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Diatoms from a brooklet affluent to Arax river (Armenian Republic, USSR)

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ABSTRACT: (Diatoms from a brooklet affluent to Arax river (Armenian Republic, USSR) - The paper describes a sample taken from a saline mountain brooklet affluent to Arax river (Armenian Republic, USSR). The material was sampled from floating over the water surface cca 500 metres from the source, and due to its secondary origin gives an aspect of the interesting diatom vegetation of the uppermost section of the brooklet. Enumeration of the 70 taxa found in the sample is given with remarks on some of the more interesting forms. Author reports a short, estimating method that might substitute for quantitative analysis when searching for patterns of distribution.

In September, 1971, the author of the present paper received a water sample of about 0,5 cubic centimetres by the courtesy of the Botanical Department of the Hungarian Natural History Museum. The material was collected by I. MILKOVITS, in the same month, from a mountainous district named Norsky Massiv, 8. kilometres to the east of Yerevan, at an altitude of 2000 metres above sea level. The sample had been examined originally from the point of algal fungi by H. GÖNCZÖL, it was found to be entirely uninteresting in that respect but proved of conspicous richness and variety concerning its diatom material; it was subsequently placed at the author's disposal who therefore is greatly indebted to both of the above researcher workers.

The peculiar environment of origin of these few drops of water, the unusually rich and diversified material justify the publication of the examination of the sample, the reporting of data from a botanically and mainly algologically imperfectly known territory motivates that purpose even more.

LOCALITY OF SAMPLING

The material in question was sampled from a brooklet-like small watercourse with its source about 5 kilometres from the river Arax. The river here is surrounded - according to MILKOVITS's report - with azonal, climate-born semideserts. The soil is highly basic and the macrophytous vegetation, represented by a single plant or two per square metre, is definitely of halophylous character. The fundamental rock is of volcanic origin and from its depths juvenile waters well up very densely, at every one or

two hundred metres. Most of the springing waters dry up after a short flow leaving concrete-hard salt-mud in their beds, however, many hundreds of them arrive to the main flow of the river Arax. The latter are all named Arax by the people there, thus making distinction between the streams that flow through and those that dry up.

The watercourse given in the title of this paper is a cataractous, very fast-running 40-50 cm broad brooklet that floes into the main river. The sampling place was located about 500 m from the source. Here, after a small waterfall, a pool of about one square metre developed. MILKOVITS sampled the material from the floating foam over the surface of that pool. The diatom material is therefore of secondary origin, but taking into consideration the impossibility of water flowback due to the gradient circumstances ant the closeness of the source there is no doubt that the mass of diatom shells, accumulated within the foam, characterizes properly the whole diatom vegetation of the uppermost 500 m section of the brooklet.

METHODS

The material of the water sample was prepared on 20 microscope spread slides with permanent embedding. The diatom frustules had to be cleaned of organic and inorganic impurities and of the live cell content as well, in order to make taxonomic identification possible. Cleaning was executed partly by heating the cover slip and the sample material dried over its surface to a red glowing state; partly by application of sulphuric acid. The material under examination remained rather stained even after the removal of organic components, therefore partly to segregate stain, partly to separate too dense shell material in order of size, 7 slides were made containing such material separated by increasing periods of sedimentation time. The embedding medium available to the author was Euparal with a rather low refraction index; however this is disturbing only in case of the most delicate diatom valves. For such cases 2 slides were prepared according to the so-called dry or mediumless technique. After the investigation, the diatom material left was preserved in distilled water conserved with 4 per cent formalin solution and was deposited together with the preparation slides to the collection of the Botanical Department of the Natural History Museum.

DISCUSSION OF DIATOM MATERIAL

The investigated material contains 70 diatom taxa (species, variety, form). With respect to the very small quantity of the single sample, this is a rather high number. Of the identified diatoms there were 3 abundant, 6 frequent, 8 average, 16 sparse and 37 rare taxa, as regarding their frequency in the sample.

