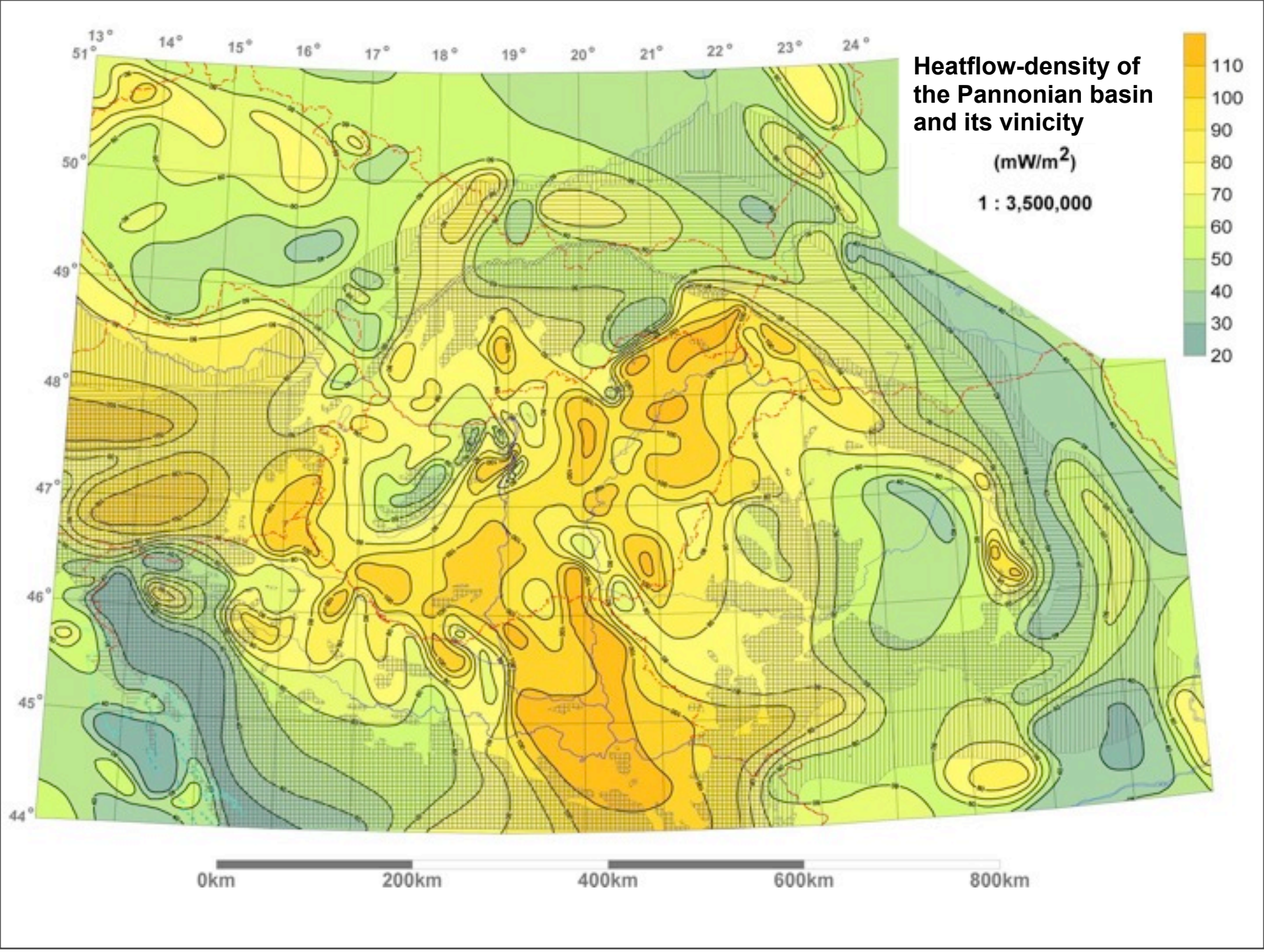
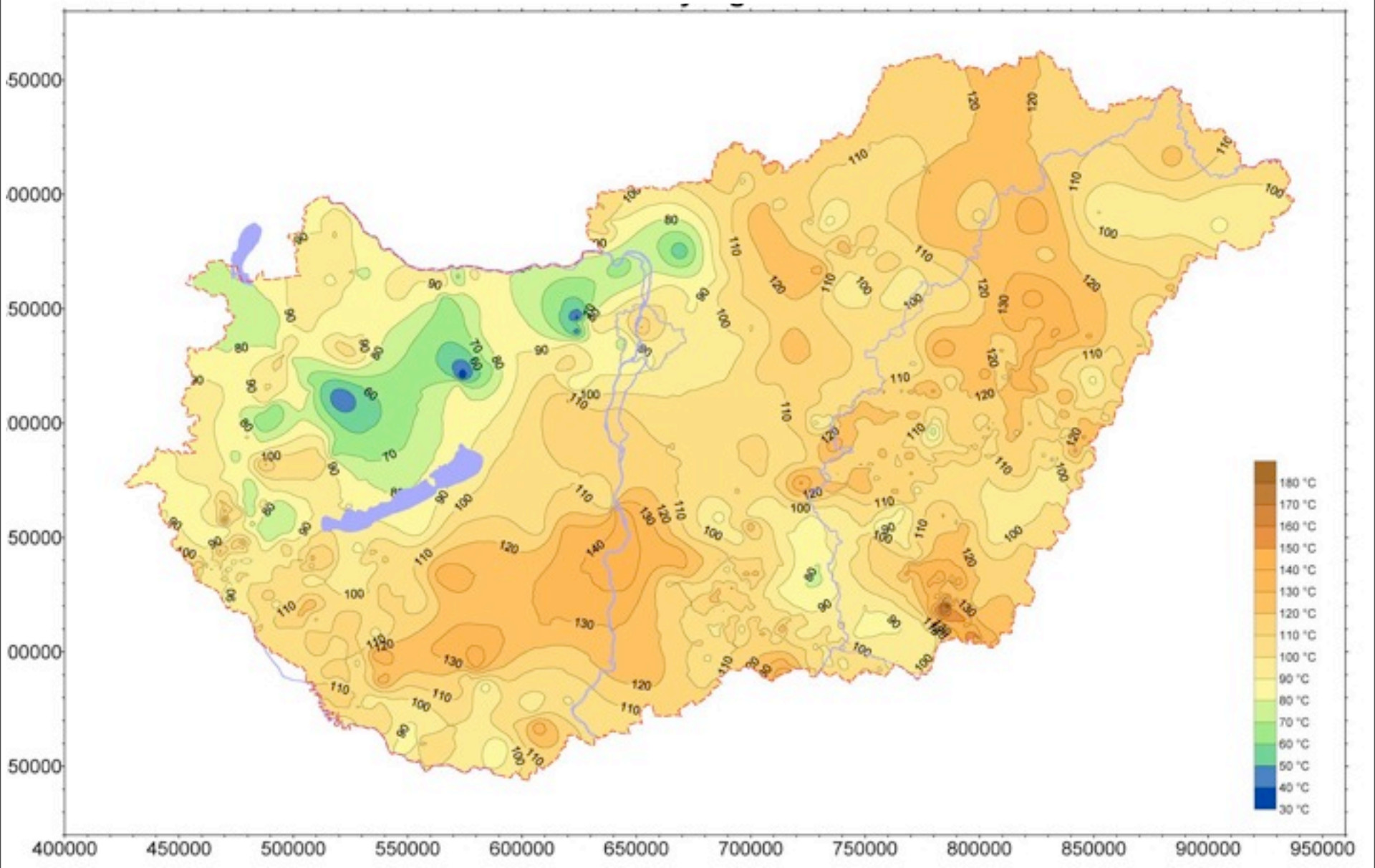
The present state and development perspectives of thermal water and geothermal energy utilization in Hungary

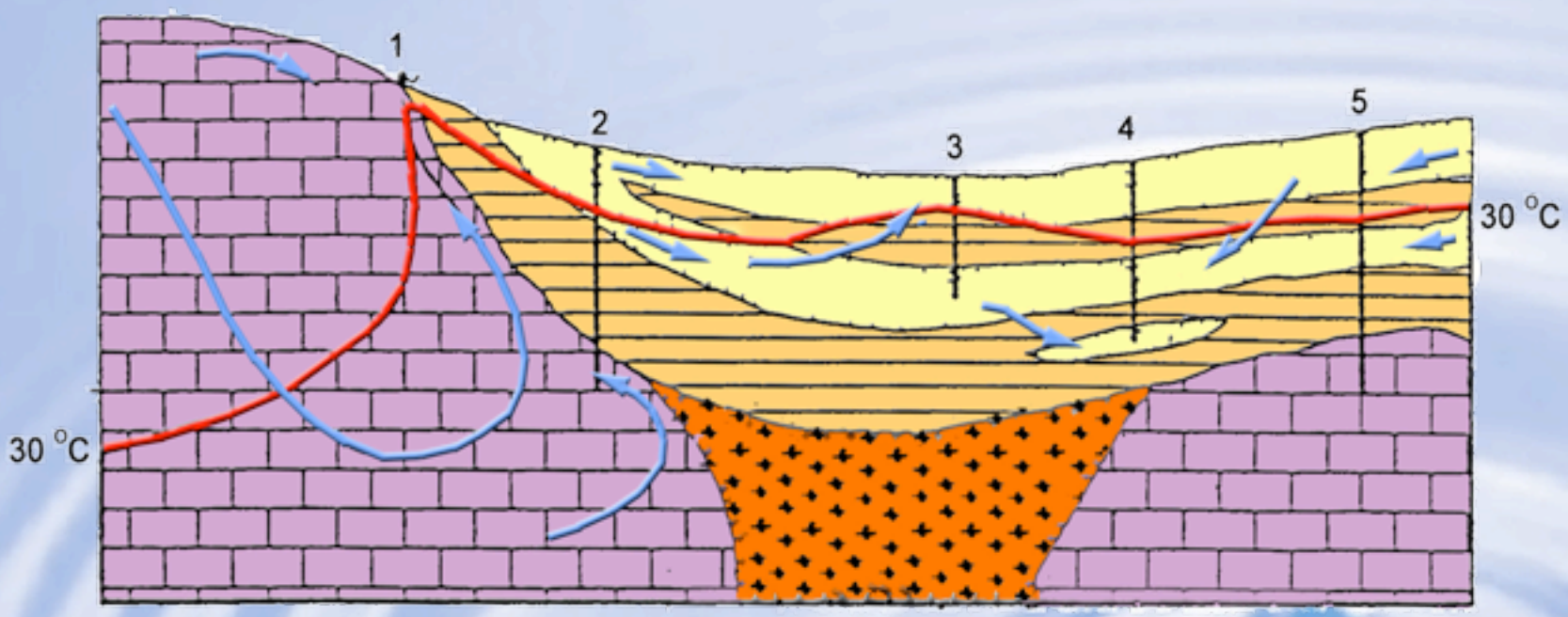
Pál, Liebe
Dr. Árpád, Lorberer
János, Maginecz


