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THE SOMEŞAN PLATEAU LAKES: GENESIS, EVOLUTION AND TERRITORIAL REPARTITION

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Abstract

The present paper analyzes the genesis of the lake depressions in the Someşan Plateau and the way they evolved in time and space, as well as the morphometric elements characteristic of the different genetic types of lakes. The natural lakes in this region are few and their dimensions are small; they generally appear solitarily and only rarely as lake complexes. In this category have been included the valley lakes, the lakes formed in abandoned meanders and the lakes formed in areas with landslides. The artificial lakes are more numerous and include several genetic types. The most representative are the remnant lakes formed in the depressions resulted from the exploitation of different construction materials (kaolin sands, lime stones) and the anthropic salty lakes lakes formed in abandoned salt mines from the diapir area of the Hills of Dej. The rapid evolution of these types of lakes has been highlighted through the comparative analysis of the morphometric elements obtained on the basis of topometric and bathymetric measurements. The lakes arranged for pisciculture include several subtypes (ponds, fish ponds) that have been identified and characterized for the fist time, their morphometric elements being determined using digital data bases, satellite images and detailed topometric maps.
Keywords: lake, genesis, evolution, genetic types, repartition, space

1. General considerations

The Someşan Plateau occupies the N-NW compartment of the Transylvanian Depression, representing one of the three great divisions of the Transylvanian Plateau. According to the particularities of the geographic components of the Someşan Plateau, several sub-units have been highlighted (fig.1). In the Someşan Plateau are present numerous lakes with various geneses and morphometric, hydrological and physico-chemical features.

Preoccupations for the research of the lacustrine units in the Someşan Plateau were recorded among the academics from the Faculties of: Geography (Alexe, M., Bătinaş, R., Fodoreanu, I., Horvath, Cs., Pandi, G., Pânzaru,

Sorocovschi, V., Şerban, Gh.), Environmental Science (Berkesy L., Vigh Melinda) and Agriculture (Stana Doina) of Cluj-Napoca as well as among the researchers from ICPE Bistriţa (Berkesy Corina).

2. Lake genesis, evolution and repartition

The individualization of the lacustrine depressions in the Someşan Plateau was triggered by the action of natural and anthropic factors. From the viewpoint of their origin, the lakes in the area of the Someşan Plateau have been included in two big categories: natural and anthropic. Most of the lakes are associated in complexes and only occasionally do they appear solitarily (fig.1.)

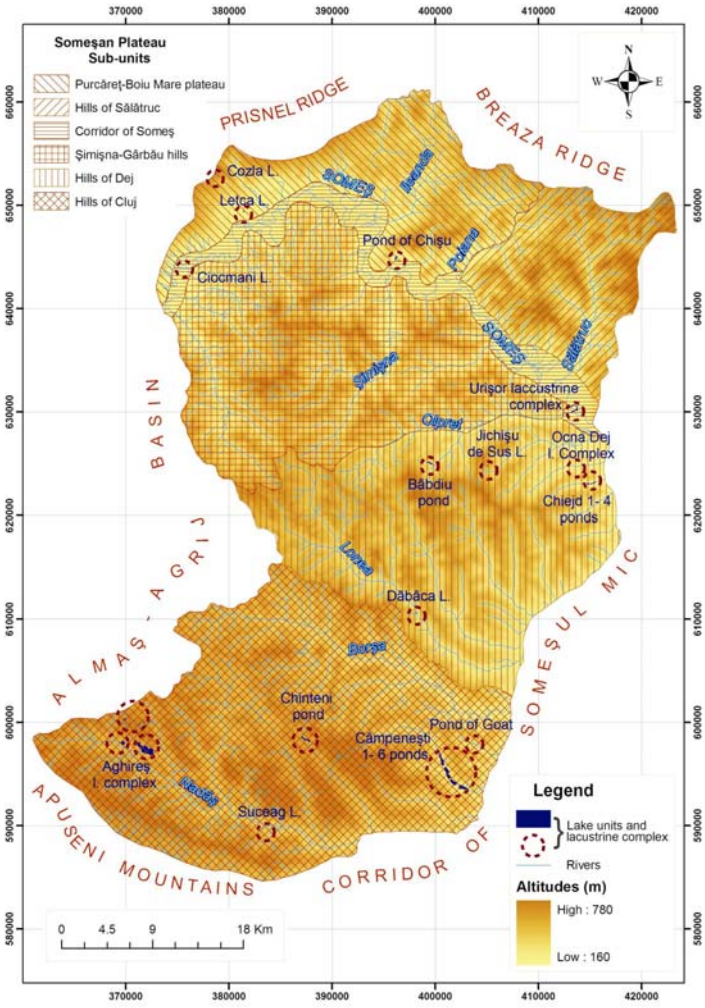

Fig.1. Repartition of the lakes and of the geographic subunits of the Someşan Plateau