The patterns of distribution of the taxa might be presented in a clearer way by the use of graphical delineation. If, in a system of coordinates, one axis bears the number of taxa and the other the logarithms of specimen numbers and one connects the values belonging together, the marking points of the sample in question, after correcting the standard errors caused by inexact estimation, will lie on a straight line. This is an evidence of the natural origin of the diatom material itself, too.

The characteristic frequency and frequency-distribution of the specimens belonging to different salinity groups might be analyzed in a similar way. Marking the frequency number used during the analysis from 1 to 5 with "f"; the number of taxa belonging to a certain salinity group with "t"; the frequency number characterizing the certain group can be given by the following formula: $n = 10^{f-1}t$.

Calculated according to the above formula, the characteristic values of the sample material are as follows:

indifferent	=	10^4	+	$2x10^3$	+	$2x10^2$	+	8x10	+	24	= 12304 (33,3 %)
halophylous	=	$2x10^4$	+	$2x10^3$	+	$3x10^2$	+	5x10	+	10	= 22360 (60,5 %)
mesohalobe	=	$2x10^3$	+	$3x10^2$	+	3x10	+	3			= 2333 (6,2 %)
											36997 (100,0 %)

There is no doubt that the method expounded above cannot replace the exact means of quantitative analysis. However, the author believes that it gives fundamentally better information about the distribution patterns of a certain material than the distribution patterns of a certain material than the plain account of the number of taxa partaking in a given group. The method also might prove to be profitable when one either needs merely quick, informative data or when there is no way to follow exact methods - as in the case of the present sample.

The results of detailed identification are given below. The enumeration follows the taxonomic system of HUSTEDT (1930-1966), the sequence within a genus is alphabetic. The frequency rate is given by the number after the taxon name, signifying as follows:

5 = abundant, 4 = frequent, 3 = average, 2 = sparse, 1 = rare occurence within the material of the sample.

The letter symbol following the frequency number gives the group of salinity, according to data in literature, using KOLBE's (1927) classification: I = indifferent, H = halophylous, M = mesohalobe taxon.

The question mark following the name of a taxon refers to the remarks after the enumeration.

ENUMERATION

1. Thalassiosira fluviatilis HUST.	5H
2. Cyclotella meneghiniana KÜTZ.	1H
3. Stephanodiscus astaea var. minutula (KÜTZ.) GRUN.	2H
4. Stephanodiscus hantzschii GRUN.	2H
5. Coscinodiscus lacustris GRUN.	1H
6. Diatoma vulgare BORY	2I
7. Diatoma vulgare var. ovalis (FRICKE) HUST. ?	3I
8. Fragilaria capucina var. lanceolata GRUN. ?	2I

