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Study of the structure and evolution of the axial zone of the Carlsberg Ridge

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We present the results of detailed studies of the axial zone of the Carlsberg Ridge (CR), which is located in the northwestern part of the Indian Ocean and is the divergent boundary of the Indian and Somali plates. More than 300 magnetometric and bathymetric profiles were analyzed, crossing the CR practically along its entire length and allowing to study variations of the seafloor depth along the ridge axis. As a result of the analysis of these data, as well as the analysis of free-air gravity anomalies and the vertical gravity gradient [Sandwell, D.T., et all., 2014], off-axis tectonic structures were mapped and a total of about thirty first- and second-order continuity discontinuities were identified.

Using linear regression of the dependence of the ocean floor opening distance for anomalies younger than C4n.1 (7.537 Ma) on the age of the isochrones for the Somali and Indian plates [Merkouriev, S., and C. DeMets (2006)], estimates of the linear spreading rate relative to its center were obtained for each segment. This allowed us to estimate the crustal accretion asymmetry ratio on the Indian and Somalia plates and its variation along the ridge. The obtained estimates of linear velocities are in good agreement with the estimates obtained from kinematic rotation models of the Indian and Somali plates [DeMets et all., 2010].

The analytical signal method was used to determine the width of the axial (Brunhes) magnetic anomaly over the Carlsberg Ridge from the magnetic profiles. Comparison of the obtained estimates of the axial anomaly widths with those calculated from the linear spreading velocity allowed us to estimate the amplitude of outward displacement of the of the polarity boundaries due to Gabbro's layer magnetized over a range of distances by cooling through a sloping blocking-temperature isotherm (at which magnetization becomes stable over geological time) and lava flows that acquired magnetization at various distances, accumulating away from the axis.

References:

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