Geophysical Research Abstracts
Vol. 16, EGU2014-7339, 2014
EGU General Assembly 2014

Experimental studies of supercritical bedforms applied to coarse-grained turbidite deposits of the Tabernas Basin (SE Spain, late Miocene)

Matthieu Cartigny (1), George Postma (2), and Kick Kleverlaan (3)

(1) National Oceanography Centre, University of Southampton Waterfront Campus, European Way, Southampton SO14 3ZH, United Kingdom, (2) of Geosciences, Utrecht University, PO BOX 80.021, 3508TA Utrecht, The Netherlands, (3) Sedimentology Consultant, a/b "Hoop op Welvaart", Zeeburgerdijk 585, 1095 AE Amsterdam, The Netherlands

Modern submarine canyon floors are often covered with bedform patterns linked to supercritical turbidity currents, while recognition of sedimentary structures associated with such bedforms in outcrops are rare.

On the basis of experimental work on bed morphodynamics and flow structure of high-density turbidity currents, a 3-dimensional bedform stability diagram and related sedimentary facies diagram have been constructed. To allow scaling of this diagram to natural flows, four non-dimensional parameters are used: 1) densimetric Froude number, 2) modified mobility parameter, 3) dimensionless grain size and 4) basal sediment concentration. Each bedform and basal sediment concentration is then linked to a characteristic facies type. Numerical and theoretical models from the literature and observations from modern turbidite depositional systems are used to estimate characteristic sizes of the bedforms for different flow types. The model is applied to the turbidite fan systems of the Tabernas Basin (SE Spain, late Miocene) and discussed along existing classical models of high density turbidity current deposits. It is concluded that the vertical sequence of supercritical bedforms have been described in these models, yet to date have never been recognized as bedforms in outcrop, presumably because of their large size that easily exceeds the dimensions of commonly available outcrop.

On the basis both experimental work and outcrop studies in the Tabernas Basin (SE Spain) a conceptual three-dimensional bedform diagram for recognition of cyclic steps in outcrop is constructed. Experimental data indicates that depositional processes on the stoss-side of a cyclic step are controlled by hydraulic jump, which temporarily stalls the flow and by subsequent waxing of the flow up to supercritical again. The hydraulic jump produces large scours with soft sediment deformation (flames) preserved in Bouma Ta, while near horizontal, massive to stratified top-cut-out turbidite beds are found further down the stoss side of the bedform.

The architecture of cyclic steps can best be described as large, up to 100's of metres lens-shaped bodies that are truncated by erosive surfaces representing the set boundaries and that consist of nearly horizontal lying stacks of top-cut out turbidite beds. The facies that characterizes these bedforms have traditionally been described as turbidite units in idealized vertical sequences of high-density turbidity currents, but have not yet been interpreted to represent bedforms produced by supercritical flow. Their large size, which is in the order of 20 m for gravelly and up to hundreds of metres for sandy steps may have hindred their recognition in outcrop so far.