

THE EFFECTS OF MINE WATER PREVENTION UPON THE  
ENVIRONMENT AND RESULTS OF ENVIRONMENT PROTECTION  
IN THE REGION OF TATABÁNYA COAL MINES

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SUMMARY

The present study summarizes the effects of water prevention system upon environment in the Tatabánya brown coal mining region. Effects of the individual water prevention methods are analyzed in details.

In addition to damages caused by water deprival to the environment, damages to buildings in the environment are dealt with, too.

After description of the water prevention system in the new areas /Nagygyháza-Mány/, the water level subsidence /sinking/ to be expected is discussed, as well as the results of water block-off in practice and the environmental results there of are analyzed.

Water raised in a bigger quantity may play a significant role in the water discharge and in the change of water quality of drift waters, streams.

The Transdanubian brown coal and bauxite mining, with its significant cavern water raising activity has changed the cavern water household of the whole Transdanubian Central Mountain area.

One of the biggest water raising activity is in the Tatabánya region; in the following, experience sofar obtained in this field are summarized, and the effects to be expected by water raising in the new areas of Nagygyháza-Mány - are briefly touched.

The Tatabánya Basin locks back upon a more than 80-years old mining activity. Brown coal mines here, can be found predominantly in the water-hazardous bedding, above Trias dolomite and

Dachstein-limestone. At the beginning brown coal deposits embedded in the less water-hazardous area were exploited, and after the extraction of these brown coal bodies, it came to the development and exploitation of banks respectively. Water inrushes became more frequent, ultimately reaching a quantity, that made it necessary to change over from the passive water prevention to the more efficient active water prevention method at some areas.

The diagramm on cavern water raising clearly shows how the water-danger rose, indicating at the same time the environmental effects as well. /Attachment No. 1/.

From the turn of the century until the beginning of the fifties, the effects of mine water raised /cavern water raised/ were observed within the Basin only. Our water-raising has reached a value of about 40 m<sup>3</sup>/Min when the water shafts located at the basin banks, producing drinking water, had to be shut down because there was a water level sinking of several meters, thus the warlier tapping places got depleted /ran dry/.

Up to 1970, water raising in the passive water preventive system gradually increased over 100 m<sup>3</sup>/Min; at that time, effects of depression manifested itself in the neighbourhood of the basin, too. It could be measured mostly in the region of Tata, where the earlier cavern water sources got dry in turn. /Attachment No. 2./

A slight decrease in the quantity of water raised was observed caused by the shutdown of Sikvölgy shaft flooded and a few water inrush of smaller size, totally 25-30 m<sup>3</sup>/Min. Some increase in the quantity of water raised, amounting to 150 m<sup>3</sup>/Min indicates the start of the active water prevention system. The present reduction in water raising observed, points to the reatreating of the basin.

The favourable effect of depression has presented itself in the areas under exploitation where the water hazard due to pressure reduction lessened.

With the spread of modern methods of water prevention, consequently with the increase of the quantity of water raised, we have to reckon with the unfavourable effects of water prevention, in a larger area.

On basis of hydrogeological exploration, carried out in the course of the brown coal mining policy, this effect can be forecasted and its degree as a function of water raising, determined approximately.

The effects of individual water prevention methods upon the environment are summarized as follows:

### PRELIMINARY WATER PREVENTION SYSTEM

The aim of the preliminary water prevention is to provide possibilities for avoiding water intrushes. The water prevention system consists of following methods: leaving behind areas of water hazard, marking cut field barriers, and preliminary blocking off of water flows, seepings etc., backfilling water passages known.

The detrimental effect of the preliminary water prevention system can manifest itself only in blocking the way of water seepings /streams/ resulting in unfavourable conditions for water development.

### PASSIVE WATER PREVENTION SYSTEM

In spite of the protective measures taken, the control and adequate handling of water intrushes form the basis of the safe water raising. At Tatabánya it has been observed, that the environmental effect of mine water raised in a bigger quantity, manifest itself within a circle having a radius of about 10-15 km. The effect of the passive water prevention system can be shown by the reduction of the water level and in the water abstraction.

### ACTIVE WATER PREVENTION SYSTEM

The aim of this system is the sinking of water level. By the preliminary tapping of the water bearing strata, by raising water stored in the rocks, the water niveau is sunk under the level of mineral deposits. Thus, good quality water is raised in a bigger quantity, but the result is that the earlier water producing sites got dry.

