

61 Ma basalts from IODP Expedition 390 Site U1556: Evidence for plume- ridge interaction during opening of the South Atlantic?

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IODP Expeditions 390 and 393 recovered basaltic basement from five sites along the South Atlantic Transect (SAT) on the western flank of the Mid-Atlantic Ridge at ~ 30°S. The oldest SAT site, Site U1556, recovered ~342 m of volcanic basement encompassing three stratigraphic sequences (SSA, SSB and SSC). The oldest rocks recovered (SSC) are the most MORB-like. They are tholeiitic, highly phyric (~20%), and multiply saturated with plagioclase, olivine, and cpx. Incompatible trace element contents and ratios, however, are more depleted than depleted MORB (e.g., Zr/TiO₂ - 54 ± 0.6 ppm/wt%). In contrast, the youngest basalts (SSA) are moderately olivine phyric, contain titanite in the groundmass, and have enriched compositions typical of OIBs (e.g., Zr/TiO₂ - 96 ± 2 ppm/wt%). The intervening stratigraphic Sequence (SSB) consists predominantly of highly altered aphyric basalts that are silica saturated and have intermediate Zr/TiO₂ ratios (80 ± 3 ppm/wt%). Although SSB basalts are more enriched than SSC, they are not as enriched as most OIBs and appear to be more akin to E-MORBs. It is tempting to equate the OIB-like basalts of SSA to plume magmatism associated with formation of the Rio Grande Rise (RGR), which is only ~ 200 km to the west and thought to have formed by melting above a mantle plume now situated beneath Tristan da Cunha. However, Site U1556 is located on normal thickness oceanic crust, which suggests limited contribution from hotspot-style volcanism. In addition, rocks from the western RGR are considerably older (120-80 Ma) and compositionally distinct from even the most enriched rocks from Site U1556, having higher incompatible trace element contents and lower Y. However, SSB basalts exhibit some trace element similarities with volcanic rocks from the eastern RGR, which formed between 80 and 60 Ma when southward propagation of the ridge separated the western RGR from the Walvis Ridge. Work is ongoing to evaluate the relationship, if any, between Site U1556 basalts and plume-ridge interactions