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RADIOACTIVITY SURVEY DATA in Japan

Part 2
I . Dietary Materials
II . Human(Teeth)

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National Institute of Radiological Sciences
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Contents

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I. Environmental and Dietary Materials*

(Japan Chemical Analysis Center)

1. Collection and pretreatment of samples

(1) Rain and dry fallout

Rain and dry fallout was collected monthly on asampling tray, approximately 5000 cm^2 in area, which was filled with water to a depth of 1 cm at the beginning of every month.

Strontium and cesium carrier solutions were added after the sample was filtered. The tray was washed with 5 ℓ of distilled water and the washing was combined to the filtrate.

The sample was passed through a cation exchange column (500 mℓ of Dowex 50W X8, 50～100 mesh, Na form)at a rate flow of 80 mℓ/min.

(2) Airborne dust

Airborne dust was collected by an electrostatic precipitator or a filter air sampler for every threemonths at a rate of more than 3000 m^3 per month. The sampling was done 1 to 1.5 meters above the ground.

(3) Service water and freshwater

Service water, 100 ℓ each, was collected at the intake of the water-treatment plant and at the tap after water was left running for five minutes. Strontium andcesium carriers were added to the filtered water sample. The subsequent process was the same as that describedin the section (1). Freshwater was treated inthe same way as the service water.

(4) Soil

Soil was collected from the location in the spacious and flat area without past surface disturbance caused by duststorms, inflow and out flow due to precipitation, etc.. Any places located under trees in a forest, in astony area or inside of river banks were avoided. Soil was taken from two layers of different depths, 0-5cm and 5-20cm. The soil lumps were crushed by hands and driedin a drying oven regulated 105℃. The soil was then passed through a 2 mm sieve to remove plant roots and pebbles.

(5) Sea water

Sea water was collected at the fixed stations where the effect of terrestrial fresh water from rivers was expected to be negligibly small. A special consideration was also given to weather conditions. The sampling was carried out when there was no rainfall for the last few days. To prevent contamination, water samples were collected at the bow of a sampling boat just before she stood still by scooping surface water using a polyethylene bucket. Immediately after the collection, the samples were acidified to a pH lower than 3 by adding concentrated hydrochloric acid in a ratio of 1mℓ to 1ℓ of sea water, and then stored in 20 ℓ polyethylene containers. The sampling equipments as well as containers were thoroughly rinsed with dilute hydrochloric acid and then with distilled water before use. Two hundred milliliters of sea water was also collected at the same stations for the determination of chlorinity.

(6) Sea sediments

Sediment was collected in the same area as that for the sea water sample, taking the following criteria into account:

a. The depth of water exceeds 1 m at low tide.
b. No significant sedimental movement is observed in the vicinity of concern.
c. Mud, silt and fine sand are preferable.

A conventional sediment sampling device was used for collecting the top few centimeters of surface sediment. Approximately 4kg of the sample in wet weight was spread on a stainless steel dish after removed of the pebbles, shells and other foreign materials, and dried in a drying oven regulated at 105℃.

(7) Total diet

A full one day ordinary diet including three meals, water, tea and otherin-between snacks for five persons was collected as a sample of "total diet".
The sample in a large stainless steel pan was carbonized carefully by direct application of gas flame, and was transfered to a porcelain dish and then ashed at 450℃ in an electric muffle furnace.

(8) Rice

Polished rice was collected in producing districts at the harvest and in consuming areas when new crops were first put on sale. The sample was carbonized and ashed in a porcelain dish.

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* Samples were sent to the Center from 46 contracted prefectures.

(9) Milk

Raw milk was collected in producing districts and commercial milk was purchased in consuming districts. Milk in a stainless steel pan or a porcelain dish was evaporated to dryness followed by carbonization and ashing.

(10) Vegetables

Spinach and Japanese radish were selected as the representatives for left vegetables and for non-starch roots, respectively. After removing soil, the edible part of vegetable sample was dried and carbonized in a stainless steel pan or a porcelain dish.

(11) Tea

Five hundred grams of manufactured green tea was collected, carbonized and ashed in a stainless steel pan or a porcelain dish.

(12) Fish, shellfish and seaweeds

a. Sea fish and freshwater fish

Fish was rinsed with water and blotted with a filter paper. Only the edible part was used in case of larger sized fish, and the whole part was used in case of smaller ones. Each sample was weighed and placed in a stainless steel pan or a porcelain dish. After carbonized, the sample was ashed in an electric muffle furnace.

b. Shellfish

Approximately 4 kg of shellfish including the shells was collected or purchased. After removing the shells, it was treated in the same way as that for the sea fish.

c. Seaweeds

Edible seaweeds were collected and rinsed with water to remove sand and other adhering matters on the surface. These were removed of excess water, weighed dried and ashed.

Table 1 shows detailes of sample collection.

Table 1 Details of sample collection

Sample	Frequency of sampling	Quantity of sample
=Environmental materials=		
(1) Rain and dry fallout		
1. For domestic program	monthly	
2. For WHO program	monthly	
(2) Airborne dust	quarterly	>3000 m^3/month
(3) Service water and freshwater		
1. Service water (source water)	semiyearly	100 ℓ
2. Service water (tap water)	semiyearly	100 ℓ
3. Freshwater	yearly (fishing season)	100 ℓ
(4) Soil		
1. 0～ 5 cm	yearly	4 kg
2. 5～ 20cm	yearly	4 kg
(5) Sea water	yearly	40 ℓ
(6) Sea sediments	yearly	4 kg
=Dietary materials=		
(7) Total diet	semiyearly	daily amount for 5 persons
(8) Rice		
1. Producing districts	yearly (harvesting season)	5 kg (polished rice)
2. Consuming districts	yaerly (harvesting season)	5 kg (polished rice)
(9) Milk		
1. Producing districts for WHO program	quarterly (February, May, August and November)	3 ℓ
2. Producing districts for domestic program	semiyearly (February and August)	3 ℓ

Sample	Frequency of sampling	Quantity of sample
3. Consuming districts	semiyearly (February and August)	3 ℓ
4. Powdered milk	semiyearly (April and October)	2～ 3 kg
(10) Vegetables		
1. Producing districts	yearly (harvesting season)	4 kg
2. Consuming districts	yearly (harvesting season)	4 kg
(11) Tea	yearly (the first harvesting season)	500g (manufactured tea)
(12) Fish, shellfish and seaweeds		
1. Sea fish	yearly (fishing season)	4 kg
2. Freshwater fish	yearly (fishing season)	4 kg
3. Shellfish	yearly (fishing season)	4 kg
4. Seaweeds	yearly (fishing season)	2～ 3 kg

2. Preparation of samples for analysis

(1) Rain, service water and freshwater

Strontium and cesium were eluted with hydrochloric acid from the cation exchange column. The residue of rain sample on the filter paper was ashed in an electric muffle furnace and the ash was dissolved in hydrochloric acid. The insoluble part was filtered and washed. The filtrate and the washings were combined to the previous eluate and used for radiochemical analysis.

(2) Soil and Sea sediment

Dried soil was crushed to smaller ones than 0.25 mm in size by a crusher. The sieved sample was ashed in an electric muffle furnace regulated at 450℃. The sample was then heated with hydrochloric acid, strontium and cesium carrier solutions and the mixture washeated. The insoluble constituent was filtered off and washed with water.

The dried sample was crushed to smaller ones than 0.25 mm by a crushing machine. The further preparation of the sample was the same as that described in the section 2-(2).

(3) Rice

The ashed sample was pulverized with a porcelain mortar and passed through a 0.35 mm sieve. The sievedsample to which both strontium and cesium carriers were added, was digested with nitric acid by heating. After the sample was heated again with nitric acid to dryness, strontium and cesium were extracted with hydrochloric acid and water. The insoluble constituent was filtered and washed. The filtrate and washings were combined for subsequent radiochemical analysis.

(4) Airborne dust, diet, milk, vegetables, fish and shellfish, seaweeds, tea and others

These ashed samples were treated with the same procedure as that described in the section 2-(4).

3. Separation of strontium-90 and cesium-137

(1) Strontium-90

Sample solutions, prepared as in the foregoing sections 2-(1) through 2-(4), were neutralized with sodium hydroxide. After sodium carbonate was added, the precipitate of strontium and calcium carbonates was separated. The supernatant solution was retainedfor cesium-137 determination. The carbonates weredissolved in hydrochloric acid and strontium and calcium were precipitated as oxalates. The precipitate was dissolved in nitric acid and strontium was separated from calcium by successive fuming nitric acid separation. Iron scavenge was made after addition of ferric iron carrier followed by barium chromate separation after addition of barium carrier to remove radium, its daughters and lead. Strontium was recovered as carbonate, and the precipitate was dried and weighed to determine strontium recovery. The strontium carbonate was dissolved in hydrochloric acid and iron carrier was added. The solution was allowed to stand for two weeks for strontium-90 and yttrium-90 to attain equilibrium. Yttrium-90 was coprecipitated with ferric hydroxide and the precipitate was filtered off, washed and counted.

(2) Cesium-137

The supernatant separated from the strontium fraction was acidified with hydrochloric acid. While stirring, cesium was adsorbed on the ammonium molybdophosphate added.

After filtered off and washed with hydrochlotric acid the precipitate was dissolved in 2.5 N sodium hydroxide solution. The solution was adjusted to pH 8.2 with hydrochloric acid and allowed to cool. Resultant molybdenum hydroxide which separated out in the solution, was filtered off and washed with water. EDTA was added to the filtrate and washings. Cesium and rubidium were adsorbed on a cation exchange column and cesiumwas separated from rubidium by eluting with hydrochloric acid.

The eluate was evaporated to dryness and was dissolved. The solution was filtered. Chloroplatinic acid was added to precipitate cesium. The precipitate was filtered onto a tared paper using a demountable filter and washed with water and then ethanol. After drying, the chemical yield of cesium was determined by weighing the precipitate. Cesium-137 radioactivity was measured for this precipitate.

4. Determination of stable strontium, calcium and potassium

A weighed amount of soil or sea sediment was heated in a electric muffle furnace at 450 ℃ and then treated with hydrochloric acid for extraction. A weighed aliquot of ashed samples of total diet, vegetables, milk, fish, shellfish or seaweeds was digested with hydrofluoric acid and nitric acid.
The extract was made up to an appropriate volume with dilute hydrochloric acid. The sample solution was analyzed for calcium by titration with standard potassium permanganate solution after separating calcium as oxalate. Atomic absorption spectroscopy was applied when appropriate. Stable strontium andpotassium were determined by atomic absorption andflame emission spectrometry, respectively.

5. Counting

After the radiochemical separation the mounted precipitates were counted for activity using low background beta counters normally for 60 to 90 min.
Net sample counting rates were corrected for counter efficiency, recovery, self-absorption and decay to obtain the content of strontium-90 and cesium-137 per sample aliquot. From the results, concentrations of these nuclides in the original samples were calculated.

6. Results

(1) Strontium-90 and Cesium-137 in Total Diet
(from Jun. 1991 to Aug. 1991)

-continued from No. 97 of this publication-

Table (1): Strontium-90 and Cesium-137 in Total Diet

Location	Ash	Ca	K	^{90}Sr		^{137}Cs	
	(g/p·d)	(mg/p·d)	(mg/p·d)	(Bq/p·d)	(Bq/gCa)	(Bq/p·d)	(Bq/gK)
June, 1991							
Sapporo, HOKKAIDO	18.8	560	2860	0.15 ±0.014	0.26 ±0.025	0.18 ±0.012	0.061 ±0.0043
Iwanai-machi, HOKKAIDO	16.9	446	2150	0.073 ±0.010	0.16 ±0.022	0.18 ±0.012	0.085 ±0.0055
Morioka, IWATE	16.0	462	2130	0.073 ±0.0098	0.16 ±0.021	0.077±0.0081	0.036 ±0.0038
Iwaizumi-machi, IWATE	16.9	514	2080	0.089 ±0.011	0.17 ±0.021	0.046±0.0066	0.022 ±0.0032
Yamagata, YAMAGATA	14.4	464	1860	0.057 ±0.011	0.12 ±0.024	0.041±0.0070	0.022 ±0.0038
Sagae, YAMAGATA	12.2	218	1310	0.060 ±0.011	0.27 ±0.049	0.026±0.0052	0.020 ±0.0040
Fukushima, FUKUSHIMA	16.8	696	1880	0.086 ±0.017	0.12 ±0.025	0.055±0.0085	0.029 ±0.0045
Ookuma-machi, FUKUSHIMA	14.5	602	1650	0.056 ±0.014	0.094±0.023	0.13 ±0.011	0.081 ±0.0066
Mito, IBARAKI	17.0	512	1730	0.050 ±0.0089	0.098±0.017	0.044±0.0072	0.025 ±0.0042
Tokai-mura, IBARAKI	15.2	699	1950	0.052 ±0.011	0.074±0.015	0.050±0.0085	0.025 ±0.0044
Shinjuku, TOKYO	11.8	337	1320	0.052 ±0.0092	0.15 ±0.027	0.059±0.0071	0.045 ±0.0054
Hachijo-machi, TOKYO	12.6	352	1590	0.057 ±0.0097	0.16 ±0.028	0.048±0.0071	0.030 ±0.0045
Yokohama, KANAGAWA	11.7	338	1510	0.026 ±0.0071	0.078±0.021	0.070±0.0077	0.046 ±0.0051
Hiratsuka, KANAGAWA	16.9	439	2210	0.052 ±0.0086	0.12 ±0.020	0.059±0.0076	0.027 ±0.0034
Utsunomiya, TOCHIGI	11.3	400	1600	0.049 ±0.0058	0.12 ±0.014	0.029±0.0057	0.018 ±0.0036
Maoka, TOCHIGI	16.8	623	2120	0.044 ±0.0088	0.070±0.014	0.073±0.0080	0.035 ±0.0038
Kashiwazaki, NIIGATA	19.3	425	2220	0.091 ±0.012	0.21 ±0.028	0.068±0.0082	0.030 ±0.0037
Nishikawa-machi, NIIGATA	21.8	761	2790	0.056 ±0.012	0.073±0.016	0.051±0.0079	0.018 ±0.0028
Toyama, TOYAMA	10.4	461	1540	0.042 ±0.0093	0.092±0.020	0.044±0.0060	0.029 ±0.0039
Takaoka, TOYAMA	15.6	471	1930	0.038 ±0.013	0.081±0.028	0.048±0.0084	0.025 ±0.0043
Nagano, NAGANO	16.4	499	2250	0.071 ±0.0077	0.14 ±0.015	0.28 ±0.016	0.13 ±0.007
Sanada-machi, NAGANO	15.8	455	1830	0.056 ±0.0069	0.12 ±0.015	0.040±0.0074	0.022 ±0.0040
Koufu, YAMANASHI	15.4	453	1800	0.0078±0.0095	0.017±0.021	0.036±0.0067	0.020 ±0.0037
Nagasaka-machi, YAMANASHI	18.1	639	1780	0.020 ±0.0089	0.032±0.014	0.070±0.0080	0.039 ±0.0045
Shizuoka, SHIZUOKA	16.5	688	2330	0.064 ±0.010	0.093±0.015	0.062±0.0074	0.027 ±0.0032
Hamaoka-machi, SHIZUOKA	12.5	526	1860	0.037 ±0.0094	0.071±0.018	0.038±0.0061	0.021 ±0.0033
Gifu, GIFU	12.7	361	1890	0.061 ±0.013	0.17 ±0.035	0.031±0.0059	0.016 ±0.0031
Nagoya, AICHI	15.7	518	1950	0.040 ±0.0094	0.076±0.018	0.060±0.0073	0.031 ±0.0038
Shinshiro, AICHI	15.1	699	1750	0.082 ±0.011	0.12 ±0.016	0.058±0.0069	0.033 ±0.0040
Tsu, MIE	12.4	322	1590	0.037 ±0.0095	0.11 ±0.030	0.028±0.0053	0.018 ±0.0033
Owase, MIE	11.4	272	1550	0.045 ±0.0093	0.17 ±0.034	0.045±0.0061	0.029 ±0.0039
Osaka, OSAKA	18.3	668	2490	0.066 ±0.012	0.099±0.018	0.11 ±0.010	0.045 ±0.0041

