

FURTHER RESULTS OF RESEARCH CONCERNING THE GAS-CONTAINING ARTESIAN WELLS OF THE HUNGARIAN PLAIN

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In the Hungarian Plain (Alföld) together with the water of many artesian wells free-gases and gases dissolved in water come to the surface. The distribution of these gas-containing layer-water wells according to area and depth was earlier studied in the southern part of the plain (3., 4.). Later the research was extended to include the whole area of the Hungarian Plain.

The aim of the work is to give an overall and detailed picture of gas-containing artesian wells which give water and the abyssal distribution and regional areal system of gas-containing layer-waters. Thus the question of the origin of the gases which can be found in the layer-waters might be answered sooner.

Data about 36513 layer-water wells of various depths from 964 administrative units in the Hungarian Plain were gathered and processed. Areal distribution of the wells is shown on Map 1 where the different numbers indicate the number of wells in each administrative unit.*

3541, i.e. 9,7% of all the wells examined, proved to be gas-containing. The frequency of the occurrence of gas-containing wells is vastly different in each area (Map 2) is not in close correlation with the total number of wells in the areal unit concerned. From the respect of the research it is the demonstration of local differences which has a great significance. Thus gas-containing and gas-free centres can be differentiated and regional differences in the rate of gasification can also be revealed which might be useful information for practical experts, too.

Geographical distribution and local differences in the frequency of occurrence can be estimated with the help of Map 3. The frequency of gas-containing and gas-free wells in the area of each administrative unit having been counted, the ratio of gas-containing wells to the total number of wells in the area was worked out as a percentage. Thus we were able to classify the whole area of each settlement according to categories. Areas where the total number of wells was under five were declared: "uncategorizable areas".

A vertical description of the gas-containing water-layers can be given by an analysis of Map 4, 5 and 6 which demonstrate the ratio of gas-containing artesian wells of different depths (0—30 m; 30—200 m; 200—500 m) to the total number of wells in the same depth-categories as a percentage.

These maps give a far more detailed picture of the areal distribution of gas-containing wells than those published earlier by E. R. SCHMIDT (5.) and M. ER-

* An administrative unit here means both the centre and the periphery of a settlement (town or village).

DÉLYI (1.) — see the fig. 1 and fig. 2 in FEHÉR 1975. — and on the basis of the information they give, certain conclusions on the rate of gassiness can be drawn, too. The rate of gassiness of the water-yielding layers in a certain area does not depend on the absolute number of gas-containing wells to be found there; it depends rather on the numerical rate of gas-containing and gas-free wells. For example: in the areas of the settlement Kiskőrös 9 out of 1081 and in the area of the settlement Méhkerék 4 out of 11 wells give gas-containing water. Although there are more gas-containing wells in Kiskőrös, Méhkerék must be regarded as the richer area as far as gas is concerned, since there the rate of gas-containing wells is 36% and in Kiskőrös it is less than 1%.

However, final consequences must not be drawn from either the percentage rate or the relative frequency of gas-containing wells as regards general gassiness. The reliability of the percentage values (depending on the total number of wells) might be different even if the numerical values of the percentage rate are the same. The reliability of the percentage values in the case of villages where there are few wells is especially doubtful since the rate of gas-containing wells could increase if more wells were drilled. Thus, in order to prove this hypothesis, the reliability of the percentage values of gas-containing wells was checked by means of calculus of probabilities in Table 1. data from some villages with the same percentage value are shown. There one can see the limiting-values of the expectable probability in the case of 95% confidence which belong to the percentage value of gas-containing wells and the intervals, too.

Table 1.

Name of the settlement	Total no. of wells	No. of gas-containing wells	Rate of gas-containing wells %	Limiting-values of probability (95 % confidence)	Interval
Zagyvarékas	11	7	64	30—91	61
Öcsöd	38	24	64	48—80	32
Fábiánsebestyén	66	42	64	51—76	25

If we look at this table we can see that the higher the total number of wells, the less the interval of diversion, so the result is more reliable. Thus the lowest and highest limiting-values of the expectable probability belonging to the percentage values of gas-containing wells in the case of a 95% confidence in each settlement were stated. Both these data and the percentage values (see Table 2) were taken into consideration when the gassiness of each areas were evaluated on the Map 7.

So thus the categories determined on the basis of the rate of gas-containing artesian wells often changed. For example: the previously mentioned settlement Méhkerék should have to be qualified "gassy" on the basis of rate (36%) but it have to be ranked only as "little gassy" on account of the less reliability of datum since the total number of wells is only 11.

