Geophysical Research Abstracts
Vol. 15, EGU2013-8106, 2013
EGU General Assembly 2013


# Intrusion of Oceanic-type Basaltic Melts Precedes Continental Break up in the Red Sea Rift

Enrico Bonatti (1), Marco Ligi (2), Sara Ronca (3), Monique Seyler (4), William Bosworth (5), and Anna Cipriani (6)

(1) Lamont Doherty Earth Observatory, Columbia University, Palisades, New York, USA (enrico.bonatti@bo.ismar.cnr.it), (2) Istituto di Scienze Marine, CNR, Bologna, Italy (marco.ligi@bo.ismar.cnr.it), (3) Dipartimento di Scienze della Terra, Universita' La Sapienza, Roma, Italy (sara.ronca@uniroma1.it), (4) UFR des Sciences de la Terre, CNRS UMR 8217 Géosystèmes, Université Lille 1, Lille, France (Monique.Seyler@univ-lille1.fr), (5) Apache Egypt Companies, New Maadi, Cairo, Egypt (bill.bosworth@apachecorp.com), (6) Dipartimento di Scienze Chimiche e Geologiche, Università di Modena e Reggio Emilia, Modena, Italy (anna.cipriani@unimore.it)

The role of magmatism in continental rifting and break up and in the birth of a new ocean are not well understood. Continental break up can take place with intense and voluminous volcanism, as in the Southern Red Sea/Afar Rift, or in a relatively amagmatic mode, as in the Mesozoic Iberian Atlantic rift. Studies of gabbros from the Brothers and Zabargad islands suggest that continental break up in the northern Red Sea, a relatively non-volcanic rift, is preceded by intrusion of oceanic-type basaltic melts that crystallize at progressively shallower crustal depths as rifting progresses towards continental break-up. A seismic reflection profile running across the central part of the southern Thetis basin, shows a ∼5 km wide reflector ∼1.25 s below the axial neovolcanic zone. We interpret it as marking the roof of a magma chamber or melt lens, similar to those identified below several mid-ocean ridges. Assuming a 4.5 km/s acoustic velocity for the upper oceanic crust at Thetis, this reflector is ∼3.5 km below the seafloor. The presence of a few kilometers deep subrift magma chamber soon after the initiation of oceanic spreading implies the crystallization of lower oceanic crust intrusives as a last step in a sequence of basaltic melt intrusion from pre-oceanic continental rifting to oceanic spreading. Thus, oceanic crust accretion in the Red Sea rift starts at depth before continental break up, emplacement of oceanic basalt at the sea floor, and development of Vine-Matthews magnetic anomalies, pointing to a rift model, where the lower continental lithosphere has been replaced by upwelling asthenosphere before continental rupturing. This model would imply depth-dependent extension due to decoupling between the upper and lower lithosphere with mantle-lithosphere-necking breakup before crustal-necking breakup. This mode of initial oceanic crust accretion may have been common in Mesozoic Atlantic-type rifts, in addition to wider, amagmatic, Iberian-type continent-ocean zones of transition.