



REMANENT LAKES FORMED THROUGH THE WORK OF KAOLIN EXPLOITING FROM AGHIREȘU (CLUJ COUNTY)

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Abstract

Fairly widespread in Romania, remanent lakes represents a great potential for recovery, provided it is taken into account and on investment, often minimal. Lakes of Aghiresu developed on exploitation of kaolin sands, are very dynamic in time and space. The permanent lakes are very important (the "Blue Lagoon" case), which provides not only an unique landscape but also a mineralised water with a great potential. Measurements and observations made since 2003, including physico-chemical analysis, have allowed detailed study of these lakes. It was possible to develop conclusions, which related to studies of water quality can be the start of projects and investment recovery in an monoindustrial area, strongly affected by the reduction by almost ceasing of mining activity.

Keywords: kaolin, remanent lakes, temporo-spatial evolution, capitalisation.

1. Introduction

Mining activity has in the Western part of the Someș Plateau an important age, started in the mid of XIXth century by the brown coal mining. The first exploitation were reported in 1850 to Aghireșu ("Alexe's pit"). Since 1878 begin the real coal industry in Ticu-Aghireșu perimeter which covers an area of 216.52 hectares and overlaps the territory of several localities: Dancu, Băgara, Ticu and Aghireșu. Later this area was expanded to 622.6 ha and in 1903 became the property of the "Compagnie des Mines de Transylvanie", which led to the colonization of large number of workers, which formed and expanded certain emplacements of localities, held also today.

Exploited coal was used to the micro-power station Aghireșu and for Diesel

locomotives.

In the year 1887 appear a new industrial activity in Aghireșu area, namely the gypsum burning, which was exploited in the Leghia area and the first patent for this domain received Kramer Tive, an specialist of this work.

From the second half of the XIXth century, but especially in the first half of the XXth century, have been carried out prospecting for quartz-kaolin sands valorisation. Its valorisation began in 1928 in the Aghireș-Cornești area, in the place called Pârâul Ursului.

Effective extraction of china clay from kaolin sands began only in 1934; initially the separation was done by handly washing and since 1935 has moved to mechanized version.

The first exploitations was in an underground galleries, but they have low productivity and costs were very high (fig. 1). Groundwater exploitation has not continued a long time because of the many galleries and unsafe geological structure (danger of collapse).



Figure 1. Mine galleries whose exploitation was suspended.

In the second half of the twentieth century began the exploitations in the quarry where the yield was much better (fig. 2).

Quarrying are possible when the fields are updated or when thick layers have low cover and allow the uncovering of deposits in economic conditions, compared to works by underground exploiting.



Figure 2. Active quarry located in the south of exploitation area

After the exploitations remained the sterile hillocks, that fill large areas, they require a more rapid rehabilitation with a view to protecting the environment. The sterile rock, which was removed from galleries in the early years of exploitations, began to get an ecological look, starting over him to increase vegetation and geomorphological processes to run slower. When its maked the preliminary works who preceded the exploitation, were disposed the external hillocks, spaced at an optimal distance to not disturb the further activity. They has usually a circular shape, which in the middle today were formed the lakes (fig. 3).

The first reservoirs were arranged by the workers for use the hydraulically agent to wash the exploited material. It's the case of the lakes from Băgara village, held also today.

At the end of '70 years were formed lakes in the pits resulting from the crash of galleries. These lakes have no uniform basin, but a very disorderly one and in many cases two or three lakes can communicate with them through the old underground galleries, generating different deep currents.

Its undiscovered has attracted many tourists who had the courage to swim deeply, toward the flooded galleries, many of them drowning and then started the veritable negative legends about the remanent lakes from Aghireșu.



Figure 3. New lake formed in the vicinity of an active quarry, in the southern zone.

Today the old mining pools are invaded by water from rainfall and from small groundwater reserves; the water is cumulate over the sand banks and hone layers, which giving a color and a unique landscape. In addition, rich chemical cargo of water resulting from the dissolution of various compounds of the exploited rocks, gives to the lakes an unique color (hence the toponymical of "Blue Lagoon") and even therapeutic qualities. These elements that could constitute an advantage in a tourist and swimming seasonal base organisation, of real importance in the conversion of a break-down monoindustriale area.

