

**TATA: COLLAPSE OF THE KARST WATER SYSTEM  
POLITICAL AND ECONOMICAL ASPECTS OF AN ENVIRONMENTAL  
CATASTROPHE IN HUNGARY, 1950-2019**

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**Abstract**

Springs and karst water played an important role in Tata's identity. The town developed a serious bath culture in the 19th century. Coal mining started at the same time in the neighbouring Tatabánya. Due to geological conditions, mining was endangered by karst water. For this reason, karst water has been increasingly pumped in Tatabánya. In the 1950s, water lifting became so large that there was a shortage of drinking water. In the 1960s, the depletion of springs in Tata, and then the re-emergence of karst water determined urban politics and public life. Disaster relief continues to this day on Tata.

**Keywords:** *Urban development, mining, environmental economics, regional economics*

**JEL classification:** *O15*

**LCC:** *HN*

**Introduction**

As a result of water extraction, one of the greatest human-made ecological catastrophes of Hungary occurred between the 1950s and 1980s. The importance of the topic is also underlined by the fact that 20-25% of the world's population is dependent on karst water.

The coal in the area is covered by karst water. In order to extract the coal, it is necessary to pump out the water. From the 1950s, more water was pumped out of the karst reservoirs than it was from the rain. Water supply has overturned, and since the 1950s there has been a general shortage of drinking water around the major mining towns.

The disaster and its social consequences are most clearly shown in the history of the Tata springs. Due to the intense drainage of the karst water system, the springs have dried up and the centuries-old bathing culture has ceased. Thirty years after stopping the water extraction, receding karst water endangers the housing of citizens.

**Material and Methodology**

Recently, more and more research has focused on analyzing the environmental impacts of human activities. In my narrower topic, there have been numerous studies in the mining literature from an economic and geological perspective. The literature on groundwater hydrological research focuses primarily on the scientific aspects.

I investigate the environmental consequences of water extraction using historical methods. I regard the literature of geohydrological research as the primary source. András Csepregi's studies provided a reliable starting point for understanding the processes. (Csepregi, 2014) (Csepregi, 2007)

Elemér Szádeczky-Kardoss 's short article: *The karst water map of the Transdanubian Mountains* became the starting point of the literature. (Elemér Szádeczky-Kardoss, 1948) Ferenc Kassai's study on Paleogene coal mining and karst water defense provides a broad framework for this. (Kassai, 1948) The mature, confident summary of Sándor Vitális: *The development of mine water defense and mine water utilization* has also provided a useful framework for understanding the relationship between karst water and mining. (Vitali, 1963)

I treated the hydrogeological literature of the 1980s with strong criticism. In the writings of Árpád Lorberer and Pál Liebe, I found subjective elements and factual contradictions. At the same time, their writings on the history of karst water research reliably summarize the development of the institutional system of Hungarian hydrogeology. (Balásházy, et al., 1986), (Böcker, 2003). In 1988, a 20-year prognosis was made in VITUKI, and its validity was confirmed 15 years later by measurements. (Hajnal et al., 2015)

After exploring the sources, my task was to identify the key players and events in the story. To do this, I had to compile a detailed chronology of events. There are also chronologies and chronological workings on the history of mining and hydrological research in the secondary literature of the subject. The difficulty was that they were not collated and there was no uniform chronology of the subject.

## Results

The Tata springs are one of the largest natural outlets of the karst water system of the Transdanubian Mountains. (Fogarasi, 2001)

The use of water from the Tata springs dates back to the Romans. The Romans built a 15 km long aqueduct to supply water to the Legion's camp in neighboring Brigetio. (Tóth, 2002)

A map of 1587 depicted a spa alongside the Tata Castle and mills. The spa was rebuilt between 1733 and 1738, and a 21 °C spring burst through holes in the plank floor at the bottom of the pool. (Körmendi, 2004) In 1747 Sámuel Mikoviny built the Általér Canal from the Great Lake of Tata to the Danube, draining the surrounding swamps. (Deák, 1995)

From the middle of the 19th century the bath culture in Tata flourished. In 1845, a swimming pool was built in the Tata Piety Secondary School, which operated until 1848. From the 1880s onwards, there were four swimming pools for the purity bath of the Jews. The bath ceased after the deportation of the Jews in Tata in 1944.

In 1886, it emerged that the water from the Tata springs would be transported to Budapest via a power line. Adolf Feszti's plan was rejected because water at 20-22 °C would have cooled down to 17-18 °C in Budapest. (Ballabás, 2004, p. 4)

In 1895, the bath of the Wágner family was opened and operated until the 1930s. In 1903 the Esterházy Manor established the Cold Bath in Swan Park. The Crystal Swimming Pool was opened in 1922, with cascading sun and sand baths and rafts. The following year, a beach bath was created, with three pools and a cabin line designed for three hundred people.

