

Article

Not peer-reviewed version

Geological Wonders of Italy: The Coveted Privilege of Disseminating Geology and Geomorphology through Science Documentaries

[Piero Farabollini](#) , [Fabrizio Bendia](#) ^{*} , [Luigi Bignami](#)

Posted Date: 26 July 2024

doi: 10.20944/preprints202407.2178.v1

Keywords: geological documentary; geoheritage; geosites; geomorphosites; geotourism; geoeducation; focus tv; Frasassi; Mount Ascensione; Castelluccio plain.



Preprints.org is a free multidiscipline platform providing preprint service that is dedicated to making early versions of research outputs permanently available and citable. Preprints posted at Preprints.org appear in Web of Science, Crossref, Google Scholar, Scilit, Europe PMC.

Copyright: This is an open access article distributed under the Creative Commons Attribution License which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Article

“Geological Wonders of Italy”: The Coveted Privilege of Disseminating Geology and Geomorphology through Science Documentaries in Marche Region

Piero Farabollini ¹, Fabrizio Bendia ^{1,*} and Luigi Bignami ²

¹ School of Sciences and Technologies, Geology Division, University of Camerino, Via Gentile III da Varano, 62032 Camerino, Italy;

² Geologist, science popularizer; science documentary anchorman for FOCUS TV

* Correspondence: fabrizio.bendia@unicam.it

Abstract: This paper proposes an unusual method for the dissemination of geological sciences and the promotion of geotourism: the scientific documentary, where a representative itinerary of geological and geomorphological evolution of this portion of the Apennines was presented. The considerations that led to the identification of the geological route proposed to the editorial staff of FOCUS TV are presented in detail. At each stop there was an explanation by academic professors and researchers, mainly from the Geology Division of the University of Camerino (MC), who explained in detail the outcrops. During the episode, insights were also given into the anthropogenic frequentation of the epigean caves in Frasassi (AN), ancient places of frequentation and worship thanks to their suggestiveness and the sense of sublime that they can elicit. In addition to the illustration of the individual stops, the article offers further insights into the geomorphology of the most important geosites depicted, all of which are in nature parks or protected areas and characterized by a high landscape value. The result was the production of an episode of the television program ‘Geological Wonders of Italy: The Marche and Umbria Regions’, which was broadcast in October 2022 by the Italian national Mediaset group.

Keywords: geological documentary; geoheritage; geosites; geomorphosites; geotourism; geoeducation; focus tv; Frasassi; mount Ascensione; Castelluccio plain

1. Introduction

The state of the art of research provides many communication strategies for the dissemination of geosciences [1]: geological scientific articles, virtual field trips [2], on field initiatives [3], , Geology Olympiads [4], geological hiking [5,6], meetings with scholarships [7], geotourism mobile apps [8–10], cartographies [11], augmented reality [12,13], 3D models [13–16], popular social channels [17,18], the institution of geosites and geoparks [19–21]. The realization of a documentary film is certainly an unusual strategy and an opportunity reserved for only a few people who have had the privilege to collaborate on this type of project. In our case, we considered ourselves very privileged because we met a special colleague, Dr. Luigi Bignami, who believed in the geological wonders of our region and our professionalism.

The documentary [22] follows a series of initiatives carried out over the years by the Geology Division of the University of Camerino to promote the geological heritage of the Marche region, such as conferences, dissemination events, virtual museum activities, field labs, activities for school groups, field trips, didactic geological notebooks, scientific articles [13]. The physiographic conformation of this region in the central part of Italy is characterized for a western and southern part by the Apennines Mountain ridge with altitudes up to 2500 m above sea level, an eastern coastal area (with beaches and sea cliffs) and an intermediate area that topographically connects the other

two (Figure 1). This setting conferred to the Marche region a large variety of landscapes, consisting of mountains, hills, plains and coasts. This geological heritage is an expression of the stratigraphic and structural setting and the geomorphological processes acting above it. The proposal was initially referred only to the Marche region. Later, Umbria was included in the production to narrate the evolution of this unique sedimentary basin in the past.

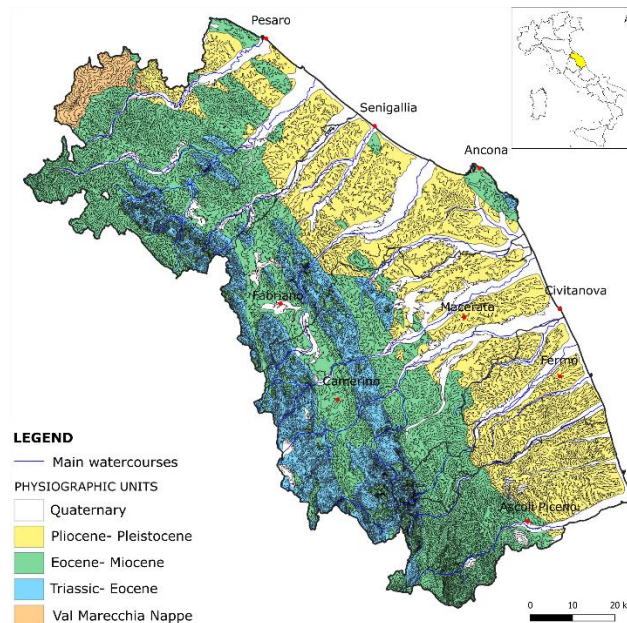


Figure 1. Physiographic setting of Marche region. Physiographic units were defined basing on the geology of the “CARG project” of the Marche Region [23].

The themes of the documentary, even if they can sometimes be considered very technical, have been treated in the simplest language, as popular as possible, so that they can be understood by all viewers (of all ages and cultural backgrounds).

The 65 minutes of the documentary were conceived as an original methodological approach to popularize the geosciences and enhance the geological heritage and the sites of geological and geomorphological interest (hereafter geosites and geomorphological sites), to promote geotourism and, last but not least, to give due importance to the figure of the geologist.

The idea was born from the Geology Division of the University of Camerino (MC), which enterprisingly decided to contact Dr. Luigi Bignami, a geologist and scientific popularizer known in Italy as the presenter of this type of documentary film. Our research team proposed an inter-regional geoitinerary that would summarise the tectonic-stratigraphic evolution of the Marche and Umbria regions which, in the past, constituted a single sedimentary basin formed below sea level.

The episode, whose original Italian title is “Meraviglie geologiche d’Italia: Marche e Umbria”, was not only praised in the scientific community for its educational value, but also represented an important opportunity for the visibility of the territory and the universities involved.

2. Materials and Methods

The question of understanding and protecting our geological heritage has led to a scientific debate in Europe in recent years, which has provided various indications of methods and criteria for the evaluation of sites of geological interest [24–32] but also various modalities for the popularization of geo-naturalistic heritage [33–36].

The physical qualities of the landscape deserve proper consideration, both for scientific and administrative reasons: Geology is part of all natural systems and plays an important role in the study of morphology, climate and biodiversity. Understanding the landscape and communicating its geo-naturalistic value is today a necessity on which the social and economic development of contemporary society is based. It is therefore equally important to provide society with knowledge

about the geological and geomorphological aspects of the landscape in order to raise awareness of natural hazards and increase resilience to them [37,38].

From a technical point of view, the documentary was recorded in 4k quality technology, with three different cameras and a quadcopter drone (DJI Mini III).

The first intellectual challenge was to create an itinerary that took into account three fundamental aspects: a high landscape value (for the television attractiveness of the panoramic images), a high representativeness in terms of tectonic-sedimentary and geomorphological evolution of the area (also considering a chronostratigraphic and tectonic order) and, finally, a logistical convenience for the television crew (Figure 2) and easy accessibility for the staff who had to transport the technical material.



