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Anthropocene fingerprint in sediments and tree rings from China

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Iodine-129 (129I) has been used as a powerful tool to investigate the impact of human nuclear activities on the environment. Historical records of 129I have been presented in a wide range of geological archives, for instance, in marine and lacustrine sediments, coral reefs, atmospheric deposition, tree rings, and ice cores. These studies cover land-ocean-air environment mainly in America and Europe, nevertheless, such studies are still rare in Asia. Investigations on temporal variation of 129I are carried out in one sediment core from Jiaozhou Bay, the east coast of China and two sediment cores from the East China Sea, and two spruce tree rings from Qinghai (NE Tibet plateau). In the Jiaozhou Bay core, significantly enhanced 129I level was observed in upper 70 cm of the core, with several peak values in the layer corresponding to 1957, 1964, 1986 and ect. It is apparent that the anthropogenic 129I has begun to increase since 1950. The sources of 129I and corresponding transport processes in this region includes nuclear weapons testing at the Pacific Proving Grounds, global fallout from a large numbers of nuclear weapon tests in 1963, the Chernobyl accident in 1986, and long-distance dispersion of European reprocessing derived 129I. The releases of 129I from the European nuclear fuel reprocessing plants were found to dominate the inventory of 129I in the Chinese sediments after 1990, not only the directly atmospheric releases of these reprocessing plants, but also re-emission of marine discharged 129I of these reprocessing plants in the highly contaminated European seas. Similar as the Jiaozhou Bay core, 129I levels (129I/127I ratio of (15.0-75.0) E-12) were significantly increased compared to the pre-nuclear value (129I/127I of 1.5 E-12) in the cores from the East China Sea. Our results also suggest that the riverine input is the main transport pathway of radioactive pollutants released from Lop Nor to the East China Sea through the atmospheric dispersion, deposition and runoff processes. In the two tree rings, the atomic ratios of 129I/127I were in the range of (4-20) E-9, reflecting the level from global fallout. In addition, other peaks of 129I/127I were observed in the two tree rings in 1962 and 1964-1968, respectively, which clearly demonstrate the 129I deposition history in the regional environment. Further 129I work is being planned in the lacustrine sediment core from Huguangyan Maar Lake, combing with other markers, e.g. black carbon, 137Cs, which will be helpful to determine the boundary of Anthropocene in the stratigraphic column.