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Aarkrog, A.; Hansen, Heinz Johs. Max; Lippert, Jørgen Emil

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Environmental Radioactivity in Greenland in 1978

A. Aarkrog, Heinz Hansen
and J. Lippert

DK8000035

Risø National Laboratory, DK-4000 Roskilde, Denmark
July 1979

Risø-R-405

ENVIRONMENTAL RADIOACTIVITY IN GREENLAND IN 1978

A. Aarkrog, Heinz Hansen and J. Lippert

Abstract. Measurements of fallout radioactivity in Greenland in 1978 are reported. Strontium-90 (and Cesium-137 in most cases) was determined in samples of precipitation, sea water, vegetation, animals, and drinking water. Tritium was determined in samples of drinking water. Estimates are given of the mean contents of ^{90}Sr and ^{137}Cs in the human diet in Greenland in 1978.

INIS Descriptors

[0] DEER, DIET, ENVIRONMENT, EXPERIMENTAL DATA, FISHES, FOOD CHAINS, GLOBAL FALLOUT, GRAPHS, GREENLAND, PLANTS, RADIOACTIVITY, SEAWATER, SHEEP, TABLES

[1] ATMOSPHERIC PRECIPITATIONS, DRINKING WATER, STRONTIUM 90

[2] CESIUM 137

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ABBREVIATIONS AND UNITS

FP	fission products
pCi	picocurie, 10^{-12} Ci, μμCi
nCi	nanocurie, 10^{-9} Ci, mμCi
mCi	millicurie, 10^{-3} Ci
S.U.	pCi ^{90}Sr (g Ca)$^{-1}$
M.U.	pCi ^{137}Cs (g K)$^{-1}$
nSr	natural (stable) Sr
S.D.	standard deviation, $\sqrt{\frac{\Sigma(\bar{x}-x_i)^2}{(n-1)}}$
S.E.	standard error, $\sqrt{\frac{\Sigma(\bar{x}-x_i)^2}{n(n-1)}}$
S.S.D.	sum of squares of deviation, $\Sigma(\bar{x}-x_i)^2$
f	degrees of freedom
s^2	the variance
v^2	the ratio between the variance in question and the residual variance
P	the probability fractile of the distribution in question
$\bar{x}$	mean value
η	coefficient of variation, relative S.D.
Σ	sum
anova	analysis of variance
A	η = 20-33% (counting error)
B	η > 33% (counting error)
B.D.L.	below detection limit

1. INTRODUCTION

1.1.

In 1978 the sampling programme was similar to that used in previous years but for a few minor modifications.

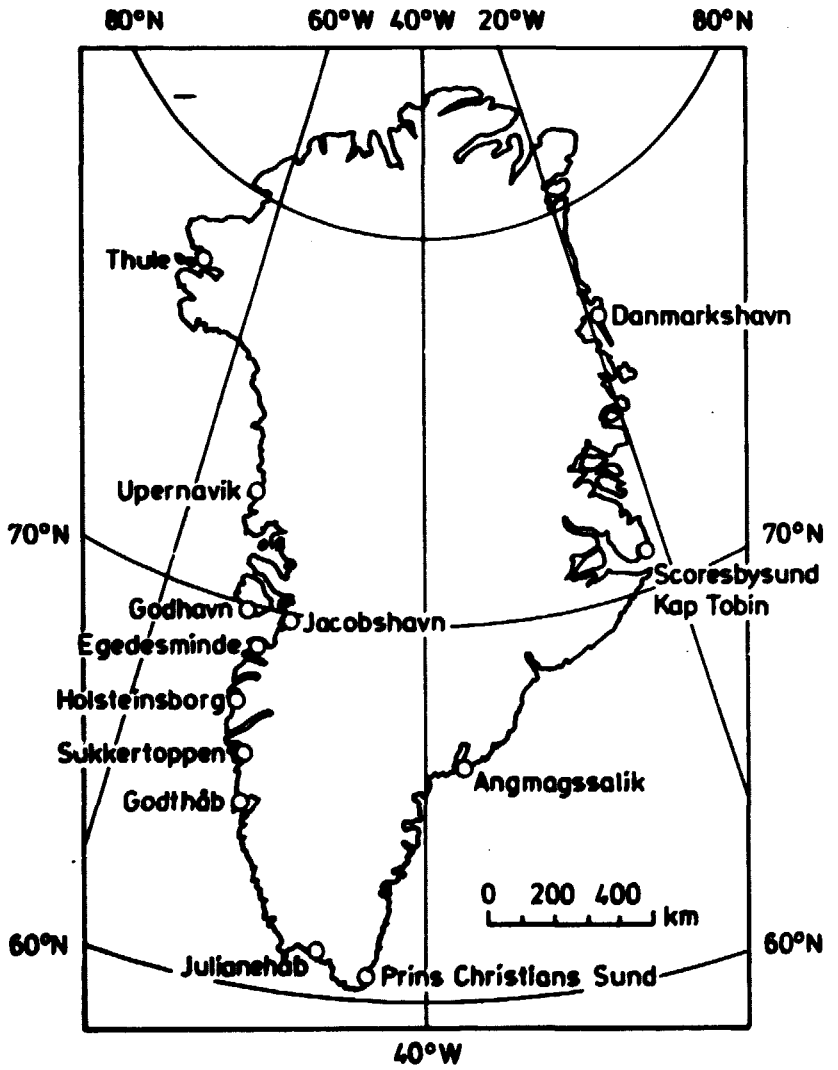

Fig. 1. Greenland.