Location	Ash	Ca	K	^{90}Sr		^{137}Cs	
	(g/p·d)	(mg/p·d)	(mg/p·d)	(Bq/p·d)	(Bq/gCa)	(Bq/p·d)	(Bq/gK)
Neyagawa, OSAKA	14.8	604	2030	0.065 ±0.010	0.11 ±0.017	0.053±0.0080	0.026 ±0.0039
Hamasaka-machi, HYOGO	13.9	591	1850	0.052 ±0.011	0.087±0.018	0.044±0.0067	0.024 ±0.0036
Kakogawa, HYOGO	13.6	585	1810	0.084 ±0.011	0.14 ±0.019	0.057±0.0095	0.031 ±0.0053
Kashihara, NARA	12.9	646	1470	0.050 ±0.010	0.077±0.016	0.032±0.0059	0.022 ±0.0040
Gojou, NARA	14.7	838	1910	0.081 ±0.0072	0.097±0.0086	0.039±0.0070	0.020 ±0.0037
Tottori, TOTTORI	12.5	414	1350	0.082 ±0.0070	0.20 ±0.017	0.028±0.0058	0.021 ±0.0043
Fukube-mura, TOTTORI	12.9	528	1700	0.076 ±0.0068	0.14 ±0.013	0.049±0.0074	0.029 ±0.0043
Matsue, SHIMANE	24.4	1040	3490	0.094 ±0.012	0.090±0.012	0.080±0.0092	0.023 ±0.0026
Kashima-machi, SHIMANE	16.0	882	2060	0.078 ±0.012	0.088±0.014	0.071±0.0088	0.034 ±0.0042
Okayama, OKAYAMA	17.4	531	2420	0.053 ±0.0073	0.10 ±0.014	0.051±0.0084	0.021 ±0.0035
Kamisaibara-mura, OKAYAMA	12.7	376	1730	0.10 ±0.008	0.27 ±0.022	0.15 ±0.012	0.085 ±0.0067
Miyoshi, HIROSHIMA	12.5	789	1580	0.040 ±0.010	0.051±0.013	0.041±0.0066	0.026 ±0.0042
Hiroshima, HIROSHIMA	14.0	693	1550	0.022 ±0.0093	0.031±0.013	0.033±0.0063	0.021 ±0.0041
Yamaguchi, YAMAGUCHI	13.6	462	1710	0.059 ±0.0094	0.13 ±0.020	0.046±0.0069	0.027 ±0.0040
Ajisu-machi, YAMAGUCHI	15.2	389	2080	0.045 ±0.0098	0.11 ±0.025	0.066±0.0082	0.032 ±0.0040
Matsuyama, EHIME	9.99	408	1250	0.037 ±0.011	0.090±0.028	0.032±0.0064	0.025 ±0.0051
Ikata-machi, EHIME	8.67	251	971	0.039 ±0.0099	0.16 ±0.040	0.011±0.0044	0.011 ±0.0045
Tokushima, TOKUSHIMA	15.0	564	1880	0.070 ±0.011	0.12 ±0.019	0.017±0.0064	0.0092±0.0034
Takamatsu, KAGAWA	14.7	531	2000	0.094 ±0.015	0.18 ±0.028	0.057±0.0084	0.029 ±0.0042
Tsuda-machi, KAGAWA	14.3	556	1730	0.052 ±0.013	0.094±0.023	0.025±0.0066	0.015 ±0.0038
Kouchi, KOUCHI	12.4	536	1690	0.064 ±0.0095	0.12 ±0.018	0.043±0.0084	0.026 ±0.0050
Saga-machi, KOUCHI	12.9	308	1630	0.14 ±0.013	0.45 ±0.041	0.050±0.0090	0.031 ±0.0055
Fukuoka, FUKUOKA	9.55	253	974	0.027 ±0.0052	0.11 ±0.020	0.023±0.0058	0.024 ±0.0060
Dazaifu, FUKUOKA	16.4	515	2230	0.069 ±0.0077	0.13 ±0.015	0.024±0.0080	0.011 ±0.0036
Genkai-machi, SAGA	22.3	917	2230	0.072 ±0.011	0.079±0.013	0.041±0.011	0.019 ±0.0049
Saga, SAGA	13.0	386	1690	0.054 ±0.0092	0.14 ±0.024	0.028±0.0078	0.017 ±0.0046
Nagasaki, NAGASAKI	14.9	580	1730	0.044 ±0.0061	0.076±0.011	0.053±0.0077	0.031 ±0.0045
Matsuura, NAGASAKI	12.8	275	1520	0.052 ±0.0062	0.19 ±0.022	0.033±0.0059	0.021 ±0.0039
Kumamoto, KUMAMOTO	10.8	254	1580	0.027 ±0.0069	0.10 ±0.027	0.032±0.0070	0.020 ±0.0044
Aso-machi, KUMAMOTO	19.1	691	1990	0.12 ±0.013	0.18 ±0.019	0.13 ±0.012	0.064 ±0.0061
Miyazaki, MIYAZAKI	15.7	523	2030	0.034 ±0.0063	0.064±0.012	0.10 ±0.011	0.051 ±0.0052
Takahara-machi, MIYAZAKI	21.4	713	3040	0.074 ±0.0082	0.10 ±0.011	0.15 ±0.013	0.049 ±0.0041
Ookuchi, KAGOSHIMA	11.7	332	1220	0.033 ±0.0073	0.10 ±0.022	0.032±0.0054	0.026 ±0.0044
Sendai, KAGOSHIMA	13.7	301	1620	0.067 ±0.011	0.22 ±0.037	0.060±0.0078	0.037 ±0.0048
Naha, OKINAWA	12.8	385	1740	0.044 ±0.0059	0.11 ±0.015	0.053±0.0074	0.031 ±0.0042
Ginowan, OKINAWA	13.7	482	2180	0.034 ±0.0056	0.071±0.012	0.044±0.0076	0.020 ±0.0035
July, 1991							
Ishinomaki, MIYAGI	12.6	417	1500	0.056 ±0.012	0.13 ±0.028	0.023±0.0053	0.015 ±0.0036
Onagawa-machi, MIYAGI	15.3	979	1760	0.048 ±0.013	0.049±0.013	0.059±0.0083	0.034 ±0.0047
Fukui, FUKUI	15.6	768	2060	0.021 ±0.010	0.028±0.013	0.039±0.0070	0.019 ±0.0034

Location	Ash	Ca	K	^{90}Sr		^{137}Cs	
	(g/p·d)	(mg/p·d)	(mg/p·d)	(Bq/p·d)	(Bq/gCa)	(Bq/p·d)	(Bq/gK)
Tsuruga, FUKUI	15.6	1250	1590	0.037 ±0.011	0.030±0.0086	0.064±0.0082	0.040 ±0.0052
Kakogawa, HYOGO	13.6	585	1810	0.084 ±0.011	0.14 ±0.019	0.057±0.0095	0.031 ±0.0053
August, 1991							
Hiroshima, HIROSHIMA	14.0	693	1550	0.022 ±0.0093	0.031±0.013	0.033±0.0063	0.021 ±0.0041

(2)-1 Strontium-90 and Cesium-137 in Rice(producing districts)
(from Aug. 1991 to Nov. 1991)

-continued from No. 97 of this publication-

Table (2)-1: Strontium-90 and Cesium-137 in Rice

Location	Component			^{90}Sr		^{137}Cs	
	Ash(%)	Ca(g/kg)	K(g/kg)	Bq/kgwet	Bq/gCa	Bq/kgwet	Bq/gK
August,1991							
Sadowara-machi, MIYAZAKI	0.517	0.037	0.941	0.0087±0.0031	0.23 ±0.084	0.0000±0.0052	0.0000±0.0056
September, 1991							
Toyoshina-machi, NAGANO	0.583	0.041	0.781	0.0049±0.0032	0.12 ±0.078	0.0035±0.0058	0.0044±0.0074
Matsusaka, MIE	0.575	0.040	0.937	0.012 ±0.0037	0.30 ±0.092	0.0049±0.0060	0.0052±0.0064
October, 1991							
Mito, IBARAKI	0.680	0.044	0.700	0.0094±0.0052	0.21 ±0.12	0.047 ±0.0090	0.067 ±0.013
Kosugi-machi, TOYAMA	0.608	0.040	0.766	0.013 ±0.0036	0.33 ±0.088	0.0056±0.0061	0.0073±0.0080
Gifu, GIFU	0.672	0.039	0.948	0.0081±0.0032	0.21 ±0.083	0.012 ±0.0060	0.013 ±0.0064
November, 1991							
Ishikari-machi, HOKKAIDO	0.646	0.034	0.975	0.0018±0.0039	0.05 ±0.12	0.0011±0.0044	0.0011±0.0045
Takisawa-mura, IWATE	0.632	0.036	0.790	0.0016±0.0036	0.04 ±0.10	0.20 ±0.013	0.25 ±0.016
Kasai, HYOGO	0.526	0.041	0.878	0.0038±0.0035	0.094 ±0.087	0.0008±0.0051	0.0009±0.0058

(2)-2 Strontium-90 and Cesium-137 in Rice(consuming districts)
(from Oct. 1991 to Nov. 1991)

-continued from No. 97 of this publication-

Table (2)-2: Strontium-90 and Cesium-137 in Rice

Location	Component			^{90}Sr		^{137}Cs	
	Ash(%)	Ca(g/kg)	K(g/kg)	Bq/kgwet	Bq/gCa	Bq/kgwet	Bq/gK
October, 1991							
Mito, IBARAKI	0.572	0.037	0.738	0.0061±0.0036	0.17 ±0.098	0.0042±0.0064	0.0057±0.0086
Shinjuku, TOKYO	0.478	0.034	0.784	0.0060±0.0033	0.18 ±0.097	0.012 ±0.0078	0.016 ±0.0099
Matsuyama, EHIME	0.523	0.035	0.858	0.0029±0.0033	0.083 ±0.093	0.0043±0.0043	0.0050±0.0050
November, 1991							
Sapporo, HOKKAIDO	0.694	0.041	0.916	0.0021±0.0049	0.05 ±0.12	0.0099±0.0059	0.011 ±0.0065
Fukui, FUKUI	0.501	0.033	0.762	0.010 ±0.0034	0.32 ±0.10	0.019 ±0.0060	0.025 ±0.0079
Osaka, OSAKA	0.626	0.039	0.926	0.0006±0.0042	0.02 ±0.10	0.024 ±0.0072	0.026 ±0.0077
Kobe, HYOGO	0.457	0.037	0.836	0.011 ±0.0033	0.29 ±0.088	0.011 ±0.0042	0.013 ±0.0051

(3)-1 Strontium-90 and Cesium-137 in Milk(producing districts for domestic program)
(from Jun. 1991 to Oct. 1991)

-continued from No. 97 of this publication-

Table (3)-1: Strontium-90 and Cesium-137 in Milk

Location	Component			^{90}Sr		^{137}Cs	
	Ash(g/ℓ)	Ca(g/ℓ)	K(g/ℓ)	Bq/ℓ	Bq/gCa	Bq/ℓ	Bq/gK
June, 1991							
Yamato-machi, SAGA	6.85	1.03	1.55	0.028 ±0.0040	0.027 ±0.0039	0.0091±0.0042	0.0059±0.0027
August, 1991							
Aomori, AOMORI	6.93	1.01	1.53	0.15 ±0.011	0.15 ±0.010	0.086 ±0.0074	0.056 ±0.0049
Takisawa-mura, IWATE	7.37	1.13	1.64	0.027 ±0.0070	0.024 ±0.0062	0.086 ±0.0090	0.052 ±0.0055
Akita, AKITA	6.30	0.939	1.35	0.039 ±0.0067	0.041 ±0.0072	0.058 ±0.0072	0.043 ±0.0053
Mito, IBARAKI	7.55	1.11	1.70	0.039 ±0.0063	0.035 ±0.0057	0.0089±0.0037	0.0052±0.0022
Nishinasuno, TOCHIGI	7.18	1.21	1.53	0.064 ±0.0088	0.053 ±0.0073	0.034 ±0.0071	0.022 ±0.0046
Tonami, TOYAMA	7.46	1.18	1.57	0.025 ±0.0081	0.022 ±0.0068	0.031 ±0.0064	0.020 ±0.0041
Takane-machi, YAMANASHI	6.88	1.04	1.64	0.035 ±0.0080	0.034 ±0.0077	0.026 ±0.0058	0.016 ±0.0036
Kasamatsu-machi, GIFU	6.82	1.07	1.44	0.039 ±0.0080	0.036 ±0.0075	0.037 ±0.0061	0.026 ±0.0043
Oouchiyama-mura, MIE	7.35	1.10	1.69	0.024 ±0.0079	0.022 ±0.0072	0.044 ±0.0050	0.0026±0.0029
Hino-machi, SHIGA	7.12	1.12	1.62	0.023 ±0.0076	0.021 ±0.0068	0.010 ±0.0048	0.0065±0.0030
Mihara-machi, HYOGO	7.06	1.04	1.69	0.020 ±0.0079	0.019 ±0.0075	0.029 ±0.0056	0.017 ±0.0033
Matsuyama, EHIME	6.90	1.03	1.60	0.015 ±0.0067	0.015 ±0.0065	0.0043±0.0032	0.0027±0.0020
Kamiita-machi, TOKUSHIMA	7.68	1.13	1.90	0.039 ±0.0085	0.035 ±0.0076	0.0099±0.0053	0.0052±0.0028
Takasa-machi, KAGAWA	7.65	1.09	1.68	0.028 ±0.0079	0.025 ±0.0072	0.016 ±0.0054	0.0098±0.0032
October, 1991							
Yamato-machi, SAGA	7.34	1.11	1.72	0.031 ±0.0047	0.028 ±0.0043	0.0065±0.0050	0.0038±0.0029

