ABSTRACT

Calculating fault displacement rates, in-situ cosmogenic chlorine-36 concentrations of a limestone normal fault scarp, northern Israel

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To calculate the rates of the most recent displacements of a fault near Karmiel, northern Israel, we measured in-situ cosmogenic ^{36}Cl in rock samples extracted from the well preserved fault scarp surface. These isotope concentrations, considered in the context of an interpretive numerical model, indicate both the long-term exposure rate of the limestone due to normal fault displacement and the date that fault motion ended.

We sampled the 1 km long, NW-SE trending Nahef East fault scarp. The samples were collected along a ~10 m down-dip scarp transect. The planar fault surface dips 55°, resulting in a total vertical displacement of ~7 m. Sampling included: 1 sample from the upper fault block surface, 26 samples at consistent 30 cm down-dip intervals from the lower 9.6 meters, 2 replicate samples one meter laterally from the main sample profile, and 3 samples from the fault surface below the current base of the scarp. In addition, we have created a detailed map of the scarp topography and surveyed a series of thirty 50 to 200 m-long topographic cross sections oriented perpendicular to the scarp surface.

^{36}Cl concentrations range from 7.6×10^6 atoms ^{36}Cl (gm rock)$^{-1}$ at the top of the scarp, to 1.0 atoms ^{36}Cl (gm rock)$^{-1}$ at the base. These data, when interpreted with our model, indicate that faulting did not begin until less than 15,000 years ago. We have also calculated that the long-term erosion rate of the limestone surface is about 25 m My^{-1}. This is the first calculation of erosion rates for this area, and the first indication for Holocene faulting activity outside the Dead Sea Transform in northern Israel.