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PRELIMINARY ANALYSIS OF KHOR WATERS IN LAKE NASSER.

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ABSTRACT

Several chemical parameters are described for some selected Khors in Lake Nasser during 1982-1983 after twenty years of impoundment. These include cations and anions: Sodium, Potassium, Calcium, Magnesium, Phosphate, Silicate, Nitrate, Sulphate and Chloride. The chosen khors represent the different water masses along the whole Lake from High Dam in the North till the border line in the South.

INTRODUCTION

The construction of the Aswan High Dam resulted in the creastion of one of the longest man-made lakes in the world, extending for about 300 Km as Lake Nasser and further south for 180 Km. as Lake Nubia in the Sudan.

Lake Nasser has a long, narrow shape with often dendritic side areas, called embayments (Khors). The number of important khors are one hundred, 58 of them located on the eastern shore and only 42 of them on the western shore. The khors along the western shore are mostly shallow with relatively large surface areas with sandy-loamy bottom, shallower relative to width e.g., Kalabsha, Tushka and El-Birba, whereas, those of the eastern shore as Korosko, Singari, El-Sabakha and Manam, are narrower, deep and rocky with steep dropoff. These Khors exhibit complex hydrological and biological phenomena very different from those of the main channel (Entz 1974) (Fig. 1).

MATERIAL AND METHODS

Chemical analyses were carried out in the field after collection of the water samples from different depths of the Khors by Van Dorn bottle of 3 l capacity. Sodium and Potassium were analysed by flame photometer; Calcium and Mangnesium were measured titrametrically using sodium salt of EDTA. Phosphate was estimated by the method of Murphy and Riley (1958). Nitrate, Silicate, sulphate, and chloride were measured according to standard methods of APHA (1975).

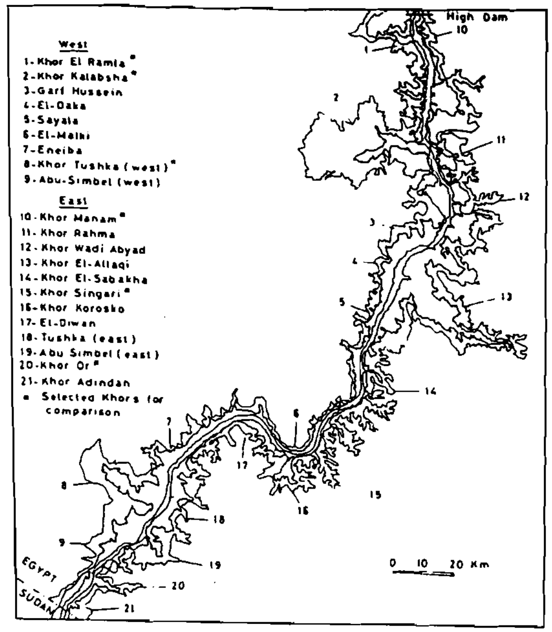

Fig. 1 : Important Khors of Lake Nasser.

RESULTS AND DISCUSSION

1. Major Cations

a- Sodium and Potassium

During the weathering, some silicate minerals e.g., alkali-feldspars are completely dissolved. Sodium and Potassium are released during the weathering to be in ionic solution.

Sodium concentration in Khors water column, decrease downward thus, at Khor Ambical, sodium concentration decreased from 16.5 mg/L at the surface water to 14.2 mg/L at 30 m. depth. At Khor singari, the values were 12.1, 11.3 mg/l at the above depths respectively, in Khore or, sodium concentrations were 18.9 and 24 mg/l at the surface, and 30 m. depths respectively. Generally, Khor Or was more rich by sodium (average 21 mg/l) compared with (10.3 mg/l) in Khor Tushka, (table 1).

Table 1.
Sodium and Potassium concentrations (mg. / l.) of some Khors water of Lake Nasser during May, 1982.

Khors Depth (m.)	AMBICOL		EL-BIRBA		SINGARI		MANAM		TUSHKA		OR	
	Na	K	Na	K	Na	K	Na	K	Na	K	Na	K
00	16.50	6.00	16.80	6.0	12.10	5.4	15.50	5.60	10.3	6.0	18.9	8.0
10	15.00	5.50	15.40	5.5	12.10	6.50	15.50	5.40	10.3	5.4	18.20	8.0
20	14.2	5.40	14.80	5.5	14.00	6.30	15.40	5.40	10.3	5.4	22.80	8.0
30	14.2	5.40	14.00	5.0	11.30	5.80	14.70	5.10	-	-	24.00	8.0
40	15.50	5.40	-	-	12.10	5.80	14.70	5.40	-	-	-	-
Average	15.08	5.54	15.25	5.5	12.32	5.96	15.16	5.38	10.3	5.6	20.97	8.0

The increase of sodium ions in Khors Or may by due to the dissolution of sodium chloride within the sandstone layer at the shore, which have an effect of percolation due to the dispersal of fine particles in the sediments.

