Vertical changes in groundwater geochemistry in the central Kanto plain on the basis of pore water analyses

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In the Kanto plain, the largest Quaternary groundwater basin in Japan, groundwater with high Cl^- concentrations of more than 100 mg/l (up to 216 mg/l) is obtained from the multi-screen wells of 150-430m depths at the centre of the plain. The area with the Cl^--rich groundwater, spreading from the northwest to southeast, corresponds with the so-called Motoarakawa Tectonic Zone (some 10 km wide by 35 km long) bounded by the faults on its longer sides. We have found the Cl^--rich groundwater is also characterized by low delta-D and low delta-^{18}O values. Both the chemical and isotopic evidence strongly suggests the Motoarakawa Tectonic Zone divides the groundwater system in the Kanto plain into three distinct hydrologic subareas. Two faults, which delineate the Motoarakawa Tectonic Zone, act as barriers to the southward and eastward regional flows of groundwater in the Kanto plain. As a result, the Motoarakawa Tectonic Zone has been under an isolated hydrologic environment for a long period of time, resulting in the occurrence of groundwater with anomalous hydrochemistry. With regard to the origin of isotopically-depleted groundwater, a potential source is assumed to be precipitation in a cooler climate than the present. Admixture of residual sea water is likely to account for the elevated Cl^- concentrations of groundwater in the tectonic zone.

The previous studies have succeeded in delineating horizontal extent of this Cl^--rich, isotopically depleted groundwater, whereas its vertical extent is poorly understood. Therefore, we carried out the 350-m deep all-core boring in the Syobu Town in the centre of the Motoarakawa Tectonic Zone to know how Cl^-concentration and isotopic composition of groundwater change depthwise. Pore waters with pF less than 3.0 were squeezed out of the undisturbed soil cores at 25 depths by a centrifuge for the chemical and isotopic analyses. The results indicate the Cl^--rich, isotopically depleted groundwater develops to the depth as shallow as around 80 m below the ground surface in the Motoarakawa Tectonic Zone. Heavy contamination of the extracted pore water samples by drilling mud made it impossible to delininate the lower extent of this groundwater with peculiar geochemical characteristics.