

The thermal waters of Jász-Nagykun-Szolnok county and their balneological utilization

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Abstract. By the end of 2002 several hundreds of hydrocarbon bore holes and hot water wells had been drilled in Jász-Nagykun-Szolnok county. On the basis of their data the author reveals the most important thermal water reservoir layers and their utilization.

Key words: thermal water reservoir, thermal bath, medical bath, thermal water

Research. The exploration of the geothermal conditions and thermal water reservoirs of Jász-Nagykun-Szolnok county began in 1928 owing to the work of geologist Ferenc Pávai Vajna. Hydrocarbon exploratory drilling Karcag (Berekfürdő)-I. and the thermal well in Szolnok were finished this year. Their bottom depths are 1224,6 meters and 949,5 meters, respectively. By the end of 2002 several hundreds of hydrocarbon drillings and almost 180 thermal water and lukewarm artesian water producing drillings had been accomplished. On their basis we have a pretty good overview of the conditions and thermal water reservoirs.

The result and utilization of the research. The most important thermal water reservoirs are the sandstone layers of the Újfalu, Zagyva and Nagyalföld Formations of the upper Pannonian area.

Geological characteristics of the formations:

Újfalu Sandstone Formation: It consists of a frequent alternation of sandstone, siltstone and clay marl, deposited in a littoral, particularly delta front-delta plain environment. The sandstone bodies in it may have a thickness of a few tens of metres. Coalified plant remnants frequently occur in it, forming a bed at some sites.

Zagyva Formation: It consists of a very frequent alternation of fluvial and lacustrine, loose, medium to fine grained sand, sandstone, silt, clay and clay marl beds containing coalified plant remnants with frequent occurrences of lignite strips. The sequence may contain sandstone intercalations with a thickness of 10 to 20m, which are channel fill, point bar, or flood plain deposits, and paleosoil levels described as "variegated clay".

Nagyalföld Variegated Clay Formation: It consists of an alteration of bluish grey sand beds with grey, yellowish grey, reddish brown spotted clay beds of varying thickness. Lignite and pebbly sand beds are frequently included. It represents a typical lacustrine, fluvial and terrestrial sequence.

Characteristics of the reservoirs. The lowest formation of the upper Pannonian beds, the Újfalu Formation has a bottom depth of 1000-2000m in the county. The parts of the formations which have higher temperature than 40°C make up a total width of 400-1300m. The widths of the aquifer sandstones vary, but they are at least 10-15m. Their total width is thought to make up the 40-60% of the column. Their porosity is 20-30%, their permeability is 500-1000md. In some parts of the county the Miocene carbonated, detrital layer below the Pannonian deposits is also a thermal water reservoir. Its capacity to store

thermal water is well known from hydrocarbon drillings. The reservoir layers are seated 1600-3000m deep below the surface. Their widths are some ten meters, their porosity are 10-15%, their permeabilities are some 100 md.

Geothermal conditions. In the forming of the geothermal conditions the water currents between the regionally pinched out aquitard and the aquifer layers play a significant role. There are recharge and discharge areas. The young faults greatly affect the directions and intensities of the currents. The geothermal gradient is between 50-70°C/km on the average. In the Jászság and the surroundings of Karcag-Berekfürdő values of 80-100°C/km may occur in some extrem cases. These rates are measured especially in the higher layers. Thermal water of at least 36°C outflowing temperature can be expected below 500-600 meters from layers of Upper Pannonian formation. Wells producing water of 70-80°C can be found in Túrkewe, Öcsöd, Karcag, Mezőtúr, Törökszentmiklós, Tiszaföldvár and Jászkisér. In areas of better geothermal value 30-35°C lukewarm water is produced from layers below 350-400 meters. In these cases the reservoirs are mostly the sand layers of the Pleistocene. From the Miocene reservoirs water of an outflowing temperature of almost 100°C can be obtained.

