Geophysical Research Abstracts
Vol. 16, EGU2014-8436, 2014
EGU General Assembly 2014

Identifying paleoseismic information from limestone normal faults with a handheld XRF

Ruben Fritzon (1,2), Arjen P Stroeven (1), Alasdair Skelton (3), Brad W Goodfellow (1), and Marc W Caffee (4)

(1) Stockholm University, Physical Geography and Quaternary Geology, Stockholm, Sweden (ruben.fritzon@natgeo.su.se), (2) Research School focusing on Natural Hazards, Stockholm University, Stockholm, Sweden, (3) Geological Sciences, Stockholm University, Stockholm, Sweden., (4) Physics, Purdue University, West Lafayette, IN, United States.

Predicting earthquakes would help immensely in saving human lives and protecting economic interest but a reliable method has not yet been found. When making risk assessments scientists continue to rely on paleoseismic studies. Determining a fast and cheap proxy for paleoseismicity is therefore of much interest. Surface exposure dating is an emergent method for paleoseismic studies of active normal fault scarps in the Mediterranean region. This method gives crucial paleoearthquake information such as timing and vertical slip along the fault but the analysis of cosmogenic nuclides is costly and the sampling is both complicated and time consuming.

In our study we employ an Olympus Innov-X DeltaTM handheld XRF to analyse the geochemistry of a scarp surface in order to determine the number and magnitude of slips along the fault. This method requires no drilling and it is possible to analyse the results at the fault scarp. Exposure dating is still required to yield the timeframe of the paleoearthquake record, but the number of sampling points may be significantly reduced since it would be possible to pin-point the sampling locations around suspected former soil horizons.

We have analysed 200 sample points with the handheld XRF from a 6.8 m section of the limestone normal fault scarp surface close to Sparta, southern Greece. Our profile is taken next to the Benedetti et al.[Geophysical Research Letters, 29, 8 (2002)] sampling site. Our results show significant variations in Yttrium concentration along the profile with a strong peak just below the present soil cover at the base of the section and then repeated peaks up along the transect on the subaerially exposed scarp surface. These Yttrium concentrations at the surface are correlated with Yttrium concentrations in the rock determined from drill cores taken every 10 cm from the same profile. The preliminary dataset appears to indicate a good correlation between the Yttrium concentrations and the earthquake events suggested by Benedetti et al.[Geophysical Research Letters, 29, 8 (2002)], although final assessment awaits further cosmogenic nuclide surface exposure dating. We tentatively propose that using a handheld XRF to determine the earthquake periodicity on limestone normal fault scarps offers a cost effective alternative to other methods.