E-I5

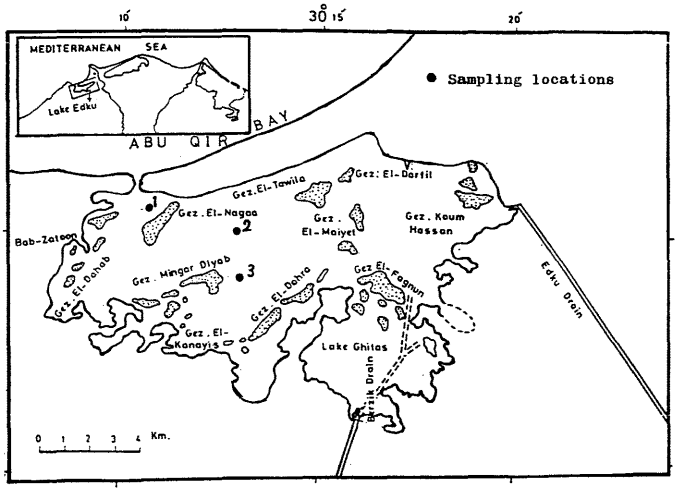
Geochemistry of Fe, Mn, Zn, Cu, Pb and Cd in Sediment Cores from Lake Edku

Atef A. MOUSSA and Mohamed A. EL-SAYED

National Institute of Oceanography and Fisheries, Alexandria (Egypt)

Lake Edku is one of the shallow, brackish-water coastal lagoons of the Nile Delta. The lake is separated from the Mediterranean Sea by a sandy coastal barrier, yet, lake-sea water exchange is kept through a narrow outlet.

The lake sediments are mostly derived from soil erosion in addition to contribution from indegenous plants and animals. On the average, the sediments compose of a mixture of 45% sand; 23% silt; and 32% clay. Mollusc shell fragments constitute in most cases the major part of sand. The clays and fine silt on the other hand compose of mixed layer smectite-illite, illite and subordinate kaolinite (Moussa and Saad, in preparation). X-ray amorphous Fe hydrous oxides seem to contribute to these fractions a lot.



For the present work we collected three sediment cores in a way to represent the three main subenvironments of the lake: 1- the lake-sea communication vicinage; 2- the central basin; 3- the area affected directly by drains.

In the laboratory, the sediment interstitial water were extracted by centrifugation. The sediments were then dried at 70 c. A carefully homogenized portion of each sediment was powdered for the determination of organic carbon, carbonate and total heavy metal concentrations. A 1.0 g cut of each nonpowdered sediment was taken for the extraction of labile elements by 1M HCl. Another suitable cut was taken for the determination of sand, silt and clay contents.

The element analysis were done by flame ASS. All the precautions of sample handling and analysis were taken in order to assure high quality of data.

The results showed that the lake average concentrations of the total Fe, Mn, Zn, Cu, Pb and Cd are: 57787, 943, 81, 55, 42, 3.4 ug/g respectively. The per cent leachable fractions of these elements in the given order are: 18, 64, 30, 53, 612, 30. The leachability of the elements decreases generally from top to bottom in the cores.

The correlation analysis of the total element concentrations with the other sediment parameters indicate two groups of element associations: a) Fe-Zn-Cu and b) Mn-Pb-Cd. The clay and to some degree the silt are the major sites for the first association, while, the calcareous shells (sand) are the sites for the second group.

The resolution of the total element concentrations into labile (HCl leachable) and residual (total - labile) gives a more clear picture.

In the labile phase, Zn of group (a) went out of the combination to become specifically correlated with organic carbon (r=0. 75) leaving Fe and Cu with clays. In group (b) assciation improved correlations are observed between Pb and Cd (r=0. 96) and between Mn, Pb and Cd (r=0. 77). Also their link to calcareous sand becomes more evident (r=0. 82-0.87).

