



Results of the geointerpretation research in the frame of the Danube GeoTour project

Rezultati raziskave o geointerpretaciji v okviru projekta Danube GeoTour

Danijela MODREJ¹, Suzana FAJMUT ŠTRUCL² & Gerald HARTMANN¹

¹ARGE Geopark Karavanke/Karawanken, Hauptplatz 7, 9135 Bad Eisenkappel/Železna Kapla, Austria

²Podzemlje Pece, d.o.o., Glančnik 8, 2392 Mežica, Slovenia

Prejeto / Received 3. 5. 2018; Sprejeto / Accepted 20. 6. 2018; Objavljeno na spletu / Published online 20. 7. 2018

Key words: geološka dediščina, geoparki, geointerpretacija, trajnostni razvoj, geoturizem, Geopark Karavanke/Karawanken, Danube GeoTour

Ključne besede: geological heritage, geoparks, geointerpretation, sustainable development, geotourism, Geopark Karavanke/Karawanken, Danube GeoTour

Abstract

Crossborder Karavanke/Karawanken UNESCO Global Geopark was established in 2011, and in 2013, it became a member of the European- (EGN) and Global Geopark Network (GGN). Its administrative boundary follows the boundaries of 14 municipalities on the Slovenian and Austrian sides. Since the early beginning, the sustainable tourism throughout the region has been developed. An important component of the Geopark activities is applying for various funding to support the regional development through the transnational cooperation between European Geoparks or through Geopark-specific projects. An example of the transnational cooperation is the project Valorisation of geo-heritage for sustainable and innovative tourism development of Danube Geoparks. Eight Geoparks of the Danube region participate in this project with the acronym Danube GeoTour, implemented in the INTERREG Danube Transnational Programme 2014-2020. The main goal of the project is establishment of the joint Danube GeoTour designed to strengthen cooperation between the regions' Geoparks and act as an innovative tourism product to accelerate visibility and tourist visits in the Geoparks. Common strategy for sustainable management of tourism pressures will form the basis for creating innovative geoproducts. Sharing experiences, testing pilot geotourism products and new interpretative approaches should increase local inhabitants' engagement, Geopark management capacities and lower the quality gap between Danube and other European Geoparks. Within the Danube GeoTour project, Karavanke/Karawanken UNESCO Global Geopark implemented a research "New competences in geoheritage interpretation". The aim of the project is to find out how to improve skills and quality of the heritage presentation in the participating Geoparks by transnational learning interaction, and to complement the uniqueness and character of the overall Danube GeoTour product. The main research objective was the introduction of new interpretation trends, techniques and methods which are used in the presentation of geoheritage, observed within and outside the participating Geoparks.

Izvleček

Čezmejni UNESCO-v globalni geopark Karavanke/Karawanken je bil ustanovljen leta 2011, z letom 2013 pa je postal član Evropske- (EGN) in Globalne mreže Geoparkov (GGN). Obsega območje 14 občin na slovenski in avstrijski strani. Že od samega začetka je prioriteta geoparka razvoj trajnostnega turizma v regiji; pomembna aktivnost je uporaba različnih finančnih skladov za podporo regionalnemu razvoju preko programov čezmejnega sodelovanja med evropskimi geoparki ali preko specifičnih projektov geoparka. Primer dobrega čezmejnega sodelovanja med evropskimi geoparki je projekt Valorizacija geodediščine za trajnostni in inovativni razvoj turizma v podonavskih geoparkih. V okviru programa čezmejnega sodelovanja Podonavje 2014–2020, v projektu z akronimom Danube GeoTour, sodeluje osem geoparkov z območja podonavske regije. Glavni cilj projekta je vzpostavitev skupne Podonavske poti Danube GeoTour, oblikovane z namenom krepitve sodelovanja med regijami z geoparki. Delovala bo kot inovativni turistični produkt za pospeševanje vidnosti in turističnih obiskov v geoparkih. Skupna strategija za trajnostno upravljanje turističnih obiskov bo osnova za ustvarjanje inovativnih geoproductov. Izmenjava izkušenj ter preizkušanje pilotnih produktov geoturizma in novih interpretativnih pristopov bo povečala vključenost lokalnih prebivalcev, kapacitet geoparkov, in zmanjšala kakovostno vrzel med podonavskimi in drugimi evropskimi geoparki. V okviru projekta Danube GeoTour je UNESCO-v globalni geopark Karavanke/Karawanken izvedel raziskavo »Nove kompetence v interpretaciji geološke dediščine«. Namen projekta je ugotoviti, kako izboljšati predstavitev dediščine v sodelujočih geoparkih ter dopolniti edinstvenost in značaj celotnega Danube GeoTour produkta. Glavni cilj raziskave je preučitev novih interpretacijskih trendov, tehnik in metod, ki se uporabljajo pri predstavitvi geološke dediščine znotraj in zunaj sodelujočih geoparkov.

