Changes in provenance and chemical weathering of Cenozoic fluvial sediments in the southwestern margin of Tarim Basin deduced from their mineral and chemical compositions

*Tomohiro Kanzaki[1], Ryuji Tada[1], Akinori Karasuda[1], Ke WANG[1], Hitoshi Hasegawa[2], Hongbo Zheng[3]

1. University of Tokyo, 2. Kochi University, 3. Yunnan University

In the surface environment of the Earth, atmospheric CO_2 pressure (pCO_2) is considered to be one of the major controlling factors of climate in various timescale. In the timescale longer than several million years, pCO_2 is controlled by the carbon exchange between the lithosphere and the atmosphere (Berner, 1999), and chemical weathering is one of the most important processes. Therefore, to understand the climate variability in such long timescales, it is necessary to understand changes in the intensity of chemical weathering in the geological timescale and to investigate its controlling factors. As for the modern environment, the intensity of chemical weathering is estimated by analyzing the river water to quantify the flux of elements that are leached out by weathering. However, to estimate the intensity of chemical weathering in the past, the only clue is the fluvial sediment that is the product of weathering, because the information of river water was lost.

It is known that the mineral and chemical composition of fluvial sedimentary rock is affected by the following three factors: chemical weathering, composition of parent rock, and grain size. Among these factors, the effect of grain size could be eliminated by conducting the grain-size separation of samples (e.g. Zhou et al., 2015). However, the effect of the composition of parent rock is not well discussed in the preceding studies, so it is still a problem to be solved.

Therefore, in this study we made an attempt to extract the effect of chemical weathering on the mineral and chemical composition of fluvial sedimentary rock by estimating and separating the effect of the composition of parent rock using grain size separated fractions. Yecheng section at the south-western rim of the Tarim Basin is selected as a studied site because studies on provenance change was already conducted by using the composition of pebbles and electron spin resonance (ESR) signal intensity of quartz (Zheng et al., 2006, Karasuda, 2013MS). Sedimentary rock samples including fluvial sandstones, matrix of alluvial conglomerate, and aeolian siltstones collected from the section are separated into 4 grain size fractions. Each fraction is analyzed by X-ray powder diffraction (XRD), and their mineral composition are quantified by Rietveld’ s analysis method (Rietveld, 1969). Then, major element composition of samples is estimated by X-ray fluorescence (XRF). Smear slide was made for a few samples, and composition and appearance of clastic grains are observed.

To examine how the type and composition of parent rock affect the mineral component of sedimentary rock, the mineral and chemical composition of sedimentary rock samples are compared to those of pebbles extracted from conglomerate, and the ESR signal intensity of quartz, an indicator of provenance. Then, an attempt was made to extract the information on the chemical weathering from the mineral composition by removing the effect of grain size and composition of parent rock.

As the result, 250-1000 μm fraction of sedimentary rock sample contains much more lithic fragments estimated to be derived directory from the parent rock than other fractions, but mineral composition of primary minerals such as quartz, plagioclase and calcite is rather closer to that of <16 μm fraction, that suggests the fraction may be affected by weathering. On the other hand, primary minerals are concentrated mostly in 63-250 μm fraction, and its primary mineral composition have good correlation with ESR signal intensity indicating that this fraction reflects the type and composition of the parent rock

©2018. Japan Geoscience Union. All Right Reserved.

best among the 4 fractions. This observation indicates that, general belief that larger grain size fraction contains more primary minerals (e.g. Lupker et al., 2013), is valid for grain size smaller than 250 μm. Some of clay minerals in <16 μm fraction are also found in probable parent rocks picked up from conglomerates. Therefore, some of clay minerals can be derived from the parent rocks. So, it is necessary to estimate and separate the effect of composition of the parent rocks to extract the effect of chemical weathering from the mineral and chemical composition of fine grain fraction (<16 μm). In our poster presentation, we will explore the method to extract the information on chemical weathering by removing the effect of parent rock composition from the mineral and chemical composition of fine grain fraction.

Keywords: Tarim Basin, Provenance change, Chemical weathering

©2018. Japan Geoscience Union. All Right Reserved.