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Thrusts and unconformities in tectonic maps: The Trattberg thrust and the Trattberg fault system

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We present a case study on the Jurassic-Cretaceous tectonic evolution in the Trattberg area (Salzburg, Austria), that shows the value of age-classified faults and unconformities in tectonic maps. Tectonic mapping in combination with 3D-modelling makes it possible to understand the evolution and geometric relationships of structures in this area.

The Trattberg thrust (TT) has been known for a long time (Plöchinger, 1953). The TT is located close to the southern margin of the Osterhorn unit ("Osterhorntirolikum"). The thrust has a length of 13 km, and a maximum offset of about 1,5 km measured parallel to the thrust faults. The central part of the fault features three fault splays. The TT superimposes Rhaetian shallow water limestones on Upper Jurassic deep water limestones. S-C-fabrics and occasional slickensides indicate reverse dip-slip motion. A coarse-grained syntectonic breccia was deposited at fault tips and on uplifted hanging wall units, the "Oberalmer Basiskonglomerat". These syntectonic deposits overlie a locally angular Upper Jurassic unconformity.

Upper Jurassic deep water limestones in the footwall of the TT form a footwall syncline containing growth strata. The growth wedge allows us to date activity of the TT to the Tithonian to Berriasian, however cross section geometry and differences in Jurassic facies indicate an onset of shortening and uplift during the Oxfordian.

In map view the TT merges with steep E-W faults, that display transpressive to transtensive sinistral strike-slip. In cross section, the southern block is downthrown across these faults, and normal offset is in the same range as reverse offset across the TT. In most sections, reverse faults dip shallower than normal faults. Only at Trattberg, the reverse fault was reactivated. In their footwall, the steep faults exhume the Dachstein Limestone of the Trattberg. Limestones of the Schrambach-Fm. unconformably overlie Dachstein and Upper Rhaetian limestones, in several places with a coarse basal breccia. The unconformity at the base has a Late Jurassic age in the hanging wall, but an Early Cretaceous age in the footwall of the steep faults.

Fault geometry and cross-cutting relationships on brittle faults suggest that the faults on the southern margin of the Osterhorn unit belong to one fault system, the Trattberg fault system. Strain partitioning caused separation of dip-slip thrusting/normal faulting across the northern, shallow dipping faults, and strike-slip movements across the steeper faults. E-W faults of Jurassic-Early Cretaceous age were suggested by previous authors and are part of an intracontinental transform fault system related to opening of the Penninic oceans (Sieberer & Ortner, 2022). Probably, the Trattberg fault system localized where the Triassic sedimentary cover was thin (relative to the Osterhorn unit) due to its position on the flank of a Triassic-age salt ridge (Fernandez et al., 2024). Salt inflation during Late Jurassic shortening and posterior collapse might help explain the succession of kinematic events and recycling of structures.

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