Geophysical Research Abstracts
Vol. 19, EGU2017-7667, 2017
EGU General Assembly 2017

Polyphase tectono-magmatic and fluid history related to mantle exhumation in an ultra-distal rift domain: example of the fossil Platta domain, SE Switzerland

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Despite the fact that many studies have investigated mantle exhumation at magma-poor rifted margins, there are still numerous questions concerning the 3D architecture, magmatic, fluid and thermal evolution of these ultra-distal domains that remain unexplained. Indeed, it has been observed in seismic data from ultra-distal magma-poor rifted margins that top basement is heavily structured and complex, however, the processes controlling the morpho-tectonic and magmatic evolution of these domains remain unknown. The aim of this study is to describe the 3D top basement morphology of an exhumed mantle domain, exposed over 200 km2 in the fossil Platta domain in SE Switzerland, and to define the timing and processes controlling its evolution. The examined Platta nappe corresponds to a remnant of the former ultra-distal Adriatic margin of the Alpine Tethys. The rift-structures are relatively well preserved due to the weak Alpine tectonic and metamorphic overprint during the emplacement in the Alpine nappe stack.
Detailed mapping of parts of the Platta nappe enabled us to document the top basement architecture of an exhumed mantle domain and to investigate its link to later, rift/oceanic structures, magmatic additions and fluids. Our observations show a polyphase and/or complex: 1) deformation history associated with mantle exhumation along low-angle exhumation faults overprinted by later high-angle normal faults, 2) top basement morphology capped by magmato-sedimentary rocks, 3) tectono-magmatic evolution that includes gabbros, emplaced at deeper levels and subsequently exhumed and overlain by younger extrusive magmatic additions, and 4) fluid history including serpentinization, calcification, hydrothermal vent, rodingitization and spilitization affecting exhumed mantle and associated magmatic rocks.
The overall observations provide important information on the temporal and spatial evolution of the tectonic, magmatic and fluid systems controlling the formation of ultra-distal magma-poor rifted margins as well as the processes controlling lithospheric breakup. In this context, our field observations can help to better understand the tectono-magmatic processes associated to these, not yet drilled domains that may form in young, narrow rifted margins (e.g. Red Sea, Gulf of Aden) or may represent the Ocean-Continent Transition in more mature, magma-poor Atlantic type systems.