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Geoheritage sites with palaeogeographical value: some geotourism perspectives with examples from Mountainous Adygeja (Russia)

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Abstract. Geoheritage sites with palaeogeographical value are excellent venues for geotourism. These sites preserve information about ancient environments, ecosystems, and their dynamics that may be of interest to professionals, students, amateur scientists, and the general public. Palaeogeographical geoheritage sites (geosites) can be used to successfully increase public awareness of past and future climate changes. However, because palaeogeographical information is typically complex and not directly visible, professional interpretation is necessary. Successful interpretive tools include posted signs and education activities that engage visitors in scientific research. Using modern analogues to help visitors visualize past environments and ecosystems may be particularly effective. Professional interpretation helps foster visitor awareness of a geosite's value. We suggest that some geosites can be visited sequentially on a guided excursion and propose a route for observing five geosites that exemplify the geodiversity of Mountainous Adygeja (Western Caucasus, southwestern Russia). Guided geosite excursions would introduce visitors to a broad diversity of palaeoenvironments and deepen their understanding of palaeogeographical phenomena. However, carrying capacity should be evaluated seriously for any geosites that are incorporated into palaeogeographical tourist excursions.

Key words: palaeogeography, geoheritage, geosite, geotourism, Mountainous Adygeja.

Апстракт: Објекти геонаслеђа са палеогеографским вредностима представљају изузетне локалитете за геотуризам. Ови објекти садрже информације о некадашњим срединама, екосистемима као и о њиховој динамици и могу бити веома занимљиви професионалцима, студентима, аматерским истраживачима као и широј јавности. Палеогеографски објекти геонаслеђа могу бити веома корисни приликом подизања свести шире јавности о климатским променама које су се дешавале у прошлости а такође и о онима које ће се дешавати у будућности. Међутим, с обзиром да су информације које се тичу палеогеографије углавном веома сложене и нису лако схватљиве неопходна је њихова стручна интерпретација. Успешна интерпретација подразумева постављање обавештења као и едукативне активности које би посетиоце укључиле у научно истраживање. Од нарочитог је значаја употреба одговарајућих примера из савременог доба како би се посетиоцима помогло да створе што бољу слику

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о некадашњим срединама и екосистемима. Стручно тумачење помаже посетиоцима да што боље разумеју значај геолошких објеката. Предлажемо да поједини геообјекти постепено буду уврштивани у стручне екскурзије и препоручујемо одређене руте за обилазак пет геообјеката који на добар начин илуструју геодиверзитет Адигеја планина (Западни Кавказ, југозападна Русија). Стручне екскурзије би упознале посетиоце са великом разноврсношћу палеосредина и проширile би њихово разумевање палеогеографских феномена. Међутим, за сваки геообјекат који је уврштен у палеогеографску туристичку екскурзију број посетиоца би требало веома прецизно одредити.

Кључне речи: палеогеографија, геонаслеђе, објекти геонаслеђа, геотуризам, Адигеја планине.

Introduction

Owing to the activity of individual researchers, research institutions, and international organizations such as the European Association for the Conservation of the Geological Heritage (ProGEO), studies of geological heritage (geoheritage) have become an important direction of Earth Science over the past two decades (e.g., Wimbledon & Smith-Meyer 2012; Prosser 2013). Yet despite numerous achievements and certain standardization of the relevant term definitions, concepts, and methods at both international and national levels (Wimbledon & Smith-Meyer 2012), further progress is necessary. Inconsistencies in classifications and approaches remain (e.g., Bradbury 2014; Garcia-Ortiz *et al*. 2014), and the perspectives of geoheritage for academic and public policies still need discussion.

Palaeogeographical information is preserved in many geological heritage sites (geosites). Palaeogeographical geosites are different from the other types of geosites because of the presence of valuable information about palaeoenvironments, palaeoecosystems, etc. (Bruno *et al*. 2014; see also below). These sites are also valuable from the point of view of geotourism (Dowling & Newsome 2010; Newsome & Dowling 2010; Dowling 2011; Gray 2013; Henriet *et al*. 2014; Bruno *et al*. 2014; Ruban 2015). Geotourists, who may include nature enthusiasts, students, amateur scientists, or professionals on vacation or participating in conference excursions (see also Hose 1996, 2000; Hose & Wickens 2004; Dowling & Newsome 2010), are excited by the possibility of seeing features that reflect the history of the Earth, its ancient life, and past environments. The modern increase in geotourism activities on the international scale (Dowling & Newsome 2010; Newsome & Dowling 2010; Dowling 2011; Hose & Vasiljević 2012; Ruban 2015) contributes to the importance of palaeogeographical geosites as tourist attractions. Deeper interest in the Earth's dynamics stimulates curiosity in phenomena more complex than solely collecting minerals and fossils.

