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3D architecture, importance of inheritance and structural evolution of an extensional detachment system related to crustal thinning and exhumation: example of the Err detachment (SE Switzerland)

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While extensional detachment systems linked to post-orogenic or oceanic settings have been described from many places, examples linked to hyper-extension and formation of magma-poor margins remain rare. Here we describe one of the best-exposed examples worldwide, the Err detachment system that is exposed over 300 km2 in the Err nappe in SE Switzerland.
Based on a detailed mapping of the Err detachment systems, we discuss its 3D architecture, the role of structural and compositional inheritance in controlling the architecture and structural evolution of this detachment system. We show that the actually describe Err detachment system can be defined by different faults that developed in-sequence. The sequential evolution of these faults allows interpreting the detachment system by the rolling hinge model. However, the occurrence of Permian basins resulting in a strong pre-structuration of the upper crust, and, the occurrence of evaporates in the Triassic pre-rift sequence strongly controlled the geometry of the detachment system. From the existing observations it remains unclear how and where the detachment fault rooted at depth.
The overall observations made in the Err nappe allow to describe how extensional detachment systems can explain the final rift evolution preceding mantle exhumation and shape the edges of continental wedges in distal margins. While these questions are difficult to answer at present-day margins due to the lack of drill hole data, the access to a well-exposed field analogue can provide important insights and enable to find some answers to these questions. One of the remaining questions is how these field observations can be up-scaled and used to interpret extensional detachment systems. This remains a key problem in particular in the seismic interpretation of hyper-extended domains.