Science, Poetry, and Music for Landscapes of the Marche Region, Italy: Communicating the Conservation of Natural Heritage

Olivia Nesci[1]and Laura Valentini[2]

[1] Department of Pure and Applied Sciences, University of Urbino Carlo Bo, Urbino (PU), 61029, Italy
5   [2] Department of Biomolecular Sciences, University of Urbino Carlo Bo, Urbino (PU), 61029, Italy

Correspondence to: Laura Valentini (laura.valentini@uniurb.it)

Abstract. We present a method for educating the public about landscapes that uses artistic works to broaden the audience, entice people to learn about landscapes in a personal and human context, and thus encourage them to preserve the natural heritage. To this aim, we use narratives about a place in plain language accompanied by visual presentations, original poetry, and ancient music. Several studies encourage to use art since it can help synthesize and convey complex scientific information and create a celebratory and positive atmosphere. Evidence suggests that the arts can deeply engage people by focusing on the emotions rather than relying only on comprehension, which is often emphasized in science communication. The multidisciplinary approach arouses an emotional and intellectual experience that enables a personal connection to the place. The work is part of a larger multidisciplinary project covering 20 sites in the Marche Region (Central Italy), which includes scientific information on geological-geomorphological genesis, trekking itineraries, poetry, ancient music, video and cultural offerings. The project resulted in live multidisciplinary performances, a book, a DVD and a web site. To give a taste of how we work, among the many amazing landscapes of the Marche Region we focus here on three sites from the north, the centre and the south of the region: "The sea-cliff of San Bartolo", "The flatiron of Mount Petrano" and "The fault of Mount Vettore", chosen as examples for their different processes of genesis and evolution.

In the long run, our goal is to promote a deeper understanding of landscapes by integrating their origin and physical aesthetic with their cultural and artistic heritage. In doing so, we intend to inspire people to have a new perception of geosites, starting from their physical beauty, building on scientific study and cultural history, and arriving to the knowledge of their social importance. So far, our direct experience with the public has been highly encouraging. The participation at our live shows demonstrated a great interest in the geological history, resulting relevant for the development of geo-tourism. The method demonstrates the potential to develop a strong personal involvement of visitors towards the places, stimulating the curiosity to know how and why that place was formed and, finally, the desire to visit and protect it.

1 Introduction

Ordinary people are often turned off by scientific language which can seem foreign and dry despite its importance. In contrast, the arts have often been used in history to successfully communicate, influence, and educate. Art is, in fact, able to motivate a

large audience, and art works are an important component in several contexts: protests or movements promoting important social and environmental issues, and for raising awareness of social and environmental problems linked to scientific contents (Jordan, 2008; Curtis, 2011; 2012). The arts can help synthesize and convey complex scientific information, promote new ways of looking at issues, touch people's emotions, and create a celebratory and positive atmosphere (Curtis et al., 2012). The arts have nowadays been rediscovered as an effective medium for conveying science to the public. Evaluating existing approaches may ultimately help to establish ways to achieve more impactful outcomes, and to measure the effectiveness of arts-based science communication for raising awareness people to complex topics (Lesen et al., 2016). Evidence suggests that the arts can deeply engage people by focusing on the affective domain of learning (i.e. engagement, attitude, emotion) rather than on the cognitive domain (i.e. comprehension, application), which is often emphasized in science education (Friedman, 2013). Some affirm that, by utilizing both domains, arts-based science communication catalyses attention and creativity by encouraging intuitive thinking (Scheffer et al., 2015). Our work, in harmony and agreement with such research, combines scientific communication with arts (poetry and music), aiming to expose the public to the great richness of information and beauty represented by a landscape, and at the same time provides evidence of a methodology that can attract visitors to learn about and experience such places.

The geological literature linked to geotourism, cultural heritage, and aesthetics, has expanded greatly in the last twenty years (Reynard et al., 2007; Coratza and Panizza, 2009; Gordon, 2018; Reynard and Brilha, 2018). Recently, newer ideas have emerged about the physical landscape, not directly linked to geotourism but, as a way of transmitting science to the public in order to increase curiosity and passion that then could also drive tourism (Lanza and Negrete, 2007). The definition given by the European Landscape Convention (The landscape is part of the Earth's surface, as perceived by local people or visitors, which evolves through time as a result of being acted upon by natural forces and human beings, Council of Europe, 2000) best expresses the meaning of landscape. In fact, the concept of perception by the human community is held in high regard. But perception is different to the extent that attention is high or low, and this depends on the emotional state of the beholder and the interest he or she has for that place. Interest arises from the curiosity to know how and why that place was formed: in practice, its geological history.

The Marche is an interesting region from many points of view. The region is still unspoiled in its multiple landscape identities: wild promontories on the sea and delightful sandy beaches, rugged mountain landscapes and soft green hills, spectacular karst caves, deep gorges. This wealth is a consequence of the geological history of the Apennine chain, which has produced great contrasts of physical forms in a very limited space. A geologist who observes a landscape does not just grasp its beauty but starts a mental process that refers back to the complex mechanisms that generated and shaped it, only then to perceive its critical issues and environmental fragility. This understanding inevitably produces a personal appreciation and attachment to the place, even a love that would not otherwise be born. These places have been, since the dawn of history, sites of very important human settlements, leaving us several testimonies of great cultural interest. Around these many beautiful landscapes, it is not difficult to find places of incomparable value: towns and villages full of charm, important historic communication routes, extraordinary cultural, artistic, and architectural riches, religious places, and popular local traditions. The region has all

the requirements to make the natural environment its strong point for driving public interest, namely high biodiversity based upon microclimatic, floristic, and faunal variety. The Marche Region also saw the birth of great personalities (e.g. Raffaello Sanzio, Giacomo Leopardi, Bramante, Gioachino Rossini, Gaspare Spontini) while many others lived in or have travelled through these lands (Piero della Francesca, Leonardo da Vinci).

