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Evolution of post-rift sediment transport on a young rifted margin : Insights from the eastern part of the Gulf of Aden

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The formation of gravity-driven sedimentary systems on continental rifted margins results from the interaction between climate, ocean currents and tectonic activity. During the early stages of margin evolution, the tectonic processes are probably as important as climate for the sedimentary architecture. Therefore, the young margins (ca. 35 Ma) of the Gulf of Aden provide the opportunity to evaluate the respective roles of monsoon and tectonic uplift in the formation and evolution through the post-rift period of gravity-driven deposits (Mass Transport Complexes (MTCs) and deep-sea systems) on the continental slopes and in the oceanic basin respectively. Here we present a combined geomorphologic and stratigraphic study of the northern margin (Oman and Yemen) and the southern margin (Socotra island), in which we classified and interpreted the gravity-driven processes, their formation and their evolution during the post-rift period. The interpretation of seismic lines reveals the presence of bottom currents since the drift phase, suggesting that the Gulf of Aden was connected to the world oceans at that time. An abrupt depositional change affected the eastern basin of the Gulf of Aden around 10 Ma or thereafter (Chron 5), characterised by the first occurrence of deep sea fans and an increase in the number of MTCs. The first occurrence of MTCs may be explained by the combined 2nd-3rd order fall of the relative sea-level (Serravalian/Tortonian transition). This variation of relative sea level combined with a climatic switch (Asian monsoon onset around 15 Ma and its intensification around 7-8 Ma) control the sediment flux. The youngest unit of the post-rift supersequence is characterised by a second important MTC occurrence that is restricted to the eastern part of the deep basin. This is caused by a late uplift of the northern and southern margins witnessed onshore by the presence of young stepped marine terraces.