

## A QUESTIONNAIRE-BASED STUDY OF THE KNOWLEDGE OF GEODIVERSITY AND GEOSITES IN NORTH MACEDONIA AS WELL AS THE CONDITION OF PROTECTED AREAS

Anita TODOROVA, Bojana ALEKSOVA  
University "Ss. Cyril and Methodius",  
Faculty of Natural Sciences and Mathematics,  
Institute of Geography, Skopje, North Macedonia  
e-mail: anitatodorova27@gmail.com, aleksova\_bojana@yahoo.com

### ABSTRACT

In this paper will be analyzing the knowledge of the geodiversity and geosites in the Republic of North Macedonia mutual the state of protected areas and their geotourist potential according to the opinions of a number of respondents. It is inconceivable to talk about the protection of a natural landscape, without seriously taking the geodiversity and giving it the meaning, it has, according to the characteristics of the landscape being analyzed. Precisely for this purpose, was use a questionnaire to certain target groups of participants to obtain specific data knowledge of geodiversity, mutual and with the geosites in Republic of North Macedonia, with reference to the condition of the protected areas and their geotourist promotion.

The purpose of this paper is to determine whether the respondents have basic knowledge of what is meant by geodiversity, diversity of geosites, their tourist arrangement and the current state of protected areas. With results determine that some of the respondents have some basic knowledge about the actual state of protected areas and geosites, but also a large number which have minimal or no knowledge about them.

For that reason, greater affirmation of all geosites in the Republic of North Macedonia is needed, and thus it will be seen with which geodiversity has at its disposal, the state of their protection and the degree of their tourist promotion.

**Keywords:** geodiversity, geosites, protected areas, questionnaire, protection.

### INTRODUCTION

Many scientists have long been involved in the study and protection of biodiversity, while the study and protection of geodiversity began in the early 90s of the 20th centuries. Significantly, the beginnings and study of geodiversity is the first international gathering of geo conservation which was held in the Netherlands in 1988. In 1993, the working group from the international gathering grew into ProGEO - International Association for the Protection of Valuable Geo Heritage (<http://www.progeo.ngo/history.html>). This organization is important for the study of geodiversity, and at the same time pays more respect to the valuable geoheritage. By keeping the rallies and organizing associations is given more importance to study it a geodiversity world-wide for its protection, promotion and sustainable use is, including the development of

geotourism, geoparks and more. To date, geodiversity and geoheritage have not been the focus of the UN political agenda, such as biodiversity protection or climate change issues. However, at the level of IUCN (International Union for Conservation of Nature) and UNESCO, in recent years there has been more talk about the problems of endangering geodiversity and geo heritage and the need to pay more attention to them (Milevski, 2019). The term "geodiversity" first time was used in 1993, as the geological equivalent of biodiversity. Geodiversity is all around you. It is all the parts of nature that aren't alive; including the Earth's minerals, rocks, fossils, soils, sediments, landforms, topography, geological and morphogenetic processes, and hydrological features such as rivers and lakes (<https://www.geodiversityday.org/>). Geodiversity can be defined simply as a natural range (diversity) of geological (rocks, minerals, fossils), geomorphological (soil form, physical processes), hydrological and pedological characteristics. Includes their assemblies, connections, properties, interpretations, and systems (Gray, 2004). Whereas biodiversity is one-dimensional, describing biotic diversity at the present day only, geodiversity involves an appreciation of the Earth and its environmental, ecological and biological variety in space and time (ProGeo, 2011). In order to achieve equal status of biodiversity and geodiversity, it is necessary to make as many strategies and plans as possible. This includes making efforts to educate and inform stakeholders who make decisions about developing these policies and ensuring that they are implemented.

