THE CONNECTION BETWEEN THE DIFFERENT SOIL-TYPES AND THE SEEPING WATER SYSTEM IN THE CAVE HAJNÓCZY

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Our further observations showed that long-lasting staying in the cave can improve significantly and permanently the pulmonary function in healthy people. This improvement gives rise to several factors. One of the most effective therapeutical component is the speleoaerosol deriving from the dropping water in the cave.

The aim of this study was to investigate the changes of the chemical compounds in the speleoaerosol and in the dropping water depending on the soil-type above the different parts of the Hajnóczy-cave.

The comparative analysis of the soil-types on the catchment area of the cave, the seepage waters as well as the dropping waters shows that the soil plays an important role in the forming the chemical compound of the dropping waters. We found dropping waters of various features /mainly in the ion concentrations/ in the different parts of the cave under various soil-types.

Our present observations show that the quality of the soils can exercise significant influence on the therapeutical efficiency of different cavities in the caves.

BEZIEHUNG UNTER VERSCHIEDENEN ERDBODENTYPEN UND DEM TROPFWASSER-SYSTEM DER HAJNÓCZY-HÖHLE

Unsere frühere Beobachtungen haben bezeigt, daß ein längerer Aufenthalt in einer Höhle die Atmungsfunktionen der gesunden Menschen wesentlich und standhaft verbessern können. Diese Verbesserung ist ein Ergebnis mehreren Faktoren. Einer der wirksamsten Therapiekomponenten ist der Speleoaerosol, der aus den Höhlen-Tropfwässern stammt.

Unsere Forschung hatte das Ziel um die Veränderungen der im Speleoaerosol und den Tropfwässern anwesenden chemischen Verbindungen — über den verschiedenen Erdbodenteilen der Hajnóczy-Höhle — in der Funktion des Erdbodentyps zu untersuchen.

Die Vergleichs-Analyse der Bodenarten, der Sickerwäller, sowie der Tropfwäller beweisen, daß der Erdboden eine wichtige Rolle in der Entstehung der chemischen Zusammensetzung von Tropfwässern spielt.

Wir haben Tropfwässer mit verschiedenen Eigenschaften gefunden /besonders in Ionkonzentrationnen/ unter verschiedenen Bodenarten, auf unterschiedlichen Teilen der Höhle.

Unsere Beobachtungen weisen, daß die Qualität /Zusammensetzung/ der Erdboden die therapeutische Wirkung der verschiedenen Räume der Höhle wesentlich beeinflussen können.

1. INTRODUCTION

In former observations we analysed the microclimate of the cave - Hajnóczy and registered changes in the respiratory function of the cave caused by the stay and speleologic activity.

We reported /2/ that a treatment-like stay in the cave could significantly improve the respiratory function of the healthy individuals. This improvement is the result of several correlated factors. Among spirometric parameters, PEF /relevant for obstructive disorders/ most precisely followed these changes. Our later observations argued in favour of the hypotetic existence of positiv bronchomotor tone in healthy individuals.

The aim of this study was to investigate the connection between the surface-soils and the microclimate of the cave.

2. RESULT

There are different soil-types on catchment-area of the cave. This variety is the result of the geologic structure /Fig.1./. The cave-Hajnoczy was formed in cherty grey limestone /Upper Ladinian/. The elder /Lower Ladinian/ sequence of dark grey shales was thrust on to the cherty grey limestone. There is shale above the cave on a big area and what is more, the overthrust was more significant earlier.

The soil-types were arranged in the following groups:

1. gritty soil is full of rubble,
2. black rendzina,
3. brown rendzina,
4. acidic brown forest soil.

On Fig. 2. you can see where the different soil-types are above the cave.

The first soil-type is in the top area of the hill Odorvar, in a little rock garden. The thickness of the soil is very little - 5-10 cm - in the rock garden. The karren-phenomena and the soil-development show that the gritty soil is the remain of the black rendzina. The thinning down of the soil can be caused by the former treefelling and by the following erosion.

