The extensive methane seeps of the U.S. Atlantic Margin (USAM) are home to mussel communities that use endosymbiotic methanotrophic bacteria as their primary dietary source. Here we present results of compound-specific isotope analysis of amino acids (CSIA-AA) of the shell periostracum, or “shell skin”, of the ubiquitous mussel species at these seeps, Bathymodiolus childressi, to assess organismal trophic position and methane reliance over mussel lifetime. We compare CSIA-AA data relating to mussel dietary sources over the individual lifespan to recently reported data from adductor and gill tissues of the same individuals in order to assess the reliability of the periostracum as an isotopic record.

**Background**

- USAM: tectonically inactive passive margin that runs along the eastern U.S.
- Bathymodiolus childressi: mussels host bacterial symbionts that oxidize methane as an energy source, while retaining a digestive system and the ability to filter-feed [1,2].
- The periostracum is a thin protein layer that forms along the shell edge in continuous growth bands [3].

**Introduction**

Objective

- Examine the trophic ecology of *B. childressi* using isotopic evidence from periostracum samples, as the periostracum forms in sequential bands, and can be analyzed after mussel death (unlike soft tissues).
- Does the periostracum represent a reliable temporal archive of methane seep ecology?

**Methods**

1. Mussels collected from the Chincoteague (925m) and Baltimore Canyon (395m) seep fields by investigators from the U.S. Geological Survey (USGS) [14].
2. Periostracum was excised at 0-3% lengths using a scalpel, forceps, and used to age periostracum samples
3. Sections of 0-30% are preferentially excised for analysis
4. Analysis was successful! Abundance and Concentration

**Results**

**Abundance and Concentration**

- **5.** Background: Image courtesy of Deepwater Canyons 2013 - Pathways to the Abyss, NOAA-UM Close Lab

**Conclusions**

- Mussel periostracum is a reliable archive of *B. childressi* isotopic patterns
- Periostracum sections (most recent) compare well to adductor muscle samples
- The periostracum records variation in amino acid composition over lifetime
- These variations are likely due in part to the quinone-tanning (hardening) process of the periostracum protein

**Future Research**

- Mark-recapture surveys of USAM *B. childressi* would improve growth curves
- Characterizing the effect of distance from the seep on methane energy-sourcing
- Characterize methanotrophic symbiont specifically
- Refined periostracum excision, increased replicability
- δ¹⁵N analysis
- Examination of archived shells from museums, etc.

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