



Seasonal Variations in C and O Stable Isotopes in Domesticated and Wild Mammalian Tooth Enamel from the Outskirts of the Roman Empire

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Carbon (C) and oxygen (O) stable isotopes from tooth enamel have become a valuable tool in both geosciences and archeology in reconstructing past environmental and climatic conditions. Oxygen isotopic values in bone apatite and tooth enamel are directly related to body fluids, which in turn are dependent upon the source of drinking water, thus being a suitable paleoclimate proxy. On the other hand, the stable isotope ratio of C from tooth enamel is based on differences in C isotope discrimination between plants using the two major photosynthetic pathways (C3/trees and C4/grasses). The abundance of trees versus grasses is controlled by climate variables and the transfer of this “signature” amid plant foods in the diet of mammals and mammalian tooth enamel $\delta^{13}\text{C}$ values ($\epsilon_{\text{diet-enamel}}$) allows us to use C isotopic composition of bioapatite as a climate proxy. This study is the first of its kind from an archaeological site in Romania, which is dated back to before the Roman conquest of Dacia.

Archaeologists have been studying the Ardeu site, located on the southern limb of the Apuseni Mountains (Romanian Western Carpathians) since the early 1970s, with intensified work after the year 2000. Artifacts (i.e. ceramics, jewelry, different materials made from iron, bronze, bone and horn) discovered here in the past 10 years indicate that the area was inhabited over several millennia, from the Eneolithic to the Bronze Age, during the Dacian Kingdom, and through the Middle Ages. The teeth we sampled for isotope analysis were found along with items dating back to the Dacian Kingdom, centuries I BC-I AD.

This study is an attempt to interpret preliminary data from ongoing efforts aimed at better understanding the lifestyle and environmental conditions of the ancient province of Dacia (the present territory of Romania), both before and shortly after the Roman conquest, based on stable isotope data from tooth enamel of domesticated and wild mammals. We analyzed both bulk and serial samples from nine different individuals including *Sus scrofa* (wild boar), *Capreolus capreolus* (Roe deer), *Cervus elphus* (Red deer), and *Equus* (horse).

Our $\delta^{13}\text{C}_{\text{enamel}}$ results indicate the presence of both C3 and C4 vegetation in the paleolandscape and the ecosystem was ranging between closed woodland to ecotons, and open woodland. The serial samples from some of the mammals indicate seasonal availability of different types of vegetation or migration. Bulk $\delta^{18}\text{O}_{\text{enamel}}$ values also indicate the availability of different water sources, evaporation, or migration of the animals from higher altitudes to lowland pastures, while sequential samples from a single tooth documented a seasonal change of up to 6.2 ‰ in $\delta^{18}\text{O}$ of the drinking water source.