

SEASONAL CHANGE OF THE ORGANIC CARBON CONTENT OF LAKE BALATON DURING 1972

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Received: 16th February, 1973

The distribution of the organic carbon content in the upper layer of the sediment of the open water of Lake Balaton has roughly been outlined in our previous papers (PONYI et al., 1972; FRANKÓ and PONYI, 1973). It has been established that Keszthely Bay and its surrounding significantly differ from the mud of other regions of the lake. Recently the seasonal change of the organic content of the mud has been investigated. However, the method of "dry combustion" having been applied so far did not prove to be suitable for this purpose, mainly because of its high time-consumption. Among the methods of "wet combustion" we found to be the best described in No. 16 of the IBP Handbook, the application of which allows us to compare our results in the future with those obtained during the examination of other lakes.

Therefore the present paper has two aims: to present the results of organic carbon analyses carried out mainly in Keszthely Bay, and on other hand, to compare the formerly used and the new methods on the mud samples of Balaton according to necessity.

Dates, places and method of collecting

Mud samples were taken monthly from the middle of May till the middle of November 1972 from 5 points of each of the 5 standard transversal sections of the lake by means of an Ekman-Birge dredge (*Fig. 1*). Aliquotes were taken

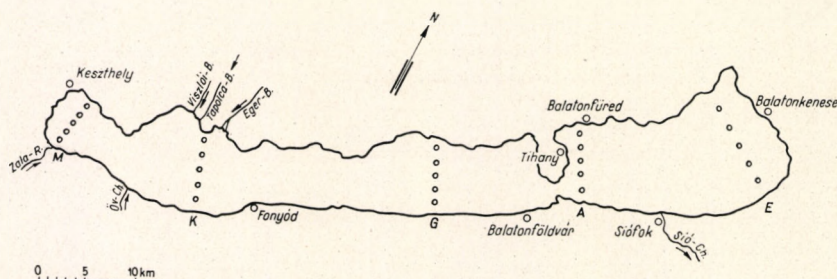


Fig. 1. Collecting places in Lake Balaton

from the upper layer of 5 cm thickness, dried at 40–50° C in a ventilated exsiccator, then powdered. The organic carbon content was determined using the method of WALKLEY and BLACK (1934) (cit. by HOLME and MCINTYRE, 1971).

Results

Mud samples taken during September 1971 were analyzed by both methods of determination of organic carbon content (*Table I*). No essential difference was found between the two series of results, apart from the samples of Keszthely Bay being richer and more heterogeneous in organic substances, where the differences were larger. The standard errors of the means obtained from the 5 places of the transversal section originate not only in the inaccuracy of the method but also in the different structure within the section.

TABLE I

Comparison of organic carbon determinations by means of the wet combustion (WALKLEY and BLACK, 1934) and the dry one (ENTZ et al. 1963) on the samples taken from different regions of Lake Balaton during September 1971

Section	% of organic carbon, value of chromic acid oxidation	% of organic carbon, value of dry oxidation
M (Keszthely)	2.23 ± 0.05	4.61 ± 1.90
K	1.83 ± 0.03	2.00 ± 0.04
G	1.71 ± 0.02	1.83 ± 0.34
A	1.52 ± 0.08	1.70 ± 0.33
E (Bfűzfő)	1.53 ± 0.34	1.60 ± 0.01

The results of a spring and autumn series of samples from 1972 clearly indicate the separation of Keszthely Bay from the other regions of the lake as regards the organic carbon content (*Table II*). A strongly significant difference was found between section M (Keszthely) and section A (in front of the Biological Institute) ($P < 0.01$).

TABLE II

The percentual occurrence of organic carbon in the mud of 5 sections of Lake Balaton in May and September 1972

Section	May	September
M (Keszthely)	1.98 ± 0.05	2.01 ± 0.05
K	1.66 ± 0.04	1.78 ± 0.01
G	1.61 ± 0.03	1.52 ± 0.03
A	1.59 ± 0.05	1.60 ± 0.03
E (Bfűzfő)	1.52 ± 0.02	1.54 ± 0.01

TABLE III
*Change of the organic carbon content
 in the transversal section of Keszthely Bay (M)
 during 1972*

Month	% of organic carbon
May	1.98 ± 0.05
June	1.85 ± 0.04
July	1.84 ± 0.03
August	1.83 ± 0.04
September	2.01 ± 0.05
October	1.96 ± 0.07
November	2.27 ± 0.09

The monthly analyses carried out in Keszthely Bay display a significant change of the organic carbon content (*Table III*). During the warmer months (June, July and August) it varied between 1.83–1.85 percent, whereas during the colder spring and autumn months, values between 1.96–2.27 percent were found.