Nevertheless, people commonly think of the scientific approach and language as too technical, or foreign, and therefore they often instinctively reject it or fail to understand its message. Geoscientists should be encouraged to transmit their technical expertise more effectively to a non-technical audience. Some forms of communication related to art, such as poetry and music, directly address the emotional sphere and can involve people deeply. Indeed, if an observer remains open to reception, as he/she becomes engaged by the art, technical information could be communicated in a more effective way. Therefore, we have combined three different forms of communication - science, music, and poetry - to convey the history and evolution of a landscape, aware that this experience has the power to amplify the beauty of a place and the people's desire to preserve it.

2 Motivation and Objectives

The purpose of this work is to facilitate a new perception of place, beginning with its beauty but ultimately arriving at a practical knowledge of its genesis, and of its environmental problems and weaknesses, which have influenced its cultural history.

A place could have the power to attract only for its beauty, nevertheless the understanding of the geological and geomorphological mechanisms that generated it allows people to fully appreciate the fragility of such beauty. Intimate knowledge might promote the desire of the public to protect a landscape, preserving it over time. Through experience comes an awareness, a connection, and even a love for the territory. Our goal is therefore to stimulate the interest of the public about the genetic aspects of the territory, since from these characteristics derive its beauty, its history, and the culture that have developed around the place.

We apply this approach to the Marche Region, by using original poetry, and not-original music but suitable to that territory. This method is needed for the difficulty shown by people in understanding the geological mechanisms. The "reading" of the territory, in fact, is not an immediate process. People do not suspect that the shape of the landscape may be the result of a more or less slow evolution of the territory, due to the geological factors: ultimately, the geological culture is still lacking. The combination of music and poetry with the narration of the territory can lead people to discover what only an expert eye can observe.

2.1 The working method

A few years ago we created a team of five researchers-artists with different skills, called "TerreRare" (which means Rare Earth Elements but also refers to the rare lands of Italy), linked by a common interest for the territory, whose mission is to promote a deeper public awareness of the landscape. To achieve this mission, we combined three types of "language": science, music,

95 and poetry. The choice of such languages is due to our sensibility and expertise: the group, in fact, consist of two geologists, a writer/poet, a musician/musicologist, an actor and a video-maker. We have expressly chosen to begin the story on the place starting from the geological and morphological features. These last allowed us to identify the key concepts of the evolution of the places, concepts that are highlighted and translated into the poetic and musical languages. Art is able, in fact, to activate an emotional involvement which ultimately takes back to a deeper understanding of the landscape. The choice to propose

100 original poetry is due to contingent reasons, but also to the effectiveness of the message. Concerning the music, it seemed interesting to match the landscape with ancient music, realized with an instrument with an unusual timbre, the harpsichord. The team was born in 2014, when the first live event was organized. Then, we presented our idea in national and international scientific conferences (Nesci and Valentini, 2015; Valentini and Nesci, 2016; Nesci et al., 2018). The whole project took place thanks to an important regional announcement dedicated to the development of the Marche Region. It started in February 2018

105 and concluded in February 2020.
Our work follows two different routes. The first step analyses the landscape from the scientific point of view, trying to explain how it evolves and responds to changes in independent variables such as climatic and tectonic conditions. This first step is accomplished using simple scientific language, conceived for lovers of the territory of all ages and all cultural backgrounds. The geologists analyse the processes and the "forces" that have created and modified the landscape over time. For each location,

110 we indicate an itinerary with some stops, from which it is possible to enjoy particularly significant "glimpses" or panoramas, and from where we can narrate the characteristics of the landscape. We convey the knowledge that the Earth has systems, sometimes in very delicate equilibrium, that can respond in an unpredictable, complicated, and often disastrous way to the events or changes originating from geological processes such as climate changes, or human intervention. The system context allows one to perceive the potential fragility in the environment.

115 The second step is to establish a personal connection so that the public is concerned with understanding and appreciating the landscape further. In other words, we try to translate the same information but following a different, more direct emotional path. This step examines the landscape from a perspective more closely related to the visual and emotional impact that a place evokes: its history, its cultural significance, and perception of its fragility in a human context. The latter is perhaps a more abstract path and more intimate, which develops fully through the use of communication forms that exist to express human

120 feelings, that is artistic language, such as music and poetry. According with Ham (2013), the best approach is to narrate the science of landscape in a rigorous but simple way, but humanizing and associating it with the interpretation that poets and musicians can provide. The musician, through musical language, tries to reproduce, or harmonize with the emotional impact of a site by searching for a piece of ancient music composed for harpsichord. The chosen pieces of music communicate aspects of the place through the elements that belong to the musical language. The choice of the musical instrument and the historical