Heatflow-density of the Pannonian basin and its vinicity
(mW/m2)
1 : 3,500,000
110
100
90
80
70
60
50
40
30
20
13°
14°
15°
16°
17°
18°
19°
20°
21°
22°
23°
24°
51°
50°
49°
48°
47°
46°
45°
44°
0km
200km
400km
600km
800km

Temperature in the depth of -2000 m below sea-level



Main types of thermal water aquifers

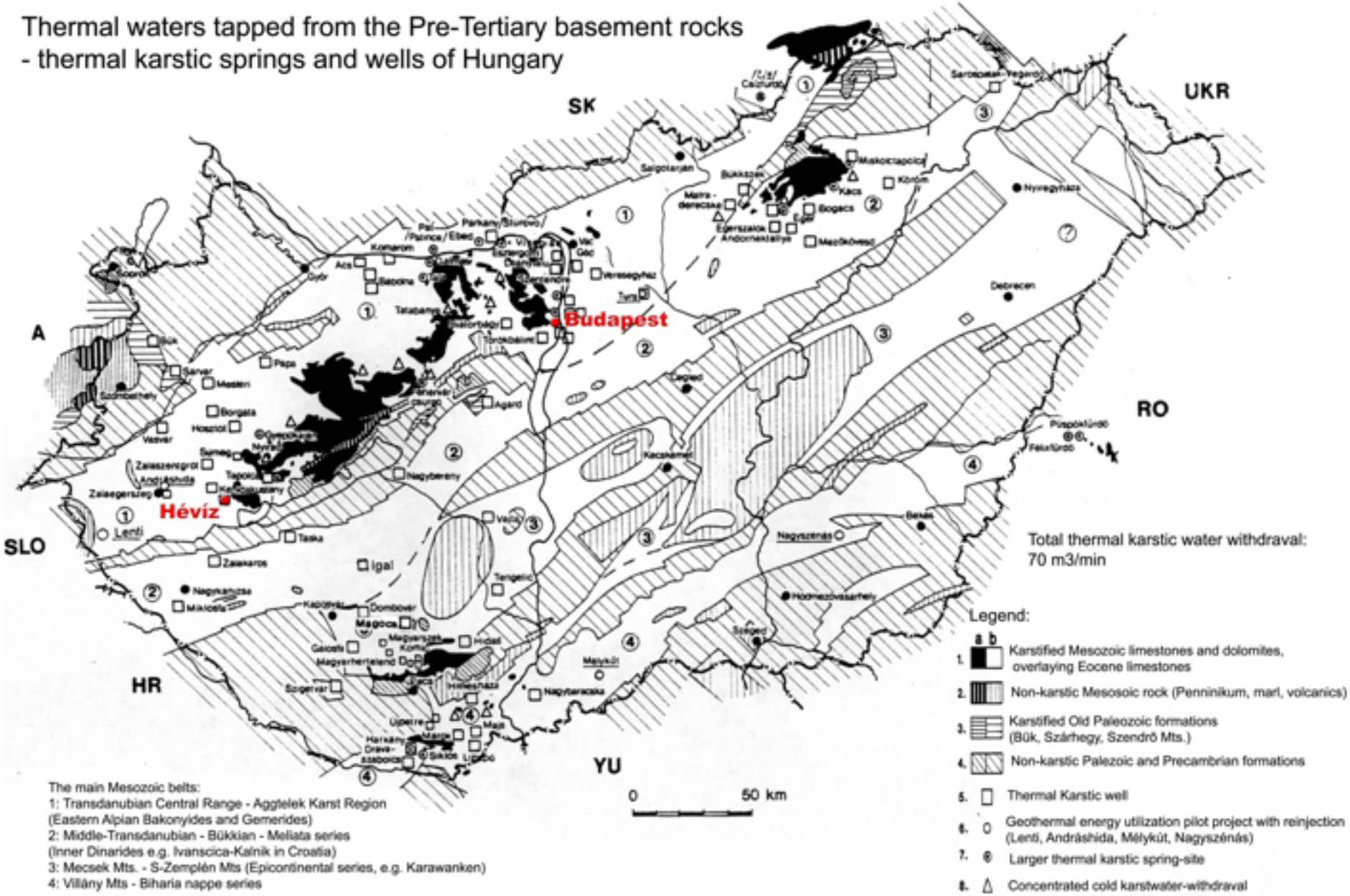


Karstic rock (aquifer)
Clay, clayed marl, silty formations (aquiclude, aquitard)
Volcanic formation (not aquifer, aquiclude)
Sand, sandstone (aquifer)

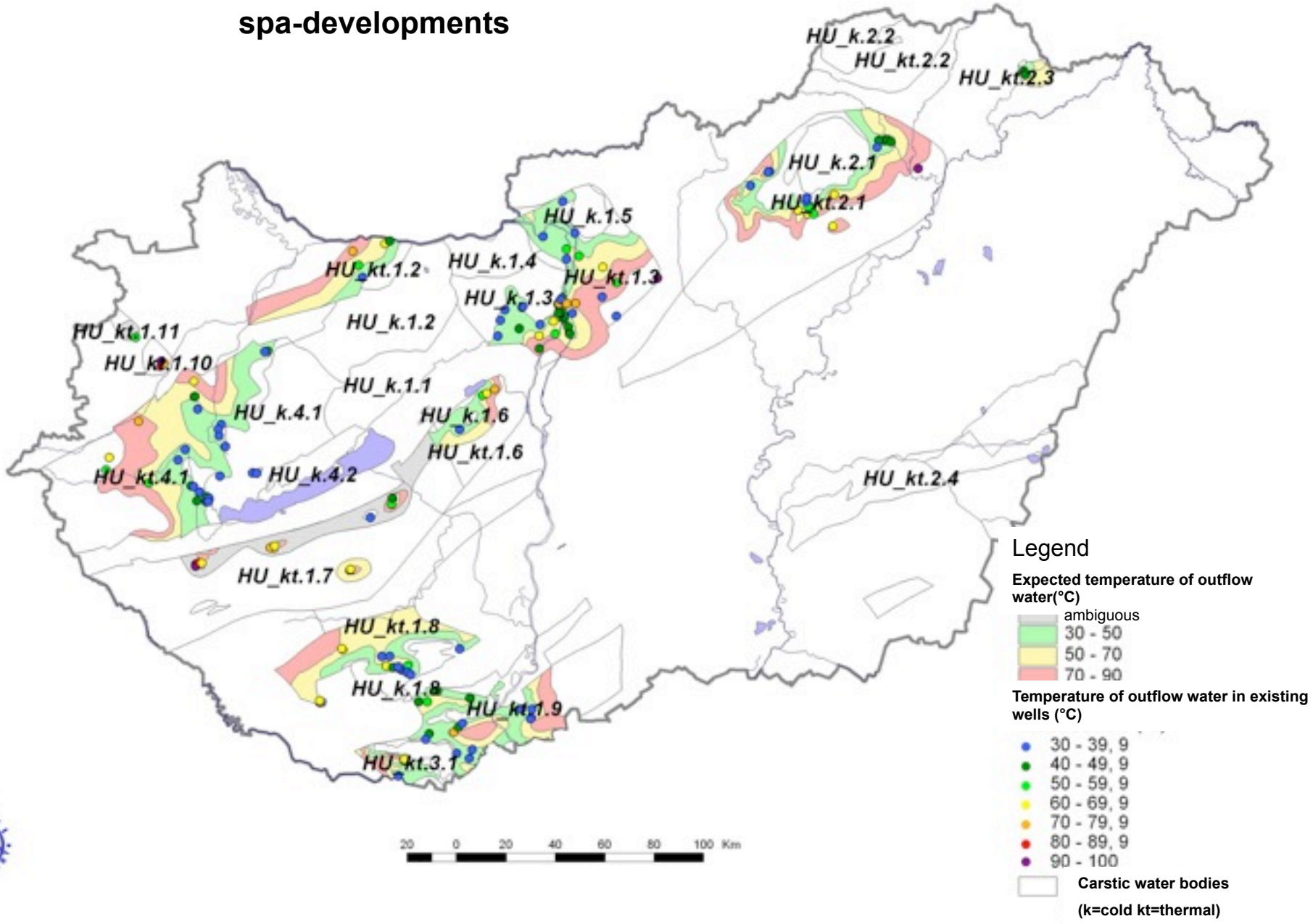
Range yielding water warmer than 30 °C
Flow direction

1. Karstic thermal spring
2. Well, taping the fissured geothermal reservoir being in connection with open cool karstic system
3. Well, taping the porous geothermal reservoir, being in hydraulic connection with the shallow layers containing cool water
4. Well, tapping confined porous layer without recharge
5. Well, tapping confined karstic formation without recharge

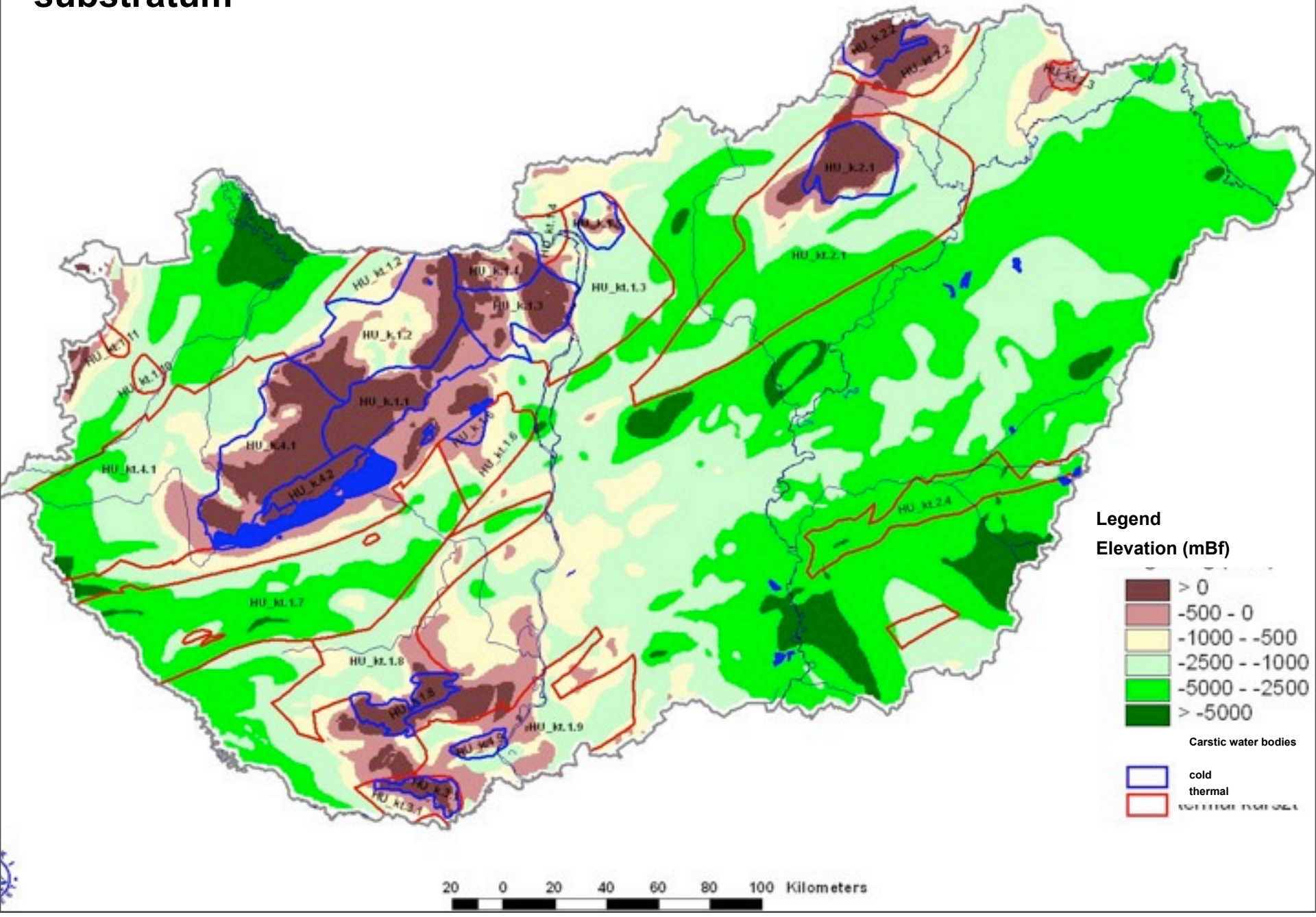
Thermal waters tapped from the Pre-Tertiary basement rocks - thermal karstic springs and wells of Hungary



