Sanak Island Alaska: A key study site to explore eastern Aleutian mercury dynamics

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Background

Natural & Anthropogenic

Volcanic

Permafrost & Glacial run-off

Industry & Mining

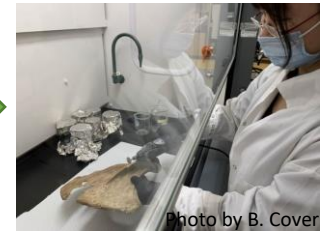
Mercury Sources

Ecosystem Sentinels

19th century Russian artists depicts an Unangan Steller sea lion hunt

Excavation of Alaska Peninsula Midden

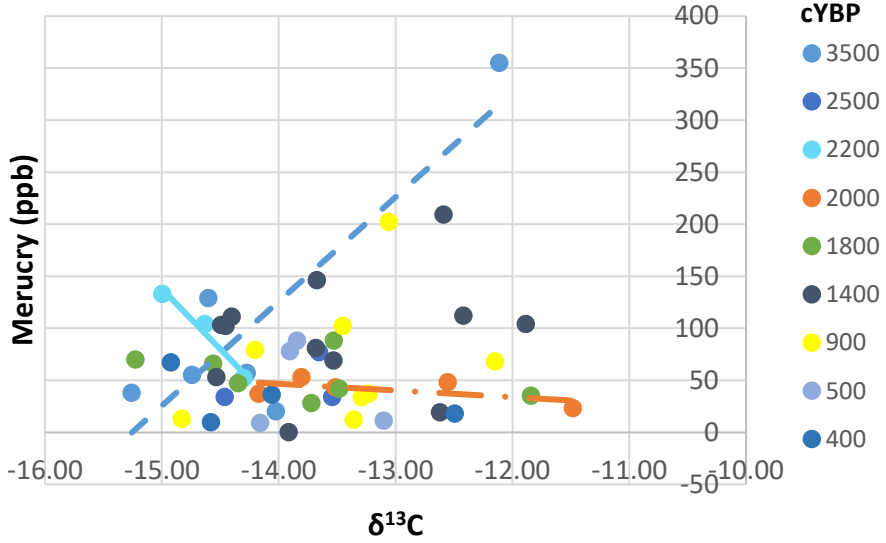
Sorting archaeological fauna in the Misarti Lab



Cutting bone fragments from specimens in the Misarti lab

Methods

- Total mercury concentration ([THg]), $\delta^{13}C$ and $\delta^{15}N$ was quantified in (n=53) unique otariid bone specimen excavated from Sanak Island in the Eastern Aleutians.
- 9 time periods (calculated years before present, cYBP) were grouped based on climatic conditions (Misarti et al 2009).
- Multiple regression models to determine association of [THg] with time period, $\delta^{15}N$, and $\delta^{13}C$. Only one model that included $\delta^{13}C$, time, and $\delta^{13}C$ x time terms significantly predicted [THg].



Concentrations of mercury in otariid compact bone were associated with $\delta^{13}C$ when grouped by climatic time period (cYBP). Three representative patterns are illustrated in the above graph: 3500 cYBP (blue), 2200 cYBP (light blue), 2000 cYBP (orange).

Findings & Future Work

RESULT: [THg] was influenced by both $\delta^{13}C$ and time period ($p=0.007$, $R^2=0.574$). The interaction term ($\delta^{13}C$ x time; $p=0.010$) indicates that the relationship of [THg] and $\delta^{13}C$ was not consistent among time periods.

INTERPRETATION: Time period differences in [THg] associated with $\delta^{13}C$ may be due either to changes in foraging location of ancient otariids (near vs offshore) or changes in growth rate of primary producers altering the C signature of the food web.

NEXT STEPS: Utilizing compound specific stable isotope analysis our team will further investigate the impact of food web alterations on [THg] of ancient otariids.

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Ancient Unangan harvests of sentinel species track natural source mercury dynamics in the Aleutian Islands

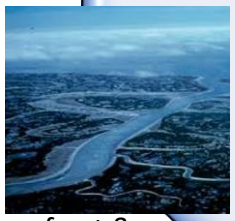
Avery Misarti Funk & Rea NSF-ARCSS/ASSP 1935816

Hypothesis

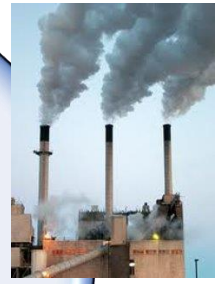
Ecosystem Sentinels

Pacific Cod Photo by: NOAA FishWatch

Volcanic



Permafrost & Glacial run-off



Industry & Mining

19th century Russian artist depicts an Unangan Steller sea lion hunt

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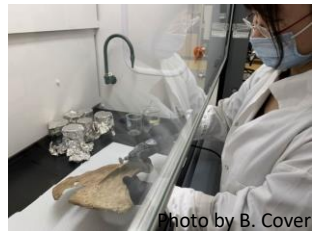
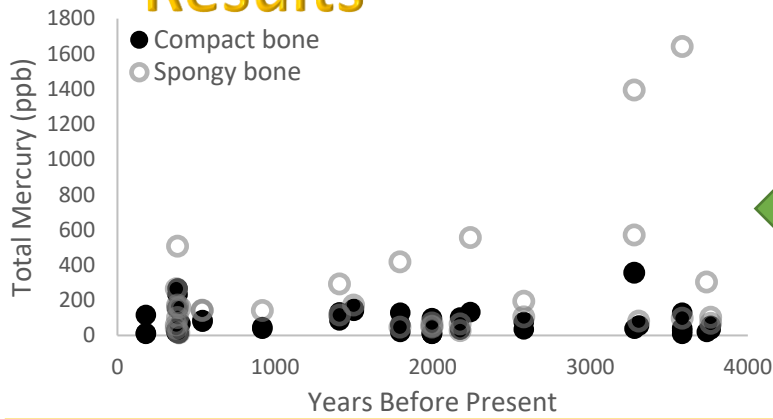
Methods

Sorting archaeological fauna in the Misarti Lab at UAF

Cutting bone fragments from specimens in the Misarti lab at UAF



Results



Spongy (left) and Compact (right) bone separated and analyzed for Hg content and stable isotopes

A wide range of Hg concentrations (8 to 1640 ppb) were observed in Steller sea lion and Northern fur seal bones from Sanak Island middens in the Eastern Aleutians. The greatest concentrations were observed 3500 calibrated YBP during a highly active period of volcanic eruptions in this region (USGS pers comm).

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What's Next?

- *Continued analysis of bone specimen from across the Aleutian Islands*
- *Community Involvement, Interested? Contact us!*