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THE ROLE AND PLACE OF HYPERTHERMAL GEOCOMPLEXES IN THE LANDSCAPE-GEOCHEMICAL SYSTEMS

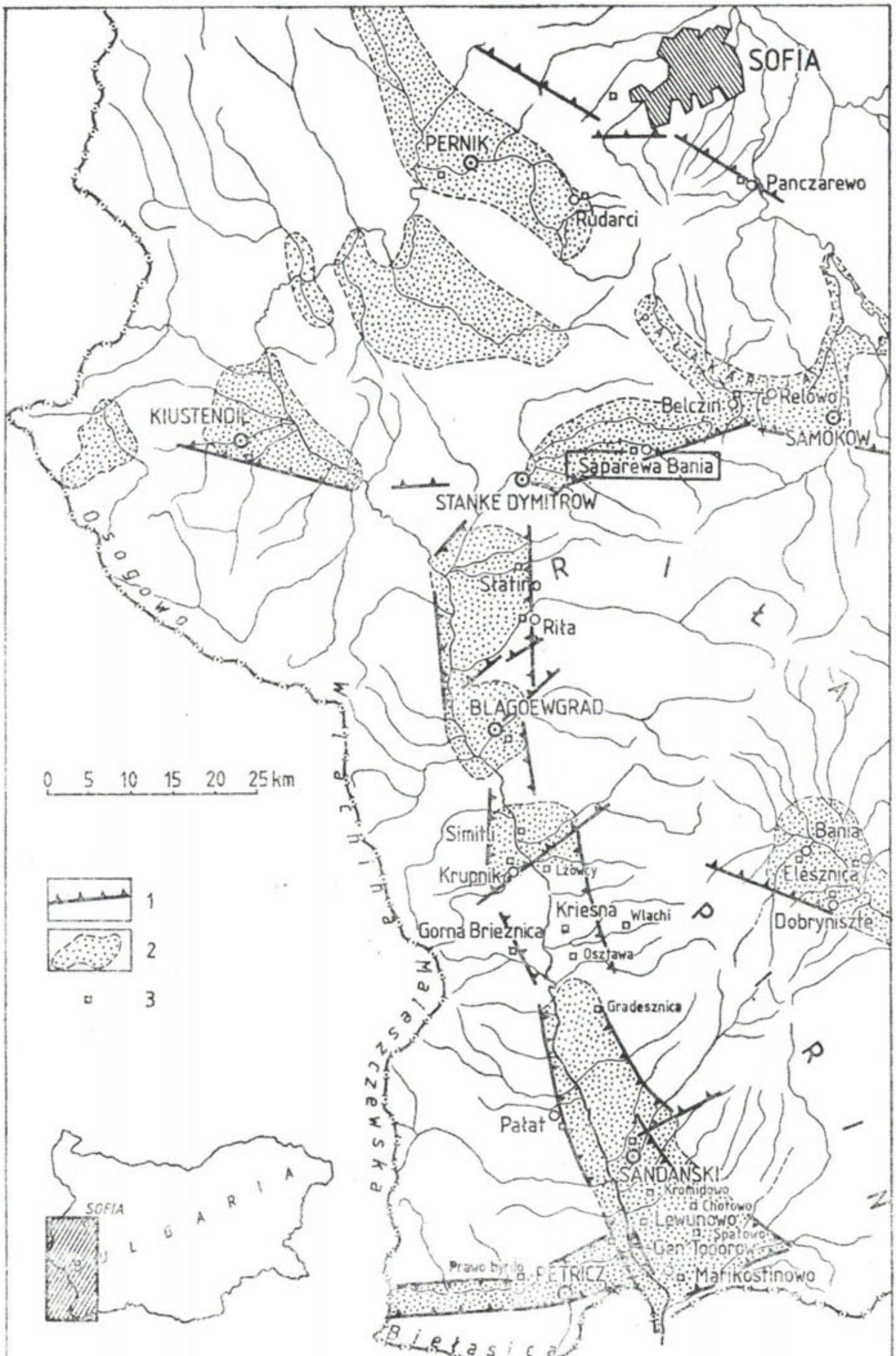
It is often accepted in physical geographic—global or regional—studies that the manner and intensity of functioning of zone landscapes is virtually determined by the quantity of solar energy caught through the processes of photosynthesis in the form of net production of zone ecosystems. Sometimes, however, one encounters locally appearing geocomplexes in which primary net production is many times greater than the background values. These specific spatial units are usually located in such conditions of natural environment in which there exists a second, besides the solar one, additional heat source. This additional heat source may, for instance, be geothermal, transmitted in the form of strong energy streams directed towards the Earth surface in certain specific tectonic-hydrological situations.

