Isotope hydrology study of the groundwater flow system of Kurobe river fan, Japan

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[Purpose]

The Kurobe river fan is the typical seaside type fan which was formed by the rapid Kurobe river originated from the northern Japanese Alps.

This fan is famous for their abundant groundwater resources with many coastal springs. After 10 years absence, the groundwater flow system study of the fan is executed, with the help of water chemistry, the stable hydrogen and oxygen isotopes, the tritium contents, and the carbon isotope ratio, to consider the recharge source, the flow condition, and the residence time of the groundwater, and also to reveal the origin of undersea groundwater discharge springs.

[Results]

[Groundwater potential]

In the sallow unconfined groundwater, the right side region of the Kurobe river shows some groundwater depression by pumping. While in the deep confined groundwater both sides region of the Kurobe river shows groundwater head depression caused by pumping. In the right side of the Kurobe river, the deep confined groundwater is mainly recharged at the top to middle of the fan, while in the left side river, the confined groundwater is recharged both top and edge of the fan which must be the influence of industrial groundwater pumping of this area.

[Water chemistry]

Water chemistry of the groundwater in the Kurobe river fan predominate Ca(HCO3-) type. Generally, the Kurobe river water has less water chemical than the groundwater, and the confined groundwater is much affected by the Kurobe river water. The water chemistry in the undersea groundwater discharge springs reflects mostly that in the unconfined groundwater.

[Hydrogen and oxygen isotope ratios]

derutaD and the deruta18O value are relatively heavy in the shallow unconfined groundwater which reflect the influence of the local precipitation recharge. On the other hand, the deep confined groundwater shows remarkably light content of derutaD and deruta18O value which reflect the influence of the Kurobe river water. Moreover, the influence of the Kurobe river water recharge is relatively dominant in the right side of the Kurobe river than that of the left side. This was also supported in the deruta13C distribution.

[Tritium and 14C contents]

The tritium contents in the shallow unconfined groundwater are about 5T.U. which is identical with the present precipitaion. The residence time of this unconfined groundwater based on the piston flow model was presumed to be 0-30 years. While the tritium contents in the deep confined groundwater of 50-100m depth was 0.2-9.7T.U. and the residence time to be 20-30 years. Undersea groundwater discharge was 6.9-9.1T.U. and estimated to be about 30 years. No tritium was found in 100m or more depth wells, and their estimated 14C age was more than 2000 years. It showed that another groundwater flow system with a very long residence time could be existed in the study area.