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Geoheritage Value of Three Localities from Kislovodsk in the Southern Central Ciscaucasus: A Resource of Large Resort Area

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Abstract: Many geographical domains possess notable geological and geomorphological features, which are yet to be characterized comprehensively in terms of geoheritage. The present study focuses on the Kislovodsk area, which is situated in the southern part of the Central Ciscaucasus (post-Paleozoic platform), where the latter joins to the Greater Caucasus (late Cenozoic orogen). Three geosites are reported from there, and their qualitative description and semi-quantitative, score-based assessment are offered. The Honey Waterfalls represent an example of river erosion affecting Carboniferous granitoids with uppermost Jurassic weathering horizon and overlain by Lower Cretaceous carbonates. The Ring Mountain is a natural arch formed as result of wind erosion. The Little Saddle is a viewpoint offering a spectacular, panoramic view toward the Elbrus Mountain that is the highest peak of Russia and Europe and an impressive dormant stratovolcano. The Honey Waterfalls and the Ring Mountain are ranked nationally (the latter receives the highest total scores), and the Little Saddle is ranked regionally. These geosites are diverse in several aspects, and, particularly, different geoheritage types and forms are established. The Kislovodsk area bearing the reported geoheritage objects is a part of the Mineralnye Vody resort area, which is large and important for the national tourism and recreation industry. The related opportunities and challenges for geoheritage resource management have to be considered.

Keywords: erosion; geological conservation; geosite; granitoids; landforms; sustainable geoheritage management; tourism; weathering processes

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1. Introduction

The increasing number of studies on geoheritage worldwide is aiding its conceptual development [1–3] and practical implications for the purposes of local socio-economical sustainability [4–6]. However, notable geological and geomorphological features are numerous, and information about them remains scarce in various regions. Many geosites have not been identified, and many others remain known only to a local research audience despite their potentially high value. Indeed, special attention should be paid to this potential geoheritage, which can easily be exploited for the purposes of science, education, and tourism.

The Ciscaucasus is a vast geographical domain, which includes high and low plains with steppe landscapes between the main part of the Russian Plain in the north, the Greater Caucasus Mountains in the south, the Black and Azov seas in the west, and the Caspian Sea in the east. Its geological history and present-day setting are complex [7–9], and many geosites can potentially exist. However, only a few have been reported [10,11]. Indeed, for the purposes of geoheritage and geotourism promotion, the southern part of the Central Ciscaucasus is a promising area. Here, several geomorphological, igneous, mineralogical, paleontological, and hydrogeological features form a peculiar ensemble on

in relatively small territory [12–21], which is of outstanding importance for the Russian tourism and recreation industries [22–26]. Particularly, attention to Kislovodsk city and its vicinities (termed provisionally as the Kislovodsk area) suggest several localities, which are interesting from the geoheritage point of view and already used in local touristic activities.

The objective of the present paper is to analyze three geosites from the Kislovodsk area of the southern Central Ciscaucasus. The study is a systematic, qualitative and semi-quantitative analysis used to determine the geoheritage value and key characteristics of each locality. The preservation and dissemination of geoheritage resources in popular resort areas require a deeper understanding, which offers practical implications of general importance.

2. Geological Setting

The study area is located in the Russian South, where the Ciscaucasian Plains meet the Greater Caucasus Mountains (Figure 1). This corresponds to Kislovodsk city and its vicinities, which belong to a large resort area known as Mineralnye Vody (Mineral Waters). Common elevations are ~800 m, although they exceed 1200 m locally. The local climate is temperate, with moderately hot summers and mild winters. The area is dominated by the Kislovodsk depression bounded by the Borgustan and Dzhinal ranges (from the north and the east, respectively) and drained by the Podkumok River and its tributaries. It is well populated and boasts intense tourism and other industrial and agricultural activities. Roads, railroads, and multiple touristic trails make this area well accessible.