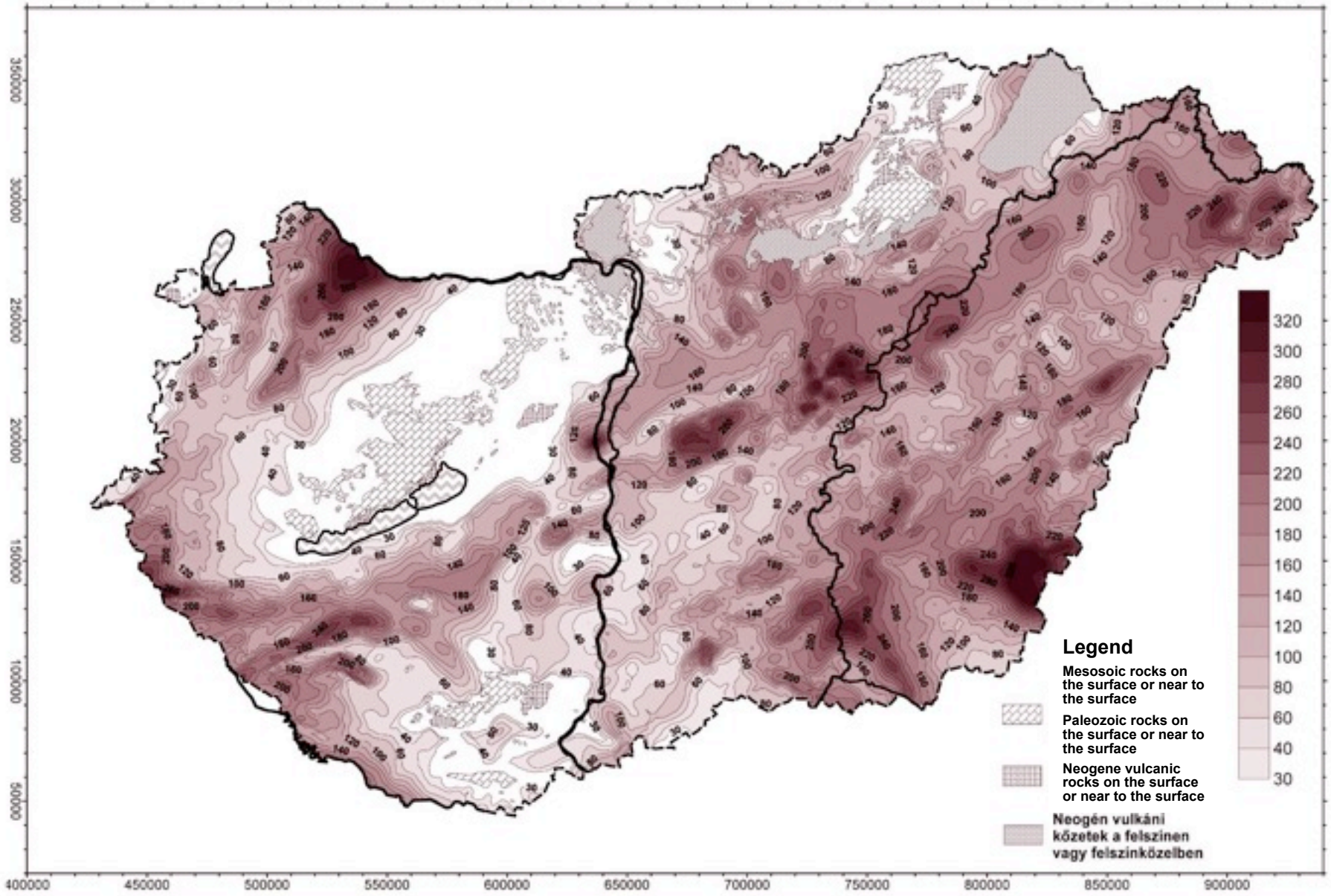
Thermal-carst areas with possibilities for spa-developments



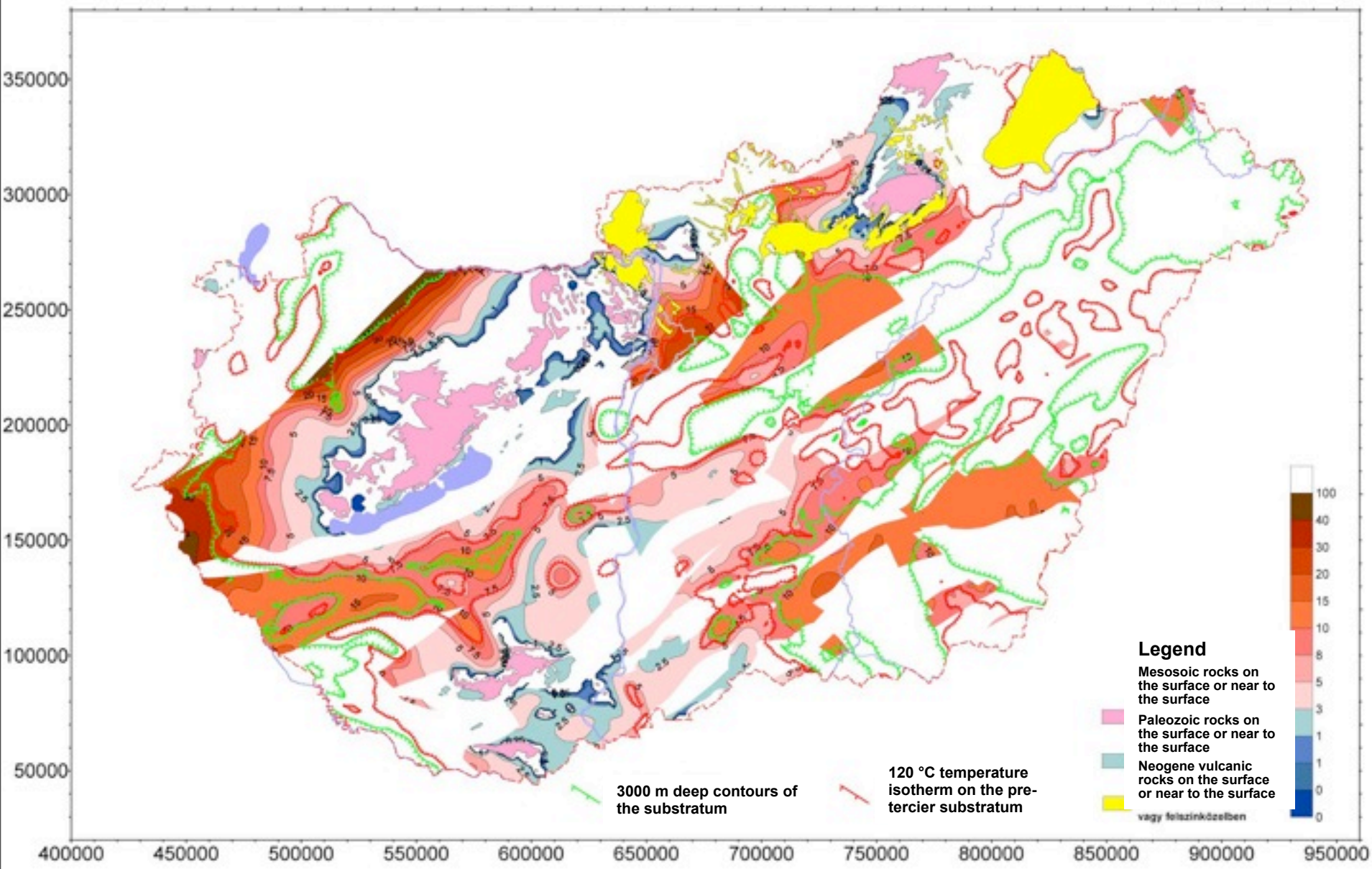
Depth the top of mesosoic-paleosoic substratum