Thus, according to Map 7, which was made so, Maps 1—6 also being taken

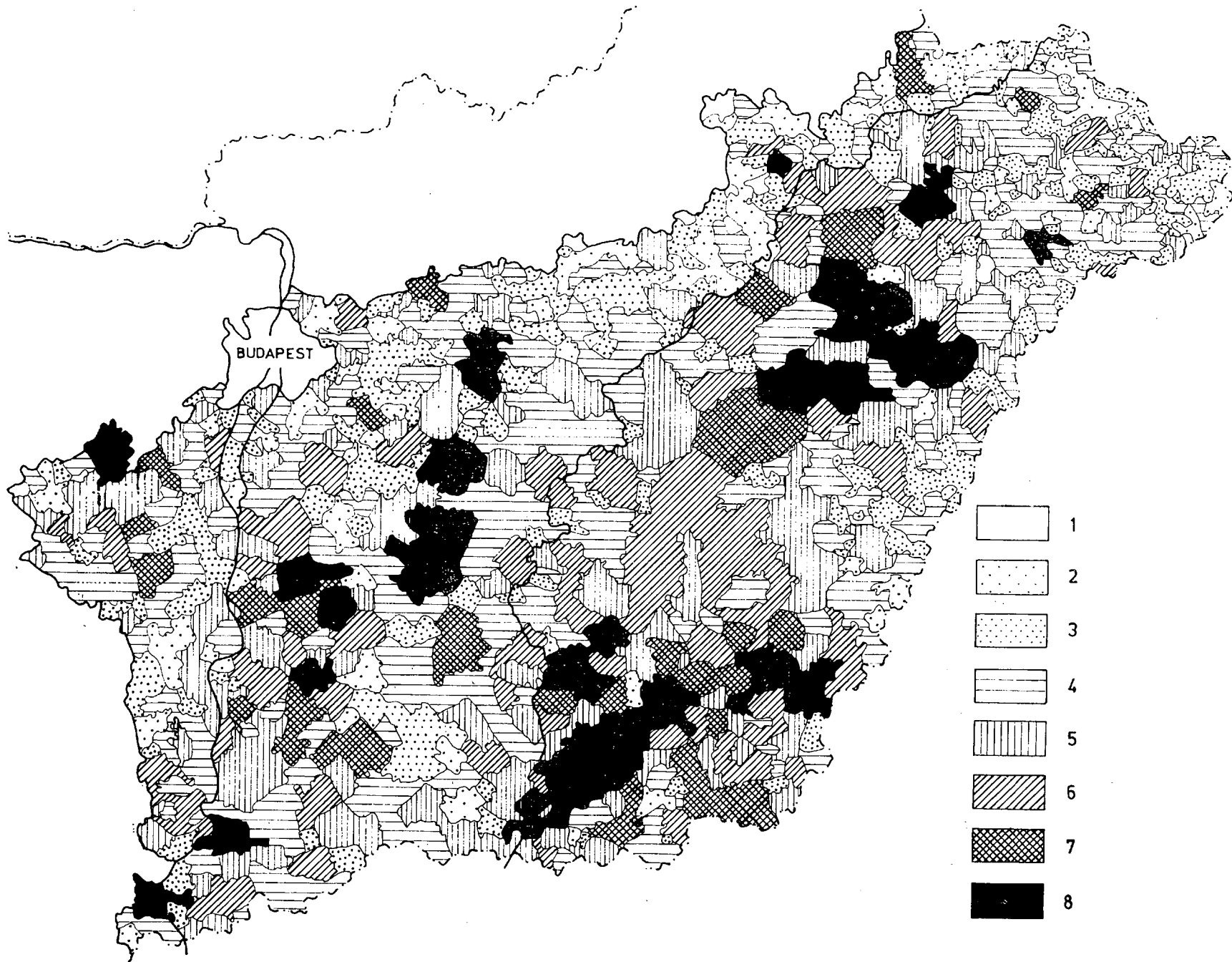


Fig. 1. Distribution of layer-water wells in administrative units in the Hungarian Plain.

- 1 = no layer-water wells
- 2 = 1-5 layer-water wells
- 3 = 6-10 layer-water wells
- 4 = 11-25 layer-water wells
- 5 = 26-50 layer-water wells
- 6 = 51-100 layer-water wells
- 7 = 101-200 layer-water wells
- 8 = 200+ layer-water wells