1.2.

As hitherto, samples were collected through the local district physicians and the heads of the telestations.

1.3.

The estimated mean diet in Greenland was the same as that in 1962, i.e., it agreed with the estimate given by Professor E. Hoff-Jørgensen, Ph.D.

1.4.

The environmental studies in Greenland were carried out together with corresponding investigations in Denmark (cf. Risø Report No. 403)[2] and in the Faroes (cf. Risø Report No. 404)[3].

1.5.

The present report does not repeat information concerning sample collection and analysis already given in ref. 1.

2. RESULTS AND DISCUSSION

2.1. Strontium-90 in precipitation

Table 2.1.1 shows the results of the measurements.

The ^{90}Sr levels in 1978 at the Greenland stations were 1.4 $\pm$ 0.4 (1SD) times the 1977 figures. In Denmark[2] and the Faroes[3] the fallout levels increased similarly from 1977 to 1978.

Fig. 2.1 shows the accumulated ^{90}Sr at the various stations in Greenland, since measurements began in 1962.

Table 2.1.1. Strontium-90 in precipitation collected in Greenland in 1978

Location	Unit	Jan-March	April-June	July-Sept	Oct-Dec	1978
Upernavik	pCi l^{-1}	1.52	6.45	1.05	0.53	$\bar{x}$ 1.16
Σ 181 mm	mCi km^{-2}	0.064	0.043	0.069	0.035	Σ 0.21
Godhavn	pCi l^{-1}	1.72	2.09	0.83	0.07	$\bar{x}$ 0.76
Σ 465 mm	mCi km^{-2}	0.057	0.151	0.133	0.014	Σ 0.36
Godthåb	pCi l^{-1}	0.83	1.35	0.44	(0.17)	$\bar{x}$ 0.48
Σ 806 mm	mCi km^{-2}	0.070	0.121	0.153	(0.048)	Σ 0.39
Prins Chr. Sund	pCi l^{-1}	0.75	0.85	0.48	0.14	$\bar{x}$ 0.51
Σ 2858 mm*	mCi km^{-2}	0.43	0.56	0.36	0.12	Σ 1.47
Kap Tobin	pCi l^{-1}	0.88	(1.85)	0.71	0.30	$\bar{x}$ 0.85
Σ 326 mm	mCi km^{-2}	0.073	(0.105)	0.073	0.025	Σ 0.28
Danmarkshavn	pCi l^{-1}	(2.17)	1.86	(1.42)	0.92	$\bar{x}$ 1.59
Σ 120 mm	mCi km^{-2}	(0.048)	0.093	(0.016)	0.034	Σ 0.19

*The missing amount of precipitation was kindly supplied by Mr. Gunnar Nielsen, Danish Meteorological Institute. Figures in brackets were estimated from VAR 3, due to missing samples.

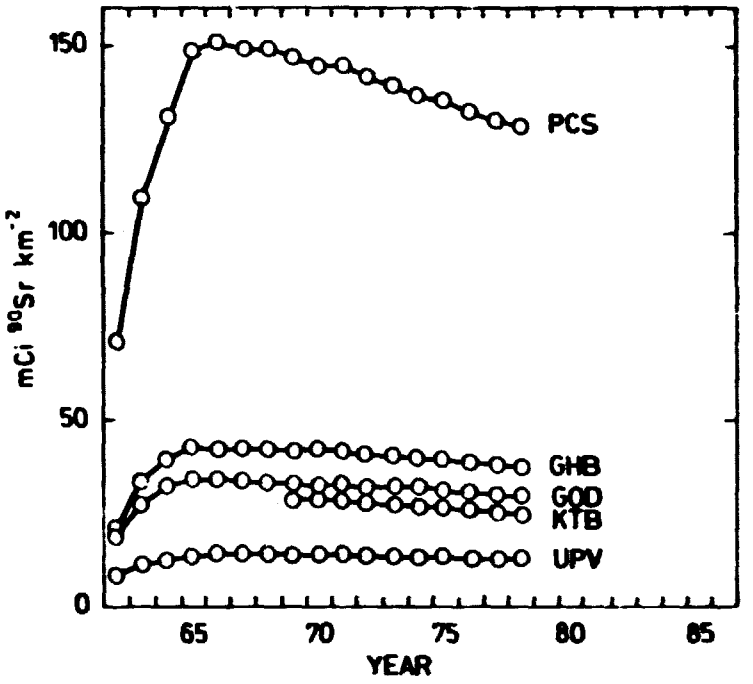

Fig. 2.1. Accumulated ^{90}Sr at Prins Chr. Sund, Godthåb, Godhavn, Kap Tobin and Upernavik calculated from precipitation measurements since 1962. The accumulated fallout by 1962 was estimated from the Danish data (cf. Risø Report No. 403[2)], Appendix D) and from the ratio between the ^{90}Sr fallout at the Greenland stations and the fallout in Denmark in the period 1962-1974.