2. 1. Natural lakes

The few lakes of natural origin generally have a solitary character; their dimensions and depths are generally low and they are relatively uniform from a genetic viewpoint. To this category belong the valley lakes developed in the lime stone horizons of the Purcăreţ - Boiu Mare Plateau. They appeared following the storage of the water resulted from precipitations and the melting of the snow in the valleys encountered on the Cozlei, Dumbrăvii and Purcăreţului plateaus. Numerous valley lakes can be found as a lacustrine complex situated on the Dumbrava Plateau in the western vicinity of Letca locality. Out of these lakes, we shall mention the lakes Felsam ((300 m^2) and Băltocul from Pietrar (Fodoreanu, 2010). A solitary lake with an area of 12,895 m^2 has been identified in the western extremity of the Dumbrava Plateau. The morphometric features of the valley lakes have been determined using digital databases, satellite images and detailed topometric maps (table 1).

Table 1. Morphometric elements of the valley lakes in the area of the Purcăreţ-Boiu Mare Plateau

Name of the lake	Area (m^2)	Length (m)	Width (m)		Axis (m)		Peri-meter (m)	Sinuosity quotient
			Avera ge	maxi-mum	big	small		
Cozla	8935	125	71	102	122	102	354	1.06
Letca	12895	163	79	123	159	126	434	1.08

Valley lakes have been identified as well in the area of the calcareous plateau of Cozla, north of the homonymous locality, in the western vicinity of the forest road connecting the localities Cozla and Vălişoara. The lakes' permanence is assured by the impermeabilization of the depression by a layer of clay that does not allow the infiltration of the water resulted from precipitations.

The Jichişul de Sus Lake from the upper basin of the Jichiş Rivulet is situated at about 1 km north of the homonymous locality. To the individualization of the lacustrine depression have contributed the landslides that affect the left slope of the Jichiş Rivulet. The lake has an area of 10,427 m^2; it is 162 m long, and its maximum width reaches 104m (table 2)

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Table 2. Morphometric elements of the Jichişu de Sus Lake*

Name of the lake	Area (m^2)	Length (m)	Width (m)		Axis (m)		Peri-meter (m)	Sinuosity quotient
			avera ge	maxi-mum	big	small		
Jichişu de Sus	10427	162	64	104	157	105	403	1.11

* The morphometric elements have been determined using digital databases, satellite images and detailed topometric maps

In the category of the *lakes formed in abandoned meanders* is included the lacustrine complex from Urişor situated in the riverside of Someş near the homonymous locality belonging to the Căşeiu Commune (Cluj County).

The lacustrine complex from Urişor is made up of three lakes whose water surface totals 9.8 ha. The lakes appeared in a deserted meander of Someş River following the course regularization works in 1962. Later on, on the former meander, which used to cover a 18.8 ha area, four lake compartments formed, of which only three have been kept to date (Urişor I, 3,6 ha, Urişor II, 3,4 ha şi Urişor III, 2,8 ha). Initially, the depression formed used to receive the waters resulted from the treatment plant of the Paper and Cellulose Complex Works (Combinatul de Celuloză şi Hârtie) from Dej. At present, the lakes' water has good qualities for the development of fish fauna. The water supply for these lakes comes from several springs with rich flows situated in their precincts.

2. 2. The artificial lakes

In the Someşan Plateau are present numerous artificial or anthropic lakes that can be grouped into several types: anthropic lakes formed in former salt mines, anthropic lakes formed in the holes resulted following the exploitation of different construction materials and ponds.

Anthropic salty lakes

The presence of this genetic type is related to the millenary exploitation, using the "bell-shaped" or "trapezoidal" mine system, of the salt deposits of the diapir area in the margin of the Transylvanian Plateau. The storage of the water coming from precipitations or springs in the former salt mines occurred depending on the type of exploitation.

The lacustrine complex of Ocna Dejului is connected to the existence of the salt deposit situated in the area of the former Ocna Dej locality, now quarter of Dej municipality. The perimeter of the salt deposit is crossed by three rivulets flowing from west to east: Codor Rivulet in the north, Ocnei (Sărat) Rivulet, in the middle and Săcădaş Rivulet in the south.

The morphology of the anthropic salty lakes is subordinated to the type and size of the exploitations and their evolution is influenced by anthropic and natural factors. We have been able to follow the evolution of the lacustrine depressions thanks to a detailed analysis of the topometric and bathymetric measurements carried out by Pânzaru (1969) and Alexe (2004).

Pânzaru (1969) identified 14 lakes, which were then grouped according to their genesis and territorial repartition into two distinct sectors. The first, the southern sector, corresponds to Ocnei Valley, including only anthropic lakes, while the

second, the northern sector or Cabdic, is characterized by the presence of the anthropic salty lakes, karst salty lakes and natural dam lakes.

