INSTRUMENTAL NEUTRON ACTIVATION ANALYSIS OF URANIUM, THORIUM AND RARE EARTH ELEMENTS IN SEDIMENTS FROM SOUTHERN PART OF THE BLACK SEA

N. M. Mukhamedshina[1], T. Akyüz[2], S. Akyüz[3], A.A. Mirsagatova[1], E. M. Ibragimova[1] and Ç. Bolcal[2]

[1]*Institute of Nuclear Physics, Uzbek Academy of Sciences, 702132, Ulugbek, Tashkent, Uzbekistan*
[2]*Istanbul Kultur University, Science and Letters Faculty, Department of Mathematics, 34510, Sirinevler, Istanbul, Turkey*
[3]*Physics Department, Istanbul University, Vezneciler, 34459, Istanbul, Turkey*

Introduction

The Black Sea is an inland sea between south-eastern Europe and Asia minor. It is the largest anoxic marine basin in the word and connected to the Mediterranean Sea by the Bosporus and the Sea of Marmara, to the Sea of Azov by the Strait of Kerch. There are two sources for supply of water to the waterbody of the Black Sea: On the one hand seawater incurses into the Black Sea from Mediterranean via the Çanakkale (Dardanelles) and Bosphorus Straits with an inflow of 200 km^3 per year. On the other hand there is an inflow of fresh water from the surrounding areas [1]. The total influx of fresh water is estimated to be 350 cubic kilometres per year. Two of the Europe's larges rivers, the Danube and the Dnieper, as well as Dniester, Don, Kuban and a number of smaller rivers contribute this inflow.

Sediments are known to be good receptacles of U, Th and REE compared with other marine materials. One of the most useful approaches to long-term monitoring the pollution of the aquatic systems is the analysis of marine sediments.

In this study, the abundance of uranium, thorium and some rare earth elements was analysed in surface sediments of the Southern part of the Black Sea using instrumental neutron activation analysis. The spatial distribution patterns of the elements studied were also investigated.

Table 1. Locations of the sampling sites

No	Latitude	Longitude	No	Latitude	Longitude
1	41^0 15’	30^0 60’	8	41^0 47’	29^0 80’
2	41^0 50’	31^0 85’	9	41^0 50’	30^0 82’
3	42^0 05’	35^0 20’	10	42^0 05’	33^0 00’
4	41^0 25’	29^0 65’	11	42^0 13’	33^0 72’
5	41^0 33’	29^0 10’	12	41^0 82’	36^0 18’
6	41^0 90’	28^0 78’	13	40^0 95’	37^0 90’
7	42^0 25’	28^0 82’	14	41^0 00’	39^0 65’

Results and Discussion

The analytical results of the sediment samples studied are given in Table 2. The relationship between the atomic numbers and concentrations (in ppm) of the lanthanides, determined in the Black Sea sediments were shown in Figure 1.

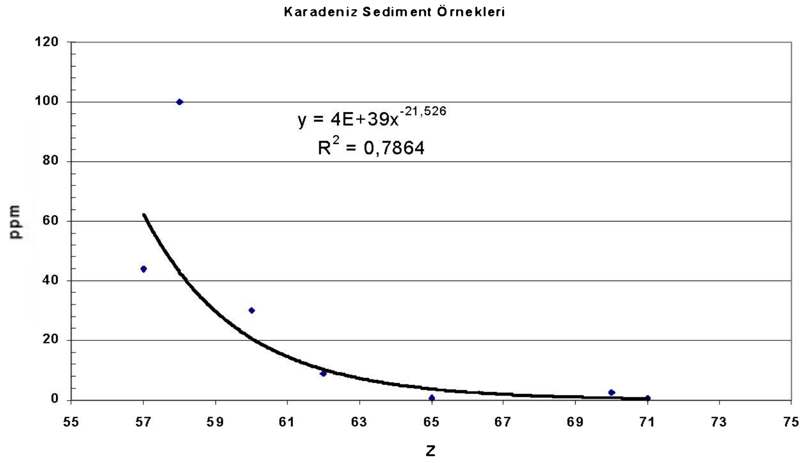

Figure 1. The relationship between the atomic numbers and concentrations (ppm) of the lanthanides, determined in the Black Sea sediments.

