Hawaiian plume source: Isotopic constraints from Mauna Loa

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Significant heterogeneities have been documented in the Hawaiian mantle plume source, especially on the Loa trend. Mauna Loa itself, the largest Hawaiian volcano, had surprisingly few isotopic analyses. We carefully selected ~120 basalt samples for high-precision isotopic analyses (<200 ppm for Pb; <50 ppm for Hf, Nd and Sr) from the submarine southwest rift zone (up to ~500 ka), HSDP1, 2 (100-12 ka), radial vents (~47-0.148 ka), prehistoric (40-0.014 ka) and historical (1843-1984) Mauna Loa lavas. Our results show the presence of chemical heterogeneities at a range of scales in the plume source. About 10% of the analyzed lavas, all from the SW rift zone, including the Mile High-Section, do not define Pb-Pb lines and have high $^{208}Pb^*/^{206}Pb^*$, lower $^{87}Sr/^{86}Sr$, $^{143}Nd/^{144}Nd$ and $^{176}Hf/^{177}Hf$ and higher Nb/Y, La/Sm than the other lavas. These older (>400 ka) lavas define separate binary geochemical and isotope trends compared to younger lavas. Their characteristics are not as enriched as the Koolau Makapuu component (i.e. recycled oceanic crust and sediment component). This indicates the presence of yet another component in the source of Hawaiian basalts.

Older lavas from both Mauna Kea and Mauna Loa sample a more heterogeneous plume source (Loihi-like?) than younger shield lavas. Pb-Pb lines fan in opposite directions with age and in slope for younger, <100 ka, Mauna Loa and HSDP2 Mauna Kea basalts.

Our large-scale isotopic study of Mauna Loa shield basalts confirms clear differences with Kea-trend volcanoes. This is maintained throughout the ~1 myr activity of these volcanoes and extends back in time on all the Hawaiian Islands (to ~5 Ma). Our study shows the presence of long-lasting geochemical heterogeneities in the plume source that are reflected in the erupted basalts, at the scale of individual volcanoes. The Loa-trend source is more heterogeneous in all isotopic systems by ~1.5 that the Kea-trend source and, Loa-trend volcanoes systematically sample more enriched material, indicating an azimuthally zoned plume conduit.

Permian-Triassic carbon isotopic signature from pedogenic carbonate, Ordos basin, China: Implications for pCO_2 reconstructions

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The end-Permian mass extinction is closely associated with a global carbon cycle instability thought to have been caused by volcanic eruptions and associated contact metamorphism of coal and carbonate crustal rocks. The current knowledge base of this event has mainly been reconstructed from marine sedimentary proxy records. Carbon isotopic composition of pedogenic carbonate from terrestrial deposits is another proxy for evaluating carbon cycle evolution and, assuming formation in equilibrium with the atmosphere, one that can be used to reconstruct atmospheric pCO_2. Currently, terrestrial isotopic proxy data for the Permian-Triassic boundary are not sufficient for detailed modeling of the linked marine-terrestrial system response to carbon cycle fluctuations. The largely undeformed strata of the Ordos basin in north-central China include a robust, mostly conformable Upper Permian-Lower Triassic section bearing Calcic paleosols. The Permian-Triassic boundary in the eastern Ordos basin is defined lithologically as the contact of predominantly purplish mudstone and medium-bedded sandstone of the Upper Permian Shiqianfeng Formation with a thick-bedded red sandstone of the Lower Triassic Liujiagou Formation. Samples of pedogenic carbonate were collected across or near the Permian-Triassic boundary from 2 sections near the town of Wubu, Sha'anxi province, along with 2 additional sites near Hangcheng, Shanxi province. These samples were analyzed in the Alabama Stable Isotope Laboratory at the University of Alabama. Results from the Wubu area indicate high $\delta^{13}C$ values (~7-11‰ V-PDB) dominate the lower 70 m of the section; however approximately 30 m above the mapped Permian-Triassic boundary, $\delta^{13}C$ values exhibit a significant decrease to ~5-8‰ V-PDB. This decrease in $\delta^{13}C$ values results in a modeled increase in pCO_2 of ~1000 ppmV. However, results from localities further south (~200 km) show markedly lower $\delta^{13}C$ values of ~3-5‰ V-PDB for upper Permian and lower Triassic samples. The decrease in $\delta^{13}C$ values corresponds to an increase in abundance of lacustrine facies in the section. This suggests basin hydrology, controlled primarily by tectonic basin evolution, may have influenced the $\delta^{13}C$ composition of soil carbonate. The north-south Permian-Triassic outcrop belt of the Ordos basin holds a unique opportunity to test possible basinal controls on pedogenic carbonate isotopic composition.