Figure 2. One of the stops with the troupe at work.

Therefore, there was not an evaluation of the scientific quality of the geomorphosites identified as stops in the documentary based on academic classification criteria [25,31,39], although the value of each site is indisputable and, in any case, was selected among the best regional geosites and geomorphosites for emotional impact. The geosites chosen were not selected by taking those with the highest frequentation but by choosing from the most popular ones, even if all of them were very frequented. Of course, many geosites were not inserted because of similarity and because of television times already defined by the production.

In addition to their high geological value, the sites selected for the in-depth studies (Figure 3) also have a high landscape value, whereby the landscape is considered an expression of the geomorphological landscape. As already mentioned, all stops are located within a natural park (both national and regional) or a protected area.



Figure 3. Geographical framework with the main stops of the documentary (extract from Google Earth).

The narration saw the presenter Dr. Bignami, undertook in an itinerary through the identified geosites to deepen the aspects of each stop and explain why that place plays a key role in the geological and geomorphological evolution of the region.

In this way, the semiotic value of the media presentation through the format of scientific-naturalistic documentation was added to the landscape- scenic aspect of the selected places. In this way, society will be introduced to the concept of geological and morphological evolution of the territory, but above all to the need to identify measures to protect and enhance geo- natural assets that could disappear either due to climate change or due to anthropogenic effects.

3. Analysis and Discussion

3.1. The Jurassic Period

The individuated geo-itinerary describes the tectonic-stratigraphic history of the Umbria-Marche regions which, in the past was, a unique underwater basin. The Calcare Massiccio geological Formation was deposited in this area during the Jurassic, 200 million years ago. During this Period, the basin was involved in an intense synsedimentary tectonic that progressively disarticulated and lowered the area into a horst and graben system composed of structural highs and lows, each one with a particular heteropic stratigraphic sequence, different in facies and thickness [40]. The geoenvironment of the Umbria- Marche basin during the Jurassic was of Bahamian type, with a shallow sea level into which the sun's rays penetrated, allowing the colonization of a wide proliferation of fauna and flora. An ichthyosaur fossil was found in an outcrop in the area [41], which is now preserved in the speleo-archeological museum of San Vittore (Genga, AN). This hamlet is located just a hundred meters from the Frasassi Gorge (Figure 4), a particularly important geotouristic site hosting the hypogeum complex with the largest cave in Europe, called Abisso Ancona.

Therefore, the site of Frasassi (Genga, AN) was chosen to represent the Jurassic Period, thanks to the outcrops of the Calcare Massiccio Fm. with an excellent stratigraphic continuity, in which the tectonic lineaments that fragmented this ancient carbonate platform are very well recognisable.



Figure 4. The spectacular landform of the Frasassi gorge view from West.

The first stop was located at the top of Mount Revellone, near the hamlet of Castelletta, municipality of Fabriano (AN), at a panoramic point where the above-mentioned physiographical units of the Apennines, the foothill and the coastal region were clearly recognizable. After that, the troupe moved to the village of Pierosara in the municipality of Genga (AN), where it was possible to admire a tectonic window on the Jurassic faulted carbonate platform [42,43]. Another very curious stop was the one in Precicchie (Fabriano, AN), where a Jurassic paleo-escarpment with onlap stratification, megabreccias and drapes is very well exposed. Another important stop was the aforementioned museum of San Vittore, an hamlet of Genga (AN). All these places fall within the jurisdiction of the regional natural park “Gola della Rossa e di Frasassi”. The last stop in the Jurassic is the Calcare Massiccio quarry in Serra San Quirico (AN), cultivated underground. It bears witness to one of the countless applications of geology and geologists in daily and economic life. The very pure limestone (approx. 99.6%) is used for animal feed, glass production, construction, agriculture and the pharmaceutical industry [44].

3.2. Cretaceous- Paleogene Periods

From the Cretaceous onwards, tectonic stress ended and sedimentation continued under conditions of relative quiet [45]. An important event during this Period was a gigantic asteroid impact above the Earth’s surface that triggered one of the largest mass extinctions on our planet, which can still be observed today in the Bottaccione Gorge in the Umbria region near Gubbio (PG). This event is so important to determine the chronostratigraphic boundary between the Cretaceous and the Paleogene and is shown in the documentary [46]. Bottaccione Gorge, saw in these last months the acknowledgment of the “Golden Spike” indicating the Golden Stratotype Sections and Points (GSSP) [47] and marking the boundary between Santonian and Campanian (83.6 million years ago).

The Marche region also has its own GSSP [48], which can be seen in the Massignano quarry (municipality of Ancona) and marks the boundary between the Eocene and Oligocene Epochs (39.9 million years ago). This site is located in the Monte Conero Regional Natural Park.

3.3. Miocene- Pliocene Epochs

During the Miocene, the seafloor of the Umbria-Marche basin started to corrugate, in response to a compressive tectonic related to the reversal of the relative movement between the European and African plates. At this time, the first fold and thrust belts began to form and the Apennine Ridge starts to migrate from west to east [45 and references therein]. This movement is still active today, leading to compression at the front of the chain (today offshore from the coast of the Adriatic Sea) and crustal extension in the hinterland (today in the Apennines of Umbria and Marche). In the Miocene, the topography of the basin consisted of a series of elevations and depressions extending in a N/NW-S/SE direction. Over time, the most depressed areas became turbiditic foredeep basins,

starving for receiving sediments (mostly arenaceous and pelitic flysch) eroded by the chain itself. The largest of these basins is known as the „Laga turbidite basin” and it extends between Marche and Abruzzo regions. Today’s landscape sees an alternation of sandstone layers remaining prominent, in opposition to layers with a greater pelitic component and are easier to shape. The village of Sala shown in the episode is part of the municipality of Ripatransone (AP) and belongs to the “Gran Sasso and Monti della Laga National Park”.

The next stop foresaw gypsum deposits of the “gessoso-solfifera Formation” of the Laga basin, deposited during the Messinian salinity crisis, outcropping in a quarry in the town of San Severino Marche (MC) and well recognizable along its historical walls because of the weathering which acted by eroding the bricks by creating particular grooves.

The uppermost and youngest rocks of the Umbria-Marche stratigraphic succession outcrops are represented by the sediments outcropping in the hamlet of Porchiano (Ascoli Piceno) on the foothill of Mt. Ascensione, once a time an underwater turbiditic foredeep [49].

The area is contained within the constituting “Mount Ascension and badlands Park”, where the geomorphological landscape created the unmistakable topographic profile of Mount Ascensione, between the Tronto and Tesino River valleys. The morphological steps present along the profile of the mountain represent depositional alternations of conglomeratic and arenaceous- conglomeratic levels (more resistant lithologies) and arenaceous and arenaceous- pelitic levels (more erodible lithologies) dated Plio- Pleistocene [50,51] (Figure 5). Due to their competence, the coarse-grained deep-water strata remain prominent along the profile with evident selective erosion scarps whose heights can sometimes exceed 80 meters. The areas with lower slopes, connecting escarpments, are characterized by a finer grain size and they appear as densely wooded. Along the foothills of Mt. Ascensione, it is well recognizable the presence of extended and well-developed badlands-type morphologies, settled up in the pelitic Pliocene Formations, with sometimes glacial remnants deposits (represented by sandy-pebbly deposits) of Upper Pleistocene - Holocene stratified and preserved at the top [52,53]. These forms, in addition to representing the dominant landscape element, have also been a conditioning factor of anthropogenic development. In many cases, in fact, the continuous evolution and retrogression of badlands head scarps led to the creation of sharp watershed ridges on which some villages have been isolated, such as the same Porchiano [54,55]. In this area, erosion processes and tectonic uplift acted with great impetuosity, also thanks to the easily disintegrated terrigenous deposits and relief energy. The geology lecturer in the documentary mentions the widespread gravitational processes in the area, creating road disruptions and the need for continuous restoration interventions. This unstable condition can be considered as the response to the presence of terrigenous lithologies added to an intense structural control (tectonic uplift): these rocks formed about 2,5- 3 million years ago at 400- 600 m below the sea level and today we found them at 1.100 meters above the sea level. Therefore, in the last 1,5 million years, this area raised 1,5 mm/ year, representing the area where the Upper Pliocene bedrock is found at the highest elevations in Europe [54,56].

