THE FUNCTION OF KARST WATER SYSTEM OF KÁCS AND SÁLY AT BÜKK MOUNTAIN

KÜRTI LÍVIA,

Assistant lecturer

Eszterházy Károly College, Department of Geography, 3300, Eger, Leányka u.6.

kurti.livia@ektf.hu

Abstract: Although karst terrains cover only 1% of the continents, but they are really important for the humanity, because they give drinking water of the global population. Hungary has a very good situation, as we have a great karst water reserve. The system of Kács and Sály is situated at the foothill of Bükk Mountain. It is really important in the drinking water supply system of the South-Borsod region. More than 12 settlement get their water supply from here, among them Mezőkövesd also. The system was studied during two years with water sampling a forthnight's period. The speciality of this system is, that here we can find cold karst springs and warm springs besides, and also mixed springs in a few meters distance. I also analysed the vulnerability of these karst system, as it gives important informations for the users. As generally the karst is very sensitive regarding the environmental changes , and the pollutants can easily find the path to the deep karstwater reservoirs.

Key words:Karst, warm springs, cold spring, Bükk mountain, system vulnerability

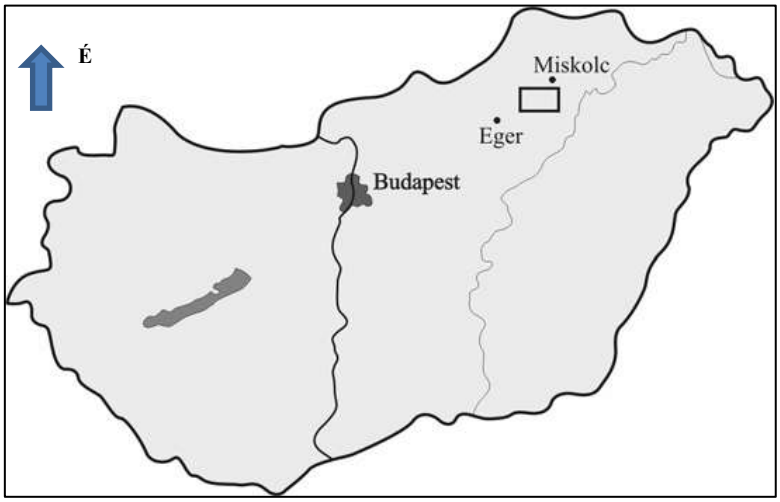
Introduction

Why is it so important to know the function of a certain karst water system? The water is not only a substance of the life on the Earth, but also it is a main component of the karstic ecosysteme. The Bükk Mountain, which is situated on the north part of the country, is one of the most important karst areas in Hungary. Several villages and towns get their drinking water from there. But nowadays there is an increasing human impact on natural systems, so I have to be aware of their effects on the karst, which is very sensitive not only to the quantity of the water, but also to the quality.

The study area is situated in the SE part of the Bükk piedmont (*Fig. 1*) near Kács, Sály and Lillafüred. The aim of my research is to learn the function of these springs during the year and also to observe the behaviour of the pollution from the springs along the streams. This study concerns only the springs. These karst springs lie by the side of a little fault line especially at Kács and Sály. There are three types of springs: springs with cold, with lukewarm and mixed water.

About this system several articles were published, but the most of them are specialised on the protection area In 1970 the spring Vízfő- (Sály) and Alap-spring (Kács) were occupied to provide water for the drinking

water supply system. However the research was not established enough so it is necessary to analyse the quality changes during the years also.



Fiure.1 The situation of the study area in Hungary

Methodology

After the basic data collection we realised I had not data about the water quality, which is very important, because it can help us recognise changes in the aquifer. So we decided also to analyse the chemical components of the different springs. I gather samples every two weeks at 11 points, 4 of which are points on the streams of Kács and Sály. Regular data acquisition is necessary for gaining knowledge of the function of the whole system. The other 7 points are the karst springs. In the field I measure conductivity, pH and temperature with a RADELKIS 104 Type II, and also with WTW cond440i instruments. After, according to the method of *HOFFMANN AND PELLEGRIN* (1996), I measure the Total Hardness, Ca, Mg, HCO_3^- ions with titration. In the laboratory I analyse the water within 24 hours, because I do not add any acid to the samples. Heavy metal content (Cd, Zn, Ni, Pb and Cu), sodium, and potassium are determined by AAS (PERKIN ELMER 3110). The SO_4 and PO_4 are measured by spectrophotometer HELIOS, according to *KRAWCZYK* (1996). The Cl is determined with titration with 0,01 mol $AgNO_3$.

