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Sediment Studies at Bikini Atoll Part 3. Inventories of Some Long-Lived Gamma-Emitting Radionuclides Associated with Lagoon Surface Sediments

V. E. Noshkin
R. J. Eagle
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W. L. Robison

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LAWRENCE LIVERMORE NATIONAL LABORATORY
University of California • Livermore, California • 94551

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V. E Noshkin, R. J. Eagle, J. L. Brunk, W. L. Robison

Abstract

Surface sediment samples were collected during 1979 from 87 locations in the lagoon at Bikini Atoll. The collections were made to better define the concentrations and distribution of long-lived radionuclides associated with the bottom material and to show what modifications occurred to the composition of the surface sediment from the nuclear testing program conducted by the United States at the Atoll between 1946 and 1958. This is the last of three reports on Bikini sediment studies. In this report, we discusse the concentrations and inventories of the residual long-lived gamma-emitting radionuclides in sediments from the lagoon. The gamma-emitting radionucides detected most frequently in sediments collected in 1979, in addition to Americium-241 (^{241}Am) (discussed in the second report of this series), included Cesium-137 (^{137}Cs), Bismuth-207 (^{207}Bi), Europium-155 (^{155}Eu), and Cobalt-60 (^{60}Co). Other man-made, gamma-emitting radionuclides such as Europium-152,154 ($^{152,154}Eu$), Antimony-125 (^{125}Sb), and Rhodium-101,102m ($^{101,102m}Rh$) were occasionally measured above detection limits in sediments near test site locations. The mean inventories for ^{137}Cs, ^{207}Bi, ^{155}Eu, and ^{60}Co in the surface 4 cm of the lagoon sediment are estimated to be 1.7, 0.56, 7.76, and 0.74 TBq, respectively. By June 1997, radioactive decay would reduce these values to 1.1, 0.38, 0.62, and 0.07 TBq, respectively. Some additional loss results from a combination of different processes that continuously mobilize and return some amount of the radionuclides to the water column. The water and dissolved constituents are removed from the lagoon through channels and exchange with the surface waters of the north equatorial Pacific Ocean. Highest levels of these radionuclides are found in surface deposits lagoonward of the Bravo Crater. Lowest concentrations and inventories are associated with sediment lagoonward of the eastern reef. The quantities in the 0–4 cm surface layer are estimated to be less than 35% of the total inventory to depth in the sediment column.

Introduction

Bikini Atoll, located at about 11 degrees 36 minutes N, 165 degrees 22 minutes E, was one of two sites in the northern Marshall Islands used by the United States between 1946 and 1958 to test nuclear devices. Most of the 23 devices were detonated on barges anchored in the lagoon or on the reef. Two were airburst detonations, two were explosions under water, and three were ground surface explosions. The locations of the test sites within the atoll are shown in Figure 1. Each nuclear explosion produced some quantity of radioactive fission products, particle-induced radionuclides, or unspent radioactive nuclear fuel that became associated with the material incorporated in the fireball from the explosions. Some of this material was deposited locally on islands and in the lagoon of the atoll. Material deposited over the lagoon eventually settled to the surface of the bottom sediments. Today only several longer-lived radionuclides remain associated with environmental components of the Atoll. In the marine environment these radionuclides are redistributed among the many components that make up the bottom sediment. They are resuspended with particles or released to solution in the water column, and are accumulated by indigenous biota. Lagoon bottom and surface currents move some material and the associated radionuclides to different regions within the lagoon. Some quantities of radionuclides in solution, or in association with resuspended fine material, are transported

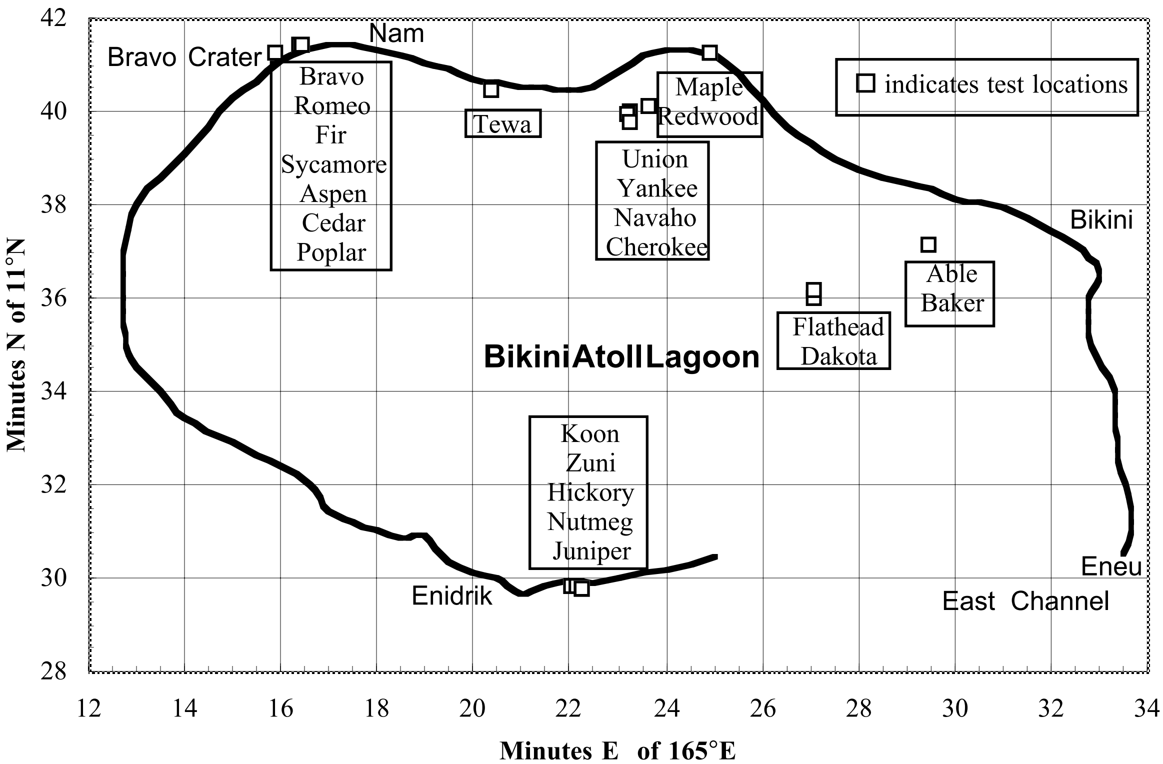

Figure 1. Nuclear test names and site locations at Bikini Atoll.

with surface currents out of the lagoon into the north equatorial Pacific Ocean.

Prior to 1972 little information was available on the inventories or spatial distribution of radionuclides associated with the lagoon sediments. Only 5 early publications (Lynch et al., 1975; Held, 1971; Beasley and Held, 1971; Welander, et al., 1967; Schell and Yang, 1973) reported measuring specific radionuclides in a few samples collected during 1964 and 1969 from craters and two mid-lagoon locations.

Personnel from the Puerto Rico Nuclear Center (PRNC), the Laboratory of Radiation Ecology (LRE), University of Washington, and the Lawrence Livermore National Laboratory (LLNL) participated in a sampling program of the marine environment of Bikini Lagoon during October and November 1972 aboard the *R.V. Palumbo* from PRNC. The primary purpose for the study was to evaluate the distribution and concentration of the transuranium radionuclides in different components of the marine environment. Included among the collected samples were surface sediments (2.5 cm in depth) from only 24 widely spaced stations and sediment cores from nine locations. Additional sediment samples were obtained from within three nuclear craters. These samples provided data to make the first estimate on the concentrations of transuranics and their distribution in the bottom sediments of the lagoon. The concentrations of the transuranic radionuclides in these samples have been discussed in several publications (Marshall and Schell, 1974; Mo and Lowman, 1975; Nevissi and Schell, 1975; Noshkin et al., 1975; Schell and Watters, 1975; Schell et al., 1978; Noshkin and Wong, 1980; Schell et al., 1980; Noshkin et al., 1981; Schell, 1987). Only Schell et al. (1980), has previously provided some information from the 72 collections on the concentration of other long-lived radionuclides in lagoon surface sediments and at depths in the sedimentcolumn.

Surface sediments were again sampled during 1979 from 87 locations within the lagoon. The purpose for this collection was (1)to better define the distribution of the long-lived radionuclides in the bottom surface sediments; (2) to compare concentrations with the 1972 results; and (3) to assess any modification in specific sedimentary components that resulted from the testing program.

During the late 1970s and early 1980s, sediment studies were assigned a low priority in the marine radiological programs conducted at the Marshall Island Atolls. Analytical efforts were focused on studies that complemented clean up at Enewetak Atoll; a large radiological survey of several other Northern Marshall Island Atolls; and resettlement at Bikini Atoll. As a result, the sediment data were set aside to assess at a later date. Support for the marine studies in the Marshall Islands ended in 1984. Therefore, the sediment data from the 1979 program remained unpublished. There is now a need for this information, since plans for resettlement at Bikini Atoll call for obtaining lagoon sediments to build causeways and to replace some contaminated soils on specific islands. A better knowledge of the radionuclide activity levels and sediment composition will aid in identifying preferred regions to dredge in the lagoon. Present support and facilities at the atoll are not adequate to resample the entire lagoon bottom for new samples. Therefore, the earlier results are assembled in a series of reports to address the original objectives and provide data for engineering considerations.

The first report (Noshkin et al., 1997a) of this three-part series addresses the distribution of the fine and coarse sedimentary components in the bottom surface sediments. The second report (Noshkin et al., 1997b) summarizes results related to the concentrations of ^{241}Am and $^{239+240}$Pu radionuclides in sediments from both the 1972 and 1979 collections. In this third report, we review the concentrations of other longer-lived, man-made, gamma-emitting radionuclides in the 1979 and the 1972 bottom sediment samples.

Collection and Processing

Shipboard procedures used for the collection of sediment samples during the 1972 and 1979 programs are described in parts 1 and 2 of this series (Noshkin et al., 1997a; Noshkin et al., 1997b). Surface sediment samples were obtained from the contents returned shipboard in a Shipek grab sampler. The contents were sampled to depths of 2 and 4 cm with end caps and a short core. The volume of material sampled with one end cap to 2 cm was 39.3 cm^3. Usually two to three surface subsamples were removed from each grab and combined as a sample for that station. The volume of sample collected to 4–cm depth with the short core was 102.1 cm^3. In 1972, a similar technique was used to obtain surface samples to a depth of 2.5 cm. The volume of each sample was 91 cm^3.

All samples were placed in plastic bags, frozen, and returned to the laboratories for processing and analysis. At LLNL, the wet weights of the 1972 and 1979 collections were determined. Most of the composite samples were then sieved through a 0.5–mm screen to separate the less than 0.5–mm fraction from the coarse components. Frozen core samples were sectioned into different depth increments before processing. Some sections of the cores were also sieved to separate the fine and coarse fraction. Other sections of cores were processed without separation. Each fraction was dried and weighed. Sample dry weights ranged from approximately 5 to 250 g. When possible, the fraction of fine material in the total sample was determined. The amount of *Halimeda* remains, shell fragments, and foraminifera in the coarse fraction were estimated in the 1979 samples. Both the fine and coarse fractions were ball milled and transferred to containers for analysis by gamma spectrometry using several Ge(Li) detection systems. Counting times were usually 1000 minutes or longer for each sample. A general-purpose computer program was used for the data reduction of all gamma-ray spectra. A brief description of the gamma-ray program and an account of our quality assurance effort are given in Noshkin, et al. (1988). All radionuclide data were corrected to the date of collection.

The man-made gamma-emitting radionuclides identified and above detection limits in most 1972 and 1979 fine and coarse components included ^{241}Am, ^{155}Eu, ^{60}Co, ^{207}Bi, and^{137}Cs. The radionuclides, ^{102m}Rh, ^{152}Eu, ^{125}Sb, and ^{101}Rh, were sometimes found in concentrations above detection limits in samples collected primarily near test site locations. Examples of the detection limits for several of these radionuclides are given in Table 1. Chemical separations were made to determine the concentrations of $^{239+240}Pu$ and the ^{241}Am to $^{239+240}Pu$ concentration ratios in a selected number of the 1979 samples. The $^{239+240}Pu$ and the ^{241}Am results are discussed in part 2 of this series (Noshkin et al., 1997b). Here, we summarize information on the concentrations and distributions of ^{155}Eu, ^{60}Co, ^{207}Bi, and ^{137}Cs in the sediments from Bikini lagoon.

Table 1. Detection limits (1 sigma) of selected gamma emitters most often detected in 1972 and 1979 Bikini lagoon surface sediment samples. (Sediment samples as a function of sample size.)

	mBq/sample based on 1000 minute counting time					
Sample Size (g)	^{60}**Co**	^{125}**Sb**	^{137}**Cs**	^{155}**Eu**	^{207}**Bi**	^{102m}**Rh**
3 ± 2	37	44	19	33	30	19
10 ± 5	59	63	30	52	56	30
70 ± 30	89	107	44	89	81	44
160 ± 60	133	170	67	148	119	67

Results

Sample data and radiological results are provided in the series of appendices associated with this report. Some additional descriptive information is provided in appendices associated with parts 1 and 2 of this series (Noshkin et al. 1997a, 1997b). The radiological data in the appendices is expressed as the activity (Bq) per unit dry weight (kg) and as activity (kBq) per unit area (m^2) in the fine and coarse fractions and in the reconstructed entire sample. Each unit is useful to describe certain features of the analytical data. The Bq kg^{-1} in the reconstructed whole sample is computed from Equation 1. The kBq m^{-2} in the reconstructed whole sample is the sum of the kBq m^{-2} in the fine plus coarse fraction of each sample.

$$\text{Bq kg}^{-1}\text{ (whole sample)} = (\text{Bq kg}^{-1}{}_{\text{fines}} \times \text{wt}_{\text{fines}}(\text{kg}) + \text{Bq kg}^{-1}{}_{\text{coarse}} \times \text{wt}_{\text{coarse}}(\text{kg})) \times (\text{wt}_{\text{fines}}(\text{kg}) + \text{wt}_{\text{coarse}}(\text{kg}))^{-1} \quad (1)$$

Appendix A contains station coordinates, volumes, and sample weights for the 0–2.5 cm depth sections of surface sediment collected during Octover through November 1972. Appendix B and C contain concentrations and inventories of the gamma-emitting radionuclides, ^{207}Bi, ^{60}Co, ^{137}Cs, and ^{155}Eu, in sections of surface sediment from the 1972 collections. Appendix D contains information on the depth distribution of ^{207}Bi, ^{60}Co, ^{137}Cs, and ^{155}Eu concentrations in core samples collected in 1972. Appendix E contains the station coordinates, volumes and sample weights for the 0–2 cm and 0–4 cm depth sections of surface sediment collected during
April through June 1979. Appendices F and G contain concentrations and inventories of the gamma-emitting radionuclides, ^{207}Bi, ^{60}Co, ^{137}Cs, and ^{155}Eu, in the fine and coarse fractions and the reconstructed whole sample from the 0–2 cm sections of surface sediment collected in 1979. Appendix H contains measured concentrations (above detection limits) for $^{152,154}Eu$, ^{125}Sb, and natural ^{40}K in the 1979 surface 0–2 cm depth sections of sediment. Some ^{210}Pb concentrations in selected samples are provided for information and have been discussed elsewhere (Noshkin et al., 1994). Appendices I and J contain concentrations and inventories of the gamma-emitting radionuclides, ^{207}Bi, ^{60}Co, ^{137}Cs, and ^{155}Eu, in the fine and coarse fractions and the

reconstructed whole sample from the 0–4 cm sections of surface sediment collected in 1979. Appendix K contains measured concentrations (above detection limits) for ^{152,154}Eu, ^{125}Sb, and natural ^{40}K in the 1979 surface 0–4 cm depth sections of sediment.

Discussion

Radionuclide Concentrations in the 1979 SurfaceSediments

Concentration data for ^{137}Cs in the 0–2 cm depth section of fine and coarse material (from Appendix G) are plotted on a lagoon chart at the stations sampled. Isoconcentration lines are constructed by intercalation to define regions of the bottom with similar concentrations. The resulting distributions for ^{137}Cs associated with the fine (<0.5 mm) and coarse (>0.5 mm) bottom material are shown in Figures 2 and 3. Individual concentrations at the stations (indicated in the figures with a circle) sampled are not shown but can be found and located using information in Appendices G and E. Concentrations are found to range from non-detected amounts to 1000 Bq kg^{-1}. The radionuclide is everywhere associated with the fine and coarse sedimentary components with highest concentrations associated with sediment from the northwestern quadrant of the lagoon, near Bravo crater. The concentrations of ^{137}Cs in both sediment fractions decrease in a southerly and easterly direction from the area of the crater. A secondary but less significant maximum is located near the island of Enidrik near Zuni crater. Distributions of the other major gamma-emitting radionuclides in the fine and coarse material (and reconstructed whole sample) resemble that for ^{137}Cs, with some notable differences however. In 1979, the concentrations of ^{155}Eu in the total reconstructed samples (fine and coarse material of the 0–2 cm section) were everywhere greater than ^{137}Cs, ^{60}Co, and ^{207}Bi. Concentrations of ^{137}Cs exceeded that of ^{60}Co in the sediments from the NE quadrant and in sediments near Enidrik. In the central and eastern sections of the lagoon, the concentrations of ^{60}Co in the sediments were larger than ^{137}Cs. Likewise, levels of ^{207}Bi exceeded those of ^{137}Cs only in sediments from the central section of the lagoon; elsewhere, ^{137}Cs concentrations were greater than ^{207}Bi levels in the surface sediments. In sediment samples from areas east of 165 degrees 20 minutes E and between 11 degrees 32 minutes and 11 degrees 36 minutes N, the ^{207}Bi levels were greater than ^{60}Co; elsewhere, ^{60}Co concentrations were greater than those of ^{207}Bi.

Figure 4 shows four examples of log-probability plots for the concentrations of ^{137}Cs, ^{60}Co, ^{155}Eu, and ^{207}Bi associated with either the fine or coarse material in the 0–4 cm surface sections of sediment from the entire lagoon. Each plot indicates a reasonable fit of a straight line to the plotted points that suggests the sediment radionuclide concentration data is best described by a lognormal distribution. Similar plots (not shown in this report) were constructed using the data set of each radionuclide associated with all 0–2 and 0–4 cm sections of fine, coarse, and reconstructed samples. Each plot and appropriate equations (Gilbert, 1987) are used to describe the relationship between any quantile and its value. The sample geometric mean (also the median) and the best estimate of the mean concentration over the entire lagoon bottom are also computed. Values for these parameters are given in Table 2.

It is found that the mean concentrations of each radionuclide in the 0–2 cm and 0–4 cm fractions are nearly identical indicating the radionuclides are well mixed in the sediment to a depth of at least 4 cm. The coarse to fine mean concentration ratio in the surface layers for ^{137}Cs, ^{155}Eu, ^{60}Co, and ^{207}Bi are approximately 0.21, 0.41, 0.44, and 1.17, respectively. It is assumed most radioactive debris was condensed originally in association with small particles. With time, fractions of the activity mobilized from the fine debris are accumulated by living organisms or adsorbed by expired bottom components such as a species of *Halimeda* algae, coral, and forams. Concentration factors and Kd values for ^{137}Cs are significantly lower than those for ^{60}Co, ^{155}Eu, and ^{207}Bi (Noshkin, 1980). Therefore, ^{137}Cs is not readily accumulated or adsorbed by the larger sedimentary components, which accounts for the observed lowest value for the coarse to fine ratio. Much of the released ^{137}Cs remains in solution and is transported from the lagoon by natural processes more rapidly than ^{155}Eu, ^{60}Co, and ^{207}Bi.