(3)-2 Strontium-90 and Cesium-137 in Milk(producing districts for WHO program)
(from May. 1991 to Jan. 1992)

-continued from No. 97 of this publication-

Table (3)-2: Strontium-90 and Cesium-137 in Milk

Location	Component			^{90}Sr		^{137}Cs	
	Ash(g/ℓ)	Ca(g/ℓ)	K(g/ℓ)	Bq/ℓ	Bq/gCa	Bq/ℓ	Bq/gK
May, 1991							
Hokudainoujou, HOKKAIDO	6.93	1.06	1.50	0.060 ±0.0084	0.056 ±0.0080	0.053 ±0.0063	0.035 ±0.0042
Hachijo-island, TOKYO	7.31	1.02	1.46	0.070 ±0.0057	0.068 ±0.0055	0.15 ±0.011	0.11 ±0.007
Nishikawa-machi, NIIGATA	7.58	1.12	1.66	0.023 ±0.0051	0.021 ±0.0045	0.17 ±0.015	0.10 ±0.009
Katsuyama, FUKUI	7.56	1.20	1.65	0.025 ±0.0040	0.021 ±0.0033	0.024 ±0.0055	0.015 ±0.0033
Nose-machi, OSAKA	7.82	1.13	1.69	0.021 ±0.0039	0.019 ±0.0034	0.024 ±0.0060	0.014 ±0.0036
Hikawa-machi, SHIMANE	7.07	1.00	1.77	0.0098±0.0067	0.0097±0.0067	0.034 ±0.0053	0.019 ±0.0030
Takamiya-machi, HIROSHIMA	7.31	1.07	1.62	0.020 ±0.0040	0.019 ±0.0037	0.013 ±0.0046	0.0080±0.0028
Kochi, KOCHI	7.51	1.15	1.66	0.070 ±0.0057	0.061 ±0.0050	0.033 ±0.0064	0.020 ±0.0038
Yasu-machi, FUKUOKA	7.33	1.10	1.54	0.026 ±0.0042	0.024 ±0.0038	0.012 ±0.0050	0.0080±0.0032
Kajiki-machi, KAGOSHIMA	7.54	1.15	1.64	0.038 ±0.0079	0.033 ±0.0069	0.045 ±0.0064	0.028 ±0.0039
August, 1991							
Hokudainoujou, HOKKAIDO	6.99	1.05	1.59	0.062 ±0.0087	0.059 ±0.0083	0.099 ±0.0080	0.062 ±0.0051
Hachijo-island, TOKYO	7.17	1.03	1.46	0.059 ±0.0085	0.057 ±0.0083	0.072 ±0.0084	0.049 ±0.0058
Nishikawa-machi, NIIGATA	7.33	1.02	1.65	0.032 ±0.0060	0.031 ±0.0059	0.016 ±0.0041	0.0095±0.0025
Katsuyama, FUKUI	7.22	1.18	1.69	0.021 ±0.0075	0.018 ±0.0064	0.030 ±0.0050	0.018 ±0.0029
Nose-machi, OSAKA	7.75	1.13	1.71	0.021 ±0.0075	0.019 ±0.0066	0.0097±0.0041	0.0057±0.0024
Takamiya-machi, HIROSHIMA	6.62	0.993	1.48	0.014 ±0.0069	0.014 ±0.0070	0.011 ±0.0036	0.0072±0.0024
Kochi, KOCHI	6.98	1.01	1.56	0.059 ±0.0085	0.059 ±0.0085	0.035 ±0.0053	0.022 ±0.0034
Yasu-machi, FUKUOKA	7.39	1.08	1.59	0.031 ±0.0047	0.029 ±0.0044	0.028 ±0.0061	0.018 ±0.0038
Kajiki-machi, KAGOSHIMA	7.42	1.12	1.62	0.042 ±0.0079	0.037 ±0.0070	0.047 ±0.0070	0.029 ±0.0043
November, 1991							
Hokudainoujou, HOKKAIDO	7.54	1.19	1.71	0.056 ±0.0084	0.047 ±0.0071	0.14 ±0.011	0.083 ±0.0063
Hachijo-island, TOKYO	7.11	1.00	1.46	0.12 ±0.011	0.12 ±0.011	0.24 ±0.013	0.16 ±0.009
Katsuyama, FUKUI	7.37	1.19	1.67	0.027 ±0.0070	0.023 ±0.0059	0.025 ±0.0060	0.015 ±0.0036
Nose-machi, OSAKA	7.75	1.18	1.68	0.040 ±0.0051	0.034 ±0.0043	0.025 ±0.0057	0.015 ±0.0034
Kochi, KOCHI	7.69	1.18	1.70	0.060 ±0.0059	0.051 ±0.0050	0.018 ±0.0050	0.011 ±0.0029
Yasu-machi, FUKUOKA	7.39	1.12	1.60	0.033 ±0.0079	0.029 ±0.0070	0.010 ±0.0047	0.0064±0.0029
Kajiki-machi, KAGOSHIMA	7.40	1.14	1.61	0.031 ±0.0079	0.027 ±0.0069	0.031 ±0.0060	0.019 ±0.0038
December, 1991							
Takamiya-machi, HIROSHIMA	6.95	1.06	1.52	0.026 ±0.0084	0.024 ±0.0080	0.011 ±0.0045	0.0071±0.0030
January, 1991							
Nose-machi, OSAKA	7.46	1.13	1.69	0.035 ±0.0085	0.031 ±0.0075	0.012 ±0.0054	0.0071±0.0032

(3)-3 Strontium-90 and Cesium-137 in Milk(consuming districts)
(from May. 1991 to Jan. 1992)

-continued from No. 97 of this publication-

Table (3)-3: Strontium-90 and Cesium-137 in Milk

Location	Component			^{90}Sr		^{137}Cs	
	Ash(g/ℓ)	Ca(g/ℓ)	K(g/ℓ)	Bq/ℓ	Bq/gCa	Bq/ℓ	Bq/gK
May, 1991							
Sendai, MIYAGI	7.33	1.12	1.68	0.034 ±0.0045	0.030 ±0.0040	0.017 ±0.0049	0.010 ±0.0029
Kyoto, KYOTO	7.30	1.07	1.62	0.028 ±0.0070	0.026 ±0.0065	0.016 ±0.0053	0.0099±0.0033
July, 1991							
Shinguu, WAKAYAMA	6.67	1.03	1.50	0.016 ±0.0075	0.016 ±0.0073	0.013 ±0.0047	0.0089±0.0032
Yonagusuku-mura, OKINAWA	7.39	1.12	1.63	0.023 ±0.0069	0.020 ±0.0062	0.0073±0.0049	0.0044±0.0030
August, 1991							
Sapporo, HOKKAIDO	7.33	1.13	1.64	0.068 ±0.0087	0.061 ±0.0077	0.10 ±0.010	0.061 ±0.0058
Yamagata, YAMAGATA	6.70	1.02	1.51	0.024 ±0.0063	0.024 ±0.0062	0.067 ±0.0082	0.044 ±0.0054
Shinjuku, TOKYO	7.01	1.01	1.63	0.024 ±0.0073	0.024 ±0.0072	0.024 ±0.0045	0.015 ±0.0028
Yokohama, KANAGAWA	7.19	1.06	1.58	0.030 ±0.0071	0.028 ±0.0066	0.0090±0.0061	0.0057±0.0038
Niigata, NIIGATA	7.66	1.12	1.66	0.047 ±0.0089	0.042 ±0.0080	0.068 ±0.0072	0.041 ±0.0043
Nagano, NAGANO	6.72	1.03	1.49	0.034 ±0.0075	0.033 ±0.0073	0.019 ±0.0052	0.013 ±0.0035
Shizuoka, SHIZUOKA	7.11	1.07	1.61	0.032 ±0.0079	0.029 ±0.0074	0.035 ±0.0068	0.022 ±0.0043
Nagoya, AICHI	7.16	1.10	1.65	0.027 ±0.0078	0.025 ±0.0071	0.048 ±0.0070	0.029 ±0.0042
Osaka, OSAKA	7.13	1.06	1.63	0.051 ±0.0092	0.048 ±0.0087	0.16 ±0.011	0.10 ±0.007
Yonago, TOTTORI	6.89	1.02	1.55	0.020 ±0.0078	0.019 ±0.0077	0.045 ±0.0067	0.029 ±0.0043
Hiroshima, HIROSHIMA	6.32	0.948	1.40	0.021 ±0.0046	0.022 ±0.0048	0.018 ±0.0038	0.013 ±0.0027
Yamaguchi, YAMAGUCHI	7.05	1.04	1.61	0.0077±0.0075	0.0074±0.0072	0.015 ±0.0050	0.0096±0.0031
Matsuyama, EHIME	7.06	1.01	1.52	0.048 ±0.0086	0.047 ±0.0086	0.042 ±0.0056	0.028 ±0.0037
Kochi, KOCHI	7.06	1.06	1.67	0.024 ±0.0074	0.023 ±0.0070	0.0088±0.0048	0.0053±0.0029
Chikushino, FUKUOKA	7.26	1.07	1.65	0.024 ±0.0043	0.023 ±0.0040	0.029 ±0.0060	0.018 ±0.0036
Kagoshima, KAGOSHIMA	7.30	1.10	1.62	0.031 ±0.0074	0.028 ±0.0068	0.10 ±0.009	0.062 ±0.0056
September, 1991							
Fukui, FUKUI	7.23	1.08	1.66	0.023 ±0.0076	0.021 ±0.0071	0.0096±0.0058	0.0058±0.0035
Okayama, OKAYAMA	7.08	1.05	1.54	0.024 ±0.0042	0.023 ±0.0040	0.015 ±0.0055	0.0097±0.0036
November, 1991							
Sendai, MIYAGI	7.26	1.13	1.60	0.0055±0.0058	0.0049±0.0051	0.017 ±0.0061	0.011 ±0.0038
Wakayama, WAKAYAMA	6.35	0.984	1.39	0.025 ±0.0058	0.025 ±0.0059	0.015 ±0.0056	0.011 ±0.0040
January, 1992							
Osaka, OSAKA	7.49	1.16	1.61	0.034 ±0.0090	0.029 ±0.0078	0.021 ±0.0058	0.013 ±0.0036

(3)-4 Strontium-90 and Cesium-137 in Milk(powderd milk)

-continued from No. 97 of this publication-

Table (3)-4: Strontium-90 and Cesium-137 in Milk

Market Milk	Component			^{90}Sr		^{137}Cs	
	Ash(%)	Ca(g/kg)	K(g/kg)	Bq/kgwet	Bq/gCa	Bq/kgwet	Bq/gK
July, 1991							
Sample A	8.06	12.3	19.3	0.47 ±0.024	0.038 ±0.0020	0.62 ±0.026	0.032 ±0.0014
Sample C	7.96	11.9	18.4	0.61 ±0.027	0.051 ±0.0023	2.4 ±0.05	0.13 ±0.003
August, 1991							
Sample B	2.54	3.35	6.27	0.044 ±0.011	0.013 ±0.0033	0.25 ±0.017	0.040 ±0.0027
Sample D	2.52	3.65	6.22	0.054 ±0.012	0.015 ±0.0032	0.071 ±0.010	0.011 ±0.0017
Sample E	2.39	3.30	5.86	0.095 ±0.013	0.029 ±0.0039	0.28 ±0.017	0.047 ±0.0029
Sample F	2.59	3.73	5.57	0.052 ±0.011	0.014 ±0.0031	0.22 ±0.016	0.040 ±0.0028
November, 1991							
Sample C	8.00	12.2	17.2	0.74 ±0.033	0.061 ±0.0027	3.8 ±0.06	0.22 ±0.004
December, 1991							
Sample A	7.97	12.4	17.3	0.48 ±0.024	0.038 ±0.0020	0.54 ±0.024	0.031 ±0.0014
Sample B	2.37	2.56	5.43	0.078 ±0.011	0.031 ±0.0043	0.23 ±0.015	0.043 ±0.0028
Sample D	2.53	3.80	5.67	0.063 ±0.011	0.016 ±0.0030	0.14 ±0.013	0.024 ±0.0023
Sample E	2.35	3.57	5.17	0.12 ±0.013	0.033 ±0.0037	0.26 ±0.016	0.050 ±0.0031
Sample F	2.52	3.63	5.09	0.061 ±0.011	0.017 ±0.0030	0.23 ±0.016	0.045 ±0.0031

*Skim milk

(4)-1 Strontium-90 and Cesium-137 in Vegetables(producing districts)
(from May. 1991 to Nov. 1991)