This paper continues a discussion started in previous papers by Bruno *et al*. (2014) and Henriet *et al*. (2014). In this brief review, we address three topics related to palaeogeographical geosites and geotourism:

1) the importance of palaeogeographical geosites for increasing climate change awareness;
2) the challenges of facilitating and managing geotourism;
3) the opportunity of including multiple palaeogeographical geosites in guided excursions.

Our goal is to alert specialists in geology as well as geoconservation to the immense potential of palaeogeographical geosites for geotourism development. However, we do not intend to propose something new to tourism. In contrast, we consider that brochures, guided excursions, and other "standard" attributes of tourism activity can be employed successfully for the purposes of palaeogeography-based geotourism, which itself is a kind of novelty.

Terminology

The terms "geoheritage" and "geosites" were defined by ProGEO. Geoheritage "encompasses the special places and objects that have a key role in our understanding of the history of the Earth - its rocks, minerals and fossils, and landscapes" (Wimbledon & Smith-Meyer 2012, p. 18). A geosite is "a key locality ... or area showing geological features of intrinsic scientific interest, features that allow us to understand the key stages in the evolution of the Earth" (Wimbledon & Smith-Meyer 2012, p. 19). Our definition of geotourism follows Hose (2000), Downling & Newsome (2010), and Hose & Vasiljević (2012). Generally, geotourism refers to any kind of tourism activity related to geoheritage.

The value of palaeogeographical features and even the palaeogeographical type of geoheritage are widely recognized (Wimbledon *et al*. 2008; Reynard *et al*. 2007; Bruschi & Cendrero 2009; Ruban 2010; Bruno *et al*. 2014). We follow the relevant definitions proposed by Bruno *et al*. (2014). Particularly, palaeogeographical geosites are understood as "geological heritage sites that represent paleoenvironments in general or highlight particular paleoenvironmental features, which are of special interest for science, education, or tourism/recreation" (Bruno *et al*. 2014, p. 301). The use of these geosites for the purposes of geotourism is defined provisionally as palaeogeography-related geotourism. Palaeogeographical geosites are diverse, and several subtypes can be distinguished (Bruno *et al*. 2014).

Palaeogeographical geoheritage and climate change awareness

Palaeogeographical geosites serve several tourism purposes (Fig. 1). Among these purposes, increasing public awareness of climate change is of crucial importance. Anthropogenically-induced global climate change (labelled commonly as "global warming") will be a serious and growing challenge for our species (Houghton, 2009; see also general discussions in DiMento & Doughman 2007; Prothero 2011; Zalasiewicz & Williams 2012). Therefore, increasing the awareness of policy-makers and the general public about this challenge is an urgent task (e.g., Sheppard 2005; DiMento & Doughman 2007; Houghton 2009; Whitmarsh *et al*. 2011; Bichard & Kazmierczak 2012; Libarkin *et al*. 2012; Pidgeon 2012; Ratter *et al*. 2012; Tiller & Schott 2013; Lieske *et al*. 2014).

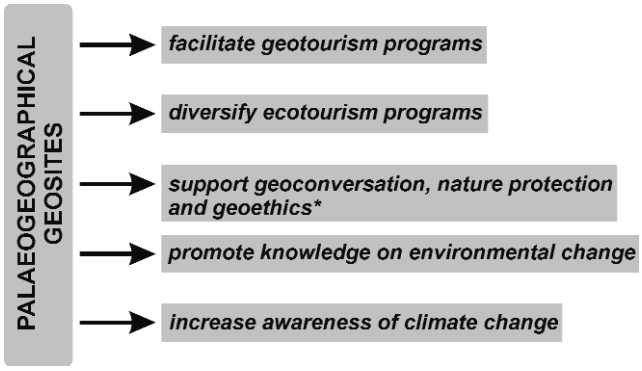

Fig. 1. Tourism utility of palaeogeographical geosites. Perspectives of such geosites go far beyond communication of 'purely' palaeogeographical information. * See Peppoloni & Di Capua (2012) for discussion of geoethics.

Palaeogeographical geosites can preserve information about ancient climates (Bruno *et al*. 2014). Some geosites exhibit features that reflect climate extremes reached in the past, providing clues for understanding the factors that trigger unusual climatic regimes, and demonstrating the consequences of icehouse and greenhouse conditions. As shown by Archer (2008), Hay (2011), and Bottjer (2012), extreme climate shifts that are comparable to current climate change and its consequences can be found in the geological history of our planet. Palaeogeographical geosites could, therefore, serve as educational tools, facilitating public awareness and comprehension of past and current climate change, and stimulating mitigation and adaptation efforts. For instance, fluvial deposits, palaeosols, and fossils preserved at the Agate Fossil Beds National Monument (Nebraska, USA) document significant climatic fluctuations and their ecological ramifications from the Oligocene into the Holocene (Johnsgard *et al*. 2007).

