

Geochemical Explorations of Trophic Interactions in the Past and Present: Beyond “Who’s Eating Whom”

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Since the 1960’s, researchers have used stable isotopes, particularly $\delta^{15}\text{N}$ of organic matter and biological tissues, to reconstruct trophic interactions (predatory interactions between consumers and their prey). The use of conventional stable isotope analysis to study trophic interactions can be limiting because of the complexity of isotopic fractionation within food webs, and some stable isotope systems (e.g., N) are rarely preserved in fossil material, hindering their use for reconstructing past food webs. Recent methods, such as $\delta^{15}\text{N}$ of specific amino acids, can help assign trophic position more accurately. Other newer methods, such as $\delta^{15}\text{N}$ of enamel-bound nitrogen and non-traditional isotopes (Ca, Zn and Mg) preserved enamel bioapatite, can be used on fossil material and hold the potential to push our understanding of food web dynamics deep into Earth’s past. As the field continues to advance, two areas of critical importance for future research are (1) quantification of geochemical variation at the base of the food chain (primary producers, plants and soils) and (2) physiological mechanisms of fractionation. This review on geochemical methods for trophic estimation will be presented in a chapter in the forthcoming 3rd edition of the Treatise on Geochemistry.