The utilization of thermal waters. 35 of the thermal water or lukewarm water wells have been eliminated or permanently closed in Jász-Nagykun-Szolnok county. We have no accurate data on the distribution of the utilization of the other 10 million m³ thermal water produced in the county. The estimated distribution of the utilization is the following:

water supply of medical and thermal baths	40%
drinking water supply	30%
agricultural water utilization	10%
heating of establishments	10%
industrial water supply	8%
no utilization	2%.

It can be seen that the utilization of thermal waters has economic significance in the county.

Balneological utilization of thermal waters. 24 thermal baths can be found in 20 of the 77 settlements of the county. 10 of them are officially acknowledged as medical spas. (Figure 1) Almost 50 wells supply the baths with thermal water. The first exploration well in the county with the expressed purpose of finding thermal water was drilled in 1928 in Szolnok. According to a booklet dealing with the topic, which was published in 1932 Szolnok "has radioactive alkaline thermal water with a temperature of 55,6 °C rising from a 957m deep artesian well." [1]. The publication also informs us about the medical suggestions and equipments among others. It also tells us that the water is sold under the name of "Áldás-víz" ("Blessing-water"). At the same time, in 1927-28, the 1224,6m deep Karcag-1, then in 1929-30 the 801,7 m deep oil-exploration wells were drilled. Oil was not found, only 65°C water mixed with natural gas. Based on this hydro-carbonated, chlorine and iodine medical water a spa opened in the area in 1932. The gas separated from water is used to run a small glass factory. [2]. Especially noteworthy is Cserkeszőlő, with the only well in the county that receives its thermal water from a Miocene reservoir. The well was drilled in 1942-43 for oil exploration. However they found a 96°C waterflow from the Miocene layers instead. The water was chemically analysed by Dr. János Bodnár, director of the Medical Chemistry Institute in Debrecen, who concluded: "The analysed water has a rather interesting and exceptional composition. No water of similar composition has been found in Hungary yet. In my opinion the water has medical characteristics are well worth further examination." [3]. The well was closed after the analysis and was opened only in September 1952. Today Cserkeszőlő - along with Berekfürdő - is the best-known and most-visited spa of the county.

Another oil-exploration drilling in Tiszaörs also led to the construction of a bath in 1930-1932.

Most of the baths in the county were established during the 1950's and 1960's. In several cases their water-sources are failed hydrocarbon bores. At the turn of the millennium large sums were invested into the development of the baths and spas. In some cases some thermal wells were drilled where no spa had existed before, e.g. in Abádszalók and Tiszaszentimre. However, a few spas were closed due to the owner's financial difficulties.

The wells get the water from a depth between 400-1800m. In every case there were more than one sandstone layers opened together. The total width of these layers in one well is usually between 20-50m. The water output ranges from a few hundred litres per minute to 3000 litre a minute. The wells used to have a surface outflow. Nowadays there are more and more wells with a negative dynamic water level. Tables No.1 and 2 show the temperature of the produced waters. The total salt content of the waters in the Jászság region is below 1000 mg/l. In the Szolnok-Berekfürdő line and to the south of it the salt reaches 2-3000 mg/l. It is exceedingly high in the area of Szolnok, where it might be as high as 10000 mg/l and above. The salt content rises in every area as we go deeper. The waters are usually alkali-carbonated, often with great chloride, calcium, iodine or bromine content. They are mostly good for curing locomotive disorder, rheumatic and gynaecological diseases or for calming their complaints. They can also be used for the aftercare of fractures or inflammatory diseases. Their effect in each bath and spa is shown in tables No.1 and 2. Some of the waters are consumed as medical or mineral water. For example: Áldás-víz, Cserke kincse. There are some which are not suitable for drinking due to their high arsenic content. In some cases the water of the wells supplying the spas are also used for communal, agricultural and industrial purposes, as well as for heating.

Conclusions: The baths and spas of Jász-Nagykun-Szolnok county are the most important tourist attractions of the region, their development is by all means reasonable. However, due to economic reasons and the lowering output of existing wells, the establishment of new spas is not advisable.