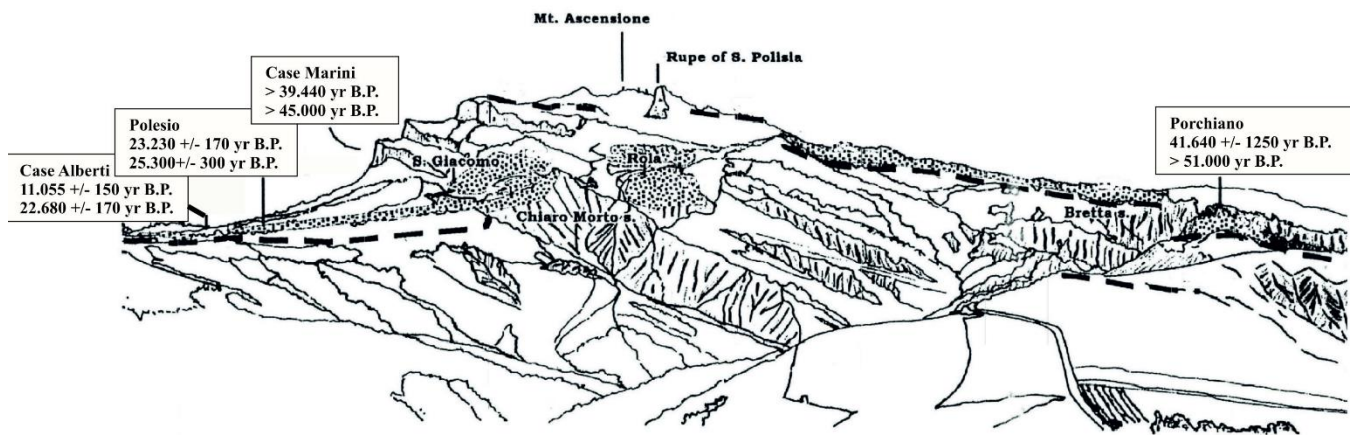


Figure 5. The geomorphological landscape of the southern slope of Mt. Ascensione and the badlands along its slopes. [53] modified.

With this stop the underwater sedimentation ends. As the compression continued, about 2.5 million years ago, during the Plio-Pleistocene epoch, the area rose above sea level and from then on erosion processes prevailed over depositional processes [57]. This led to the creation of a badlands landscape of immense naturalistic value, where the litho-structural and tectonic controls are clearly and distinctly reflected in the morphology that characterizes the Mt. of Ascension area [55] (Figure 5): the more resistant lithologies of the conglomeratic levels correspond to obvious selective erosion escarpments with heights above 80 m. In correspondence with less resistant lithologies, such as the Pliocene pelites, the morphology is more articulated with a highly hierarchical hydrographic network, which is accompanied by the formation of extensive and well-developed calanque phenomena.

These morphologies are not only the predominant feature of the landscape in this area, but also a determining factor of anthropogenic development: in many cases, the continuous development and retreat of gully heads led to the formation of lean and sharp watershed ridges, on which anthropogenic structures and infrastructures remain isolated [52,53].

3.4. Quaternary Period

One of the first examples of subaerial processes is admirable in Avigliano Umbro (TR) where in a paleolacustrine environment developed *Glyptostrobus europaeus*, a variety of Cupressaceae today extinct and found as fossilized in this important paleontological site (this is one of the four cases in

the world and the only easily accessible and equipped for sightseeing) [58]. The mineralization is not completed but cellulose and lignin are almost perfectly maintained.

Remaining in Umbrian territory, one of the active tectonic subsidence evidence is given by the structurization of back basins. The Apenninic territory of the Umbria-Marche regions is characterized by a series of tectonic valleys alternated with mountain ridges. One of these depressions reached a low topographic elevation that was able to interfere with the local water table level giving rise, precisely, to Lake Trasimeno, a reservoir developed in a tectonic plain [59].

Talking about subsiding plains it was impossible not to mention the active tectonic of Castelluccio di Norcia plain (PG), moreover responsible for the dramatic 2016 earthquakes in the central part of Italy. The expert lecturers illustrated the morphogenesis setting of this tectonic-karst plain, in this way structured as the surface expression of the Mount Vettore- Mount Bove fault system [60,61] and its antithetic lineaments. During the scientific deepening, geomorphological evidence of this particular valley have been shown, such as the fault plane and the sinking stream of “fosso dei Mergani”. The western slopes of Cima del Redentore and the same plain show a lot of landforms referable to tectonic, karst, fluvial, gravity, and cryo-nival processes, even if the latter are scarce on this side. From a geomorphological point of view, in this area it is possible to recognize structural elements such as fault scarps and triangular facets; a lot of forms and deposits due to running water and glacialism such as alluvial fans, slope waste deposits, gullies and gully heads, debris/ earth/ mud rapid flows, glacial cirque escarpments and the karst forms represented by sinkholes and dolines (Figure 6). The scarce presence of glacial forms is attributable to a recent and very intense tectonic activity whose action did not allow or erased the maintenance of Pleistocene glacial forms [60].

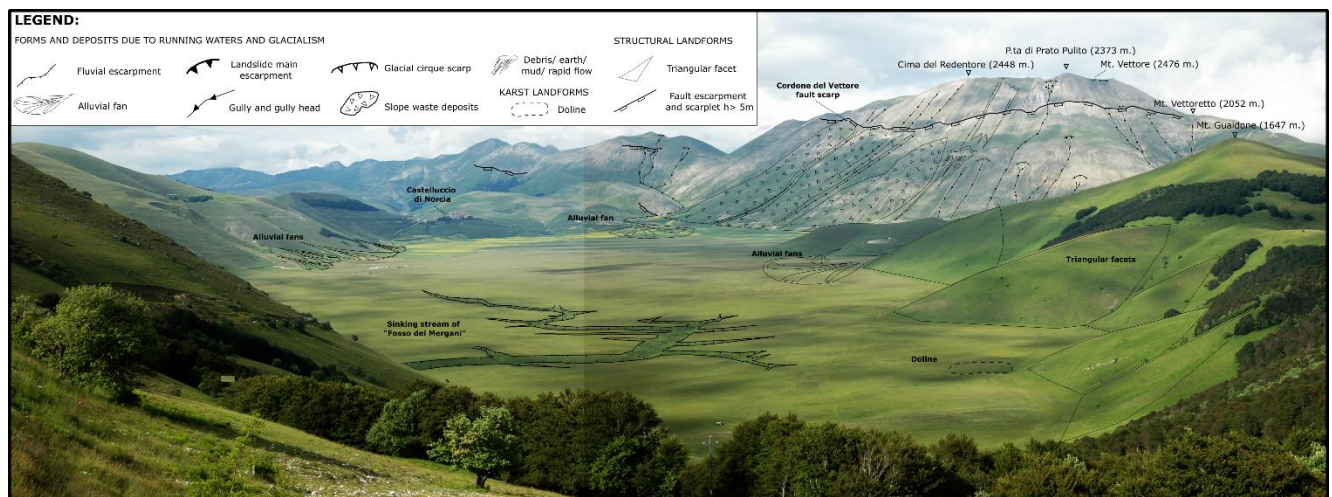


Figure 6. Main representative landforms of Castelluccio di Norcia intermountain basin [redraw from 60].

