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Rodrigues Ridge and the Central Indian Ridge: Another Type of Hotspot-Ridge Interaction?

J. Dyment [1], C. Hemond [1], H. Guillou [2], M. Maia [1], A. Briais [3], P. Gente [1]

[1] CNRS UMR 6538, IUEM - UBO, 1 place N. Copernic, 29280 Plouzané, France
[2] LSCE, CNRS-CEA, Bat. 12, avenue de la Terrasse, 91198 Gif sur Yvette Cedex, France
[3] LEGOS, GRGS, OMP, 18 rue E. Belin, 31401 Toulouse Cedex 4, France

The Rodrigues Ridge is an E-W volcanic structure which extends at 19°S from the Mascarene Plateau (59°30'E) to 100 km East of Rodrigues Island (64°30'E). It is neither parallel to seafloor spreading flowlines nor to the 'absolute' motion of Africa in the hotspot reference frame. 39Ar-40Ar dating of dredged samples has shown that the whole ridge formed at 8-10 Ma (Duncan, 1990), suggesting a rather rapid emplacement between the former position of the Reunion hotspot and the nearest segment of the CIR at 10- 8 Ma. This rules out in Morgan (1978) hypothesis that the Rodrigues Ridge was progressively built near the CIR axis, at the end of a 'channeled' asthenospheric flow originating from the Reunion hotspot. Sr, Nd and Pb isotopes show a gradual fading of the Reunion hotspot influence with increasing distance from the Mascarene Plateau (Mellor, personal communication, 1999). Signs for a more recent activity are the Rodrigues Island, dated about 1 Ma (Duncan, 1990), and a set of en echelon volcanic ridges, the Three Magi and Gasitao Ridges, discovered during cruise Magofond 2 of R/V Marion Dufresne. They extend the Rodrigues Ridge up to the CIR axis. These ridges display a clear sigmoid shape and align along an E-W direction at 19°40'S. Another parallel, less prominent volcanic alignment is observed about 30 km north, at 19°25'S. K-Ar dating (Cassignol method) provides an age of 0.4 Ma for the easternmost Gasitao Ridge and 1.8 Ma for the underlying oceanic crust. This second age is in agreement with the magnetic anomalies. Isotopic compositions are intermediate between those measured on the Rodrigues Ridge and on the CIR axis. The lack of conjugate bathymetric feature and the age measured on the Gasitao Ridge demonstrate that it was built off axis, in the close vicinity of the CIR. The sigmoid morphology and en-echelon alignment of Three Magi and Gasitao Ridges suggest that they formed in a dextral transtensional environment. Magmas resulting from decompression melting of underlying mantle would have filled opening tension crack-analogs. Repetition of such magmatic events results in increasing volume as ridges get older, in agreement with the morphology. The hotspot contamination would result from either upper mantle-derived partial melts contaminated by Rodrigues Ridge material or magmas which would have sampled a mantle contaminated by the presence of the Reunion plume head for about 55 m.y. This enrichment of the upper mantle has probably favored the partial melting during decompression (Vlastelic, 1998). Such model for the emplacement of the Gasitao and Three Magi Ridges can be extended to the whole Rodrigues Ridge and to other volcanic structures like the Puka Puka Ridge in the Pacific Ocean (Janney et al., 2000), leading to the definition of another type of hotspot-ridge interaction.

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