-continued from No. 97 of this publication-

Table (4)-1: Strontium-90 and Cesium-137 in Vegetables

Location	Component			^{90}Sr		^{137}Cs	
	Ash(%)	Ca(g/kg)	K(g/kg)	Bq/kgwet	Bq/gCa	Bq/kgwet	Bq/gK
(Japanese radish)							
May, 1991							
Tahara-machi, AICHI	0.767	0.209	3.14	0.026 ±0.0077	0.13 ±0.037	0.0000±0.0028	0.00000±0.00090
August, 1991							
Ishikari-machi, HOKKAIDO	0.485	0.146	2.25	0.11 ±0.009	0.75 ±0.061	0.013 ±0.0066	0.0058 ±0.0029
October, 1991							
Tamayama-mura, IWATE	0.607	0.263	2.71	0.073 ±0.0055	0.28 ±0.021	0.011 ±0.0043	0.0041 ±0.0016
November, 1991							
Chiba, CHIBA	0.542	0.301	1.79	0.19 ±0.012	0.63 ±0.040	0.0000±0.0063	0.0000 ±0.0035
Kosugi-machi, TOYAMA	0.400	0.175	1.74	0.026 ±0.0047	0.15 ±0.027	0.0000±0.0047	0.0000 ±0.0027
Kanazu-machi, FUKUI	0.520	0.201	2.32	0.10 ±0.009	0.51 ±0.045	0.0000±0.0077	0.0000 ±0.0033
Saku, NAGANO	0.427	0.190	1.84	0.018 ±0.0050	0.098 ±0.026	0.027 ±0.0070	0.014 ±0.0038
Takane-machi, YAMANASHI	0.595	0.308	2.48	0.13 ±0.010	0.43 ±0.034	0.0047±0.0091	0.0019 ±0.0037
Gotenba, SHIZUOKA	0.681	0.275	2.94	0.13 ±0.008	0.46 ±0.027	0.037 ±0.0068	0.013 ±0.0023
Hamamatsu, SHIZUOKA	0.623	0.213	2.82	0.12 ±0.008	0.57 ±0.036	0.0098±0.0041	0.0035 ±0.0015
(Onion)							
July, 1991							
Kumatori-machi, OSAKA	0.373	0.131	1.35	0.017 ±0.0076	0.13 ±0.058	0.0006±0.0028	0.0005 ±0.0021
(Spinach)							
May, 1991							
Tahara-machi, AICHI	1.53	0.581	6.29	0.041 ±0.011	0.070 ±0.018	0.0005±0.0041	0.00007±0.00066
October, 1991							
Toyama, TOYAMA	1.65	0.851	7.36	0.021 ±0.0043	0.024 ±0.0050	0.0048±0.0056	0.00065±0.00076
Gifu, GUFU	1.56	0.764	6.24	0.052 ±0.0066	0.068 ±0.0087	0.021 ±0.010	0.0034 ±0.0016
November, 1991							
Fukui, FUKUI	1.82	0.604	8.35	0.13 ±0.009	0.21 ±0.015	0.012 ±0.0061	0.0014 ±0.00073
Gotenba, SHIZUOKA	1.73	0.823	6.92	0.059 ±0.0063	0.071 ±0.0077	0.17 ±0.013	0.024 ±0.0019
Kasai, HYOGO	1.75	0.500	7.98	0.18 ±0.010	0.36 ±0.020	0.0083±0.0089	0.0010 ±0.0011
Takamatsu, KAGAWA	1.68	0.815	7.12	0.064 ±0.0069	0.078 ±0.0084	0.0029±0.0050	0.00041±0.00070

Location	Component			^{90}Sr		^{137}Cs	
	Ash(%)	Ca(g/kg)	K(g/kg)	Bq/kgwet	Bq/gCa	Bq/kgwet	Bq/gK
Shime-machi, FUKUOKA	1.96	1.33	8.37	0.056 ±0.0065	0.042 ±0.0049	0.017 ±0.0072	0.0020 ±0.00086
Koushi-machi, KUMAMOTO	2.13	0.560	9.18	0.071 ±0.0081	0.13 ±0.014	0.030 ±0.0081	0.0033 ±0.00088
(Chinese cabbage)							
October, 1991							
Tamayama-mura, IWATE	0.608	0.476	2.46	0.15 ±0.008	0.32 ±0.016	0.022 ±0.0054	0.0089 ±0.0022

(4)-2 Strontium-90 and Cesium-137 in Vegetables(consuming districts)
(from May. 1991 to Nov. 1991)

-continued from No. 97 of this publication-

Table (4)-2: Strontium-90 and Cesium-137 in Vegetables

Location	Component			^{90}Sr		^{137}Cs	
	Ash(%)	Ca(g/kg)	K(g/kg)	Bq/kgwet	Bq/gCa	Bq/kgwet	Bq/gK
(Japanese radish)							
October, 1991							
Akita, AKITA	0.534	0.250	2.38	0.28 ±0.014	1.1 ±0.06	0.018 ±0.0078	0.0077 ±0.0033
Yamagata, YAMAGATA	0.445	0.153	1.99	0.017 ±0.0046	0.11 ±0.030	0.0051±0.0055	0.0025 ±0.0027
November, 1991							
Sendai, MIYAGI	0.584	0.200	2.47	0.050 ±0.0047	0.25 ±0.024	0.0081±0.0039	0.0033 ±0.0016
Saga, SAGA	0.632	0.231	3.00	0.062 ±0.0053	0.27 ±0.023	0.0017±0.0035	0.0006 ±0.0012
(Cabbage)							
October, 1991							
Akita, AKITA	0.255	0.268	0.885	0.26 ±0.009	0.97 ±0.032	0.088 ±0.0072	0.099 ±0.0081
(Spinach)							
May, 1991							
Sendai, MIYAGI	2.06	0.540	9.02	0.046 ±0.012	0.086 ±0.022	0.0010±0.0043	0.00011±0.00047
June, 1991							
Niigata, NIIGATA	1.35	0.883	5.29	0.045 ±0.0096	0.051 ±0.011	0.083 ±0.0090	0.016 ±0.0017
November, 1991							
Shinjuku, TOKYO	2.16	0.672	9.57	0.042 ±0.0067	0.063 ±0.010	0.012 ±0.0079	0.0013 ±0.00083
Osaka, OSAKA	1.75	0.525	7.95	0.18 ±0.010	0.34 ±0.019	0.010 ±0.0078	0.0013 ±0.00099
Saga, SAGA	1.82	0.797	8.01	0.019 ±0.0048	0.023 ±0.0060	0.017 ±0.0071	0.0021 ±0.00089

(5) Strontium-90 and Cesium-137 in Tea(Japanese Tea)
(from May. 1991 to Jun. 1991)

-continued from No. 97 of this publication-

Table (5): Strontium-90 and Cesium-137 in Tea(Japanese Tea)

Location	Component			^{90}Sr		^{137}Cs	
	Ash(%)	Ca(g/kg)	K(g/kg)	Bq/kg	Bq/gCa	Bq/kg	Bq/gK
May, 1991							
Kameyama, MIE	4.93	2.35	18.7	0.77 ±0.053	0.33 ±0.023	0.43 ±0.052	0.023 ±0.0028
Oodai-machi, MIE	5.45	3.22	18.5	1.2 ±0.07	0.37 ±0.021	0.12 ±0.041	0.0066±0.0022
Nara, NARA	5.73	3.02	19.4	0.34 ±0.039	0.11 ±0.013	0.19 ±0.046	0.0098±0.0024
Nara, NARA	6.17	2.43	22.0	0.65 ±0.055	0.27 ±0.022	1.7 ±0.11	0.076 ±0.0048
Mifune-machi, KUMAMOTO	5.33	3.09	18.3	0.29 ±0.039	0.095 ±0.013	0.16 ±0.041	0.0087±0.0023
Ue-mura, KUMAMOTO	5.19	2.61	18.9	1.1 ±0.06	0.41 ±0.025	0.47 ±0.055	0.025 ±0.0029
Kawaminami-machi, MIYAZAKI	5.48	2.29	21.0	0.99 ±0.063	0.43 ±0.028	3.3 ±0.13	0.16 ±0.006
Miyakonojo, MIYAZAKI	4.96	2.86	19.2	0.53 ±0.045	0.19 ±0.016	0.91 ±0.074	0.048 ±0.0038
June, 1991							
Uji, KYOTO	5.38	2.96	20.4	0.57 ±0.050	0.19 ±0.017	0.044 ±0.037	0.0022±0.0018
Kaya-machi, KYOTO	5.04	3.94	16.8	1.0 ±0.06	0.25 ±0.016	0.54 ±0.060	0.032 ±0.0036
Miyanojo-machi, KAGOSHIMA	5.35	2.63	19.0	1.1 ±0.07	0.43 ±0.025	0.72 ±0.067	0.038 ±0.0035
Chiran-machi, KAGOSHIMA	5.70	2.62	20.5	0.49 ±0.049	0.19 ±0.019	2.8 ±0.13	0.14 ±0.006

(6) Strontium-90 and Cesium-137 in Sea Fish
(from Mar. 1991 to Sep. 1991)

-continued from No. 97 of this publication-

Table (6): Strontium-90 and Cesium-137 in Sea Fish

Location	Component			^{90}Sr		^{137}Cs	
	Ash(%)	Ca(g/kg)	K(g/kg)	Bq/kgwet	Bq/gCa	Bq/kgwet	Bq/gK
(Sardinops melanosticta) August, 1991 Yamagata, YAMAGATA	2.91	5.67	2.32	0.0048±0.0034	0.00084±0.00060	0.076 ±0.0093	0.033 ±0.0040
(Sebastiscus marmoratus) April, 1991 Hamada, SHIMANE	5.93	13.9	2.80	0.030 ±0.0050	0.0022 ±0.00036	0.15 ±0.012	0.053 ±0.0044
(Katsuwonus pelamis) May, 1991 Tosa, KOCHI	1.17	0.145	3.65	0.0000±0.0097	0.000 ±0.067	0.32 ±0.017	0.088 ±0.0046
(Limanda herzensteini) July, 1991 Sendai, MIYAGI	2.78	5.98	2.28	0.016 ±0.0046	0.0027 ±0.00077	0.047 ±0.0081	0.021 ±0.0036
(Sillago shihama) June, 1991 Minamichita-machi, AICHI	4.10	9.92	3.78	0.015 ±0.0042	0.0016 ±0.00042	0.13 ±0.012	0.034 ±0.0032
(Scomber japonicus) August, 1991 Matsuyama, EHIME	1.48	0.682	3.98	0.0000±0.0034	0.0000 ±0.0050	0.22 ±0.014	0.055 ±0.0036
(Chrysophrys major) July, 1991 Fukuoka, FUKUOKA	1.55	0.679	4.34	0.011 ±0.0041	0.017 ±0.0060	0.23 ±0.014	0.054 ±0.0033
(Mugil cephalus) September, 1991 Morodomi-machi, SAGA	1.25	0.428	4.01	0.0055±0.0041	0.013 ±0.0095	0.11 ±0.010	0.027 ±0.0026
(Ammodytes, personatus Girard) May, 1991 Akashi, HYOGO	2.33	3.68	3.96	0.0000±0.0073	0.0000 ±0.0020	0.071 ±0.010	0.018 ±0.0026
(Mouth sardine) March, 1991 Kujukuri-machi, CHIBA	3.35	7.53	3.66	0.0043±0.0044	0.00057±0.00058	0.084 ±0.0090	0.023 ±0.0025

Sea Fish

Japanese name	English name	Scientific name
Iwashi	Sardine	Sardinops melanosticta
Kasago	Scorpion-fish	Sebastiscus marmoratus
Katakuchi-iwashi	Anchovy	Mouth sardine
Katsuo	Bonito	Katsuwonus pelamis
Karei	Flatfish	Limanda herzensteini
Kisu	Sillago	Sillago sihama
Saba	Common mackerel	Scomber japonicus
Tai	Sea bream	Chrysophrys major
Bora	Gray mullet	Mugil cephalus
Ikanago	Sando lance	Ammodytes personatus Girard

(7) Strontium-90 and Cesium-137 in Freshwater Fish
(from Jul. 1991 to Sep. 1991)

-continued from No. 97 of this publication-

Table (7): Strontium-90 and Cesium-137 in Freshwater Fish

Location	Component			^{90}Sr				^{137}Cs			
	Ash(%)	Ca(g/kg)	K(g/kg)	Bq/kgwet		Bq/gCa		Bq/kgwet		Bq/gK	
(Cyprinus carpio) September, 1991 Fukushima, FUKUSHIMA	3.85	7.62	2.77	0.85	±0.022	0.11	±0.003	0.13	±0.011	0.047	±0.0041
(Carassius auratus) July, 1991 Barato-lake, HOKKAIDO	5.06	5.57	2.56	0.55	±0.016	0.099	±0.0029	0.14	±0.012	0.053	±0.0046

Freshwater Fish

Japanese name	English name	Scientific name
Koi	Carp	Cyprinus carpio
Funa	A crucian carp	Carassius auratus

(8) Strontium-90 and Cesium-137 in Shellfish
(from May. 1991 to Jun. 1991)

-continued from No. 95 of this publication-

Table (8): Strontium-90 and Cesium-137 in Shellfish

Location	Component			^{90}Sr		^{137}Cs	
	Ash(%)	Ca(g/kg)	K(g/kg)	Bq/kgwet	Bq/gCa	Bq/kgwet	Bq/gK
(Venerupis phillipinarum)							
May, 1991							
Konagai-machi, NAGASAKI	1.79	0.494	2.00	0.013 ±0.0050	0.027 ±0.010	0.027 ±0.0083	0.013 ±0.0041
June, 1991							
Minamichita-machi, AICHI	1.81	0.748	3.26	0.015 ±0.0093	0.020 ±0.012	0.060 ±0.014	0.018 ±0.0044
(Turbo cornutus)							
May, 1991							
Ryotsu, NIIGATA	2.25	0.557	3.48	0.000 ±0.015	0.000 ±0.026	0.010 ±0.023	0.0028±0.0066
June, 1990							
Sakata, YAMAGATA	2.57	1.11	2.75	0.014 ±0.0059	0.013 ±0.0054	0.042 ±0.0096	0.015 ±0.0035

Shellfish

Japanese name	English name	Scientific name
Asari	Short-necked clam	Venerupis phillipinarum
Sazae	Wreath shell	Turbo cornutus

(9) Strontium-90 and Cesium-137 in Seaweeds
(from Apr. 1991 to Jun. 1991)

