Detrital signal of early exhumation of the Central Ranges, Taiwan

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The Coastal Range contains the earliest sedimentary archive of active, mountain building in eastern Taiwan. The sediments were deposited in a collisional basin adjacent to the developing accretionary wedge to the west during the Plio-Pleistocene. In this study we combine low temperature fission track thermochronology and higher temperature U-Pb dating of detrital zircons to reveal the history of the region pre- and syn-exhumation.

The new provenance data show that the sediment was derived primarily from south-east China and is thermally unreset by the collision of the Philippine Sea Plate with the passive China Margin. This suggests that early exhumation rates of 5-7 mm/year, determined in previous studies, are overestimates. A requirement of the data in this study is for accelerated exhumation to be a recent feature initiated in the Late Pliocene. This is coincident with a regional hiatus in sedimentation that marks a period of relative quiescence between ~3-2 Ma prior to a change in regional tectonic forcing.

Paired $\delta^{44/40}$Ca, Mg/Ca and Sr/Ca in cultured *G. ruber*

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$\delta^{44/40}$Ca, Mg/Ca and Sr/Ca ratios were determined on a single species of cultured planktonic foraminifera (*G. ruber*) and the culturing solutions. The foraminifera were grown in seawater at (i) constant temperature but varying salinities of 32 to 44 ‰, (ii) constant oceanic salinity but varying temperatures of 18 to 30°C. In an additional culturing experiment, the carbonate system was manipulated so as to keep the total inorganic carbon constant but to alter the pH (and hence total alkalinity).

The $\delta^{44/40}$Ca value of cultured G. ruber shows a significant (R^2 =0.91, $p<0.02$) inverse linear correlation with salinity [$\delta^{44/40}$Ca (‰) = 1.27(± 0.36) - 0.016(± 0.009)*S]. Paired Mg/Ca and Sr/Ca both have negative linear correlations with $\delta^{44/40}$Ca (R^2 =0.84 and R^2 =0.94, respectively) in these salinity experiments, indicating a common control on all three proxies.

Ca isotopes have a nearly constant degree of fractionation between 21 and 27°C ($\delta^{44/40}$Ca ~ 0.77‰), but the degree of fractionation increases ($\delta^{44/40}$Ca < 0.77‰) at higher and lower temperatures. Mg/Ca shows 8% increase per °C. $\delta^{44/40}$Ca has no apparent correlation with Mg/Ca or Sr/Ca in the temperature experiments, but appears to reveal an optimum curve.

$\delta^{44/40}$Ca values of *G. ruber* have a weak dependence (with a slope of +0.0005 ± 0.0002 ‰/µM) on [CO_3^{2-}]. At [CO_3^{2-}] < 200 µM, Mg/Ca increases by ~30% per 0.1 unit decrease in pH.

The data can be explained by a model based on our understanding of the mechanisms of calcite formation in planktonic foraminifera.