Potassium fluctuated between 5.1 and 8 mg/l. at Khor Manam and Khor Or, respectively. Generally, potassium decrease by depth in the different Khors.

b- Calcium and Magnesium

Khor Tushka shows a lower calcium concentration (16.5 mg/l), compared with the highest values at Khor Ambicol (27.6 mg/l) and Khor Manam (27.1 mg/l). Generally, the pattern of calcium in the Khor water is similar to sodium. Again, calcium concentration in Khor Ambicol, El-Birba and Manam increased with depth, (table 2). Calcium is not precipitated as hydroxide until pH 11, therefore this compound does not exist in nature (pH in Lake Nasser 7.2-9.2). Micro-organisms may favour the precipitation of $CaCO_3$, particularly in some tropical regions. However, these micro-organisms are indirectly responsible for its precipitation. They produce ammonia which acts as a precipitating agent.

In addition, bacteria may decompose organic compounds containing calcium; as a result $CaCO_3$ is produced by CO_2 formed during its decomposition.

Magnesium concentration varies between 5.4 mg/l in the bottom water at Khor reached 11.3 mg/l in the surface water of Khor Or, (table 2).

Generally, Khor Or was more rich in magnesium with an average of (9.73 mg/l) in comparison with Khor Singari (6.98 mg.l) and Khor El-Birba (7.25 mg/l).

Table 2.
Calcium and Magnessium (mg/l). of some Khors of Lake Nasser during May 1982.

Khors Depth (m.)	Ambicol		El- Birba		Singari		Manam		Tushka		Or	
	Ca	Mg	Ca	Mg	Ca	Mg	Ca	Mg	Ca	Mg	Ca	Mg
0	17.2	7.2	20.7	8.3	17.9	5.4	20.3	8.1	16.7	7.8	18.8	11.3
10	24.1	7.2	20.7	8.3	16.9	5.9	23.7	8.1	16.7	8.9	16.7	10
20	24.1	8.3	24.1	6.2	16.1	9.6	27.1	8.1	16.5	8.9	16.7	8.8
30	24.1	8.3	24.1	6.2	17.9	8.6	27.1	8.1			16.7	8.8
40	27.6	6.2				5.4		9.2				
Average	23.42	7.44	22.4	7.25	17.2	6.98	24.55	8.32	16.63	8.53	17.23	9.73

According to Cole (1979), Magnesium lies at the heart of the chlorophyll molecule and seems to occupy therefore, a chosen position in community events.

2. Nutrients

a- Phosphates

In Lake Nasser Khors, the maximum values of phosphate (163 µg PO_4^{3-} - P/L) occurs in the bottom water at Khor Manam in November and the minimum values (29.34 µg PO_4^{-3} - P/L) in the surface water of Khor Kalabsha during August, (table 3). This highest level may be influenced by the biological activity in the sediment, the distribution of cations in the sediments, physico-chemical conditions such as pH, redox potential and mineral composition of the sediments. These findings were previously confirmed by Golterman (1975), who stated that during summer the algal growth may reduce the phosphate concentrations to values below those detectable by chemical analysis. High values in Delta regions in lakes are due to the deposition of clay adsorped phosphate.

Hutchinson (1957), pointed out that in productive lakes, with Clinograde oxygen curves, there is an increase in soluble phosphate in the oxygen-difficient part of the hypolimnion due to decomposition of sinking plankton, but in most cases is primary caused by liberation of phosphate from sediments. Adsorption of phosphates on colloidal ferric hydroxide, line particles of calcium carbonate and on clay minerals, which occur in most lake sediments originate from eroded material transported into the lake by the river. Phosphate anions are taken up from water by alumina or by clay minerals through chemical bonding of the anions to positively charged edges of clays on which substitution of phosphates on silicate in clay structure. Adsorption is favoured by lower pH and also by freshly precipitated ferric and aluminum hydroxides, (Olphen, 1963).

Thomas (1968), showed that the phosphate uptake from lake water depends on the presence of phytoplankton and by organic compounds and ferric complexes in the mud, at the same time, phosphate is released into solution from the superficial layers of the mud when a lake is stratified and the bottom water be anaerobic.

The phosphate concentration in water overlying sediments has a buffering action by solubility and adsorption, or ion exchange equilibria at the sediment - water interface, (Stumm and Morgan, 1970 and Golterman, 1973).

Generally, the highest level of phosphate was recorded in November in Khor Manam with average of 110.9 µg PO_4^{3-} - P/L as compared with 58.6 and 48.9 µg PO_4^{3-} - P/L in Khor Tushka and El-Birba, respectively.

In the early years of storage in Lake Nasser, Nesseim (1972) found that phosphate concentrations in khors water ranged between 0 - 550 µg PO_4^{3-}

P/L, with maximum values in Khor El-Birba.

b- Silicates

In Khor water of Lake Nasser, the silicate concentration varies between 8 mg/l in the bottom water of Khor Manam during May and 30 mg/l in the surface water of Khor Kalabsha in August, (table 3).

According to Golterman (1973), silicate oxides is of immense significance as a major nutrient for diatoms of most lakes. Thus, silica comes to the reservoire from predominately recycling from diatom decomposition and river loading. Again, silica usually increased in the deep water of the lakes during summer stratification in the anaerobic deep water having clinograd oxygen curves.

