

Analysis of spring water formation mechanism used by ^{222}Rn concentration at Masutomi-Onsen located in Yamanashi, Japan

*Eiki Mochizuki¹, Takuya Hayakawa¹, Hiroshi Kobayashi¹

1. Yamanashi Institute of Public Health and Environment

The ^{222}Rn content of Masutomi-Onsen in the northern part of Yamanashi Prefecture is one of the best in the country and many users are visiting as spa resort areas. In order to use this hot spring for a long term, planned use, it is important to clarify the current formation mechanism of spring water.

In Masutomi-Onsen, it is reported that the sedimentary rock near the surface of the earth is a source of ^{222}Rn . Therefore, the behaviors of the ^{222}Rn concentration and other component concentrations except ^{222}Rn are considered to be different. Therefore, we attempted to estimate the formation mechanism of spring water based on ^{222}Rn concentration and other component concentration.

In this study, we regularly monitored Nyuzawa spring in the Masutomi-Onsen area for 2 years from April, 2016 to March, 2018, about discharge amount, ^{222}Rn concentration, other component concentrations, and water temperature.

As a result, periodic fluctuations were observed in ^{222}Rn concentration range from 3,700 to 7,800 Bq / kg. However, except for Unusual decrease in concentration at October 2017 and March 2018, other component concentrations, discharge amount, and water temperature were constant.

In October 2017 and March 2018 in which Unusual decrease in other component concentration was observed, both were consistent with the time when the periodic fluctuation of ^{222}Rn concentration showed minimum. lot of rain was observed immediately before monitoring, and it seemed that this was related to ^{222}Rn and other component concentration reduction. From this, we analyzed the variation of ^{222}Rn concentration, Unusual decrease of other component concentrations and the relevance of precipitation.

When water was supplied to the surface by rainfall, ^{222}Rn concentration decreased, and Then it took 4 months to recover. other component concentrations were constant regardless of the amount of precipitation except Unusual decrease.

I set the following hypothesis to explain this. ^{222}Rn arising from sedimentary rocks becomes ^{222}Rn gas in the soil, and this ^{222}Rn gas is one of ^{222}Rn sources in spring water. Normally, shallow groundwater does not intersect with spring water, but shallow groundwater deprives ^{222}Rn gas according to its amount, so ^{222}Rn concentration in spring water fluctuates.

In order to verify this hypothesis, we confirmed the relationship between shallow groundwater level estimated from precipitation and ^{222}Rn concentration, and as a result, a significant negative correlation was observed, and a result supporting the hypothesis was obtained.

From these facts, it was possible to explain formation mechanism of spring water based on ^{222}Rn concentration, other component concentrations and precipitation in Nyuzawa spring.

Keywords: hot spring, Masutomi-Onsen, Yamanashi prefecture, Radon-222, formation mechanism