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## The current state of springs – geological monuments of nature (Belgorod oblast, Volokonovskiy district)

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## The current state of springs – geological monuments of nature (Belgorod oblast, Volokonovskiy district)

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**Abstract.** The current state of springs which belongs to natural monuments of regional significance on the territory of the Volokonovskiy district (Belgorod oblast) was considered, special attention is paid to three objects that are included in the group of hydrological - hydro-geological monuments of nature. Extremely uneven distribution of hydrological-geological monuments of nature on the territory of the oblast was determined. During the continuation of monitoring studies, certification of the studied springs, assessment of sanitary and technical condition, recreational and cultic significance was carried out. The differences of springs in their outputs, the karst nature of some of them, and irregular use for recreational purposes have been ascertained. Springs have ceased to be «gushing». The necessity of continuing monitoring of the state of springs and further work on the development of criteria for classifying them as geological monuments of nature, as well as the coordination of the status of such springs at different levels was substantiated.

### 1. Introduction

One of the trends in the development of specially protected natural areas (SPNA) network in the world is the organization of geoparks. The purpose of their creation is the preservation and study of unique geological objects of cultural, aesthetic and scientific value, as well as the organization of tourism and recreation. The united Global Network of Geoparks under the auspices of UNESCO, which currently unites 119 geoparks from 33 countries, has been in existence for twenty years [1].

There is no category of «geopark» in Russian environmental legislation, therefore, for the protection of unique geological objects, they are usually referred to existing categories of protected areas, in particular, to monuments of nature. The website «Unique geological objects of Russia» [2] provides information about six active geological monuments of nature in the Belgorod oblast. These objects are springs, and they belong to the hydrological - hydro-geological monuments of nature. In a number of regions of Russia, active work is underway to scientifically substantiate the belonging of springs to the category monuments of nature. In particular, such studies are typical for the Bryansk oblast [3]. In the Belgorod oblast, scientists of the National Research University «BelSU» have been studying and certifying springs for many years, their substantiation as monuments of nature [4-5]. According to [2], geological monuments of nature in the region are allocated only on the territory of two administrative entities - Starooskolskiy city district and Volokonovskiy district. This article presents the results of the study of such objects on the territory of the Volokonovskiy district in 2021.



## 2. Materials and methods of study

Belgorodoblast is located in the European part of Russia. It is the old-developed and densely populated region. According to [6], nowadays the following types of regional SPNA are allocated on the territory of the Belgorodoblast: natural parks, state nature reserves, monuments of nature, arboretum parks and botanical gardens. Among the monuments of nature of regional significance in the Belgorodoblast, springs are in the lead in terms of number: 85 of them belong to this category.

Five springs were attributed to the monuments of nature of regional significance on the territory of the Volokonovskiy district:

- 1) Gushing spring in the village of Staroivanovka;
- 2) Gushing spring in the village of Verkhniye Lubyanki;
- 3) Gushing spring in the village of Plotvyanka;
- 4) Krinitisa «Deer» of the stow between the villages of Volokonovka and Pyatnitskoye («Spring of health»);
- 5) Krinitisa «Gomonovo» in the village of Golofeyevka.

The objects of our study were springs No. 1-3, which, according to [2], are included in the list of geological monuments of nature and belong to the hydrological-hydrogeological type. It should be emphasized that not all authors recognize springs as part of geological monuments of nature. So T. Ananyeva et al [7], evaluating the geological monuments of nature of the Krasnoyarsk Territory is given the following types of them: stratigraphic, paleontological, petrographic, geomorphological, geocryological, ore-mineralogical, cosmogenic, complex, historico-geological. Following [2], we consider that springs should occupy a certain place in the system of geological monuments of nature.

For the certification of springs, the passport scheme proposed by the scientists of the Moscow Geological Exploration University was used, with some changes and additions, since this scheme fully corresponds to the scientific purposes of the description of spring. The evaluation of the sanitary and technical condition of the springs, including the technical condition of the damming, the sanitary condition of the spring and the area of its nutrition, was also carried out according to the methodology [8]. The evaluation of the recreational and cult significance of the springs was carried out according to the author's methodology developed at the National Research University «BelSU».

## 3. Results and their discussion

In Figure 1 the skeleton map of the placement of springs-regional monuments of nature on the territory of the Volokonovskiy district is presented. The numbering of springs on the skeleton map coincides with their numbering in the text. The icon with a dot inside means that this spring belongs not only to regional monuments of nature, but also to the hydrological - hydro-geological ones.