9.	Fragilaria pinnata EHR.	1I
10.	Synedra acus KÜTZ.	1I
11.	Synedra tabulata (AG.) KÜTZ.	1I
12.	Asterionella formosa HASSAL	1I
13.	Cocconeis pediculis EHR.	4H
14.	Cocconeis placentula EHR.	1I
15.	Achnanthes lanceolata (BRÉB.) GRUN.	1I
16.	Rhoicosphaenia curvata (KÜTZ.) GRUN. ?	3H
17.	Anomoeoneis sphaerophora (KÜTZ.) PFITZ.	1H
18.	Stauroneis minuscula VIDA	1(H)
19.	Navicula cari EHR.	2I
20.	Navicula cincta (EHR.) KÜTZ. ?	1H
21.	Navicula cincta var. heuffleri GRUN.	2H
22.	Navicula cryptocephala KÜTZ.	3I
23.	Navicula cryptocephala var. minima VIDA	5(H)
24.	Navicula cryptocephala var. veneta (KÜTZ.) GRUN.	4I
25.	Navicula cuspidata var. ambigua (EHR.) CLEVE	1I
26.	Navicula gracilis EHR.	1I
27.	Navicula gregaria DONKIN	4M
28.	Navicula halophila fo. subcapitata ÖSTR. ?	4M
29.	Navicula popula KÜTZ.	1I
30.	Navicula pupula fo. rostrata HUST.	1I
31.	Navicula Pygmaea KÜTZ.	1M
32.	Navicula salinarum GRUN.	1M
33.	Navicula viridula var. avenacea (BRÉB.) GRUN.	2H
34.	Caloneis bacillum (GRUN.) MERESCHKOWSKY	1I
35.	Gyrosigma acuminatum (KÜTZ.) RABH.	2I
36.	Pleurosigma angulatum (QUECKET) W. SMITH	2M
37.	Amphora veneta KÜTZ.	2I
38.	Cymbella ventricosa KÜTZ.	1I
39.	Gomphonema angustatum (KÜTZ.) RABH.	1I
40.	Gomphonema parvulum (KÜTZ.) GRUN.	2I
41.	Gomphonema olivaceum (LYNGBYE) KÜTZ.	1I
42.	Epithemia sorex KÜTZ.	1H
43.	Rhopalodia musculus (KÜTZ.) O. MÜLL.	1M
44.	Hantzschia amphioxys (EHR.) GRUN.	1I
45.	Bacillaria paradoxa GMELIN	3H
46.	Bacillaria paradoxa var. tumidula GRUN.	1H
47.	Nitzschia acicularis W. SMITH	1I
48.	Nitzschia apiculata (GREG.) GRUN.	3M
49.	Nitzschia claussii HANTZSCH.	1I
50.	Nitzschia dissipata (KÜTZ.) GRUN.	1I
51.	Nitzschia dubia/W. SMITH	3H
52.	Nitzschia fonticola GRUN.	1I
53.	Nitzschia hungarica GRUN.	3M
54.	Nitzschia kützingiana HILSE	1I
55.	Nitzschia linearis W. SMITH	2I
56.	Nitzschia lorenziana var. subtilis	1M
57.	Nitzschia obtusa W. SMITH	1H
58.	Nitzschia palea var. capitata WILS. et PORETZKY	5I

59. Nitzschia recta HANTZSCH	1I
60. Nitzschia sigma (KÜTZ.) W. SMITH	2M
61. Nitzschia sigmoidea (EHR.) W. SMITH	1I
62. Nitzschia thermalis var. minor HILSE	2I
63. Nitzschia tryblionella var. debilis (ARNOTT) A. MAYER	1H
64. Nitzschia tryblionella var. levidensis (W. SMITH) GRUN.	2H
65. Nitzschia vitrea var. salinarum GRUN.	3M
66. Cymatopleura solea (BRÉB.) W. SMITH	1I
67. Surirella angustata KÜTZ.	1I
68. Surirella ovalis BRÉB.	4H
69. Surirella ovata KÜTZ.	4I
70. Surirella peisonis PANTOCSEK ?	1H

REMARKS UPON THE TAXA

ad 1. Thalassiosira fluviatilis HUST. Fig. 1.

HUSTEDT (1926) described this rare and interesting species from the plankton of the rivers Weser and Werra where it had been found in the years 1925 and 1926. No other data concerning occurence of the species is known to me, and it is probable that it has not been reported since from European areas. As for its occurence in the Soviet Union, PROSKINA-LAVRENKO (1951) makes no report, and SKABIČEVSKIJ (1960), although describing the species in details, mentions that it has not been found there so far. PORECKIJ and ANISIMOVA (1933) describe another species, Thalassiosira hustedtii from the Soviet Union. This, being an extremely rare diatom, was found at a single spot, at the mouth of a saline stream near Staraya Russa, district of Novgorod, and was reported inhabiting bottom-mud of very slowly moving waters, coating submerged wood and macrophytes like Enteromorpha. Meanwhile, it could not be found in any of the neighbouring saline waters.

Based upon the original diagnoses of the authors, the most important taxonomic marks separating the two species are as follows:

Thalassiosira fluviatilis HUSTEDT: Frustules solitary. Valves bearing a few larger pores in the centre, other parts of the shell wall bear extremely delicate pattern of radiate punctae. Density of marginal striae 10-13/10 μ. Diameter 15-23 μ.

Thalassiosira hustedtii PORECKIJ et ANISIMOVA: Frustules solitary, rarely forming chains of 2-4 frustules. Valves bearing one larger pore in the centre, with the role of jelly secretion and consequently colony formation. Other parts ot the shell wall plain, structurelles, except a small area round the central pore that bears an irregularly outlined and extremely finely punctated wreath. Density of marginal striae 16/10 μ. Diameter 17,2-19,5 μ.