Introduction

Geology is a science concerned with the origin, history, composition and structure of our planet Earth. Without doubt this is one of the most important branches of Earth sciences, but often neglected, while geology-related topics are not appropriately visualized to general public. With the use of suitable presentation technique, we can make often too complicated geological phenomena more interesting and easier to understand.

In general, there are two reasons why we need presentation of geological heritage. Firstly, our geological heritage is important in underpinning the famous landscapes and biodiversity that we have. Despite this fact, the geological heritage is farther from the hearts and minds of the population than other more easily identifiable aspects of the natural heritage, namely the flora and fauna. However, similar to the biodiversity, the geological heritage is vulnerable to the activities of mankind, which may damage it. The damage is long-term and difficult to be remediated, often even impossible. Therefore, only those people and local communities who are aware of their geological heritage and can both identify with it and relate to it, can contribute to its conservation and sustainable development. Geological heritage presentation has a clear role in establishing the real links between the bio- and geodiversity and the need to preserve them both equally. The second reason for the requirement of geological presentation, is the opportunity the geodiversity offers in touristic efforts at local or national level. Good explanation and presentation of geological phenomena will enhance the visitor experience and help boost geotourism (Internet 1).

A significant role in the geo-presentation and geo-tourism have today Geoparks. Geopark is a territory with a great geological heritage, important not only at the national level, but also global. They are a relatively young establishment. The European Geoparks Network was established in the year 2000 by four Geoparks: Reserve Géologique de Haute-Provence (France), Natural History Museum of Lesvos Petrified Forest – Lesvos island (Greece), Geopark Gerolstein/Vulkaneifel (Germany) and Maestrazgo Cultural Park (Spain). In 2004, the Global Geoparks Network (GGN) was founded, when 17 European and 8 Chinese Geoparks came together. As of April 2018, 140 Geoparks in 38 Member States are currently members of the Global Geoparks Network. 70 Geoparks from 23 European Countries form today's European Geoparks Network (EGN).

UNESCO patronage on Geoparks began in 2001. In November 2015, the 195 Member States of UNESCO set-up the creation of a new label – the UNESCO Global Geoparks. According to the definition, UNESCO Global Geoparks are single, unified geographical areas where sites and landscapes of international geological significance are managed with a holistic concept of protection, education and sustainable development (Internet 2). Functioning in the same way as museums, zoos, parks and science centres, geoparks serve as centres for informal learning, providing visitors with geological, historical and cultural stories. They offer these opportunities through interpretation programmes, guided tours, exhibits, signage, brochures, lectures and online sites (Buhay et al., 2015).

In the last decade, the multi-medias increasingly impact the way of spreading the knowledge and represent a new modern approach in geo-presentation. Today, we live increasingly in a digital society. If we want to reach and engage wide audience, it is important to select the most appropriate means of communication. This does not mean abandoning old methods, but rather developing and introducing additional approaches. Digital technologies can provide off- and online presentation, as well as on- or offsite experiences. It is a major and growing trend in museums and education. Numerous recent digital heritage projects have demonstrated the usefulness of the information and communications technologies (Boile et al., 2014; Antlejš, 2014). The new technologies enable the creation of virtual databases using virtual globes – e.g., Google Earth – and other personal-use geomatics applications (smartphones, tablets, PDAs) for accessing geological heritage information in “real time” for scientific, educational, and cultural purposes via a virtual geological itinerary. With these technologies, Geoparks and other relevant institutions can create mapped and georeferenced geosites (Martínez-Graña et al., 2013).

The development of the Geoparks goes hand in hand with the vision of Interpret Europe (European Association for Heritage Interpretation). High quality heritage presentation is the key to foster broader understanding of – and respect for – all natural and cultural heritage. This opens up new possibilities for cooperation in the field of environmental education and interpretation between Interpret Europe and the Geoparks, as well as the European Geoparks Network. Geoparks must look forward to developing new networks to foster creativity and to drive innovations in heritage

presentation and the Geoparks must try to bring geo-presentation to the next level with the use of new technologies (multi-media, virtual reality, etc.), for visualisation and presentation of complex geological phenomena and processes, and popularisation of geological science (Hartmann et al., 2012; Bedjanič et al., 2014).

