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Occurrence of high-Al D-MORB along the Easternmost Southwest Indian Ridge

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One of the deepest and slowest part of the mid-ocean-ridge system lies within the easternmost part of the Southwest Indian Ridge between 61°E and 69°E. In this region, a distinctive sea-floor terrain characterized by high-relief segments separated by long, deep tectonized sections shows a predominance of tectonic over magmatic extensional processes, suggesting an unstable and weak, but locally focalized magma supply. Other features of this section include the absence of long-lived transforms, thick lithosphere, high upper mantle seismic wave velocities and thin oceanic crust (4-5 km).

When compared to other ridge segments, most MORB erupted along this section distinguish themselves by their higher Na_2O, Sr and Al_2O_3 compositions, very low CaO/Al_2O_3 ratios relative to TiO_2 and depleted heavy rare-earth element (REE) distributions. Another peculiar feature is their subparallel LREE enriched patterns. However, the high-Al-MgO magma type erupted periodically around the ridge system is also found in this region at 61.93°E. These lavas are characterized by high Al_2O_3(> 17 wt.%), MgO (>8.8 wt.%) and FeO contents, low SiO_2 (<49 wt.%) and Na_2O and very lowTiO_2, and a LREE depleted pattern compared to the main population. At slightly lower MgO, sporadically, two other dredges located at 63.36-63.66°E share some of these distinct compositionalcharacteristics. As a whole, these lavas are the most depleted in highly incompatible elements, but are also characterized by an offset toward lower MREE/HREE ratios relative to the main population.

These peculiar basalts are not parental to the more common lower MgO compositions and cannot be related to them by fractional crystallization alone. Instead, their major element features, and the occasional presence of positive Eu and Sr anomalies might indicate assimilation of plagioclase cumulates, while their offset in MREE/HREE might require a multistage melting evolution with an earlier event in the garnet stability field.