

## Article

# Promoting Geosites on Web-Pages: An Assessment of the Quality and Quantity of Information in Real Cases

Anna V. Mikhailenko <sup>1</sup>, Svetlana O. Zorina <sup>2</sup>, Natalia N. Yashalova <sup>3</sup> and Dmitry A. Ruban <sup>4,\*</sup> 

<sup>1</sup> Department of Physical Geography, Ecology, and Nature Protection, Institute of Earth Sciences, Southern Federal University, Zorge Street 40, Rostov-on-Don 344090, Russia

<sup>2</sup> Institute of Geology and Petroleum Technologies, Kazan Federal University, Kremlyovskaya Street 18, Kazan 420008, Russia

<sup>3</sup> Department of Economics and Management, Business School, Cherepovets State University, Sovetskiy Avenue 10, Cherepovets 162600, Russia

<sup>4</sup> Department of Organization and Technologies of Service Activities, ITSCI, Southern Federal University, 23-ya Linija Street 43, Rostov-on-Don 344019, Russia

\* Correspondence: ruban-d@mail.ru

**Abstract:** Geological information present on web-pages determines the efficacy of the online marketing of geosites. In this paper, a new approach aimed at an easy and quick assessment of geosite-focused web-pages is proposed. It is based on scoring by several criteria reflecting the quality and the quantity of geological information. Attention is paid to the simplicity and correctness of information, mention of technical properties (accessibility, location, and safety), relative and absolute amounts of information, and adaptation to persons with disabilities. Textual and graphical elements are considered differently. The approach is tested in three cases, namely, the Granite Gorge in the Western Caucasus, Pechischi in the Volga Region, and the Red Stones in the Southern Ciscaucasus. These are well-known geosites already used as important (geo)tourist attractions. It is established that the web-pages devoted to them chiefly allow minimally perfect promotion. Some examples of misinterpretations of geological information and errors are specially considered. The approach seems to be promising, and its application allows finding the deficiencies of web-pages, an improvement of which will enhance geosite promotion. Cooperation between representatives of the tourism industry and geological faculty members of local universities or administrations of protected areas is reasonable to create more informative geosite-focused web-pages.

**Keywords:** geoheritage; geological information; geotourism; natural resources; online marketing



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## 1. Introduction

Geological heritage (geoheritage) requires proper conservation as a constituent of the Earth's identity and as outstanding information sources for contemporary society [1–8]. The concept of geoheritage is rather broad and it intersects to a certain degree with the idea of geodiversity. Detailed conceptualization and terminological definitions were offered, particularly, by Brilha [9], Habibi et al. [10], and Reynard and Brilha [6]. However, it would be too early to say about any universal treatment, especially because new kinds of geoheritage are reported regularly [2]. In this work, geoheritage is understood as the entity of more or less unique geological features known from any territory, country, or the world as a whole. In fact, they may be either very typical or very peculiar. Geoheritage sites (geosites) are localities representing unique geological features in situ (uniqueness is a relational characteristic, and it can be global, national, regional, and local), and they are common but not the only geoheritage objects. It should be noted that “geosite” is a rather broad, scientific term, whereas these localities can have different names in different countries depending on their language and traditions of geoconservation. For example,

many geosites are established as natural monuments in Russia, where “natural monument” is the official category of specially protected areas with the smallest size.

Geoheritage is a highly valuable natural resource, which can be exploited for the purposes of science, education, and tourism [11–17]. The interest in these resources is conjugated with technological advances and innovations [18–25]. Geosites are able to contribute to sustainable development when the above-mentioned conservation and exploitation are balanced and effective. The related ideas were developed by Bentivenga et al. [26], Lazzari and Aloia [27], Oyelami et al. [28], Roberts [29], Somma [30], Štrba et al. [31], Suzuki and Takagi [32], and Xu and Wu [33]. Principally, these specialists argued that geoheritage-driven sustainability is a new and important idea with big potential for practical applications.