125 period is not accidental: the harpsichord has a punchy and gritty tone that clearly expresses the "strength" of the landscape. Early music, in addition, is aptly suited to represent natural forms whose history began millions of years ago; many late Renaissance or Baroque pieces have been composed to describe a specific situation, in fact, many pieces of music have a title. At other times, the musical form (prelude, toccata, passacaille, rondeau, variation, canon, etc.) is critical in identifying the

associations with the place. In parallel, the poet expressly dedicates verses to these places, using powerful metaphors that become a cognitive tool linking nature and thought. Everything that in the realm of geological process might be shrouded in mystery is where the poet unlocks it, makes it available, lovable and palpable through a metric balance, and studied cadences of heartbeats. Such analogies foster love for a place, even parts unknown, not only for the great scientific interest, but also for the purely poetic fascination of all the things, which emerges from the deepness of time.

The sites of the project were selected for their high inherent aesthetic value and diverse genesis and evolution, which result in very different visual impacts. Finally, for each site we suggest a section dedicated to one aspect of natural, historical or cultural interest: a proposal to know "something more" around that place.

How are all these elements communicated to the public?

The results are offered to the public through different products: an important medium is a book (Nesci and Valentini, 2019), dedicated to 20 sites in the Marche Region (central Italy). The contents of the book have been summarized and posted in a website (https://www.terreraremarche.it). The poems and the pieces of music, which can be enjoyed individually for each place, are also the soundtrack of videos that, by using beautiful images of these places, creatively interpret the science and nature through the art. These videos can be found in the website and in the DVD attached to the volume, where the book is also available in interactive form. However, above all, the results of our project are offered to the public through live events dedicated to the individual places.

2.2 Live events

 The most effective and engaging communicative method of our work is through live events. Since the beginning of this project, we planned to address the public directly through shows of about one hour and half, that combine scientific communication (always by means of simple and popular language) with the reading of poems and the performance of musical pieces. The project, as described above, includes 20 sites from the region, but the shows were dedicated only to five or six of them, usually those closest to the place where the live event took place. The events are structured in two parts: the first is carried out by means of verbal communication, with the employment of figures, sketch and schemes, trying to communicate the geological genesis and the geomorphological evolution of the places. It is not an academic lesson, rather the speaker uses a conversational language to involve the public, focusing on the most interesting aspect of the genesis, and investigating how the morphology of the landscape has influenced the history and culture of the place. The speaker guides the public and identifies some key words for the place. These key words represent the link between the science, the music and the poetry. The speaker, at the end of this part, encourages questions from the public. The second part of the events is a performance *sensu strictu*: the actor and the musician are on a different plain with respect to the public and there is no interaction among the performers and the public until the end of the performance. The lights are softened, and the shows develop. The performances are conducted in front of a large screen with projections of images and videos of the places: the result is a total emotional immersion of the public in the place. Up to now, we have organized about ten live events, all in central Italy, always involving intimate and attractive places with acoustic features suitable to the kind of the music (ancient, by using the harpsichord). Among these

locations, the most suggestive were probably the church of S. Maria in the charming bay of Portonovo (Ancona), one of the most spectacular examples of Romanic architecture of central Italy; the theatre of the prominent Renaissance Fortress of Sassocorvaro (PU); the "Sala del Maniscalco", part of the magnificent Ducal Palace of Urbino (PU). We are also planning outdoors events, but they have not yet been realized. Moreover, we hope to organize more events outside of the Marche Region and also from elsewhere in Italy, with the aim to attract people in a territory that still has a great development potential, and is still uncontaminated and rich in nature, culture and traditions.

2.3 Experience with the public

In the events, we always distribute a program of the show, indicating the localities that we are going to illustrate, the text of the poems and a track about the pieces of music chosen for each site; also, we add our contacts in the program. Until now, we never performed an evaluation of our method. Our experience, therefore, is based on the direct feedback from the public: the evidence of interest shown, the questions we are asked there, the requests for further information we receive by email, the interest shown in the YouTube channel (about 27,000 views in the whole project) and in social media (871 followers on Facebook). The involvement of the public during the shows was always very high, and the number of participants was also satisfactory, even if it is difficult to quantify these factors, because they depends from several variables (e.g. the advertising before the event, the season and the weather, the beauty of the place and how difficult it is to reach). Is also important the capacity of the performance hall and the context of the event (if it is, or not, linked to a group of events organized that day in the place). We underline that the project is now at a crucial point: we have concluded the book in February 2020 and we are still improving the web site. This material represents a fundamental phase in the diffusion of the project. The project is still young; it was concluded in full Covid-19 time. This event was responsible of the lack of opportunities to present and promote the project. The collection of data on the response of the public will represent a good opportunity to test the effectiveness of the method. In the long run, it would be interesting to understand how effective the methodology is, to make people fall in love with places and trigger virtuous behaviour in defence of the landscape. A questionnaire, to the participants at the shows or to the visitors of the places, will be proposed in the web site. Now, we have the material to propose and deliver public events and collect the responses of the participants. We have not done performances in educational contexts (schools and museums), but the presence of students of different ages at the shows encourages us to move in this direction also. Our events are addressed to a general public of all ages and cultures, an assorted and wide audience, people interested in the territory, or in the poetry or in the ancient music. Although the live event was not conceived for an audience of scientists, we proposed it as a cultural event linked to a scientific meeting of geomorphologists, which took place in the Ducal Palace of Urbino (Marche Region). The show resulted in a large participation and enthusiasm of the scientists.

