

Observations on the Nitrite Changes in the Barents Sea.

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The present contribution deals with some data regarding the seasonal distribution of nitrites in the Barents Sea along the Kola meridian, collected during the cruises of the "Nikolai Knipovitch" in the year 1930. Being only a part of the general work upon chemistry, hydrography and biology of the Barents Sea, these data are published separately only because of the scarcity of our knowledge about the nitrite changes in the open sea.

The observations were made on 7 cruises along the meridian $73^{\circ}30'$ E., from the sea shore as far as the ice margin, in December 1929, March, June, August, September, November 1930 and January 1931.

The nitrites were determined by the Griess colorimetric method. All the determinations were made on board as soon as the samples of water were collected. The colour comparison was made in Heyner tubes, 30 cm. long, fixed on a stand in such a way as to enable 4 samples to be compared concurrently. One of the tubes was filled with distilled water, which made it possible to notice the presence of a very faint tint.

The seasonal distribution of nitrites was as follows. In December 1929 the nitrites could not be detected anywhere along the section. In some places a very faint coloration of the samples was observed, but the intensity was so weak that it was quite impossible to make any quantitative evaluation.

At the end of March 1930 the nitrites appear evenly distributed in the water column, but their concentration is very low, never exceeding 0.3 mg./m^3 .

In June, at the time of the intense consumption of phosphates and nitrates, the nitrites appear in considerable, readily measurable quantities. Together with the increase in the concentration of nitrites, a peculiarity in their distribution may be observed. The maximal content of nitrites was found in the 50—100 m. layer, where their concentration reached 0.5—2.0 mg./m.³. In the regions of water of Atlantic origin the nitrite content was higher and the distribution in the water column more even. On the most Arctic stations, close to the ice margin, the nitrites could be found only in the intermediate 50—100 m. layer.

In August the peculiar distribution of nitrites was still more pronounced. Nearly all the nitrites were confined within the 50—100 m. layer. In the surface water, as well as in the bottom strata, the nitrites were entirely absent or their content was very low, whereas in the 50—100 m. layer, especially at 50 m. depth, the content of nitrites sometimes reached 14 mg./m.³.

The September cruise showed no further development of the summer picture in nitrite content and distribution. The distribution of nitrite in September is rather a transitional state to the winter one. The concentration of nitrites had decreased, to 1—2 mg./m.³. on the average. In certain places only the nitrite content reached 3—6 mg./m.³. The peculiar summer distribution could be detected only on the northernmost stations, to the north of Lat. 76°30' N., where the nitrites were still collected in the 50—100 m. layer. All the remaining (southern) part of the section showed a rather even vertical distribution of nitrites, with only a slight increase at 50 metres.

In November (18—25) no nitrites could be detected anywhere along the meridian, with the exception of the northernmost stations in 75° and 75°30' N., where they were found in very low concentrations (0.1—0.2 mg./m.³.) in the 25—50 m. layer.

In January (2—8) 1931 the nitrites totally disappeared on the Kola meridian.

We are sorry to state that no parallel determinations of ammonia were made, which of course materially decreases the value of the nitrite data.

The comparison of the nitrate and nitrite changes (see KREPS and VERJBINSKAYA, 1 and 2) permits us to reach certain conclusions. The nitrites appear at the time when the nitrates begin to be utilised by the photosynthetic activity of phytoplankton (in June). Concurrently with the decrease in nitrates there is an increase in nitrites, which accumulate in the 50—100 m. layer. At the time of the lowest nitrate content (August), when the nitrates are totally used up, the nitrites reach their maximal values.

Table 1. The distribution of nitrites, June 4—10, 1930. Kola meridian.

Depth	69°30'	70°	30'	71°	30'	72°	30'	73°	30'	74°	30'	75°	76°30'
0 m.....	—	0	0.35	0.98	1.0	0.72	0.71	0	0	0.43	traces	0	0
25 -	—	0.66	0.50	0.98	1.14	0.81	0.73	traces	0	1.16	0.60	0	0
50 -	—	1.53	0.79	1.26	1.20	1.15	1.0	0.76	1.0	1.51	0.68	0.75	2.43
100 -	—	1.06	0.26	1.86	1.96	1.33	2.25	1.19	1.43	1.51	2.33	0.73	3.11
200 -	—	—	0.17	1.10	1.20	1.33	1.69	0.57	1.40	1.33	0.44	0.83	0
bottom.....	—	2.10	0.15	0.79	1.30	0.57	1.24	—	traces	0.32	0.28	—	0

Table 2. The distribution of nitrites, August 8—16, 1930.

Depth	69°30'	70°	30'	71°	30'	72°	30'	73°	30'	74°	30'	75°	30'	76°	30'
0 m.....	0	0.2	0	0	0	0	0	0	0.9	1.1	0	0	0	0	0
25 -	1.1	0.2	0	0	1.1	1.0	0	2.6	1.4	1.1	0	0	0	0	0
50 -	1.6	2.5	0	6.3	4.6	5.2	2.7	14.7	11.3	5.1	3.3	2.6	6.4	7.8	4.3
100 -	1.6	2.5	5.3	0	4.2	0	4.6	0	0	0	1.6	2.3	4.8	2.7	0.8
200 -	1.9	—	0	0	0.3	1.3	1.9	2.0	2.4	3.0	1.3	—	0.7	0	—
bottom	2.0	—	0	0	1.5	1.1	0	2.6	0	1.2	1.0	2.2	0.9	0	0.7

Table 3. The distribution of nitrites, September 20—24, 1930.