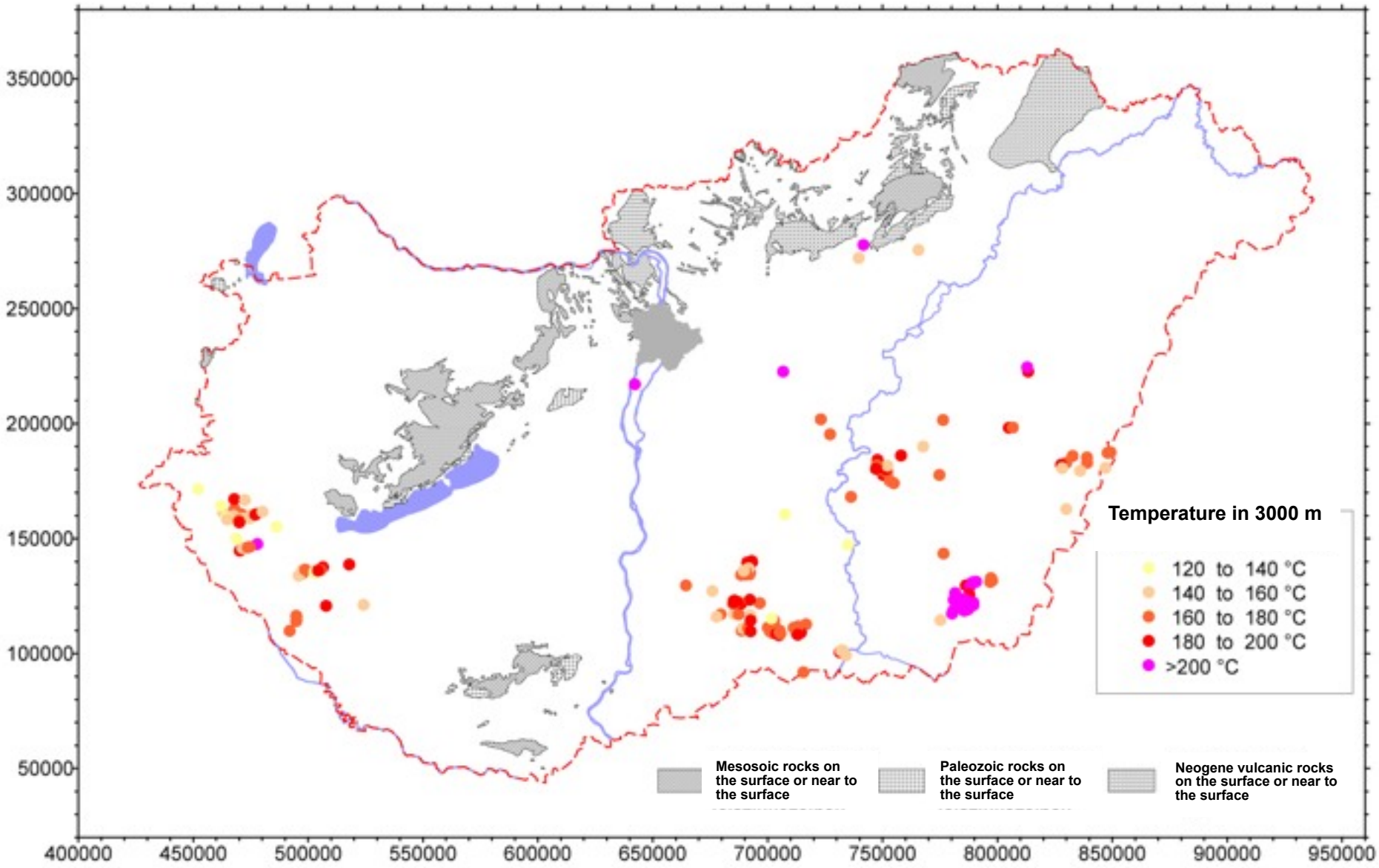
Surface temperature of substratum (°C)

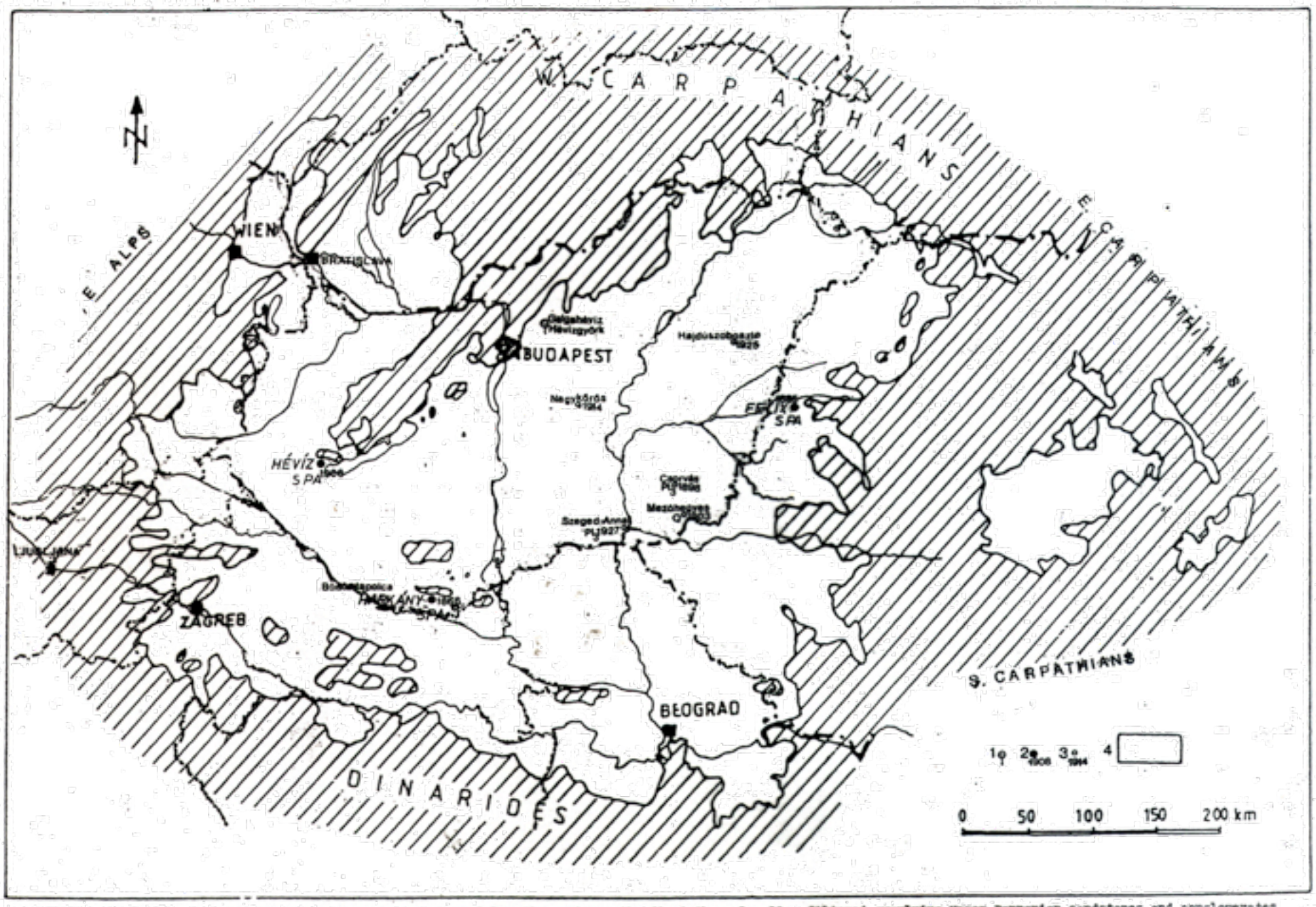


Geothermic energy density map of mezosoic substratum (GJm^{-2})



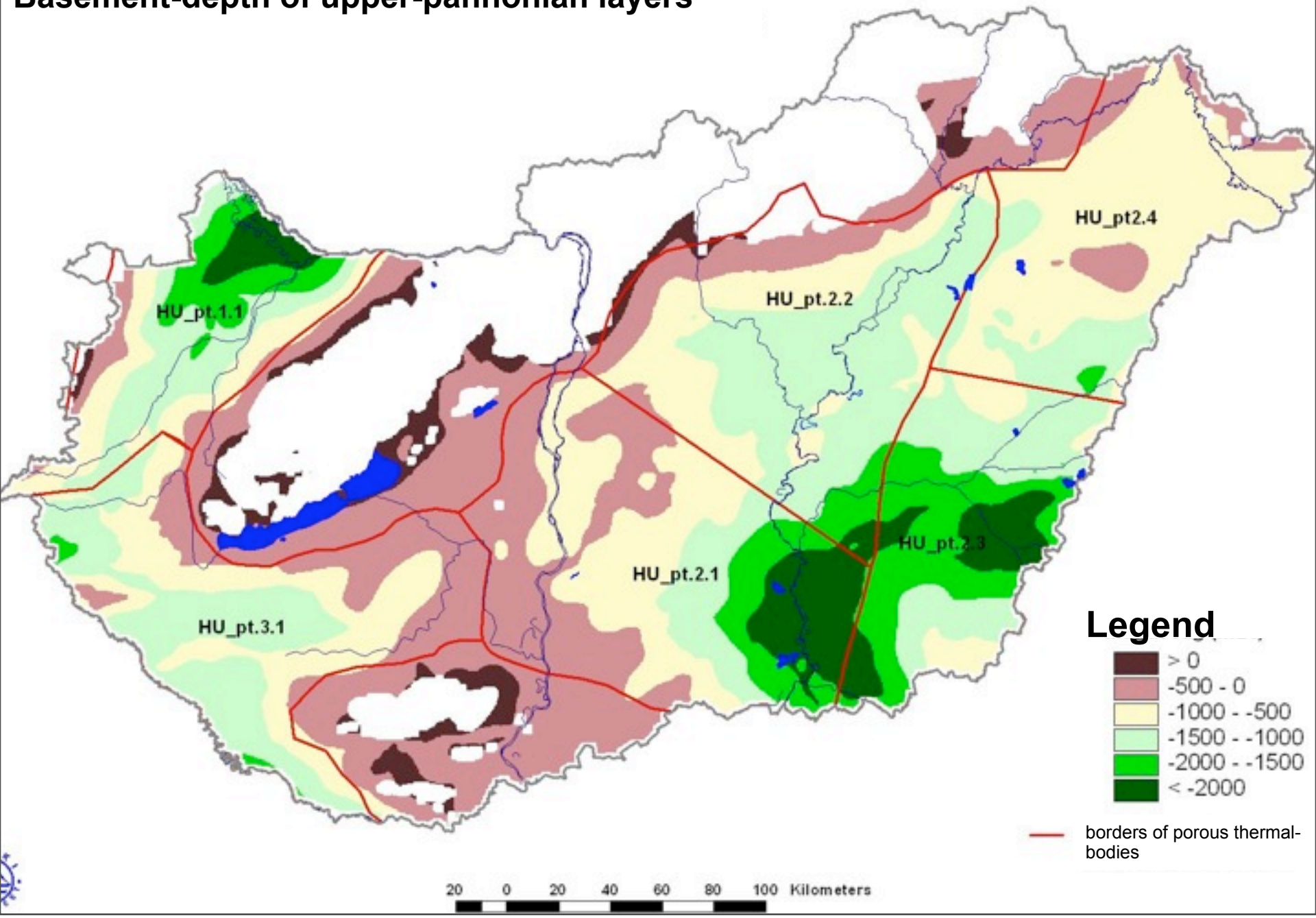
Less than 3000 m deep oil-exploratory drillings in mezosoic rocks where the temperature is higher than 120 °C





1: Luke warm springs from Upper Pannonian aquifers 2; Thermal karstic springs, the first thermal wells, filtered overlying Upper Pannonian sandstones and conglomerates
3: The first thermal water wells tapped Upper Pannonian, Upper Pliocene and Lower Pleistocene aquifers 4. Pannonian s. l. formations in the Carpathian basins /JUHÁSZ,GY.1992