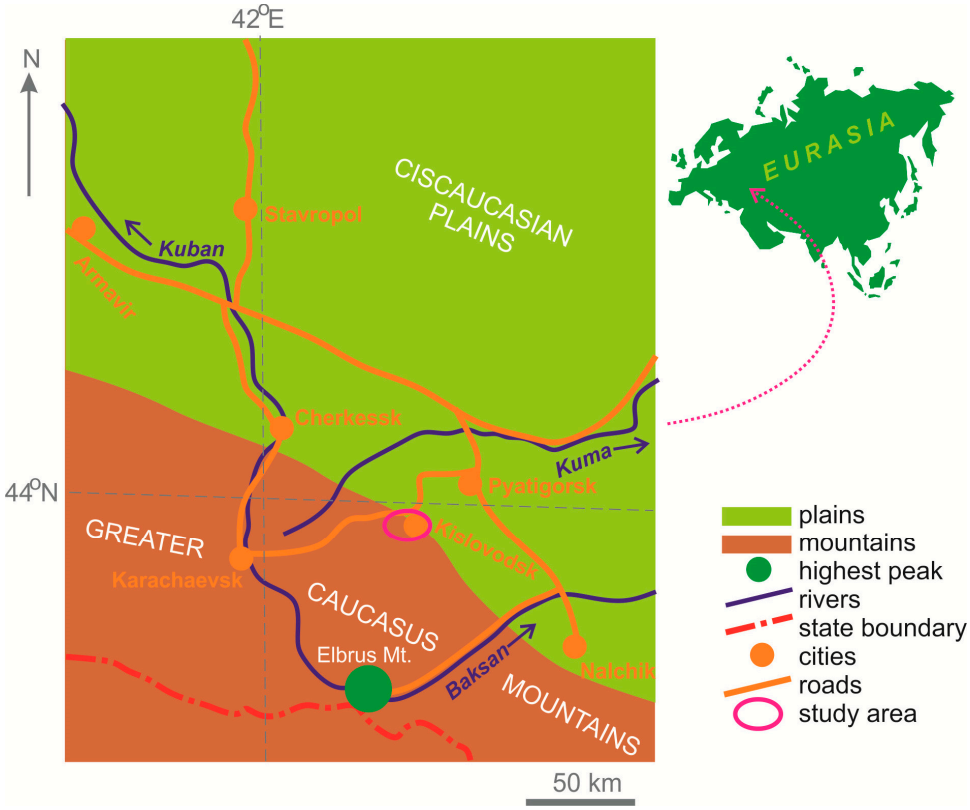

Figure 1. Geographical location of the study area. This scheme depicts the southern Central Ciscaucasus and shows the position of the Kislovodsk area. See below for the location of the considered localities.

Geologically, the Kislovodsk area corresponds to the southern edge of the Scythian Platform stabilized in post-Paleozoic times where it contacts with the Greater Caucasus orogen grown in the late Cenozoic [8,27–31]. This area is dominated by Lower Cretaceous deposits, with exposures of older rocks in the deepest parts of river valleys (Figure 2).

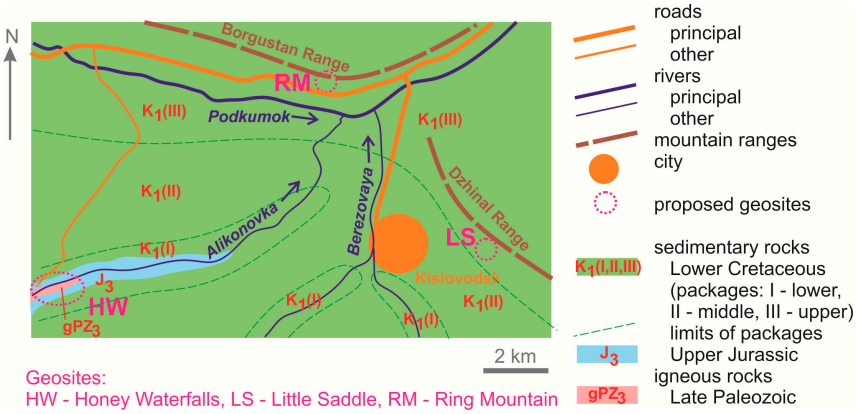

Figure 2. Simplified geological scheme of the study area.

The stratigraphical sequence is rather simple (Figure 3). The oldest rocks are granitoids (biotite granites are common) of late Carboniferous (Pennsylvanian) age [32]. They are overlain by a highly-specific, often red package consisting of mixed coarse siliciclastics with different rounding of clasts and some clay. Close examination indicates that these are products of weathering of underlying granitoids. This package can be attributed to the Mezmay Formation, and it has a Tithonian age [33]. The local stratigraphy of Lower Cretaceous deposits was developed, particularly, by Drushits and Mikhailova [34], Enson [35], Mordvilko [36], and Snezhko et al. [37]. These deposits are represented by carbonates in the lower part and siliciclastics in the upper part (Figure 3). The two most notable lithologies are Berriasian–Valanginian limestones and Aptian sandstones; the latter are known as the Pescherny (Cave) Horizon due to the presence of giant cavities of aeolian origin. The litho-stratigraphical subdivision of these deposits into formations remains questionable. Tentatively, it is possible to subdivide them into three informal packages (Figure 3). The lower package includes Berriasian–Valanginian carbonates above the Mezmay Formation. The middle package includes Hauterivian–Barremian siliciclastics, including red sandstones cropping out locally in Kislovodsk. The upper package represents Aptian sandstones (also the Cave Horizon) and Albian finer siliciclastics. The middle and upper packages are the most widely distributed in the study area (Figure 2).