As mentioned before, the migration of the Apennines from West to East is responsible for compressive tectonic in front of the ridge which accompanies the thrust and, in response to this migration, a crustal extension in the internal part is active (Apennines area). The Apennines, from a geological point of view, are not exclusively represented by the Umbria-Marche Mountain ridge. In this schematic hinterland- -thrust belt- foredeep- foreland system (Figure 7), Apennines are progradating offshore of the Adriatic Sea, East of the promontory of Mount Conero, where it overthrust under the sea level [62,63] and references within.

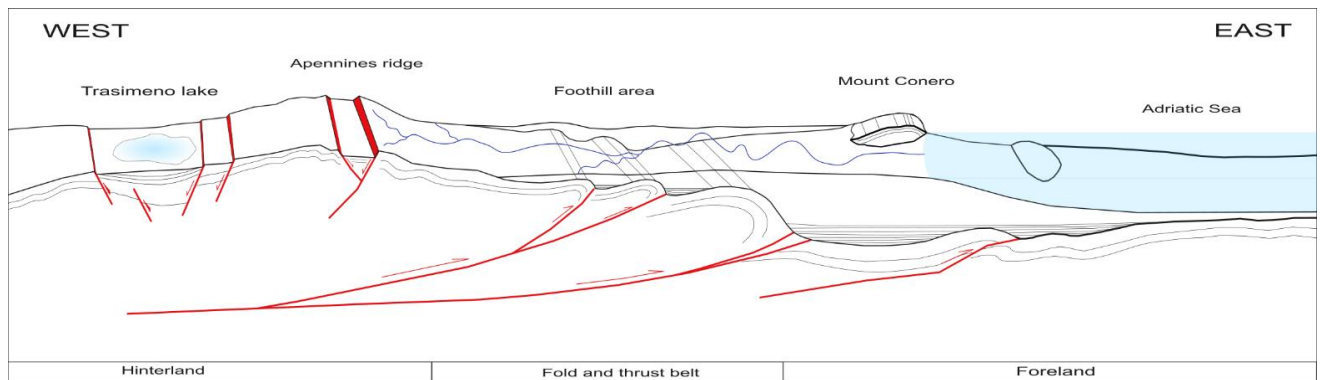


Figure 7. Schematic reconstruction of hinterland- fold and thrust belt- foredeep- foreland system of Umbria-Marche area (drawn from Farabollini & Bendia).

The external portion of the thrust front is somehow landward represented by the promontory of Mount Conero, whose structure is in outcrop recognizable as a pericline, which just to the east ceases its fold on the hanging wall of the thrust [64].

From a geomorphological point of view, along the Conero seacliff, in addition to the magnificent landscape, many landforms are well recognizable such as the “scoglio del trave”, the head of a calcarenitic layer that remained prominent due to its degree of cementation (differential erosion), rather than the landslide of Portonovo.

The landslide of Portonovo is probably one of the most educational examples of coastal landslides on the western coast of the Adriatic, where the physiognomic elements (landslide crown, main scarp, displaced material, etc.) are well recognizable (Figure 8). This large mass movement gravity driven was able to originate two lagunas. In addition to this, the landslide produced a lot of debris causing modifications to the coastline, able to condition the long coast solid transport and, consequently, the dynamics of the shoreline in this section [65,66]. The gravity movement was probably triggered after other previous landslides, in fact, the three-centuries-old Benedictine Santa Maria in Portonovo Abbey was built on top of an old landslide deposit [67,68].

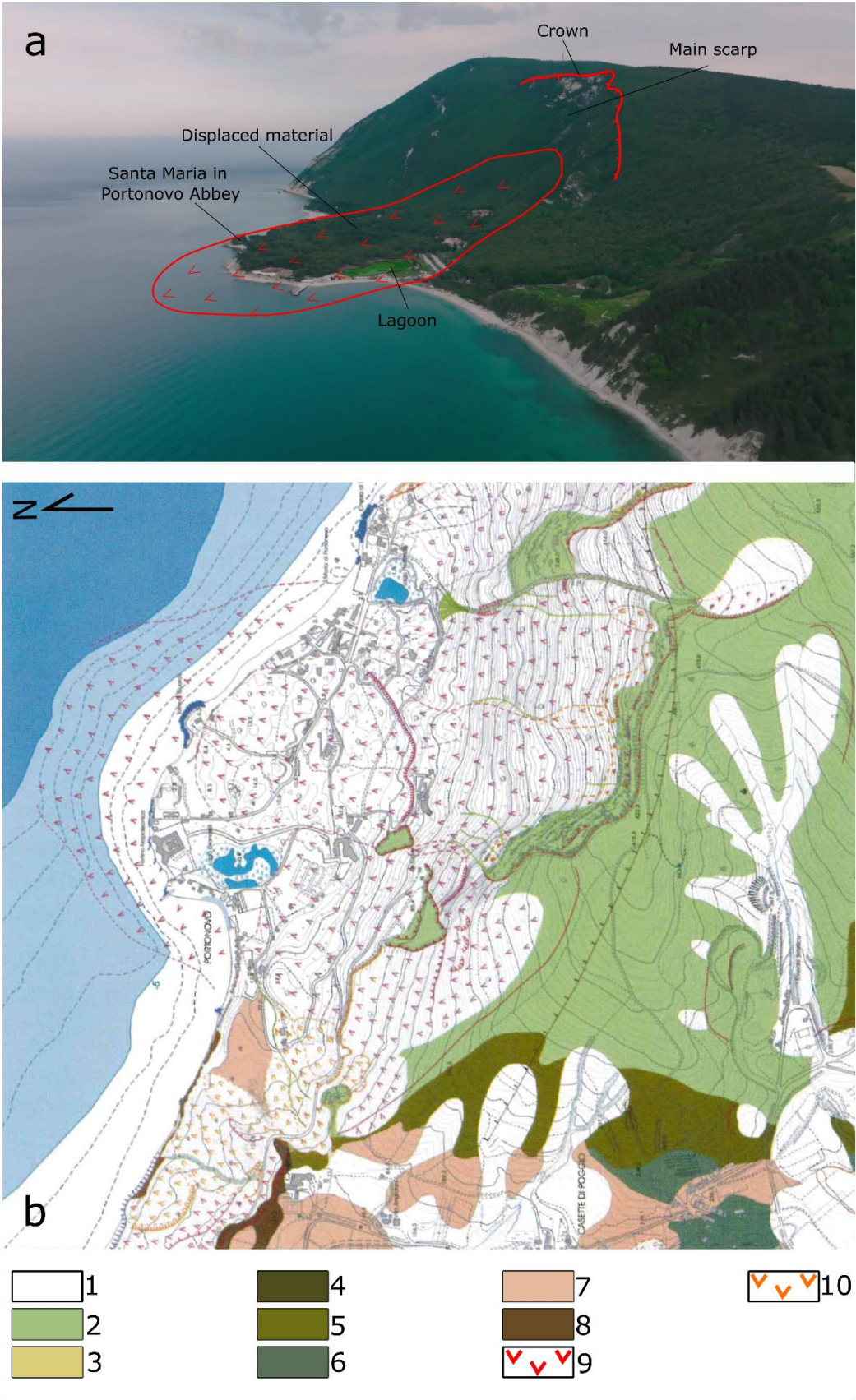


Figure 8. a: a drawn frame of the documentary with a panoramic view of Portonovo bay, northern portion of Mount Conero. b: Geomorphological map of the Portonovo area; 1) slope deposits; 2-3-4-5-6-7-8) mainly calcareous and marly calcareous Formations; 9) active landslides; 10) dormant landslides [redraw from 67].

