Journal of Archaeological Science: Reports 21 (2018) 1215–1224

Contents lists available at ScienceDirect

Journal of Archaeological Science: Reports

journal homepage: www.elsevier.com/locate/jasrep

Determining seasonality of mussel collection from an early historic Inuit site, Labrador, Canada: Comparing thin-sections with high-resolution stable oxygen isotope analysis

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ARTICLE INFO

Keywords:
Seasonality
Stable oxygen isotopes
Inuit
Labrador
Mussels
Mollusk growth analysis
Shell midden

ABSTRACT

Stable oxygen isotope ($\delta^{18}O$) analysis of mussels (*Mytilus* sp.) from a 16th to mid-18th century Inuit site in southern Labrador, Canada, indicates multiple seasons of shellfish collection, and by proxy, multiple seasons of site occupation. High-resolution $\delta^{18}O$ sampling of shell permits a precise season of mussel collection since the temperature and freshwater signal of the local water is retained in the shell. Live-collected specimens of *Mytilus* sp. obtained from Labrador, were analyzed for stable oxygen isotopes and for growth patterns. These data were used to interpret results from the archaeological shells. Growth pattern analysis was conducted to test the relationship between $\delta^{18}O$ values, growth lines and shell colour. Of the two approaches, high-resolution $\delta^{18}O$ sampling proved to be more reliable for determining seasonality, and showed that the Inuit at Schooner Cove harvested mussels primarily during the spring months, with some harvesting evident in the winter and autumn.

1. Introduction

Identifying patterns of seasonal resource procurement at coastal sites can be used to interpret settlement, subsistence and mobility. The seasonal and migratory nature of key large-mammal foods in Labrador, Canada, specifically seals and caribou, influenced settlement patterns and movement between seasonally occupied sites for millennia and across several cultures. As part of a study of historic-era Inuit seasonal settlement in coastal Labrador, we consider evidence from a less-examined species, mussels (*Mytilus* sp.), to ascertain whether seasonality can be determined from mussel shells recovered from this site. We also compare high-resolution stable isotope analysis ($\delta^{18}O_{shell}$) and growth line/colour analysis from mussel shells (*Mytilus* sp.) to demonstrate that stable isotopes, rather than growth lines, are a more reliable method to determine the season of mussel collection. The archaeological shells were recovered from an Inuit cold-season/winter camp site in southern Labrador (FeAx-3), occupied between the 16th and mid-18th centuries.

To interpret growth line formation and $\delta^{18}O_{shell}$ in the archaeological shells, we first analyzed live-collected mussels from the shoreline at the site of North Island-1 (FeAx-3) in St. Michael's Bay, as well as a genotyped *Mytilus edulis* from Nain in northern Labrador. The latter specimen allowed us to evaluate the reproducibility of using *Mytilus* sp. for future studies of archaeological seasonality from the broader Labrador geographic region. Middens at Inuit sites generally consist of quantities of seal bone, and the middens at FeAx-3 are the only ones presently known for southern Labrador where the matrix is primarily mussel shell. This suggests an element of resource procurement previously not found in archaeological evidence from Inuit sites. Although most of the matrix consists of highly fragmented shell a few whole valves used in analysis were recovered from within one of the sod houses. Their excellent preservation and careful recovery presented a unique opportunity to test methodologies for studying seasonality using mussel shells.

Bivalves are sensitive environmental monitors that can capture daily, weekly, monthly and annual ambient water changes in their shells (Schöne and Kraus Jr, 2016). Since *Mytilus* sp. are a nearshore species, they have the potential to record local variability in sea surface temperature [seasonality] in their shell since the isotope signature of the ambient water is incorporated in the shell carbonate as the mussel shell grows (e.g., Wanamaker et al., 2007; Versteegh et al., 2012). Using $\delta^{18}O_{shell}$ to identify the season of mollusk collection, and by proxy site occupation, has been widely applied in coastal regions for over 30 years

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https://doi.org/10.1016/j.jasrep.2018.02.016
Received 22 November 2016; Received in revised form 8 February 2018; Accepted 13 February 2018
Available online 10 April 2018
2352-409X/