Relationship between geology and riverbed form in the tributary river basins of the Naruse River, Miyagi Prefecture, northeastern Japan

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I investigated the present riverbed sediment and riverbed form in order to examine the relationship between geology and riverbed form in the mountain river basin. Total 18 study sites were set at every 250 to 500 meters along the Neko and Ono rivers belonging to the Naruse river basin in the Miyagi Prefecture. The geology in the Neko river basin is composed by the highly consolidated andesites of Quaternary in the upper basin and semi-consolidated tuff and/or sedimentary rocks of Neogene in the middle to lower part. In contrast, the Neogene sedimentary rocks and tuff accompanied by the andesite gravel occupy the whole basin in the Ono river. Concerning riverbed form, the gravel riverbed dominated, especially in the upper part of the basin, in the Neko river, while the bedrock riverbed occupied in the upper basin and the gravel one was distributed in the downstream in the Ono river. In the Neko river, the present riverbed gravel, composed mainly of larger andesite, showed poor sorting and low roundness. The matrix consists mainly of sand, and its proportion increased downstream in the Neogene bedrock area. The gravel in the riverbed of the Ono river was smaller, well sorted, and more rounded, particularly in the lower basin. The matrix had relatively high proportion of sand, and the particle-size distribution was more or less similar in all sites.
The differences recognized in the riverbed form and present sediment between two basins are discussed below from the viewpoint of bedrock lithology. It is estimated that highly consolidated andesites, insusceptible to abrasion, produces larger, untransportable, and consequently less rounded gravel in the Neko river basin. As the result, gravel and/or gravel step riverbed are dominant. On the other hand, the semi-consolidated Neogene rocks in the Ono river basin provides abrasive gravel and abundant sand. It is suggested that the riverbed sediment can be easily transported and, in consequence, the bedrock riverbed become dominant in the upper basin. In the lower part of the basin, smaller tractive force due to gentle bed slope and presence of the andesite gravel yielded from the tuff result in the formation of the gravel riverbed.

Keywords: Mountain river, Riverbed form, Riverbed sediment, Lithology, The Naruse river,Miyagi prefecture

