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THE MANTLE RIDGE OF THE GALICIA PASSIVE MARGIN: GEOCHEMICAL EVIDENCES FOR THE DENUDATION OF A PIECE OF THE LITHOSPHERIC MANTLE DURING OCEANISATION

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ABSTRACT

The northern part of the Iberian continental passive margin is characterised by the presence of a ridge made of mantellic and magmatic rocks. This ridge, roughly parallel to the margin and continuous over several hundred kilometres, was emplaced at the end of the major rifting event that preceded North-Atlantic ocean opening. Petrological and geochemical studies on mantle rocks, whose results are presented here, are essential to characterise mantle affinity and processes that have affected this part of the mantle during or before continental break-up. In this work we would like to answer some questions like: Does this mantle correspond to the upwelling of the upper asthenospheric mantle at the end of the rifting event or rather correspond to the denudation of lithospheric mantle that was beneath the American-Iberian continent before oceanisation? Does the mantellic and magmatic ridge represent the first North-Atlantic oceanic lithosphere?

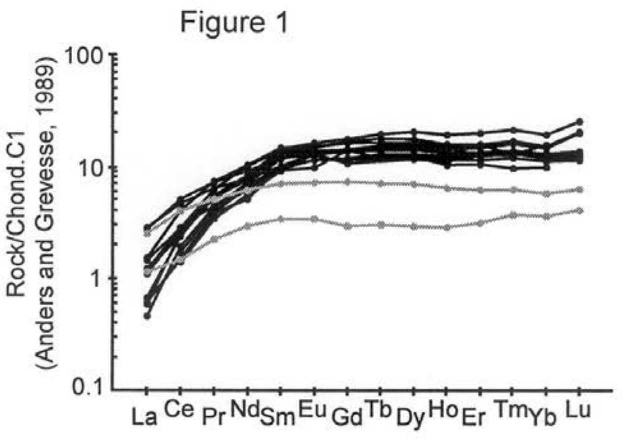
The studied peridotites were sampled by submersible on the northwest part of the Galicia bank during the Galinaute II campaign (Boillot et al., 1995). As all samples are weathered, we have only performed analyses on fresh minerals. All peridotites have common mantle assemblage (Ol+Opx+Cpx+spinel) but according to microscopic observations and geochemical results we have defined three different types of peridotites.

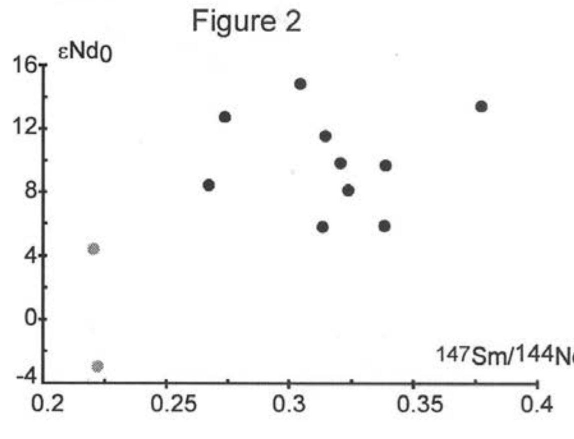
The first type is characterised by aluminous spinel (Cr* < 0.2) and relatively abundant Cpx which is rather rich in Na and Ti, poor in Cr but depleted in light REE compared to middle and heavy REE (Fig. 1). ε_{Nd} values of Cpx are scattered and range from +5.8 to +14.9 (Fig. 2).

The second type is characterised by refractory spinels (Cr* > 0.2) and rare Cpx which is poorer in Na and Ti, richer in Cr, and have rather flat REE patterns, but, strikingly, lower middle and heavy REE contents compared to type 1 Cpx. Type 2 Cpx has also the lowest observed ε_{Nd} values (-2.9 and +4.4.

The third type of peridotite is rather different: it is characterised by a strong high-temperature strain, by the occurrence of scattered pargasitic amphiboles and dioritic dykelets made of pargasite and plagioclase, and by the presence of plagioclase rim around spinel. Dioritic dykelets are contemporaneous with the rifting high-temperature strain of the host mantle (Féraud et al., 1988). Amphibole in these dykelets shows rather homogeneous geochemical features: +5.6 and +5.8 ε_{Nd} values and REE contents about one hundred times chondrite, with middle REE maxima and La_N/Sm_N ratios < 1. Scattered amphibole in peridotites shows the same kind of REE patterns but variable REE contents ranging from 5 to 80 the chondrite composition.

From all these results, the first point to note is that the Galicia mantle ridge has been locally influenced by fluid circulation (type 3 peridotites), which was channelled inside active simple shear zones during rifting; moreover, the fluid associated with strain have probably favoured partial recrys-





● Type 1 CPX ● Type 2 CPX

tallisation of the mantle from spinel to plagioclase facies. Type 1 and 2 peridotites probably give us more information on mantle affinity before oceanic opening, the most important fact being their contrasted ε_{Nd} values. In this geodynamical context of passive rifting we can't explain the lowest ε_{Nd} values by metasomatism of the asthenospheric mantle reservoir by enriched fluids during the rifting or oceanisation. Moreover, the ε_{Nd} values calculated at rifting time are always so different that we can't explain the present isotopic values by different degrees of partial melting and so, different Sm/Nd time integrated evolution of an initially homogeneous asthenospheric mantle. Therefore, geochemical features of the Galicia ridge samples indicate that the mantle was already heterogeneous before rifting and probably represents a part of a sub-continental lithospheric mantle. To conclude, we can say that the Galicia mantle ridge is neither an asthenospheric diapir mantle emplaced during the rifting event, nor the mantellic part of the first North-Atlantic oceanic lithosphere, but likely is a piece of the lithospheric mantle that was beneath the American-Iberian continent before North-Atlantic opening. The Galicia mantle shows geochemical heterogeneities similar to what is known in many orogenic lherzolite massifs (Beni-Bousera, Ronda, Pyrénées, etc.) but these heterogeneities have probably been amplified during the rifting processes.

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