Similarly, marine terraces that border many Italian coasts were formed by frequent marine transgressions and regressions during Pleistocene glacial and interglacial phases. These terraces (e.g., Bianca *et al*. 2011), which are currently exposed high above sea level, contain an abundance of molluscs and corals, providing evidence for how climatically induced sea-level changes (balanced with local tectonics) can affect nearshore ecosystems (Carobene & Dai Pra 1990). The corestones, or boulders, of the Sila Massif (Calabria, Italy) provide another example of fluctuating climate in the past. These boulders are embedded in roughly 100 m of saprolite and regolith of granitoid and low-grade metamorphic rocks, representing ancient tropical weathering on a massive scale (Guzzetta 1974; see Le Pera & Sorriso-Valvo 2000 and Scarciglia *et al*. 2005 for the other explanations). In Puglia (Italy), the most part of the coast is characterized by numerous caves result of interaction between the karstic phenomena and sea level fluctuations during glacial and interglacial episodes of Quaternary (Canora *et al*. 2012). In the same region, red bauxite deposits fill old palaeokarst basins developed in the Bari Limestone (mid-Cenomanian) during the continental meso-Cretacic phase. These deposits represent residual rocks that occur on carbonate rocks formed in tropical to sub tropical climates (Bardossy 1982). The bauxites mark local or regional unconformities associated with subaerially exposed carbonates. These deposits are important for provenance studies (Boni *et al*. 2012) and palaeogeographic reconstructions (Mongelli *et al*. 2014). A similar example can be found at the famous Giant's Causeway World Heritage Site, Ireland. Here, a thick palaeosol between Paleogene basalt lava flows provides evidence for a tropical palaeoclimate in a place that currently experiences temperate conditions (Lyle 1996; Smith 2005). Such sites can facilitate public understanding of the magnitude of regional changes in climate as well as climate extremes.

Challenges of palaeogeography-related geotourism activities

The necessity of professional interpretation for geoheritage is a serious challenge for geotourism because many visitors of geosites and geoparks are occasional tourists with no background in the Earth Sciences (Hose 1996, 2000; Hose & Wickens 2004). This is particularly true for palaeogeographical geosites, which are inherently complex. "Palaeogeography" could potentially become a key word attracting tourists, but these tourists will need to know what this word means. Understanding the preserved feature may be beyond the abilities of most people without proper guidance. Geoscientists offer interpretation of features that are not easily visualized by ordinary visitors.

In addition, these sites may appear unspectacular, and therefore would be unlikely to generate excitement, with some exceptions. Providing an explanation for the connections between observed rocks and fossils with environments and ecosystems of the past and present to such geotourists is crucial. The above-mentioned Agate Fossil Beds National Monument offers an excellent example of proper tourist guidance. Park visitors are presented with abundant information about the geologic history of the site, the palaeoclimatic and paleoenvironmental information it preserves, and the ecology of its fossil mammals (http://www.nps.gov/agfo/naturescience/). Conversely, a well-established tourist trail offering a 360° panoramic view of the Oshten Mountain, which is an impressive Late Jurassic reef in Mountainous Adygeja (Western Caucasus Russia) with outstanding heritage value (Bruno *et al*. 2014), lacks any accompanying interpretative information. This trail is used daily by dozens of tourists travelling individually or in groups, generally for holiday outdoor recreation, but also for adventure tourism and ecotourism. However, without a guide or any interpretative signs, few visitors will recognize that the exposed carbonate rocks and their fossil content preserve an ancient coral reef.

There are many interpretative approaches that could be used in geotourism to help the public appreciate palaeogeographical geosites. These include distribution of posters and brochures (these have been used successfully in many countries for decades - e.g., Puri & Vernon (1959); for the general importance of brochures in tourism see Molina & Esteban (2006) and Quelhas Brito & Pratas (2015)), installation of interpretative signs, and interpretation by professional excursion guides (see Hose (2000), Hughes & Ballantyne (2010), Cardozo Moreira (2012), and Gordon (2012) for an evaluation of the efficacy of these approaches). An example of a well-designed and useful brochure is the field guidebook to the "Jurassic Coast", which is a famous World Heritage Site in southern England. This brochure provides informative explanations of geological features exposed at the site, for instance Triassic cross-bedding and Jurassic tree stumps that were preserved due to algal growth on ancient trees (Westwood 2011; Brunsden 2013). On-line tools may also work well for the purposes of palaeogeographical interpretations* .