2.2. Strontium-90 in sea water

Six samples were obtained in 1978. Table 2.2 shows the results. The ^{90}Sr level was comparable with those of the previous years. The ^{137}Cs/^{90}Sr mean ratio was 1.45 $\pm$ 0.49 (1SD), i.e. there was no indication of any surplus ^{137}Cs in Greenland waters in the 1978 samples.

The concentrations in the East Greenland waters were as usual higher than the levels along the west coast of Greenland.

Table 2.2. Strontium-90 and Cesium-137 in sea water from Greenland in 1978

Location	pCi ^{90}Sr l^{-1}	pCi ^{137}Cs l^{-1}	Salinity o/oo
Dundas	0.11	0.11	26.8
Godhavn	0.09	0.16	33.0
Godthåb	0.12	0.14	30.7
Prins Chr. Sund	0.18	0.22	33.2
Angmagssalik	0.10	0.23	30.6
Danmarkshavn	0.19	0.24	32.1
Mean	0.13	0.18	31.1

2.3. Strontium-90 and Cesium-137 in terrestrial animals

Five samples of lamb were received from Julianehåb in 1978. The mean levels were 7.4 pCi ^{90}Sr kg^{-1} meat and 0.87 nCi ^{137}Cs kg^{-1}. The lamb bones contained 97 pCi ^{90}Sr (g Ca)$^{-1}$.

One sample of reindeer (meat and liver) from the Sukkertoppen showed mean levels of 12 pCi ^{90}Sr kg^{-1} meat, 8.1 nCi ^{137}Cs kg^{-1} and in bone: 150 pCi ^{90}Sr (g Ca)$^{-1}$.

Table 2.3.2.1. Strontium-90 and Cesium-137 in terrestrial animals collected in Greenland in 1978

Date	Location	Sample type		pCi ^{90}Sr kg^{-1}	pCi ^{90}Sr (g Ca)$^{-1}$	pCi ^{137}Cs kg^{-1}	pCi ^{137}Cs (g K)$^{-1}$
Aug	Julianehåb	Lamb I	Meat	5.3		660	
"	- " -	Lamb I	Bone		90		
"	- " -	Lamb II	Meat			1200	
"	- " -	Lamb II	Bone		86		
"	- " -	Lamb III	Meat			570	
"	- " -	Lamb III	Bone		79		
"	- " -	Lamb IV	Meat	9.4		1080	
"	- " -	Lamb IV	Bone		156		
"	- " -	Lamb V	Meat			820	
"	- " -	Lamb V	Bone		74		
Feb	Sukkertoppen	Reindeer	Meat	14.5	239	10040	3030
"	- " -	Reindeer	Liver	9.1	233	6079	2900
"	- " -	Reindeer	Bone		150		

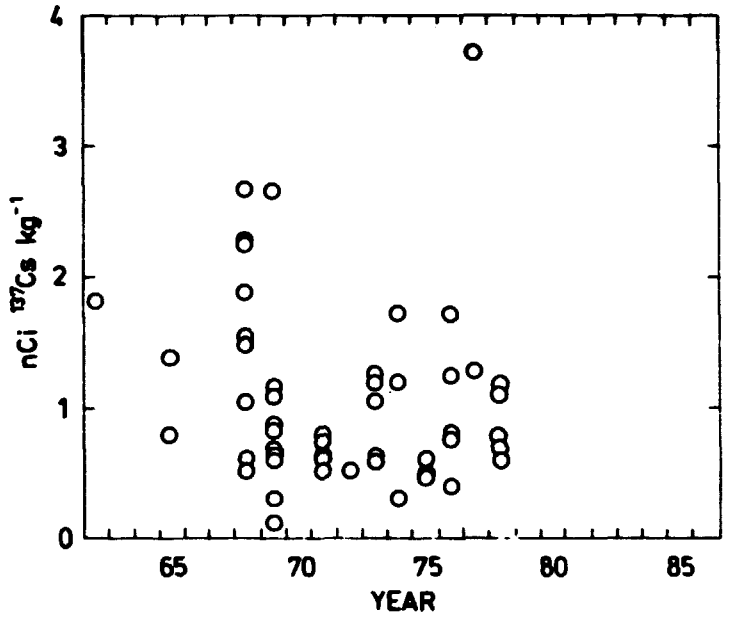

Fig. 2.3.1. Cesium-137 in mutton, 1962-1978.

