Slump Structures and Paleoslope: Case Study in Pelagic Limestones of the Ammergau Formation, Ampelsbach Gorge, Northern Calcareous Alps, Tyrol, Austria

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One method to estimate paleoslope orientation is to study and interpret slump folds. Existing methods for analysis of slump structures require collection of orientation data on a scale similar to the size of the slump body. Given the nature of a typical outcrop, which is usually 2D and some ten meters long, this requirement will not be met, and the sample will be incomplete, giving unreliable information. In the outcrop described here, typically 1–4 slump fold axis measurements per slumped bed could be made, which is not sufficient to interpret slump dynamics. Only the assumption of unchanged slope throughout deposition of the Ammergau Formation and the treatment of all collected data together allows an interpretation.

The Upper Jurassic to Lower Cretaceous Ammergau Formation of the Ampelsbach gorge in the Achensee region has many slumps. They are typically restricted to single or multiple beds between undisturbed beds. Some slumps are erosionally truncated or sealed at the top, whereas the base shows gradual increase in deformation. Slump folds have typically axial surfaces parallel or slightly inclined to bedding and fold style of most folds is similar, only few parallel folds were observed. Facing of folds is not systematic. Type 3 fold interferences are more common than type 2 fold interferences. In the latter case, the refolded fold is of similar type, whereas the overprinting fold is of parallel type. Lineations on folded bedding planes are parallel to hinges of similar folds. Tensional structures, i. e. listric normal faults and boudins are abundant, but are not observed together with folds. Axes of similar style slump folds cluster about an E–W direction, hinges of parallel folds trend N–S. Neither slump folds nor normal faults do indicate a preferred direction of slump movement. However, total thickness of the Ammergau Formation increases to the west from 80 m in the studied section to 600 m 10 km to the SW (NAGEL et al., 1976), giving an independent estimate of paleoslope orientation. Therefore we interpret a westdirected slump movement.

Various aspects of slump sheet kinematics can be described by

1. a dislocation model (FARRELL, 1984) and
2. a shear zone model (ORTNER, 2007).

The first model describes orientation of fold axes on the scale of the slump as a function of the maximum offset across the basal glide plane relative to its size. It neglects the effects of large simple shear strain during transport, which leads to a downslope re-orientation of foldaxes, change of fold style from parallel to similar and rotation of axial planes of folds toward parallelity with bedding, and formation of stretching lineations. Therefore we suggest (also) to use a shear zone model when interpreting slump deposits.

References

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ORTNER, H. (2007): Styles of soft-sediment deformation on top of a growing fold system in the Gosau Group at Muttekopf, Northern Calcareous Alps, Austria: Slumping versus tectonic deformation. – Sed. Geol., 196, 99–118, Amsterdam.