ABSTRACT

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

GRAN, Sara E., Geology Dept., Univ. of Vermont
MATMON, Ari, Inst. of Earth Sci., Hebrew University
BIERMAN, Paul R., Geology Dept., Univ. of Vermont
CAFFEY, Marc, CAMS, Lawrence Livermore National Laboratory

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 x 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.