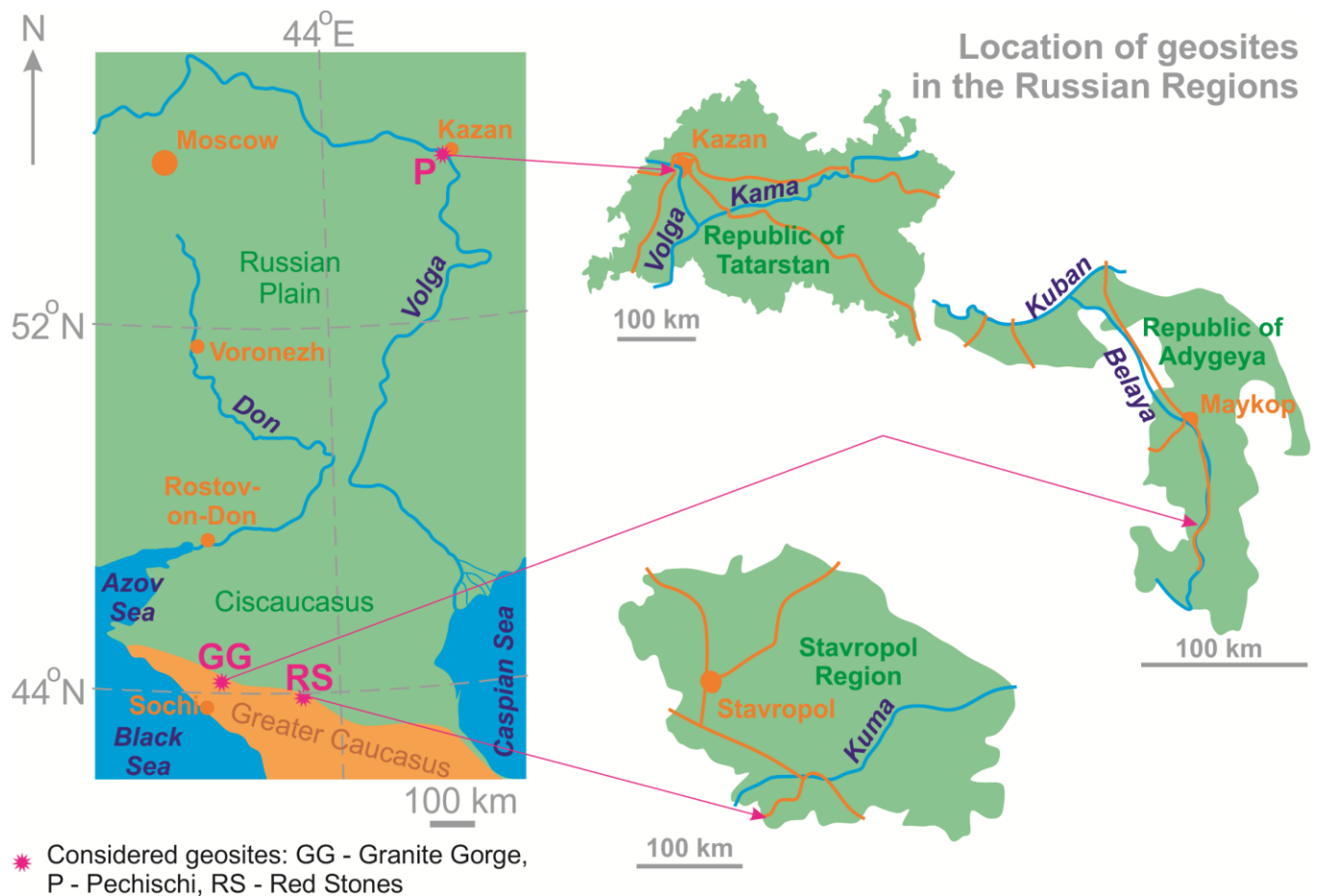
Awareness of geoheritage is essential to its conservation and exploitation. As such, special efforts should be paid to the promotion of geosites with the use of different communication tools and channels, as well as marketing techniques [34–47]. Web-pages devoted to either geoheritage or geotourism are among the most evident instruments for geosite promotion. The related experience has been considered in many works, and the related discussions started together with the global-scale acceleration of the interest in geoconservation and geotourism activities in the 2000s [48–55]. These studies proved that, on the one hand, web-pages can be very informative and, thus, influential on the broad public, and, on the other hand, they are highly demanded by geotourists and other geosite visitors. It is very common for such web-pages to be developed by representatives of the tourism industry or enthusiasts without the proper geological knowledge and skills or by professional geologists who are not always aware of how to communicate their professional knowledge to the broad public in the most optimal form. Moreover, geoheritage is a too specific and even too difficult theme to many tourists who may interpret it differently from experts in geology [56–58], and, thus, its promotion on web-pages tends to employ its landscape context [59–61] and cultural frames [62,63]. Taking the above into account, it is not surprising that online geosite promotion faces various challenges, and the related web-pages are often not as informative as desired.