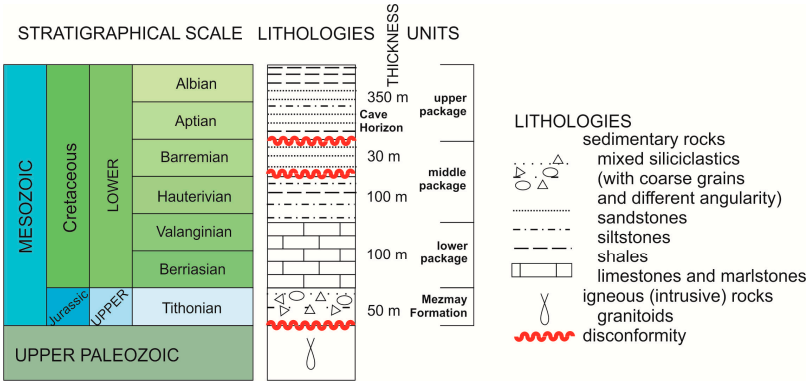

Figure 3. Composite stratigraphical section of the study area (see text for related explanations and literature).

The above-mentioned stratigraphical sequence reflects the complex history of the Greater Caucasus and the adjacent parts of the Ciscaucasus. An emplacement of granitoids in the late Paleozoic can be related to the Hercynian (Variscan) orogeny, which involved some Caucasian terranes [38–40]. The Triassic–Jurassic evolution of the study area is poorly known, but it appears that the Kislovodsk area remained a rather stable domain and probably a long-lived land mass north of the tectonically active zone [41]. Late Jurassic–Early Cretaceous sedimentation took place on the margin of the Caucasian Sea that occupied

an elongated and asymmetrical back-arc basin that stretched along the southern margin of the Scythian Platform [42,43]. This sea transgressed in the Early Cretaceous. The Alpine orogeny of the Caucasus led to uplift in the study area, erosion of Upper Cretaceous–Paleogene strata, and slight tectonic distortion of Lower Cretaceous deposits. The latter form a northeast-dipping, gentle ($<10^0$) monocline.

3. Materials and Methods

Diverse principles and techniques for description and assessment of geosites exist [44–48]. They emphasize geosite properties and propose related scoring systems and assessment tools. However, any universal approach does not exist, and it would be difficult (if necessary) to expect its appearance in the near future. The problem of objectivity often (if not always) matters [1], and various local, regional, and national conditions (natural, cultural, and socio-economic) can limit the utility of particular principles and techniques. Moreover, qualitative characteristics of geosites cannot be less important than criteria for (semi-)quantitative assessment.

The present work was based on the field observations made in the study area, although some published information was also consulted. The visits to the study area permitted specification of three notable localities, which can be treated as potential geosites. Each site was analyzed in order to provide its geological and geomorphological description, as well as to provide the essential parameters important to its management, such as location, general view, configuration, and dynamic state. The same information argued for their importance in geoheritage terms and for classification of geoheritage features according to their geological and geomorphological essence (content). Due to the outstanding scenery of the proposed geosites and their overcrowding by tourists, photographs from professional artists were employed (all are published with permission).

The semi-quantitative assessment of the proposed geosites was based on several criteria and related system of scores. For the purposes of the present study, the technique by Ruban et al. [46] was preferred because it was already tested in the conditions of the Russian South. Its application in the different parts of the latter makes regional geosite inventories more consistent. To avoid repetitions, the methodological peculiarities of this technique are not explained in detail in this paper, and they are summarized in Figure 4. Nonetheless, it should be stressed that the value of geosites depends, first of all, on their spatial rarity, and can also be modified by their other (technical, functional) properties such as accessibility and vulnerability. Summarizing the related scores permits ranking of geosites globally, nationally, regionally, and locally (Figure 4). Each proposed geosite of the Kislovodsk area was assessed with this technique, which allowed evaluation and comparison.