Results and discussion

The Bükk Mountain is in the moderately humid continental climate region. The yearly sunshine duration is between 1850 and 1900 hours. The mean annual temperature is 8.5-9.6°C, during the growth season it changes between 15.5-16.7°C, and it depends on the altitude and the exposition. Generally the last frost comes before 20 April, and the first freeze in autumn is after 15 October. Annual precipitation is approximately 650mm and half of it falls during the growth season. In winter snow is frequent, generally there are 40-55 snow-covered days173 and the mean maximal thickness of the snow is 18 cm.

The latest geological analyses have shown that in the Bükk Mountain there is not a homogeneous karst water system, but several independent systems exist. In consequence, we cannot speak about a homogeneous karst water level (*SÁSDI ET AL.,* 2002). The system of Kács and Sály get the water from the south part of the Bükk and this water is banked up by the rhyolite tuffs, which lies on the Eocene limestone at the Bükk piedmont. In the catchment area there is dolomitic limestone, limestone with silex. According to *RÁDAI* (1988) this little water system has no relation with the other karst water systems around. But the latest research of *JAMBIK AND LÉNÁRT* (1995) has shown a relationship between the system of Miskolctapolca and Kács-Sály. Thus the former system grows at the expense of the latter. *JAMBIK AND LÉNÁRT* (1995) has modified some data in his work, in which he has treated the articles published so far critically. For example he has modified the superficial extent of the catchments area, because the discharge data did not verify an extent of 51.4 km^2. He presents two values for the catchment area, one before the occupations of the springs and one after: 23.8 km^2 and 16.2 km^2. The springs rise to surface on a low altitude (f.e. 194.9 mBf) on the mountain front (*Fig. 2)*. This altitude shows the lowest karst water level in the Bükk mountain.

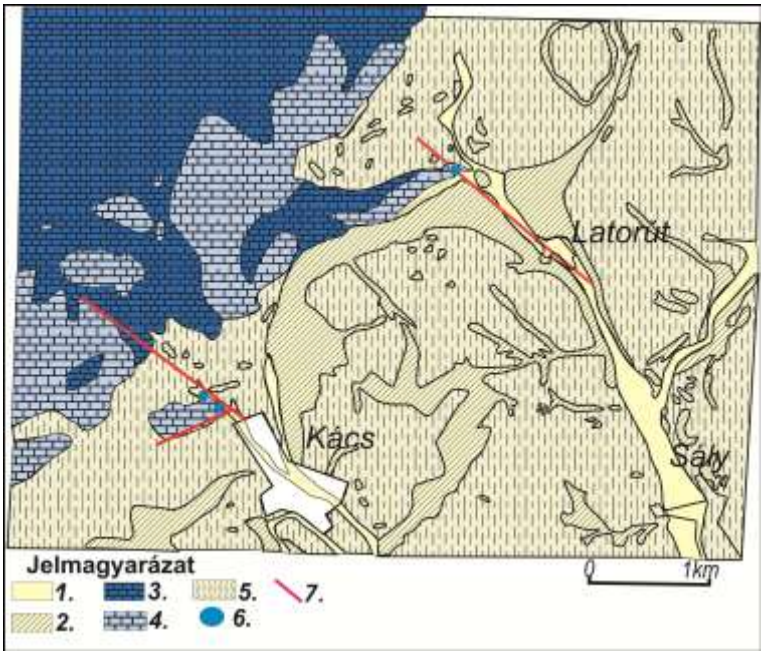


Figure 2. Geological map of Kács-Sály spring,1. Alluvial deposit, 2.Rhyolite Tuff, sand, 3. Triassic limestone with flint, 4. Eocene limestone, 5. Loess, clay, travertine, 6. Spring, 7. Faults

Regarding the discharge, I have data concerning the Alap-spring at Kács. According to the last years climat we have a clear tendencey of growing discharge, due to the more precipitation. But the electrical conductivity does not move in time as the discharge. It could be explained by the ascending water component. Sometimes the two curves show matches as we can see on *figure 3*.