Eight Geoparks of the Danube region participate in the project Danube GeoTour - Valorisation of geo-heritage for sustainable and innovative tourism development of Danube Geoparks, implemented in the INTERREG Danube Transnational Programme 2014-2020. Karavanke/Karawanken UNESCO Global Geopark, as the coordinator of the Workpackage *Geointerpretation*, implements a research about *New competences in geoheritage interpretation*. The aims of the research were (a) the introduction of new approaches, which are used in the geoheritage presentation and are observed within and outside the participating Geoparks; (b) to improve skills and quality of the heritage presentation in the participating Geoparks by transnational learning interaction; (c) to complement the uniqueness and character of the overall Danube GeoTour product.

Research New competences in geoheritage interpretation - data collection tools

The main aim of the research *New competences in geoheritage interpretation* was to find out new trends and competences in geo-presentation and geo-communication as well as new specific presentation methods of 8 selected geological challenges in the Danube region, i.e. tectonics,

volcanology, geohazards, geology over time, water in time, metamorphic processes and rocks, geomorphology and dialogue between Earth & humans. For this purpose, following data collection tools was used:

1. In order to gain better insight into existing presentation methods and technologies, used in participating Geoparks and into the quality of presentation the geological heritage, a Questionnaire concerning geo-presentation practices in project partners Geoparks was prepared. Questions were mainly related to the existing geological heritage presentation in Geopark - how does Geopark presents its geological heritage, which of selected geological processes/challenges are described in personal or non-personal geo-presentation, what kind of personal (guided tours in different trails and paths, training for guides/rangers/interpreters, educational seminars for educational institutions, workshops for children, ...) and non-personal (booklets/books, information panels, audio-visual equipment, info-points, info-centres, ...) geo-presentation are used in Geopark, ...

2. With the objective to get a deep insight into the current developments in presentation of natural phenomena in other protected areas, several information centres in Austria have been visited, as the examples of best practice in the geo-presentation (Nationalparkzentrum Hohe Tauern in Mittersill, Spring Water Museum in Wildalpen, Visitor centre Erz der Alpen) (fig. 1).



Fig. 1. Field visit of info centres in Austria.

3. An online research - *A screening of the most recent developments, technologies and best practices of interpretative methods applicable to Danube Geoparks*, was carried out, to find examples of best practice in the presentation of selected geological challenges all over the world. Each of the participating Geoparks addressed one geological presentation challenge (problem) that is common, well investigated and presented in the partner territory. At the same time, all selected challenges are typical for the Danube region Geoparks.

4. Data collection in the frame of the joint geo-presentation training - While one of the main ideas of the Danube GeoTour project is learning interaction between project partners, the joint geo-interpretation training was organised for key Danube Geopark personnel responsible for geoguide service and/or presentation (fig. 2). The training covered the following 3 topics: familiarizing with newest developments, methods and best practices - learning from others; exchange of different personal experiences and practices in the presentation of the selected top 8 interpretation challenges - this was implemented in the form of a workshop with a goal to learn from each other; modes of communicating complex geological facts in easy-to-understand language. As part of this topic, a vocabulary of English and all partners' language terms commonly used in geo-presentation was prepared.

Results and discussion

The research *New competences in geoheritage interpretation* geographically covers 7 countries in the Danube region. These represent territories of project partners who contributed best practices, experiences, as well as gained new skills. Moreover, best practices outside of the programme area were researched, being EU or third countries, which were gathered and exchanged at the various EGN/GGN international events. These countries are: Ireland, United Kingdom, Scotland, France, Germany, Italy, Greece, Denmark, Spain, Canada, United States, China and Japan. In total, research includes more than 70 cases of best practice examples in geo-presentation (Table 1 and Table 2).

The idea of the joint geointerpretation training was learning interaction and sharing concrete practical examples from other Geoparks and nature parks, which all lead to better insight into new presentation trends and improved practical presentation skills through learning new presentation and communication methods. This will significantly open perspectives as well as strengthen the competences of individual parks management and the Danube Geopark Tour partnership as a whole and in comparison to other more advanced Geoparks within the EGN and GGN Network.