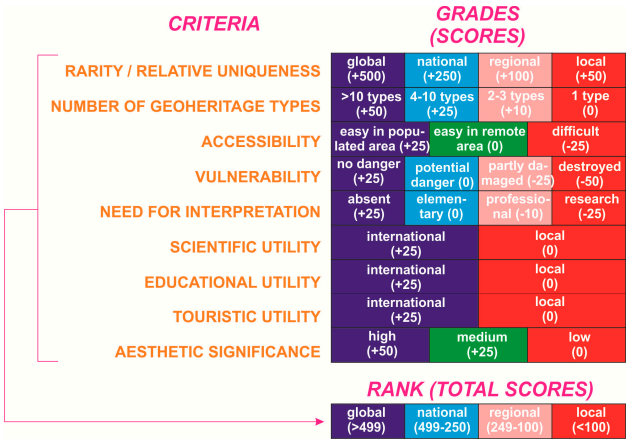

Figure 4. Criteria and scores used in the employed semi-quantitative assessment (based on [46]). Rarity is the main criterion, but considering the other criteria can change a geosite's rank. The colors are used for better visualization of grades.

4. Results

4.1. Description of Geosites

4.1.1. Honey Waterfalls

The Honey Waterfalls (Medovye vodopady) are a common name for a relatively small locality in the southwestern part of the Kislovodsk area (Figure 2). There, the Alikonovka River cuts hard late Paleozoic granitoids and forms a narrow gorge with splendid waterfalls (one of them is essentially the 'hanging mouth' of a stream that is a small tributary of the noted river) (Figure 5a). The length of the gorge is measured by hundreds of meters, and the height of some waterfalls exceeds 10 m. Natural granitoid outcrops are abundant and picturesque (Figure 5b). Red siliciclastic deposits (Mezmay Formation) consist of weathering products and overlaid granitoids, and they are exposed in a cutting of the road that leads to the locality (Figure 5c). Berriasian–Valanginian fossiliferous limestones (lower package of the Lower Cretaceous sedimentary succession) crop out in high scarps (Figure 5d). It is easy to reach these outcrops by climbing gentle slopes. In other words, the considered locality represents a significant portion of the stratigraphical sequence of the study area (Figure 3) and creates a unique possibility of seeing pre-Cretaceous features. This locality also represents an ongoing river erosion.

Figure 5. The Honey Waterfalls geosite: (**a**)—general view of the gorge (photo: Igor Strukov, Lori Photobank), (**b**)—small waterfall and granite outcrop (photo: Eugene Sergeev, Lori Photobank), (**c**)—Tithonian red siliciclastics (photo: Natalia Popova, Lori Photobank), (**d**)—exposures of Berriasian–Valanginian limestones (photo: Valery Shilov, Lori Photobank). All photos are published with permission.

The geoheritage importance of the Honey Waterfalls is linked to the diversity of the represented phenomena (see above), exceptional representation of the local stratigraphical sequence, and picturesque views of the geological landscape. The registered features belong to the geomorphological (gorge), hydro(geo)logical (waterfalls, river erosion), igneous (granitoids), sedimentary (Tithonian–Valanginian deposits), stratigraphical (reference section of Tithonian red beds), and paleo-geographical (terrestrial and marine facies) types of geoheritage. The paleontological and geohistorical types cannot be excluded because there is preliminary evidence of fossil occurrence in Berriaian–Valanginian limestones and

the historical importance of the outcrops of Tithonian siliciclastics for Russian geoscience research and education is vital (clarifying the related information requires a new, specially organized round of field and archive studies). The considered locality can be treated as a true geosite. It has a linear configuration, and it shares features of static and dynamic geosites. Although reaching it from Kislovodsk requires up to an hour of driving, this geosite is connected by a good road, and all its elements are not only accessible, but can also be observed distantly. Indeed, mass tourism activities in this locality have led to its slight modification for the purposes of infrastructure construction (trails, stairs, decorative figures). However, these activities did not make this geosite less informative or less picturesque. The aesthetic properties of this geosite are exceptional, and they are related, particularly, to the views of the narrow gorge with waterfalls (Figure 5a,b), the red color of Tithonian siliciclastics (Figure 5c), and the scarp shapes (Figure 5d). Panoramic views of the local natural landscapes are available from several points.

