The Cenozoic Evolution of Topography of the Patagonian Andes: An Organic Molecular Stable Isotope Perspective

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ABSTRACT

Orogenic processes can affect the transport, accumulation, and preservation of organic material in sedimentary basins. This process can drive significant carbon storage in tectonic basins, and ultimately the formation of terrestrial hydrocarbon reservoirs. At present, the feedbacks between tectonics, surface processes and the storage of carbon are poorly understood. A key uncertainty is the timescale of changes in topography. This is one of the most direct responses to surface uplift and has direct impact on the efficiency of erosion and carbon export from an orogen. The goal of my research is to quantify the spatial and temporal paleoelevation history of the Patagonian Andes through the Cenozoic. This study aims to answer the long-standing debate about the mechanism for southern Andean orogenic growth – is it continuous steady growth or punctuated growth with episodicity? To answer this question, I will analyze the leaf-wax biomarker hydrogen (δD) and carbon (δ13C) isotopes in organic-rich mudstones of the Eocene thru Miocene strata within the Magallanes foreland basin in southern Patagonia. The δD of leaf-wax biomarkers reflects the isotopic composition of precipitation during rainout across an orogen, and is dependent on temperature and elevation, while the δ13C reflects the type of vegetation in response to altitude and local climate. The hypothesis is that the punctuated growth of the mountain ranges will be reflected by a sharp decrease in δD and increase in δ13C due to increasing topographic elevation and aridity caused by the rain shadow effect. This study will help to constrain mechanism of topographic generation in response to the coupling of tectonics and erosion processes, and the consequent influences on the development of sedimentary basins.

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