

Impact of volcanic activity on Late Holocene sedimentation pattern of a river-lake system in Hokkaido

PARKNER, Thomas^{1*}, Seji Yanai²

¹Graduate School of Life and Environmental Sciences, University of Tsukuba, ²Ishikawa University

Sediment production and sediment transfer through fluvial systems into oceans is very high on the Japanese Islands compared to other regions of the world, as most rivers in Japan are relatively short, show high gradients and are disturbed by human activity. In this study we reconstruct the sedimentation history of the floodplain of Bibi River and Lake Utonai to analyse the impact of volcanic activity on this river-lake system located in Southern Hokkaido. Bibi River is 17 km long and its catchment of 88 km² consists of the Eastern slopes of the active volcanic complex Shikotsu-Tarumae. The flat, 4.1 km²-large floodplain formed 3000 years ago after the regression of the Pacific Ocean. Bibi River drains into the North-Eastern section of Lake Utonai, which has a total area of 2.3km² with a maximum depth of 1m. During the last 3,000 years the catchment has been continually used for agriculture and was systematically developed since the beginning of the last century.

To analyze the volcanic impact 6 cores on the floodplain and 7 cores in the lake were taken. To distinguish between air-fall sediment and fluvially transported sediment the cores were sliced into 3cm or 5cm thick samples. For the 620 samples the parameters dry density and ignition loss mean grain size, sorting, skewness and kurtosis were determined.

Three air-fall deposits were identified as Ta-a (1736 A.D.), Ta-b (1667 A.D.), and Ta-c (3000 yBP) which each deposited 1.4 Mio t to 1.8 Mio t sediment on the floodplain and in the lake. Layer thickness on the floodplain depended on eruption direction. For the lake deposits, lake currents seem to focus of the air-fall tephra during flotation. About 0.6 Mio t of fluvial sediment was deposited on the floodplain during the last 3,000 years. During the period 1667 A.D. - 3,000 yBP an average of 0.070t/ha/y were deposited with an increasing sedimentation rates downstream. During 1736 A.D. and 1667 A.D. an average of 1.5t/ha/y accumulated on the floodplain with highest rates in the middle reach. Sedimentation rates decreased to 0.69t/ha/y during the recent period (2006 A.D. - 1736 A.D.), but showed very high values near road construction sites of the last century. Lake deposition reached 0.05t/ha/y (present - 1736 A.D.), 0.47t/ha/y (1736 A.D. to 1667 A.D) and 0.04t/ha/y (1667 A.D. to 3,000 yBP) with highest sedimentation rates in the northern section due to sediment focusing.

Results suggest that the sediment stored on the floodplain and in the lake is dominated by air-fall tephra (4.6 Mio t out of 5.2 Mio t). Even though the catchment was disturbed by human activity only very little fluvial sediment was deposited on the floodplain or in the lake after the Ta-a eruption. This indicates that mid-Holocene coastal plains can significantly reduce sediment transfer through fluvial systems into oceans by buffering sediment on floodplains and lakes. This finding might not only apply to the study area, but also to other volcanically disturbed catchments with mid-Holocene coastal plains. In such systems the impact of volcanic activity may dominate over human and climate impact.

Keywords: volcanic impact, river, lake, Late Holocene