The black rendzina developed closely to the cherty grey limestone. The dark colour soil, which is rich in humus, covers the surface uniformly. The rubble of dark grey shale accumulated in the sand-fraction of the black rendzina and in the cave-parts under that area. The geologic overthrust is proved by this fact.

The brown rendzina is paler and less abundant in humus. It shows the geologic boundery line between the cherty grey limestone and the dark grey shale. The brown rendzina occupies an intermediate position between the black rendzina and the acidic brown forest soil. The hidden-opened karst changes continously into the covered karst.

The acidic brown forest soil developed on the dark grey shale. The rubble of the shale occuring in the soil increases the speed of the soil-erosion.

The analysis of the water soluble ions of the soil shows that the greatest number of ions are in the black rendzina /Fig. 3./. The brown rendzina and acidic brown forest soil contain almost the same quantity of ions. This is the result of the humus as well as of the replaceable ions in larger quantity in the black rendzina /Fig. 4./.

The water dropping into the cave have different chemichal compounds. The dropping waters can be compared with each other because the sample plots are found near to each other in every place in the cave. The sample plots arranged in groups based on the ionconcentrations of dropping water /Fig. 5./. A high level of Calcium and Magnesium characterizises the first group. The sample plots were always under the surface with black rendzina. The minimum quantity of the Calcium and Magnesium is in the second group. These places are under the surface covered by brown rendzina. The values of the third group are between the previous groups. Their sample plots in the cave are always under the acidic brown forest soil.

You can see that the dropping waters kept their character in ionconcentrations, which were shown by the investigation of the water soluble ions of the soils.

The soil-layer is thick in the karst covered by forest. The rainfall seeps down slowly there, it becomes more aggressive and richer in humus. The development of the dripstone is slower in the cave-parts under barren-opened karstfield, because the ionconcentration is smaller and the rainfall flows away quickly on the rocks.

3. DISCUSSION

The characteristic microclimate of the cave, for example, the high relative but small absolute humidity, the high carbondioxide concentration of the air, the chemichal compounds of the speleoaerosol have a significant influence on the therapeutical efficiency in the cave. These factors are result of the quantity and quality components of the seeping waters.

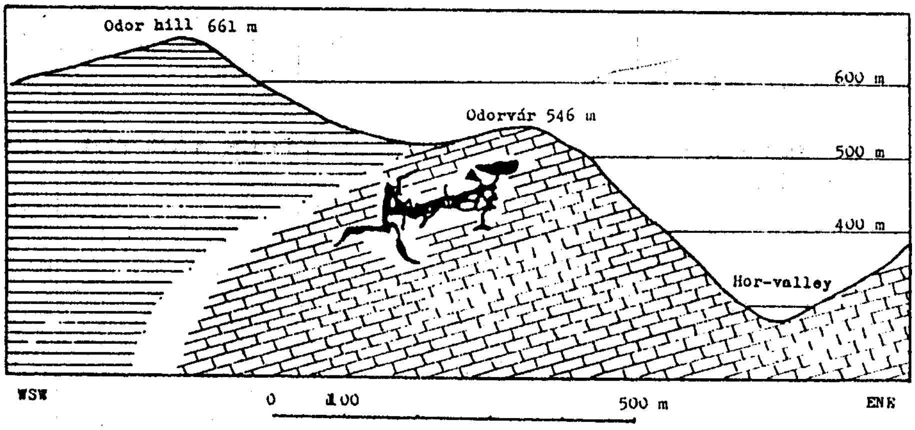

Fig.1. The geological profile of Odorvár.

