The structure and classification of the Mozambique Ridge based on seismic reflection data

Abstract

The Mozambique Ridge (MozR), a prominent basement high in the southwestern Indian Ocean, consists of four major geomorphological units associated with numerous phases of volcanic activity between 140 Ma and 122 Ma. Over the last decades nature and origin of the Mozambique Ridge have been intensely debated with one hypothesis suggesting a Large Igneous Province (LIP) origin. This would have had immense influence on climate during the early Cretaceous with the emission of gases and heat into atmosphere and ocean but also implications on the development of the South African gateway with the formation of obstacles for surface and deep circulation.

An extensive seismic survey was conducted over the Mozambique Ridge with the aim of solving the questions about its origin and evolution. High-resolution seismic reflection data reveals a number of magmatic centers with a random distribution. Intra-basement reflections can be identified up to several hundred ms TWT below top of basement. The internal reflections generally dip away from their magmatic centers and individual reflections can typically be traced for 5-15 km. These are interpreted to represent massive lava flow units, which are characteristic of oceanic plateau eruptions. Additionally to primary volcanic features associated with the initial emplacement of the individual segments of the Mozambique Ridge we identify secondary volcanic features indicating magmatic reactivation after its initial build-up. The total volume of the southern Mozambique Ridge is estimated to be 2.2×10^6 km^3. We use this estimation to obtain a more precise reconstruction for the emplacement of the Mozambique Ridge. Based on our results we propose an oceanic LIP origin of the southern Mozambique Ridge and show that our data points toward a sequential development of its segments.