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STRONTIUM-90 LEVELS IN THE DIETS AND BONES OF CHILDREN

PROGRESS REPORT - 1966

Beninson, D ; Ramos, E.; Abramides, E.; Menossi, C.
Argentine Atomic Energy Commission

INTRODUCTION

The information presented in previous Progress Reports (1, 2, 3) can be summarized as follows:

(a) Strontium in the diet. Measurements of Sr-90 and natural strontium in food, together with dietary information, allowed the estimation of the intakes of children of different age groups. Typical daily intakes in young children in Buenos Aires and the Argentine litoral area are a few picocuries of Sr-90 about 1 mg of stable strontium. The Sr-90/Ca ratio in milk is very close to that of the average total diet of the first year of life.

(b) Strontium in bone. Data on Sr-90 and stable strontium in bones of children for which it was possible to compile an adequate diet "history", were presented in an age group classification. It was estimated that the mineral turnover in the first year of life is about 50% and that young infants discriminate less strontium than older ones. The mean discrimination factor for the first year of life was estimated to be about 0.4. Uncertainties in these estimates were substantial and no significant information on the variation of the parameters during the first two years of life could be presented.

The work covered by the present Progress Report had two main objectives:

(a) Updating the information on diet and bone levels, representative of some areas of Argentina.

Except where specifically mentioned, the sampling and pooling routines were those described in previous reports.

(b) Continuation of the study on bone turnover and on strontium to determine discrimination factors as a function of age. This is the main part of the report. In particular, emphasis was given to the estimation of the variation of these parameters during the first two years of life. This trend may give hints on the mechanisms involved and also may help to identify the "critical" age group for peak discrimination in the diet.

The data for this study relate to a "controlled" group, mainly children who lived almost their entire life in Pediatric Hospitals, and for which individual diet information is reasonably acceptable.

Bone data for older age groups (3 years to early adolescence) were also collected, but at present they are not sufficient to allow any reasonable estimate of turnover or discrimination. It should be pointed out also that in this case diet information cannot be readily assembled.

The radiochemical and counting procedures for Sr-90 and the X-rays fluorescence techniques for stable strontium used in this work were described in previous reports.

2. STRONTIUM-90 LEVELS IN 1965

Analysis of food items continued in 1965. Table 1 presents the estimates of Sr-90/Ca ratios in total diet for different age groups; together with the values for previous years. Relative composition of the diets used in the calculations are those included in previous Progress Reports.

In particular, breast feeding is taken into account as contributing 1/3 the calcium intake from birth to the age of 6 months; the OR (mother's diet $\rightarrow$ breast feeding) value used was 0.13 (1965 Progress Report).

The column on stable strontium in Table 1 contains new estimates which are slightly higher than previous ones. It is felt that the survey is at present quite representative for the region (Buenos Aires province and the littoral area).

The diet levels of Sr-90 in 1965 are lower than those of 1964 for all age groups, changing the time-trend observed in the recent years. On the other hand, the trend with age has not varied significantly.

Table II shows the average Sr-90/Ca ratios in bone for several age groups in 1965. It should be pointed out that these values are based on samples collected in the above mentioned region and do not overlap completely those of the "control" population used for discrimination studies. The number of samples indicated in the table is not large, particularly for some age groups, and the values are not very representative. Standard errors of the means range from 10% to 20%. The levels in Table II show a maximum for young children in the 1 to 2 year group; the distribution with age is quite smooth.

3. STUDY ON DISCRIMINATION FACTORS AND SKELETAL TURNOVER

The data assembled so far on Sr-90 and natural strontium bone levels of the "controlled" population (children in Pediatric Hospitals) are listed in detail in Table III. Values included in previous reports are marked with an asterisk; new data amount to 110 bone samples. The table includes also the relevant diet levels, estimated from food analysis and diet information obtained from the Hospital. When the dietary information assembled was only qualitative, the diet level was taken to be that of the general population (Table I).

Calculations of turnover rates and discrimination factors from the data of Table III require additional information, such as the calcium and stable strontium contents in the skeleton as a function of age. This information has been presented in previous Progress Reports and is not repeated here.

