Crevasse-splay deposits of the 2015 Kanto-Tohoku Torrential Rain Disaster in Kami-Misaka, Joso City, Ibaraki, Japan

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Introduction

The 2015 Kanto-Tohoku Torrential Rain (JMA, 2015) caused a severe flood disaster along the middle reaches of Kinugawa River. Rapid water level rise resulted in a dike break 200 m wide in Kami-Misaka district in Joso City. The KRDB (2015) reported that overbank flow had been recognized at 11:00 and dike break began at 12:50. In order to clarify distribution and sedimentological feature of "crevasse-splay deposits (Masuda, 1998)" in this flooding, we conducted small trench excavation survey in Kami-Misaka district.

Distribution of crevasse-splay deposits

Erosional landforms, including pools and crevasse channel were dug by flood stream near the dike break site, which have >1.6 m depth and <60 m width. From that point, crevasse-splay deposits were distributed westward to southward. At least three sandy lobes elongated downward were found. Thickness of crevasse-splay deposits was less than 10 cm in the range of 150 to 250 m off the dike except for behind scattered rubbles. Thick crevasse-splay deposits were found between 250 m and 700 m, which consisted of sandy lobes. We found that thickness reached the maximum (around 80 cm) at ~400 m off the dike and decreased gradually downward from there. Only muddy flood deposits were distributed in southern area from 700 m off the dike.

Sedimentary Facies

Crevasse-splay deposits were suggested to be divided into 3 units, Facies A to C in ascending order.

Facies A: This unit was inverse graded sandy deposits from silt or silty fine sand to fine sand. This covered directly artificial soils of paddy fields with sharp boundary. Some layers of plant debris such as paddy were found. The thickness reached 25 cm in NW part of the lobe and declined southward.

Facies B: This unit consisted of fine to medium sand showing normal grading. Lenticular thin medium sand layers were sometimes found. Upper part showed parallel lamination. Concentrated layers of plant debris and small rubbles were found. The thickness became the maximum, around 20 cm, in the center of transverse section and decreased toward both edges.

Facies C: This unit consisted of well-sorted fine to medium sand with parallel lamination. Upper part showed ripple lamination. Cross lamination developed at the marginal part of the lobe. Rounded to sub-rounded granules, ~3 cm in diameter, were found. The thickness increased southward.

Discussion

Facies A to C were suggested to coincide with sedimentary processes during the flood.

It is suggested that the Facies A deposited at the overbank stage. Inverse grading shows that velocity of overbank flow and/or coarser sediments supply increased. At the beginning of flood, washed load was supplied from river, and then coarser sediments were transported by high velocity flood current (Masuda and Iseya, 1985).

Graded beds indicate that the Facies B was deposited by sediment gravity flow or at decreasing stage of clastic materials supply. It is possible that the sediment gravity flow occur when dike was broken. Distribution pattern that this facies distribute on the downstream side of the erosion landforms supports this idea. While, temporal large supply from the river just after the dike break probably resulted in few sediment supply and fine suspended materials deposition.

Parallel lamination and granules suggest that the Facies C deposited at upper flow regime. Expansion of broken dike had accelerated flood current for a few hours (Tsuneda, 2015). This suggests that the Facies C deposited after the dike break event. Ripple lamination indicates declining of flood current.

Reference

JMA (2015) available in: http://www.jma.go.jp/jma/press/1509/18f/20150918_gouumeimei.pdf (published in Sep. 18, 2015).
KRDB (2015) available in: http://www.ktr.mlit.go.jp/ktr_content/content/000633805.pdf (published in Oct. 13, 2015)

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