Chemical complexity of the Kea Component preserved in West Maui lavas

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In order to characterize the chemical variability that defines the Kea component, the depleted compositional endmember in Hawaiian shield-stage magmas, we analyzed a 250m section of valley-exposed lavas and a 400m section of well cuttings from West Maui volcano, an extreme Kea-type volcano. The stratigraphic context of the samples allows us to evaluate temporal variability in the expression of the Kea component in the West Maui lavas during the late shield-building stage.

Hf, Pb, Nd and Sr isotope compositions of the West Maui lavas show a limited range, and the depleted compositions are consistent with a significant contribution from the Kea component. ε_{Hf} varies from +11.5 to +13.1, and decreases slightly towards the bottom of the section. Pb isotopes were analyzed by both TIMS and MC-ICP-MS. The higher-precision MC-ICP-MS analyses resolve trends in the Pb data that are not apparent in the TIMS analyses. $^{206}Pb/^{204}Pb$ ranges from 18.39 to 18.48, and does not correlate with ε_{Hf}. $^{87}Sr/^{86}Sr$ and ε_{Nd} range from 0.703368 to 0.703661 and +6.6 to +7.6, respectively. ε_{Hf} correlates with ε_{Nd}, but does not correlate with $^{87}Sr/^{86}Sr$.

The high resolution of the new data reveals that $^{87}Sr/^{86}Sr$ – $^{206}Pb/^{204}Pb$ variability in the West Maui samples defines two subparallel trends. These are orthogonal to the trend defined by all Hawaiian shield-stage lavas, and therefore are not the result of mixing between the Kea component and the Koolau component (the relatively enriched Hawaiian endmember). We instead attribute these trends to mixing between heterogeneities within the Kea component. The two trends may share a common radiogenic endmember, but require distinct endmembers at the less-radiogenic extreme. The linear nature of the trends also requires that mixing between the two less-radiogenic endmembers is limited or non-existent. The observed positive correlation of $^{87}Sr/^{86}Sr$ and $^{206}Pb/^{204}Pb$ is consistent with predicted compositions of aged, variably hydrothermally altered oceanic crust.

Coral reconstruction of abrupt tropical cooling 8,000 years ago

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Establishing the relative timing and magnitude of climate change in the tropics and high latitudes provides an important means for evaluating the role of the tropics in global climate change. The largest abrupt climate change in the Holocene occurred between 8,400 and 8,000 calendar years ago, when the temperature dropped by 4-8°C in central Greenland and 1.5-3°C around the North Atlantic region. However, little is known about the nature of the so-called ‘8.2 ka cold event’ in the tropics.

We drilled a sequence of well-preserved *Porites* corals within a rapidly uplifted paleo-reef in Alor, Indonesia, with ^{230}Th ages spanning 8,400 to 7,600 calendar years before present. The corals are positioned within the Western Pacific Warm Pool, which at present has the highest mean annual temperature on Earth. Measurements of coral Sr/Ca and $\delta^{18}O$ have yielded a semi-continuous record (310 years) showing that sea-surface temperatures were essentially the same as today from 8,400 to 7,600 years ago. However, both tracers show that this period of climatic stability is interrupted by an abrupt ~3°C cooling over a period of ~100 years, reaching a minimum 8,000 years ago.

The rapid cooling of ~0.3°C per decade in the Warm Pool 8,000 years ago is nearly synchronous with abrupt cooling in the North Atlantic region, as indicated by the sudden decrease in $\delta^{18}O$ values of ice from the GISP2 ice core. This finding supports the hypothesis that abrupt climate change at high latitudes can propagate rapidly to the tropics via atmospheric teleconnections. In the case of the 8.2 ka event, initial cooling at high latitudes could serve to enhance the equator-to-pole temperature gradient and strengthen meridional atmospheric circulation and tradewind velocity in the tropics. Stronger tradewinds would increase near-equatorial upwelling, providing an efficient means for cooling the tropical ocean surface. The results suggest that the tropical ocean-atmosphere could serve to propagate abrupt climate changes between the northern and southern hemispheres without a significant time lag.

We are in the process of making high-resolution measurements of coral Sr/Ca and $\delta^{18}O$ to determine if ocean-atmosphere coupling and ENSO perturbations remain fixed during such an altered climate state.