# Serpentinization in hyperextended rifted margins: possible implication for restricted basins

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Serpentinization during mantle exhumation in magma-poor rifted margins can extend over a width of hundreds of km and reach down to 5–6 km. Although these observations are mainly possible in the Iberia margin where a set of ODP/ DSDP and geophysical data are available, the remnants of hyperextended domains preserved in orogens can be used to investigate the detailed relationships between tectonic evolution, serpentinization, and fluid-rock interactions in mantle, crustal and sedimentary rocks.

In order to investigate these relationships, we use field observation and structural/ microstructural analysis, petrological, and geochemical data from the remnant of magma-poor rifted systems preserved in the Alps and the West Pyrenees. Through the integration of these data with refraction data from Iberia and petrophysical data (density and Vp) from serpentinites, we make a simple quantification of the amount of fluids stored in the mantle as well as the mass of elements lost during serpentinization.

Our structural/microstructural studies show that basement rocks are affected strongly by fluid circulation along extensional detachment faults as evidenced by quartz and calcite veins, and syn-kinematic phyllosilicates along fault rocks. The geochemical analysis points to enrichment of elements with mantle affinity (e.g., Ni, Cr and V) in the detachment fault and the overlying sediments. The petrological and geochemical analyses on mantle rocks point to major losses of elements that in part are incorporated in the fault rocks and the sediments, but also contributed to enrich the seawater. Refraction and petrophysical data allowed us to estimate the amount of seawater stored in the mantle and to quantify the mass of elements lost per km3 of serpentinized mantle. If one applies these results to the central segment of the South Atlantic, where evidence of mantle exhumation are observed in seismic data, the results suggest that a large amount of Si, Mg, and Ca may be released during mantle exhumation.

We conclude: (1) a high volume of seawater can be stored in the mantle, (2) mantle-reacted fluids, formed by serpentinization, can migrate over tens of km along detachment faults towards the sedimentary basins in hyperextended domains, and (3) a large mass of Si, Mg and Ca can be transported from the crust/mantle in the overlying sediments and/or seawater. If these processes occur in restricted basins, such as the proto-South Atlantic at Aptian times, they can provide the elements necessary for the carbonate sedimentation and diagenesis observed in the pre-salt and may have implications for the petroleum system.

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