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OIB/seamount recycling as an alternative process for E-MORB genesis

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The area of the Fifteen-Twenty fracture zone of the mid-Atlantic ridge is characterized by an increasing enrichment of the lava compositions from north to south through the fracture zone. MORB enrichment was readily attributed to a ridge/hotspot interaction and in absence of identified neighboring hotspot, to more questionable ones (e.g. incipient plume or plume activity residue). More recently, the existence of enriched MORB away from any identifiable hotspot was attributed to different origins (i.e. recycled oceanic crust and/or enriched mantle after subduction metasomatism). Within this frame, we present here a new set of geochemical analyses of major and trace elements and Sr, Nd and Pb isotopes on samples collected by submersible on both intersections of the 15°20'N fracture zone with the spreading axis of the Mid-Atlantic Ridge. Results show that the geochemical enrichment observed with a different intensity on both sides of the fracture zone is linked to the 14°N topographic and geochemical anomaly. Our modeling results show that both trace element and isotopic compositions are consistent with a binary mixing between the regional depleted MORB mantle source and a recycled OIB/seamount, as previously proposed to explain the observed enrichment at 14°N (Hémond et al., 2006). This model can also explain other enriched MORB from the 18°-20°S region of the Central Indian Ridge, illustrating that it does not represent an isolated and local process. Based on our results and on the DMM isotopic evolution, the age of the recycled OIB/seamount is estimated to be less than ~250 Ma, suggesting a recycling within the upper mantle. Considering the large number of ocean islands and seamounts on the ocean floor, their recycling into the upper mantle may be a significant alternative process to produce enriched MORB.