In our opinion, interpretative approaches to palaeogeographical geosites are most useful if they provide visitors with modern examples to visualize palaeoenvironments and palaeoecosystems. This requires some simplifications and imagination, but finding approximate analogues is possible, even for ancient environments and ecosystems (e.g., Russell 2009). On rare occasions, such analogues might exist near the interpreted geosites, which is an outstanding opportunity for geotourism. An example is the Merzhanovo section (northern Azov Sea, southwestern Russia), where upper Miocene deposits representing a cliffed coast facies are exposed in a modern steep slope situated on a very similar seashore (Ruban 2011). Such coincidence of palaeogeographical phenomena with their modern analogue(s) greatly facilitates visitor comprehension. Additionally, souvenir vendors, local restaurants, etc. may offer products explaining the essence of palaeogeographical geosites and promoting deeper knowledge (cf. the idea of "geoproducts" presented by Rodriguez & Neto de Carvalho (2009)). For instance, the traditional food of the Adygejans is sold at the tourism destination "Rufabgo" in the Western Caucasus (Russia), which is known for its splendid waterfalls as well as outstanding geology (see below). Boxes with this food accompanied by an explanation could potentially be used to promote the picturesque geological features of the canyon, including those linked to palaeogeography.

Geosites where a person or family can actively view or take part in scientific research can also greatly enhance public appreciation and awareness of these valuable natural historic resources. With increased public interest follows the increased likelihood of preservation of important geosites (although without proper conservation measures, there is also the increased potential for geosite destruction). An excellent example of a geosite where visitors can view scientific research is the Dinosaur National Monument (Colorado and Utah, USA) (www.nps.gov/dino/parkmgmt/statistics.htm). This actively excavated palaeontological site works like a museum in the field. The site contains an enclosure of a large quarry of fossils comprised of hundreds of bones from 10 different species of dinosaurs and has an open viewing area for visitors to see how an active, scientific dig site works. Archaeological materials such as petroglyphs and pictographs from local Native Americans are also available for viewing.

At some geosites, visitors are given the opportunity to receive rudimentary training in fieldwork methods and then participate in the scientific process. For example, the Two Medicine Dinosaur Center (Montana, USA) is dedicated to hands-on education of the public through experience in active scientific research (www.timescale.org/about.html). Visitors are trained in some of the basics of geological and local history as well as palaeontological field prospecting, and then participate in documenting, uncovering and relocating dinosaur bones to the museum. All fossils and documentation are retained by the museum for scientific study

* http://travel.nationalgeographic.com/travel/sustainable/about_geotourism html, http://thecentralcascades.com/explore/?map, http://www.naturbornholm.dk/top/forside.aspx)

and perhaps later museum display. At places like this, visitors gain a clearer understanding of various aspects of the procedures used to properly find and excavate fossils as well as how excavated material can be utilized to enhance scientific knowledge. They also gain an appreciation for the importance of this type of work, including the value of documentation and site preservation.

Similar to other geosites (Gray 2013), palaeogeographical geosites are prone to anthropogenic influences. An increase in their exploitation for geotourism purposes can have negative consequences, including irreparable damage. This concern can be clearly seen in Iceland, where geotourism is greatly on the rise in response to the decline of traditional economies, such as fishing, and the country's 2008 banking crisis (Braun 1999; Jóhannesson & Huijbens 2010). Iceland's sits directly on the Mid-Atlantic rift and resides on two tectonic plates and a hot spot. This unique geographic setting offers numerous nationwide opportunities to see active volcanoes, geothermal phenomena (i.e. geysers and "mudpots"), and glaciers (Dórasæþósdóttir 2010). These geological phenomena make Iceland an important geotourism destination (it should be noted that large quantities of visitors to a few popular attractions can endanger the natural environment and ecosystems surrounding sites there (Jóhannesson & Huijbens 2010)).

Attempts to minimize anthropogenic influences may be challenging. The community of the largest Westman Island, Vestmannaeyjar, is currently constructing a state-sanctioned museum at the remains of several partially-excavated homes that were buried during the last large volcanic eruption in 1973. This is a useful and informative way to observe how the environment is perturbed by a natural hazard as well as exploit a devastating natural phenomenon.

Despite the above-mentioned problems, it should be noted that promoting awareness of palaeogeographical heritage in schools and other educational centres can increase the awareness of regional residents and visitors to the heritage value of these sites and the necessity of their protection, including safety and conservation concerns (e.g., Prosser *et al*. 2006). Among other benefits, this increased awareness may help reduce the need for excessive signage or protective barriers.