Average turnover rates for given age periods can be computed from specific activity data (Sr-90/Sr). Using the same formulation as in the 1965 Progress Report, it can be shown that the bone specific activity in any period j is related to that of the previous period i and the diet levels by the following expression:

$$B_j = \frac{B_i \cdot m_i (1-K) + D_j (\Delta m + K m_i)}{m_j}$$

where B is specific activity in bone (Sr-90/Sr)

m is the total content of stable strontium in skeleton

D is the specific activity in the diet

Δm is the net stable strontium increment ($\Delta m = m_j - m_i$)

K is the fraction of the amount of stable strontium present

at i which is replaced by new strontium (turnover)

Diet specific activity values were derived for the corresponding data of Table III and the stable strontium to calcium ratios of Table I.

Using the expression mentioned above, mean turnover rates for several age periods were computed (clearly the average rate is obtained dividing K by the time involved). Calculations were made using mean bone values at different age groups, a procedure which may be questionable. However, the near constancy of both daily intakes and skeletal strontium accretion supports averaging assuming linearity.

Figure 1 presents the results of these calculations. The length of the time periods were selected somewhat arbitrarily, but with the aim of including in each a significant number of bone data. It should be pointed out that the uncertainties in the estimates are substantial, mainly because the specific activities are not very different all along the age period studied.

It appears from Figure 1 that the turnover rate changes strikingly with the age. Very young infants have a fast turnover rate of about 7% per month; the rate slows down almost exponentially as the age increases and reaches 1.5% per month in the second year of life. Assuming that this trend continues to be approximately valid over a further period of several months, the adult "accepted" rate of 3.5% per year would be attained during or shortly after the third year of life. It is worth mentioning that the values obtained support the figure of 50% for the average annual turnover rate in the first year of life, included in the 1965 Progress Report.

Strontium to calcium discrimination factors can also be computed from the data of Table III and the additional information referred to above.

Using the same type of formulation as in the previous Report, the Sr/Ca ratio in bone in an age group j is related to that of the previous period i and with the diet by the expression:

$$L_j = \frac{L_i C_i (1-K) + D_j F_j (\Delta C + K C_i)}{C_j}$$

where L is the bone Sr/Ca ratio

C is the calcium content in skeleton

D is the diet Sr/Ca ratio

F is the discrimination factor

ΔC is the net calcium increment ($C_j - C_i$)

K is the turnover in the period $i \rightarrow j$

Using this expression, discrimination factors for different age groups were derived and presented in Figure 2; the uncertainties again are substantial

Figure 2 shows that strontium is less discriminated against in very young infants than in older children. Discrimination factors found range from about 0.7 in the first months after birth, down to 0.3 for the second year of life. The average discrimination factor for the first year of life as deduced from Figure 1 is approximately 0.42, very close to the estimate of the 1965 Report (0.37).

Skeletal turnover rates and strontium to calcium discrimination factors seem to be interrelated. Furthermore, both reach the "adult" values during or shortly after the third year of life. It seems possible that these values remain constant in the 3-10 year period. In the early adolescence, on the other hand, the increased bone remodelling suggests again a faster turnover and correspondingly less discrimination against strontium.

Bones from these older age groups were sampled during 1965. It is worth mentioning that these samples are quite difficult to obtain. Table IV summarizes the results of Sr-90 and stable strontium measurements in these samples. The information collected so far is not sufficient to derive discrimination and turnover values for these age groups. In particular, precise information on the corresponding diets is needed.

REFERENCES

- (1) Beninon, D., Migliori, A. and Ramos, E.
"Strontium-90 Levels in the Diets and Bones of Children - Progress
Report 1962-63"
HASL-149 Oct. 1, 1964, p. 105
- (2) Beninon, D., Ramos, E., and Touzet, R.
"Strontium-90 Levels in the Diets and Bones of Children - Progress
Report 1964"
HASL-149, Oct. 1, 1964, p. 119
- (3) Beninon, D., Ramos, E., and Touzet, R.
"Strontium in Children - Progress Report - 1965"
HASL-165, Jan. 1, 1966, p. 289

TABLE I

STABLE STRONTIUM AND SR-90 IN TOTAL DIET.

