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Morphotectonics on bedrock scarps on the Island of Crete, Greece

Thomas Wiatr (1), Klaus Reicherter (1), Tomas Fernandez-Steeger (2), and Ioannis Papanikolaou (3)

(1) RWTH Aachen University, Inst. Neotectonics and Natural Hazards, Aachen, Germany (t.wiatr@nug.rwth-aachen.de), (2) RWTH Aachen University, Department of Engineering Geology and Hydrogeology, Lochnerstr. 4-20, 52064 Aachen, Germany, (3) Laboratory of Mineralogy & Geology, Department of Sciences, Agricultural University of Athens, 75 Iera Odos Str., 11855 Athens, Greece

Crete is the biggest Greek Island with an area of $\sim$ 8300 km^2 and approx. 900 km coastline. The development of a multidirectional tectonic regime on the Mediterranean Island of Crete is interpreted as a result of the Hellenic subduction zone in the south and the westward extrusion of the Anatolian plate in the north. The Island is a horst structure in the Hellenic fore arc zone, which is also influenced by the roll back of the African subduction. Rapid uplift of $\sim$ 1.2 mm/yr (Meulenkamp et al., 1994) can be observed on the entire Island. The island of Crete depending on the influence of different tectonic blocks has been uplifted since the Middle Miocene from 1 up to 2 km. During the field campaign in spring 2010 five different continuous limestone escarpments of active normal faults were mapped and scanned with a terrestrial LiDAR (Light Detection and Ranging) in central Crete some of them exhibiting postglacial scarps. These faults can produce extensive surface faulting with maximum displacements up to 1 – 1.5 m and can generate earthquakes of $\sim$ M 6.5 and have slip-rates ranging from 0.5 up to 1.3 mm/yr (Caputo et al., 2010). We have scanned parts of the free face from the Asomatos fault, the Spili fault, the Giouchtas fault in the Heraklion basin, the Kasteli fault and the Fournafarango-Pirgos fault in the southern Messara basin. A complex pattern of normal faulting and possible active faults in different limestone formations have been studied, mostly appearing in the geotectonic units of Tripolis and Pindos. The analysed fault planes have different scarp heights, degradations stages, orientations (NNE-SSW, W-E), and geomorphological characteristics. The natural fault planes of the scarp surfaces host important indices for identifying the relative slip age such as:

1) Change of roughness from bottom to top
2) Different weathering stages
3) Variable tectonic geomorphology and postglacial features

For estimating the slip per event along the bedrock scarp and where possible (e.g. postglacial scarp) an estimate regarding the slip rate of the individual faults we used the backscattered signal of the laser beam, the geomorphological geometry and the fault plane conditions. The range of the point to point scale is between 2 mm and several centimetres. We were able to reconstruct the scarp surface in 3D with by using a high resolution digital elevation model (HRDEM). The backscattered signal provides information on the surface conditions such as lichen growth, vegetation and biokarstic.

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Caputo, R., Catalano, S., Monaco, C., Romagnoli, G., Tortorici, G., Tortorici, L., 2010. Active faulting on the island of Crete (Greece). Geophys. J. Int. 183, 111-126. doi: 10.1111/j.1365-246X.2010.04749.x.