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Sediment Dynamics and Geohazards offshore Uruguay and Northern Argentina: First Results from the multi-disciplinary Meteor-Cruise M78-3

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About 90% of the sediments generated by weathering and erosion on land get finally deposited at the ocean margins. The sediment distribution processes and landscape evolution on land are relatively well understood, but comparably little is known about the role and relative importance of marine sediment dynamics in controlling the architectural evolution of ocean margins. Important players include hemi-pelagic settling, down-slope and current-controlled along-slope sediment transport, depositional and post-depositional sedimentary processes (e.g. consolidation and diagenesis), as well as the destabilization of sediment bodies and their erosion. Submarine landslides in this context thus may represent an important sediment transport process, but also a major geo-hazard due to the increasing number of offshore constructions as well as their potential to instantaneously displace large water masses triggering waves in densely populated coastal areas.

Here we present first results from a seagoing expedition that aimed at investigating the interaction processes of sediment redistribution, partitioning, deposition and diagenesis from the coast to the deep-sea along the western South-Atlantic passive continental margin. During RV Meteor Cruise M78/3 in May-July 2009 the shelf, slope and rise offshore Argentina and Uruguay have been investigated by means of hydroacoustic and seismic mapping as well as geological sampling with conventional coring tools as well as the new MARUM seafloor drill rig (MeBo) that revealed recovery of geological strata sampled from up to 50m below seafloor.

The working area is characterized by a high amount of fluvial input by the Rio de la Plata river. The continental slope is relatively wide and shows average slope gradients between 1 and 2.5 but locally higher slope gradients may occur (>5). The transition for the continental rise with low slope gradients is found in $\sim$ 3000m water depth. The working area is located in a highly dynamic oceanographic regime. Cold Antarctic water masses of the northward flowing Malvina current meet warm water masses of the southward flowing Brazil current in the working area.

Various types of sediment instabilities have been imaged in geophysical and core data, documenting particularly the continental slope offshore Uruguay to be locus of frequent submarine landslides. Apart from individual landslides, however, gravitational downslope sediment transport along the continental slope is restricted to the prominent Mar del Plata Canyon and possibly to smaller canyons indentified in the bathymetric data. The location of the canyons might be controlled by tectonics. In contrast, many morphological features (e.g. progradational terraces and slope parallel scarps with scour-geometries) reveal that sediment transport is predominantly influenced/controlled by strong contour bottom currents. This suggests a significant impact of the western boundary currents on the overall architectural evolution of the margin.

Future studies using the acquired geophysical, sedimentological, physical property and geochemical data will (i) quantify the relative contribution of gravitational down-slope vs. along-slope processes through time in shaping this ocean margin and how it relates to the global ocean circulation pattern and sea-level change through time, (ii) investigate depositional and post-depositional processes and how they control submarine slope stability and submarine landslide initiation and (iii) explore the interaction and relative contribution of the various processes in controlling margin evolution, sediment dynamics and geohazard off Uruguay and Northern Argentina.