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What controls the reactivation or preservation of distal ocean-continent transitions: the example of the Err-Platta nappes, SE Switzerland

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Studies in the Alps suggest that remnants of former Ocean-Continent Transitions (OCT) can be preserved, even in internal parts of mountain belts. In the past, these units have been erroneously interpreted as either mélanges related to subduction channels or polyphase penetrative Alpine deformation. Good examples have been described from the eclogitic Piemonte units in the Western Alps and in Corsica [Beltrando et al., 2014], leading to the question of what may have controlled the preservation of these structures. In our study we used the example of the Err-Platta nappes that expose remnants of the OCT of the former Alpine Tethys. The aim of our presentation is to: 1) define the characteristic features of an OCT across a fossil magma-poor rifted margin, and 2) show the control of the rift-inherited structures during the subsequent reactivation of the OCT.

The characteristics of OCTs at magma-poor rifted margins are the juxtaposition of serpentinized mantle and crustal rocks and pre-rift sediments limited by brittle extensional detachment faults sealed by syn- and post-tectonic sediments locally associated with magmatic rocks. Thus, in contrast to proximal margins, where lithologies are continuous layer cakes, OCTs are characterized by non-continuous layers and isolated blocks. To identify extensional detachment faults in mountain belts, different fingerprints can be found such as fault rocks (gouges and cataclasites) that bear a mantle derived fluid signature, or the occurrence of massive breccias that contain clasts of the underlying exhumed basement.

Using field examples, we will show how Alpine structures selectively reactivated some inherited structures of the OCT, while others remained undeformed and were preserved in the nappe stack. How far the complex morphology, fault architecture and rheology of OCTs control the reactivation is still unclear, however, it appears that serpentinization fronts, or former extensional detachment faults may have played a key role during the reactivation of the margin. This study allows us to reconsider “mélange zone” described in many collisional orogens, and to test, using diagnostic criteria and field observations, if they could represent former OCTs.

Beltrando et al. Earth Science Reviews (2014)