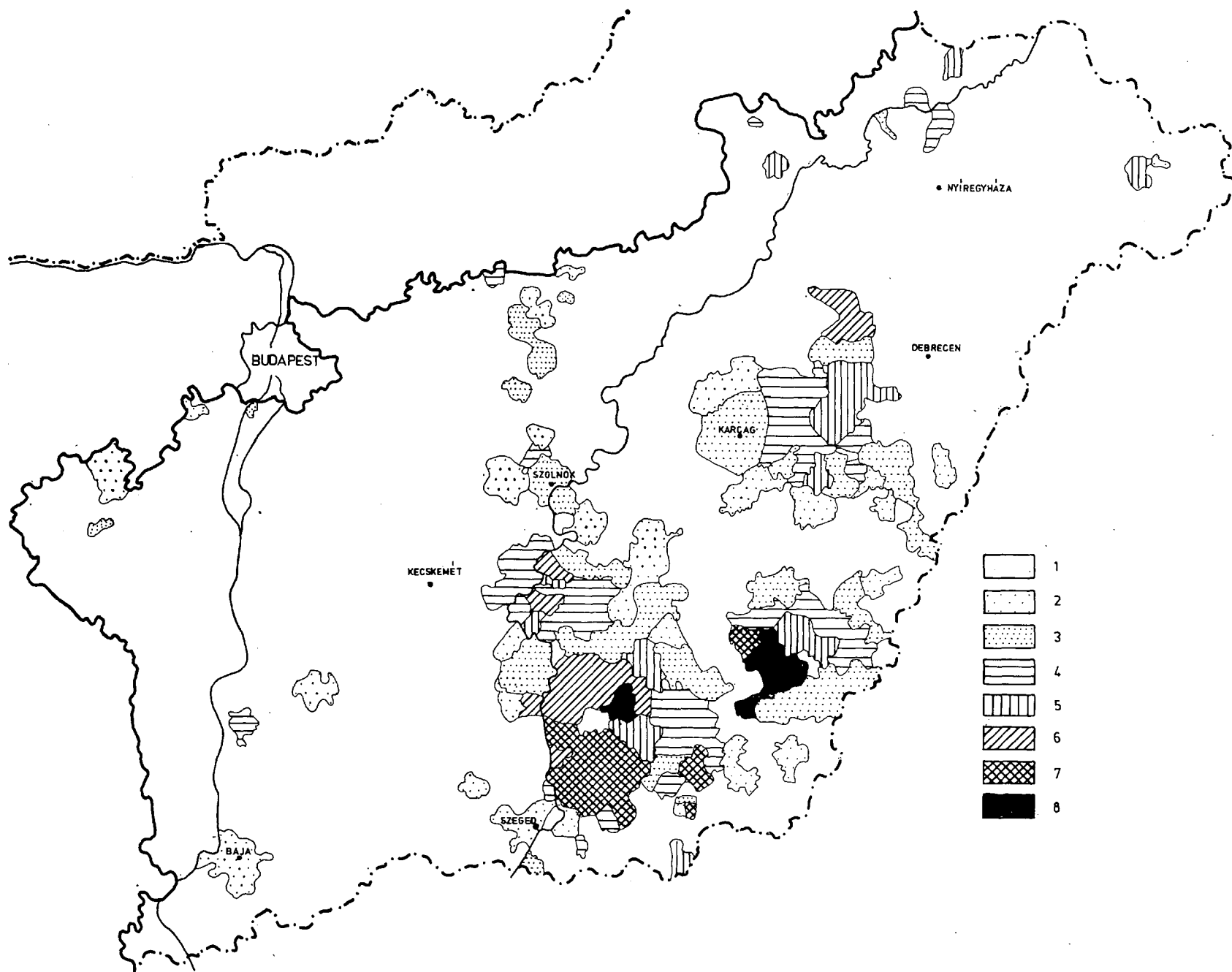


Fig. 2. Average density of the gas-containing layer-water wells in the Hungarian Plain.

- 1 = 0—0,05 well per km²
- 2 = 0,051—0,10 well per km²
- 3 = 0,11—0,20 well per km²
- 4 = 0,21—0,30 well per km²
- 5 = 0,31—0,50 well per km²
- 6 = 0,51—0,70 well per km²
- 7 = 0,71—1,00 well per km²
- 8 = 1 < wells per km²

