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Geotourism development in the protected area Llogara-Karaburun

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ABSTRACT
The protected area Llogara – Karaburun represents an area of great importance for different types of tourism such as balnear tourism, ecotourism, speleology, fishing, hunting, etc. The coastal landscape and special geosites of different forms such as karstic caves, canyons, small bays, small beaches, etc., are the main touristic attractions to domestic and foreign visitors. However, despite their values, the geodiversity of this area is still unknown to the admirers of these landforms, due to poor promotion, lack of information and infrastructure to reach them. Geoinformation of the protected area Llogara-Karaburun is a digital database of the geosites, which is being created to inform the visitors and stimulate geotourism development. The paper describes the geotouristic values of this area based on their valorization according to four criteria of Knapik.at.al.

Keywords: Geodiversity, geomonument, geotourism, valorisation, promotion.

INTRODUCTION

The protected area Llogara – Karaburun is situated between the mountain range Cikë-Lungara on the east and the Adriatic and Ionian seas on the west. Three protected areas are proclaimed within this area: National Park of Llogara (1.010 ha), Managed Nature Reserve of Rrëza e Kanalit-Karaburun (20.000 ha) and Marine Protected Area of Karaburun–Sazan 12.570,82 ha, where 9.8 ha belong to the marine area close to Karaburun peninsula and 2.7 ha to the marine area close to the Sazan island. Besides, this area has a great number of monuments of nature (third category of IUCN) such as geomonuments, hydromonuments, and biomonuments.

Due to its scenic beauty, diverse landscape including mountains, hills, and plains, small beaches, underwater caves, land and sea biodiversity, archaeological sites, etc., this area is increasingly being visited by native and foreign visitors. Most of them do come to this area to explore the unknown misteries of the peninsula and the island of Sazan, but they are not properly informed where to go and what values the geosites possess. Modest efforts are made by the local authority for the geotourism promotion of this area, such as the publication of map boards, leaflets or short videos in media. Some contribution is also given by the geographers, geologists, and biologists who have published papers or studies about geology, structural relief and biodiversity of certain areas of this zone. This research project undertaken in the scope of the natural heritage study and promotion intends the recognizing and popularizing the geosites of this protected area with complex geological, geomorphological, biological and archaeological values.

METHODOLOGY

The geotouristic potential of the geosites of this area is evidenced through their

valorization according to four criteria of Knapik.at.al. such as accessibility, state of preservation, scientific value and education values modified by Anna Solarska and Zdzisław Jary (Solarska & Jary, 2010). In order to determine the importance of individual geosite, each criteria has five features with values of points from 1-5 for the accessibility and state of preservation and from 2-10 for the scientific and education criteria (Tab. 1). The database of the geosites is organized in an inventory card which contains general and specific data of each geosite.

GEOLOGY AND RELIEF

The protected area Llogara-Karaburun belongs to the tectonic zone of Sazani (Akademia e Shkencave 1990a) and is made mainly by the carbonate rocks of cretak and flysch on the southwest edge of the peninsula. The relief is hilly-mountainous with the predominance of the mountain landform. This area is made of three important physical units: Llogara Pass, Mountain range Rrëza e Kanalit and Karaburun peninsula.

Llogara Pass represents an important geosite for its geological, geomorphologic and biological values. It is situated on the tectonic uplift line of two tectonic zones, that of Sazani on the southwest and that of Jonike on the northeast. From the lithological viewpoint it is situated on the tectonic contact of carbonates of mesozoi with the terrigenes of paleogjen-neogjen. Llogara Pass represents also the geobotanical borderline of the typical Mediterranean vegetation with that of the Central Europe, characterized by a mix forest. The southeastern slope of the Llogara Pass has barely any vegetation,

Tab. 1 Criteria of assessment for inventoried geomonuments (according to Knapik et al., 2009, modified)

Criteria	Traits	Points
Accessibility	Site clearly visible, located directly on the touristic trail or nature's path	5
	Site clearly visible, located on the road or path	4
	Site barely visible, located more than 250 m away from the path or road	3
	Site difficult to access for tourist (ex. significantly overgrown or difficult to access)	2
	Site unavailable for tourists	1
State of preservation	Well preserved site with no visible signs of degradation	5
	Site in slight violation of its structure	4
	Partially destroyed	3
	Site heavily modified by human	2
	Site destroyed - loss character of geosites	1
Scientific worth	Very high: one site in the region, unique in a wider scale	10
	High: very important for regional studies	8
	Average: significant for regional research	6
	Low: common site with average values	4
	Very low: no particular distinctive features	2
Education	Very high: number of represented issues: 5 and more	10
	High: number of represented issues: 4	8
	Average: number of represented issues: 3	6
	Low: number of represented issues: 2	4
	Very low: number of represented issues: 1	2

unlike the northwestern one, due to the steepness and exposure of this slope. National Park of Llogara covers an area of 1040 ha protecting the biodiversity of the northwest side between the altitude of 470-2018m. This forest of the black pine is the habitat for many wild animals and birds such as wild pig, wild goat, deer, rabbits, pigeons, etc. Besides the rich biodiversity this park is significant for the beautiful landscapes with high peaks of the Mountain of Vetëtima on the east and stunning views of the Albanian riviera on the west.

Mountain range Rrëza e Kanalit is situated on the southwest of the mountain range Cikë–Lungara and stretches toward the northwest with a length of 24 km from Llogara pass to the Bay of Brisani. This monocline crest has very steep slopes due to its tectonic origin and carbonate formation. The mountain with maximum altitude of 1499 m (Maja e Shëndëllisë) creates morphological contrast with Bay of Vlora on the northeast and the coastline on the southwest. The tectonic fault from Bay of Brisani to the Bay of Dukat i Ri has differentiated the southeastern part of this horst (mountain landform of Rrëza e Kanalit) from the northwestern part where the hilly landform of Karaburun is created. Due to its morphological active evolution this mountain range is significant for the long, high and very steep slopes which stand vertical to the sea and the dense stone streams network which have formed small beaches (Grama, Llovizi). The northeastern slope from the peak of Gjoka (954 m) to the peak of Vali (1362m) and especially the southwestern slope from the peak of Kollovoçka (1228m) to the peak of Shëndëllisë (1499m) have the precipice shape in their major parts. Rrëza e Kanalit is significant for the karstic forms such as the caves (Dukë Gjoni, Daci), funnels, cliffs and the underground karstic forms such as karstic holes, wells, etc. The coastline is very high with cliffs, holes and caves which are created as a result of both tectonic and abrasion activity.

Karaburun peninsula with an area of 62 km^2 is the biggest one of the country, extending from the bay of Brisani to the Cape of Gjuhëza (16km long). Mezokanali trait separates the peninsula from Sazan island, the biggest one of the country. The lithology is represented by the carbonate rocks of cretak and molasic terrigenes of neogjen on the edge of the bay of Shën Jani. The hilly relief of Karaburun culminates in the central part at the peak of Çadërës 839m. The tectonic fault from bay of Dafina to the bay of Rogozha has differentiated the southeastern part of the peninsula from that of the northwest. Therefore the peninsula presents two different landforms. The plain landform of Ravena with the altitude 200-300m on the southeast, and the monoclinal crest on the northwest. The crest is significant for the structural asymetry of the slopes with completely different morphological features. The southwestern part of this crest is characterized of the vertical high slopes 600-800m, especially from the peak of Hilqes (732m) to the peak of Çadërës. It has the magnificant view of a gigand natural wall by the sea almost without any stone streams. Unlike this, the northeastern slope has a dense stone streams network reaching up to 3km long, which have created small beaches of Shën Vasil, Shën Jani, etc. Superficial and underground karstic forms are present in Karaburun such as funnels, holes, caves, etc. Karstic forms such as holes and small dolines are found especially on Ravena plain. Along the coast there are small tectonic - abrasive bays such as bay of Rogozhës, bay of Shën Janit, bay of Dafina, bay of Brisani - the biggest and most beautiful of the peninsula which stretches about 750-800 m deep inland (Kabo, 1990). The coastal caves are very attractive for their fantastic shapes that appear mostly underwater, small lakes, and legends, such as the cave of Haxhi Alisë on the northwest coast between Cape of Gjuhëzës and Cape of Galloveci.

VALORISATION OF THE GEOSITES AND TOURISTIC FREQUENTATION

Based on the bibliographical research and field data collection 24 geosites with geological, geomorphological and archaeological interest were identified. For each of them, an inventory of basic data including location, main features and processes is created. Data from different sources were organised in an inventory card which holds information allowing the evaluation of the geosites from the scientific, aesthetic, cultural and accessibility point of view. The four criteria assessment of Knapik.at.al allows making a statement of every object significance for their geotouristic and educational functions (Solarska & Zdzisław 2010), which will add scientific information to the database and will suggest to visitors itineraries based on their expectations.

The results of valorization proved the existence of a significant geotouristic potential of geosites of Llogara-Karaburun area. Five of the 24 evaluated sites resulted with the highest potential for geotourism, including: National Park of Llogara, Sazan island, Shën Vasil beach, Cave of Haxhi Alisë, Cave of Dukë Gjonit (Tab. 2).

Llogara National Park has average to high scientific value. It is clearly visible, located directly on the touristic trail, easily accessible with many touristic attractions and touristic facilities such as restaurants, hotels, camping areas, etc. This park is frequented all year long by both native and foreign visitors who prefer the fresh air, the breathtaking panorama of the coast from above, the characteristic food and the diverse habitats and species of the park.

All five geosites are well preserved with no visible signs of degradation, especially the caves and the island of Sazan, which are naturally protected. However, the most frequented activities such as diving and spear gun fishing are associated with damages of habitats or rare species. Also, sporadic cases of procesenaria is evidenced on the pine forest of the National Park of Llogara.

Concerning the accessibility, only the National Park of Llogara is easily accessible. Sazan island, the cave of Haxhi Alisë, Cave of Dukë Gjonit and Shën Vasil beach are difficult to access by visitors. They are reachable only by motor boats or yachts in the period June-August, whose cost is relatively high, especially for the native tourists.

All five geosites have high education values from the geology, geomorphology, biodiversity and archaeology point of view, although people are poorly aware or informed of their values. Visitors can hardly find any information board with maps except at Shën Vasil and Llogara. They visit these sites mainly for their aesthetic values, quietness and sport activities such as diving, fishing, exploring, etc.

Other geosites of this area also have geotouristic potential due to their scientific and aesthetic values such as the southwestern slope of the mountain range Rrëza e Kanalit, bay of Brisani, Cape of

Tab. 2 Valorisation of geosites of LLogara-Karaburun

Nr.	Geosite	Criteria				
		Accessibi-lity	State of preservation	Scientific values	Education	Summarised value
1	Llogara National Park	5	5	8	8	26
2	Sazan island	2	5	6	8	21
3	Cave of Haxhi Alisë	2	5	6	6	19
4	Shën Vasil beach	3	5	4	6	18
5	Cave of Dukë Gjonit	2	5	4	6	17

Gjuhëza, Gryka e Xhenemit (Sazan Island), underground caves, etc., but these sites are difficult to be accessed by visitors, for they are located far away and in difficult terrain.

The number of the visitors is increasing continuously in this area, but geotourism development should consider providing basic facilities to the visitors, which in most of the geosites are missing except National Park of Llogara and Shën Vasil beach.

GEOINFORMATION OF THE GEOSITES OF LLOGARA - KARABURUN AREA

Geoinformation of geosites of Llogara-Karaburun created with the help of ArcGIS10, is a digital database about each geosite, where general and specific data about geographical position, geology, geomorphology, biodiversity, state of preservation, management, etc., are provided. Following the approach proposed by Giardino and Mortara (2004) to each geosite a card containing pictures and descriptions divided into sections is created. The general data of the site is presented in the first section; pictures and text in the second, cultural values, curiosities and legends in the third section and state of preservation and risks in the last one. The card needs to be completed with further information about geology and geomorphologic evolution, stratigraphic sections, 3 D views, etc. The database completion is an ongoing process, for in many cases there is no updated data or the information is completely missing. This gap needs to be filled through continuous monitoring of the geosites from the experts in the field of geology, geomorphology, biology, speleology, archaeology, etc. In order to make available, the results of the project to the public are combined GIS

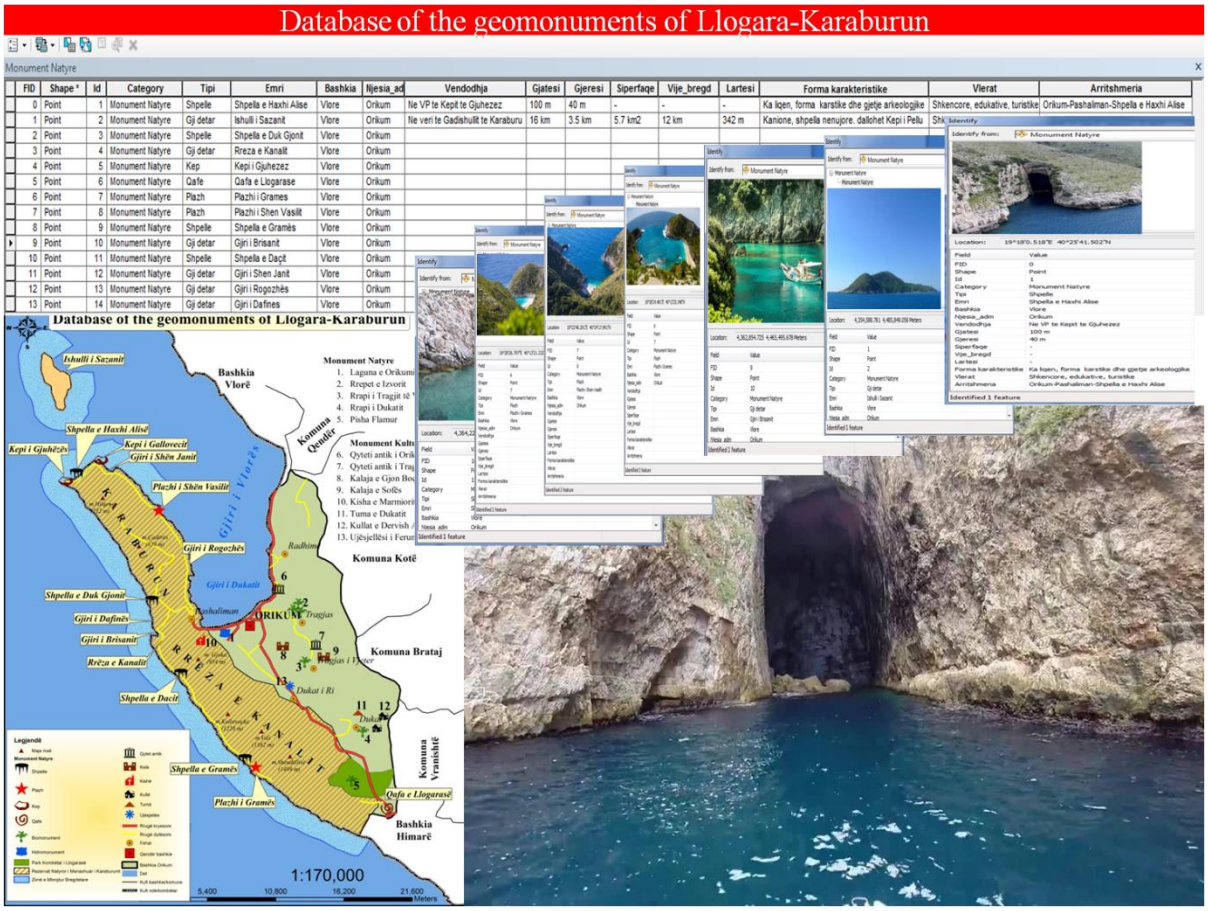

Fig. 1 Database of the geomonuments of Llogara- Karaburun

applications with Internet technology, allowing the publication of cartographical data integrated with other information, including images and descriptive cards (Ghiraldi et al., 2009).

The creation and publication of the website www.geositesofkaraburun.com should be the next step where itineraries of geotours are proposed to the general public together with maps and other information.