2.4. Strontium-90 and Cesium-137 in sea animals

Two samples of seabirds (quillemot and black guillemot) were analysed in 1978 (table 2.4.1). The mean levels were 0.19 pCi ^{90}Sr kg^{-1} flesh and 10 pCi ^{137}Cs kg^{-1}. The levels in fish (ang masetter) were: 0.4 pCi ^{90}Sr kg^{-1}, 7 pCi ^{137}Cs kg^{-1}, and seal contained 0.05 pCi ^{90}Sr kg^{-1} meat and 14 pCi ^{137}Cs kg^{-1}, and 0.035 pCi ^{90}Sr kg^{-1} and 19 pCi ^{137}Cs kg^{-1}.

Table 2.4.1. Strontium-90 and Cesium-137 in sea animals collected in Greenland in 1978

Date	Location	Sample type		pCi ^{90}Sr kg^{-1}	pCi ^{90}Sr (g Ca)$^{-1}$	pCi ^{137}Cs kg^{-1}	pCi ^{137}Cs (g K)$^{-1}$
Feb	Sukkertoppen	Piked whale	Meat	0.035	0.79	19	6.5
June	Angmagssalik	Seal	Meat	0.042	0.80	11	5.8
"	- " -	"	Bone		0.058		
July	Jacobshavn	Seal	Meat	0.016	0.21	9	3.6
"	- " -	"	Bone		0.068		
Aug	Julianehåb	Seal	Meat	0.093	1.43	22	7.2
"	- " -	"	Bone		0.034		
June	Angmagssalik	Black Guillemot	Meat	0.33	5.0	12	3.5
"	- " -	- " -	Bone		0.11		
Aug	Julianehåb	Guillemot	Meat	0.048	1.15	7	2.4
"	- " -	- " -	Bone		0.046		
June	Angmagssalik	Angmasetter	Total	0.39	0.21	7	3.1

2.5. Strontium-90 and Cesium-137 in vegetation

Lichen, moss, grass, crowberry and seaweed were collected along the Greenland coast during the summer. Table 2.5 shows the results.

The geometric mean levels in moss and lichen were 0.6 nCi ^{90}Sr kg^{-1} and 1.2 nCi ^{137}Cs kg^{-1}. The levels in lichen were lower than the values observed earlier (cf. fig. 2.5). This was probably because no samples from the west coast were included in the material.

In September 1978 two lichen samples were collected at Narssarssuk. The sample analysed for ^{137}Cs in table 2.5 was collected near the coast. The other sample was obtained in a small river valley. Both samples were analysed for plutonium, because

Table 2.5. Strontium-90 and Cesium-137 in vegetation samples collected in Greenland in 1978

Location	Species	Sampling time	pCi ^{90}Sr kg^{-1}	pCi ^{90}Sr (g Ca)$^{-1}$	pCi ^{137}Cs kg^{-1}	pCi ^{137}Cs (g K)$^{-1}$
Scoresby Sund	Lichen	Summer	370	330	290	440
Narssarssûk, Thule	Lichen	Sept	-	-	5300	1000
Danmarkshavn	Lichen I*	Summer	990	103	1360	600
- " -	Lichen II*	Summer	900	76	1930	750
Danmarkshavn	Moss*	Summer	500	720	460	280
Sukkertoppen	Moss	Summer	-	80	1860	1440
Scoresby Sund	Grass	Summer	230	180	420	80
Julianehåb	Grass	Summer	630	-	420	370
Sukkertoppen	Crowberry leaves and twigs	Summer	200	-	860	370
Sukkertoppen	Rhododendron	Summer	230	-	840	590
Scoresby Sund	Fucus sp. I	Summer	66**	6.0	220**	51
- " -	Fucus sp. II	Summer	236**	26.0	134**	31
- " -	Fucus sp. III	Summer	99**	4.9	175**	2[illegible]
Angmagssalik	Fucus sp.	Summer	13	12	35	5.8

* I: 4.6 nCi ^{90}Sr m^{-2} and 6.3 nCi ^{137}Cs m^{-2}; II: 3.1 nCi ^{90}Sr m^{-2} and 6.8 nCi ^{137}Cs m^{-2}.
Moss: 23.5 nCi ^{90}Sr m^{-2} and 21.5 nCi ^{137}Cs m^{-2}.

**Dry samples; the 3 Fucus samples from Scoresby Sund contained also ^{144}Ce, I: 2300 pCi kg^{-1}, II: 1900 pCi kg^{-1} and III: 3400 pCi kg^{-1} and so did the Fucus sample from Angmagssalik: 2400 pCi kg^{-1}.

To obtain concentration per kg fresh weight the dry weight concentrations should be divided by approximately five.

