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The interplay between large scale mass wasting and channelized sediment transport: examples from the NW-African Continental Margin

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The continental margin off Northwest Africa is largely shaped by a complex interplay of sediment transport processes directed both downslope and along-slope. During Meteor-Cruises M58/1 and M65/2 we investigated the sediment transport processes between 12˚ and 22˚ N off Senegal and Mauritania by means of geophysical, sedimentological, and geochemical methods. Bathymetric and high-resolution seismic data were used to study the areal extent and the internal structure of redeposited sediments. Based on these measurements sediment cores were taken for sedimentological and geochemical analyses.

Sediment transport off Mauritania with the Sahara Desert in its hinterland operates with different rates and styles including a significant transfer of land-derived terrigenous and hemipelagic sediments to the deep sea. One section off Mauritania shows a large concentration of upper slope canyons but no indication for large scale mass wasting. The incisions are typically between 50 and 150 m deep (with exceptions up to 300 m deep) at water depths of 1000-2000 m, and have a spacing of up to 10 canyons per 100 km at the 2000 m isobath. In between are numerous small gullies $<$25 m deep, which are roughly spaced 1-5 km apart at the 2000 m isobath. A section immediately to the south is characterized by large scale mass wasting but no canyons and gullies were found. We speculate that the open slope areas without any major incisions allowed undisturbed rapid sediment build-up which gave rise to sediment instabili-

ties arising primarily from underconsolidation of the deposited sediments, while the canyons and gullies represent and effective pathway for ‘semi-continuous’ downslope sediment transport by turbidity currents.

A different setting was found off Senegal. The upper continental slope is remarkably stable without any indications of large scale downslope sediment-transport and only some major canyons. The largest canyon system in the investigated area is the Dakar Canyon, a relatively straight up to 700m deep canyon. The upper part of the canyon is incised in a complex pattern of slope sediments with some tributary canyons, several buried canyons, and major erosional unconformities, suggesting a complex evolution of Dakar Canyon and the upper slope. The middle part of the canyon is incised in well stratified slope sediments. The most interesting part is the distal part of the canyon. On a distance of $<$10km, incision depth decreases from $\sim$100m to $<$20m. Seismic data show that the original canyon is now filled with slide deposits and was therefore destroyed by a major mass wasting event, which originated on the lower slope at 3500m water depth. Our data suggest that the confined flows travelling in Dakar Canyon spread over a large area further downslope once the canyon was destroyed by the slide. Hence large scale mass wasting in this area had a direct effect on subsequent sediment transport. Slides in water depths around 3500m were also imaged off the southern edge of the Senegal and off Cap Blanc suggesting that large scale mass wasting in water depths $>$3000m is more important at this margin than previously suggested.