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A selection of geological tours for promoting the Italian geological heritage in the secondary schools

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Abstract

Twenty Italian geological tours have been selected and studied for creating a didactic multimedia product devoted to secondary schools. The aim is to enhance the knowledge of the Italian geological heritage, starting from teachers and students, through the proposal of virtual geological tours.

Particular attention has been given both to the relevance of Earth Sciences in everyday life and to the multidisciplinary topics proposed, having care of such aspects as the use of the land and the prevention of natural resources from degradation. An emotional approach has been applied, because emotions are essential to stimulate curiosity and to build affection towards a territory, for raising the awareness of the value of the geological heritage.

The project required collaboration among researchers, professionals, associations, and institutions involved in studying, protecting, and promoting the Italian geological heritage. Moreover, a further collaboration with teachers and students is foreseen, in order to test the effectiveness of the product in the teaching/learning process. The feedback collected will be useful for realizing a new multimedia product on the geosites of the Piemonte Region, as an output of the multidisciplinary PROactive management of GEOlogical heritage in the Piemonte region (PROGEO-Piemonte) research project.

Keywords: geoheritage, geosite, geoethics, education, multimedia, Italy

Introduction

There is no doubt about the importance of promoting geological heritage in order to increase public awareness of the relevance of Earth Sciences in everyday life (Press 2008; Wimbledon 1999; VVAA 1991). Within this perspective, the multidisciplinary PROactive management of GEOlogical heritage in the Piemonte region (PROGEO-Piemonte) research project aims to achieve a new conceptual and operational discipline in the management of the geological heritage of the Piemonte Region (Ferrero et al. 2012; Giardino et al. 2012; Giardino et al. 2013). In this context, it is fundamental to find new ways for communicating these values, in order to enhance a sustainable fruition of the territory, with a final result of economic support to local communities. A good communication strategy is essential because the first step towards an effective conservation plan is by raising the public awareness of the value of the geological heritage (Carrada 2006; Gray 2004; Gray 2011; Henriques et al. 2011; King 2008; Wimbledon 1999, Wimbledon et al. 2000).

In the PROGEO-Piemonte project, an interdisciplinary research team on “Geodiversity action plans for dissemination activities” designs didactic tools for educators, schools, and public in general (Belluso et al. 2011). This group is carrying out a research on the multimedia product “Geological tours in Italy,” devoted to the secondary schools. The research aims to study the effectiveness of using multimedia products in the teaching/learning process of Earth Sciences, according to the guidelines of the PROGEO-Piemonte project (Magagna et al. 2012a, 2012b).

Geological tour selection

The selection of the Italian geological tours was based on the following steps:

1. Preliminary work with the research team, in order to define the purposes and constraints
2. Bibliographic and online research about the Italian geological heritage and geosites
3. Identification of 20 geological tours, considered suitable for the contents, the accessibility, and the availability of data

Step 1: aims and constraints

The multimedia product “Geological tours in Italy” has been developed as a supernatural educational material, and it is presented as an attachment of an Earth

Science textbook devoted to the grades 3 and 4 of the Italian upper secondary school (age 17-18; Pignocchino Feyles 2012). The aim of the product is to stimulate students and teachers to explore Earth Sciences topics by means of virtual geological tours.

In this context, the first task has been to select a limited but significant number of geological tours within the Italian national territory. Requirements for the selection were as follows: (1) allow the largest representativeness of Italian regions and (2) deal with the topics required by the Italian ministerial directives for the Earth Sciences curricula of the above-mentioned grades (MIUR 2010). Following the requirement, (1) a number of 20 tours has been considered fair, allowing almost all Italian regions to be represented (Fig. 1). About the requirement, (2) minerals and rocks had to be considered as the main focus of the geological tours.

