Determining glacial and interglacial climate conditions using stable isotopes from fossil mammal teeth

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Stable isotopes in fossil mammal teeth record dietary and climate information. Specifically, relative proportions of oxygen isotopes ($\delta^{18}O$) are a function of the water consumed by mammals either in food material and/or through drinking. As further demonstrated by Levin *et al*. [1], an increase in $\delta^{18}O$ values of evaporation sensitive mammals can indicate increased aridity. We used the aridity index of Levin *et al*. [1] to identify glacial and interglacial sites in coastal Florida. Using the method here described, we compared both the total range of $\delta^{18}O$ values and serial samples of high-crowned horse teeth to assess overall aridity and relative seasonality. We first established glacial and interglacial isotopic ranges from sites with geological evidence indicating their occurrence during glacial and interglacial periods, respectively. Additionally, we expanded on the work of Levin *et al*. [1] by further determining the stable isotope ecology of extant tapirs, a mammal with a contrary pattern of oxygen isotope changes in the fossil record, i.e. decreased $\delta^{18}O$ values with increased aridity.

Based on an improved understanding of stable isotope dynamics in mammals during glacial and interglacial periods, we subsequently compared both the total range of $\delta^{18}O$ values of ungulate taxa present at all sites and inferred seasonality from serial samples of high-crowned tooth and tusk enamel from an unknown fossil locality (Haile 7G) to our established oxygen isotope baselines. Our data indicate that Haile 7G was deposited during a climatic regime more similar to a glacial climate than an interglacial climate. Furthermore, serial samples from tooth and tusk enamel demonstrate a relatively seasonal climate and may help to calibrate the growth rate of gomphothere tusk enamel.

[1] Levin *et al*. (2006) *PNAS* **103**, 11201–11205.

Zinc and Cadmium retention by two Gram-negative bacteria: Surface adsorption or internalization?

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This study examines the sorption and subcellular distribution of Zn and Cd in two Gram-negative bacteria. The studied bacteria are the metal-tolerant *Cupriavidus metallidurans* CH34 (Mergeay *et al.* 1985), which resists to high metal concentrations and the metal sensitive *Escherichia coli* K12DH5α. Cadmium and Zinc adsorption and distribution outside and inside the cells were determined to compare the responses of the two species to different metal concentrations. Metal sorption isotherms were used to characterize both the type and the amount of charged functions on the bacterial surfaces that act as the initial metal ion binding sites. Then the sub-cellular distribution of Zn and Cd in the two bacteria was determined by disruption of the cells and separation of cell compartments (extracellular, membrane and cytoplasm) by ultra-centrifugations. Metals were shown to be unequally distributed between the three cell compartments and also between the two bacteria. The internalization of both metals appeared to be important in the two bacteria and especially in the metal-resistant *C. metallidurans* CH34. Thus, the dominant metal accumulation compartment was found to be the cytoplasm. Surprisingly the membrane compartment appeared poorly reactive, in disagreement with the common concept of surface complexation of metals onto bacteria. These results suggest that both metal-resistant and sensitive bacteria can internalize important amounts of heavy metals and also that adsorption onto cell surface is only a first step in metal management by bacteria.