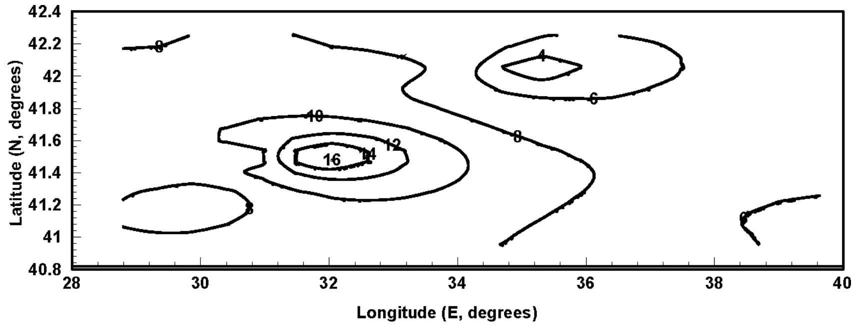

Figure 2. The contour map of Th depending on the longitude and latitude of the Black Sea sediments

A linear regression correlation test was performed to investigate the correlation between the elemental concentrations of our sediment samples. Correlation analysis revealed close relationships between Th and U, Th and La, Th and Ce. The contour maps of thorium and uranium depending on the longitude and latitude of the sampling stations of the Black sea sediments collected, were given in Figures 2 and 3, respectively. The contour map of Th, depending on La and Ce of sediment samples was given in Figure 4. In nature, rare earth elements are often associated to thorium, thus the results indicate that Th and lanthanides have a natural origin. The mean values of thorium (8.37) to uranium (3.79) is found to be Th/U= 2.21.

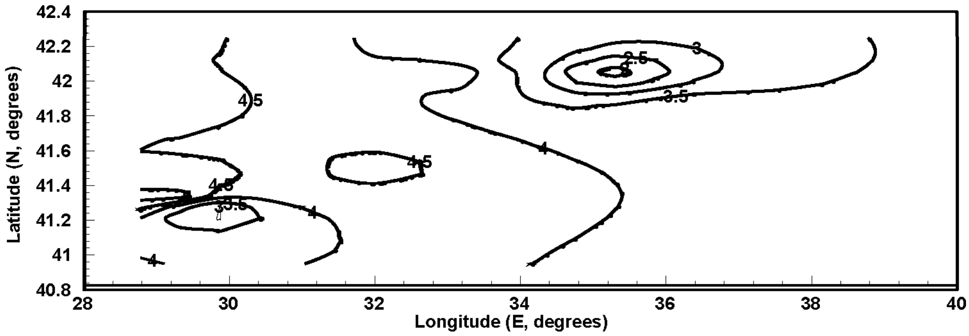

Figure 3. The contour map of U depending on the longitude and latitude of the Black Sea sediments

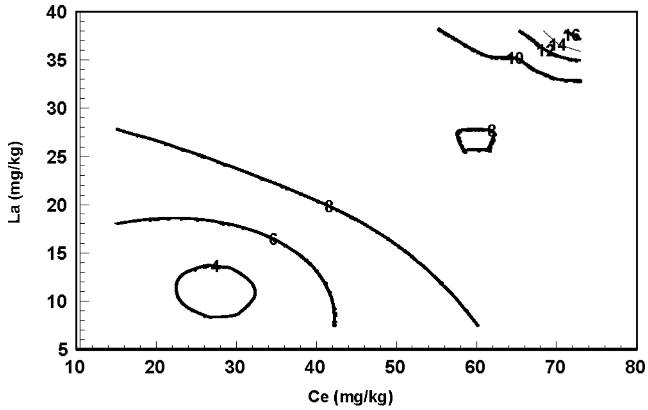

Figure 4. The contour map of Th depending on Ce and La concentrations of the Black Sea sediments

Table 2. INAA results of the sediment samples (mg/kg)

No	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Th	5.3	17	2.7	5.3	9.7	9.3	7.8	9.7	9.2	8.6	7.7	6.0	6.9	4.2
U	2.9	4.7	1.8	2.6	5.5	5.0	4.7	4.6	4.3	4.3	3.5	3.9	3.8	3.6
La	12	38	10	8.7	34	33	22	32	30	28	27	20	20	35
Ce	21	73	22	10	65	54	63	72	46	71	60	45	43	51
Nd	10	54	7	6	22	21	17	20	19	18	16	15	15	22
Sm	1.9	6.5	1.5	2.5	5.3	5.0	4.8	6.1	5.3	5.8	4.7	4.5	3.6	2.8
Tb	0.18	0.7	0.83	0.2	0.72	0.63	0.89	0.92	0.55	0.66	0.79	1.0	0.5	0.5
Yb	1.4	2.5	1.5	0.8	2.6	1.7	2.0	1.7	1.6	1.9	1.9	3.1	1.3	1.6
Lu	0.13	0.45	0.14	0.06	0.45	0.36	0.22	0.36	0.32	0.28	0.29	0.3	0.28	0.33

Acknowledgement

This study was supported by NATO Grant EST.CLG 979598.

References

1. A.R. Miller, In Estuaries and Enclosed Seas (Ecosystems of the World, 26), Ketchum B. H., Ed., Elsevier, Amsterdam, (1983) pp 219-238.
2. L.D. Tochilina, L.K. Kaganov, N.M. Mukhamedshina (1995) Radiochemical Determination of Mo in Pure Tungsten, J. Radioanal. Nucl. Chem., Lett., 201, 177-183.