Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

SCG73-04 Room:202 Time:May 21 14:30-14:45

Stratigraphic patterns of turbidites in ponded submarine minibasins: Implications from flume experiments

TAKAHASHI, Hiroki[1*], Hajime Naruse[2], Tetsuji Muto[3]

[1]Graduate School of Science, Chiba University, [2]Department of Geology and Mineralogy, Graduate School of Science, Kyoto University, [3]Graduate School of Science and Technology, Nagasaki University

Minibasins are an important geomorphological feature on continental slopes. Minibasins are formed by various processes such as thrust movements or salt diapirs, and filled by hemipelagic mudstone and turbidites. Thus, morphodynamics of minibasins are significantly affected by the dynamics and depositional processes of turbidity currents. The behavior of turbidity currents can be classified into two types: surge and sustained types. Surge-type turbidity currents are reflected by the downstream lip of the minibasin, and the sustained turbidity current causes ponding of the minibasin. Ponded minibasins have clear interface of ambient water and turbid water, and this interface strongly affect the dynamics of inflowing turbidity currents. The resulting turbidite stratigraphic patterns are also supposed to be influenced by the ponding of the minibasins. This study aims to reveal the morphodynamics of the sustained turbidity currents and the resulting turbidite stratigraphic patterns in the minibasin.

To understand the depositional processes in minibasins, we conducted a series of flume experiments. The experimental tank used for the present study was Margi 6 (Length 6.5m $*$ Width 0.6m $*$ depth 1.3m) in Muto Laboratory, Faculty of Enviromental Studies, Nagasaki University. Inside Margi 6, a plastic tank (Length 6.5m $*$ Width 0.18m $*$ depth 0.83m) was placed, which kept salt water. During the experiment, both Margi 6 and plastic tank were filled with clear water. Inside plastic tank, an acrylic flume (length 4.0m $*$ width 0.04m $*$ depth 0.5m) was placed with a fixed inclination to simulate a minibasin. Then turbidity current was generated by mixing blue colored salt water (1.18 g/l) and plastic grains (specific density 1.5). Experimental turbidity current flows into the tank, causing the ponding of the minibasin with the interface between salt water and clear water. During the experiments, turbidity currents were supplied at a constant rate, and the interface raise also at a constant rate.

We conducted a series of experiments with different conditions, and the observation of the experiments revealed following six points:

(1) Subaqueous delta was formed in all experiments. The morphology of deltas resembles to the Gilbert-type delta whereas they show gradual transition from topsets to foresets.

(2) Slope of depositional surface changes from gentle to steep at near the saltwater-clear water interface, which corresponds to the location of topset-foreset transition

(3) Antidune and cyclic steps were formed on the topset slope, and plane bed were formed on the foreset slope.

(4) Topset foreset transition initial migrated downstream and then moved upstream when the saltwater-level was raised at a constant rate (autoretreat).

(5) During topset foreset transition was moving upcurrent, sediments did not reach the downstream slope (autobreak)

(6) Turbidite stratigraphic pattern at intersection (interface and acrylic frame tank), downstream part was filled with foreset deposits, middle part was filled with foreset deposits, and upcurrent part was filled with topset sediment. Movement of topset-forset transition depends on water discharge, sediment supply and rising rate of interface. Autobreak at downstream is caused by the limited length of topset.

Topset-foreset transition and the movement can be also observed at seismic section of the natural minibasins. Also the movement of topset foreset transition was reconstructed in numerical models. Comparing with flume experiment, numerical model and fieldwork, a synthetic model of the stratigrafic pattern of minibasin will be established in future studies.

Keywords: Minibasin, Ponding, Turbidite, Flume experiments