

Earthquake precursory and co-seismic changes of the hot spring water in Central Part Japan

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We have observed the radon concentration, the flow rate and the temperature of the underground water in the 16 observation stations on the active faults in Gifu Prefecture, Center Part Japan from August 1998. The high sensitivity radon detectors for water were installed in the “Heisei hot spring” in Fukui Prefecture, and “Wari-ishi hot spring” in Gifu Prefecture. Amount of the hot spring water was measured by the electromagnetic flow meter with the accuracy of 0.1 liter/min, and the water temperature was measured by the precise thermometer with the accuracy of 0.01 degree C in the water main pipe. The observation results in the underground water were displayed with the real time in the Web Page.

The many co-seismic and three pre-seismic changes were detected on the Heisei hot spring and Wari-ishi hot spring. The pre-seismic anomalous changes of accompanied to the three earthquakes, Gifu Hida earthquake, Ishikawa Prefecture west offing earthquake and Tottori Prefecture west earthquake, were summarized in this report.

Anomalous changes in the flow rate, the deviation of flow rate and radon concentration were observed at the Wari-ishi Hot Spring, before 3 weeks of the Gifu Hida Earthquake M5.4 on August-16, 1998: decrease of water flow rate from 29 to 27.4 liters/min, and increase of deviation of flow rate from 0.2 to 0.5 liters/min, decrease of the number of RaA counts of about 40%, ²¹⁸Po daughter nuclei of ²²²Rn. The deviation of flow rate became 0.05 liters per minute or less per minute among two weeks after the earthquake occurrence. The amount of gas in the underground water showed anomalous change before and after the earthquake occurrence.

The decrease of water flow rate from 183 liters to 170 liters per minute, and temperature from 27.72 to 26.15 degrees C were observed at the Heisei Hot Spring, before 42 hours of the Ishikawa Prefecture west offing earthquake M5.8 on June-7, 2000. The number of RaA counts was decreased gradually after the earthquake occurrence.

The increase of water flow rate from 151.5 liters to 153.5 liters per minute, and temperature from 26.35 to 26.56 degrees C were observed at the Heisei Hot Spring, before 2.5 hours of the Tottori Prefecture west earthquake M7.3 on October-6, 2000. The number of RaA counts decreased for the period of October-3 to October-4 before the earthquake. The standard deviation of the flow rate was 0.7 liter/min before the earthquake, and has decreased 0.2 liter/min after the earthquake among a day. This phenomenon is thought to be a decrease of the amount of the gas in the hot spring water.