Radionuclide Accumulation by Anodonta piscinalis Nilsson (Lamellibranchiata) in a Continuous Flow System *)

by

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(with 3 figs.)

INTRODUCTION

Freshwater species of the phylum Mollusca have for a long time been recognized as useful indicators for radioactive contamination of inland recipients. But the knowledge about their ability to concentrate specific radionuclides is based on limited experimental investigations only. The information available has come from a number of sources, including studies of contaminated water courses – Nelson (1962), environmental measurements of natural and fall-out radioactivity – Ravera et al. (1961), and aquaria experiments under laboratory conditions – Polikarpov (1960). The laboratory investigations have been performed with a few species only, and a very restricted selection of radionuclides.

It was considered of interest to study the accumulation of radionuclides by a freshwater lamellibranch under conditions such that the environmental factors and the organism interacted in approximately the same way as in nature.

During an experimental investigation on bioaccumulation and transfer of some radionuclides among a few components of freshwater communities, we had the opportunity to do a field experiment on the

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response of *Anodonta piscinalis* NILSSON to six radionuclides. Specimens of *Anodonta piscinalis* were exposed for 125 days to approximately constant concentrations of the radionuclides phosphorus 32, cesium 137, strontium 89, cerium 144 and zirconium 95 – niobium 95. In addition, ruthenium 103 was introduced into the system during the last 55 days of the experimental period.

A model recipient through which flowed water pumped from a nearby river, provided a biotope for *Anodonta piscinalis* with the following properties: Water of the same chemical quality and with mainly the same temperature variations as that in the river, a natural food supply for the test animals and exposure to selected radionuclides at controlled concentrations. Thus it was possible to describe the bioaccumulation of the radionuclides together with the conditions under which it occurred.

**THE GENERAL PROBLEM**

The ratio of the concentration of an element in the organism to the concentration in the environment is an expression of the possible accumulation factor for the radioactive element. Our knowledge of the elementary composition of molluscs is unfortunately very slight at the present time. VINOGRADOV states that the analyses are less complete than for other groups of organisms (1953, p. 271). Quantitative data are almost absent for lamellibranchs, and the scanty information found in literature is rather old. Modern investigations of the mineral metabolism of lamellibranchs have centered around physiological aspects of osmoregulation and shell formation (for references see MORTON 1958, JODREY et al. 1955, KADO 1960).

It is known that certain elements are found in remarkably high concentrations in *Anodonta*. This applies to phosphorus – KADO (1960, p. 172), manganese – VINOGRADOV (1953, p. 325) and the materials of which their valves are constructed. Almost nothing is known about the mineral composition in relation to individual development, environmental conditions and seasonal variation.

Species of the genus *Anodonta* are ciliary feeders and live on suspensions or deposits. The food is taken from the particle fraction of the surrounding water without selection or discrimination. Filtering is very efficient, and it is reported that seston down to 1 μ in size can be retained by their filtering organs – MORTON (1958, p. 77). The animal is permeable to water and excretes a dilute urine. A high daily water flux through the body has been demonstrated experimentally. There are varying estimates in the literature of the daily quantity of urine excreted. PROSSER et al. (1961, p. 25) state that the urine