Geophysical Research Abstracts
Vol. 12, EGU2010-2030-1, 2010
EGU General Assembly 2010

A unified history of the ocean around southern Africa

Colin Reeves (1,2) and Sharad Master (2)

(1) Earthworks BV, Delft, Netherlands (reeves.earth@planet.nl), (2) School of Geosciences, University of the Witwatersrand, Johannesburg, South Africa.

The movement with respect to Africa of the hotspot marked by present-day Bouvet island is extrapolated backward in time to a position in the Lower Limpopo Valley at the time of the Karoo-Ferrar basalt event (183 Ma). In a tight reconstruction of the Precambrian fragments of Gondwana at this time, the triangular gap that remains between South Africa's Precambrian, that of Dronning Maud Land, Antarctica, and the eastward-extrapolated front of the Cape Fold Belt we fill with the Precambrian fragments of South Patagonia and the Falkland Islands. We postulate that the 183 Ma mantle upwelling produced a triple junction-type fracture marked by the alignments of the Lebombo, the SE margin of the Zimbabwe craton and the giant Botswana dyke swarm (178 Ma) that was rather quickly followed by the expulsion of the South Patagonia terranes from the Gondwana assembly along the alignment of the Falklands-Agulhas Fault Zone (FAFZ) as a transform margin. The space created was filled with igneous material akin to the present day Afar triangle. The magma supply generated not only oceanic crust but also overlying igneous deposits, much probably erupted subaerially. These developed progressively into the Falklands Plateau, the Mozambique Plains, the Mozambique Rise and the Explora Wedge of Antarctica. Not until the early Cretaceous did the growth of normal ocean crust start to exceed the ability of the declining mantle plume to cover the new ocean crust in a confined space with subaerial deposits that substantially thickened otherwise 'oceanic' crust. When Antarctica and Africa began to separate before about 167 Ma, the future Mozambique Rise moved with Antarctica until, at about 125 Ma, a modest ridge reorganization east of Africa left Madagascar and the Mozambique Rise as part of the Africa Plate. An increasing westerly component to the movement of Antarctica against Africa preceded the initial opening of the South Atlantic and the fusing of the South Patagonia terranes with the bulk of South America. The triple junction jumped from off Cape St Lucia to immediately south of the Mozambique Rise as part of this 125 Ma reorganization and normal ocean crust grew from each of the three ridges emanating from it. The Agulhas Bank represents a reactivation of the mantle plume at about 100 Ma and the Maurice Ewing Bank and other submarine features east of the Falklands Plateau later and smaller ones. The model conforms with limited magnetic anomaly evidence in the oceans and the direction of preserved transforms before Anomaly 34 time (84 Ma). After Anomaly 34, events around the triple junction are well-defined by both magnetic anomalies and preserved transforms. The model may be demonstrated by a geometrically correct animation and offers simple solutions to a number of geological enigmas concerning (a) the Falkland Islands, (b) supposedly 'continental' plateaus off South Africa, (c) the sudden ending of the Karoo igneous episode well before substantive Gondwana disruption and (d) the exotic nature of the Precambrian rocks of South Patagonia in the context of South American geology. The central role of the Bouvet mantle plume suggests that it has produced a volume of magma comparable with – and a longevity 50 myrs in excess of – that demonstrated by the Kerguelen plume.