Surprisingly, the mean concentration of ^{207}Bi associated with the fine and coarse

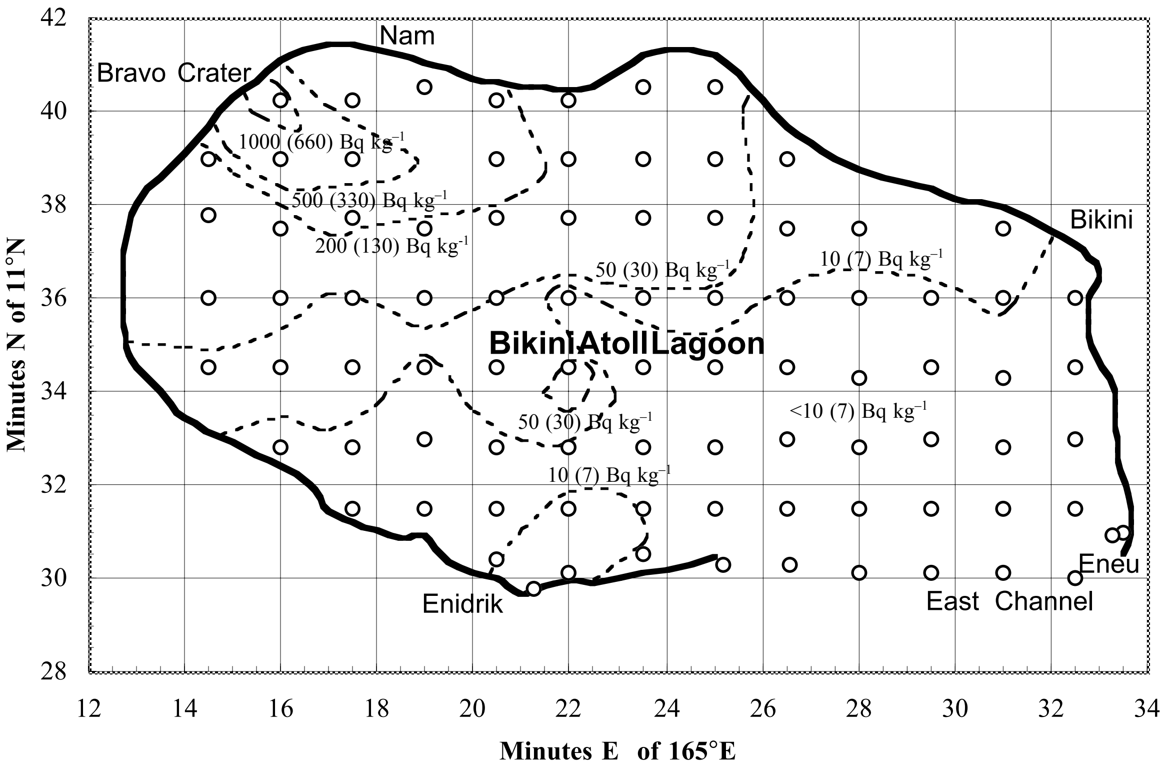

Figure 2. Concentration (Bq kg^{-1}) of ^{137}Cs associated with the fine (<0.5 mm) fraction of lagoon surface (0–2 cm depth) sediment collected in 1979. Values in parenthesis represent concentrations decay corrected to June 1997.

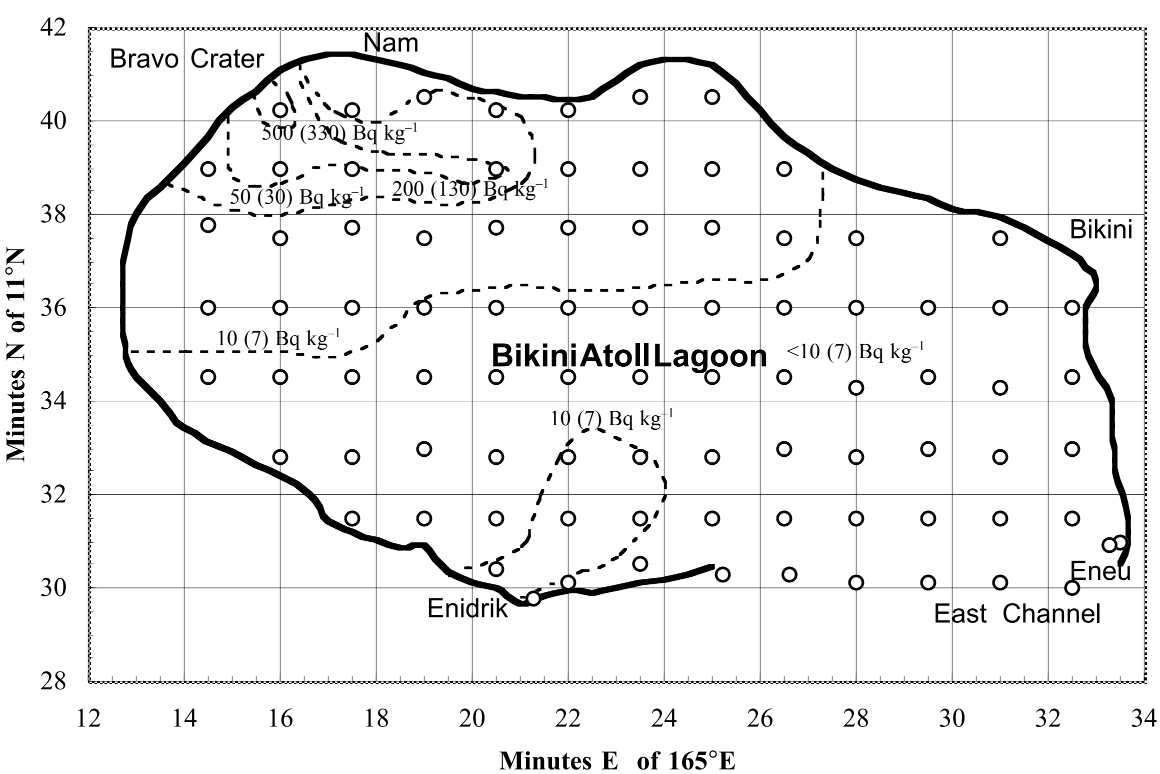

Figure 3. Concentration (Bq kg^{-1}) of ^{137}Cs associated with the coarse (>0.5 mm) fraction of lagoon surface (0–2 cm depth) sediment collected in 1979. Values in parenthesis are concentrations decay corrected to June 1997.

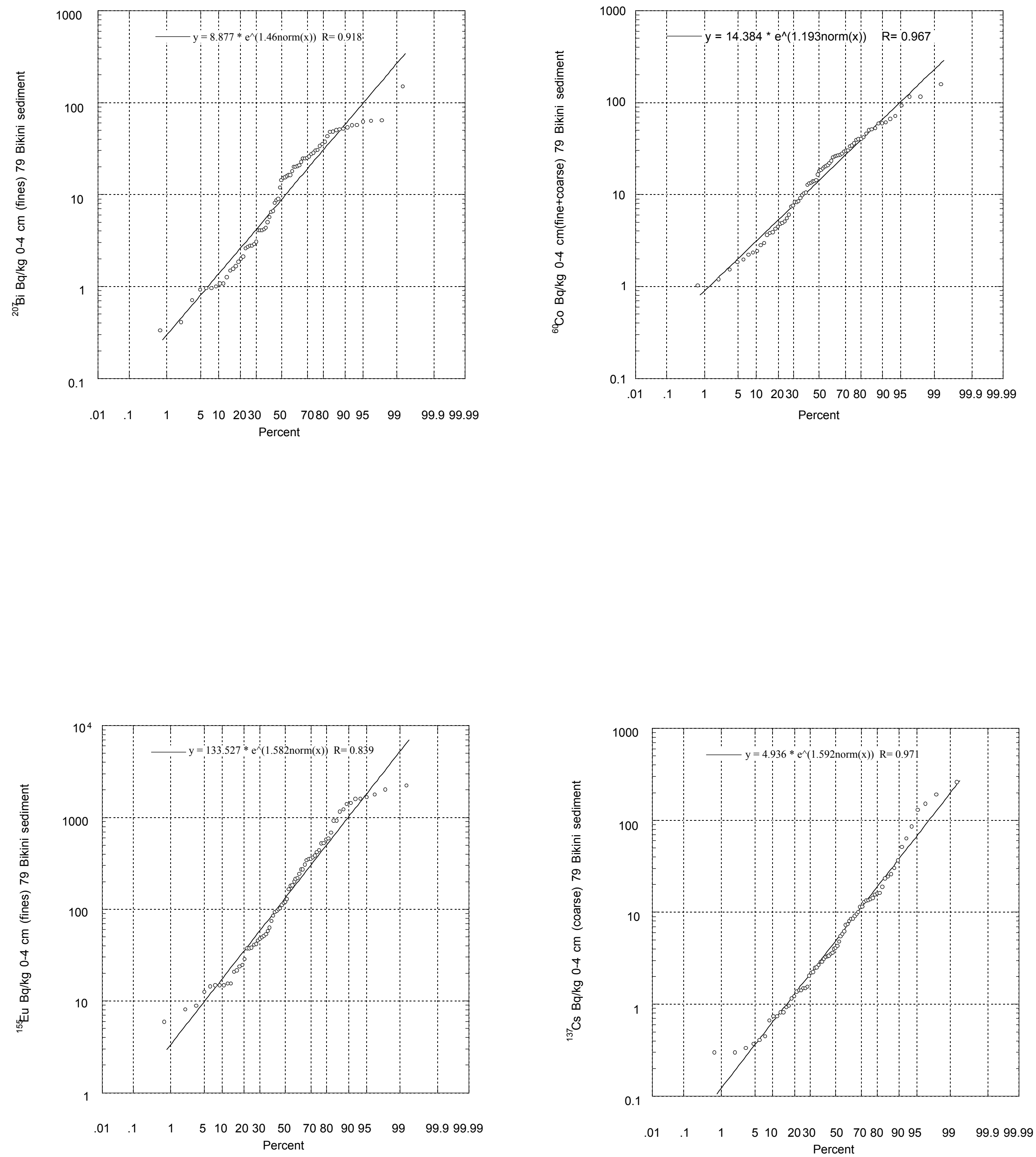

Figure 4. Log-probability plots for ^{207}Bi, ^{60}Co, ^{155}Eu, and ^{137}Cs in fine or coarse fractions of 0–4 cm deep surface sediments.

Table 2. Statistical parameters from log-probability plots of concentration (Bq kg^{-1}) data for ^{137}Cs, ^{60}Co, ^{207}Bi, and ^{155}Eu in fine, coarse, and reconstructed samples of 0–2 cm and 0–4 cm surface sections of 1979 Bikini lagoon sediment.

Isotope	Depth increment (cm)	Sediment component	Best fit relationship[a] x = exp(ybar)*exp(Zp*sy)	R^2	Concentration range Bq kg^{-1}	Geomean (Bq kg^{-1}) [=exp(ybar)]	Mean (Bq kg^{-1}) & standard deviation as of 6/79	Mean (Bq kg^{-1}) & standard deviation as of 1997 (loss only by radioactive decay)
^{137}Cs	0–2	fine	= 17.1*exp(Zp*1.77)	0.94	0.4–1010	17.1 ± 5.9	80 ± 400	50 ± 260
	0–2	coarse	= 5.3*exp(Zp*1.68)	0.93	0.2–830	5.3 ± 5.4	20 ± 90	20 ± 60
	0–2	fine&coarse	= 9.2*exp(Zp*1.75)	0.96	0.4–1015	9.2 ± 5.7	40 ± 190	30 ± 130
	0–4	fine	= 18.0*exp(Zp*1.92)	0.82	0.3–760	18.0 ± 6.9	120 ± 720	80 ± 470
	0–4	coarse	= 4.9*exp(Zp*1.592)	0.94	0.3–260	4.9 ± 4.9	20 ± 60	10 ± 40
	0–4	fine&coarse	= 8.9*exp(Zp*1.79)	0.92	0.5–750	8.9 ± 6.0	40 ± 200	30 ± 140
^{60}Co	0–2	fine	= 22.3*exp(Zp*1.32)	0.81	0.4–280	22.3 ± 3.7	50 ± 100	5 ± 10
	0–2	coarse	= 10.7*exp(Zp*1.22)	0.83	0.4–540	10.7 ± 3.4	20 ± 40	2 ± 4
	0–2	fine&coarse	= 13.7*exp(Zp*1.23)	0.99	0.6–230	13.7 ± 3.4	30 ± 60	3 ± 5
	0–4	fine	= 24.0*exp(Zp*1.29)	0.78	1.0–200	24.0 ± 3.6	60 ± 100	5 ± 11
	0–4	coarse	= 10.6*exp(Zp*1.18)	0.98	0.6–170	10.6 ± 3.2	20 ± 40	2 ± 4
	0–4	fine&coarse	= 14.4*exp(Zp*1.19)	0.94	1.0–160	14.4 ± 3.3	30 ± 50	3 ± 5
^{207}Bi	0–2	fine	= 7.0*exp(Zp*1.52)	0.92	0.4–375	7.0 ± 4.5	20 ± 70	15 ± 45
	0–2	coarse	= 6.9*exp(Zp*1.65)	0.88	0.2–530	6.9 ± 5.2	30 ± 100	20 ± 70
	0–2	fine&coarse	= 7.2*exp(Zp*1.56)	0.94	0.3–380	7.2 ± 4.8	20 ± 80	20 ± 50
	0–4	fine	= 8.9*exp(Zp*1.46)	0.84	0.3–150	8.9 ± 4.3	30 ± 70	20 ± 50
	0–4	coarse	= 7.4*exp(Zp*1.64)	0.84	0.2–140	7.4 ± 5.2	30 ± 100	20 ± 70
	0–4	fine&coarse	= 8.4*exp(Zp*1.56)	0.82	0.1–150	8.4 ± 4.8	30 ± 90	20 ± 60
^{155}Eu	0–2	fine	= 123.4*exp(Zp*1.58)	0.72	7–2650	123.4 ± 4.9	400 ± 1400	40 ± 120
	0–2	coarse	= 77.3*exp(Zp*1.37)	0.96	4–3530	77.3 ± 3.9	200 ± 460	20 ± 40
	0–2	fine&coarse	= 93.7*exp(Zp*1.46)	0.9	7–2540	93.7 ± 4.3	270 ± 700	20 ± 60
	0–4	fine	= 133.5*exp(Zp*1.58)	0.7	5–2220	133.5 ± 4.9	470 ± 1500	40 ± 130
	0–4	coarse	= 71.9*exp(Zp*1.32)	0.97	4–1430	71.9 ± 3.7	170 ± 370	10 ± 30
	0–4	fine&coarse	= 93.75*exp(Zp*1.45)	0.84	5–1770	93.8 ± 4.3	270 ± 720	20 ± 60

[a] Best fit to a 2 parameter lognormal probability plot (see Fig. 4). x is any quantile, and Z_p values can be found in Table A1 of Gilbert (1987).

bottom material is similar, whereas the mean concentration of ^{60}Co and ^{155}Eu in the coarse material is approximately 50% of the concentration associated with the fine material. The reason for the higher accumulation of ^{207}Bi by the coarse sedimentary material and the suggested longer residence time is not known. However, it has been determined from an analysis of fish radionuclide concentration data that ^{207}Bi has a long residence time in Bikini lagoon (Noshkin et al., 1997c).

In 1979, the sequence for the total radionuclide mean concentration in the surface (fine & coarse) sediment was ^{155}Eu >> ^{137}Cs> ^{60}Co ≅ ^{207}Bi. By 1997, radioactive decay and natural processes reduced these values. The mean concentration of each radionuclide resulting from radioactive decay during this period is given in the last column of Table 2. The mean concentrations changed from decay so that the sequence of expected mean activities in the sediments during 1997 would be ^{137}Cs> ^{155}Eu ≅ ^{207}Bi>> ^{60}Co.

The radionuclides occasionally found above detection limits in the 1979, 0–2 and 0–4 cm deep sediment samples, included ^{152,154}Eu, ^{125}Sb, and ^{102m}Rh. The highest concentrations are associated with sediment samples taken lagoonward of Bravo crater and, especially, for ^{102m}Rh in the vicinity of Zuni crater off Enidrik Island. ^{125}Sb and ^{102m}Rh would be non-detectable in a 100-g sediment sample counted for 1000 minutes in 1997.

Radionuclide Inventories in the 1979 SurfaceSediments

The kBq m^{-2} values in the reconstructed total sample from Appendices F, G, I, and J are plotted and isoconcentration lines constructed by intercalation to distinguish areas with comparable inventories in the 0–2 and 0–4 cm surface increments. As examples, the resulting distribution of inventories for ^{137}Cs, ^{155}Eu, ^{60}Co, and ^{207}Bi in the 0–2 cm and ^{137}Cs in the 0–4 cm surface sections of sediment are shown in Figures 5 to 9. Individual values are not shown at the stations sampled in the figures, but these can be found in the appendices. The distribution of inventories is similar to the distribution in concentration. The highest amounts are associated with sediments from the NW quadrant of the lagoon, but not necessarily with the sediment adjacent to Bravo crater. The lowest inventories of the gamma emitters are associated with the sediments from the eastern half of the lagoon. There are increased amounts noted only in the 0–2 cm sections of sediments for ^{137}Cs near Enidrik. However, a small maximum is also evident in this area for the other radionuclides measured in the 0–4 cm sections.

The area between adjacent contour lines is determined along with the lognormal mean inventory from the data points in the respective region. Multiplying the area by the mean inventory provides an estimate of the total amount of the radionuclide associated with the surface sediments within the region. Summing these quantities produces an estimate of the total amount associated with surface layer of sediment over the entire lagoon. Respective inventories for these radionuclides in the 0–2 and 0–4 cm surface sections are computed in this manner and are shown in Table 3. For comparison the lognormal mean for each radionuclide is also computed using the data set for the whole lagoon. These values are also entered in Table 3. Analysis of the concentration data demonstrated that the radionuclides are well mixed to 4 cm within the sediments of the lagoon. Therefore, the inventory to 2 cm is extrapolated to a depth of 4 cm by multiplying the values by 2. The 0–4 cm mean value and the 2 × (0–2 cm) mean value are averaged and shown in the last column of Table 3.

Mean inventory values for the radionuclides computed by summing the subgroup areas of the lagoon, and the mean computed for the entire lagoon are in reasonable agreement considering the large associated errors (not so however for the 1972 data sets). However, the values determined from the analysis of geographical areas are considered the most reliable estimate of the inventory and will be used in subsequent discussions of 1979 and 1972 data sets. The sequence of radionuclides based on mean inventory in the sediment follow the ordering encountered for mean concentrations in 1979: ^{155}Eu> ^{137}Cs> ^{60}Co ≅ ^{207}Bi. In 1997, the inventories also are smaller as a result of radioactive decay (and natural processes). The predicted sequence for the inventories of gamma-emitting radionuclides in the sediments is ^{137}Cs> ^{155}Eu ≅ ^{207}Bi>> ^{60}Co. In the late 1990s, the lowest (and likely non-detectable) concentration and inventory for these radionuclides can be anticipated to be associated with any sediments from the eastern third of the lagoon. The dominate gamma-emitting radionuclide in sediments during subsequent years at Bikini Atoll will be ^{241}Am with the present inventory of about 24 ± 4 TBq in the 0–4 cm surface layer (Noshkin et al., 1997b).

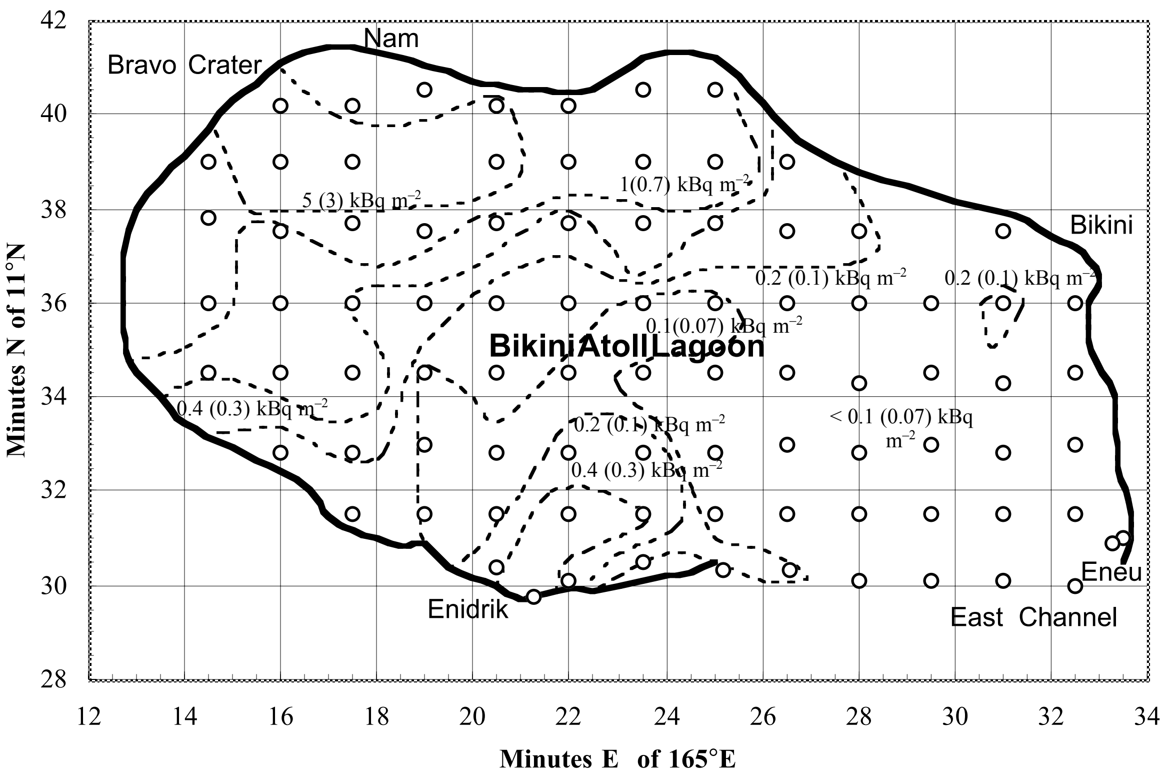

Figure 5. Distribution of inventory for ^{137}Cs in 0–2 cm surface layer of lagoon sediment collected in 1979. Values in parenthesis are inventories decay corrected to June 1997.