Consideration of the consequences of geotourism activities is very important at any geosite; proper policy and careful management are always required. Such concerns, however, are typical for all kinds of nature-based tourism (e.g., Krüger 2005; Stolton *et al*. 2010). Unfortunately, the legal basis for adequate management and conservation of palaeogeographical geosites is ambiguous. As shown by some examples (e.g., Cairncross 2011; Tiess & Ruban 2013), even those policies that recognize geoheritage as a special legal category, frequently use very general terms, or restrict the heritage to include only minerals and fossils. Proper conservation of palaeogeographical heritage will require a more comprehensive approach, and, at the very least, recognition of the fact that geological phenomena exposed today represent important, irreplaceable fragments of past environments. Rapidly evolving geoconservation legislation in European countries (Wimbledon & Smith-Meyer 2012) leaves a hope that the problem will be resolved successfully. Additionally, development of an on-line dictionary and thesaurus for proper and broadly-accepted definitions of all terminology related to palaeogeography, geoconservation, and geotourism will help improve existing policies. This would be a single website maintained by an international organization that would be accessible to both researchers and the public from around the world (see example in Rapisardi *et al*. 2013). It should be noted that not only specialists in geoconservation and geotourism should be involved, but also stratigraphers and palaeontologists. We envision that this on-line resource would serve as a "participatory open space" that is constantly updated following the growing requests for revised terminology in this topic, combined with linked data. Of course, edits to this resource would require some moderation (e.g., to prevent the development of superficial or incorrect definitions). This is an effort that will probably require collaboration between multiple research institutions, but would likely have a large payoff. ProGEO has made a lot of relevant developments (e.g., Wimbledon & Smith-Meyer 2012). Organizations like this may help to establish research networks and resolve international debates about terminology.

Potential for guided palaeogeographical excursions

Because palaeogeographical geosites reflect various palaeoenvironments and palaeoecosystems (Bruno *et al*. 2014), a series of different geosites located within the same territory could be combined to illustrate a more complete geological history or diversity of ancient environments. For example, in the same general area, there may be one outcrop that exhibits Paleocene continental rocks and fossils, a second that shows Eocene shallow-marine rocks and fossils, and a third that exposes Oligocene deep-marine rocks and fossils. If these outcrops are located close to one another, they could be used to demonstrate the spectrum of regional palaeoenvironments associated with bathymetrical changes through the Paleogene. In other words, we propose that local or even regional palaeogeographical geosites can be linked to form geotourism excursion routes. Due to the common necessity of professional geosite interpretation, such excursions would be most valuable if guided.

We use the excellent example of Mountainous Adygeja (Western Caucasus, Russia) to consider the oppor-

tunities and challenges of organizing such excursions. This geodiversity hotspot, recognized by Ruban (2010), would be ideal for palaeogeography-related guided excursions. The study area includes several important geoheritage sites with palaeogeographical value, and it is a nationally important destination for nature-based tourism and recreation.

We have selected five geosites for a proposed palaeogeographical excursion route (Fig. 2). Specific information about these sites has been previously published (Ruban 2010; Plyusnina *et al*. 2015) and is not repeated here. The main selection criterion is their significant and complementary palaeogeographical value. Following this route, a geotourist would be exposed to a large spectrum of palaeoenvironments and their fossil assemblages preserved in sedimentary rocks (Table 1). The one-day excursion would start at the Khamyshki Section representing continental strata (geosite 1), then lead to the Little Khadzhokh Valley with lagoonal sandstones and clays (geosite 2). The excursion would next stop at two geosites representing shelf deposits (the Lago-Naki Highlands and the Rufabgo Canyon; geosites 3 and 4, respectively) and finish at the Partisan Glade Section, where deep-marine organic-rich shales outcrop (geosite 5). Because of the loop-like configuration of its route (Fig. 2), this excursion could be split into two parts (Part 1: geosites 1 and 2; Part 2: geosites 3, 4, and 5) or shortened (i.e., starting with geosite 2, where some evidence of a continental palaeoenvironment can be demonstrated). This excursion would contribute significantly to the local development of geotourism because it provides an exceptional opportunity to present information about the diversity of palaeoenvironments that existed in Mountainous Adygeja. Mountainous Adygeja is a significant Russian tourist destination that is visited by numerous "occasional" geotourists. Moreover, several large universities use this territory for field educational programs in geology, geography, and tourism. Thus, one should expect a large number of visitors to potentially be interested in learning about its geological past.

Undoubtedly, the possible palaeogeographical excursion mentioned above should be guided.

Table 1. Geosites to be included into the possible guided palaeogeographical excursion in Mountainous Adygeja (Western Caucasus).