Another important aspect of the subaerial processes is represented by the karst process, very active in the Umbria-Marche area due to the large limestone outcrops. This process acted creating epigean and hypogean caves. These locations became very frequented places, starting from the Palaeolithic, not only as simple shelters but also as places of worship and burial [69,70] and references within. One example is given by the “Beata Vergine cave”, along the Frasassi gorge, where geo-archaeological excavations and findings confirmed the presence of ancient human frequentations and today is considered a sacred place thanks to the presence of two Christian structures: a little temple of 1828 and a hermitage of at least 1000 years B.P. (Figure 9) [71]. This location represents today a very important touristic destination thanks to its natural and cultural heritage, element able to also enhance the value of this geomorphosite [72].

But the most important attraction in Frasassi gorge is represented by the hypogeum complex “Grotta del Fiume- Grotta Grande del Vento”, so-called Frasassi caves [69].



Figure 9. the “Santa Maria Infra Saxa” hermitage on the left and the “Beata Vergine temple” in the right, under the homonymous cave. In the background, the steep limestone walls (Calcare Massiccio) of the Frasassi gorge.

The documentary allows to admire hypogean morphologies thanks to cave footages exceptionally conducted via drone, even if the underground karst complex of Frasassi is so large and important that it would require a specific treatment on its own.

The last stop interests the youngest rocks of the stratigraphic succession, which are continental deposits of travertine in a quarry of Acquasanta Terme (AP). Here, along the hydrographic right of the Tronto River, it is possible to find three depositional levels of travertine, placed at different heights with respect to the present valley floor. These sedimentary deposits, well known in the world for mining and usages as „Marmi di Acquasanta” even if they are not marbles, show considerable thicknesses (even hundreds of meters) and areal extension of different square kilometers.

Their emplacement, so far essentially associated with the emergence from deep fractures of warm waters over-saturated in calcium carbonate (today still present) [73–75], also show a different deposition in environmental and hydrodynamic key. Travertine deposits testify their deposition in a typically fluvial environment with deep water mixing, due to their arrangement (mostly symmetrical and parallel to the river axis), the presence of typical transport structures and the close relationships with the alluvial deposits present along the riverbed [76]. An important role seems to be played by the sudden and intense climatic changes that occurred during the transition between the glacial and interglacial periods especially of the middle and upper Pleistocene and in the Holocene, which would have intensely affected the genesis and development of travertines.

4. Conclusion

The episode not only focused on geo-heritage resources but also provided some insight into the geological and geomorphological hazards. The mechanics of earthquakes and faulting (compressive and extensional tectonic of Jurassic, Miocene and Quaternary), impact asteroids capable of causing mass extinctions (Bottaccione and Massignano sections) and some examples of landslides (Jurassic megabreccias, olistoliths and Portonovo landslide) were illustrated and reproduced, thanks also to specific created graphic 3D video animations, realized under the supervision of the University of Camerino (Figure 10). Sometimes the modelling may not be properly correct, or it might deviate slightly from reality because it has been simplified due to technical limitations or to make communication easier to understand from a non-expert public.

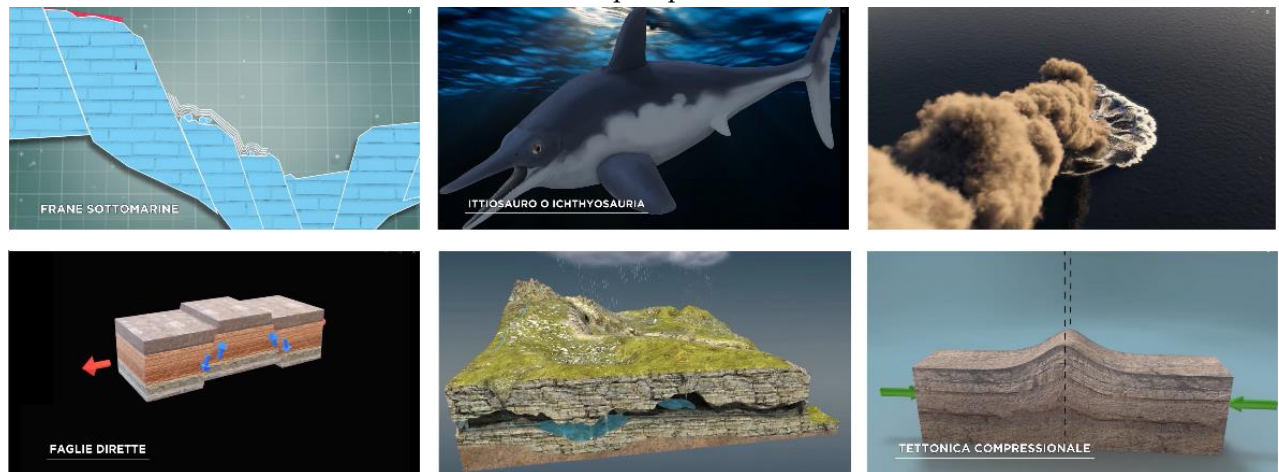


Figure 10. Some of the 3D animations reproduced to improve the communication making it easier to understand.

The episode, broadcast on SKY pay-per-view platform and on the national uncoded channels of „Digitale Terrestre” on air on FOCUS tv, channel 35, on 20th October 2022, reached about 1% of share (a value that indicates the percentage ratio between the listeners of a TV channel and the total number of viewers who are watching any other programme on the different networks).

This typology of divulgation may contribute to making communities aware of the prestige of the geomorphological landscape [77] and of its fragility [78]. Simplification does not mean banalisation and impoverishment but is rather the enrichment of knowledge by enhancing comprehensibility in the context of a wider cultural and ideological debate [79].

This strategy of geological dissemination conducted through the predisposition of scientific documentaries is expected to be a valid method of mass communication because, being broadcast several times on public TV and social media, it could be able to reach many recipients. It is easily accessible to the public and, at the same time, it can be considered an extraordinary and direct example of geoeducation. Each stop shown can be considered as a starting point on which to set up geosites, or geotourism hiking [6], rather than educational lessons aimed at geoeducation, thanks to its language and animations (visual storytelling helps to explain complex ideas) that should make it well received by all recipients.

The share result is certainly to be considered excellent, especially considering that during the evening it was broadcast there were very important programs, such as soccer matches, fictions and talk shows, which are historically very popular and followed in Italy.

The documentary is continuously broadcast within the speleo- paleontological museum of San Vittore di Genga (AN), near Frasassi caves, hundreds of thousands of visitors each year. Furthermore. Our research group is planning to distribute it to high schools to bring students closer to geoheritage of their area and attracting enrollment in geology degree programs.

This result undoubtedly means that there is growing attention to science and cultural documentaries. The appreciations shown by the geological community and people confirmed the importance of an initiative aimed at consolidating the importance of geology and the dissemination

of geological processes in a way to preserves the inestimable value of the landscape, intended as unique expression of the geological and geomorphological heritage.

Supplementary Materials: The documentary episode “Meraviglie geologiche d’Italia: Episode 3: Marche and Umbria” can be viewed on the producer’s website: https://mediasetinfinity.mediaset.it/video/meravigliegeologicheditaliailsud/ep-3-marche-umbria_F311126401000301.

