Active Tectonics of the Alps-Dinarides junction

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The northward motion and rotation of the Adriatic Plate leads to crustal deformation in the Southern Alps and in the Dinarides. Many aspects of the active tectonics in that area have not been properly understood, for example the distribution and localization of strain, the paleoseismic history of the largest faults, the seismic sources for large historical earthquakes, and the landscape record of active faulting. In the framework of SPP2017, we worked in the Southern Alps-Dinarides transition area, encompassing W Slovenia, NE Italy, and S Austria (Fig. 1). We used tectonic geomorphology studies on high-resolution digital elevation models, satellite imagery, field mapping, near-surface geophysics, paleoseismology, and Quaternary dating techniques to understand the pattern of Late Quaternary tectonics. Our results how that in Slovenia, deformation is distributed across a system of major NW-SE striking right-lateral strike slip faults in a more than 60 km-wide zone (Grützner et al., 2021). Many smaller, <15 km long faults show postglacial activity, too. In general, the deformation is widely distributed. In Italy, most of the deformation is accommodated by thrusting at the South Alpine orogenic front. Several thrust faults have stepped out into the Friulian Plain, where they are often blind (Viscolani et al., 2020). Although historical earthquakes with magnitudes larger than M6 occurred in the interior of the mountain chain, instrumental seismicity here is low. There is only very poor geological evidence of fault activity because sedimentation, high erosion rates, and anthropogenic modification dominate the present-day landscape and outpace almost any tectonic signal. In addition, glacial processes have erased most potential evidence for Late Quaternary active tectonics (Diercks et al., 2021, 2022, in press). The situation is similar in Austria, where geological evidence of active faulting is sparse, despite a record of strong historical earthquakes. New dating results from both deformed and undisturbed geomorphic markers allow us to place constraints on the maximum amount of deformation that is accommodated in southern Austria and on fault activity in Slovenia. Our latest results on seismically-triggered mass movements show that the 1348 Earthquake, one of the strongest historical events in the entire Alps, has likely occurred on the Fella-Sava Fault.

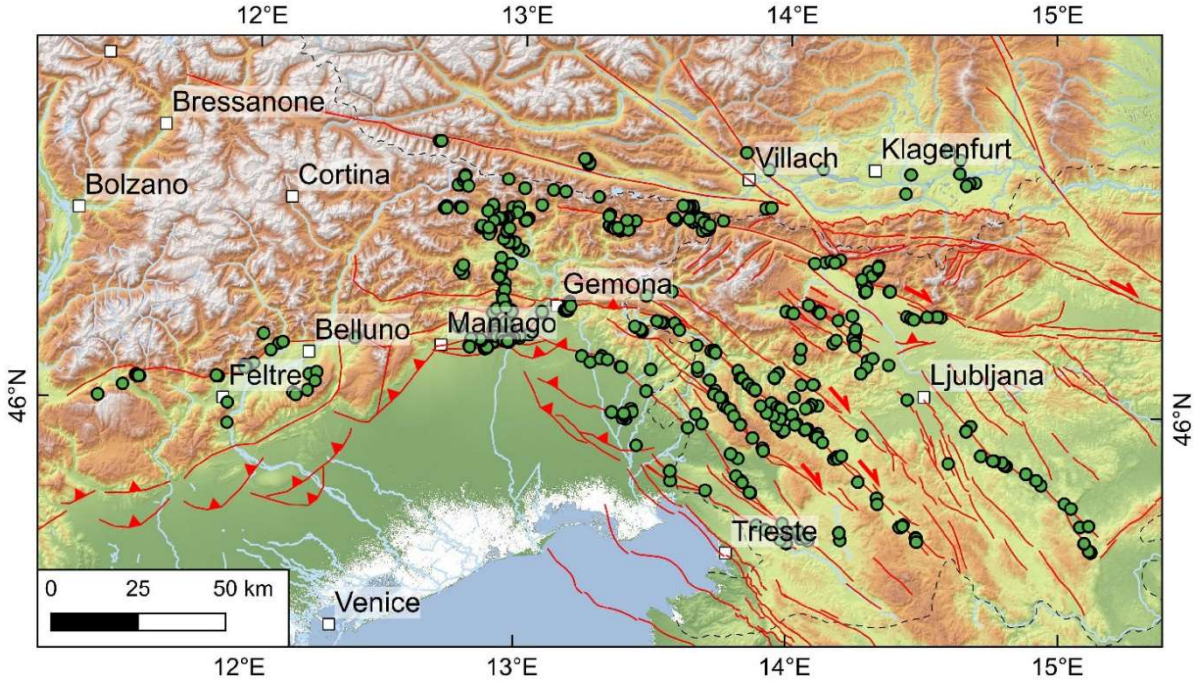

Figure 1: Active faults (red lines) in the Eastern Southern Alps-Dinarides junction compiled from the literature and own mapping, and our field work sites 2017-2023 (green dots).

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