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Sediment transport off Senegal: A complex interplay of large scale mass wasting, channelized transport and bottom current activity

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The shape of the Northwest African continental margin is highly influenced by the occurrence of different sediment transport patterns. This includes gravitational driven donwnslope transport as well as alongslope transport caused by bottom current activity. Off Senegal and The Gambia different sediment transport features such as, two major canyons, an enormous submarine landslide and large scale sediment waves are concentrated in a relatively small area between 12.5°N and 14°N. High resolution seismic profiles combined with bathymetric data both collected during Meteor cruise M65/2, allow a detailed investigation of this complex scenario with respect to (1) the shape and position of the observed sediment transport features and (2) their interplay over time and space.

The Dakar Canyon is a straight canyon which develops offshore the Dakar Cape and proceeds in southeastern direction until it disappears abruptly at a water depth of 3900 m. On the upper slope the canyon incises up to 700 m into the surrounding sediments whereas on the distal 10 km incision depth suddenly decreases from 100 m to less than 20 m. Seismic data gives evidence that at least the distal part of the Canyon was repeatedly destroyed by large submarine landslides, the latest one named Dakar Slide. Characteristic levee structures indicate that the canyon once was a highly active pathway for turbidity transport. After it was destroyed for the first time the canyon was reactivated and turbiditic flow leads to the erosion of the canyon fill. However, after its second and final termination caused by the Dakar Slide the abyssal part of the canyon remained inactive and confined flows having traveled through the canyon are expected to spread over a larger area further downslope. The headwall of the Dakar Slide is situated in about 3500 m water depth. The slide covers an area of about 110 km alongslope and is bordered by another canyon system in the south, the Diola Canyon. Contrary to the Dakar Canyon the abyssal part of the Diola Canyon seems to be unaffected by submarine slide sediments. Both canyons incise the surrounding sediments to a depth well below the base of the Dakar Slide. Therefore, the Dakar and the Diola Canyon are interpreted as natural boundaries for a further alongslope migration of the slide. Around 13.5°N large scale sediment waves are observed below the distinct headwall of Dakar Slide. They indicate that this area was influenced by strong bottom current activity prior to the generation of Dakar Slide. However, it is not clear yet if or how the buildup of these sediment structures contributed to the observed slope failure.

By means of high resolution seismic imaging we were able to describe the different sediment transport patterns off Senegal and The Gambia and to examine their influence on the underwater landscape. The filling history of the Dakar Canyon, which is characterized by a complex interaction of deposition and erosion could be reconstructed. Furthermore, we showed that slope instability in this area is not a unique feature over time as our data holds evidence for a massive landslide prior to the Dakar Slide.