DISCUSSION AND CONCLUSIONS

Based on the valorization of the geosites, the area Llogara-Karaburun has a high potential for geotourism development. The results of the geosite valorisation realized by this study can be considered as initial steps for the public awareness raise about the geosites importance. Geotours need to provide geological, geomorphological and biological knowledge to the visitors to raise their understanding of the area. Valorisation of the geosites of Llogara-Karburun is the first step toward geoheritage cataloging. Much more is needed to be done for the information update, monitoring the state of the art of the geosites, completion of the database with more geological and geomorphological aspects of the geosites, etc.

REFERENCES

Akademia e Shkencave (1990a) Gjeografia Fizike e Shqipërisë, vol. 1, pp.43. (Techtonic zones of Albanides: Korabi, Alpet, Vermoshi, Sazani, Mirdita, Gashi, Krasta-Cukali, Jonike, Kruja).

Akademia e Shkencave (1990b) Gjeografia Fizike e Shqipërisë, vol. 2, pp.413.

Ghiraldi, L., Coratza, P., De Biaggi, E., Giardino, M., Marchetti, M. and **Perotti, L.** (2009) Development and usage of Geosites: new results from research and conservation activities in the Piemonte Region (Italy), Studia Universitatis Babeş-Bolyai, Geologia, 54 (2) 25.

Giardino, M. and **Mortara, G.** (2004) I *geositi nel paesaggio della Provincia di Torino*. Pubblicazione del Servizio Difesa del Suolo della Provincia di Torino, v. I, pp. 116.

Solarska A. and **Jary Z**. (2010) Geoheritage and Geotourism Potential of the Strzelin Hills, Geographica Pannonica, Vol.14, Issue 4, 118-125.

The GHR Project: New tools and strategy for an historical geotourism

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ABSTRACT
The GHR project (*GeoHistorical Routes*) aims to create geo-historical touristic itineraries both digital and real by means of a multidisciplinary approach. It is organized into three working groups: research, ICT, communication and education. Through a solid work of historical research the itineraries are realized in order to follow the same steps undertaken by scientist-travelers of the past, such as Carlo Amoretti (1741-1816), an Italian eclectic polymath and traveler. In this paper I show a geo-historical digital path for some of the Amoretti's trips, that is planned to be available for the users of the net. The added value of the GHR project is the integration of different skills (historical, geological, cartographic, local management and computer science) which are able to link web and digital technologies to the needs of territorial sustainable development through the promotion of geotourism.

Keywords: geotourism, history, geoscience, scientific travels, technology.

INTRODUCTION

Could the historical research play a role in the contest of geoheritage, geoconservation and geotourism? The idea to follow the steps of scholars, scientists, voyagers of the past could be an interesting approach for the geotourism (Allan, 2012; Dowling & Newsome, 2010; Hose, 2008). We define *Historical Geotourism* the use of historical sources as a concrete scientific tools for the reconstruction of the geological history of a given area, following the footsteps of scientists and explorers of the past (Vaccari, 2005); not easy to do but not impossible. Diaries, letters and primary sources, in particular of the 18th and the 19th century, could be a precious cultural heritage of geo-mineralogical knowledge about the practice of travel and could be used today for the enhancement of geotourism (Hose, 2012).

METHODOLOGY

The GHR project[1] aims, on one hand, to enhance and to protect the historical and environmental heritage and, on the other hand, to make accessible to the general public and to the schools those historic and scientific richness of our territory often forgotten. We intend to achieve this goal through a combination of complementary skills and an interdisciplinary way to enhance the geotouristic offer that so far is few widespread. Our method is organized into three steps, each one managed by a GHR team characterized by specific skills (Fig. 1), as described in the following.

RESEARCH TEAM

Made up of teachers, researchers, PhD

[1]Italian website: http://itinerarigeostorici.jimdo.com/

Fig. 1 The GHR working teams organisation

students from universities with different backgrounds (historical and scientific), this team works to achive the first goal of the project: the historical reconstruction of significant routes. Through the reading of the historical sources, published and unpublished (travel guides, diaries, letters, etc.), this group have to highlight significant issues related to the geological scenery between the 18th and the 19th century, during the birth and the institutionalization of the geological sciences. Therefore, the historical traces left by this type of work permit to reconstruct a cross-section of the history of geology from a non-conventional viewpoint.

INFORMATION AND COMMUNICATION TECHNOLOGY TEAM

This second team is formed by ICT developers and its goal is to create all the virtual contents for the net using multimedia instruments for managing the website for the transmission of content, the socialization and the sharing among the users. Through the portal users can share experiences, engage in discussions and suggest specific topics that will be examined by the experts of the GHR team. The creation of a mobile application will be essential. The app will be integrated with the portal, with specific locations along the route marked with GPS and qr code, as well as with the major social networks (facebook, twitter, google+, youtube, vimeo) and enriched with features of augmented reality through camera and gyroscope of modern devices.

EDUCATION AND COMMUNICATION TEAM

This third team, consisting of advisers, experts in communication and teaching and translators, has to spread the content created during the first two steps of work to the general public using all kind of media, different levels and languages. Particular attention should be done to the schools, creating educational content to improve the

educational tourism of the local area. The team is expected to create advertising campaigns in schools and associations and marketing campaigns on search engines, to use travel agencies as a promotional channels; to write newsletters for maintaining the client pool; to offer promotions and discounts, events and conferences. Nowadays, this working step is only planned but we expect to achieve this goal as soon as possible.

OTHER PROFESSIONAL COMPETENCES

The GHR project will be complemented by external consultancy services according to the need, for example we think to use the knowledge of expert guides (mid-mountain guides and caving) for the GHR tours that require this kind of professionality.

A natural consequence, using this kind of working method, will be the enhancement of natural environment (mountains, hills, lakes, rivers) containing historical and scientific peculiarities (Brox, 2008; Candela, 2009) in cooperation with local municipalities and local authorities.

RESULTS

Nowadays this type of historical research has been tested for the study of some handwritten letters of Carlo Amoretti (1741-1816), a Ligurian polymath that lived between the 18th and the 19th century (Bossi 1819; Labus 1824) and author of a particular travel guide *Viaggio da Milano ai laghi Maggiore, Lugano e Como, e sui monti che li circondano* (Amoretti, 1794). First, we have studied and then reconstructed some routes of geological and naturalistic tasks taken from the Amoretti's diaries written in the late 18th century (Vaccari 2005). It is important underline that we have used the Amoretti's published and unpublished written (Amoretti 1794; ILASL), as a concrete scientific tools for the reconstruction of the geological history of a given area.

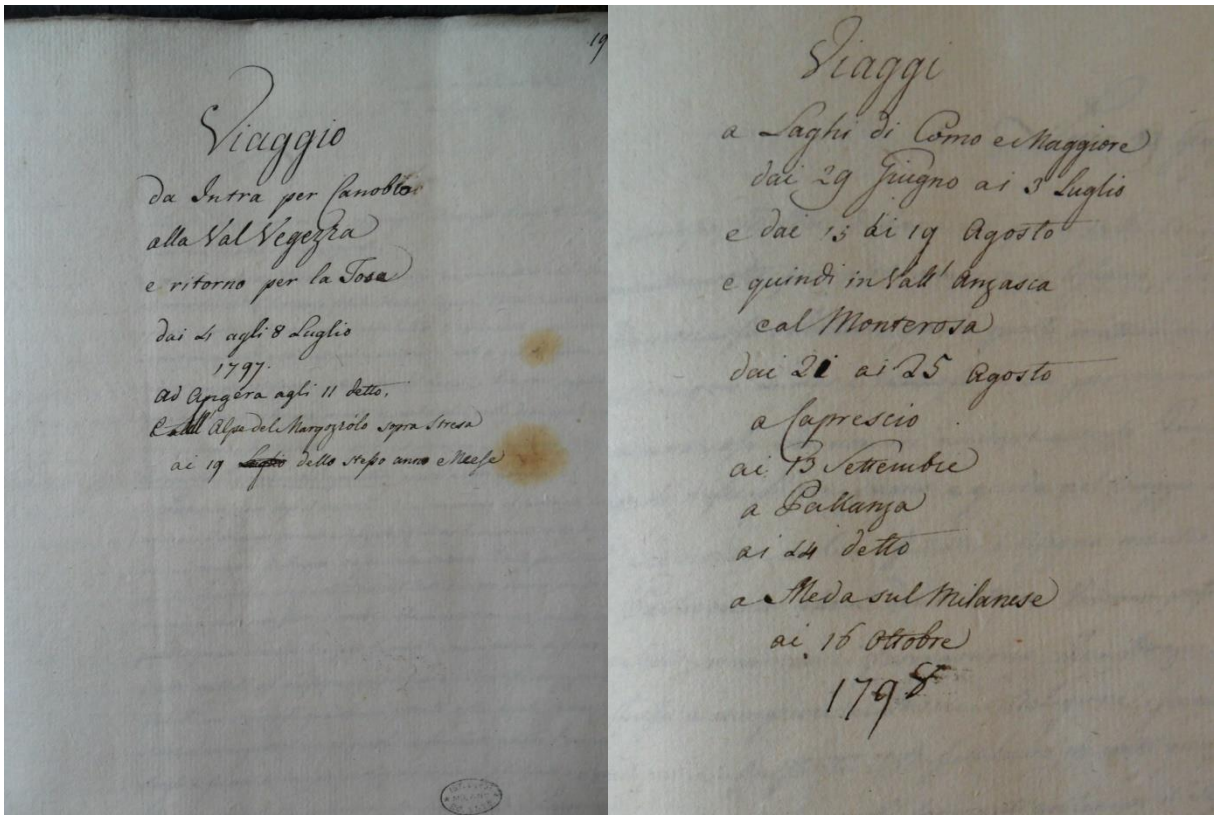

Fig. 2 The frontispieces of the handwritten Amoretti's letters of the 1797 and 1798

RECONSTRUCTION ON THE FIELD: FROM THE TEXT TO THE GEOGRAPHICAL LOCATION

During the summer 2010, with the manuscripts sources in the hands (Fig. 2), I tried to follow the same steps made by Amoretti in 1797 and 1798 in the Piedmont area of Intra, Ossola, Vigezzo and Cannobina Valleys and observing what he sow during the route (Tab. 1).

While the identification of the general track of the paths that Amoretti accomplished was not difficult (thanks to the precision of the geographical information provided by Amoretti) the localization of specific observation points has been more complex. This is due, both to the lack of accurate data in the sources, and to the different landscape conformation caused by more than two centuries of human and natural changes and transformations.

After this reconstruction on the field, through the historical sources of some geological and naturalistic trips made by Carlo Amoretti in the late 18th century**,** it was possible to draw interesting conclusions about the Amoretti travel arrangements and in particular retracing, more or less exactly, the trail and the geological observations made by Amoretti.

VIRTUAL TOUR: FROM THE GEOGRAPHICAL LOCATION TO THE DIGITAL ROUTE

The second step was the creation of geo-historical digital paths of the reconstructed Amoretti's trip planned for the users of the net. Through the use of the *Google Earth* application, it was possible to compare the historical maps with the current ones, tracing the path followed by the scientist-traveler, identifying places and points of litho-geo-mineralogical interest and so on. The application, under construction, could provide users with a complete picture of all possible information for a geohistorical hike. In particular, the planned application based on *Google Earth*, gives three possible options: paths, geo-litho-mineralogical observations and maps. Choosing the option ‘paths’, the user could further choose between areas and years of interest. For example choosing the Intra valley, *Google Earth* displays two excursions: to the Simmolo and Torrione mount (Fig. 3); or choosing the Ossola Valley, the application shows the path of that area.

For the ‘mineralogical observations’, the user of the net could choose a particular object of interest from the options created on the basis of the Amoretti's mineralogical classification. He divided the mineralogical

Tab. 1 The reconstruction in 2010 of six routes made by Amoretti between 1797 and 1798.

Date Amoretti's trip		Location of reconstruction trip	Mineralogical observation
1797	January	Cimolo (Simmolo) Mount	“trappo”[2]
	4-9 July	Intra to Vigezzo Valley through Canobina Valley and Ossola Valley	Kaolin
	19 July	Treffiume (Baveno – Maggiore Lake)	Peat
1798	3 July	Baveno	Granite
	20 August	Macugnaga, Lower Ossola Valley	marble, gold mines
	13 September	Torrione (Turrione) Monunt	“trappo”

[2] Amoretti performed chemical analysis to understand the composition of his rock and he expressed the idea that it was a sort of basalt.

Fig. 3 Option "paths" to see the routes in a certain area.

objects in four classes: 'simple lands and stones' (silica, clay, magnesia, lime, trap); 'simple minerals' (salts, nitrates, muriates, carbonates); 'fuels' (native sulfur, bitumen, plumbago) and 'metals' (platinum, gold, iron, silver, copper). For example, choosing the trap, the user could see on *Google Earth* the point were Amoretti observed and found this particular stone. The same could be seen for granite or other mineralogical objects observed by Amoretti (Fig. 4).

The third option planned for this virtual tour is the 'maps'. The users could overlap different maps, for example put a modern map on a past one, highlighting the geographical difference of the routes (Fig. 5).

This interactive tour could be enriched by a number of other geological and cultural information and by the use of technological tools like the GPS systems, that could give the opportunity to create geo-located paths. To this end, a collaboration among experts in different fields of geological and computer science, tourism and local government would be fruitful. The final application could provide users with a complete picture of the necessary information to explore directly on the field the geo-historical routes of interest.

DISCUSSION AND CONCLUSIONS

Nowadays we have only partialy achieved the GHR project idea. We need to realized the third step, the comunication and education process and to improve the other two steps because we want to include the GHR tours in the tourism market and in the field of natural and cultural heritage. In addition, we want to implement the creation of the GHR tours studing many others scientists of the past, inserting the GHR project in a bigger project idea, that wants to create an international network, to coordinate the different geosites, geoparksand geo routes, planned by professor Ezio Vaccari, of the Insibria University of Varese (Italy). Many are the manuscripts and the historical sources (for example: De Robilant 1786; Pini 1792; De Saussure 1779; Breislak 1801; De Dolomieu 1797; Santi 1806; Spallanzani 1792; Young 1792) that are waiting someone that took them again in life for

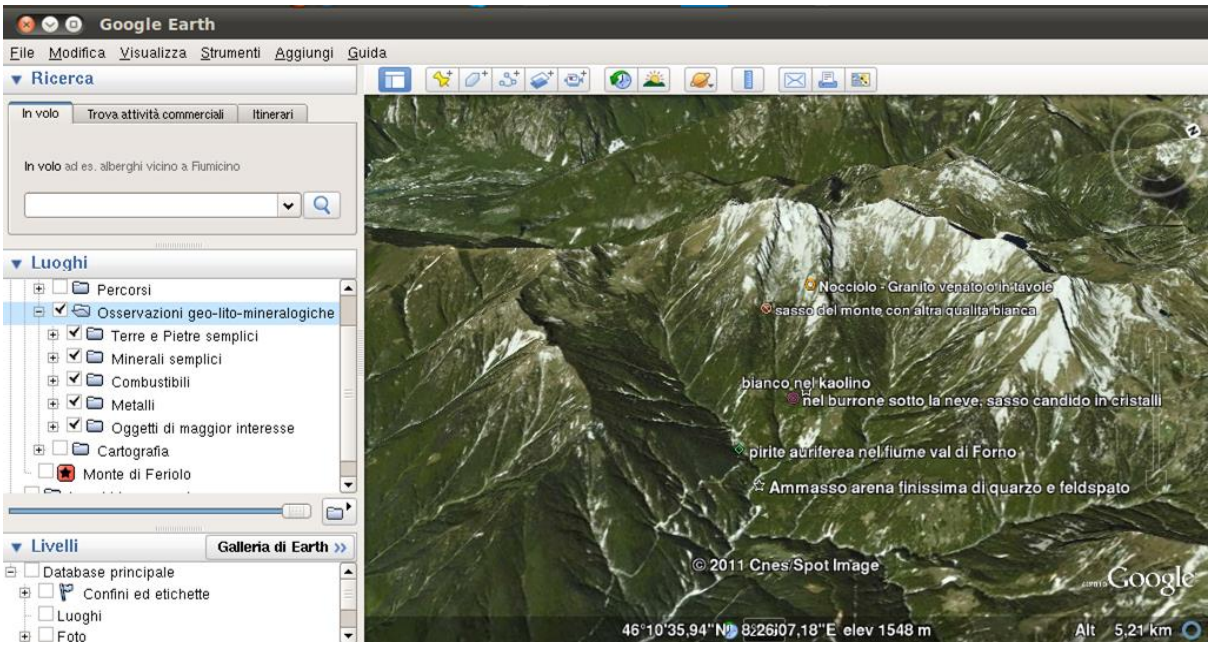

Fig. 4 Option "Mineralogical observations" to see where Amoretti found the different mineralogical object that he observed.

