Changes in shapes and microtextures on quartz grains of fluvial sediments at Hime Kawa.

*Hiromi Itamiya[1,2], Toshihiko Sugai[2]

1.National Research Institute of Police Science, 2.The Graduate School of Frontier Science, The University of Tokyo

[Introduction]
Quartz is a highly resistant and ubiquitous mineral in nearly every environment. Microtextures such as small pits and conchoidal fractures can be observed on quartz grain surface. Many researchers have observed quartz surface by scanning electron microscope (SEM) and studied to link microtextures to the sedimental environments and transport mechanisms (Krinsley and Doornkamp, 1973; Mahaney 2002). Quartz microtextures have been mainly examined in continental regions such as Europe. It is supposed that geological and geomorphological features relate to the frequency distribution of microtextures. However, little is known on the microtextures of quartz deposited in orogenic belt and monsoon region like Japan.
In this study, we focused on the fluvial sediments in Japan. The changes in the surface textures of quartz grains were determined from upstream to downstream areas of a steep river, Hime Kawa. The shapes of the quartz grains were also examined.
[Methods]
The studied area was situated in Hime Kawa in Nagano and Niigata Prefectures. Seven fluvial sediment samples from the bed of Hime Kawa and one nearshore sample near the mouth of Hime Kawa were collected. Carbonates, iron oxides and organic matters were removed from samples by chemicals. The quartz grains in the size range of 0.1mm up to 1mm were sputter coated for 60s with a current of 40 mA in a palladium coating. Fifteen grains per sample were observed by SEM (JEOL, JSM-6610LV) in high vacuum mode and the voltage was 25kV.
[Result and Discussion]
Most of the quartz grains in fluvial samples show angular outline and there are no clear changes along Hime Kawa. The nearshore sample also contains angular grains which resemble the fluvial samples. Most of the grains in upstream area have high relief, and the relief gets slightly lower along Hime Kawa. These changes may be caused by the collision of the grains in subaqueous environment. Some grains show characteristics shapes, namely twinned quartz. Both penetration twin and contact twin are found in fluvial samples.
On the quartz surface, conchoidal fractures, V-shaped percussion cracks and straight steps are found in both fluvial and nearshore samples. It has been proposed that they are produced by a powerful impact or pressure on the grain surface in high-energetic subaqueous environment (Vos, 2014). In our study, frequency distribution of each microtexture has not drastically changed except small pits.
Small pits (< 5μm), which derives from small inclusions in quartz, can be abundantly observed in the samples along upstream area of Hime Kawa. They are observed sparsely along downstream area. It means the amount of inclusions in quartz is quite different between upstream and downstream areas at Hime Kawa. The tributaries such as Tsuchitani Gawa and Nakatani Gawa flow into the middle reaches of Hime Kawa. Quartz particles we observed in this study may have different derivations due to the sediment supply from tributaries in the middle reaches.

Keywords: quartz, surface texture, SEM, twins, provenance study