In the XIX-XX. By the turn of the century, Tata had become a popular resting place. A spa was built near the town at the Light Spring in 1903, but the humble conditions did not attract many. In 1927, the city built roads in the spa area, and buses ran to the public several times a day. There was a free beach on the shore of the Old Lake. (Körmendi, 2004) Beaches and swimming pools in the II. they continued to operate after World War II.

This bath culture was destroyed by mining water extraction from the 1950s.

Deep coal mining has many environmental impacts. In my paper I only analyze in detail the ecological catastrophe associated with water extraction. I do not discuss other environmental damage in my dissertation. Mining has a negative impact not only on the quantity but also on the quality of groundwater. Oil and battery residues may also enter the karst water during machine operation. Coal extraction can also lead to significant surface movement, which can endanger the area's buildings. Air pollution and vibration occur in underground workplaces. Combustible materials from open pit dumps may release sulfur dioxide and carbon monoxide. Coal preparation produces water pollution, surface and soil pollution, noise, vibration and dust load.

In Tatabánya, the mining water was pumped from the early 1920s. Water lifting took place in the 1950s. Over 100 years of operation, the mining company has raised 1.5 billion m<sup>3</sup> of water. (Fogarasi, 2001)

Due to the water extraction in 1951 the drinking water supply of Tatabánya became disastrous. (Vitális, 1963, p. 88) In 1954, the suggested solution to water scarcity was to build a water pipeline from Tata to Tatabánya. According to the government's proposal, "*The city of Tata will renounce the use of the water at the beach at the Bright Spring.*" (Ministry of Chemical Industry and Energy, 1954) But this was not true. Tata citizens in all forums protested against the plan. In 1958, the Ministry of Heavy Industry finally gave up the idea. (Dolgozó Lapja, 1958) The drinking water supply of Tatabánya was solved by karst water from the XIV/A and XV/C shafts, which continue to supply the settlements with drinking water today.

However, the Tatabánya water extraction also had a dramatic effect on Tata's water balance. Before the start of mining water highlights, in 1919 156.8 m<sup>3</sup>/min<sup>1</sup> dropped to 48.7 m<sup>3</sup>/min by 1950. (Csepregi, et al., 2004) However, water lifting was further increased in Tatabánya. In 1960, the XV/A shaft in Tatabánya was flooded with a huge amount of karst water. The effect of this was felt in Tata in days. (Sashegyi, 1976) In 1964 the Laundry Springs dried up, in 1966 the Lo Presti spring. (Schmidt Elegius, 1969) In Tatabánya in 1972 the XIV/A and XV/C dredging shafts reached their full capacity. As a result, the last of the glowing springs still giving water dwindled. (Ballabás, 2004)

In 1963, the a conference was held in Tatabánya concerning the topics of mine water. Sándor Vitális, President of the Hungarian Hydrological Society summed up the situation in simple, hard words: "The amount of water extracted by mining today in this area is approximately 270 m<sup>3</sup>/min, while natural water supply from precipitation is calculated by Hubert Kessler. - 310 m<sup>3</sup>/min in the mid-mountain range, which means that the mining water uptake has already disrupted the natural water supply in some areas because it consumes (static) water stored in the karst, which results in a significant decrease or complete loss of natural karst springs. Perhaps the best example of this is the relationship between the volume of water produced by the Tatabánya mining industry and the decline in the water yield of the Tata karst springs. (...) I do not think that any special expertise, complicated hydrodynamic calculations are needed to see clearly the relationship between the two extremes of the discharge." (Vitális, 1963)

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<sup>1</sup> András Csepregi reminded me that this is probably a highly overestimated value.

On this basis, Vitális formulated a gloomy prognosis: "Over 20 years, active mining water protection will result in no operational karst resources in the northern foreground of our Transdanubian Mountains" (Vitális, 1963).

Tata people was worried about their beach, the dried-up springs. Both the Waterworks and the mine were trying to calm the citizens. Since 1967, they have been regularly promised to do something to keep their beaches. The promises realized only in a 50x21 meter, 1.7 meter and 2.5-meter-deep concrete pool and a 2500 square meter pool in 1974.

The springs ecosystem has been made vulnerable artificially. Drying and degradation processes started. The destruction of the alder swamp began. On the verge of extinction were the area's highly protected spider moth and great wormwood, as well as the black grouse. (Musicz, 2010)

In 1978 the Tata wells dwindled, not covering the city's drinking water needs. The situation was solved by transporting water from the XIV/A water shaft from Tatabánya. Since 2002, drinking water has been supplied entirely by the Tatabánya Water Mine, and local wells in Tata play only a reserve role. (Csepregi, et al., 2004)

In the early 1980s, the new water lifting started, as part of the Eocene program's new mines, Nagyegyháza, Mány and Csordakút, reached 257 m<sup>3</sup>/min. As a result, the karst water level in Tata dropped to 27-28 meters. (Ballabás, 2004, p. 5)

In 1988, the government shut down the mines with the highest water lifting. (Maróthy, 1988) The karst system began to recharge with natural rainfall. Based on measurements and models, the karst water balance of the Transdanubian Mountains was adjusted.

