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Three-dimensional mapping of geochemical and isotopic characteristics of groundwater beneath the Osaka Plain

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Osaka Basin, which is a large Quaternary sedimentary basin beneath the Osaka Plain, is a large reservoir of groundwater resources. The uptake of groundwater has been strictly regulated since 1960 to avoid land subsidence, which actively occurred in the period of rapid economic growth. Although the land subsidence has stopped since 1970s because of the regulation, it became a threat again due to start of uptake of groundwater for private water supplies after 2000 ' s. Excess groundwater uptake from 100 to 300 m depths for those purposes would squeeze porewater from impermeable marine clay layers causing subsidence again.

In this study, groundwaters were mainly sampled from the wells >100 m depths, and stable hydrogen and oxygen isotope ratios and major chemical components were determined to estimate origins of water. Combining the results of our and previous studies, overall picture of three-dimensional mapping of groundwater geochemistry was drawn to discuss the groundwater flow system and the relationship to the land subsidence.

In the coastal region below sea level, seawater invaded into the groundwater aquifers <100 m depth. Stable isotope ratios of the groundwater at >100m of this area(δ^2H:-50 ‰~ -60 ‰,δ^{18}O:-8 ‰~ -9 ‰) is smaller than those of groundwater at <100m(δ^2H:-40 ‰~ -50 ‰,δ^{18}O:-6 ‰~ -7 ‰). Especially low isotope ratios of the groundwaters, of which chemistry was diluted Na-HCO3 type, from the lowland west of Uemachi plateau suggest squeezing the pore water from clay layers.

In the same area, high electric conductivity and Na-Cl type chemistry indicates seawater invasion into the groundwater aquifers <100 m depth. Uemachi Fault works as recharging path for the groundwater aquifers <100 m along the western edge of Uemachi plateau. However, the recharge is not enough to fill the aquifer >200 m apart from the fault. These observations indicate that the aquifers in the aquifers beneath western lowland of Osaka Plain have not been recovered by newly recharged groundwater.

Keywords: groundwater, isotope