Radionuclide distribution of Holocene sediments and its effects on the habitat of recent foraminifers: A case study from the Western Marmara Sea (Turkey)

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ABSTRACT

Radionuclides cause radioactive contamination in aquatic environments just as other non-biodegradable pollutants, such as heavy metals, sink to the seafloor and accumulate in the sediments. These radioactive pollutants especially affect benthic foraminifera living on the sediment surface or in the sediments in the seafloor. Foraminifera were used as bioindicators to analyze the effect of radioactivity pollution on ecosystems. In this study, we have investigated natural and artificial radionuclide (232Th, 226Ra, 40K and 137Cs) distribution in sediment samples taken in the living areas of benthic foraminifera in the Western Marmara Sea by means of gamma spectrometry. Accordingly, 29 core samples taken in 2016 from depths of about 20–35 m close to the shores of the Marmara Sea were used. Core samples representing the pollution of the study area were collected at locations such as discharge points for domestic and industrial areas, port locations, and others. Other samples were taken from areas unaffected or less affected by pollution.

The radionuclide concentration activity values in the sediment samples obtained from the locations, in Bq/kg, were 137Cs, 0.9–9.4; 232Th, 18.9–86; 226Ra, 10–50; 40K, 24.4–670. These values were compared with the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) data, and an environmental analysis was carried out. The 226Ra series, the 232Th series, and the 40K radionuclides accumulate naturally, and they are also increasing continuously due to anthropogenic pollution. Although the 226Ra values obtained throughout the study areas remained within normal limits according to the UNSCEAR values, the 40K and 232Th series values were found to be higher in almost all locations. According to these results, the main causes of radioactive pollution in the investigation area are agricultural and mining activities.

Keywords: Ra-226, Th-232, K-40, Cs-137, radionuclide, Western Marmara Sea, Foraminifera