-continued from No. 97 of this publication-

Table (9): Strontium-90 and Cesium-137 in Seaweeds

Location	Component			^{90}Sr		^{137}Cs	
	Ash(%)	Ca(g/kg)	K(g/kg)	Bq/kgwet	Bq/gCa	Bq/kgwet	Bq/gK
(Undaria pinnatifida)							
April, 1991							
Togi-machi, ISHIKAWA	3.46	0.820	5.61	0.006 ±0.010	0.008 ±0.012	0.040 ±0.011	0.0072±0.0020
May, 1991							
Ryotsu, NIIGATA	3.87	1.06	5.52	0.012 ±0.085	0.011 ±0.0081	0.035 ±0.0092	0.0064±0.0017
June, 1991							
Sakata, YAMAGATA	2.67	1.38	5.79	0.040 ±0.0074	0.029 ±0.0053	0.041 ±0.0092	0.0070±0.0016

Seaweeds

Japanese name	English name	Scientific name
Wakame	Wakame seaweed	Undaria pinnatifida

(10) Others
Strontium-90 and Cesium-137 in Pain needles
(from Jun. 1991)

Location	Component			^{90}Sr		^{137}Cs	
	Ash(%)	Ca(g/kg)	K(g/kg)	Bq/kgwet	Bq/gCa	Bq/kgwet	Bq/gK
June, 1991							
Hamamatsu, SHIZUOKA	1.33	2.01	1.72	12 ±0.1	6.0 ±0.04	0.092 ±0.0094	0.053 ±0.0055
Numazu, SHIZUOKA	1.29	1.87	1.83	2.1 ±0.04	1.1 ±0.02	0.15 ±0.014	0.081 ±0.0074

* * * Total Diet * * *

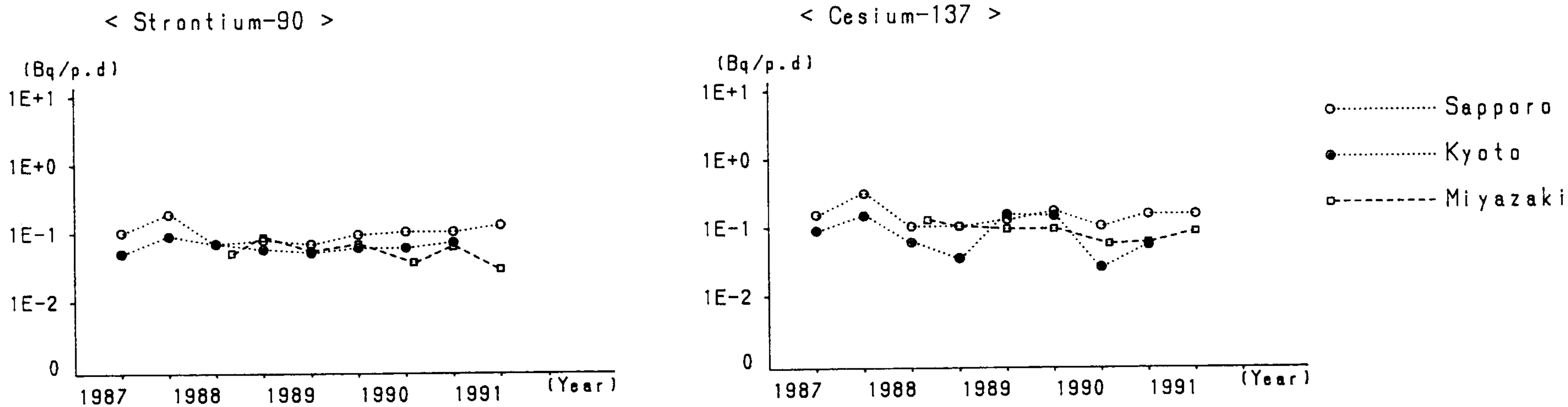


Fig.1

* * * Rice(producing districts) * * *

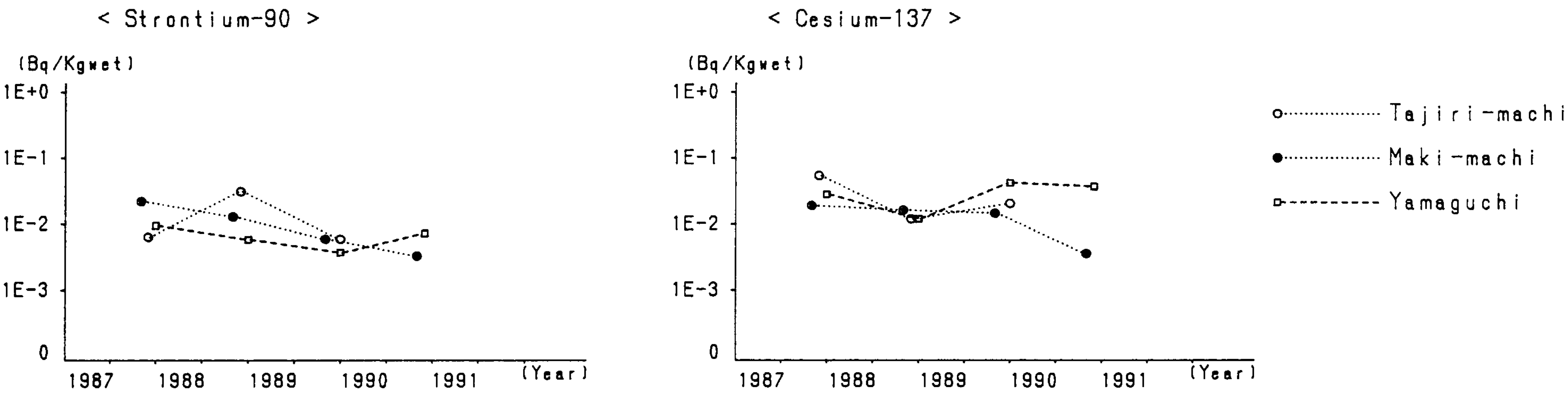


Fig.2-1

* * * Rice (consuming districts) * * *

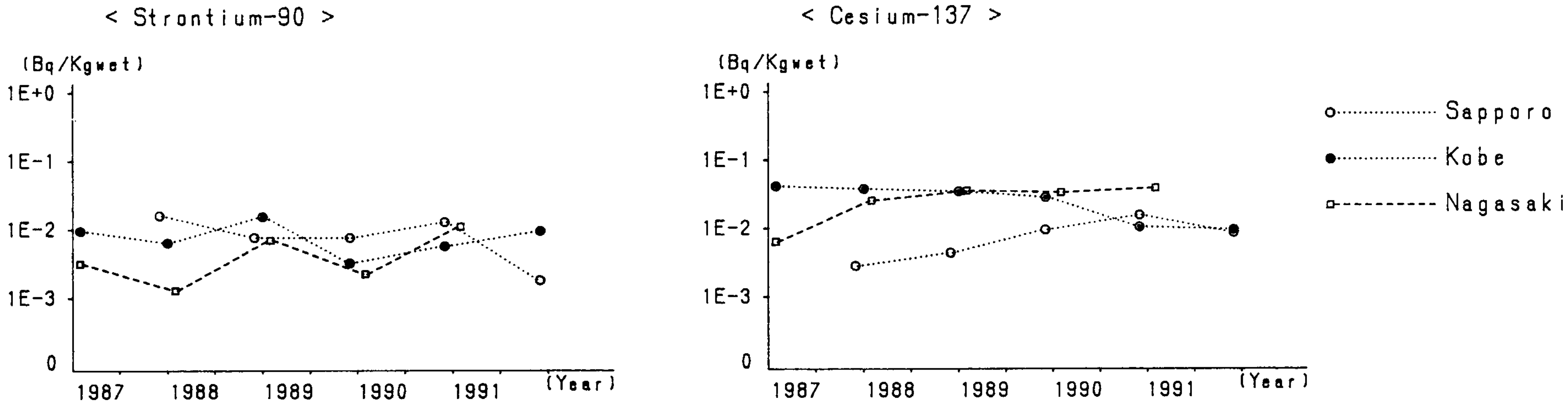


Fig.2-2

＊ ＊ ＊ Milk(producing districts for domestic program) ＊ ＊ ＊

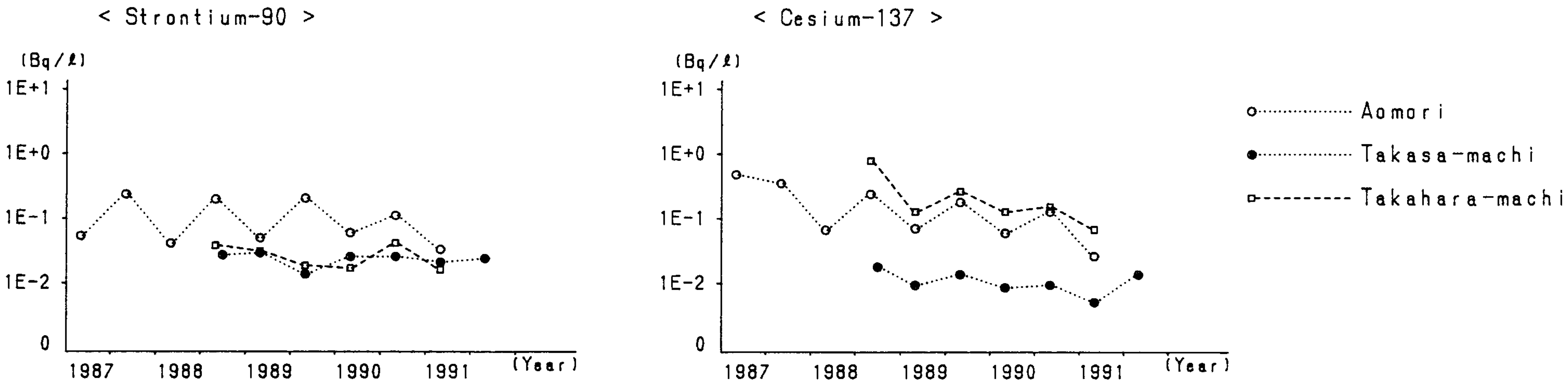


Fig.3-1

* * * Milk (producing districts for WHO program) * * *

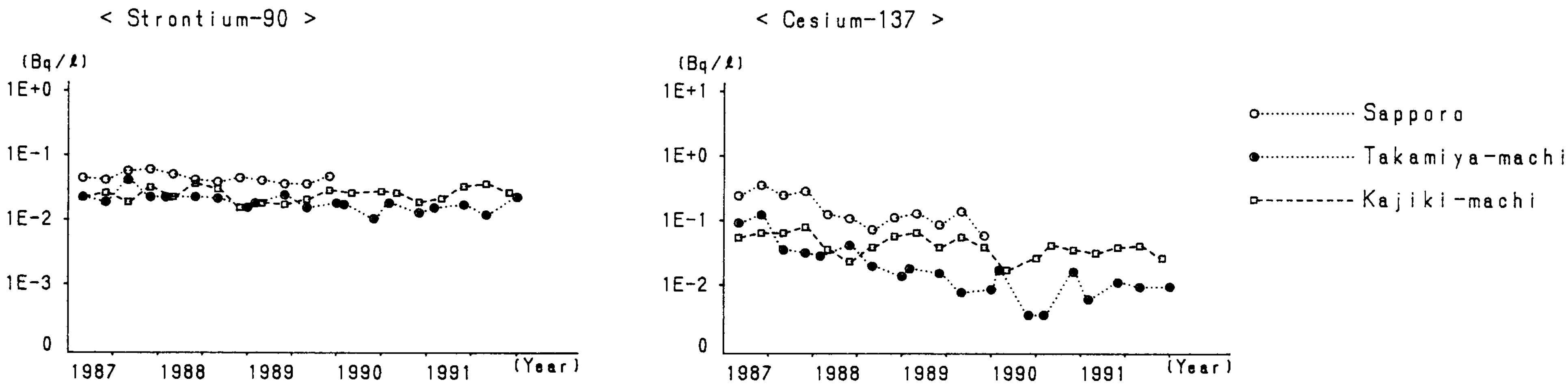


Fig.3-2

＊＊＊ Milk (consuming districts) ＊＊＊

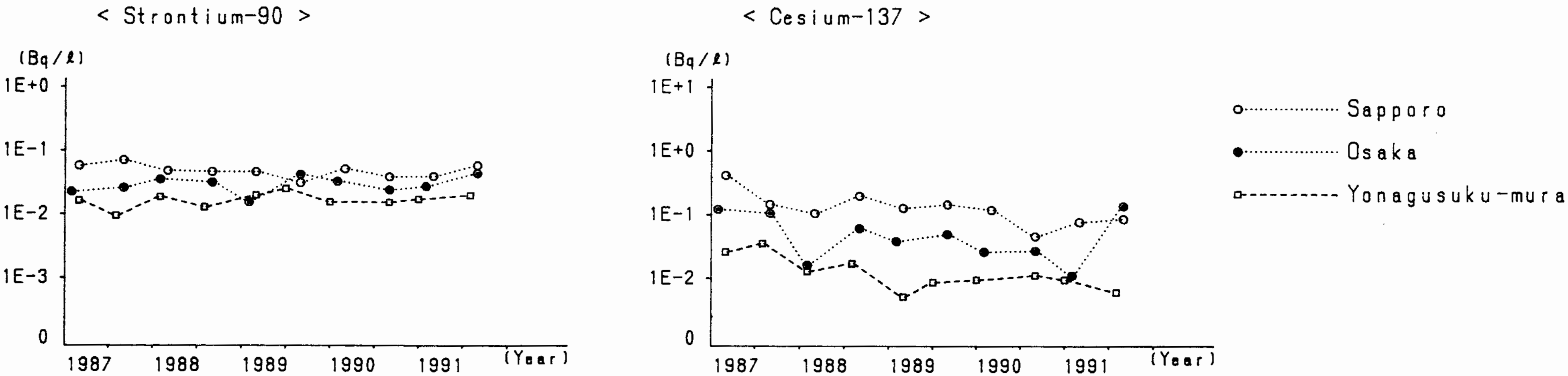


Fig.3-3

* * * Powdered Milk * * *

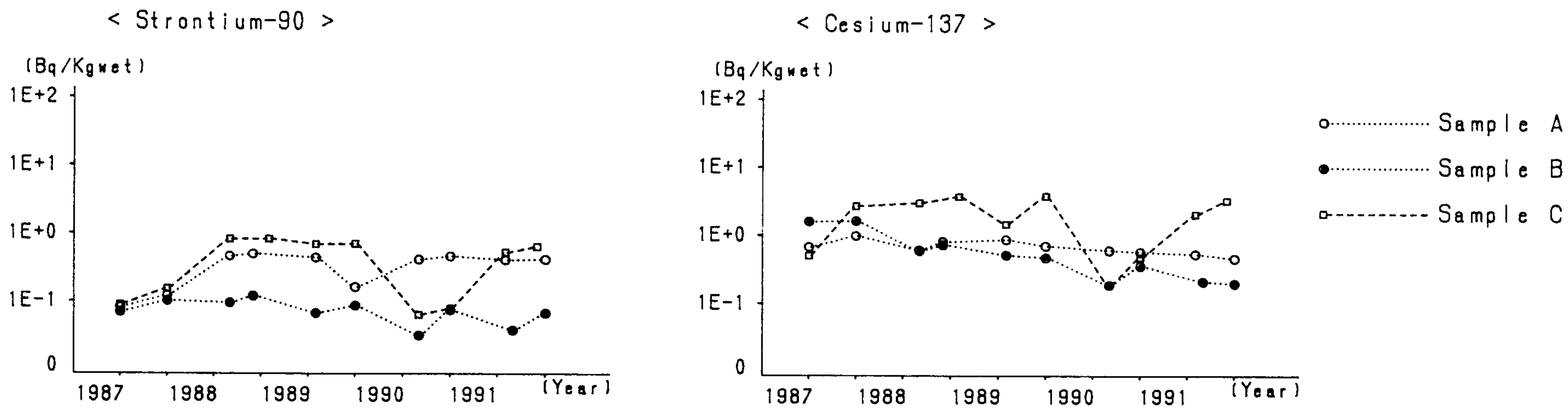


Fig.3-4

＊＊＊ Vegetables(producing districts) ＊＊＊

[Japanese radish]