Perhaps, the most satisfying result are those participants who show interest in the landscape evolution and consequently, the history of human settlements and culture because they realize that we have described their place in the story. According with Strauss (1996), these are the keys to connecting the listener. We make the learning a part of their journey, to take them to a place they recognize as their own, and to suggest that they have a role in the future of the landscape.

195 Among the many amazing landscapes of Italy we focus on three case studies from the Marche Region (Fig. 1): "The sea-cliff of San Bartolo", "The flatiron of Mount Petrano" and "The fault of Mount Vettore".

3.1 The sea-cliff of San Bartolo

3.1.1 The geology

The northernmost sector of the Marche Region is characterized by a high and rocky coast that interrupts the continuity of
200   beaches that fringe the Adriatic Sea south of Trieste. The sea-cliff of Mount San Bartolo (Fig. 2) is more than 200 m high and represents the outermost ridge of the Apennine chain, which extends to the Adriatic Sea. The natural beauty of Mount San Bartolo makes it home to a natural park very popular with tourists during the summer season (Savelli et al., 2017). The outcropping late Miocene rock formations are represented by marls, marly limestones, dark mudstones and bedded sandstones and marls. The small and sporadic pebbly beaches that protect the base of the cliff and the less protected rocky ridges are both
205   eroded by sea waves during the strongest storms (Fig. 3). For this reason, but also because of the easily erodible lithology and the fracturing of the rocks, the slope facing the sea is affected by extensive landslides that endanger the overlying villages of Gabicce Monte, Casteldimezzo, Fiorenzuola di Focara, Santa Marina, and all of the panoramic road (Fig. 4). The anthropic causes of the instability of the mountain are superimposed on the natural ones: in fact, human activity has intervened heavily and disturbed the natural balance, accelerating erosional processes. One of the most important causes of coastal erosion is the
210   decrease in the sedimentary contribution by the rivers, which flow southeast of the relief. The sediment load of these rivers, in fact, contributes to feeding the Pesaro beaches as the coastal currents transport the sediment to the north. The movement of solid matter in rivers has significantly decreased due to the construction of dams on rivers and due to the extraction of aggregates from the riverbeds (Colantoni et al., 2004). To stop the advance of the sea and reduce the risk of landslides, several barriers have been built which, while slowing down the process, have not solved the problem of the erosion of the cliff face,
215   and they corrupt its wild beauty. The response of the coastal system has been the unnatural formation of sandy beaches between the cliffs and the shoreline, due to the triggering of complex refraction and diffraction processes of the wave motion on the breakwater structures, which also determines dangerous coastal currents. The retreat of this stretch of coast has been fast and discontinuous during the Holocene (the last 11,000 years) and the shoreline has changed continuously over time. The paleo-coasts are now erased even though there is unmistakable geomorphological evidence of their existence in seaward locations
220   of the submerged beach. Geomorphological data testify that about 6000 years ago, the position of the paleo-coast compared to the current one was advanced by about 2 km and the relief of San Bartolo was much more extensive and stretched out towards the sea (Nesci, 2003).

Here we propose a geo-trail that leads from Fiorenzuola di Focara, an ancient village balanced on the cliff (Fig. 5, stop 1), to the beach below. Along the path, the thick and dense sequence of marly and clayey layers of Mount San Bartolo can be
225   observed and the precariousness of the rock-wall on which the village rests is perceived (Fig. 5, stop 2).

How to communicate the peculiarities of this landscape through poetry and music? Our main objective was to identify a key to interpretation and some key words, which synthetize the main genetic as well the process mechanisms: stratification, balance, fragility.

3.1.2 The Poem

230 The title "Up / Down / Fragile" recalls the "handle with care" written on the packaging of fragile objects. In a sense, Mount San Bartolo should not exist, so much is the stress placed on it as it undergoes a continuous consumption by erosion, of human development, and of economic profit. Yet in the moment, it remains in perfect balance just by virtue of its beauty. The visual (color), olfactory (scent) and physical (sky and sea) balance is represented by the warmer and motionless hour of the summer season ("hour without a shadow"). To balance the Mount is the set of ecstatic visions and love that history, despite everything,

235 offers. Appreciate this beauty says the poet, for it is fragile. Below is the poetry in the original language and its translation.

Alto/basso/fragile

Oblio di un'ora senz'ombra
     Occhio distratto alla Storia
         Dove per eritemi ed ustioni

240   Per strappi graffi ulcerazioni
              Oltre /memorie/ di imboscamento
              cede finalmente la mano
           (al tuo) essere nonostante
         (al tuo) essere sacro Monte

245   inspiegabilmente te-stesso testimone
del tuo esistere per sottrazione

          In questo tuo
     ALTO   BASSO

250   FRAGILE

Dove ogni strategia umana
     Mai è apparsa così vana
        È vanità di utilissimo umano andare

255   Di avido & arido e vacanze week end e utilitarie
           È il brusìo giallo delle tue ginestre
             Impossibili a categorizzare

E poi tu

dispendioso

260   ancora tu o Monte

orsù (scendi) è ora di andare

sù sù Monte è la tua ora

è una questione tra te e il mare.