The natural conditions in North Macedonia (geological composition, relief, climate, hydrography, soils, flora and fauna) made it possible to count as one of the few countries in Europe with a wealth of natural rarities (Todorova, et al, 2019). Although it has a relatively small area, the Republic of North Macedonia has a rich geodiversity and numerous geosites. In that context, our country boasts an outstanding geodiversity in a small space. The territory of the Republic of North Macedonia has numerous, significant and unique geosites and phenomena. However, regardless of that, in the past not paid enough attention to their protection and promotion (such as geovalues) (Milevski, Temovski, 2018). Geosites are area showing geological features of intrinsic scientific interest, features that allow us to understand the key stages in the evolution of the Earth. Such important geosites are normally, or should be, statutorily protected under national conservation legislation. Geosite is a neutral term for geological sites (without legalistic or ethnic complications), and a geosite can be small (in various country usages; monument, point, site) or large (park, reserve, protected area). Large or small, they are distinguished by their characteristic interest, and sometimes by great vulnerability combined with their high importance for science (ProGeo, 2011). The current state of the geosites is far improved, because with the appropriate studies and elaborations they are given the status of a protected area and thus more attention is paid to their sustainable development which is in the function of geotourism.

The promotion of geotouristic destinations in January raises public awareness of the values of the geosites, but and for their endangerment. The geosites in the Republic of North Macedonia possess high values and attractions that can adequately be to interpret, regulate and promote the geotouristic goals. (Todorova et al, 2018) The economic value of geoheritage can be interpreted through various forms of tourism, i.e., through geotourism. Geotourism is a form of natural area tourism that specifically focuses on geology and landscape. It promotes tourism to geosites and the conservation of geodiversity and an understanding of earth sciences through appreciation and learning. This is achieved through independent visits to geological features, use of geo-trails and viewpoints, guided tours, geoactivities and patronage of geosite visitor centers (Newsome and Dowling, 2010).

There are many threats to geodiversity. Wildlife has always been known to be vulnerable and therefore more attention has been paid to its protection, but given that rocks and mountains are considered stable, static and numerous, there was no reason for them to be endangered. Sprott efficient, competitive, many geosites, including them cave decorations, and other fossil trees are very fragile and they need adequate protection. Other threats to geodiversity are quarries or stone extraction, thus destroying the entire landscape. Also, urbanization, soil erosion associated with unsustainable agricultural production, and topography remodeling to create golf courses, but the biggest threat of all is probably ignorance of the potential impacts of human actions. Due to the threats to geodiversity, measures must be taken for its conservation (protection).

Protected area is a geographically defined area, allocated or declared by the competent authorities to be managed in terms of achieving specific goals of protection and conservation, ie a place that is subject to legal or administrative protection regime intended for conservation and promotion of species who live in it (Official Gazette of RM, no. 84/07). According to IUCN a protected area is: "A clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values" (Dudley N., 2008). The network of protected areas in the Republic of North Macedonia includes 86 areas with a total area of 230 083 ha, which represents about 8.9% of the total territory of the country (Environmental Statistics, 2019). It is worth noting that in June 2021, part of the Shar Mountain is declared as a National Park and it increases the number of another backup but area and protected the surface. While, if taken into account the Spatial Plan of the Republic of Macedonia until 2020 provided was to be about 265 protected areas, or 11.6% of its territory, but let's hope that it will be realized gradually, because the procedure for protection of an area is long.

The purpose of this paper is to analyze the knowledge of geodiversity geosites in the Republic of North Macedonia, to see the knowledge of the number of protected areas and their geotourism promotion and order of a number of respondents from two age categories (I age group (18-29) and II age group (30-64)) based on a questionnaire. By analyzing the data, the state of knowledge of the same will be seen and based on that, it is necessary to take appropriate measures to raise public awareness for the protection of geodiversity in general.

## **OBJECTIVES AND METHODS OF THE RESEARCH**

Goal of this research is to determine the state of awareness in terms of knowledge of geodiversity and the geosites in the Republic of North Macedonia, state of protected areas and their sustainable use in terms of geotourism, whose goal is to fight not to destroy geovalues. The sample method was used as a method of this research. The method of the sample is based on examination of a relatively small number of randomly selected people, for getting the information about the observed hallmark of the entire population (Risteski, Trpkova-Nestorovska 2014). For that purpose, as part of the labor research, 119 respondents were randomly selected according to a pre-established anonymous questionnaire. According to the age group, they are divided into two groups, namely: Group I from 18 to 29 years, with a total number of 54 respondents or 45.4 % and Group II from 30 to 64 years, with a total number of 65 respondents or 54.6 %. Also, the survey was conducted o the period of 14/05/2021 to 05/31/2021 via social media. According to the gender structure, the survey is dominated by female respondents (55.7%), otherwise the

male gender is represented by (44.3%). During the survey, some of the geosites and protected areas in the Republic of North Macedonia were selected, which helped us to obtain results on what people know about geodiversity, geosites, protected areas and their geotouristic potential. The selected geological sites are categorized into three groups: unknown / little known, tourist visited and protected areas. In the first group are given the geosites that are and are not protected by law, but their promotion is on a low level. In the second group, the selected geosites are also classified in the same category (protected and not protected by law), but are appropriately touristic arranged and highly visited. In the third group, on the other hand, are the geosites that are adequately protected by legal regulations.