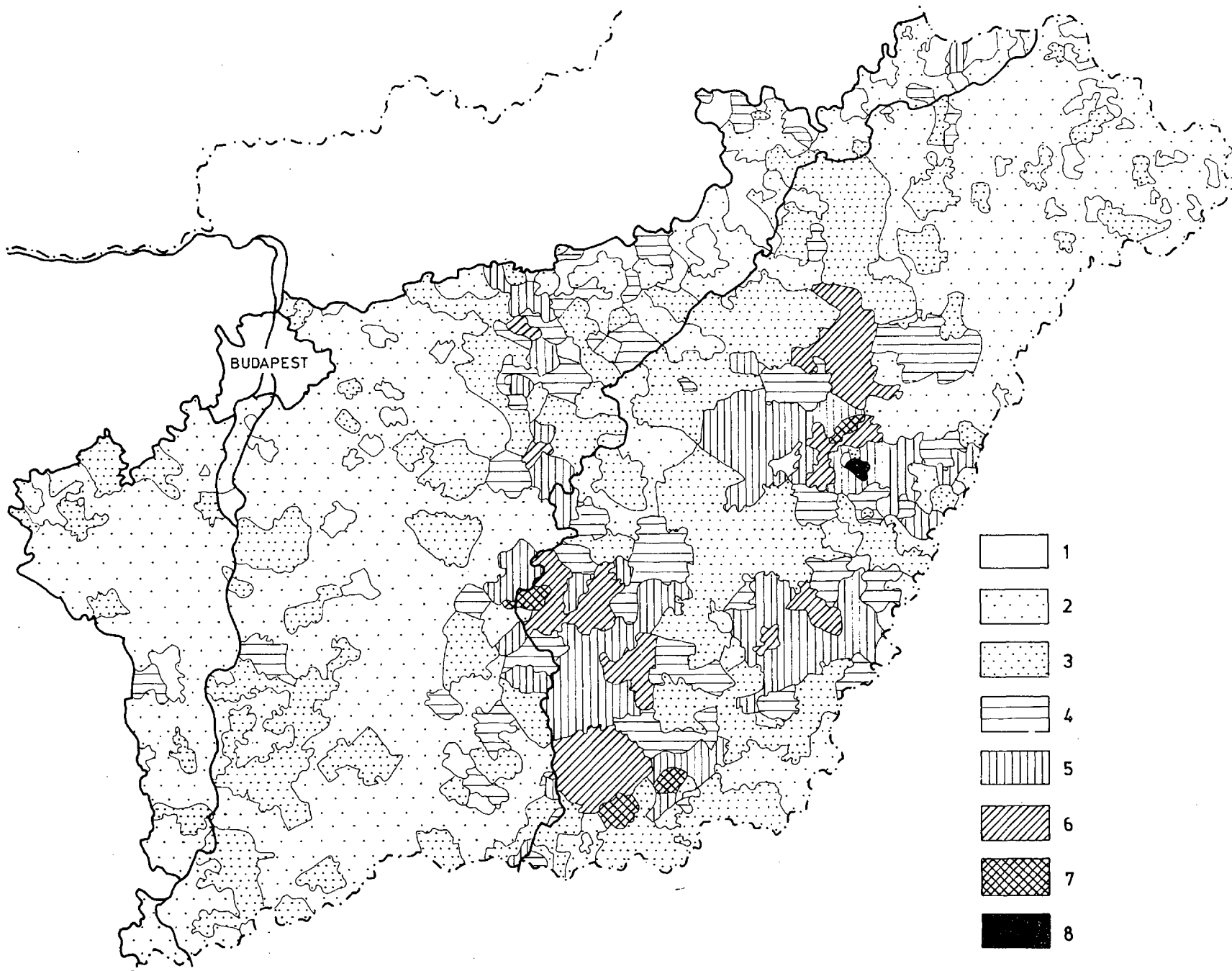


Fig. 3. Proportion of the gas-containing layer-water wells in the Hungarian Plain
 1 = uncategorizable (less than five wells)
 2 = proportion of gas-containing wells is 0%
 3 = 1—10%, 4 = 11—25%, 5 = 26—50%,
 6 = 51—75%, 7 = 76—90%, 8 = 91—100%