Up/down/fragile

265 Now is the time:

forget your shadow

steal your eye away from History

sneak through scalds and burns

snatches and drills then overturn

270   where are your /memories/ ambushing

surrender at last

(to you) being despite

(to you) Holy Mountain

unexplainably yourself

275 witness of your existence by abstraction

This is you:

UP   DOWN

FRAGILE

280

just where each human strategy game

never has been so vain

vain is the valuable man

vain is the eager vain is the barren

285   vain's out for the weekend on a cheap city car

But there: the never classified

whispering of your brooms

And then you

lavish

290 you again Mountain

come on (come down) we must try to go right now

hurry up, Mountain, it's time

the matter's between you and the sea somehow

3.1.3 The Music

295   The piece of music selected to represent this site is the Passacaille from Suite VII in G minor HWV 432, by George Friedrich Händel (1685-1759). The Passacaille is a folk dance of Spanish origin and summarizes in its main structure the morphological appearance of the San Bartolo cliff and, besides, the poetic interpretation by the writer of the poem. The Passacaille, indeed, is made up of variations on a ground bass; the same sequence proposed in a varied repetition, following accurate rules of composition. That is exactly like the repetition of the layers on the cliff: layers that are in balance, although at times surprisingly

300   unstable. This piece of music is bright and overwhelming, as the San Bartolo cliffs are an explosion of colours and vitality. In the last variations, there are several repeated arpeggios, like a series of sea waves on the cliff (https://youtu.be/-2a4i6iOGE0).

3.2 The flatiron of Mount Petrano

3.2.1 The geology

Mount Petrano has an elevation of 1162 m, which stands out in the landscape for its characteristic flattened top visible even

305   from long distances. The gorges of the Burano and Bosso streams, which cross the mountain ridge transversely (Fig. 6), separate Mount Petrano from Mount Catria to the south and Mount Nerone to the north. The panorama that can be enjoyed from Mount Petrano embraces a large territory offering spectacular views of the major peaks around it, and across the whole Province of Pesaro and Urbino, up to the Republic of San Marino and the Adriatic Sea. The relief constitutes a beautiful example of an anticlinal ridge (Nesci et al., 2005). Anticlines are one type of folded rock layers, formed by compressive forces

310   that act slowly over a very long time period. But folded rocks are intriguing, hard to imagine and yet there they are, in plain sight. The morphology of Mount Petrano perfectly follows the wide anticline, and no tectonic dislocation seems to disturb the simple regularity of the fold (Fig. 7), exposing the anticline in its full and awesome natural wonder. Then too, the sedimentary rocks that outcrop in the ridge are alternately more or less erodible. The large smooth and almost flat upper surface consists of carbonate rocks of the Maiolica Formation, highly resistant to degradation. The rocks of the Marne a Fucoidi Formation, which

315   rests on the Maiolica Formation, are more degradable, being formed by marl and clays. The rocks above are again more resistant, comprising Scaglia Bianca and Rossa hard limestones (Alvarez, 2019). The selective erosion caused by run-off waters promotes the formation of the so-called "flatirons" which are subtriangular prismatic forms that recall the tip of an iron, from which their name derives. The observation of these spectacular forms is almost like being inside a natural laboratory, where the public gets to observe folded rock formed underground, somehow raised to the surface, and then sculpted by streams

320   on the surface. The scale is overwhelming, the forces involved immense, and the resulting landscape is a work of art. The streams running down the mountain from the flat top of Mount Petrano follow paths related by the degree of erodibility and

fracturing of the rocks, finally producing these characteristic morphologies. The flatirons are very well exposed on the sides of Mount Petrano, even if they represent forms that are quite common to other anticline ridges of the Apennines; the most significant in this area is the one called "La Roccaccia" (Fig. 8). At this feature is genetically linked the small relief of "La Rocchetta" (1163 m), which rises above the structural surface of Mount Petrano (Fig. 7). This little hill represents a remnant of the ancient structure removed by the erosion.

For this site, we propose a route at the top of the Mount Petrano (Fig. 9). The path surrounds the hill of "La Rocchetta" and allows the visitor to climb to the top of this hill. From there the visitor can benefit from an impressive 360-degree panoramic view over much of the northern Marche Region and part of the Umbria Region (Stop 1). Finally, reaching stop 2 the visitor can observe, in all its magnificence, "La Roccaccia" flatiron.

Again, the same question. How to communicate the characteristics of this place through art? Here, the interpretation key words chosen to communicate the place through poetry and music were selective erosion, geometric shapes, childhood games.

3.2.2 The poem

The vision of pointed shapes on a plain dotted with lawns and flowers remembers one-day holiday, and cries of children playing and drawing. On joyful suspension of play, the reality, far away and top view, burns and disappears in the flames.

