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AN ENVIRONMENTAL CONFLICT IN HUNGARY: BAUXITE OR MEDICINAL WATER?

ABSTRACT: RÉTVÁRI L. & TÓZSA I., *An environmental conflict in Hungary: bauxite or medicinal water?* (IT ISSN 0391-9838, 1998).

The economic expansion under the socialist regime led to environmental crises in some regions of Hungary. The technology of bauxite mining in the Transdanubian Mountains is a typical example for a prominent activity causing far-reaching environmental impacts and attracting great attention. The lasting deleterious effects of mining are manifested in water and related physical processes and in regional management.

Environmental degradation began with the introduction of active dewatering technology in the exploitation of bauxite and coal in the early 1960s. The applied technology caused an average 30 m dropping of karst-water level over an area of 3,000 km². It reached its lowest level (110 m) in the major mining region in the western portion, at Nyírád. Many wells and springs of the region dried out, including the most abundant Hungarian spring at Tapolcafő. The world famous and unique spa, Hévíz, with incomparable balneological medical, recreational and infrastructural value, situated only 6 km from the southwestern basin of Lake Balaton, was also affected.

Due to academic argumentation and pressure from local authorities, the government decided to close down the deep bauxite mine at Nyírád. This measure was followed by a slow rising of the karstwater table, also in the Hévíz spa region. As there has been no recultivation, however, the pits and caverns resulting from mining can still be seen. In the paper the landforms related to mining are presented and micro-scale changes in land use are detected in the environs of Nyírád.

KEY WORDS: Karst hydrology, Thermal water, Bauxite mining, Environmental conflict, Transdanubian Mountains (Hungary).

RIASSUNTO: RÉTVÁRI L. & TÓZSA I., *Un conflitto ambientale in Ungheria: bauxite o acqua curativa?* (IT ISSN 0391-9838, 1998).

L'espansione economica durante il regime socialista ha provocato alcune crisi ambientali in diverse regioni dell'Ungheria. La tecnica di estrazione della bauxite nelle Montagne Transdanubiane è un tipico esempio di un'attività importante capace di causare impatti ambientali rilevanti. Gli effetti deleteri più durevoli dell'attività mineraria si sono manifestati nelle acque, nei processi ambientali e nel governo del territorio.

Il degrado ambientale iniziò con l'introduzione di tecnologie pervasive di estrazione dell'acqua nella coltivazione della bauxite e del carbone agli inizi degli anni '60. Essa ha provocato l'abbassamento di 30 m del livello della falda acquifera carsica su un'area di 3.000 km². L'abbassamento massimo (110 m) fu raggiunto nella maggior zona mineraria, Nyírád,

nella parte occidentale del Paese. Molti pozzi e sorgenti della regione si sono inariditi, compresa la sorgente di Tapolcafő, la maggiore dell'Ungheria. Anche la famosa società Hévíz, con le sue infrastrutture di natura ricreativa ma soprattutto di acque curative, posta a 6 km a SW del lago Balaton, è stata in qualche modo danneggiata.

Dietro argomentazioni scientifiche e la pressione delle locali autorità, il governo decise di chiudere la profonda miniera di Nyírád. Questo provvedimento ebbe come risultato una lenta risalita del tetto della falda idrica, anche nella zona della società Hévíz. Poiché non è stato eseguito alcun lavoro di ripristino ambientale, i cumuli e le cavità sono ancora visibili. In questa nota viene discusso il paesaggio legato all'attività mineraria e mostrati i cambiamenti a piccola scala nell'uso del suolo nei dintorni di Nyírád.

TERMINI CHIAVE: Idrologia carsica, Acqua termale, Coltivazione di bauxite, Conflitto ambientale, Montagne Transdanubiane.

INTRODUCTION

The Transdanubian Mountains in Western Hungary have rich resources of subsurface water, minerals, forests, cultural heritage as well as numerous touristic attractions and sites of recreation. These resources, however, had been managed carelessly by society and lavishly by the economic policy of previous decades. Not only the exploited resources are paying the expenses for the lack of foresight in management, but other valuable natural factors, like relief, are also involved.

Researchers called attention in time to increasing environmental damage springing from the extensive economic development in previous decades. They warned both governmental offices and the municipalities to harmful consequences, but they had not been observed until an environmental crisis ensued and until the landscape changes reached a threshold of irreversibility, endangering the economic bases of local communities.

