

Genesis of thermal water related to Iwaki-Nairiku earthquake

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An earthquake (M7) occurred at 6 km depth on April 11, 2011 in Iwaki City, Fukushima, Japan. Thermal waters sprang out at 3 places in Iwaki just after the earthquake. Observed groundwater changes, such as flow rate and water level changes are thought to be due to volumetric strain changes occurred by the earthquake. The newly formed springs are still spouting as of Jan. 2013, and some of their flow rates do not decrease. Iwaki area is placed at a fore arc position of NE Japan and there are no volcanoes there. However, temperature of thermal waters found from bore holes (1000m deep) are up to 80 deg C, and heat source is unknown. The thermal NaCl waters thought to come from basement granite through the faults.

In this study, we analyzed chemical and isotopic compositions of thermal waters around Iwaki, to understand the cause of new springs formation and their origin.

From the analytical results, the thermal waters are classified into NaCl-type, and the stable isotopic composition of water suggests that they are of seawater origin. However, the chlorine concentration of the endmember of NaCl-type water is depleted in Cl, and Cl concentrations varied from 6000 mg/L to 20000mg/L similar to that of formation water found in oil fields. The age of saline water is determined to be from several hundreds thousand years to more than one million years, using Cl-36/Cl ratio of waters and chemical composition of rocks forming aquifers. The origin of NaCl water is possibly implied as 1) formation water from Joban-Oki Basin placed in Pacific Ocean 50 km east from Iwaki, or 2) dehydrated or squeezed water from the sediments of the subducting Pacific slab.

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