The objective of the present study is to propose a new approach for the assessment of information presented on geosite-focused web-pages. Indeed, such an approach should not require too specific knowledge and skills to be applied broadly and quickly for general judgments of existing web-pages, as well as for planning new web-pages. In other words, it should help to find deficiencies in the online promotion of geosites and to recommend related improvements. The present study offers application of this approach to three real cases, i.e., well-established geosites located in Russia. Their selection was determined by the research experience of the authors (accurate initial tests of the methodological proposal require precise knowledge of these geosites). All of the chosen sites already function as tourist attractions, and they are more or less actively promoted on various web-pages.

## 2. Materials and Methods

The approach proposed in this study is tested for three geosites located in different regions of Russia, namely, the Granite Gorge in the Republic of Adygeya, Pechischi in the Republic of Tatarstan, and the Red Stones in the Stavropol Region (Figure 1). These geosites have been previously studied comprehensively [64–66] and, thus, they do not need re-description (nonetheless, their very brief characteristics are provided below, together with each case example). Importantly, the present study focuses on how these geosites are promoted on web-pages, i.e., web-pages, not geosites, are the subject of the analysis. Although the selected geosites are popular tourist attractions, it would be difficult to expect their promotion on multiple web-pages. Tentatively, it is established that the selected geosites are noted on a very limited number of web-pages. Therefore, three popular web-pages are examined in each case, and they serve as the material for this study. This seems to be enough to illustrate the application of the proposed approach, which can be used for the

assessment of single web-pages. The web-pages are anonymized to avoid any occasional challenge of the interests (also commercial) of their owners.



**Figure 1.** Location of the geosites considered in the present work.

The proposed approach is aimed at collecting only information from geosite-focused web-pages. Technical aspects of the latter, such as design, functional advance, and language, are not considered. On the one hand, these differ too much depending on the skills of the web-page creators. On the other hand, judgments of these aspects depend on aesthetic preferences and digital skills of tourists, which may differ substantially, reflecting personal attitudes and experience [67–71]. Information from geosite-focused web-pages can be analyzed in regard to their quality and quantity. Evidently, text and images (drawings, photographs, and maps) should be considered separately. Audio and video materials can also be found on some web-pages, and the former can be analyzed similarly to text and the latter can be analyzed similarly to images (indeed, these may be considered separately if present in large amounts, but this is not so in the cases addressed below). The proposed approach is novel, and it differs from that offered previously by Molokac et al. [51]. The former deals with geological information and geosites, but not with geoparks, which are essentially different establishments. It does not pretend to be better than the latter, but only offers the other frame of vision of geoheritage-related web-pages.

The quality of the information presented on web-pages can be assessed with three criteria, namely, simplicity, correctness, and the technical properties of geosites (Table 1). Simplicity is important because many geosite visitors are not experts in geology and have minimal geological knowledge (or do not have it at all); they often seek new experiences (latent geotourist sense [72]) or natural beauty [73]. Overly professional explanations or too complex schemes on web-pages make the information difficult to understand and, thus,

disinteresting to them. Indeed, judgments of simplicity may be only subjective, depending on the background of the web-page users. However, it appears possible to tentatively establish some objective criteria based on the presence of more or less complicated information (Table 1). For instance, the use of unexplained professional terms such as “pegmatites” or the demonstration of the local stratigraphical column make the web-page difficult for visitors without geological knowledge. Secondly, correctness is important because the attempts to deliver information to the broad public or the insufficient geological knowledge of web-page creators may cause misinterpretations and errors. As for the technical properties of geosites, they appear to be essential to inform potential visitors about location, access limitations (entrance fees, lengthy trails, or car parking possibilities), and safety aspects (for instance, recommended behavior in bad weather conditions) [74–76]. Indeed, the presence of this information enhances geosite promotion because it allows tourists to make definite plans. One would also recommend taking into account the completeness of geosite descriptions, but this seems to be a challenging solution: this property may be evident only to professionals and it depends on the breadth of their education and research experience; moreover, not all facts may be useful and clear to “ordinary” visitors.

