Proof

CONTROL ID: 1196691

TITLE: Middle to late Miocene Plant Respiration Rates from the Southern Altiplano Indicate Increasing Aridity during Surface Uplift

PRESENTATION TYPE: Assigned by Committee (Oral or Poster)

CURRENT SECTION/FOCUS GROUP: Tectonophysics (T)

CURRENT SESSION: T52. Terrestrial Sedimentary Record of Cenozoic Topography, Paleoclimate and Paleoenvironments

AUTHORS (FIRST NAME, LAST NAME): Johanna Jin-Sook Smith[1], Carmala N. Garzione[1], David J Auerbach[2, 1], Bruce Macfadden[3], Darin Croft[4]

INSTITUTIONS (ALL): 1. Earth and Environmental Sciences, University of Rochester, Rochester, NY, United States.
2. Norwich University, Northfield, VT, United States.
3. University of Florida, Gainesville, FL, United States.
4. Anatomy, Case Western Reserve University, Cleveland, OH, United States.

SPONSOR NAME: Carmala Garzione

ABSTRACT BODY: The interactions between climate and tectonics have likely played an important role in shaping the central Andes, where extreme climate gradients exist today (e.g., Masek et al., 1994; Horton et al., 1999; Montgomery et al., 2001). However, the feedback between these processes is still not fully understood (e.g., Molnar and England, 1990), and some have argued that climate change has resulted in a false signal of elevation change in the region (Ehlers and Poulsen, 2009; Poulsen et. al., 2010). This study attempts to resolve this debate by examining the history of aridification of the southern Altiplano by using plant respiration rates as a proxy for aridity, and comparing this to the studies of surface uplift. Assuming all other factors are constant, plant respiration rates should decrease with increasing aridity (Cerling and Quade, 1993), and therefore this calculation provides an estimate of the relative amount of precipitation. Changes in the aridity of discrete portions of the Andean plateau help determine the local climate response to Andean surface uplift and allow us to tease out the effects of surface uplift versus global climate change on this region. Paleoelevation studies have indicated rapid surface uplift of ~1.6 km in the southern Altiplano from ~16 to 13 Ma (Smith et al., 2009) followed by ~2.5 km in the north between 10 and 6 Ma (Garzione et al., 2006; 2008; Ghosh et al., 2006). These different surface uplift histories should have coincided with distinct climate change events in the northern and southern Altiplano due to the development of a rain shadow associated with the rising Eastern Cordillera and Altiplano basin (currently between ~3.6 km and 4 km). This study calculates plant respiration rates in paleosols dating from ~16 to 8 Ma (i.e., the period of inferred surface uplift) in the southern Altiplano/Eastern Cordillera using the soil carbon isotope model of Quade et al. (2007), which is based on the relationship between the carbon isotopic values of soil CO2 (estimated from d13C of paleosol carbonates) and plant-respired CO2 (estimated from d13C of fossil teeth). Calculations show a decrease in plant respiration rates throughout the middle to late Miocene, which indicates increasing aridity in the southern Altiplano that is synchronous with surface uplift. This lends support to the argument that the observations of Miocene changes in the central Andes, such as surface temperature changes in the northern and southern Altiplano (Ghosh et al., 2006; Smith et al., 2009), are caused by surface uplift rather than global climate change due to the distinct timing of changes within each region. This paleoclimate evidence also supports the rapid uplift hypothesis by documenting the aridification that is expected to accompany the surface uplift in each area.

(No Image Selected)

(No Table Selected)

INDEX TERMS: [8100] TECTONOPHYSICS, [1000] GEOCHEMISTRY, [1637] GLOBAL CHANGE / Regional climate change.