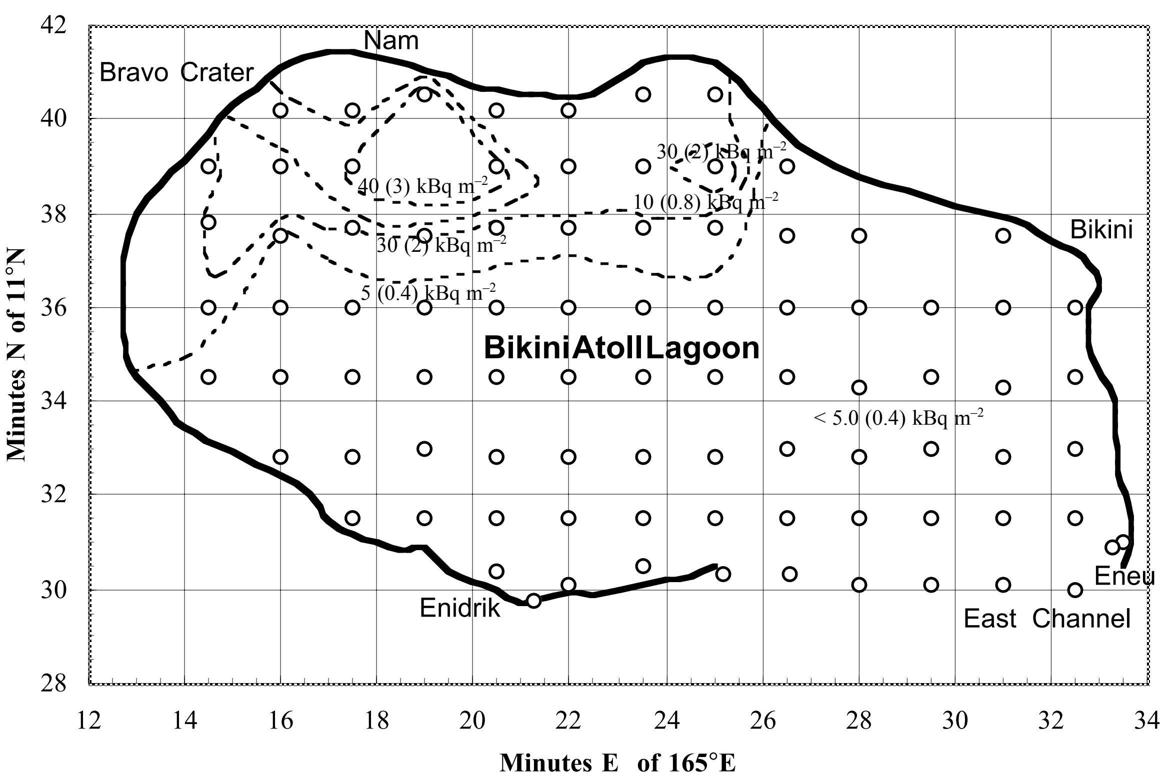

Figure 6. Distribution of inventory for ^{155}Eu in 0–2 cm surface layer of lagoon sediment collected in 1979. Values in parenthesis are inventories decay corrected to June 1997.

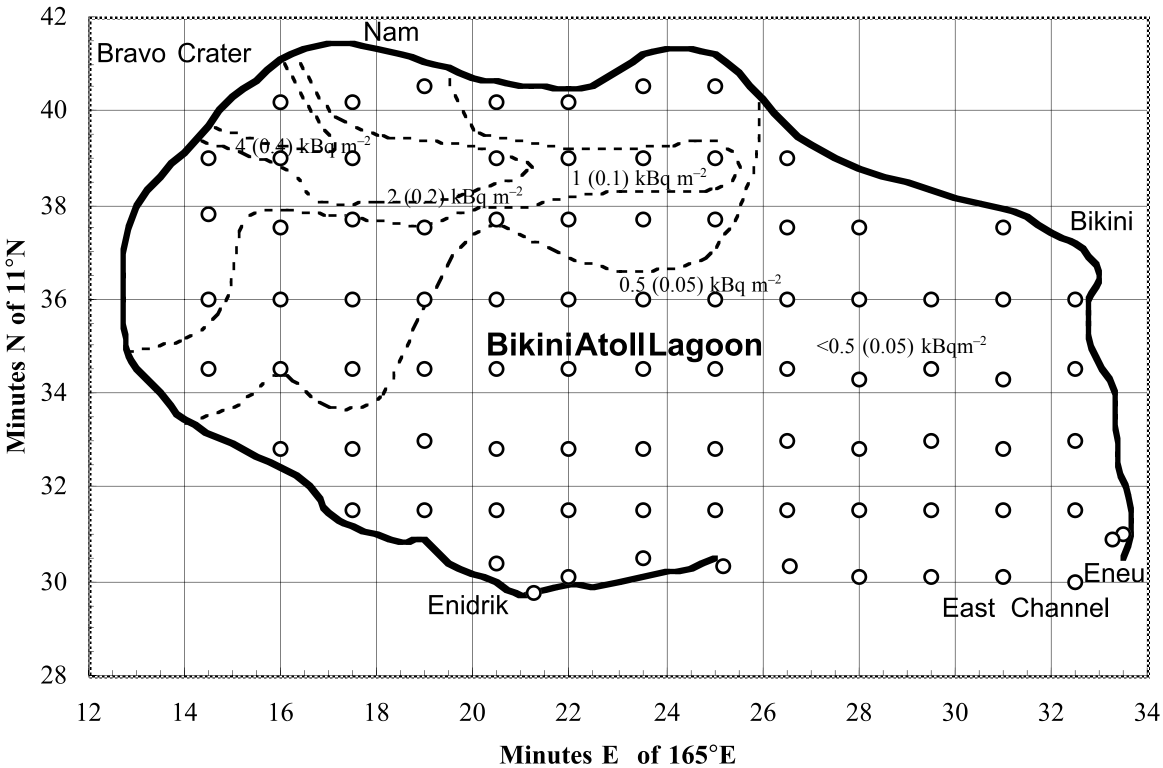

Figure 7. Distribution of inventory for ^{60}Co in 0–2 cm surface layer of lagoon sediment collected in 1979. Values in parenthesis are inventories decay corrected to June 1997.

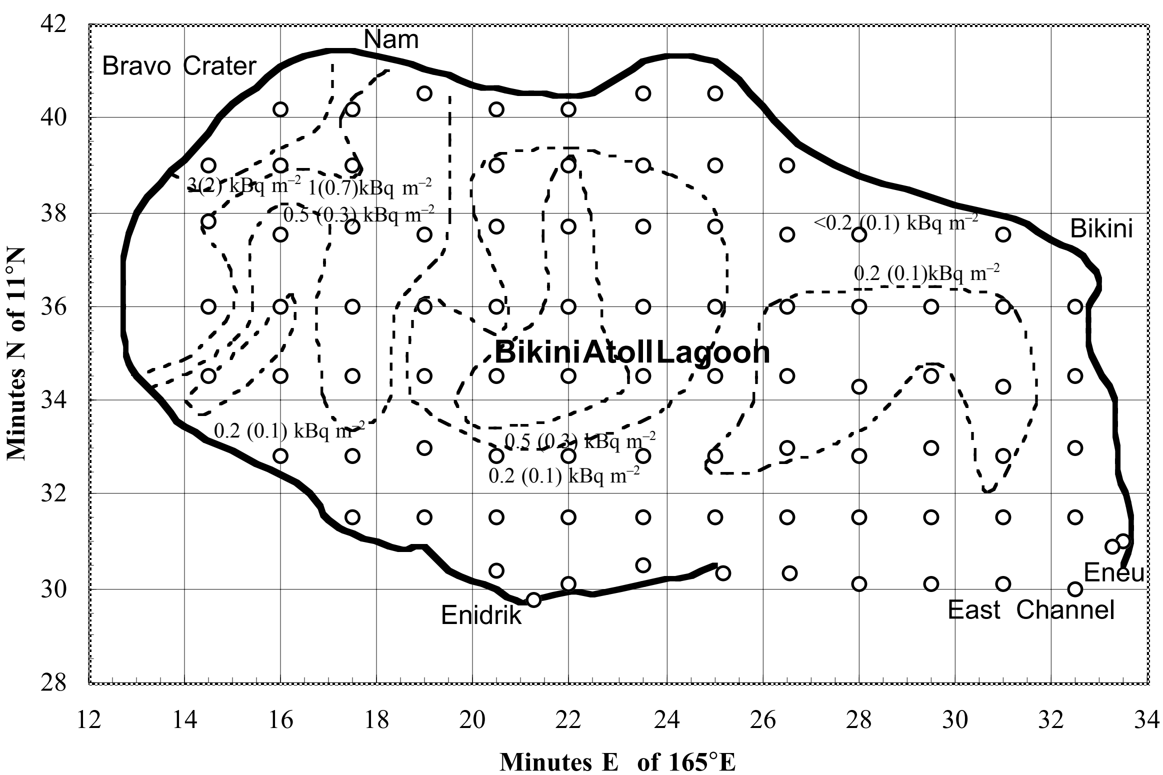

Figure 8. Distribution of inventory for ^{207}Bi in 0–2 cm surface layer of lagoon sediment collected in 1979. Values in parenthesis are inventories decay corrected to June 1997.

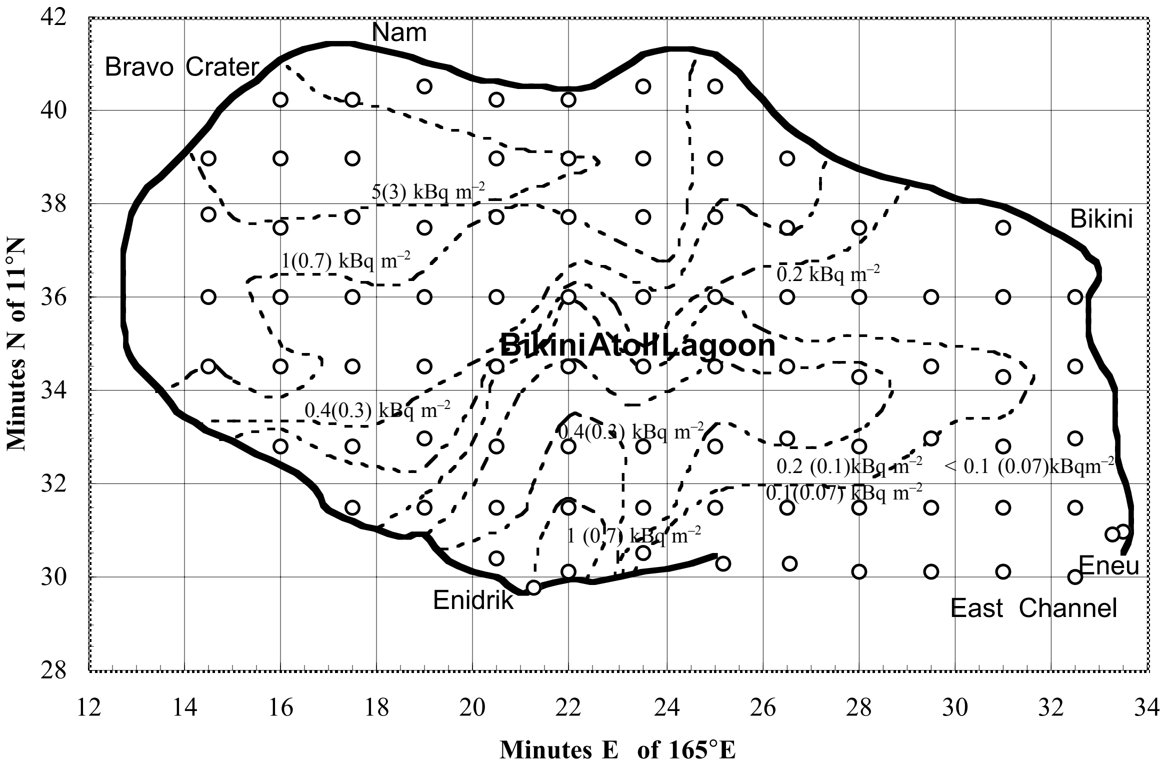

Figure 9. Distribution of inventory for ^{137}Cs in 0–4 cm surface layer of lagoon sediment collected in 1979. Values in parenthesis are inventories decay corrected to June 1997.

Table 3. Total inventories (TBq) of radionuclides in surface sediments of Bikini lagoon during 1979.

$kBq\,m^{-2}$ region	No. of data points in region	Ln normal mean inventory	Area of interval (km^2)	Total TBq in interval to depth	No. of data points in region	Ln normal mean	Area of interval (km^2)	Total TBq in interval to depth	Mean TBq to (4 cm[b])
	^{60}Co (0–2.0 cm) 1979					**^{60}Co (0–4.0 cm) 1979**			
0–0.5	60	0.2 ± 0.2	407	0.09 ± 0.08	36	0.3 ± 0.2	269	0.08 ± 0.05	
0.5–1.0	16	0.7 ± 0.3	118	0.09 ± 0.04	17	0.7 ± 0.12	148	0.10 ± 0.02	
1.0–2.0	8	1.4 ± 0.3	72	0.10 ± 0.02	11	1.5 ± 0.4	103	0.15 ± 0.04	
2.0–4.0	3	2.9 ± 1.0	23	0.07 ± 0.02	6	2.6 ± 0.6	83	0.22 ± 0.05	
>4.0	1	5.65	8.7	0.05	3	6.8 ± 1.4	26	0.18 ± 0.04	
Sum				0.40 ± 0.09				0.73 ± 0.09	0.77 ± 0.10
Entire[a]	88	0.54 ± 0.92	629	0.34 ± 0.58	73	0.99 ± 1.53	629	0.62 ± 0.96	0.65 ± 0.72
	^{137}Cs (0–2.0 cm) 1979					**^{137}Cs (0–4.0 cm) 1979**			
0–0.1	38	0.04 ± 0.02	262	0.010 ± 0.005	22	0.05 ± 0.02	179	0.009 ± 0.003	
0.1–0.2	9	0.13 ± 0.02	59	0.008 ± 0.001	10	0.15 ± 0.04	65	0.010 ± 0.003	
0.2–0.4	14	0.27 ± 0.05	82	0.022 ± 0.004	12	0.29 ± 0.06	95	0.028 ± 0.006	
0.4–1.0	13	0.60 ± 0.16	77	0.05 ± 0.01	12	0.65 ± 0.18	115	0.08 ± 0.02	
1.0–5.0	11	2.2 ± 0.9	105	0.23 ± 0.10	11	2.8 ± 1.8	125	0.35 ± 0.22	
>5.0	5	14.6 ± 8.9	45	0.66 ± 0.40	6	20.4 ± 18.9	50	1.02 ± 0.95	
Sum				0.98 ± 0.41				1.5 ± 1.0	1.7 ± 0.6
Entire[a]	90	0.9 ± 4.5	629	0.6 ± 2.9	73	1.7 ± 8.3	629	1.1 ± 5.2	1.1 ± 3.9
	^{155}Eu (0–2.0 cm) 1979					**^{155}Eu (0–4.0 cm) 1979**			
0–5.0	65	1.3 ± 1.1	448	0.56 ± 0.49	50	2.3 ± 2.0	374	0.84 ± 0.75	
5.0–10	9	7.7 ± 1.6	62	0.48 ± 0.10	8	6.4 ± 1.9	82	0.53 ± 0.15	
10–30	8	18.6 ± 6.9	79	1.47 ± 0.55	8	17.2 ± 5.0	92	1.58 ± .46	
30–40	2	33.9 ± 1.0	22	0.75 ± 0.02	2	33.4 ± 2.4	36	1.2 ± 0.1	
>40	3	43.2 ± 3.4	17.7	0.77 ± 0.06	5	74.1 ± 21.0	45	3.3 ± 1.0	
Sum				4.0 ± 0.7				7.5 ± 1.3	7.8 ± 1.0
Entire[a]	87	5.2 ± 13.0	629	3.2 ± 8.2	73	8.8 ± 20.6	629	5.6 ± 12.9	6.0 ± 7.6
	^{207}Bi (0–2.0 cm) 1979					**^{207}Bi (0–4.0 cm)1979**			
0–0.2	47	0.07 ± 0.06	350	0.03 ± 0.02	27	0.09 ± 0.08	211	0.02 ± 0.02	
0.2–0.5	23	0.31 ± 0.08	139	0.04 ± 0.01	14	0.37 ± 0.10	101	0.04 ± 0.01	
0.5–1.0	11	0.67 ± 0.11	90	0.06 ± 0.01	16	0.75 ± 0.12	154	0.12 ± 0.02	
1.0–3.0	4	1.2 ± 0.3	35	0.04 ± 0.01	14	1.5 ± 0.4	126	0.18 ± 0.05	
>3.0	2	7.2 ± 6.2	15	0.11 ± 0.09	2	5.2 ± 2.3	37	0.19 ± 0.09	
Sum				0.28 ± 0.10				0.55 ± 0.10	0.56 ± 0.11
Entire[a]	87	0.4 ± 1.0	629	0.2 ± 0.6	73	0.8 ± 2.0	629	0.5 ± 1.2	0.5 ± 0.9

[a] Inventory computed using all values from lagoon.
[b] 0–4 cm value averaged with 2 times the 0–2 cm value.

Distribution with Depth in the Sediment Column

The inventories for the major gamma-emitting radionuclides in the 1972 core samples to the maximum depth sampled are determined from data in Appendix D and information in Noshkin et al. (1997b). The surface layer to about 9–cm appears well mixed and the inventory increases approximately linearly with depth. Below about 10 cm, the total inventory changes only slowly. The inventory of all radionuclides in the 0–2 cm (0–4 cm) layer compared to the total inventory (to depths of 10–35 cm) in the core is about 13 ± 5% (26 ± 0%). If these percentages apply to the entire lagoon, then the inventory of any radionuclide shown in Table 3 in the surface 4–cm layer is only 26% of the total sediment inventory to depths of 16 cm. This percentage should be viewed as a lower limit since radionuclides are evident to greater depths in some cores from Enewetak (Noshkin, 1980; McMurtry et al., 1985). This may be the case at Bikini as well.

1972 Sediment Inventories Compared with 1979 Inventories

Considerably fewer sediment samples were collected during 1972. However, using the surface 2.5 cm data in Appendices B and C, core data from Appendix D, and previously published sediment results by Schell et al. (1978), mean surface values are estimated for the radionuclides from 24 lagoon stations. Isoconcentration lines are also constructed to distinguish areas of the surface sediment having comparable concentrations. The areas between the lines are determined along with the lognormal mean inventory in the respective regions. Multiplying the area by the mean inventory provides an estimate of the total amount of radionuclides associated with the sediments within a region. Summing these quantities produces an estimate of the total amounts associated with the surface 2.5–cm layer of sediment. Table 4 shows the kBq m^{-2} of the radionuclides to a depth of 2.5 cm estimated from the isoconcentration diagrams. The estimated values to 2.5 cm are multiplied by 1.6 to provide an inventory to 4–cm depth. This extrapolation is justified since it has been shown that the sediments are well mixed to a depth below 4 cm. Because of the limited sampling in 1972, these inventory values should only be considered rough estimates. They are, however, useful in two comparisons. First, a comparison is made with the estimated inventories of the four radionuclides measured in Enewetak (the other U.S. test site in the Marshall Islands) sediments during 1972. Inventories for ^{137}Cs, ^{60}Co, ^{155}Eu, and ^{207}Bi in the lagoon sediment at Enewetak are shown in the last column of Table 4. These values are corrected to the appropriate units and a mean depth of 4 cm from data in Nelson and Noshkin (1973). Table 4 shows that the total amount of ^{60}Co and ^{137}Cs in the surface 0–4 cm of sediment at Bikini and Enewetak Atolls was very similar in 1972. The inventory of ^{155}Eu at Bikini exceeded that at Enewetak while there is approximately 10 times more ^{207}Bi associated with the surface sediments at Enewetak Atoll.

A comparison between the 1972 and 1979 inventories for the four radionuclides is shown in Table 5. The total amount of each radionuclide decreased during the intervening 6.58 y as a result of radioactive decay and loss by processes acting on the sediments to return the radionuclides to the water column. Assuming a condition of steady state was established, it is possible to generate an effective decay constant (and half time) from the differences in inventory estimated for the respective sampling periods. Values for the effective decay constant and half-life are given in Table 5 with comparable values of the effective half-life (only for ^{60}Co, ^{137}Cs, and ^{207}Bi) derived from an analysis of concentration differences observed in fillets of reef fish from Bikini between 1964 and 1995 (Noshkin et al., 1997c). Considering the error terms, it cannot be determined with any degree of certainty that the values assessed from the sediment and fish data are different. It would appear that most of the ^{60}Co and ^{155}Eu are reduced in the marine environment through radioactivity decay. Little amounts are mobilized to the water column. The results also suggest that decay and, to a larger extent, natural processes of mobilization act to reduce the amount of ^{137}Cs and probably ^{207}Bi in the sedimentary reservoir. Desorption of the radionuclides, and especially ^{137}Cs, is known to occur as determined from analysis of filtered lagoon water samples (Noshkin et al., 1974; Nelson and Noshkin, 1973; Noshkin and Robison, 1997).