Talling (1976), stated that the lower concentration of silica (2-2.8 mg/L) is measured in the head water lakes in comparison with (10-24 mg SiO_2/L) in the river stretches of Sudan and Egypt. This mainly results from depletion by planktonic diatoms and partially from the dissolution and its transfer of ubiquitous rock and soil silicates in running waters.

c. Nitrate

In khors of Lake Nasser, the maximum level of NO_3^- was 406.8 ug NO_3^- - N/L recorded in the bottom water at khor Tushka in November compared with the minimum of 113 µg NO_3^- - N/L in the bottom water at khor Kalabsha in August, (table 3).

According to Talling (1976), nitrate is an exceptional anionic constituent; its concentration increases steeply with discharge. This feature is connected with its behaviour as a readily leached soil-constituent and probably its sharp pulse of concentration in many African soils after the onset of the rainy season (Viner 1975), before the main period of phytoplankton development (Talling and Rzoska, 1967) but declined thereafter to < 0.03 mg/l.

3. Major Anions

a. Chloride

Chloride concentration in Khor water fluctuated in the range of 6 and 12.1 mg/l recorded in the bottom water of khor Or and in the surface water of Khor Ambicol respectively, (table 4). Generally, the highest chloride concentration recorded in the surface water except for Khor Singari and Tushka. For average content, Khor Or was a lowest one (6.4 mg/l), as compared with the highest value of 10.8 mg/l at Khor El-Birba.

Chloride is the major halid stored in most fresh water algal cells, although the marine kelps and other brown algae are worthy for their uptake and concentration of iodiate (Cole 1979).

Table 3.
Nutrients concentration of some Khors of Lake Nasser during 1982-1983.

Months	August 1982		November 1982		May 1983		September 1983	
Khors.	Surf.	Bottom	Surf.	Bottom	Surf.	Bottom	Surf.	Bottom
PO_4-P µg/l								
El-Birba	48.90	48.9	48.90	65.20	32.60	48.90	45.64	55.42
Manam	45.64	48.9	58.68	163.00	29.34	29.34	52.16	48.90
Kalabsha	29.34	65.2	52.16	48.90	32.60	65.20	29.34	78.24
Tushka	32.60	32.6	58.68	61.94	45.64	48.90	58.68	58.68
NO_3-N µg/l								
El-Birba	203.40	158.2	339.00	271.20	180.80	316.40	203.40	180.80
Manam	180.80	180.8	180.80	361.60	203.40	271.20	180.80	180.80
Kalabsha	180.80	113.0	203.40	226.00	113.00	180.80	226.00	271.20
Tushka	203.40	226.0	384.20	406.80	180.80	180.80	180.80	203.40
SiO_2 mg/l								
El-Birba	25.00	21.3	20.00	14.50	16.30	13.00	15.00	18.00
Manam	12.50	18.80	12.50	20.00	11.30	08.00	16.30	15.00
Kalabsha	30	18.8	20.00	20.00	15.00	12.50	22.50	22.50
Tushka	17.50	17.5	12.50	15.00	20.00	20.00	18.00	20.00

Table 4.
Chloroide and sulphate concentrations (mg/l) of some khors of Lake Nasser.
1. Chloroide concentration during August 1981.

Khors	Ambicol	El-Birba	Manam	Kalabsha	Singari	Tushka	Or
Surface	12.1	10.8	8.1	8.2	8	9.6	6.8
Middle	8	10.8	8	8	10	8	6.4
Bottom	8.1	10.8	7.2	7.2	12	10	6.0
Average	9.4	10.8	7.77	7.8	10	9.2	6.4

2. Sulphate concentration during 1982-1983.

Months	August 1982		November 1982		May 1983		September 1983	
Khors	Surface	Bottom	Surface	Bottom	Surface	Bottom	Surface	Bottom
El-Birba	8	5	7	7.5	7	7	8	7
Manam	5	7	7.5	11.0	6	5	10	7
Kalabsha	8	5	8.0	8.0	6	8	10	6
Tushka	5	5	6.0	6.0	5	3	6	5

b. Sulphates

In Lake Nasser main channel, sulfate content varies between (2-14 mg/l), in the bottom water at Adindan and in the surface water at High Dam, respectively. During the first few weeks of the flood, there is an increase in the sulphate concentration in the southern part of Lake Nubia in Sudan, estimates as 10-14 mg/l, as compared with 5 - 5.5 mg/l. in the northern part of the reservoir.

In Lake Nasser Khors, sulphate concentration fluctuated between (3-11 mg/l) in the bottom water at Khor Tushka and in the surface water of Khor Manam during May and November respectively, (table 4). Generally, the low concentration measured in the bottom water of Khor Tushka as compared with (5-11 mg/l) in Khor Manam.

As reported by Beadle (1981), Beauchamp (1953) suggested that the apparently very low concentration of sulphate in several African Lakes, including Lake Victoria (0.8 - 1.8 mg/l) is a sign that sulphate is in short supply and this lakes lie in regions where sedimentary rocks containing this ion are rare and is limiting the rate of primary production.

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