Discussion

The results obtained using the method of "wet combustion" for the determination of organic carbon content support the earlier findings (PONYI et al., 1972), namely that the organic carbon content of the mud of the open water of Lake Balaton is low, furthermore, the mud of Keszthely Bay differs from other regions of the lake because of its higher organic matter content.

Essentially similar results were obtained using the former and the present method, differences occur only in the section of Keszthely Bay. Considerably wide variations were found between the 5 points of this section by means of the method of "dry combustion". The question may arise in connection with that method that the duration (15 min) of destruction by the mixture of chrome and sulphuric acids may perhaps be short for the mud samples being richer in organic substances (cf. *Table I*). However, the treatments of the same samples of the section M for 15 and 60 min resulted in the same figures (2.21 percent after 15 and 2.30 percent after 60 min). On this basis one can assume that above 2 percent organic substance content, the results obtained by the method of "wet combustion" are more reliable than those of the "dry" method.

Apart from Keszthely Bay, the distribution of the organic substance of the mud of the open water is relatively homogeneous which can obviously be explained by the effects of wind and waves. One can mention as a characteristic instance for that the percentual frequency of distribution of the organic carbon content. Comparing the data of 5 points of each of the 20 sections dividing the points into groups being nearer to the south and the north shoreline, one can find that in a ratio of fifty : fifty either the southern or the northern values are higher. (The 20 sections used for this comparison involve all the standard sections in May and September and only section M during the other months.)

The decrease of organic carbon content observed in the mud of Keszthely Bay during the summer months and its increase during the colder period is undoubtedly connected with the amount and activity of bacteria (PONYI et al., 1972). The carbon content of the richest alga biomass in the water (TAMÁS, 1972) is negligibly low as compared to a difference of 0.2 percent of the organic matter content observed by us. The reed-grass vegetation amounts to 281 tons wet weight per year (KÁRPÁTI and VARGA, 1970) in Keszthely Bay. This and the reed detritus having not been calculated may be sufficient for the seasonal change of the organic matter content. This indicates the importance of the macrovegetation in our lake.

Summary

1. Determinations of organic carbon content obtained by means of the "dry" (ENTZ et al., 1963) and "wet" (WALKLEY and BLACK, 1934) methods of oxidation are to be used well on the mud of the open water of Lake Balaton. The former method gives higher values above 2 percent organic carbon content than the latter one.

2. Apart from the Keszthely Bay, the organic carbon content in the mud of the open water of Lake Balaton shows a relatively uniform distribution, it varies between 1.52–1.78 percent.

3. The amount of the organic carbon changes seasonally in the transversal section through the Keszthely Bay. It was 1.83–1.85 percent during summer (June–August) and 1.96–2.27 percent during the spring and autumn. The autumnal increase represents a consequence of the destruction of the macrovegetation.

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A SZERVES SZÉN MENNYISÉGÉNEK ÉV SZAKOS VÁLTOZÁSA A BALATONBAN 1972-BEN

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Összefoglalás

1. A száraz (ENTZ et al., 1963) és nedves oxidálás (WALKLEY és BLACK, 1934) módszerével kapott szerves szén meghatározások a Balaton nyíltvízi iszapján jól használhatók. A száraz oxidációval 2% organikus szén felett magasabb értékeket kapunk, mint nedves oxidációval.

2. A Keszthelyi öböltől eltekintve a Balaton nyíltvízi iszapjának szerves szén tartalma viszonylag egyenletes megoszlást mutat, és 1,52–1,78% között változik.

3. A Keszthelyi öbölben vizsgált keresztzelvényen a szerves szén mennyisége évszakosan változik. Nyáron (június–augusztus) 1,83–1,85, őszi és tavaszi időszakban pedig 1,96–2,27% között ingadozik.