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Structurally controlled 'teleconnection' of large-scale mass wasting (Eastern Alps)

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In the Brenner Pass area (Eastern Alps) , closely ahead of the most northward outlier ('nose') of the Southern-Alpine continental indenter, abundant deep-seated gravitational slope deformations and a cluster of five post-glacial rockslides are present.

The indenter of roughly triangular shape formed during Neogene collision of the Southern-Alpine basement with the Eastern-Alpine nappe stack. Compression by the indenter activated a N-S striking, roughly W-E extensional fault northward of the nose of the indenter (Brenner-normal fault; BNF), and lengthened the Eastern-Alpine edifice along a set of major strike-slip faults. These fault zones display high seismicity, and are the preferred locus of catastrophic rapid slope failures (rockslides, rock avalanches) and deep-seated gravitational slope deformations.

The seismotectonic stress field, earthquake activity, and structural data all indicate that the South-Alpine indenter still – or again – exerts compression; in consequence, the northward adjacent Eastern Alps are subject mainly to extension and strike-slip.

For the rockslides in the Brenner Pass area, and for the deep-seated gravitational slope deformations, the fault zones combined with high seismic activity predispose massive slope failures.

Structural data and earthquakes mainly record ∼W-E extension within an Eastern Alpine basement block (Oetztal-Stubai basement complex) in the hangingwall of the BNF.

In the Northern Calcareous Alps NW of the Oetztal-Stubai basement complex, dextral faults provide defacement scars for large rockfalls and rockslides. Towards the West, these dextral faults merge into a NNW-SSE striking sinistral fault zone that, in turn, displays high seismic activity and is the locus of another rockslide cluster (Fern Pass cluster; Prager et al., 2008).

By its kinematics dictated by the South-Alpine indenter, the relatively rigid Oetztal-Stubai basement block relays faulting and associated mass-wasting over a N-S distance of more than 60 kilometers – from the Brenner Pass area located along the crestline of the Alps to mount Zugspitze near the northern fringe of the Northern Calcareous Alps. Major fault zones and intercalated rigid blocks thus can 'teleconnect' zones of preferred mass-wasting over large lateral distances in orogens.

Reference:
Prager, C., Zangerl, C., Patzelt, G., Brandner, R., 2008. Age distribution of fossil landslides in the Tyrol (Austria) and its surrounding areas. Natural Hazards and Earth System Science 8, 377-407.