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Paleoceanographic and paleogeodynamic reconstruction of the Mozambique Channel – contribution of Nd isotopes in ferromanganese crusts

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The Mozambique Channel plays a key role in the exchange of water masses between the Indian and Atlantic Oceans. Recent hydrographic studies suggest that the North Atlantic Deep Water (NADW) flows to the Comoran Basin indicating that the Davie Ridge may not constitute a topographic barrier to deep water circulation (Collins et al., 2016). However, the Cenozoic geodynamic history and its consequences on the Mozambique Channel topography probably induced a modification of the hydrodynamic conditions during the last 50 million years. This might have an impact on the sedimentary systems and their evolution through time.

Ferromanganese crusts, which precipitate from the water column, represent archives of the water masses geochemistry. Radiogenic isotopes studies (Nd, Pb, Sr, Hf) of these encrustations may provide important information for the reconstruction of paleocirculation patterns and/or paleogeographic changes (Frank et al., 2002). During the oceanographic cruises MOZ1 (Olu, 2014) and MOZ5 (Moulin and Evain, 2016) of the PAMELA project (PAssive Margin Exploration Laboratories), more than 50 crusts were dredged over 2,000 kilometers in the Mozambique Channel. Surface scrapings of 31 crusts were investigated to provide the Nd isotope composition of water masses in the channel from the Glorious islands to the Mozambican margin. Additionally, two thick crusts localized southwest (MOZ1-DR17-01) and northeast (MOZ1-DR11-01) of the Davie Ridge were selected for Nd isotope time-series studies (i.e. investigation of water masses changes during the Cenozoic).

The Nd isotope data of surface scrapings provide evidence of the NADW influence in the Comoran basin. This is in agreement with the hydrographic studies of Collins et al. (2016) and demonstrates that the Davie Ridge does not act as topographic barrier to deep currents. Nd time-series study of MOZ1-DR11-01 points to a stronger NADW (or proto-NADW) influence during the Eocene and Oligocene. Our results show that the Davie Ridge did not stop the exchange between Atlantic and Indian deep water masses during the Cenozoic. Variations in the Nd isotope composition recorded in MOZ1-DR17-01 might be related to a subsidence event during the late Miocene as proposed by Courgeon et al. (2016).

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