Distribution of Transuranics along the Palomares Submarine Canyon

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Transuranics and other long-lived radionuclides are useful tools to evaluate transport processes along the rivers and through the sediments. They also serve as tracers to determine the behaviour of other pollutants of industrial origin in the marine ecosystem.(1)

The radioecology studies in Palomares region have focused on two fields : a) Study of the behaviour and preferential migration of the transuranics, plutonium and americium, in the Almanzora dry river bed (gulch); b) Study of land-to-sea transfer from the river to the neighbouring continental shelf (the main recipient of the rivers terrigenous contribution), and subsequent transport of these radionuclides through submarine canyons.

The influence of the turbidity currents, formed along the slope, on the transport of radionuclides trough submarine canyons is well-known. These currents play an important role in transferring radionuclides from continental shelves to offshore areas. These processes will be studied in Palomares canyon and compared with another Mediterranean canyons (i.e. Taranto Canyon), in the frame work of cooperation among participants in CEC-sponsored Radiation Protection Programme.

The Palomares continental shelf shows a group of secondary canyons tributaries of the main Canyon. The activity in the canyon could transport the radionuclides fixed in the shelf sediments to deeper areas.

The studies of this area started in 1985 (2, 3, 4) and will be completed with the results obtained from a sampling cruise in 1991 on board the vessel Bannock. (5)

Sampling

a) Sediments (1991)

Thirteen stations, located in the sea close to the Almanzora river mouth were selected for study in order to assess whether the status of this sensitive environment had changed since the previous study (1) and to determine whether a significant portion of the americium present in this environment was in the form of the so-called "hot particles"(6). Additional objectives were to evaluate recent terrigenous contributions and to investigate the role of submarine canyons in the transport of transuranics. Sampling was carried out along the main Almanzora river canyon and to the south of its mouth. Marine sediment samples were collected with a box-corer designed to slice sections of 1 cm thickness. The analyses of Pu, Am were carried out at CIEMAT following standard procedures.

b) Sea water and suspended particulate matter (1991)

The Palomares area is located in a semi-desert region and receives frequent winds. It is well established that such winds can produce the resuspension of deposited transuranics and may, in fact, give rise to a measurable land to sea transfer via airbone translocation. This fact could produce a temporary increase in transuranic concentrations in coastal waters close to Palomares and, possibly, further afield. Therefore, the water-sampling programme is expected to provide the first comprehensive data on transuranics concentrations in suspended particulate matter and filtered sea water. Surface and near-bottom water samples were collected from two stations, one close to Palomares in the predominant wind direction and the other near the end of the submarine canyon. The 200 l samples were obtained with Gerhard-Ewing bottles and transferred to 500 l containers prior to preliminary chemical concentration of the transuranics. UCD and UAB (5) carried out separation of the suspended particulate matter from sea water and the radionuclide preconcentration step. The radiochemical analysis were performed by CIEMAT. This work will be complemented by chemical speciation and colloidal association studies undertaken by UCD in the Vera Gulf and western Mediterranean.

Preliminary results

Transuranic concentration profiles from four different stations have been completed. Some preliminary results are shown in the table below.

Station	Depth(m)	Inventory(Bq/m^2)		$^{238}Pu/^{239+240}Pu$
		$^{239+240}Pu$	^{238}Pu	
13	49	63.47	1.31	0.02
17	71	54.39	1.10	0.02
16	599	4.42	0.16	0.04
07	1025	2.11	0.34	0.15

These results will be compared with those previously obtained in the area in 1985.

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Fission track measurements of uranium concentration and distribution in the Mussel *Mytilus galloprovincialis* and some macrophytes from the Romanian Sea Coast, 1987-1990

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Abstract

The bivalve mollusc *Mytilus galloprovincialis* and the macrophytes *Enteromorpha linza, Cystoseira barbata* and *Ceramium rubrum* were analyzed for uranium by the fission track micro-mapping technique. Pending on the site sampled, a variation in uranium concentration was found in *M. galloprovincialis* which decreased from the north to south along the coast of Romania. In the macrophytes, uranium distribution was generally uniform except for *C. rubrum* in which U is found as inclusions.

Introduction

In a previous research (DANIS *et al.*, 1979), the uranium distribution and content in Black Sea rocks, sediments and water were determined by the fission track method. These results, along with those of other investigators (Georgescu *et al.*, 1990) on the uranium content in different biota, permit us to discern the uranium distribution in the mussel *Mytilus galloprovincialis*, the macrophyte *Enteromorpha linza (Ent.l.), Cystoseria barbata (Cyst.b.)* and *Ceramium rubrum (Cer.r.)* from the Black Sea during 1987-1990.

Materials and Methods

Mussels of 4-5 cm length were sampled from different depths along the Black Sea Romanian shoreline during 1987-1990. The soft tissue and the byssus were dissected and dried at 105°C. Measurements of U distribution and content were performed using the uranium micro-mapping technique. Uranium micro-mappings were obtained both for natural and powedered dry samples in the following way: the samples, placed in intimate contact with the muscovite track detector sheets, were irradiated with thermal neutrons at fluxes of $\approx 10^{14}$n cm^{-2} in the VVR-S reactor in Bucharest. During neutron irradiation, the fission fragments from the neutron induced fission of the uranium nuclei were corded by trails in the muscovite detectors. These tracts were observed by optical microscopy following chemical etching by HF≥38% for 4 hours at room temperature. Thus, in muscovite detectors the fission track replica of the uranium distributions were obtained (Fig.1). The SL-1 IAEA Certified Reference Material was used in the determinations of U content in the samples. For each sample analyzed, three separate analyses were performed.

Results and Discussion

1. In all samples of mussel, uranium was more concentrated in the soft tissues than in the byssus.

2. A decrease of U concentrations was observed in mussels going from the north to the south along the Romanian Black Sea shore. During 1987, this variation ranged between 0.21 ± 0.03 ppm to 0.11 ± 0.03 ppm in the soft tissue. In the byssus, a mean value of 0.07 ± 0.01 ppm was observed.

3. During 1989 in the southern Danube Delta at Portitza, elevated uranium levels (0.89 ± 0.13 ppm) were observed in the soft tissue of mussels which is assumed to be due to contamination.

4. In most of the macrophytes analyzed, uranium was uniformly distributed, except in the case of *Ceramium rubrum* which contained numerous uranium inclusions. These inclusions are represented by track clusters in the micromass (Fig.1) and range between 10.5 ± 1.6 ppm and 134 ± 20 ppm for *C. rubrum*. In *E. linza*, the uranium concentration varied between 0.42 ± 0.06 ppm at Eforie South (1987) and 0.13 ± 0.02 ppm at Mangalia (1990). For *C. barbata*, the uranium ranged from 0.10 ± 0.01 ppm to 0.18 ± 0.03 ppm.

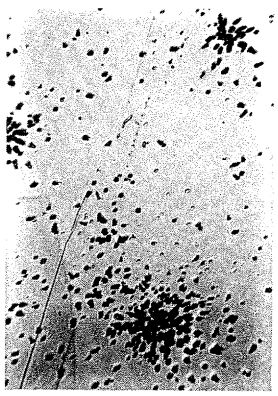

Fig. 1. Detail of U fission track micro-mapping in a Ceramium rubrum sample (x 900 magnification).

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