



The Afar-Red Sea-Gulf of Aden volcanic margins system : early syn-rift segmentation and tectono-magmatic evolution

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The Afro-Arabian rift system is characterized by complex interactions between magmatism and rifting, leading to long-term segmentation of the associated continental margins. However, past studies focused on specific rift segments and no attempt has yet been made to reconcile them into a single comprehensive geodynamic model. To address this, we present interpretations of seismic profiles offshore the Eritrea-Yemeni margins in the southern Red Sea and the Yemeni margin in the Gulf of Aden and reassess the regional geodynamic evolution including the new tectonic evolution of the Central Afar Magmatic margin.

We point out the role of two major transform zones in structuring the volcanism and faulting of the Red Sea-Afar-Aden margins. We show that those transform zones not only control the present-day rift organization, but were also active since the onset of rifting in Oligocene times. Early syn-rift transform zones control the emplacement and the development of seaward-dipping-reflector wedges immediately after the Continental Flood basalts (30 Ma), and are closely associated with mantle plume melts in the course of the segment extension.

The margins segmentation thus appears to reflect the underlying mantle dynamics and thermal anomaly, which have directly influenced the style of rifting (wide vs. narrow rift), in controlling the development of preferential lithospheric thinning and massive transfer of magmas in the crust.