Estimation of the Microgram Amount of Thorium in the Arima Hot Spring Waters and Deposits

Shinnosuke HIGASHI*

(Shigematsu Laboratory)

Received February 12, 1959

This is the seventh in a series of the papers dealing with the determination of microgram amount of thorium in natural substances. The thorium content in the Arima Hot Spring Waters were estimated to be 10.2~21.7 microgram per liter and in the deposits 10.4~22.6 microgram per gram by a method of colorimetric analysis.

The values that were cited above were about one-tenth of the values that were estimated by the "Thoron Method".

Some discussions were made on the problem of radioactive equilibrium in the hot spring waters.

EXPERIMENTAL

The processes for the determination of the thorium content in the hot spring water are as follows.

Each sample of about 2 liters in volume was filtered with the filter paper of Tôkyô-Roshi No. 5C. To carry the thorium, ferric hydroxide was precipitated by adding slight excess of ammonium hydroxide to the sample solution. The hydroxide precipitation was washed with distilled water and was dissolved in dilute hydrochloric acid. Perchloric acid was added to the solution, which was then evaporated to fumes in platium crucible. Addition of hydrofluoric acid and repeated fuming served to remove silica.

The final solution was evaporated to dryneess and fused with sodium bisulfate. The flux was dissolved in dilute hydrochloric acid. Ferric hydroxide was precipitated by adding slight excess of ammonium hydroxide. The hydroxide precipitation was washed with distilled water and dissolved in nitric acid.

Thorium was extracted with cyclohexanone and was determined with the colorimetrical method[1].

The method of analysis for spring deposit was that reported in the previous paper[1].

RESULTS AND DISCUSSION

The thorium content of the Arima Hot Springs and Deposits were shown in Table 1.

Using "Thoron Method", Shimokata has studies in great detail on the thorium content of hot spring waters and deposits in Japan. The values were

* 東慎之介

Table 1. Thorium content in the Arima Hot Springs.

Date of sampling	Tenjin Water	Deposit	Ariake Water	Deposit	Shin-onsen Water	Deposit
May 23, 1958	14.5 γ/l	18.8 γ/g	10.2 γ/l	10.4 γ/g	18.6 γ/l	22.6 γ/g
Oct. 19, 1958	13.3 γ/l		9.5 γ/l		21.7 γ/l	

Table 2. Thorium content in the Arima Hot Springs by "Thoron Method" (Shimokata)

	Tenjin Water	Th γ/l	Ariake Water	Th γ/l	Shin-onsen Water	Th $\gamma/1$
Date of sampling	3,22 (1949)		3,22 (1949)		4.26 (1949)	
Measured	4,14 (1950)	70	2.18 (1950)	43	11,17 (1950)	49
Measured	1,6 (1953)	110	3.16 (1954)	78	3,16 (1954)	227
Measured	3.16 (1954)	159				

shown in Table 2.

An obvious disagreement was found between our values and those of Shimokata. This disagreement is supposed not to be ascribed to the error in the experiment, but to the fact that the radioactive equilibrium is not maintained between the thorium disintegration series in those samples, because the thoron content (calculated as the thorium content in Table 2) increases as times goes on. (If the radioactive equilibrium be established on the sample, such phenomenon not could be observed).

The analogous results have been given on the uranium and radium content in hot spring waters. For example, Nakanishi[3] reported that the ratio of U to Ra (Max.) is about 1 to 1,000 for the Arima Spring Waters. Hoffmann[4] also reported that the ratio of U to Ra is about 1 to 10 for the Erzberge Spring Waters.

Many interesting problems concerning the radioactive equilibrium in hot spring waters are lying before us, the study of which is now in progress.

ACKNOWLEDGEMENT

The author is deeply indepted to Professor Masayoshi Ishibashi for his helpful advice and encouragement.

REFERENCES

(1) Ishibashi, M. and Higashi, S., This Bulletin, **35**, 1 (1957).
(2) Ishibashi, M. and Higashi, S., *Japan Analyst*, **5**, 135 (1956).
(3) Shimokata, K., *J. Chem. Sod. Japan*, **77**, 4,7,558 (1956).
(4) Nakanishi, M., *J. Chem. Soc. Japan*, **69**, 4 (1948).
(5) Hoffmann, J., *Monatsh.*, **74**, 38 (1941).