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Neotectonics in the central and western Swiss Alps: two examples of active faults

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The area of the central and western Swiss Alps was chosen for examination of post-glacial lineaments because it has the highest uplift rates of Switzerland (1.5 mm/a near Brig, Schlatter & Marti 2002) and shows a concentration of earthquake occurrence over the last 30 years (e.g. Baer et al. 2001). Aerial photographs from the whole area were searched for linear features, which could be of gravitational or tectonic origin. A number of lineaments were visited in the field to study their origin.

We found scarce but positive evidence for neotectonic fault movements. Two of them are presented in the following: The first example is located NE of Martigny/VS. A NNE-SSW striking fault shows evidence for recent activation as Holocene debris screes and Quaternary deposits are displaced across the fault. Our observations rule out gravitational reactivation of the fault. A 2.5m long and 1.5m deep trench was dug across the fault. The strongly in situ weathered rock shows two scarps with a normal down throw of the NW-block of at least 1m. Soil horizons are inclined towards the scarps indicating recent movement along the fault. No suitable material for dating the movement has been found.

The second example is located at the Gemmi Pass. A prominent NW-SE striking fault has been investigated. Because of the displacement of Quaternary sediments, which overlay the fault in places, the fault is judged to have been reactivated in postglacial times. The position of the fault at the bottom of a large high-lying valley speaks against gravitational reactivation. A 3-D georadar survey was carried out in an attempt to find evidence for recent movement of this fault.

The lineament transects a small (˜60m x 30m) post-glacial, sediment-filled depression

which was targeted for the 3-D georadar survey. Stacked radar data were acquired on a dense (18cm x 18cm) grid over the depression using 200 MHz antennas for the purpose of detecting disrupted sediments attributable to recent movement on the fault. Processing included topographic migration, to collapse diffractions and reposition dipping reflectors while accounting for topographic gradients within the survey area. A semblance-based migration scheme was also applied to detect the origins of edge diffractions resulting from displacements within the sedimentary layers. A linear feature is detected from time slices within the migrated data volume indicating a potential fault strand. Further processing will include trace attribute analysis which may better resolve fault strands within the sediments. In addition, prominent sedimentary reflections will be picked throughout the 3-D data volume to map layer truncations and aid with interpretation.

References: Baer, M. et al., 2001, Eclogae geol. Helv, 94-2, 253-264. Schlatter, A. & Marti, U., 2002, Vermessung, Photogrammetrie, Kulturtechnik, 1, 13-17.