

## Hg isotope fractionation in sediment cores

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Analytical advances in the past decade and the recent advent of multicollector inductively coupled plasma mass spectrometry (MC-ICP/MS) have made it possible to measure fractionation of non-traditional elements such as mercury.

We measured the isotope fractionation of mercury in different sediment cores to establish historical records. Marine sediment profiles from deep Pacific locations and from remote lakes on Vancouver Island (British Columbia) and the Experimental Lakes Area (Ontario) were investigated. While the Pacific and Ontario cores (going back to approx. 1800) compare well with each other in that older sediments become progressively enriched with lighter Hg isotopes ( $\delta^{202}\text{Hg}$  ranging from -0.327 ‰ to -1.844 ‰), the much older BC records (dating back to ~8000 BC) show the opposite trend starting with  $\delta^{202}\text{Hg} = -2.25$  ‰ at around 500 AD increasing to -1.5 ‰ in the bottom layers. Only a small degree of mass independent fractionation ( $\Delta^{199}\text{Hg}$  and  $\Delta^{201}\text{Hg}$ ) was detected in this study.

While most samples contained sufficient mercury for the measurement, some were as low as 5 ng/g and required preconcentration prior to the isotope ratio measurement. Nitric acid/sulfuric acid sediment digests were evaporated to near dryness and re-dissolved in max. 20 % acid.  $\delta^{202}\text{Hg}$  before and after pre-concentration were statistically not different from each other, demonstrating that this preconcentration process does not fractionate Hg isotopes.

## Performance of the ETH Zurich *in situ* <sup>14</sup>C extraction line

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Extracting the tiny amounts of <sup>14</sup>C from terrestrial quartz samples represents one challenging task in the application of *in situ* cosmogenic <sup>14</sup>C analyses to quaternary geology and geomorphology. The ETH Zurich all-metal <sup>14</sup>C extraction line is dedicated to achieve low-blank total quartz degassing and obtain pure CO<sub>2</sub> gas after a thorough gas purification procedure. High temperatures can be reached in the extraction furnace by using a sapphire tube enclosing the platinum sample holder omitting the addition of a flux agent. Without prior graphitization the recovered CO<sub>2</sub> is measured with the gas ion source at the MICADAS AMS system at ETH/PSI.

Yield tests show a very good performance of the gas cleaning system. Consistent CO<sub>2</sub> recovery of at least 98.8 % demonstrates that no significant amount of CO<sub>2</sub> is lost by cryogenic trapping or passage through a Cu-Ag filled tube. Line blanks are equally encouraging. The complete extraction cycle without heating the sample combustion furnace yields at most  $1.2 \times 10^4$  <sup>14</sup>C atoms, of which about  $6 \times 10^3$  <sup>14</sup>C atoms are associated with the gas purification system. Heating the combustion furnace at ~1350°C for 1.5 hours results in a higher extraction blank of about  $1.8 \times 10^5$  <sup>14</sup>C atoms. However, we are capable of further reducing the blank level by repeated O<sub>2</sub> flow through the combustion furnace that acts as main contamination source. Quartz outgassing experiments will reveal the temperature needed for complete degassing of quartz. Thereupon, cosmogenic <sup>14</sup>C will be extracted and analyzed from quartz samples with a precisely known <sup>10</sup>Be concentration to systematically test the analytical precision and accuracy of the <sup>14</sup>C method. Results will be presented at the meeting.