Seasonal variation of $^{239+240}$Pu fluxes in the western equatorial Pacific

M. YAMADA, T. AONO AND Z.L. WANG

Nakaminato Laboratory for Marine Radioecology, National Institute of Radiological Sciences, Isozaki 3609, Hitachinaka, Ibaraki 311-1202, Japan
m_yamada@nirs.go.jp

Introduction

The plutonium isotopes, ^{239}Pu (half-life: 2.44 x 10^4 year) and ^{240}Pu (half-life: 6.58 x 10^3 year), have been added to the surface oceans primarily as a consequence of atmospheric nuclear weapons testing, which took place mostly during the 1950's and early 1960's (UNSCEAR, 1982). A number of studies have been made on the water column distributions of $^{239+240}$Pu (e.g. Bowen et al., 1980). Direct measurements of the vertical fluxes of $^{239+240}$Pu remain rare (Fowler et al., 1983; Livingston & Anderson, 1983), even though such information is essential for quantifying its scavenging rate in the water column. The aims of this study were to measure the concentrations of $^{239+240}$Pu in sediment trap time-series samples, to quantify the fluxes of $^{239+240}$Pu, and to understand $^{239+240}$Pu scavenging process in the water column.

Materials and methods

Sediment trap experiments were carried out in the western equatorial Pacific. Settling particles were collected from the West Caroline Basin by using time-series sediment traps and analyzed for $^{239+240}$Pu. Two sediment traps were deployed at depths of 970 m and 2940 m (1800 m above the bottom) from January to November 1999. These time-series traps were conical with 0.5 m^2 collecting area and 26 receiving cups.

Results and discussion

The $^{239+240}$Pu concentrations in settling particles ranged from 2.6 to 8.8 mBq/g. The $^{239+240}$Pu fluxes showed large seasonal variations, similar to the trend of the total mass fluxes. The maximum $^{239+240}$Pu fluxes occurred in early March and late May at 970 m depth and early June at 2940 m depth. The annual mean fluxes of $^{239+240}$Pu were 0.237 and 0.263 mBq/m^2/day at depths of 970 m and 2940 m, respectively.

References

Bowen V.T., Noshkin V.E., Livingston H.D. and Volchok H.L., (1980), *Earth Planet. Sci. Lett*. **49,** 411-434.

Fowler S.W., Ballestra S., La Rosa J. and Fukai R., (1983), *Deep-Sea Res*. **30,** 1221-1233.

Livingston H.D. and Anderson R.F., (1983), *Nature* **303,** 228-231.

UNSCEAR, (1982), *Report to the General Assembly, United Nations*, 773pp.

The survival of dissolved glycoproteins in oceanic waters

NAMIHA YAMADA[1] AND EIICHIRO TANOUE[2]

[1]Department of Environmental Science, Graduate School of Environmental Studies, Nagoya University, Japan (namiha@ihas.nagoya-u.ac.jp)

[2]Department of Environmental Science, Graduate School of Environmental Studies, Nagoya University, Japan (tanoue@ihas.nagoya-u.ac.jp)

Dissolved organic matter (DOM) in seawater is one of the largest organic reservoirs on earth's surface. However, nature of DOM has been least understood. Tanoue *et al.* (1995) found the occurrence of fewer than 30 dissolved protein molecules in DOM, and identified one of the dissolved proteins was porin protein. The porin protein is trans-outer membrane channel protein of Gram-negative bacteria. Since porin protein has resistant structure, the resistant structure is thought to give rise to the survival of dissolved proteins in DOM. Consequently, unidentified dissolved proteins was anticipated to be porin proteins. On the other hand, many proteins in organisms are known to contain covalently bound sugar, termed glycoproteins. Their sugar chains have been shown to play a key function in complex cellar events. In this study, we have surveyed a universal occurrence of dissolve protein and tried to detect the precence of dissolved glycoproteins, and discuss the possible role of their sugar chains of glycoproteins in DOM.

The widespread occurrence of dissolved proteins as well as porin protein was confirmed in water columns at five stations located in the North Pacific, the northern North Pacific, and the Bering Sea, where no investigation has heretofore been made with regard to dissolved protein. The major dissolved proteins detected in this study were determined to be glycosylated, based on the detection of an aldehyde group formed by the periodate oxidation of the electrophoretically separated dissolved proteins. The cross reactivity against lectins to the glycoproteins indicated that there were two types of linkage between sugar chain and polypeptide; one was an N-linked sugar chain and the other was an O-linked sugar chain.

The occurrences of glycoproteins demonstrated that proteins other than porin protein accounted for the majority of dissolved proteins, since no glycosylated porin protein is known. There must therefore be an additional mechanism by which dissolved proteins are protected from biological attack and survived in marine environments. The possibility that glycoprotein sugar chains can help preserve other dissolved proteins in seawater, as well as the glycoproteins themselves, are speculated.

References

Tanoue E., Nishiyama, S., Kamo, M and Tsugita, A. (1995) *Geochim. Cosmochim. Acta*, **59**, 2643-2648.