Deformation of a mountain-sized olistolith: Schwarzer Berg, Northern Calcareous Alps of Salzburg

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Passive and active continental margins are sites of emplacement of huge slides and olistoliths. In most cases, some kind of tectonic process leads to mobilization of large blocks of the sedimentary succession. If these continental margins are involved in an orogeny at a later stage, it may be difficult to distinguish very large slides from nappes. We studied deformation at the base of the Schwarzer Berg olistolith that has a thickness of 1.5 km and several km length and width. It consists of Triassic limestones and dolomites, and a discontinuous carpet of evaporitic shales and cellular dolomites (Permian Haselgebirge) at the base. It was emplaced into Jurassic pelagic siliceous shales of the Lower Juvavic Lammer zone of the Northern Calcareous Alps south of Salzburg. Cross sections of the olistolith demonstrate that the basal carpet is flat, but an internal anticlinal structure exists within the olistolith on top. Both limbs are truncated at the level of the carpet. The basal contact of the olistolith to the Jurassic pelagic siliceous shales is characterized by the absence of major and pervasive macroscopic deformation features. It is an irregular, wavy surface. Right below the contact in the Jurassic siliceous shales cm-scale verging folds occur. In a calcareous layer 50 cm below the contact, bookshelf structures are found, in another layer 80 cm below the contact brecciated clasts occur. The kinematic indicators allow to deduce a transport direction towards the east. Locally, the lower viscous sediments are injected into the higher viscous dolomite of the olistholith. This interface resembles a mullion-type structure. The cusps are up to m-scale and filled with the Jurassic shales where the olistolith rests on the Jurassic strata. In addition, there are also cusps at contacts to Permian Haselgebirge shales in several m-scale that follow pre-existing striated faults within the dolomite. On the microscopic scale, cataclastic deformation is observed in the Triassic dolomites at the base of the olistolith, and in the uppermost calcareous layer of the Jurassic, but not in the Jurassic deposits below. There, deformation features are almost absent corresponding to the field observation. The structural inventory can be related to three different stages of structural evolution: The km-scale antiformal structure resembles the geometry of a turtle anticline that might have developed during (1) breakaway of the olistolith. The absence of pervasive deformation at the base of such a large olistolith points to (2) transport of the olistolith on a layer of overpressured fluid, or a Haselgebirge salt pillow. In the first case, fluid pressure must have been high enough to support the olistolith. The existence of asymmetric mullion-like structures documents simple shear and traction at the base of the olistolith. This requires fluid pressure release and (3) grounding of the olistolith, associated with formation of mullions, folds and bookshelf structures. Final emplacement of the olistolith on Jurassic sediments requires a topography at the sea floor, which could have been formed by late Jurassic thrusting that has been observed at Trattberg N of Schwarzer Berg.