**Table 1.** Part of the geosites in the Republic of North Macedonia that were used for the needs of the survey research

<b>PART OF THE GEOLOGICALITIES IN THE REPUBLIC OF NORTH MACEDONIA WHICH WERE USED FOR THE NEEDS FOR THE SURVEY RESEARCH</b>		
<b><i>Unknown/ Little known</i></b>	<b><i>Tourist visited</i></b>	<b><i>Protected areas</i></b>
Basalt plateaus -v. M. Na-goričane	Canyon of the Gradeška River	Upper Slatinska Cave
Katlanovo Swamp	Lešnica	Demir Kapija Gorge
Ploče litotelmi - v. Stracin	Šarkova Dupka Cave	Dona Duka Cave
Makaroec Cave	Kočulski Waterfalls	Bela Voda Cave
Stone balls and plates-Ulanci	Bislimska Gorge	NP Pelister
Ubavica Cave	Katlanovska Bath	NP Galičica
Skočivirska Gorge	Canyon Kamnik	NP Mavrovo
Kukulje – v. N. Istevnik	Nežilovi karpi (rocks)	
Katlanovski Hill	Babuna Waterfall	
Canyon Kozjak (Plačkovica)	Kalin Kamen	
Zletovska Gorge	Pehčhevski Waterfalls	
Mokliško Lake	Gorge Pešti	
Pillow lava - v. Miravci	Duf Waterfall	
Ratkova Skala	Plaster cave Alčia	
Taorska Gorge	Solfatara Duvalo	
Paleontological site Karaslari	Markovi Kuli	
	Canyon Matka	
	Vrelo Cave	
	Smolarski Waterfalls	
	Kolešinski Waterfalls	
	Kuklica	
	Kokino	
	Vevčani Springs	

	Pešna Cave	
	Baderska Gorge	
	Gabrovski Waterfalls	

The questionnaire consists of 20 questions, which are adapted to respondents with different age structure, which according to the topic belong to three groups, namely: Knowledge of geodiversity and geosites, their protection, protected areas and their sustainable development which is in place in geotourism. The questions, as well as their answers are statistically processed and refer to the knowledge of the respective terms, areas, their protection or the thinking of the respondents on certain problems. Most often, the questions themselves contain 4 to 5 categories, which correspond to the evaluation from the best (excellent) to the worst (unsatisfactory). For each question, the percentage ratio of the answers belonging to the previous grades is calculated.



**Figure 1.** Solfatara Duvalo (tourist arranged) (photo: Todorova, 2019).



**Figure 2.** Ploche litotelmi - v. Stracin (slightly known locality) (photo: Aleksova, 2020).



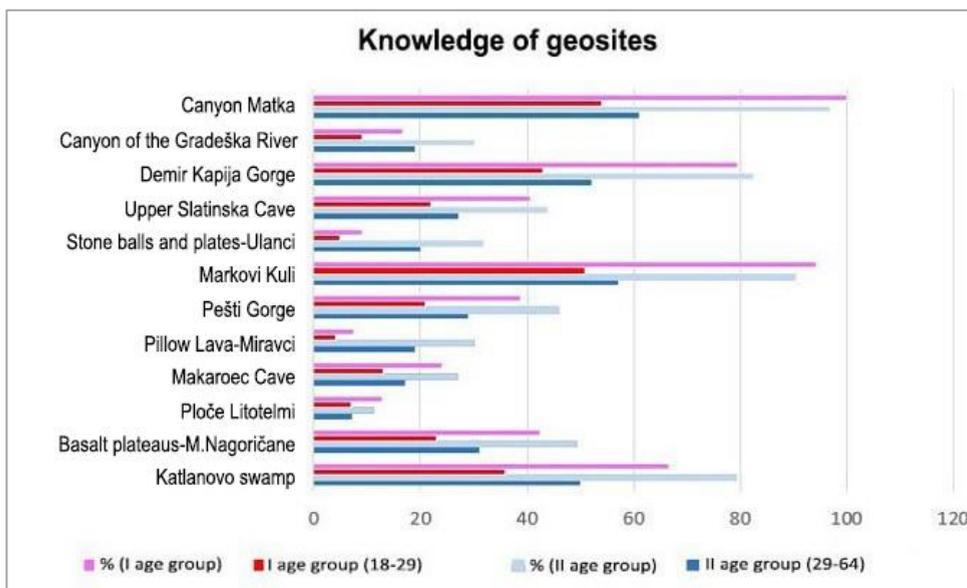
**Figure 3.** Dona Duka Cave (protected area) (photo: Aleksova, 2021)

