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^{40}Ar/^{39}Ar ages and geochemistry of Maranhão CAMP tholeiites (Brazil): implications for low and high-Ti basalts sources

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The Central Atlantic magmatic province (CAMP) emplaced at the Triassic-Jurassic boundary, is composed by prevailing low-Ti ($TiO_2 < 2.0$ wt%) and rare high-Ti basalts ($TiO_2 > 2.0$ wt%). The latter were so far confined to the circum-Atlantic regions of northernmost South America (French Guyana, Surinam and Cassiporé area of Brazil) and of western Africa (Liberia, Sierra Leone). Here we report the first data for high-Ti basalts sampled up to 800 km inland in the Maranhão basin of Brazil. The Western Maranhão Basin tholeiites (WMBT) are generally evolved basalts to basaltic andesites (MgO = 2.6-7.9 wt%). Three distinct groups are clearly distinguished: low-Ti group ($TiO_2 < 1.3$ wt%; $5.6 < MgO < 7.9$ wt%), intermediate-Ti tholeiites ($TiO_2 \approx 2.1$ wt%; $6.6 < MgO < 7.2$ wt%) and high-Ti group (TiO_2 = 3.4-3.7 wt%; $2.6 < MgO < 2.7$ wt%).

The new ^{40}Ar/^{39}Ar plateau ages obtained on plagioclase separates for intermediate-Ti (199.7 $\pm$ 2.4 Ma) and high-Ti tholeiites (197.2 $\pm$ 0.5 Ma and 198.2 $\pm$ 0.6 Ma) are indistinguishable and are also identical to previously analyzed low-Ti tholeiites (198.5 $\pm$ 0.8 Ma) and to the mean ^{40}Ar/^{39}Ar age of the Brazilian CAMP (mean 199 $\pm$ 2.4 Ma).

The three chemical groups display almost flat to very slightly enriched REE patterns precluding a garnet-bearing source. Positive Pb and negative Nb anomalies are observed in the three groups. There are strong in the low-Ti WMBT patterns, less pronounced in the high-Ti WMBT and very weak in the intermediate-Ti WMBT, suggesting a variable continental contribution to the geochemical characteristics of these lavas.

The intermediate-Ti and high-Ti groups display MORB-like Sr-Pb isotopic signatures (initial $^{87}Sr/^{86}Sr$ = 0.7030-0.70306, $^{206}Pb/^{204}Pb$ = 17.85-17.94, $^{207}Pb/^{204}Pb$ = 15.50-15.52, $^{208}Pb/^{204}Pb$ = 37.75-37.81; $^{87}Sr/^{86}Sr$ = 0.70341-0.70356, $^{206}Pb/^{204}Pb$ = 18.00 -18.03; $^{207}Pb/^{204}Pb$ = 15.48-15.49; $^{208}Pb/^{204}Pb$ = 37.73 -37.86 respectively). Nevertheless, the intermediate-Ti samples have Nd compositions less radiogenic than MORB (εNd = +6.19 and +6.43) but more than the high-Ti ones (εNd = +5.63 and +6.02) and slightly radiogenic $^{207}Pb/^{204}Pb$ for low $^{206}Pb/^{204}Pb$ ratios. The low-Ti group like other low-Ti analogues of CAMP, displays more enriched signatures ($^{87}Sr/^{86}Sr$ = 0.706155-0.707129, εNd = -1.92 and -1.93), in particular, radiogenic $^{207}Pb/^{204}Pb$ values for relatively low $^{206}Pb/^{204}Pb$ ($^{206}Pb/^{204}Pb$ = 18.168; $^{207}Pb/^{204}Pb$ = 15.621; $^{208}Pb/^{204}Pb$ = 38.300) suggestive of a crustal component. However, $^{187}Os/^{188}Os$ initial ratios of WMBT, ranging between 0.12830 and 0.13161 (the low-Ti group being slightly more radiogenic than the two other groups) preclude any large assimilation of continental crust. Thus, the enriched signature of the low-Ti WMBT could be due to melting of a subduction-related metasomatised subcontinental lithospheric mantle. The high-Ti and intermediate WMBT could be derived from an asthenospheric source possibly slightly contaminated by the continental crust and by the metasomatised subcontinental mantle, respectively.