In the frame of the joint geo-interpretation training, all participants (Geopark Idrija, Geopark Papuk, Geopark Hateg, Geopark Styrian Eisenwurzen, Balaton-Bakony Geopark, Bohemian Paradise Geopark, Geopark Karavanke) shared



Fig. 2. Geo-interpretation training in the Karavanke/Karawanken UNESCO Global Geopark on 20th of September 2017.

Table 1. Best practices from third countries.

No.	Best practice	Location	Type of presentation	Type of best practice
1	Dynamic Earth - Home of the Big Nickel - Earth sciences centre	Ontario, Canada	Exhibition Earthquakes of Canada, where visitors can create their own earthquake, use a seismometer to measure their impact	Best practice for direct linkage with scientific labs
2	Geologic Exhibit	Central Washington University Science II, United States of America	Model of the geologic timeline, built into the floor of a 58.5-meter-long corridor	Best practice for school workshop and digital interpretation
3	The Trail of Time	Grand Canyon, United States of America	A giant geologic timeline, where every meter along the trail, each of which is identified by a bronze marker, represents one million years of Earth's history	Best practice for interpretation route
4	Dynamic Earth - Home of the Big Nickel - Earth sciences centre	Ontario, Canada	Erosion Table; discover simple principles about erosion and water forces	Best practice for children interpretation and children workshops
5	Hong Kong Geopark app	Hong Kong UNESCO Global Geopark, China	An excellent interpretation example, which contains interpretation pictures, text, maps, and different videos	Best practice for mobile application

best practices and methods they use for presentation of geological heritage, especially for their selected geological challenge (tectonics, volcanology, geohazards, geology over time, water in time, metamorphic rocks and processes, geomorphology, dialogue between Earth and human) and visited a good practice example in the Karavanke/Karawanken UNESCO Global Geopark – visitor centre »World of geology« in Bad Eisenkappel/Železna Kapla with the presentation of different kinds of demonstration methods and applications – Geopuls System, Geoclock, GeoGames, etc. This visit was very good insight into the presentation of geological heritage through different kinds of methods and technologies; a combination of personal (guided visit) and non-personal (booklets/books, audio-visual equipment, info-centre) presentation of geological heritage was also presented.

The aim of the joint geo-interpretation training was that all participating Geoparks became familiarized with the modern methods and new trends in geo-presentation and with the best practices from all over the world. This transnational dimension of the training was very useful; each Geopark found out new approaches for geo-presentation through learning from other participants and also got new ideas for heritage presentation – some of the given approaches/ideas are presented below:

- Objects that can be weighed, touched, kept in hand are memorable elements of the presentation;
- gestures, tone of voice and expressive words, its magnitude and the events that accompanied it can make the explanation much more interesting, more fun and more memorable for the visitors;

- use not too much information and facts on the panels; a mix of maps, graphics and pictures with a good short information text is the best way;
- avoiding the overloading visitors with many scientific data in short period of time;
- it is important to connect/compare information with some familiar facts/events in the real life;
- active participation of visitors can not only enhance their experience but also helps them to remember important facts more easily;
- involve children and you will automatically involve adults;
- combination of personal (guided visits) and non-personal (use of illustrations, publications, audio-visual equipment, multi-media, etc.) presentation methods – although the geo-heritage presentation today uses a range of communications media and is delivered in many different ways, it is observed that the direct person-to-person contact is still the most efficient;
- ideally, presentation is carried out on two levels: for children and for adults, with different approaches;
- effective geo-presentation with the use of interactive, constructive learning, explanation of complex topics and ideas connected to a site's main themes in simple words and images that are easily accessible for non-expert audiences.

As the result of the geo-interpretation training, questionnaire, field trip (visits of several information centres in Austria) and on-line research, several recommendations were made, which should be followed when presenting geo-

Table 2. Best practices for 8 selected geological challenges.