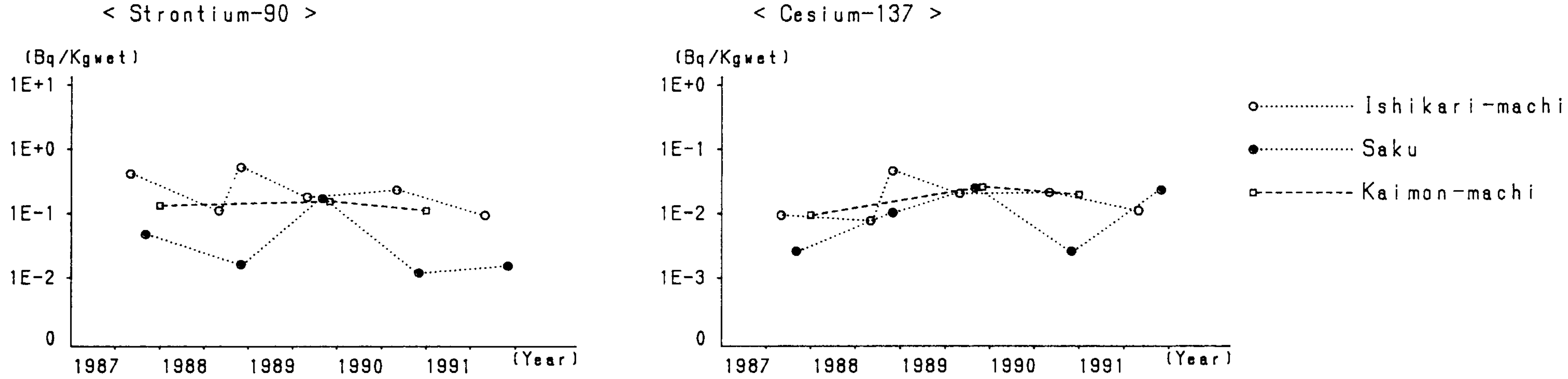


Fig.4-1

*** Vegetables(consuming districts) ***

(Japanese radish)

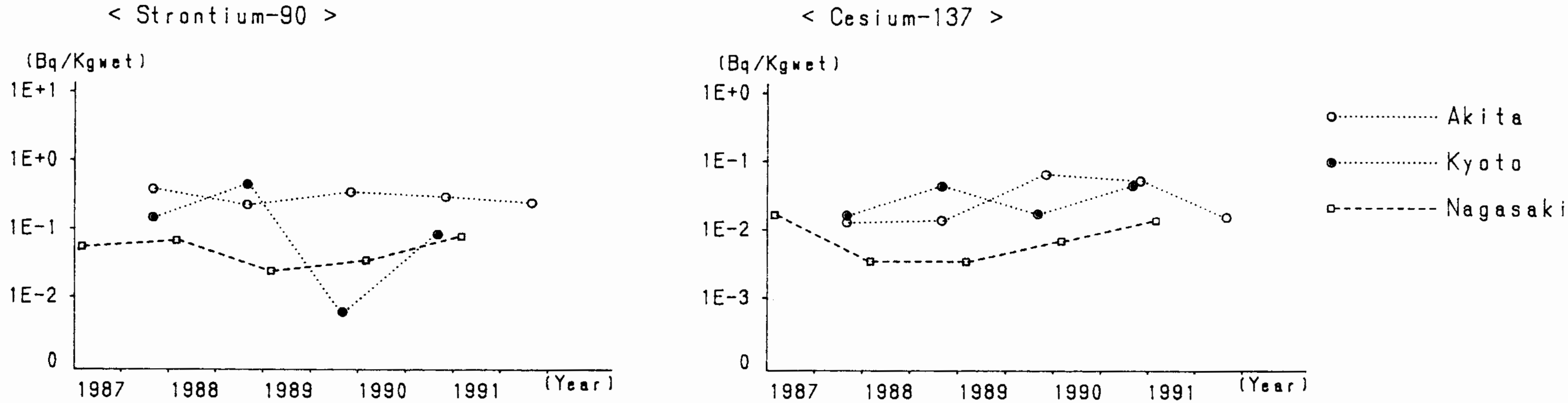


Fig.4-2

* * * Tea (Japanese Tea) * * *

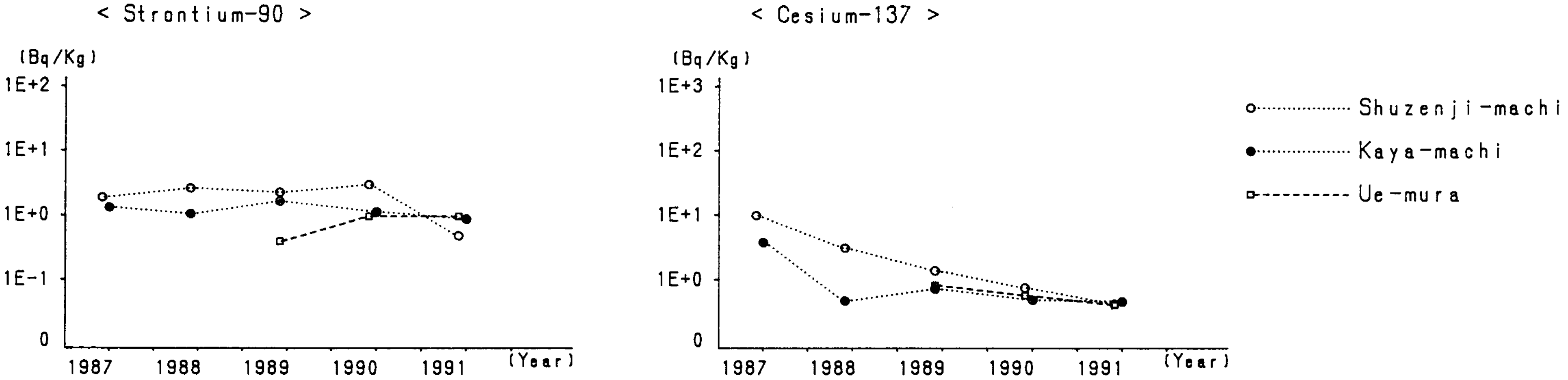


Fig.5

* * *   Sea Fish   * * *

(Chrysophrys major)

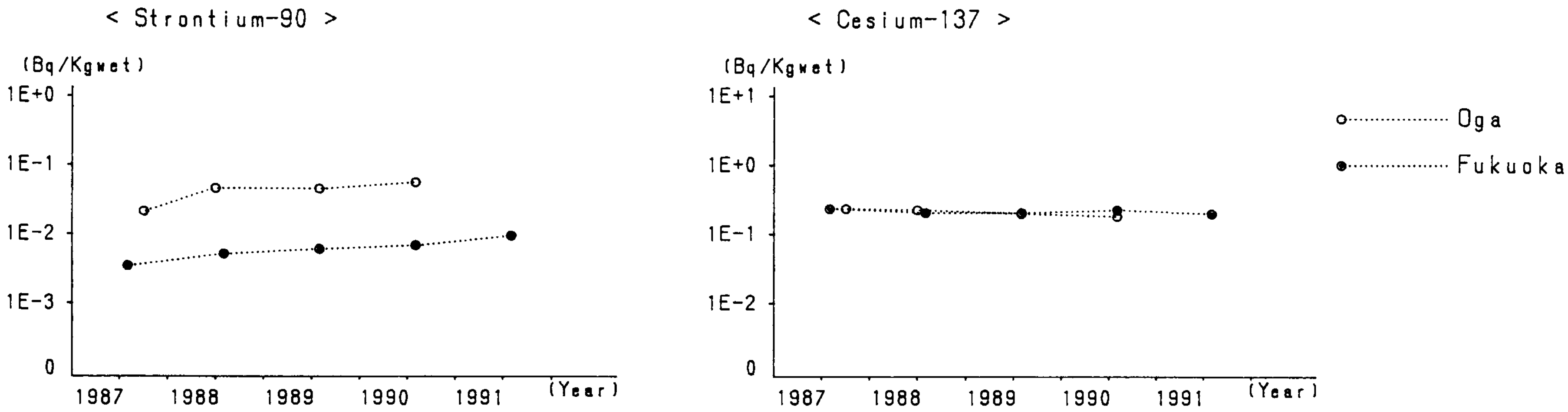


Fig.6

* * * Freshwater Fish * * *

(Cyprinus carpio)

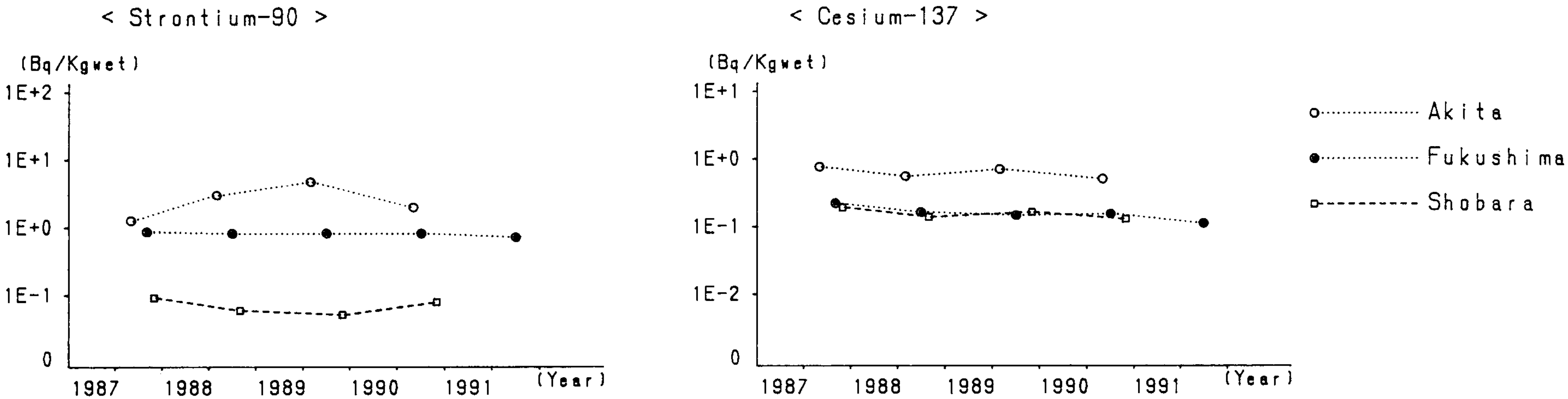


Fig.7

＊＊＊ Shellfish ＊＊＊

(Turbo cornutus)

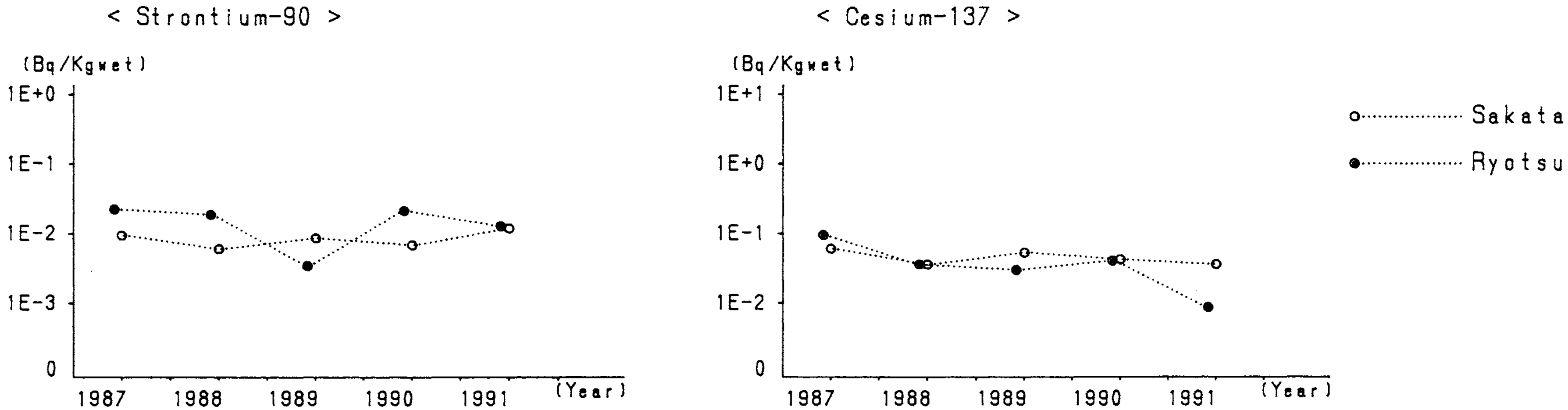


Fig.8

* * *   Seaweeds   * * *

(Undaria pinnatifida)

