

Effect of active faults on the water quality of the Ado river and neighboring spring waters in Shiga Prefecture

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Along a fault plain, there is a fractured damage zone, which has high permeability. This zone is often become groundwater path from deep to shallow (Faulkner et al., 2010). As a result, the fault-related groundwater stably supplies heat and chemical materials including water itself, which make some effect on the environment in and around the fault zone. For example, hot and mineral springs tends to distribute in and around fault zones (Koizumi et al., 1985; Mino et al., 1985). Since river has a base flow from groundwater, an active fault along or across the river also can have some effects on the water quality of the river by the base flow. The active fault causes a large earthquake at a very low frequency such as once every several thousand to tens of thousands years and destroys the surrounding environment. However, during the period when the large earthquake or the fault movement does not occur, the active fault forms and maintains the environment through the groundwater.

The length of the Ado river, which is located in the western part of Shiga Prefecture, is 58km and the second longest in the rivers which flow into Lake Biwa, which is the largest lake in Japan. The catchment area of the Ado river is 300 km² and the third largest in the rivers which flow into Lake Biwa (Shiga Prefecture, 2018). In the part of the upstream and most of the midstream, the Ado river runs along the Hanaore fault. In the downstream the Ado river crosses the Biwako-seigan fault (Fig.1). Both of the faults are the main active faults in the western part of the Shiga Prefecture. In addition the Ado river basin is not well developed (Biwa basin study group, 2003). Therefore the Ado river is suitable for investigating the effect of active faults on the river water quality. There are some spring waters in the end of the alluvial fan of the Ado river. There are also some spring waters along the Biwako-seigan fault, which crosses the top of the fan. Hereafter they are called the fan spring water and the fault spring water, respectively.

During the period from 1996 to 1998, the water quality of the Ado river at ADG in Fig.1 was firstly Ca-HCO₃ type and later turned mainly into NaHCO₃ type or rarely into Na-Cl type (Koizumi et al., 2019). Water quality of the hot springs along the Hanaore fault and Biwako-seigan fault around the Ado river is Na-HCO₃ type and its concentration is several times to 10 times larger than that of river water (Koizumi et al., 2019). Therefore it is considered that the major cation should change from Ca²⁺ to Na⁺ when the effect of the hot spring waters through the faults increases.

We surveyed the Ado river during the period from August 12 to August 14 in 2018. Before this period there had been no precipitation for thirteen days. Therefore it is considered that the river water was mainly composed of the base flow. The results showed that the water quality of the Ado river was Ca-HCO₃ type from the upstream to the downstream at the period (Koizumi et al., 2019).

We have regularly surveyed the downstream of the Ado river, the fan spring waters and the fault spring waters about once a month since April, 2018 (Fig.1). In this survey, the water quality of the downstream was Ca-HCO₃ type until August 2018. However since September 2018, the water quality have been Na-HCO₃ type. The water quality of two of the fan spring waters, i.e. HRE and KWS in Fig.1, was also Ca-HCO₃ type until August 2018 although it has also been turned into Na-HCO₃ type since September 2018. In the presentation we will report the factors for those water quality changes.

Fig.1:Left: Solid circles indicate the sampling points of the Ado river during the period from August 12 to August 14 in 2018. Solid triangles show meteorological observation stations of JMA. Right: Regular sampling points since April 2018. Solid and open squares indicate fault spring waters and fan spring waters, respectively. Background map is from the active faults database of AIST(AIST, 2020).

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