No.	Best practice	Location	Type of presentation	Topic of geointerpretation / Geological challenge
1	Animation of plate tectonics and formation of Idrija territory	Idrija UNESCO Global Geopark, Slovenia	Animation at the 1511 Anno Domini exhibition	Tectonics
2	3D models, showing the types of faults and movements along different faults	Idrija UNESCO Global Geopark, Slovenia	Animation for interpretation of the Idrija territory formation and Idrija fault	Tectonic
3	Wooden 3D model	Idrija UNESCO Global Geopark, Slovenia	Didactical tool, used for presentation of movements along different types of faults	Tectonic
4	Interpretation point TIC Topla	Karavanke UNESCO Global Geopark, Slovenia/Austria	Didactic tools and interpretative boards showing tectonic plates boundaries and geological time-scale	Tectonic/ Geology over time
5	Visitors centre Cliffs of Moher	Burren and Cliffs of Moher UNESCO Global Geopark, Ireland	Multimedia exhibition, which enables to move in time and see distribution of tectonic plates throughout the Earths' geological history	Tectonic
6	Geological clock	Karavanke UNESCO Global Geopark, Slovenia/Austria	Special animation- clock, where the geological time is divided and presented in 12 hours	Tectonic/Geology over time/Water in time
7	High Definition 3D adventure cinema	Nationalparkzentrum Hohe Tauern in Mittersill, Austria	3D film, which shows the formation of the Alps and the Hohe Tauern window	Tectonic
8	Visitors center Our Dynamic Earth	Edinburgh, Scotland	Interactive exhibition, experience with erupting volcanoes and lava flow	Volcanology
9	Adventure park VULKANIJA	Grad, Slovenia	Power of volcanoes and their activity is presented through images, text and film, through play and interactive content	Volcanology
10	Vulcania theme park	Saint-Ours, Auvergne, France	Projections, special effects and mapping on the rock walls; exploring volcanoes and the planet Earth with attraction named Abyss explorer.	Volcanology
11	Illustrative tools used by geohike guides	Balaton-felvidéki National Park Directorate, Bakony-Balaton UNESCO Global Geopark, Hungary	Guiding a group of visitors on a field trip or on a geohike	Volcanology
12	Hegyestű Geological Visitor Site	Bakony-Balaton UNESCO Global Geopark, Hungary	Information panel of the evolution of volcanic remnant cones	Volcanology
13	Tapolca Lake Cave Visitor Centre	Bakony-Balaton UNESCO Global Geopark, Hungary	Model of volcanic remnant cones	Volcanology
14	Lavender House Visitor Centre	Bakony-Balaton UNESCO Global Geopark, Hungary	Geyser and thermal spring simulator	Volcanology
15	Lavender House Visitor Centre	Bakony-Balaton UNESCO Global Geopark, Hungary	Model of a volcano	Volcanology
16	Volcano Nature Trail	Bakony-Balaton UNESCO Global Geopark, Hungary	"Stone heaps": 4 models of the volcano cut into half	Volcanology
17	Volcano Nature Trail	Bakony-Balaton UNESCO Global Geopark, Hungary	"Stone map": model of Lake Balaton and the volcanoes around it	Volcanology
18	Volcano Nature Trail	Bakony-Balaton UNESCO Global Geopark, Hungary	"Stone wall": timeline of the volcanic activity in the area	Volcanology
19	Portable volcano model	Nógrád-Novohrad UNESCO Global Geopark, Hungary	Portable volcano model	Volcanology
20	Volcano simulator	Pannon Sea Museum, Geology and Natural History Exhibition of Herman Ottó Museum, Hungary	The simulator and the panels	Volcanology