Difference between the two species looks significant from the point of their biotops. Nevertheless, already SKABIČEVSKIJ (1960) pointed out that Thalassiosira hustedtii is probably a genuine planktonic diatom like most of the Centricaceae, and thus the benthic-epiphytic occurence in that site should be regarded as secondary.

Summarizing these data one conclusion seems to be inevitable, namely that the differing diagnoses of Thalassiosira fluviatilis and Thalassiosira hustedtii represent the same species in different phases of the frustule development. The formation of jelly that might lead to formation of colonies (a rare phenomenon, here) is not an absolutely obligatory taxonomic mark, as it can be observed in case of related species as well. When the structure of a cell wall tends to be at the border of microscopic distinction, then structure is not in the least an exact taxonomic mark. The radially punctated lines of Thalassiosira fluviatilis valves can be observed clearly only when frustules are large enough, the embedding medium is of a high refraction index, and observation is made with an objective of excellent aperture. If all these conditions are not present simultaneously, valves of Thalassiosira fluviatilis show exactly the same structure as described in the diagnosis and presented in the drawings of Thalassiosira hustedtii. It is necessary to remark here that neither the number of central pores nor the density of striae on the margin can be regarded as specific marks when separating different taxa of centric diatoms. The number of pores in the centre of valves might vary from 0(?), 1 to 8, according to my observations (cf. the number of central pores at Melosira roeseana!) Meanwhile marginal striae varied between 12/10 μ and 18/10 μ. I think highly probable that Thalassiosira hustedtii belongs to the form range, or rather to the synonims, of Thalassiosira fluviatilis.

It is also necessary to remark here another feature connected with this diatom species. Namely, Thalassiosira fluviatilis apperently belongs, according to the available data, to the rarest diatoms. However, one should take into consideration the difficulties connected with the observation of valve structure, and the fact that by a superficial perusal of mixed diatom material Thalassiosira fluviatilis valves might appear at first sight as strongly corroded Melosira varians frustules. So it looks easily possible that the species is much widerspread than supposed to be. In any case, I collected Thalassiosira fluviatilis several times from different localities in Hungary, too. I found it in the river Danube, in its affluent rivers Rába and Rábca, in saline brooks and canals near Győr, and also in lake Balaton; and found its frequency to be often abundant. The microscopic examination and comparison proved that specimens of Armenian and Hungarian Thalassiosira fluviatilis are taxonomically identical.

ad 7. Diatoma vulgare var. ovalis (FRICKE) HUST. Fig. 2.

HUSTEDT's diagnosis gives 8-14μ as the length of cells for the taxon. All specimens of the sample are much smaller than that; their length varies between 4-7 μ. It may perhaps represent an independent saline form of the species.

ad 8. Fragilaria capucina var. lanceolata GRUN. Fig. 3.

In contrast with the original diagnosis, specimens of the sample never form colonies, and are always solitary ones. The transapical ribs are strong, the central area has a distinct contour. The habitus of frustules has a Synedra character in all respects. These contradictions underline the difficulties in the separation, acceptable only from practical points of view, of the genera Fragilaria and Synedra, emphasized clearly by HUSTEDT (1930).

