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The Dead Sea Rift, a key to the tectonic link between the NeoTethys closure of and opening of the Red Sea

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The closure of the central NeoTethys Ocean took place progressively as the subduction of the oceanic lithosphere off Africa-Arabia gradually changed into collision, advancing southeastwards along the Zagros front since the early Miocene. That subduction-collision is contemporaneous with the opening of the Red Sea, and structural modeling suggested that the oblique convergence along frontal Arabia formed extensional stresses in the Arabia-Africa plate which matured in time to become the tectonic plate boundaries of the Gulf of Aden and the Red Sea (Bellahsen et al., 2003). However such marine basins are not known to occur along subducting plates, and the contemporaneity of the Zagros collision and the Red Sea extension could have been tectonically unrelated. Fortuitously the key to the tectonic linkage between the opening of the Red Sea and the closure of the NeoTethys can be found in the Dead Sea Rift.

The tectonics of the Dead Sea Rift has been debated for decades to be interpreted either as a transform fault or an extensional rift, both extending from the northern Red Sea. The transform fault interpretation requires the Dead Sea structure to be contemporaneous with the Red Sea, whereas if it is an extensional rift, its structural development should be subsequent to that of the the Suez Rift. It is well established that the Red Sea and its extension in the Suez Rift developed during the Miocene. However, the reconstruction of the Miocene river drainage of the Levant shows that large rivers flowed then from NW Arabia to the Mediterranean, predating the Dead Sea Rift. This sequence of events sets the structural evolution of the dead Sea Rift to the Plio-Quaternary. The Rift is thus contemporaneous with the termination of the tectonic activity of the Gulf of Suez, indicating a clockwise rotation of the regional stress field in the last 5 Ma. These observation suggest that the extensional stresses caused by the gradual change from subduction to collision along the converging tectonic front of Arabia and the Zagros formed extensional domain that affected the propagating Carlsberg Ridge. It is suggested that that extensional domain first caused the change in the direction of the propagation of Carlsberg ridge westwards, to form its NW trend and break open the Gulf of Aden. Clockwise rotation of the stress field diverted the rifting northwestwards to form the Red Sea and the Suez Rift. Another clockwise deflection in the Pliocene shifted the axis of the northern extension of the Red Sea to abandon the Suez Rift and form the Dead Sea Rift. That latter rifting event is thus a product of the conversion of subduction to collision along the southern section of the Zagros-Arabia tectonic convergence.

Reference

Bellahsen, N., Faccenna, C., Funiciello, F., Daniel J. M. and Jolivet, L., 2003. Why did Arabia separate from Africa? Insights from 3-D laboratory experiments. Earth Planet. Sci. Lett., 216, 365-381