The southern sector, situated in the east central area of the neighborhood Ocna Dejului, used to include the lakes: Minei Mari, Ştefan, Iosif and the pool's basin. The northern sector from the northern slope of the Cabdic Hill, used to include four anthropic salty lakes (of which the biggest was Cabdic Lake), three smaller natural dam lakes, and a karst salty lake and three anthropic salty lakes. At present out of the 14 lakes only two have been preserved: Cabdic Lake and Minei Mari Lake.

Cabdic Lake, a lake with salty water (called by the local people Toroc Lake) is situated on the hill bearing the same name and appeared following the storage of the water in the hole resulted after the collapse, in August 1926, of an ancient bell-shaped exploitation. The movement of the material from the mine roof into the lake lifted the bed of the depression over 2 meters higher. However, the volume of the lake increased by over 3000 m^3 due to the extension of the depression in space, especially along the direction of the big axis (table 1).

Table 1. Morphometric and hydrological elements of the lakes from the area of Ocna Dejului determined based on topometric and bathymetric measurements in 1969 (Pânzaru) and 2004 (Alexe).

Morfphometric and hydrological elements	Cabdic		Minele Mari	
	1969	2004	1969	2004
Area (m^2)	1350.0	1524.8	189.0	240.9
Length (m)	45.0	53.9	69.3	78.2
Average width (m)	30.0	28.3	39.3	44.3
Maximum width (m)	42.0	42.1	57.5	65.1
Big axis (m)	45.0	53.9	69.2	78.2
Small axis (m)	42.0	42.1	57.5	65.1
Average depth (m)	7.67	8.85	1.58	1.21
Maximum depth (m)	41.0	38.2	2.85	2.5
Absolute depth (m)	-	-	275.08	275.50
Perimeter (m)	132.0	154.0	189.0	240.9
Sinuosity quotient of the borders	1.02	1.11	1.02	1.15
Volume (m^3)	10539.2	13499.5	4281.9	4204.6

The other nine lacustrine units identified by Pânzaru (1969) in this sector have reached an advanced evolutionary stage, being invaded by vegetation (reed, rush, bulrush). By means of a non-permanent emissary, Cabdic Lake has a runoff northwards towards a former lake, which has reached an advanced clogging stage.

Minei Mari Lake (*also called "Lacul Mare")*, situated in the SE of Dej municipality, corresponds to the mining exploitation from the sector of Valea Sărată ("the Salty Valley"). It appeared in the year 1773 on the location of a former closed mine, and has kept, to date, its almost circular shape. It is not known for sure how

much the “salty lake” stage lasted, yet it is known that in the year 1883, the salt grinding mill of this sector received sweet (fresh) water from the lake.

Comparing the morphometric data obtained from the two topometric and bathymetric measurements, it results that the values of those determined in 2004 are slightly higher, except for the maximum depth, which has slightly decreased (table 1), which proves the fact that the lake’s clogging process is quite slow.

The lakes from the holes resulted following the exploitation of different construction materials (remnant lakes)

The denomination of this category of anthropic lakes has been given by Găştescu (1963), and, later on, Şerban et ali. (2009) called them remnant lakes. The presence of these lakes has to do with the exploitation and processing of the kaolin sands from the hills of Cluj and of the lime stone from the Purcăreţ-Boiu Mare Plateau. In the micro-depressions resulted following the exploitation and processing of the above-mentioned rocks, the water from precipitations and springs gathered and formed lakes of different dimensions.

The Lacustrine complex from Aghireşu, situated 28 kilometers away from Cluj-Napoca municipality, has appeared on the location of some former kaolin sand mining exploitations in the south-west of the Hills of Cluj. Following the topsoil stripping, the opening and the arrangement of the dumps, there have appeared circular depressions in the middle of which water gathered, giving birth to numerous lakes.

The first water storages were arranged by men to use the hydraulic agent to wash the exploited material. Among these lakes, noticeable are the lakes in the vicinity of Băgara locality, which had numerous drainage canals around the quarries. Later on, other new lakes appeared following the crumbling of certain galleries. The superficial erosion and the infiltrations made the galleries’ roof thinner and favored the penetration of the water in the underground. The shapes of these lakes’ depressions are very irregular and in some cases they communicate by means of the old galleries, generating different bottom currents. So, their origin is mixed, being both anthropic and natural. By the end of the 70s, several lakes took shape in the holes resulted following the collapse of certain galleries.

Based on satellite images, cartographic materials and computerized GPS data processing, 24 lake units were identified (Şerban, Maria Antonie, Roman, 2009) (fig. 2). Out of the numerous lakes appeared in the area of the kaolin sands exploitations, representative are 14 (Pandi *et al.*, 2010). Because of the very friable and unstable bedrock and because of the numerous unconsolidated sterile dumps from their neighborhood, the lakes’ depressions have a special dynamics in space and time. So, within the interval of just a few years, some lakes may disappear and some new lakes may appear, as their morphometric characteristics change substantially.