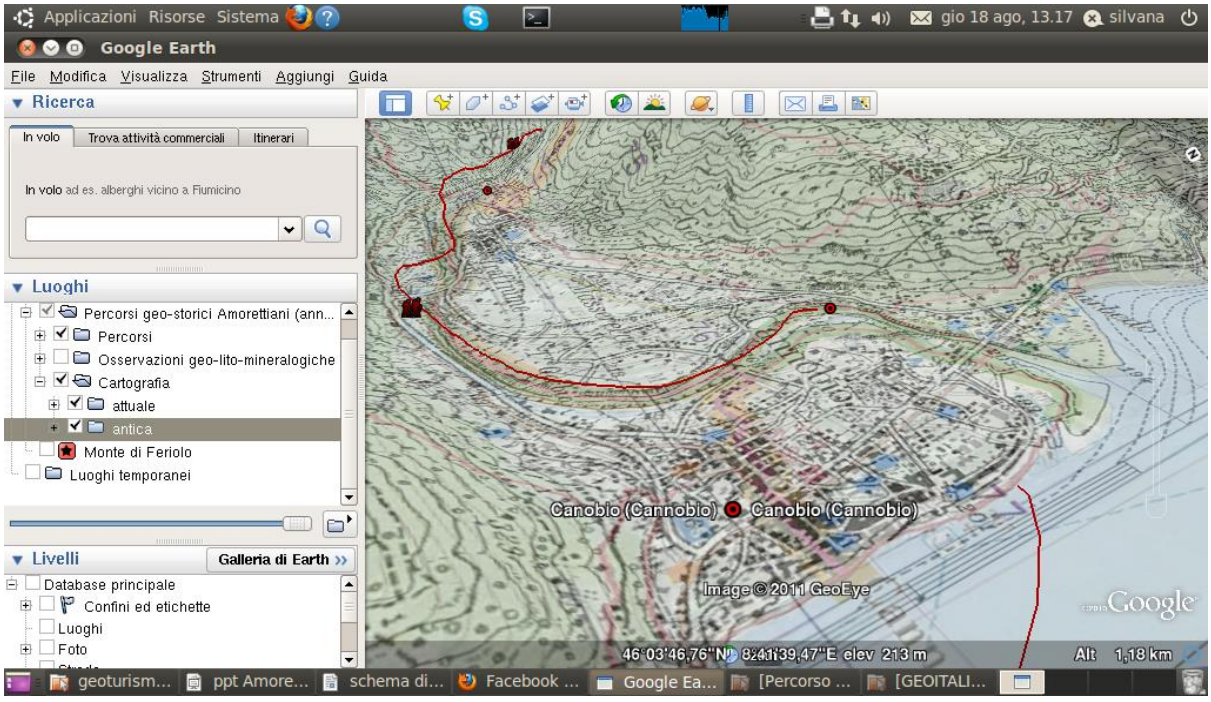

Fig. 5 Option "maps" to see and compare different maps in the area.

creating new geo-historical paths usable by the general pubblic and for all of them that whish to make a natural walking as a cultural and scientific travel in the past. To reach this goal, the keyword is 'synergy' of different skills. Only in this way the GHR project could create, in an original and innovative way, a bridge between two worlds: History and Earth Sciences, allowing the useres to be involved in the discovery of the land where they live.

REFERENCES

Allan M. (2012) Geotourism: Toward A Better

Understanding Of Motivations For A Geotourism Experience (A Self-Determination Theory Perspective), Lap Lambert, Academic Publishing.

Amoretti C. (1794) Viaggio da Milano ai tre laghi, di Lugano, Maggiore e di Como e né monti che li circondano. Galeazzi Giuseppe, prima edizione, Milano. Other Editions: 1801, 1806, 18014, 1817, 1824.

Amoretti C. (1798) Sul tarppo d'Intra e del monte Simmolo. In: Memoria della società italiana, tomo VIII, parte I, 46.

Arena L P. (2011) Finding and Using peat and coal in Northern Italy between the Eighteenth and the Nineteenth century: fieldwork instructions in the writtings of Carlo Amoretti. In: History of Research in mineral resources, Istituto Geológico y Minero de España, 2011, 253-262.

Arena L P., Candela A., Gerali F., Luzzini F. and **Vaccari E.** (in preparation), Viaggi geologici nelle aree montane dell'Italia settentrionale. La ricerca sul campo nei luoghi della stratigrafia del Settecento.

Bossi L. (1819) Dizionario portatile di geologia, litologia e mineralogia, Giegler P., Milano.

Bossi L. (1819) Eleogio letterario dell'abate Don Carlo Amoretti. In: Memorie della Società Italiana delle Scienze residente in Modena, Tomo XVIII, fasc. I, Modena.

Breislak S. (1801) Voyage phisiques et lytologiques dans la Campanie, Dentu Imprieur.

Brox M. (2008) Geoheritage, from global perspectives to local principles for conservation and planning, Western Australian Museum, Perth, Western Australia.

Candela A. (2009) Tutela e valorizzazione del patrimonio geologico. In: Nuova Museologia, 20, 7-11.

De Dolomieu D. (1797) Rapport sur les Voyages in 1797. In: Journal des mines, VII, 385.

De Robilant E-B N. (1786) Essai Géographique suivi d'une topographie souterraine, minéralogique, et d'unedocimasie des états de S.M. en terre ferme. In: Mémoire de L'Académie Royale des sciences 1784-85, Briolo Torino, 191-306.

De Saussure H.B. (1779) Voyage dans les Alpes, précédés d'un essai sur l'Histoire Naturelle des environs de Genevre, Neuchâtel, Genèvre, 4 voll, 1779-1796.

Dowling K.R. and **Newsome D.** (2010) Global Geotourism Perspectives. Goodfellow Publishers, Oxford.

Hose T.A. (2008) Towards a history of geotourism: definitions, antecedents and the future, in C.V. Burex, C.D. Prosser, «The history of geoconservation», Geological Society, Special Publication 300, pp. 37-60.

Hose T. A. (2012) 3G's for Modern Geotourism, in «Geoheritage Journal», 4: 7-24.

ILASL (Istituto Lombardo Accademia di Scienze e Lettere), Milano. Fondo Amoretti. Fald. XXIV, Viaggio letterario-scientifico; Box Miei Viaggi.

Labus G. (1824) Vita di Carlo Amoretti. In: Silvestri, G. (ed) Viaggio da Milano ai tre laghi, di Lugano, Maggiore e di Como e né monti che li circondano. Giovanni Silvestri, VI edizione, Milano, 9-40.

Pini E. (1792) Viaggio geologico per diverse parti meridionali d'Italia esposto in lettere. In: Memorie di Matematica e Fisica della Società Italiana di Scienze Naturali, IX, 118-230.

Santi G. (1806) Viaggio terzo per le due provincie senesi che forma il seguito del viaggio al Montamiata di Giorgio Santi, professore d'Istoria Naturale dell'univeristà di Pisa, Ranieri Proseperi, Pisa.

Spallanzani L. (1792) Viaggio alle due Sicilie e in alcune parti dell'Appennino, Comini B., Pavia 1792-1797.

Vaccari E. (2005) I viaggi mineralogici di Carlo Amoretti in territorio lombardo, tra Settecento e Ottocento. In: Istituto di storia dell'Europa Mediterranea (ed) Pratiche e linguaggi, contributi a una storia della cultura tecnica e scientifca. Edizioni ETS, Pisa, 251-259.

Vaccari E. (2005) Le istruzioni per i geologi viaggiatori. In: Bossi, M., Greppi, C.(eds) Viaggio e Scienza, le illustrazioni scientifche per i viaggiatori nel secolo XVII, XIX. Olschki Editore, Firenze, 3-25.

Young A. (1792) Travels during the years 1787, 1788 and 1789, Rackham, London.

Directions of the development of tourism mining on the example of mines in Poland

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ABSTRACT
Mining tourism is a phenomenon, which can be described as visiting mining sites, which are open to the public, operating or decommissioned both underground and overground, and mining infrastructure. The value and quality of mining tourism are affected not only by the particular sites, but whole mining centers, towns with residential areas, architecture, customs and traditions characteristic of a given region. In Poland and other countries of Central and Eastern Europe, growing awareness of utilizing industrial sites was born in the period of social and economic transformation. Therefore, trends in e.g. revitalization of old industrial sites in Poland are completely new. The examples are set by Western Europe, experienced in this matter.

Keywords: mining tourism, industrial tourism, types of tourism, mines, economic transformation

INTRODUCTION

The beginning of the twenty-first century was groundbreaking in many ways, both in politics and economy as well as in tourism. Tourism, from the fifties of the last century, continues to increase and it seems that this will continue.

However, so far traditional forms of tourism were cultivated. Tourists are becoming increasingly demanding, they are also looking for new experiences and sensations. Dynamically developing is particularly active and cultural tourism. In this framework, they are formed new types of tourism ever. Particular attention should be paid to industrial tourism within which there is also situated mining tourism.

The restructuring of industry, including mining, causes problems with the management of the objects that were the workplace and the great objects of industrial architecture. In the era of rapid development of tourism, there was noticed a great opportunity for inactive mines (Kršák et al., 2015). It was quickly correlated to the interests of tourists who look for new experiences and new impressions.

Easiness of traveling, especially among the citizens of Europe led to an increase in the number of trips to other countries. Therefore, every region, every country has to offer to foreign tourists often unique offer. Examples of such may be mining companies for a variety of ores and deposits. One of the most interesting offers possesses Slovenia with former mercury mine in Idrija. In Central Europe, including Poland are also available for visitors diverse in their bids mines. Each of them has something unique, something that makes it special. Such is the way of mining tourism development of Poland; the main concern is to prepare a unique, distinctive offer and often positively surprising tourist. Increasingly, there are implemented the elements of multimedia, which are also

characteristic for museums in various fields of art. Almost every mine open to the public has several routes to choose from, including children. The creativity of designers and organizers of underground tourist routes constitutes the attractiveness of mines and attracts more and more new tourists. The article presents a number of interesting examples of the development of tourism offer of mining in Poland. Some of them have already worked out, known the worldwide brand, while others are only new tourist products. However, thanks to good promotion and marketing treatments often become leaders of the tourism industry in the regions.

Although there are centers with a relatively longer period of development of mining tourism, mining and industrial tourism in Tarnowskie Góry still has a relatively long history. Wieliczka, Bochnia, Krzemionki Opatowskie and Tarnowskie Góry all have their own history. A good utilization of industrial and technological "monuments" can make the already existing tourist offer more attractive but also create and a whole new one. It often happens that industrial sites are the only worth-noting sites in a given town. Recently, it has been observed that adapting post-industrial buildings particularly mining-related is in fashion. Interesting examples are coal mines in Nowa Ruda and Zabrze, a gold mine in Złoty Stok and a uranium mine in Kletno.

Additionally, relics of industry and technology have more and often become an object of interest not only of a narrow group of specialists, but also tourists who want to learn the cultural heritage of a given region. The offer of industrial tourism perfectly complements the traditional tourist offer based on anthropogenic qualities, mainly architectural sites.

Geotourism often goes hand in hand with mining tourism. It is about learning about the site and geological processes and deriving pleasure from the contact with them (Słomka & Kicińska-Świderska, 2004).

CHARACTERISTICS OF MINING TOURISM IN POLAND TARNOWSKIE GÓRY

According to geophysical division (Kondracki, 2000), the Tarnowskie Góry region lies on the border of two mesoregions. In the larger, southern part of the town, this is Tarnogórski hump, which is a part of the Silesia Upland. This is an element of the Middle Triassic Verge, which, considering its development, is one the most typical morphological edges in Poland. Tarnowicki Lowland is elevated compared to surrounding morphological elements and is cut off from them with mild hills, 10 to 70 m high. The contemporary landform of Tarnowskie Góry is the result of the operation of many natural factors in the past eras: tectonic movements, denudation and accumulation, and contemporary, anthropogenic factors. Glaciers and human activity played a particularly important role in creating the current landform.

The "Czarny Pstrąg" Adit is open to the public. It is a part of the Deep Adit "Fryderyk", hollowed-out in the dolomite rock in the years 1821-1834. It is the longest and deepest adit in the draining system of excavations in Tarnowskie Góry. Back then, hollowing-out the adit required miners to solve many problems, which was not an easy task, considering technological possibilities in the 19th century.

In the European mining, there is a tradition of changing the names of the mining sites when their function changes. Therefore, new names were given to adits and ventilation shafts. The "Czarny Pstrąg" (Black Trout) adit is named after trouts observed there. Even though they are of rainbow color, in the light of carbide lamps they seemed black. Opening the adit to tourists was conducted step-by-step. The first tourists visited the adit on September 15, 1957, during the "Days of Miners" ("Dni Gwarków") festival. At first, tourists

descended the "Ewa" shaft, covered 300 meters, turned around and left with the same shaft. This method was in use until stairs in the "Sylwester" shaft were built.

Zabrze

Zabrze is located in south-western part of Poland, in the western part of Silesia province and the Upper Silesia Industrial district, located in Katowice Upland, by the Kłodnica and Bytomka rivers, in the basin of the river Oder. It borders a few other big centers: Bytom, Gliwice, Ruda Śląska, and Gliwice and the Tarnowskie Góry county.

The most popular sites in the town are:
The Guido Mine is unique in the world, as the excavation preserved has no counterpart in other museums in the world. It is also unique because it has the lowest (at 320 meters) gallery open to the public in Europe. The museum comprises corridors at the level of 170 and 320 meters and a complex of overground buildings with technical equipment. In the mine, one might see strata of geological rock formation with tectonic symptoms.

Level 320 - Excavations at this level are kept in the condition as close as possible to the original ones, when the miners finished their work and left the mine for the last time. Part of the chambers at this level is already used for shops and restaurants, there are concerts, meeting and theater plays. In other chambers, photos of the life of mine are shown. In one of the chambers, one might listen to a few-minute classical musical piece, accompanied by a couple of point lights. A mere fact of being in such an extreme environment is an unforgettable experience for tourists.

Tourists in the Guido mine - After the opening of level 320, the mine comprises two levels of an entirely different character. At level 170, the history of Silesia mining and the methods of extraction from the 19th and 20th century are shown. There is also a chapel here. Audio-visual effects (e.g. miners' talks, the creaking of the ceiling) resemble the climate of the era and the way of miners' work. Level 320 shows a more contemporary side of the mining industry. The ticket price includes a professional tour guide.

Since 1933 the shaft and steam park have became features in the newly created Open-air Museum of Mining "Królowa Luiza", which is a branch of the Coal Mining Museum in Zabrze.

The revitalization in recent years has also included the Carnall shaft. In the shaft tower, there is a viewing platform, where visitors can admire the view of the town.

The Museum of Coal Mine was established in 1981 in Zabrze. It has a very wide selection of exhibits related to the history of mining and mining culture and technology. Without a doubt, this is one of the most interesting museums of mining in Europe.

The museum is divided into the following sections: Geology and paleobotany, Mining Technologies, A history of Mining, Coal processing, Mining culture, Library, and Archive.

Dąbrowa Górnicza

The training mine Sztygarka is located in Dąbrowa Górnicza, and since 2010 it has been open to the public, owing to 650 meters of underground tourist routes (it functions by the Sztygarka Municipal Museum). As the mine used to serve students of a mining school in Dąbrowa Górnicza, where they could learn the techniques of the underground work, today it is possible to watch the teaching posts in the field of mechanics, electronics and securing mining posts, which remained there and served to students.

