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Structural complexities at and around the Triassic–Jurassic GSSP at Kuhjoch, Northern Calcareous Alps, Austria

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Abstract

The Global Stratotype Section and Point (GSSP) for the Triassic–Jurassic system boundary is located in the Lechtal nappe of the Northern Calcareous Alps. It was defined on the overturned limb of the Karwendel syncline in two subparallel artificial trenches on either side of the Kuhjoch pass (Kuhjoch West and East). The system boundary was drawn at the first occurrence of Psiloceras spelae, regarded as the oldest Jurassic ammonite species, in the clays of the Tiefengraben Member of the Kendlbach Formation. To supplement the large amounts of existing stratigraphical, paleontological and geochemical data, the authors carried out field work at the site in August 2012. They constructed a geological profile across the GSSP, describing the deformation history and conditions in the area, and clarifying structural geological phenomena at the site.

In the homogeneous clays of the GSSP, two intersecting surface sets were identified, with the steeper set tentatively established as bedding, the flatter one as axial planar foliation of the large scale overturned fold.

The contact between the Triassic Kössen Limestone and the stratigraphically overlying clays of the Tiefengraben Member is tectonic in both trenches: a steep, roughly east-west trending fault separates the two formations. Fault striations and slickenfibres indicate a reverse setting. Based on the outcrop pattern, the minimum offset on the fault is 6-8 metres. In the footwall, a continuous sequence from the Kössen Limestone to the basalmost Tiefengraben Member could be excavated. In the hanging wall, only the Tiefengraben Member and underlying younger formations were identified, the Kössen Formation being eroded. Thus there is no complete and continuous stratigraphic section across the Tiefengraben Member in the Kuhjoch trenches.

The trace of the fault is shifted between the eastern and western trenches by ~ 5 metres: a north-south trending fault with apparent dextral offset separates the two sections.

Based on our transect across the Karwendel syncline, the steep, overturned, almost isoclinal fold was deformed in a semiductile manner. This is indicated by outcrop scale asymmetric, mainly upright, isoclinal folds in many places in the vicinity of the GSSP, and disjunctive axial planar foliation in the marl and clay intervals.

Brittle deformational features are also abundant. The majority of observed faults clearly postdate folding/tilting. The geometry of some of them, however, becomes kinematically more valid if the structures were rotated back to bedding being horizontal. This means that these faults are more

likely to be pre-tilt (i.e. pre-folding) structures. This scenario is also thought to be valid for the fault at the GSSP: the steep reverse fault would become a simple normal fault if the now overturned bedding was rotated to the pre-folding geometry.

Based on these findings, the Kuhjoch GSSP does not fulfil the requirement for a GSSP to be free of tectonic disturbances near the boundary level.