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Halokinetics and other features of GLORIA long-range sidescan sonar data from the Red Sea

Neil Mitchell (1) and Nico Augustin (2)

(1) University of Manchester, School of Earth, Atmospheric and Environmental Sciences, Williamson Bldg, Williamson Building, Manchester, United Kingdom (neil.mitchell@manchester.ac.uk), (2) GEOMAR, Kiel, Germany

The Red Sea is an unusual example of a rift basin that has transitioned from its evaporitic stage to fully open-ocean conditions at the end of the Miocene (∼5.3 Ma), much more recently than older Mesozoic margins around the Atlantic and Gulf of Mexico. The patterns of halokinetic deformation occurring in the Red Sea are potentially of interest for understanding more generally how evaporite deposits deform during this early stage. Relevant to this issue, a line of reconnaissance sidescan sonar data (GLORIA) collected along the Red Sea in 1979 is re-evaluated here with the aid of newly compiled bathymetry from multibeam sonars. Features in the acoustic backscatter data are associated with ridges, valleys and rounded flow fronts produced by halokinetic deformation. Some areas of higher acoustic backscattering from the evaporites are suggested to relate to roughness produced by deformation of the evaporite surface. Within the volcanic (oceanic) axial valleys, areas of differing high and low backscattering suggest varied sediment cover and/or carbonate encrustations. Farther north beyond the main area of our multibeam data, rounded fronts of halokinetic deformation are present in the Zabargad Fracture Zone, a broad valley crossing the Red Sea obliquely. The presence of halokinetic deformation here is evidence that subsidence has occurred along the fracture zone. Elsewhere in the northern Red Sea, the GLORIA data reveal folds in the evaporite surface, suggesting local areas of convergence, like those implied by multibeam data from inter-trough zones further south. Some faults in the evaporite surface run NE-SW, probably the result of differential movements in different parts of the evaporites. Comparing these structures with new maps of the free-air gravity field, we suggest that this differential movement in the northern Red Sea is strongly affected by basement topography.