Conclusions

The long-lived gamma-emitting radionuclides most frequently detected in sediments collected from Bikini Atoll in the 1970s include only ^{241}Am, ^{137}Cs, ^{60}Co, ^{155}Eu, and ^{207}Bi. In a few samples near testing sites, other man-made radionuclides such as $^{152,154}Eu$, ^{125}Sb, and $^{101,102m}Rh$, were occasionally

Table 4. Total inventories (TBq) of radionuclides within surface sediments of Bikini lagoon during 1972 and at Enewetak Atoll.

kBq m^{-2} region	No. of data points in region	Lnnormal mean inventory	Area of interval (km^2)	Total TBq in interval to depth of 2.5 cm	Total TBq to depth of 4 cm[a]	Total TBq estimated in sediments to 4 cm at Enewetak Atoll during 12/72[b]
		^{60}Co				
0–0.5	4	0.3 ± 0.2	76	0.02 ± 0.02		
0.5–1.0	6	0.8 ± 0.1	174	0.13 ± 0.02		
1.0–2.0	3	1.5 ± 0.5	155	0.23 ± 0.08		
2.0–4.0	6	3.4 ± 1.6	112	0.39 ± 0.18		
>4.0	5	10.3 ± 4.8	112	1.2 ± 0.5		
Sum				1.9 ± 0.6	3.1 ± 0.9	3.1
		^{137}Cs				
0–0.1	5	0.08 ± 0.03	130	0.010 ± 0.004		
0.1–0.2	4	0.15 ± 0.03	176	0.03 ± 0.01		
0.2–0.4	3	0.26 ± 0.05	67	0.017 ± 0.003		
0.4–1.0	2	0.5 ± 0.1	73	0.04 ± 0.01		
1.0–5.0	5	2.4 ± 1.5	96	0.23 ± 0.14		
>5.0	5	11.4 ± 7.9	87	1.0 ± 0.7		
Sum				1.3 ± 0.7	2.1 ± 1.1	3.4
		^{155}Eu				
0–5.0	11	3.0 ± 2.9	324	1.0 ± 0.9		
5.0–10	2	6.9 ± 1.3	56	0.39 ± 0.07		
10–30						
10–40	5	27.6 ± 5.4	139	3.8 ± 0.8		
30–40						
>40	6	75.9 ± 13.6	111	8.4 ± 1.5		
Sum				13.6 ± 1.9	21.8 ± 3.1	15.9
		^{207}Bi				
0–0.2	9	0.12 ± 0.02	192	0.023 ± .004		
0.2–0.5	7	0.3 ± 0.1	222	0.07 ± 0.02		
0.5–1.0	3	0.8 ± 0.1	99	0.08 ± 0.01		
1.0–3.0	5	2.4 ± 1.6	115	0.28 ± 0.18		
>3.0						
Sum				0.5 ± 0.2	0.7 ± 0.3	7.0

[a] Inventory to 2.5 cm multiplied by 1.6 to provide estimate to 4–cm depth.
[b] Estimated surface inventories from Nelson and Noshkin (1973).

Table 5. Effective decay constant and half-life based on change in sediment inventory between 1972 and 1979.

Radionuclide	12/1972 inventory TBq to 4 cm	6/1979 inventory TBq to 4 cm	Inventory ratio 1972/1979	Radiological half-life (y)	Computed effective decay constant (y^{-1})[a]	Computed effective half-life (y)[a]	Computed effective half-life from fish studies[b]
^{60}Co	3.1 ± 0.9	0.7 ± 0.1	0.24 ± 0.08	5.26	0.22 ± 0.07	3.2 ± 1.0	5.3 ± 0.5
^{137}Cs	2.1 ± 1.1	1.7 ± 0.6	0.81 ± 0.53	30	0.031 ± 0.020	22 ± 14	8.8 ± 1.7
^{155}Eu	21.8 ± 3.1	7.8 ± 1.0	0.36 ± 0.07	4.96	0.16 ± 0.03	4.4 ± 0.8	
^{207}Bi	0.7 ± 0.3	0.6 ± 0.1	0.76 ± 0.33	32.2	0.042 ± 0.019	15 ± 7	30 ± 12

[a] Effective decay constant and half-life based on the change in inventory (0–4 cm) between 12/1972 and 6/1979.

[b] Based on data in Noshkin et al. (1997c). Effective decay constant and half-life were based on least square analysis of changes in concentrations in fish fillets caught at Bikini during different years between 1964 and 1995.

detected. In the 1990s, the only remaining radionucides of any significance in the surface sediments from the lagoon are ^{241}Am, ^{137}Cs, and ^{207}Bi. The others have been substantially reduced to near non-detectable amounts, principally by radioactive decay. Highest concentrations of the four major radionuclides (^{137}Cs, ^{60}Co, ^{155}Eu, and ^{207}Bi) discussed herein are associated with the fine (>0.5 mm) sedimentary material from the NW quadrant of the lagoon. Lowest concentrations and inventories are associated with sediment lagoonward of the eastern reef. It is estimated that the quantities in the 0–4 cm surface layer only represent about 35% of the total sediment inventory to depth in the sediment column. There was a reduction in the mean radionuclide inventories in surface sediments between 1972 and 1979. This reduction occurred as a result of radioactive decay and natural processes that act on the sedimentary reservoir to release a different amount of the associated radionuclides back to the water column. Effective half-times assessed from the sediment data for ^{137}Cs, ^{60}Co, and ^{207}Bi do not differ substantially from the values determined from an analysis of fish concentration data during the time period from 1964 to 1995.

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Appendix A

Station Coordinates, Volumes, and Sample Weights for 0–2.5 cm Sections of Surface Sediment Collected from Bikini Lagoon during October through November 1972

Appendix A. Station coordinates, volumes, and sample weights for 0–2.5 cm sections of surface sediment collected from Bikini lagoon during October through November 1972.

LogID	Minutes east of 165°E *X*-coordinate	Minutes north of 11°N *Y*-coordinate	Volume sampled cm^3 0–2.5 cm section	Dry wt (g) 0–2.5 cm fine and coarse fraction	Water depth (m)
B3F	13.28	37.22	91	102.4	28.3
C				39.8	
B19F	19.10	40.63	91	14.8	21.5
C				50.1	
B18F	23.22	40.52	91	37	29.0
C				62.3	
B21F	15.83	36.00	91	90.4	52.0
C				33.2	
B22F	19.63	36.52	91	10.8	56.7
C				40.5	
B24F	22.40	37.93	91	6	42.1
C				49.4	
C11F	22.15	29.93	91	52.6	25.2
C				54.4	
C8F	20.33	40.37	91	97.6	40.7
C				6.65	
B2F	15.70	39.50	91	98.9	52.0
C				8.3	
B4F	13.78	34.77	91	17.3	32.0
C				103.3	
B6F	15.83	33.00	91	90.3	31.1
C				44.7	
B7F	18.00	31.55	91	71.3	49.6
C				51.7	
B8F	21.16	31.63	91	73.5	43.7
C				62.3	
B10F	27.82	29.90	91	14.1	73.2
C				103.3	
B11F	27.65	30.73	91	58.1	30.8
C				65.5	
B16F	26.17	39.52	91	29.6	20.0
C				51.5	
B23F	18.82	33.66	91	68.3	48.6
C				58.2	
B25F	21.86	35.33	91	26.2	50.4
C				81.7	
B26F	26.58	36.20	91	2.75	44.8
C				40.6	
B15F	30.88	36.63	91	51.9	31.7
C				50.7	
C6F	20.30	40.37	91	91	38.2
C				19.6	

F = fine; C = coarse

Appendix B

Concentrations and Inventories of ^{207}Bi and ^{60}Co in Fine and Coarse Fractions, and Total Sample of Surface (0–2.5 cm) Sections of Sediment Samples Collected from Bikini Lagoon during October through November1972

Appendix B. Concentrations and inventories of ^{207}Bi and ^{60}Co in fine and coarse fractions, and total sample of surface (0–2.5 cm) sections of sediment samples collected from Bikini lagoon during October through November 1972.

LogID	^{207}Bi Bq kg^{-1} fine and coarse	^{207}Bi kBq m^{-2} fine and coarse	% error	^{207}Bi Bq kg^{-1} total sample	^{207}Bi kBq m^{-2} total sample	% error	^{60}Co Bq kg^{-1} fine and coarse	^{60}Co kBq m^{-2} fine and coarse	% error	^{60}Co Bq kg^{-1} total sample	^{60}Co kBq m^{-2} total sample	% error
B3F	37.8	1.06	9	36.5	1.43	8	136.3	3.83	3	129.9	5.07	3
C	33.3	0.36	15				113.3	1.24	5			
B19F	20.0	0.08	39	24.6	0.44	29	266.7	1.08	6	172.0	3.07	4
C	25.9	0.36	35				144.1	1.98	5			
B18F	31.5	0.32	56	31.7	0.87	34	375.9	3.82	4	282.3	7.70	3
C	31.9	0.55	42				226.7	3.88	4			
B21F	58.5	1.45	7	55.5	1.89	7	114.8	2.85	4	106.6	3.62	4
C	47.4	0.43	17				84.1	0.77	8			
B22F	187.4	0.56	14	109.6	1.55	8	525.9	1.56	4	234.7	3.31	3
C	88.9	0.99	9				157.0	1.75	5			
B24F	28.5	0.05	67	29.5	0.45	12	254.8	0.42	12	135.9	2.07	5
C	29.6	0.40	11				121.5	1.65	5			
C11F	3.7	0.05	100	7.5	0.22	40	305.9	4.42	3	244.5	7.19	2
C	11.1	0.17	42				185.2	2.77	3			
C8F	3.7	0.10	64	3.6	0.10	62	100.7	2.70	5	100.6	2.88	5
C	1.9	0.00	100				97.8	0.18	20			
B2F	191.1	5.19	4	185.1	5.45	4	281.9	7.66	3	276.0	8.13	3
C	113.3	0.26	17				206.7	0.47	11			
B4F	4.4	0.02	100	6.7	0.22	43	61.1	0.29	9	27.8	0.92	9
C	7.0	0.20	46				22.2	0.63	12			
B6F	2.6	0.06	100	3.0	0.11	72	20.0	0.50	9	19.8	0.73	8
C	3.7	0.05	100				19.3	0.24	18			
B7F	3.7	0.07	100	3.5	0.12	70	43.0	0.84	7	34.7	1.17	6
C	3.3	0.05	89				23.3	0.33	14			
B8F	1.9	0.04	100	3.0	0.11	75	13.7	0.28	14	12.5	0.47	14
C	4.4	0.08	100				11.1	0.19	28			
B10F	1.9	0.01	100	3.5	0.11	94	6.3	0.02	71	3.4	0.11	41
C	3.7	0.11	100				3.0	0.09	48			
B11F	1.5	0.02	100	2.9	0.10	39	9.3	0.15	6	8.3	0.28	11
C	4.1	0.07	40				7.4	0.13	23			
B16F	3.7	0.03	100	4.6	0.10	67	27.0	0.22	17	30.6	0.68	11
C	5.2	0.07	85				32.6	0.46	14			
B23F	6.3	0.12	35	4.6	0.16	37	27.4	0.51	10	23.7	0.82	9
C	2.6	0.04	100				19.3	0.31	17			
B25F	16.7	0.12	32	12.7	0.38	27	100.0	0.72	7	55.7	1.65	6
C	11.5	0.26	37				41.5	0.93	10			
B26F	7.4	0.01	100	28.6	0.34	15	459.3	0.35	12	81.5	0.97	7
C	30.0	0.33	15				55.9	0.62	8			
B15F	5.9	0.08	32	4.8	0.14	43	11.5	0.16	17	9.1	0.26	16
C	3.7	0.05	100				6.7	0.09	33			
C6F	2.2	0.01	100	2.2	0.07	84	44.1	0.24	3	83.4	2.53	5
C	2.2	0.06	100				91.9	2.30	5			

Appendix C

Concentrations and Inventories of ^{137}Cs and ^{155}Eu in Fine and Coarse Fractions, and Total Sample of Surface (0–2.5 cm) Sections of Sediment Samples Collected from Bikini Lagoon during October through November 1972

Appendix C. Concentrations and inventories of ^{137}Cs and ^{155}Eu in fine and coarse fractions, and total sample of surface (0–2.5 cm) sections of sediment samples collected from Bikini lagoon during October through November 1972.

LogID	^{137}Cs Bq kg^{-1} fine and coarse	^{137}Cs kBq m^{-2} fine and coarse	% error	^{137}Cs Bq kg^{-1} total sample	^{137}Cs kBq m^{-2} total sample	% error	^{155}Eu Bq kg^{-1} fine and coarse	^{155}Eu kBq m^{-2} fine and coarse	% error	^{155}Eu Bq kg^{-1} total sample	^{155}Eu kBq m^{-2} total sample	% error
B3F	39	1.10	5	34	1.32	5	589	16.57	1	507	19.79	1
C	19	0.21	14				295	3.23	1			
B19F	570	2.32	2	184	3.27	2	5463	22.21	1	2558	45.61	1
C	69	0.95	5				1700	23.40	1			
B18F	165	1.68	4	102	2.78	3	5130	52.14	1	3410	93.03	1
C	64	1.10	6				2389	40.89	1			
B21F	66	1.63	4	54	1.83	4	881	21.89	1	739	25.11	1
C	22	0.20	15				353	3.22	2			
B22F	480	1.43	3	131	1.84	3	5296	15.71	1	1966	27.71	1
C	37	0.42	10				1078	11.99	1			
B24F	115	0.19	14	26	0.40	11	2230	3.68	1	1143	17.40	1
C	15	0.21	16				1011	13.72	1			
C11F	237	3.43	3	169	4.97	2	881	12.74	1	735	21.59	1
C	103	1.54	4				593	8.86	1			
C8F	194	5.20	2	184	5.27	2	1911	51.24	1	1857	53.20	1
C	37	0.07	32				1070	1.96	2			
B2F	349	9.49	2	338	9.95	2	2148	58.37	10	2078	61.21	10
C	201	0.46	8				1248	2.85	2			
B4F	11	0.05	24	2	0.08	15	117	0.56	3	86	2.86	2
C	1	0.03					81	2.30	3			
B6F	4	0.09	25	4	0.16	20	61	1.51	2	58	2.17	2
C	6	0.07	34				54	0.66	5			
B7F	9	0.17	16	6	0.22	16	89	1.75	2	85	2.86	2
C	4	0.05	46				79	1.12	3			
B8F	20	0.40	8	18	0.68	11	50	1.02	3	47	1.75	3
C	17	0.29	25				43	0.73	6			
B10F	3	0.01	88	2	0.06	47	17	0.07	18	10	0.33	10
C	2	0.05	55				9	0.26	12			
B11F	2	0.03	45	1	0.04	31	33	0.53	3	27	0.92	3
C	1	0.01					21	0.39	6			
B16F	11	0.09	28	6	0.13	36	87	0.71	4	79	1.76	3
C	3	0.04	97				74	1.05	4			
B23F	6	0.12	19	4	0.13	17	99	1.85	2	98	3.41	2
C	1	0.01					97	1.56	3			
B25F	47	0.34	8	22	0.66	9	467	3.36	1	257	7.63	1
C	14	0.32	17				190	4.27	2			
B26F	49	0.04	54	7	0.09	34	630	0.48	4	299	3.56	1
C	4	0.05	44				276	3.08	1			
B15F	5	0.07	23	6	0.17	16	49	0.70	3	50	1.40	3
C	7	0.09	22				50	0.70	4			
C6F	89	0.48	6	271	8.22	1	626	3.37	1	1318	40.04	1
C	310	7.74	1				1467	36.67	1			

Appendix D

Concentration of ^{137}Cs, ^{207}Bi, ^{60}Co, and ^{155}Eu in Fractions of Sediment Core Sections Collected from Bikini Lagoon during October through November 1972

Appendix D. Concentration of ^{137}Cs, ^{207}Bi, ^{60}Co, and ^{155}Eu in fractions of sediment core sections collected from Bikini lagoon during October through November 1972.

LogID	Depth increment (cm)	Fines (fraction of total wt)	^{137}Cs dry Bq kg^{-1}	% error	^{207}Bi dry Bq kg^{-1}	% error	^{60}Co dry Bq kg^{-1}	% error	^{155}Eu dry Bq kg^{-1}	% error
B-3	0–5f	0.46	42	5	51	8	187	2	496	1
11/8/72	0–5c		27	8	43	10	129	4	341	2
	5–10f	0.30	39	7	86	6	253	3	548	2
	5–10c		10	19	98	6	149	4	253	2
	10–15f	0.31	72	5	438	2	276	3	830	1
	10–15c		14	14	136	4	144	6	260	1
	15–20f	0.33	59	7	460	3	177	5	641	2
	15–20c		4	31	103	4	63	6	99	4
	20–25f	0.33	28	9	135	5	74	6	323	2
	20–25c		2	43	36	5	25	9	44	4
	25–30f	0.31	8	17	42	8	32	9	77	4
	25–30c		0	100	14	16	11	18	6	24
	30–35f	0.28	7	17	25	10	22	12	70	4
	30–35c		0	100	14	16	7	25	5	30
B-4	0–3		5	24	4	100	31	9	110	2
11/8/72	3–6		6	22	7	40	31	8	113	2
	6–7		6	40	9	35	31	13	100	3
B-16	0–3		6	21	4	28	27	9	79	3
11/4/72	3–6		8	14	1	100	26	7	88	3
	6–9		6	19	7	100	38	6	92	3
	9–12		5	25	30	40	37	6	85	3
	12–15		6	23	1	100	37	7	83	3
B-18	0–3		107	3	21	30	289	3	4185	1
11/4/72	3–6		126	3	28	25	356	3	4704	1
	6–9		145	3	53	20	478	2	5963	1
	9–10.5		153	3	67	10	537	2	6593	1
B-20	0–5f	0.94	904	1	20	15	506	2	1989	2
11/8/72	0–5c		101	8	11	100	152	10	793	3
	5–10f	0.95	922	1	4	100	641	2	1470	1
	5–10c		87	8	11	100	134	10	184	5
	10–15f	0.58	194	2	4	100	104	3	232	3
	10–15c		19	15	11	100	33	8	31	5
B-25	0–3		13	4	98	4	108	4	347	1
11/5/72	3–6		89	4	140	8	314	3	1189	1
	6–9		90	4	95	7	322	3	996	1
	9–12		17	11	23	15	94	5	174	2
	12–15		9	13	13	11	61	5	101	3
	15–18		2	57	4	37	35	7	21	7

Appendix D. (Continued.)

LogID	Depth increment (cm)	Fines (fraction of total wt)	^{137}Cs dry Bq kg^{-1}	% error	^{207}Bi dry Bq kg^{-1}	% error	^{60}Co dry Bq kg^{-1}	% error	^{155}Eu dry Bq kg^{-1}	% error
C-2	0–6		272	2	2330	1	1085	1	1619	1
11/13/72	6–12		313	2	2896	1	1126	1	1833	1
Bravo	12–18		335	2	7481	1	5330	1	1885	1
Crater	18–24		361	2	8556	1	6589	1	1911	1
	24–30		336	2	8074	1	6163	1	1793	1
	30–36		357	2	8185	1	6285	1	1830	1
	36–42		374	2	8370	1	6481	1	1870	1
	42–48		378	2	8556	1	6578	1	1900	1
	48–54		415	2	9296	1	7137	1	2022	1
	54–60		374	2	7519	1	5859	1	1637	1
	60–66		400	2	8111	1	6311	1	1781	1
	66–72		404	2	8704	1	6774	1	1952	1
	72–78		393	2	8148	1	6404	1	1844	1
	78–84		426	2	8889	1	6937	1	1967	1
	84–90		437	2	9296	1	7163	1	1996	1
	90–96		374	2	8370	1	6441	1	1859	1
	96–102		400	2	8556	1	6593	1	1874	1
	102–108		437	2	8889	1	6856	1	1930	1
	108–114		396	2	8333	1	6448	1	2070	1
	114–120		400	2	7926	1	6337	1	1837	1
C-3	0–6		345	1	4515	1	2156	1	1559	1
11/13/72	6–12		248	1	4559	1	3470	1	1174	1
Bravo	12–18		227	1	933	1	1319	1	489	1
Crater	18–24		228	1	689	1	1144	1	430	1
	24–30		223	1	581	1	1059	1	404	1
	30–36		237	1	563	1	1185	1	430	1
	36–42		232	1	489	1	1126	1	448	1
	42–48		259	1	767	1	1330	1	644	1
C1	0–6		217	1	896	1	389	1	1015	1
11/13/72	6–12		229	1	1052	1	452	1	1115	1
Bravo	12–18		248	1	1615	1	611	1	1330	1
Crater	18–24		262	1	2774	1	1281	1	1311	1
	24–30		222	1	3363	1	1819	1	989	1
	30–36		160	1	3033	1	1426	1	915	1
	36–41		84	1	489	1	644	1	519	1
C-11	0–6		277	1	89	10	1130	1	1778	1
11/14/72	6–12		151	3	52	14	652	1	841	1
Zuni	12–18		164	3	49	8	804	1	937	1
Crater	18–24		160	3	39	8	378	1	485	1
	24–31		251	2	58	8	700	1	781	1
C-8	0–6		165	3	2	>100	112	5	1833	1
11/14/72	6–12		170	3	8	50	123	5	1837	1
Tewa	12–17.5		184	3	3	70	127	5	2100	1
Crater										

Appendix D. (Continued.)

