

# Development of the exploration and exploitation of subsurface waters\* in Hungary till 1920.

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To supply the population with uncontaminated water some deeper wells were drilled in Europe first in the area of Artois (France) in the 12th century, though in Asia and also in Africa the art of deep well digging was well known some centuries before. Hungarian endeavours in this respect began in the 19th century only.

New methods of water exploitation were demanded by the fast economic development during the first decades of the 19th century. The frequency of epidemics requested also the exploration of drinkwater of satisfactory quality. All these contributed to the exploration of subsurface waters to be found below the contaminated ground waters.

In every country, thus also in Hungary, first the miners got acquainted with the subsurface waters, being miners the forbearers of geological and hydrogeological sciences. The first related maps were compiled by S. STASZIC (1815) and later by F. S. BEUDANT.

Although drilling was long before employed in mining for the exploration of mineral raw-materials, yet with the purpose of water exploitation it was introduced in Hungary considerably later. Water exploration, based on scientific principle begins with the work of V. ZSIGMONDY while at the same time Professor J. SZABÓ, a geologist, and M. HANTKEN, a paleontologist are making some efforts to develop Hungarian geological science. The endeavours of these three persons gave impetus to and predetermined for the decades to come, the development of subsurface water exploration, the development of geology and that of paleontology.

## *The beginning Period of subsurface water exploration*

Artesian wells were located in this period usually in the vicinity of natural water sources making the exploration of the water bearing formation generally successful.

Less successful were the wells, located in unknown, or less known geological environment with the aim to find subsurface waters under thick covering layers.

The first drillings for water were carried out in Hungary by foreign specialists. The medicinal water well at Ugod was completed by a French specialist in 1825, the drinkwater well at Csór by an Austrian specialist from Vienna.

\* In the followings the definitions given below are employed: ground water = water forming the water table below the surface; subsurface water = water to be found in deep lying formations below the layers containing ground water (formation water). Including: Artesian waters, thermal waters, karst waters and oil field waters. Of course interrelation between the two kinds is usually possible under certain conditions. (Translator)

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J. SZABÓ and V. ZSIGMONDY contributed also in solving the water supply of the city Pest, yet instead to drill water wells, promising dubious results, the terrace gravels along the Danube river were exploited (1868).

### *The role of science and technology in water exploration*

The milder political atmosphere of the last decades of the 19th century favoured the progress of economical and scientific development. Leading personality of the exploration of water resources was in this period V. ZSIGMONDY, a mining engineer. The importance of artesian waters is clearly accentuated already in his book, written about „Mining Science”. Following this he drilled a thermal water well at Harkány, starting the most successful period of his life, laying a solid foundation for Hungarian artesian well drilling.

The geological maps, descriptions available at that time were not satisfactory from point of view of locating artesian wells properly, therefore ZSIGMONDY used to gather more information by studying the stratigraphical and structural conditions of the area in question. He built his hydrogeological conclusions upon geological studies. In consequence he was pressed to deal with the origin of thermal waters, with the problems of covered and open karsts and with the problem of raising and descending karstic waters.

The new wells (Margaret-Island, City-Woods No.-1) created also some new technical problems. To protect the casing against corrosion larch-lining was applied. ZSIGMONDY constructed a high pressure thermometer as well and the first bottom-hole temperature measurement was completed in the hot water well City Woods No.-1 at 970.48 m depth (1875). His continuous well temperature measurements could be well utilized by J. SZABÓ for geothermic gradient calculations. With the successful completion of the hot water well City Woods No.-1., being the deepest at that time (1878) in Europe, the first, relatively short period of scientifically well based water exploration was concluded. Typical for this period was the one man enterprise, the man: V. ZSIGMONDY being a drilling engineer, a geologist and a hydrogeologist in one person.

During the following years the solution of drinkwater supply in the Great Plain continued to remain the central problem. V. ZSIGMONDY began with the investigation of the porous basin-sediments. Although he was following the path of his predecessor, yet he left the geological-hydrogeological problems to be solved by the Hungarian Royal Geological Institute. In the history of Hungarian drilling technology the application of water circulation in the first public well at Hódmezővásárhely is considered as a milestone (1880). The method was adapted by numerous small scale contractors without any satisfactory technical knowledge resulting in a series of badly completed dry holes. Though the exploration and exploitation of subsurface waters were regulated by the first water-rights act (1885), yet no significant change occurred.

At the end of the century the *Geological Institute* took over, holding in its hand consulting, permission and documentation about water well drilling. The first artesian water well register was prepared by GY. HALAVÁTS in 1896, containing the data of 1290 artesian wells. The material was illustrated by a 1 : 360 000 scale map, prepared by T. SZONTAGH.

The role and participation of the Geological Institute increased when in 1908 L. LÓCZY, SEN. became head of the institute. The „General map of the water pipelines in the towns, and of the artesian and drilled wells in the territory of

the states of the Hungarian holy crown", was published in the same year, prepared also by T. SZONTAGH. The technology of interpretation and representation on the map is even today still up-to-date.

L. LÓCZY, SEN. also submitted the first recommendation about the necessity of governmental control and supervision of the wells. He supposed that the interaction of individual wells thus could be clarified and the wells yielding mineral water, medicinal water, and common drinkwater, could be separated by governmental supervision. He is urging the establishment of a governmental chemical laboratory for the determination of the chemical composition and gas content of artesian waters (1912). His other suggestion, i.e.: that every government should establish an institute where all rock samples needed for geological information should be kept on store, was also quite farsighted. LÓCZY considered the introduction of drilling technology into the curriculum of the university and mining school also as an urgent task.

In addition to the Geological Institute the professors of geology of the *Budapest Technical University* played also an important role especially with respect to the examination of the hydrogeological conditions of medicinal and karstic waters exploited in Budapest. Especially the work of F. SCHAFARZIK was outstanding who, contradicting some erroneous aspects, drilled the first well in 1919 to increase the yield of thermal water springs at Buda.

The interpreting work of the hydrogeologists was much supported by the work of the chemist K. THAN, having worked out a new method to compare the results of mineral water analyses and in 1891 introducing his new theory about the electric charge of the salts present in mineral waters and about the effects of these electric charges. He was the first to prove the presence of carbonylsulphide in the hot water of the well at Harkány, and that of the fluoride in the hot water of the well in the Budapest City Woods. At the turn of the century began the examination of radium emanation in indigenous hot waters, mainly of those at Budapest (GY. WESZELSZKY), being this an important factor in the interpretation of medicinal waters.

To discuss the occurring hydrogeological problems an independent organization was requested, yet the postwar years after World War I were not suitable to establish an independent Hydrological Society, thus in 1917 only a section organized within the *Hungarian Geological Society* was formed counting 79 members. The publications of the *Hydrological Section* appeared from 1921 on in the *Hydrological Bulletin*.