On the total beta radioactivity in suspended matter, filtered water and bed sediments of the Danube River during 1984

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Résumé

Des échantillons d'eau et de sédiments prélevés sur trois profils du Danube en avril-mai 1984, ont été analysés pour déterminer l'activité bêta totale, après correction du ^{40}K. A l'entrée du Danube, en Roumanie, l'eau filtrée a 7.7 pCi/l et le sédiment séché 37 pCi/g. Dans la zone du delta du Danube, on a mesuré 125.2 pCi/g. sédim. sec. valeur corrélée avec le débit de 6300 m^3/s du fleuve. La plupart des grains de sédiments ont un diamètre variant entre 0.1 et 0.25 mm. L'activité bêta totale est incorporée dans les grains de diamètre $\prec$ 0.5 mm.

Summary

In Spring 1984 surface water and bed sediments were sampled and analysed for gross beta activity. The highest level of radioactivity (125 pCi/g dry sediment) in the Danube Delta is due to the high mean liquid discharge of 6300 m^3/s. Filtered water had a maximum value of 7.7 pCi/l at the entrance of the Danube into Romania; many samples of suspended matter showed zero beta activity. All the data were corrected for 40_K.

Material and Methods

Samples of water and bed sediments on three "significant vertical" profiles named left (L), center (C), and right (R) riverside, which can adequately characterize the total radioactivity of the cross section, were collected from the entrance of the Danube River into Romania at Bazias to the Danube Delta at Tchatal-Ismail. Previous measurments have been performed when the liquid discharge of the Danube was low, i.e. 2360 m^2/s in 1976 (1). In Spring 1984, the liquid discharge of the Danube at the entrance to the Delta was 6300 m^3/s. The sampling methodology has been reported elsewhere (1). The samples were measured for beta radioactivity by means of a low-background G-M counter coupled to a scaler. Constant geometry was assured for all samples and standards.

Results and Discussion

Total beta radioactivity of the filtered water and bed sediments are included in TABLE I.

In general Danube River radioactivity in suspended matter radioactivity varied between 0.62 and 4 pCi/l.

Table 1. Radioactivity of Danube River water and bed sediments during Spring 1984, correlated with the granulometric fractions.

Site and date of sampling	LRS	C	RRS	Radioactivity
BAZIAS 13 April	4.05 37.0 silty clay	7.71 not sampled	5.16	pCi/l pCi/g *
BECHET 29 April	5.5 35.25 <1 mm(0.15%)	5.64 23.7 <1 mm(6.12%)	3.4 16.3 1 mm(2.67%)	pCi/l pCi/g *
GIURGIU 3 May	3.8 20.8 <1 mm(2.3%)	1.96 43.23 0.4-0.5 mm (1.03%)	4.43 0 0.5-0.6 mm (10.56%)	pCi/l pCi/g *
TCHATAL- ISMAIL 14 May	2.12 0 <1 mm(0.12%)	0.3 8.25 1 mm(0.64%) 125.2 0.8-1 mm(0.01%)	1.55 45.7 silty clay	pCi/l pCi/g * pCi/g *

Obs. Water was filtered, bed sediment dryed and ^{40}K activity substracted.

* Granulometric fractions in dryed sediments.

References

/1/. GEORGESCU, I.I., FLOREA, J. and BARAN, Gh. (1978). Distribution of ten artificial radionuclides in the cross section of the Danube River, at Mile 34, during 1976. Rev. Roum. Sci. Tech.-Méc. Appl., 23, No. 6, 953-960.

Discussion

S. FOWLER: In your Table I, what are the errors around your concentration measurements?

I. GEORGESCU: The errors depend on the activity of the samples, i.e. the higher the activity, the lower the errors. They ranged from 2% to 40% for the very low radioactivity.

S. DANALI-COTSAKI: What correction factors have you taken into account for gross beta measurements of your sediment samples? How low was the background of your equipment?

I. GEORGESCU: All the samples of water and sediments have been corrected for the activity of K^{40}. In this respect we carried out some determination of the K content in the samples by means of flame photometry. From the total beta activity of a sample, the activity of K^{40} has been substracted as well as the background of the instrument. The background inside the lead shielding was about 1-2 counts per minute. A new G-M counter (1983 Phillips) with low background was used.

A. MESLI: Il semble qu'il existe une contradiction, vis à vis des contaminations relevées sur les deux rives du Danube, entre sédiment et eau. Sur la rive Hongroise, les sédiments sont plus contaminés que sur la rive Roumaine. La situation est inverse pour l'eau.

I. GEORGESCU: Les données proviennent du rapport du COMECON (Pays Socialistes de l'Est). Plusieurs facteurs peuvent expliquer cette différence de contamination entre sédiment et eau des deux rives. L'accumulation des radionucléides dans les sédiments dépend du débit liquide de fleuve, de la présence plus ou moins importante de suspensions dans l'eau, de la forme géomorphologique du lit fluvial et de certains autres paramètres hydrologiques. Le coefficient de répartition entre eau et sédiment pour chaque espèce de radionucléide peut également être responsable de telles différences.

P. KRITIDIS: One of the findings of a 1975-1977 sediment survey of the Bulgarian Black Sea coastal region (by Sofia University) was the existence of a "tail" of increased ^{137}Cs concentration in sediment whose form approximated that of the north-south current influenced by the Danube. Values of the order of several pCi/g were measured in some cases.

I. GEORGESCU: The existence of this "tail" of increasing manmade radionuclides at the entrance to the Black Sea on the Bulgarian Coast can be explained by the existence of marine current (anticyclonic) due to the great rate of flow of Danube water. For instance, at the bifurcation of the Danube in the three branches that form the Danube Delta at the entrance to the Black Sea, the flow rate was 6300 m^3/second in June 1984. This was studied years before by the Laboratoire de Hydrologie de la Marine de Roumanie. It must also be taken into account that there is increasing salinity of the Black Sea from the southern Romanian littoral to the Bulgarian coast.