An anomalous seamount filling the axial valley of CIR, Indian Ocean: unstable spreading at intermediate-rate spreading ridges

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As a part of an interdisciplinary project to investigate tectono-geologic constraints on establishment of HyperSLiME at Kairei-hydrothermal field, named as *Ultra-H^3 linkage project*, some 8000 km^2 of the southernmost area of the Central Indian Ridge (CIR), near Rodriguez Triple Junction (RTJ) were mapped during YK05-16 Leg.1 Cruise. The seafloor morphologies mapped in the cruise are quite contrastive. In the north part of the area, well-developed abyssal hills parallel to the current ridge axis were mapped off the segments-2 and 3 of CIR. At the southern end of the 3rd segment of CIR, an anomalous topographic high fills the axial valley of CIR-3; it is known as Knorr Seamount or Mound A (Van Dover et al., Science, 2001; Wakabayashi, M. Sc. Thesis, 2003). In contrast to the northern part of the area, a deep-axial valley was mapped at the segment-1 (CIR-1), near RTJ. In addition, serpentinized peridotites or gabbros were sampled at Oceanic Core Complexes near the northern end of CIR-1 (Kumagai et al. JPGU 2006). One of them have been described in literatures (e.g. Mitchell et al., EOS trans, 1998). Another peridotite exposure has also been reported within the area (Hellebrand & Snow, EPSL, 2003).

As one of the ten dives of *Shinkai6500* submersible in the cruise, the 924th dive was conducted on the western flank of Knorr Seamount (24deg. 28.9min.S, 69deg. 49.3min.E at the commencement). Along the dive track, thick sedimentation was observed, 1.3 m in average (Joshima et al., this symposium). Occasionally, some exposures of floating rock fragments or rubbles were found, where one or two rock fragments were sampled. The sampled rock fragments are dominantly aphyric basalts.

Two glass chunks separated from the suite of samples were analyzed for standard noble gas geochemistry. One was sampled in the middle part of the western flank of Knorr Seamount (sample ID: 6K924R13), the other at the near one of the highest points of the seamount (6K924R20). These samples show strongly enriched nature in trace elements as Mid-Oceanic Ridge Basalts (MORBs). Because respective $(La/Sm)_N$ ratios, normalized by the primitive mantle value, are 1.12 and 1.22, these two samples are categorized as E-MORB (or T-MORB).

Both glasses show normal ^{3}He/^{4}He ratio as MORBs, ca. 7.9 R_A with 2 - 3x10^{-6} cm^{3}STP/g concentration of ^{4}He. Although these values are well within the MORB global variation (regarded to be ~8+/-1 R_A), published data of ^{3}He/^{4}He of glass sampled nearby are significantly higher, ~8.4 R_A (Kumagai and Kaneoka, GCA, 2005; Nishio et al., EPSL, 1998). One exception is KH93-3-DR1-F1 that shows 8.13 R_A of ^{3}He/^{4}He (Nishio et al, 1998). This also shows enriched trace-element nature. If this is the case of radiogenic ingrowth of the ^{3}He/^{4}He ratio in the source region, it takes 30 Myr for required ^{4}He accumulation. On the other hand, in the case of accumulations after eruption, it takes 2Myr.

Solely on these enriched nature of the lava samples, contribution of hotspot magma is usually suspected. However, there is no sign of continuous tracks indicating any hotspots at the position of the Knorr seamount. Rather, abrupt commencement and termination of the seamount activity indicates the relatively small blob-like geochemically enriched domain just beneath the ridge axis seems to be plausible. Roughly uniform thickness of sediment along the dive track suggests relatively short activity of the seamount. The observed lava morphology indicating high effusion rate - smooth surfaced sheeted flows, also requires relatively rapid emplacement of the magma.

In the intermediate-rate spreading Mid-Ocean Ridges, thus, may sensitive to the local heterogeneity of the source region resulting to some change of morphological variation of seafloor, e.g. between axial high-type and rift valley-type.