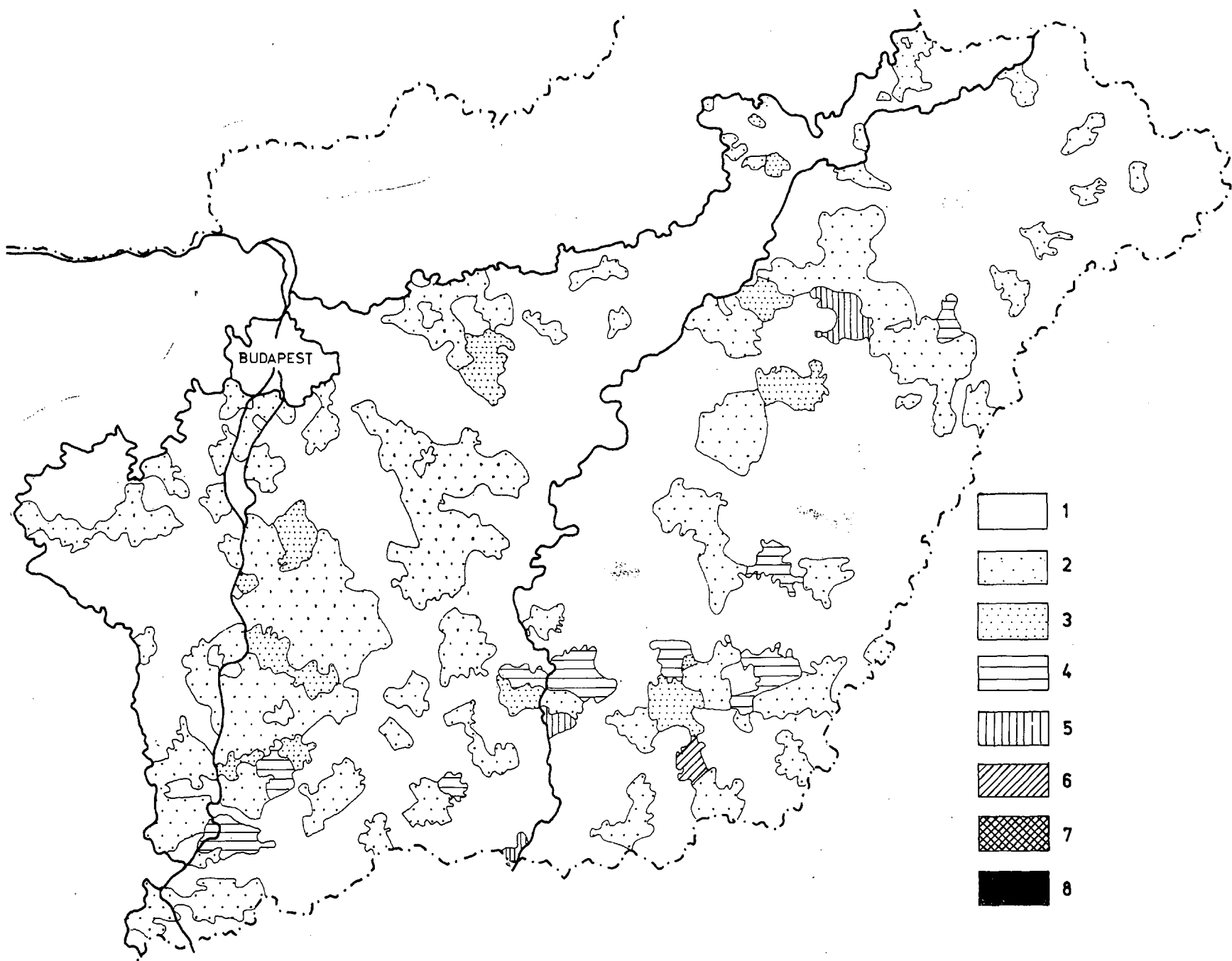


Fig. 4. Proportion of the gas-containing layer-water wells at a depth of 0—30 m in the Hungarian Plain

1 = uncategorizable (less than five wells)

2 = proportion of gas-containing wells is 0%

3 = 1—10%, 4 = 11—25%, 5 = 26—50%, 6 = 51—75%, 7 = 76—90%, 8 = 91—100%.