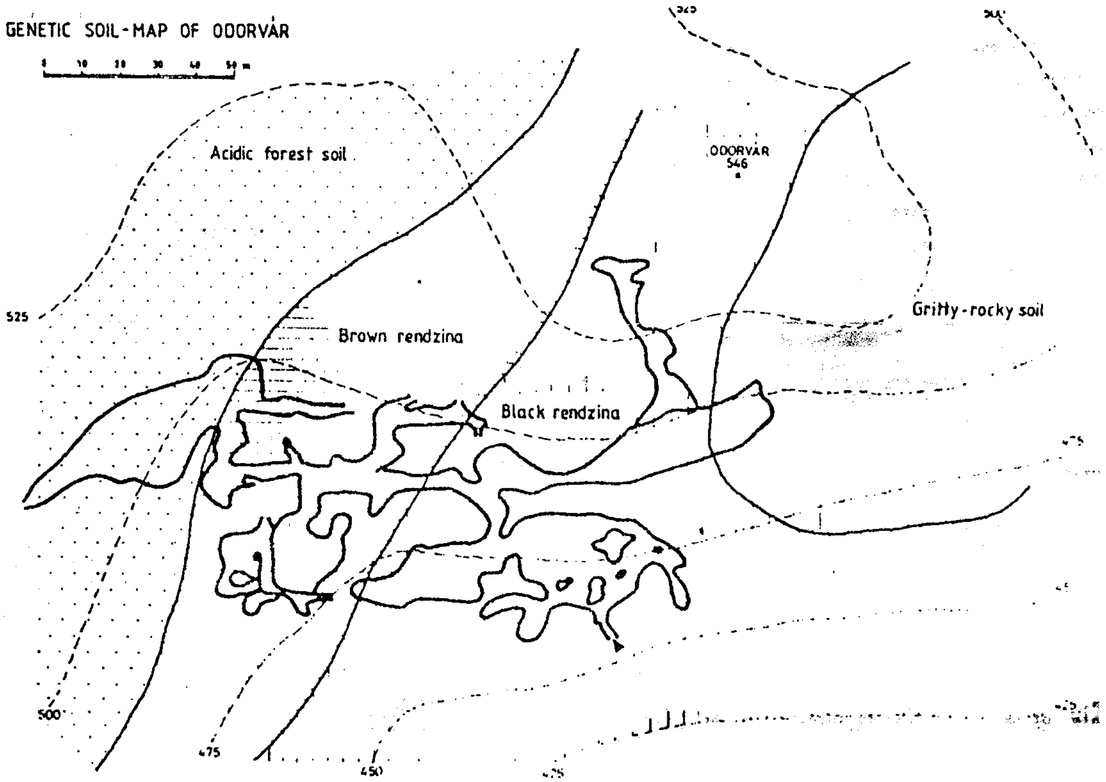

Figure 2. Genetic soil-map of Odorvar
cave-Hajnoczy
entry of the cave
level-line

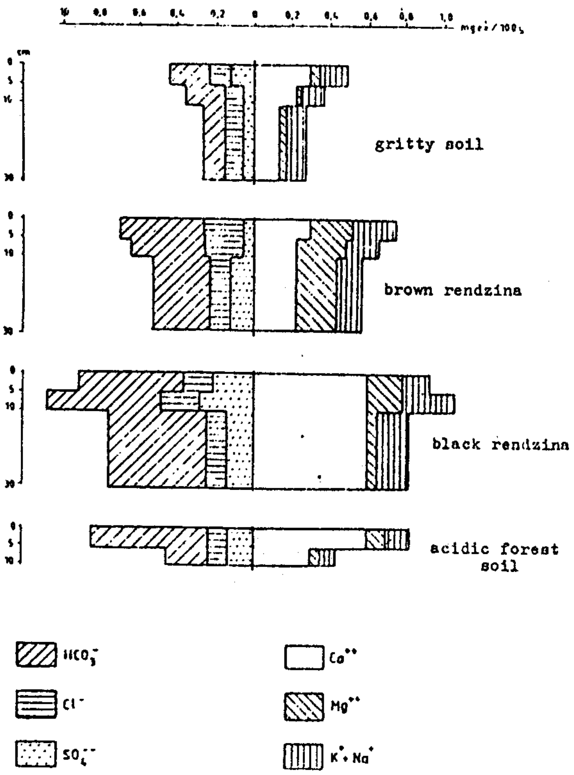

Figure 3. Replaceable ions of the different soil-types

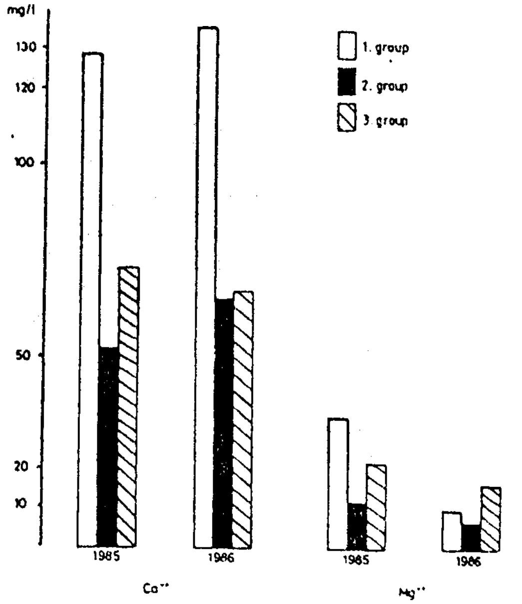

Figure 5.
The Ca- and Mg-ion-content of the water-samples collected in Hajnoczy-cave in July 1985.1986., in terms of milligram/litre.

Soil-type	G.s.	G.s.	B.r.	B.r.	B.r.	Br.r.	Br.r.	Br.r.	A.f.	A.f.	A.f.
deepness	5 cm	10 cm	5 cm	10 cm	30 cm	5 cm	10 cm	30 cm	5 cm	10 cm	30 cm
pH KCl	6,63	6,75	6,58	6,91	6,91	5,97	5,96	5,94	5,55	4,4	4,04
pH H_2O	7,05	7,18	6,55	6,76	7,13	6,38	6,41	6,55	6,24	5,54	5,34
$CaCO_3$ %	5,2	7,2	0,1	0,1	0,7	0	0	0	0	0	0
NO_3+NO_2 ppm	2,9	6,6	12,3	6,8	9,4	43,3	16,5	5,0	8,3	2,3	1,5
Fe ppm	82,4	59,8	832	487	442	512	451	471	437	555	509
Mg ppm	126	106	87	51	57	278	248	192	181	148	208
Na ppm	61	71	11	18	14	19	15	20	51	61	77
Zn ppm	14,6	9,5	15,6	13,6	16,8	20,9	12,5	4,6	6,5	4,2	2,9
Cu ppm	4,7	4,1	8,1	9,8	12,4	5,4	4,7	4,2	3,4	3,8	4,1
SO_4 ppm	11	1	2,5	0,1	1,3	9,2	2,8	0,2	10,8	11,0	25,4
humus %	5,5	5,2	5,15	4,93	5,29	5,46	5,32	2,5	4,3	3,2	2,7
0,00-0,002 mm %	13	16	19	20	23	11	13	15	6	8	9
0,002-0,02 mm %	15	16	15	18	21	19	18	15	8	10	11
0,02-0,1 mm %	19	20	17	22	23	21	20	16	17	18	27
0,1-2 mm %	46	43	32	26	26	22	43	21	44	44	48
2-20 mm %	7	4	27	14	7	27	5	33	25	20	15

Figure 4.

G.s. = Gritty soil B.r. =Black rendzina
Bl.r.= Brown rendzina A.f. =Acidic forest soil

The soil-types can be found on the catchment-area of the cave, and the oozing in water, just as the analyse of the dropping-water of the cave shows that the soils are important from the point of view of chemical composition of the dropping-water. It is provable that the dropping-water, which have got various characteristics, first of all they have got various ion-compositon, appear in the parts of the cave being under the different soil-types. The characteristics of the disolved-ion-content of these dropping-waters are coming into being next to the infiltration through the soil.

In consequence the surface-soils are very important in the forming of the therapeutical effect in the cave. This connection is the reason why the soil-erosion can decreases and on the other hand the forest-plantation and the soil-strengthening can improve the therapeutical effectivity.

Our present observation shows that the quality of the soils has a significant influence on the therapeutical efficiency of different cavities in the cave.

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