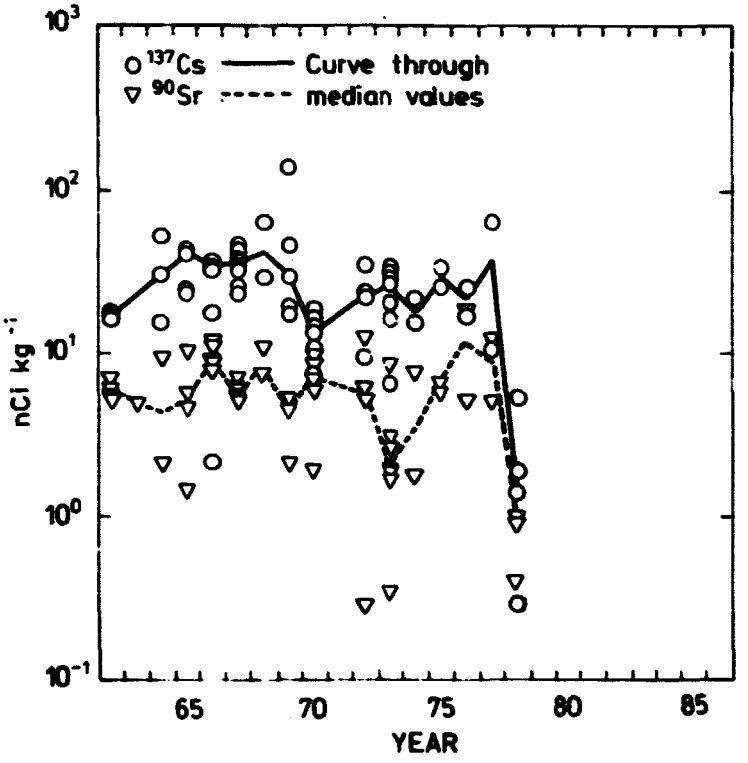

Fig. 2.5. Cesium-137 and Strontium-90 in lichen (fresh weight) collected along the Greenlandic coast, 1962-1978.

lichen samples from Narssarssuk, since the B-52 accident at Thule in 1968, occasionally have contained elevated Pu concentrations. The ^{239,240}Pu concentrations were 126 and 136 pCi kg^{-1} lichen in the two samples collected in September 1978. The ^{238}Pu/^{239,240}Pu ratios were 0.026 and 0.035 respectively, and the ^{239,240}Pu/^{137}Cs ratio was 0.024.

Hanson[5] has studied the plutonium and ^{137}Cs levels in lichen communities at Thule in 1968 and 1974. In samples which Hanson did not consider to be contaminated with Pu from the 1968 accident, he found in 1974 mean ratios of 0.033 $\pm$ 0.010 (1SD) for ^{238}Pu/^{239,240}Pu and of 0.019 $\pm$ 0.011 (1SD) for ^{239,240}Pu/^{137}Cs. These ratios are compatible with observations and we may conclude that the two lichen samples from 1978 did not show pronounced indications of surplus plutonium originating from the 1968 Thule accident.

2.6. Strontium-90 in drinking water

Quarterly samples of drinking water were collected from a number of locations in Greenland. Table 2.6 shows the results from 1977, and fig. 2.6 the geometric annual means of all samples for the period 1962-1977.

As in previous years, we found it most expedient to choose the geometric mean of all figures, i.e. 0.49 pCi $^{90}Sr\ l^{-1}$, as representative of the mean level of ^{90}Sr in Greenland drinking water in 1978, this level was not significantly different from that observed in recent years (fig. 2.6).

Four samples were analysed for tritium. Drinking water from Scoresby Sund from July-Sept. contained 0.19 nCi l^{-1} and a sample from Prins Chr. Sund collected in Oct.-Dec. contained 0.14 nCi l^{-1}. Two samples from Scoresby Sund collected in July-Sept. 1977 and in Oct.-Dec. 1977 contained 0.16 and 0.12 nCi l^{-1} respectively. The mean ratio between tritium and ^{90}Sr in the samples was 470. This was a little higher than found in Danish precipitation in 1977 and 1978, but definitely lower than the ratio in Danish lakes and streams. We conclude that drinking water in Greenland may be closer to precipitation than to surface fresh water, or that Greenland surface waters are not depleted in ^{90}Sr to the same degree as Danish lake and stream water.