Basement-depth of upper-pannonian layers



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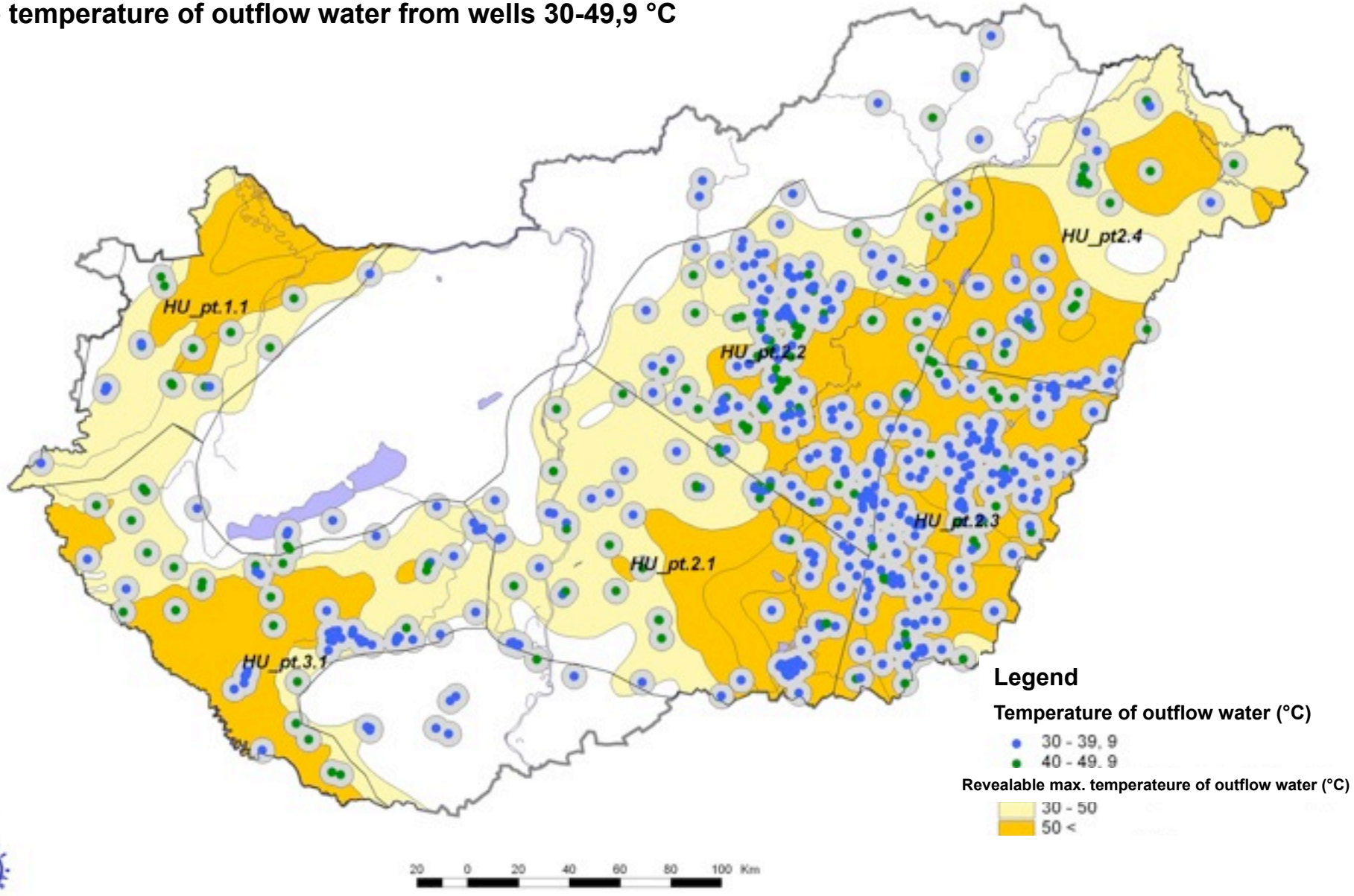
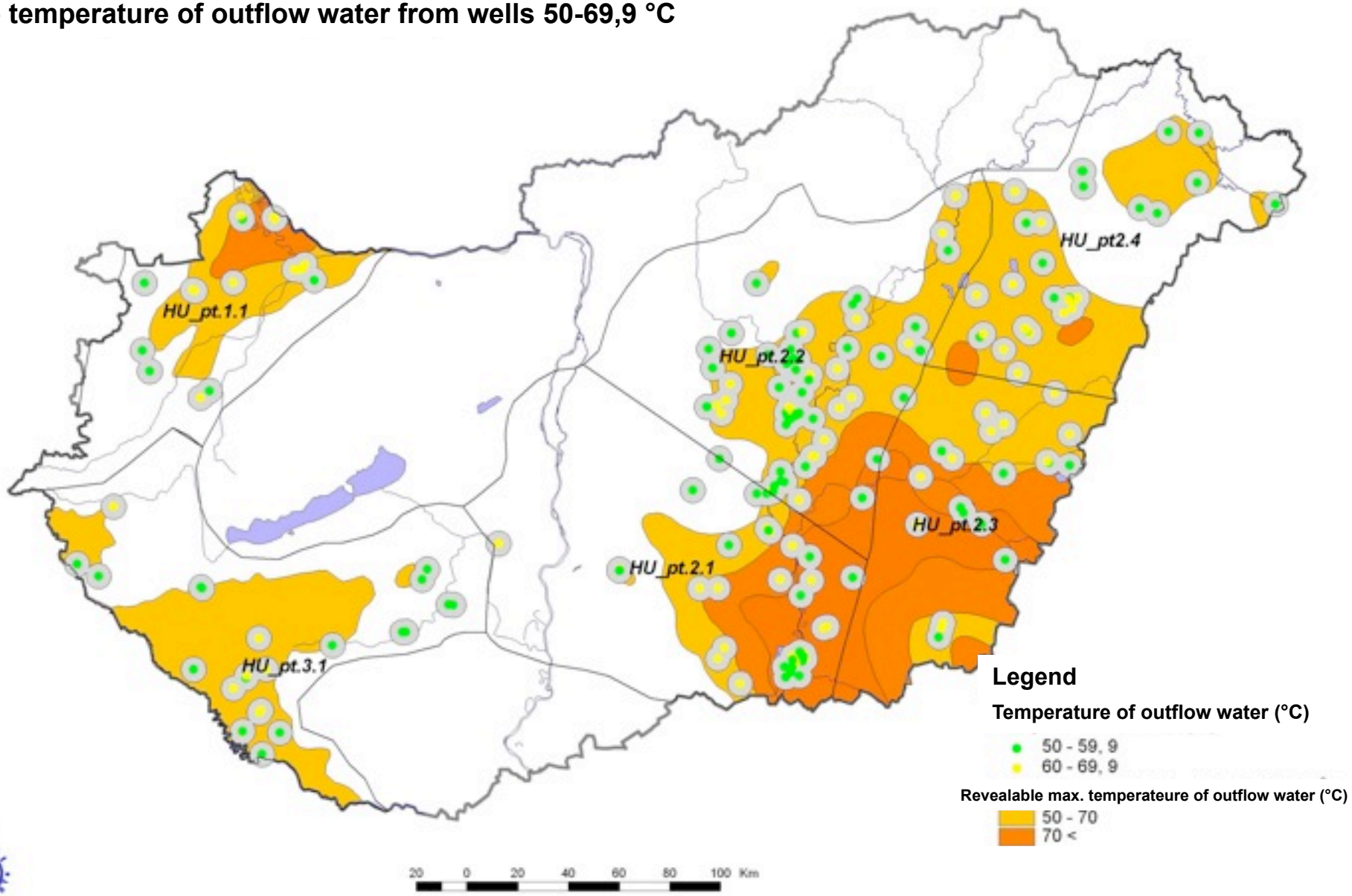
Porous water-bodies temperature