4.1.2. Ring Mountain

The Ring Mountain (Gora Koltso in Russian) is a small, but highly-peculiar geomorphological feature in the northern part of the study area (Figure 2). The height is 871 m, and the relative elevation (above the toes) is ~100 m. Essentially, this is a natural arch formed at the edge of the Borgustan Range (Figure 6a). The "hole" has a slightly irregular oval shape, and it is ~10 m in diameter (Figure 6b). This natural arch is associated with large cavities ("caves") of a comparable size in the slope (Figure 6a,c). These peculiar landforms were carved by wind erosion in Aptian sandstones (Cave Horizon) of the upper package of the Lower Cretaceous sedimentary succession exposed in the range's scarp (influence of chemical weathering cannot be excluded). The northern slopes of the Borgustan Range are gentle, and its southern slopes are rather steep, with a well-developed scarp. By its shape and origin, this is a typical cuesta [49–51], which formed thanks to the low-angle, monocline distortion of Lower Cretaceous sedimentary rocks differently prone to erosion. The shape of the Ring Mountain is irregular, with slopes differing in steepness (Figure 6b,d).

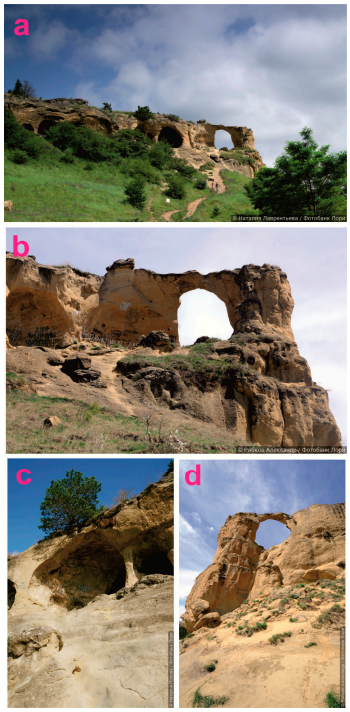

Figure 6. The Ring Mountain geosite: (**a**)—general view (photo: Natalia Lavrentieva, Lori Photobank), (**b**)—close view (photo: Aleksandr Ryabkov, Lori Photobank), (**c**)—associated cavities (photo: Natalia Popova, Lori Photobank), (**d**)—view from the opposite side (photo: Aleksandr Ryabkov, Lori Photobank). All photos are published with permission.

The geoheritage importance of the Ring Mountain is linked to the uniqueness of this natural landform to the Russian South, and to its picturesque view. This landform can be attributed to the geomorphological type of geoheritage, and, thus, it is a typical geomorphosite (sensu [52–56]). Provisionally, it can also be termed as a geosite because the distinction between geosites and geomorphosites is not strict, and the latter seem to be a kind of the former. It is worth mentioning that there are different types of sedimentary, paleo-geographical, and stratigraphical information that associate with outcrops of Aptian sandstones. However, similar outcrops can be found both within and beyond the study area, and, thus, the heritage value of the sections available at Ring Mountain is minimal. This geosite is small, and, thus, it looks like a point even on detailed maps. The apparently ongoing wind erosion and slope processes make it dynamic. This geosite is located close to the main road connecting Kislovodsk with other cities of the Russian South, there is a special place for bus and car stop and souvenir vendors, and trails lead from toes of the Borgustan Range to the natural arch (Figure 6a). Therefore, the geosite's accessibility is perfect. The place inside the natural arch is vast and flat to accommodate large groups of visitors, who also have the opportunity to take panoramic photos of the local landscapes. This is one of the most popular tourist attractions of the Kislovodsk area, which means strong anthropogenic pressure (trail widening, writing on sandstones, occasional damage, even hand polishing of sandstone surfaces). The locality has already been modified, and there are risks of future damage and even destruction, i.e., it demonstrates an elevated vulnerability. Nonetheless, the Ring Mountain has an official protected status as a monument of nature, and its state is monitored; rocks surfaces are cleaned to remove writing and strengthened where necessary, and it is also planned to install wooden stairs to facilitate access of visitors to the natural arch and to minimize the direct influence of crowds of tourists on the slope. The aesthetic properties of this geosite are high, and they are related, first of all, to its unusual shape (Figure 6b).

4.1.3. Little Saddle

The Little Saddle (Maloe Sedlo) is an elevated point (1325 m) of the Dzhinal Range in the southeastern part of the study area (Figure 2). This place itself is of low (if any) geoheritage interest, but it offers a spectacular, panoramic view towards the Elbrus Mountain, giving an opportunity to observe this highly unique feature (Figure 7). It should be noted that such viewpoints are valued by specialists in geoheritage, and they are known as viewpoint geosites [57–61]. Their importance is determined by the visibility of geological and geomorphological landscapes and particular objects.

