



The role of magmatism in the tectonic vs. climatic control on the Cenozoic evolution of the Earth's surface: a key to the “chicken or egg” conundrum?

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Much of the research on feedbacks between mountain building, erosion and climate changes over geological timescales stems from the suggestion that uplift of Tibet triggered the late-Cenozoic climate cooling and the inverse proposal that climate cooling was responsible for inferred increases in mountain elevation and erosion. If climate cooling may explain widespread observations of a post ~ 5 Ma increase in global sedimentation/erosion rates, weathering of fresh silicate minerals exposed at the surface through uplift and erosion consumes atmospheric CO_2 , implying that enhanced denudation should be the cause, rather than the effect, of climate cooling. Long-term proxies of past atmospheric CO_2 provide no clear evidence for the expected reduction in atmospheric CO_2 concentrations in the late-Cenozoic, which led several authors to question the apparent increase in sedimentation and erosion rates.

Until now, this debate has paid little to no attention to the possible role of magmatic activity. However, on timescales of millions of years, magmatism directly impacts global climate through emissions of CO_2 into the atmosphere and oceans, thereby buffering CO_2 consumption by silicate mineral weathering. In turn, climate, tectonic and erosional changes control the distribution of the surface water, ice and rock masses, which can all affect magmatism by modulating the production, transfer and eruption of magma and hence the emissions of greenhouse gasses.

In this talk, I will present and discuss examples of geological contexts and events where the links between surface processes and magmatism appear particularly relevant and revisit the debate about the tectonic vs. climate control on the evolution of the Earth's surface in the light of these links. The objective is to explore the potential crucial role of magmatism in the coupled climatic, tectonic and erosional history of the Earth and stimulate research in this novel direction.