Picnic

Felice di accettare l'invito
<p style="text-align:center">a nozze</p>
<p style="text-align:center">a tempo</p>
<p style="text-align:center">a luogo</p>
per la casetta di fata di fiaba ^
felice convito sul tetto ^
<p style="text-align:center">partita</p>
<p style="text-align:center">pic-nic</p>
<p style="text-align:center">ovetto sgusciato di nuovo</p>

<p style="text-align:center">*«Mentre dall'alto possiamo ammirare*</p>
<p style="text-align:center">*il moderno complesso andare in fumo»*</p>

<p style="text-align:center">_ _ _ _ _ _ _ _ _ _ _</p>

Picnic

I revel in coming here
<p style="text-align:center">on time</p>

on place

a fairy tale hut ^

355   the merriest banquet up on the roof ^

scrimmage

picnic

wriggling by this little lovely egg

360   *"While down there we can admire*

the modern complex caught by fire"

_ _ _ _ _ _ _ _ _ _ _

3.2.3 The music

The music selected was Twelve Variations in C major on the theme "Ah, vous dirai-je, Maman" KV 265, which is a keyboard
365   composition by Wolfgang Amadeus Mozart (1756-1791), published in Vienna in 1785 and probably composed when he was
around 25 years old (1781 or 1782). This piece consists of 13 sections: the first one is the theme, the French folk song "Ah!
vous dirai-je, maman". This French melody first appeared in 1761, and has been used for many children's songs, such as
"Twinkle, Twinkle, Little Star", "Baa, Baa, Black Sheep" and the "Alphabet Song". This traditional piece deeply fascinated
Mozart, who took up the theme in a playful composition. The following twelve variations (in rhythm, harmony, and texture)
370   are developed in a very simple way, to produce funny transformations that gradually articulate the starting melody, like several
pieces of a children's game. The simplicity of this paradigmatic example of musical variation reflects effectively the idea of
geometric shapes in childish drawings, or a toy of building blocks (https://youtu.be/RYS5-25rulk).

3.3 The fault system of Mount Vettore

3.3.1 The geology

375   Central Italy was struck by strong earthquakes in 2016 (Aringoli et al., 2016). On August 24, a magnitude 6.1 event shook the
area between Marche, Lazio, and Umbria, devastating the villages of Accumoli, Amatrice (Rieti), Arquata del Tronto and
Pescara del Tronto (Ascoli Piceno, Fig. 10). A second quake occurred on October 26 with magnitude 5.9 and epicentre between
Mount Cardosa, Castel-Santangelo sul Nera, Ussita and Visso (Macerata). Four days later, on October 30, an even larger event
(magnitude 6.5) destroyed the town of Norcia (Perugia). With the choice of this site, we wanted to instil a "beauty shock" to
380   infuse positive energy, break the darkness of destruction, and rekindle the life and creativity in a land rich in geological heritage
and artistic masterpieces.
The Castelluccio di Norcia basin is a closed depression of over 12 km in length and 8 km in width, located in the southern part
of the Umbria-Marche Apennines and surrounded by an uninterrupted mountain ring. It consists of three closed plains: Pian

Grande, Pian Piccolo and Pian Perduto. The Pian Grande (Fig. 11), 5 km long in the N-S direction and 2 km wide, is the largest and most spectacular one, and it is located to the west of the alignment of Mount Vettore – Mount Priora.

To comprehend the genesis of this area, it is necessary to understand the formation of the Apennine chain that consists of a compressive thrust system towards the Adriatic Sea. Toward the Tyrrhenian side, in the innermost part of the Apennine compressional system, an extensional zone occurs. Just in this sector, large and elongated intermontane plains have formed, which are bordered by complex systems of normal faults and fractures. Imagine a bulldozer that shoved layers of the upper crust and then when it stopped pushing, some of those layers started to slide backwards. But there was no bulldozer, just an Earth system, evolving, whether you are watching it or not. And yet you can't avoid "hearing" this evolving process, because you can still feel the rumble of this process which we call earthquakes. Our site captures a moment in this process.

The Castelluccio plain was not always a closed depression; in fact during the Middle Pliocene - Lower Pleistocene (~3.3-0.7 Ma) the subtropical humid conditions created a landscape with low-energy relief, a large paleo-surface. The subsequent distensional tectonic phase characterized by the reactivation of normal fault systems with NNW-SSE trend and by intense uplift of the area, has strongly disrupted the paleosurface preserving it only in reduced fragments in the ridges. These processes interrupted and disarticulated the previous landscape, forming a series of tectonic depressions that characterize the whole Apennine area. A bundle of Quaternary faults of Mount Vettore - Mount Bove to the east and of Mount Castello - Mount Cardoca to the west surrounds the depression of Castelluccio. This depression is related to an extension direction, oriented N-S, which led to an oblique movement along the main border faults, and to the development of the tectonic depression of Pian Grande (Passeri, 1994).

Starting from the end of the Middle Pleistocene (~0.7 Ma), the depressions were filled with debris deposited by streams flowing off the adjacent slopes. The debris originated from glacial and periglacial processes as evidenced from the presence of large cirques and glacio-nival niches in the surrounding areas. The flat surface of the Pian Grande is affected by sinkholes in which the surface waters are dispersed at depth (Aringoli et al., 2018).

To the east of the plain stands Mount Vettore which, with its 2476 m height, is the major topographic feature in the whole Marche Region. Even the most inexperienced eyes cannot miss the large scar that cuts the mountain (Fig. 12), the normal fault that displaces the Sibillini's Thrust. This fault appears in all its greatness at the base of the Aquila rock, consisting of massive limestone. Other faults are less visible, for example, the huge fault at the base of the mountain associated with the formation of the plain and many fractures scattered on the side. The whole slope is strongly deformed by landslides, both deep and superficial, and by some fractures reactivated by the earthquake.