LogID	Depth increment (cm)	Fines (fraction of total wt)	^{137}Cs dry Bq kg^{-1}	% error	^{207}Bi dry Bq kg^{-1}	% error	^{60}Co dry Bq kg^{-1}	% error	^{155}Eu dry Bq kg^{-1}	% error
B-15	0–2.5f	0.53							60	4
10/31/72	0–2.5c								49	4
	2.5–5.0f	0.55							49	3
	2.5–5.0c								40	4
	5.0–7.5f	0.39							50	4
	5.0–7.5c								40	3
	7.5–10.0f	0.41								
	7.5–10.0c								34	4

All cores: diameter 6.8 cm; area 36.32 cm^2
f = fine; c = coarse fractions

Appendix E

Station Coordinates, Volumes, and Sample Weights for 0–2 cm and 0–4 cm Sections of Surface Sediment Collected from Bikini Lagoon during April through June 1979

Appendix E. Station coordinates, volumes and sample weights for 0–2 cm and 0–4 cm sections of surface sediment collected from Bikini lagoon during April through June 1979.

LogID	Minutes east of 165°E *x*-coordinate	Minutes north of 11°N *y*-coordinate	Volume sampled cm^3 0–2 cm section	Dry wt (0–2 cm) fine and coarse fraction (g)	Volume sampled cm^3 0–4 cm section	Dry wt (0–4 cm) fine and coarse fraction (g)
4-22-79-1F	33.5	31	117.9	110.37	no sample	
C			117.9	36.71	no sample	
2F	32.5	30	117.9	25.93	no sample	
C			117.9	121.3	no sample	
3F	32.5	31.5	117.9	63.21	102.07	60.12
C			117.9	71.52	102.07	51.72
4F	32.5	33	117.9	65.81	102.07	57.88
C			117.9	90.14	102.07	78.87
5F	32.5	34.5	117.9	33.47	102.07	34.27
C			117.9	77.68	102.07	58.27
6F	32.5	36	117.9	144.06	no sample	
C			117.9	17.28	no sample	
7F	31	37.5	117.9	14.02	no sample	
C			117.9	58.84	no sample	
9F	28	37.5	78.6	33.37	no sample	
C			78.6	63.59	no sample	
10F	26.5	37.5	117.9	20.27	102.07	21.48
C			117.9	98.87	102.07	83.09
11F	26.5	36	117.9	3.77	102.07	3.27
C			117.9	54.36	102.07	48.81
12F	28	36	117.9	4.58	102.07	5.03
C			117.9	56	102.07	55.43
13F	29.5	36	117.9	7.94	102.07	2.88
C			117.9	70.23	102.07	46.14
14F	31	36	117.9	93.35	no sample	
C			117.9	64.45	no sample	
4-23-79-1F	29.5	34.5	117.9	57.86	102.07	57.46
C			117.9	94	102.07	88.22
2F	29.5	33	117.9	23.17	102.07	28.14
C			117.9	77.03	102.07	68.72
3F	29.5	31.5	117.9	70.72	102.07	71.69
C			117.9	102.15	102.07	77.09
4-24-79-1F	26.5	31.5	117.9	66.47	102.07	69.28
C			117.9	92.22	102.07	67.4
2Fa	26.5	33	117.9	10.6	102.07	40.54
C			117.9	73.9	102.07	63.2
2Fb			117.9	26.9	102.07	11.78
C			117.9	73.8	102.07	57.09
3Fa	26.5	34.5	117.9	3.7	102.07	5.41
C			117.9	55.6	102.07	48.9
3Fb			117.9	2.1	102.07	1.45
C			117.9	56	102.07	48.21
4F	25	34.5	117.9	26.1	102.07	32.42
C			117.9	94.7	102.07	81.07

Appendix E. (Continued.)

LogID	Minutes east of 165°E *x*-coordinate	Minutes north of 11°N *y*-coordinate	Volume sampled cm^3 0–2 cm section	Dry wt (0–2 cm) fine and coarse fraction (g)	Volume sampled cm^3 0–4 cm section	Dry wt (0–4 cm) fine and coarse fraction (g)
5F	23.5	34.5	117.9	1.9	102.07	2.56
C			117.9	61.1	102.07	52.15
6F	22	34.5	117.9	8.2	102.07	10.33
C			117.9	55.8	102.07	52.13
7F	20.5	34.5	117.9	7.2	102.07	4.35
C			117.9	59.6	102.07	50.62
8F	19	34.5	117.9	82.2	102.07	81.69
C			117.9	81.3	102.07	67.16
9Fa	17.5	34.5	117.9	66.7	no sample	
C			117.9	47.2	no sample	
9Fb			117.9	102.2	no sample	
C			117.9	57.9	no sample	
10F	16	34.5	117.9	145	102.07	110.32
C			117.9	44.4	102.07	35.09
11F	14.5	34.5	117.9	113.3	102.07	115.04
C			117.9	61.5	102.07	60.83
12F	14.5	36	117.9	125.5	102.07	100.82
C			117.9	43	102.07	31.77
13F	16	36	117.9	26.7	102.07	17.63
C			117.9	85.2	102.07	101.75
14F	16	37.5	117.9	63.9	no sample	
C			117.9	81.3	no sample	
15F	17.5	39	117.9	116.4	102.07	107.11
C			117.9	32	102.07	28.92
15Fb					102.07	89.98
15Fb					102.07	50.69
17F	20.5	39	117.9	145.2	102.07	123.18
C			117.9	0.7	102.07	0.57
4-25-79-1F	19	40.5	117.9	56.5	102.07	47.6
C			117.9	52.7	102.07	69.26
2F	19	37.5	117.9	41.5	no sample	
C			117.9	72.3	no sample	
3F	19	36	117.9	14.3	102.07	14.3
C			117.9	99.9	102.07	89.27
4F	19	33	117.9	106.7	102.07	89.67
C			117.9	65.5	102.07	48.64
5F	19	31.5	117.9	113.9	102.07	93.62
C			117.9	66.2	102.07	61.93
6F	21.25	29.75	117.9	102.3	102.07	99.1
C			117.9	70.6	102.07	47.65
6-15-79-lF	33.3	30.9	78.6	102.5	102.07	108.46
C			78.6	4.5	102.07	3.03
2F	31	31.5	78.6	66.9	102.07	90.14
C			78.6	35.6	102.07	45.95

Appendix E. (Continued.)

LogID	Minutes east of 165°E x-coordinate	Minutes north of 11°N y-coordinate	Volume sampled cm^3 0–2 cm section	Dry wt (0–2 cm) fine and coarse fraction (g)	Volume sampled cm^3 0–4 cm section	Dry wt (0–4 cm) fine and coarse fraction (g)
3F	28	31.5	78.6	58.5	102.07	74.22
C			78.6	44.4	102.07	48.56
4F	25	31.5	78.6	44	102.07	31.16
C			78.6	61	102.07	81.23
5F	23.5	31.5	78.6	7.4	102.07	26.05
C			78.6	47.7	102.07	54.15
6F	22	31.5	78.6	76.5	102.07	92.25
C			78.6	82.5	102.07	50.13
7F	20.5	31.5	78.6	41	102.07	64.07
C			78.6	66.3	102.07	85.49
8F	17.5	31.5	78.6	73.7	102.07	104.65
C			78.6	36.7	102.07	64.1
9F	16	32.8	78.6	34.1	102.07	42.76
C			78.6	69.4	102.07	85.37
10F	17.5	32.8	78.6	67.3	102.07	72.1
C			78.6	47.5	102.07	46.65
11F	20.5	32.8	78.6	63.8	102.07	89.65
C			78.6	35.5	102.07	49.82
12F	22	32.8	117.9	58.2	102.07	56.66
C			117.9	70.1	102.07	59.12
13F	23.5	32.8	78.6	70.2	102.07	95.57
C			78.6	36.6	102.07	26.83
14F	25	32.8	78.6	17.2	102.07	21.47
C			78.6	53.2	102.07	55.69
15F	28	32.8	78.6	55.7	102.07	50.58
C			78.6	44.3	102.07	53.77
16F	28	34.3	78.6	7.5	102.07	24.9
C			78.6	52.9	102.07	52.95
17F	31	32.8	78.6	3.4	102.07	3.55
C			78.6	38.2	102.07	46.91
18F	31	34.3	78.6	2.9	102.07	19.55
C			78.6	41.8	102.07	46.78
6-16-79-1F	26.5	39	78.6	26.5	no sample	
C			78.6	41.9	no sample	
2F	25	39	78.6	89.7	no sample	
C			78.6	9.5	no sample	
3F	25	40.5	78.6	57.3	no sample	
C			78.6	23.5	no sample	
4F	23.5	40.5	78.6	45	no sample	
C			78.6	44.6	no sample	
5F	22	40.2	78.6	29.8	no sample	
C			78.6	33.8	no sample	
6F	20.5	40.2	78.6	83.8	no sample	
C			78.6	14.2	no sample	
7F	17.5	40.2	78.6	37.5	102.07	41.9

Appendix E. (Continued.)

LogID	Minutes east of 165°E *x*-coordinate	Minutes north of 11°N *y*-coordinate	Volume sampled cm^3 0–2 cm section	Dry wt (0–2 cm) fine and coarse fraction (g)	Volume sampled cm^3 0–4 cm section	Dry wt (0–4 cm) fine and coarse fraction (g)
C			78.6	47.3	102.07	54.35
8F	16	40.2	78.6	96.7	no sample	
C			78.6	0.3	no sample	
9F	16	39	78.6	91.9	102.07	93.55
C			78.6	1.7	102.07	3.07
10F	14.5	39	78.6	88.5	102.07	102.68
C			78.6	5.1	102.07	3.92
11F	14.5	37.8	78.6	41	102.07	50.93
C			78.6	51	102.07	48.37
12F	17.5	37.7	78.6	15.1	102.07	28.35
C			78.6	53.2	102.07	65.26
13F	17.5	36	117.9	32.4	102.07	20.06
C			117.9	67.9	102.07	59.29
14F	20.5	36	117.9	5.7	102.07	15.07
C			117.9	68.1	102.07	37.08
15F	22	36	117.9	3.1	102.07	2.23
C			117.9	51.1	102.07	44.81
16F	23.5	36	117.9	5.5	102.07	6.21
C			117.9	61.6	102.07	41.52
17F	25	36	117.9	9.2	102.07	4.6
C			117.9	59	102.07	40.37
18F	25	37.7	117.9	5.4	102.07	2.97
C			117.9	51	102.07	47
19F	23.5	37.7	117.9	35	102.07	43.66
C			117.9	57.8	102.07	41.69
20F	22	37.7	117.9	5.4	102.07	5.06
C			117.9	56	102.07	40.25
21F	20.5	37.7	117.9	11	102.07	5.72
C			117.9	71.6	102.07	45.24
22F	22	39	117.9	60.5	102.07	71.74
C			117.9	65.1	102.07	46.93
23F	23.5	39	117.9	86.6	102.07	73.94
C			117.9	74.4	102.07	33.57
6-17-79-1F	31	30.1	117.9	25.4	no sample	
C			117.9	132.3	no sample	
2F	29.5	30.1	117.9	53.8	102.07	54.26
C			117.9	117.6	102.07	75.45
3F	28	30.1	117.9	24.3	102.07	11.96
C			117.9	146.5	102.07	99.35
4F	26.6	30.3	117.9	29.7	102.07	29.06
C			117.9	129.2	102.07	84.55
5F	25.2	30.3	117.9	76.8	102.07	76.76
C			117.9	90.5	102.07	69.54

Appendix E. (Continued.)

LogID	Minutes east of 165°E x-coordinate	Minutes north of 11°N y-coordinate	Volume sampled cm^3 0–2 cm section	Dry wt (0–2 cm) fine and coarse fraction (g)	Volume sampled cm^3 0–4 cm section	Dry wt (0–4 cm) fine and coarse fraction (g)
6F	23.5	30.5	117.9	128.2	102.07	95.84
C			117.9	41.4	102.07	38.42
7F	22	30.1	117.9	114.5	102.07	26.6
C			117.9	56.6	102.07	34.61
8F	20.5	30.4	117.9	128.6	102.07	18.09
C			117.9	70.5	102.07	31.79

F = fine; C = coarse fraction

Appendix F

Concentrations and Inventories of ^{207}Bi and ^{60}Co in Fine and Coarse Fractions, and Total Sample of Surface (0–2 cm) Sections of Sediment Samples Collected from Bikini Lagoon during April through June 1979

Appendix F. Concentrations and inventories of ^{207}Bi and ^{60}Co in fine and coarse fractions, and total sample of surface (0–2 cm) sections of sediment samples collected from Bikini lagoon during April through June 1979.

LogID	^{207}Bi $Bq\,kg^{-1}$ fine and coarse	^{207}Bi $kBq\,m^{-2}$ fine and coarse	% error	^{207}Bi $Bq\,kg^{-1}$ total sample	^{207}Bi $kBq\,m^{-2}$ total sample	% error	^{60}Co $Bq\,kg^{-1}$ fine and coarse	^{60}Co $kBq\,m^{-2}$ fine and coarse	% error	^{60}Co $Bq\,kg^{-1}$ total sample	^{60}Co $kBq\,m^{-2}$ total sample	% error
4-22-79-1F	1.1	0.02	100	1.0	0.02	85	0.4	0.01	100	0.6	0.01	71
C	0.7	0.00	100				1.1	0.01	100			
2F	2.6	0.01	100	1.5	0.04	33	4.4	0.02	100	1.8	0.04	49
C	1.3	0.03	21				1.2	0.02	36			
3F	2.7	0.03	13	2.3	0.05	10	4.6	0.05	11	4.0	0.09	11
C	2.0	0.02	15				3.4	0.04	20			
4F	0.4	0.00	100	0.5	0.01	35	4.0	0.04	18	2.9	0.08	16
C	0.6	0.01	20				2.1	0.03	29			
5F	1.4	0.01	100	2.6	0.05	17	9.7	0.06	19	6.9	0.13	9
C	3.2	0.04	7				5.7	0.08	7			
6F	0.6	0.01	100	0.5	0.01	92	3.0	0.07	22	3.0	0.08	20
C	0.4	0.00	100				3.3	0.01	16			
7F	4.6	0.01	100	8.5	0.11	11	31.6	0.08	20	12.7	0.16	11
C	9.4	0.09	5				8.3	0.08	12			
9F	6.1	0.05	27	6.4	0.16	10	12.0	0.10	37	9.2	0.23	17
C	6.6	0.11	7				7.7	0.13	8			
10F	3.7	0.01	100	3.0	0.06	23	29.6	0.10	22	9.4	0.19	13
C	2.8	0.05	12				5.3	0.09	10			
11F	25.2	0.02	100	37.7	0.37	6	95.6	0.06	26	30.6	0.30	7
C	38.6	0.36	4				26.1	0.24	6			
12F	19.7	0.02	32	29.1	0.30	3	38.3	0.03	32	14.1	0.15	10
C	29.9	0.28	2				12.1	0.12	10			
13F	42.3	0.06	19	24.7	0.33	5	56.3	0.08	33	16.9	0.22	12
C	22.7	0.27	4				12.4	0.15	6			
14F	8.9	0.14	5	7.7	0.21	4	11.6	0.18	6	9.4	0.25	5
C	5.9	0.06	4				6.2	0.07	5			
4-23-79-1F	1.5	0.01	100	3.1	0.08	19	9.9	0.10	21	6.8	0.18	14
C	4.1	0.07	8				5.0	0.08	17			
2F	5.8	0.02	10	5.3	0.09	5	17.4	0.07	6	9.2	0.16	4
C	5.1	0.07	5				6.7	0.09	5			
3F	1.0	0.01	29	1.3	0.04	14	4.4	0.05	11	3.2	0.09	12
C	1.4	0.03	16				2.3	0.04	24			
4-24-79-1F	0.4	0.00	100	0.3	0.01	71	4.5	0.05	13	3.6	0.10	9
C	0.3	0.00	100				2.9	0.05	13			
2Fa	6.6	0.01	100	14.4	0.21	8	36.3	0.07	23	12.5	0.18	9
C	15.6	0.20	6				9.1	0.11	7			
2Fb	29.5	0.13	6	27.9	0.48	6	31.9	0.15	12	16.4	0.28	7
C	27.3	0.34	8				10.7	0.13	6			
3Fa	17.8	0.01	100	37.2	0.37	10	51.5	0.03	39	24.1	0.24	10
C	38.5	0.36	10				22.3	0.21	10			
3Fb	31.5	0.01	100	49.0	0.48	4	85.7	0.03	42	41.5	0.41	6
C	49.6	0.47	3				39.8	0.38	5			
4F	4.1	0.02	100	6.7	0.14	14	19.9	0.09	24	10.3	0.21	11
C	7.4	0.12	6				7.7	0.12	7			

Appendix F. (Continued.)

LogID	^{207}Bi Bq kg^{-1} fine and coarse	^{207}Bi kBq m^{-2} fine and coarse	% error	^{207}Bi Bq kg^{-1} total sample	^{207}Bi kBq m^{-2} total sample	% error	^{60}Co Bq kg^{-1} fine and coarse	^{60}Co kBq m^{-2} fine and coarse	% error	^{60}Co Bq kg^{-1} total sample	^{60}Co kBq m^{-2} total sample	% error
5F	22.2	0.01	100	45.9	0.49	2	44.4	0.01	100	22.6	0.24	7
C	46.7	0.48	2				22.0	0.23	4			
6F	45.2	0.06	16	55.2	0.60	5	88.9	0.12	14	32.2	0.35	6
C	56.7	0.54	5				23.9	0.23	5			
7F	62.8	0.08	11	72.1	0.82	3	73.0	0.09	18	24.7	0.28	7
C	73.2	0.74	3				18.8	0.19	6			
8F	7.9	0.11	6	7.6	0.21	4	15.1	0.21	7	12.8	0.36	6
C	7.4	0.10	6				10.6	0.15	10			
9Fa	43.8	0.50	2	43.0	0.83	1	40.0	0.45	3	31.3	0.60	3
C	42.0	0.34	2				18.9	0.15	5			
9Fb	21.3	0.37	3	18.4	0.50	2	35.4	0.61	3	28.8	0.78	3
C	13.2	0.13	4				17.2	0.17	6			
10F	4.4	0.11	8	4.0	0.13	7	17.7	0.44	4	16.3	0.52	4
C	2.7	0.02	16				11.8	0.09	9			
11F	9.7	0.19	5	9.0	0.27	4	28.9	0.56	4	24.8	0.74	3
C	7.8	0.08	7				17.4	0.18	5			
12F	52.8	1.12	3	64.2	1.84	2	41.7	0.89	5	39.7	1.14	4
C	97.5	0.71	2				33.9	0.25	4			
13F	21.1	0.10	11	13.7	0.26	5	72.8	0.33	8	31.0	0.59	5
C	11.4	0.16	4				17.9	0.26	4			
14F	4.1	0.04	5	3.6	0.09	6	30.0	0.33	5	21.7	0.53	3
C	3.2	0.04	12				15.1	0.21	4			
15F	45.6	0.90	3	38.9	0.98	3	181.6	3.59	2	153.4	3.86	2
C	14.4	0.08	5				50.8	0.28	5			
17F	15.4	0.38	5	15.5	0.38	5	102.4	2.52	2	102.7	2.54	2
C	36.6	0.00	27				177.2	0.02	9			
4-25-79-1F	36.7	0.35	5	34.3	0.64	4	120.2	1.15	3	90.1	1.67	3
C	31.7	0.28	5				57.8	0.52	5			
2F	39.8	0.28	5	40.7	0.78	2	68.2	0.48	5	39.8	0.77	3
C	41.1	0.50	2				23.5	0.29	4			
3F	27.2	0.07	20	19.6	0.38	4	68.0	0.17	14	25.4	0.49	5
C	18.5	0.31	3				19.3	0.33	3			
4F	2.9	0.05	11	3.0	0.09	7	14.0	0.25	5	12.2	0.36	4
C	3.2	0.04	8				9.2	0.10	7			
5F	1.0	0.02	24	1.0	0.03	17	9.5	0.18	10	8.4	0.26	7
C	1.0	0.01	22				6.6	0.07	6			
6F	5.4	0.09	25	4.0	0.12	21	13.0	0.22	4	10.5	0.31	3
C	1.9	0.02	33				7.0	0.08	6			
6-15-79-lF	0.7	0.02	100	0.7	0.02	92	0.5	0.01	100	0.6	0.02	88
C	1.3	0.00	100				1.8	0.00	100			
2F	0.8	0.01	23	0.8	0.02	35	4.3	0.07	8	4.2	0.11	8
C	0.7	0.01	100				4.0	0.04	18			
3F	1.0	0.01	100	0.9	0.02	72	4.3	0.06	24	3.9	0.10	16
C	0.9	0.01	100				3.4	0.04	12			
4F	1.1	0.01	100	1.9	0.05	26	6.6	0.07	30	5.0	0.13	17

Appendix F. (Continued.)

