values in winter than those in summer. Estimated atmospheric Hg depositional fluxes ranged from 0.74 to 7.89 μg m-2 yr-1. Consecutive snowpit sampling at Zhadang glacier in the southern TP during summer season revealed that Hg in glaciers is mainly preserved in the form of particulate-bound Hg, Hg tends to accumulate in dust-enriched stratums during its percolation down to lower snow stratums. The presence of dust layers, usually formed yearly in winter/spring seasons, likely act as effective "adsorbers" enhancing the preservation and seasonality of the atmospheric Hg deposition records in glaciers over the TP. A high-resolution Hg record reconstructed by the Mt.Geladiandong ice core provided insight into historical atmospheric Hg deposition during the past 500 years. Notable elevated THg concentrations and fluxes were observed since 1940s, which coincides the increase of global Hg production, especially the Asian Hg production history. Ice core reconstructed Hg depositional flux for post-1940s era is over 6 times of that for pre-20th centuries, which clearly indicated anthropogenic influences on the regional, and perhaps even the global atmospheric Hg background and deposition rate.