Kłodawa – Salt Mine

Although salt is still being extracted here (at present, deposits at 600 and 750 meters below the ground are excavated), it also possible to see parts of the site taking a tour along a tourist route. It is possible to learn the history of deposits formation in Kłodawa, go down in mining cage to the 600 meters level, walk down the underground corridor to St. Kinga of

Poland chapel and the decommissioned salt chambers and see machines and tools used in mining.

Kłodawa S.A. Salt Mine – the largest operating salt mine in Poland, located in Kłodawa in the Greater Poland province. At present, there are ongoing works to open a health resort in the mine.

In the mine, only a chamber operation system is used, with shelves and inter-chamber pillars. Initially, excavation was conducted at the levels of 450 and 600 meters. At present, mining works are conducted at the level of 750 meters. Deposits at this level will make it possible for the company to operate for dozens of years to come.

The mine is also open to the public. The deepest underground tourist route (600 meters below the ground) operates here. At 600 meters, near the shaft station, in a salt cave, there is a chapel made of salt with Saint Kinga (patrol of salt miners) figure. On the chapel wall, names of 20 miners who lost their lives underground are engraved on a memorial board. The oldest part of the chapel was included in the official list of monuments in 2007.

Wieliczka

The "Wieliczka" Salt Mine in Wieliczka is one of the most popular tourist sites in Poland and Europe. Sometimes it is a priority for tourists visiting Poland and Central Europe. The fact that it is located near Krakow also attracts visitors. Between the 13th century and 1772, along with the Bochnia salt mine, it was a part of Polish salt mining company "Żupy Krakowskie" (Krakow Mines). Salts excavated in the mine are from Miocene.

In 1976, the mine was included in the list of national monuments. Two years later, in 1978, it was included in the first UNESCO World Heritage List. In 1989, the Wieliczka Salt Mine was included in the list of World Heritage in Danger. It was taken off the list in 1998. Since 1994, it has been registered as a Polish relic of history. On June 30, 1996, salt extraction was stopped entirely. In 2007, in the "Rzeczpospolita" newspaper poll, the Wieliczka Salt mine was named one of the Polish wonders, with the highest number of votes. Every year the mine enjoys a growing number of visitors. Considering the fact it is a mine, over one million tourists a year is an impressive result.

The Wieliczka mine has nine levels, the first one – the Bono level – is 64 meters deep and the last one is 327 meters below the ground. The total length of the galleries combining 3000 excavations (drifts, slopes, operation chambers, lakes, shafts, and fore-shafts) exceeds 300 km.

The mine has unique micro-climate, which comprises – apart from high humidity and high content of sodium chloride – constant temperature (about 14-16°C), pressure, ionization and high concentration of potassium, magnesium, and calcium. This is why it is particularly popular to organize "health trips" at 135 meters in the Wessel Lake chamber for people with respiratory tract conditions.

Routes open to visitors - The world-famous underground tourist route in Wieliczka mine was built at the turn of the 19th century. Every year, around one million tourists, visit a 3-kilometer route, which comprises 20 chambers, located 64-135 meters below the ground (levels I to III). There are 800 steps in the route. A part of the route is wheelchair user-friendly. The mine is also visited by national leaders, scientists and artists. It takes 2 to 3 hours to visit the mine.

The Museum of Żupy Krakowskie (Kraków Mines) in Wieliczka - In the Wieliczka mine, apart from the tourist route it is also possible to see the underground exhibition of the Museum of Żupy Krakowskie located on level III, 135 meters deep. The collections, gathered in 14 chambers, present both the history of the mine, mining and transportation tools and equipment, and the history of the town itself.

Bochnia

The Bochnia salt mine (from the 13th century till 1772, a part of Żupy Krakowskie). The history of the mine dates back to 1248, when deposits of rock salt were discovered. The discovery is closely linked to the legend of St. Kinga. Much earlier though, from 3500 years B.C., the surroundings of Bochnia were famous for extracting salt by evaporating salt water (boiled salt). Salt water wells near Babica were the origin of two shafts, Gazaris and Sutoris, where people started mining salt. The Sutoris shaft is still operated nowadays. Among many historical devices in the mine, there is an efficient (and sometimes operated) driving mechanism of the shaft cab, powered by steam engine. This industrial monument is unique in Europe. On October 6, 2000, the site was included in the register of the Polish monuments of history. On June 23, 2013, the mine was included in the UNESCO World Heritage Site list.

Złoty Stok - A Gold Mine

The Museum of Gold Mining and Metallurgy in Złoty Stok – a museum located in the former arsenic and gold mine in Złoty Stok, Silesia province, opened on May 28, 1996. The museum shows an exhibition of the history of gold mining, a tour to the "Czarna" (Black) adit, where one can see a 10-meter underground waterfall. It is also possible to pan for gold.

Złoty Stok is a picturesque town at the bottom of the Góry Złote (the Golden Mountains) in the northern part of the Kłodzko region. It is famous for its 10-century long history of gold excavation and processing.

At present, the gold mine is a tourist attraction in Złoty Stok. In 2008, the underground tourist route received a certificate of the best tourist product of the year from the Polish Tourism Organization. Very interesting adits are open to the public: The Gertruda adit, The Czarna Góra (Black Mountain) adit, with the only underground waterfall in Poland (8 m high), and the newest part, the Czarna Dolna Adit. During the underground boat tour, a tourist guide gives away the secrets of this amazing place, where the history dates back 2000 years B.C and is present now. Then, the first excavation works took place near Złoty Stok. One can learn more about it in the Museum, where a vast selection of minerals is available. An ideal follow-up of the trip is a lesson of a dying craft – papermaking. The first traces of mining works in Złoty Stok were found in the previous century. In the beginning of the 16th century, a town called Reichenstein (which means "rich stone") by Germans, flourished, owing to gold mining and metallurgy. Seeking the precious mineral lasted until the mine was closed in the 1960s, although not everything had been excavated.

Złotoryja - The Aurelia Mine

Gold mining in Złotoryja developed mainly on the alluvium deposits. Extraction was also conducted in auriferous sands revealed on the hillside of Kaczawa valley. Gold was extracted from mining deposits containing gold in hard rock such as diabase, rhyolite, and slates. An example of such operation is the "Aurelia" gold mine, carved under St. Nicolas Mountain. Little is known about the history of the mine. We know that the adit was opened in 1660, while other drifts and shafts were hollowed-out in the 20th century as exploratory shafts.

There are a lot of mysteries hidden in the mine. The reason why some of the galleries were buried remains unknown. Maybe the reason was the German army withdrawing from these areas. That is why nowadays, many explorers have worked for free in the mine digging out and penetrating forgotten adits and shafts. In 1997, a buried shaft was discovered and it was named after the discoverer "Karol". It is 28 meters long and there are many lateral corridors there.

Tourists can see a 100-meter part of the route. The adit is carved in the hard rock diabase where one can see the accumulation

of iron ore. Off the main gallery, there are many lateral corridors and ventilation shaft, now inhabited by bats.

Kletno - A uranium mine

Kopaliny (Fossils) – a code name of a secret Soviet uranium mine, operating in Poland in the 1950s near Kletno in Lower Silesia, in Stronie Śląskie commune. Ores were explored near Kletno as early as the Middle Ages. Materials for e.g. melting iron, silver, and copper were excavated here. In 1948 by the virtue of an agreement made between the Polish and the USSR governments, exploratory works began in the whole country. The aim was to find uranium. These works were supposed to be conducted and funded by the USSR. After a preliminary research, only the Sudety mountains region turned out to be promising.

Radioactivity of these deposits affected the change of qualities of rocks in the area. Urininite is accompanied by a yellow variety of calcite, a smoky quartz and a fluorite, which is initially pale pink, but near uranium ores turns more and more violet until it turns black.

The tourist route - The route prepared goes along a small part of the highest levels of the mine, where basically only exploratory works were conducted. This is the so-called adit 18. Its entry is 773 meters above sea level, on the north-western side of the Żmijowiec hill. No uranium ores were found here, but it was possible to penetrate through the layers where there are numerous interesting minerals. Tour guides talk about geology, mining history of the region and explain how the underground corridors were built. In total, the route is 200-meter long.

Kowary - A uranium mine

The Kowary Adits – an underground tourist route, opened on April 24, 2000, 1200-meter long in a closed uranium mine in Kowary. On the route, there are 13 dosimetric points, constantly monitored by the Institute of Occupational Medicine in Łódź. The mine was operated by Germans during the Second World War. After the war – by the USSR. Excavation works finished in 1973. Since then, Wrocław University of Technology has been researching the mine and organizing classes for students there.

Chełm

Chalk underground in Chełm – a historical chalk mine is a unique relic of the chalk mining in Europe. A multilevel complex of corridors and chambers inside was formed as a result of multigenerational operation of chalk, whose deposit lie under the town.

A historical outline - People started extracting chalk in the 13th century, after Chełm was rebuilt by a Galician duke, Daniel. The oldest tunnels are located near the castle hill. Tunnels also served as a shelter during wars and attacks.

Unlimited extraction lasted until the 19th century. Chalk extraction was first limited, and in the beginning of the 20th century, banned altogether. This decision was made by the local authorities, in order to provide safety to the residents of Chełm. Another incident took place in the 1970s. One of the corridors collapsed under the weight of a lorry. The accident was a stimulus to start excavation works. As a result, more corridors were discovered. The underground was then secured by miners from Silesia. Several corridors were buried. Others were reinforced and in the 1970s they were again opened to tourists. On January 25, 1995 by a decision of the regional conservator-restorer, a multilevel complex of mining excavations under the old town in Chełm was included in the monuments register.

The tourist route - Underground, there is a constant temperature (+9°C), not affected by weather conditions outside. The tourist route is about 2-km long and is located under the center of the old town. On the route, one can see an exhibition on the archeology, chalk mining and the history of the town, come across bats and meet the

ruler of underground, a ghost called "Bieluch" (loosely translated as "Chalky White"). There are also seasonal exhibitions in the entry pavilion. It is possible to leave the route through the 18th-century brick mining frame, straight to the restaurant.

Krzemionki Opatowskie

Krzemionki, also known as Krzemionki Opatowskie is an archeological reserve, which protects a set of neolithic mines of striped flint. Located between villages Sudół and Magonie in Ostrowiec county in Świętokrzyskie province, 5 km north-east from Ostrowiec Świętokrzyski. On September 16, 1994, by a decree of the Polish president, Krzemionki were included in the list of the monuments of history.

A historical outline - Stripped flint mines were operated in the years 3900-1600 B.C. This mine was one of the most important in Europe. In Neolithic, this mineral was extracted by the people of Funnelbearer and Globular Amphora cultures. In the Bronze age – by the people of Mierzanowicka culture. A part of the flint extracted here was processed in the neighboring villages and then transported, even as far as 660 km away. The most popular products were axes and chisels. Near the mine terrain, there are reconstructed households from the end of the Neolithic and the beginning of the Bronze Age

Nowa Ruda

The Coal Mine Nowa Ruda – a closed coal mine in Nowa Ruda, Lower Silesia province in the Kłodzko county. The mine was established in 1781. Since 1945, it has been called "Nowa Ruda". In 1946, two mines, "Przygórze" and "Jan" were joined to it. In 1954, the mining area of the former "Jan" mine was transformed into the "Słupiec" mine. Since 1971, the mines: "Nowa Ruda" and "Słupiec" were connected to form one mine, "Nowa Ruda" in Słupiec. In 1922 the mine was liquidated. In 1994 in the mining terrain Piast, a mining museum was established, later turned into the underground tourist route Kopalnia Węgla Kamiennego (Coal Mine) in Nowa Ruda.

Bóbrka

The Bóbrka mine is the oldest operating crude oil mine. Various techniques, technologies and constructions, which gave foundations to develop many branches of the oil industry (geology, research, drilling, operation, refinery industry, distribution of oil) were born here. This is where the branch of industry, which brought to the world an enormous civilizational development, was born. In order to understand this global phenomenon better, one must look far into the past.

In 1895 Bóbrka mine became an ownership of the Galicia Carpathian Joint-Stock Oil Company, where MacGarvey was the main shareholder. In 1920, the Bóbrka mine was a part of the Lesser Poland petroleum syndicate – a Group of French Industrial and Commercial Associations in Poland.

CONCLUSIONS

Analysis of tourist attractiveness of available in Poland mines leads to the conclusion that the offer proposed by the different tourist products is extremely diverse, it can be also attempted to create a tourist route or a tourist track that would include several selected objects. Noteworthy above all deserve mines in Wieliczka, Bochnia, Zabrze, Tarnowskie Góry and in Złoty Stok, Kletno and Nowa Ruda. It could be a car route. In the future, it is worth to extend cooperation with neighboring countries, including Slovakia and the Czech Republic. Tourists' interests have a trans-boundary nature now. Therefore, they eagerly travel through thematic routes, wider area, and even through several countries. This offer is all the more noteworthy because it leads through the tourist centers far less known, and have excellent qualities properly developed and being an attraction for

tourists of all ages, with different shape and tourist experience. It is worth also considering the extension of the offer with other underground objects, mainly with military or historical nature. In Poland and in neighboring countries there are plenty of such places. While being in Lower Silesia (nearby mines Nowa Ruda and Złoty Stok) it is worth recommending tourists Riese underground complex, built during the Second World War in the Owl Mountains. This area was chosen because of the geological structure. The hollow in the mountain tunnels was supposed to be underground factories or cities. Therefore, the choice of location was not accidental. These and other factors are taken into account when choosing a place. Currently, They are the major tourist attractions in the region. Examples of various nature is much more. All this allows to claim that mining tourism will enjoy growing interest and constantly will develop its offer.

REFERENCES

Kondracki J. (2000) Geografia regionalna Polski. Warszawa: Wydawnictwo Naukowe PWN.

Kršák B., Sidor C., Štrba L., Molokáč M., Hvizdák L., Blišťan P., Koľveková G., Liptáková E., Delina R. and **Mesároš P.** (2015) Maximizing the potential of mining tourism through knowledge infrastructures, Acta Montanistica Slovaca, 20 (4).

Słomka T. and **Kicińska-Świderska A.** (2004) Geoturystyka - podstawowe pojęcia, Geotourism, 1 (1), 5-7.

Examining the tourism value of geological landscape features: the case of Terme San Giovanni in the Siena clay lands of Tuscany

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ABSTRACT

The area of the Siena clay lands is famous for its aesthetic value, acknowledged at a national and international level. Though landscapes may have a strong visual attractiveness, other factors are also relevant in determining the extent to which they are appreciated. In this study, we hypothesized that a deeper knowledge of landscape is ever more required by visitors and also by local citizens, therefore a survey was built and submitted to visitors to the San Giovanni spa, located in one of the geologically richest locations. Though wellness and health are the main attraction, this study confirms that "landscape" still plays an important role in tourism attraction, but that visitors are not generally aware of more specific geological features despite proximity and easy accessibility. Nevertheless, increasing awareness of environmental and cultural significance, by "qualifying" these features, would increase the appreciation and would be decisive in capitalizing on this attraction.

Keywords: awareness; faults; CO_2 lake; geotourism value; landscape; nature; survey; thermal tourism

INTRODUCTION

The healthful properties of the thermal water at Terme San Giovanni are well known since ancient Roman times, and natural thermal springs represent a very important resource for both medicinal value and tourism attraction. In recent years, thanks to ongoing social changes and a more stressful lifestyle, the demand for relaxation and recreation opportunities has also increased compared to the need for treatment of physical illnesses. Potentially successful thermal facilities that integrate treatment with wellness are less susceptible to the effects of the recent economic and financial crises. In Tuscany, for instance, many thermal tourism locations are facing a structural economic crisis due to their limited tourism income, while others that have pointed to "health and wellbeing" have increased their incomes (IRPET, 2014).

Thermal tourism could have a margin for further improvement if, for example, services provided in a spa were augmented by local activities that exploit the informational value of the natural surroundings. In other countries, thermal tourism is increasingly linked to other forms of tourism, such as sport, recreation and culture. For instance in Poland, health spas are located in regions with a diverse offering of natural attractions, usually bordering on national parks and reserves (De Carlo, 2013). In this way they offer the possibility of spending time outdoors and taking benefit from the surrounding environment as well as the spa itself.