Mount Vettore represents one of the most popular destinations for excursions in the Marche Region. The proposed route, (Fig. 13), starting from "Forca di Presta" (1550 m) until crossing the fault of Mount Vettore, can be, for trained and experienced walkers, only the first part of the longest and most difficult itinerary that leads to the top of Mount Vettore (2476 m) or to the beautiful Lake of Pilato (1941 m). The route is always well signposted; the difficulty is medium, due to the steepness of the slope and the coarse gravel on which it is not easy to walk. Enjoy the magnificent view of the Castelluccio Plain at Stop 1, and then continue towards the top of Mount Vettoretto (2032 m). After about an hour of ascent, the fault of Mount Vettore appears

impressive, on the left. The fault plain is clearly visible, exposed for about 2.5 meters (Fig. 14). A little higher up, the route crosses a series of fractures resulting from the 2016 earthquake, some of which form open ground fractures 30-40 cm wide (Fig. 15).

Here, the interpretation key words chosen to communicate the main characteristics of this place through poetry and music are; fault system, readjustment, and balance.

3.3.2 The poem

The spectacle of the suspended mountain, in precarious balance, captures the attention and forces you to breathe with your gaze turned upwards, with an apparently unnatural rhythm. The natural cycle of nature tends to the "horizontal world", but some events are opposed, and this creates tension, even emotional. Reading backwards from the last verse to the title of the poem emphasizes this "return and stay" and accompanies the gaze and the contemplation.

Funambolo

ansioso
all'altrui sguardo
appeso unicamente
torni e resti,
in perenne squilibrio
tu come me
monte funambolo,
vorrei raggiungerti
Nel tuo regno orizzontale

Tightrope walker

anxious gaze
to another Man's
hung
you go back and stay,
in everlasting imbalance
you, just like me
tightrope walker Mount,
I would like to join you
In your horizontal kingdom

3.3.3 The music

The music selected is Johann Sebastian Bach (1685-1750) - *Canone per Augmentationem in Contrario Motu* (from *L'Arte della Fuga* BWV 1080). The basic principle of the canon is the imitation. In the canon, a melody is faithfully repeated by the various voices in regular succession. An elementary example, well known to all, is Fra' Martino campanaro (Brother Martin), whose melody is always the same, repeated in the other voices in subsequent times. That is the case of a canon in unison, while more interesting is when the main motif is repeated at different heights from the initial one. The movement of the main voice is "the law", and is repeated in the other voices, at different heights, or reversed (retrograde canon), at the mirror (inverse canon) or with different rhythmic measures (mensuration canon). The absolute summit in the construction of the most complicated canon compositions belongs to Johann Sebastian Bach. In his masterpieces *L'Offerta musicale* and *L'Arte della fuga*, the most interesting examples appear: infinite, retrograde, inverse, retrograde-inverse, mensuration and enigmatic canons. The *Canone per Augmentationem in Contrario Motu* is a perpetual canon with two voices where the second voice repeats (at the lower fourth) the same melody but exposed for opposite motion (specular) and with notes of doubled value.

As in the canon's repetition of melody in various voices, in a fault system the movement is followed by readjustment along the various faults in the surrounding area. The analogy among the mechanisms of the canon and this fault system is very strong: it is a wide, intermountain basin, delimited by several faults, mostly distensional, with different orientations but strongly linked together. The fault of Mount Vettore is there, the principle melody, concrete and clearly visible. To its movement, the whole system reacts accordingly, until reaching new equilibrium (https://youtu.be/nXZGPwJDdAc).

4 Discussion and Conclusions

This work presents a multidisciplinary and interactive method, which seeks to promote the communication of rigorous and complex scientific content, related to the geological genesis and the evolution of a landscape, through art forms such as poetry and music. Art has a great power in-and-of-itself and provides a powerful means to communicate specific subjects, an opportunity not to be overlooked. By addressing the emotional sphere, art manages to engage the observer in a profound and passionate way. Based on studies of cognitive and social psychology (Ham, 2013) the communication of information of any nature through the emotional sphere is recognized to be much more effective than traditional communication methods. Our experience confirms this effectiveness evidenced by the presence of a very large and varied audience, mostly without a scientific background, at our live shows indicated a great interest in the origins of the landscape. We believe that the narrating of the landscape with art creates a personal relationship with the audience consistent with other studies (Strauss, 1996). The published volume, the DVD with the same contents of the book in interactive form, and the material posted on the web site, represent an important milestone of the project. The next one, probably within one year, will be to evaluate the response of the public with reference to these different communicative methods.

