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High-resolution sclerochronological analysis of the bivalve mollusk *Saxidomus gigantea* from Alaska and British Columbia: techniques for revealing environmental archives and archaeological seasonality

Nadine Hallmann [a,*], Meghan Burchell [b], Bernd R. Schöne [a], Gail V. Irvine [c], David Maxwell [d]

[a] *Earth System Science Research Centre, Department of Applied and Analytical Paleontology (INCREMENTS), Institute of Geosciences, University of Mainz, Johann-Joachim-Becherweg 21, 55128 Mainz, Germany*
[b] *Department of Anthropology, McMaster University, 1280 Main Street West, Hamilton, Ontario, Canada*
[c] *U.S. Geological Survey, Alaska Science Center, 4210 University Dr., Anchorage, AK 99508, USA*
[d] *5331 Meadedale Drive, Burnaby, British Columbia V5B 2E6, Canada*

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ABSTRACT

The butter clam, *Saxidomus gigantea*, is one of the most commonly recovered bivalves from archaeological shell middens on the Pacific Coast of North America. This study presents the results of the sclerochronology of modern specimens of *S. gigantea*, collected monthly from Pender Island (British Columbia), and additional modern specimens from the Dundas Islands (BC) and Mink and Little Takli Islands (Alaska). The methods presented can be used as a template to interpret local environmental conditions and increase the precision of seasonality estimates in shellfish using sclerochronology and oxygen isotope analysis. This method can also identify, with a high degree of accuracy, the date of shell collection to the nearest fortnightly cycle, the time of day the shell was collected and the approximate tidal elevation (i.e., approx. water depth and distance from the shoreline) from which the shell was collected.

Life-history traits of *S. gigantea* were analyzed to understand the timing of growth line formation, the duration of the growing season, the growth rate, and the reliability of annual increments. We also examine the influence of the tidal regime and freshwater mixing in estuarine locations and how these variables can affect both incremental structures and oxygen isotope values. The results of the sclerochronological analysis show that there is a latitudinal trend in shell growth that needs to be considered when using shells for seasonality studies.

Oxygen isotope analysis reveals clear annual cycles with the most positive values corresponding to the annual winter growth lines, and the most negative values corresponding to high temperatures during the summer. Intra-annual increment widths demonstrate clear seasonal oscillations with broadest increments in summer and very narrow increments or no growth during the winter months. This study provides new insights into the biology, geochemistry and seasonal growth of *S. gigantea*, which are crucial for paleoclimate reconstructions and interpreting seasonality patterns of past human collection.

1. Introduction

Knowledge of local climate and environmental conditions are essential for understanding seasonal procurement strategies of past populations. Incorporating seasonality into archaeological analyses provides insight as to how specific resources were used within a subsistence-settlement system, and information pertaining to seasonal patterns of site occupation. Sclerochronological analyses of shell growth patterns (Jones, 1983; Koike, 1973, 1975, 1980; Milner, 2001; Quitmyer et al., 1997; Rhoads and Pannella, 1970; Schöne et al., 2002a) and their geochemical properties can be used to identify shifts in local climates such as precipitation and temperature (Andrus and Crowe, 2000; Davis and Muehlenbachs, 2001; Jones and Quitmyer, 1996; Schöne et al., 2002b; Schöne et al., 2005a). This information can be used to identify the season of shellfish collection and to proxy the season of site occupation. Identifying seasonal patterns of procurement addresses not only patterns of site use, but it also contributes to understanding how shellfish were incorporated into prehistoric diets.

* Corresponding author.
E-mail address: meiern@uni-mainz.de (N. Hallmann).

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