No.	Best practice	Location	Type of presentation	Topic of geointerpretation / Geological challenge
21	Phreatomagmatic eruption simulator	Kemenes Vulcano Park, Celldömök, Hungary	Simulator showing the process of the phreatomagmatic explosive eruption	Volcanology
22	Models of lava types	Kemenes Vulcano Park, Celldömök, Hungary	Lifelike imitations of two interesting lava types: AA and pahoehoe lava	Volcanology
23	Simulations of volcanic processes	Kemenes Vulcano Park, Celldömök, Hungary	Touchscreen, modelled volcano videos, like magma chamber processes, movement of the lava flows, simulation (2D, 3D) etc.	Volcanology
24	Models of volcano types	Kemenes Vulcano Park, Celldömök, Hungary	Six major types of idealized volcanoes are displayed by professionally detailed and accurate relief models on a table	Volcanology
25	The House of Volcanoes	Hateg Country Dinosaurs UNESCO Global Geopark, Romania	An interpretation and education point with main interpretation theme - ancient volcanoes from the Cretaceous	Volcanology
26	Smrekovec – extinct giant	Karavanke UNESCO Global Geopark, Slovenia/Austria	The interpretation point reveals the geological story of Slovenia's only volcanic mountain range.	Volcanology
27	Seismic table simulator	Natural history museum of the Lesvos petrified forest, Lesvos Island UNESCO Global Geopark	Seismic table, which simulate the seismic movement of some of the most destructive earthquakes of the recent years.	Geohazards
28	Earthquake: Life on a Dynamic Planet	California academy of sciences, United States of America	Interactive exhibition with an earthquake simulator	Geohazards
29	Application of Modern Technologies in Popularization of the Czech Volcanic Geoheritage	Czech Republic	3D animation	Geohazards
30	Hiking tour “Hike to the seabed”	Karavanke UNESCO Global Geopark, Slovenia/Austria	Guided tour where the Geology over time is interpreted	Geology over time
31	Lavamünd Geopath	Karavanke UNESCO Global Geopark, Slovenia/Austria	Geopath with detailed explanations, where the history of the Earth from Devon to the Quaternary can be discovered	Geology over time
32	Children's book “Geological treasures of the Geopark Karavanke”	Karavanke UNESCO Global Geopark, Slovenia/Austria	Book, which include very interesting and easy to understandable geological time scale with illustrations	Geology over time
33	Family Geotime Trail	English Riviera UNESCO Global Geopark, Torquay, United Kingdom	Very interesting and attractive geo trail where visitors can explore 4.600 million year long history of our planet	Geology over time
34	Geology park	St. Martin near Lofer, Austria	Walkable adventure trail	Geology over time
35	“Among rocks and flowers at Hlevišce Hill”	Idrija UNESCO Global Geopark, Slovenia	Playground with detailed stratigraphic column and equipment arranged in the circle	Geology over time
36	“Journey through the time”	Slovenian Museum of Natural History (Ljubljana), Slovenia	Interactive publication for children aged 3 and up	Geology over time
37	A journey through time in Geopark Odsherred	Odsherred UNESCO Global Geopark, Denmark	3D technology - 3D graphics and augmented reality	Geology over time
38	Live timeline of Earth's history	Pannon Sea Museum, Geology and Natural History Exhibition of Herman Ottó Museum, Miskolc, Hungary	The 18 meters long timeline made live by the 5 round windows in which 4 characteristic paleogeographic environments can be rotated by the wheels next to the window	Geology over time
39	Centro de Interpretación de Geológica Nautilus	Basque Coast UNESCO Global Geopark, Mutriku, Spain	Special exhibition about fossils and the life in water over different time periods	Water in time

No.	Best practice	Location	Type of presentation	Topic of geointerpretation / Geological challenge
40	The OMIC Observatório Microbiano dos Azores	Azores UNESCO Global Geopark, Furnas, Portugal	The exhibition with various interactive stations, showing the changing microbiology in water within changing conditions and over various time periods	Water in time
41	Interpretation point Feistritzbach Stream	Karavanke UNESCO Global Geopark, Slovenia/Austria	Interpretation point explains the area's complex water network through animation, educates about water flora and fauna, and offers water-play facilities	Water in time
42	Spring Water Museum Wildalpen	Styrische Eisenwurzen UNESCO Global Geopark, Austria	The collection of the Museum comprises many original documents that enable visitors to understand the historical development of the drinking water system in Vienna	Water in time
43	Haus der Natur - Exhibition Salzach lifeline	Salzburg, Austria	Exhibition with the flight simulator	Water in time
44	Exhibition Gletscherleben	Visitor Centre Kaiser-Franz-Josefs-Höhe, National Park Hohe Tauern, Austria	Interactive Station of the Pasterze glacier; GlacierLife exhibition provides a deep insight into the glacier habitat, its origins and its influence on nature	Water in time
45	Exhibitor "Wasserleben"	Ökopark Hartberg, Styria, Austria	Partly outdoors exhibition with various interactive experiments	Water in time
46	A glance into the Hohe Tauern window	Neukirchen, National Park Hohe Tauern, Austria	The thematic trail which shows how water is shaping landscapes	Water in time
47	Hexenwasser Hochsöll	Tyrol, Austria	The mountain adventure world with games of safe nature watching	Water in time
48	The Natural History Museum	London, United Kingdom	Different kind of panels with text and examples of rocks, describing and showing metamorphic processes and rocks; interactive installation where visitors can change metamorphic conditions with button	Metamorphic rocks and processes
49	Knocken Craig outdoor Visitor Centre	North West Highlands UNESCO Global Geopark, Scotland	Interpretation panels with examples from real life explaining process of metamorphism; interactive installation with micro and macro rock examples	Metamorphic rocks and processes
50	Assynt Visitor Center	United Kingdom	Rock boulders of metamorphic and other rocks with description and interactive panels	Metamorphic rocks and processes
51	Interpretation panels in Rokua Geopark	Rokua UNESCO Global Geopark, Finland	Interpretation panels in Rokua Geopark describing metamorphic rocks of the area	Metamorphic rocks and processes
52	Interpretation panels in Papuk Geopark	Papuk UNESCO Global Geopark, Croatia	Interpretation panels regarding to metamorphic rocks	Metamorphic rocks and processes
53	Itoigawa's GeoStation GeoPal	Itoigawa UNESCO Global Geopark, Japan	Geopark tourist information center	Geomorphology
54	Serra de Santa Bárbara Interpretation Centre	Terceira Natural Park, Azores UNESCO Global Geopark, Portugal	Interpretation center, explanation of geomorphological process of formation and evolution of the island and its relation to areas of high interest in terms of bio and geo-diversity	Geomorphology
55	Touchable glacier and Pasterze time wheel	Nationalparkzentrum Hohe Tauern, Mittersill, Austria	Information about the glaciers of the Hohe Tauern, about snow, corn snow and glacial ice, about the ice flowing and other peculiarities of the glaciers is given; the highlight is the real glacier; that is placed in the middle of the room	Geomorphology
56	Expo Postojna cave karst	Postojna, Slovenia	The biggest exposition of the karst and karst caves in the world	Geomorphology
57	Trail guide maps	Rokua UNESCO Global Geopark, Finland	The guides combine detailed explanations of the sites and a map that gives a good overall picture on the terrain and the location of sites of interest	Geomorphology