<u>Age Group</u>	<u>Stable Sr</u> (mg/g Ca)	<u>Sr-90</u> (pc/g Ca)					
		<u>1960</u>	<u>1961</u>	<u>1962</u>	<u>1963</u>	<u>1964</u>	<u>1965</u>
0-6 months	0.68	1.62	2.01	2.28	3.20	4.28	4.10
6-12 months	1.16	2.33	2.61	3.28	4.63	6.87	5.81
12-24 months	1.31	2.46	2.76	3.48	4.45	6.55	7.08
24-36 months	1.36	2.62	3.59	4.11	5.20	8.50	7.32
Adults	2.03	3.15	3.88	5.97	6.88	9.19	8.69

TABLE II

SR-90 IN HUMAN BONE DURING 1965

<u>Age Group</u>	<u>pe Sr-90/g Ca</u>	<u>Number of samples</u>
Stillbirths	1.57	12
0-6 months	1.93	32
6-12 months	2.21	7
1-2 years	2.26	3
2-3 years	1.96	5
3-5 years	1.74	4
6-10 years	1.50	12
> 10 years	1.39	8

TABLE III

STRONTIUM IN BONES AND DIETS

		<u>B O N E</u>			<u>D I E T S</u>			
A g e (months)	Date of Birth	$\frac{\text{Sr-90/Ca}}{(\text{pc} / \text{g})}$	$\frac{\text{Sr/Ca}}{(\text{mg/g})}$	$\frac{\text{Sr-90/Sr}}{(\text{pc/mg})}$	$\frac{\text{Sr-90/Ca}}{(\text{pc} / \text{g})}$			
					0-6 Mos.	6-12 Mos.	12-24 Mos.	24-36 Mos.
+ Stillbirth	5/63	0.99	0.37	2.67	-	-	-	-
+ Stillbirth	5/63	0.92	0.31	2.97	-	-	-	-
+ Stillbirth	5/63	0.62	0.25	2.48	-	-	-	-
+ Stillbirth	6/63	0.45	0.20	2.25	-	-	-	-
+ Stillbirth	6/63	0.46	0.10	4.60	-	-	-	-
+ Stillbirth	8/63	0.57	0.12	4.75	-	-	-	-
+ Stillbirth	8/63	0.86	0.21	4.09	-	-	-	-
+ Stillbirth	8/63	0.74	0.20	3.70	-	-	-	-
+ Stillbirth	9/63	1.04	0.20	5.20	-	-	-	-
+ Stillbirth	9/63	1.15	0.21	5.48	-	-	-	-
+ Stillbirth	10/63	1.12	0.16	7.00	-	-	-	-
+ Stillbirth	10/63	1.30	0.46	2.83	-	-	-	-

TABLE III - (cont'd)

STRONTIUM IN BONES AND DIETS

	A g e (months)	Date of Birth	<u>B O N E</u>			<u>D I E T S</u>			
			<u>Sr-90/Ca</u>	<u>Sr/Ca</u>	<u>Sr-90/Sr</u>	<u>Sr-90/Ca</u>			
			(pc / g)	(mg/g)	(pc/mg)	0-6 Mos.	6-12 Mos.	12-24 Mos.	24-36 Mos.
I - 39	+ Stillbirth	10/63	1.21	0.22	5.50	-	-	-	-
	+ Stillbirth	10/63	0.86	0.21	4.09	-	-	-	-
	+ Stillbirth	10/63	0.63	0.20	3.15	-	-	-	-
	+ Stillbirth	10/63	1.02	0.25	4.08	-	-	-	-
	+ Stillbirth	11/63	0.85	0.20	4.25	-	-	-	-
	+ Stillbirth	6/64	1.12	0.19	5.89	-	-	-	-
	+ Stillbirth	6/64	1.28	0.27	4.74	-	-	-	-
	+ Stillbirth	6/64	1.87	0.27	6.93	-	-	-	-
	+ Stillbirth	6/64	1.75	0.25	7.00	-	-	-	-
	+ Stillbirth	6/64	1.76	0.42	4.19	-	-	-	-
	+ Stillbirth	6/64	0.91	0.26	3.50	-	-	-	-
	+ Stillbirth	7/64	1.01	0.36	2.81	-	-	-	-

TABLE III - (cont'd)