Author Contributions: Conceptualization, F.B. and P.F.; methodology, P.F. and F.B.; validation, P.F.; resources, P.F. and F.B.; original draft preparation, F.B.; writing—review and editing, F.B. and P.F.; supervision, P.F. and L.B. All authors have read and agreed to the published version of the manuscript.

Data Availability Statement: In this section, please provide details regarding where data supporting reported results can be found, including links to publicly archived datasets analyzed or generated during the study. Please refer to suggested Data Availability Statements in section “MDPI Research Data Policies” at <https://www.mdpi.com/ethics>. If the study did not report any data, you might add “Not applicable” here.

Acknowledgments: First of all, it represents our duty to thank all the professors of the Geology Division of the University of Camerino and other athenaeums (Angela Baldanza, Massimiliano Barchi, Claudio Di Celma, Marco Peter Ferretti, Marco Materazzi, Stefano Mazzoli, Alessandro Montanari, Gaia Pignocchi, Emanuele Tondi) who provided many decades of field knowledge and research offering their total and indispensable support. Thanks also to all those whom, because of television time, we were unable to involve but whose research and teachings were essential to making this program a reality. Thanks for the work of the filmmaker Manuele Mandolesi, photography director Gianluca Gulluni, Maurizio Milie’ for aerial filming with drone and cinematographer Luca Losurdo, a close-knit team that we hope to meet again for other adventures. Thanks to the Administrators of “Consorzio Frasassi” and Genga municipality: Dr. Sara Bonacucina, Ing. Lorenzo Burzacca, Dr. Marco Filipponi, Dr. Maurizio Tosoroni and for the usual unconditional support in the hypogeum complex and to Dr. Luca Alfieri (Gola della Rossa Mineraria) and Dr. Antonelli Umberto (Eurobuilding) for allowing the filming to take place in the quarries. Finally, we would like to thank the National Council of Geologists and the Council of the Professional Order of Geologists of the Marche region for granting sponsorship to the initiative.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Stewart, I. S., & Nield, T. Earth stories: context and narrative in the communication of popular geoscience. *Proceedings of the Geologists’ Association* **2013**, *124*(4), 699-712.
2. Pereira, D. I., & Brilha, J. B. Virtual field trip in the Mirandela region (NE Portugal). *Ciências Da Terra: Número especial* **2000**, 59.
3. Seno, S., & Coccioni R. Discovering the Italian Geological Heritage with the Planet Earth Week. In *AGU Fall Meeting Abstract volume* **2018**. AGU.
4. Fesharaki, O., Calonge, A., & López Carrillo, M. D. The educational role of geology olympiads in Spain: promotion of geological heritage and geoconservation in youngsters. *Geoheritage* **2020**, *12*, 1-12.
5. Farabollini, P., Graziano, G., Luger, F. R., Luger, N., & Luger, M. (2013). Earth Sciences divulgation, geoheritage and landscape approach: the project of the Geologi d’Italia. In *Geoparks: an innovative approach to raise public awareness about geohazard, climate change and sustainable use of our natural resources*; National Park of Cilento, Vallo di Diano e Alburni, **2013**, Vol. 1, pp. 55-60.
6. Farabollini P, Aringoli D, Bendia F, et al. The Geo-Itinerary of the “Anello della Sibilla” between sciences, history and myth: a vehicle for the renaissance of the territories affected by the earthquake **2022a**. *Rend. Online Soc. Geol. It.*, Vol. 58, pp. 28-33.
7. Korkmaz, B. C., & Altinsoy, M. G. The Position and Importance of Geology Education in the Schools. *The Journal of Limitless Education and Research* **2023**, *8*(2), 158-170.
8. Baucon, A., & De Carvalho, C. N. Taking Ichnology to the general public: the experience of TERRAGAZE and TERRAGAZE mobile. *Studi Trentini Science Naturali Acta Geologica* **2008**, *83*, 31-41.
9. Balestro, G., Cassulo, R., Fioraso, G., Nicolò, G., Rolfo, F., Bonansea, E., ... & Mosca, P. IT applications for sharing geoheritage information: The example of the geological and geomorphological trail in the Monviso massif (NW Italy). *Rendiconti Online della Società Geologica Italiana* **2015**, *34*, 85-88.
10. Luger, F. R., Farabollini, P., Luger, N., Amadio, V. & Baiocco, F. LANDSCApp”: a friendly way to share the Italian geoheritage. *Acta Geoturistica*, **2017**, *8*(2), 79-86.

11. Santos-González, J., & Marcos-Reguero, A. Applying the geological heritage in land management: Cartography and management proposals of geosites in Burgos Province (Spain). *Geoheritage*, **2019**, 11(2), 485-500.
12. Mathiesen, D., Myers, T., Atkinson, I., & Trevathan, J. Geological visualisation with augmented reality. In *2012 15th International Conference on Network-Based Information Systems* **2012**, (pp. 172-179). IEEE.
13. Farabollini P., Bendia F. Frasassi caves and surroundings: a special vehicle for the geoeducation and dissemination of the geological heritage in Italy. *Geosciences* **2022b**, 12 (11): 418. <https://doi.org/10.3390/geosciences12110418>.
14. Cayla, N. An overview of new technologies applied to the management of geoheritage. *Geoheritage* **2014**, 6(2), 91-102.
15. Balestro, G., Cassulo, R., Festa, A., Fioraso, G., Giardino, M., Nicolò, G., & Perotti, L. 3D geological visualizations of geoheritage information in the Monviso Massif (Western Alps). *Rendiconti Online Della Società Geologica Italiana* **2016**, 39, 81-84.
16. Cayla, N., & Martin, S. Digital geovisualisation technologies applied to geoheritage management. In *Geoheritage* **2018**, (pp. 289-303). Elsevier.
17. Newman, N. How publishers are learning to create and distribute news on TikTok **2022**. <https://ora.ox.ac.uk/objects/uuid:a2121c08-e16d-4bf9-bbe7-18f34ceaa64e/files/spr76f484j> (accessed on 19 July 2024).
18. Bizzotto, D. Ocean Literacy e Comunicazione della scienza. L'utilizzo di instagram nella divulgazione della scienza oceanica **2023**. https://thesis.unipd.it/retrieve/f545d485-253b-4f05-a0c6-15807ef2b90f/Davide%20Bizzotto_Tesi%20magistrale.pdf (accessed on 19 July 2024).
19. Aringoli, D., Farabollini, P., Gentili, B., Materazzi, M., & Pambianchi, G. Examples of geoparks and geoconservation strategies from the Southern Umbro-Marchean Apennines (central Italy) **2010**, *Geoacta*, 3, 153-166.
20. Piacentini, T., Castaldini, D., Coratza, P., Farabollini, P., & Miccadei, E. Some examples in the field of Geotourism in Emilia Romagna, Marche and Abruzzo Regions (Northern-Central Italy). *GeoJournal of Tourism and Geosites* **2011**, 240-262.
21. Aloia, A., Guida, D., & Valente, A. Geodiversity in the Geopark of Cilento and Vallo di Diano as heritage and resource development. *Rendiconti Online della Società Geologica Italiana* **2012**, 21, 688-690.
22. Mediaset Infinity website. Available online: https://mediasetinfinity.mediaset.it/video/meravigliegeologicheitaliasud/ep-3-marche-umbria_F311126401000301 (accessed on 19 July 2024).
23. Cartographic website of the Marche Region. Available online: <https://www.regione.marche.it/Regione-Utile/Paesaggio-Territorio-Urbanistica/Cartografia/Repertorio/Cartageologicaregionale10000> (accessed on 19 July 2024).
24. Wimbledon, W. A. GEOSITES-an International Union of Geological Sciences initiative to conserve our geological heritage. *Polish Geological Institute Special Papers* **1999**, 2, 5-8.
25. Coratza, P. & Giusti, C. Methodological proposal for the assessment of the scientific quality of geomorphosites. *Alpine and Mediterranean Quaternary* **2005**, 18 (1), 307-313.
26. Pralong, J. P., & Reynard, E. A proposal for a classification of geomorphological sites depending on their tourist value. *Alpine and Mediterranean Quaternary* **2005**, 18(1), 315-321.
27. Reynard, E., & Panizza, M. Geomorphosites: definition, assessment and mapping. An introduction. *Géomorphologie: relief, processus, environnement* **2005**, 11(3), 177-180.
28. Bruschi, V. M. & Cendrero A. Direct and parametric methods for the assessment of geosites and geomorphosites. *Geomorphosites* **2009**, 9, 73-88.
29. Pena dos Reis, R., & Henriques, M. H. Approaching an integrated qualification and evaluation system for geological heritage. *Geoheritage* **2009**, 1, 1-10.
30. Reynard, E. The assessment of geomorphosites. *Geomorphosites* **2009**, 63-71.
31. Pereira, P. & Pereira, D. Methodological guidelines for geomorphosite assessment. *Géomorphol Relief Processus Environ* **2010**, 16(2):215-222. <https://doi.org/10.4000/geomorphologie.7942>
32. Morante- Carballo, F., Merchán-Sanmartín, B., Cárdenas-Cruz, A., Jaya-Montalvo, M., Mata-Perelló, J., Herrera-Franco, G., & Carrión-Mero, P. Sites of geological interest assessment for geoeducation strategies, ESPOL University Campus, Guayaquil, Ecuador. *Land* **2022**, 11(6), 771.
33. Rogers, E.M. Diffusion of Innovations. Third Edition, *The Free Press*, New York, **1983**.

