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Large-scale pattern of mantle evolution through rifting in hyper-extended margins

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New ideas and concepts have been developed to understand and be able to give a simplified large-scale view of the evolution of the mantle lithosphere in hyper-extended magma-poor rifted margins based on the ancient Alpine Tethys rifted margin. In contrast to the classical assumption assuming a simple, isotropic mantle lithosphere, these new models integrate observations from exposed and drilled mantle rocks and propose that the mantle lithosphere evolved and was modified during an extensional cycle from post-orogenic collapse through several periods of rifting to embryonic oceanic (ultra-) slow seafloor spreading. But it is, at present, unclear how far these ideas can be generalized at Atlantic type rifted margins.

In our presentation, we review the available mantle data from dredged samples in the North Atlantic and from ophiolite massifs and xenoliths in preserved and reactivated passive margins i.e. the Alpine Tethys, the Pyrenean domain, and the Dinarides and Hellenides. We revisit the available terminology concerning mantle massifs and xenoliths and compile the available data to identify different mantle domains. We define chemical and petrological characteristics of mantle domains based on clinopyroxene and spinel compositions and compile them on present-day and paleo-geographic maps of Western Europe. Finally we link the observed distribution of mantle domains to the post-Variscan extensional cycle and link domains to processes related to the late post-Variscan extension, the rift evolution and refertilization associated to hyper-extension and the development of embryonic oceanic domains.