The temperature of outflow water from wells 30-49,9 °C



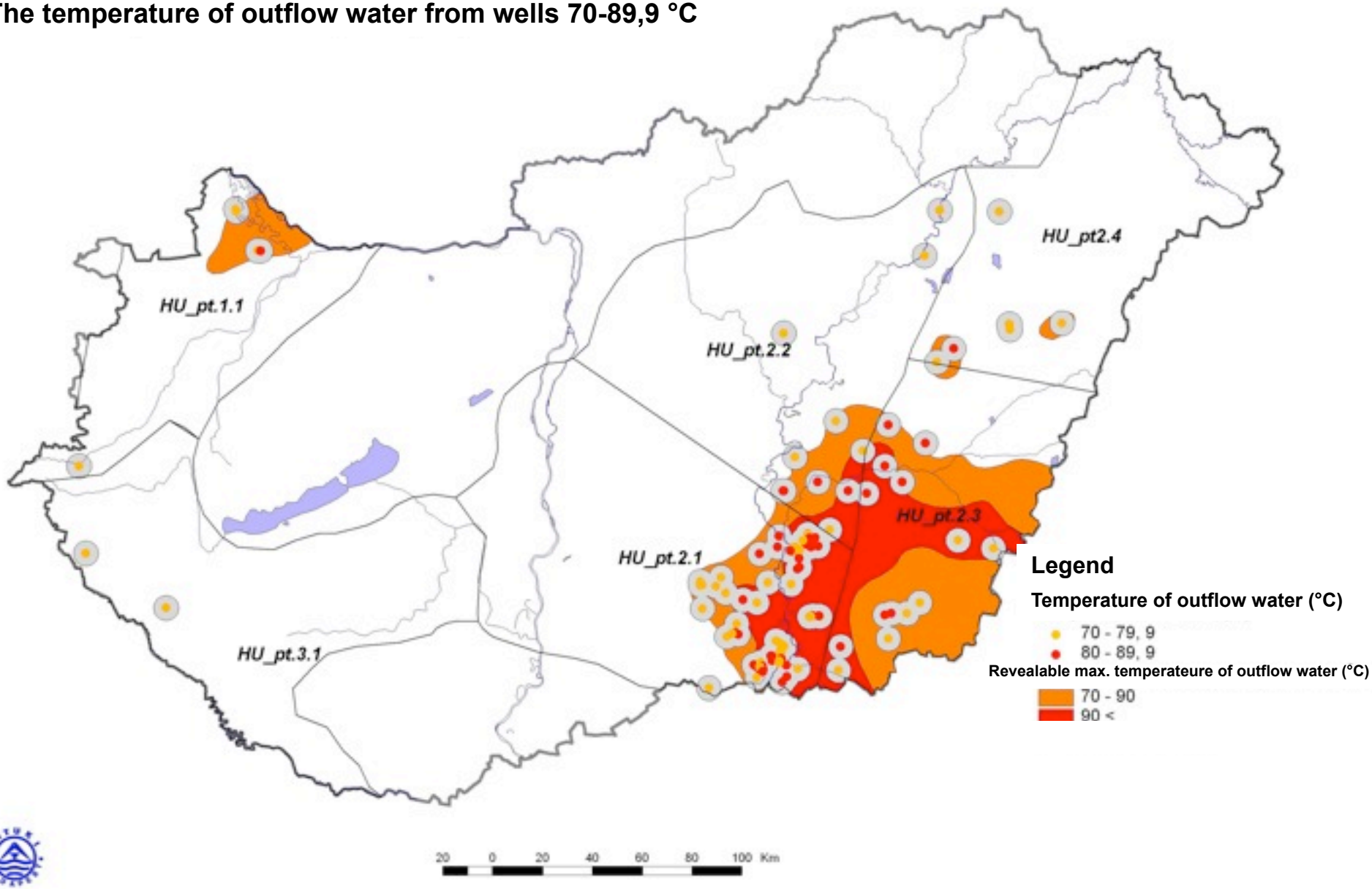
Porous water-bodies temperature

The temperature of outflow water from wells 50-69,9 °C



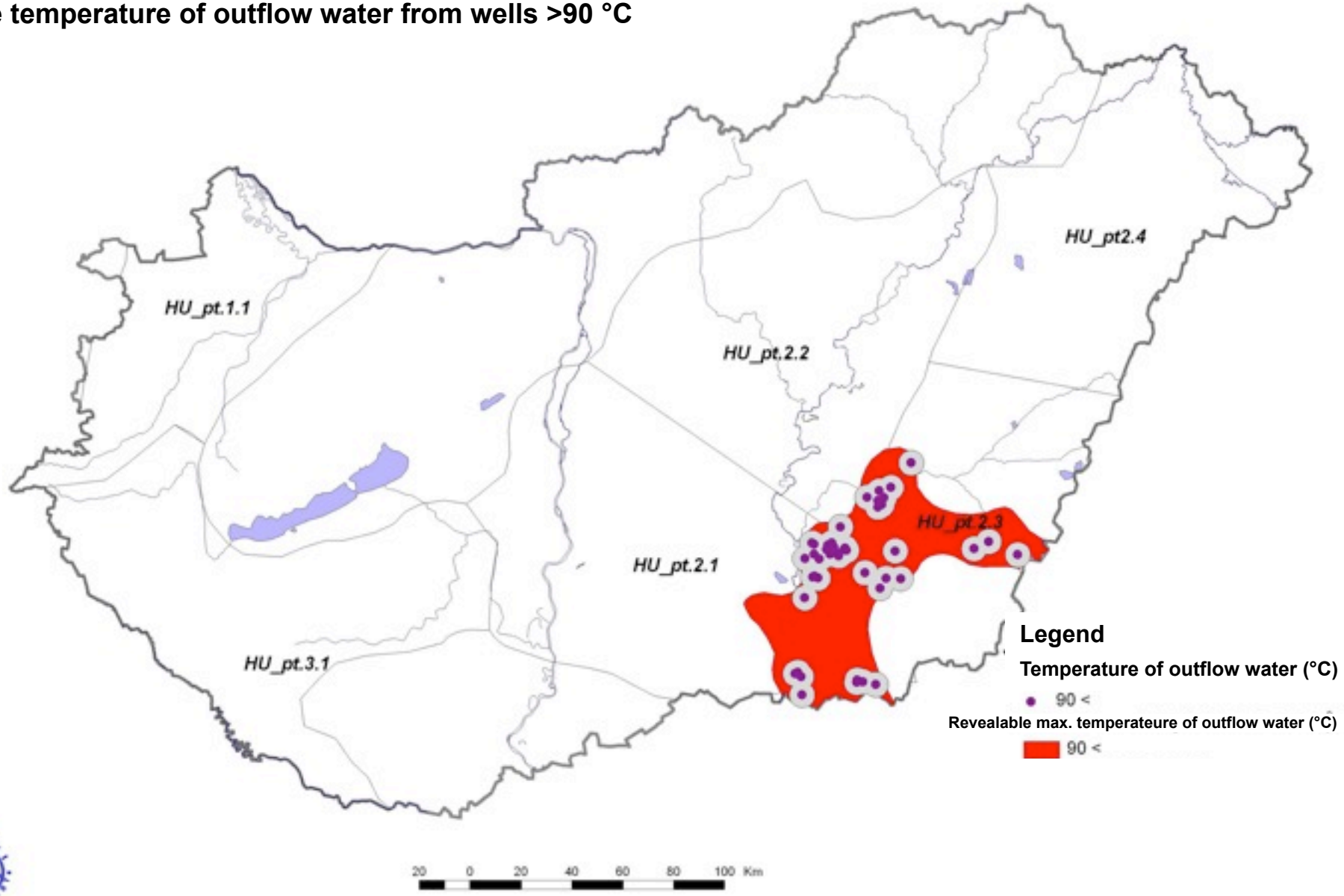
Porous water-bodies temperature

The temperature of outflow water from wells 70-89,9 °C

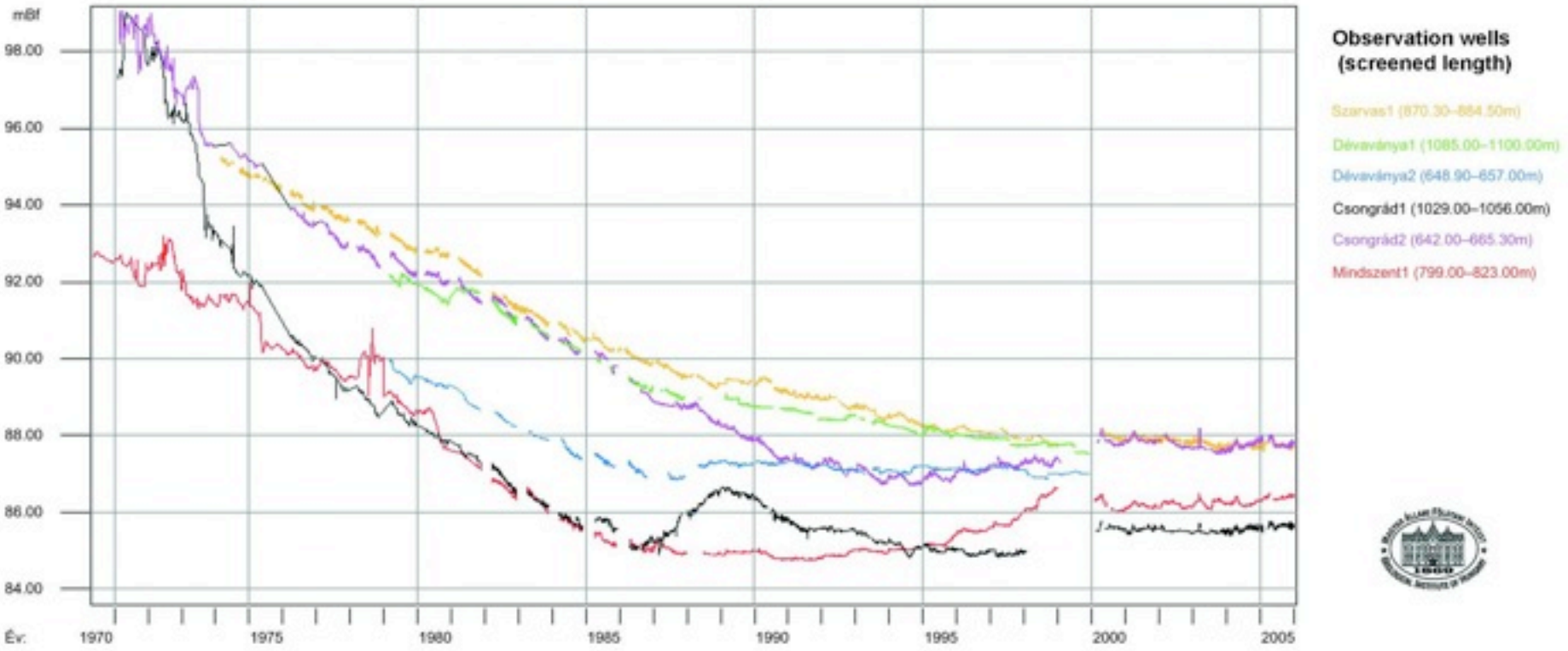


Porous water-bodies temperature

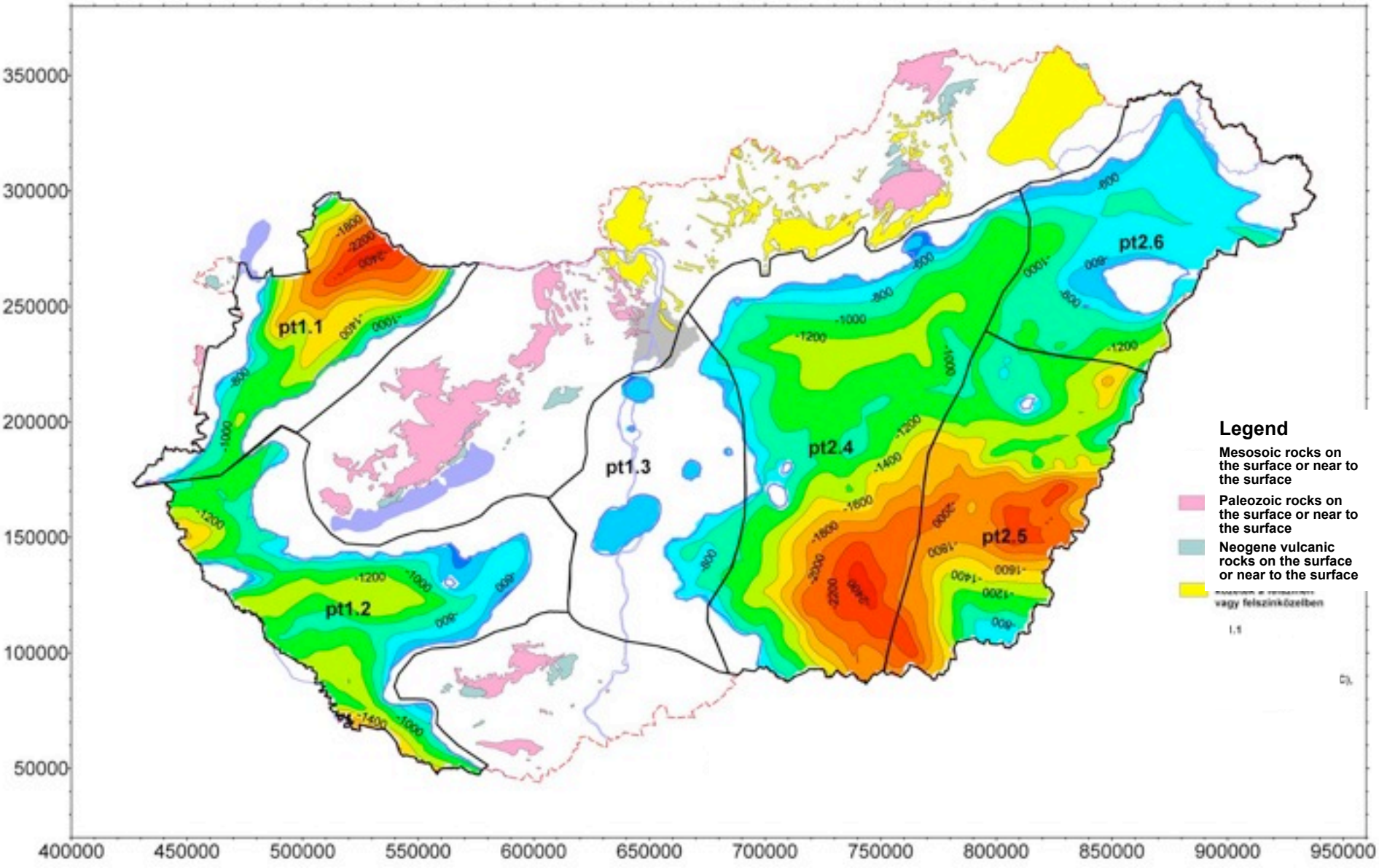
The temperature of outflow water from wells >90 °C