**Table 1.** Criteria and scoring system proposed for the quick, semi-quantitative assessment of the quality and quantity of information about geosites on web-pages.

Property	Criteria	Object	Grades	Scores
Quality	Simplicity (S)	Geological text	Simple (clear to non-professionals: geological concepts not presented, specific geological terms (e.g., time units) are very few and well-explained)	10
			Complicated (require basic geological knowledge: elementary geological concepts (e.g., magmatism) are considered, specific terms are few and chiefly not explained)	5
			Professional (require in-depth geological knowledge: advanced geological concepts (e.g., diagenesis) and scientific discussions (e.g., about palaeobiogeographical interpretations) are considered, specific terms are numerous)	3
			Absent	0
		Geological images	Simple (photographs of geological features)	10
			Complicated (photographs of geological features and/or easy explanatory drawings; also photographs illustrating complex geological phenomena)	5
			Professional (photographs of geological features and/or maps, stratigraphical columns, diagrams, etc.)	3
			Absent	0

Table 1. Cont.

Property	Criteria	Object	Grades	Scores	
Quantity	Correctness (C)	Geological text	Generally correct	10	
			Some misinterpretations	5	
			Errors	1	
			Absent	0	
		Geological images	Generally correct	10	
			Some misinterpretations	5	
			Errors	1	
			Absent	0	
	Technical properties such as accessibility, location, and safety (T)	Text and/or images	Generally complete	10	
			Incomplete or incorrect (only some properties are addressed)	5	
			Insufficient (too limited information)	1	
			Absent	0	
	Relative quantity (R)	Geological text	>50% of the entire text	10	
			10–50% of the entire text	7	
			<10% of the entire text	3	
			Absent	0	
		Geological images	>50% of all illustrations	10	
			10–50% of all illustrations	7	
			<10% of all illustrations	3	
			Absent	0	
		Absolute quantity (A)	Geological text	Extensive descriptions	10
				1–2 paragraphs	7
				1–2 sentences	3
				Absent	0
			Geological images	>3 items	10
				2–3 items	7
				1 item	3
				Absent	0
Special tools/solutions for persons with disabilities (D)			Present	10	
			Absent	0	
Total scores			0–100		
Categories of web-pages depending on total scores			Very perfect	>90	
			Perfect	71–90	
			Minimally perfect	51–70	
			Imperfect	30–51	
			Very imperfect	<30	

The quantity of information can be assessed with two criteria, namely, relative quantity and absolute quality (Table 1). The former reflects the ratio between geological and non-geological information. In fact, geosite-focused web-pages are often overwhelmed by text notions and images of landscapes, wildlife, and local culture/history [51]. Their importance to effective site promotion is undisputable (and it appears to be a norm if such notions and

images take half or an even larger portion of the given web-page), but it is also evident that non-geological information masks facts about geosites themselves. Absolute quantity reflects the true amount of geological information. Indeed, more extensive descriptions and a bigger number of photographs promote geosites better (if they are too professional or “boring”, they affect the quality of information assessed by the above-mentioned criteria, and, thus, the situation is avoided where web-pages that are overwhelmed by unnecessary or complex texts and images receive higher scores). Importantly, both criteria employed for the assessment of the quantity of informative are objective because they depend on the easy-to-establish properties of web-pages (Table 1). For instance, one can easily measure the abundance of the geological information in the entire text of the given web-page, as well as count the number of geological illustrations. Notably, such an assessment is performed by professionals who easily understand what is geological and what is not. Finally, it appears reasonable to check whether web-pages offer special opportunities for persons with disabilities who should always be considered among potential geotourists [77,78]. On the one hand, this makes geosite promotion more inclusive and, thus, ethical. On the other hand, this enlarges the target audience.

