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Initial Emplacement of oceanic lithosphere in the Northern Red Sea

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The Red Sea is an ideal natural setting to investigate tectonic and petrological aspects of the transition from a continental to an oceanic rift, the formation of passive margins and the origin of transform faults, and to address problems of sedimentation in an embryonic ocean and of bio-geochemistry in the axial hydrothermal cells.

We carried out in December 2004-January 2005 an expedition to the Red Sea with the research ship "*Urania*" of the Italian National Research Council. We focused our work in the northern part of the Red Sea, because here is where the most recent nuclei of oceanic crust emplacement are located. We obtained a new multibeam morphostructural map of the Thetis axial through and of the areas to the north and to the south of the through. Sub Bottom Profiler and Multi Channel Seismic reflection data were also obtained.

These data indicate that the Thetis Deep is made of three en-echelon fault-bounded axial basins that are joined together, with axial volcanic ridges (resembling neovolcanic zones of mature slow-spreading mid ocean ridges) and a large number of scattered central volcanoes. The three basins are separated by shallower transfer zones where the deformation is more diffuse, as they are intensively faulted and covered by a larger amount of small volcanic cones. We joined the Thetis data with multibeam data from the Nereus axial through to the north, in order to achieve coverage of a considerable slice of the axial Red Sea. We obtained magnetometric coverage of the area, that will hopefully give us the age of emplacement of oceanic crust in the different segments. Complex structures, partly due to evaporite tectonics, were mapped in the transfer zones north and south of the Thetis trough. Fresh basalts, including basaltic glasses, were sampled at a number of sites within the Thetis Trough. We have started a petrographic-geochemical study of these samples, that will include also major and trace element chemistry as well as isotopic (Sr, Nd, Pb and He) chemistry, in order to characterize their affinity to MORB, and to check possible systematic variations in the composition of the Red Sea crust moving from south to north.

The hypothesis is that, if the opening of the Red Sea will continue, the subdeeps will evolve into oceanic ridge segments, perpendicular to the relative plate motion direction, and the transfer zones will evolve in oceanic transforms, parallel to the motion. This segmentation could be derived either from the ongoing coalescence of regularly spaced diapirs of upwelling astenosphere, or from an initial structural segmentation of the rift in the continental stage, exploiting pre-existing structural discontinuities as suggested by the correspondence between axial valley segmentation and eterogeneities observed onshore on the continental margins.