Central Indian Ridge and Reunion Hotspot in Rodrigues Area : Another Type of Hotspot - Ridge Interaction?

C. HEMOND[1*], J. DYMENT[1], M. MAIA[1], P.GENTE[1]

[1] : UMR "Domaines océaniques" IUEM, place Nicolas Copernic, 29280 Plouzané, France
* (chhemond@univ-brest.fr)

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 flow-lines nor to the "absolute" motion of Africa in the hotspot reference frame. ^{39}Ar-^{40}Ar dating of dredged samples has shown that the whole ridge formed at 8-10 Ma, 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 the hypothesis that the Rodrigues Ridge was progressively built near the CIR axis, at the end of a "channeled" asthenospheric flow originating from Reunion hotspot. Sr, Nd and Pb isotopes show gradual fading of the Reunion hotspot influence with increasing distance from the Mascarene Plateau.

Signs for a more recent activity are the Rodrigues Island, dated about 1 Ma, and a set of recently discovered en-echelon volcanic ridges, the Three Magi and Gasitao Ridges. 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 ages of 0.4 and 1.8 Ma for the easternmost Gasitao Ridge. This second age is slightly younger than that of the underlying crust given by the magnetic anomalies. Isotope compositions are intermediate between those measured on Rodrigues Ridge and 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 correspond to tension cracks filled by magmas resulting from decompression melting of underlying mantle. 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.

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, leading to the definition of another type of hotspot-ridge interaction.

Weathering control of river and ocean (^{234}U/^{238}U)

GIDEON M. HENDERSON[1], LAURA F. ROBINSON[1], ANDY SMITH[1], IAIN MATTHEWS[1], DANNY BARKER[1], AND BRENDA L. HALL[2]

1 Department of Earth Sciences, University of Oxford, Parks Road, Oxford, UK. (gideonh@earth.ox.ac.uk)
2. Department of Geological Sciences, University of Maine, ME04469, USA.

Riverwater (^{234}U/^{238}U) values range from slightly below, to more than three times higher than, secular equilibrium. Variation in the style and rate of weathering doubtless play a role in creating this wide range. For instance, an increase in physical weathering may increase the riverine ratio. But the full range of controls which set riverine (^{234}U/^{238}U) have never been appraised, preventing the use of this ratio as even a qualitative measure of the weathering environment now or in the past.

We have measured more than 70 surface waters from around the world in order to better understand how the weathering environment controls riverine (^{234}U/^{238}U). Particular focus has been placed on two areas - The Dry Valleys of Antarctica, and the South Island of New Zealand. The Dry valleys are a frigid desert and represent an end-member weathering environment. Even within this single climate setting, (^{234}U/^{238}U) ranges from 1.1 to 3.5 with the major control being the freshness of weathered material. Surface drainage on fresh basement, particularly in the presence of glacial grinding, exhibits higher ratios than that draining reworked sediments. This probably reflects release of ^{234}U from damaged sites when rocks are first mechanically fractured - an effect which may generate a pulse of high (^{234}U/^{238}U) to the oceans at times of deglaciation.

The south Island of New Zealand was selected as it has a wide range of rainfall, climate, and weathering styles. Initial results indicate a very wide range in U concentration and isotope ratio. Analysis of these results, coupled with those from elsewhere, will help to build a fuller picture of the controls on riverine (^{234}U/^{238}U), and to assess the modern ocean budget for U isotopes.

As part of this study we have also searched for any spatial variability in seawater (^{234}U/^{238}U) which might result from local river inputs, particularly into relatively enclosed basins. The Ross Sea, Red Sea, and Caribbean Sea all have values identical to fully open marine conditions. The Mediterranean, however, exhibits a value ≈5‰ higher than the open ocean, apparently due to high (^{234}U/^{238}U) inputs from the Black Sea. In the Mediterranean, (^{234}U/^{238}U) may represent a conservative tracer of ocean circulation.