Step 2: bibliographic and online research

The promotion and coordination of initiatives aimed to enhance Earth Sciences in Italy are mainly developed by the Italian Geological Society, the Italian Society of Environmental Geology, the Geology and Tourism Association, the Italian Federation of Earth Sciences, and various other minor associations on geotourism. The websites and the publications of these associations allowed to collect a further list of interesting websites, scientific publications, and popular books on the Italian geological heritage. This research permitted to look at different ways used by other authors (Garofano 2010; Martellos et al. 2006; Prinetti F 2010; Scortegagna 2010; Terranova 2011) to communicate the Italian geological heritage, both through traditional and innovative methods. Moreover, publications related to international, national, and regional projects on geological heritage were useful to deepen the knowledge about selected geological tours and geosites. Some examples are the following: for the Alpine area, the Via Geoalpina international project published a volume that promotes an educational tour throughout the chain (VVAA 2010c); the Friuli Venezia Giulia Region published a volume and created a website on the regional geosites (VVAA 2010a), as well as the Puglia Region (VVAA 2010b) and the Emilia-Romagna Region (Angelelli 2008); for a more local scale, it is possible to cite, as examples, the Sondrio, Venice, and Turin districts (VVAA 2008a, b, 2004).

The Geosies geodatabase (<http://sgi2.isprambiente.it/geositiweb/>) that contains information on Italian sites of geological, pedological, and geoarcheological interest, collected in the National Inventory of Geosites (D'Andrea and Di Leginio 2002;

Giovagnoli 2012) by the Institute for Environmental Protection and Research was very useful for acquiring data on the variety of the Italian geosites.

Step 3: identification of 20 geological tours

Thanks to the bibliographic and online research and the data available on different Italian geosites, it was possible to select a number of geological tours. Starting from this list, we selected the 20 final tours (Tab. 1), taking into account further relevant criteria, such as (1) the accessibility of the sites by school groups, both for security reasons and for the presence of qualified structures and professionals devoted to the protection and promotion of the sites, and (2) the availability of related books, articles, and photographs, essential for editing the virtual tours. These materials were acquired thanks to the collaboration of researchers, professionals, associations, and institutions involved in studying, protecting, and promoting the sites.

In the selection of the 20 final geological tours, as well as in the editing phase, a fundamental role was played by the multidisciplinary and emotional approach: it was a relevant guideline for the whole multimedia product. For this reason, the approach is detailed in the following paragraph.

The multidisciplinary and emotional approach

The multimedia product “Geological tours in Italy” would not only show the variety of Italian lithologies, as a requirement of the Italian national curricula (MIUR 2010), but aims to promote the multiplicity of topics connected to Earth Science disciplines. This approach intends to stimulate curiosity towards the topics proposed, which is fundamental for the learning process: by showing multiple topics related to Earth Sciences, the likelihood that such subject might be considered interesting by the users of the multimedia product will increase. Curiosity is the engine for bringing people to the experience of discovery, innovation, and response and for generating in the mind a sense of accomplishment. Curiosity involves interests and emotions (Bertacchini 2008; Gordon 2012; Gordon et al. 2012; Piacente 2008). Earth Sciences stimulate these sensations for many different reasons, such as the possibility to reconstruct the history of the Earth, to explain impressive natural phenomena as volcanic eruptions, to influence the humankind settlement and economy, etc. These could be all possible motivations for studying Earth Sciences. Last but not least, there is the aesthetic value of

some geological elements and phenomena that are related to the scenic content of a landscape (Pena dos Reis and Henriques 2009). Geological heritage is involved with all these values: it is important to communicate them because they are fundamental for engaging people with Earth Sciences and for increasing people awareness about the importance of geological disciplines in everyday life (Compiani 2011; Gordon et al. 2012).

According to these ideas, the multimedia product “Geological tours in Italy” promotes the geological heritage by means of the proposal of 20 geological tours including very different geosites; a selection of sites with a high natural value (e.g., protected areas in the province of Asti, Adamello Brenta Natural Park, Beigua Regional Natural Park) and sites with a high anthropic impact (e.g., the Carrara marble extractive district and the Carbonia coal extractive district). Every single geological tour introduces a detailed description of a main lithologic topic (Tab. 1). Besides that, other lithologic and related geological topics are always illustrated using photographs, schemes, and drawings, in order to provide a practical approach to the teaching process. It is important to remember that students acquire the basic information about minerals and rocks by the textbook, and the “Geological tours in Italy” aims to link these notions with specific examples in the Italian territory.