STRONTIUM IN BONES AND DIETS

A g e (months)	Date of Birth	<u>B O N E</u>			<u>D I E T S</u>			
		$\frac{\text{Sr-90/Ca}}{(\text{pc} / \text{g})}$	$\frac{\text{Sr/Ca}}{(\text{mg/g})}$	$\frac{\text{Sr-90/Sr}}{(\text{pc/mg})}$		$\frac{\text{Sr-90/Ca}}{(\text{pc} / \text{g})}$		
					0-6 Mos.	6-12 Mos.	12-24 Mos.	24-36 Mos.
+ Stillbirth	7/64	0.76	0.23	3.30	-	-	-	-
+ Stillbirth	7/64	1.47	0.23	6.39	-	-	-	-
+ Stillbirth	7/64	1.95	0.22	8.86	-	-	-	-
+ Stillbirth	7/64	1.24	0.26	4.77	-	-	-	-
+ Stillbirth	7/64	0.54	0.16	3.37	-	-	-	-
+ Stillbirth	8/64	0.97	0.10	9.70	-	-	-	-
+ Stillbirth	8/64	1.53	0.24	6.37	-	-	-	-
+ Stillbirth	8/64	1.17	0.33	3.55	-	-	-	-
+ Stillbirth	8/64	1.12	0.28	4.00	-	-	-	-
+ Stillbirth	8/64	1.42	0.31	4.58	-	-	-	-
+ Stillbirth	9/64	1.28	0.38	3.37	-	-	-	-
+ Stillbirth	9/64	1.18	0.28	4.21	-	-	-	-

TABLE III - (cont'd)

STRONTIUM IN BONES AND DIETS

	A g e (months)	Date of Birth	<u>B O N E</u>			<u>D I E T S</u>			
			$\frac{\text{Sr-90/Ca}}{(\text{pc} / \text{g})}$	$\frac{\text{Sr/Ca}}{(\text{mg/g})}$	$\frac{\text{Sr-90/Sr}}{(\text{pc} / \text{mg})}$	$\frac{\text{Sr-90/Ca}}{(\text{pc} / \text{g})}$			
						0-6 Mos.	6-12 Mos.	12-24 Mos.	24-36 Mos.
I 7 - I	+ Stillbirth	10/64	1.38	0.26	6.00	-	-	-	-
	+ Stillbirth	10/64	1.42	0.23	6.17	-	-	-	-
	Stillbirth	10/64	1.06	0.18	5.89	-	-	-	-
	Stillbirth	10/64	1.11	0.24	4.63	-	-	-	-
	Stillbirth	10/64	1.43	0.21	6.81	-	-	-	-
	Stillbirth	12/64	2.36	0.42	5.62	-	-	-	-
	Stillbirth	2/65	1.49	0.26	5.73	-	-	-	-
	Stillbirth	3/65	1.42	0.26	5.46	-	-	-	-
	Stillbirth	5/65	1.72	0.26	6.62	-	-	-	-
	Stillbirth	6/65	1.36	0.42	3.24	-	-	-	-
	Stillbirth	6/65	1.85	0.38	4.87	-	-	-	-
	Stillbirth	7/65	1.12	0.35	3.20	-	-	-	-

TABLE III - (cont'd)

STRONTIUM IN BONES AND DIETS

A g e (months)	Date of Birth	<u>B O N E</u>			<u>D I E T S</u>			
		$\frac{\text{Sr-90/Ca}}{(\text{pc} / \text{g})}$	$\frac{\text{Sr/Ca}}{(\text{mg/g})}$	$\frac{\text{Sr-90/Sr}}{(\text{pc} / \text{mg})}$		$\frac{\text{Sr-90/Ca}}{(\text{pc} / \text{g})}$		
					0-6 Mos.	6-12 Mos.	12-24 Mos.	24-36 Mos.
Stillbirth	7/65	1.18	0.33	3.58	-	-	-	-
Stillbirth	8/65	1.88	0.30	6.27	-	-	-	-
Stillbirth	8/65	2.08	0.32	6.50	-	-	-	-
Stillbirth	9/65	0.97	0.28	3.46	-	-	-	-
Stillbirth	9/65	1.06	0.26	4.08	-	-	-	-
Stillbirth	9/65	1.14	0.29	3.93	-	-	-	-
Stillbirth	9/65	1.63	0.27	6.04	-	-	-	-
Stillbirth	10/65	1.04	0.30	3.47	-	-	-	-
Stillbirth	11/65	1.57	0.27	5.81	-	-	-	-
+ 0.2	7/64	1.32	0.31	4.26	4.06	-	-	-
0.4	3/65	2.24	0.25	8.96	5.01	-	-	-
0.4	8/65	1.17	0.32	3.66	4.11	-	-	-

TABLE III - (cont'd)