Geosite ID (see Fig. 2 for location)	Geosite affinity* and type	Geological formations	Age	Interpreted palaeoenvironment	Carrying capacity**	Safety and accessibility issues***
1	Khamyshki Section (~5 km-long series of lengthy outcrops along the road)	red-coloured silicilastic Molasse	Early?–Middle Permian	mountainous land	7–10	hectic traffic on road, unstable slope
2	Little Khadzhokh Valley (a few smal outcrops in the steep slope of the river valley)	sandstones and clays of variegated colour	Late Jurassic	desiccated lagoon	5–7	wet and slippery soil, possible stream flooding, limited space for visitors, ongoing construction
3	Lago-Naki Highlands (~5-km series of small outcrops in the roadcut)	carbonates	Late Jurassic	carbonate shelf	7–10	hectic traffic on road, unstable slope
4	Rufabgo Canyon (~1.5 km-long series of small and middle-sized outcrops in the slopes of the canyon)	folded carbonates with siliciclastic interbeds (quasi-flysch)	?Early–Middle Triassic	outer carbonate shelf to upper part of continental slope	7–10	insufficient space for visitors, crowds of tourists visiting the Rufabgo Waterfalls
5	Partisan Glade Section (~10 km-long series of lengthy outcrops in the roadcut)	Dark-coloured shales with siderite concretions intercalated with medium-sized siliciclastics	Early–Middle Jurassic	deep-marine oxygen-depleted setting of ontinental slope	10–15	unstable slope, poor quality of some parts of the road

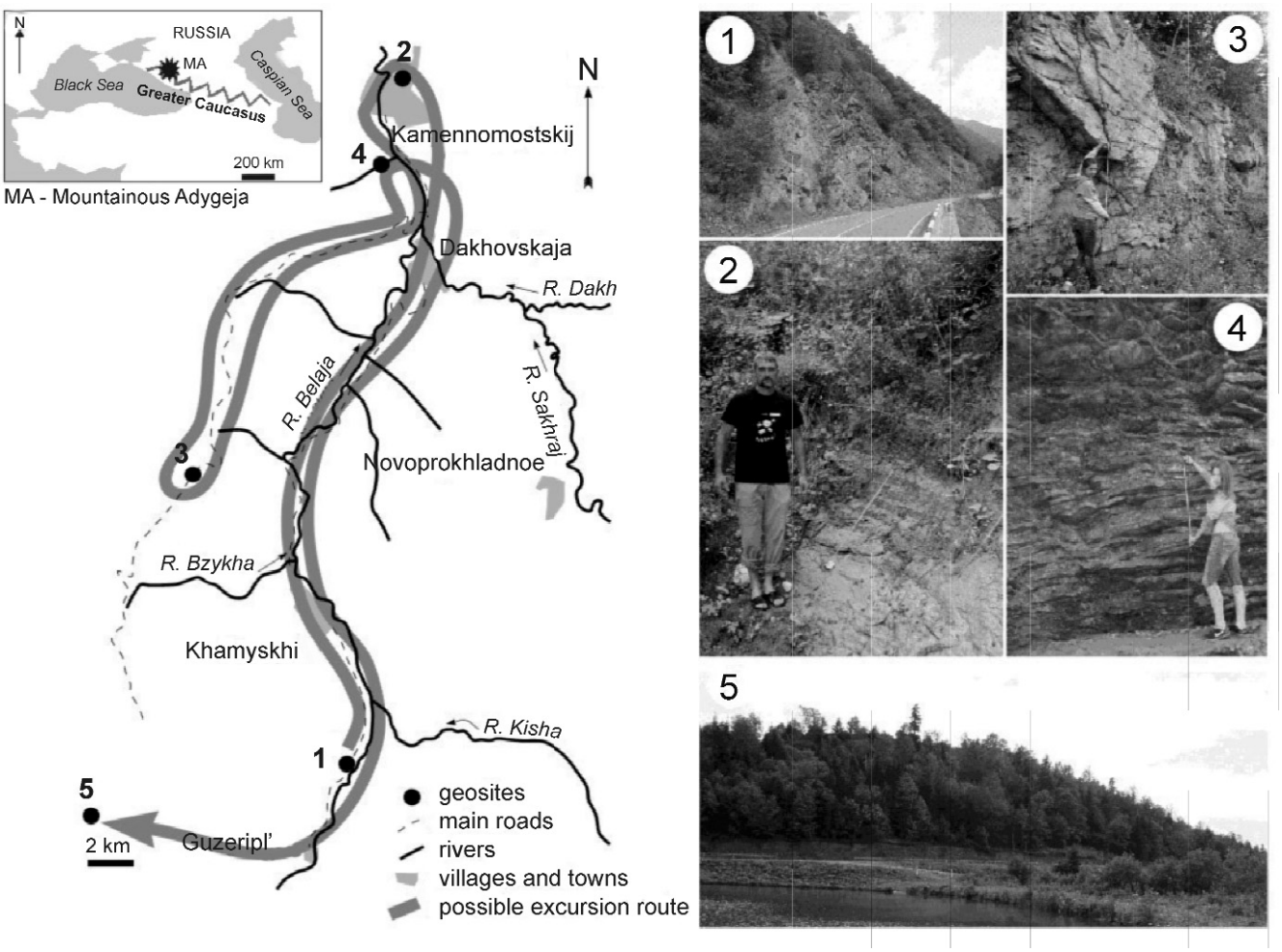

Fig. 2. Outline of a possible palaeogeographical excursion in the Mountainous Adygeja (Western Caucasus). Numbers for photos correspond to geosite numbers on the map. See Table 1 for geosite names and more details.