In order to call the attention on the relevance of Earth Science in everyday life, rocks are presented as *resources* for the humankind. It is underlined for their use not only as a raw material in buildings and art, as combustible (in the case of coal), but also as sites for living (e.g., caves) and protection (e.g., in case of military structures, as trenches). However, the *scientific value* is pointed out, too, showing rocks as important testimonies of the history of the Earth. In some cases, a preferential attention is drawn on the fragility of the geological elements, due to the degradation by exogenous agents (among which, man is included). Therefore, many examples of effective *protection* from degradation (bioengineer, restoration, etc.) and protection through management (natural parks and geoparks) are presented (Tab. 2). By illustrating that many parks devoted to enhance and protect the geological heritage exist and that three Italian geosites (Aeolian Islands, Monte San Giorgio, and the Dolomites) are recognized as World Heritage and are included in the UNESCO's World Heritage list, it would be a way to further underline the relevance of geology as a scientific discipline for the society.

From both pedagogical and communication points of view, it is well known that *emotions* are essential to build *affection* towards a territory (Calonge 2010; Compiani 2011; Goleman 1995; Lucchesi and Giardino 2012; Orion 2007). Positive emotions can

raise *respect* towards the geosites and awareness of their value. An actual example of the validity of this statement is given by the Fondo Ambiente Italiano association (FAI, National Trust for the Italian Environment), a not-for-profit trust promoting a real culture of respect for natural heritage, art, history, and traditions of Italy. A famous FAI initiative, called “Places I Love,” is based on the affection of people towards Italian places: the FAI asks citizens to identify those places they feel as particularly beloved and important and that they wish to be remembered and preserved for future generations. The first edition of the project occurred in 2003 and had 24,200 referrals, while the successive editions (2004, 2006, 2008, 2010) showed an increase of referred sites, from 92,468 in 2004 to 464,640 in 2010 (150th anniversary for the Unification of Italy; www.iluoghidelcuore.it). These data confirm that the emotional approach is an effective way to communicate with people about the cultural heritage.

Through a multimedia product, thanks to the selection of beautiful images, interesting videos, accessible texts, and engaging topics, it is possible to trigger emotions, as curiosity and wonder, and to stimulate both emotional and cognitive aspects of knowledge. Besides that, the importance of studying and preserving the geological heritage could be communicated thanks to some specific examples, such as areas included in natural parks and geoparks or recognized as UNESCO World Heritage.

Content analysis of the geological tours

Twenty virtual geological tours around Italy are proposed, based on different spatial and temporal scales and set on some fundamental geological heritage values.

Spatial and temporal scales

In multimedia educational material devoted to secondary schools, it is important to underline the variety of the spatial and temporal scales because they are the founding concepts in Earth Sciences.

In “Geological tours in Italy,” the objects of the virtual tours range from wide outcrops (e.g., *Neapolitan Yellow Tuff* and *Porphyries of the Alto Adige area*) to millimeter-thick stratigraphic levels (e.g., *marine clays of Vrica*), whose rock and mineral composition is illustrated, as well as the related geological topics.

The temporal scales range from recent geological formations and geomorphological features (e.g., *marbles of Apuane Alps* tour mainly show the impact of quarrying

industry) to elements with a long geological history (e.g., *ophiolites of the Ligurian hinterland* allow to talk about the Liguria-Piemonte Ocean).

This approach allows to show a variety of related geological elements, emphasizing different geological aspects (e.g., stratigraphy, paleontology, geomorphology, etc.).

Some tours offer to explore a single site (e.g., *Dunarobba fossil forest*), while others also offer a visit to nearby sites (e.g., *the Karst on the Duino Cliffs, travertines in Roman architecture, the limestone of Altamura*). Not much importance is given to the track of the tours because the goal is to allow teachers connection with local institutions or associations for visiting them and stimulating original proposals.