Taking into account the above-mentioned criteria, a scoring system for the semi-quantitative assessment of information on geosite-focused web-pages is proposed (Table 1). Several grades can be proposed for these criteria (these grades are established provisionally, but on the basis of the previous authors’ experience with such web-pages), each with its specific scores. Calculating the total scores for a given object allows assigning it to one of five categories (see the bottom of Table 1). The entire approach requires the assessment of the studied web-page(s) by all these criteria with the calculation of the total scores. This procedure seems to be rather objective; indeed, it requires from the evaluator a good geological background in order to understand what are too professional explanations (criterion “Simplicity”) and find possible misinterpretations and errors (criterion “Correctness”).

### 3. Results

#### 3.1. Case 1: Granite Gorge (Western Caucasus)

The Granite Gorge is an important geosite in the Republic of Adygeya (southwestern Russia); it belongs to the mountain-dominated domain of the western part of the Greater Caucasus (Figure 1). This geosite has the official status of natural monument approved by the regional administration. It has been described in detail by Mikhailenko et al. [64]. This is a linear geosite, which corresponds to the long (up to 5 km), deep (several hundreds of meters), and narrow (less than one hundred of meters somewhere) gorge cut by the Belaya River in the Late Paleozoic granitoids, i.e., granites and granodiorites (Figure 2). These rocks form the Dakh Crystalline Massif, which is crossed by the noted gorge. This igneous body was emplaced together with the Hercynian tectonic movements. The gorge has appeared thanks to the river incision in the hard rocks uplifted due to the Cenozoic (Alpine) orogeny. A paved road stretches along the gorge and allows observation of its morphology as well as of numerous rock outcrops (special observation points are constructed there). This is one of the best known (geo)tourist attractions of Mountainous Adygeya, which itself is a major tourist destination of the Russian South. This is why the Granite Gorge geosite is promoted on several web-pages (Table 2).

The semi-quantitative assessment of the web-pages considering the Granite Gorge geosites demonstrates that the promotion by them can be judged minimally perfect (Table 2). The most striking deficiencies are the absence of adaptation for persons with disabilities and the insufficiency of attention to the technical properties of this geosite. The correctness and the quantity of geological information are also questioned in some cases. Notably, the images seem to be generally better than the text. These web-pages boast a high simplicity of storytelling.





**Figure 2.** View of the Granite Gorge geosite. One can note a typical V-shaped profile of the gorge and outcrops of pinkish Late Paleozoic granitoids along the Belaya River.

The misinterpretations and the errors in the information about the Granite Gorge on the selected web-pages are different. For instance, minor waterfalls formed by the principal stream (the Belaya River) are considered, whereas these are absent in fact. The authors of the web-page's text referred either to several "hanging" mouths of the small tributaries formed by the less intense cutting of the hard parent rocks than that of the Belaya River or to the small cataracts of the latter, although these are also considered in the text. Another example is where the web-page mentions "big deposits" of hydrothermal minerals, although these are absent in the Granite Gorge. In another web-page, the Tethys Ocean is mentioned. It is considered in a very questionable, folklore context, but even more important is that it is linked to granitoids and one peculiar landform, although the former

are not marine rocks and the latter formed dozens of millions of years after the closure of this ocean. It appears that all web-pages were created by non-experts in geology who only heard some basic geological facts about this geosite but did not have deep understanding about it.

**Table 2.** Semi-quantitative assessment of the quality and quantity of information about the Granite Gorge geosite on selected web-pages.

Web-Pages (Anonymized with Indication of the General Affinity of Creators) and Their Brief Characteristics	Criteria (See Table 1 for Scoring System and Abbreviations, t—Text, i—Images)										Total Scores
	S		C		T	R		A		D	
	t	i	t	i		t	i	t	i		
GG1 (tourism): richly illustrated description of the Granite Gorge as a natural attraction of Adygeya; emphasis is made on natural (chiefly geological) features	10	10	5	10	1	7	10	7	10	0	70
GG2 (tourism): brief characteristics of the Granite Gorge with several spectacular photographs; significant attention is paid to tourist activities and accommodation opportunities	10	10	5	10	1	7	10	7	10	0	70
GG3 (tourism and public media): very popular description of the Granite Gorge arguing its attraction to tourists as a natural (not only geological) attraction	10	10	1	10	1	3	10	3	7	0	55

