407872

SILVER-108m IN BIOTA AND SEDIMENTS AT BIKINI AND ENIWETOK ATOLLS

T. M. BEASLEY
and
E. E. HELD

(*Reprinted from Nature, Vol.* 230, *No.* 5294, *pp.* 450–451, *April* 16, 1971)

DOE ARCHIVES

The occurrence of this long-lived silver radionuclide ^{108m}Ag ($T_{1/2} > 100$ yr) in biota from the Pacific Ocean has been held to suggest that the silver radionuclide ratio $^{110m}Ag/^{108m}Ag$ may be useful as a tracer of environmental processes. It also appears[1] that large amounts of ^{110m}Ag and ^{108m}Ag were not produced during the 1958 test series or earlier, and that the production activity ratio $^{110m}Ag/^{108m}Ag$ was 162, a ratio derived solely from the thermal neutron activation of stable silver. We consider that their observations require reconsideration.

We have found ^{108m}Ag in biota and sediments collected at previous nuclear testing sites in the Pacific. We first detected the radionuclide in a composite sample of the hepatopancreases of spiny lobsters collected at Bikini Atoll in 1969, and have since measured its concentration in several samples from Bikini and Eniwetok Atolls. Gamma-ray spectra were made using both NaI(Tl) and a solid state Ge(Li) detector system. The resolution of the Ge(Li) detection system permitted precise identification of the radionuclide photopeaks and the NaI(Tl) crystal systems were used to quantitatively measure the ^{108m}Ag. More specific information was obtained by chemically isolating the ^{108m}Ag using a solvent extraction technique[2] by means of which the silver radionuclides are effectively separated from a number of other radio elements, especially ^{125}Sb, ^{207}Bi, ^{60}Co, ^{54}Mn, ^{102}Ru and $^{230,232}Th$.

Comparison (Table 1) of the concentrations of ^{108m}Ag in the hepatopancreas of spiny lobsters taken from Bikini with biota reported in ref. 1 shows that the Bikini specimens contain 2 to 3 times more ^{108m}Ag. By contrast, the concentration of ^{108m}Ag in the composite sample from Eniwetok is less than that in the Guadalupe lobster specimen. The last test series at Bikini and Eniwetok Atolls occurred in 1958, so that the time between the cessation of tests and the collection of the specimens ranges from 6 to 12 yr. It is reasonable to conclude that higher concentrations of both ^{108m}Ag and ^{110m}Ag were present at earlier times. Indeed, Seymour[3] has reported a ^{110m}Ag concentration of approximately 100 d.p.m./g of wet tissue for the hepatopancreas of a spiny lobster collected at Guam in November 1959, and although ^{108m}Ag was not determined in the sample, it is significant that this activity was observed in biota collected 1,200 miles downstream of the test site as early as 1959.

DOE ARCHIVES

which is exposed to both lagoon and sea water and which is therefore a source of ^{108m}Ag for the biota of the area (^{110m}Ag having largely decayed between 1954 and 1969). Thermonuclear tests at other sites in the atoll have also produced silver radionuclides. The last test at Bikini was in 1958, yet we have measured a ^{110m}Ag concentration of 5.2 ± 0.06 d.p.m./g of soil on Eninman Islet at the atoll and thus the amount of ^{108m}Ag present in the Pacific Ocean and elsewhere as a result of pre-1959 testing may be significant.

The second observation about the initial production activity ratio of $^{110m}Ag/^{108m}Ag$ in ref. 1 may be conservative in its estimate of ^{108m}Ag production. As we have said, the initial activity ratio of $^{110m}Ag/^{108m}Ag$ was assumed to be due only to thermal neutron activation of stable silver. There are other production mechanisms for these two radionuclides, the most notable being (n,2n) reactions on stable silver (^{108m}Ag) and (n,p) reactions on stable cadmium ($^{108m,110m}Ag$). The cadmium reaction is probably not important because the quantity of stable cadmium in nuclear devices would probably be kept to a minimum on account of the large thermal neutron cross-sections. The excitation functions for (n,p) reactions at atomic weights between 100–110 and neutron energies between 10–20 MeV (ref. 4) are small (1–100 millibarns) by contrast with the excitation functions for (n,2n) reactions at atomic weights > 100 and similar neutron energies, which are significantly higher (> 1 barn).

DOE ARCHIVE

gies, which are significantly higher

* Present address: Division of Biology and Medicine, US Atomic Energy Commission.

Received November 2, 1970.

DOE ARCHIVES

Jun., A. W.), 151 (Reinhold and American Institute of Biological Science, 1963).
[4] Barbier, M., in *Induced Radioactivity*, 177 (North-Holland, Amsterdam, 1969).

Printed in Great Britain by Fisher, Knight & Co., Ltd., St. Albans.

DOE ARCHIVES