

confidence limits  $\rho_1=0.13$ ,  $\rho_2=0.95$ .

For comparison, if we calculate the sample correlation coefficient (7) by the same data, we get  $r=0.584$ , and the 90% confidence limits 0.26, 0.78.

The length of the confidence interval by the simple method is  $0.95-0.13=0.82$ , while  $0.78-0.26=0.52$ .

On the other hand, for the period 1887~1920 ( $N=34$ ), we have

$$(9) \quad k'=13, k_0'=2 \text{ and } \hat{\rho}'=(13+1)/34=0.41.$$

From Fig. 1 or Fig. 2 we get  $\hat{\rho}'=-0.27$ . In order to test the significance of the difference between  $\hat{\rho}$  and  $\hat{\rho}'$ , we use Fig. 2 and we have  $\rho_2'=0.08$  and  $\rho_1=0.39$ .

Since  $\rho_2'<\rho_1$ , the difference between the correlations in the periods 1887~1920 and 1921~1940 is significant on 4% level of significance.

### References

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550.35 : 539.16

## On the Artificial Radioactivity in the Sea near Japan

by

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### 1. Introduction

As a result of Japanese Bikini Expedition aboard the "Shunkotsu-maru" remarkable radioactivity was found around Bikini Atoll [1]. The investigation of radioactivity in sea water near Japan was done next, because the North Equatorial Current on which the main activity flowed has undoubtedly some relation to Kuroshio Current flowing off the coast of Japan.

Sampling of sea water was made during the period from July to September in 1954 by members aboard the following survey vessels: The "Ryōfū-maru" of Central Meteorological Observatory, the "Shumpū-maru" of Kōbe Marine Observatory, the "Meiyō-maru" of Hydrographic Office, the "Shin-yō-maru" of Tokyo University of Fisheries and the "Atsumi-maru" of Maritime Safety Agency.

### 2. Sampling and measurement

Samples of sea water were collected at positions approximately between 30°N ~35°N and 131°E~140°E. Besides, samples were also collected by several fishing

boats near the equatorial zone of the Pacific. Samples are taken up mainly from the sea surface, but some of them at layers of 25 m or 50 m below the surface. The volume of sea water brought to the land was only from 500 ml to 3 l.

The measurement of total radioactivity in sea water was made in the following way at the laboratory of our institute about 20 days after sampling. After adding 2 g of solid ammonium chloride, 1 ml of the aqueous solution of iron alum (86.3 g/l) and 1 ml of barium chloride solution (17.8 g/l) to 1 litre of sea water, the water is heated to 60°~70°C while being stirred well. A few drops of an alcoholic solution of phenolphthalein (1%) are added as an indicator, then ammonium hydroxide solution (1:1) is carefully dropped in with a pipet until a faint pink color appears. After two minutes boiling, the precipitate is settled on standing for a couple of hours at room temperature. The precipitate is filtered under suction on a round filter paper (dia. 3.5 cm) laid above a glass filter. The precipitate remaining on the filter paper is dried in an air bath or a desiccator holding it in a small brass case to avoid the folding of the surface. Measurements of radioactivity are done by putting the precipitate kept in a brass case under a mica window of G-M counter. The G-M counter used is Radiation Counter, Model 32 manufactured by Science Research Institute Ltd., Tokyo. The thickness of mica window is 3.7 mg/cm<sup>2</sup> and the distance between the mica window and the surface of the precipitate is 1.5 cm. After the measurement has been done, the precipitate is covered by a poly-ethylene film to protect the surface. It was confirmed that at least 70~80% of the total activity in sea water could be transferred to the precipitate by preliminary tests using the fission materials that fell aboard the fishing boat the "Fukuryū-maru". Therefore, the actual activities might be 25~40% higher than observed values. To obtain the counting efficiency the aqueous solution containing Ce-144, of which activity had been referred to the standard RaE, was treated chemically as mentioned above, and its radioactivity was measured under the same geometrical conditions. Thus, the efficiency of the measurement was found to be 7.7%, that is 1000 cpm is equivalent to about 5.9 mμC.