One form of tourism that meshes

perfectly with thermal features is geotourism. Hose (1995) first defined geotourism as "the provision of interpretive and service facilities to enable tourists to acquire knowledge and understanding of the geology and geomorphology of a site (including its contribution to the development of the Earth sciences) beyond the level of mere aesthetic appreciation". Several other definitions followed, though all share a focus on landscape and geology, and on promoting knowledge and conservation of Earth features (Newsome & Dowling, 2010) for future generations (Hose, 2012).

The area of the Siena clay lands is famous for its charming landscape, with gentle clay hills crested by lines of cypresses, patterned by wheat fields, olive orchards and vineyards or Mediterranean woods. The area, however, is also rich in thermal water springs that have been exploited for health and well-being purposes, particularly in the form of spas such as in Rapolano Terme.

Rapolano Terme, located at the North-East border of this area (Martini & Sagri, 1993), on a slope alongside the Chianti Hills and Mount Cetona (Bertini et al., 1991), faces the clay lands and it is rich in natural resources connected to the geology of the area, that strongly mark the economy of the region.

An important geological feature known as Rapolano fault (Bambini et al., 2010) – which interfered during the Pliocene with the formation of the Siena-Radicofani basin (Brogi, 2004; Bambini et al., 2010) – runs north-south and is interrupted by smaller orthogonal faults that generated travertine depositions and thermal water springs during the Late Pleistocene (Brogi, 2004; Brogi et al., 2010).

A natural hot-water spring (located to the south-west from Rapolano Terme) replenishes the San Giovanni spa which, besides the daily entrance, also offers wellbeing and health care packages for visits of varying duration. However, in the same area there are many peculiar features that deserve tourist attention and may offer an alternative cultural offering to visitors.

The objective of this study was to assess the receptiveness of tourists for a better knowledge of the natural area regarding aspects complementary to the primary reason for their visit to the spa (mostly recreation and wellness). In particular, we investigate 1) visitor interest in landscape aspects; 2) type of tourists and their curiosity for landscape features; 3) their assessment of local services; 4) their assessment of the landscape and geological features in the area around the spa as tourist attraction; and 5) suggestions for improved tourist offerings regarding landscape knowledge and geotourism.

MATERIALS AND METHODS

The area and its natural features

The study was conducted at the San Giovanni spa, close to the village of Rapolano Terme. The spa exploits the thermal water originating from the hydrological water circulation of secondary faults at a temperature of 40°C, often associated with CO_2 emissions (Minissale et al., 2002; Minissale, 2004). A number of significant geological features can be found in the surrounding area (Figs. 1, 2):

- The Campo Muri Archaeological Excavations (AE) bear witness to Etruscan and Roman thermal baths (3rd century B.C.) (Brogi & Capezzuoli, 2009). They were identified in the 1970s, during the first opening of the local quarry at Campo Muri, about 200 m east of San Giovanni spa, and they extend along two sides of the travertine quarry, covering 8000 square meters. At that time, the mineral waters were believed to have holy (evidenced by a votive element identified in Buca delle Fate) as well as therapeutic worth. A large spa pool surrounded by stone terraces, paved with regular overlapping slabs of travertine, was identified as typical of Roman baths. The area was also considered a votive area, since

Fig. 1 Map of the geological features around the spa Terme San Giovanni worthy of tourist promotion and awareness

Fig. 2 Environmental, cultural and geological features that are located in proximity of the San Giovanni spa, in the Siena clay lands. AE) Archaeological excavations; Q) Campo Muri quarry; M) Montagnola fissure ridge; B) Bossoleto mofette; G) Geyser – artesian well

many votive statues have been found around. In the woodland next to the archaeological excavations, natural travertine channels that used to discharge the waters from the ancient baths are now covered by vegetation.

- *The travertine quarry of Campo Muri* (Q) is an active quarry that employs residents of the nearby villages. The travertine dates to the Late Pleistocene-Olocene (Carrara et al., 1998) and its extraction dates back to the medieval period. The quarry is visible from the spa and the ancient Etruscan cut, visible from the archaeological excavations, shows the deposition system with angular unconformities and colluvial deposits and paleosols of different periods.
- *The Montagnola active travertine fissure ridge* (M) (Guo & Riding, 1998; Brogi & Capezzuoli, 2009), is about 250 m long and located 50-100 m from the spa. From the geological point of view, the ridge is located on the Eastern side of an alluvial terrace formed during the Pleistocene by the evolution of the Ombrone river. A height difference of about10 m between the east and west sides likely suggests that Montagnola is the fault line along which the alluvial terrace has been displaced. The fissure on top varies in width from 1-2 mm up to 30 cm and in SE extremity still emits water and forms calcium carbonate deposits. On the smooth parts of the slope, macro and micro-carbonate terraces can be observed. Along the fissure, a transversal cut made for research purposes allows the observation of the travertine stratification and hear the bobbling water underneath.
- *The Bossoleto mofette* (B) is a round-shaped doline (80 meters in diameter and 6 meters in depth) where naturally every night a CO_2 lake is formed. William Jervis was the first to describe the doline in 1868. Its origin is likely due to the rock collapse of the travertine rock by acid water (CO_2 of volcanic origin reacting with the water table, beside the rain water acidified by atmospheric CO_2). Recent studies have monitored, more or less continuously, the CO_2 concentration inside the doline and proved the formation of a CO_2 lake especially at night time, reaching the concentration of 80% at 1 m from the bottom (vs. 0.04% of ambient concentration) (Kies et al., 2014). During the daytime on sunny days (especially in the summer), thermal convection generated by solar radiation lowers the concentration to levels around 2000 ppm (0.2%). This site is very interesting, being a natural science laboratory for studying the effects and responses of high CO_2 on the ecosystem's abiotic and biotic components (Osborne et al., 1997; Miglietta et al., 1998; Selvi & Bettarini, 1999). The Bossoleto is not accessible to the general public, but guided tours can be organised on demand to the scientific community or in public events like "Settimana del Pianeta Terra".
- *The geyser* (G) located in the spa garden, which is easily accessible by visitors, was generated by an artesian well (20 m deep) drilled in 1950. This provoked the outflow of water and gases: water emerges at temperatures between 38-39°C, with a flow rate of about 1 m^3/min (Guerra & Raschi, 2004).

The questionnaire

The questionnaire was 15 minutes long with 13 questions gathered in four parts, as shown in Table 1.

Most of the questions (those relative to personal details. awareness of landscape context, information means used and features noticed around the spa) were multiple choice questions with a possibility to choose one or two options.

Some other questions (e.g. assessment of attractiveness and accessibility, information source; factors important for tourism promotion) asked for the level of agreement

Tab. 1 Structure of the questionnaire

Personal details and staying	Gender (Q1), Age (Q2), Country and Town of provenience (Q3), Interest in geography and earth/landscape knowledge (Q4) Travelling with (Q5), Staying length (Q6), Reason for staying (Q7), Practiced activities (Q8)
Awareness of the landscape context	Landscape forms noticed traveling across the clay lands (Q9), Landscape aspects of interest (Q10)
Assessment of local services and information sources	Roads and public transport (Q11), Information means used (Q12) and assessment (Q13)
Geological features awareness in the area nearby San Giovanni spa	Features noticed around the spa (Q14), Attractiveness and accessibility of the feature (Q15, Q16)
Suggested improvements for the tourist offer	Suggested information means (Q17) What to improve in Terme San Giovanni (Q18)

of respondents to certain items according to a five-point Likert scale (ranging from "Totally agree" to "Totally disagree").

Sample

The sample was composed of clients of the San Giovanni spa, generally staying for curative or wellness purposes. The hotel accommodates averagely about 80 guests and the volume of daily visitors to the spa is about 50 in the week whilst on weekends typically reaches the double. Clients are in prevalence Italians in the age range between 30 and 60 years. Therefore, it was decided to build a sample as much as proportional to the clients' typology regarding age and length of staying. Due to cost limitations, data collection was during the tourist season of September-October 2015, with submissions made during three week-days and three weekends, mostly at lunch time for not bothering tourists. Author's assistance was provided in filling out the questionnaire, also to make additional interviews.

Statistical analysis

The analysis was carried out using the statistical analysis using Statistica (data analysis software system) version 12 (StatSoft, Inc. 2014). Data from the completed questionnaires were analyzed using descriptive statistics. ANOVA, followed by LSD test for post hoc comparison of means at $P<0.05$, was applied to observe any difference in responses regarding travel typology (Q5; Q6; Q7), respondents' age groups (Q2) or travel distance (Q3).

Frequencies and percentages were calculated for all multiple choice questions (Q1-Q6; Q8; Q9; Q10; Q13; Q14) and mean scores were calculated for questions with Likert-scale selection modality (Q7; Q11; Q17; Q18), followed by a T-test for independent variables to observe significant differences between the items.

Correlation analysis was also performed between items treated as separate independent variables to find out any relation between age (Q2), travel distance (Q3), traveller typology (Q5), length of stay (Q6) and activities (other than thermal baths) during the visit (Q8), land forms observed travelling across the clay lands (Q9) or between respondent suggestions regarding what they would like to know more about (Q10) and what they have seen around the spa (Q14).

RESULTS

The results of the survey are divided into five parts according the structure of the questionnaire.

Personal details and visitation

The sample was made up of 50 respondents, whose 45% was made up of daily visitors, and 55% of those of longer staying. Regarding the age, 42% was between 31 and 45 years old, 27% between 46 and 60 and 17% between 61 and 75.

Nearly all were Italian (98%) and the majority of these were female (66%). Most of the visitors were from the central and northern parts of the country, with 17% of respondents coming from towns nearby (less than 50 km), 28% from middle distances (51-100 km), 26% from large distances (101-200 km) and 23% from farther away (over 201 km). Their ages ranged mostly between 30 and 60, with 42% of respondents between 31 and 45 years old, 27% between 46 and 60 and 17% between 61 and 75.

Regarding their interest in the topic of the questionnaire, "Earth knowledge and geography", a large majority of respondents, 80% of the sample, confirmed having an interest while 20% did not express such interest. The majority indicated that they were traveling with family (58%) or friends (26%), and this correlated with the length of their stay: those with family mostly stayed at the spa for two days (r^2=0.09, P=0.04) or even up to a week (r^2=0.17, P=0.006), whereas respondents traveling with friends stayed just for one day (r^2=0.12, P=0.01).

When asked to rank their reasons for being at the spa in order of importance (Fig. 3), all respondents except for foreigners considered 'relaxation' and 'health' to be significantly more important than other options (P<0.001); both items were highly prioritized regardless of age. Other important reasons given were 'escaping from the routine of the daily life' and 'travelling with friends or family', particularly linked to youth (<25 years old) and adults up to 45, especially compared to elders (more than 76 years old) (P<0.05).

"Learning new things" and "exploring new places" were considered more important by those coming from farther distances (201-500 km), than by those coming from nearby towns (51-100 km) (*P*<0.01). Italians seemed to reach happiness more than foreigners did (P<0.01), whilst "fun", which is also rather important, was of very little importance for youth (younger than 25) compared to all the other age groups (P<0.01).

In order to assess their interest and awareness for landscape in practice, respondents were asked about the kind of activities they engaged in during their staying in the whole area of the Siena clay lands. Most reported (Fig. 4) visiting the nearby towns (58%) and cultural monuments (32%), but many also listed hiking (32%) and excursions to natural sites (28%) – and quite a few spent time in "observation" activities like birdwatching (8%) and nature photography (14%), or nature-based sports like horse riding (4%) or biking (12%).

The percentage of respondents engaging in different activities was not significantly correlated with the length of their stay in the region, with exception of local residents living in Rapolano Terme (corresponding to a length of stay of "other") – who demonstrated a preference for hiking and biking (r^2= 0.13, r^2=0.18 respectively, P<0.01).

Awareness of the landscape context

All respondents were asked if they noticed particular geomorphological and geological features across the area of the clay lands (Fig. 5 A). The great majority affirmed seeing thermal water springs (92%), though significant numbers reported also quarries (50%) and badlands (44%). Other features such as faults and hillocks were seen by only 8% of respondents, and these were mostly visitors who stayed in the area for more than one week) (r^2=0.3,

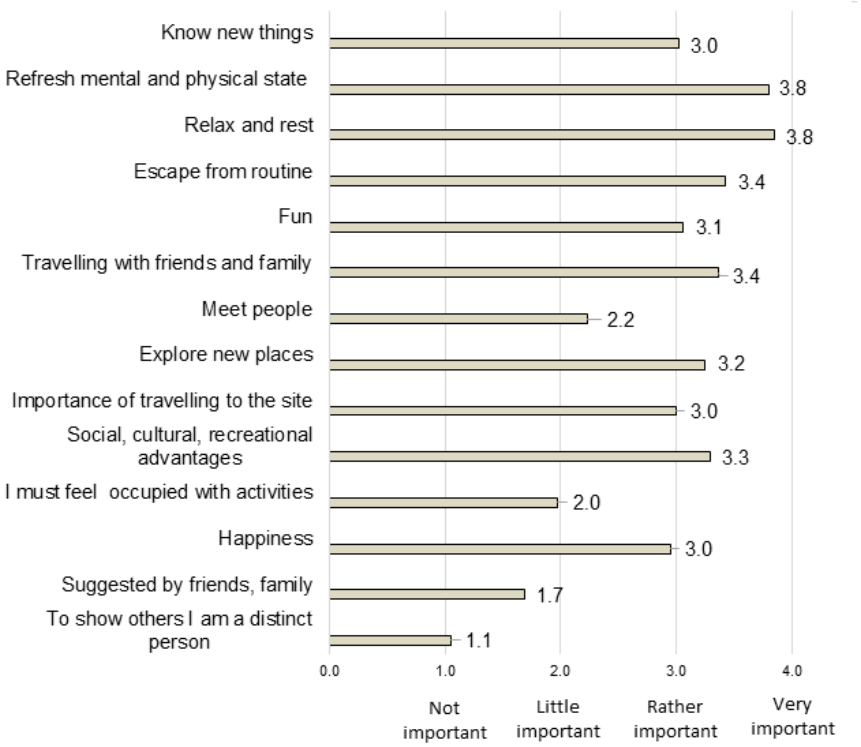

Fig. 3 Relative importance of the suggested reasons for staying at the spa.

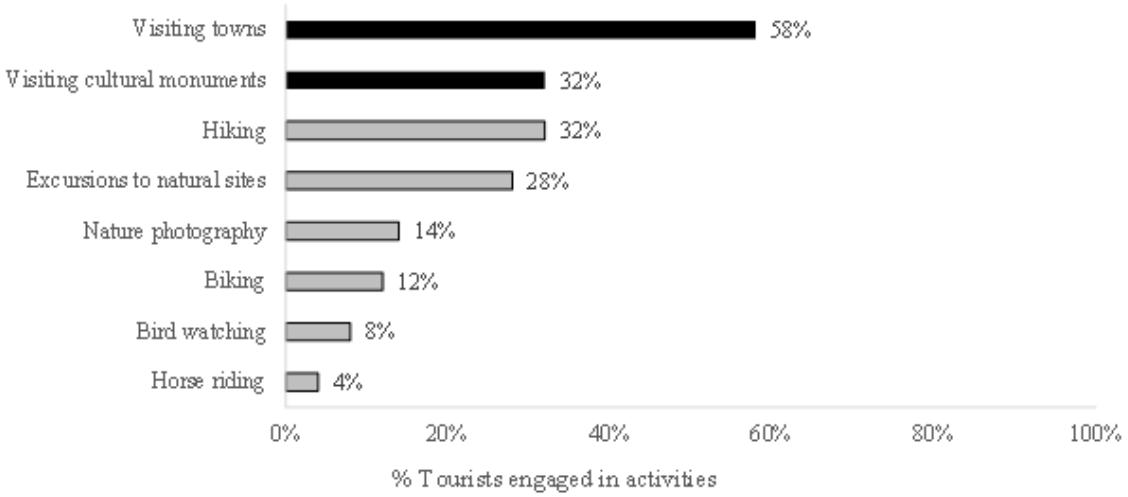

Fig. 4 Activities engaged in by respondents during their stay in the region (percentage reporting "yes" for each item).

P<0.001).