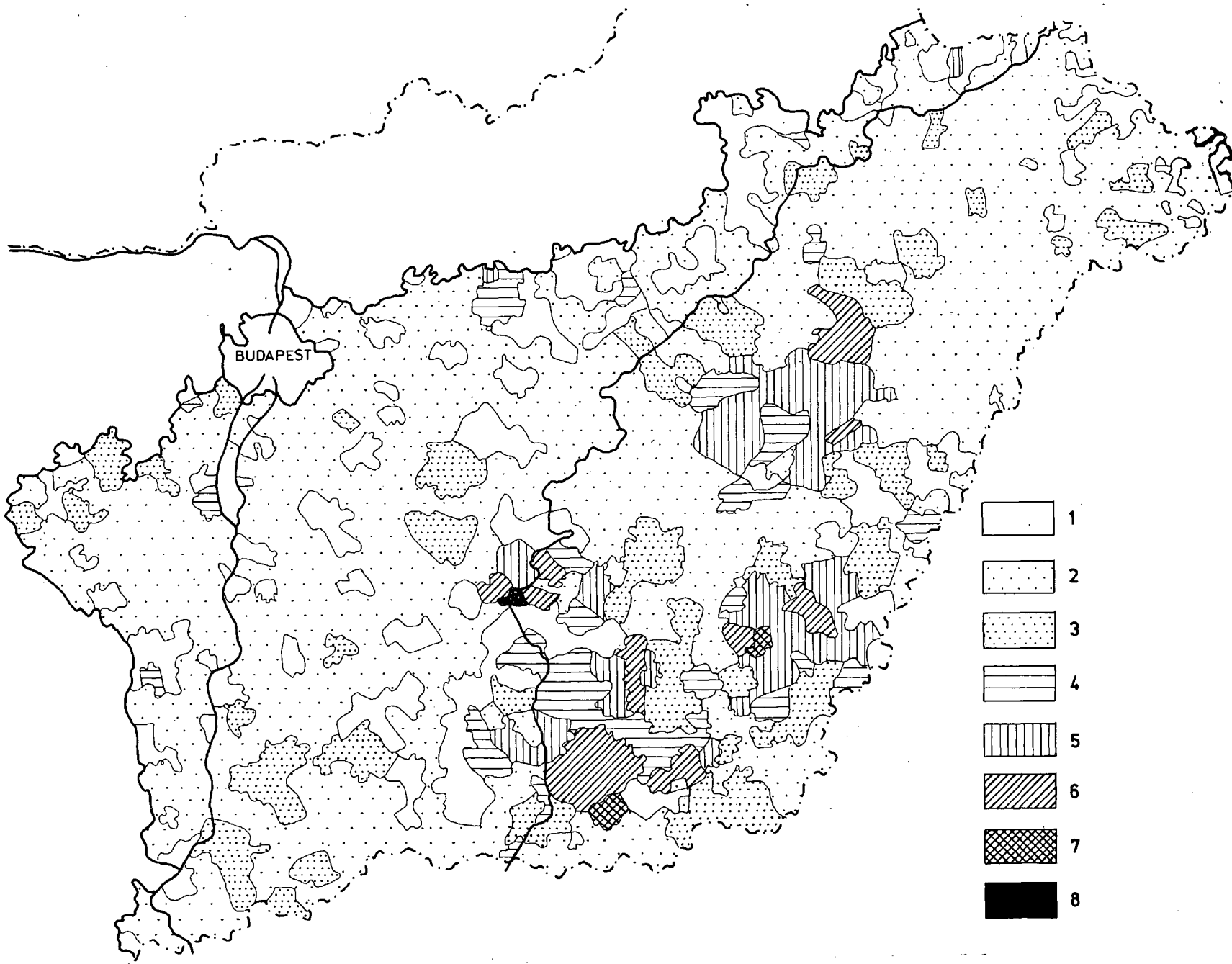


Fig. 5. Proportion of the gas-containing layer-water wells at a depth of 30–200 m in the Hungarian Plain

1 = uncategorizable (less than five wells),

2 = proportion of gas-containing wells is 0%,

3 = 1–10%, 4 = 11–25%, 5 = 26–50%, 6 = 51–75%, 7 = 76–90%, 8 = 91–100%.

