Geophysical Research Abstracts
Vol. 15, EGU2013-7003, 2013
EGU General Assembly 2013

Fluid history in hyper-extended rifted margins: Examples from the fossil Alpine and western Pyrenean rift systems and the present-day Iberia rifted continental margin.

Victor Hugo Pinto (1,2), Gianreto Manatschal (1), Anne Marie Karpoff (1), Emmanuel Masini (1), Damien Lemarchand (1), Nicholas Hayman (3), Rudolph Trow (4), and Adriano Viana (2)

(1) Université de Strasbourg-CNRS, IPGS, EOST, Strasbourg, France (vpinto@unistra.fr), (2) Petrobras, (3) University of Texas, (4) Universidade Federal do Rio de Janeiro

The evolution of deep-water, magma-poor rifted margins is intimately linked with complex and polyphase fault structures. These structures, known as detachment faults, are responsible for extreme crustal thinning and mantle exhumation. During the evolution of detachment faults fluid-rock interaction plays an important role, changing the chemical and physical properties of rocks. These processes likely have major implications for the strain localization and structural evolution of the margin. The change in rock chemistry and rheology is best indicated by the breakdown of feldspars and olivine into clay and serpentine minerals and the pervasive cementation and precipitation of quartz along the fault zones.

Although the chemical and mineral reactions are well known, it is still unclear to what extent these reactions lead to changes in the overall rheology of the extending lithosphere and how they can affect the thermal evolution of the hyper-extended rifted margins. In order to answer to these questions it is important to understand the origin, timing, pathways and composition of the fluids generated during rifting. Are fluids solely of marine origin or do they have a metamorphic- or mantle-derived component? Can we determine the range of temperature and consequently at what depth these fluids are formed? And can we constrain the age of their migration? These questions can be addressed in the well-known hyper-extended rift systems such as the Alpine Tethys margins exposed in the Alps, the Mauléon basin in the Western Pyrenees and the Deep Iberia margin drilled and seismically imaged offshore Portugal. All of these rift settings show evidence for detachment systems associated with hyper-extension and mantle exhumation.

The aim of this ongoing study is to characterize the fluid signature in hyper-extended domain in magma-poor rifted margins. Including different sites with different degrees of compressional and metamorphic overprint enables us to compare results and to define the general importance of fluid systems in the development of hyper-extended rifts systems.

The first results show that in all three geological settings fluid percolation can be recognized in fault rocks linked to the detachment systems. Evidence for the presence of fluids comes from the analyses of hydration reactions in fault zones. In the Alps the major and trace elements show a gain in elements typical from mantle rocks (Mg, Ni, Cu, Co, V). In the Pyrenees, microstructural studies show that detachment faulting crossed a range of crustal depths providing constraints on the depths of fluid migration. Future analyses will focus on additional major and trace elements and isotopic ratios (Sr and B) of hydrated rocks recovered from these hyper-extended domains, which will be linked with the temporal and spatial evolution of the major detachment structures.