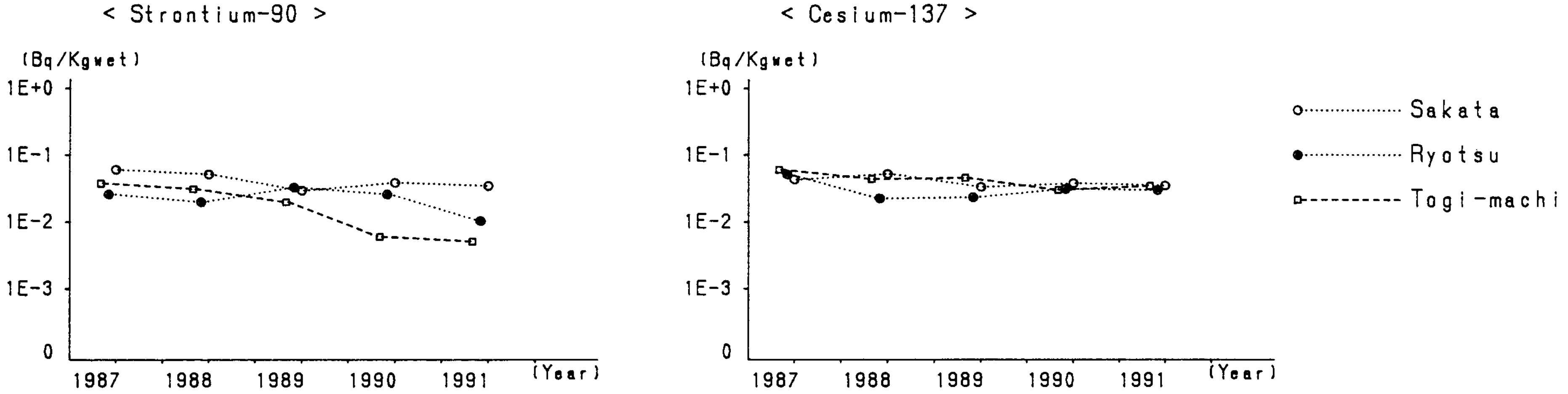
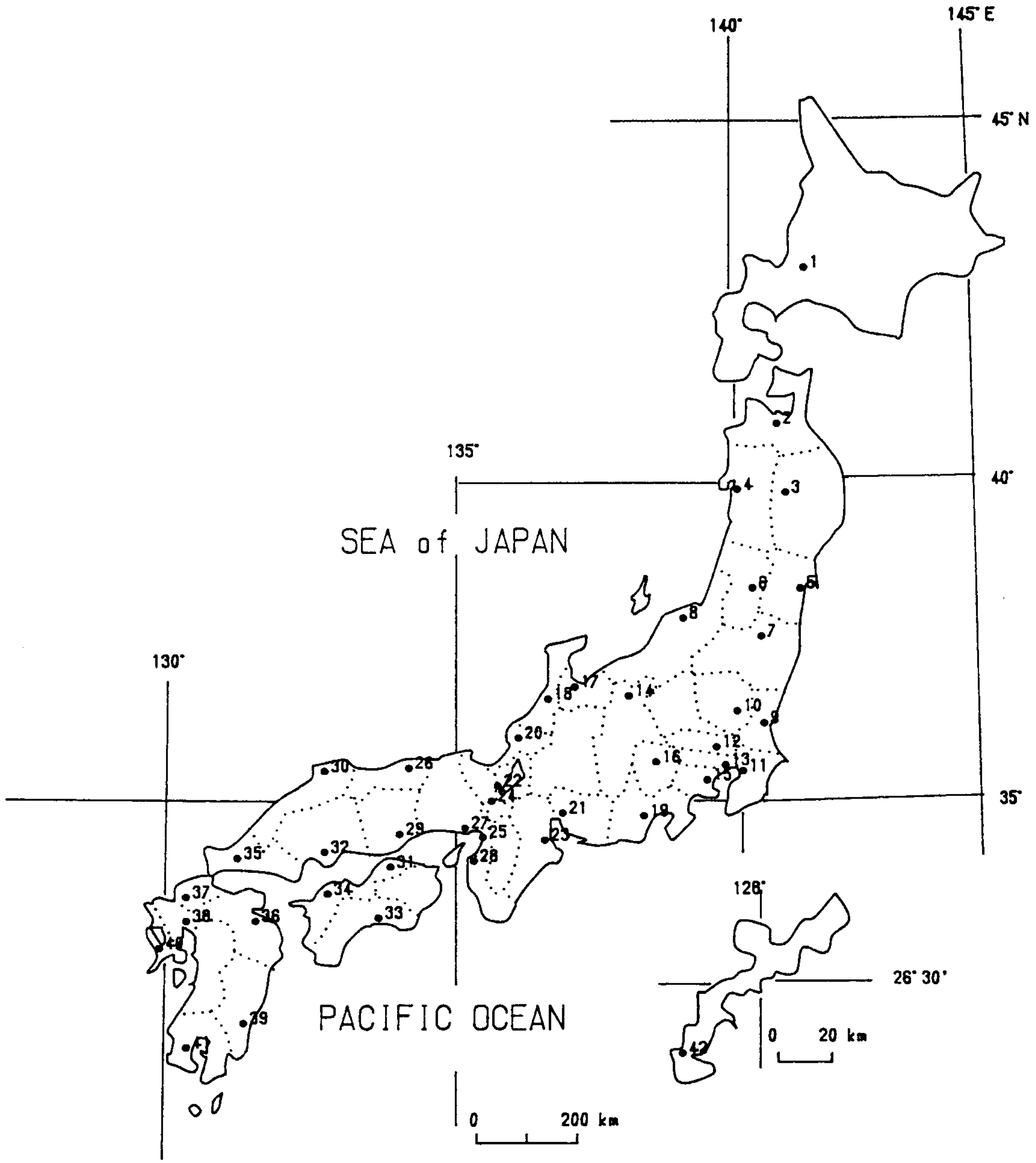


Fig.9

** Sampling Locations in Japan **

1 : Sapporo
2 : Aomori
3 : Morioka
4 : Akita
5 : Sendai
6 : Yamagata
7 : Fukushima
8 : Niigata
9 : Mito
10 : Utsunomiya
11 : Chiba
12 : Urawa
13 : Shinjuku
14 : Nagano
15 : Yokohama
16 : Kouhu
17 : Toyama
18 : Kanazawa
19 : Shizuoka
20 : Fukui
21 : Nagoya
22 : Ootsu
23 : Tsu
24 : Kyoto
25 : Osaka
26 : Tottori
27 : Kobe
28 : Wakayama
29 : Okayama
30 : Matsue
31 : Takamatsu
32 : Hiroshima
33 : Kochi
34 : Matsuyama
35 : Yamaguchi
36 : Ooita
37 : Fukuoka
38 : Saga
39 : Miyazaki
40 : Nagasaki
41 : Kagoshima
42 : Naha



II.Annual Changes in the Level of ^{90}Sr in Japanese Third Molar
(National Institute of Health)

Artificial radioactive materials released from nuclear weapon tests in the past have deposited on the earth. The UNSCEAR has estimated the effective dose equivalent commitment to the world population from these activities.Both ^{137}Cs and ^{90}Sr have half-lives of about 30 years, and so will have delivered most of their doses by the year 2000.For the world population, the contribution of ingestion(3.0mSv) is found to be about 4 times higher than that of external irradiation(0.7mSv) which in turn is about 5 times greater than that of inhalation(0.13mSv). The gamma-emitting radionuclides ^{137}Cs and ^{131}I have photon energies in the range 300 to 700keV, which are easily detected outside the body, while the pure beta-emitters ^{90}Sr and ^{89}S are not detectable by external *in vivo* counting.

In general, the development of the third molar starts approximately at 9 years old and ends at about 18 years old, although the major part crown which contains about 70 % of calcium in a tooth may be retained, although the ^{90}Sr activity decreases with a physical half-life of 28 years.The purpose of present study is to examine the annual changes in the ^{90}Sr activity from the radioactive fallout due to nuclear weapon tests in 1950s to 1960s.

Materials and Methods

1)Collection of samples:The measurements of ^{90}Sr activity were carried out for a total number of 1,312 samples .All of the samples were the third molar teeth of Japanese ,and were classified according to the birth year and the age at the extraction of teeth as for the donors.About half number of samples were collected in Kanto area and the remains from the whole of Japan except for the coast of the Sea of Japan(Fig.1).

2)Preparation of specimens:Soft tissues and dental calculus were removed from the raw teeth with a dental scaler. Then, glass beads were sprayed over the surface of the teeth with a sandblast instrument at 6 atm. to remove organic and colored materials attached to the teeth.The measurements of ^{90}Sr activity were carried out in the experiments 1 and 2, dividing the tooth samples into two groups according to the time of sampling. In the experiment 1, a tooth sample was cut into two parts along the long axis in the buccal-lingual direction using a dental diamond disk.The one was used in the experiment and the other was preserved. In the experiment 2, the whole part of a tooth sample was used.A mixture of 10 to 30 teeth was measured as one sample. Table 1 shows that there are no significant differences among teeth in each sample.

3)Measurement of activity:The mixture sample was incinerated in an electric furnace at 550℃. and the residue was crushed into powder in a mortar. For each mixture sample, 10 g of the powder was used for the measurements.The calcium content in the powder was determined with the ICP emission spectrometry. Strontium was chemically separated by adding the fuming nitric acid and a carrier to the powder. ^{90}Sr activity was measured with a low background beta counter(Beckman-Widebeta II).In present measurement,the minimum detectable amount of activity was 2 mBq.The results of measurement were given as a ratio of ^{90}Sr activity (mBq) to calcium content(Ca g).

Results

1)Variation of $^{90}Sr/Ca$ ratios by birth ages and by ages at extraction of tooth

Table 2.gives the $^{90}Sr/Ca$ ratios of the third molar extracted at various years from donors who were born in 1900 to 1930. The ^{90}Sr activity was detected from the teeth extracted before 1960, but even for higher age groups the teeth extracted after 1960 gave significant values of $^{90}Sr/Ca$ ratio as given in Table 2. These results show that ^{90}Sr can be taken in the third molar after the teeth development.

2)Annual change in the $^{90}Sr/Ca$ ratios(mBq/Ca g)

Table 3 gives the $^{90}Sr/Ca$ ratios by birth year for the third molars extracted at the twenties. In this table, the ^{90}Sr activity for each birth year group was converted into the activity at 12 years old using the decay constant of ^{90}Sr in order to simplify a comparison of results.The weighted mean ratios represent average values of experiments 1 and 2 weighted by the number of teeth used for the measurements.The ^{90}Sr activity was below a minimum detectable amount of beta counting system for the donors who were born in 1925 to 1931. For the younger donors who were born after 1932, the significant amounts of ^{90}Sr activity were measured. The relationship between the ^{90}Sr./Ca ratios and the birth years is shown in Fig.2. The $^{90}Sr/Ca$ ratios increased gradually up to a maximum value of 117 mBq/Ca g in 1953 ,and then decreased gradually to 25 mBq/Ca g in 1970.

In future, additional measurements will be performed to determine the correlationq between ^{90}Sr activities in the teeth and the intakes of ^{90}Sr from the diets.

(Moriyo Hinoide, Makoto Yamamoto, Kazuhiko Inoue,Hideo Nakamura and Susumu Imai)

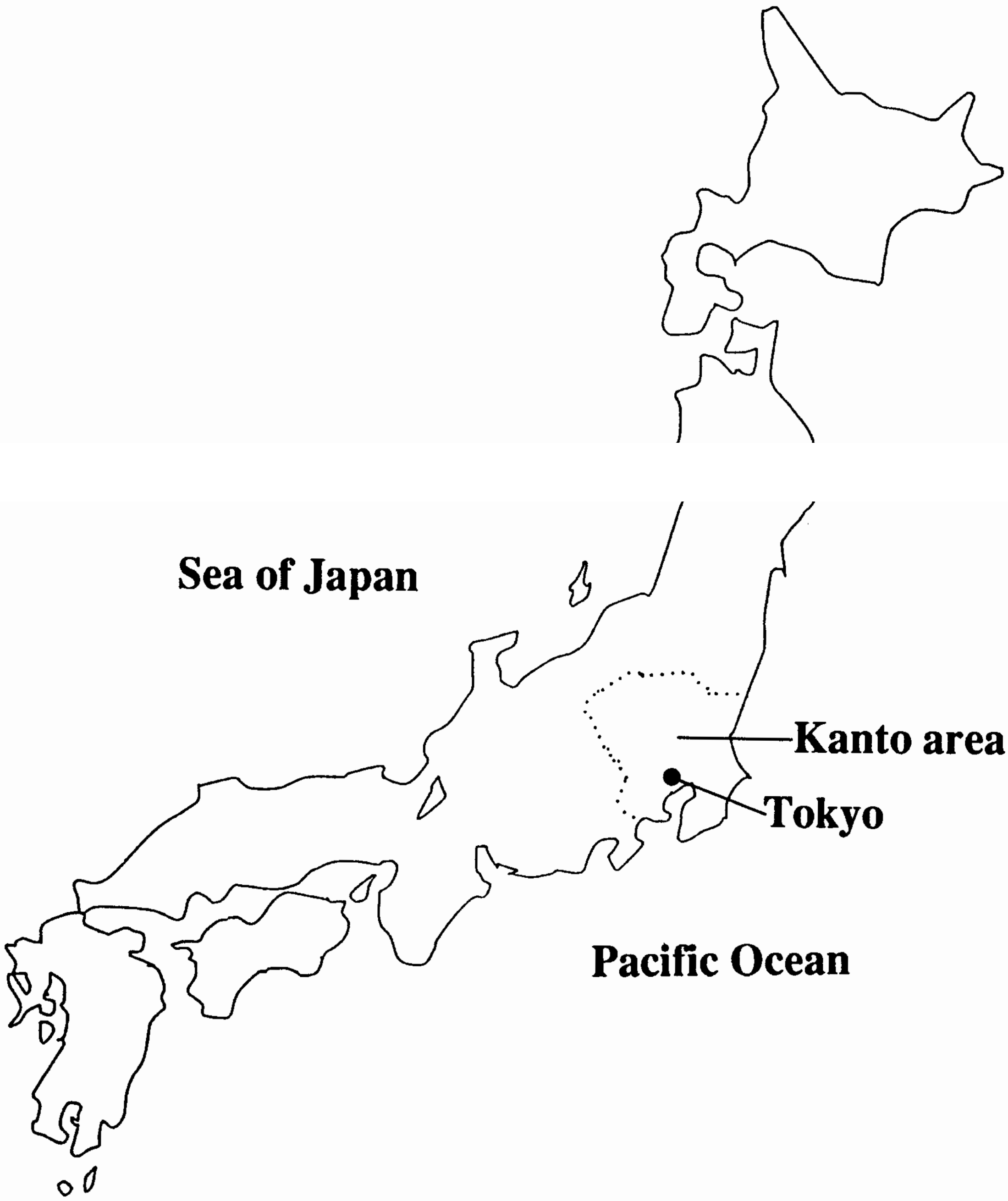


Fig. 1. The areas of the teeth collection in Japan.

