論 文 の 内 容 の 要 旨

論文題目　Aspect ratio variation in lower reach rivers focusing on sediment size distribution
（河床材料の粒度分布に着目した下流河道の川幅水深比の変化に関する研究）
氏　名　アグス　サントソ

Understanding river channel shape is important for the effective river management. Especially the characteristics of the river channel shape in Segment 2-2 (alluvial plain), which usually lies in a densely populated urban area, should be analyzed well in order to understand the stable channel shape. As a parameter that describes river channel shape, aspect ratio, well known as a width/depth ratio (B/H) is useful and important. For example, Kuroki-Kishi (1984) described the relationship between aspect ratio and gravel bar types. Schumm (1963) stated that sinuous streams on the Great Plains are characterized by smaller aspect ratio, higher percentage of silt and clay forming the perimeter of the channel, and a gentler gradient for the same discharge than those of less sinuous streams. Relationship among sinuosity, width/depth ratio and silt-clay ratio are shown by him and Aisuebeogun (2014). It is also pointed out that riverbed material size, riverbed slope, mean annual maximum discharge, and width control the channel characteristics (Yamamoto 2004). The stable aspect ratio and its variation as well as the forming process in each river, however, have not been clarified yet. Based on such a background, the final goal of this study is to clarify the stable aspect ratio and the determinant factor of it especially by focusing on the sediment size distribution of riverbank and bed material size distribution.

In this study, 11 rivers, which consist of 10 rivers located in Kanto Plain and one river in Izu Peninsula, were analyzed. In each river, geology, channel network, width/depth variation, bank and bed material size are different. In all rivers, field observations were carried out at all target rivers to collect bed and bank material samples, and clarify natural levee condition. The reason why the natural levee is investigated is that the current river channel shape is affected by many kinds of human impacts such as revetment or dredging etc, but I considered that there

are some hints in the shape of natural levee. By examining the data obtained in all fields, following characteristics were found.

(1) The size distribution of riverbank material is almost constant in all target rivers and representative diameter is from 0.1mm to 0.5mm (usually around 0.25mm). Differences can be found in silt-clay ratio, but the difference is limited and the previous theory suggested by Schumm (1963) cannot be applied.
(2) The size distribution of riverbed material can be classified into three types: Type1. Relatively uniform sand and the size distribution is quite similar with the riverbank one; Type2. Relatively uniform fine gravel whose diameter is less than 1 cm. The representative diameter is from 0.5mm to 2.0mm; and Type3. Diverse distribution with coarse material whose diameter is more than 2 cm. The representative diameter is from 0.9mm to 35mm. These differences correspond to the difference of the geology. If Jurassic system is included in a drainage basin, then significant amount of the gravel is contained and the riverbed is Type3. If the Quarternary volcano exists in a drainage basin, then significant amount of sand is contained and the riverbed is Type1.
(3) When the coarse gravel, whose diameter is more than 2 cm, is included (Type3), aspect ratio tends to be small and is less than 25. Aspect ratio of 25 is considered to be the suitable value to classify high and low aspect ratio, because of meso-scale riverbed configuration etc. Riverbed is composed of relatively uniform fine material (Type1 and 2), however, aspect ratio tends to be larger than 25.
(4) When coarse gravel whose diameter is more than 2cm is included on a riverbed, the grain size distribution becomes wide, and the porosity of the riverbed is considered to be the smallest.
(5) The riverbed material of Type1 as well as river bank material of all segment2-2 rivers is transported as a suspended load under mean annual maximum discharge.
(6) High, wide and continous natural levee seems to be created when the Quarternary volcano exists in a drainage basin. Those rivers correspond to the river whose bank and bed material are similar (Type1).
(7) Low natural levee is found around the river with low silt clay ratio on the bank.

Based on the analysis explained above, some flume experiments were also conducted to clarify the mechanism of each characteristic feature. Then

following conclusions could be suggested.

1. The bank material size, is made by suspended material and the size is not so different among all rivers. The representative diameter is around 0.25mm. And if Quarternary volcano or some geology with high production rate of sand exists in a drainage basin, the riverbed is also covered with same suspended material (Type1). Such a condition can be understood through the high, wide and continuous natural levee around the river. In the low aspect ratio rivers with similar bank and bed material, coarse gravel might be buried under the suspended material transported during recession period of flood.
2. If gravel whose diameter is more than 2cm exists on the riverbed (Type3), the gap among coarse material is filled with fine material and quite stable bed condition with low porosity is created. Based on the diagram suggested by Yamamoto (1994), 2cm material is the critical size for transportation at the end of segment1. That means the size is considered to be quite stable in segment2. If the Jurassic system is included in a drainage basin, large amount of gravel is produced and this condition tends to be created.
3. The effect of the silt-clay ratio on aspect ratio cannot be found in Japanese rivers. But the natural levee is quite unclear when enough silt-clay is not produced in the river basin.
4. In Segment2-2 where the bank material is made of suspended material, bank erosion is caused by the erosion of foot of the bank. Therefore, riverbank does not occur and low aspect ratio is created if the river bed is stable. If the bank material is bedload, the relationship between material size and aspect ratio is different.