ISSUES OF THE CONFLICT

The tension between governmental policy and municipalities led to an open conflict and in 1984 the government

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turned to the Geographical Research Institute of the Hungarian Academy of Sciences for an independent opinion in the following issues:

- What are the environmental impacts of the 80-years old bauxite and coal mining activities in the Transdanubian Mountains?
- What is the financially evaluated national significance of the most important Transdanubian bauxite reserve at Nyírád compared to that of the world famous medicinal spa at Hévíz?
- Is there an opportunity to preserve and use the Hévíz Lake simultaneously with the exploitation of bauxite at Nyírád?

Researchers attempted to answer the above questions on the basis of surveys and available data. In addition to a comparative evaluation of benefits Nyírád versus Hévíz, an expertise report was formulated on the simultaneous exploitation and priority of resources. After the surveys (Bernát & *alii*, 1984), however, the situation deteriorated, as the Aluminium Works of that time, the powerful «alulobby», responded to the revealed environmental problems with insufficient or one-sidedly engineering solutions.

Five years later, immediately before the economic turn in 1989, the Academy was asked again to deliver its opinion (Rétvári & *alii*, 1989). The Academy proposed the preservation of Lake Hévíz at the expense of the aluminium industry and the central government decided to close down the bauxite mine at Nyírád.

Political interests got deeply involved in the above environmental conflict, so its management depended on whether or not an environmental approach can be given priority in the changing political structure. After closing down the deep mines at Nyírád, the equipment was removed from the mines and reclamation began. In spite of insufficient precipitation in those years, the karst water system started to revive.

DROPPING KARST WATER TABLE AND LAKE DETERIORATION

The major elements of the environmental crisis dating back to three decades can be summarised in the following. In the subsiding Hungarian basin, the joints of the 3000 m thick Mesozoic and Tertiary karst series hold the largest and best quality water reserves of the country (ca 50 billion m³). Because of geological and geothermal conditions, mineral and medicinal waters are also very common (Rétvári, 1994). Under natural circumstances subsurface water is in a dynamic balance. Water extraction accompanying bauxite mining caused a depression in karstwater table, depending on the intensity of mining. It can also be observed in the decreasing yields of karst springs. After the coal and bauxite reserves above the karstwater level were depleted in the early 1960s, «active dewatering» was introduced to protect life and instruments in the mines (tab. 1).

The karst water level of the Transdanubian Mountains was continuously dropping to an average 30 m by the early 1980s, though in the vicinity of bauxite and coal mines the

TABLE 1 - Karstwater extraction before (1957) and after (1980) the introduction of the active dewatering mining technology in the Transdanubian Mountains, Hungary

water extraction		1957	1980
artificial	location	m ³ /min	m ³ /min
	Csordakút	0.0	5.0
	Dorog	63.2	6.0
	Tatabánya	44.2	136.0
	Kincsesbánya	13.2	74.0
	Várpalota	2.7	15.0
	Balinka	3.2	15.0
	Dudar	1.6	2.0
	Ajka	18.2	16.0
	Nyírád	4.0	307.0
	total	150.4	576.0
natural (springs)			
	location		
	Hévíz	34.8	26.1
	Tapolcafé	55.7	0.0
	Tata	27.0	0.0
	Budapest baths	59.1	32.3
	Balaton Uplands	111.6	20.4
	total	288.2	78.8

depression reached 50 to 100 m (fig. 1). From the mid-60s the karstwater depression at Nyírád had extended over 3000 km² and it reached the vicinity of Hévíz, 6 km west of Lake Balaton. The yields of its springs, the mixture of which used to produce an average 500-520 l/sec and 39°C hot water, had dropped to its lowest recorded amount with 270 l/sec by 1984. Tab. 2 shows the water discharge slowly increasing, although in recent years, due to little precipitation, it is stagnant. With the continuous drop of its water temperature the biological state and balneological value of the 4.64 ha large and 1.5 to 40 m deep spring lake (see fig. 2) deteriorated. Thus, the world famous and very valuable spa became endangered. The surface water temperature of the lake dropped below 28°C, without medical effects, for 100-140 days instead of the former 25-30 days a year. Thus the local holidaying facilities of ca 33 million USD estimated value in the mid-80s became also seriously endangered.

