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Seismic source characterization for low slip-rate faults near Krško, Slovenia

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Recent tectonic geomorphic and geochronological investigations provide an improved understanding of tectonic activity in the Krško Basin, Slovenia, and are addressing challenges associated with low slip-rate faults. The Krško basin is structurally defined by the post-Miocene Krško Syncline, which has formed in response to generally N-S convergence of the Adriatic Microplate and the European Plate. Shortening of the basin is also recognized in contemporary data, including reverse and transpressional earthquake focal mechanisms and regional geodetic data. There are numerous faults mapped and inferred in the basin and surrounding hills; but their activity is not well constrained. While strain rates are low in the region, there are well documented historical and instrumental earthquakes in the region, the largest of which is less than Mw 6.

Neogene and Quaternary deformation is archived in the landscape's topography; however, three aspects of the geologic setting and the pre-existing state of knowledge make accurate assessment of deformation problematic: [1] presumably low slip rates (<0.1 mm/a), [2] sparse data to provide geochronologic constraints (biased towards the latest Pleistocene and Holocene), and [3] lack of readily-identifiable outcropping and/or near-surface evidence of deformed Pliocene-Quaternary sediments. In addition, Quaternary climate-driven geomorphic processes impose a strong imprint on the landscape. Evidence for Quaternary tilting and discrete Neogene faulting is corroborated by geological mapping, with numerous faults identified within Neogene bedrock, but in most areas the faulted bedrock is unconformably overlain by undeformed, latest Holocene sediments. These factors have historically hampered the development of robust spatial and temporal constraints on discrete faulting and pose considerable challenges to determining rates of regional deformation.

To improve spatial and temporal constraints on tectonic deformation we have applied tectonic geomorphic and geochonometric methods to assess the timing, rates, and spatial patterns of regional deformation. Our analyses are based on high resolution topographic datasets (lidar and structure from motion), a suite of geochronometers (OSL, pIR-IRSL, 26Al/10Be, and AMS 14C) to target a range of timescales throughout the Pliocene-Quaternary, multiple geophysical methods, and paleoseismic trenching. The new data improve our ability to disentangle the climate signal from the tectonic signal in the landscape and to develop a robust seismic source characterization model for a probabilistic seismic hazard analysis in the Krško Basin.