Thermal anomalies, which subsist in such landscapes are especially conditioned by the influence of hyperthermal and mineralized waters.

They constitute a good object for conducting the studies both in theoretical and practical aspect (see Wicik 1988). Usually, they are relatively small, as to their surface, spatial units, disposing of high energy and trophic potential of geothermal origin.

Units of this type have not found, as yet, an adequate position in the commonly applied systems of physicogeographical spatial classification.

The Strum zone of tectonic faults in Southern part of Bulgaria was chosen as the field of initial studies of this question. The magnitude of heat flow in this area often exceeds 50 MW per sq. m. (see Popov et al., 1987). Within the area numerous sources are located of mineral waters with increased temperature (Fig. 1). In the vicinities of all the effluences of thermal waters there occur mineral gley soils or peaty-gley soils, occupied by the communities of meadow, meadow-boggy and water vegetation. It is common to encounter there compact stands


SOFIA
PERNIK
Rudarci
Panczarewo
KIUSTENDIL
Belczin
Relowo
SAMOKOW
Saparewa Bania
STANKE DYMITROW
Osogowo
Statin
Rila
BLAGOEWGRAD
0 5 10 15 20 25 km
Simitli
Krupnik
Lżowcy
Kriesna
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Gorna Brieżnica
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Pałat
SANDANSKI
Kromidowo
Chotowo
Lewunowo
Spatowo
Gen. Todorow
Prawo byrdo
PETRICZ
Marikostinowo
Bielasica
Maleszczewska
1
2
3
SOFIA
BULGARIA

of very high (up to 4—5 mts) reeds, where there are some 80—100 well-developed specimens of this plant per 1 sq. meter.

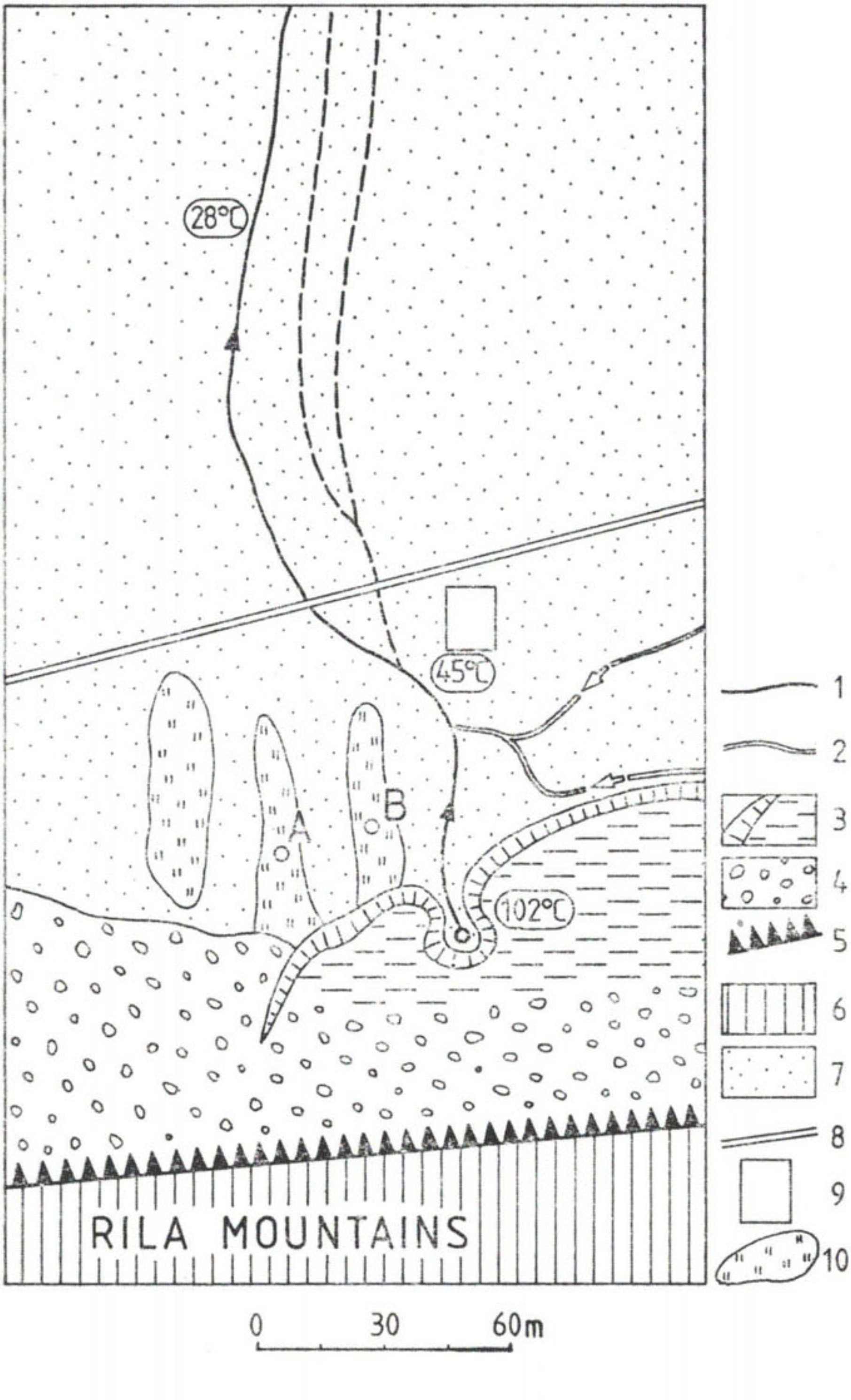
More detailed observations have been conducted in the areas of effluences of thermomineral waters in Sapareva Banja located within the foreland of the Rila ridge. The temperature of outflowing waters is here at 102 degrees C. These are alkaline waters of pH equal 9.35, sulphate-sodium ones with an important contents of fluorine (14.6 grams of F per 1 cu. meter). Of the trace elements somewhat greater concentrations are displayed by, for instance, Sr, Li, Zn, Ni and Co. Mineralization of water is at the level of 0.678 g per litre (Shcherev 1964).