The analysis of the distribution of all protected springs in the district shows that most of them (No. 2, 3, 5) are confined to floodplains (their near terrace depressions), one spring (No. 4) is developed on the slope of the terrace and one spring (No. 1) is in the talweg of the ravine. The following types of vegetation are represented at the outlets of springs: slope light forest (spring No. 1), meadow-boggy motley grass (springs No. 2 and 5), meadow and weed vegetation (spring No. 3), floodplain forest (spring No. 4). The «Spring of Health» is regularly used by the population for utility drinking and recreational purposes, springs in the villages of Verkhniye Lubyanki and Plotvyanka are used irregularly (mainly for recreational purposes), springs in the villages of Staroivanovka and Golofeyevka are practically not used.

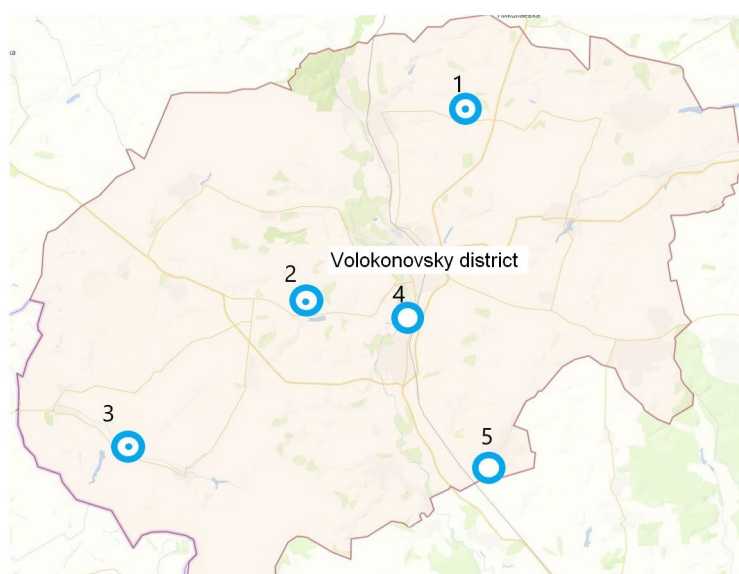
The table shows some characteristics of three springs related to geological monuments of nature.

**Table.** Features of springs- geological monuments of nature.

№	TCD	SCS	SCNA	STCS	Output, l/s	Recreational assessment	Assessment of the cult significance of the spring
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1	Good	Good	Sat.	Sat.	0.06	Very low	Very low
2	Unsat.	Good	Good	Unsat.	> 1	Medium	Low
3	Unsat.	Good	Good	Unsat.	> 3	Medium	Low

Note: TCD - technical condition of damming; SCS - sanitary condition of spring; SCNA - sanitary condition of nourishment area; STCS - sanitary- technical condition of spring.



**Figure 1.** Placement scheme of springs- monuments of nature on the territory of the Volokonovsky district

Symbols:

○ – Monument of nature

⊙ – Geological monument

1 – Sotnitsky spring; 2 – spring in Verkhniye Lubyanki village; 3 – spring in Plotvyanka village; 4 – «Spring of health»; 5 Krinitisa «Gomonovo» in the village of Golofeyevka

