Age and Geochemical Constraints on Formation of Fault-Related Late Quaternary Carbonate Veins from Southern Turkey

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Combined U-series dating and high-resolution geochemical analyses of co-seismic carbonate veins offer an invaluable opportunity to document young (<1 Ma) earthquake activity and for tracing origins of associated fluids. In this study, we analysed a total of 23 samples of fault-related carbonate veins and slickenfibered calcites collected from two separate SW–S-trending fault zones developed near Anamur and Gazipaşa areas in Southern Turkey.

Microtexturally the carbonate veins mainly comprise medium- to coarse-grained, columnar calcite crystals elongated along growth direction. U-series dating indicated episodic fault-related carbonate mineralization between 132 ± 2 and 5.6 ± 0.4 ka and between 530 ± 63 and 30.0 ± 2.1 ka in Anamur and Gazipaşa areas, respectively. Carbon and oxygen isotope compositions of carbonates from both Anamur ($\delta^{13}C$ = -12 to -6‰, $\delta^{18}O$ = -7 to -4‰; relative to V-PDB) and Gazipaşa ($\delta^{13}C$ = -12 to -7‰, $\delta^{18}O$ = -7 to -3‰) areas are almost identical, whereas Anamur samples (0.7074–0.7080) have slightly lower $^{87}Sr/^{86}Sr$ ratios compared to Gazipaşa samples (0.7081–0.7096). The $^{87}Sr/^{86}Sr$ values correlate well with that of modern and Cenozoic seawater (~0.709) and Permian limestone host rocks (~0.707). PAAS-normalized rare earth element-Yttrium patterns of most samples are characterized by negative Ce and positive Y anomalies, confirming a predominantly seawater source for calcite precipitating fluids.

Our acquired age and geochemical data not only has revealed young (<500 ka) seismic activity for these previously undocumented fault systems, but it also has implications for upper crustal fluid flow and palaeoclimatological conditions in the region.