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Simulation of Canyon and Fan Development Using Analog Modeling of Erosional and Depositional Gravity Flows

Sub-marine gravity flows are recognized as the major processes controlling sediment transport and accumulation along continental margins. However, little is known about these flows, as in-situ observations and hydraulic measurements in the deep marine environment are very difficult to carry out. Consequently, analog modeling is an essential source of information to better understand the physics of these processes and to mimic the erosion, the transport and the sedimentation in the deep offshore.

We developed a microscale physical hydraulic model of a sub-marine ramp draped by a sediment blanket. The experiment takes place in a 2 m X 0.5 m tank filled with fresh water. A continuous brine stream is injected at the top of the ramp. Turbulence in the brine stream induces erosion of the sediment layer and the progressive incision of a canyon. The canyon first shows a straight morphology, then its sinuosity increases through time. The sediment eroded during the canyon formation is deposited at the base of the ramp, and constructs a depositional lobe.

The parameters of the experiments are the slope angle, the brine density and the brine injection flow rate. By testing the influence of these parameters on the final geometry of the incisions and of the depositional lobe, we have clues to assess the impact of the evolution of geologic factors such as climate and structural evolution on the transport processes controling the stratigraphic architecture of continental margins.