2. Methods

The evidence of lake units and its spatial and temporal evolution follow, was made possible by using satellite images, topographic maps and plans of 1:25000 and 1:5000 scale and following several topometrics, batimetrics and physico-chemical parameters measurements campaigns. Thus, for topometric measurements was used a Magellan GPS terminal doubled by theodolite for the largest lakes of the system. For the bathimetric measurements, limited only to "Blue Lagoon" and the Lake 5 C, were used singly or with winch leads.

For other determinations (physico-chemical parameters), whose results will be published later, was used a portable kit for water quality sensors capable to measure the values of 8 parameters (transparency, temperature, pH, conductivity, dissolved oxygen, salinity, resistance, oxygen saturation). The complete analysis of the samples were performed in an approved laboratory in the municipality of Braşov. Centralization and information processing was done in a computer using software from endowment of Hydrology-Hydrometry Laboratory and the Faculty of Geography: Microsoft Office XP, The Scientific Software Group's "Groundwater Modeling System GMS", The Scientific Software Group's "Watershed-Modeling System WMS", The Scientific Software Group's "Surface-Water Modeling System-SMS", ESRI ArcView 3.x, ESRI ArcGIS / ArcInfo 8.x.

3. Results

After the satellite images and cartographic materials study and computer processing of GPS data, have been inventoried 24 lake units, many of them small and without a great potential for recovery (fig. 4).

Were noted also sparkle of water who are lost for years or who have severely area restricted because of the cessation of holdings in certain sectors or because of very aggressive clogging induced by the torrential alluvial flow of slope. To these are added frequently the reduction of the water mineralisation, because of the basin bed isolation with clay and mud and, also, an higrofile and hidrofile vegetation invasion.

Analyzing the spatial distribution map of the remanent lakes from Aghireşu, outlines four areas of the existence of lake units formed by the specific of activity or by the continuation or ceasing of the exploitations:

- The North Zone, characterized by the initially existence of three sparkle of water - Lake 1-N, Lake 2-N and Lake 3-N; of these, currently, is still only 1 and 3 lakes, with large surface variations, while from the Lake 2 remained only a small basin without water;
- The Central Zone, still in exploitation, is remarkable by a very dynamic of the lake

units; if at level of 2004 year, there were only four lakes, including "the pearl - Blue Lagoon" (fig. 5), currently number rises to nine, based on the disappearance of Lake 5 and the emergence of six new lakes in the remaining basins after exploitations;

