

## Three-dimensional mapping of groundwater flow system in Osaka Basin based on the database of water chemistry

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Osaka Basin is a large reservoir of groundwater resources, which can be used for various applications as industrial and domestic water resources. However, the uptake of groundwater has been strictly regulated in the center of Osaka Basin since 1960s to avoid geogenic disasters such as land subsidence, which actively occurred in the period of rapid economic growth. The land subsidence has stopped since 1970s because of the regulation, and groundwater has not been extensively used for more than three decades. However, the uptake of groundwater has been a threat again due to increasing consumption of groundwater for private water supplies since 2000s. Depths of private wells for industries, hospitals, etc., are mostly from 100 to 300m from the ground surface, where the shrinking clay layers severely occurred. Because those groundwaters have not been used for long time, present water chemistry is not well documented.

In this study, groundwaters mainly sampled from the wells between 100 and 300m depths were studied for the stable hydrogen and oxygen isotope ratios and major chemical components to estimate the origins of groundwaters. Combining the results of this study and previous studies, three-dimensional mapping of groundwater geochemistry was drawn to discuss the groundwater flow system of the basin and the effect of the land subsidence to the present groundwater geochemistry. Aquifers of groundwater were classified by geological information including marine clay layers. This study was successful to visualize the groundwater chemistry as three-dimensional maps, which clearly show the following features of groundwater chemistry.

Hydrogen and oxygen isotope ratios of the groundwater  $\leq 100$ m depths increased from mountainous areas to the center of plain, and the origin of these groundwaters were local meteoric water. In the western plain of Uemachi plateau, of which altitude is below sea level, the stable isotope ratios of groundwaters ( $\delta^2\text{H}$ :  $-40\text{‰} \sim$ ,  $\delta^{18}\text{O}$ :  $-5\text{‰} \sim$ ) are larger than those of local meteoric water ( $\delta^2\text{H}$ :  $-45\text{‰} \sim -40\text{‰}$ ,  $\delta^{18}\text{O}$ :  $-7\text{‰} \sim -6\text{‰}$ ), due to mixing with seawater. Thus, the seawater invaded into the aquifers of these areas, especially those between marine clay layers Ma12 and Ma9.

The stable isotope ratios of the groundwater were low ( $\delta^2\text{H}$ :  $\sim -55\text{‰}$ ,  $\delta^{18}\text{O}$ :  $\sim -8\text{‰}$ ) in the deeper aquifers than the Ma9. Slightly lower isotope ratios of the groundwaters than those of local meteoric water with diluted Na-HCO<sub>3</sub> type chemistry suggested that the groundwater contained squeezed pore water from the overlying clay layers. It would be the evidence of excessive wage of groundwater when the land subsidence actively occurred.

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