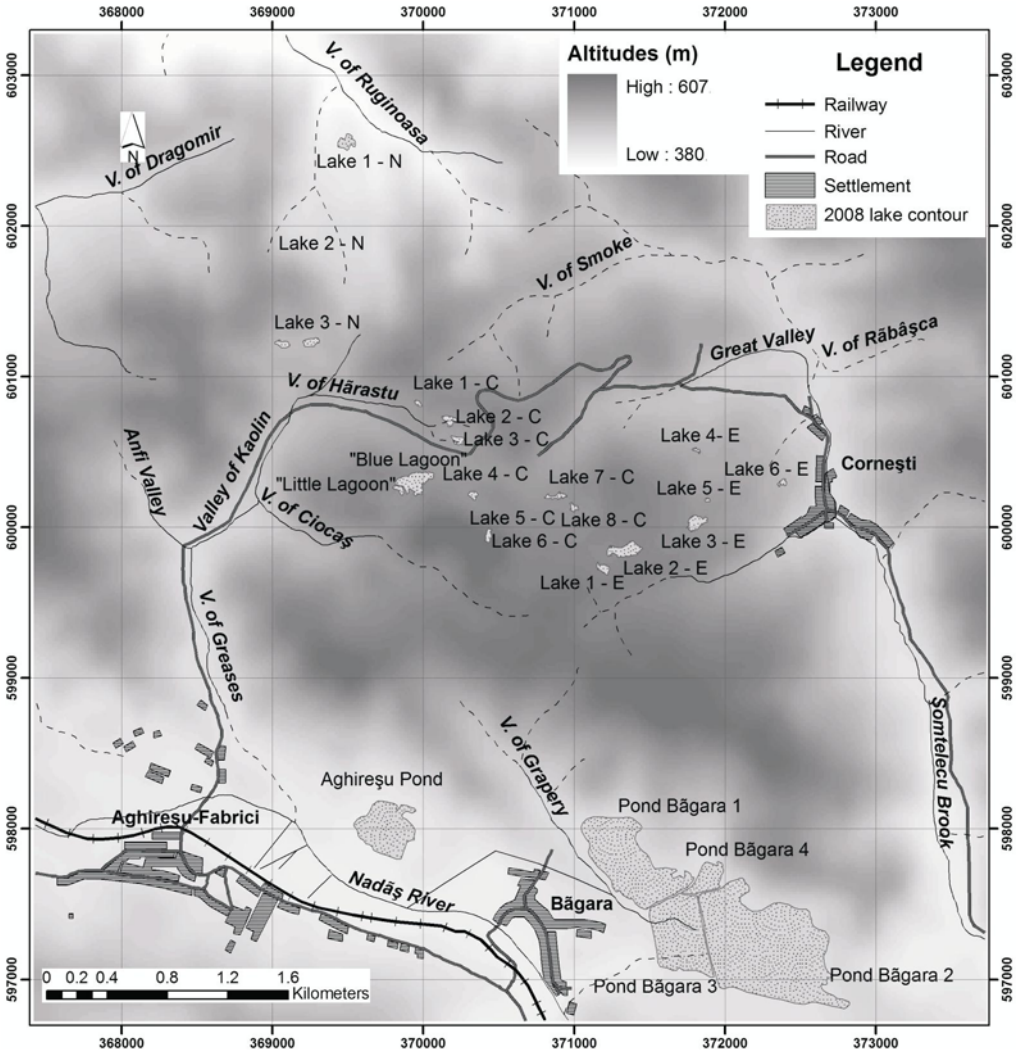

Fig.2. The remnant lakes from Aghireşu

The lakes' morphology has largely been modified by subaerial factors, the slope processes strongly modeling the lake border and implicitly the lacustrine depressions. The depressions formed following landslides have a higher instability degree, and on their borders there will appear rapidly different forms of zonal and linear erosion.

The determination of the main morphometric elements of the remnant lakes on the level of the years 2004 and 2008 allowed the highlighting of the dynamics of the lacustrine units from Aghireşu area (table 1).

Table 1. The dynamics of several morphometrical elements of the remnant lakes from Aghireşu (Cluj County) (according to Şerban, Antonie, Maria, Roman, 2009).

