CHARACTERISTICS OF SEDIMENT TRANSPORT IN TORRENTIAL RIVERS IN THE EAST COAST OF KOREA

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INTRODUCTION

As the dividing mountain chain of the Korean Peninsula is not placed in the centre of the peninsula, rivers dewatering east have a short length of the channel with a steep slope in upper reaches and sudden transformation to gentle slope in lower reaches. The geology of catchments in the east coastal area can be divided into deep weathered Granite of Jura Period and metamorphic rocks of Precambrian Period. Owing to the stable massif with a little uplift rate of 0.1 m/ka, the landscape of catchments shows the old stage remained only the skeletal structure without any development of alluvial fan. Exposed bed rocks are distributed stair-likely at different altitudes, characterized as cascade in the longitudinal channel slope. The human impacts such as wild fires and excessive deforestation have eroded away the slope surface materials for the last half-century to accelerate widely the surface erosion which can provide fine materials into the channel. Furthermore, typhoon-induced heavy rainfalls have frequently triggered numerous shallow landslides on mountain slopes, including debris flows, in the area of weathered Granite.

In this study, we contrastively examined sources of sediment supply and features of sediment transport for two torrential rivers with different geologic conditions. The type, magnitude and frequency of sediment transport by heavy rainfalls in both mountainous catchments were discussed, based on morphological and botanical evidences obtained from field surveys, to clarify the property of sediment delivery in the catchment scale.

DESCRIPTION OF STUDY SITES

Gungchon River in metamorphic rocks region has the catchment area of 42.7 km^2 with the river length of 13.6 km. The channel slope from river mouth continues upstream with 1.2%, and turns significantly to steepness near by the margin of the mountain area. The channel bed in mountain area is comprised of rounded boulders with the diameter of 0.5 to 1.2 m. The accumulation of rounded boulders which lacks fine materials as matrix was formed at every bend on the channel bed. No constructive facilities for torrent control are situated in the entire catchment area.

Hwangpo River flowing through the weathered Granite region has the catchment area of 10.3 km^2 with the river length of 8.7 km. The channel slope showed less than 0.3% in lower course and turned suddenly into steepness with over 14% in upper course. The channel bed was overlaid mainly with fine materials smaller than 20 mm in diameter and few boulders in an edged shape. The development of terraces along mainstream is scarcely.

DISCUSSION

In Gungchon River, the rounded boulders are considered to be originally produced from the mountain slope where fissures in rocky surface have been developed. There coarse materials were detached by slope failures and alteration of freezing and melting, and moved downslope due to gravity. Accumulated boulders in the valley bottom were transported by water gradually into the mainstream, to be rounded by transport. The existence of slope failure area is not distinguished at the present time, therefore both processes are considered to take the long term over thousand years.

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In Hwangpo River, the detachment of weathered Granite comprising the surface layer on slopes by heavy rainfalls and their reworking can be the trigger of mass movement. The deformation of terraces has contributed also to the sources for sediment supply during floods.

Results from field surveys suggested a clearly different pattern of sediment transport by heavy rainfalls between two catchments that mass transport of fine materials was dominant in Hwangpo River, whereas debris flow occurred in Gungchon River. Because any historical records of previous disasters caused by sediment transport do not exist but for 2002 typhoon-induced disasters in the local office, tree rings analyses of even-aged woods on river terraces as well as the distribution of terraces were performed to estimate the occurrence period of recent events.

In particular, the terrace formation in Gungchon River was strongly depending on the transformation of the longitudinal profile changing to be gentle. Besides, terraces were formed remarkably at the tributary junction or the site adjacent the outlet of large tributaries (Fig. 1), as described by Morisawa (1985). Consequently, it was found that tributary largely contributed to source of coarse materials, although their influences on mainstream might be variable (Rice, 1998). Also, it can be seen that terraces formed at the tributary junction act as an obstruction to sediment delivery. Tree ring of vegetation (*Alnus japonica*) on the terrace at the distal reach of the study site showed that they were only injured by 2002 typhoon-induced event during the past 30 years (Fig. 2), whereas morphological and botanical evidences associated with recent deformation by sediment re-transport remained on several terraces along upper reaches. From these results, rounded boulders on the channel beds are considered to move themselves gradually downward as process repeating temporary storage and re-transport not as debris flow. Fine material on channel beds have been transported contrastively by small scale floods occurring in intervals of 2 or 3 years. Filling up the matrix between accumulated boulders by fine materials can be assumed to set the stage for the initiation of debris flows, which return period is estimated to be recently once by 30 to 50 years.

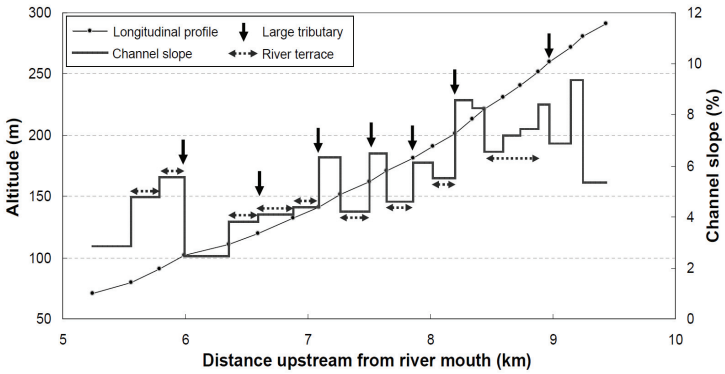

Fig. 1 Distribution of terraces along mainstream (Gungchon River)

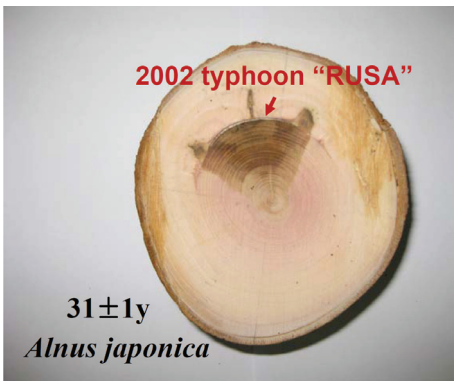

Fig. 2 Tree ring of *Alnus japonica*

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