## RESULTS AND DISCUSSION

The first group (knowledge of geodiversity and the geosites) includes four questions (1, 2, 5 and 11) which give the situation in terms of knowledge here of the term geodiversity, its geotouristic potential and knowledge of participants from various publications and media. As mentioned in the previous text, the analysis was done according to two age groups: I age group (18-29) and II age group (30-64).

According to the respondents from the 1st age group, about 31 or 57.4 % have basic knowledge about the term geodiversity, while the respondents from the 2nd age group have about 63 % or 41 answered with an appropriate description. The description of natural heritage is used as the most commonly used definition of the term geodiversity. Of the total number of respondents, most of them, or about 91.5 % believe that the Republic of North Macedonia has great potential for geodiversity. In terms of knowledge of the geosites that were proposed in the polls it has been established that the total respondents of the first and second age group, reported that most famous are geosite Canyon Matka (I group 100 %, II group with 96.8 %). On the second place is the geosite Markovi Kuli (I group with 94.4 %, and II group with 90.4 %), and on the third place is Demir Kapija Gorge (I group with 79.6 %, and II group with 82.6 %). As a result of the great knowledge of these three geosites due to their favorable geotourist promotion and their availability.

Also, the results show that from group I respondents (18-29) they have the least knowledge about the geosite Pillow Lava near the village Miravci to 7.4 %, and in II-th group participants, at least known as geosite Ploče Litotelmi – v. Stracin with 11.1 %. Due to the poor information about these geosites and their insufficient promotion, the respondents have little knowledge about them.



Graph 1. Knowledge of geolocations by age groups.

Under the proposed geosites 23 and the total number of respondents (119) most data they receive from books and Internet sites, but a large part (about 40 to 60 %) have given an answer to what kind of data sources using the appropriate geosites.

The second group of questions (3, 4 and 8) refer specifically to the protection of geosites and protected areas in the Republic of North Macedonia. In fact, for the purpose of the research in the survey (questionnaire) were used a large number of geosites from different parts of the country, all in order to have greater efficiency in the results. According to information of respondents about their knowledge about the types of protected areas, it can be concluded that since I-th age group have knowledge about 25 respondents from a total of 54, while the II-th age group 29 respondents from a total of 65 responded positively to several types of protected areas. The most common answer for a protected area is the term National Park. It is worth noting that out of a total of 119 respondents, about 54 or 45.3 % have no knowledge of which types of protected areas exist.

While for the knowledge of the number of protected areas in the Republic of North Macedonia, from the results obtained from the survey sheet it can be concluded that a large number of respondents (about 59.6 %) answered that they have no knowledge of the total number of protected areas in our country. Also, a small percentage (16.6 %) answered correctly, ie that there are 86 protected areas in North Macedonia

Of the proposed 23 geosites, 17 are protected by law according to the appropriate categorization of protected areas, and only 6 of them are not protected, ie they are proposed for protection. According to the total number of respondents (119), they believe that the geosites: Kokino, Kuklica, NP Pelister, Vevčani Springs, Pešna Cave, NP Galičica, NP Mavrovo, Smolarski Waterfalls, Canyon Matka, Markovi Kuli and Vrelo Cave are protected by law. According to their answers, they answered correctly for all geosites, except for the geosites Kokino and Pešna Cave, whether the wrong answer, i.e., they are not protected by law.