Figure 7. Panoramic view of the Elbrus Mountain (indicated by an arrow) from the Little Saddle (photo: ArhSib, Lori Photobank). The photo is published with permission.

The Elbrus Mountain with its heights of 5642 m (western summit) and 5621 m (eastern summit) is the highest peak in Russia and in the whole of Europe. Essentially, this is a dormant stratovolcano with hydrothermal and seismic activities. It is covered by extensive glaciers (>100 km^2). The geology and natural environment of this mountain have been studied for a long time, and contemporary knowledge can be found, particularly, in the

works by Bindeman et al. [62], Dubinina et al. [63], Dudarov et al. [64], Holobâcă [65], Koronovskii et al. [66], Koronovsky and Myshenkova [67], Kutuzov et al. [68], Lebedev et al. [69], Milyukov and Myasnikov [70], Milyukov et al. [71], and Rogozhin et al. [72]. The Elbrus is an emblematic mountain of the Russian South. The direct distance between it and the Little Saddle viewpoint is <80 km, although road distance is more than twice as long (driving requires 3–4 h). Unique physical parameters (height) and volcanic origin make the Elbrus Mountain a world-class geosite (also a geomorphosite), and it was already treated as such by Lapo et al. [73]. Nonetheless, this geosite is rather remote from the Mineralye Vody resort area, and its distant observation facilitates a better comprehension of the characteristic shape of this volcanic edifice.

The geoheritage importance of the Little Saddle is linked to the possibility of distant observation of the unique Elbrus Mountain and the exceptional scenery (Figure 7). This geosite can be attributed to the geomorphological (highest mountain) and igneous (volcanism) types of geoheritage. Although more types (for instance, mineralogical and geothermal) can be established for the Elbrus Mountain itself, these related features are invisible from the Little Saddle. As explained above, this small, point-size geosite is a viewpoint geosite, and is static. It is connected well by trails with Kislovodsk and, particularly, its famous recreational park. Getting there is not challenging, but requires readiness for hiking on rather gentle mountain slopes for up to an hour. This may be a limitation to some visitors, and, thus, accessibility is slightly limited. There is enough space for accommodation of visitors willing to enjoy panoramic views of the Elbrus Mountain (of course, visibility of the latter depends on weather conditions). Although anthropogenic pressure can perturb the environment of the Little Saddle, this does not influence the visibility of the Elbrus. In any case, the Little Saddle geosite is located on the territory of the Kislovodsk National Park, which is a protected area with high-quality management and permanent maintenance. If so, the vulnerability of this geosite is absent. The exceptional aesthetic properties are determined by the availability of panoramic views (Figure 7).

4.2. Assessment of Geosites

The score-based approach employed for the purposes of the present study (Figure 4) pays attention mainly to the rarity of the geosites, which can be established taking into account their content (see descriptions given above) and the availability of similar features in the same area, region, country, and the world. The related scores are reflected in Figure 8 and explained below.

CRITERIA	GEOSITES		
	HW	RM	LS
RARITY / RELATIVE UNIQUENESS	+100	+250	+50
NUMBER OF GEOHERITAGE TYPES	+25	+25	+10
ACCESSIBILITY	+25	+25	0
VULNERABILITY	+25	0	+25
NEED FOR INTERPRETATION	0	+25	+25
SCIENTIFIC UTILITY	+25	+25	0
EDUCATIONAL UTILITY	+25	0	0
TOURISTIC UTILITY	+25	+25	+25
AESTHETIC SIGNIFICANCE	+50	+50	+50
RANK	300	425	185

Figure 8. Results of the semi-quantitative assessment of the considered geosites of the study area. See Figure 4 for explanation of scores (particularly, zero values do not necessary mean poor qualities or absence of something). Abbreviations: HW—Honey Waterfalls, LS—Little Saddle, RM—Ring Mountain.

The Honey Waterfalls seem to be rare on the regional scale: on the one hand, somewhat similar geosites are known in other places in Russia [10]; on the other hand, the combination of phenomena (granitoids, weathering crust, Lower Cretaceous carbonates, active river erosion, and waterfalls) is unique to the southern Central Ciscaucasus and, probably, the entire Northern Caucasus. The Ring Mountain is rare on the national scale: natural arches and natural bridges are known in different places of the world [74–80], but they are not so frequent and tend to degrade or even disappear [81,82]; this means that natural arches are highly unique for each particular country, including one so large as Russia (especially in the case of such a typical, large, and famous feature as the Ring Mountain). The Little Saddle is rare only on the local scale: it is highly suitable for distant observation of the Elbrus Mountain from the Kislovodsk area, but some other viewpoints can be found in other neighboring areas of the southern Central Ciscaucasus and the central Greater Caucasus.