About half of the teeth were collected in Kanto area and other teeth from whole Japan exept for the coast of the Sea of Japan.

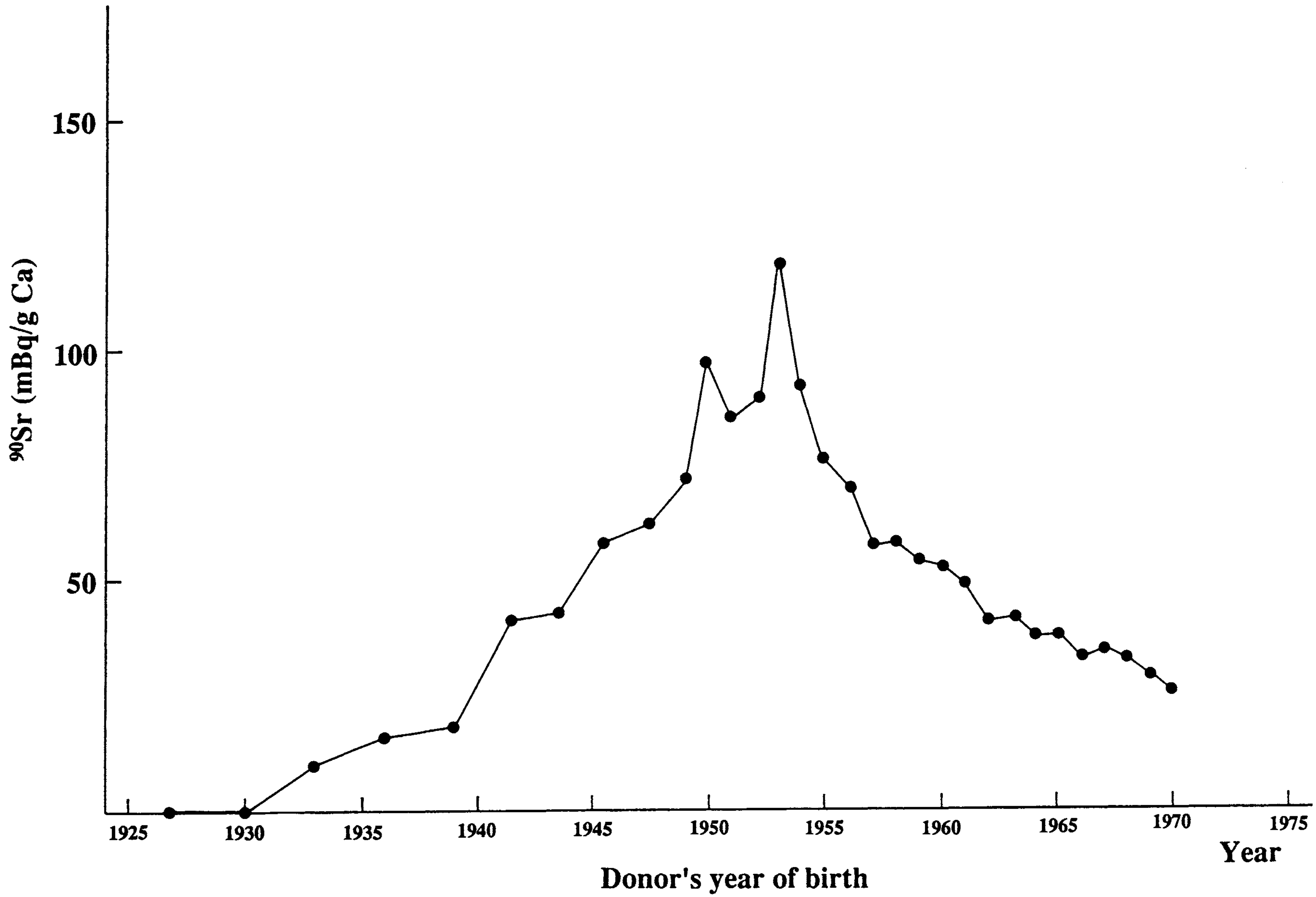


Fig. 2. Annual changes in the level of ^{90}Sr in Japanese third molar.

Table 1. Condition of individual group used for ^{90}Sr analysis

Donor's year of birth	Number of teeth	Donor's age at tooth extraction		Tooth name					Eruption				Sex			
				Upper third molar		Lower third molar		Sum	Full	Half	?	Sum	Male	Fe-male	?	Sum
		a) Med.	b) R.	c) R.	d) L.	c) R.	d) L.									
1900-1914	18	59	15	2	2	7	7	18	15	3	0	18	6	9	3	18
1915-1919	22	55	17	0	7	10	5	22	20	2	0	22	13	7	2	22
1920-1924	28	49	13	5	9	8	6	28	26	2	0	28	20	5	3	28
1925-1928	10	26	8	6	0	2	2	10	4	2	4	10	8	2	0	10
1925-1928	10	28	2	2	0	4	4	10	5	0	5	10	2	0	8	10
1925-1928	22	47	17	6	4	3	9	22	20	2	0	22	10	9	3	22
1929-1931	10	27	3	1	3	4	2	10	9	0	1	10	6	3	1	10
1929-1931	26	25	8	3	7	8	8	26	14	4	8	26	16	10	0	26
1929-1931	20	35	9	1	4	9	6	20	16	4	0	20	10	10	0	20
1929-1931	23	45	18	1	7	5	10	23	18	5	0	23	13	8	2	23
1932-1934	10	25	6	2	2	3	3	10	10	0	0	10	5	5	0	10
1932-1934	26	25	8	6	5	6	9	26	12	6	8	26	17	8	1	26
1935-1937	10	24	6	1	1	6	2	10	6	2	2	10	6	4	0	10
1935-1937	16	24	7	3	1	4	8	16	8	4	4	16	10	6	0	16
1938-1940	10	25	5	6	1	3	0	10	2	3	5	10	6	4	0	10
1938-1940	24	23	9	4	3	10	7	24	9	8	7	24	13	9	2	24
1941-1942	10	27	6	3	2	3	2	10	3	2	5	10	4	6	0	10
1941-1942	26	25	8	3	7	8	8	26	9	7	10	26	8	15	3	26
1943-1944	10	26	5	5	2	2	1	10	4	4	2	10	4	5	1	10
1943-1944	26	25	8	4	5	11	6	26	10	7	9	26	12	14	0	26
1945-1946	10	25	4	2	5	1	2	10	8	1	1	10	6	4	0	10
1945-1946	26	25	6	10	3	7	6	26	16	5	5	26	9	15	2	26
1947-1948	10	23	6	3	3	2	2	10	7	2	1	10	4	5	1	10
1947-1948	27	23	5	5	4	8	10	27	7	8	12	27	9	13	5	27
1949	10	22	9	1	3	3	3	10	5	2	3	10	2	7	1	10
1949	26	24	7	6	7	7	6	26	11	8	7	26	9	16	1	26
1950	10	24	9	1	3	3	3	10	2	3	5	10	4	5	1	10
1950	27	24	9	7	6	5	9	27	6	9	12	27	8	17	2	27
1951	10	24	9	3	3	2	2	10	4	3	3	10	4	5	1	10
1951	28	25	9	4	5	12	7	28	9	11	8	28	10	17	1	28
1952	10	25	6	1	2	2	5	10	5	0	5	10	4	4	2	10
1952	28	26	8	8	6	6	8	28	13	5	10	28	13	15	0	28
1953	10	26	5	3	2	2	3	10	8	0	2	10	5	5	0	10
1953	10	26	5	3	2	2	3	10	8	0	2	10	5	5	0	10
1953	10	27	5	1	1	4	4	10	5	3	2	10	4	6	0	10
1953	28	25	7	5	4	9	10	28	10	13	5	28	12	16	0	28
1954	10	26	8	4	4	0	2	10	3	3	4	10	2	8	0	10
1954	29	24	7	5	3	16	5	29	8	10	11	29	13	14	2	29
1955	10	26	6	3	0	6	1	10	5	1	4	10	3	6	1	10
1955	30	25	8	5	4	8	13	30	10	6	14	30	10	16	4	30
1956	10	24	8	3	4	3	0	10	3	4	3	10	2	6	2	10
1956	30	24	7	2	8	8	12	30	5	10	15	30	12	15	3	30
1957	10	26	6	4	3	2	1	10	6	2	2	10	4	6	0	10
1957	28	24	8	6	3	5	14	28	7	8	13	28	10	17	1	28
1958	10	24	7	5	0	4	1	10	4	4	2	10	2	7	1	10
1958	30	23	6	6	4	13	7	30	6	15	9	30	8	21	1	30
1959	10	25	5	4	1	3	2	10	4	6	0	10	4	6	0	10
1959	30	24	6	6	5	10	9	30	7	11	12	30	9	20	1	30
1960	10	25	7	3	1	1	5	10	4	1	5	10	3	6	1	10
1960	30	22	5	5	5	10	10	30	11	8	11	30	8	20	2	30
1961	10	25	8	2	4	2	2	10	7	2	1	10	3	5	2	10
1961	30	25	9	6	4	7	13	30	7	10	13	30	7	22	1	30
1962	10	26	6	2	1	4	3	10	2	4	4	10	6	4	0	10
1962	30	22	4	4	6	12	8	30	10	10	10	30	5	19	6	30

1963	10	24	3	2	3	3	2	10	4	5	1	10	1	8	1	10
1963	30	23	4	9	5	7	9	30	13	11	6	30	7	21	2	30
1964	10	24	5	1	2	6	1	10	4	3	3	10	4	5	1	10
1964	30	23	4	5	3	7	15	30	9	14	7	30	12	17	1	30
1965	10	25	5	1	4	4	1	10	4	3	3	10	2	8	0	10
1965	30	22	3	5	8	8	9	30	12	12	6	30	8	21	1	30
1966	10	24	1	6	1	0	3	10	6	2	2	10	0	8	2	10
1966	30	21	2	3	8	10	9	30	6	17	7	30	7	21	2	30
1967	10	23	0	1	3	3	3	10	2	7	1	10	3	6	1	10
1967	30	20	1	8	8	8	6	30	14	13	3	30	16	14	0	30
1968	10	21	0	5	1	3	1	10	5	1	4	10	3	7	0	10
1968	30	20	0	9	5	13	3	30	14	12	4	30	7	20	3	30
1969	10	21	0	2	2	3	3	10	5	4	1	10	5	5	0	10
1969	30	18	1	4	6	6	14	30	7	15	8	30	10	19	1	30
1970	10	20	0	3	1	3	3	10	4	5	1	10	6	3	1	10
1970	28	17	2	3	4	10	11	28	3	18	7	28	7	20	1	28
Total	1312			269	255	399	389	1312	565	397	350	1312	506	715	91	1312

a):Median b)Range c):Right d):Left

Table 2. Changes in the level of ^{90}Sr in third molar classified by donor's year of birth and age at tooth extraction.

<table>
<tr><th rowspan="2">Donor's year of birth</th><th colspan="5">Donor's age at tooth extraction</th></tr>
<tr><th>20-29</th><th>30-39</th><th>40-49</th><th>50-59</th><th>60-69</th></tr>
<tr><td>1900-1914</td><td></td><td></td><td></td><td colspan="2">7[a)] (18)[b)]</td></tr>
<tr><td>1915-1919</td><td></td><td></td><td></td><td colspan="2">5 (22)</td></tr>
<tr><td>1920-1924</td><td></td><td></td><td colspan="2">3 (28)</td><td></td></tr>
<tr><td>1925-1928</td><td>< 2 (10)
< 2 (10)</td><td></td><td colspan="2">11 (22)</td><td></td></tr>
<tr><td>1929-1931</td><td>< 2 (10)
< 2 (26)</td><td>4 (20)</td><td colspan="2">10 (23)</td><td></td></tr>
</table>

a): ^{90}Sr level in 1992 (mBq/g Ca).
b): The figures in parenthesis indicate the number of tooth samples.

Table 3. Annual changes in the level of ^{90}Sr in Japanese third molar.

Donor's year of birth	Experiment 1 Number of teeth	Experiment 1 ^{90}Sr [a)]	Experiment 2 Number of teeth	Experiment 2 ^{90}Sr [a)]	Weighted mean level of ^{90}Sr [a)]
1925-1928	10	< 2	10	< 2	< 2
1929-1931	26	< 2	10	< 2	< 2
1932-1934	26	11	10	6	10
1935-1937	16	19	10	12	16
1938-1940	24	20	10	13	18
1941-1942	26	45	10	30	41
1943-1944	26	42	10	46	43
1945-1946	26	60	10	54	58
1947-1948	27	65	10	55	62
1949	26	73	10	64	71
1950	27	98	10	96	97
1951	28	90	10	72	85
1952	28	85	10	97	88
1953			10	118	
	28	111	10	129	117
			10	118	
1954	29	92	10	87	91
1955	30	75	10	77	75
1956	30	69	10	67	69
1957	28	54	10	63	56
1958	30	58	10	55	57
1959	30	54	10	52	54
1960	30	52	10	53	52
1961	30	49	10	46	48
1962	30	40	10	38	40
1963	30	42	10	37	41
1964	30	35	10	44	37
1965	30	38	10	33	37
1966	30	31	10	36	32
1967	30	36	10	28	34
1968	30	33	10	27	32
1969	30	28	10	30	29
1970	28	23	10	30	25

a): ^{90}Sr levels donor's age was 12 years old. (mBq/g Ca)