How to deal with environmental change – the impact of three major environmental events on prehistoric coastal societies and their main prey species

The newly financed project by the Swedish Research Council (2020-2023) is hosted at the Archaeological Research Laboratory, with participation of Kerstin Lidén (PI), Aikaterini Glykou, Gunilla Eriksson and Sven Isaksson.

The main question of our project is: How did prehistoric societies deal – culturally and economically – with environmental change? We propose a cross-disciplinary study on how humans used culture as a means to handle sudden environmental change, and detect common patterns of human behaviour in prehistoric coastal societies in the Baltic Sea area. We are focusing on three major global environmental events that are likely to have affected both humans and marine mammals, and consequently should be possible to trace in the archaeological record: the 8200 cal BP cold event in the Mesolithic (the 8.2 event), the 4200 cal BP aridification event in the Neolithic (the 4.2 event) and the 536 AD dust-veil event in the Migration Period. These events have been associated with cultural shifts in different regions worldwide, but not previously in the Baltic Sea Region. Although there are detailed records on both geological/environmental processes and the archaeological cultural contexts, respectively in this area, the impact of climatic change on cultural shifts has, however, not been previously taken entirely into consideration. By integrating studies on archaeology, bioarchaeology, marine mammal ecology and environment, the project will provide new data on how the prehistoric environment was entangled with both human culture and marine mammal ecology, affecting each other both ways.

The project will address the following questions:

1. How did humans deal culturally with environmental/climatic change?
2. Is it possible to identify temperature fluctuations caused by such events in skeletal remains of humans and seals?
3. Can we recognize dietary shifts and mobility triggered by environmental/climatic change?

To address the main research questions the project is organized into three work packages:

WP 1. Identifying temperature fluctuations during the climatic events: We will apply oxygen isotope analysis (δ¹⁸O) on seal teeth to study any possible correlation between changes in abundance of seal populations and climatic shifts. Analysis of human remains will consequently provide detailed climate data at the individual level, which will then be related to the faunal isotopic signature. These data will be correlated with temperature proxies from the Greenland ice core GISP2 and other palaeoenvironmental proxies to identify the direct impact and magnitude of temperature changes on humans and seals and detect seasonal patterns of mobility.
**WP 1. Cultural human responses to environmental/climate change:** To understand how humans operated in terms of economy, material culture and resource management during periods of drastic climatic events as well as during periods of stable climate we will conduct a temporal assessment of faunal remains of marine mammals in particular and exploitation of aquatic resources in general will be made for the time periods surrounding the three climate/environmental events. Assessment on cultural shifts will be implemented by performing meta-data analyses for the archaeological cultures surrounding the 8.2 event. For the archaeological cultures surrounding the 4.2 event and the 536 AD event, typological and lipid analysis on pottery from selected sites of the transition from the Middle to the Late Neolithic and of the transition from the Migration to the Merovingian Period will be performed to obtain pottery use and shifts in diet. Finally, to reconstruct diet, identify dietary shifts or starvation, we will apply carbon and nitrogen isotope analysis on teeth and bones from humans and seals. Strontium isotope analysis will be performed by Laser Ablation MC-ICP-MS on human tooth enamel to identify mobility.

**WP 3. Synthesis of the project**
The final work package is designed to ensure integration of data from WP1–WP2 and to provide a synthesis of the project. The isotopic data from WP1 and WP2 will be integrated with isotopic data from Greenland Ice Cores, pollen analyses and other palaeoenvironmental proxies, to reconstruct the direct impacts of climatic and environmental change on humans and marine mammals. This will be evaluated together with the results of WP2 to assess human responses, in form of cultural shifts, economic shifts or other responses to a changing environment. In order to provide a synthesis, the research group will meet regularly, and four times annually on minor conferences to discuss results and plan new strategies.