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Uplift of the Owen Ridge and giant landslides (NW Indian Ocean)

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The present-day India-Arabia plate boundary in the NW Indian Ocean is located along a 800 km long dextral strike slip fault system, known as the Owen Fracture Zone (OFZ). This fault system connects the spreading centres of the Sheba and Carlsberg ridge system to the Makran subduction zone. The OFZ is bounded to the west by the Owen Ridge, a series of seamounts and topographic highs which isolate the Owen Basin from Indus turbiditic supply. In March 2009, this area has been surveyed by the R/V Beautemps-Beaupré using a high resolution multibeam echo-sounder and sub-surface seismic profiles to reveal tectonic and sedimentary features related to the OFZ.

To the south, the OFZ crosscuts the southern portion of the Owen Ridge and offsets it dextrally over 12 km. The southern portion of the Owen Ridge consists in a 300 km-long, 2000 m-high, N-S trending relief. This ridge portion is asymmetric with a steep (15°) east-facing scarp associated with the OFZ and a gentle western slope corresponding to sedimentary beds tilted 3° to the west.

Our morphometric analysis provides a detailed map of the Southern Owen Ridge (including the OFZ) and reveals giant landslides on its western flank. The destabilization involves a large variety of mass wasting processes, such as slump, slide, rockfall, debris flows and crown cracks. The volume of all the removed material, estimated at 135 km3, has been drained off westwards in the Owen Basin. In the light of our new data, we re-analyse previous seismic profiles and cores collected during the ODP LEG 117. These data suggest that several episodes of destabilization occurred during the uplift of the Southern Owen Ridge which began 20 Myr ago. Giant landslides could have been triggered by earthquakes along the OFZ, and/or by the uplift motion, and could have provoked tsunamis, affecting the East coast of Oman.

The uplift is thought to be of transpressive origin and consistent with early Miocene compressive structures observed inland in the vicinity of the Qalhat Fault (East Oman). However, our data on the Owen ridge only show recent features of compression associated with small restraining bends along the OFZ.