No.	Best practice	Location	Type of presentation	Topic of geointerpretation / Geological challenge
58	Rokua Geopark 3d Mobile app	Rokua UNESCO Global Geopark, Finland	In the mobile application visitors can explore landforms, attractions and tourism services with respect to their own positions in a three dimensional map view	Geomorphology
59	Levels of interpretation in the Geosite “Foz do Enxarrique”	Naturtejo UNESCO Global Geopark, Portugal	Interpretation panels, billboard, different thematic panels	Geomorphology
60	The Promenade Museum	Haute Provence UNESCO Global Geopark, France	Nature, contemporary art and geology which show the history of our planet during the last 300 million years.	Dialogue between Earth and human
61	The Natural History Museum of the Lesvos Petrified Forest	Lesvos UNESCO Global Geopark, Greece	Two permanent exhibitions presented through rare fossils and through impressive models and charts, geological phenomena and processes.	Dialogue between Earth and human
62	Visitor information center for the Messel fossil pit	Bergstraße-Odenwald UNESCO Global Geopark, Germany	Significant monolithic wall panels and the various exhibition rooms with effective architectural means such as confinement and expanse, light and dark effects, high and low ceilings.	Dialogue between Earth and human
63	Natural History Education Center Ulm	Swabian Albs UNESCO Global Geopark, Germany	The Natural history education center; scientific collections with over 60,000 objects	Dialogue between Earth and human
64	Exhibition Nature in human hands	Natural History Museum, Graz, Austria	Exhibition about the relationship Human - Nature	Dialogue between Earth and human
65	The Visitor Centre of the Troodos National Forest Park	Troodos UNESCO Global Geopark, Cyprus	Collection of rocks and minerals, a model of the geology of the area, depicting sites of geological importance and interest and informational panels	Dialogue between Earth and human
66	Mine of lead and zinc Mežica	Karavanke UNESCO Global Geopark, Slovenia/Austria	Numerous exhibited objects in the mine reveal the everyday work and lives of miners	Dialogue between Earth and human
67	Anthony’s shaft – tourist mine in Idrija	Idrija UNESCO Global Geopark, Slovenia	Presentation of the hard daily work routine of miners, the precious cinnabar ore, drops of mercury and the unique and extraordinary underground chapel	Dialogue between Earth and human
68	Thematic tours and activities guided with local know-how and the travelling exhibition “When we went for ore”	Naturtejo UNESCO Global Geopark, Portugal	The travelling exhibition “When we went for Ore” is an open way to knowledge transfer between old miners and geologists that provide training to tour guides and educational monitors.	Dialogue between Earth and human
69	Footpath for everyone	Adamello Brenta UNESCO Global Geopark, Italy	Interpreted trail where visitors can learn how to read the landscape and the environment using their five senses	Dialogue between Earth and human
70	Intangible cultural heritage	Buzau Land Aspiring Geopark, Romania	Exhibitions, publications and a visitor centre	Dialogue between Earth and human