LogID	^{207}Bi Bq kg^{-1} fine and coarse	^{207}Bi kBq m^{-2} fine and coarse	% error	^{207}Bi Bq kg^{-1} total sample	^{207}Bi kBq m^{-2} total sample	% error	^{60}Co Bq kg^{-1} fine and coarse	^{60}Co kBq m^{-2} fine and coarse	% error	^{60}Co Bq kg^{-1} total sample	^{60}Co kBq m^{-2} total sample	% error
C	2.5	0.04	11				3.9	0.06	10			
5F	11.5	0.02	10	19.2	0.27	4	65.6	0.12	5	23.5	0.33	4
C	20.4	0.25	4				17.0	0.21	6			
6F	3.0	0.06	8	4.0	0.16	11	7.5	0.15	8	7.3	0.29	6
C	4.9	0.10	16				7.0	0.15	9			
7F	2.0	0.02	100	1.0	0.03	79	10.0	0.10	28	7.4	0.20	15
C	0.4	0.01	100				5.8	0.10	10			
8F	0.9	0.02	32	0.9	0.02	25	7.0	0.13	8	6.3	0.18	7
C	0.9	0.01	37				4.7	0.04	11			
9F	2.0	0.02	100	0.8	0.02	80	3.8	0.03	100	2.5	0.07	52
C	0.3	0.01	100				1.8	0.03	22			
10F	2.9	0.05	10	3.5	0.10	8	12.2	0.21	5	12.3	0.36	4
C	4.4	0.05	12				12.3	0.15	6			
11F	2.1	0.03	11	2.1	0.05	10	8.8	0.14	25	7.9	0.20	18
C	2.0	0.02	20				6.3	0.06	10			
12F	2.0	0.02	100	2.9	0.06	32	10.0	0.10	25	8.7	0.19	16
C	3.7	0.04	9				7.7	0.09	20			
13F	3.3	0.06	10	3.7	0.10	8	7.8	0.14	6	8.0	0.22	6
C	4.3	0.04	13				8.3	0.08	11			
14F	9.1	0.04	35	12.4	0.22	8	26.1	0.11	22	12.0	0.21	15
C	13.5	0.18	6				7.4	0.10	20			
15F	6.2	0.09	18	5.7	0.14	13	7.4	0.10	24	6.8	0.17	18
C	5.0	0.06	18				5.9	0.07	28			
16F	11.5	0.02	100	22.8	0.35	7	46.1	0.09	28	19.2	0.29	10
C	24.4	0.33	4				15.4	0.21	7			
17F	19.6	0.02	100	21.0	0.22	9	58.3	0.05	46	17.4	0.18	14
C	21.1	0.21	5				13.7	0.13	7			
18F	17.0	0.01	100	34.4	0.39	4	33.3	0.02	100	17.2	0.20	14
C	35.6	0.38	3				16.1	0.17	7			
6-16-79-1F	3.1	0.02	20	5.3	0.09	8	40.4	0.27	34	22.2	0.39	24
C	6.7	0.07	8				10.7	0.11	8			
2F	6.8	0.15	9	6.5	0.17	9	77.6	1.77	2	72.9	1.84	2
C	4.4	0.01	23				29.1	0.07	9			
3F	1.4	0.02	100	1.1	0.02	89	32.0	0.47	8	28.2	0.58	6
C	0.5	0.00	100				18.8	0.11	4			
4F	4.3	0.05	30	5.9	0.13	12	43.3	0.50	8	31.8	0.72	6
C	7.4	0.08	8				20.1	0.23	5			
5F	5.6	0.04	32	5.8	0.09	15	43.1	0.33	9	35.4	0.57	5
C	6.0	0.05	8				28.6	0.25	3			
6F	1.4	0.03	18	1.3	0.03	20	33.3	0.71	2	30.9	0.77	2
C	1.0	0.00	100				16.4	0.06	10			
7F	26.8	0.26	7	33.4	0.72	3	77.8	0.74	5	52.1	1.12	3
C	38.7	0.47	2				31.7	0.38	3			
8F	374.8	9.22	1	375.3	9.26	1	227.8	5.61	1	228.8	5.65	1
C	533.0	0.04	7				536.7	0.04	18			

Appendix F. (Continued.)

LogID	^{207}Bi Bq kg^{-1} fine and coarse	^{207}Bi kBq m^{-2} fine and coarse	% error	^{207}Bi Bq kg^{-1} total sample	^{207}Bi kBq m^{-2} total sample	% error	^{60}Co Bq kg^{-1} fine and coarse	^{60}Co kBq m^{-2} fine and coarse	% error	^{60}Co Bq kg^{-1} total sample	^{60}Co kBq m^{-2} total sample	% error
9F	42.0	0.98	2	41.7	0.99	2	84.3	1.97	1	85.6	2.04	1
C	25.2	0.01	13				159.2	0.07	4			
10F	140.0	3.15	2	136.6	3.25	2	68.9	1.55	3	67.7	1.61	3
C	78.5	0.10	5				45.9	0.06	9			
11F	54.7	0.57	4	41.9	0.98	3	71.7	0.75	6	47.6	1.12	4
C	31.6	0.41	6				28.3	0.37	4			
12F	45.9	0.18	8	31.2	0.54	5	109.0	0.42	8	44.2	0.77	5
C	27.0	0.37	7				25.8	0.35	6			
13F	29.6	0.16	7	45.2	0.77	2	55.7	0.31	7	45.1	0.77	3
C	52.7	0.61	2				40.0	0.46	2			
14F	22.4	0.02	32	1.7	0.02	32	69.3	0.07	19	5.3	0.07	19
C	0.0	0.00	100				0.0	0.00	100			
15F	40.6	0.02	22	60.7	0.56	3	73.9	0.04	22	22.7	0.21	14
C	62.0	0.54	3				19.6	0.17	16			
16F	27.7	0.03	20	23.3	0.27	7	97.0	0.09	11	26.6	0.30	4
C	22.9	0.24	7				20.3	0.21	4			
17F	27.6	0.04	26	31.8	0.37	5	78.4	0.12	11	27.6	0.32	6
C	32.5	0.33	5				19.7	0.20	7			
18F	34.3	0.03	22	29.2	0.28	8	166.8	0.15	9	58.9	0.56	3
C	28.7	0.25	9				47.5	0.41	3			
19F	25.6	0.15	9	17.6	0.28	6	88.2	0.52	6	45.9	0.72	5
C	12.7	0.12	7				20.3	0.20	8			
20F	40.7	0.04	30	56.5	0.59	3	177.6	0.16	13	64.0	0.67	4
C	58.0	0.55	2				53.1	0.50	3			
21F	35.3	0.07	10	25.1	0.35	3	92.4	0.17	10	29.5	0.41	5
C	23.6	0.29	3				19.9	0.24	4			
22F	24.5	0.25	3	25.0	0.53	5	82.7	0.85	2	55.3	1.18	2
C	25.4	0.28	9				29.9	0.33	3			
23F	15.7	0.23	7	14.9	0.41	4	62.5	0.92	2	43.1	1.18	2
C	13.9	0.18	3				20.5	0.26	2			
6-17-79-1F	2.5	0.01	100	1.2	0.03	36	4.4	0.02	100	1.0	0.03	76
C	1.0	0.02	23				0.4	0.01	100			
2F	1.6	0.01	100	0.6	0.02	80	2.9	0.03	100	1.6	0.05	58
C	0.2	0.00	100				1.0	0.02	25			
3F	2.8	0.01	100	1.9	0.05	22	4.5	0.02	100	1.3	0.04	53
C	1.7	0.04	9				0.7	0.02	33			
4F	1.8	0.01	100	1.0	0.03	36	3.1	0.02	100	1.3	0.04	46
C	0.8	0.02	20				0.9	0.02	24			
5F	0.6	0.01	23	0.5	0.01	45	2.7	0.04	9	1.6	0.05	24
C	0.4	0.01	100				0.7	0.01	100			
6F	0.6	0.01	35	0.7	0.02	23	3.2	0.07	10	3.6	0.10	8
C	1.1	0.01	17				4.7	0.03	10			
7F	0.8	0.02	100	3.4	0.10	17	3.3	0.06	35	9.0	0.26	10
C	8.6	0.08	9				20.5	0.20	6			
8F	0.9	0.02	100	1.0	0.03	59	5.0	0.11	24	5.1	0.17	16
C	1.1	0.01	20				5.3	0.06	16			

Appendix G

Concentrations and Inventories of ^{137}Cs and ^{155}Eu in Fine and Coarse Fractions and Total Sample of Surface (0–2 cm) Sections of Sediment Samples Collected from Bikini Lagoon during April through June 1979

Appendix G. Concentrations and inventories of ^{137}Cs and ^{155}Eu in fine and coarse fractions and total sample of surface (0–2 cm) sections of sediment samples collected from Bikini lagoon during April through June 1979.

LogID	^{137}Cs $Bq\,kg^{-1}$ fine and coarse	^{137}Cs $kBq\,m^{-2}$ fine and coarse	% error	^{137}Cs $Bq\,kg^{-1}$ total sample	^{137}Cs $kBq\,m^{-2}$ total sample	% error	^{155}Eu $Bq\,kg^{-1}$ fine and coarse	^{155}Eu $kBq\,m^{-2}$ fine and coarse	% error	^{155}Eu $Bq\,kg^{-1}$ total sample	^{155}Eu $kBq\,m^{-2}$ total sample	% error
4-22-79-1F	1.0	0.02	30	0.9	0.02	31	14	0.27	9	20	0.51	6
C	0.7	0.00	100				38	0.24	6			
2F	3.0	0.01	100	1.7	0.04	35	24	0.11	33	19	0.46	9
C	1.4	0.03	21				17	0.36	5			
3F	2.1	0.02	22	1.6	0.04	18	22	0.23	5	26	0.60	3
C	1.1	0.01	31				31	0.37	4			
4F	1.0	0.01	41	1.3	0.03	17	13	0.15	8	14	0.36	5
C	1.4	0.02	14				14	0.21	6			
5F	4.0	0.02	37	2.0	0.04	24	33	0.19	14	32	0.60	5
C	1.1	0.02	25				31	0.41	4			
6F	1.8	0.04	32	2.2	0.06	24	13	0.31	12	16	0.43	9
C	5.4	0.02	11				41	0.12	4			
7F	26.0	0.06	22	6.2	0.08	18	113	0.27	14	49	0.61	7
C	1.5	0.02	23				34	0.34	5			
9F	12.9	0.11	26	8.9	0.22	14	63	0.53	11	47	1.15	6
C	6.8	0.11	9				38	0.62	4			
10F	14.3	0.05	36	12.7	0.26	8	93	0.32	14	59	1.20	4
C	12.4	0.21	5				53	0.88	3			
11F	31.1	0.02	100	3.0	0.03	75	183	0.12	33	181	1.78	4
C	1.0	0.01	100				181	1.66	3			
12F	11.1	0.01	100	2.9	0.03	33	133	0.10	19	128	1.32	3
C	2.2	0.02	22				128	1.22	3			
13F	11.1	0.01	100	3.2	0.04	37	254	0.34	21	126	1.68	5
C	2.3	0.03	19				112	1.33	2			
14F	10.3	0.16	7	8.2	0.22	5	52	0.82	4	48	1.29	3
C	5.1	0.06	6				43	0.47	4			
4-23-79-1F	1.9	0.02	100	2.3	0.06	33	41	0.40	13	37	0.96	6
C	2.5	0.04	15				35	0.56	4			
2F	4.9	0.02	18	2.6	0.04	11	85	0.33	4	54	0.92	2
C	1.9	0.02	13				45	0.58	3			
3F	1.3	0.02	30	0.7	0.02	34	17	0.20	8	14	0.40	5
C	0.3	0.01	100				11	0.20	6			
4-24-79-1F	1.0	0.01	34	0.6	0.02	41	12	0.14	8	12	0.33	6
C	0.4	0.01	100				12	0.19	8			
2Fa	7.8	0.01	100	2.6	0.04	45	113	0.20	16	59	0.84	5
C	1.9	0.02	40				51	0.64	4			
2Fb	17.0	0.08	20	17.0	0.29	18	158	0.72	6	97	1.65	3
C	17.0	0.21	23				74	0.93	3			
3Fa	22.2	0.01	100	3.8	0.04	46	195	0.12	26	90	0.91	6
C	2.6	0.02	44				83	0.79	6			
3Fb	35.9	0.01	100	3.9	0.04	38	115	0.04		154	1.52	3
C	2.7	0.03	26				156	1.48	3			
4F	5.6	0.02	100	4.5	0.09	28	78	0.34	15	78	1.60	4
C	4.2	0.07	12				78	1.26	3			

Appendix G. (Continued.)

LogID	^{137}Cs Bq kg^{-1} fine and coarse	^{137}Cs kBq m^{-2} fine and coarse	% error	^{137}Cs Bq kg^{-1} total sample	^{137}Cs kBq m^{-2} total sample	% error	^{155}Eu Bq kg^{-1} fine and coarse	^{155}Eu kBq m^{-2} fine and coarse	% error	^{155}Eu Bq kg^{-1} total sample	^{155}Eu kBq m^{-2} total sample	% error
5F	25.6	0.01	100	4.6	0.05	20	216	0.07	46	161	1.72	3
C	3.9	0.04	14				160	1.66	3			
6F	67.4	0.09	19	14.2	0.15	13	415	0.58	10	180	1.95	4
C	6.4	0.06	13				145	1.37	3			
7F	33.3	0.04	31	7.1	0.08	20	260	0.32	10	119	1.35	4
C	4.0	0.04	26				102	1.03	4			
8F	7.9	0.11	10	5.6	0.16	8	69	0.96	5	57	1.59	3
C	3.3	0.05	15				46	0.63	3			
9Fa	57.8	0.65	3	37.8	0.73	3	330	3.73	3	239	4.62	2
C	9.6	0.08	9				111	0.89	2			
9Fb	33.2	0.58	3	25.6	0.70	3	188	3.26	3	149	4.06	2
C	12.2	0.12	6				81	0.80	3			
10F	16.6	0.41	4	14.7	0.47	4	105	2.58	4	98	3.15	3
C	8.6	0.06	12				76	0.57	3			
11F	18.1	0.35	4	13.5	0.40	4	120	2.31	3	103	3.05	2
C	5.0	0.05	15				71	0.75	4			
12F	55.3	1.18	4	46.4	1.33	4	309	6.58	4	296	8.45	3
C	20.4	0.15	6				257	1.87	2			
13F	55.8	0.25	6	22.4	0.43	4	326	1.47	4	134	2.55	3
C	12.0	0.17	6				74	1.08	3			
14F	24.1	0.26	4	18.8	0.46	3	156	1.69	4	133	3.27	3
C	14.7	0.20	5				115	1.58	3			
15F	588.1	11.61	1	473.7	11.92	1	1931	38.13	2	1612	40.59	2
C	57.3	0.31	3				452	2.45	2			
17F	415.2	10.23	1	414.2	10.25	1	1694	41.74	3	1692	41.89	3
C	220.0	0.03	8				1260	0.15	3			
4-25-79-1F	321.1	3.08	2	204.3	3.78	2	2648	25.38	5	2538	47.01	3
C	79.1	0.71	3				2419	21.63	2			
2F	124.8	0.88	3	60.8	1.17	2	594	4.18	3	367	7.09	2
C	24.1	0.30	4				237	2.91	3			
3F	53.7	0.13	15	14.6	0.28	8	264	0.64	8	147	2.86	3
C	9.0	0.15	7				131	2.22	3			
4F	6.3	0.11	9	5.4	0.16	7	56	1.01	3	55	1.59	2
C	4.0	0.04	9				52	0.58	3			
5F	3.9	0.08	11	3.4	0.10	9	29	0.57	7	29	0.87	5
C	2.5	0.03	14				27	0.31	4			
6F	37.2	0.65	2.5	26.0	0.76	2	51	0.89	6	37	1.10	5
C	9.6	0.12	6				17	0.20	8			
6-15-79-lF	0.4	0.01	100	0.4	0.01	87	12	0.32	7	12	0.32	7
C	1.5	0.00	100				4	0.00				
2F	0.9	0.01	30	0.8	0.02	39	19	0.33	4	21	0.54	4
C	0.8	0.01	100				23	0.21	9			
3F	1.3	0.02	100	0.9	0.02	83	13	0.19	19	13	0.35	11
C	0.4	0.00	100				14	0.16	6			
4F	3.9	0.04	34	1.8	0.05	32	25	0.28	14	21	0.57	7

Appendix G. (Continued.)

LogID	^{137}Cs Bq kg^{-1} fine and coarse	^{137}Cs kBq m^{-2} fine and coarse	% error	^{137}Cs Bq kg^{-1} total sample	^{137}Cs kBq m^{-2} total sample	% error	^{155}Eu Bq kg^{-1} fine and coarse	^{155}Eu kBq m^{-2} fine and coarse	% error	^{155}Eu Bq kg^{-1} total sample	^{155}Eu kBq m^{-2} total sample	% error
C	0.3	0.01	100				19	0.29	4			
5F	10.8	0.02	14	29.7	0.42	22	140	0.26	3	69	0.96	3
C	32.6	0.40	23				58	0.70	4			
6F	19.0	0.37	4	22.1	0.89	3	43	0.84	3	40	1.60	3
C	25.0	0.52	4				37	0.77	5			
7F	7.3	0.08	36	4.1	0.11	26	27	0.28	20	22	0.61	10
C	2.1	0.03	23				19	0.32	8			
8F	3.0	0.06	16	2.4	0.07	15	25	0.47	4	23	0.64	3
C	1.0	0.01	42				18	0.17	6			
9F	2.5	0.02	100	1.1	0.03	80	21	0.18	26	14	0.37	13
C	0.4	0.01	100				11	0.19	7			
10F	6.7	0.12	6	8.0	0.23	5	57	0.98	5	60	1.75	3
C	9.7	0.12	8				63	0.77	3			
11F	6.4	0.10	7	4.8	0.12	8	38	0.62	8	35	0.90	6
C	1.8	0.02	35				31	0.28	5			
12F	8.5	0.08	27	11.0	0.24	10	36	0.35	16	36	0.79	9
C	13.1	0.16	5				37	0.44	9			
13F	6.8	0.12	6	8.6	0.23	5	48	0.86	7	44	1.20	5
C	12.0	0.11	9				36	0.34	5			
14F	5.4	0.02	100	3.2	0.06	44	86	0.38	12	59	1.07	5
C	2.6	0.03	30				51	0.69	5			
15F	4.8	0.07	33	3.2	0.08	32	45	0.63	10	39	0.99	7
C	1.1	0.01	100				32	0.36	9			
16F	13.4	0.03	100	2.4	0.04	76	295	0.56	12	132	2.03	4
C	0.9	0.01	100				109	1.47	4			
17F	24.0	0.02	100	2.7	0.03	77	96	0.08		60	0.64	3
C	0.9	0.01	100				57	0.55	4			
18F	19.1	0.01	100	2.8	0.03	47	105	0.08	34	90	1.03	6
C	1.7	0.02	30				89	0.95	6			
6-16-79-1F	21.9	0.15	6	15.0	0.26	5	97	0.66	3	88	1.53	2
C	10.6	0.11	8				82	0.88	3			
2F	136.3	3.11	2	130.0	3.28	2	1465	33.43	3	1369	34.56	3
C	70.3	0.17	4				467	1.13	2			
3F	60.9	0.89	4	56.8	1.17	3	640	9.33	2	541	11.12	2
C	46.9	0.28	3				299	1.79	3			
4F	51.8	0.59	7	29.9	0.68	6	1446	16.56	5	1015	23.15	4
C	7.8	0.09	11				580	6.59	3			
5F	71.0	0.54	5	37.7	0.61	5	1586	12.03	2	985	15.95	2
C	8.3	0.07	8				456	3.92	3			
6F	250.7	5.35	1	224.1	5.59	1	345	7.36	2	317	7.91	2
C	66.7	0.24	4				152	0.55	5			
7F	252.7	2.41	2	135.5	2.92	2	1115	10.64	2	718	15.48	2
C	42.6	0.51	3				403	4.85	2			
8F	1015.2	24.98	1	1014.6	25.04	1	1336	32.88	2	1343	33.15	2
C	828.9	0.06	6				3533	0.27	3			

Appendix G. (Continued.)

