Weak sub-fault shear zones revealed by earthquake activity on the slowly-deforming Kenchreai Fault (central Greece)

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Abstract

Many regions of rapid and well-studied deformation are flanked by zones with much lower strain rates. Although often overlooked, these slowly deforming regions, and their relationship to adjacent high strain rate areas, can give crucial insights into the mechanical properties and behaviour of the brittle and ductile parts of the lithosphere. Of particular importance are the controls on the location and rate of interseismic strain accumulation, with implications for both understanding the underlying cause of lateral variations in strain rates, and also for assessing the resulting earthquake hazard. This presentation will address these issues by using geodesy, high-resolution elevation models, and palaeoseismic trenching to examine the low slip rate faults (previously assumed to be inactive) to the south of the rapidly-extending Gulf of Corinth in central Greece.

The Kenchreai Fault, to the south of the normal faults that accommodate the great majority of the extension across the Gulf of Corinth, has ruptured in the Holocene. Along with the adjacent Pisia and Heraion Faults (which ruptured in 1981), our results indicate the presence of closely-spaced and parallel normal faults that are simultaneously active, but at different rates. Such a configuration allows us to address one of the major questions in understanding the earthquake cycle, specifically what controls the distribution of interseismic strain accumulation? Our results imply that the interseismic loading and subsequent earthquakes on these faults are governed by weak shear zones in the underlying ductile crust. In addition, the identification of significant earthquake slip on a fault that does not dominate the late Quaternary geomorphology or vertical coastal motions in the region provides an important lesson in earthquake hazard assessment.

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