Time evolution of the interaction between the tristan hotspot and the south atlantic ridge

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Abstract

The continental traps of Parana-Etendeka, dated 137-127 Ma, are the early manifestation of the activity of the Tristan da Cunha mantle plume. This plume, presently located beneath the Tristan da Cunha group, formed the Rio Grande rise and the Walvis ridge, respectively on the South America and Africa plates. The distance between the mid-oceanic ridge and the mantle plume increased through time. As a consequence, both the morphology and the basalt composition of the off-axis volcanoes changed, as well as the thickness of the oceanic crust produced at the ridge axis. Large volcanic plateaus, such as the Rio Grande rise and the northern part of the Walvis ridge formed when the ridge was located above the mantle plume. Accordingly, the basalt composition show a mixing between a plume source and a typical upper mantle term (MORB). The increase in the distance between the ridge and the plume resulted in the formation of a series of elongated coalescent volcanoes, with higher percents of plume material in the basalt composition. This time interval corresponds to the middle part of the Walvis ridge. The last stage of the ridge-hotspot interaction correspond to the building of intraplate volcanoes with a clear plume chemical signature. During this evolution, the influence of the plume on the ridge processes progressively decreased. The spatial distribution of the plume-ridge mixing trends strongly suggests the presence of two individual magmatic phases.