logical or any other (natural, cultural, technical, etc.) heritage to the audience in more efficient and quality way: Proper geo-presentation planning (Why are we doing this? Who is it for? What will we presented? How will we do it? How will it be managed? How will it be monitored and evaluated?); start of the geo-presentation with the basics; the combination of personal and non-personal presentation; personal contact; involvement of the audience; suitability and accessibility of the geo-presentation for different target groups; explanation of complex geological phenomena in simplified and interesting way, in easily under-

standable language, supported with illustrative materials, other interpretative tools or technologies; active training programmes for Geopark personnel and geotour guides; supportive infrastructure for comprehensive geo-presentation - visitors centres, interpretation points, learning path, etc.

Raising the multi-media and new technologies, such as QR codes and augmented reality simplifies the way of presentation of geological heritage to the public and helps scientists interpret difficult geological phenomena and processes. Geoparks need educated guides, and educa-

tion for them has to be guaranteed. Geopark staff must be trained as geoguides and interpreters to assure high quality guiding and programmes, able to explain complex geological processes in easily understandable language. Good guide can encourage excitement and curiosity, link presentation to personal experiences from everyday life, disclosure of new insights and wider sense, using different and as effective communication tools as possible. New presentation approaches will increase local inhabitant's engagement, Geopark management capacities and lower the quality gap between Danube and other European UNESCO Global Geoparks - this is beside the joint Danube GeoTour, designed to strengthen cooperations between the region's Geoparks and creating innovative geo-tourism products to accelerate visibility and tourist visits in the Geoparks, one of the main Danube GeoTour project result.

Conclusions

The goal of the research was to improve the knowledge-base and exchange practices on quality geoheritage presentation in participating Geoparks with special focus on 8 selected geological challenges. The research provides a guideline in every day practice of Geoparks and other heritage sites within or outside Danube programme area. Participating partners identified contemporary presentation methods and technologies and also best practice examples of geo-presentation in their Geoparks and abroad. Through training and creative process, new ideas were born giving us sometimes completely different perspective to the presentation of the geological heritage.

In the frame of the research, we draw out lessons learnt, several recommendations and new trends that will be useful for project partners, as well as other Geoparks, natural protected areas and sites outside the project partnership designing presentation points or centres.

References

- Antlejš, K. 2014: 3D technologies in heritage interpretation: the Hungry Dragon fast food kiosk (K67). In: Lehnés, P. & Frost, S. (eds.): Interpret Europe: Conference proceedings 2014/2015. Interpret Europe: 14–24.
- Bedjanič, M. & Rojs, L. 2014: Geo-interpretation: The interpretation of the geological heritage of Karavanke Geopark. In: Lehnés, P. & Frost, S. (eds.): Interpret Europe: Conference proceedings 2014/2015. Interpret Europe: 31–42.
- Boile, M., El Raheb, K. & Toli, E. 2014: Valorisation of EU project results in the area of access to cultural content Grant D.1.2 – Stock-taking Analysis. Internet: http://www.ecultobservatory.eu/sites/ecultobservatory.eu/files/documents/eCultValue_D1.2_Stock-taking%20Analysis_Final.pdf (02.07.2017).
- Buhay, D. N. & Best, L. A. 2015: Informal Learning at Stonehammer and English Riviera Geoparks. *Geoheritage*, 7/2: 165–175, doi: <https://doi.org/10.1007/s12371-014-0125-9>.
- Hartmann, G., Fajmut Štrucl, S., Bedjanič, M., Rojs, L. & Vodovnik, P. 2012: Osnutek načrta upravljanja Geoparka Karavanke-Karawanken. Mežica: Geopark Karavanke-Karawanken. Internet: https://www.geopark-karawanken.at/files/2012_01_06_upravljaljski_nacrt_slo.pdf (02.07.2017).
- Martínez-Graña, M., Goy, J. L. & Cimarra, C.A. 2013: A virtual tour of geological heritage: Valourising geodiversity using Google Earth and QR code. *Computers & Geosciences*, 61: 83–85, doi: <https://doi.org/10.1016/j.cageo.2013.07.020>.
- Internet sources:
- Internet 1: http://www.interpretacija.si/arhiv/geoloska_dediscina.pdf (02.07.2017)
- Internet 2: <http://www.unesco.org/new/en/natural-sciences/environment/earth-sciences/unesco-global-geoparks/> (02.07.2017)