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Can we understand the Alps if we ignore the structure of deep rifted margins?

G.Manatschal(1)

(1) CGS-EOST, 1 rue Blessig, F-67084 Strasbourg, France

More then a century ago, Alpine geologists started to understand that mountains are the descendents of seas. With the discovery of plate tectonics, the “sea” became an “ocean”, the “mountains” an “orogen” and new terms and concepts helped to clarify and unify the way to explain the Alps. In more recent years, geophysical methods combined with existing geological data sets enabled to get a larger scale view of the Alps. However, despite the probably most dense data set acquired from a collisional orogen in the world, some key questions are still not answered, such as the number of oceans, the along strike correlations of paleogeographic domains or the structure of internal parts of the orogen. A possible explanation is that the structure of the former rifted margins is not considered in most of the interpretations. Although it is common knowledge that collisional orogens follows the formation, and consequently overprint the structure, of rifted margins, ignoring the particular structure of deep margins can result in odd and inconsistent interpretations of the Alpine orogen.

In the last two decades, geophysical data and drilling results from the Iberia-Newfoundland conjugate margins together with direct observations from the Alps provided compelling evidence for a complex and highly asymmetric architecture of deep margins which is supported by different lithological (velocity), magmatic, and thermal structures of the two conjugate margins. The results show that within the Ocean Continent Transition (OCT) thinned continental and oceanic crusts are separated by a 40 to 170 km wide zone of exhumed continental mantle. The OCT shows a complex basement topography including peridotite highs and extensional allochthons of continental origin, tens of kilometres wide and up to 2 km thick. Thus, the OCT in a non-volcanic margin cannot be considered as a simple sharp contact between continental and oceanic crusts.

In my presentation, I will illustrate, using the example of the distal margins exposed in the Alps, how these new observations may change previous interpretations of the tectonic evolution and the structure of internal parts of the Alps. More particularly I will address the problem concerning the interpretation of oceanic domains and will scrutinize some of the concepts that were used to define paleogeographic domains in the Alps. The aim of the presentation is to show that the inherited structures derived from the rifting phase are important and need to be considered in order to understand the evolution and ultimately the architecture of the Alpine orogen.