The geochemical study about the aqueous environment of Chikusa River in Hyogo prefecture

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The Chikusa River belongs a class B river system, which runs through the southwestern part of Hyogo prefecture. Because of heavy rain, this river sometimes flows over and its basin is damaged, so Hyogo prefecture has carried out river reforming works to improve the capacity of flow until May, 2016. But the works changed the environment of this river, the impact on the quality of river water and the river ecosystem is concerned and we need the basic data of this river to measure this impact scientifically. In this study, we analyzed concentrations of dissolved ion and trace elements, stable isotopes of water (δD, δ^{18}O), nitrate (δ^{15}N, δ^{18}O), strontium ($^{87}Sr/^{86}Sr$). In addition, we plotted the result of analysis on a basin map with a geographical information system so that the result could be seen easily and we aimed to offer the basic data which was easy to use. Furthermore, we estimated the formation factor of dissolved ion, trace elements and stable isotopes through a comparison between the result of analysis and the land use, geological features and topography of the basin.

In the Chikusa River, Chikusa River Conservation Committee has been holding “The simultaneous survey of water temperature all around Chikusa River” in every August since 2002. In this survey, the committee and many local residents measure water temperature at 94 sites, from headwaters to river-mouth and some tributaries. From 2015, Research Institute for Humanity and Nature, Kobe University and University of Hyogo has joined in this survey and started collecting water samples. In the survey of 2016 (held in August 7, 13:00~16:00), we received the water samples from local residents and we filtered them at once, with cellulose acetate filters whose diameters of holds are 0.2 μm. After filtering, we subdivided the samples into some polyethylene bottles and a glass vial and stored them at 20℃ or -30℃. We analyzed concentrations of trace elements and bicarbonate ion, δD, δ^{18}O (water) and $^{87}Sr/^{86}Sr$ 20℃ samples. We also analyzed concentrations of dissolved ion, δ^{15}N and δ^{18}O (nitrate) with -30℃ samples.

As a result of the analysis, the concentrations of dissolved ion were gradually increased from the upstream toward the downstream. From the upstream to the middle reaches, most of the dissolved ion were likely derived from the rock or the precipitation. On the other hand, the downstream and the tributaries flowing through well-populated areas, the concentrations of it were higher because of living or agricultural wastewater. The concentrations of nitrate or phosphate ion were higher from the upstream to the middle reaches and lower in the downstream. At the high concentrations points, most of them were likely derived from nitrogen load from nitrogen saturated forest areas or livestock wastewater. At the downstream, low concentrations points, the water temperature was higher, so aquatic lives became active and they likely consumed nitrate or phosphate ion.

δD and δ^{18}O were lower in the upstream and higher from the middle reaches to the downstream. From the upstream toward the middle reaches, they became lower as the altitude became higher because of the precipitation affected by the altitude effects. On the other hand, they were higher from the middle reaches to the downstream in spite of the altitude. These areas’ river became shallower and wider in the river reforming works, so the effects of sunlight on the river became big and the evaporation from the surface of river became more active. This is why δD and δ^{18}O became higher in these areas.

Furthermore, rice farming is flourishing in these areas, so the paddy water having high δD and δ^{18}O likely flowed into the river. This is also why they became higher.
There are other analysis points affected by the rock or the wastewater. We will also discuss results of these points in this presentation.

Keywords: Hyogo prefecture, the Chikusa River, river water, concentrations of dissolved ion, stable isotopes, geochemistry