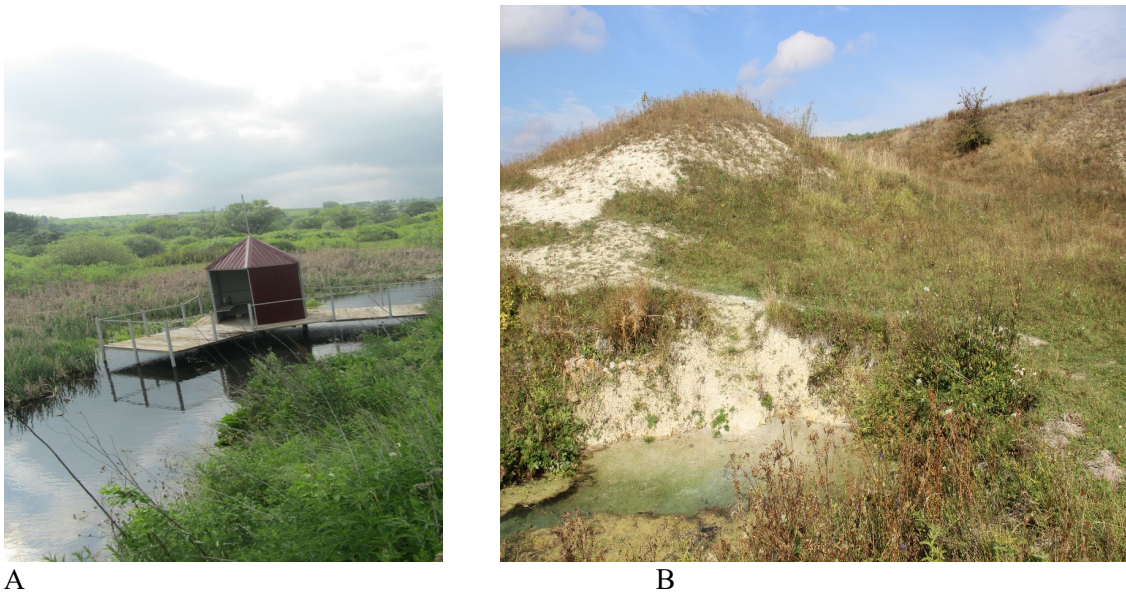
According to the sanitary-technical condition, two springs have an unsatisfactory assessment, which is due to the lack of damming. Earlier [5] we noted that geological monuments of nature should preserve the features of the geological environment, therefore unsatisfactory assessment of the state of the captage should be welcomed, but it is necessary to use such springs taking into account this feature, i.e. the absence of damming means restrictions on the use of springs for drinking purposes.

Recreational assessment of springs varies from very low to medium, and their cult significance - from very low to low. The low level of assessments means that the studied springs have no traditions of use for recreation or for religious ceremonies, so they are not equipped for such purposes.

Figure 2 shows the current state of springs No. 2 near the village of Verkhniye Lubyanki in the floodplain of the Mandzhoga stream and No. 3 in the village of Plotvyanka in the floodplain of the Plotva river.

The studied springs differ in their output: at spring 1 it is small, at springs 2 and 3 it is at least medium. A more precise determination of the output for springs 2 and 3 is impossible, because they are represented by spring funnels - small reservoirs formed at the outlet of springs. The outlets of the springs themselves were flooded at the time of the survey. The term «gushing spring» does not correspond to the current state of all these springs and, apparently, has a historical character. A decrease in the flow rate of springs is also marked in other regions of the world; in particular, progressive drying of springs in Poland is shown [9].

The presence of chalk outcrops near springs 2 and 3 suggests their karst nature. Thus, springs that are heterogeneous in their characteristics have fallen into the category of geological monuments of nature: on the one hand, karst springs with medium or high damming, on the other hand, the erosive spring with a low damming. This situation is not unique: O.V. Petrov and co-authors [10] note that when classifying geological objects as objects of geological heritage, scientific assessment of their significance, organization of protective measures, as well as rational use, there is a wide range of unresolved problems, one of which is the lack of clear criteria for classifying geological objects as objects of geological heritage.



**Figure 2.** Karst springs related to the hydrological - hydro-geological monuments of nature: A) spring No. 2 near the village of Verkhniye Lubyanki; B) spring No. 3 in the village of Plotvyanka.

The spring in the village of Golofeevka can serve as the confirmation of the last statement (Figure 3).



**Figure 3.** Crinita «Homonovo» in the village of Golofeyevka is a large spring funnel.

If we compare this spring with the object in the village of Plotvyanka, then there is no fundamental difference: both springs are located near the terrace depressions of floodplains, they are represented by spring funnels, the aquifer is chalk, they belong to natural monuments of regional significance. Why does one of them belong to the geological monuments of nature, and the other does not? It is not possible to answer this question.

The studied springs are not unique to the district or region: in the course of our studies on the territory of other districts, dozens of springs with similar characteristics, some of which belong to natural monuments of regional significance without specifying their geological were described by us. In this regard, it is necessary to continue monitoring the state of geological monuments of nature (springs) and further work on the development of criteria for classifying them as geological monuments of nature.

#### 4. Conclusion

The analysis of the location and current state of the springs of the Volokonovskiy district of the Belgorod oblast, which are classified as unique geological objects of Russia, showed that this is a heterogeneous group of objects differing in the type of aquifers and output, and little used by the population. Obviously, it is necessary to coordinate the status of these springs at different levels, since there is no mention of their geological significance in the region. The urgent problem is the development of measures to coordinate the development goals of specially protected natural areas (SPNA) and socio-economic development of the region.

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