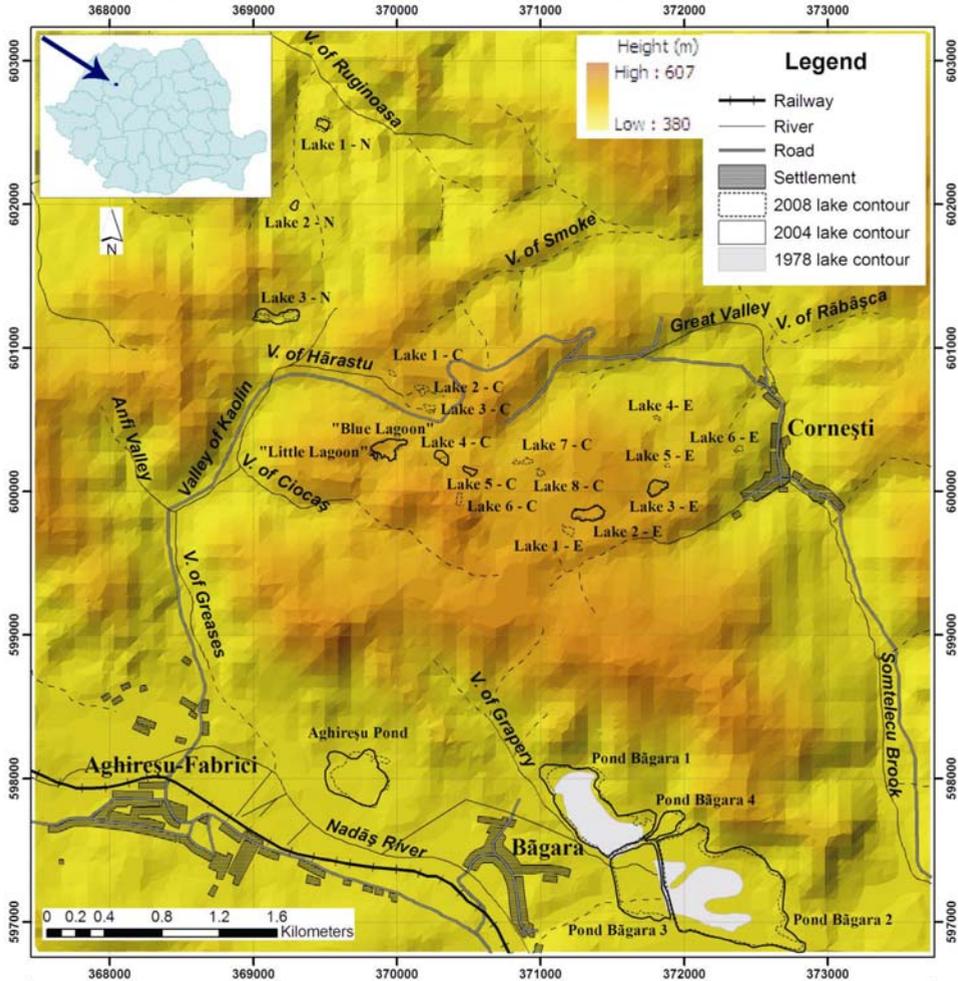


Figure 4. Evolution in time and space of the remanent lakes formed due to the exploitation of kaolin-sand from the Aghireșu, Cluj county.

- The Eastern Zone includes six lake units, where four new lakes; the latter is added to the lakes 2 and 3, which are known like as "the lakes from Cornești" and which has appeared earlier to the year 2000, like as "Blue Lagoon"; these lakes were populated with fish fauna, and are often frequented by amateur fishermen in the area or neighborhood (municipality of Cluj-Napoca);



Figure 5. "Blue Lagoon" (right) and "Small Lagoon" (left) under the effect of a major torrent developed on the northern front of the hill with active exploitation.

- The South Zone, including the large lake units, respectively the decantation ponds from Băgara-Aghireșu; these lakes are in an advanced stage of warping and through to development of the activities in the communist period its surfaces has increased greatly.

4. Discussions

Particular dynamics of the remanent lakes from the exploitation zone of the kaolin-sand from Aghireșu is highlighted by the appearance or disappearance of lake units and by the important improvement of the main morphometrical elements of the basins (Table 1).

Thus, in the areas where mining activity has ceased, there is a reduction in lake area and other dimensional parameters, or even a total disappearance of the lakes; increase of the parameters were signaled where the bed of the basin covered with clay and mud, but, also, the hone prevented the infiltration of the water in depth (ex. the Northern Zone).

Table 1. The dynamics of several morphometrical elements of the remanent lakes from Aghireșu (Cluj County).

Nr. crt.	Lake / Year	Surface (m ²)		Lenght (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	Aghireșu Pond	12009 0	10205 0	489	421	398	368	1418	1477	1.15	1.30
21	Pond Băgara 1	24428 8	22020 2	1002	926	363	390	2400	2406	1.37	1.45
22	Pond Băgara 2	54126 0	49447 5	1120	1082	678	634	3354	3452	1.29	1.39
23	Pond Băgara 3	15786 3	16108 2	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										
	** maximum depth of the "Blue Lagoon" in 2004 was 7.4 meters and the volume was 74146 m ³										

The kept of some great lakes, formed on the exploitation holes, has been reported especially in the Central and Eastern zones. Thus, the "Blue Lagoon", the most spectacular lake from the system, resisted in time (fig. 6) and recorded a slight growing of the surface and a modelling of the shores.