### 3.2. Case 2: Pechischi (Volga Region)

Pechischi is an important geosite in the Republic of Tatarstan (central Russia); it belongs to the plain domain of the Volga Region (Figure 1). This geosite has the official status of natural monument approved by the regional administration. It has been described in detail by Zorina et al. [66]. This is a linear geosite, which corresponds to the lengthy (several kilometers) section of Guadalupian (Middle Permian) dolostones with abundant fossils stretching along the right bank of the Volga River near Pechischi village (close to large Kazan city); there are also karst features and historical mining sites (Figure 3). The locality is a stratotype of the Upper Kazanian regional stratigraphical unit of the Russian Platform (the regional series, stages, and substages of the Permian System are used in this territory). Carbonates accumulated in the Late Kazanian (mid-Permian) sea that existed in the eastern part of this platform, close to the Hercynian Urals. Dolostones were mined for centuries for the purposes of the local building industry. The geosite is accessible by car and river ships, and there are many well-established trails allowing its examination in detail. This is a notable (geo)tourist attraction in the vicinities of Kazan, which itself is one of the most important tourist destinations of Russia. As expected, the Pechischi geosite is promoted on several web-pages (Table 3).

The semi-quantitative assessment of the web-pages considering the Pechischi geosites reveals their striking difference (Table 3). There are examples of perfect, minimally perfect, and imperfect promotion. The common problems of web-pages are the absence of information for persons with disabilities and too superficial consideration of the technical properties. One web-page is distinguished by simplicity of the text, correctness of images, and relative abundance of geological information. Another web-page received low scores because it lacks illustrations.





**Figure 3.** View of the Pechischi geosite. One can note an impressive outcrop of Gaudalupian dolostones and an abandoned, historical oven on the bank of the Volga River.

**Table 3.** Semi-quantitative assessment of the quality and quantity of information about the Pechischi geosite on selected web-pages.

Web-Pages (Anonymized with Indication of the General Affinity of Creators) and Their Brief Characteristics	Criteria (See Table 1 for Scoring System and Abbreviations, t—Text, i—Images)										Total Scores
	S		C		T	R		A		D	
	t	i	t	i		t	i	t	i		
P1 (tourism): brief but rather informative description of the Pechischi section as the object of special tourist excursion; there are good illustrations (also of fossils) and simplified geological explanations	10	10	5	10	1	10	10	7	10	0	73
P2 (unclear): rather “dry”, not illustrated description of the Pechischi section; the status of natural monument is emphasized	5	0	10	0	1	7	0	7	0	0	30
P3 (enthusiasts): richly illustrated characteristics of the Pechischi section; various geological facts are communicated, and photographs represent different views of the section and its geological features	5	5	10	10	1	10	10	7	10	0	68

The misinterpretations found on one web-page are about the palaeogeographical patterns. The authors of the text suggest that the dolomite layers were formed in the ancient sea, although dolostones are diagenetic in this case [66]. Indeed, this is a minor

misinterpretation, which could be avoided by obtaining professional knowledge. In another web-page, it is written that this sea existed more than 200 million years ago. Although this is principally correct, the notion of 200 Ma may leave impression about this age, which corresponds to the Triassic [79]. In fact, the sea existed before 250 Ma, i.e., in the mid-Permian. Moreover, expressions such as “Permian geological layer” seem to be quasi-scientific. Nonetheless, the selected web-pages seem to be created by persons with some basic geological knowledge or, at least, who have access to such knowledge (for instance, in the form of geoconsultancy).

### 3.3. Case 3: Red Stones (Southern Ciscaucasus)

The Red Stones is an important geosite in the Stavropol Region (southwestern Russia); it belongs to the domain dominated by hills and low mountains in the southern part of the Ciscaucasus (Figure 1). This geosite has the official status of natural monument approved by the regional administration, and it is situated in the territory of a larger protected area, namely, Kislovodsk National Park. It has been described in detail by Ruban and Yashalova [65]. This is a rather small geosite, which is an outcrop of weathered, red-colored Barremian (Lower Cretaceous) sandstones on a gentle slope (Figure 4). These accumulated in a shallow basin with significant iron fluxes from the nearby land. Although the rocks are rather hard, their weathering has led to disintegration and, thus, large clasts occur at the toe of the steep “walls” of the outcrop with a height of several meters. The locality is accessible through park trails, and it is also allowed to climb on the top of the rocks. This is one of the most popular and symbolic attractions of Kislovodsk National Park, which is a constituent of the large Caucasian Mineral Waters resort area—one of the most known and demanded tourist destinations of Russia. The Red Stones geosite is promoted on several web-pages (Table 4).