András Csepregi found that, with the largest water outlets, the karst water level had fallen by 100-120 meters from the original. (Csepregi, 2007)

In 1989, the first forecast was made, which remained valid for 15 years. In 1989, the Institute for Scientific Research in Water Management (VITUKI) produced a forecast of karst water levels around Tata. Six different water supply scenarios have been studied, five of which model the expected karst water level by 2000 and one by 2020.

In 2015, the accuracy of the forecasts was verified on the basis of facts. It was found that 1989 saw exactly the trends. The strongest correlation with the measured data for Tata Bright Source is forecast 5, 0.981, but the weakest correlation is 0.945 with facts. (Hajnal et al., 2015)

Since 1992, the municipality of Tata has informed the population of the city annually about the rising karst water. (Toth, 2002)

Between 1990 and 2001 the karst water level increased by 25 meters in Tata. In 2001, a spring came to life at the Military Lake in the Bright Bath, and a year later it had a yield of 3 m<sup>3</sup>/min. (Horváthy & Lénárt, 2009)

Previous interventions had to be eliminated. For example, in 1974, Military Lake was filled with pumped water. The bottom of the lake was covered with 20-30 cm thick clay pillows to prevent the water from escaping. The two pools were built by the waterworks from the \$ 12

million compensation paid by the mine.<sup>2</sup> After 2000, due to rising karst water, the Military Lake had to remove the clay cover used to insulate the lake bed in 1974. Thousands of cubic meters of clay were extracted and transported. (24 hours, 2001)

In 2002, the Glossary Spring came also alive. (Tóth, 2002) In 2007, the yield of the resulting waters of the Light Bath was 12 m<sup>3</sup>/min. In 2010, 15-degree Sulphur springs appeared on the eastern shore of the Old Lake in Tata. (MTI, 2010) Between 2003 and 2014 the karst water level in Tata increased by another 20 meters. (Csepregi, et al., 2015, p. 13) Figure 2 shows the increase of the karst water level.

Rising karst water has endangered houses built since the 1970s. (Ballabás, 2004, p. 9) The first damage occurred in 2010. 1973 parcelled out of the vicinity of Bright sources previously watery, swampy areas, and constructed 350 weekend houses. Since the mid-1970s, panel houses have been built on what used to be former sources in an area of 1.5 square kilometers. (Horváthy & Lénárt, 2009, p. 50)

Rising karst water also jeopardizes the quality of drinking water. (Ballabás, 2004, p. 9) In the 1970s, only 30% of Tata's households were connected to a sewerage system, sewage was drained to dry wells. (Sashegyi, 1976)

In addition to the Gloss Springs, the side wall of the sports pool cracked in 2006 due to rising water levels. The experts recommended that the facility be abandoned. (Lorberer, 2007)

Several models have been prepared for the rise of karst water, and experts estimate that by 2040 the level of karst water in Tata will rise.

Estimates of the karst level rise in the Transdanubian Mountains and the costs of minor interventions in 2015 were estimated at nearly HUF 500 million. In 2017, HUF 727.7 million was spent on the management of water damage in the Tata and the assessment of the situation. The Buda districts of Budapest, Tata, Tatabánya, Várpalota, Bicske, Ajka and 5 smaller settlements were included in the analysis of karst water damage. (24 hours, 2016)

Five years after the cessation of mining excavations, the 1995 LIII. Law. Section 18 states that water protection covers both surface and groundwater. It took another nine years for groundwater issues to be regulated by three government decrees in 2004.

Government Decree 219/2004 provides for the protection of groundwater. Article 9 of the Decree regulates the issues of quantitative water protection important to our subject. It regulates the findings of groundwater legislation from environmental and water management laws. Section 12 sets out the rules for authorizing water abstractions. The provision also provides for a cost-benefit analysis to allow for non-potable water requirements.

## **Conclusions**

The concept of externalities related to economic activities is a basic idea of environmental economics. The theory assumes that all actors are aware of externalities at the time of the activity. Technologies have been constantly evolving, enabling miners to effectively intervene in environmental processes without understanding what systems they are involved in. The

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<sup>2</sup> The story is continually reported in the Workers' Journal, May 14, 1966, June 1967, May 21, 1968, May 18, 1968, May 26, 1970, April 16, 1972, November 9, 1972, 18.19.1973, 1.7.1973, 9.8.1973, 22.8.1973, 9.8.1973, 20.4.1974, 31.5.1974, 4.8.1974, 13.2.1975.

consequences were long unaware of mining engineers and owners, the inhabitants of the area, scientific researchers and governmental decision-makers.

The state could not effectively protect the environment in the case of water lifting. Economic motivation was stronger than regulation. Mining water extraction was stopped when it was obvious for almost two decades that mining was unprofitable.

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