Fundamental values

Thanks to the multidisciplinary and emotional approach, some core values emerge by consulting the virtual tours; these values accord to the criteria proposed by different authors for evaluating the geological heritage and integrate the *social role* that people attributes to the geological elements, with the *scientific role* attributed by scientific communities (Pena dos Reis and Henriques 2009; Pereira et al. 2012). Therefore, the multimedia product “Geological tours in Italy” proposes a cultural approach to the geological heritage, whose protection is needed. The motivations for the protection change from one site to another, from individual to individual, from society to society, and, especially, from the context.

The fundamental values emerging from the virtual tours are listed below:

- AESTHETIC VALUE: It consists in the intrinsic beauty of the visited geosite, or in the appreciation of its beauty, in term of harmony of the landform, or structure, or another geological element in the landscape.
- EDUCATIONAL VALUE: It relates to the characters of the geosites included in the tours, useful for promoting knowledge and understanding about Earth Sciences.
- SCIENTIFIC VALUE: It consists of the relevance of the contents of the tour within the world of scientific research; it integrates both geological and biological contents.
- ARCHAEOLOGICAL VALUE: It includes the importance of the tour’s contents as evidences of ancient human activities during prehistory; it mainly relates to artifacts and/or other physical remains within the tour area.
- HISTORICAL VALUE: It refers to evidences concerning past events of the humankind being registered or connected to the visited geosites.
- ECONOMIC VALUE: It includes the relevance of geological/geomorphological contents as cultural and material resources.
- CONSERVATION VALUE: It underlines the degree of maintenance of the visited geosites in their original or existing state.
- RECREATIONAL VALUE: It considers the touristic and sports attractions available within the tour.

These values have different relevance in different geological tours and in most sites they are combined (Fig. 2). For example, in the tour devoted to the *marine sands of Asti Hills*, the scientific and the preservation values are prevalent: it is an important palaeontological site in the Piemonte Region, where fossil outcrops are protected by bioengineering structures. On the other hand, the geological tour dedicated to the *marbles of Apuane Alps* is mainly based on the quarrying industry and on the historic value of the extractive site: marbles have been an important economic resource for the local communities since the Roman Empire and have a relevant historic role in the artistic and architectural context; the preservation value is underlined through the description of a human activity that strongly modified the geomorphology of the landscape. Instead, the *Neapolitan Yellow Tuff* geological tour is more varied because it shows archaeological and historic values of the Bourbon Tunnel (it was dug for military reasons, it intercepts a sixteenth century aqueduct, and currently it keeps the cars stowed after the Second World War), as well as the aesthetic and scientific value of the Gaiola Underwater Park (it is a popular tourist spot for the scenic content of the coast and it is important from the geological point of view because the western slope of the Posillipo's hill is a part of the caldera's edge formed by the eruption of the Neapolitan Yellow Tuff); in both cases, particular attention is posed on the preservation value: emphasis is given to the recovery that the Bourbon Tunnel has undergone for becoming accessible (it was a dumping) and it highlighted the presence of a protected area devoted to preserve the underwater archaeological finds.

Assessment of the multimedia product

The research undertaken by the interdisciplinary team on “Geodiversity action plans for dissemination activities” of the PROGEO-Piemonte project aims to investigate the effectiveness of multimedia products in the teaching/learning process of Earth Science. Therefore, the multimedia product “Geological tours in Italy” is intended as a test to be performed through participant teachers and students for understanding the effectiveness of multimedia products in terms of communication and usability (Elliott 1993; Mayer 2009; Pimenta 2005; Qiu and Hubble 2002; Small 2005).

The virtual tours are composed of many images with short captions: satellite and aerial images, maps, photographs, drawings, sketches, graphs, etc. Besides, the product has a number of tools useful to customize the didactic geological tours (Fig. 3; Magagna et al.

2012a, 2012b). It is important to understand the effectiveness both of the content and the didactic tool, for improving the quality of future multimedia products.

In the first phase we will work with teachers and students in the classroom, using PC and interactive whiteboard, but we are convinced that a further field trip phase of experimentation will be required. In fact, the multimedia product could trigger wonder and curiosity towards beautiful images, interesting videos, accessible texts, and topics related to the everyday life, but authentic emotions are given by the direct experience in the field, in which all senses are involved.