Respondents were also asked about those aspects of the territory which they would appreciate knowing more about (Fig. 5 B). Most of them would like to know more about history (46%) and food (40%), though other topics were of interest as well, including geology and landforms (selected by 34%), specifics and characteristics of thermal water (30%) and flora and fauna (28%). In contrast, less interest (only by 14%) was given to agriculture – which is, in fact, the primary land use in the area and which strongly affects food-related traditions. Again, respondents staying in the area for at least two days were also those most willing to get further information, especially about thermal waters (r^2=0.4,

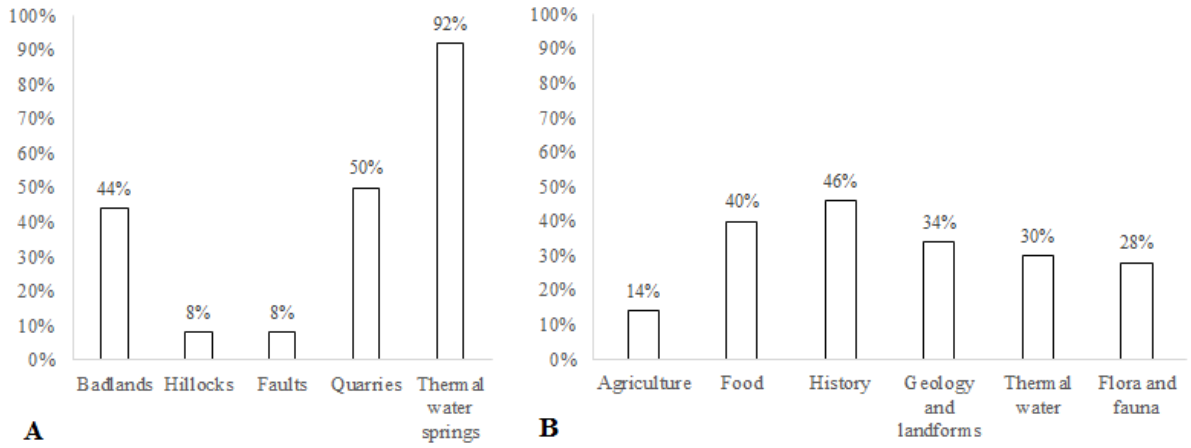

Fig. 5 Land forms seen by the respondents (A) and what they would like to know about the territory (B).

P<0.001) but also about the history of the area (r^2=0.11, P=0.023). To the extent that landscape features were noticed, they did indeed generate interest in further information (r2=0.08, P=0.46 for thermal waters; r2=0.1, P=0.03 for hillocks and faults; and r2=0.14, P<0.009 for quarries).

Assessment of local services and information sources

In order to verify whether the knowledge of the territory has some connection to the means of transport across the area and information sources, the respondents were asked to assess these means.

About means and ways of transport (Fig. 6), respondents considered hiking and biking routes very important to improve, compared to local transport and roads (P<0.001).

The source of information used by tourists and the quality of this information were also investigated (Fig. 7). Information conveyed by friends and family (word of mouth) and through the internet (25% and 26% respectively) were the main sources of knowledge on the area in general and the spa in particular. Personal experience was also an important source of knowledge for 18% of respondents, while direct forms of information (onsite material, maps, books and magazines or hotel or tourist info points) were less used.

These results are not related to the age of respondents, with exception of the personal

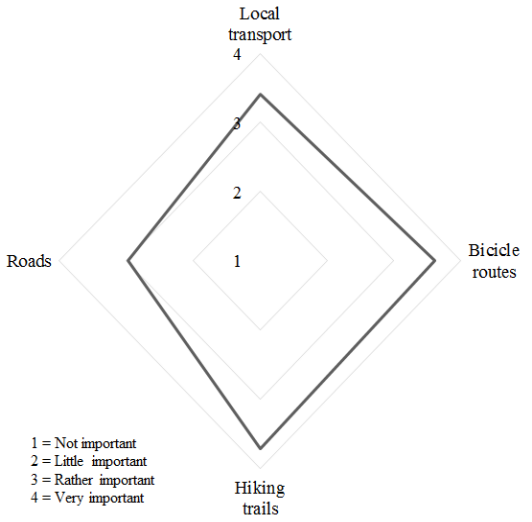

Fig. 6 Level of importance for the improvement of transport means.

experience which is positively correlated to age (r^2=0.297, P=0.04). Only 44% of respondents evaluated the quality of the information acquired from information points or hotel receptionists. The level of quality, calculated as a weighted average, was mainly quite basic (considered excellent by 17%, brief and concise by 23%, basic by 37% and poor by 23%).

Regarding the services connected to the knowledge of the territory (Fig. 8), informative panels and leaflets in tourist places were valued as important means compared to guided tours (P=0.016) or scenic flights (P<0.001) and apps (P<0.01). Apps and virtual tours were seen as somewhat important, though guided tours

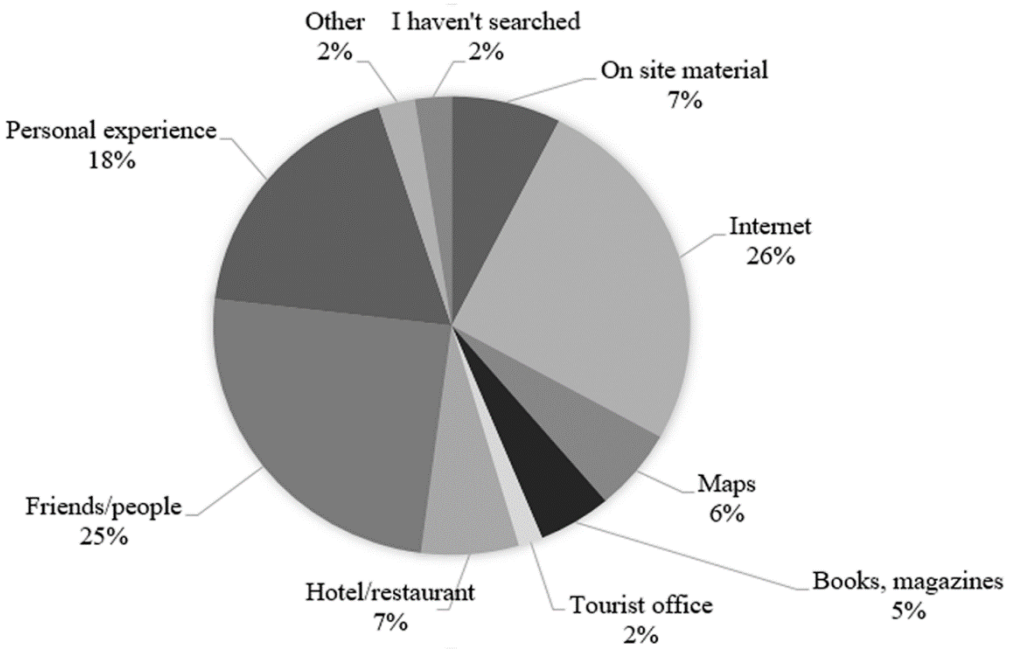

Fig. 7 Distribution of the selection of information sources used by the tourists at the spa.

onsite were appreciated more than virtual ones (P=0.03). The types of information preferred were correlated to age – with more adults suggesting panels (r^2=0.17, P=0.028) and leaflets (r^2=0.398, P=0.0003) – but also to the length of staying. For instance, people staying for one day and less than a week preferred technological tools like apps and virtual tours (r^2~0.2, P<0.05).

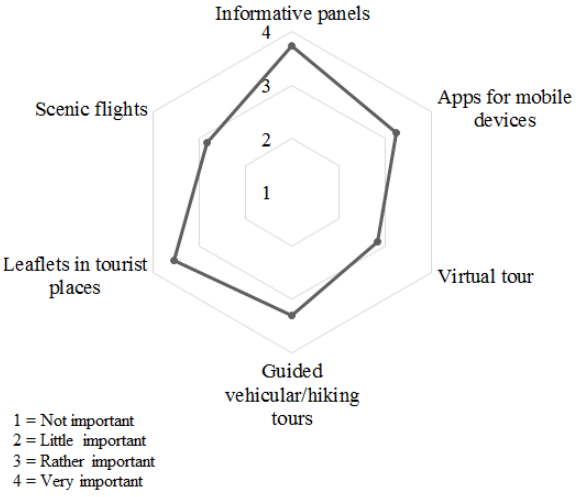

Fig. 8 Level of importance for the improvement of transport means and information means.

Geological features awareness in the area nearby San Giovanni spa

Relating more specifically to the area around San Giovanni spa, which is especially rich in geological features, respondents were asked if they had noticed 5 key geological or landscape features located within a distance of 100 m from the spa: *Montagnola fissure ridge*, *the Campo Muri quarry*, *the geyser*, *the Campo Muri archaeological excavations and the Bossoleto mofette* (Fig. 9).

Surprisingly, 46% of respondents (21/50) reported to have not seen any of the geological features around the spa. Despite their vicinity to the swimming pools (the most frequented place), only 22% declared to note at least one feature, generally the quarry or the geyser. Only 9% of respondents (4) had seen all the features, among which the fissure ridge, the geyser and the quarry are easily visible around the spa. The archaeological excavations, in contrast, were the most unvisited especially compared to the quarry and the geyser (P<0.001). There are only a few correlations between length of staying and features noticed around the spa. For shorter staying there is less chance or interest to look around, whilst for longer staying (usually less than a week), the geyser only has the most chance to be seen (r^2=0.094, P<0.034) (let's remind that the geyser is

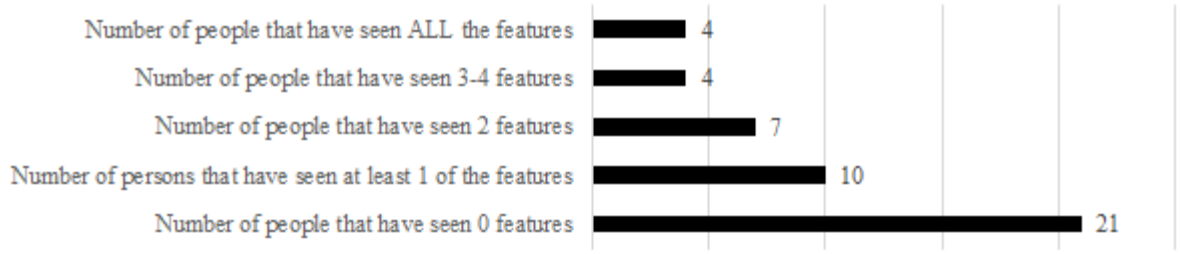

Fig. 9 Number of persons having noticed a certain number of geological and historical features around the spa.

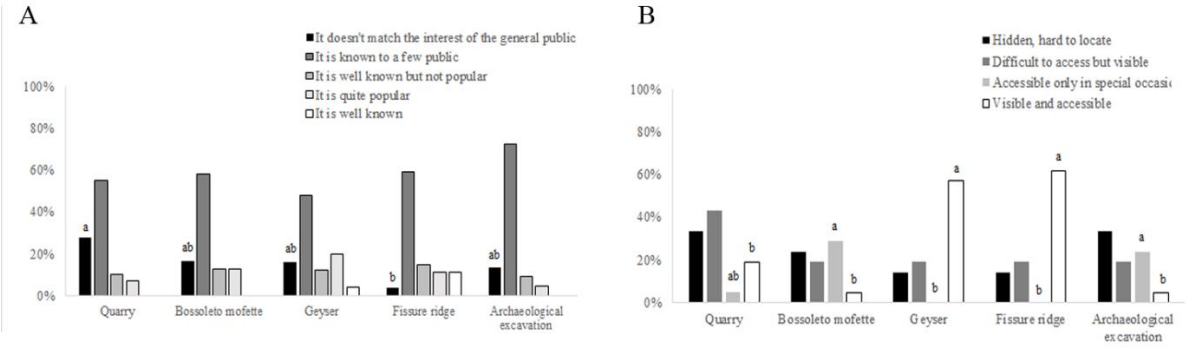

Fig. 10 Interest and accessibility of the geological features around the spa. Letters indicate the significant differences between geological features in each item, identified by the ANOVA followed by LSD test at P<0.05. Items on the top represent the weighted average from selections for each geological feature.

placed in the garden of the spa.

Almost 50% respondents declared to have not idea about the features and not be able to assess their interest toward them, therefore, the following results are based on the remaining sample. Respondents evaluated the popularity and accessibility of each feature to public.

For all of them, the most selected option about popularity was "it is known to a few public" (Fig. 10). Apparently, despite the objective visibility of most of the features, only the travertine quarry did not match the interest of the general public compared to the other elements (P=0.014), and the Montagnola fissure ridge and the geyser (by the way easily "visible and accessible") were considered inconsistently "well known but not popular" and "accessible in special occasions" respectively.

Suggested improvements for tourist offerings

When asked about the most important aspects (among *landscape, information for tourists, recreation activities, traditional food, proximity to cities,* and *local transport*) that are needed to attract tourists, we can affirm that just a few aspects are of added importance relative to the others. For instance, landscape is more important than the proximity to cities (P<0.05) or local transport efficiency (P<0.01), and offering recreation activities is also more important than local transport efficiency (P<0.05).

Focusing attention on the information offered for a better knowledge of the territory, the respondents of San Giovanni spa agreed that information panels and leaflets would be very appreciated, especially compared to guided or virtual tours (P<0.05 and P<0.001 respectively).

DISCUSSION AND CONCLUSIONS

The area of the Siena clay lands is famous for its aesthetic value, acknowledged at a national and even international level. Though landscapes may have a strong visual attractiveness, other factors are also

Tab. 2 Importance of information means in the area of the spa. T test for independent samples by suggested items at P<0.05

PANELS	Very important	a
APPS	Somewhat important	ab
VRTUAL TOURS	Somewhat important	b
GUIDED TOURS	Somewhat important	b
LEAFLETS	Very important	a

relevant in determining the extent to which they are appreciated – such as built heritage, other stimuli like sounds and tastes, and contact with people and nature (Carmeiro et al., 2015). Despite the prevalence of studies which show rising public awareness of geodiversity stemming from the need for rediscovering a sense of wonder and reconnecting with the landscape (Gordon & Baker, 2015), it appears that in this case people are not particularly aware of Crete Senesi's visible environmental features when they travel in the region. In this study, our premise was that a deeper knowledge of landscape (in its wider meaning) is ever more required by visitors and sometimes also by local citizens. This was reinforced by the survey, in which 80% of visitors expressed interest in earth and geography knowledge.

By gauging the extent to which visitors are aware of – and potentially interested in – the geological features surrounding the San Giovanni spa, we aimed to gain insight into ways of increasing the attractiveness of such geologically rich locations. Our analysis of a sample population of visitors showed firstly that the main purpose for visitation is fairly homogenous, and focused on relaxation, health, and respite from the routine of the daily life. It was clear that most visitors are coming from distant locations (between 200 and 500 km away) and express an interest in learning about environmental features and exploring new places, in addition to enjoying the spa. In fact, a high percentage of visitors took time to visit the main towns or cultural monuments nearby, and many hiked and visited natural sites nearby – most likely in connection to personal hobbies and skills like photography.

Focusing on visitors' recognition of geologically significant features, the survey firstly inquired as to whether the respondent had seen those features which are typical of the Siena clay lands region in general. Excluding thermal water features, which are well known and accessed by nearly all visitors to the spa in the form of the constructed pools, the most widely visible geological features were quarries and badlands (reportedly seen by about half of all respondents). It was found that visitors were not generally aware of more specific geological features like faults and hillocks, which are localized in an area about 20 km from the spa and were reportedly seen by only 8% of respondents, mostly those staying in the area for longer periods of time.

At the same time, some of these features – like the Montagnola fissure ridge – are remarkably unique and immediately accessible from the spa, but remain nearly invisible to most visitors. Survey results showed that the percentage of those who had not noticed the geological features located within several hundred meters of the spa (*montagnola*, *quarry*, *geyser*, *archeological excavations*, *bossoleto mofette*) was even higher than for those features located at farther distances. In fact, despite their close proximity to the swimming pools, only 22% of respondents reported having seen at least one of these features (mainly the quarry, which is visible at a distance, or the geyser, which is located in the garden of the spa). It is quite clear that the attention of spa visitors is not being adequately drawn to these features, with a lack of visual indications or information panels.

