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3.5-D model of sediment age and grain size for the Northern Gulf of Aqaba-Elat (Red Sea) using submarine cores

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The Northern Gulf of Aqaba-Elat (NGAE) is the northeast extension of the Red Sea, located at the southernmost part of the Dead Sea Fault, at the transition zone between the deep en-echelon submarine basins of the Red Sea and the shallow continental basins of the Arava Valley (Israel and Jordan). We aim to characterize the top sedimentary cover across the NGAE in order to check the effect of tectonics on the sedimentary column, using high resolution grain size data and radiocarbon dating of core sediments. We analyzed 11 piston cores and 9 short cores: high resolution grain-size and radiocarbon age determinations were used to compile a 3.5-D (3.5 dimensional) model of age-depth-grain size for the top 3-5 meters of the NGAE.
Two general trends of the grain size spatial distribution are observed: grains are coarsest at the NE corner of the NGAE (Aqaba coastline) and grow finer with the distance to the west on the shelf and with the distance from shore to the south. Long- and short-term accumulation rates were compiled for the entire NGAE, demonstrating a distinct E-W trend on the shelf and a NNE-SSW trend in the deep basin.
The 3.5-D age-depth-grain size model conforms to- and validates the tectonic structure of the shelf detailed by previous authors. We suggest that the impact of tectonic structure of the shelf is highly significant in terms of spatial variations across the shelf, both in age of the sediment and its grain size characteristics. The temporal-spatial distribution of the grain size in the deep basin of the NGAE reveals a correlation between sediment age, dominant grain size and active tectonics: fine-grain, old sediment in the margins (Late Pleistocene, as old as >40 ka on the west margin; Early Holocene, as old as 7.5 ka, on the east margin), and Late Pleistocene sediment farther south from the dominant active diagonal fault which underlies the Elat Canyon. Young coarse sediment is present in the middle of the basin, where most of the active sediment transportation (and tectonic activity) take place. The dominant sedimentary activity follows the migration of the active tectonic fault segments from east to west between 40 ka to present. We observe focusing of turbidites to the location of the dominant active tectonic fault.
A spatial/temporal evolutionary model is presented for the sedimentary processes of the NGAE since 40 ka to present, suggesting three phases of development: (a) Late Pleistocene 40 to 12 ka; (b) Early to Mid-Holocene 12 to 5-4 ka; (c) Late Holocene 5-4 ka to present.