References:

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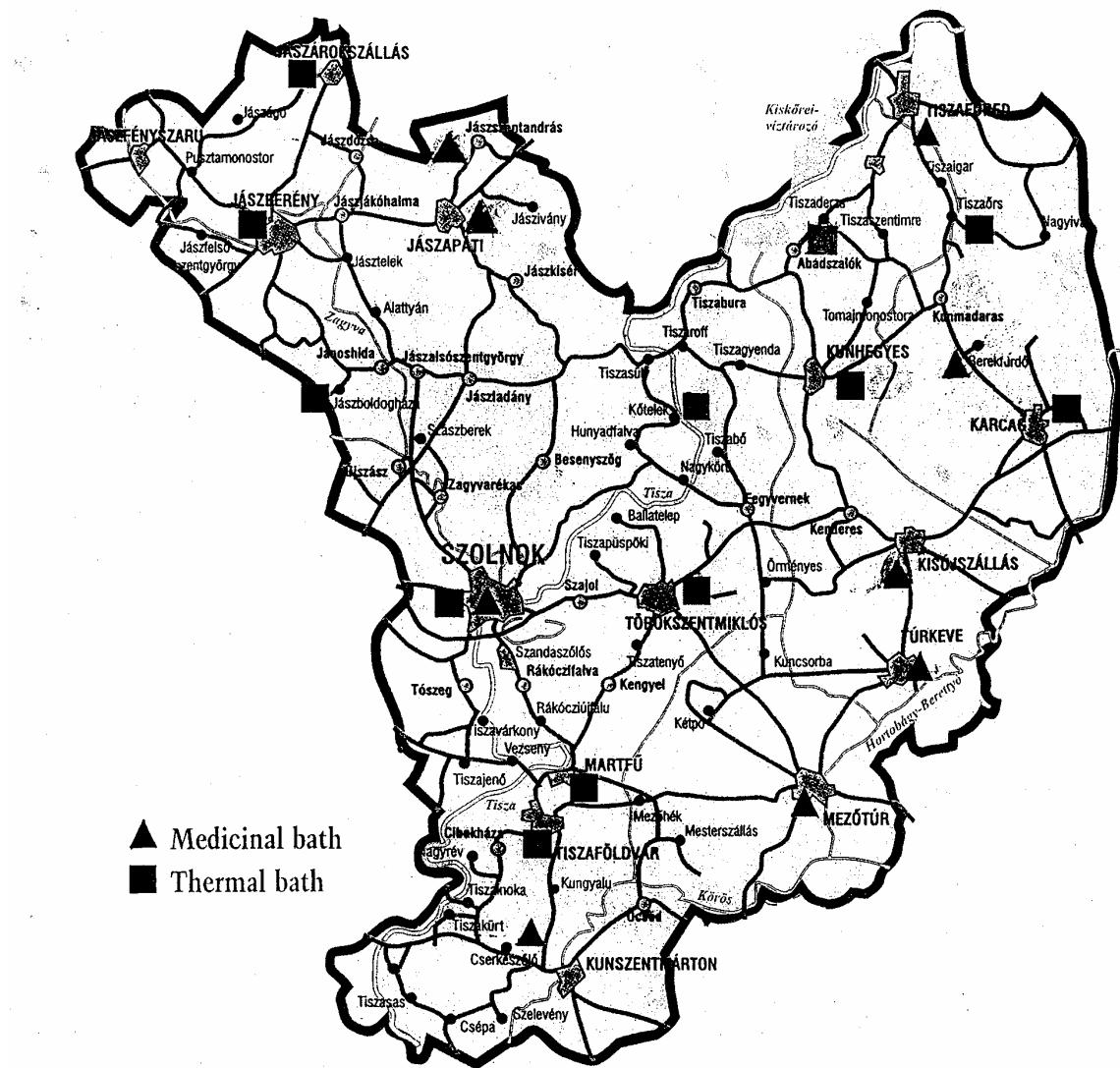