The semi-quantitative assessment of the web-pages considering the Red Stones geosite implies they are minimally perfect in its promotion (Table 4). Like the two previous cases, these web-pages do not serve persons with disabilities and provide minimal information about the technical properties of this geosite. They boast a high quality and quantity of illustrations, but the textual parts are questionable in regard to the correctness of the geological information (errors are found in two samples) and somewhat its simplicity; the relative and absolute amounts of this information are often restricted.

**Table 4.** Semi-quantitative assessment of the quality and quantity of information about the Red Stones geosite on selected web-pages.

Web-Pages (Anonymized with Indication of the General Affinity) and Their Brief Characteristics	Criteria (See Table 1 for Scoring System and Abbreviations, t—Text, i—Images)										Total Scores
	S		C		T	R		A		D	
	t	i	t	i		t	i	t	i		
RS1 (protected area): very brief characteristics of the Red Stones, with emphasis on its cultural importance within the national park; this web-page can be used for planning individual excursions	10	10	10	10	1	3	7	3	7	0	61
RS2 (tourism and public media): rather detailed description of the Red Stones; geological information is rather extensive, but it is overwhelmed by the local folklore context	5	10	1	10	1	7	7	3	7	0	51
RS3 (tourism): well-illustrated description of the Red Stones; geological and cultural knowledge co-occur, and the local folklore context is discussed	10	10	1	10	1	3	7	3	7	0	52





**Figure 4.** View of the Red Stones geosite. One can note Barremian Fe-rich sandstones forming a peculiar landform in Kislovodsk National Park; trails leading to this geosite are also visible. An unknown figure on the top (near the sculpture of eagle) serves as scale.

Various errors are found on two web-pages. For instance, one of them informs that the Jurassic sea existed there 100 million years ago. In fact, the rocks are of the Barremian (Early Cretaceous) age [80–82], and the Jurassic Period ended much earlier [Gradstein et al., 2020]. A user of this web-page will be fully disoriented about the age of the rocks. The suggested tectonic pushing of the rocks from the sea bottom is more than a simplification of their origin. Moreover, it is explained that the rocks are colored by “hydroxide of nitrogen”, which is scientifically unreasonable (surprisingly, iron oxides are also mentioned in this text). The same statement is found on the other web-page. It is notable that such pseudo-geological information is mixed with the true facts: one can learn about the correct interpretation of the sedimentary material delivery by rivers to the palaeosea from the nearby land. Generally, it appears that two web-pages were created by non-experts who were not able to make a distinction between correct and incorrect ideas. In contrast, the other selected web-page communicates the geological information briefly but professionally, which is expected as this is the official description offered by the above-mentioned national park.

#### 4. Discussion and Conclusions

Three cases employed for the purposes of the present study point out the differences between geosite-focused web-pages by the established criteria, which prove the utility of the

latter for such an assessment. It appears that the consideration of the special tools/solutions for persons with disabilities and the technical properties of geosites allows more critical assessment of information from such web-pages. The majority of the analyzed web-pages were created by representatives of the tourism industry (Tables 2–4). Although their geological knowledge cannot be checked directly, it appears that it is chiefly minimal or absent, as evidenced by the above-mentioned misinterpretations and mistakes. Finally, the separate analysis of texts and images is very reasonable due to the evident differences in the quality and the quantity of the related geological information. Taken together, these observations corroborate the usefulness of the proposed approach, which can be applied easily and quickly. Its two main limitations are (1) partial dependence on the professional understanding of a given geosite by the evaluator (judgments of the information correctness may require some specific knowledge about the given geological features) and (2) lacking attention to the relative importance of the criteria (for instance, the information about the technical properties of geosites may be even more demanded than the simplicity of their descriptions, and the simplicity and the correctness of images may be more important than those of the text). However, the first of these limitations cannot be avoided totally because many geosites represent too specific and unique features. The second limitation strongly depends on particular situations and knowledge/experience of web-page users and, thus, establishing any universal system for additional criteria “weighting” seems to be unreasonable.