The validation of this multimedia tool will be useful to realize a new multimedia product connected to the PROGEO-Piemonte project, based on the feedback obtained by students and teachers. In PROGEO-Piemonte, the geothematic research teams are already planning geological tours suitable for the new multimedia product and for field trips (Lozar et al. 2013; Bertok et al. 2013). We hope this research process will be useful for enhancing communication strategies devoted to the geological heritage.

Conclusions

“Geological tours in Italy” promotes the Italian geological heritage by means of the proposal of 20 virtual tours related to the main topics required by the Italian ministerial directives for grades 3 and 4 of the secondary school.

The multimedia product combines the scientific and educational approaches with the emotional and multidisciplinary ones, proposing a cultural approach to the geological heritage. “Geological tours in Italy” appraises geological heritage as a “non-renewable geological resources of cultural nature” (Henriques et al. 2011) whose protection is needed. The reasons for protection could be connected to the individual perception of the value proposed, as well as to the social role that people attributes to the geological elements. Positive emotions play a fundamental role in enhancing the awareness of people on the relevance of Earth Science in everyday life because they can build affection towards the territory.

By communicating the geological heritage, we use an approach including everyday life examples: this makes possible not only to raise the comprehension of the scientific value of the geological elements, but also to enhance the people awareness about the importance of protecting and preserving it.

The preservation of geological heritage is fundamental for the whole society because it allows geologists to carry on with the research and the people themselves to benefit

from the beauty and the relevance of the uniqueness of testimonies of the history of the Earth (Fig. 4; Gray 2011; Van Loon 2008).

By exploring new ways to communicate these “geoethics” values, it is possible to enhance a sustainable fruition of the territory, with a final result of economic support to local communities. In this sense, a good communication strategy is the first step towards an effective conservation plan.

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CAPTIONS, FIGURES AND TABLES

Fig 1 The virtual tours are selected by paying attention to the coverage of the entire Italian territory. In the figure, a preliminary version of the multimedia product, with 15 tours, can be viewed