Water which flows out there is partly used in balneotheraphy, and partly, after it had been cooled down, is distributed via channels for purposes of irrigation of orchards and vegetable gardens. Consequently, around this geochemical "crown" formed by the effluence locations there emerged, partly, a fan-shaped dissipation system, both for the termal energy (water temperature in the irrigation channel in the distance of some 400 metres from the effluence location was at +28°C), and for the chemical elements transported in water solution (see Fig. 2).

Within the location analysed very distinct areas were observed characterized by the exceptionally abundant development of boggy--meadow vegetation, which is directly related to the fact that hot waters supply both heat and nutrients. Drillings executed (see Fig. 3) confirmed a distinct temperature increase from the shallow to deeper levels of soil profile. Consequently, specific types of physicogeographic units are formed here, characterized by the increased temperature as well as by a greater richness in nutrients, when compared to the surrounding areas.

The question arises how such type of objects should be classified, since—as it was mentioned before—they have not found their place in the existing taxonomic systems. The literature concerning the methods of discrimination of natural geocomplexes (see, for instance, Kondracki 1976, Bartkowski 1977, Richling 1981) divides, in the most general manner, all the geocomplexes into homogeneous (topical) and heterogeneous (chorical). Numerous scientists speak also of the so-called partial geocomplexes (see, e.g., Haase 1964, or Richling and Ostaszewska 1983), reflecting the variability of individual components of nature in relation

Fig. 1. Location of hydrothermal springs in South-Western Bulgaria
1. bowls, 2. faults, 3. hydrothermal springs.



28°C
45°C
102°C
A
B
RILA MOUNTAINS
1
2
3
4
5
6
7
8
9
10
0
30
60m

to the differentiation of the whole natural environment. G. Haase (1964) introduced the following names for the units of this kind: morphotopes, climatopes, hydrotopes, biotopes and pedotopes. Each of these names refers to the least surface which is uniform from a given point of view.

In the case of studies conducted in the areas of appearance of hot water sources in Bulgaria we are dealing with the modelling influence of thermomineral waters upon the remaining components of natural environment. These sources determine the development and functioning of both the partial units (mainly in the topic dimension) and the complete units (in choric and regional dimension). This influence leads on the local scale to the increase of temperature of partial units and to the increase of their nutrient resources, while for the greater surfaces it is limited to the increase of the environment's trophism through the watership transmission of chemical elements constituting the components of mineral waters.

Observations conducted indicate the need for complementing the existing classifications of physicogeographical units with new varieties, which would account for the dependence upon factor of geothermal origin. It is for such units that the names "hyperthermal" and "hypertropic" are proposed.

Thus, it would be purposeful to distinguish the hyperthermal pedo- and hydro-topes, as well as hypertropic biotopes. Such names could also be used for reference to complete units of a higher order, depending upon the magnitude of outflow (intensity of source and effluence) of hot water springs.

Introductory studies conducted in the area of Sapareva Banja in Bulgaria have confirmed the objective existence of such geocomplexes in nature.