The findings of the three case studies provide interesting matters for further discussion. First, one would expect that the web-pages created by tourism industry representatives or associates would be more concerned about technical issues (modes of access, exact location, and safety rules) and adaptation to persons with disabilities, because these two aspects are highly important in contemporary tourism [83–87]. However, this is not registered in fact (Tables 2–4), and the established deficiencies of the information reflect a certain unprofessionalism, which is not related to the specifics of geotourism. It should be stressed that the infrastructural frameworks of all considered geosites allow their use for persons with disabilities; however, two of these geosites (the Granite Canyon and Pechischi) cannot be recommended even for trained persons in the winter season and during heavy rains. Second, it appears that many creators of the selected web-pages are aware of some geological facts about “their” geosites, but do not understand them properly or cannot communicate them correctly. As such, many web-pages fail to offer proper interpretation, which is essential to (1) the correct comprehension of geosites and (2) putting them into the broad context of present environmental problems [88–92]. Third, it appears that the graphical information on the analyzed web-pages is generally better than the textual information (see examples in Tables 2–4). Most probably, this has happened unintentionally because the web-page creators were concerned with finding picturesque photographs, which are rarely difficult to understand or incorrect. Importantly, some specific images (such as geological maps, stratigraphical columns, or explanatory drawings) are absent.

The majority of the analyzed web-pages promote geosites with minimal perfectness (see scores in Tables 2 and 4). This can affect the promotion because such web-pages would be less demanded by many potential geotourists, including geology professionals, students, and amateurs. Moreover, it cannot be excluded that these web-pages may not only disappoint some users, but also distract from visits and/or disorient potential visitors. According to the previous research [93–95], geotourists have various motivations and their satisfaction also depends on different conditions. Indeed, the quality and the quantity of the promoted information can affect them, especially because web-pages can be highly demanded by geotourists always needing interpretation support. Notably, the web-pages with somewhat higher quality are either created by administrations of the protected area (the case of the Red Stones geosite in the Kislovodsk National Park) or appear for those geosites which are actively exploited for research and field teaching by large universities from nearby cities (the case of the Pechischi geosite near Kazan city where the Kazan Federal University, with its strong geosciences program, is based). These inferences stress the



importance of the involvement of administrations of protected areas and faculty members of universities in geosite marketing.

Three basic solutions can be recommended to avoid the possible pitfalls in the promotion of geosites. First, special management initiatives/programs can be developed to include geosites with the largest geotourist potential to strengthen cooperation between professional geologists and the tourism promotion “community”. Second, short and free online/offline courses can be organized by universities for representatives of the local tourism industry in the geology-rich areas to improve their geological knowledge and awareness. Third, well-accessible networks for geological consultancy can be maintained with the Earth science departments of universities. In addition to these solutions, which seem to be proactive, it is also necessary to monitor the quality of the already existing web-pages promoting geosites to improve them when necessary. This task can be performed by the authorities responsible for or interested in tourism development, enthusiastic groups, and professionals involved in local geoconservation activities.

In conclusion, the present study proposes an approach for the semi-quantitative assessment of information presented on web-pages promoting geosites. It appears to be reasonable to pay attention to both the quality and quantity of this information. The application in three real cases demonstrates the efficacy of this approach, which permits easy and quick finding of deficiencies of web-pages. As such, it is of practical importance because it indicates where improvements are necessary. This study also offers examples of geological misinterpretations and errors. The perspectives for further research are linked to more extensive testing and possible justification of the proposed approach. Moreover, it would be reasonable to take into account the opinions of users and creators of geosite-focused web-pages to understand their preferences and the sources of the established deficiencies. Experiments measuring the level of understanding of the geological information from web-pages are also necessary, although their outcomes can reflect only certain social contexts. More generally, this work contributes to the better understanding of the complexity of online geoheritage marketing, which depends on the efficacy of all its tools and channels, including web-pages.

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