Depth	70°	30'	71°	30'	72°	30'	73°	30'	74°	30'	75°	30'	76°	30'	77°
0 m.	0.2	0.3	0.4	0.5	0.4	0.5	1.7	0.4	1.3	1.1	0.6	1.9	1.6	2.1	0
25 m.	0.2	0.3	0.4	0.6	0.5	0.6	2.1	1.4	1.5	1.1	0.7	2.1	1.9	2.0	0.6
50 -	1.2	0.7	1.0	1.3	0.6	0.6	3.5	1.3	1.8	3.1	1.1	2.1	traces	6.7	6.0
100 -	0.3	0.2	0.4	0.4	0.3	0.4	0.5	traces	0	1.7	0	0	"	3.2	2.5
200 -	—	—	—	0.5	—	traces	0.7	"	0.8	—	0.6	0	"	0.6	—
bottom	0.3	0	0.4	0.4	0.3	0.3	1.6	"	0.7	0.9	0.6	0	"	0	0

Table 4.

Depth	24 December 1929	2 April 1930	7 June 1930	11 August 1930	22 September 1930	21 November 1930
0 m.	0	0.1	0.7	0	0.5	0
25 m.	0	0.1	0.7	0	0.6	0
50 -	0	0.1	1.0	2.7	0.6	0
100 -	0	0.1	2.3	4.6	0.4	0
200 -	0	0.1	1.7	1.9	traces	0
bottom	0	0.2	1.2	0	0.3	0

The regeneration of nitrates is followed by a decrease in nitrite concentration. In September the nitrates already begin to appear in the upper strata and the nitrites show a marked diminution. Finally, towards November, when the stock of nitrates is nearly totally restored, the nitrites fall to zero (see Fig. 1).

At the present state of knowledge of the nitrogen balance in the

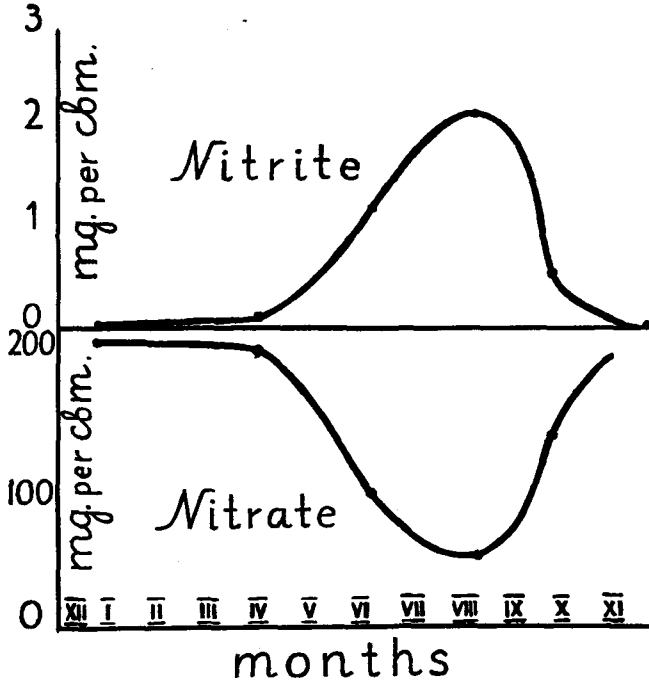


Fig. 1. The mean content of nitrites and nitrates in a water column 0—100 m. in different months in 1930. Barents Sea. Position Lat. 72° — $72^{\circ}30'$ N. Long. $33^{\circ}30'$ E.

sea it is not easy to say whether the nitrites are to be considered as the products of ammonia oxidation or of the reduction of nitrates. The observed seasonal changes in the Barents Sea agree well with ATKINS' opinion that the nitrites in sea water exist only as a temporary, intermediate stage in the process of ammonia oxidation. The nitrites appear in noticeable amounts at the time of the increase in phytoplankton growth, when the dead and decaying organisms begin to supply enough matter for ammonia formation, followed by a production of nitrites. The maximum of nitrite content coincides with the complete exhaustion of nutrient salts in the sea, i.e., with the time when the store of decaying protein matter is enormous. And, according to the rise in nitrate con-

tent, the nitrites gradually diminish. As soon as nitrification ends, the nitrites disappear totally from the Barents Sea.

Table 4 shows the content of nitrites in different months at station 72°30' N. 33°30' E.

The solution of NaNO_2 which served as standard for comparison was made on distilled water. As a result the nitrite data are perhaps too high, as the coloration developed by the nitrites in distilled water is weaker than the coloration developed in sea water.

Summary.

1) The seasonal changes in nitrite distribution in the Barents Sea agree well with ATKINS' observations in the English Channel.

2) The nitrites appear in the Barents Sea in spring concurrently with the onset of phytoplankton growth, increase during the summer months and decrease again in autumn. Towards November the nitrites completely disappear from the water.

3) The maximal content of nitrites was observed in August, when the nitrates were at their minimum.

4) The maximal concentration of nitrites was found at 50—100 m. depth.

References.

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