

## **CHEMICAL COMPOSITIONS AND ISOTOPE RATIOS OF UPWELLING FLUIDS FROM MATSUSHIRO EARTHQUAKE SWARM AREA, NAGANO, JAPAN**

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Matsushiro earthquake swarm which occurred from August, 1965 to May, 1967 brought about remarkable uplift of the ground. In the earthquake which continued for five months from August, 1965 large number of ground fissures were generated in the Matsushiro basin around Mt. Minakamiyama, and the much groundwater of the ten million cube meter gushed out from uplift area near the epicenter. The upwelling fluids such as free gas and spring water were collected from Matsushiro earthquake swarm area, and then methane/ethane ratio, carbon isotope ratio of the carbon dioxide which is main component of the free gas, isotope ratios of oxygen and hydrogen, and concentration of anion, cation in the spring water were measured for estimation of origins of upwelling fluids. Most is under ten on the values of methane/ethane ratio in collected free gas except for the one site, and according to Suzuki(1997), the values of carbon isotope ratio of the methane were -7.9 permil to -9.8 permil. This indicates that the methane from Matsushiro earthquake swarm area is mixed thermogenic methane with mantle methane. Considering that the thickness of the sediment in the Matsushiro earthquake swarm area is about 1.2km, thermogenic methane was probably generated in the place which was shallower than 1.2km. The value of carbon isotope ratio of the carbon dioxide is -4.8 permil to -7.1 permil. The value suggests that the carbon dioxide in the spring water has its origin in the mantle. A linear correlation is seen between concentration of (Na+Ca)ion and concentration of Cl ion in the spring water. The relation is interpreted in terms of mixing of upwelling fluids from the deep water into the surface water. The isotope ratio of oxygen and hydrogen in the spring water are -3.6 permil to -7.1 permil, -52.7 permil to -72.1 permil respectively and are not plotted on the meteoric line. This suggests that the spring water undergoes the interaction between rock and upwelling fluids in the underground. The value of Na/Mg ratio which greatly changed around the earthquake in 1965 is almost 4.8 at present. The value is equal to the value in 1977 which the seismic activity is low. This indicates that the gush mechanism has not changed for 20 years very much.