Fairfield Award Runner Up and Audience Favourite: Casey Clark

Title:
Braving the elements: Investigating Pacific walrus life history and movements using trace elements in teeth

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Abstract:
Organic structures containing incremental growth layers act as biological archives, recording and storing information throughout an organism's life. Pacific walrus (*Odobenus rosmarus divergens*) tooth cementum accrues dark and light bands seasonally. Naturally occurring trace elements are included in the cementum in concentrations reflecting those of the environment in which walruses lived and fed. By measuring element concentrations, a lifetime history of exposure can be reconstructed, providing information about the movements and life histories of individual walruses. The purpose of this study was to 1) investigate the association between trace element concentrations and seasonal growth layers in walrus teeth; and, 2) examine trends in element concentrations across the lives of individual animals. We used an Agilent 7500ce ICP-MS to measure concentrations of arsenic, barium, cadmium, chromium, cobalt, copper, iron, lead, manganese, molybdenum, nickel, strontium, vanadium, and zinc in modern-day walrus teeth taken during Alaska Native subsistence harvests (n = 30), historic teeth collected between 1883 and 1981 (n = 40), and archaeological teeth from the last 2,500 years (n = 20). Variability in trace element concentrations was compared with annual growth layers to identify elements associated with seasonal movements. Changes in element concentrations within the lifetimes of individual walruses were compared qualitatively. Historic and archaeological samples allowed for comparisons of walrus movements and life histories before and after the onset of recent Arctic warming. Multidimensional scaling revealed strong separation in trace element concentrations between the breeding and feeding periods (nMDS stress = 0.001), but no separation between sexes. Males and females exhibited different patterns of accumulation for some elements (*e.g.*, females tended to accumulate lead across their lives, whereas males did not), but showed similar patterns for most. These results provide novel insight into walrus biology and ecology, and demonstrate the viability of trace element analysis for studying these topics.