Geophysical Research Abstracts
Vol. 19, EGU2017-7961, 2017
EGU General Assembly 2017

Nature of the crust in the northern Red Sea

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

(1) Consiglio Nazionale delle Ricerche, Istituto di Scienze Marine, Bologna, Italy, (2) Lamont Doherty Earth Observatory of Columbia University, Palisades, New York, USA, (3) Apache Egypt Companies, New Maadi, Cairo, Egypt, (4) Dipartimento di Scienze Chimiche e Geologiche, Universita' degli Studi di Modena e Reggio Emilia, Modena, Italy, (5) Dipartimento di Scienze della Terra, La Sapienza Universita' di Roma, Rome, Italy, (6) Laboratoire d'Océanologie et de Géosciences, UMR LOG 8187 CNRS-Lille1-ULCO, UFR Sciences de la Terre - Bât. SN5, Villeneuve d'Ascq, France

We present here 3D seismic reflection and gravity data obtained from an off-axis area of the NW Red Sea, as well as results of a study of gabbroic rocks recovered in the same area both from an oil well below a thick evaporitic-sedimentary sequence, and from a layered mafic complex exposed on the Brothers islets. We show that magmatism can play an important role in the evolution of narrow rifts, and that our results can help to solve the controversy on the nature of the crust in the northern/central Red Sea, i.e. the crust outside the axial oceanic cells is either oceanic or it consists of melt-intruded extended continental crust. The studied gabbros show petrologic and geochemical signatures similar to those of mid-ocean ridge basalts (MORB) and are compatible with their having been emplaced either in a continental or in an oceanic context. We explored the different hypotheses proposed to explain the lack of magnetic anomalies in presence of oceanic crust in the northern Red Sea. Our results combined with a review of all the geophysical and geological data in the area point to a stretched and thinned continental crust with few isolated sites of basaltic injections, in line with a model whereby asthenospheric melt intrusions contribute to weaken the lower crust enabling some decoupling between upper and lower crust, protracting upper crust extension and delaying crustal breakup. Our findings show that continental rupture in the northern Red Sea is preceded by intrusion of basaltic melts with MORB-type elemental and isotopic signature, that cooled forming gabbros at progressively shallower crustal depths as rifting progressed towards continental separation.