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International Council for the
Exploration of the Sea

C.M. 1974/C:23
Hydrography Committee



Investigations on the nutrient supply by
Sahara dust in the upwelling area off NW-Africa

by

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Since 1970 the GDR r/v "Alexander v. Humboldt" of the Institute of Marine Research in Rostock-Warnemünde carries out oceanological investigations in the NW-African upwelling area (Schemainda, Nehring, Schulz, 1975). During the investigations in February/March 1973 large amounts of Sahara dust descended to the ship. An extremely intensive dust precipitation was observed in the area between Cap Blanc and Cap Vert. At the 5./6. March 1973, during the investigations at the standard stations 862 - 868 (area off Nouakchott, vgl. Nehring, Schemainda, Schulz, 1975), about $9,6 \text{ g/m}^2$ dust precipitated on deck of the "Alexander v. Humboldt" within 16 hours ($0,6 \text{ g/m}^2\text{h}$). During this time weak winds between 2 - 5 m/s from northerly to northeasterly directions prevailed.

Samples of the Sahara dust were investigated after the return from the cruise on their content of soluble micronutrients. Extractions of phosphate, nitrate, nitrite, and ammonia were carried out with seawater (pH 8.0 - 8.4), distilled water (pH 6 - 6.5), and diluted sulphuric acid (pH 2 - 3). The tables 1 and 2 contain the results of the investigations.

The solubility of phosphate is strongly affected by the pH of the extractant. It was the lowest in the weak alkaline pH range of seawater. In the weak acid range, as in the distilled water, mainly during short times of extraction more phosphate was soluted, until after about 2 months equal values were reached. After this time of extraction in the weak alkaline as well as in the weak acid range no soluble phosphate seems to be available. Only by the decomposition with diluted sulphuric acid the amounts of soluble phosphate increased. The investigated samples of Sahara dust contained also considerable amounts of nitrate and ammonia, whereas nitrite was not proveable (table 2).

Although the Sahara dust is relatively rich in soluble micro-nutrients, it affects scarcely the nutrient cycle of the NW African upwelling area. If we take in account, in conformity with the observed situation, an atmospheric fallout of 0.144 g/dm^2 within 24 hours ($\text{dm}^2 \rightarrow \mu\text{g-at./dm}^3$), about $0.084 \mu\text{g-at. PO}_4/\text{dm}^2$, $0.455 \mu\text{g-at. NO}_3/\text{dm}^2$, and $0.749 \mu\text{g-at. NH}_4/\text{dm}^2$ are brought daily into the NW African upwelling region by the Sahara dust. Compared to the high nutrient content of the upwelling water these concentrations are not momentous, particularly if they are distributed on a larger water column.

References

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Table 1 Soluble phosphate in Sahara dust in the dependence of the extractant and the time of extraction

Time of extraction (hours)	Seawater pH 8.0-8.4	Dest. water pH 6 - 6.5	Diluted H ₂ SO ₄ pH 2 - 3
	(μg-at. PO ₄ / g Sahara dust)		
0.25	-	-	10.4
0.5	-	-	10.9
1	0.50	0.84	11.4
3	0.63	0.94	11.8
6	0.64	0.94	-
12	0.56	0.93	-
(days)			
2	0.68	1.20	-
4	0.87	1.27	-
7	0.85	1.27	-
14	1.25	1.15	-
34	1.45	1.55	-
57	1.56	1.58	-
123	1.59	1.60	-

Table 2 Soluble inorganic nitrogen compounds in Sahara dust
(Extractant: Seawater, time of extraction: 0,25 hours)

	μg-at./g Sahara dust
NO ₃	3.16
NO ₂	0.00
NH ₄	5.20