Figure 1.
Thermal and medicinal baths in Jász-Nagykun-Szolnok county

<p style="text-align: center;">THERMAL BATHS OF JÁSZ-NAGYKUN-SZOLNOK COUNTY</p>			
SETTLEMENTS	TEMPERATURE of produced water °C	TYPE OF WATER	FAVORABLE EFFECT ON THE FOLLOWING DISEASES
ABÁDSZALÓK	52	Alkali-hydrogen carbonated thermal water	
JÁSZÁROKSZÁLLÁS	52	Thermal water	Convalescent treatment of accident injuries
JÁSZBERÉNY thermal bath	45	Alkali-hydrogen carbonated thermal water	After paralysis, bony structure, locomotive diseases, gristle changes
JÁSZBERÉNY Bath of Lehel	45	Thermal water	Rheumatic diseases
JÁSBOLDOGHÁZA	38	Thermal water	Locomotive illnesses
JÁSKISÉR	69	Alkali-hydrogen carbonated thermal water	
KŐTELEK	62	Alkali-hydrogen carbonated thermal water	
KUNHEGYES	58	Iodine thermal water	Gynaecological and joint diseases
MARTFŰ	62	Alkali-hydrogen carbonated, iodine mineral water with chloride and fluoride content	Rheumatic and joint illnesses
SZOLNOK Damjanich swimming pool	62	Alkali-hydrogen carbonated, iodine thermal water with high salt content	Convalescent treatment of locomotive, gynaecological, rheumatic and joint diseases
SZOLNOK Open-air bath in Tiszaliget	60	Sodium-hydrogen carbonated, iodine thermal water	Rheumatic, gynaecological diseases
SZOLNOK swimming pool and bath of MÁV	56	Thermal water	Treatment of chronic diseases
TISZAFÖLDVÁR	71	Hydrogen-carbonated, alkali-chloride thermal water	Rheumatic and joint illnesses
TISZAÖRS	51	Thermal water	Locomotive, gynaecological diseases
TÖRÖKSZENTMIKLÓS	64	Thermal water with high iron content	Accident injures, spinal diseases, nervous system diseases

Thermal water: the total salt concentration less than 1000mg/g

Table 1.

MEDICINAL SPAS
OF JÁSZ-NAGYKUN-SZOLNOK COUNTY

SETTLEMENTS	TEMPERATURE of produced water °C	TYPE OF WATER	COURING EFFECT ON THE FOLLOWING ILLNESSES
BEREKFÜRDŐ	54-57	Alkali-hydrogen-carbonated, iodine medicinal water	Suitable for curing locomotive illnesses and inflammation diseases of nervous origin, rehabilitation after accidents
CSERKESZŐLŐ	83	Hydrogen-carbonated, iodine, bromine, alkali-chloride medicinal water	Convalescent treatment of locomotive, rheumatic, gynaecological, inflammation illnesses, suitable also for rehabilitation after accidents
JÁSZAPÁTI	49	Thermal water	Rheumatic illnesses
JÁSZSzentandrás	42	Thermal water with iron content	Rheumatic and gynaecological illnesses
KARCAG	75	Calcium,magnesium hydrogen-carbonated, limy medicinal water, with high salt content	For easing gynaecological complaints, treatment of locomotive diseases and curing some skin-diseases
KISÚJSZÁLLÁS	52	Alkali-hydrogen-carbonated, iodine medicinal water	Curing of locomotive and gynaecological diseases, rehabilitation after fractures, galvanic treatment, tangentor, electric and hydro therapy, medical massage
MEZŐTÚR	54	Iodine, fluorine, alkali-hydrogen-carbonated thermal water with high salt content, alkali-hydrogen-carbonated, iodine medicinal water	Locomotive rehabilitation, rheumatic, joint illnesses, allergic complaints
SZOLNOK Hotel Tisza	54	Alkali-hydrogen-carbonated, iodine medicinal water	Curing gynaecological complaints and locomotive illnesses, suitable for reduction of the excess of gastric juice and prevention of diseases
TISZAFÜRED	49	Alkali-hydrogen-carbonated medicinal water	Suitable for curing locomotive, gynaecological illnesses and diseases of nervous origin, accompanied by wear of vertebral disc, muscular atrophy and paralysis
TÚRKEVE	80	Alkali-hydrogen-carbonated iodine, sulphide medicinal bath	Suitable for curing locomotive, gynaecological and skin-diseases

Table 2.