

The Importance of Uranium-Series Dating For Investigation of the Late Quaternary Paleoseismicity: Çermik-Reşadiye Fissure-Ridge Travertine (Kelkit Segment of North Anatolian Fault System-TURKEY)

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Determination of the earthquake cyclicity along the active fault zones is of great importance to be able to understand the historical evolution of the tectonic regime. Calcite deposition along active fault systems occurs commonly as fracture filling by hypogenic fluids after sudden seismicity-induced CO₂ degassing. It is known that the long axes of the carbonate veins correspond either to locations of fault bouncing zones (relay ramps) or to strike-slip faulting. Both cases occur where fracture propagation is insufficient and at times earthquake fracturing ceases and dilation starts, due to the emergence of different stresses. These types of settings provide the ideal places for fluid migration during and after the earthquake fracturing, and thus for the vein networks. Such carbonate veins that are formed within the last 500 ka can be precisely dated by Uranium-series dating technique.

The Çermik-Reşadiye travertine is one of the important example of such deposits. It is ~NW-trending fissure-ridge type travertine and developed along the dilation fracture parallel to the compression linked to the main fault of the Kelkit Valley segment of the North Anatolian Fault System (NAFS). This suggests that the formation of travertine is controlled by activity along the main fault. Collected samples along the travertine ridge were analyzed by XRD-whole rock mineralogy and examined through thin section petrography. The sampled calcite veins were unaltered and not coated by secondary minerals. Coarsely crystalline samples consisting of 100% calcite were sent to the laboratories for dating analyses.

Obtained age data and resultant probability density curve suggested 6 periods of crustal deformation. These periods coincide with paleoseismic earthquakes (9 events) and regional historical earthquakes (5 events) that were recorded in the Kelkit Segment of NAFS. This indicates that the calcite vein formations along the Çermik fissure-ridge travertine are related to the earthquakes.

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