Table 2.6.1. Strontium-90 in drinking water collected in Greenland in 1978 (Unit: pCi $^{90}Sr\ l^{-1}$)

Location	Jan-March	April-June	July-Sept	Oct-Dec
Danmarkshavn	0.57		1.80	
Scoresby Sund	0.85	0.68	0.24	
Prins Chr. Sund	0.76		0.82	1.08
Godthåb	0.54		0.19	0.62
Upernavik	0.03			

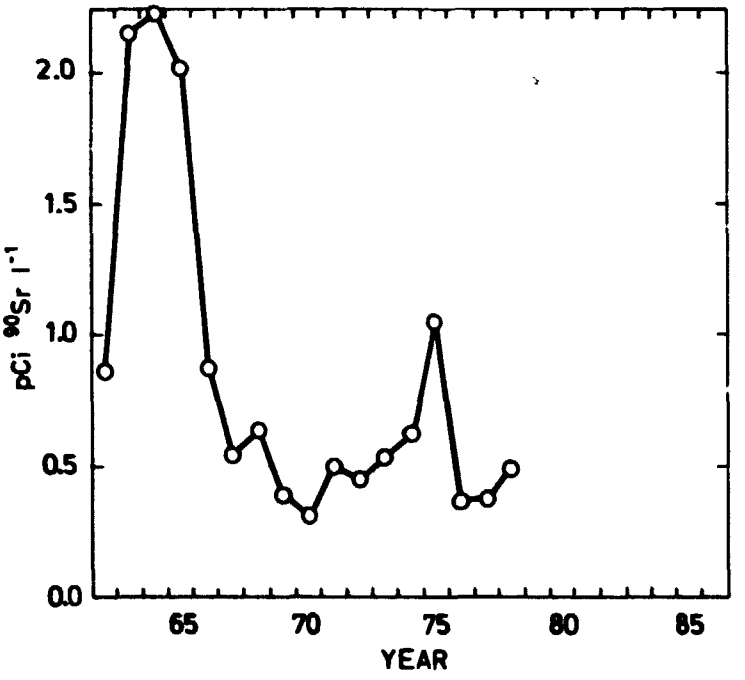

Fig. 2.6. Strontium-90 in Greenlandic drinking water (Geometric mean), 1962-1978.

3. ESTIMATE OF THE MEAN CONTENTS OF ^{90}Sr AND ^{137}Cs IN THE HUMAN DIET IN GREENLAND IN 1978

3.1. The annual quantities

The estimate of the daily per capita intake of the different foods in Greenland is still based on the figures given in 1962 by Professor E. Hoff-Jørgensen, Ph.D., in Risø Report No. 65[1].

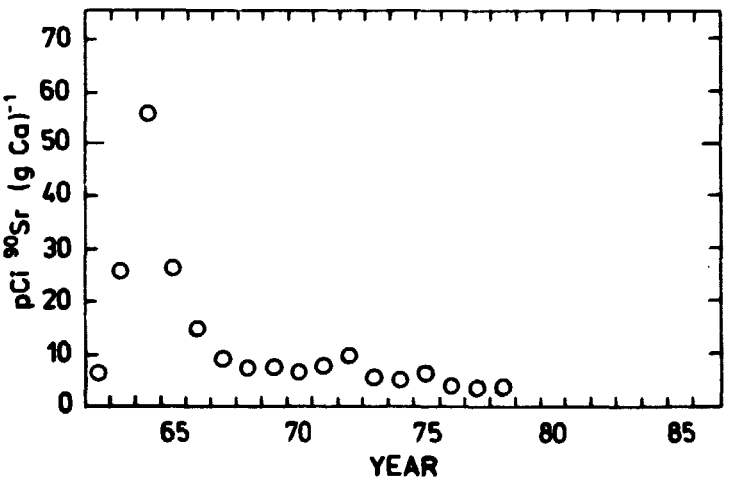

Fig. 3.1. Strontium-90 in Greenlandic diet, 1962-1978.

3.2. Milk products

All milk consumed in Greenland was imported as milk powder from Denmark. The mean radioactivity content in milk prepared from Danish dried milk produced in 1978 was 3.8 pCi ^{90}Sr kg^{-1} and 7.0 pCi ^{137}Cs kg^{-1} [2].

Cheese was also imported from Denmark and contained 27.2 pCi ^{90}Sr kg^{-1} and 5.0 pCi ^{137}Cs kg^{-1}.

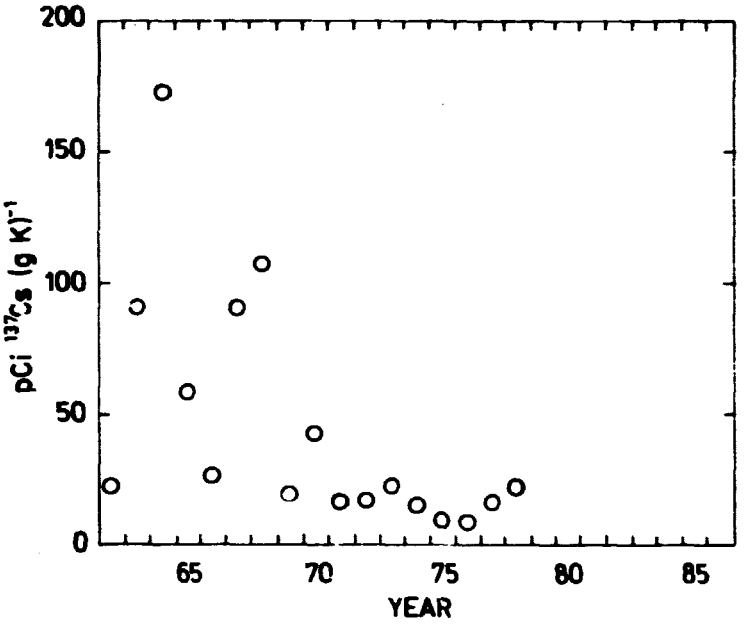

Fig. 3.2. Cesium-137 in Greenlandic diet, 1962-1978.

