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The deformation pattern of subducting seamount: insights from the structural evolution of the Late Cretaceous Durkan Complex in the North Makran domain (Makran Accretionary Prism, SE Iran)

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The occurrence of topographic relief along the subducting plate is thought to play a significant role in controlling the architecture and the deformation processes of subduction complexes Seamounts and seamounts chain represent topographic reliefs of the seafloor whose ultimate fate is the interaction with subduction complexes at convergent plate boundaries. Geophysical data (e.g., von Huene & Lallemand, 1990) and numerical modeling (e.g., Ruh et al., 2016) demonstrate that subducting seamounts contribute to modify the frontal part of the subduction complexes controlling the morphology of the frontal wedge, the fore-arc subsidence, the deformation and stress pattern, the triggering of tectonic erosion, as well as the migration and localization of the basal décollement. Complementary data with respect to geophysics and numerical modeling dataset can be derived from structural investigations on seamounts accreted in ancient accretionary prism or within collisional belts.

Here, we present the results of a multiscale (from map- to micro-scale) structural study of the western Durkan Complex in the Makran Accretionary Prism (SE Iran) that has been recently interpreted as including fragments of Late Cretaceous seamounts with the aim to shed light on the mechanism of accretion of seamount materials and the factors controlling the localization and propagation of the basal décollement. The results from the Durkan Complex indicate a polyphase deformation history characterized by three main deformative phases (D1, D2, and D3), likely occurred from the Late Cretaceous to the Miocene-Pliocene (?). The D1 is characterized by sub-isoclinal to close folds associated to an axial plane foliation and shear zone, and likely represents the underplating of seamount fragments at shallow to intermediate levels of the Makran accretionary prism. The D1 shear zones are preferentially composed of volcaniclastic rocks derived from successions representing seamount slope and cap. The D2 deformation stage is characterized by open to close folds with sub-horizontal axial plane and likely developed during the progressive exhumation up to shallow structural levels of previously accreted seamount fragments. The D1 and D2 structures are unconformably sealed by a late Paleocene – Eocene

siliciclastic succession that is, in turn, deformed by W-verging thrust faults typical of the D3 phase. This phase likely testifies for a Miocene (?) -Pliocene (?) tectonic rework of the accreted seamount fragments with the activation of out-of sequence thrusts.

In conclusion, our findings indicate that seamounts are deformed within subduction complexes during the underplating and subsequent exhumation at shallower structural levels. As a general rule, the stratigraphic architecture of the subducting seamount, in particular the occurrence of thick volcaniclastic successions, likely controls the position of the basal décollement of the prism during the underplating phase.

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