More detailed larger-scale studies aiming at delimitation of natural units within this object shall be continued next year.

Fig. 2. Situational sketch of the vicinity of the "Sapareva Banja" effluence

1. warm waters
2. cold waters,
3. embankment and anthropogenic formations
4. deluvial-proluvial formations,
5. underslope deluvials,
6. granite-gneisses,
7. tectonic fault,
8. peat fields,
9. road,
10. old bathhouse.

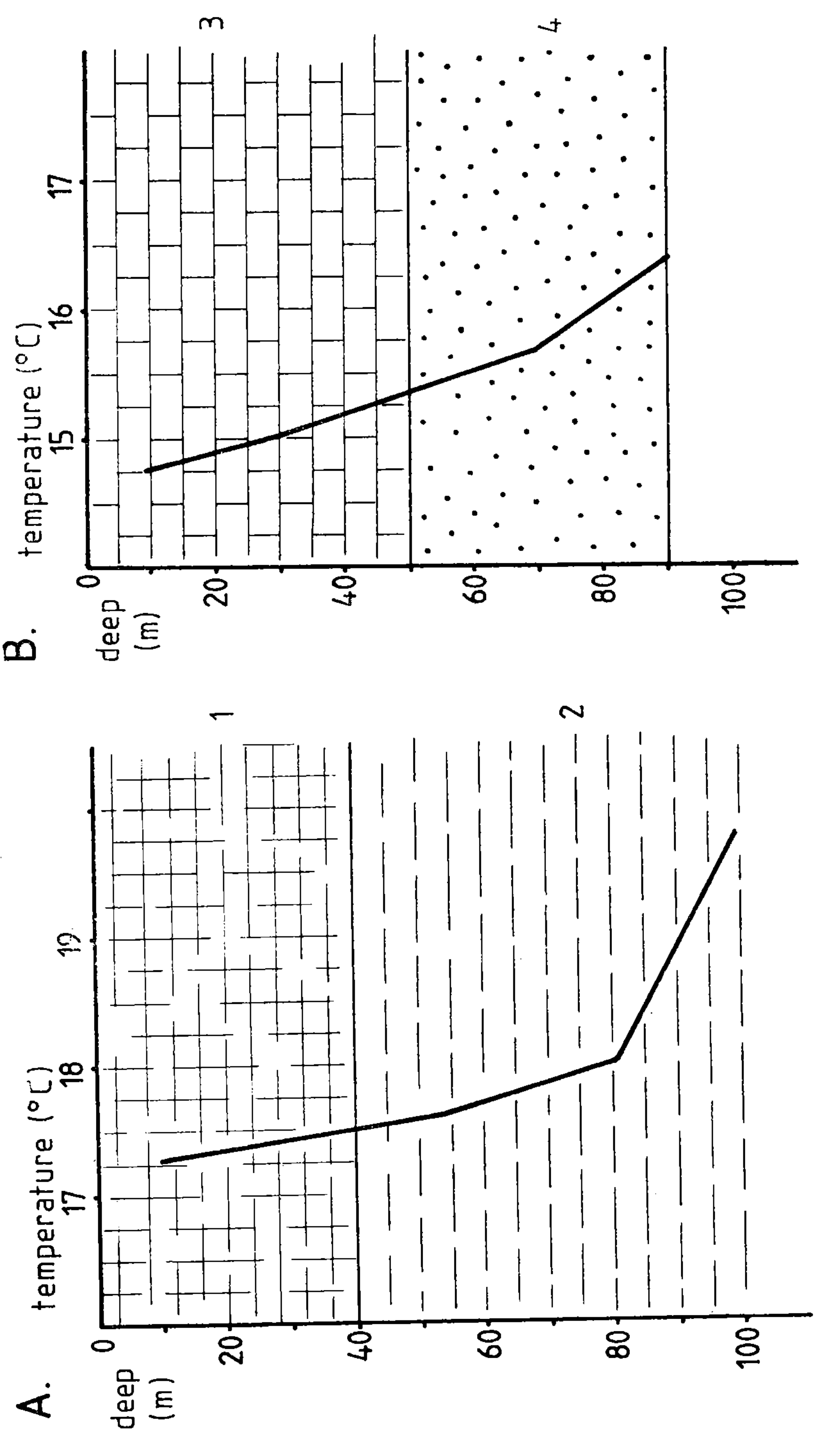


Fig. 3. Diagrams of soil temperature in the vicinity of thermal waters efflu-ence "Sapareva Banja" (taken in points A and B of Fig. 2)

1. boggy soil, 2. sandy (gleyey) dust, 3. reed peat, 4. clayey sand.

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