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Saline groundwaters in and around the Osaka Basin and those origins

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Many saline waters including high amounts of Fe and occasionally CO_2 and bicarbonate ions are issuing in the mountainous areas surrounding Osaka Basin. Among those waters, Arima hotspring is the most famous and the hot saline water has been called Arima-type brine, which is characterized by heavy oxygen isotope shift and high 3He/4He ratio similar to the mantle derived component (e. g., Nagao et al. 1981). High CO_2 and $^3He/^4He$ saline waters similar to the Arima-type brine have been known at Ishibotoke at southern mountainous area of Osaka (e. g., Matsumoto et al., 2003). Saline groundwaters were found in the Quaternary sediments and underlying basement rocks of Osaka Basin. Those waters occasionally contained high $^3He/^4He$ ratios and were suggested the similarity to the Arima-type brine (Morikawa et al., 2008). In this study, saline waters containing $>$500 mg/L chloride ions and $>$400 mg/L HCO_3^- ions were three-dimensionally mapped assuming the well depth was the sampling depth of groundwater to see the relationship between the occurrence of saline waters and geological structure. Then, the origins of saline waters were estimated from the relationships among hydrogen and oxygen isotope ratios and chloride ion concentrations.

The saline waters distribute characteristically along the boundary between sedimentary basin and surrounding mountains and the bottom of the basin including the lowermost sedimentary formation and basement rocks. The former is usually along active faults; Arima-Takatsuki Tectonic Line at the north and Ikoma faults system at the east and south. These faults would work as recharging paths of deep groundwater and seawater might inflow using these faults. The latter does not have clear relationship to the tectonic structure.

Hydrogen and oxygen isotope ratios of saline waters are plotted on a mixing line of seawater and local meteoric water. If seawater is one of the end members, relationships of chloride concentration and those isotope ratios also give mixing lines. Although these relationships of saline waters at $<$100 m depths show the mixing lines, the those of deeper ones do not give simple mixing lines; chloride concentration and oxygen isotope ratio of saline waters at 100-500 m depths are on the mixing line while hydrogen isotope ratios are smaller than those affected by seawater, and the saline waters $>$500 m depth have smaller isotope ratios than those contributed by seawater. Compared with the Arima-type brine, oxygen shift is not large for these saline waters, however, such an isotope characteristics would be on the formation process of Arima-type brine.

Keywords: Deep groundwater, Arima-type brine, active faults, hydrogen and oxygen isotope ratios