Professional geologists may understand the geological setting without guides. However, students and various non-professional visitors would need some explanation of what the observed deposits and fossils mean. For instance, understanding the nature of Triassic quasi-flysch strata (e.g., GAETANI *et al*. 2005) or Jurassic lagoonal and carbonate platform deposits (e.g., RUBAN 2006) might be difficult even for geologists. This proposed excursion might be especially suitable for a conference field experience or a student field trip. Professional guidance could be provided by the staff of a university camp (specially created for student field practice), which is located in the midst of the considered territory, or by the staff of the Caucasus State Natural Biosphere Reserve that is situated in southern Mountainous Adygeja. Interpretative signs installed near the geosites may also help, although their efficacy would be limited.

The other possibility for palaeogeography-related geotourism in Mountainous Adygeja exists in the Lago-Naki Highlands. There, on the top of the Stonesea Range, one can observe a 360°-panoramic view of the mountains of the Western Caucasus. Two tall

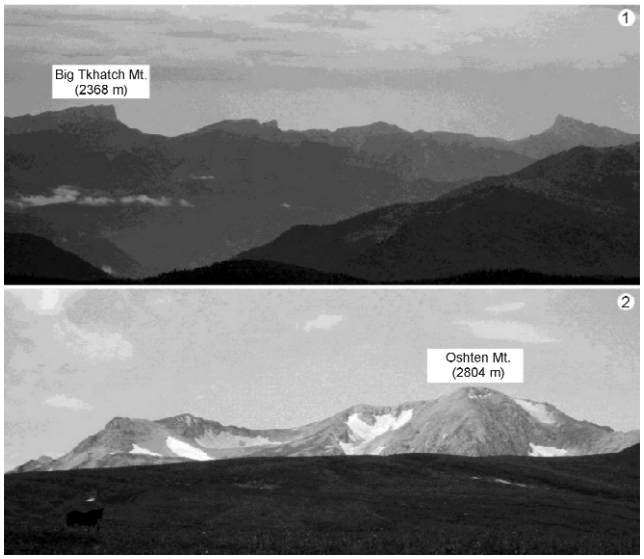

Fig. 3. Big Tkhatch Mountain (1) and Oshten Mountain (2), which are Late Triassic and Late Jurassic reefs, respectively, are visible from the same place on the top of the Stonesea Range of the Lago-Naki Highlands.

mountains are visible: the Big Tkhatch Mountain and the Oshten Mountain (Fig. 3). Both are ancient reefs of Late Triassic and Late Jurassic age, respectively. Thus, a geotourist can view the carbonate build-ups of different palaeoseas in one place by just turning the head. This site has great potential as a geotourism locality. However, the importance of this panoramic view for understanding the latter cannot be understood without professional guidance.

Organization of guided palaeogeographical excursions faces an additional challenge, which is not limited to Mountainous Adygeja. The carrying capacity of geosites, which is used for the purposes of crowd management and stipulates the maximum number of visitors that can visit a site at once (JIN & RUBAN 2011), is very limited. Efficient communication of palaeogeographical information requires small, compact groups of tourists. The carrying capacity for groups at selected geosites should always be carefully considered when planning palaeogeography-related geotourism excursions (Fig. 4). The geometry of the geosites, as well as safety and accessibility issues may leave only a few places for groups to gather. In the case of Mountainous Adygeja, the maximum size of a group at any given locality should not exceed 10 persons in most cases (Table 1), even if some of the geosites (e.g., the Khamyshki Section) are very large and can host dozens if not hundreds of individual visitors. Of course, the accessibility and tourist perception of the above-mentioned (and all other) palaeogeographical geosites can be improved with "standard" geoconservation procedures like vegetation removal (full or partial), renewal of road sections, etc. (see PROSSER *et al*. 2006). Various factors that affect the "natural beauty" of these sites should be also taken into consideration (KIRILLOVA *et al*. 2014).

Fig. 4. Differences in carrying capacity of the Little Khadzhokh Valley and the Rufabgo Canyon (see Fig. 2 and Table 1 for location and general characteristics of these geosites): 1 (Little Khadzhokh Valley) – a student (first author) at the toe of the slope and near the stream to indicate discontinuity in the Upper Jurassic siliciclastics that probably mark the palaeorelief surface (note that the space is very limited); 2 (Rufabgo Canyon) – a geologist (second author) that has enough space to comfortably examine folds in the Triassic carbonates.