TABLE 2 - Water output of the Hévíz Lake (yearly averages in litres /sec)

year	1950	1955	1960	1965	1970	1975	1980	1984	1990	1994	1996
water output	606	527	560	503	440	379	336	270	322	356	404

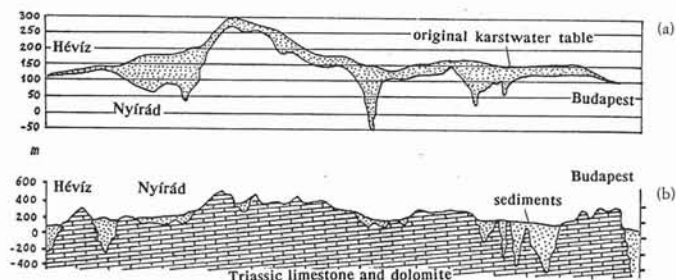


FIG. 1 - Longitudinal profile of the karstwater system in the Transdanubian Mountains, Hungary, with karstwater depression (a) and reservoir rocks (b).

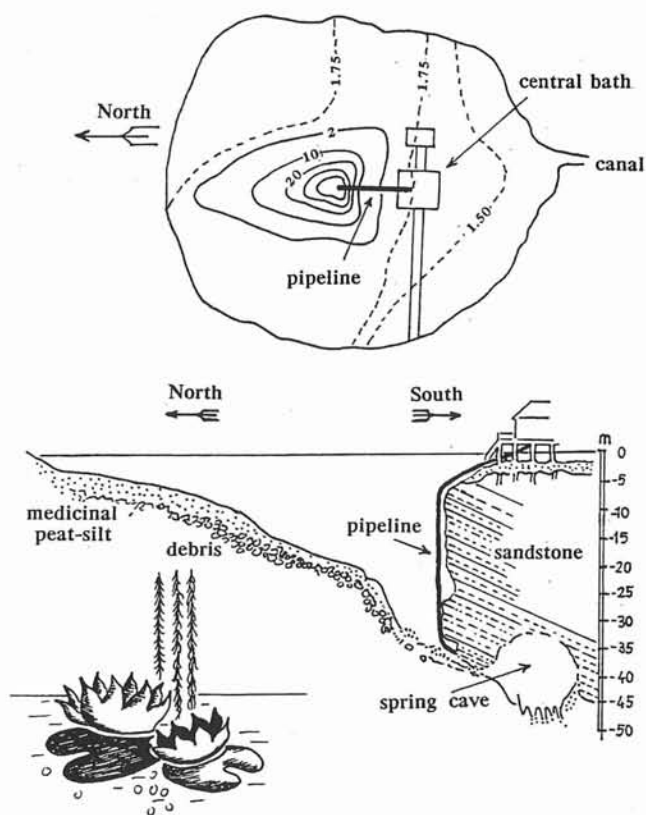


FIG. 2 - Depth of water in Lake Hévíz and the location of the pipeline installed.

The technical developments to «improve» the situation (like the pipeline from the main spring to the bath) was opposed by the medical, touristic experts and the local council staff, because it was promising a symptomatic treatment with great environmental risks. Not only the water discharge did drop below 350 l/sec, but the level of the lake sank 32 cm in 1984 and this unconsidered technical operation was followed by a harmful effect to natural biology, causing the water-lilies disappear. The original water level was then restored and the water yield stabilised around 300 l/sec by the end of 1988.

A COMPARATIVE ECONOMIC EVALUATION

The known and estimated total bauxite reserve in the Upper Cretaceous formations of the Transdanubian Mountains reached ca 150 million tons by the end of the 1980s. According to the demand of that time, the reserve was estimated to last for 50 years. The good quality bauxite at Nyirád amounted to 12 million tons. Economic calculations and estimations in 1984 and in 1988 showed that the value of the mineable bauxite reserve is approximately equal to that of resort facilities around Lake Hévíz on the national level. Lake Hévíz, however, is an exceptional rarity (there is only one spring lake with similar water yield in the world, at Rotorua, New Zealand). Social interests on be-

half of maintaining Lake Hévíz was stronger than that in exploiting the Nyirád bauxite reserve that could last for 5-8 years only.

