Breaking of the continental lithosphere: a mantle perspective

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Résumé

Previous studies from the Western Iberia magma-poor rifted margin enabled to describe the evolution of the mantle lithosphere during rifting based on the study of dredged and drilles magmatic and mantle rocks. These data, with those from the fossile Alpine Tethys and the present day Australia-Antarctica margins (Ballay et al., in prep), enabled to distinguish mantle types and propose models for the tectono-magmatic evolution of rift systems going to breakup. However, key questions remain such as how, when, where and how much magma is produced; how and when does magma focus and how is it extracted; and how do magmatic and extensional processes interact during rifting and breakup. Answering to these questions is a prerequisite to understand lithospheric breakup and the formation of a new plate boundary, which is among the least understood plate tectonic processes at present.
The current PhD thesis is a part of the ANR project FirstMove (2022-2025), which aims at understanding and characterizing tectonic and magmatic processes occurring at magma-poor rifted margins and their evolution to steady state seafloor spreading. This study will focus on the Northwestern and Western Iberia margins, including drilled and dive-recovered samples from the Galicia Bank (Galinaute I and II), and drilled samples from the Iberia abyssal plain (ODP Legs 103, 149, 173, 210). Bulk rock, in situ chemical and isotopic analysis of ultramafic rocks will be used to constrain mantle dynamics during final rifting and breakup along the southern North Atlantic margins. In particular, the major and trace element concentrations of primary minerals like olivine, pyroxenes and spinel will provide constrains of the conditions of mantle exhumation and nature and emplacement processes of first magma (e.g., thermo-barometry and speedometry data) along the Iberia margin.
Here, we present a compilation of existing data with new analyses of pyroxenes and spinel compositions from mantle rocks dredged from the Northwestern Iberia margin. Our approach combines micro-X-ray fluorescence mapping, in-situ majored trace element concentrations of minerals from ultramafic rocks, various geo-thermo-barometers and pyroxene speedometer. These preliminary results are used to identify mantle domains mantle-melt reactions and mantle exhumation celerity during rifting and breakup.

Mots-Clés: Iberia rifted margin, mantle, melt interaction, refertilization, peridotites

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