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The Inn valley - does geological history help to understand present-day tectonic processes?

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Geologists often use an actualistic approach and compare present day processes with processes of the geological past for a better understanding. However, in many geologic settings rates of geologic processes are slow, difficult to measure and hard to understand. In these cases it might be useful to extrapolate geologic processes from the geologic past to the present and take advantage of the much longer interval of observation.

The Inn valley, Tyrol, Austria is one of these areas. It follows a major transcurrent fault which was active during the Oligocene and Miocene. Present-day seismicity is scattered broadly around the valley and suggests that tectonic processes are active, but field data and focal solutions from earthquakes are controversial. Therefore we suggest to compare Neogene deformation in the greater vicinity of the Inn valley to available information about active tectonics.

Paleogene-Neogene tectonic history in the Inn valley area was influenced by tectonic processes active on different scales: 1) On the orogen scale NNW-directed thrusting caused transport of upper plate units onto the lower plate and into the Alpine foreland basin. Structures related to this process are observed mainly in the Alpine foreland basin, where major thrusting ends during sedimentation of the Upper Freshwater Molasse (OSM) in the Pannonian. This process is directly related to plate convergence. 2) Subsidiary to this process is the formation of the Alpine foreland basin. Oligocene deposits preserved in the Inn valley are part of the foreland basin and indicate a depositional wedge top, which probably was also influenced by NS-extension due to tangential strain caused by flexure of the lower plate. 3) Another secondary process was lateral escape of Central Alpine units toward the east and related sinistral shearing

across ENE-striking faults (e.g. the Inntal fault) which delimited eastward movement to the north. A NNE-oriented secondary stress field was imposed on neighbouring rocks.

Detailed investigation of the brittle deformation in Triassic to Quaternary rocks revealed that there is no unequivocal sequence of brittle deformations. On a local scale, NNW- and NNE- directed orientations of the maximum horizontal stress are alternating, and NS-directed normal faulting was repeatedly active.