Abstract : The vertical deformation along the southern end of the Dead Sea Fault system highlighted by tectonic markers on Tiran Island – Red Sea, Saudi Arabia.

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Defined as a transform plate boundary between the Arabian plate and Sinai micro-plate, the Dead Sea Fault (DSF) extends from the compressive Taurus mountains in the north to the Red Sea extensive system (RSS) in the south. Tiran Island, located near the southernmost end of the DSF, shows clear evidence of active tectonic uplift. More specifically, the southern side of the island seems to be highly affected by active tectonics and exhibits at least 16 levels of uplifted coral terraces.

In this study, we used high-resolution tri-stereo Pleiades satellite imagery to build a Digital Surface Model (DSM) at 0.5 meter resolution and mapped in detail the extent and heights of the uplifted coral terraces. The terrace heights range from one meter to almost five hundred meters above the mean sea level and they are tilted towards the east. Combining our DSM, the eustatic curve, and the Marine Isotopic Stage (MIS) variations, we derive the relative age for each terrace level. Assuming a constant uplift rate through the last 5 Myrs, we calibrate an age model consistent with an uplift rate close to 0.2 ± 0.02 mm/yr, which indicates that Tiran Island has recorded at least 2.3 Myrs of tectonic uplift.

In parallel, we combined high resolution multibeam bathymetric datasets acquired by R/V Thuwal in June 2018 and September 2019 with the Beautemps-Beaupré dataset (2004) into the first complete high-resolution bathymetric map of the area. South of Tiran Island, we trace the location of the main strike-slip Tiran fault along the western side of the Hume deep pull-apart basin, as well as a normal fault oriented NW-SE along the southern edge of Tiran Island. Hence, we propose that the Tiran fault and the normal fault as the key fault structures responsible for the tectonic uplift of Tiran Island.