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Continental break-up history of a poor magmatic margin from seismic reflection (northeastern Gulf of Aden margin, offshore Oman)

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The Gulf of Aden is an oceanic basin separating Arabia from Somalia. The rifting started 35 Ma ago followed by oceanic spreading from 17.6 Ma. The gulf orientation (N75˚E) and the kinematics (about N30˚E divergence) mark an oblique rifting where normal faults striking between N70˚E (rift axis parallel) and N110˚E (perpendicular to the divergence), are due to an extension direction probably evolving from N20˚E to N160˚E.

The accurate 3D structure of the margins and the influence of structural inheritance or thermal and rheological evolution need to be better constrained. In order to answer this question, we mapped the tectonic features of the first-order segment between Alula-Fartak and Socotra Fracture Zones of the eastern Gulf of Aden continental margin.

The Encens cruise (Leroy et al., 2006) take place in this area where the syn-rift structures are well exposed and covered by thin post-rift sediments onshore. Multibeam bathymetry, 360 channels seismic reflection (10 km spaced profiles), gravity and magnetism data were gathered. Furthermore one reflection seismic profile was processed with a pre-stack depth migration method. This excellent-quality dataset will permit us to image the structure of the margin and to propose an evolution from rifting to the onset of oceanic spreading.

These results complement the field work realized onshore on conjugate margins (Oman and Socotra). Thus the land evolution can be correlated to the oceanic evolution. The style of deposit seems completely different in the proximal and in distal parts of the margin. Indeed fault controlled syn-rift carbonate systems, well developed onshore, are not really well expressed offshore. The onset of rifting is marked by large offset normal faults which root on the brittle-ductile transition (BDT). The Ocean-Continent Transition (OCT) formation is accompanied by syn-OCT deposits. Uplift occurs onshore. The differential vertical movement between land and basin increases the slope and causes a landslide which possibly root on an upper pre-rift detachment level. Then the post-rift cover is affected by two discordances. They indicate surrections around the volcano and on the main basin northern edge. The second postdates a submarine erosion.

The structural scheme of the area provides a faults organization, which can be compared to analogic models of oblique rifting. Furthermore refraction and seismological studies, providing MOHO depth, will constrain the lithospheric scale analogue models.