RADIOACTIVITY AND TRACE ELEMENT LEVELS IN SEDIMENTS OF THE BLACK SEA

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Radioactive and trace element pollution in the marine environment are usually monitored by measuring the contaminants in water, biota and sediment samples. The relative abundances of the radionuclides or trace elements in each group depend on both the properties of the sediment and biota and the chemistry of the pollutants. Element or radionuclide concentrations in sediment are relatively invariable over time compared to water and biota. Furthermore, the integrated concentrations of radionuclides or trace elements in sediments have been assumed to give the rate of pollution for comparison purposes.

Several studies have been published concerning radioactivity and trace element levels observed in some marine organisms in the Black Sea (GÜVEN *et al.*, 1990, 1992; TOPCUOGLU *et al.*, 1988, 1990). However, data on these subjects for the sediments are limited. We report here the results obtained on the concentrations of radionuclides and some elements in sediments collected from two sites along the Turkish Black Sea coast, Kilyos and Sinop (Fig.1).

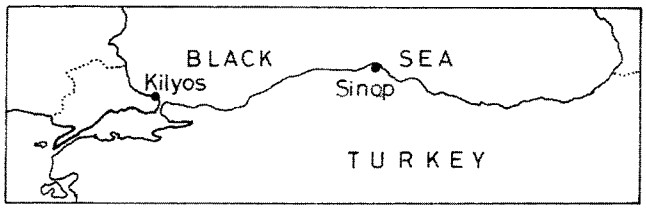

Fig. 1. The collection sites for Black Sea sediments.

The top 4 cm of sediment samples were collected near the shore of the stations using a Lenz Bottom Sampler. Sediments were stored frozen in plastic cups until analyzed. The gamma isotopic analyses were carried out using a high resolution HpGe detector coupled to a multi channel analyzer. The trace element levels in sediment samples were determined by instrumental neutron activation analysis. Other procedures were similar to those previously described (TOPCUOGLU *et al.*, 1988, 1990). ^{137}Cs and ^{238}U activities in the Sinop sample are higher than those found in sediment collected from Kilyos (Table 1). For ^{137}Cs, this is an expected result if we consider the location of Sinop in relation to the Chernobyl fallout pattern. On the other hand, ^{232}Th and ^{40}K levels in the Sinop sample are lower than concentrations in Kilyos sediment. However, more data on radionuclides in sediments are needed before any clear pattern on radioactivity distribution in this area of the Black Sea can be discerned.

Table 1. Radionuclides in sediment samples collected from the Black Sea in January 93.

Sampling site	Bq Kg^{-1} dry weight			
	^{137}Cs	^{238}U	^{232}Th	^{40}K
Sinop	9.3 ± 3.9	26.2 ± 12.3	<1.3	152 ± 37
Kilyos	3.2 ± 1.2	4.9 ± 1.6	5.5 ± 2.4	225 ± 18

The trace element contents of the sediment samples are shown in Table 2. Concentrations of As, Cr, Rb, Fe, Zn and Ba showed considerable variations. There is no significant difference among the concentrations of Ce, La, Cs, Sc, Co and Sb. Arsenic is higher in Kilyos sediment; but Cr and Zn are much lower than corresponding levels found in the Sinop sample. However, many factors (river discharges, mining wastes, etc.) can cause these variations. Present data are thus insufficient to draw any definitive conclusion regarding contamination levels.

Table 2. Trace element concentration (μg g^{-1}) in dry sediment samples collected from the Black Sea in January 1993.

Sampling site	As	Ce	La	Cr	Sc	Rb
Sinop	3.9 ± 0.8	7.36 ± 1.14	3.86 ± 0.58	18.1 ± 1.9	1.91 ± 0.08	10.6 ± 3.1
Kilyos	42.8 ± 13.8	10.20 ± 1.50	5.59 ± 1.00	4.4 ± 0.6	0.77 ± 0.04	32.4 ± 5.2
	Cs	Fe	Zn	Co	Sb	Ba
Sinop	0.60 ± 0.15	5587 ± 118	15.0 ± 2.6	2.15 ± 0.13	0.27 ± 0.06	72 ± 32
Kilyos	0.45 ± 0.10	3238 ± 74	3.8 ± 1.4	1.29 ± 0.09	0.22 ± 0.05	293 ± 43

Se, Hg and Ni levels were below the detection limits.

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