



Jurassic normal faulting controls deformation style during Alpine Orogeny, external Northern Calcareous Alps, Tyrol, Austria

Patrick Oswald*, Hugo Ortner

Institute of Geology, University of Innsbruck, Austria; *patrick.oswald@student.uibk.ac.at

The Northern Calcareous Alps (NCA) are a typical thin-skinned fold-and-thrust belt consisting of permo-mesozoic sediments derived from the northern margin of the Neotethys. During Alpine Orogeny, the sediments are sheared off their basement, transported over several hundreds of km and stacked in nappes. Fold architecture is mainly controlled by thick rigid carbonates, whereas low-strength stratigraphic horizons floor and core folds and are used as preferred detachment horizons. Contemporaneous thrusting and isoclinal buckle folding lead to often observed peculiarities, such as folds truncated on top or at the base, a carpet of slices of hanging-wall units immediately below a thrust and a patchy distribution of synorogenic sediments.

In the western part of the NCA, structural field work and interpretation of seismic sections were carried out at one of the major thrusts in the NCA, the Lechtal thrust, separating the lowermost and paleo-geographically most external unit of the NCA, the Allgäu nappe, from the next higher Lechtal nappe. The Lechtal thrust was active in Aptian/Albian times with a minimum displacement of 30km and mainly strikes NE-SW due to Top-NW thrusting. According to a general eastern dip of the NCA thrust belt in the study area, the Allgäu nappe appears in a greater extent to the west in (half)windows beneath the upper Lechtal nappe. Hence, deformation style and kinematics can be studied in good outcrop conditions.

In the Allgäu nappe, a normal-fault scarp can be mapped immediately below the Lechtal-thrust. Along this irregularly concave shaped normal-fault, Upper-Triassic lagoonal carbonates in the footwall are truncated obliquely to bedding by Lower-Jurassic syntectonic deep-marine marly limestones in the hangingwall, which show extensional Top-SW soft-sediment deformation. Hence the activity of normal-faulting is indirectly datable to Lower-Jurassic times, which correlates well with spreading of the Alpine Tethys oceanic system.

During Alpine shortening, this pre-existing Lower-Jurassic fault-scarp acts as a distinct morphological irregularity in the footwall and therefore also as a spatial irregularity in resistance for the approaching Lechtal nappe. As a result, the Lechtal thrust is forced to retrace this pre-existing morphological irregularity and is offset about 1,5km dextrally in NW direction. This offset produces non-noteworthy deformation in the footwall except of semi-ductile bending and rotation of structures immediately below the thrust. The hanging wall, however, is buttressed against the fault block in the footwall, resulting in the formation of two duplexes with drag folds accompanied by a NW-SE trending dextral tear fault.