

Chemical and instrumental Neutron Activation Analysis of Bed sediments sampled on Danube River, during 1991

Maria SALAGEAN*, Ana PANTELICA* and Iulia I. GEORGESCU**

* Inst. of Physics and Nuclear Eng., BUCHAREST (Romania)

** Polytechnical Inst, Fac. of Chemical Technology, BUCHAREST (Romania)

Abstract

Bed-load sediments sampled on the both Danube river sides in front of the Nuclear Power Plant at Koslodui, by chemical and instrumental neutron activation analysis were investigated. The Cr ranged between (74 : 128) ppm, Zn(37 : 78)ppm, Ba (201 : 327) ppm, U (1,1 : 2,9) ppm.

From a radioecological point of view the study of stable elements in natural systems such rivers and seas is important since radioisotope introduced into the water follow similar pathways to the stable elements already present in nature. It is well known that the chemical composition of the river bed sediments has a great influence on the retention and the exchange of man-made radionuclides between crystalline lattice and the soluble form of the radionuclide in water (GEORGESCU *et al.*, 1973 and 1981).

The sampling was carried out with simultaneously hydraulic measurements on significant verticals according to the methodology applied by the National Institute of Meteorology and Hydrology in Bucharest. Each wet sample of about 1 kg was stored in plastic bags. The chemical analyses were effected as described by GEORGESCU and STROILA (1981). The instrumental neutron activation analyses were carried out at the VVRS nuclear reactor in Bucharest. The counting was made by means of HPGc crystal coupled to a multichannel analyzer.

In the **Table 1** are listed contents of ten macroelements, in **Table 2** of 24 macro- and microelements, The last column of **Table 1** shows that the loss of weight at 1000°C in percent is low for organic matter. It must be outlined, an increasing of Fe, Ca, Ti, Mg, Mn, Na, K. The sediments of left river side have more As, Br, Cr, Th, U and Zn. Barium has a concentration of 327 ppm on the right and 201 ppm, on the left river side. Si and Al are about constant, while phosphorous is decreasing. These changes in the concentration of the microelements are correlated with the grain size diameter of the sediment, the velocity flow on the bed river, the surface and average velocity and turbidity.

It is a decrease of phosphorous and an increase of some toxic microelements in the investigated Danube sediments.

Cross-section and date of prelevation	Element										Loss of weight at 1000°C(%)
	Si	Fe	Al	Ti	Mn	Ca	Mg	P	Na	K	
Upstream Bechet right* 17.06.1991	38.4	2.2	1.5	0.1	0.1	3.2	1.3	0.03	0.8	1.0	2.5
Downstream Bechet right 18.06.1991	32.0	3.6	2.2	0.07	0.07	5.02	1.9	0.04	2.06	1.8	6.6
Turnu Magurele - left 19.06.1991	38.9	3.6	0.6	0.06	0.08	2.3	0.6	0.03	0.7	0.6	3.9

Table 1- Chemical composition of the sediments collected on the bottom of the Danube river, in percent dry weight.

Sample Elem.	River side		Sample Elem.	River side	
	left	right		left	right
As(ppm)	8.9 ± 0.3	6.2 ± 0.2	Lu(ppb)	84 ± 5	34 ± 3
Br(ppm)	3.7 ± 0.5	1.8 ± 0.5	Na(%)	1.38 ± 0.01	1.20 ± 0.01
Ba(ppm)	201 ± 40	327 ± 14	Nd(ppm)	26 ± 6	< 17
Ca(%)	0.40 ± 0.01	0.10 ± 0.01	Rb(ppm)	48 ± 22	27 ± 16
Ce(ppm)	60 ± 2	14 ± 1	Sb(ppm)	1.2 ± 0.1	0.60 ± 0.05
Co(ppm)	9.2 ± 0.8	7.0 ± 0.7	Sc(ppm)	8.2 ± 0.1	2.80 ± 0.06
Cr(ppm)	128 ± 4	74 ± 3	Sm(ppm)	4.9 ± 0.1	1.3 ± 0.1
Cs(ppm)	2.3 ± 0.4	0.6 ± 0.3	Tb(ppm)	0.50 ± 0.2	0.5 ± 0.2
Fe(%)	2.31 ± 0.07	1.10 ± 0.04	Th(ppm)	7.2 ± 0.4	1.5 ± 0.2
Hf(ppm)	6.2 ± 0.3	1.2 ± 0.1	U (ppm)	2.9 ± 0.3	1.1 ± 0.2
K (%)	1.09 ± 0.07	0.90 ± 0.07	W (ppm)	1.2 ± 0.4	0.7 ± 0.3
La(ppm)	26.5 ± 0.3	6.9 ± 0.1	Zn(ppm)	78 ± 19	37 ± 15

Table 2 - Microelements identified in the bed-load sediments of Danube river in front of Bechet site in June 1991 (long-lived radionuclides)

* right - the right river side; left - the left river side.

REFERENCES

- GEORGESCU I.I., LUPAN S., SALAGEAN M. and OANCEA M., 1973.- Chemical composition of Danube water, sea water, algae and sediments of the Black Sea determined by the analytical methods and instrumental neutron activation analysis *Thalassia Jugoslavica*, 9 (1/2); 87 - 99.
- GEORGESCU I.I. and STROILA I., 1981.- Contributions to the chemical study of bed-load sediments collected on Romanian cross-sections of the Danube river. *Thalassia Jugoslavica*, 17(2); 95-101.
- GEORGESCU I.I., Chief Scientific Investigator, 1982-1985.- The mathematical modelling of man made radionuclides transferred and transported on the Danube river under nuclear accident conditions. Research Contract RB/3260 IAEA - Vienna.

Rapp. Comm. int. Mer Médit., 33, (1992).