STRONTIUM IN BONES AND DIETS

	A g e (months)	Date of Birth	<u>B O N E</u>			<u>D I E T S</u>			
			<u>Sr-90/Ca</u> (pc / g)	<u>Sr/Ca</u> (mg/g)	<u>Sr-90/Sr</u> (pc / mg)	<u>Sr-90/Ca</u> (pc / g)			
						0-6 Mos.	6-12 Mos.	12-24 Mos.	24-36 Mos.
I - 43	0.5	6/65	1.20	0.32	3.75	5.01	-	-	-
	+ 0.5	9/63	1.42	0.33	4.30	2.73	-	-	-
	0.8	5/65	1.67	0.50	5.34	5.01	-	-	-
	+ 0.8	1/64	0.83	0.42	1.98	4.06	-	-	-
	0.9	6/65	2.11	0.30	7.03	5.01	-	-	-
	+ 1.0	4/64	2.06	0.27	7.63	4.06	-	-	-
	1.0	1/65	2.04	0.40	5.10	5.01	-	-	-
	1.0	6/65	1.55	0.35	4.43	5.01	-	-	-
	1.0	11/64	1.83	0.33	5.55	4.28	-	-	-
	1.1	11/64	2.01	0.34	5.91	4.28	-	-	-
	1.1	9/64	1.51	0.26	5.81	4.28	-	-	-
	1.3	10/64	2.73	0.28	9.75	4.28	-	-	-

TABLE III - (cont'd)

STRONTIUM IN BONES AND DIETS

	A g e (months)	Date of Birth	<u>B O N E</u>			<u>D I E T S</u>			
			<u>Sr-90/Ca</u> (pc / g)	<u>Sr/Ca</u> (mg/g)	<u>Sr-90/Sr</u> (pc /mg)	<u>Sr-90/Ca</u> (pc / g)			
						0-6 Mos.	6-12 Mos.	12-24 Mos.	24-36 Mos.
	1.3	2/65	2.17	0.38	5.71	5.01	-	-	-
+	1.3	5/64	1.18	0.29	4.07	4.06	-	-	-
77 - 1	1.3	2/65	2.71	0.40	6.78	5.01	-	-	-
+	1.3	5/64	1.27	0.15	8.47	4.06	-	-	-
	1.3	3/65	1.61	0.30	5.37	5.01	-	-	-
	1.4	4/65	2.26	0.53	4.26	5.01	-	-	-
	1.6	10/64	1.20	0.34	3.53	4.28	-	-	-
+	1.7	2/64	1.42	0.23	6.17	4.06	-	-	-
	1.7	10/64	1.68	0.23	7.30	4.28	-	-	-
+	1.9	9/63	0.90	0.22	4.09	2.73	-	-	-
+	2.0	11/63	2.41	0.33	7.30	4.06	-	-	-
+	2.0	2/64	1.60	0.34	4.71	4.06	-	-	-

TABLE III - (cont'd)

STRONTIUM IN BONES AND DIETS

	Age (months)	Date of Birth	<u>B O N E</u>			<u>D I E T S</u>			
			$\frac{\text{Sr-90/Ca}}{(\text{pc} / \text{g})}$	$\frac{\text{Sr/Ca}}{(\text{mg/g})}$	$\frac{\text{Sr-90/Sr}}{(\text{pc} / \text{mg})}$		$\frac{\text{Sr-90/Ca}}{(\text{pc} / \text{g})}$		
						0-6 Mos.	6-12 Mos.	12-24 Mos.	24-36 Mos.
I - 45	+ 2.0	7/64	1.49	0.40	3.73	4.06	-	-	-
	2.0	3/65	2.61	0.57	4.58	5.01	-	-	-
	2.0	4/65	1.32	0.23	5.74	5.01	-	-	-
	2.0	5/65	1.31	0.34	3.85	5.01	-	-	-
	2.0	5/65	1.68	0.38	4.42	5.01	-	-	-
	2.2	10/64	2.45	0.48	5.10	4.28	-	-	-
	2.2	12/64	3.00	0.39	7.69	4.28	-	-	-
	+ 2.3	6/64	1.64	0.31	5.29	4.06	-	-	-
	+ 2.3	3/64	2.27	0.37	6.13	4.06	-	-	-
	+ 2.4	3/64	1.40	0.33	4.24	4.06	-	-	-
	+ 2.4	4/64	1.73	0.37	4.68	4.06	-	-	-
	+ 2.4	2/64	1.97	0.33	5.97	4.06	-	-	-