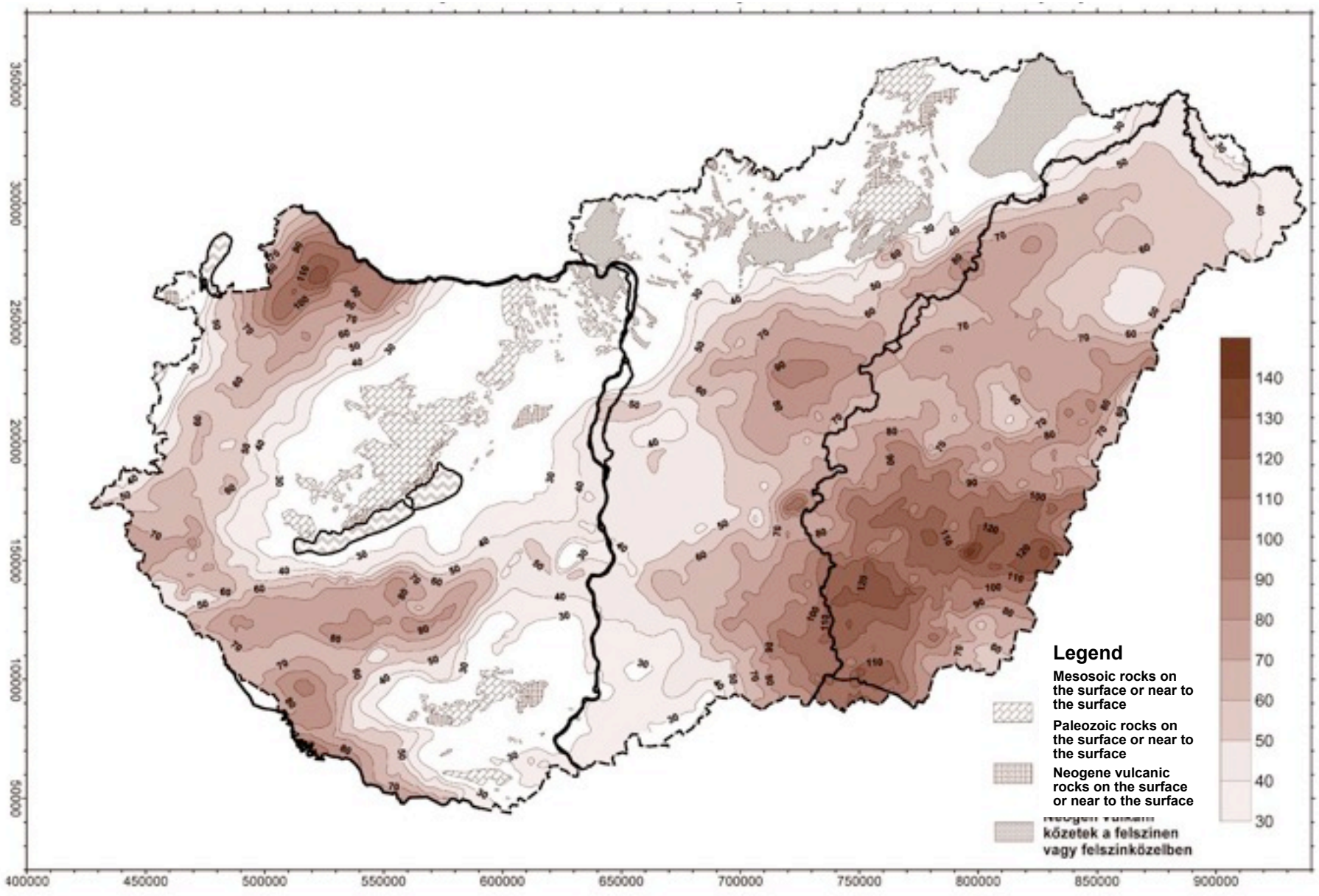
Pressure changing in the Great Hungarian Plain thermal-aquifer



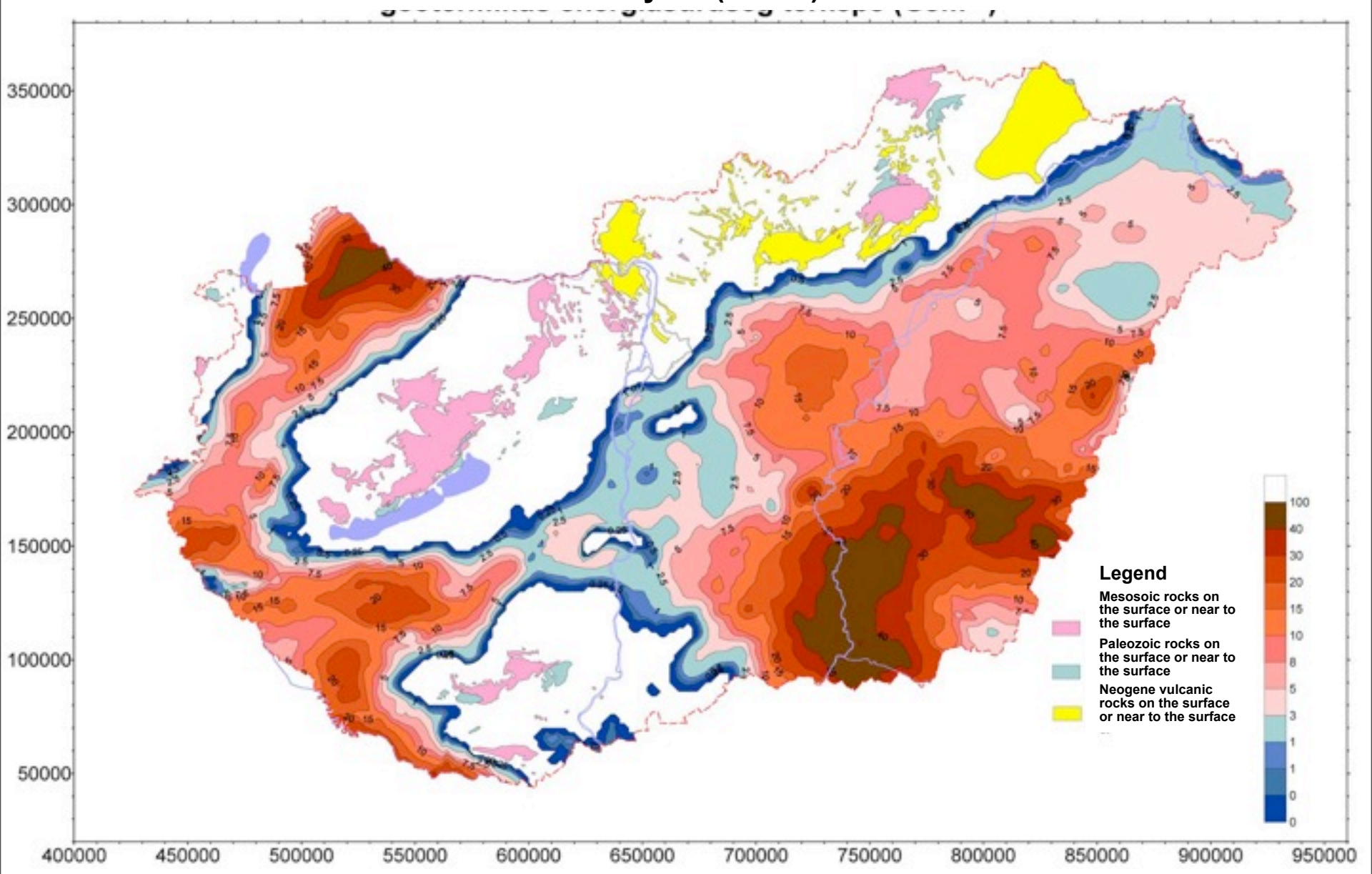
Spread of porous-thermal aquifers with higher temperature than 50 °C