Taking into account these notions of the rarity of the considered geosites and their characteristics given above, it is possible to assess them semi-quantitatively with the approach of Ruban et al. [46]. The results imply that the most valuable geosite is the Ring Mountain; two geosites (Honey Waterfalls and Ring Mountain) can be ranked nationally, and one geosite (Little Saddle) can be ranked regionally (Figure 8). The Honey Waterfalls and the Little Saddle are examples of when the consideration of technical (functional) properties can increase the rank of geosites. Generally, these results mean that the Kislovodsk area possesses precious geoheritage resources. These can be exploited for the purposes of geological science (international projects focused on granitoid weathering and Early Cretaceous carbonate sedimentation at the Honey Waterfalls and natural arch evolution at the Ring Mountain), education (learning about river erosion and granitoid weathering at the Honey Waterfalls, sandstone landscape evolution at the Ring Mountain, and orogenic volcanism at the Little Saddle), and tourism (enjoying waterfalls and the peculiar geological landscape at the Honey Waterfalls, visiting the natural arch at the Ring Mountain, and distant observation of Russia's and Europe's highest peak and volcano at the Little Saddle).

5. Discussion and Conclusions

5.1. Geosite Diversity of the Kislovodsk Area

Three geosites from the Kislovodsk area differ in several aspects (Table 1), and, thus, it is reasonable to consider their diversity. The term "geodiversity" has become popular in contemporary geoscience [4,83–88]. However, its meaning has narrowed and become qualitative, almost philosophical and even slogan-like (such terminological developments are normal processes in science). In such a situation, this term should not be used to describe the diversity of geosites in order to avoid confusion and inconsistencies. If so, it is reasonable to refer to geosite diversity, which can be defined provisionally as difference between geosites in the same area. Importantly, geosites can differ in their value, geological and geomorphological content, and physical forms. For instance, geosites of any given area can be judged as diverse if they are ranked globally, nationally, regionally, and locally; in another case, geosite diversity can result from the co-existence of multiple geoheritage types in a given area.

In the Kislovodsk area, it is possible to trace the geosite diversity in five aspects. The first of these aspects is the difference between the three geosites in their total value (nationally- and regionally-ranked geosites coexist) and particular properties (for instance, different vulnerability and educational utility). This difference appears to be moderate in the light of the semi-quantitative assessment (Figure 8). The second aspect is the extrinsic content diversity, which is related to the presence of several geoheritage types in the three geosites taken together. Although the considered geosites exhibit many types (Table 1), one should note that all of them are geomorphological features (river gorge at the Honey Waterfalls, natural arch at the Ring Mountain, and visible high mountain at the Little Saddle), and two of them (Honey Waterfalls and Little Saddle) are related to igneous activities (Carboniferous granitoids and Quaternary stratovolcano, respectively). If so, this diversity is also moderate. The third aspect is intrinsic content diversity, which is related to

the presence of different geoheritage types in one geosite. The Honey Waterfalls and the Ring Mountain demonstrate a significant diversity of this kind because several geoheritage types are found there (Table 1).

Table 1. The presence of geoheritage types, forms, and other features in the proposed geosites.

Features	Geosites		
	Honey Waterfalls	**Ring Mountain**	**Little Saddle**
Geoheritage types			
Geomorphological	+	+	+
Hydro(geo)logical	+		
Igneous	+		+
Sedimentary	+	m	
Stratigraphical	+	m	
Paleogeographical	+	m	
Paleontological	?		
Geohistorical	?		
Geoheritage forms			
Natural outcrop	+	+	
Natural landform (geomorphosite)	+	+	
Road cutting	+		
Dynamic geosite	+	+	
Viewpoints	+	+	+
Touristic infrastructure			
Car/bus stops	+	+	
Trails	+	+	+
Advanced constructions (e.g., stairs)	+		

Note: + marks presence, ? marks potential presence, which cannot be confirmed without special investigations, m marks presence, but minimal value.