Third part (9, 10, 12, 13, 14, 15, 16 and 17) refers to the promotion of the geosites, their sustainable development which is aimed at geotourism for this purpose respondents gave interesting information used to obtain a clearer picture of the specific geotouristic condition of the geosites.

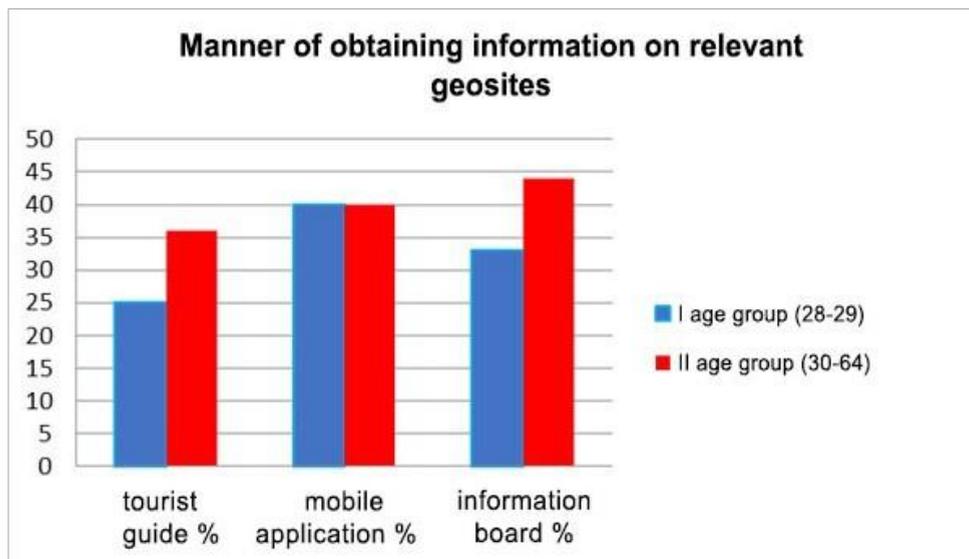
From 119 respondents, the highest percentage of them reported that most tourist d and have visited NP Mavrovo (108 or 92.3 %), then canyon Matka (105 or 89.7 %) and NP Pelister (87 or 74.3 %). In terms of less than interest for attendance of respondents to this questionnaire, the results show that the slightest tourist visit is the cave Alčija (0 replies or 0 %), then the cave Šarkova Dupka (8 or 6.8 %) and just behind it is Baderska Gorge (10 or 8.5 %).

Regarding the delimitation (milestones) and organized path the geosites that were proposed for the survey, respondents reported that the best (clear) delimitation (milestones) and organized trail is NP Mavrovo (78 responses or 70.9 %), followed canyon Matka (74 or 67.2 %) and NP Galičica comes in third (61 or 55.4 %). On the other hand, the results of the survey concluded that the weakest marking (signposts) and the least poorly arranged path is Baderska Gorge (0 answers, ie 0 %). In second place are Pešti Gorge and Alčija Cave (1 or 0.9 %), followed by the cave Bela Voda (2 or 1.8 %). In fact, it should be noted that in the other answers there are answers such as "I do not know, I have not noticed, no to most, no" (4 or 3.6 %).

In addition, the tourist mark along roads suitable geosites that were proposed for the survey, analysis shows that of the total respondents (119), the majority (99 or 90.8 %) responded that canyon Matka has the most appropriate tourist mark along roads leading to this geolocation, while in second place is NP Pelister (80 or 73.3 %). On the other hand, the respondents stated that with the weakest tourist mark next to the appropriate roads is the geosite Kukulje (1 or 0.9 %), and in second place are the cave Ubavica and Skočivirska Gorge (4 or 3.6 %).

Regarding tourist editing the geosites who were chosen to better tourist exploitation of the same, the total number of respondents, the analysis shows that the best tourism trim (paths, signposts, information boards, restaurants, souvenir shops, etc.) is canyon Matka (98 or 89 %), then Vevčani Springs (76 or 68.1 %) and NP Galičica (66 or 60 %). While, with the weakest tourist arrangement, according to the respondents are Baderska Gorge and the geosite Kukulje (1 or 0.9 %), then Pillow Lava near the village Miravci (3 or 2.7 %) and Taorska Gorge (4 or 3.6 %).

