Geophysics

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Fig. 1

Figure 1: Fig. 1

Abstract

Full Text

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Investigation of the Radioactivity of Atlantic Ocean Waters

(Presented by Academician V. V. Shuleikin, 26 IV 1960)

In 1958–1959, at the Department of Physics of the Sea and Inland Waters of the Faculty of Physics of Moscow State University, under the direction of A. G. Kolesnikov, an instrument was constructed for the direct determination of the radioactivity of seawater. Since the instrument was constructed on the principle of a scintillation spectrometer, it proved possible not only to measure the distribution of radioactive elements with depth in the upper 120-meter layer, but also to identify these elements.

Measurements with the instrument were carried out during the sixth voyage of the expedition vessel of the Academy of Sciences of the USSR *Mikhail Lomonosov* in the Atlantic Ocean in the period from 1 to 20 X 1959, while the vessel was sailing from the point with coordinates 22°45′ N, 63°06′ W to the point with coordinates 15°22′ N, 20°56′ W. Observations carried out down to a depth of 120 m made it possible to trace changes in radioactivity in the upper mixed layer above the thermocline, in the thermocline layer, and below it, i.e., to cover the most important regions influencing the spread of radioactivity in the ocean.

Fig. 1

In processing the results obtained, it was possible to identify certain radioactive elements: K^{40}, Cs^{137}, Kr^{85} and, apparently, Eu^{155}. The sufficient identity of the patterns of radioactivity distribution from station to station indicates the atmospheric character of the contamination of ocean waters (stratospheric fallout). The data obtained made it possible to compare the distribution with depth of radioactive elements of different half-lives with the position of the temperature-jump layer. In order to determine the influence of the jump layer on the distribution of radioactivity with depth, all the results obtained were divided in such a way that each group of measurements contained only results from stations with a similar position of the jump layer. In Fig. 1, as an example, the distribution with depth of the above-mentioned isotopes is shown (jump depth $\bar{z} = 40$ m).

The analysis makes it possible to detect a relation between the distribution with depth and the position of the jump layer. Each distribution curve of a radioactive element with a given half-life has three characteristic sections. In the upper, intensely mixed layer, the specific activities are characterized by values that are essentially identical. The second section of the distribution curve gives a sharp decrease in activity; it is located in the jump layer. Below this layer the activity remains practically constant.

The rather wide range of half-life periods of the identified elements (2–33 years) makes it possible to form an idea of the rate at which radioactive contamination penetrates through the discontinuity layer.

On the basis of the results presented, the following conclusions may be drawn:

1. The uniform distribution of radioactivity in the region studied indicates the atmospheric character of its contamination.
2. From the standpoint of the distribution of radioactivity, there are three well-defined layers by depth down to 120 m.
3. The upper layer is characterized by the highest values of specific activity, practically constant throughout its entire depth.
4. The intermediate layer is characterized by a sharp decrease in specific activities.
5. Below the intermediate layer there is a relatively passive layer with low values of specific activities.
6. The position of the indicated layers is directly determined by the position of the discontinuity layer.
7. The decrease in the value of the specific activity of each isotope is related to its half-life period in such a way that, as the period decreases, it increases.

In conclusion, the author expresses gratitude to Prof. A. G. Kolesnikov for the assistance provided in constructing the instrument and in processing the results obtained.

Moscow State University
named after M. V. Lomonosov

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Note: Figure translations are in progress. See original paper for figures.