Calcium and carbon stable isotope ratios as paleodietary indicators

Abstract

Calcium stable isotope ratios are hypothesized to vary as a function of trophic level. This premise raises the possibility of using calcium stable isotope ratios to study the dietary behaviors of fossil taxa and to test competing hypotheses on the adaptive origins of euprimates. To explore this concept, we measured the stable isotope composition of contemporary mammals in northern Borneo and northwestern Costa Rica, two communities with functional or phylogenetic relevance to primate origins. We found that bone collagen δ13C and δ15N values could differentiate trophic levels in each assemblage, a result that justifies the use of these systems to test the predicted inverse relationship between bioapatite δ13C and δ44Ca values. As expected, taxonomic carnivores (felids) showed a combination of high δ13C and low δ44Ca values; however, the δ44Ca values of other faunivores were indistinguishable from those of primary consumers. We suggest that the trophic insensitivity of most bioapatite δ44Ca values is attributable to the negligible calcium content of arthropod prey. Although the present results are inconclusive, the tandem analysis of δ44Ca and δ13C values in fossils continues to hold promise for informing paleodietary studies and we highlight this potential by drawing attention to the stable isotope composition of the Early Eocene primate Cantius.