The earlier water-household equilibrium gets out of its balance at a bigger area, and it must be reckoned with a depression having a radius of action of 30-50 kms. The damage caused and the restoration mode, however, can be planned beforehand, but the "maintenance" and preservation of the original landscape or the effort to restore the damage to the environment can be tremendously expensive and not always feasible.

### COMBINED INSTANTANOUS WATER PREVENTION SYSTEM

This method was elaborated by taken into consideration various environmental aims; the essence of the method consists of lifting /raising/ only so much water from the individual mines that would result spontaneously from exploitation. This water prevention system collects water in a preliminary water tapping and drainage network which does not interfere with the operations of mining, and can be controlled so that the quantity of water raised can be reduced, if necessary.

The effects of this method upon the environment, however, present themselves, the gradually increasing number of water raising stations result in a depression extending over a bigger area, which is, however, insignificant, if compared to that of the active water prevention system. If tectonics of the area is known, effects of the depression can be reduced by backfilling the water seepings in individual areas.

Sofar, we have briefly summarized the effects of the individual water prevention systems upon the environment; let us now deal with the various kinds of experience obtained in Tatabánya with respect to environment and let us discuss what can be expected when new mine fields will be exploited.

In the course of mining activities, water-raising at Tatabánya resulted primary in water-level sinking and in depletion of water sources. At Tata there were springs of significant water discharges, out of which Springs FÉNYES - the deepest seated springs with respect to the terrain, ran dry at the last, as a consequence of raising water in bigger quantities in the frame of active water prevention system started.

In this latter case, water raising was started only when we undertook the financing of investments ensuring the further operation of the recreation area based on FÉNYES-springs.

Additional water supply was assured by deep drilling wells. The previous passages /seepings/ of the springs were blocked off and the original water surface was provided by new reservoirs.

The water level singing has had other effects, in addition to depletion of the springs. In case of FÉNYES springs, the alder forst /fenwood/ living in the carstic mud shrivelled and flora and fauna were seriously damaged in the neighbourhood of spring-ponds.

In village Vértesszöllős, it was observed that wells dug run dry as a result of the water deprivel /abstraction/. Namely, one part of the village here, is sited on uplifted block /horst/ whereon Trias Pleistocene sand can be found. The water wupply of the wells dug, came from this Pleistocene sand; layer was, however, identical with that of the cavern water. Thus, wells, previously abounding of water, got depleted at the same time.

In case of acquifer layers deposited on Trias, the wet layer dries up with the sinking of the water level and land subsidence has occurred at Tata causing damages to buildings.

In case of more intricate geology, casual relationships can only be cleared up by a through geological exploration.

The Company compensates for these damages in each case from the mine damage allocation in the budget.

The majority of damages reported so far as due to water deprivation is in connection with the active water prevention system /Attachment No.3./.

With the planning of mining operations in the new coalfields explored, active water prevention system had to be, simultaneously planned, too.

Coal and bauxite deposits are located in the waterhazardous bed, the extraction of bottom coal deposit was considered to be feasible only by the application of the active water prevention system, in the phase of exploration, at that time.

Water-quantity to be expected was estimated by the method of geological analogy on basis of which water-raising seemed to be feasible only in a quantity of several hundreds m<sup>3</sup>/min.

The depression caused this way, would have disturbed the equilibrium of cavern-water-household at an area of nearly 1200 km<sup>2</sup>. Thus, cavern water springs of Budapest would have run dry also, as, according to the calculations, a water-level sinking of 50-60 meters would have been the result in this region, too. However, the project called the attention to the fact, that the hydrogeological parameters of the rocks in the area to be dewatered are not known enough for making a satisfactory project /Attachment No. 4./.

Consequently, a new geological exploration work was started in the region of Nagygyhaza, and several geological information were obtained on basis of which, the mine projects could be reworked.

It was stated that below the coal bodies, the Dolomite detritic rock, of which previously it was thought to be the fundamental complex, is a redeposited complex of varying thickness, in which and under which bauxite ore deposits can be found, too.

The redeposited complex, the "aquifer" ability of which is less than that of Dolomite, and the intersticious bauxite ores under the coal deposits form a "protective layer".

This new recognition led to the elaboration of the combined water prevention system, which can be briefly given as follows: Making use of the existing protective layer, processes of rock movements are also utilized in water draining.

Under the coal deposits, a water draining system is established which collects and drains off mine water flowing towards the areas under exploitation.