LogID	^{137}Cs Bq kg^{-1} fine and coarse	^{137}Cs kBq m^{-2} fine and coarse	% error	^{137}Cs Bq kg^{-1} total sample	^{137}Cs kBq m^{-2} total sample	% error	^{155}Eu Bq kg^{-1} fine and coarse	^{155}Eu kBq m^{-2} fine and coarse	% error	^{155}Eu Bq kg^{-1} total sample	^{155}Eu kBq m^{-2} total sample	% error
9F	731.5	17.11	2	722.6	17.21	2	966	22.58	2	963	22.94	2
C	241.0	0.10	3				842	0.36	2			
10F	119.7	2.70	1	117.7	2.80	1	386	8.69	4	377	8.97	4
C	82.7	0.11	4				216	0.28	4			
11F	138.4	1.44	3	75.6	1.77	3	690	7.19	4	429	10.05	3
C	25.0	0.32	5				220	2.85	3			
12F	260.7	1.00	3	90.5	1.57	2	1287	4.95	3	568	9.86	2
C	42.1	0.57	3				363	4.92	3			
13F	41.8	0.23	7	22.7	0.39	5	261	1.43	9	250	4.26	3
C	13.6	0.16	6				246	2.83	2			
14F	48.1	0.05	28	3.7	0.05	28	407	0.39	13	31	0.39	13
C	0.0	0.00	0				0	0.00				
15F	16.7	0.01	100	6.2	0.06	22	307	0.16	11	250	2.30	4
C	5.6	0.05	18				246	2.13	4			
16F	43.1	0.04	26	10.9	0.12	10	332	0.31	8	180	2.05	4
C	8.1	0.08	8				167	1.74	4			
17F	46.3	0.07	26	12.1	0.14	16	448	0.70	8	265	3.07	2
C	6.7	0.07	16				237	2.37	2			
18F	122.2	0.11	10	24.4	0.23	6	1767	1.62	2	629	6.02	2
C	14.1	0.12	7				509	4.40	3			
19F	82.2	0.49	6	42.2	0.66	5	1035	6.15	2	570	8.97	2
C	18.0	0.18	10				288	2.83	2			
20F	141.1	0.13	19	23.6	0.25	11	1154	1.06	5	535	5.57	2
C	12.3	0.12	10				475	4.51	2			
21F	160.9	0.30	6	36.4	0.51	4	1165	2.17	4	462	6.47	2
C	17.3	0.21	5				354	4.30	2			
22F	150.3	1.54	2	84.9	1.81	2	1736	17.82	2	1078	22.97	2
C	24.1	0.27	4				467	5.16	2			
23F	117.8	1.73	2	71.5	1.95	2	1445	21.23	2	934	25.50	2
C	17.7	0.22	2				338	4.27	3			
6-17-79-1F	3.1	0.01	100	0.7	0.02	75	11	0.05		16	0.43	5
C	0.3	0.01	100				17	0.38	6			
2F	1.9	0.02	100	0.8	0.02	78	7	0.07		11	0.32	6
C	0.3	0.01	100				13	0.25	8			
3F	3.0	0.01	100	0.6	0.02	78	13	0.05		10	0.28	3
C	0.2	0.00	100				9	0.22	4			
4F	2.1	0.01	100	4.4	0.12	12	16	0.08	27	11	0.29	9
C	4.9	0.11	8				10	0.21	8			
5F	0.7	0.01	32	0.5	0.02	48	10	0.13	8	7	0.19	8
C	0.4	0.01	100				4	0.07	18			
6F	1.6	0.04	18	1.4	0.04	17	14	0.31	5	15	0.43	4
C	0.5	0.00	40				17	0.12	6			
7F	13.1	0.26	8	10.2	0.29	8	26	0.51	11	34	0.99	6
C	4.1	0.04	26				49	0.47	5			
8F	10.9	0.24	11	11.1	0.37	7	20	0.44	14	18	0.61	10
C	11.4	0.14	5				15	0.17	5			

Appendix H

Concentrations of Other Radionuclides Found above Detection Limits in Some Fine and Coarse Fractions of Surface (0–2 cm) Sediment Samples Collected from Bikini Lagoon during April through June 1979

Appendix H. Concentrations of other radionuclides found above detection limits in some fine and coarse fractions of surface (0–2 cm) sediment samples collected from Bikini lagoon during April through June 1979.

LogID	^{152}Eu Bq kg^{-1}	% error	^{154}Eu Bq kg^{-1}	% error	^{125}Sb Bq kg^{-1}	% error	^{40}K Bq kg^{-1}	% error	^{210}Pb Bq kg^{-1}	% error	^{102m}Rh Bq kg^{-1}	% error
4-22-79-1F												
C												
2F									40.3	6		
C												
3F												
C												
4F							22.6	38				
C							8.9	38				
5F												
C												
6F									24.9	15		
C												
7F												
C												
9F									69.0	7		
C												
10F												
C												
11F												
C												
12F												
C												
13F												
C												
14F							15.6	41	43.5	7		
C												
4-23-79-1F												
C												
2F							55.6	32	18.6	10		
C												
3F							21.9	28				
C												
4-24-79-1F							23.7	28	19.8	12		
C												
2Fa												
C												
2Fb												
C												
3Fa												
C												
3Fb												
C												
4F												
C												

Appendix H. (Continued.)

LogID	^{152}Eu Bq kg^{-1}	% error	^{154}Eu Bq kg^{-1}	% error	^{125}Sb Bq kg^{-1}	% error	^{40}K Bq kg^{-1}	% error	^{210}Pb Bq kg^{-1}	% error	^{102m}Rh Bq kg^{-1}	% error
5F												
C												
6F												
C												
7F												
C												
8F											2.1	23
C											1.3	25
9Fa											15.0	5
C											4.8	14
9Fb							23.0	28	36.8	6	12.1	5
C											3.9	13
10F											4.9	10
C											27.8	21
11F							23.3	30			5.0	10
C											2.5	26
12F									31.0	6		
C											3.1	25
13F												
C											1.2	20
14F												
C	2.0	30										
15F	5.1	51										
C												
17F	4.1	43			18.5	24			70.5	4	10.8	15
C												
4-25-79-1F											15.9	18
C							27.8	40			3.1	24
2F												
C												
3F												
C											1.4	24
4F											2.5	16
C											2.2	12
5F											1.3	32
C	1.1	41					14.1	35			1.4	18
6F	1.3	48	1.6	42							8.3	5
C											3.8	25
6-15-79-lF												
C												
2F									14.1	27		
C												
3F												
C												
4F												

Appendix H. (Continued.)

LogID	^{152}Eu Bq kg^{-1}	% error	^{154}Eu Bq kg^{-1}	% error	^{125}Sb Bq kg^{-1}	% error	^{40}K Bq kg^{-1}	% error	^{210}Pb Bq kg^{-1}	% error	^{102m}Rh Bq kg^{-1}	% error
C												
5F	8.5	32	5.9	44			152.2	18			4.5	27
C											2.0	29
6F	1.5	36	0.9	58							3.7	8
C											1.9	24
7F												
C												
8F											3.7	19
C											1.7	20
9F												
C												
10F											2.7	18
C	5.5	11									1.9	20
11F							20.0	25	50.9	7	2.1	18
C												
12F												
C											1.0	38
13F											1.2	29
C												
14F												
C												
15F									39.8	11		
C												
16F									115.4	9		
C												
17F												
C												
18F												
C												
6-16-79-1F							40.4	34				
C			1.6	31								
2F									53.3	7	7.9	9
C												
3F												
C	3.0	27	1.7	32								
4F												
C											2.9	18
5F												
C											2.4	33
6F					6.8	22					1.2	30
C												
7F												
C												
8F	10.8	15	4.9	24	20.7	15	16.7	27	45.2	9	9.9	13
C												

Appendix H. (Continued.)

LogID	^{152}Eu Bq kg^{-1}	% error	^{154}Eu Bq kg^{-1}	% error	^{125}Sb Bq kg^{-1}	% error	^{40}K Bq kg^{-1}	% error	^{210}Pb Bq kg^{-1}	% error	^{102m}Rh Bq kg^{-1}	% error
9F							10.0	40	73.4	6	4.2	19
C	5.3	19	3.2	32	17.5	15						
10F	4.0	20	2.6	29	5.4	29					4.6	11
C												
11F												
C												
12F									58.3	7		
C												
13F									23.1	7		
C	3.3	28									3.2	14
14F												
C												
15F												
C												
16F												
C												
17F												
C												
18F									141.6	5		
C												
19F												
C												
20F												
C											2.0	30
21F												
C												
22F	5.7	22			9.3	21					9.9	8
C											2.7	13
23F	2.7	33			7.6	30					9.9	8
C	1.6	38			1.3	54	50.4	11			2.4	11
6-17-79-1F												
C												
2F									10.3	13		
C												
3F												
C												
4F												
C												
5F							13.7	28				
C												
6F											2.7	13
C											1.4	19

Appendix H. (Continued.)

LogID	^{152}Eu Bq kg^{-1}	% error	^{154}Eu Bq kg^{-1}	% error	^{125}Sb Bq kg^{-1}	% error	^{40}K Bq kg^{-1}	% error	^{210}Pb Bq kg^{-1}	% error	^{102m}Rh Bq kg^{-1}	% error
7F											7.1	18
C	3.4	29									31.9	4
8F											6.0	21
C											4.2	8

F = fines; C = Coarse fractions.

Radionuclides determined by gamma spectrometry except ^{210}Pb that was separated and determined by alpha counting ^{210}Po after equilibrium was established.

No entry indicates the concentration for the specific radionuclide was below detection limits.

Appendix I

Concentrations and Inventories of ^{207}Bi and ^{60}Co in Fine and Coarse Fractions and Total Sample of Surface (0–4 cm) Sections of Sediment Samples Collected from Bikini Lagoon during April through June 1979

Appendix I. Concentrations and inventories of ^{207}Bi and ^{60}Co in fine and coarse fractions and total sample of surface (0–4 cm) sections of sediment samples collected from Bikini lagoon during April throughJune 1979.

LogID	^{207}Bi $Bq\,kg^{-1}$ fine and coarse	^{207}Bi $kBq\,m^{-2}$ fine and coarse	% error	^{207}Bi $Bq\,kg^{-1}$ total sample	^{207}Bi $kBq\,m^{-2}$ total sample	% error	^{60}Co $Bq\,kg^{-1}$ fine and coarse	^{60}Co $kBq\,m^{-2}$ fine and coarse	% error	^{60}Co $Bq\,kg^{-1}$ total sample	^{60}Co $kBq\,m^{-2}$ total sample	% error
4-22-79-3F	2.7	0.06	14	2.2	0.10	10	4.5	0.11	16	3.6	0.16	12
C	1.6	0.03	13				2.6	0.05	16			
4F	1.0	0.02	100	0.9	0.05	51	2.9	0.07	76	2.3	0.13	42
C	0.8	0.02	35				1.9	0.06	29			
5F	1.6	0.02	33	2.6	0.09	14	6.4	0.09	13	5.1	0.19	10
C	3.2	0.07	15				4.3	0.10	16			
10F	4.1	0.03	100	3.0	0.12	28	19.4	0.16	25	9.2	0.38	12
C	2.7	0.09	7				6.6	0.21	7			
11F	16.3	0.02	100	36.4	0.74	3	128.7	0.16	18	33.3	0.68	5
C	37.8	0.72	2				26.9	0.52	4			
12F	22.6	0.04	35	29.7	0.70	6	49.1	0.10	28	18.5	0.44	8
C	30.4	0.66	6				15.7	0.34	7			
13F	24.8	0.03	100	22.7	0.44	7	51.9	0.06	100	14.0	0.27	24
C	22.6	0.41	4				11.6	0.21	14			
4-23-79-1F	1.9	0.04	100	2.1	0.12	43	7.1	0.16	28	4.8	0.27	18
C	2.3	0.08	38				3.3	0.11	18			
2F	4.1	0.04	100	4.9	0.18	25	10.3	0.11	50	8.4	0.32	18
C	5.2	0.14	7				7.7	0.21	8			
3F	14.4	0.41	6	7.4	0.43	6	4.1	0.12	20	3.0	0.17	15
C	0.9	0.03	28				1.9	0.06	19			
4-24-79-1F	0.4	0.01	100	0.4	0.02	71	3.4	0.09	24	2.8	0.15	20
C	0.3	0.01	100				2.2	0.06	35			
2Fa	15.2	0.24	9	13.4	0.54	4	18.4	0.29	11	12.7	0.52	8
C	12.2	0.30	3				9.1	0.23	10			
2Fb	24.8	0.11	6	28.8	0.78	6	36.2	0.17	6	13.8	0.37	6
C	29.6	0.66	7				9.2	0.21	10			
3Fa	61.9	0.13	16	43.1	0.92	3	94.4	0.20	19	30.0	0.64	7
C	41.0	0.79	3				22.9	0.44	5			
3Fb	48.1	0.03	100	45.3	0.88	5	85.2	0.05	100	41.9	0.82	8
C	45.2	0.85	4				40.6	0.77	6			
4F	6.5	0.08	21	6.2	0.28	8	17.9	0.23	14	10.3	0.46	7
C	6.1	0.19	6				7.2	0.23	4			
5F	20.0	0.02	100	50.7	1.09	3	40.7	0.04	100	21.0	0.45	10
C	52.2	1.07	2				20.0	0.41	5			
6F	52.2	0.21	11	54.4	1.33	4	65.0	0.26	16	29.5	0.72	7
C	54.8	1.12	4				22.4	0.46	6			
7F	43.1	0.07	29	72.7	1.57	2	99.2	0.17	19	36.1	0.78	5
C	75.3	1.49	2				30.7	0.61	4			
8F	6.6	0.21	4	6.6	0.38	3	16.5	0.53	4	13.2	0.77	3
C	6.5	0.17	6				9.3	0.24	5			
10F	5.7	0.24	4	4.8	0.28	6	23.0	0.99	2	20.1	1.14	2
C	2.2	0.03	47				11.0	0.15	13			
11F	12.0	0.54	3	11.7	0.81	5	31.0	1.40	2	26.5	1.82	2
C	11.2	0.27	13				17.9	0.43	4			

Appendix I. (Continued.)

LogID	^{207}Bi Bq kg^{-1} fine and coarse	^{207}Bi kBq m^{-2} fine and coarse	% error	^{207}Bi Bq kg^{-1} total sample	^{207}Bi kBq m^{-2} total sample	% error	^{60}Co Bq kg^{-1} fine and coarse	^{60}Co kBq m^{-2} fine and coarse	% error	^{60}Co Bq kg^{-1} total sample	^{60}Co kBq m^{-2} total sample	% error
12F	57.0	2.25	1	65.6	3.41	1	43.0	1.70	1	40.5	2.10	1
C	93.0	1.16	3				32.3	0.40	5			
13F	20.4	0.14	19	14.1	0.66	5	78.1	0.54	10	26.1	1.22	7
C	13.0	0.52	4				17.0	0.68	9			
15F	47.7	2.00	3	40.6	2.17	3	186.5	7.83	1	157.6	8.40	1
C	14.2	0.16	4				50.5	0.57	2			
15bF	56.7	2.00	3	44.7	2.46	3	160.0	5.64	1	115.9	6.39	1
C	23.3	0.46	4				37.7	0.75	9			
17F	16.3	0.79	11	16.4	0.80	11	115.2	5.56	3	115.4	5.60	3
C	44.1	0.01	26				169.6	0.04	12			
4-25-79-2F	33.7	0.63	5	30.0	1.38	4	65.9	1.23	5	39.1	1.79	4
C	27.5	0.75	6				20.7	0.56	5			
3F	20.0	0.11	6	17.8	0.72	4	50.7	0.28	4	22.0	0.89	2
C	17.4	0.61	4				17.4	0.61	3			
4F	2.9	0.10	15	2.2	0.12	20	11.2	0.39	9	9.8	0.53	8
C	0.9	0.02	100				7.2	0.14	20			
5F	1.1	0.04	25	0.8	0.05	28	6.9	0.25	6	6.0	0.37	5
C	0.4	0.01	100				4.7	0.11	10			
6F	5.0	0.19	8	4.3	0.25	7	12.7	0.49	5	17.9	1.03	4
C	2.7	0.05	19				28.7	0.54	6			
6-15-79-1F	1.0	0.04	21	1.0	0.05	21	1.0	0.04	39	1.0	0.04	37
C	2.1	0.00	100				3.3	0.00	100			
2F	0.9	0.03	34	0.7	0.04	33	5.1	0.18	11	4.2	0.23	9
C	0.4	0.01	100				2.5	0.04	17			
3F	1.0	0.03	30	1.0	0.05	21	4.0	0.12	13	3.8	0.18	14
C	1.1	0.02	26				3.4	0.07	31			
4F	1.5	0.02	100	1.9	0.08	23	4.0	0.05	78	3.9	0.17	26
C	2.1	0.07	12				3.9	0.12	18			
5F	9.0	0.09	19	12.4	0.39	6	32.4	0.33	11	16.4	0.52	8
C	14.0	0.30	5				8.7	0.19	9			
6F	3.1	0.11	10	3.2	0.18	8	8.7	0.32	6	7.4	0.41	6
C	3.5	0.07	14				4.9	0.10	15			
7F	1.1	0.03	19	0.9	0.05	13	7.3	0.18	5	5.5	0.32	4
C	0.7	0.02	17				4.1	0.14	7			
8F		0.00	100	0.1	0.01	100			100	2.0	0.13	9
C	0.4	0.01	100				5.1	0.13	9			
9F	2.0	0.03	100	0.8	0.04	84	3.7	0.06	100	2.4	0.12	52
C	0.2	0.01	100				1.8	0.06	17			
10F	2.8	0.08	14	3.3	0.15	10	11.9	0.34	7	10.5	0.49	6
C	4.1	0.08	13				8.4	0.15	10			
11F	2.1	0.07	12	1.9	0.10	10	8.7	0.31	5	7.6	0.41	4
C	1.6	0.03	21				5.6	0.11	7			
12F	2.8	0.06	17	7.2	0.33	6	14.1	0.31	10	14.4	0.65	6
C	11.5	0.27	6				14.7	0.34	6			
13F	4.1	0.16	11	4.1	0.20	9	8.7	0.33	7	8.3	0.40	6

Appendix I. (Continued.)

LogID	^{207}Bi Bq kg^{-1} fine and coarse	^{207}Bi kBq m^{-2} fine and coarse	% error	^{207}Bi Bq kg^{-1} total sample	^{207}Bi kBq m^{-2} total sample	% error	^{60}Co Bq kg^{-1} fine and coarse	^{60}Co kBq m^{-2} fine and coarse	% error	^{60}Co Bq kg^{-1} total sample	^{60}Co kBq m^{-2} total sample	% error
C	3.9	0.04	14				6.6	0.07	14			
14F	8.6	0.07	23	11.6	0.35	5	12.9	0.11	28	4.9	0.15	34
C	12.7	0.28	3				1.9	0.04	100			
15F	4.4	0.09	28	5.0	0.21	12	11.0	0.22	24	8.2	0.34	16
C	5.7	0.12	5				5.7	0.12	10			
16F	30.1	0.29	9	25.5	0.78	5	45.8	0.45	10	26.7	0.82	6
C	23.4	0.48	5				17.8	0.37	6			
17F	25.2	0.04	100	25.3	0.50	10	48.1	0.07	100	20.3	0.40	19
C	25.3	0.46	7				18.2	0.33	10			
18F	63.6	0.49	6	40.2	1.05	4	53.7	0.41	11	25.4	0.66	7
C	30.5	0.56	4				13.6	0.25	7			
6-16-79-7F	25.8	0.42	5	30.5	1.15	2	88.5	1.45	3	60.9	2.30	2
C	34.1	0.73	2				39.6	0.84	3			
9F	37.4	1.37	3	36.8	1.39	3	92.2	3.38	2	93.2	3.53	2
C	18.4	0.02	14				123.0	0.15	9			
10F	150.4	6.05	1	150.1	6.27	1	71.0	2.86	1	71.3	2.98	1
C	142.8	0.22	2				79.6	0.12	9			
11F	64.6	1.29	4	49.1	1.91	3	62.3	1.24	10	46.4	1.81	7
C	32.9	0.62	3				29.6	0.56	5			
12F	51.3	0.57	6	34.9	1.28	3	110.6	1.23	4	52.6	1.93	3
C	27.9	0.71	2				27.4	0.70	6			
13F	30.6	0.24	14	45.5	1.42	3	76.0	0.60	8	40.0	1.24	5
C	50.6	1.17	3				27.8	0.65	5			
14F	53.7	0.32	9	39.2	0.80	4	80.0	0.47	11	34.3	0.70	8
C	33.3	0.48	3				15.7	0.23	7			
15F		0.00	100	55.4	1.02	2			100	19.2	0.35	10
C	58.1	1.02	2				20.2	0.35	10			
16F	20.7	0.05	25	20.7	0.39	5	75.6	0.18	15	29.8	0.56	6
C	20.7	0.34	5				22.9	0.37	5			
17F	15.9	0.03	100	27.3	0.48	7	70.9	0.13	26	28.0	0.49	8
C	28.6	0.45	4				23.1	0.37	6			
18F	17.9	0.02	100	28.9	0.57	5	202.4	0.24	12	51.2	1.00	4
C	29.6	0.55	3				41.6	0.77	3			
19F	28.3	0.48	8	21.5	0.72	6	89.0	1.52	8	59.7	2.00	6
C	14.3	0.23	6				29.0	0.47	5			
20F	50.4	0.10	15	54.3	0.96	3	148.0	0.29	11	66.4	1.18	4
C	54.8	0.86	3				56.1	0.89	3			
21F	35.2	0.08	23	24.0	0.48	6	91.1	0.20	15	27.1	0.54	7
C	22.6	0.40	6				19.0	0.34	7			
22F	27.4	0.77	5	26.5	1.23	4	79.4	2.23	3	59.2	2.75	3
C	25.2	0.46	5				28.2	0.52	4			
23F	15.4	0.45	4	14.6	0.61	3	63.4	1.84	3	50.2	2.12	3
C	12.8	0.17	3				21.1	0.28	3			
6-17-79-2F	1.3	0.03	100	0.7	0.04	79	2.6	0.06	100	1.5	0.08	72
C	0.3	0.01	100				0.8	0.02	55			

Appendix I. (Continued.)

