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Surface heat balance of Lake Burullus

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Studying the heat balance of lakes has various applications in limnology and meteorology. This balance determines the contribution of the different factors affecting the heat budget.

In the present work, different processes controlling the surface heat budget of Lake Burullus are studied; in addition , the monthly heat balance of the water body relative to the yearly mean temperature was computed. The different heat balance components (Q_r, Q_e, Q_c, and Q_w) were computed using semi-emperical equations.

The Lake is situated at the northern part of the Nile Delta between the two branches of the Nile (Fig.1). The Lake area is ca. 546 km^2; it is rather narrow and its breadth varies between 5 and 17 km. The sole connection with the Mediterranean Sea is a narrow opening (Al-Boghaz out let) through a sandy stripe of land , that separates the Lake from the Sea. The depth of the lake varies between 0.42 and 2.07 m, increasing westerly and northerly.

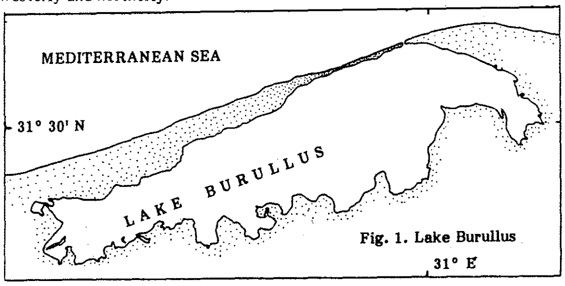

Fig. 1. Lake Burullus

During the year 1987 and Jan. 1988, 19 hydrographic stations were covered monthly. The mean monthly hydrothermal parameters were calculated. A direct measurement of the evaporation was carried out in one station, in order to get the evaporation coeffecient of the area under investigation (0.1695667×10^{-6}).

The annual surface heat balance of the water of Lake Burullus shows that the value of the heat gain at summer is less than the value of the heat loss at autumn and winter. The net heat loss in 1987 was calculated to be 5.54 k cal/cm^2. The main factor affecting the surface heat balance in Lake Burullus is Q_e as shown in Fig. 2. This heat loss from the surface must be compensated . This compensation follows a horizontal heat transport from the drainage water, pouring from six drains into the southern borders of the Lake. Moreover, Q_b which is the heat gain from the bottom of the lake, may be considered as another source of heat to the Lake water.

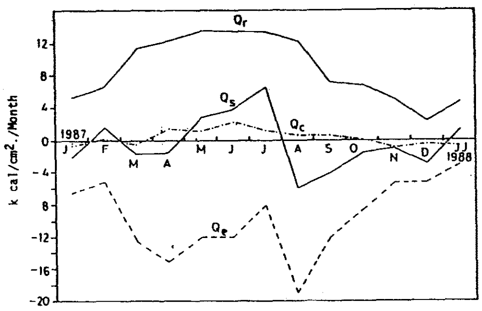

Fig.2 The monthly surface heat balance components.

From Fig. 3 , it is clear that Q_s and Q_w started their positive values in April. Q_s started to lose heat in August, while Q_w started to that in October. During the period from August to October the Lake lost heat as a result of maximum evaporation occurring during this period. The lake water of high heat content was transported to the Mediterranean Sea through Al-Boughaz out let causing more heat loss during the same period.

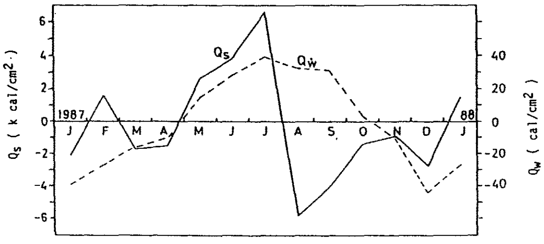

Fig. 3. The monthly surface heat balance (Q_s) and the monthly heat content of the Lake water (Q_w) in 1987.

Q_r: the absorbed solar radiation, Q_c: the heat loss or gain due to conduction

Q_s: the surface heat exchange, Q_e: the heat loss due to evaporation

Q_w: the heat loss or gain due to the vertical turbulance and horizontal movements of water bodies

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Preliminary investigation on the levels of heavy metals in the sediments of Lake Burullus

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The Recent sediments of the bottom of Lake Burullus, Egypt, have a specific textural composition. Shells and shell fragments constitute a significant part of the sediments. Shelly materials seem to be a determinant factor in the distribution of grain size. Sands are represented mainly by shells, shell fragments, quartz, feldspars, ostracods and foram tests. Little amounts of heavy minerals form a minor part of the sediments. The fine fraction of the sediment is composed of silt and clay derived from the Nile Delta soils. According to Beltagy (1985) the carbonate content of the sediments of Lake Burullus, on the average, is less than 30%. The organic matter content varies between 1.0 and 2.0%.

The pH and Eh of the sediments were measured. The concentrations of Cd, Cu, Fe, Mn, Ni, Pb and Zn were studied in the different fractions of the sediments, viz: carbonate, 2N HNO_3 extract and the total sediments. The averages of the results obtained are presented in table 1. The contribution of the different components of the sediments to the total amounts of the metals studied was calculated and presented in table 2. The study indicates that, the biogenous and hydrogenous components contribute between 20 and 30 % of the total content of Fe, Zn and Pb; and between 40 and 50 % of Cu, Cd and Ni, while 81 % of the total Mn is contributed by the hydrogenous components. The relationships between Eh and both Mn and Fe in the extractable fraction are established and shown in Fig. 1.

Table.1.- Average Concentration of Heavy Metals in Different Components of the Sediments (ppm)

Component \ Element	Cd	Cu	Fe%	Mn	Ni	Pb	Zn
Total Sediment	4.3	66.8	3.46	826.0	63.9	110.2	129.7
2N HNO_3 Extract	1.9	30.7	1.04	671.0	30.1	24.3	26.4
Carbonate	4.2	8.6	0.07	159.7	13.9	27.5	9.3

Table. 2.- Percentage Contribution of 2N HNO_3 Extract to the Total Heavy Metal Content of the Sediments

Element	Cd	Cu	Fe	Mn	Ni	Pb	Zn
% Contribution	44	46	30	81	47	23	28

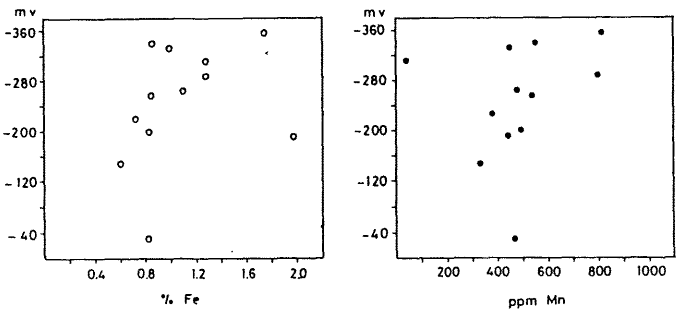

Fig.1.- Relationship Between Fe (o), Mn (•) and Eh (mv) of the Sediments

It is concluded that, the amounts of heavy metals contributed to the Lake are within the natural background levels and the shells of organisms contained higher amounts of Cd, Pb and Zn, and it could act as a sink for those elements in this well defined area. Biogenic carbonate also affects the relationship between both Fe and Mn and Eh, and results a pronounced scattering in the diagrame (Fig.1).

REFERENCES

Beltagy, A.I. (1985) Sequences and Concequences of Pollution in Northern Egyptian Lakes,1 - Lake Borollos, A Review with Discussion.**Bull. Inst. Oceanogr. & Fish. ARE,** 11 : 73 - 97.