

# Mantle re-melting in an intra-transform ridge domain at the Doldrums Megatransform (Atlantic 7-8°N)

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Located at 7-8°N in the Equatorial Atlantic, the Doldrums Megatransform (MTS) is a 110 km-wide multi-fault transform system characterized by four 'intra-transform' ridge segments (ITR) bounded by five active transforms<sup>1</sup>. The medial ITRs are substantially deeper than the peripheral rift segments, and thus the central rift valleys may represent pull-apart basins opened by a dextral strike-slip fault overstep. To evaluate this hypothesis and to unravel changes the conditions of mantle melting at the ITRs, we determined major, trace element and Sr-Nd-Hf-Pb isotope measurements of on-axis lavas erupted in the entire fracture zone. Basalts from the central ITRs are selectively enriched in alkalis (Na+K= 4.3 wt%; Na<sub>8</sub> up to 3.7) and LREE (La/Sm<sub>N</sub>=0.86 -0.97), suggesting low degrees of mantle melting of cold sub ITR mantle. These basalts have lower Sr and Pb isotope ratios than MORB in the wider area of the equatorial Atlantic (i.e., <sup>87</sup>Sr/<sup>86</sup>Sr ~ 0.70237 and <sup>206</sup>Pb/<sup>204</sup>Pb ~ 18), and relatively high Nd and Hf isotope ratios (<sup>143</sup>Nd/<sup>144</sup>Nd = 0.5131-0.5132; <sup>177</sup>Hf/<sup>176</sup>Hf = 0.2831-0.2832). The combined major-trace and isotopic compositions reveal that a source with pronounced time-integrated incompatible element depletion melts to a small extent at the central ITR segments. Given its location in the central Doldrums Megatransform, the local mantle probably melted at the MAR before being transported into the ITR domain. During this prior melting event, the most fusible, geochemically enriched heterogeneities, have probably been scavenged from this part of the mantle, similar to what is observed at the Garrett transform zone in the Pacific (cf. ref 2). Hence, MORB from intra-transform rifts often allow better constraining the isotopic composition of incompatible element depleted source components than on-axis MORB.

<sup>1</sup> Skolotnev, S.G., Sanfilippo, A., Peyve, A., Muccini F., Sokolov, S. Y., Sani, C., ... & Ligi, M., 2020. Large-scale structure of the Doldrums multi-fault transform system (7-8°N Equatorial Atlantic): preliminary results from the 45th expedition of the R/V AN Strakhov. *Ofioliti*, 45(1), 25-41.

<sup>2</sup> Wendt, J.I., ... & Collerson, K.D., 1999. Geochemistry of lavas from the Garrett Transform Fault: insights into mantle heterogeneity beneath the eastern Pacific. *Earth and Planetary*