A new approach to measuring the elevation history of mountains using organic molecules.

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Estimates of the paleoelevation history of an orogen are critical to understanding the links and feedbacks between rock-uplift, erosion, and long-term climate. However, there are few ways of constraining paleotopography for regions with high temperature, abundant rainfall, and rapid rates of erosion. In addition, there are challenges to linking marine sedimentary archives with quantitative estimates of terrestrial topographic change. We present a new approach to quantifying changes in paleoelevation that is based on the geochemical signature of organic matter exported via the main river networks of an orogen. This new approach builds on fundamentals of stable isotope paleoaltimetry and is similar to approaches of quantifying catchment-integrated erosion using cosmogenic isotopes. Specifically, we utilize predictable patterns of precipitation and organic molecular biomarker stable isotopes to relate the hypsometry of organic matter in a catchment to the geochemical signal in exported organic carbon. We present data from two sites (the cold temperate White Mountains of New Hampshire, USA and the tropical, rapidly eroding landscape of Taiwan) to demonstrate this relationship between exported carbon geochemistry and catchment hypsometry and the validity of this approach.