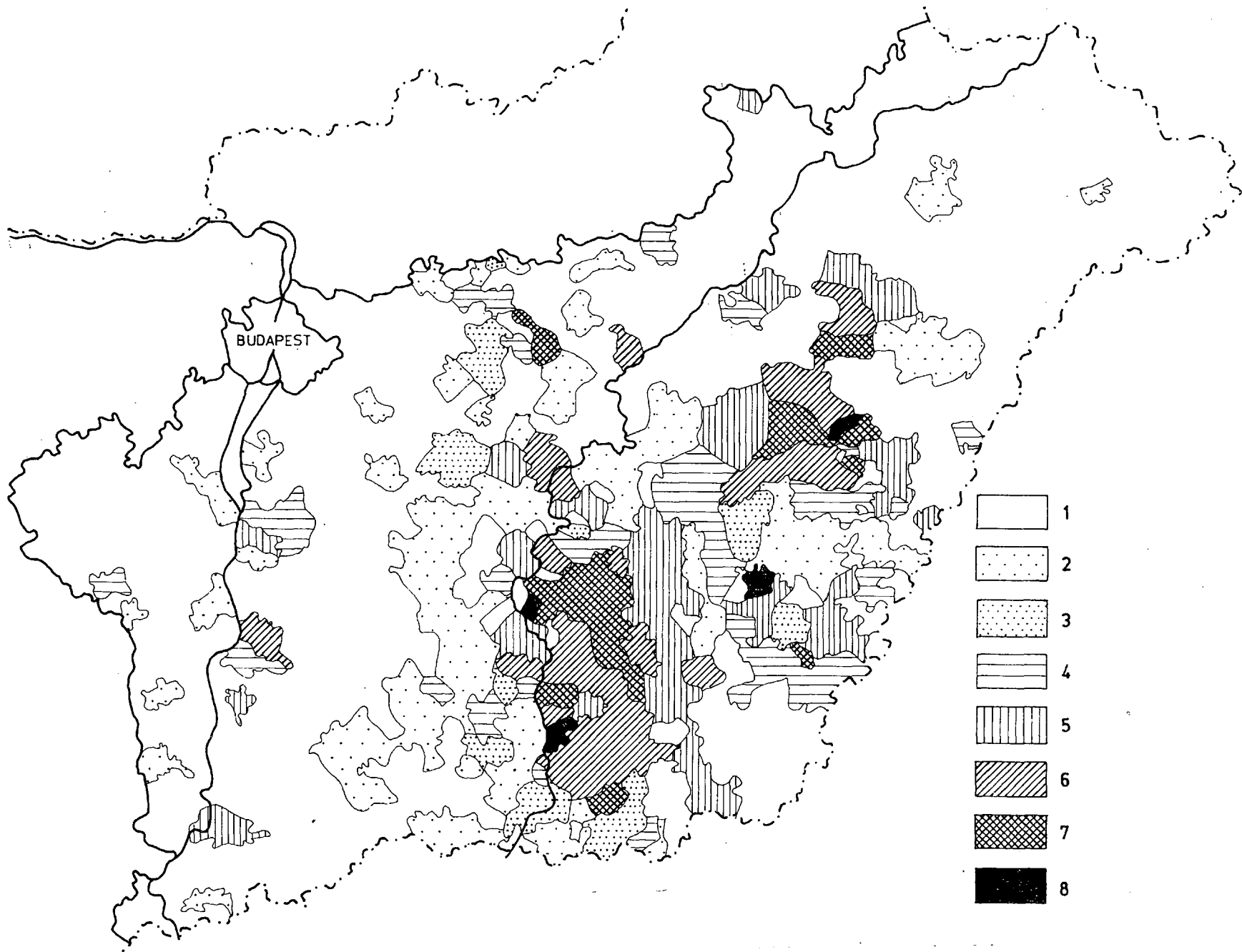


Fig. 6. Proportion of the gas-containing layer-water wells at a depth of 200—500 m in the Hungarian Plain
 1 = uncategorizable (less than five wells),
 2 = proportion of gas-containing wells is 0%,
 3 = 1—10% 4 = 11—25%, 5 = 26—50%, 6 = 51—75%, 7 = 76—90%, 8 = 91—100%.