Therefore, many of these features, which

are easily accessible and appear to be of genuine interest for visitors, are not well visited – because satisfying this interest requires informational support that is not being provided. Previous studies have recognized that environmental amenities, whether their value is primarily cultural, traditional or naturalistic, are a determinant force in tourism development (Talandier, 2009; Banski & Wesolowska, 2010; Klepeis et al., 2009; Lokocz et al. 2011). A crucial insight is that even when these natural amenities go relatively unnoticed by the casual observer, they can be "re-qualified" to increase the appreciation of landscapes and to derive eco-tourism value from the inherent environmental qualities of a place (Domon, 2011). Ultimately, the attractiveness of such areas is dependent not only on their visual aesthetics, but on the capacity of tourism service providers to bring their aesthetic and informational value to interested visitors. The fact that many such providers are unaware of the "geo-tourism" potential embodied in such places only underscores the importance of matching the interests and needs of visitors with the tourism services offered, using integrated measures for marketing, product development and conservation purposes (Carneiro et al., 2015).

With respect to the needs of tourists, this study has identified a number of instructive relationships between visitors' priorities and the nature of their visit. For short-term visits, a predominant motivating interest is the history of the place, particularly in terms of food and other cultural aspects which tourists can get a "quick taste" of while visiting the area. Geology and landforms, characteristics of thermal water and flora and fauna are also of importance to many visitors, especially if the duration of their stay is medium- to long-term (several days or more).

The assessment of local services by tourists represents an important source of informational-feedback which can decisively contribute to the improvement of touristic offerings and visitor experience. For instance, a common sentiment voiced by respondents is that the enhancement of hiking and biking routes should not be under-prioritized compared with motorized transport and roads. Regarding information sources, it is interesting to note how traditional information tools such as on-site informative panels and leaflets are still favoured even when more innovative digital tools like apps and virtual tours are available. Utilizing the potential of various means of communication requires collaborative relationships between tourism service providers and the providers of informational content (including academic and applied research institutions), especially regarding the relation between landscape attributes, their scientific explanation, and their economic valuation.

There is an increasing need among visitors for localized site knowledge, and this represents an implicit awareness of the importance of high-quality information delivery in sustaining local tourism. This study adds to a growing body of empirical findings (Murphy et al., 2007; Sotiradis & van Zyl, 2013) which has demonstrated that along with the internet, word of mouth communication – and therefore personal experience – is still the most common and widely-used source of information. Therefore, a more comprehensive knowledge base, embracing landscape interpretation and science-based information, might be the key to increasing tourists' awareness of a site's natural context.

In conclusion, this study has evidenced that tourists may be familiar with the most popular landscape features in an area, but at the same remain unaware of particularly unique geological elements in the closest proximity of their destination (such as the spa in the case described above). Though wellness and health are the main attraction, there is a significant portion of tourists (especially those coming from far-away locations) that would also be interested in a deeper knowledge of the environmental context and landscape features. This study

confirms that "landscape" still plays an important role in tourism attraction, but that knowledge and awareness of its environmental and cultural significance can be decisive in capitalizing on this attraction. The informational content that is necessary to transfer this knowledge and raise this awareness may be conveyed by increasingly innovative technological tools – but at the same time, a useful role can still be played even by the most traditional forms of communication, as long as they succeed at tapping into the natural curiosity possessed by so many travellers.

REFERENCES

Bambini A.M., Brogi A., Cornamusini G., Costantini A., Foresi L.M. and **Lazzarotto A.** (2010) Geologia dell'area di Rapolano Terme in Provincia di Siena (Appennino Settentrionale). Italian Journal of Geosciences, vol. 129, nr. 3, 457-495.

Banski J. and **Wesolowska M.** (2010) Transformations in housing construction in rural areas of Poland's Lublin region – influence on the spatial settlement structure and landscape aesthetics. Landscape Urban Planning, vol. 94, 116–126.

Bertini G., Cameli G.M., Costantini A., Decandia F.A., Di Filippo M., Dini I., Elter F.M., Lazzarotto A., Liotta D., Pandeli E., Sandrelli F. and **Toro B.** (1991) Struttura geologica fra i monti di Campiglia e Rapolano Terme (Toscana meridionale): stato attuale delle conoscenze e problematiche. Studi Geologici Camerti, vol. 1, 155-178.

Brogi A. (2004) Faults linkage, damage rocks and hydrothermal fluid circulation: tectonic interpretation of the Rapolano Terme travertines (southern Tuscany, Italy) in the context of Northern Apennines Neogene-Quaternary extension. Ecologae Geologicae Helvetiae, vol. 97, 307-320.

Carneiro M.J., Lima J. and **Silva A.L.** (2015) Landscape and the rural tourism experience: identifying key elements, addressing potential, and implications for the future. Journal of Sustainable Tourism, vol. 23, nr. 8-9, 1217-1235. DOI: 10.1080/09669582.2015.1037840

Carrara C., Ciuffarella L. and **Paganin G.** (1998) Inquadramento geomorfologico e climatico ambientale dei travertini di Rapolano Terme (SI). Il Quaternario, vol. 11, 319-329. (in Italian)

De Carlo A.F. (2013) Towards alternative forms of tourism. The Polish experience. Tourism and tourist promotion around the world: a linguistic and socio-cultural perspective, pp. 31-46. http://siba-ese.unisalento.it/index.php/tourismandtourist/article/view/13600

Domon G. (2011) Landscape as resource: Consequences, challenges and opportunities for rural development. Landscape and Urban Planning, vol. 100, nr. 4, 338–340. doi:10.1016/j.landurbplan.2011.02.014

Dowling K.R. and **Newsome D.** (2006) Geotourism. Elsevier/ Heineman, Oxford, UK.

Gordon J.E. and **Baker M.** (2015) Appreciating geology and the physical landscape in Scotland: from tourism of awe to experiential re-engagement Geological Society. London, Special Publications 417: 25-40. Doi:10.1144/SP417.1

Guerra M. and **Raschi A.** (2004) Field Trip Guide Book D03 – Field sight near Rapolano Terme (Siena, Tuscany). Relationship between tectonics and fluid circulation. Post Congress. 32nd International Geological Congress 3(D03): 1-14. Florence – Italy, August 20-28, 2004.

Hose T.A. (1995) Selling the story of Britain's Stone. Environmental Interpretation, vol. 10, nr. 2, 16-17.

Hose T.A. (2012) 3G's for Modern Geotourism. Geoheritage, vol. 4, nr. 1, 7-24. DOI 10.1007/s12371-011-0052-y

Kies A., Hengesch O., Tosheva Z., Raschi A. and **Pfanz H.** (2015) Diurnal CO_2-cycles and temperature regimes in a natural CO_2 gas lake. International Journal of Greenhouse Gas Control, vol. 37, 142-145.

Klepeis P., Gill N. and **Chisholm L.** (2009) Emerging amenity landscapes: invasive weeds and land subdivision in rural Australia. Land Use Policy, vol. 26, 380–392.

Lokocz E., Ryan R.L. and **Sadler A.J.** (2011) Motivations for land protection and stewardship: exploring place attachment and rural landscape character in Massachusetts. Landscape Urban Planning, vol. 99, 65–76.

Martini I.P. and **Sagri M.** (1993) Tectono-sedimentary characteristics of Late Miocene-Quaternary extensional basins of the Northern Apennines. Earth Sciences Rewiews, vol. 34, 197-233.

Miglietta F., Magliulo V., Bindi M., Cerio L., Vaccari F.P., Loduca V. and **Peressotti A.** (1998) Free Air CO_2 Enrichment of potato Solanum tuberosum L.: development, growth and yield. Global Change Biology, vol. 4, 163-172.

Murphy L., Mascardo G. and **Benckendorff P.** (2007) Exploring word-of-mouth influences on travel decisions: friends and relatives vs. other travellers. International Journal of Consumer Studies, vol. 31, nr. 5, 517–527.

Newsome D. and **Dowling R.K.** (2010)

Geotourism: The Tourism of Geology and Landscape. Goodfellow Publishers, Oxford.

Osborne C.P., La Roche J., Garcia R.L. and **Long S.P**. (1997) Does long term elevation of CO_2 concentration increase photosynthesis in forest floor vegetation? Indiana strawberry in a Maryland forest. Plant Physiology 114, 337-344.

Sadry B.N. (2009) Fundamentals of Geotourism: with emphasis on Iran. Tehran, Samt Organization publishers. pp. 220. (English Summary at: http://physio-geo.revues.org/3159?file=1)

Selvi F. and **Bettarini I.** (1999) Geothermal biotopes in central-western Italy from a botanical point of view. Cambridge University Press, Cambridge. pp 14-133.

Sotiriadis M.D. and **van Zyl C.** (2013) Electronic word-of-mouth and online reviews in tourism services: the use of twitter by tourists. Electronic Commerce Research, vol. 13, nr. 1, 103-124.

Talandier M. (2009) Mesurer l'impact des aménités naturelles, culturelles et environnementales sur le développement économique local. XLVIe Colloque ASRDLF, Clermont-Ferrand (12/23/2010) available at: http://www.asrdlf2009.com/propositions/final/upload_final/talandier.pdf

New technologies for the sustainable development of cultural routes: the case study of the Holy Face Route in Garfagnana Region and in the Serchio River Middle Valley

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ABSTRACT
The aim of this work is to understand if cultural tourism and pilgrimage are good opportunities for the sustainable development of a destination and in which way new technologies can be used to develop and communicate this tourist destination. In the last 20 years, cultural routes have become important for sharing European identity, and we can confirm that this kind of "touristic product" is growing and is a real economic opportunity for a destination – e.g. Santiago De Compostela and Galicia. Moreover, pilgrimage and cultural tourism have a low environmental impact - especially if travelers decide to move on foot or by bike. Concerning the new technologies, in this case, the route has been marked with a GPS and the gpx file has been elaborated with a GIS with the aim to create a virtual and interactive map, containing all the most important information for those who are traveling on foot. This map has been elaborated with two different software. With Google Earth has been created a video showing the route in a "plane view", with the aim to be used as "commercial" showing the route. We also created a Web App with ArcGIS in which all the most important touristic information, photos, videos have been collected and that could be used by those travelers who are interested in the route before and during their trip. These technologies could be used not only to communication and promotion touristic destination, but they could be a real utility for travelers. Last but not least all this could be made with a low economic and environmental impact for the destinations.

Keywords: cultural tourism, GIS, sustainability, tourism, technology, development

INTRODUCTION

Tourism is indisputable an economical resource for many countries all over the world. According to UNWTO "over the past six decades, tourism has experienced continued expansions and diversification to become one of the largest and fastest-growing economic sector of the world". A demonstration of this continuous growth is the international tourist arrivals, which have increased from 674 million in 2000 up to 1.186 million in 2015 (UNWTO Tourism Highlights, 2016). Today the challenge is not to understand how to increase tourism, but which is the best way to develop tourism in a sustainable way.

Tourism is one of the few "industries" that really needs to preserve the environment, as it is part of the "touristic product". Moreover a large section of the tourist market in always more interested in "new" types of tourism - especially tourists that are coming from countries with a "mature" touristic history. Sustainable tourism can be defined as "Tourism that takes full account of its current and future economic, social and environmental impacts, addressing the needs of visitors, the industry, the environment and host communities" (UNEP and UNWTO, 2005, p. 11-12).

As it isn't simple to define what culture tourism is (Richards, 2003) and keeping in mind the sentence regarding sustainable

tourism written above, we can affirm that cultural routes are a good mix between both types of tourism as they give the opportunity to plan and develop a destination and its territory in a sustainable way, without spoiling environment but preserving landscape, cultural identity, natural and territorial resources. In fact, travelers interested in cultural routes mostly travel on foot or by bike and the impact is lower compared to those traveling by car, train or airplane. Moreover, these travelers are interested in preserving the cultural identity and in the active protection of the natural resources of the destinations. For all these reasons, 2016 has been announced as "Anno dei Cammini d'Italia" by the MIBACT – Ministero dei beni e della attività culturali del Turismo.

We should underline how sustainability should be considered in all the different steps when "planning" a touristic destination. In this case study we have tried to keep in mind a simple but effective idea: is it possible to rediscover, value and promote in a sustainable way a cultural itinerary through the new technologies?

Moreover, we decided to study a route that runs along two geographical regions "Garfagnana Region" and "Serchio River Middle Valley" that belongs to Tuscany, but that are not important as other parts of the Region (e.g. Chianti). This is relevant for our study, as we are working with an almost unspoiled territory without crowds of tourists. Moreover, the geographical landscape and the natural resources are impressive, especially gullies and Apuan's Alps.

METHODOLOGY

The work has been divided into four main parts. First of all, we have analyzed which are the European Organizations contributing to the development of the Cultural Routes and their policies. That lead us to a statistical-economic analysis of the motivation and the tourist flow. Later we conducted a historical study concerning the Holy Face route, its history, and its historical path. We have also conducted a Tourism Resource Audit.

In this paper, we will not go into details on these three parts, as we want to be focused on the last and main part of the work: how to use new technologies for the sustainable development of a destination. Three are the main technologies used: a GIS software, Google Earth and the WebApp of ArcGIS.

TOURISM RESOURCE AUDIT OF THE HOLY FACE ROUTE

After defining the story of this route and the ancient itinerary, we have tried to recreate it, keeping in mind that today some of the original paths could have been destroyed. The maps used were maps in scale 1:50.000 (Multigraphic map) and 1:30.000 (map created by the Florentine association "Comunità Toscana Il Pellegrino") together with some ancient maps preserved in the Archivio di Stato in Lucca.

After the definition of the route that could be philologically correct, we tried to evaluate the power of cultural- touristic attraction on the route and the power of attraction for the landscape resources.

The methodology used is called Tourism Resource Audit (Godfrey & Clark, 2002).

The first step of this audit is to verify the resources of a destination and then to evaluate them. For the case study we decided to classify the resources themselves following their nature:

- Natural and environmental
- Cultural and historical
- Perspective and sensitive aspects.

After this audit, we passed to the field work, and we tested and geo-referenced the chosen track, paying attention to the resources but also on the problems found during the trip. We also kept in our mind

that the final output had to be useful not only for trekking tourists but also for cultural tourists and pilgrims.

This leads us to the main important part of our paper.

NEW TECHNOLOGIES FOR THE SUSTAINABLE DEVELOPMENT OF CULTURAL ROUTES

This is the most innovative part of the work and the one that needs to be deeply analyzed. As said before, we have geo-referenced the track. We have used a GPS, marking the cultural, historical, landscape resources we were meeting – using placemark and waypoints. Moreover, we also have pointed out the handy information for those traveling on foot, such as dangerous streets, inaccessible paths, but also more touristic information like drinking fountains, ATM, bar and so on.

GIS – Geographical Information System

After the field job, we have used a GIS as we should combine the GPX file with all these information. We have used QGIS (Quantum GIS), an open source GIS. GIS are really useful as we wanted to realize an output that should be customizable following the different needs of the targets. This is the reason why we have decided to work on several shape files. The final project has to be the first step for creating several "products", available on different devices – computers but also smartphone - so the information contained in the database of each shapefile should have been short and effective.

We have realized several layers in order to customize as much as possible the final output. This is the reason why we divided the several resources into different layers: there is one for "bridges", one for "churches", but also a shapefile for "attention" or "drinking fountain". The layers can be overlaid and selected.

The project has been saved in several extensions, as we had to realize different "products".

