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Tectono-Stratigraphic Evolution of the Western Somali basin: Sediment Dynamics, Margin Instability and the Legacy of the East African Rift System

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Summary

The evolution of the East African Margin changed drastically after the onset of East African Rift System (EARS). The uplift of the coastal basins and the formation of new rift structures in both onshore and offshore domains modified not only the rate of sediment delivery to the western Somali basin but also the sediment distribution pathways. Such changes have been recorded in the stratigraphy offshore Tanzania by a series of sediment depocenters bounded by basin-wide unconformities and laterally confined by main structural lineaments. In this contribution we reconstructed the post-Oligocene tectono-stratigraphic history of the Tanzanian margin by using a combination of large broadband multiclient seismic data and few boreholes, aiming to elucidate the role of the EARS in promoting sediment supply to the basin, in modifying the path of ocean bottom circulation and in triggering mass failure phenomena.

Abstract
The hydrocarbon potential of the East African margin, known since the Songo Songo discovery in the early '70, has been the main driver of the recent acquisition of regional and 3D multiclient seismic data, aimed to reveal the hydrocarbon potential of the conjugate margins of East Africa and Madagascar. As a result of this large acquisition campaign, a better picture of the regional tectonic framework of the area has been defined and more than 57 tcf of natural gas have been discovered in Tanzania from shallow to deepwater settings.

The current regional tectonic model supports the idea that the opening of the Somali basin and the development of the passive margins of East Africa and Madagascar started during the Jurassic with the break-up of Gondwana. During the Cretaceous, the southward drift of Madagascar along the Davie Fracture Zone (DFZ) modified the Tanzanian passive margin into a transform margin. Since the Oligo-Miocene, the tectonic setting of the area further evolved following the onset of the East African Rift System (EARS) that triggered the uplift of the coastal basins and the formation of new rift structures in both onshore and offshore domains, through also the reactivation of existing fault lineaments.

The stratigraphy of the western Somali basin in the offshore Tanzania, defined by a series of sediment depocenters with diagnostic seismic facies and bounded by basin-wide unconformities, recorded this sequence of tectonic events and potentially the changes in climate, sea level and oceanography occurred.

In this contribution we reconstructed the post-Oligocene tectono-stratigraphic history of the Tanzanian margin by using a combination of large broadband multiclient seismic data and few boreholes. We identified major depocenters, sediment entry points and their evolution through time on the basis of key stratigraphic horizons. This approach helped to assess depositional environments and their deposits, to quantify the influence of allogenic and autogenic forcing factors in the growth of the margin and to evaluate the control of tectonic deformation (as the Quirimbas Graben system and the DFZ) and pre-existing sea floor morphologies on sediment dispersal pathways. Moreover, we were able to elucidate the role of the EARS in promoting sediment supply to the basin, in modifying the path of ocean bottom circulation and in triggering mass failure phenomena.