No.	Lake / Year	Surface (m^2)		Length (m)		Width (m)		Perimeter (m)		Quotient of sinuosity	
		2004	2008	2004	2008	2004	2008	2004	2008	2004	2008
1	Lake 1 – N	4762	7657	105	133	72	75	282	400	1.15	1.29
2	Lake 2 – N	2517	-	75	-	49	-	194	-	1.09	-
3	Lake 3 – N *	22613	7883	330	212	91	96	788	535	1.48	1.70
4	"Blue Lagoon" **	19588	21719	256	266	149	154	686	823	1.38	1.58
5	"Little Lagoon"	1086	2306	67	96	23	32	156	222	1.34	1.30
6	Lake 1 – C	-	1221	-	62	-	28	-	146	-	1.18
7	Lake 2 – C	-	4258	-	106	-	72	-	286	-	1.24
8	Lake 3 – C	-	3241	-	96	-	62	-	258	-	1.28
9	Lake 4 – C	6380	2336	122	64	66	49	317	193	1.12	1.13
10	Lake 5 – C	3483	-	96	-	49	-	264	-	1.26	-
11	Lake 6 – C	-	2600	-	92	-	39	-	243	-	1.34
12	Lake 7 – C	-	3242	-	151	-	45	-	421	-	2.09
13	Lake 8 – C	-	1886	-	76	-	47	-	216	-	1.40
14	Lake 1 - E	-	3699	-	114	-	51	-	302	-	1.40
15	Lake 2 - E	16458	14384	228	240	93	94	597	717	1.31	1.69
16	Lake 3 - E	10445	8517	162	154	97	88	417	460	1.15	1.41
17	Lake 4 - E	-	903	-	61	-	24	-	195	-	1.83
18	Lake 5 - E	-	665	-	39	-	22	-	111	-	1.21
19	Lake 6 - E	-	1752	-	65	-	48	-	237	-	1.60
20	Aghireşu Pond	120090	102050	489	421	398	368	1418	1477	1.15	1.30
21	Pond Băgara 1	244288	220202	1002	926	363	390	2400	2406	1.37	1.45
22	Pond Băgara 2	541260	494475	1120	1082	678	634	3354	3452	1.29	1.39
23	Pond Băgara 3	157863	161082	548	645	337	334	1597	1681	1.13	1.18
24	Pond Băgara 4	24762	30862	332	353	122	163	758	853	1.36	1.37
	* just two little basins remained along of four years of evolution (the western and the eastern compartments of the basin) - in this table their elements were cumulated **the maximum depth of the "Blue Lagoon" in 2004 was 7.4 m and its volume was 74,146 m^3										

Within the lacustrine complex from Aghireş, four areas of lake appearance have been highlighted, triggered by specific activities or the continuation or the ceasing of the exploitations.

In the northern area, there have been three water surfaces (Lake 1 – N, Lake 2 – N and Lake 3 –N), of which today are still present just the lakes 1 and 3, with great area variations. In exchange, Lake 2 has remained just a small depression without water.

In the central area, still under exploitation, the dynamics of the lacustrine units is remarkable. So, on the level of the year 2004, there were just four water surfaces, of which the "pearl of the area – the Blue Lagoon" (fig. 4). At present, the number of the lacustrine units is 9, following the appearance of six new lakes in the depressions remained behind after the disappearance of Lake no. 5.

The biggest lake of the Aghireşu Complex is the Blue Lagoon (21,719 m^2) whose irregular shape has been determined by the shape of the quarry and of the initial galleries. The littoral patch presents an accentuated slope in the north and in the west, while in the other areas it has a gradual slope (fig. 3).

Fig. 3. "Blue Lagoon" (right) and "Small Lagoon" (left) (photo Gh. Şerban).

The lake's length is 255 m, while its width is 132 m. The lake's maximum depth has significantly decreased because of its clogging, so today it is of just 7 m.

The water volume in the lake's depression has been evaluated to 50,000 m^3 water (Pandi *et al.*, 2009).

In the eastern area are included six lacustrine units, of which four are recent; the lakes from Corneşti (lakes 2 and 3) have appeared after the year 2000, just like the "Blue Lagoon".

In the eastern compartment of the lacustrine complex from Aghireş, on the road towards Corneşti locality, two large lakes have been identified, which along with the Blue Lagoon and two more lakes from Băgara are considered as the largest lake units of the lacustrine complex from Aghireşu. So, the lakes 2 E and 3 E have areas comprised between 13,000 and 16,000 m^2 (Pandi, Bătinaş, Vig Melinda, 2010). The morphometric elements of the three lakes have been rendered in table 2.

Table 2. Morphometric data concerning some lakes from the eastern compartment of the lacustrine complex from Aghireşu (according to Pandi, Bătinaş, Vig Melinda, 2010).