TABLE III - (cont'd)

STRONTIUM IN BONES AND DIETS

<u>B O N E</u>					<u>D I E T S</u>			
Age (months)	Date of Birth	$\frac{\text{Sr-90/Ca}}{(\text{pc} / \text{g})}$	$\frac{\text{Sr/Ca}}{(\text{mg/g})}$	$\frac{\text{Sr-90/Sr}}{(\text{pc} / \text{mg})}$		$\frac{\text{Sr-90/Ca}}{(\text{pc} / \text{g})}$		
					0-6 Mos.	6-12 Mos.	12-24 Mos.	24-36 Mos.
2.5	4/65	1.60	0.30	5.33	5.01	-	-	-
2.8	8/64	1.77	0.18	9.83	4.28	-	-	-
2.9	5/64	1.62	0.24	6.75	4.06	-	-	-
+ 3.0	9/63	1.87	0.32	5.84	2.73	-	-	-
+ 3.0	10/63	1.42	0.35	4.06	2.73	-	-	-
+ 3.0	1/64	1.50	0.27	5.55	4.06	-	-	-
3.0	7/64	2.11	0.29	7.28	4.28	-	-	-
3.0	12/64	1.96	0.42	4.67	4.28	-	-	-
+ 3.2	1/64	2.10	0.35	6.00	4.06	-	-	-
3.2	4/65	1.82	0.36	6.28	5.01	-	-	-
+ 3.2	7/63	1.84	0.31	5.93	2.73	-	-	-
+ 3.5	2/64	1.89	0.35	5.40	4.06	-	-	-

TABLE III - (cont'd)

STRONTIUM IN BONES AND DIETS

<u>B O N E</u>						<u>D I E T S</u>				
A g e (months)	Date of Birth	Sr-90/Ca (p c / g)	Sr/Ca (mg/g)	Sr-90/Sr (p c / m g)	Sr-90/Ca (p c / g)					
					0-6 Mos.	6-12 Mos.	12-24 Mos.	24-36 Mos.		
I - 47	+	3.6	1/63	0.53	0.25	2.12	2.73	-	-	-
		3.7	1/65	2.13	0.35	6.09	5.01	-	-	-
	+	3.9	2/64	1.87	0.20	6.45	4.06	-	-	-
		3.9	9/64	1.94	0.46	4.22	4.28	-	-	-
	+	4.0	9/63	1.24	0.40	3.10	3.28	-	-	-
	+	4.0	9/63	1.77	0.36	4.92	3.28	-	-	-
		4.0	10/64	1.94	0.37	5.24	5.22	-	-	-
		4.0	10/64	1.70	0.39	4.36	5.22	-	-	-
		4.0	12/64	1.44	0.31	4.65	5.13	-	-	-
		4.0	2/65	1.22	0.31	3.94	5.01	-	-	-
		4.2	8/64	1.96	0.36	5.44	4.28	-	-	-
	+	4.4	3/64	1.19	0.28	4.25	4.06	-	-	-

TABLE III - (cont'd)

STRONTIUM IN BONES AND DIETS

		<u>B O N E</u>			<u>D I E T S</u>				
A g e (months)	Date of Birth	Sr-90/Ca (pc / g)	Sr/Ca (mg/g)	Sr-90/Sr (pc/mg)	Sr-90/Ca (pc / g)				
					0-6 Mos.	6-12 Mos.	12-24 Mos.	24-36 Mos.	
+	4.8	12/63	2.13	0.39	5.46	2.73	-	-	-
	4.8	6/64	2.07	0.26	7.96	4.28	-	-	-
	5.0	6/64	1.88	0.26	7.23	4.28	-	-	-
	5.0	2/65	1.54	0.40	3.85	5.01	-	-	-
	5.2	8/64	2.06	0.32	6.44	4.28	-	-	-
	5.3	2/65	2.07	0.35	7.39	5.01	-	-	-
	5.3	5/64	3.06	0.28	10.93	4.28	-	-	-
	5.4	6/64	2.80	0.25	11.20	4.28	-	-	-
	7.0	12/64	2.29	0.53	4.32	4.66	7.80	-	-
+	7.6	7/63	2.90	0.37	7.84	3.67	5.86	-	-
+	8.0	10/63	1.41	0.30	4.70	3.67	5.86	-	-
+	8.0	3/64	0.95	0.25	3.80	4.06	7.25	-	-