The drained water will not be more in quantity than that of

a spontaneous water inrush, at the same time it can be "collected" in a separate system; it does not contact stopings and it can be blocked off, if necessary.

Environmental considerations led us first of all, to the establishment of this mode of water prevention system, as in this case water damages of smaller size, - caused by the traditional passive water prevention system, - are to be reckoned with.

However, taking into consideration that water raising to be carried out, will - even in this case - be considerable /about 200 m<sup>3</sup>/min/, we have to reckon with the water abstraction in several areas after a period of 15-20 years. In the course of the first cost scheme /investment/ planned, we prepare ourselves for the damages to be expected and the water supply will be solved by other ways, in due time. Upon the effect of water raising, the water level sinking planned in the region of Nagyegyháza-Mány will reach a level at totally 28 drinking water producing sites, which will make operation impossible /Attachment No.5./.

The damage to be expected will amount to approx. 10 Mill. Forints.

Dewatering will cause damages to buildings also, at several places. In connection with the reopening of the old V-shaft, we had to drain off Pleistocene sand - abundant in water - and the flooded old mine, the result of which was the underground water level in the environment and as a consequence, several surface buildings were damaged. In the case mentioned above there was only some soil movement extending to a smaller area.

We have made plans for dewatering shafts I-I/a - II-III in order to get coal out of the ground left there.

We studied water levels observed during exploration and it has been stated that in the old mines a more-or-less uniform water level, corresponding to that of Eocene /+180 m a.A./ developed.

In the course of dewatering, mine spaces of considerable extension would collapse /tumble down/ which would result surface dislocations /shiftings/ of m magnitude, too.

Since that time the areas mentioned had been built over, consequently blocks of houses, dwellings, office buildings, hospitals and miscellaneous objects would be damaged.

Thus, the region cannot be dewatered without causing major damage to the environment.

In order to reduce the extent of damages caused by water deprivel /abstraction/, an experimental work had been carried out in Tatabánya region, the experince obtained is summar-

ized in the following:

At the western uplifted block /horst/ of the Tatabánya basin, a depression of N-S direction developed, according to the geotectonical conditions. We wanted to change this depression, therefore we made a try to fill up water seepings /water passages/ at suitable points and thus, to change the direction of water flow; this way we wanted to reduce the area of depression. The work began, but it could not be finished, however the partial results, available, were promising.

Totally 35 000 m<sup>3</sup> sand-slurry was fed through 2 drill holes, blocking off water passage at two sites. As a result of this /see Attachment No. 6/:

1. the cavern-water level changed, compared with the previous level, so that there was a bigger extent of sinking at the required areas, and the sinking of water level at Tata-Fényes springs reduced. The difference of water level between Tatabánya and Tata increased from the earlier 1.25 m to 2.6 m.
2. The trumpet-head drawdown "rounded out".
3. A bigger depression /drawdown/ could be achieved by the water quantity reduced by approximately 8 m<sup>3</sup>/min.

Otherwise, the water blocking activity reduces the environmental effects, too. By blocking off a water inrush of 20 m<sup>3</sup>/min discharge in Sikvölgy shaft, a water level increase of several meters was obtained at Tata. Among the water blocking methods, sand filling was used to close down water passages at sites where water seepings of bigger extent were supposed. Smaller water seepings /water passages/ were blocked off by injection of cement mortar. At present mostly clay is used for rock sealing. The main point of this method is that a water sealing suspension is injected into the rock, which by filling out previous cracks, makes the rocks impervious.

This method of water sealing is successfully used at shaft sinking, drift advances etc.; it can be used in any water bearing rock. By sealing of the limestone cover, connection to the miscellaneous water bearing rocks next to the surface comes to an end, which can be of favourable or unfavourable effect, depending on the type of the original water flow.

In case of water sealing in the fundamental complex, the discharge of water raised drops, thus damages due to water deprical /abstraction/ reduce, too.

The protective effect of this method upon the environment manifest itself first of all in the smaller discharge of water raised from the rocks made impervious and this results

in a depression /drawdown/ of smaller extent.

Concrete results of our water sealing activities with the use of clay-slurry are not yet known, as the previously packed sites have not been developed, yet.

The other environmental effect of mine water prevention can be observed in live waters. This is not always detrimental as a considerable quantity of "pure" water may result in very favourable effect in the neighbourhood of a waterway, stream /Attachment No. 7./.

