

On the Equilibrium of the Radioactive Elements in the Hydrosphere. VI.⁽¹⁾ Radioactivity Measurement of Natural Waters with the Geiger-Müller Counter:

By Kazuo KURODA.

(Received March, 14, 1949.)

The radioactivity of a large number of natural waters in Japan has been mainly measured with the fontactoscopes, such as Schmidt-type, I.M.-type etc. The radioactivity measurement of natural waters with the Geiger-Müller counter was recently tried for the first time by the present author, and the results are reported in this paper.

Experimental Part. (1) Apparatus. A Geiger-Müller counter of Nippon-Denki Co. was used. The thickness of aluminum wall of the counter tube was about 0.1 mm. and the background was about 30 per minute. (2) Radioactivity measurement. The water sample (about 100 c.c.) was placed near the counter-tube (about 2 cm. from the wall of the counter-tube), and the number of counts per minute was recorded.

Results. (1) Relation between the number of counts and the radon content of natural waters. The results of radioactivity measurement of the radioactive springs of Misasa, Tottori Prefecture are shown in Table 1.

Table 1. Relation between the number of counts and the radon content of mineral water of Misasa.

Name	Radon Content (10^{-10} Curie/Litre)	Number of Counts (Counts/Minute)
Yamada-ku, Kyodo-yu, Nomi-yu	1044	19.5
OTR (Ohasi, Tennen-buro-Reisen)	263	19

(1) Previous Paper V. Kazuo Karoda, This Bulletin, 22 (1949), 149.

Okayama-University	59.5	5
Hanaya	741	8.5
Moto-Aburaya	142.5	3
Eirakuan		3.5
Akasakiya	85	0
Matsubara	111.1	7
Yakuba-no-yu	424	5.5
Gunze-no-yu	1021	15.5
Tap water		5.5
Distilled water	0	2

The number of counts is almost proportional to the radon content of natural water, but the natural waters containing thorium emanation show exceptionally large values of counts, as in the case of spring OTR of Misasa. The sensitivity of radioactivity measurement with the counter was considerably low compared with that of the fontactoscopes. Thus the radioactivity of the springs containing less than 10 Mache-unit of radon could not be detected with the counter.

(2) Increase of β and γ radioactivity of fresh mineral waters. It was reported in the previous paper,⁽²⁾ that the intensity of β and γ radioactivity of fresh mineral water is usually very low, and it increases after the mineral water has issued, and a constant value is obtained within about three hours. It was explained in the previous paper to be due to the increase of the decay products of radon after the mineral waters have issued. This phenomenon was also observed in the case of the radioactivity measurement with the Geiger-Müller counter. The results are shown in Table 2.

Table 2. Increase of β and γ Radioactivity of Fresh Mineral Waters.

Name of the Springs	Time elapsed after the Springs issued (Minutes)	Number of Counts per Minute
Yamada-ku, Kyodo-yu Nomi-yu	15	2.5
	33	4
	63	15.5
	160	20
Yamada-ku, Kyodo-yu (Stagnant Water)	25	12
	73	17
	275	16
Seito-kan, Nomi-yu	22	9
	64	7
	165	17
	238	13
Gunze-no-yu	22	1
	60	15
	117	15
	180	14

(2) Kazuo Kuroda and Yuji Yokoyama, This Bulletin, **21** (1948), 52.

(3) Measurement of radioactivity due to radium with the Geiger-Müller counter. The radioactivity of mineral waters containing radium was measured with the Geiger-Müller counter, several months or several years after the sample was taken. The radioactivity of mineral waters containing high amounts of radium ($n \times 10^{-12}$ to $n \times 10^{-10}$ g. radium per litre) could not be detected with the Geiger-Müller counter, and it was concluded that it is impossible to estimate the radium content of natural waters directly with the counter.

(4) Radioactivity of Sinter Deposits. The radioactivity of sinter deposits of the thermal springs of Misasa and the mineral springs of Masutomi was measured with the Geiger-Müller counter. Some sinter deposits of Misasa showed considerably strong radioactivity, which is almost equal to that of monazite. This radioactivity is considered to be due to radium and mesothorium in the sinter deposits.

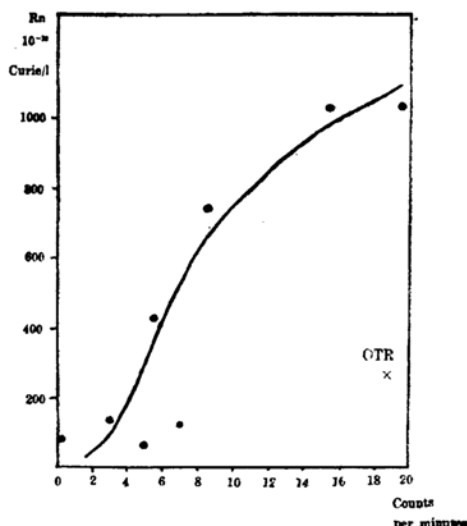


Table 1. Relation between the number of counts and the radon content of mineral waters of Misasa.

Summary

The radioactivity of the natural water was measured with the Geiger-Müller counter. The relationship between the radon content of the thermal springs of Misasa and the number of counts was studied. The increase of β and γ radioactivity of fresh mineral waters was observed.

The author expresses his hearty thanks to Professor Kenjiro Kimura for his kind guidance. The cost of this research was defrayed from the Scientific Research Encouragement Grant from the Department of Education, to which the author's thanks are due.

*Chemical Institute, Faculty of Science,
Tokyo University.*