Conclusions

Palaeogeographical geoheritage sites can facilitate understanding of the Earth's ancient environments and ecosystems, and they can also enhance awareness of past and future climate change. However, effective communication of palaeogeographical information to tourists requires professional explanation and use of interpretative tools. Palaeogeographical geosites can be visited sequentially on guided excursions that enable deeper appreciation of the geological past. An important topic for further research is discussion of the tourism potential of palaeogeographical geosites based on quantitative assessment of tourist preferences.

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Резиме

Обејекти геонаслеђа са палеогеографским значајем: перспектива геотуризма на примерима Адигеја планина (Русија)

Палеогеографске информације су сачуване у многим објектима геонаслеђа (геообјекти). Палеогеографски објекти геонаслеђа се разликују од других типова геонаслеђа по томе јер садрже корисне податке о палеосрединама, палеоекосистемима и др. Ови објекти су такође корисни са становишта геотуризма. Палеогеографски објекти геонаслеђа имају вишеструки значај за туризам. Посебну пажњу јавности заузимају климатске промене које су од изузетног значаја.

Глобалне климатске промене проузроковане антропогеним фактором (познате као "глобално отопљавање") биће озбиљан и све већи проблем за савременог човека. Неки објекти геонаслеђа одсликавају климатске екстреме из прошлости и омогућавају боље разумевање фактора који су проузроковали необичне климатске услове, а такође указују и на последице које настају услед ефеката ледених и стаклених башта. Стога, палеогеографски објекти би могли да послуже као едукативно средство, повећавајући свест јавности о актуелним климатским променама као и онима које су се дешавале у прошлости, подстичући при томе иницијативу за смањење глобалних климатских промена. Неопходна је стручна интерпретација геонаслеђа и она представља прави изазов за геотуризам с бзиром да су многи посетиоци геообјеката и геопаркова туристи који не поседују довољно знања о наукама о Земљи. Ово се нарочито односи на палеогеографске објекте геонаслеђа који су по својој природи веома комплексни. "Палеогеографија" може потенцијално постати кључна реч за привлачење туриста али будући туристи би требало да буду упознати са значењем те речи. Разумевање карактеристика које поседују објекти геонаслеђа за већину људи је тешко разумљиво без стручног објашњења.

Геолози могу да понуде објашњења оних карактеристика геообјеката које обичан посетилац не може лако да уочи. Постоје многи различити приступи за објашњавање палеогеографских геообјеката. Најкориснији приступи којима се објашњавају палеогеографски геообјекти су они који омогућују посетиоцу да кроз савремене примере стекне бољу слику о палеосрединама и палеоекосистемима. Овакав приступ захтева одређено упрошћавање и употребу маште, али свакако да је могуће наћи одговарајуће примере за некадашње средине и екосистеме. С обзиром да палеогеографски објекти одражавају слику различитих палеосредина и палеоекосистема, неколико различитих геообјеката који се налазе на истој области могу да се комбинују како би се стекла што потпунија слика геолошке историје или разноврсности некадашњих средина. Одличан пример за ово су Адигеја планине (Западни Кавказ, Русија) које дозвољавају да разматрамо могућност и изазов за организовање такве екскурзије. За предложену палеогеографску екскурзију изабрано је пет геообјеката. Током ове екскурзије геотуристима би био показан велики број палеосредина заједно са њиховим фосилним заједницама које су сачуване у седиментним стенама. Једнодневна екскурзија би започела са Камишким профилом који је представљен континенталним слојевима, а затим би се

обишла долина Мала Кадзхок са лагунским седиментима и глинама. Ескурзија би се затим зауставила на два геообјекта представљеним шелфним седиментима (узвишење Лаго-Наки и кањон Руфабго) и завршила код профила Партизанског пропланка, где су откривени дубокоморски алевролити богати органском материјом. Због руте која је кривудава екскурзија може бити подељена у два дела или скраћена. Екскурзија би значајно допринела локалном развоју геотуризма јер пружа изузетну могучност за представљање информација о разноликости палеосредина које постоје на Адигеја планинама. Несумљиво да предложену горе поменуту палеогеографску екскурзију треба реализовати. Професионални геолози могу да разумеју геолошку грађу и без водича. Међутим, студентима и не професионалним посетиоцима било би потребно објаснити значење посматраних седимената и фосила. Друга могућност палеогеографског геотуризма у Адигеја планинама је узвишење Лаго-Наки. На врху планинског венца Стонесеа пружа се могућност панорамског погледа од 360° на планине Западног Кавказа. Могу се посматрати два висока узвишење: Велика Ткач планина и Осхтен планина. Оба представљају старе спрудове горњег тријаса и горње јуре. Тако, геотуристи могу видети карбонатне творевине различитих палеомора на једном месту.

Приликом планирања палеогеографских геотуристичких екскурзија требало би пажљиво испланирати број посетилаца у групама за одређене геообјекте. Облик геообјекта као и његова безбедност и приступачност оставља на располагању свега неколико локалитета на којима се могу окупити групе.

Б. Р.