TABLE III - (cont'd)

STRONTIUM IN BONES AND DIETS

	A g e (months)	Date of Birth	<u>B O N E</u>			<u>D I E T S</u>			
			$\frac{\text{Sr-90/Ca}}{(\text{pc/g})}$	$\frac{\text{Sr/Ca}}{(\text{mg/g})}$	$\frac{\text{Sr-90/Sr}}{(\text{pc/mg})}$		$\frac{\text{Sr-90/Ca}}{(\text{pc/g})}$		
						0-6 Mos.	6-12 Mos.	12-24 Mos.	24-36 Mos.
	8.0	3/64	1.04	0.28	3.71	4.06	7.25	-	-
	8.0	10/64	1.05	0.38	2.76	4.66	7.80	-	-
+	8.3	9/63	1.16	0.28	4.14	3.67	5.86	-	-
	8.3	2/64	2.43	0.26	9.35	4.06	7.25	-	-
	8.5	2/64	1.94	0.29	6.69	4.06	7.25	-	-
	8.5	5/64	3.74	0.58	6.45	4.06	7.25	-	-
+	8.6	9/63	2.29	0.35	6.54	3.67	5.86	-	-
+	9.0	11/63	1.47	0.26	5.65	3.67	5.86	-	-
	9.0	9/64	2.41	0.41	5.88	4.66	7.80	-	-
+	9.3	9/63	2.08	0.40	5.20	3.67	5.86	-	-
+	9.8	9/63	2.47	0.31	7.97	3.67	5.86	-	-
+	10.2	10/63	1.42	0.41	3.46	3.67	5.86	-	-

TABLE III - (cont'd)

STRONTIUM IN BONES AND DIETS

	A g e (months)	Date of Birth	<u>B O N E</u>			<u>D I E T S</u>			
			$\frac{\text{Sr-90/Ca}}{(\text{pc/g})}$	$\frac{\text{Sr/Ca}}{(\text{mg/g})}$	$\frac{\text{Sr-90/Sr}}{(\text{pc/mg})}$		$\frac{\text{Sr-90/Ca}}{(\text{pc/g})}$		
						0-6 Mos.	6-12 Mos.	12-24 Mos.	24-36 Mos.
I - 50	+ 10.3	1/63	1.85	0.32	5.77	2.57	4.73	-	-
	+ 10.5	11/63	1.51	0.37	4.08	3.67	5.86	-	-
	10.5	3/64	2.47	0.47	5.26	3.58	5.54	-	-
	11.0	6/64	2.61	0.35	7.46	4.28	7.63	-	-
	11.0	8/64	1.75	0.46	3.80	4.28	7.63	-	-
	+ 12.0	8/62	0.91	0.40	2.27	2.73	3.71	-	-
	12.0	9/63	1.83	0.30	6.10	3.67	5.86	-	-
	13.3	6/64	2.51	0.37	6.78	4.28	7.63	8.15	-
	13.5	5/64	1.99	0.41	4.85	4.28	7.63	8.15	-
	+ 15.2	5/63	1.09	0.36	3.03	3.28	5.86	7.67	-
	15.6	4/64	2.30	0.37	6.22	3.58	5.54	6.10	-
	+ 16.0	5/62	1.24	0.43	2.88	2.73	3.71	5.00	-

TABLE III - (cont'd)

STRONTIUM IN BONES AND DIETS

	A g e (months)	Date of Birth	<u>B O N E</u>			<u>. D I E T S</u>			
			$\frac{\text{Sr-90/Ca}}{(\text{pc/g})}$	$\frac{\text{Sr/Ca}}{(\text{mg/g})}$	$\frac{\text{Sr-90/Sr}}{(\text{pc/mg})}$	$\frac{\text{Sr-90/Ca}}{(\text{pc/g})}$			
						0-6 Mos.	6-12 Mos.	12-24 Mos.	24-36 Mos.
I - 51	+ 16.0	1/63	2.05	0.30	6.83	2.57	4.73	6.20	-
	16.0	6/63	1.74	0.32	5.44	3.28	5.86	7.66	-
	16.0	8/63	2.32	0.54	4.30	3.67	5.86	7.66	-
	+ 16.2	11/62	1.95	0.32	6.09	2.65	4.73	5.00	-
	+ 17.8	12/62	1.36	0.27	5.04	2.65	4.73	5.00	-
	17.9	10/63	1.75	0.34	5.15	3.67	5.86	7.66	-
	20.0	4/63	1.34	0.39	3.44	3.28	5.86	7.67	-
	20.0	9/63	2.51	0.46	5.46	3.67	5.86	7.67	-
	20.0	8/63	2.18	0.37	5.89	3.67	5.86	7.67	-
	21.0	1/62	1.99	0.34	5.85	2.73	3.71	5.00	-
	21.0	2/63	1.03	0.30	3.43	2.57	4.73	6.20	-
	21.0	9/63	1.49	0.30	4.97	3.67	5.86	7.67	-

