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# Multi-Disciplinary Investigation of Active Strike-Slip Fault Propagation in the Julian Alps: The Ravne Fault, NW Slovenia

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The structural geology of the transition zone between the Southern Alps and Dinaride chain is complex. There is a gradual eastward change in structural style from south directed thrusting in the Italian Alps to oblique and predominately dextral strike-slip deformation in the Dinaric region. These patterns are generally due to continued NNE directed indentation of the Adria plate into southeastern Europe since the Eocene, and the curved shape of that indentor.

The Ravne Fault is a right-lateral, right-stepping sub-vertical NW-SE striking fault that runs through the Slovenian part of the Southern Alps (Julian Alps). In overstepping zones between en echelon segments, sub-km-scale releasing bends are well expressed as topographically low areas within an overall mountainous landscape. The stepover zones also represent geometric barriers, which inhibit fault linkage and growth and are likely areas of past earthquake activity, based on the degree of rock damage and alteration observed there. The fault is best exposed around the Tolminka spring area, whereas exposure decreases along its northwest continuation towards the Bovec Basin. In 1998 and 2004, two medium sized shallow earthquakes (Ml=5.6 and 5.1 respectively) occurred along the Ravne Fault zone causing loss of property and life, and significant local landsliding. According to new data on epicenter locations for the two main shocks and aftershocks, the Ravne Fault is propagating in a northwest direction towards the area of its poorest ground expression. A change in the general orientation of the aftershock cluster can be observed for the two seismological events. For the 1998 event, the aftershocks are distributed in a clear NW-SE direction, whereas the 2004 aftershock cluster displays more of a N-W striking orientation, indicating a

change in the overall orientation of the growing fault zone. Preliminary focal mechanisms for the two main events suggest that dextral strike slip movements predominate, however the aftershock events accommodated oblique thrust movements at the northwest and southeast ends of the fault.

The Ravne Fault is an important case study of how a strike-slip fault propagates through heterogeneous crust and mountainous terrain within a diffuse transpressional plate boundary zone. In this presentation, we show how different geological and seismological methods including detailed structural field mapping and DEM and orthophoto image analyses can be used to better understand processes of fault growth and linkage. Combining these results with paleostress analyses of microtectonic kinematic data, regional geodetic data, and other geomorphological analysis allows us to document the regional stress regime responsible for ongoing dextral transpressional deformation in the Julian Alps. Our detailed studies of Ravne Fault segmentation, propagation, and earthquake activity provide a basis for predicting future fault behaviour. Recent activity on the Ravne Fault may be a good analog for the evolutionary development of other sub-parallel and important dextral strike-slip fault systems in NW Slovenia.