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Evidence of multi-phase Cretaceous to Quaternary alkaline magmatism on Tore-Madeira Rise seamounts from $^{40}Ar/^{39}Ar$ ages

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The Tore-Madeira Rise (TMR) is an alignment of seamounts, located 300 km to the West of Southern Portugal. The origin of the TMR is generally attributed to a hot-spot activity. Abundant alkaline lavas were dredged along the whole rise and two sets of contrasting ages were obtained on lavas from several seamounts. Titanite and zircon U-Pb ages from alkaline lavas of the northern and central part of the rise range between $\sim$104 and $\sim$80 Ma [1]. $^{40}Ar/^{39}Ar$ measurements carried out on groundmass and mineral separates from central and southern TMR seamounts yielded Cretaceous to Pleistocene (94 Ma to actual) ages [2, 3, 4].

Here, we present new $^{40}Ar/^{39}Ar$ measurements (based on FCs=28.02 Ma and constants of [5]) performed on plagioclase, biotite and amphibole separates in order to obtain a better picture of the geodynamics of TMR. $^{40}Ar/^{39}Ar$ measurements of plagioclase separates from the northernmost TMR seamount (Bikini Bottom) and Torillon yielded tilde-shaped age spectra interpreted as reflecting alteration by adularia. The least altered part of the spectra suggest minimum ages of $\sim$90 Ma and $\sim$50 Ma for Bikini Bottom and Torillon, respectively. Amphibole separates from Seine seamount yielded an age of 24.0 Ma $\pm$ 0.8 Ma. This age is to be compared with a previous $^{40}Ar/^{39}Ar$ age obtain on groundmass at 21.7 $\pm$ 0.2 Ma [2]. Our results confirm that $^{40}Ar/^{39}Ar$ ages on groundmass are in general unreliable for high-resolution geochronology, due to cryptic alteration, and ^{39}Ar and ^{37}Ar recoil effects [6, 7]. Bi-

otite separates from lavas of Ashton seamount yielded $^{40}Ar/^{39}Ar$ plateau ages of 97.4 $\pm$ 1.1 Ma (single grain) and 97.8 $\pm$ 1.1 Ma (multi-grain population). The biotite ages validate the zircon U- Pb age (96.3 $\pm$ 1.0 Ma) previously obtained by [1] and confirm that the zircon extracted from the alkaline lavas were magmatic and not inherited from the continental lithosphere. Considering that the $^{40}Ar/^{39}Ar$ ages only marginally allow the expected $\sim$1% intercalibration bias within errors, the data also seem to indicate minimal pre-eruptive magma residence time.

These new data together with previously published ages [1, 2, 3, 4] reveals that at least 3 pulses of alkaline magmatism occurred on TMR between 104-80 Ma, around 70-50 Ma and between 27 and 0.5 Ma. No space-time correlation is observed for alkaline volcanism of the TMR, excluding a Hawaiian-type hot spot. The age pattern on TMR strengthens the hypothesis of pulses of magmatism randomly emitted in space and time on the eastern Atlantic and question the origin of TMR with regard to the current plate tectonic model.

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[3] Geldmacher et al., JGR 111 (2006), B09206.

[4] Geldmacher et al., EPSL 265 (2008) 167-182.

[5] Steiger and Jäger, EPSL 36 (1977), 359-362.

[6] Jourdan et al., Lithos 98 (2007), 195-209.

[7] Jourdan et al., GCA 71 (2007) 2791-2808.