RADIOACTIVE NUCLIDES

4. Anthropogenic Radionuclide Geochemical Studies and Analysis in Fallout Samples

Aoyama, Hirose, Igarashi, and Miyao (1996)

Since 1957, GRD scientists of the MRI have measured anthropogenic radionuclides in fallout samples collected in Japan — over 40 years. In the series of studies, we obtained information useful to understanding the behavior of anthropogenic radionuclides in connection with meteorology and atmosphere dynamics and on the atmospheric contamination level.

In the Meteorological Research Institute Technical Report No.36, Aoyama *et al.* (1996) described a detailed radiochemical analysis of long-lived anthropogenic radionuclides (i.e., ^{90}Sr, ^{137}Cs and plutonium isotopes) in fallout samples together with a data set of monthly deposition rates of ^{137}Cs and ^{90}Sr at 12 stations in Japan (Fig. 96-22 and Table 96-2). To control the fallout sample quality in radiochemical analysis, a fallout reference was prepared based on deposition samples collected at 14 stations throughout Japan during 1963-1979 as referenced in the 1995 ACTIVITIES (Otsuji-Hatori *et al.*, 1995). Using this reference, several independent institutions determined the activities of ^{137}Cs, ^{90}Sr, and plutonium isotopes. The results show good agreement among individual institutions, meaning that the fallout reference is useful in guaranteeing the quality of radiochemical analysis for anthropogenic radionuclides.

The Report discusses the geochemical behavior of anthropogenic radionuclides in deposition samples originating from atmospheric nuclear testing and nuclear reactor accidents such as the Chernobyl accident (Fig. 96-23). The major processes controlling the behavior of radioactive deposition are stratospheric fallout, tropospheric fallout, and resuspension. Resuspended radionuclides are considered a major source of recent ^{90}Sr and ^{137}Cs deposition observed at MRI.

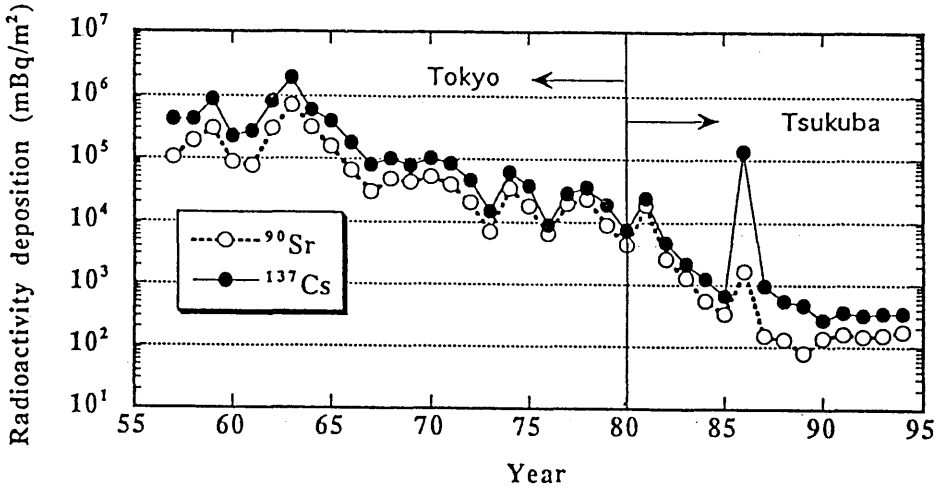

Fig. 96-22 Temporal variation in annual radioactivity deposition observed at MRI.

Table 96-2 Annual deposition of ^{90}Sr, ^{137}Cs and plutonium observed in MRI. (1958-1994)

Year	^{90}Sr Bq m^{-2}	^{137}Cs Bq m^{-2}	$^{239,240}Pu$ Bq m^{-2}	Amount of ppt mm
1958	386	1092		1796
1959	219	692	3.59	1612
1960	64.9	168	1.6	1176
1961	56.8	197	1.37	1232
1962	219	592	4.06	1153
1963	516	1414	7.41	1657
1964	232	435	6.85	1136
1965	116	286	4.47	1761
1966	48.6	135	2.71	1796
1967	21.6	59.5	0.78	1208
1968	35.1	75.7	0.93	1644
1969	32.4	59.5	0.44	1472
1970	52.9	102	0.22	1082
1971	39.6	84	0.48	1396
1972	20.4	45.9	0.19	1701
1973	7.0	14.8	0.096	1207
1974	34	61.6	0.23	1757
1975	18.1	37.4	0.24	1621
1976	6.7	8.9	0.034	1559
1977	19.6	28.1	0.2	1617
1978	22.9	34.8	0.27	1064
1979	8.9	18.9	0.15	1575
1980	4.4	7.4	0.036	1479
1981	18.9	24.1	0.26	1222
1982	2.6	4.8	0.052	1324
1983	1.3	2.1	0.0136	1362
1984	0.56	1.2	0.0079	1826
1985	0.33	0.67	0.0026	1374
1986	1.7	135	0.0032	1182
1987	0.15	0.96	0.0032	1098
1988	0.13	0.56	0.0038	1296
1989	0.079	0.47	0.0017	1520
1990	0.19	0.29	0.0021	1284
1991	0.16	0.36	0.0030	1841
1992	0.15	0.32	0.0044	1282
1993	0.15	0.35	0.0078	1381
1994	0.18	0.42		