In what can this effect appear, in general:

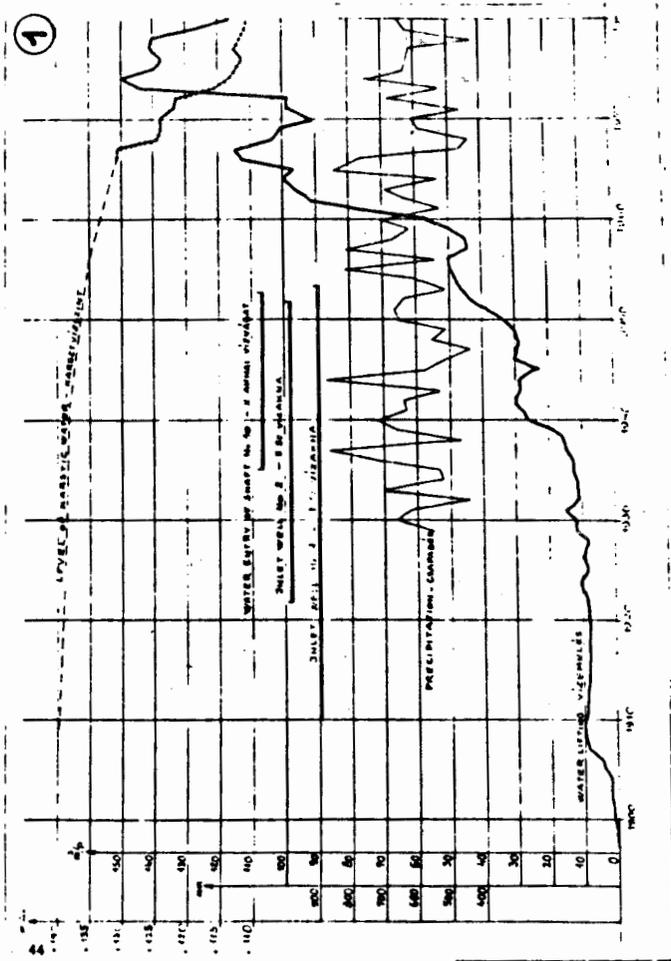
1. The water raised gets into the live water courses with river beds suitable for water drainage. The high quality water, as we have seen, increases the water discharge, thus, it has a favourable effect.
2. The river bed is not capable of handling excess mine water. /Floods at some places, considerable erosion at certain sections of the river bed/. River bed settling is necessary.
3. Objectionable water quality. It may ruin living matter.
4. Some natural water courses have to be diverted because of the exploitation. In lack of water, environment may suffer damages.
5. Raising water in a larger quantity for a long period brings about a condition in which stopping of water-raising, damages the equilibrium of the nature and the water household.
6. By blocking the water seepings /streams/ from one day to the other, water discharge /water power/ of the intake may change considerably. Heavy drop in water discharge may cause troubles for the users.

Our concrete task in connection with the above mentioned, is to solve additional water supply to Általér after ending the mining Activities in the region of Tatabánya. Current water discharges are fully utilized by the thermal power stations of Bokod and Tatabánya, make-up water /additional water/ was only supplied by the mine. Water discharge is to be increased somehow, when the mines becomes inoperative, to compensate for the polluted water drained at Tatabánya. In summertime, a shortage in cooling water supply presents itself at Tatabánya thermal power station, which is also to be compensated for by an "artificial" water supply. The problem solution can include the further water-raising from flooded mines, or the diverting of surface water streams into the catchment area of Általér

increased this way.