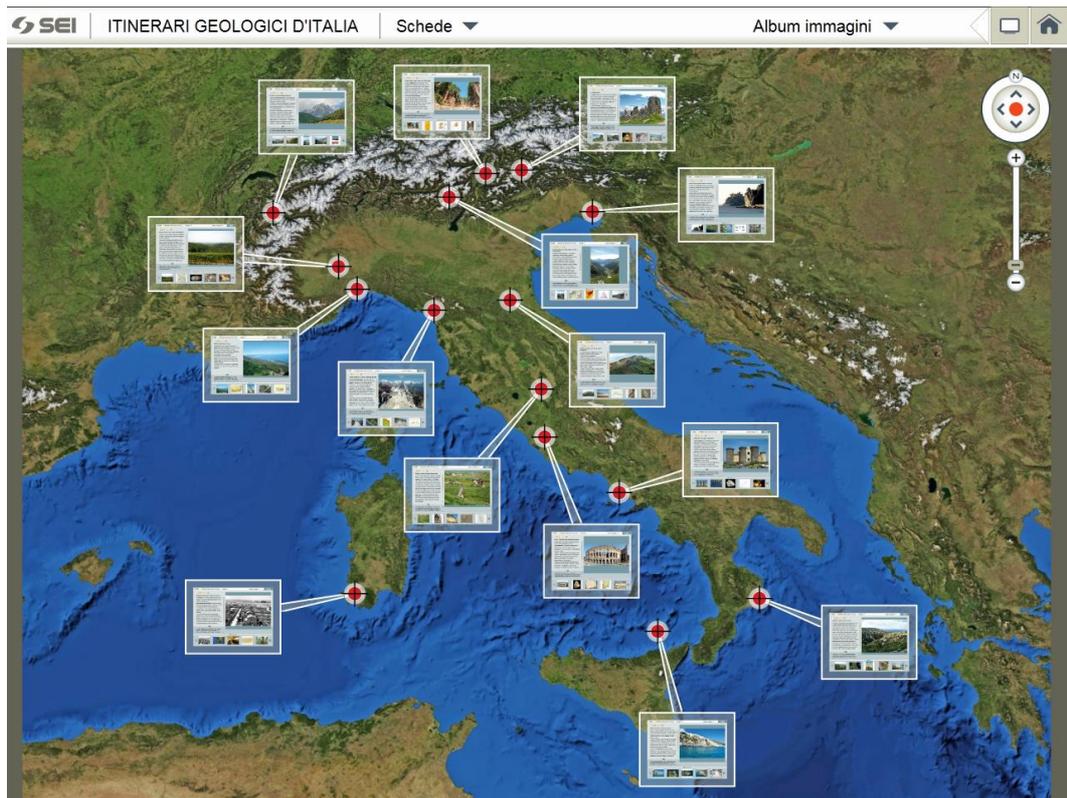


Fig 2 A selection of photographs from different virtual tours, as examples for the values outlined. **a** *The karst on the Duino Cliffs*: the aesthetic and recreational values are the strength of this tour (photo: F. Cucchi); **b** *Tonalite of the Adamello*: the scientific, educational, and conservation values are outlined by the geological tour in the Fumo Valley, included in the Adamello Brenta Geopark (photo: G. Bazzoli); **c** *Carbonia, the town of coal*: the freight train and the castles for extraction are industrial archeological remains of the coal pit (photo: CICC archive); **d** *The Cinque Torri*: the World War I pillbox carved into the rock is an important historical record of the Dolomiti mountains (photo: S. Zardini); **e** *Marbles of Apuane Alps*: Carrara marbles are a relevant economic resource, which extraction changed the morphology of the Apuane Alps (photo: A. Criscuolo); **f** *Marine sands of Asti Hills*: the protective structures built with ecological engineering methods underline the importance of protecting the geoheritage

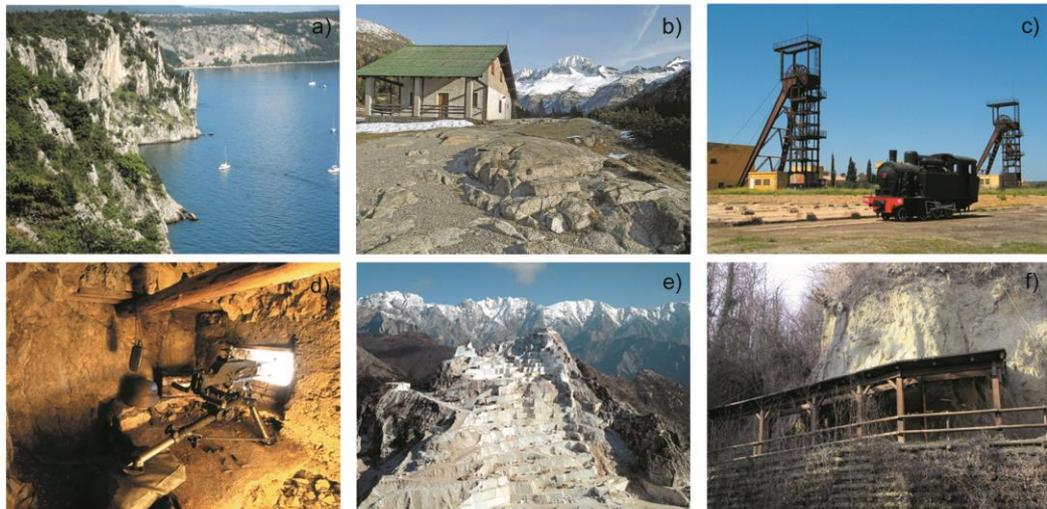
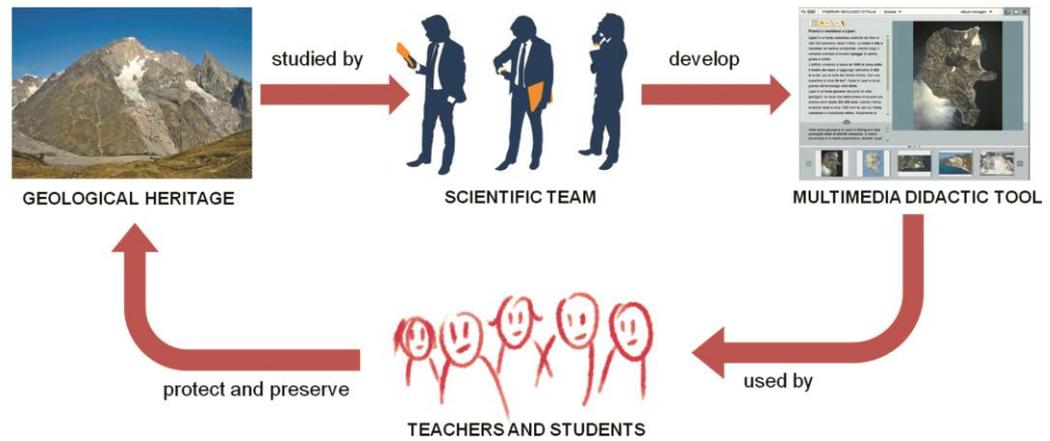


