

## Paleoenvironmental information from U-series measurements of pedogenic opal

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U-series isotopes are sensitive indicators of water-rock interaction. Variations in initial ( $^{234}\text{U}/^{238}\text{U}$ ) (activity ratios) in layered pedogenic deposits, such as opal and calcite pebble coatings, may contain information about relative changes in chemical weathering rates and moisture fluxes in the soil column. We hypothesize a link between regional climate fluctuations and the initial ( $^{234}\text{U}/^{238}\text{U}$ ) and  $^{230}\text{Th}$ -U ages of authigenic soil minerals. However, to explore this link requires an analytical technique with very high spatial resolution and a suitable target material.

Opal commonly occurs in soil carbonate horizons. The genesis and preservation of soil opal may also indicate certain environmental conditions. We examined opal concentrations found in soils developed on Quaternary shorelines of the Great Basin and on alluvial fans in the Mojave Desert, USA. We used the sensitive high-resolution ion microprobe reverse-geometry (SHRIMP-RG) to measure trace element and U-series variations of opal layers within soil carbonate. Opal occurs as 2-200  $\mu\text{m}$  thick layers throughout carbonate coatings formed in both carbonate and volcanic parent materials. Opal with 50 to 1000 ppm U adjacent to calcite with <1-2 ppm U, suggests that analytical techniques with spatial resolutions less than  $\sim 30 \mu\text{m}$  may bias measurements towards the values of the highly concentrated zones.

The opal ages range from 10-250 ka. Variations in initial ( $^{234}\text{U}/^{238}\text{U}$ ) and trace element concentrations correspond to glacial-interglacial transitions — elevated initial ( $^{234}\text{U}/^{238}\text{U}$ ) values occur during interglacial periods, and lower values occur during glacial periods. These oscillations reflect variations in weathering intensity and moisture flux and dust input,



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