Since we used only one litre or less amount of each water sample for measurements, the radioactivity was mostly so weak that it could hardly be measured with the G-M counter. Therefore, counting was done for as long as 30 minutes or more to attain high accuracy.

### 3. The results of measurements

Table 1. The radioactivity in sea water near Japan.

Positions	Depth m	Date of sampling	Date of measurement	Radioactivities cpm/l
32-00.9 N, 140-13.9 E	50	July, 16	Aug., 11	3.1±1.7
31-01.6 N, 140-20.2 E	0	15	13	3.1±1.3
30-29.0 N, 140-29.5 E	50	14	13	3.1±1.5
30-01.1 N, 140-30.0 E	0	14	7	4.8±2.1
do	25	14	7	6.4±2.1
33-10.0 N, 137-47.0 E	0	July, 4	Aug., 13	2.1±1.6
32-23.0 N, 139-15.0 E	0	4	13	3.3±1.6
32-55.0 N, 138-30.0 E	0	Aug., 15	Sept., 19	2.2±1.8

Table 2. The radioactivity in sea water collected at positions near the equatorial zone of the Pacific.

Positions	Date of sampling	Date of measurement	Activities cpm/l
01-01 S, 148-38 E	June, 29	July, 9	4.0±1.7
03-50 N, 145-30 E	30	9	5.7±1.7
07-14 N, 142-14 E	July, 1	9	4.7±1.6
12-48 N, 140-30 E	2	9	4.2±1.7
18-02 N, 138-38 E	3	9	4.4±1.7.
08-53 N, 150-41 E	Aug., 15	Sept., 21	22.4±3.8
13-00 N, 149-00 E	16	21	140.8±6.8
15-58 N, 148-09 E	17	21	6.4±3.6
09-40 N, 150-37 E	Sept., 8		24.8±2.5
07-38.6 N, 130-35.8 E	Nov., 7	Dec., 10	10.2±2.0
10-44.5 N, 131-01.5 E	8	10	14.4±6.7
14-07 N, 131-03 E	9	10	4.6±3.5
17-26.8 N, 131-03.8 E	10	10	5.2±1.8

Table 1 and Fig. 1 show the results of measurements. It is to be noticed that the radioactivity in sea water was found in the area lying between about 33°N, 138°E and 30°N, 141°E, i.e. the north or north-east from "Tori-shima" Island. The reason of this peculiar distribution has not yet been made clear.

Table 2 shows the radioactivities in sea water collected after finishing the survey by the "Shunkotsu-maru" near the equatorial zone in the Pacific.

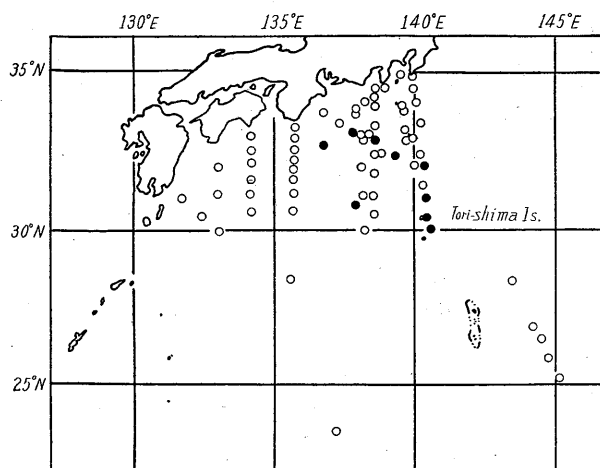


Fig. 1. The distribution of radioactivity in the sea near Japan. Open circles show the positions of sampling. Solid circles show those where radioactivities were found.

#### Reference

- [1] MIYAKE, Y., SUGIURA, Y. and KAMEDA, K., 1955: On the Distribution of Radioactivity in the Sea around Bikini Atoll in June, 1954. *Pap. Met. Geophys.*, 5, p. 253.