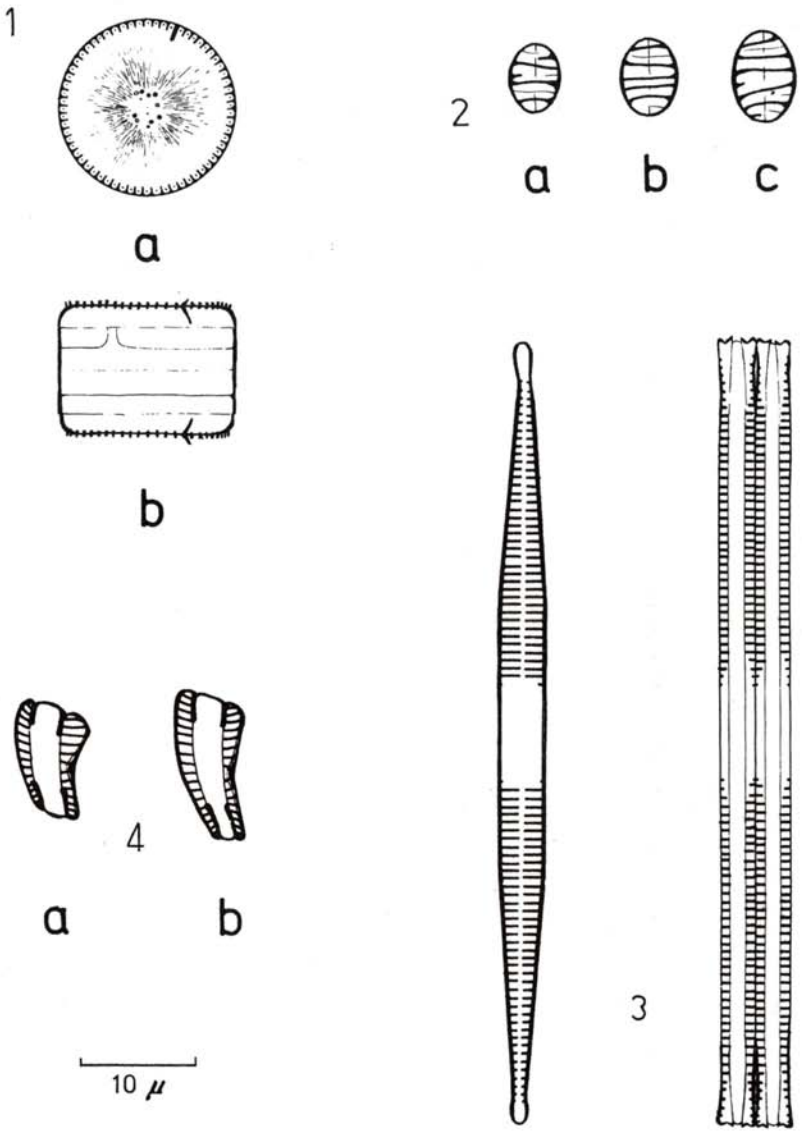


Table 1. - 1. tábla

Fig. 1. Thalassiosira fluviatilis HUST.
Fig. 2. Diatoma vulgare var. ovalis (FRICKE) HUST.
Fig. 3. Fragilaria capucina var. lanceolata GRUN.
Fig. 4. Rhoicosphaenia curvata (KÜTZ.) GRUN.

ad 16. Rhoicosphaenia curvata (KÜTZ.) GRUN. Fig. 4.

The majority of specimens in the sample are very small. GRUNOW's diagnosis and author's comparative material gives the limits of length as 12 and 75 μ s. Frustules in the sample vary between 9 and 13 μ. Perhaps another saline form.

ad 18. Stauroneis minuscula VIDA

Description, diagnosis and iconography in VIDA (1973).

ad 20. Navicula cincta (EHR.) KÜTZ. Fig. 5.

The specimens found in the sample do not resemble the illustrations available in the literature, although most points of the diagnosis can be easily identified. Differing points are: the transapical striae edging the central area are not conspicuously stronger and sparser than the average ones. Density of the striae 12-14/10 μ in the middle, and 14-16/10 μ toward the cell ends. Striae are distinctly lineolate. Outline of central area irregular, with "cryptocephala" character.

