

## **The gravity response of reef islands in the Red Sea and their significance to seismic interpretation**

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### **ABSTRACT**

The complex nature of the Red Sea subsurface represents a true challenge for seismic data acquisition, processing and interpretation. Allochthonous salt structures, multiple stages of faulting and folding, and complex rift geometries in the basement, collectively make seismic imaging very difficult. Within the shallow water transition zone, sea floor bathymetry complicates acquiring conventional offshore seismic data in the region. Overall, these characteristics provide a drive for a better understanding of the airborne potential field data as a guide for subsurface geologic model building.

As part of the geologic model building, airborne Bouguer corrected gravity was thought to provide a good guide of basement geometry. In the Red Sea, Bouguer corrected gravity surveys suffer, similar to seismic data, when acquired over reef Islands. These islands can rise to up to 600 m above surrounding bathymetry to the near water surface.

They also have thick carbonate roots that extend through adjacent seabed sediments several hundreds of meters deep.

The existence of reef Islands within the Red Sea presents two challenges for gravity data:

The root of the reef underneath the seabed causes a density anomaly in comparison to the loose sediment surrounding it.

The density of the reef is higher than the density used when applying the Bouguer correction. This results in having a “remnant” effect of the reef bathymetry that will also create a gravity anomaly. To gauge the island gravity response in comparison with that of a basement step at depth, it is important to model the gravity response of the described reef islands along with a geological model of the basement structure in a rift basin.

The basement response is effectively masked by that of the reef island response. Using parameters from well penetration, we forward model different scenarios of basement geometry, to gauge the extent to which the island response can mask the basement response. We confirm that the basement in the well locality had almost no bearing on the anomaly measured by our survey, and the response was due, primarily, to the reef island effect.