

THE BEGINNINGS OF CAVE CLIMATE RESEARCH IN THE CARPATHIAN BASIN

István Fodor

The analysis of early cave climate research in the Carpathian basin can be a rather exciting task from the point of view of the history of science. As a geographical large area the Carpathian basin has a great variety of caves as for their geological formation, their karst genetics and karst morphology to begin with the thermal caves through cold water caves up till ice caves. No wonder that at the dawn of the European scientific speleology many-sided interest turned toward the research of the karst areas of the Carpathian basin and records, observations, then individual studies and analysis concerning climate are more and more numerous. These works beyond their research-historical significance have become indispensable sources for scientific analysis and monographs.

Beyond the early meteorological records (the end of the 18th, beginning of the 19th century; *TOWNSON, R. 1797; RAISZ K. 1807.* – his observation from the Baradla Cave of Aggtelek) there are other remarks concerning the climate of the caves. E. g. a statement on the Baradla Cave: "...the cave is not homothermous all the time, a change can be brought about by the water flowing along it, that is of different temperature in the different seasons of the year." (*VASS I. 1831.*) However, this time the climate evaluations were based on subjective observations. *FÉNYES E. (1851)* writes about the Baradla Cave as follows: "As for the temperature of the cave it is about seven times colder than the air outside..." His statement is not true even for extreme summer conditions. The meteorological records of *V. K. KÖLESY (1820)* and *A. SCHMIDL (1856)* served to make more complete the physical description of the caves. However, the observation of *A. SCHMIDL (1856)* – namely, that the temperature of the standing water lakes in the entrance hall of the Baradla Cave is colder (6,2°R around the Csontház and the Teknősbéka) than that of the flowing water at the same spot, the average value of which 7,7°R in August – can be regarded as an intention to describe the decisive processes of cave climate.

Climate research on the karst areas of the Carpathian Basin began in the second half of the 19th century. These examinations are not only sporadic meteorological records any more, but they are going to describe certain elements of cave climate, so they open a new scientific age.

Cave climate examinations in the second half of the 19th, beginning of the 20th century were temporarily observations of temperature and aimed at the research of special, interesting phenomena, e. g. that of the ice caves. More and more researchers began to deal with the formation and development of caves, with their general description and classification. *M. FISCHER (1888)* in his book describes eight ice caves of the Carpathian Basin. "... beyond the most outstanding Dobsina Ice Cave (Dobsinai-jégbarlang, Dobšinská ľadová jaskyňa) the best known ones are: the Zapodia Cave (Žapodie) in Bihar county discovered in 1860; the Deményfalva Ice Cave (Deményfalvi-jégbarlang, Demänovská ľadová jaskyňa) in the Lower Tatra described in the 1867'es volume of the Review of the Hungarian Geological Society by Ferencz Kubinyi; Szilicze Ice Cave (Szilicei-barlang, Silická ľadnica) in Abauj-Torna county first presented by Mátyás Bél in the Review of the London Royal Society, then by Robert *TOWNSON* in his work "Travels in Hungary" (1797) and by *A. SCHMIDL* in his paper "Die Eishöhle Lednica bei Szilicze" (1856).

N. FEHÉR (1872) developed even further the detailed and professional description of the Dobsina Ice Cave on the basis of his observations of the temperature in the Dobsina Ice Cave since 1870 till 1871. It turns out that the author walked along the cave several times, but it is a shortcoming of his work that it does not indicate the place of the measurements when publishing the data of the cave temperature. Judged from the high summer values *N. FEHÉR* must have taken his measurements in the vicinity of the entrance (on the 14th of August 1870: +5°C; on the 31st of August +3,75°C; on the 27th of May 1871: +3,75°C) as the temperature in the inner parts of the Dobsina

Cave is not higher than +1°C even in the warmest months. The importance of N. Fehér's researches from climatological point of view is that on the basis of concrete measurements he pointed out the regular yearly change of the temperature in the cave, and explained the delusion based on subjective temperature sensation that the cave feels cold in summer (compared to the higher outside temperature) and warm in winter (compared to the colder air outside). The researches of N. FEHÉR (1872) were carried on by J. KRENNER (1874) then by J. PELECH (1884). On the basis of J. Pelech's measurements M. FISCHER (1888) gave a very precise and detailed description of the temperature conditions of the Dobsina Ice Cave exactly indicating the time and spot of the temperature measurements. In 1881 for twelve months regular measurements of the air temperature were taken four points of the cave. He explained the importance of the measurements as follows: "the exact knowledge of temperature conditions is the most important help to set up the theory of ice caves..." On the basis of monthly values from 1870, 1880, 1881, 1883 and 1885 the author stated the mean annual temperature that was between -0,15°C and -0,86°C in the great hall of the cave. (According to the data put at my disposal by J. Ruffinyi).

From the point of view of the history of science the records of H. SCHWALBE (1887) are significant, beyond values from the Dobsina Ice Cave he gave air temperature data from the Deményfalva Ice Cave and the Szilice Ice Cave. Using the measurements of M. Róth, S. Róth and S. Weber, K. KOLBENHEYER (1889) published a coherent study on the temperature conditions of the Béla Cave of the High Tatra. Kolbenheyer analysed a rather interesting collection of data, as the measurements of the temperature of air were taken in every year between 1882-1885, mostly in August.

On the 26th of July 1882 measurements were taken only at four points of the cave, however, between 1883 and 1885 in August months they were taken at 9-18 places and the average temperature of the whole length of the cave was 7°C and 9°C. In the same I myself measured 3,3°C and 5,8°C on 19th of November 1967.

The main importance of Kolbenheyer's study from the point of view of the early cave climate research lays in that it examines for the first time the whole air capacity of caves in the Carpathian Basin. Starting from the entrance and going inward into the cave he took measurements at 19-20 spots at a time. The description of such a detailed research can be found only in the specialized literature of the 20th century.

The first period of cave climate research can be concluded by activity of A. PENCK (1889) at the end of the 19th century. In 1889 A. Penck published the results of his measurements of the temperature conditions in the St. Canzian Cave. It is outside the sphere

of our research but Penck's work is important as beyond the valuable temperature facts of the St. Canzian Cave he took into consideration the results of measurements taken in the Carpathian Basin when preparing the first significant classification of caves on climatic basis.

In the first decades of the 20th century the ice caves are still the favorites as for the cave-climate research. L. STEINER (the director of the Hungarian Royal National Meteorological Institute) is an outstanding figure of this period, whose activity on the field of cave-climate research opened a new epoch as his research carried out in the Dobsina Ice Cave is a climate analysis based on systematic collection of data for years. The new field of scientific research in speleology was based on the more and more perfect instrumentation and the method of climate research. These researches were broken by the 1st World War, so the results of his 1910's research could have been published only after the war (cf. STEINER L. 1922).

Dr. István Fodor
Kulich Gyula u. 22.
Pécs,
H-7621
HUNGARY

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