No.	Name of the lake	Area (m^2)	Length (m)	Depth (m)		Width (m)		Peri-meter (m)	Axis (m)		Sinuosity quotient
				Average	Maximum	Average	Maximum		Big	Small	
1	Lake 1E	4961	128	2.02	5.60	38.7	51	325	130	56.7	1.30
2	Lake 2E	15278	247	2.92	6.35	61.8	97	739	251	99	1.69
3	Lake 3E	13363	203	1.54	3.70	65.8	107	600	205	107	1.46

The lakes' linear morphometric values range from 128 m to 251 m for the length and the big axis, and from 51 m to 107 m for the width and the small axis. The lakes' maximum depth does not go over 7 m, while the depths' average values range between 1.5 m and 3 m.

The water volumes stored in the lakes depend on their area. So, Lake 3E has twice the volume of 1E, while 2E has more than four times the volume of the first (table 3).

Table 3. The water volumes stored in the lakes of the eastern compartment of the lacustrine complex from Aghireşu (according to Pandi, Bătinaş, Vig Melinda, 2010).

Name of the lake	Partial volumes of depth strata (m^3)							Total volume (m^3)
	0 – 1 m	1 – 2 m	2 – 3 m	3 – 4 m	4 – 5 m	5 – 6 m	> 6 m	
Lake 1E	3639.89	2556.09	1954.34	1309.03	519.42	46.45	-	10025.22
Lake 2E	13676.17	11186.44	8528.98	5897.61	3764.56	1476.12	117.49	44647.37
Lake 3E	10448.84	6949.33	2936.59	310.68	-	-	-	20645.44

Out of the analysis of the bathymetric profiles, it results that the lakes 1 E and 2 E have a cone-shaped form, with just one abyssal compartment, situated centrally. In exchange, Lake 3 E presents a marked irregularity, due to the existence of several abyssal compartments. The small depths and the intense development of the vegetation have turned Lake 3 E into an unattractive lake.

In the southern area are included large lakes, namely the decantation ponds from Băgara – Aghireşu, which are in an advanced clogging state.

The dynamics of the remnant lakes is highlighted not just by the appearance or the disappearance of certain lacustrine units, but also by the substantial modification of the depressions' main morphometric elements. So, in the areas where the mining activity has ceased, one can notice a shrinking of the lacustrine areas and of the other morphometric parameters or even the disappearance of some water surfaces.

Some increases of the parameters have been signaled in the northern area, where the coating of the bed of the depression with clay and slime as well as the grit stone bedrock have prevented the in-depth infiltration of the water.

The retaining of some large lacustrine units has been signaled especially in the central and eastern area. So, the "Blue Lagoon" resisted in time and recorded a slight increase of its area and a remodeling of its borders (fig. 4).

For almost all the lakes preserved during the two topometric measurements (2004 and 2008), an increase of their sinuosity quotient has been signaled. Lakes 2 and 3 E have slightly reduced their area, yet they remain along with the "Blue Lagoon" the best known and the most visited lacustrine units of the area.

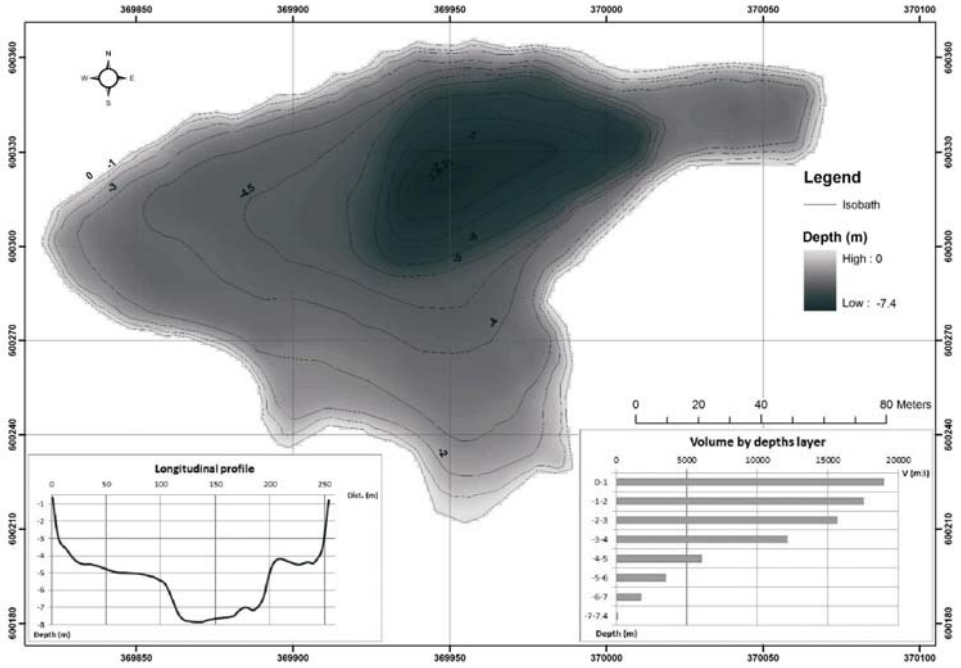

Fig.4. The bathymetric map of the "Blue Lagoon" Lake, the lake's longitudinal cross-section and the distribution of the water volumes vertically

The lakes in the southern area have recorded a particular evolution, as they functioned as decantation ponds for the exploited material. The intense activity during the communist period determined the increase of the area and volume of the ponds Băgara 1 and 2 and the arrangement of new basins, including in the vicinity of the Aghireşu-Fabrici locality. To date, they are clogged and do not represent a valorizable potential, except eventually for amateur fishing, in the deeper sectors, which are still immersed.