The fourth aspect is the extrinsic diversity of forms, which is related to the presence of different geoheritage forms (natural outcrops, quarries, isolated landforms, etc.) in all geosites taken together. The proposed geosites of the Kislovodsk area exhibit different forms (Table 1), and this diversity seems to be high. The fifth aspect is the intrinsic diversity of forms, which is related to the presence of different geoheritage forms in one geosite (for instance, co-existence of natural and artificial outcrops). The Honey Waterfalls geosite combines several (also natural and artificial) forms, and shares both static and dynamic features (Table 1). The Ring Mountain is a typical geomorphosite, but some other forms can also be established there. The Little Saddle is a viewpoint geosite. If so, this diversity seems to be moderate-to-high.

5.2. Geoheritage Management in Resort Areas: Opportunities and Challenges

The geoheritage of the Kislovodsk area represented in the three considered geosites is found in the specific context of the nationally important, all-season resort area of Mineralnye vody, which is highly popular in Russia and boasts more than a century of strong development of the tourism and recreation industries [22–26]. This resort area is overcrowded by tourists, and all three geosites serve as very popular tourist attractions. Indeed, this geoheritage creates opportunities, but also raises challenges, which can be identified, particularly, on the basis of personal observations.

The position of the geosites in the resort area can be helpful for their conservation. The local administrations and other stakeholders are interested in the sustainability of the natural resources, which are important to tourists. Moreover, two geosites (Ring Mountain and Little Saddle) are protected officially, and the Honey Waterfalls are actively exploited by the local tourism firms caring about their condition. Generally, the dedication of the state and municipal authorities to conservation initiatives in the Kislovodsk area and the entire Mineralnye Vody resort is strong, because both territories are treated as a national and regional pride and treasure. Moreover, the position of the geosites in the resort area is helpful to their effective exploitation. On the one hand, the existing level of development of the tourism and recreation industries is high to facilitate promotion of these geosites among all segments of the target audience. On the other hand, the available infrastructure is enough for easy access to these geosites and accommodation of visitors (not only tourists, but also scientists and guided student groups). The development of the touristic infrastructure contributes to the growth of geoheritage itself—for instance, it is the maintenance of the Kislovodsk National Park with its multiple trails and specially selected panoramic viewpoints that has permitted the proposing of the Little Saddle viewpoint as a geosite.

The position of the geosites in the resort area also raises several concerns. The first is the abundance of visitors, which is especially high in the case of the Honey Waterfalls and the Ring Mountain. Such abundance affects the perceived aesthetic properties of tourist attractions [89,90] and tourist satisfaction [91–95], even if related interpretations should be understood with some caution [96,97]. Crowds of visitors, even at ideally managed localities, increase risks of occasional damage, accumulation of litter, and environmental pollution. Moreover, a concentration of multiple tourist attractions and activities in resort areas can shift the interest of some visitors from geosites as highly-specific objects to other attractions.

The presence of significant geoheritage resources and the noted opportunities and challenges make the development of a special geoheritage management plan urgent for the Kislovodsk area. The need for such plans has already been argued other places of globally [98–100]. In the discussed case, the plan can be developed and implemented by the local administrative authorities and the Kislovodsk National Park. The main elements of this plan should include the inventory and the regular monitoring of the geosites available in the Kislovodsk area (the latter possesses some notable geological features [11,17,101] in addition to those reported in this paper), their active promotion with special focus on scientists and guided tourist groups, and the regulation (but not limitation) of their touristic accessibility.

5.3. Conclusion

The present paper characterizes three geosites from the Kislovodsk area of the southern Central Ciscaucasus, with the principal outcomes as follow. First, the Honey Waterfalls, the Ring Mountain, and the Little Saddle possess geological and geomorphological features that represent the late Paleozoic–Mesozoic and late Cenozoic evolution of the region, including granitoid emplacement in the Carboniferous, their weathering in the end-Jurassic, the Early Cretaceous marine transgression, and the Quaternary volcanism, river and wind erosion. Second, the rarity and the technical (functional) properties of these geosites permit their ranking nationally and regionally; they reflect the diversity of geoheritage types (geomorphological, hydro(geo)logical, igneous, sedimentary, stratigraphical, paleogeographical) and forms (natural outcrops, road cutting, geomorphosites, viewpoints). Third, the position of the considered geosites in the large resort area of Mineralnye Vody is related to several opportunities and challenges, which can be addressed effectively with a local geoheritage management plan.

The Kislovodsk area and the neighboring areas of the southern Central Ciscaucasus appear to be promising for a further geoheritage inventory. Three reported geosites were identified easily because they are popular and well-accessible. Nonetheless, new field

investigations coupled with analysis of the published knowledge may result in finding some other geological and geomorphological objects with heritage value.

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