DEEP GEOTHERMAL RESERVOIRS IN THE PANNONIAN BASIN: NEW RESULTS AND PERSPECTIVES

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The low-enthalpy geothermal reservoirs of the Pannonian basin are generally connate waters of the young-Tertiary sediments of the basin. Their depths are of 1-3 km, with temperatures as lower as 100 °C. The utilization begun in the Roman times; after the second world war however an essential thermal industry was developed for agricultural, heating, sanitary and balneological purposes (Ottlik, Gálfi, Horváth, Korim, Stegena: The Low Enthalpy Geothermal Resource of the Pannonian basin, Hungary. In: L. Rybach, L.J.P. Muffler Ed.'s: Geothermal Systems, John Wiley and Sons, 1981.)

In the last years, theoretical considerations showed that the existence of high enthalpy reservoirs in greater depths of the basin is possible. These considerations are based on the followings: (1) Elevated heat flow density; the mean for the basin amounts to about 106 mW/m^2. This means that the high geothermal gradients (about 60 K/km for the uppermost 1-2 km) are to be continued in bigger depths too, at least partly. (2) Several boreholes reaching the Mesozoic or Palaeozoic basement of the basin showed that considerable secondary porosity could exist in the basement, especially in the carbonatic Mesozoic rocks which are sometimes kartstified and/or tectonically fragmented.

In order to approach the geographic setting of the supposed deep-seated geothermal reservoirs, the following order of ideas was followed:

- Using borehole data, the areas with Mesozoic carbonate rock basement were delineated,
- Comparing these areas of Mesozoic carbonates with the geothermal maps, the areas are marked out, where the top of Mesozoic carbonates is as warmer as 150 °C (supposing that this temperature means the lower limit for electric utilization),
- Based on hydrogeological and borehole observations, there are some conceptions referring to the distribution of the karstified, fragmented zones of the carbonatic basement (Alföldi, Böcker, Lorberer: Hydrological Character of Broken Carbonatic Aquifers in Hungary. (in Hung.) In: Thermal Wells of Hungary, 3. 17-28. VITUKI, Budapest, 1977). From the areas with carbonatic basement hotter as 150 °C, the non-karstified areas are excluded.

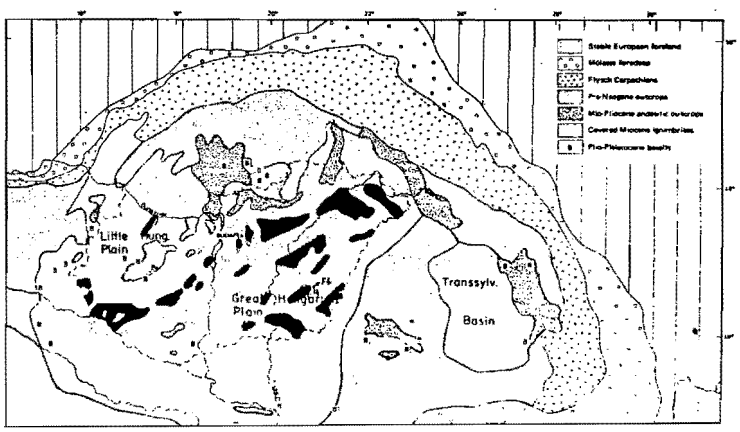
The remaining areas, i.e. with carbonatic rock basement, with karstified-fragmented character and with temperatures as higher as 150 °C, delineate the locations of the presumable deep-lying high enthalpy geothermal reservoirs.

The above speculation is corroborated by silica-thermometry too. The grundwaters namely above the supposed reservoirs often exhibit silica temperatures significantly higher as the geotemperatures, indicating an upward migration of water, from larger depths.

During 1985/86, an unexpected, tremendous vapor/water outburst happened from a borehole at Fábiánsebestyén is SW Hungary (F 4 on the map) giving a direct proof for the existence of high enthalpy reservoirs in the Pannonian basin. The outburst came from the depth of 4400 m and yielded enormous masses of about 150 °C vapor and water. After 46 days operation only succeeded to close it, getting the hole ruined.

Geological and geophysical studies after the outburst showed that there is a NE-SW stretching, tectonically fragmented zone in the basement rocks at Fábiánsebestyén, having a length of n.10 km and n.km width. The reservoir rocks are in the depth zone of 4-6 km; the temperature and pressure are estimated as 202 °C and 72 MPa. At these conditions, the water exists in fluid state (Stefanson, Björnson: Physical Aspects of Hydrothermal Systems. In: G. Palmason Ed.: Continental and Oceanic Rifts. A.G.U. Geodynamics Series 8. 1982).

The water is however very salty (about 25 g/l) and not applicable for turbines. It is hoped however that in other places of the Pannonian basin, deep-lying reservoirs are filled with infiltration- or reinfilitration water, the salinity of which being much more lower.



Presumable high enthalpy reservoirs in the Pannonian basin, Hungary (black areas)