Stable isotope ecology of Holocene carbonates from the Frazier Mountain paleoseismic site, southern California

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Frazier Mountain is an important paleoseismic site situated on the Big Bend of the San Andreas Fault, CA. In order to gain a more detailed understanding of the environmental history of this site, the stable isotopic composition of calcite nodules was analyzed. Nodules were collected at thirty-three sample sites from 15m^2 of trench wall (representing the top 3m of stratigraphy at Frazier Mountain). The nodules form layers throughout the finer sediments and are absent from the sandy layers. There is an increase in nodule size with depth. Nodules were microsampled at every half millimeter using a 0.5mm Foredom microdrill and the resulting powders analyzed for stable isotopic composition. $\delta^{18}O$ values ranged from -10.2 to -9.2‰ (V-PDB) (ave = -9.8‰, 1-σ = 0.24), $\delta^{13}C$ values ranged from -9.7 to -8.7‰ (ave = -9.3‰, 1-σ = 0.26), and both isotopes varied coherently across each nodule. More importantly, the average value of both $\delta^{18}O$ and $\delta^{13}C$ increases with depth, suggesting that the older nodules formed in a drier climate than the younger nodules, lending support to the idea that a paleoenvironmental signal can be determined from the Frazier nodules and perhaps used to correlate events between nearby paleoseismic sites. Thin section analysis of the calcite nodules shows euhedral, zoned, sparry calcite crystals. Coupled with the variation in isotopic values within individual nodules, these crystals indicate multiple calcite precipitation events, which suggests that the individual nodules record short term climate change whereas the change in the average $\delta^{18}O$ and $\delta^{13}C$ values through time can illustrate longer term climate shifts on the order of 100's of years.