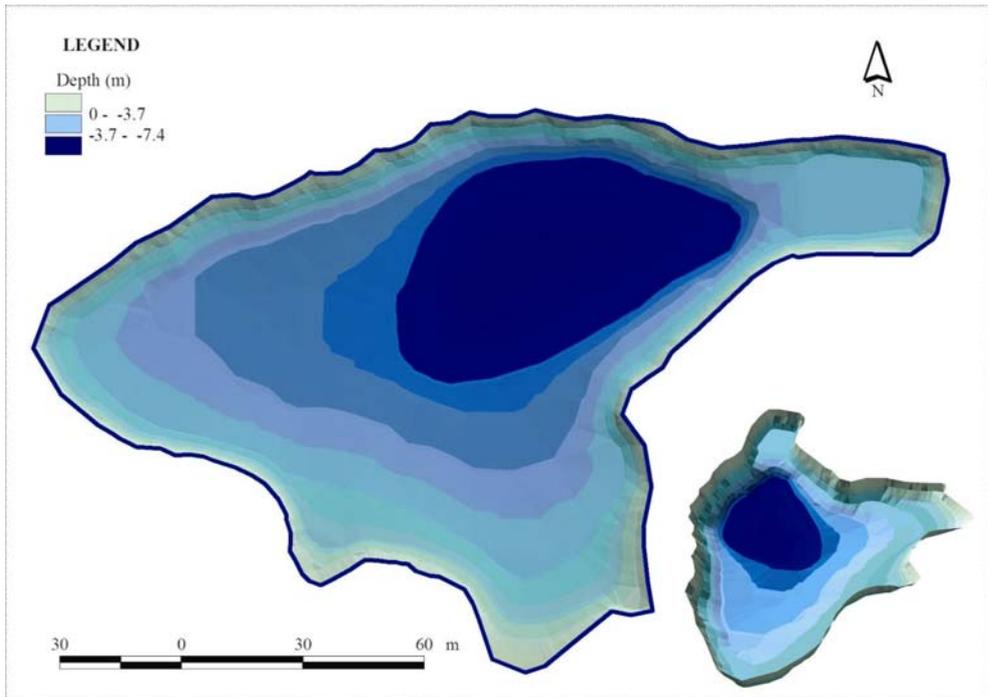


Figure 6. 2D and 3D models of the “Blue Lagoon” basin after the 2004th topometric and bathimetric surveys.

Moreover, increase of the coefficient of sinuosity is reported in nearly all the lakes which have been preserved between the two topometric measurements. Lakes 2 and 3-E slightly reduced the surface, but remains along with "Blue Lagoon" the most known and frequented lake units.

The lakes from South Zone have been evolving particularly, since worked as decantation ponds of the exploited material. The very important development of the activity during the communist period has determined the increasing of the surface and capacity of the ponds Băgara 1 and 2 and fitting of new reservoirs, including near the Aghireșu-factory (fig. 4).

Currently its are clogged and not represents a capitalize potentially, only possible in terms of sport fishing in the deepest areas.

The special qualities of water for swimming, which will be the subject for a further study, attract permanently hundreds of tourists in the summer season (fig. 7). Beneficial effects of water with high chemical load were not allowed expected – from improving the status of rheumatic diseases in the body, until the acne disappearance.

The study of questionnaires completed among tourists show their very positive perception on the lakes water and confirm the beneficial effects of these waters. Furthermore, there is even a color therapy and landscape therapy on people

affected by stress, associated to unpolluted air in these space. The natural combination of yellow-reddish of the sands, conglomerates and hones and with the pure open blue of the water delight the human eye.



Figure 7. Tourism, extreme sports and local practices for chasing the tourists – “Blue Lagoon”, Aghireșu, Cluj county.

Unfortunately the local authorities and the forest adjacent domain administrator has not proved to be as receptive and interested to make a conversion and to develop the region based on tourism and through the other type of valorisation of the industrial area almost exhausted in terms of profitability. In contrast, to called the practice of the most humiliating for chasing the tourists (the tilling of the beaches, the mounting panel to prohibit access, blocking access roads to the lakes by digging ditches etc.. (fig. 7).

In our view this would be the only chance of the entire mining areas from Aghireșu: rehabilitation and conversion by tourist exploiting of the lake and landscape potential created after the exploitations.

5. Conclusions

Situated at a distance of 28 kilometers from the Cluj-Napoca municipality, remanent lakes from Aghireșu, Cluj County, occurred at the site of a kaolin-sand mining exploitation, used

in the porcelain industry in the mentioned city. Lake basins are characterized by a different temporo-spatial dynamic, because of rocks very friable and unstable, and of many sterile hillocks which are adjacent.

Within a few years, many lakes of the four identified occurrence areas, may appear, to modify substantially the shape or the size or even disappear.

Water and landscape quality, even ruiniform, constitute a particularly potential, complete uncaptured today on various grounds by local authorities and managers of the mining and the contiguous area.

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