In the residual phase all the elements are interrelated. About 70% of Fe and 50% of Pb are shown to be incorporated in the silt and clay minerals. The weak correlation between Zn, Cd, Cu and the silt and clay minerals suggests that these elements are most probably incorporated in heavy minerals.

References

Moussa, A. A. and Saad, N. A., Mineral composition of Lake Edku sediments (in preparation)

E-I6

Copper Speciation in the Sediments of the Nile River Delta Lakes in Egypt

A.-R. ABDEL-MOATI

Oceanography Department, Faculty of Science, Alexandria University, Alexandria (Egypt)

A five step sequential extraction scheme (Tessier et al., 1979) was applied to surfacial sediments collected during the period 1982-1989 from four northern Nile River delta lakes in Egypt namely Lake Mariut, L. Edku, L. Burullus and L. Manzalah to illustrate the different species of Cu associated with their sedimentary phases. Cu concentration in each phase was determined using a Perkin Elmer AAS. Almost, the summation of sequential extracts showed a good agreement (within 6%) with the total metal concentration. The accuracy was tested against NBS standard River Material 1645 and concentrations were within 3-5% of certified values. Triplicates showed high reproduceability not exceeding 10%.

Information for the sampled lakes as well as the average concentrations of the different Cu species are shown in Table 1.

Table 1. Area, depth range, trophic status, flushing time and mean Cu species concentrations (µg/g) as well as organic matter (%) and Cu/Al ratio in the Nile delta lakes.

LAKE	MARIUT 1986	EDKU 1989	BURULLUS 1988	MANZALAH (1982/83)
AREA (Km^2)	70	115	370	700
DEPTH (cm)	90-150	50-150	50-200	100
TROPHIC STATUS	Hypereutrophic	Mesotrophic	Mesotrophic	Eutrophic
FLUSHING TIME (d)	ND	21	42	38
Exchangeable *	1.03±0.54	0.16±0.04	0.34±0.1	0.67±0.3
Carbonate*	1.20±0.25	0.80±0.13	3.10±0.4	1.90±0.4
Fe/Mn oxide *	6.80±0.90	9.30±1.10	5.26±0.9	12.40±3.6
Organic/sulphide*	36.40±18.3	11.80±1.50	7.50±0.8	28.10±12.6
Residual*	28.80±5.10	16.90±2.10	12.80±1.6	32.20±6.1
ORGANIC MATTER (%)	10.1	2.4	1.8	6.9
Cu/Al * 10^{-5}	325	139	95	267

ND = Not determined *= µg/g

The exchangeable fraction of Cu showed no statistically significant magnitude between the different lakes. The carbonate fraction as well was only enriched in samples collected at the lake-sea connection sites where the carbonate content of sediments reached >55%. Despite the presence of Fe and Mn in considerably high concentrations in the studied lakes, the easily reducible fraction was the third in abundance. The organic and sulphide associated Cu were enriched in the sediments of Lake Mariut and Manzalah forming on the average 49% and 43% of the total Cu, respectively. Both lakes receive huge amounts of sewage discharge and are suffering from anoxia in most of there productive areas with H_2S values reaching >15 ml H_2S/l. Station to station variations were reflected on elevated standard deviations from the mean in both lakes. Lake Edku receives sea-derived industrial wastes which may elevate the Cu concentration at the lake-sea connection while L. Burullus is comparatively clean receiving only agricultural discharge and local sewage.

The use of $CuSO_4$ as an algicide in controlling aquatic plants' blooms, specially during warm season, is the main route of Cu to the northern delta lakes. The accumulation of dissolved Cu by phyto-, zooplankton as well as floating and submerged macrophytes may transfer Cu to the lake sediments after their death and decay. The Cu/Al ratio calculated for the different delta lakes showed Cu enrichment in all lakes when compared with the Cu/Al ratio of standard shale. Table 1 showed that Cu is enriched in the sediments of the delta lakes in the order : Mariut > Manzalah > Edku > Burullus.

References

Tessier, A. et al. (1979). Anal. Chem. (51) 7: 844-850.

E