The lakes in the lime stone quarry from Cuciulat (Cuciulat I and Cuciulat II) are situated in the area of the former quarry, in-between the localities Cuciulat and Băbeni (Sălaj County), in the southern extremity of the Purcăreţ-Boiu Mare Plateau. The two lacustrine units are situated 250 m away from the railroad connecting the localities Dej and Jibou.

The origin of the two lacustrine units is largely anthropic, the lakes' depression resulting following the storage of the precipitations water in the depressions formed in-between the sterile dumps resulted following the processing of the lime stone. It seems that the natural factor has had a contribution as well in the formation of the depression of Lake Cuciulat I. So, this lake can be attributed a mixed origin.

Table 4. Morphometric and hydrological features of the lakes Cuciulat I and Cuciulat II

Name of the lake	Area (m^2)	Average depth (m)	Maximum depth (m)	Maximum width (m)	Maximum length (m)	Volume (m^3)
Cuciulat I	759.95	1.36	3.40	22.4	53.2	1038.00
Cuciulat II	400.22	1.49	3.55	13.4	35.6	597.33

On the basis of the topometric and bathymetric measurements carried out on August 17, 2009, the bathymetric maps have been drawn and the morphometric and hydrological characteristics of the two lakes have been determined (table 4).

The lakes from Cuciulat have small dimensions, ranging between 400.2 m^2 (Cuciulat II) and 759.9 m^2 (Cuciulat II), while the depths are very close (1.36 m -1.49 m average depth, 3.40 m – 3.55 m average depth).

Lakes arranged for pisciculture

To this category belong the ponds, the fish ponds and the marshes for pisciculture. Among them, the most frequently encountered are the ponds resulted following the damming of certain water courses.

Ponds and fish ponds

In the Someşan Plateau, the ponds do not impose themselves as a major component of the local landscape, as it happens in the Transylvanian Plain. They

are encountered solitarily and more frequently under the form of lacustrine complexes. The ponds have been arranged by damming certain river courses, while the fish ponds are situated laterally to the water course.

Most of the ponds are present on the small water courses of the Hills of Cluj and Dej. In the arrangement of these ponds, a significant role has been played by a series of natural factors: the rivers' balanced longitudinal profile; the narrowing of the valleys as they crossed tougher rock formations (tuffs, grit stones), landslides and proluvial storages; the presence of impermeable deposits on the bottom of the valleys (clays, marls), preventing the water infiltration.

The ponds in the Hills of Cluj are situated on the courses of the rivulets Chinteni, Feiurdeni and Prodae. The ponds' area ranges from 6162 m^2 (Iazul Caprei) to 245051 m^2 (Iazul Câmpeneşti I), while their length goes from 113 m (Iazul Caprei) to 1241 m (Iazul Câmpeneşti). The morphometric elements of the ponds are presented in table 5.

Table 5. The morphometric elements of the ponds and fish ponds in the Hills of Cluj*

Name of the pond	Area (m^2)	Length (m)	Width (m)		Axis (m)		Perimeter (m)	Sinuosity quotient
			average	maximum	Big	small		
Chinteni	136146	1036	131	229	926	190	2604	1.99
Câmpeneşti I	245051	1241	197	278	1222	277	2900	1.65
Câmpeneşti II	166960	628	266	371	617	370	1773	1.22
Câmpeneşti III	149197	600	249	280	598	287	1656	1.21
Câmpeneşti IV	187856	712	264	343	707	347	1918	1.25
H.Câmpeneşti I	134541	444	303	372	433	370	1400	1.08
H.Câmpeneşti II	73351	343	214	236	342	235	1107	1.15
Caprei	6162	113	55	79	109	79	312	1.12

* The morphometric elements have been determined using digital databases, satellite images and detailed topometric maps

Chinteni Pond represents a solitary lacustrine unit situated in the middle course of the Chinteni Rivulet, whose hydrographic basin is characterized by a not very high relief with frequent slope-related processes, which favored the arrangement of the pond. The initial area of the Chinteni Lake (13.6 ha) has shrunk a lot, because of its clogging and of its invasion by vegetation.

