

PRELIMINARY EXPERIMENTAL DATA ON THE UPTAKE OF SOME  
RADIONUCLIDES BY BLACK SEA MOLLUSCS

Alexandru S. BOLOGA

Romanian Marine Research Institute, R-8700 Constantza,  
ROMANIA

ABSTRACT

Preliminary data are given on experimentally-derived concentration factors for  $^{59}\text{Fe}$ ,  $^{65}\text{Zn}$  and  $^{85}\text{Sr}$  in mussel Mytilus galloprovincialis and for clam Mya arenaria collected along the Romanian Black Sea coast.

RESUME

*Les données préliminaires sur les facteurs de concentration du  $^{59}\text{Fe}$ ,  $^{65}\text{Zn}$  et  $^{85}\text{Sr}$  déterminés en conditions expérimentales chez Mytilus galloprovincialis et Mya arenaria du littoral roumain de la mer Noire sont exposées dans ce travail.*

Due to their sessil character, including phytobenthos, the zoobenthic organisms show the cumulative effects of pollutant agents, including radioactive wastes, on marine biota (e.g. PENTREATH, 1973). Following earlier radioecological studies with marine macroalgae (BOLOGA et al., 1983), similar investigations were also performed with marine molluscs species from the Romanian Black Sea. Concentration factors of some radionuclides for Mytilus galloprovincialis and Mya arenaria have been determined under experimental conditions.

MATERIAL AND METHOD

Specimens of M. galloprovincialis and M. arenaria - Mollusca (Bivalva) were collected at Jupiter and Mamaia between 1982-1983. The experiments were carried out in 30 l aquaria containing sea water which was continuously aerated. The molluscs were acclimated for 48 hours in aquaria prior to adding the radionuclides.  $^{59}\text{FeCl}_3$ ,  $^{65}\text{ZnCl}_2$  and  $^{85}\text{SrCl}_2$  were added as aqueous solutions with specific activities between  $3 - 6/\mu\text{Ci l}^{-1}$ . The experiments lasted between 20 - 105 days. Samples were collected and radioanalyzed every 2 - 3 days.

The radioactivity in water and molluscs samples, at each sampling period, was measured simultaneously. Analyses were made for M. galloprovincialis (adults) shell and viscera, and for M. arenaria (juveniles, adults) shell, viscera and syphon.  $^{59}\text{Fe}$ ,  $^{65}\text{Zn}$  and  $^{85}\text{Sr}$  were measured with a mono-gamma counter IFIN-L8, coupled to a well-type NaI(Tl) scintillator crystal; counting efficiencies were about 7%, 14% and 20%, respectively. The samples were measured 10 times between 60 - 100 s. Natural background was subtracted. The measurements were reported at the 95% confidence level.

For each radionuclide a concentration factor (CF) was computed; the CF was defined as  $\text{dpm g}^{-1}$  shell or wet tissue divided by  $\text{dpm ml}^{-1}$  water. During the experiments the radioactive water was not changed; therefore, the absolute values of the CF should be viewed accordingly.

#### RESULTS AND DISCUSSION

In adults of M. galloprovincialis the following maximum whole body CF were determined (1982):  $^{59}\text{Fe}$  = 1,710 (26 days),  $^{65}\text{Zn}$  = 674 (34 d),  $^{85}\text{Sr}$  = 9 (26 d). In shell and viscera (1983):  $^{59}\text{Fe}$  = 2,245 and 1,415, respectively (53 d); or, 1,494 and 1,209, respectively (63 d);  $^{65}\text{Zn}$  = 313 and 2,008, respectively (57 d); or, 193 and 553, respectively (74 d);  $^{85}\text{Sr}$  = 5 and 1, respectively (57 d); or, 4 and 4, respectively (105 d).

The CF values for  $^{59}\text{Fe}$  are higher than those reported in the literature, i.e. 49 for shell and 99 for viscera (POLIKARPOV, 1966). The CF values for  $^{65}\text{Zn}$  are comparable with those in the literature; e.g., the following CF values are known: shell = 49, viscera = 80 (KECKES et al., 1969), and shell = 49, viscera = 629 (POLIKARPOV, 1966). In addition whole body CF values of  $\sim 80$  (8-10 days) and  $\sim 100$  (20 d), and CF for viscera  $\sim 300$  have also been reported (VAN WEERS, 1973). The CF values for  $^{85}\text{Sr}$  in the literature are also very low; e.g., shell = 6 and viscera = 0.6 (POLIKARPOV, 1966). The uptake of this radionuclide by mussels is very low. It is possible either that  $^{85}\text{Sr}$  is little concentrated, or that a fast exchange between the environment and organism takes place.

In adult M. arenaria the following CF were determined in shell, viscera and syphon (1983):  $^{59}\text{Fe}$  = 74, 148 and 930, respectively (20 d);  $^{65}\text{Zn}$  = 17, 65 and 127, respectively (20 d);  $^{85}\text{Sr}$  = 3, 6 and 11, respectively (20 d).

In juvenile M. arenaria the following CF were determined in shell and viscera + syphon (1983):  $^{59}\text{Fe}$  = 2,042 and 5,825, respectively (43 d);  $^{65}\text{Zn}$  = 415 and 1,182, respectively (41 d);  $^{85}\text{Sr}$  = 17 and 6, respectively (41 d).

For all three radionuclides, in M. arenaria higher CF were recorded in juveniles than in adult organisms. The following order of radionuclide concentration in tissues was evident: shell < viscera < syphon. No comparative literature data concerning CF of these radionuclides in the soft clam have been found so far.

Both in mussel and soft clam the following relationship between the CF for these radionuclides was noted: CF  $^{59}\text{Fe}$  > CF  $^{65}\text{Zn}$  > CF  $^{85}\text{Sr}$ .

These preliminary data suggest the use of these two molluscs as possible indicator organisms for radionuclide contamination by  $^{59}\text{Fe}$  and  $^{65}\text{Zn}$  in the Black Sea coastal marine environment.

#### REFERENCES:

- BOLOGA (A.S.), BALABAN (D.), CHIOSILA (I.), 1983 - Rapp. Comm.int.Mer Médit., 28, 7, 263-265.
- KECKEŠ (S.), OZRETIĆ (B.), KRAJNOVIĆ (M.), 1969 - Rapp.Comm.int.Mer Médit., 19, 2, 949-952.
- PENTREATH (R.J.), 1973 - J.mar.biol.Ass.U.K., 53, 127-143.
- POLIKARPOV (G.G.), 1969 - Radioecology of Aquatic Organisms. North Holland Publ.Comp., Amsterdam, Reinhold Book Div., New York, 314 p.
- VAN WEERS (A.W.), 1973 - in Radioactive Contamination of the Marine Environment, Proc.Symp.Seattle, 1972, 385-401.

#### Discussion

H. FLOROU: Are you sure that Sr concentrations are low in the shells of the mussels? Sr has a similar behaviour to Ca. Furthermore, is the time of the experiment long enough to ensure that Sr is not accumulated in place of Ca?

A. BOLOGA: Yes, because in spite of the similar behaviour of Ca and Sr, the  $^{85}\text{Sr}$  uptake by both mussels is very low (the experimental duration was 74 days).

H. UYSAL: Why are the Fe and Zn concentration factors so different in the two species? Is Mya arenaria common in your coastal waters?

A. BOLOGA: We just obtained these results concerning the different uptake of  $^{59}\text{Fe}$  and  $^{65}\text{Zn}$  but have not yet the explanation for this different behaviour of the mollusc species. Yes, Mya arenaria is very common in Black Sea coastal waters of Romania.