Google Earth

The first "product" that we wanted to realize is a KMZ file that includes all the shape files contained in the GIS project. KMZ is readable by Google Earth and let us decide which layer we want to select and

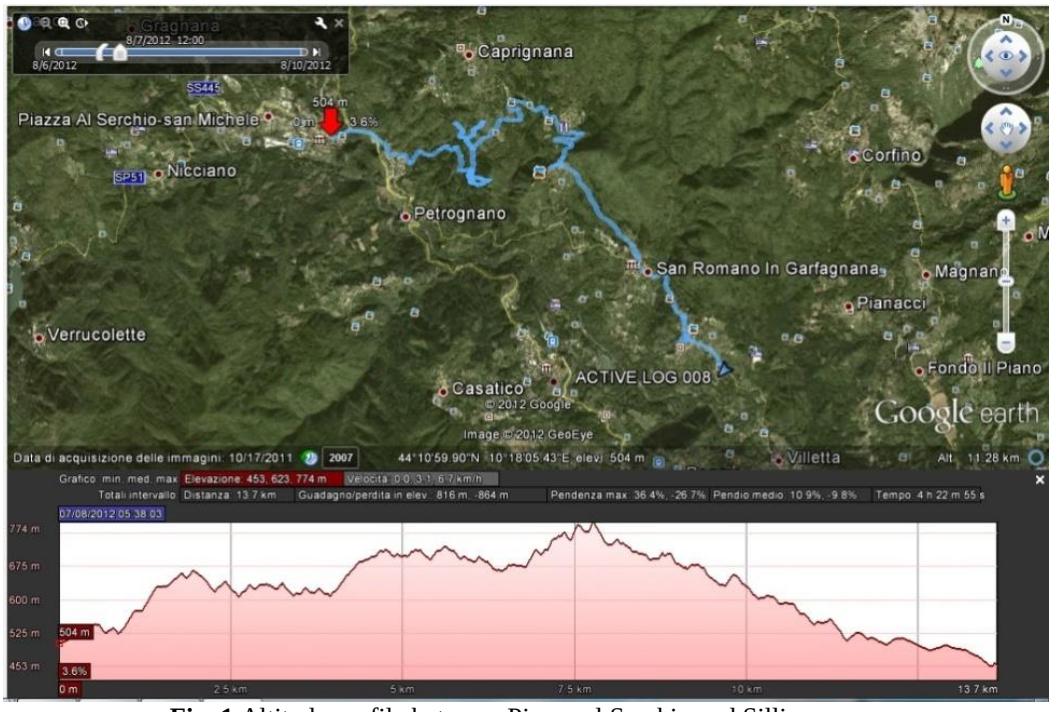

Fig. 1 Altitude profile between Piazza al Serchio and Sillicagnana.

see. Google Earth is a useful software, as it has lots of utility - like the altitude profile. This kind of information is fundamental for those who are walking around 20 km per day. In Fig. 1, we can see the altitude profile between Piazza al Serchio and Sillicagnana.

The biggest chance Google Earth gives us is to upload updates and realized new "interactive maps" without a loss of time and money.

It is also possible to recognize the different resources using different icons. If we click on them, we have the opportunity to read the main important information concerning the resources. Let us take as an example the Religious buildings. Clicking on its icon (the logo of a church), we can find out:

- Category: Religious building
- Location: Name of the city/town
- Type of building: Church/Bell Tower/etc
- General information

Lastly, we have also realized a "movie" of the route with the Google Earth "Tour tool", that record a flight along the track of the route (Fig. 2). The appeal of this kind of technology is increasing and in this kind of output the component of "entertainment" is relevant so that it could be used as a commercial video on websites. Moreover, it is a free software, and anyone should download it on its own device.

WebApp with ArcGIS online

The second software used is "WebApp" a Web Mapping Application developed by ArcGIS, allowing us to create a real App. We have chosen to use WebApp because it is handy, the result is effective and it is a nice union between a GIS and an App developer. Moreover, many Institutions – Universities, but also CAI (Club Alpino Italiano), Croce Rossa and much more – are using this software.

First, we have created a free account on the website www.arcgis.com. In our case study, we wanted to develop an app in which collecting maps, photos, videos, and text. The next step is the creation of the maps. Clicking on "Map" section is possible to create our own map, uploading layer from the web or, like in our case, from a file (the shapefile elaborated with the GIS). In this section is also possible the selection of which type of base map has to be used (Fig. 3).

After uploading the shapefile, it is

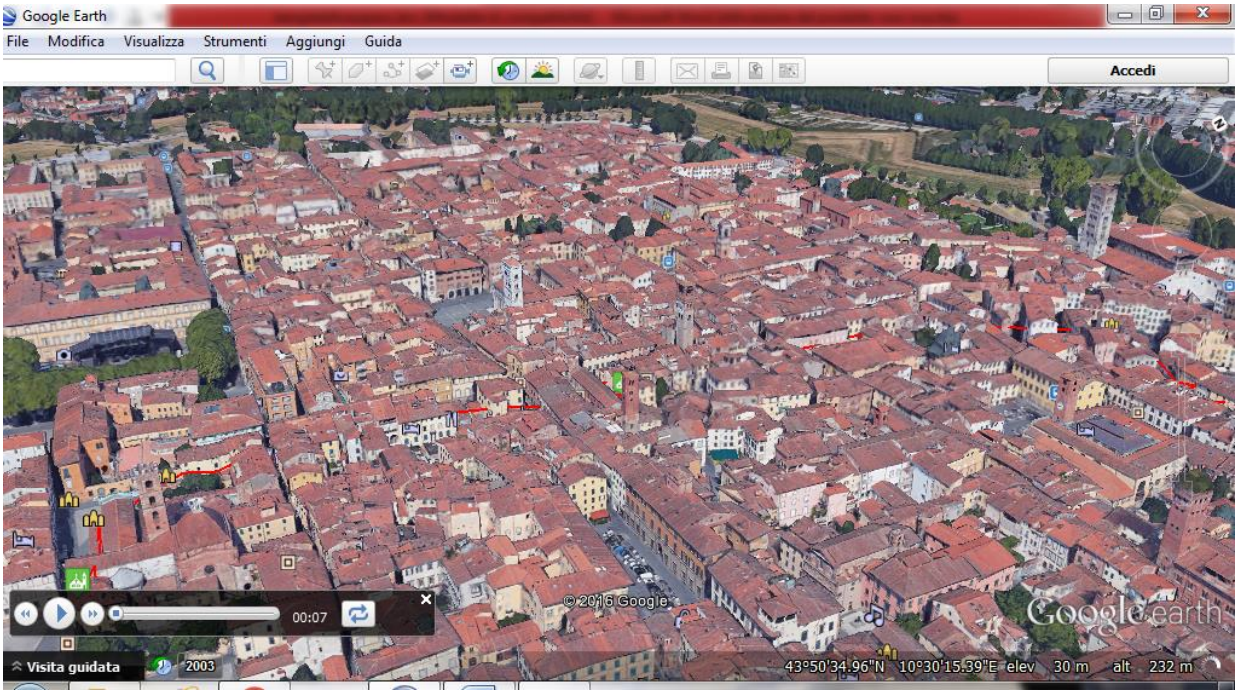

Fig. 2 Tour movie created using Google Earth Tour tool

possible to add information and icons on the map. In our case has been useful the tool: "Add notes to the map". With this tool, it is possible to add information and significant icons on the map. With information, we do not mean to add only text, but also photos.

After the creation of the all the maps, we have begun the real development of the App. After going on "my content" section, it is possible to select which type of Web App we want to create.

In this case, we have chosen a Diary – Story map. With this template, it is possible to combine interactive maps with text and movies. For the movies, we need to have a URL, and it is possible if we have shared the video previously on Youtube or other channels. After the development of the WebApp, it is possible to share it on directly on Facebook and Twitter or to obtain a sharable link (in our case the link is http://arcg.is/1qTR7dc). Moreover, clicking on the "share icon" it is possible to catch the Html code and put it inside a web page. The final output is a real Diary containing all the information, the videos, the texts we want to share (Fig. 4).

RESULTS

We would like to draw your attention to the following facts. For the European Institutions (EU and COE) the development of cultural tourism is the main instrument for the protection of the landscape identity and for the development of sustainable tourism. Moreover having a look at the results of the Tourism Resource Audit we can underline how this territory is rich in cultural resources, with beautiful landscapes and a strong local identity: all things that we need to preserve. The technologies used in this case study help us, as apps and video are impressive but at the same time cheap and easy to be developed. This is important as this kind of touristic product is often developed and promoted by associations. Finally, yet importantly, the outputs could be easily updated and are readable with software available on all the mobile devices, helping tourists in appreciating the route before – during – after the journey.

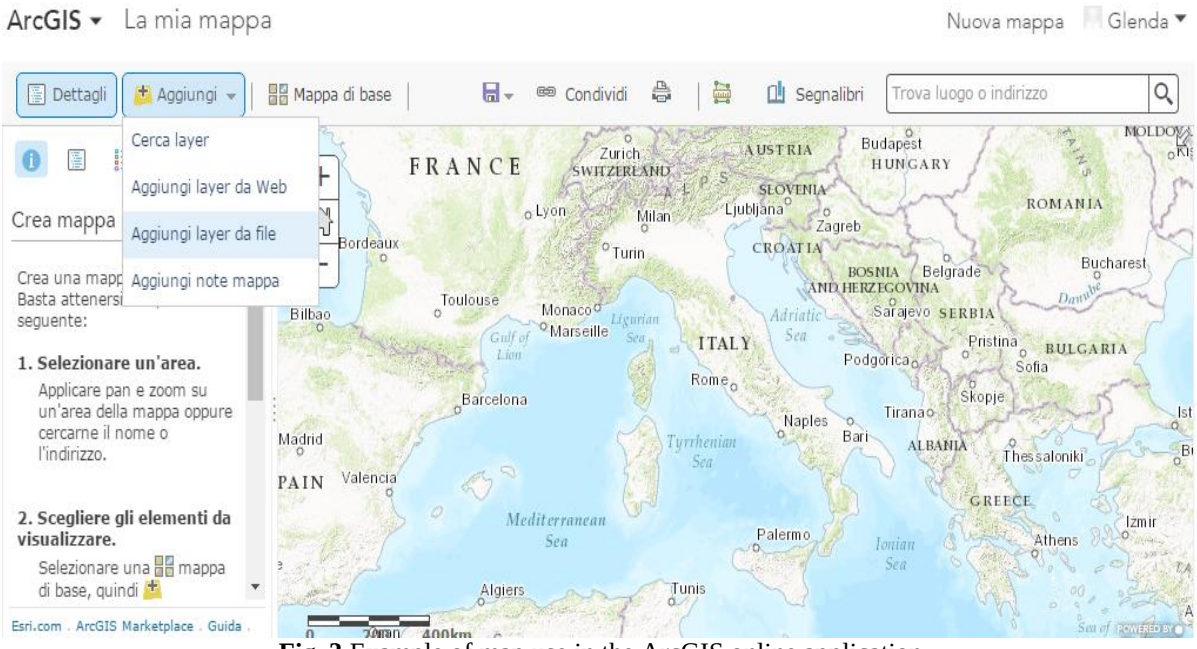

Fig. 3 Example of map use in the ArcGIS online application

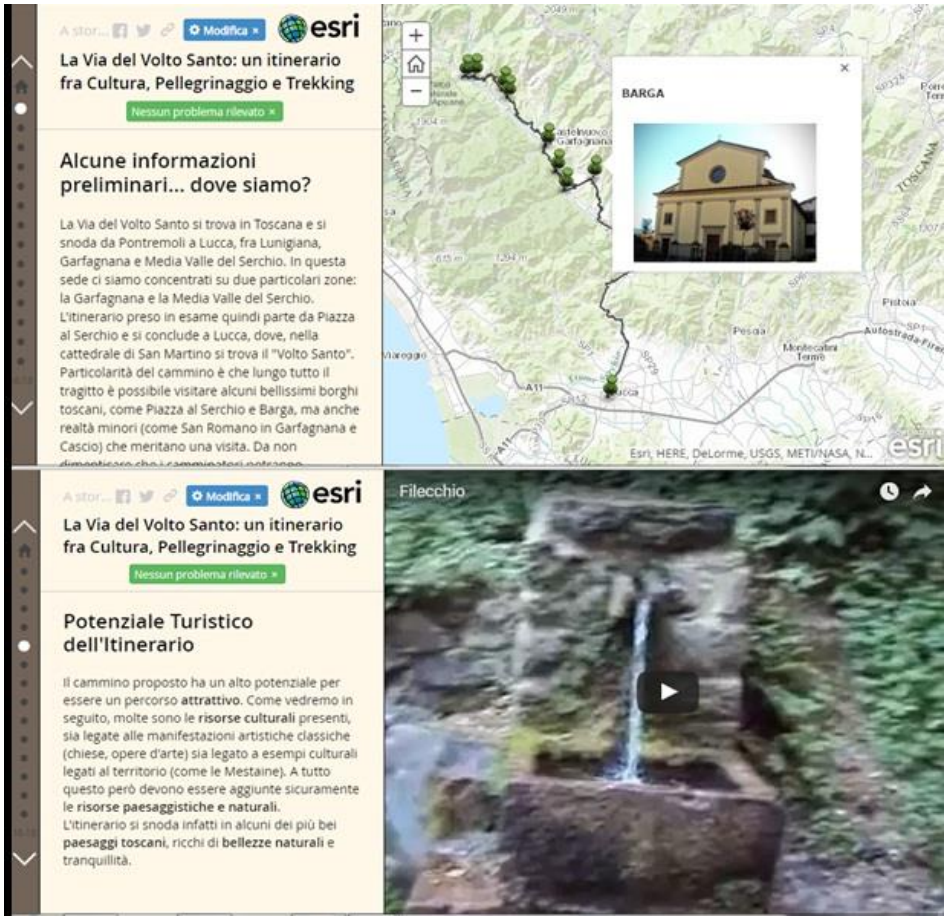

Fig. 4 Diary – Story Map

DISCUSSION AND CONCLUSIONS

Cultural tourism is growing and cultural routes are following the same trend. Plan and promotion of this kind of routes are necessary, not only for the economic development of these territories but also for the protection of the local identity.

Through the Tourism Resource Audit is clear how much the Garfagnana Region and Serchio River Middle Valley are full of cultural resources, beautiful landscapes and local identity. Our question in this specific case was if and how many new technologies could help the touristic development of this kind of routes. The answer is that new technologies, especially those analyzed here, could really become an opportunity for this kind of cultural routes.
First, these technologies can be used free and let us create something that is updatable constantly, despite what we could do in the past with paper maps.

Then, we would like to underline that these technologies could be used in two different ways and by two actors. The first way is the most intuitive: local tourism organizations and the association could use them for the development and above all for the promotion of this kind of cultural routes on social networks (e.g. “Abbots Way” on Facebook) or publishing the videos on institutional websites.

The second way is the one that could be even more interesting and is now unexplored. Nowadays Social networks let us be really focused on what our peers are sharing: most of the conversations are peer to peer. Even on Youtube, the most followed persons are “youtubers”, that are “normal” persons, an expert in a theme and giving advices on-line. As these technologies are really handy and smart and because almost in every smartphone there is the opportunity to download GPS for tracking the route, we think that the old

websites should be integrated by the apps created by the new "pioneers" of cultural routes. We are not saying that Public Institutions should not plan or organize in the best way tourism, but we underline how new tourists may be part of the discovering and promotion of these types of tourism, like they are already doing with other aspects of the travel (e.g. TripAdvisor).

REFERENCES

Andreucci G. (2011) Creare applicazioni con Google Earth e Google Maps. In: Collana *Pro Digital Life Style, Edizioni FAG Milano, Milano. (in Italian)

Baroni F. (1999) Rapporti e collegamenti viari medievali attraverso il Passo di Tea fra la Garfagnana, la Lunigiana e il mare. In: La Garfagnana dall'epoca comunale all'avvento degli Estensi. Aedes Muratoriana. Modena. (in Italian)

Dainelli N., Bonechi, F., Spagnolo M. and **Canessa A.** (2008) Cartografia numerica – Manuale pratico per l'utilizzo dei GIS. Dario Flaccovio Editore. Palermo. (in Italian)

Godfrey K. and **Clarke J.** (2002) Manuale di Marketing territoriale per il turismo. Felice Le Monnier. Firenze.

Richard, G. (2003) What is Cultural Tourism? In Van Maaren, A. (ed.) Erfgoed voor Toerisme. Nationnal Contact Monumenten.

Stopani R. (1995) Guida ai percorsi delle Via Francigena in Toscana. Casa Editrice Le Lettere. Firenze. (in Italian)

Unep, UNWTO. (2005) Making tourism more sustainable – A guide for policy makers.

UNWTO (2016) – UNWTO Tourism Highlights 2016.

Websites

www.francigena.beniculturali.it
www.camminideuropa.eu