The Hungarian Academy of Sciences therefore proposed to continue bauxite extraction strictly depending on the ecological conditions of Lake Hévíz. No proposals of the Ministry of Industry was accepted for the regulation of spring yield, as they all involved heavy risks. After the threatening drop of the water level in 1988 and the repeated surveys, the Academy proposed to withdraw the right of the Mining Company to extract water from the mine at Nyirád. (The Company paid only equivalents of 0.4-0.5 cents for one cubic metre of water.) The proposal included the closing down of the Nyirád mine from 1989 and its subsequent reclamation. The government accepted this proposal in the first year of the political-economic change in 1989. The resolution resulted in a slow improvement.

ENVIRONMENTAL DAMAGE

During the above surveys it was found that the desiccation of stream channels, the drying up of the karst marshes and other karst springs (like the well-known one at Tapolcafü supplying the town of Pápa) and the damage to agricultural land around the mines (some 120 thousand hectares) all had been caused by the pressure loss of the karstwater system in the Transdanubian Mountains since the end of the 60s.

The fifteen years of open and deep mining of the bauxite caused damage to both organic and inorganic formations on the surface and mining wastelands expanded. The surface caved in above abandoned mine shafts, leaving extensive damaged and abandoned land behind. The caverns of deep coal and bauxite mining could have easily allowed contaminants from the non-reclaimed surface seeping through the possibly loosened and jointed overlying strata into the karstwater system with precipitation. This potential pollution may seriously endanger the most important natural resource of the Transdanubian Mountains, i.e. the 50 billion m³ of clear karstwater today. This important national water reserve does not only contribute to supplying the densely populated industrial region in Central Transdanubia with drinking water, but also provides water for the resorts along the shores of Lake Balaton.

THE PRESENT SITUATION

The most serious conflict of interests in the Transdanubian Mountains in the 1980s seems to be over. The Hungarian aluminium industry has lost its best quality domestic bauxite supplier at Nyirád. Regarding the present economic situation, this loss can be tolerated. The ever improving environmental state of the Hévíz Lake, on the other hand, offers an excellent opportunity to exploit the available well-developed touristic facilities at the spa. (Almost one fourth of the total investments in 130 settlements

with thermal baths was implemented at Hévíz in recent years.) After the period of crisis is past, the National Balneological Hospital, Hotel Thermal and Hotel Aqua (built from Austrian capital) and a lot of company and private resort houses keep on operating. This advantage cannot only be evaluated in Hungarian and foreign currencies, but through the recreation of human capacity. In this viewpoint, the resolution of the conflict is beneficial for the whole society.

Problems of the physical environment, however, survive. The several decades long mining has left its traces on the environment. Water extraction associated with mining has been one-third exceeding the volume of precipitation. Stream channels dried up, karst marshes disappeared, the yields of water supply wells have dropped and this depression affects the water budget of soils in the vicinity of the mines, unfavourably affecting cultivation. Tracts of the undermined landscape are turned into disturbed mining wastelands. There are more than 100 abandoned open mines with pits and spoil heaps and hollows caved in above the deep mines. The continuous reclamation of this terrain is not yet planned. The caverns of deep mining also involve the risk of the infiltration of pollutants and thus endangering the drinking water base. The bauxite mined at Nyirád was transported on road to the Ajka Alumina Factory. Now the bauxite mined at Csabpuszta near Nyirád, above the karst water level, is even today carried there. The environmental pollution caused by the many thousand tons of bauxite dust, noise and exhaust gases along the 20 km long road via the settlements (Szöc, Halimba, Padragkút) is still considerable.

CONCLUSION

The Transdanubian Mountains are the richest region in natural resources in Hungary. Local coal-fields contain more than half of the country's total reserves; all of Hungary's bauxite and manganese reserves; two huge quarries and more than 200 abandoned stone and sand-pits; and other minerals used by construction industry. In the cracks of calcareous deposits huge karst water reserves accompanied with medicinal water springs are clear enough for direct use. Elongated depressions and basins dissect the mountains, about half of which is cultivated land, 22 per cent is forested and the same amount is covered by settlements and other artificial surfaces (industrial and mining plants, wastelands). The sustainable exploitation of environmental resources, the maintenance or improvement of the quality of life for the population and nature protection consideration call for the resolution of environmental conflicts in the area, which is exemplified here by the debate bauxite mining versus medicinal water utilisation.

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