According to the way of obtaining information (travel guide mobile application and information board) for themselves geosies, the analysis is divided and the two age groups of divided responses. To this end, Ith age group declared a predominantly obtaining information through a mobile application (40 or 74 %) and IIth age group are declared and for the greater percentage of getting information through information board (44 or 69.8 %). In fact, it should be noted that the answers are a result of the development of digitalization that enters every sector, including tourism. Although responses indicate that the majority of respondents, while visiting a geosite want to receive information through a mobile application or information board, it must be noted that the inevitability of the tour guide is more than necessary. Precisely due to the formation of appropriate tourist routes to some geosites, the need for a tourist guide is of great importance.



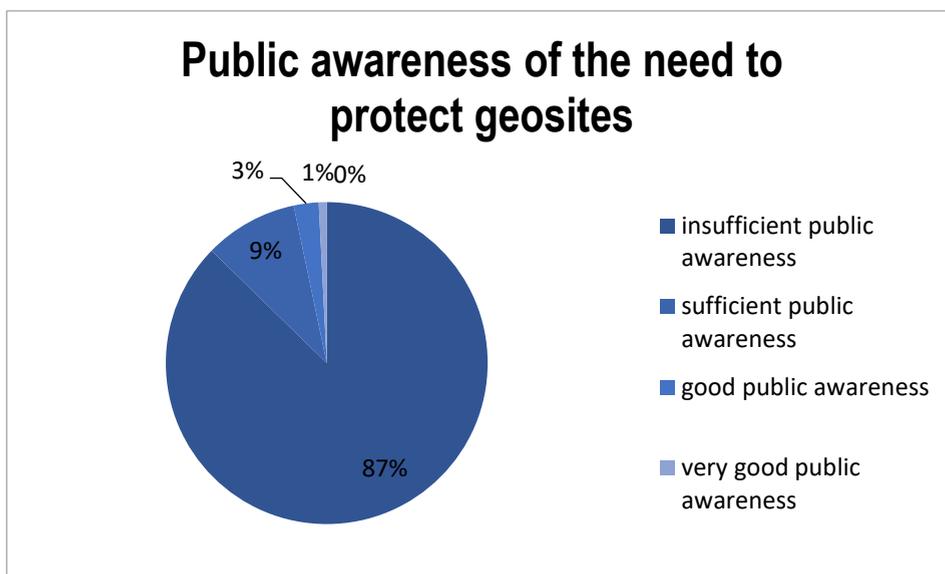
**Graph 2.** Manner of obtaining information on the respective geosites by age groups.

In terms of promotion so the the geosites (were taken into consideration 21 geosites) of foreign and domestic tourists, the majority (93 or 80.6%) reported that the spring of St. Naum deserves the greatest opportunity to promote foreign and domestic tourists. Then follow Smolarski Waterfalls (89 or 77.3%) and Kuklica (86 or 74.7%). After all, the slightest opportunity to promote the domestic and foreign tourists, the respondents said that it would be a the geosites Katlanovski Hill and Ratkova Skala (20 or 17.3 %), followed Zletovska Gorge (27 or 23.4 %) and solfataru Duvalo (29 or 25.2 %). However, it should be noted that the figures cannot be fully taken into account, as some of the geosites are not sufficiently known to the public. Because of that, the purpose of the paper is with the intention to get better acquainted with them, because each of them has its own unique beauties, after which it can be promoted to tourists, and on the other hand properly used for tourism. In fact, since geotourism is not yet sufficiently developed in the Republic of North Macedonia, we hope that this paper will be a contribution to the geotourism promotion of geosites.

Does the Republic of North Macedonia have geotourism potential, about 77.7 % of the respondents answered that it has a large tourist potential, while 14.5 % answered that it has a small tourist potential. According to the representation of the tourist values in the protected areas, about 50 % of the total number of respondents think that they have significant tourist values, while 40.7% stated that they have certain tourist values, and only 5.1 % answered that the protected areas in the Republic of North Macedonia have small tourist values.