Fig 3 All virtual tours are composed of a preliminary text and various images with short captions that can be collected in personalized folders. In the figure, the first page of the geological tour “Granite of the Monte Bianco” is developed using aerial and satellite images, as well as photographs and schemes



Fig 4 Geological heritage is studied by scientific teams of geologists that develop multimedia didactic tools devoted to teachers and students. They raise their awareness about the relevance of Earth Science topics, giving back protection and preservation. This positive feedback allows scientific teams to continue their research process because the geological heritage is preserved



Tab 1 List of the 20 geological tours, indicating the corresponding Italian region, the main rocks and minerals, as well as the minor ones, presented in each virtual tour

ITALIAN REGION	GEOLOGICAL TOUR	MAIN LITHOLOGIC TOPICS	OTHER LITHOLOGIC TOPICS
Valle d'Aosta	Granite of the Monte Bianco	Intrusive igneous rocks: granite	Migmatites, quartz, and fluorite
Piemonte	Marine sands of Asti Hills	Detrital sedimentary rocks: sands	Sandstones
Liguria	Ophiolites of the Ligurian hinterland	Metamorphic rocks: serpentinites	Rodingites with garnets
Trentino - Alto Adige	Porphyries of the Alto Adige area	Effusive igneous rocks: rhyolitic ignimbrite of the Atesina porphyry platform	Val Gardena sandstones; Bellerophon, Werfen, and Contrin Formations
Lombardia/ Trentino - Alto Adige	Tonalite of the Adamello	Intrusive igneous rocks: tonalite	Granodiorites and gabbros
Veneto	The Cinque Torri	Organogenic carbonate sedimentary rocks: dolomite	Travenanzes Formation
Friuli Venezia Giulia	The karst on the Duino Cliffs	Organogenic carbonate sedimentary rocks: rudist limestones	Nummulites and Alveolines limestones
Toscana	Marbles of Apuane Alps	Metamorphic rocks: marble	Debris clusters
Emilia Romagna	The Vena del Gesso in Romagna	Sedimentary rocks of chemical deposit: gypsum	Bituminous shales; Argille Azzurre and Colombacci Formations
Marche	The stratigraphic limits of Monte Conero	Organogenic carbonate sedimentary rocks: limestones	Volcanic ash layers; iridium level
Umbria	Dunarobba fossil forest	Detrital sedimentary rocks: clays and sands	Fossil trunks in life position
Abruzzo	The deformed rocks of the Gran Sasso Chain	Organogenic carbonate sedimentary rocks: limestones and dolomite	Cataclasites
Lazio	Travertines in Roman architecture	Carbonate rocks of chemical deposit: travertine	Sedimentary carbonate rocks; pyroclastic deposits
Molise	The caves of the Matese area	Organogenic carbonate sedimentary rocks: micritic limestones and calcarenites	Calcirudites with rich levels of rudists
Campania	Neapolitan Yellow Tuff	Pyroclastic magmatic rocks: tuff	Pozzuoli solfatara
Basilicata	The Sassi of Matera	Detrital sedimentary rocks: calcarenites	Altamura limestone; clays
Puglia	The limestone of Altamura	Organogenic sedimentary rocks: Altamura limestone	Concretions of calcite
Calabria	Marine clays of Vrica	Detrital sedimentary rocks: marly and silty clays with microscopic fossils	Calcarenites
Sicilia	Obsidians and pumices at Lipari	Effusive igneous rocks: obsidian and pumice	Basaltic and andesitic lavas
Sardegna	Carbonia, the town of coal	Organogenic sedimentary rocks: coal	Detrital sedimentary rocks: shales and sandstones