34. Panizza, M. & Piacente, S. Geomorphosites: A bridge between scientific research, cultural integration and artistic suggestion Geomorphological sites and geodiversity. *Il Quaternario* **2005**, 18, 3–10.
35. Luger, F.R., Farabollini, P., Greco, R. & Amadio, V. The Geological Characterization of Landscape in Major TV Series: A Suggested Approach to Involve the Public in the Geological Heritage Promotion. *Sustainability*, **2015**, 7(4), 4100-4119. <https://doi.org/10.3390/su7044100>
36. Wang, N., Clowdus, Z., Sealander, A., & Stern, R. Geonews: Timely geoscience educational YouTube videos about recent geologic events. *Geoscience Communication Discussions*, **2021**, 1-26.
37. Farabollini, P., Luger, F. R., Aldighieri, B., & Amadio, V. The role of earth science and landscape approach in the ethic geology: communication and divulgation for the prevention and reduction of geological hazard. In: *Engineering Geology for Society and Territory* **2014**, Volume 7: Education, Professional Ethics and Public Recognition of Engineering Geology (pp. 115-120). Springer International Publishing.
38. Luger, F. R., Farabollini, P., & Luger N. Landscape analysis as a tool for risk reduction. *Aims Geosciences* **2019**, 5(3), 617-630.
39. Panizza, M. Geomorphosites: concepts, methods and examples of geomorphological survey. *Chinese science bulletin* **2001**, 46, 4-5.
40. Calamita, F., Cello, G., Deiana, G., & Paltrinieri, W. Structural styles, chronology rates of deformation, and time-space relationships in the Umbria-Marche thrust system (central Apennines, Italy). *Tectonics* **1994**, 13(4), 873-881.
41. Paparella I., Maxwell E. E., Cipriani A., Roncace S., Caldwell M. W. The first ophthalmosaurid ichthyosaur from the Upper Jurassic of the Umbria-Marchean Apennines (Marche, Central Italy). *Geological Magazine* **2017**, 154 (4), 837-858.
42. Coltorti, M. *Geologia della regione di M. Pietroso-M. Murano (Appennino marchigiano)*. **1980**, Università degli studi di Ferrara.
43. Galdenzi, S. Rapporti laterali tra diverse sequenze giurassiche nella dorsale marchigiana fra la Gola della Rossa e Monte Canfai. *Memorie della Società Geologica Italiana* **1986**, 35, 49-55.
44. Fuffa, E., Neri, E., Pulselli, R.M., Farabollini, P. & Boria, S. Dalla PCR alla EPD: il percorso di sostenibilità dell'attività estrattiva del calcare micronizzato di Gola della Rossa Mineraria (Ancona). Atti del XIV Convegno della Rete Italiana LCA- IX Convegno dell'Associazione Rete Italiana LCA Cortina d'Ampezzo 9-11 dicembre **2020**, 437-445 (ISBN: 978-88-8286-416-3).
45. Centamore, E. & Deiana, G. La geologia delle Marche. *Studi Geologici Camerti* **1986**, volume speciale 73° Congresso Società Geologica Italiana, 146pp.
46. Alvarez W. A review of the Earth history record in the Cretaceous, Paleogene, and Neogene pelagic carbonates of the Umbria-Marche Apennines (Italy): twenty-five years of the Geological Observatory of Coldigioco. In: Koeberl C, Bice DM (eds) *250 million years of Earth history in Central Italy: celebrating 25 years of the Geological Observatory of Coldigioco. Geological Society of America Special Paper*, **2019**, vol 542, pp 1–58.
47. Gale, A., Batenburg, S., Coccioni, R., Dubicka, Z., Erba, E., Falzoni, F., ... & Walaszczyk, I. The Global Boundary Stratotype Section and Point (GSSP) of the Campanian Stage at Bottaccione (Gubbio, Italy) and its Auxiliary Sections: Seaford Head (UK), Bocieniec (Poland), Postalm (Austria), Smoky Hill, Kansas (USA), Tepayac (Mexico). *Episodes Journal of International Geoscience* **2023**, 46(3), 451-490.
48. Jovane, L., Coccioni, R., Marsili, A., Acton, G., Koeberl, C., & Montanari, A. The late Eocene greenhouse-icehouse transition: Observations from the Massignano global stratotype section and point (GSSP). *Geol. Soc. Am., Special Paper* **2009**, 452, 149-168.
49. Di Celma, C., Cantalamessa, G., Didaskalou, P., Lori, P., & Potetti, M. Sedimentology And Stratigraphic Architecture of Coarse-Grained Slope Canyon Fills: Monte dell'ascensione and Castignano Systems (Pliocene, Central Italy). In *Sedimentary environments of mediterranean Island (s)* **2009**, (pp. 497-497). Edeseditrice democratica sarda.
50. Cantalamessa, G., & Di Celma, C. Sequence response to syndepositional regional uplift: insights from high-resolution sequence stratigraphy of late Early Pleistocene strata, Periadriatic Basin, central Italy. *Sedimentary Geology* **2004**, 164(3-4), 283-309.
51. Di Celma, C., Cantalamessa, G., Didaskalou, P., & Lori, P. Sedimentology, architecture, and sequence stratigraphy of coarse-grained, submarine canyon fills from the Pleistocene (Gelasian-Calabrian) of the Peri-Adriatic basin, central Italy. *Marine and Petroleum Geology* **2010**, 27(7), 1340-1365.
52. Dramis F., Gentili B., Coltorti M. & Cherubini C. Osservazioni geomorfologiche sui calanchi marchigiani. *Geografia Fisica e Dinamica Quaternaria* **1982**, 5(1), 38-45.