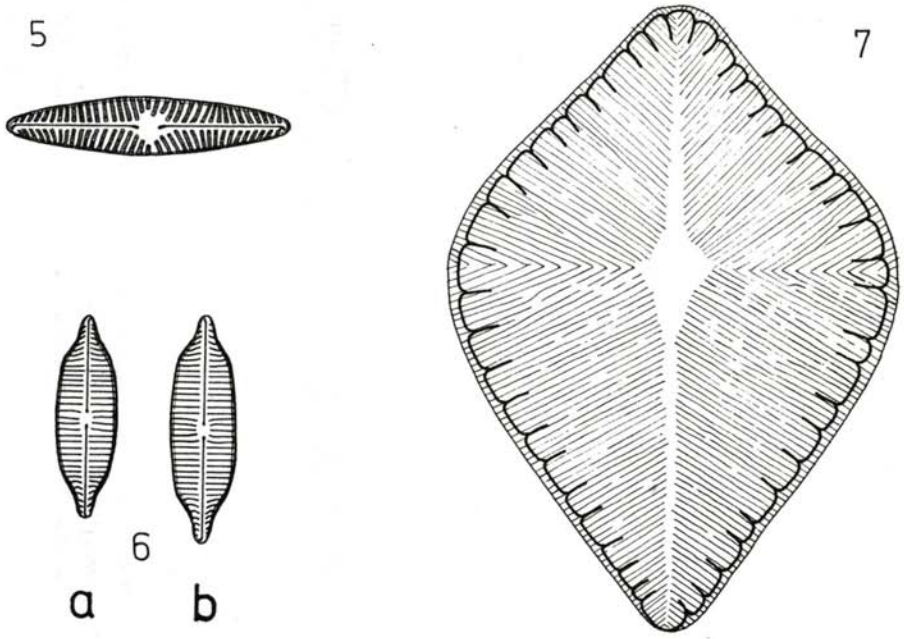


Table 2. - 2. tábla

Fig. 5. Navicula cincta (EHR.) KÜNTZ
Fig. 6. Navicula halophila f. subcapitata ÖSTR.
Fig. 7. Surirella peisonis PANTOCSEK

ad 23. Navicula cryptocephala KÜTZ. var. minima VIDA

Description, diagnosis and iconography in VIDA (1973).

ad 28. Navicula halophila f. subcapitata ÖSTR. Fig. 6.

The specimens in the sample are very small ones, their length is 15-20 μ, the outline of valves much resembles that of Navicula accommoda HUST., but they do not possess the most important mark, namely the conspicously sparser striae at the middle that are gradually thickening towards the cell ends. In contrasting with the diagnosis, the striae of the taxon in question show a uniform density.

ad 36. Pleurosigma angulatum (QUECKET) W. SMITH

This principally marine diatom species appears rarely in continental saline lakes. Its presence in the water of a fastrunning cataractous mountain stream is unique.

ad 70. Surirella peisonis PANTOCSEK Fig. 7.

In spite of the improbability of the occurence of the characteristic diatom in waters like the sampled stream, the identification of the taxon, based upon the diagnosis and drawings, is unambiguous. Howevever, the fact that the taxon shows several transitional forms towards Surirella ovalis similarly present in the material, casts doubt on the taxonomy of Surirella peisonis as independent species.

VIDA, L.: Kovamoszatok az Arax-folyó (Szovjetunió, Örmény SzSzK) egyik mellékvizéből

A dolgozat az Arax folyó (Örmény SZSZK) egyik mellékvizéből, egy hegyipatak jellegü sósvizü csermelyből származó mintát ismertet diatomológiai szempontból. A minta a forrástól kb. 500 méterre, a viz felszinén uszó hab anyagából való. A másodlagos eredetü diatomaanyag jól jellemzi a forrás és a gyüjtőhely közti 500 méteres csermelyszakasz érdekes diatomavegetációját.

A dolgozat kritikai megjegyzésekkel követett részletes enumerációt közöl a mintából kimutatott 70 taxonról. Az anyag érdekesebb diatomái közül kiemelhetők a következők: Thalassiosira fluviatilis, Bacillaria paradoxa, Stauroneis minuscula, Navicula cryptocephala var. minima, Pleurosigma angulatum, Nitzschia lorenziana var. subtilis, Surirella peisonis.

Szerző a minta analizise során ismertet egy kvantitativ analizis helyett alkalmazható gyors becslési módszert az eloszlási törvényszerüségek megállapitására. A vizsgált minta esetében a diatomaanyag sótürési kategóriák szerinti megoszlása fenti módszerrel a következő arányokat eredményezte: mezohalób 6,2 %, halofil 60,5 %, indifferens 33,3 %, halofób 0 % egyedsürüségre vonatkoztatva.

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