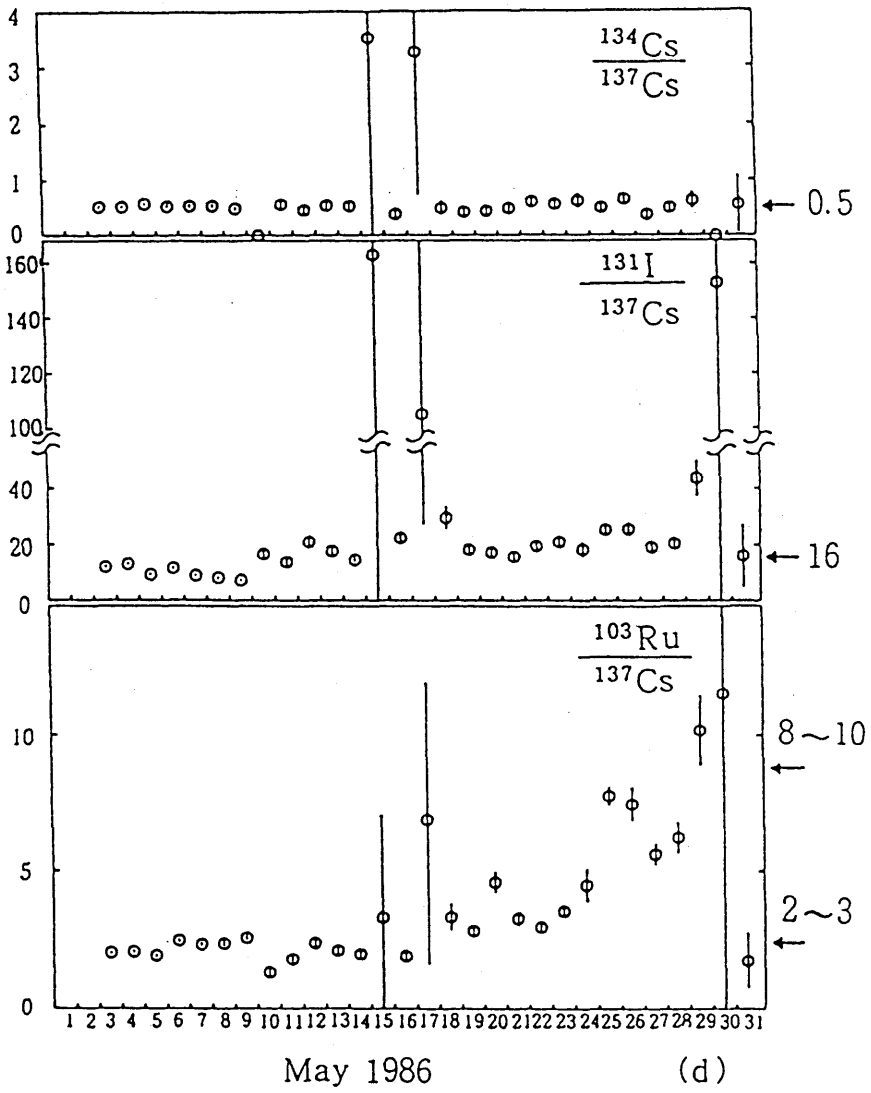

Fig. 96-23 Temporal variation of activity ratios of Chernobyl-derived radionuclides in surface air at Tsukuba.

ORGANIC MATTER AND LIGANDS

5. Ocean Biogeochemistry

5.1 Characterization of particulate protein in Pacific surface waters

Tanoue (1996)

Dissolved organic matter (DOM) is one of the largest but most poorly understood active reservoirs of organic matter on the planet. Although most DOM is marine in origin, its sources and sinks are not well known. As referenced in the 1995 ACTIVITIES, Tanoue extracted dissolved proteins from seawater and found that a limited number of protein species accounted for most of the dissolved proteins and that proteins contributed quantitatively to dissolved organic N throughout the water column.

Protein is the major cellular constituent of phytoplankton and 85% of phytoplankton nitrogen is in the form of protein (e.g., Billen, 1984). Cellular proteins in living organisms may be converted to detrital "combined amino acids" or "proteinaceous compounds" through biogeochemical processes. Particulate-combined amino acids (PCAA), the largest identified fraction of particulate organic matter (POM) in oceanic surface waters, represent a mixture of cellular proteins of organisms and of detrital combined amino acids. The dynamics of the