3.3. Grain products

All grain was imported from Denmark. It is assumed that only grain from the harvest of 1977 was consumed in Greenland during 1978. The daily per capita consumption was: rye flour (100% extraction): 80 g, wheat flour (75% extraction): 110 g, rye flour (70% extraction): 20 g, biscuits (rye, 100% extraction): 27 g, and grits: 25 g. The content of ^{90}Sr in these five products was 26, 5.0, 5.2, 19.3, and 11.6 pCi kg^{-1} respectively. Hence the mean content of ^{90}Sr in grain products was 13.5 pCi kg^{-1}. The content of ^{137}Cs in the five products was 25, 9.0, 12.5, 18.5, and 11.7 pCi kg^{-1}. Hence the mean content of ^{137}Cs in grain products was 15.4 pCi kg^{-1}.

The activity levels in rye flour (100% extraction), wheat flour (75% extraction), and grits were all taken from tables 5.9.1 and 5.9.2 in Risø Report No. 403[2]. The ^{90}Sr level in rye flour (70% extraction) was calculated analogously with the level in wheat flour (75% extraction), i.e. as one-fifth of the whole-grain activity. The ^{137}Cs content in rye flour (70% extraction) was calculated as one half of the whole-grain level in rye in

analogy with the ratio between ^{137}Cs in whole wheat grain and in wheat flour (75% extraction)[2]. The ^{90}Sr and ^{137}Cs contents in biscuits were calculated by dividing the levels of the rye flour (100% extraction) by 1.35, since 1 kg flour yields 1.35 kg bread[2].

3.4. Potatoes, other vegetables, and fruit

The Danish mean levels for 1978 were used[2] since the local production is insignificant compared with imports from Denmark.

The Danish mean levels were: in potatoes 2.0 pCi $^{90}Sr\ kg^{-1}$ and 3.8 pCi $^{137}Cs\ kg^{-1}$, in other vegetables 7.0 pCi $^{90}Sr\ kg^{-1}$ and 1.7 pCi $^{137}Cs\ kg^{-1}$, and in fruit 1.8 pCi $^{90}Sr\ kg^{-1}$ and 2.7 pCi $^{137}Cs\ kg^{-1}$.

3.5. Meat

Nearly all meat consumed in Greenland is assumed to be of local origin. Approx. 10% comes from sheep, 5% from reindeer, 60% from seals, 5% from whales, and 20% from sea birds and eggs.

The activity in reindeer and lamb was estimated from 2.3. Activity in seals and whales was estimated from 2.4 and so was the levels of sea birds and eggs. Hence the mean levels in Greenland meat from 1978 were 1.4 pCi $^{90}Sr\ kg^{-1}$ and 499 pCi $^{137}Cs\ kg^{-1}$.

3.6. Fish

All fish consumed was of local origin, and the mean levels from 2.4 were used, i.e. 0.4 pCi $^{90}Sr\ kg^{-1}$ and 7 pCi $^{137}Cs\ kg^{-1}$.

3.7. Coffee and tea

The Danish figures for 1978[2] were used for coffee and tea, i.e. 29 pCi ^{90}Sr kg^{-1} and 71 pCi ^{137}Cs kg^{-1}.

3.8. Drinking water

The geometric mean calculated in 2.6 was used as the mean level of ^{90}Sr in drinking water, i.e. 0.49 pCi ^{90}Sr l^{-1}. The ^{137}Cs content was as previously[1] estimated at 1/4 of the ^{90}Sr content, i.e. approx. 0.1 pCi ^{137}Cs l^{-1}.

Tables 3.1 and 3.2 show the diet estimates of ^{90}Sr and ^{137}Cs respectively.

Table 3.1. Estimate of the mean content of ^{90}Sr in the human diet in Greenland in 1978

Type of food	Annual quantity in kg	pCi ^{90}Sr per kg	Total pCi ^{90}Sr	Percentage of total ^{90}Sr in food
Milk and cream	78	3.8	296	12.4
Cheese	2.5	27.2	68	2.9
Grain products	95.6	13.5	1291	54.3
Potatoes	32.8	2.0	66	2.8
Vegetables	5.5	7.0	38	1.6
Fruit	13.5	1.8	24	1.0
Meat and eggs	45.6	1.4	64	2.7
Fish	127.6	0.4	51	2.1
Coffee and tea	7.3	29	212	8.9
Drinking water	548	0.49	269	11.3
Total			2379	100.0

The mean annual calcium intake is estimated to be 560 g (approx. 200-250 g creta praeparata). Hence the ^{90}Sr $(g\ Ca)^{-1}$ ratio in Greenland total diet in 1978 was 4.2 S.U. and the daily intake 6.5 pCi ^{90}Sr.