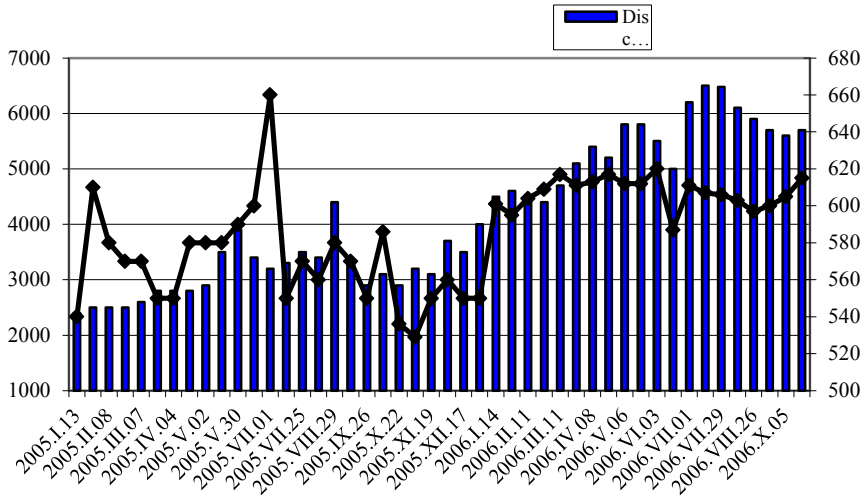


Figure 3. The discharge and the electrical conductivity of Alap-spring at Kács

As to the carbonate system, the values are very similar in the whole system. Generally the whole system moves together the same way. However, there is an exception:the spring Máriás at Kács has a content of Ca and Mg higher than the other springs. Total Hardness changes between 6-7.2 meq/l, while in the former spring its value is between 8.9- 10.4 meq/l. The proportions of the Ca and Mg ions are relatively high, due to the relatively long time spent in the limestone, and also in the deep karst.

The temperature of these spring are interesting. There are mainly 3 groups. The first the mixed water with temperature 14-16°C, and the second group contains the springs with 20-21°C. The temperature does not vary a lot during the year, only 0,5°C. The third group present the karst spring feeding by clearly descending karst water, and it varies according to the outside temperature of its environment.

Conclusion

As I have written before, there are two mixed-water springs and according to *Jambik and Lénárt* (1995) the spring Kács gets its water mostly from descending waters. But according to my observations the precipitation and the melting of the snow arrive with a difference of approximately 1 month. This period can be detected in the changes of each parameter.

We have to pay attention to the pollutants, their movements in time and space, because these springs are connected to the drinking water supply

system of the region Borsod. This research is a part of a more general analysis of which the aim is to explore the relation between pollution possible in the soil, in the vegetation.

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Összefoglaló

A víz, mint éltető forrás nagyon fontos az emberiség számára. Különösen igaz ez a karsztvizekre, mert egy nagyon érzékeny rendszer részeként ivóvízbázisként szolgálnak az emberiség ¼ számára. A Kács – sályi vízrendszer a Bükk-hegység lábánál, Északkelet-Magyarországon. A rendszer 196 m tengerszintfeletti magasságon erednek, és törésvonalak mentén lépnek felszínre, eocén mészkőben. A terület érdekessége, hogy viszonylag kis távolságon belül, hideg, langyos források lépnek a felszínre. Működésüket tekintve, elmondható, hogy az év egyes periódusaiban a felszálló, míg máskor a leszálló ág kerül előtérbe. A 20-21°C források inkább a felszálló források vize dominál. Összetételüket tekintve a kalcium-hidrogénkarbonátos vizekhez tartoznak.