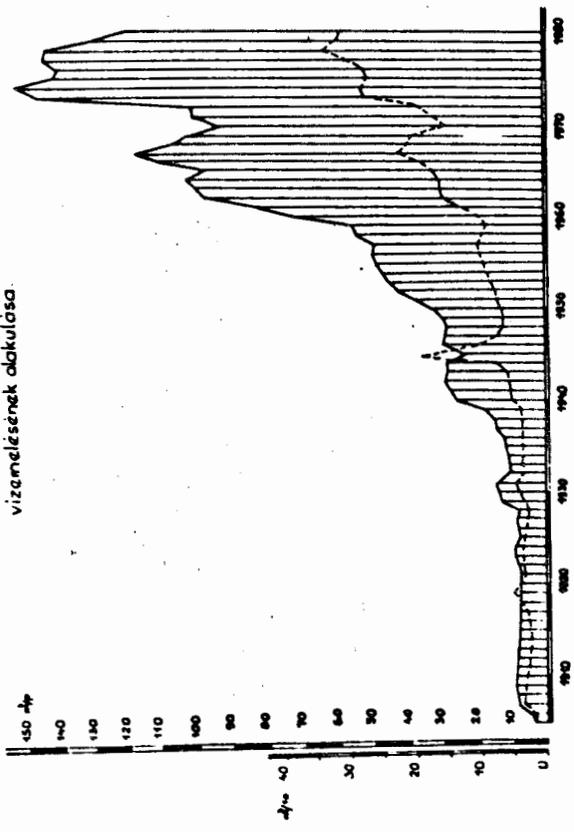
#### LITERATURE

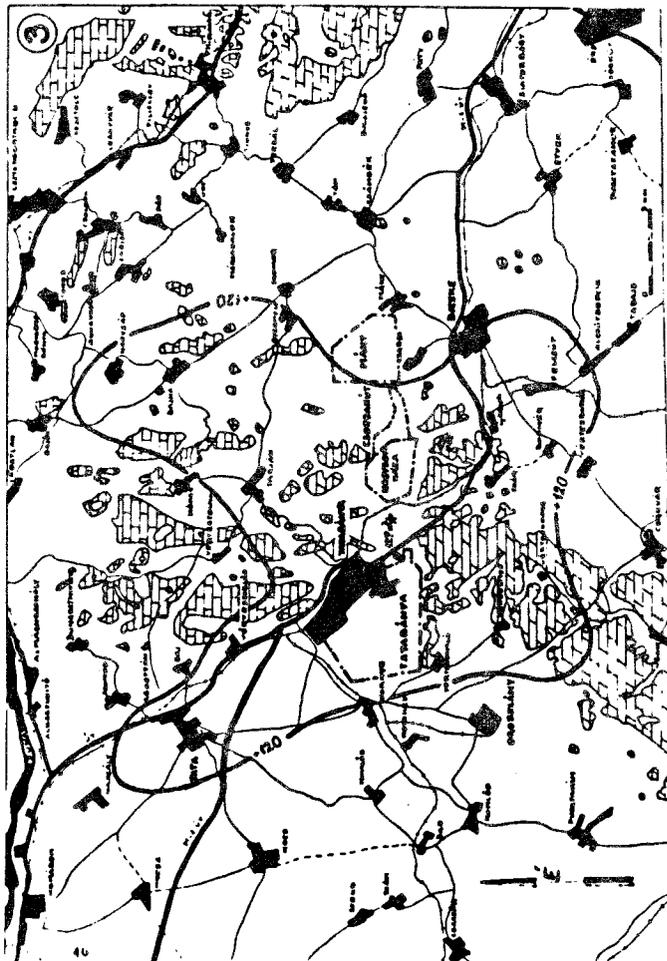
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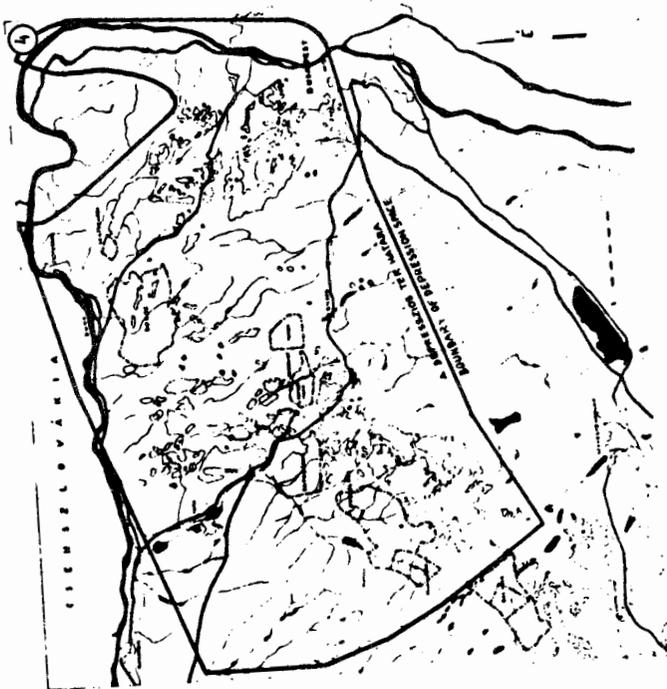


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A talabányai medence tényleges és fajlagos vizameletének alakulása.









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