Table 3.2. Estimate of the mean content of ^{137}Cs in the human diet in Greenland in 1978

Type of food	Annual quantity in kg	pCi ^{137}Cs per kg	Total pCi ^{137}Cs	Percentage of total ^{137}Cs in food
Milk and cream	78	7.0	546	2.1
Cheese	2.5	5.0	12	0
Grain products	95.6	15.4	1472	5.6
Potatoes	32.8	3.8	125	0.5
Vegetables	5.5	1.7	9	0
Fruit	13.5	2.7	36	0.1
Meat and eggs	45.6	499	22754	86.1
Fish	127.6	7	893	3.4
Coffee and tea	7.3	71	518	2.0
Drinking water	648	0.1	55	0.2
Total			26420	100.0

The mean annual potassium intake is estimated to be approx. 1200 g. Hence the ^{137}Cs $(g\ K)^{-1}$ ratio becomes 22 pCi ^{137}Cs $(g\ K)^{-1}$. The daily intake in 1978 from food was 72 pCi ^{137}Cs.

3.9. Discussion

The most important ^{90}Sr source in the Greenland diet is still grain products, which contribute 54.3% of the total ^{90}Sr content in the diet. Milk products came next in importance, contributing 15.3%. Approx. 84% of the ^{90}Sr in the food consumed in Greenland in 1978 originated from imported Danish food.

Meat is still for the most important ^{137}Cs source in the Greenland diet, contributing 86% of the total content in 1978. Approx. 90% of the ^{137}Cs in the Greenland diet in 1978 came from local products.

As compared with the 1977 figures, the ^{90}Sr and ^{137}Cs contents in the total diet in 1978 was approx. 30% higher than the 1976 level.

To estimate the maximum per capita intakes of ^{90}Sr and ^{137}Cs in Greenland in 1978 we again assume[1] that the only grain product consumed by a person is dark rye bread, and that he only eats lamb meat. His daily intake of ^{90}Sr is thus 10.5 pCi (6.9 S.U.) and his ^{137}Cs intake 121 pCi day^{-1} (using the quantities in tables 3.1 and 3.2). At the lower limit we can imagine a person eating white bread and seal and drinking water with hardly any activity (e.g. water formed by the melting of old ice). In this case the daily intakes are 3.4 pCi ^{90}Sr (2.2 S.U.) and 10 pCi ^{137}Cs. Hence the ratios between the levels in the maximum and minimum diets become 3.1 for ^{90}Sr and 12 for ^{137}Cs.

The ^{90}Sr content of the Greenland diet in 1978 was 88% of the estimated Danish mean content[2], and 65% of the Faroese level[3]. The ^{137}Cs level in the total diet in Greenland was 4.1 times that of the Danish diet and half the Faroese diet level.

4. CONCLUSION

4.1.

The ^{90}Sr fallout rates in 1978 were the following: Godhavn: approx. 0.4 mCi ^{90}Sr km^{-2}; Godthåb: 0.4 mCi ^{90}Sr km^{-2}; Prins Christians Sund: approx. 1.5 mCi ^{90}Sr km^{-2}; Upernavik: 0.2 mCi ^{90}Sr km^{-2}. The accumulated fallout levels by the end of 1978 were estimated at approx. 29 mCi ^{90}Sr km^{-2} at Godhavn, 37 mCi ^{90}Sr km^{-2} at Godthåb, 129 mCi ^{90}Sr km^{-2} at Prins Christians Sund, and 12 mCi ^{90}Sr km^{-2} at Upernavik.

4.2.

The food consumed in Greenland in 1978 contained on the average 4.2 pCi ^{90}Sr $(g\ Ca)^{-1}$, and the daily mean intake of ^{137}Cs was estimated at 72 pCi. The most important ^{90}Sr contributors to the diet were grain products and milk products, together accounting for approx. 84% of the total ^{90}Sr content of the diet. Cesium-137 originated mainly from meat (reindeer and lamb) and fish, contributing 90% of the total ^{137}Cs content of the diet.

4.3.

No ^{90}Sr analyses of human bone samples have hitherto been carried out on the population of Greenland. Considering the estimated ^{90}Sr levels in the diet, it seems probable[4], however, that the 1978 ^{90}Sr levels of humans in Greenland were on the average rather similar to those found in Denmark, i.e. the mean levels in human bone in Greenland were approx. 1 S.U. (vertebrae). From diet measurements the ^{137}Cs content in Greenlanders was estimated at 60 pCi ^{137}Cs $(g\ K)^{-1}$.

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