Tab 2 List of the 20 geological tours, indicating the corresponding geological and anthropic topics proposed

ITALIAN REGION	GEOLOGICAL TOUR	RELATED GEOLOGICAL TOPICS	RELATED ANTHROPIC TOPICS
Valle d'Aosta	Granite of the Monte Bianco	Hints of glacialism	Use of granite in local building
Piemonte	Marine sands of Asti Hills	Fossils; paleoenvironmental reconstruction	Bioengineering; protection of paleontological site
Liguria	Ophiolites of the Ligurian hinterland	Connection between lithology and flora	European Geoparks
Trentino - Alto Adige	Porphyries of the Alto Adige area	Stratigraphic sequences to reconstruct the geological evolution of the dolomites	Use of porphyry in building; dolomites, UNESCO World Heritage
Lombardia/ Trentino - Alto Adige	Tonalite of the Adamello	Hints of glacialism; Adamello Glacier	Evidences of the First World War; European Geoparks
Veneto	The Cinque Torri	Paleoenvironmental reconstruction; monitoring systems for slope instability	First World War (Open Air Museum); UNESCO World Heritage
Friuli Venezia Giulia	The karst on the Duino Cliffs	Karst and resurgences (Timavo River); fossils and relative dating; Dinosaur Antonio	Protection and preservation of the fossil record; Trieste Museum of Natural History
Toscana	Marbles of Apuane Alps	Regional metamorphism	Man as geomorphological agent; rocks as economic and cultural resource
Emilia Romagna	The Vena del Gesso in Romagna	Karst phenomena in gypsum	Protection of a site of industrial archaeology
Marche	The stratigraphic limits of Monte Conero	Mass extinction and K-T boundary; GSSP	Protection of the exposure of the sedimentary section
Umbria	Dunarobba fossil forest	Paleobotany; paleoecology reconstruction of paleoenvironment	Preservation of paleontological assets subject to degradation
Abruzzo	The deformed rocks of the Gran Sasso Chain	Hints of glacialism; alluvial fans	Movies and landscape
Lazio	Travertines in Roman architecture	Thermal and sulphurous waters; secondary volcanism fossils prints and casts	Building industry; meteoric degradation and restoration
Molise	The caves of the Matese area	Karst and caves	Speleology
Campania	Neapolitan Yellow Tuff	Bradisism	Building industry; historic value of the Bourbon Tunnel
Basilicata	The Sassi of Matera	Ravines; differential erosion of limestone and calcarenite	Cultural landscape and UNESCO World Heritage
Puglia	The limestone of Altamura	Dinosaur footprints and paleogeography; Puli and caves	Aesthetic value of the geological heritage and pictures
Calabria	Marine clays of Vrica	Geochronology; GSSP	ISPRA Geosites geodatabase
Sicilia	Obsidians and pumices at Lipari	Volcanology, earthquakes and monitoring systems by INGV	Uses of obsidians and pumices; archaeological finds; industrial archaeology
Sardegna	Carbonia, the town of coal	Hints on extraction systems	Industrial archaeology; resources and society; Sardinia Geo-Mining Park

GSSP global stratotype section and point, INGV Istituto Nazionale di Geofisica e Vulcanologia, ISPRA Institute for Environmental Protection and Research