The lacustrine complex situated on the lower course of the Feiurdeni Rivulet includes four ponds covering a 71.9 ha area. The ponds' area ranges from 14.9 ha (Câmpeneşti III) to 24.5 ha (Câmpeneşti I) (table 5). The length of the lacustrine units oscillates between 343 m (H. Câmpeneşti II) and 1241 m (Câmpeneşti I), their

maximum width between 236 m (H. Câmpeneşti II) and 371 m (Câmpeneşti II), and the sinuosity quotient of the borders between 1.08 and 1.65 (table 5).

Downstream from the four ponds, there are two fish ponds (Câmpeneşti I and II) and a complex for fish breeding situated between the ponds and the fish ponds.

Caprei Pond, situated on the course of Prodae Rivulet, a tributary of Someşul Mic, has the smallest linear dimensions of all the ponds in the Someşan Plateau (table 5).

The ponds from the Hills of Dej and the Corridor of Someş are situated on the courses of some small tributaries of Someşul Mic (Chiejd), Olpret (Bobâlna) and Someş (Valea Dijei).

The lacustrine complex situated along the Valley of Chiejd is made up of four ponds, totaling 7.1 ha and whose length ranges from 207 m (Chiejd I) to 312 m (Chiejd IV). The largest is the pond Chiejd IV whose water surface occupies about 3 ha (2.8 ha), while the other ponds do not go over 2 ha (table 6).

Table 6. Morphometric elements of the ponds in the area of Dejului Hills*

Name of the pond	Area (m)	Length (m^2)	Width (m)		Axis (m)		Peri-meter (m)	Sinuosity quotient
			averag e	maxi-mum	Big	small		
Chiejd I	13886	207	67	82	206	81	564	1.35
Chiejd II	10980	237	46	67	235	67	591	1.59
Chiejd III	18416	280	66	88	277	88	686	1.43
Chiejd IV	27928	312	90	113	303	119	757	1.28
Băbdiu	49369	576	86	105	554	107	1232	1.56
Chişului	52985	494	107	143	489	143	1361	1.67

* The morphometric elements have been determined using digital databases, satellite images and detailed topometric maps

Băbdiu Pond, situated on a tributary of Olpret, in the SW extremity of the homonymous locality, is the biggest lake in the Hills of Dej (4.9 ha). The lake's length is 576 m, and its maximum width reaches 105 m.

Chişului Pond in the Corridor of Someş has been arranged on the Dijei Valley, a tributary on the right side of Someş, downstream from the locality of Glod (Sălaj County). Chişului Pond has an area of 5.3 ha and is situated 200 m away from the national road DN 1 C connecting the towns of Dej and Baia Mare.

Fish ponds

In this category have been included the lacustrine units arranged for pisciculture and which are situated either at the basis of the slopes in areas with an excess of humidity or in the riversides.

The fish ponds from Suceag have been arranged in a former marshy area situated at the basis of the right slope of Nadăşului Valley, in-between the localities Suceag and Rădaia (Cluj County). Their dimensions are small and they are supplied with water from a basin that receives the water of several springs.

Dăbâca Lake, situated in the meadow of Lonea Rivulet, a tributary of Someşul Mic, in-between the localities Pâglişa and Dăbâca (Cluj County), has an area of 6302 m^2, a length of 134 m and a maximum width of 87 m.

Table 6. Morphometric elements of the fish ponds used for pisciculture*

Name of the pond	Area (m)	Length (m^2)	Width (m)		Axis (m)		Peri-meter (m)	Coef. de sin. a mal.
			avera ge	maxi-mum	big	small		
Suceag I	2517	87	29	36	85	38	222	1.25
Suceag II	272	23	12	15	21	16	71	1.21
Dăbâca	6302	134	47	87	127	84	329	1.17
Ciocmani	3216	86	37	75	85	74	229	1.14

*The morphometric elements have been determined using digital databases, satellite images and detailed topometric maps

Ciocmani Lake is situated in the riverside of Someş, east of Ciocmani locality (Sălaj County), on a semi-permanent water course. Compared to the dimensions of the lakes Dăbâca and Jichişul de Sus, its dimensions are smaller. So, the lake's area is of 3216 m^2, and it is 86 m long.

Conclusions

The natural lakes in the Someşan Plateau are few and of small dimensions and appear in most cases solitarily. In this category have been included: valley lakes, lakes formed in abandoned meanders and lakes formed in areas with landslides.

The artificial lakes are more numerous and include several genetic types. The most representative are the remnant lakes formed in depressions resulted from the exploitation of different construction materials and the anthropic salty lakes formed in abandoned salt mines from the diapir area of the Hills of Dej. The rapid evolution of these types of lakes has been highlighted through the comparative analysis of the morphometric elements obtained on the basis of topometric and bathymetric measurements.

The lakes arranged for pisciculture include several subtypes (ponds, fish ponds) that have been identified and characterized for the fist time, their morphometric elements being determined using digital data bases, satellite images and detailed topometric maps.

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