TABLE III - (cont'd)

STRONTIUM IN BONES AND DIETS

A g e (months)	Date of Birth	<u>B O N E</u>			<u>D I E T S</u>			
		$\frac{\text{Sr-90/Ca}}{(\text{pc/g})}$	$\frac{\text{Sr/Ca}}{(\text{mg/g})}$	$\frac{\text{Sr-90/Sr}}{(\text{pc/mg})}$		$\frac{\text{Sr-90/Ca}}{(\text{pc/g})}$		
					0-6 Mos.	6-12 Mos.	12-24 Mos.	24-36 Mos.
24.0	3/63	1.79	0.35	5.11	2.57	4.73	6.20	-
24.0	5/63	1.75	0.37	4.73	3.28	5.86	7.67	-
26.0	11/62	1.85	0.41	4.51	2.65	4.73	5.00	5.75
29.6	1/63	2.19	0.45	4.87	2.57	4.73	6.20	6.12
32.0	2/62	1.94	0.49	3.96	2.73	3.71	5.00	5.30
33.0	5/63	1.51	0.39	3.87	3.28	5.86	7.67	5.92

+ Data on these samples were already included in former progress reports.

TABLE IV

STRONTIUM-90 AND STABLE STRONTIUM IN BONE
(3 years - early adolescence age group)

A g e (years)	Date of Birth	Ca (in ash) %	Sr-90/Ca (pc / g)	Sr/Ca (mg/g)	Sr-90/Sr (pc / mg)
4	12/60	36.0	1.41	0.51	2.76
4	9/60	32.2	1.28	0.65	1.97
4	9/60	33.4	1.89	0.45	4.20
4	4/60	33.6	2.00	0.68	2.94
5	6/59	31.9	1.17	0.35	3.34
5	2/60	36.7	1.76	0.79	2.23
6	10/58	32.7	1.18	0.30	3.93
6	1/59	33.1	1.56	0.63	2.48
6	6/59	36.3	1.20	0.47	2.55
6	7/59	34.2	1.30	0.48	2.71
6	7/59	36.8	1.06	0.46	2.30
7	8/57	36.0	1.40	0.57	2.46

TABLE IV - (cont'd)

STRONTIUM-90 AND STABLE STRONTIUM IN BONE
(3 years - early adolescence age group)

A g e (years)	Date of Birth	Ca (in ash) %	Sr-90/Ca (pc / g)	Sr/Ca (mg/g)	Sr-90/Sr (pc / mg)
7	4/58	33.9	0.64	0.38	1.68
8	7/57	37.8	0.87	0.49	1.78
9	12/56	35.4	1.96	0.76	2.58
9	1/56	37.6	1.55	0.49	3.16
9	7/56	36.5	0.60	0.28	2.14
10	1/54	36.3	1.67	0.39	4.28
10	1/55	35.1	2.68	0.68	3.94
10	4/55	34.5	1.05	0.80	1.31
10	6/55	30.7	1.24	0.71	1.75
12	1/52	35.1	1.63	0.65	2.51
12	12/52	35.5	1.18	0.87	1.36
12	11/52	35.2	1.30	0.43	3.02

TABLE IV - (cont'd)

STRONTIUM-90 AND STABLE STRONTIUM IN BONE
(3 years - early adolescence age group)

A g e (years)	Date of Birth	Ca (in ash) %	Sr-90/Ca (pc / g)	Sr/Ca (mg/g)	Sr-90/Sr (pc / mg)
12.	1/53	32.8	1.95	0.72	2.71
12	5/53	32.8	1.08	0.33	3.27
12	6/53	36.3	1.18	0.60	1.97
14	1/50	31.6	1.52	0.46	3.30
15	4/49	33.1	1.81	0.38.	4.76

MINERAL TURNOVER RATE IN THE SKELETON



