UC **SANTA BARBARA**

Department of Earth Science

Speakers Club

WEBB 1100 • THURSDAY JAN 16th. • 2:00 PM

Recycling the Lower Crust via Density Foundering: Petrological and Numerical Constraints from a Collisional Orogen

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Geochronological and thermobarometric data in a collisional orogen (the Pamir) record the transport of crustal lithologies to mantle depths after an episode of slab breakoff. In order to investigate whether and how this transport corresponds to density foundering—the loss of lower crust and/or mantle lithosphere to the convecting mantle—I compare geological constraints in the form of pressure-temperature-time (P-T-t) paths from xenoliths to P-T-t paths derived from numerical models. Key petrological observations from xenoliths are: (1) an initial temperature increase in lower crustal xenoliths is followed by (2) a sharp increase in pressure as the lithosphere founders with continued heating. Lithospheric delamination, the peeling back of a dense layer of lower crust and lithospheric mantle, may explain the available P-T-t paths, but gravitational "drip" instabilities, though potentially necessary for the geometry of the problem, fall along a colder P-T path. Overall timescales are modulated by contraction rates, the composition of foundering material, and thicknesses of individual crustal layers. Foundering may have important consequences for the composition of the crust during continent-continent collision; I find that the positive feedback between contraction and densification leads to the loss of initially stable lower crust.

Controls on the preservation of Precambrian organic-walled microfossils

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Much of our understanding of early eukaryote diversity and paleoecology comes from the record of organic-walled microfossils in shale, yet the conditions controlling their preservation are not well understood. Given that nearly 80% of Proterozoic fossil-bearing successions are shale dominated, any bias introduced through this preservational pathway could greatly influence fossil trends.

It has been suggested that low concentrations of total organic carbon (TOC) and high concentrations of certain clay minerals (e.g. berthierine) are primary controls on the preservation of organic-walled microfossils. This idea stems from evidence that clay minerals can adsorb and deactivate degradative enzymes and that high levels of TOC interfere with this reaction. Although this idea has anecdotal support, it has never been tested. I first compared the presence and preservational quality of organic-walled microfossils to TOC concentrations from 345 shale samples that span late Paleoproterozoic to late Neoproterozoic time, and found that preservational quality decreases with increasing TOC content, and that shales that contain fossils have significantly lower TOC values than those that do not. To determine whether this relationship reflects the interactions of TOC with clays, clay mineral assemblage was compared to fossil preservational quality in 42 shale samples from late Mesoproterozoic to late Neoproterozoic time. Preliminary results show that clay mineralogy is not a strong predictor of preservational quality. Thus, although low TOC favors the preservation of fossils, this cannot be explained by interactions between clay minerals and TOC. Alternative explanations include changes in sedimentation rate or in the efficiency of organic matter recycling by microbes. These results suggest that future searches for microfossils should focus on low TOC shales and that variation in TOC content within successions and through time could introduce preservation bias into fossil diversity trends.