53. Gentili, B., Materazzi, M., Pambianchi, G., & Scalella, G. I depositi di versante del Monte dell'Ascensione (Marche meridionali, Italia). *Geografia Fisica e Dinamica Quaternaria* **1998**, 21, 205-214.
54. Centamore, E., Farabollini, P., & Angelini, S. Guida all'escursione: "Geologia e geomorfologia del settore fermano nel bacino periadriatico marchigiano-abruzzese". *Rend. Online Soc. Geol. It* **2009**, 8, 162-168.
55. Farabollini, P., & Scalella, G. Itinerari geoturistici nel comprensorio del Monte dell'Ascensione e dei calanchi. *Memorie Descrittive Carta Geologica d'Italia* **2014**, 102, 57-72.
56. Farabollini, P., Gentili, B., & Pambianchi, G. Contributo allo studio dei calanchi: due aree campione nelle Marche. *Studi Geologici Camerti. Nuova Serie* **1992**, 12, 105-115.
57. Buccolini, M., Gentili, B., Materazzi, M., Aringoli, D., Pambianchi, G., & Piacentini, T. Human impact and slope dynamics evolutionary trends in the monoclinial relief of Adriatic area of central Italy. *Catena* **2007**, 71(1), 96-109.
58. Martinetto, E., Bertini, A., Basilici, G., Baldanza, A., Bizzarri, R., Cherin, M., ... & Pontini, M. R. The plant record of the Dunarobba and Pietrafitta sites in the Plio-Pleistocene palaeoenvironmental context of central Italy. *Alpine and Mediterranean Quaternary* **2014**, 27(1), 29-72.
59. Gregori, L., Melelli, L., Rapicetta, S., & Taramelli, A. The main geomorphosites in Umbria. *Il Quaternario* **2005**, 18(1), 93-101.
60. Coltorti, M., & Farabollini, P. Quaternary evolution of the Castelluccio di Norcia basin (Umbro-Marchean Apennines, central Italy). *Il Quaternario* **1995**, 8(1), 149-166.
61. Aringoli D., Farabollini P., Galindo-Zaldivar J., Gentili B., Giano S.I., LòPez-Garrido A.C., Materazzi M., Pambianchi G., Pedrera A., Ruaro P., Ruiz-Constà N.A., Sanz De Galdeano C., Savelli D., Tondi E. & Troiani F. Morphotectonic and sedimentary infill of the Colfiorito, Norcia, Castelluccio and Leonessa basins (Central Apennines, Italy). *Rendiconti Online Società Geologica Italiana* **2012**, vol. 21, 1228 – 1230 (ISSN: 2035-8008).
62. Calamita, F., Cello, G., Invernizzi, M. C., & Paltrinieri, W. Stile strutturale e cronologia della deformazione lungo la traversa MS Vicino-Polverigi (Appennino marchigiano esterno). *Studi Geologici Camerti Nuova Serie* **1990**, (1), 69-86.
63. Chicco, J. M., Pierantoni, P. P., Costa, M., & Invernizzi, C. Plio-Quaternary tectonics and possible implications for geothermal fluids in the Marche Region (Italy). *Tectonophysics* **2019**, 755, 21-34.
64. Roveri, M., Boscolo Gallo, A., Rossi, M., Gennari, R., Iaccarino, S. M., Lugli, S., ... & Tavian, M. The Adriatic foreland record of Messinian events (central Adriatic Sea, Italy). *GeoActa* **2005**, 4(139), 158.
65. Cancelli, A., Marabini, F., Pellegrini, M., & Tonnetti, G. Incidenza delle frane sull'evoluzione della costa adriatica da Pesaro a Vasto. *Memorie della Società Geologica Italiana* **1984**, 27, 555-568.
66. Santaloia, F., Cotecchia, V., & Monterisi, L. (2004). Geological evolution and landslide mechanisms along the central Adriatic coastal slopes. In *Advances in geotechnical engineering: The Skempton conference: Proceedings of a three-day conference on advances in geotechnical engineering, organised by the Institution of Civil Engineers and held at the Royal Geographical Society, London, UK, on 29–31 March 2004*, **2004**, pp. 943-954. Thomas Telford Publishing.
67. Aringoli D., Gentili B., Materazzi M., Pambianchi G. & Farabollini P. Il ruolo della gravità nell'evoluzione geomorfologica di un'area di falesia: il caso del Monte Conero (Mare Adriatico, Italia centrale). *Studi costieri* **2014**, 22, 19-32.
68. Montanari, A., Mainiero, M., Coccioni, R., & Pignocchi, G. Catastrophic landslide of medieval Portonovo (Ancona, Italy). *Bulletin* **2016**, 128(11-12), 1660-1678.
69. Galdenzi S, Menichetti M. Occurrence of hypogenic caves in a karst region: examples from central Italy. *Environ Geol* **1995**, 26, 39–47.
70. Sarbu, S., Galdenzi, S., Menichetti, M., & Gentile, G. Geology and Biology of the Frasassi Caves in Central Italy: An Ecological Multi-disciplinary Study of a Hypogenic Underground Ecosystem. *Ecosystems of the World*, **2000**, 359-378.
71. Pignocchi G., Montanari A. La Grotta della Beata Vergine di Frasassi (Genga – AN): vecchi e nuovi dati geo-archeologici. *Rivista di Scienze Preistoriche – LXVI –* **2016**, 143-180.
72. Coratza, P. & Panizza, M. Geomorphology and cultural heritage, *Mem Descr Carta Geol d'It.* **2009**, 87, 189 pp, ISBN: 978-88-240-2956-8, ISSN: 0536-0242.
73. Boni, C. F., & Colacicchi, R. I travertini della Valle del Tronto: giacitura, genesi e cronologia. *Pacini Mariotti*. **1966**

74. Della Porta, G., Capezzuoli, E. & De Bernardo, A. Facies character and depositional architecture of hydrothermal travertine slope aprons (Pleistocene, Acquasanta Terme, Central Italy). *Marine and Petroleum Geology* **2017**, 87, 171-187.
75. Sembroni, A., Molin, P., Soligo, M., Tuccimei, P., Anzalone, E., Billi, A., Franchini, S., Rainaldi, M. & Tarchini, L. The uplift of the Adriatic flank of the Apennines since the Middle Pleistocene: New insights from the Tronto River basin and the Acquasanta Terme Travertine (central Italy). *Geomorphology* **2020**, 352, 106990, 22pp.
76. Farabollini, P., Gentili, B. & Materazzi, M. Freshwater travertine deposition in the Umbria-Marche Apennine: genesis and neotectonic and paleoclimatic significance. *Proc. V Int. Conf. on Geomorphology, Tokyo 23-30 September 2001*, **2001**, 4pp.
77. Valentini, L., Nesci, O., Carnevali, L., Baiocchi, S., Brizigotti, M., Teodori, S., & Argalia, S. Landscape as a Cultural Resource: Science, Poetry, and Ancient Music for the Enhancement of the Marche Region, Central Italy. *In: Recent Research on Geomorphology, Sedimentology, Marine Geosciences and Geochemistry: Proceedings of the 2nd Springer Conference of the Arabian Journal of Geosciences (CAJG-2), Tunisia 2019* (pp. 107-109). Springer International Publishing. **2022**
78. Coratza, P. & De Waele, J. Geomorphosites and natural hazards: teaching the importance of geomorphology in society. *Geoheritage* **2012**, 195–203. <https://doi.org/10.1007/s12371-012-0058-0>.
79. Piacente, S. Geosites and geodiversity for a cultural approach to geology. *Il Quaternario* **2005**, 18(1), 11-14.

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.