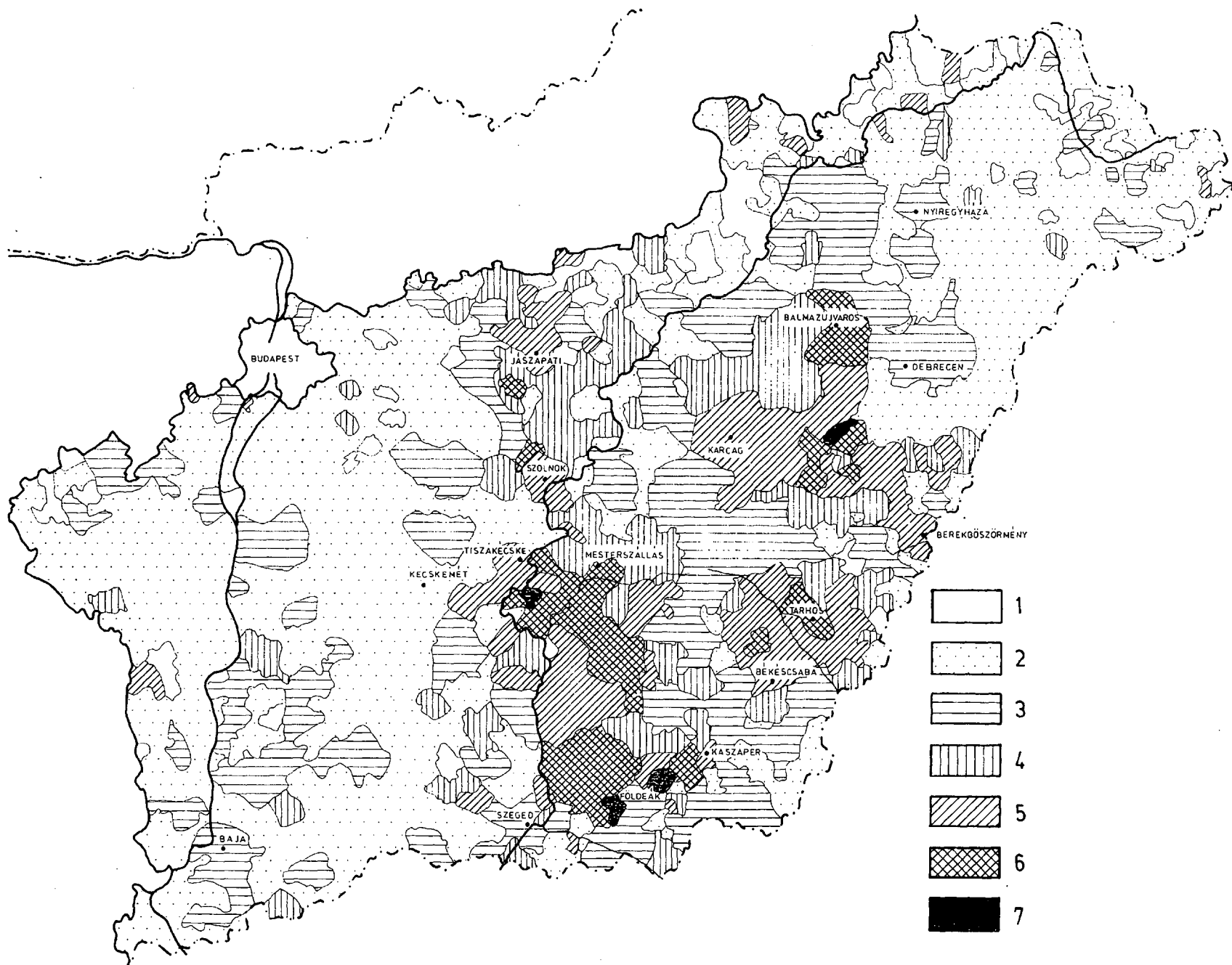


Fig. 7. Regional system of the gas-containing layer-waters in the Hungarian Plain

1 = uncategorizable (less than five wells)

2 = gas-free area

3 = hardly gassy area

4 = little gassy area

5 = gassy area

6 = very gassy area

7 = extremely gassy area

Table 2.

Rate of gas-containing artesian wells %	Estimation
0	gas-free areas
1—10	hardly gassy areas
11—25	little gassy areas
26—50	gassy areas
51—75	very gassy areas
76 <	extremely gassy areas

into consideration, conclusions as regards the regional system of gas-containing layer-water wells in the Hungarian Plain can be drawn.

The less gassy areas are the sand ridge of the Danube—Tisza Midregion and the areas situated west of the Danube, furthermore the north-eastern part of the Hungarian Plain where the water of artesian wells are generally gas-free (0%) or only hardly gassy (1—10%).

Layer-waters most rich gas can be found in the middle of the Tiszántúl* area, in the western part of south Tiszántúl and in the north-eastern part of the south Tiszántúl area.

1. The largest gassy contiguous area is the western part of the south Tiszántúl area, i.e. the area bordered by the following settlements: Cibakháza, Szarvas, Gádoros, Nagymágocs, Hódmezővásárhely, Kaszaper, Óföldségek and Szeged. Within this area there are very gassy areas such as Cibakháza—Mesterszállás—Árpádhalom—Tiszaug; Hódmezővásárhely—Óföldségek—Mártély and Tótkomlós. The areas of Tiszakürt, Földségek and Nagykopáncs are extremely gassy.

2. One gassy area is that bordered by the settlements called Kőröstarcsa—Okány—Sarkad—Békéscsaba in the “Békés sagging” in the north-eastern part of the south Tiszántúl area. Within this, very gassy areas are Bélmegyer—Tarhos and Murony.

3. In the middle of the Tiszántúl area the centre bordered by Balmazújváros—Földes—Eszlár—Berekböszörmény—Karcag is gassy. Within this, the areas of Balmazújváros—Nagyhegyes; Báránd—Földes—Biharnagybajom and Bihartorda are very gassy. Area of Tetétlen is extremely gassy.

Apart from these three big contiguous areas there are some smaller gassy centres: west of the Tisza, such as Jászapáti—Nagyfüged is gassy, Alattyán is very gassy in the north. In the middle part: Szolnok—Szandaszőlős is gassy. The very gassy area of Zagyvarékas belongs to it. The areas of Bordány—Zsombó in the south are gassy, too.

If Map 7 is compared with the map showing hydro-dynamics, the pressure conditions of the layer-waters by hydrogeological profiles in the Hungarian Basin and the hydrodynamic gradient map of the Hungarian Basin, the following obvious coincidences and important connections can be observed:

a) Areas which have a decreasing potential the deeper we go, i.e. areas with a negative vertical hydrodynamic gradient — sandy areas like Nyírség and in the

* The Tiszántúl is the part of the Hungarian Plain, situated east of river Tisza.

area between the Danube and the Tisza — are not gassy; only a few little patches are designated as “hardly gassy” or “little gassy”.

b) In areas which have an increasing potential the deeper we go, i.e. areas with a positive vertical hydrodynamic gradient, layer-waters contain gas and all the “extremely and very gassy” areas, as well as the “gassy” areas can be found here.

These observations might raise new points of view, thus the problem of the origin of the gases might be solved in the near future.

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