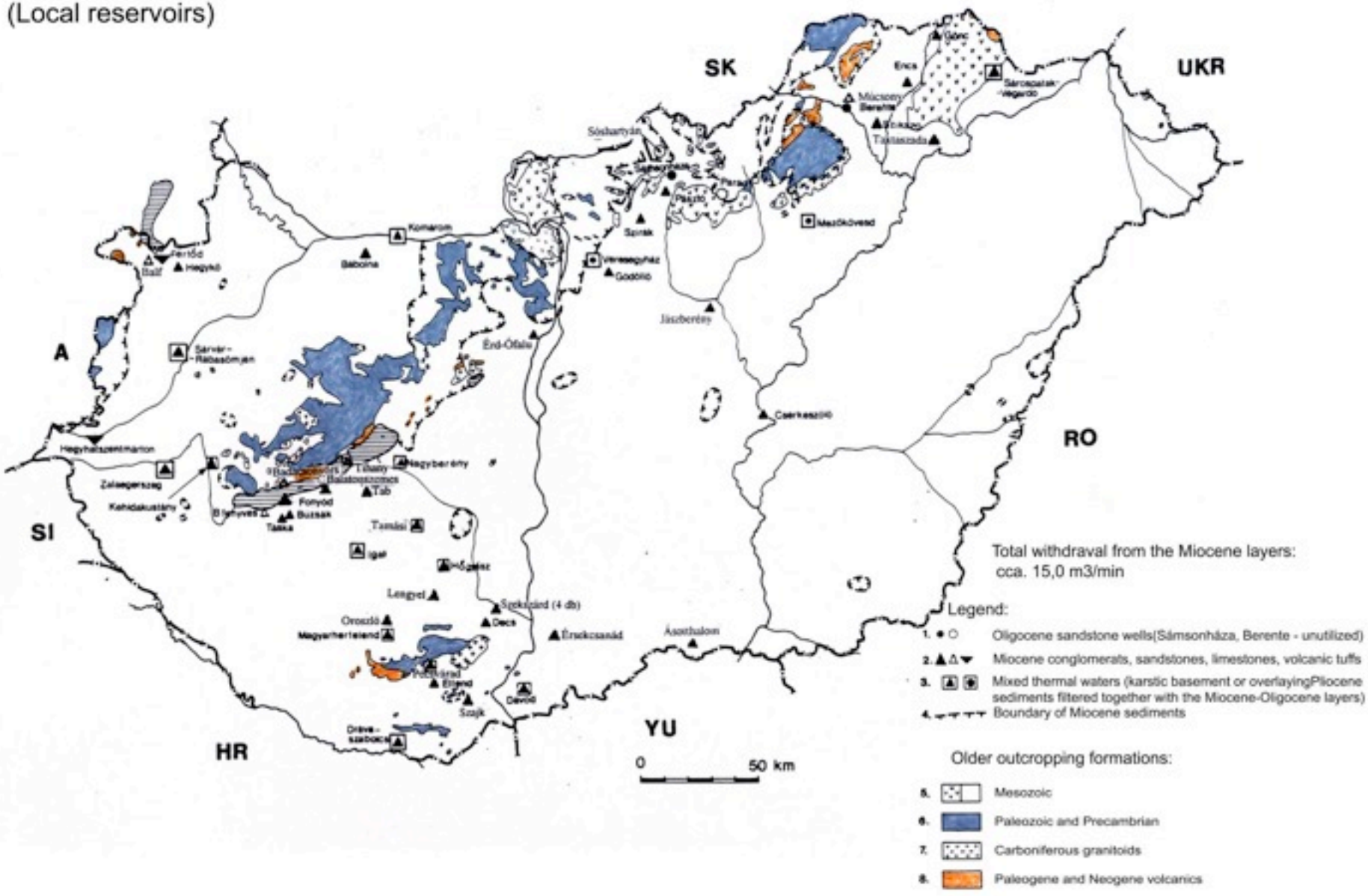
The temperature of Upper-Pannonian aquifer basement (°C)



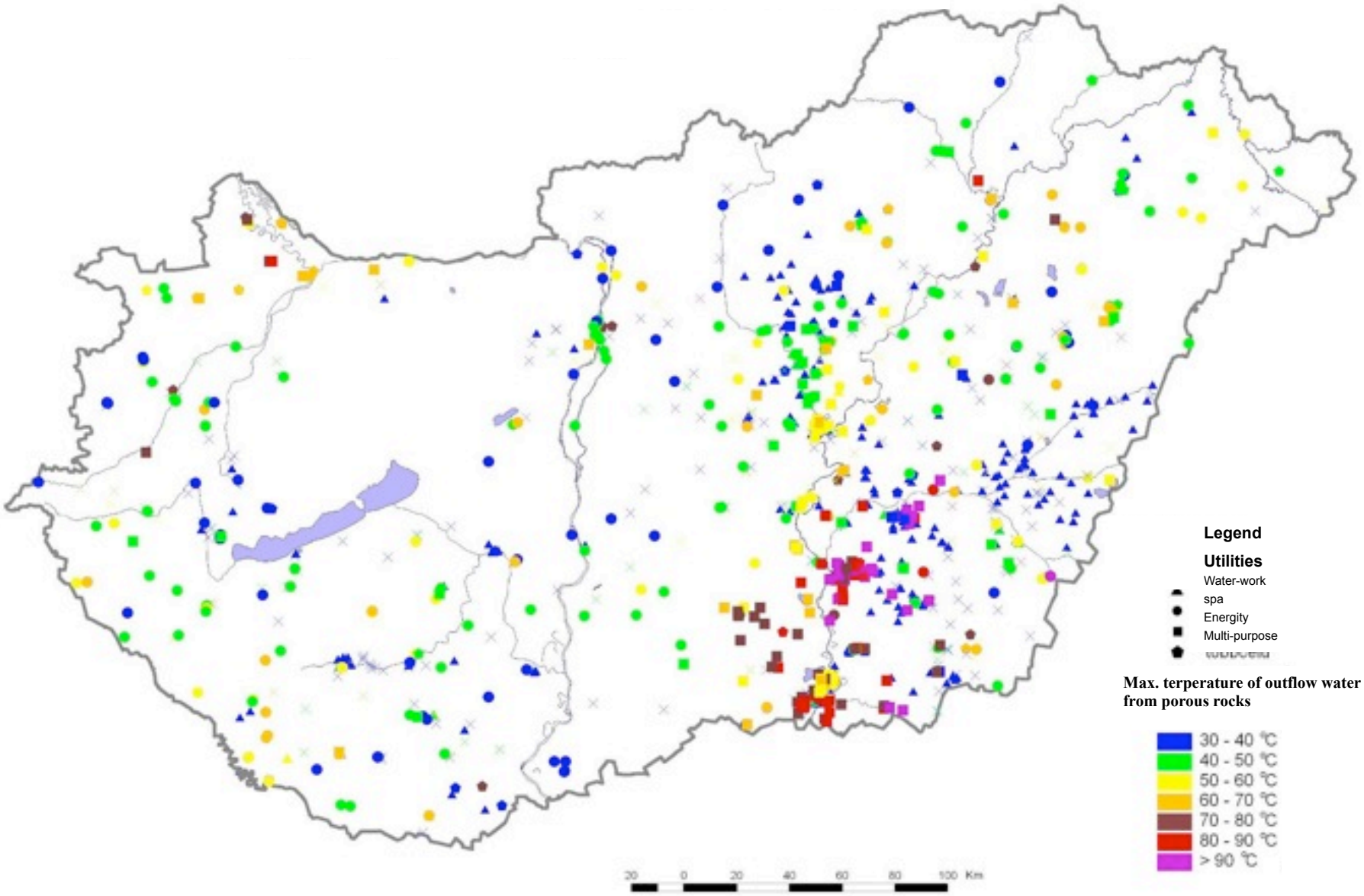
Geothermic energy density map of Upper-Pannonian layers (GJm^{-2})



Thermal water producing wells filtered on Oligocene and Miocene layers
(Local reservoirs)



Temperature and utilization of thermal wells in Hungary (2005)




Legend:
Localities with medicinal water
Localities with mineral water
Localities with medicinal and mineral water
thermal waters
non-thermal waters
20 0 20 40 60 80 100 Kilometer
Gönc
Zsurk
Sárospatak
Edelény
Kisvárda
Sajószentpéter
Bánhorváti
Miskolc
Fehérgyarmat
Sóshartyán
Bükkszék
Tiszavasvári
Nyíregyháza
Tiszaújváros
Pásztó
Eger
Bogács
Polgár
Hajdúnánás
Nagykálló
Parádsasvár
Andornaktálya
Nyírbátor
Egerszalók
Hajdúdorog
Mezőkövesd
Mosonmagyaróvár
Lipót
Fertőrákos
Szob
Visegrád
Esztergom
Komárom
Sopron
Győr
Leányfalu
Göd
Tiszacsege
Hajdúböszörmény
Hegykő
Piliscsaba
Veresegyház
Csány
Kapuvár
Nagycenk
Csorna
Bábolna
Tiszafüred
Balmazújváros
Petőháza
Budapest
03. ker.
02. ker.
13. ker.
14. ker.
01. ker.
09. ker.
11. ker.
20. ker.
21. ker.
Tóalmás
Jászapáti
Debrecen
Tiszaszentimre
Bicske
Jászberény
Hajdúszoboszló
Bük
Nagykáta
Berekfürdő
Nádudvar
Szeleste
Pusztazámor
Kaba
Pápa
Érd
Tápiószentmárton
Karcag
Püspökladány
Földes
Szomlyathely
Sárvár
Halásztelek
Szigethalom
Albertirsa
Moha
Velence
Kisújszállás
Berettyóújfalu
Abony
Biharnagybajom
Székesfehérvár
Gárdony
Cegléd
Szolnok
Törökszentmiklós
Túrkeve
Füzesgyarmat
Nyirád
Kunszentmiklós
Nagykőrös
Tiszajenő
Aba
Martfű
Mezőtúr
Dévaványa
Zalaszentgrót
Monostorapáti
Csopak
Balatonfüred
Lajosmizse
Szentkirály
Tiszaföldvár
Biharugra
Tapolca
Tihany
Kecskemét
Tiszakécske
Gyomaendrőd
Kehidakustány
Nemesgulács
Mindszentkálla
Ádánd
Nyárlőrinc
Szarvas
Kékkút
Lakitelek
Cserkeszőlő
Hévíz
Kisapáti
Badacsonytomaj
Nagyberény
Alap
Dunaföldvár
Békés
Pölöske
Fonyód
Kiskunfélegyháza
Csongrád
Balatonfenyves
Vajta
Akasztó
Nagyszénás
Békéscsaba
Pusztaszentlászló
Tabdi
Szentes
Gyula
Táska
Buzsák
Tamási
Paks
Lenti
Gelse
Somogyvár
Kiskőrös
Nagymágocs
Gerendás
Marcali
Igal
Hőgyész
Kalocsa
Orosháza
Zalakaros
Tengelic
Kiskunmajsa
Székkutas
Kiskunhalas
Mezőkovácsháza
Kaposvár
Attala
Dombóvár
Hódmezővásárhely
Tótkomlós
Bikal
Battonya
Szeged
Nagyatád
Mórahalom
Makó
Baja
Csokonyavisonta
Szigetvár
Nagybaracska
Dávod
Harkány
Siklós

Utilization of geothermal-energy in Hungary

Type of utilization	Thermal-wells		Water production in 2003		Energy production in 2003	
	Number db	%	Q (m3)	%	W (GJ)	%
Agricultural	74	68	9 900 663	67	728 854	62
Multi-purpose	11	10	1 181 779	8	77 310	7
Communal	13	12	2 350 524	16	224 793	19
Industrial	11	10	1.363 632	9	138 350	12
Total	109	100	14 796 598	100	1 169 307	100

Still utilized geothermic energetic stockpiles

- **utilized energy: total ≈ 2,46 PJ/y;**

- **heat content of leaking water until 30 °C: total 0,58 PJ/y;**

- **heat content of leaking water until 20 °C: összesen 1,17 PJ/y.**

57,8% of the working thermal wells (915) made for spas and hospitals (289) or water works (240); the most of other utilized, but only 30-50°C outflow-temperature wells used for water-supply too. Because the lack of knowledge on particular datas of water yield the estimated value of the extracted geothermic energy is between **12–24 PJ/y**.

Possibilities of developing of geothermal energy

Exploitable geothermic energy :
343.000 PJ

Supplied heat per year from heatflow :
264 PJ/y

Utilized heat from thermal water in 2003:




Thanks your kind attention!