LogID	^{207}Bi Bq kg^{-1} fine and coarse	^{207}Bi kBq m^{-2} fine and coarse	% error	^{207}Bi Bq kg^{-1} total sample	^{207}Bi kBq m^{-2} total sample	% error	^{60}Co Bq kg^{-1} fine and coarse	^{60}Co kBq m^{-2} fine and coarse	% error	^{60}Co Bq kg^{-1} total sample	^{60}Co kBq m^{-2} total sample	% error
3F	8.1	0.04	100	2.3	0.10	39	12.6	0.06	100	2.2	0.10	64
C	1.6	0.06	14				1.0	0.04	47			
4F	1.7	0.02	100	1.0	0.04	48	3.0	0.03	100	1.2	0.05	74
C	0.7	0.02	33				0.6	0.02	100			
5F	0.7	0.02	22	0.8	0.05	20	1.9	0.06	25	1.8	0.11	15
C	0.9	0.03	32				1.8	0.05	17			
6F	0.3	0.01	100	0.4	0.02	71	4.7	0.18	15	4.5	0.23	12
C	0.6	0.01	100				4.0	0.06	17			
7F	2.6	0.03	100	5.6	0.13	21	29.0	0.30	12	23.4	0.56	7
C	7.9	0.11	6				19.0	0.26	8			
8F	4.1	0.03	100	2.3	0.04	66	30.1	0.21	23	13.5	0.26	19
C	1.3	0.02	33				4.0	0.05	15			

Appendix J

Concentrations and Inventories of ^{137}Cs and ^{155}Eu in Fine and Coarse Fractions and Total Sample of Surface (0–4 cm) Sections of Sediment Samples Collected from Bikini Lagoon during April through June 1979

Appendix J. Concentrations and inventories of ^{137}Cs and ^{155}Eu in fine and coarse fractions and total sample of surface (0–4 cm) sections of sediment samples collected from Bikini lagoon during April through June 1979.

LogID	^{137}Cs Bq kg^{-1} fine and coarse	^{137}Cs kBq m^{-2} fine and coarse	% error	^{137}Cs Bq kg^{-1} total sample	^{137}Cs kBq m^{-2} total sample	% error	^{155}Eu Bq kg^{-1} fine and coarse	^{155}Eu kBq m^{-2} fine and coarse	% error	^{155}Eu Bq kg^{-1} total sample	^{155}Eu kBq m^{-2} total sample	% error
4-22-79-3F	1.6	0.04	26	1.4	0.06	19	21	0.51	5	19	0.81	4
C	1.2	0.02	25				15	0.31	7			
4F	1.1	0.03	100	1.1	0.06	45	16	0.35	16	14	0.73	8
C	1.1	0.04	27				12	0.37	6			
5F	3.9	0.05	19	2.3	0.08	18	38	0.51	5	41	1.50	4
C	1.4	0.03	35				43	0.99	6			
10F	18.9	0.16	23	9.7	0.40	10	117	0.98	14	71	2.90	5
C	7.3	0.24	4				59	1.92	3			
11F	19.6	0.03	100	3.3	0.07	39	243	0.31	20	188	3.84	2
C	2.2	0.04	19				184	3.53	2			
12F	13.7	0.03	100	3.2	0.08	40	200	0.39	14	132	3.12	4
C	2.2	0.05	27				126	2.73	4			
13F	31.5	0.04	100	2.5	0.05	78	96	0.11	100	99	1.90	6
C	0.7	0.01	100				99	1.79	3			
4-23-79-1F	2.2	0.05	100	2.9	0.17	33	46	1.03	14	34	1.96	8
C	3.3	0.12	18				27	0.93	5			
2F	5.0	0.05	100	2.5	0.09	60	49	0.54	18	76	2.89	4
C	1.5	0.04	34				87	2.34	2			
3F	0.5	0.01	100	0.7	0.04	37	14	0.40	6	13	0.75	5
C	1.0	0.03	29				11	0.34	7			
4-24-79-1F	0.5	0.01	100	0.6	0.03	47	15	0.40	6	14	0.74	4
C	0.8	0.02	44				13	0.34	6			
2Fa	13.6	0.22	16	6.9	0.28	13	112	1.78	8	77	3.14	5
C	2.7	0.07	14				55	1.35	3			
2Fb	21.3	0.10	10	7.0	0.19	13	214	0.99	4	111	2.98	4
C	4.0	0.09	24				89	2.00	5			
3Fa	60.5	0.13	24	9.3	0.20	17	524	1.11	10	187	3.97	4
C	3.6	0.07	22				149	2.86	3			
3Fb	55.6	0.03	100	3.1	0.06	71	521	0.30	28	128	2.50	4
C	1.5	0.03	100				117	2.20	3			
4F	7.0	0.09	32	5.4	0.24	13	93	1.18	9	66	2.93	4
C	4.8	0.15	10				55	1.75	2			
5F	26.3	0.03	100	4.6	0.10	29	180	0.18	18	174	3.73	2
C	3.5	0.07	16				174	3.55	2			
6F	66.8	0.27	17	18.1	0.44	12	419	1.69	7	204	4.99	3
C	8.4	0.17	15				161	3.29	3			
7F	47.1	0.08	31	7.7	0.17	17	271	0.46	18	139	3.00	4
C	4.3	0.09	17				128	2.54	3			
8F	10.2	0.33	4	8.4	0.49	4	74	2.38	5	69	4.01	3
C	6.2	0.16	8				62	1.63	3			
10F	20.8	0.90	3	19.6	1.12	3	119	5.16	4	107	6.09	3
C	16.0	0.22	9				68	0.94	3			
11F	18.6	0.84	4	14.2	0.98	4	129	5.81	2	113	7.81	2
C	5.8	0.14	11				84	2.00	3			

Appendix J. (Continued.)

LogID	^{137}Cs Bq kg^{-1} fine and coarse	^{137}Cs kBq m^{-2} fine and coarse	% error	^{137}Cs Bq kg^{-1} total sample	^{137}Cs kBq m^{-2} total sample	% error	^{155}Eu Bq kg^{-1} fine and coarse	^{155}Eu kBq m^{-2} fine and coarse	% error	^{155}Eu Bq kg^{-1} total sample	^{155}Eu kBq m^{-2} total sample	% error
12F	65.3	2.58	1	54.1	2.81	1	350	13.84	2	326	16.96	2
C	18.9	0.24	8				250	3.12	3			
13F	54.1	0.37	11	15.8	0.74	7	308	2.13	8	107	5.02	4
C	9.1	0.36	8				72	2.89	4			
15F	652.6	27.39	1	527.4	28.11	1	2021	84.82	2	1671	89.06	2
C	63.5	0.72	2				374	4.24	3			
15bF	544.1	19.19	1	379.0	20.89	1	2222	78.36	2	1573	86.72	2
C	85.9	1.71	3				421	8.36	2			
17F	462.6	22.33	1	461.7	22.39	1	1774	85.66	3	1773	85.98	3
C	260.6	0.06	6				1429	0.32	3			
4-25-79-2F	124.9	2.33	3	58.9	2.70	3	680	12.68	4	354	16.22	3
C	13.5	0.37	8				130	3.53	3			
3F	53.0	0.30	5	14.2	0.58	4	354	1.98	2	148	6.01	1
C	8.0	0.28	5				115	4.03	2			
4F	5.7	0.20	10	4.8	0.26	9	51	1.81	4	46	2.50	3
C	3.3	0.06	18				36	0.69	4			
5F	2.4	0.09	14	2.0	0.12	13	25	0.91	7	43	2.63	4
C	1.4	0.03	27				71	1.72	5			
6F	41.5	1.61	3	69.9	4.02	2	58	2.24	4	71	4.08	3
C	129.0	2.41	2				98	1.83	3			
6-15-79-lF	1.1	0.05	32	1.1	0.05	31	13	0.54	6	12	0.54	6
C	2.5	0.00	100				7	0.01	100			
2F	0.5	0.02	100	0.5	0.03	75	16	0.55	10	17	0.90	7
C	0.4	0.01	100				20	0.35	10			
3F	0.5	0.01	100	0.5	0.02	74	15	0.43	7	15	0.71	7
C	0.4	0.01	100				15	0.28	13			
4F	2.1	0.03	100	0.8	0.03	78	21	0.25	15	16	0.69	6
C	0.3	0.01	100				14	0.44	5			
5F	18.1	0.19	16	7.8	0.25	13	102	1.04	9	53	1.67	6
C	2.9	0.06	22				30	0.63	4			
6F	20.1	0.73	3	17.8	1.00	3	41	1.49	3	35	1.94	3
C	13.7	0.27	9				23	0.46	8			
7F	8.3	0.21	5	5.5	0.32	4	29	0.72	7	20	1.18	5
C	3.4	0.11	8				14	0.46	5			
8F	0.0	0.00	100	0.6	0.04	29	0	0.00	100	8	0.53	4
C	1.6	0.04	29				21	0.53	4			
9F	2.5	0.04	100	1.3	0.06	66	24	0.40	27	15	0.73	15
C	0.7	0.02	37				10	0.33	9			
10F	6.7	0.19	100	5.2	0.24	78	63	1.78	3	54	2.52	2
C	2.9	0.05	21				40	0.73	4			
11F	6.3	0.22	5	4.8	0.26	5	37	1.32	4	38	2.06	3
C	2.0	0.04	15				38	0.75	3			
12F	12.4	0.28	8	12.9	0.59	5	53	1.18	4	64	2.93	2
C	13.4	0.31	7				75	1.74	3			
13F	7.4	0.28	9	8.0	0.38	7	41	1.55	6	41	1.94	5

Appendix J. (Continued.)

LogID	^{137}Cs Bq kg^{-1} fine and coarse	^{137}Cs kBq m^{-2} fine and coarse	% error	^{137}Cs Bq kg^{-1} total sample	^{137}Cs kBq m^{-2} total sample	% error	^{155}Eu Bq kg^{-1} fine and coarse	^{155}Eu kBq m^{-2} fine and coarse	% error	^{155}Eu Bq kg^{-1} total sample	^{155}Eu kBq m^{-2} total sample	% error
C	10.0	0.11	10				37	0.39	4			
14F	12.0	0.10	25	5.6	0.17	16	85	0.72	18	64	1.92	7
C	3.1	0.07	12				55	1.20	3			
15F	7.6	0.15	24	4.4	0.18	21	48	0.95	11	42	1.74	6
C	1.4	0.03	26				37	0.79	3			
16F	19.5	0.19	18	10.0	0.30	13	218	2.13	7	169	5.15	3
C	5.5	0.11	15				146	3.02	3			
17F	32.2	0.04	100	3.0	0.06	79	100	0.14	100	48	0.96	15
C	0.8	0.01	100				44	0.82	5			
18F	15.4	0.12	24	6.3	0.16	20	271	2.08	9	138	3.59	6
C	2.5	0.05	33				83	1.51	5			
6-16-79-7F	290.5	4.77	2	155.5	5.87	2	1441	23.66	2	841	31.70	2
C	51.5	1.10	2				378	8.05	4			
9F	763.0	27.97	1	744.8	28.20	1	922	33.81	3	925	35.02	3
C	191.9	0.23	3				1007	1.21	3			
10F	121.0	4.87	1	122.1	5.10	1	441	17.73	2	438	18.28	2
C	151.6	0.23	3				354	0.54	3			
11F	133.0	2.65	3	80.8	3.15	3	575	11.48	4	401	15.62	3
C	25.9	0.49	5				218	4.14	2			
12F	281.9	3.13	2	110.9	4.07	2	1225	13.61	4	545	19.98	3
C	36.7	0.94	4				249	6.37	3			
13F	47.4	0.37	16	21.6	0.67	10	343	2.70	5	220	6.86	3
C	12.9	0.30	9				179	4.16	3			
14F	114.1	0.67	8	39.0	0.80	7	592	3.50	5	252	5.15	3
C	8.5	0.12	11				114	1.65	2			
15F	0.0	0.00	100	9.1	0.17	13	0	0.00	100	216	3.97	3
C	9.6	0.17	13				226	3.97	3			
16F	75.6	0.18	14	19.7	0.37	9	364	0.89	7	194	3.63	3
C	11.4	0.19	10				169	2.74	3			
17F	20.0	0.04	100	5.7	0.10	38	386	0.70	12	268	4.71	2
C	4.1	0.06	21				254	4.02	2			
18F	124.4	0.14	20	18.2	0.36	10	1405	1.64	7	583	11.41	2
C	11.5	0.21	9				531	9.78	2			
19F	82.2	1.41	5	53.5	1.79	4	1154	19.75	3	806	26.97	2
C	23.3	0.38	5				442	7.22	4			
20F	168.1	0.33	9	32.6	0.58	6	1669	3.31	3	634	11.26	4
C	15.6	0.25	9				504	7.95	5			
21F	163.6	0.37	9	31.1	0.62	6	923	2.07	4	399	7.97	2
C	14.3	0.25	8				333	5.90	2			
22F	141.3	3.97	2	97.4	4.53	2	1596	44.87	2	1170	54.43	2
C	30.3	0.56	4				520	9.56	2			
23F	121.1	3.51	2	88.4	3.72	2	1581	45.83	2	1209	50.94	2
C	16.3	0.21	3				389	5.11	2			
6-17-79-2F	1.6	0.03	100	0.9	0.05	80	6	0.13	100	5	0.26	49
C	0.4	0.01	100				4	0.13	13			

Appendix J. (Continued.)

LogID	^{137}Cs Bq kg^{-1} fine and coarse	^{137}Cs kBq m^{-2} fine and coarse	% error	^{137}Cs Bq kg^{-1} total sample	^{137}Cs kBq m^{-2} total sample	% error	^{155}Eu Bq kg^{-1} fine and coarse	^{155}Eu kBq m^{-2} fine and coarse	% error	^{155}Eu Bq kg^{-1} total sample	^{155}Eu kBq m^{-2} total sample	% error
3F	0.4	0.00	100	0.9	0.04	28	37	0.18	100	15	0.65	27
C	0.9	0.04	29				12	0.48	7			
4F	2.0	0.02	100	0.7	0.03	76	8	0.09	100	9	0.39	25
C	0.3	0.01	100				9	0.29	9			
5F	1.0	0.03	35	0.7	0.04	36	9	0.27	8	9	0.50	7
C	0.3	0.01	100				9	0.23	11			
6F	2.1	0.08	20	1.7	0.09	21	15	0.56	7	13	0.70	6
C	0.7	0.01	100				10	0.14	13			
7F	97.1	1.01	4	46.4	1.11	4	165	1.72	7	103	2.47	5
C	7.4	0.10	10				55	0.75	6			
8F	75.1	0.53	9	42.8	0.84	6	182	1.29	7	77	1.50	6
C	24.4	0.30	5				17	0.21	10			

Appendix K

Concentrations of Other Radionuclides Found above Detection Limits in Some Fine and Coarse Fractions of Surface (0–4 cm) Sediment Samples from Bikini Lagoon during April through June 1979

Appendix K. Concentrations of other radionuclides found above detection limits in some fine and coarse fractions of surface (0–4 cm) sediment samples from Bikini Lagoon during April throughJune 1979.

LogID	^{152}Eu Bq kg^{-1}	% error	^{154}Eu Bq kg^{-1}	% error	^{125}Sb Bq kg^{-1}	% error	^{40}K Bq kg^{-1}	% error	^{102m}Rh Bq kg^{-1}	% error
4-22-79-3F							25.2	33		
C										
4F										
C										
5F										
C										
10F										
C										
11F										
C										
12F										
C										
13F										
C										
4-23-79-1F										
C										
2F										
C										
3F							20.7	40		
C										
4-24-79-1F							24.1	26		
C										
2Fa										
C							15.6	28		
2Fb							82.6	30		
C										
3Fa										
C										
3Fb										
C										
4F										
C										
5F										
C	5.3	22							1.3	35
6F										
C										
7F										
C									1.9	38
8F							18.9	24	1.9	14
C									1.3	24
10F	1.1	39					13.0	29	5.1	5
C									2.8	22
11F							10.7	37	4.8	9
C									3.1	15

Appendix K. (Continued.)

LogID	^{152}Eu Bq kg^{-1}	% error	^{154}Eu Bq kg^{-1}	% error	^{125}Sb Bq kg^{-1}	% error	^{40}K Bq kg^{-1}	% error	^{102m}Rh Bq kg^{-1}	% error
12F	2.6	21	1.3	43	3.9	27	10.7	31	5.5	7
C									2.6	30
13F										
C										
15F	3.9	49	3.8	41	17.1	18			5.6	23
C	4.1	21	3.6	430	3.4	29				
15bF	6.4	32			15.9	30			6.7	22
C										
17F	3.2	41			20.7	12			10.7	9
C										
4-25-79-2F										
C										
3F										
C	2.3	22							1.4	16
4F									2.9	16
C									1.7	20
5F									1.7	19
C									1.1	37
6F	3.9	17							9.3	5
C	5.2	19							4.8	15
6-15-79-lF							16.7	34		
C										
2F										
C										
3F										
C							19.3	42		
4F										
C										
5F										
C									2.0	32
6F									3.9	9
C									2.7	24
7F							13.3	34	2.6	14
C									1.1	33
8F										
C									1.5	22
9F										
C									0.7	24
10F									2.6	16
C									1.6	30
11F							14.4	33	2.1	12
C									1.2	25
12F										
C									3.9	14
13F	1.8	61							1.4	31

Appendix K. (Continued.)

LogID	^{152}Eu Bq kg^{-1}	% error	^{154}Eu Bq kg^{-1}	% error	^{125}Sb Bq kg^{-1}	% error	^{40}K Bq kg^{-1}	% error	^{102m}Rh Bq kg^{-1}	% error
C										
14F										
C										
15F										
C										
16F										
C										
17F										
C										
18F										
C										
6-16-79-7F	8.8	21			12.1	32			4.4	31
C					5.7	27			2.3	23
9F	7.2	31			19.5	21			4.2	25
C	15.4	35			19.0	32	171.9	39		
10F	4.3	18	2.7	31	4.7	25	18.1	21	5.6	9
C										
11F							61.9	43		
C							433.3	4		
12F										
C									1.7	23
13F										
C									2.2	34
14F										
C										
15F										
C										
16F										
C										
17F										
C										
18F										
C										
19F										
C										
20F										
C										
21F										
C										
22F	3.9	22							10.3	14
C										
23F							26.7	28	10.0	9
C									2.9	13
6-17-79-2F										
C										

Appendix K. (Continued.)

LogID	^{152}Eu Bq kg^{-1}	% error	^{154}Eu Bq kg^{-1}	% error	^{125}Sb Bq kg^{-1}	% error	^{40}K Bq kg^{-1}	% error	^{102m}Rh Bq kg^{-1}	% error
3F										
C										
4F										
C										
5F							24.1	17		
C										
6F									2.2	17
C										
7F	16.9	24							84.4	6
C	4.8	16							40.9	2
8F	34.7	37							91.3	10
C									2.3	25

F=fines; C=coarse fractions.
No entry indicates the concentration for the specific radionuclide was below detection limits.

Technical Information Department · Lawrence Livermore National Laboratory
University of California · Livermore, California 94551