OCEANOGRAPHY

Strontium-90 in the Waters of the Baltic Sea

THE distribution of strontium-90 in the oceans has been examined intensively during recent years¹. In order to obtain information on the level and distribution of strontium-90 in the Baltic Sea waters, 48 samples collected during the years 1959–63 from the River Kemijoki and from the Baltic Sea were analysed.

The sampling stations are shown in Fig. 1, and the main results are given in Table 1.

Fig. 1. The sampling stations

Compared with the previously published results, our values are in general some 3–4 times higher than the North Atlantic values for lower latitudes (1959–60) and about 2–5 times higher than the values found around Greenland and The Faeroes, respectively. The agreement with the Danish values from the Sound is satisfactory².

During the period of this study, the ratio $^{90}\text{Sr}/\text{Ca}$, expressed in pc. $^{90}\text{Sr}/\text{g Ca}$, has been relatively constant in each area: 100–400 in the Kemijoki, 10–15 in the Bothnian Bay and in the eastern part of the Gulf of Finland and 4–8 in the Baltic proper. Only a slight rise, by a factor of not more than 2, was found in 1963 in the foregoing ratio, that is, markedly less than, say, the rise in the activity of milk³. The bottom samples, excluding those from the Gotland Deep, show values of 3–6 without a rise in 1963. It can be seen that the ratio $^{90}\text{Sr}/\text{Ca}$ in the Baltic Sea is up to now so low that its contribution through

the sea food chain to the strontium-90 content of man will be negligible as compared with the other sources of food.

The sampling results and detailed analytical procedure will be published later⁴.

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¹ Rocco, G. G., and Broecker, W. S., *J. Geophys. Res.*, **68**, 4501 (1963).

² Aarkrog, A., et al., *Risø Reps.* Nos. 63–65 (1963); No. 85 (1964).

³ Paakkola, O., *Nature*, **202**, 349 (1964).

⁴ Paakkola, O., and Voipio, A., *Suomen Kemistilehti*, **B**, **38** (in the press).

Effect of Photosynthesis and Respiration on the Electrical Conductance of Sea-water

RECENTLY one of us (K. P.) and his colleagues examined the effect of carbon dioxide on the electrical conductance of sea-water¹. They stated that one of the major causes of changes in the conductance due to the changes in carbon dioxide content in the sea is by biological activities (photosynthesis and respiration). A recent experiment in the laboratory shows that there is a measurable change in conductance as a result of the photosynthesis and respiration of a marine alga.

Approximately 18 l. of sea-water was enriched with nutrients, including vitamins and thiourea, and sodium bicarbonate. The resulting water had a salinity value of 28.3 parts per thousand and a titration alkalinity of 4.77 m.equiv./l. The enriched sea-water was placed in a 'Pyrex'-glass container under a light intensity of 2,250 lux. A thick culture of a marine diatom, *Skeletonema costatum*, was then introduced into the sea-water. In order to reduce the evaporation of sea-water and the exchange of dissolved gases with the atmosphere, a layer of mineral oil was laid over the sea-water. A magnet bar stirred the water gently throughout the experiment. Temperature was maintained at 17° C.

Water samples were obtained from the container by siphoning for the analysis of pH, alkalinity, dissolved oxygen, total carbon dioxide, chlorophyll and electrical conductance. The dissolved gas analysis was done by gas chromatography²; a 2-ml. sample yielded values for these two gases. The electrical conductance was measured by a temperature-compensated inductive salinometer³.

A light period of 65 h was followed by a dark period (respiration) of 49 h (Fig. 1). Electrical conductance was recorded as a ratio with respect to the lowest conductance observed at the 65th h.

During the 65-h light period, pH increased from 8.01 to 8.03, oxygen from 0.13 mM/l. to 0.14 mM/l. and total chlorophyll from 9 to 30 µg/l. The conductance decreased by 0.06 per cent. A change in total carbon dioxide was not measurable by gas chromatography; its concentration was 4.25 mM/l. Titration alkalinity value was 4.77 m.equiv./l. and was constant throughout the experiment.

Table 1. STRONTIUM-90 CONCENTRATIONS (PC. $^{90}\text{Sr}/\text{l.}$) IN THE BALTIC IN 1959–63
S is the salinity in parts per thousand

Area	Depth	1959		1960		1961		1962		1962		1963	
		S	June pc./l.	S	June-July pc./l.	S	June-July pc./l.	S	June-July pc./l.	S	Sept.-Oct. pc./l.	S	June-July pc./l.
River Kemijoki	0 m	—	0.46	—	0.33	—	0.41	—	1.1	—	—	—	0.54
L/V Kemi	0 m	2.59	0.37	2.27	0.35	2.76	0.63	2.21	0.50	3.30	0.45	3.17	0.53
Bothnian Bay	0 m	—	—	3.64	0.24	—	—	3.71	0.48	—	—	3.66	0.54
Bothnian Sea	ca 60 m	—	—	—	—	—	—	4.38	0.32	—	—	4.47	0.41
	0 m	—	—	5.88	0.23	5.84	0.40	5.52	0.38	—	—	5.08	0.60
Tammio	ca 100 m	—	—	—	—	—	—	6.24	0.32	—	—	6.02	0.32
	0 m	—	—	3.80	0.46	4.78	0.57	4.29	0.57	—	—	3.93	0.97
Gulf of Finland	35 m	—	—	—	—	—	—	—	—	—	—	6.22	0.52
	0 m	—	—	5.63	0.38	—	—	5.81	0.50	—	—	5.68	0.52
Gotland Deep	60 m	—	—	—	—	—	—	—	—	—	—	8.39	0.52
	0 m	—	—	7.02	0.35	7.07	0.39	7.18	0.36	7.34	0.51	6.53	0.64
Southern Baltic	ca 200 m	—	—	12.75	0.05	13.03	0.36	12.79	0.34	12.70	0.30	12.76	0.22
	0 m	—	—	—	—	7.86	0.43	7.88	0.50	—	—	7.83	0.79
Danish Sounds	0 m	—	—	—	—	20.46	0.45	—	—	9.69	0.55	15.86	0.87
	25 m	—	—	—	—	—	—	—	—	—	—	33.24	1.8