According to the answers given in the questionnaire, about 85.6 % of the respondents prefer to visit natural heritage sites. Most of them do not visit the geosites insufficiently, which is due to the insufficient promotion of the same. And respondents from both age groups, rarely (a few times a year) their leisure time use for visiting a protected area around 63.1 % while still only a small percentage of about 6.2% II age group reported very frequently (every Sunday-week) his free time to benefit t for visiting a protected area. During the visit to a geosite, the visitors, if

they do not behave properly, can be degraded or completely destroyed, and thus affect the ecosystem itself. In the questionnaire set question "Are the protected areas visited degraded by humans"? In response to this question, about 57.3 % of the respondents stated that protected areas are severely degraded. Therefore, it is inevitable to note that some of the geosites, although protected by law, are not given sufficient care, and this contributes to the degradation (destruction) of their values. In order to stop the anthropogenic degradation of geolocations, it is necessary to take appropriate measures and protection. According to the total number of respondents, about 66.9% believe that measures are taken for their protection. This is due to the weak commitment of institutions, municipalities and non-governmental organizations. As a result, it is necessary to raise public awareness of the need to protect the values of geosites. Respondents from both age groups, about 87 % think that there is insufficient public awareness for their protection, while only a small percentage about 0.8 % think that there is very good public awareness. In order to encourage public awareness of nature protection in general, and this includes the protection of geosites (geodiversity), it is necessary to take bigger steps. It refers to the introduction of educational activities and information materials through all levels of the educational process. Also, there is a need for greater promotion of the same and emphasis on their geo-values, and thus the protection itself will be emphasized.



**Graph 3.** Public awareness of the need to protect geosites in %.

When analyzing the details of the respondents from both age groups, it can be seen that about 70 % share the same knowledge about geodiversity, geosites, their protection and tourism promotion. When comparing the data on the need for their information, the respondents from I age group prefer to receive the information through a mobile application, while the respondents from II age group through an information board. As mentioned previously, this is due to the rapid development of technology, that it is part of our everyday life from a younger age. It was also noted that the respondents from age group II would prefer to use their free time to visit

a geosite, unlike the respondents from age group I. This is probably due to the greater information of the respondents (in this case the II age group) regarding the knowledge of the geosites.

## **CONCLUSION**

From the aspect of geodiversity, on the territory of the Republic of North Macedonia there are many interesting and rare phenomena. Some of them are protected as with monuments of nature, natural rarities, national parks, some are proposed for protection and the others. Our country, like rarely any other country in Europe and beyond, boasts an extremely large geodiversity of small space (Milevski, 2019). Despite the relatively small area, the Republic of North Macedonia (25,713 km<sup>2</sup>) has areas with extremely valuable and attractive geosites (Milevski, 2015).

Every country, region and area that strives for the development of geotourism at the same time pays great attention to the protection of the natural values of that area. This is for the simple reason that most tourists come to a destination precisely to enjoy and "discover" those unique attractions, which they cannot see in their area or their country. Therefore, the development of geotourism is inextricably linked with the protection and preservation of the landscape, nature and natural values. The development of geotourism in a country promotes natural values that create economic benefit from an old one, and on the other hand they should be adequately protected and ensured sustainable use. Tourism is an important driver of economic development in the Republic of North Macedonia, but the potential for development of geotourism has not yet been fully exploited (Todorova et al, 2018). Geotourism is one of the newest concepts in the field of tourism, which is developing rapidly and has become widespread in recent years.

It is necessary to note that the results of this paper cannot be considered as complete, because it is a partially small number of respondents and requires more detailed research, with a larger number of respondents, more age groups, selection or selection of more appropriate and more specific issues, etc. From the results obtained from the total number of respondents it can be concluded that the knowledge of the values of the geosites, the actual condition of the protected areas by categorization and their geotouristic promotion is at a very low level. Therefore, it is necessary to take appropriate measures to increase awareness of them. Such measures can be taken: holding public debates on nature protection, inserting content for nature protection in the educational process, greater presentation of geolocations using digital media and publications and many other ways. In that sense, the inevitability of greater information and increased knowledge of the number of geological sites and protected areas, and their geotourist promotion is more than necessary, because the territory of North Macedonia has a rich geodiversity and it is necessary to properly use its benefits. Also, the application of such measures will increase the geotourism potential of the geosites themselves. On the other hand, because geotourism in the Republic of North Macedonia is not yet developed, with its development in the future and proper sustainable use, for this purpose, this paper will serve to contribute to greater promotion of geodiversity and geosites, in parallel, leading at the expense of preserving them.

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