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"Deep Alpine Valleys" and their implications on active Alpine tectonics

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The temporal evolution and formation of Alpine mountain range topography in response to tectonics and changing climate during the youngest geological history is one of the current challenges of Alpine geology. Processes governing the Quaternary evolution of Alpine-type landscapes include active deformation leading to faulting, surface uplift and/or local subsidence, fluvial/glacial erosion, and the response of erosion/sedimentation to vertical motions and changing glacial/interglacial conditions. The rationale of "Deep Alpine Valleys" is to use Quaternary sedimentary archives of valleys from the inside of mountain ranges, which record both climatic changes and young deformation in order to assess these processes and their mutual dependencies.

This trailer to the session "Deep Alpine Valleys" focuses on the implications of such valleys on active Alpine tectonics. Recent GPS data indicates 2 - 3 mm/yr of N-S Adria-Eurasia convergence (Grenerczy et al., 2005), which is compensated by distributed deformation in the Eastern Alps. Seismicity patterns, orientations of nodal planes of focal solutions, geomorphologic data and geodetic measurements show that shortening presently is compensated by a combination of crustal thickening and large-scale folding in the central part of the orogen, south-directed backthrusting in the Southern Alps, and eastward lateral extrusion out of the collision zone. The absence of thrust-related seismicity along the northern margin of the Eastern Alps and correlations of Quaternary terraces and landforms along rivers crossing the northern floor thrusts of the Eastern Alps apparently exclude active thrusting along the northern floor thrust of the orogen.

Additional geological data, however, suggest that Lower/Middle Pleistocene kinematics were distinct from the present-day. Data includes along-river sections, which indi-

cate that thrusting along the northern floor thrusts did occur prior to about 400 ky; and structural evidence showing that the extrusion-related faults of the Vienna Basin fault system were not active prior to the Middle Pleistocene. It is concluded that kinematics of Alpine shortening changed during the Pleistocene from older foreland-directed thrusting (and non-active lateral extrusion?) to present crustal thickening in the center of the orogen, back-thrusting in the Southern Alps and eastward extrusion.

Details of the suspected kinematic complexity, the timing of deformations as well as quantifications of the relative importance of fold-thrusting versus lateral extrusion so far remain unsolved making “Deep Alpine Valleys” attractive for tectonic reconstructions. The approach utilizes the fact that the large extrusion-related active faults are all located in major Alpine valleys (Inntal, Salzach-Ennstal, Mölltal, Lavanttal, Mur-Mürztal, Vienna Basin), and that most faults host Quaternary intra-mountain basins, which formed at releasing bends / negative flower structures, or as infill after deep glacial erosion. These archives together with tectonic geomorphology techniques probably provide the only opportunity for dating and quantifying Quaternary deformation within the Alpine orogen.