This work proposes short real or virtual trips to the Marche Region: it is possible to go to places, follow paths and stop there to listen to the piece of music, read and listen to poetry. Alternatively, you can follow the route from home, using the virtual

480 mode, listening to music and poetry while watching the videos of the places. It is possible to visit the website, where the contents of the book are summarized; one can participate in live shows, periodically organized in various locations, within and outside the study region (the site contains information on the dates and places of the shows). The performances are organized following the multidisciplinary communication method described above, combining science, projections of images and videos, recitation of poems and live musical performances (Fig. 16), with the aim of generating an emotional fusion that introduces

485 the public in the strongest and most engaging way to the wonders that our land offers. The aim of this project is not to provide yet another guide to visiting a beautiful region. The project is in fact much more ambitious, since it wishes to stimulate love for the territory through knowing it, in its formative and evolutionary mechanisms. From this knowledge, indeed, it is possible to understand how nature, human settlements, history, culture and the traditions of a place have developed. This method addresses the curious, the lovers of the territory and art, those who want to get to know "the place" in all its aspects. People

490 of all ages and backgrounds can participate in this experience, to stimulate in them an awareness of which cultural heritage the landscape represents, with the aim of increasing their desire to understand the fragility of the territory to finally stimulate the protection and conservation of this heritage. The landscape must be understood to be loved and protected. We have the scientific responsibility for the conservation of the priceless landscape heritage of our Earth for future generations.

Author contribution

495 The authors contributed equally to the research and writing of the manuscript.

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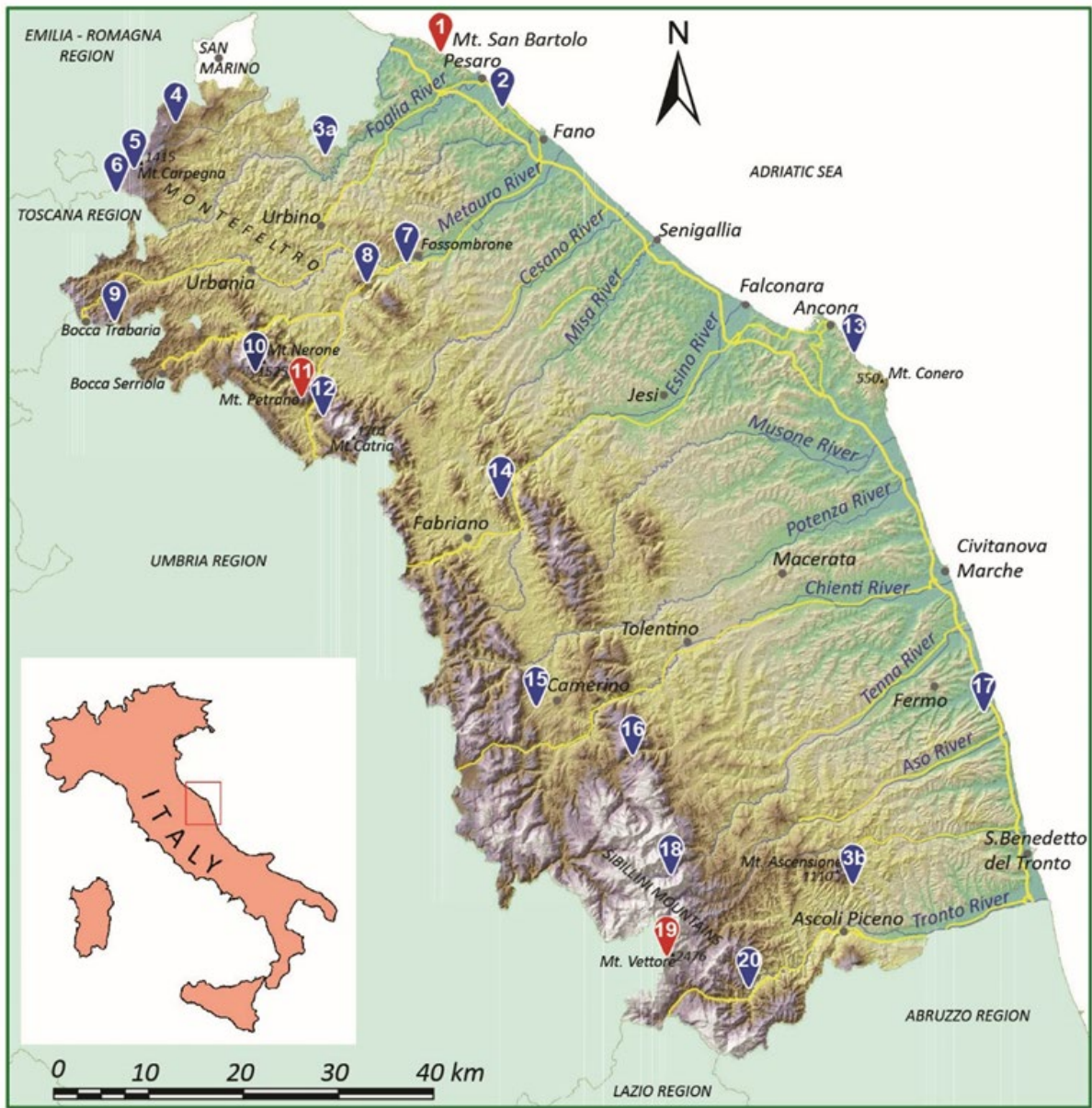
Figure 1: Digital elevation model of the Marche Region with the sites involved in the Project. In red the three case studies analysed in this paper. ©2020 Marche Region.

Figure 2: Panoramic view of Mount San Bartolo. The orientation of the cliff is NW-SE. In the background, towards SE, the harbour pier of Pesaro town.

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Figure 3: Two stretches of the San Bartolo cliff showing the pebbly beach in the northernmost sector (A) and the substrate eroded by the storm waves in southernmost one (B).

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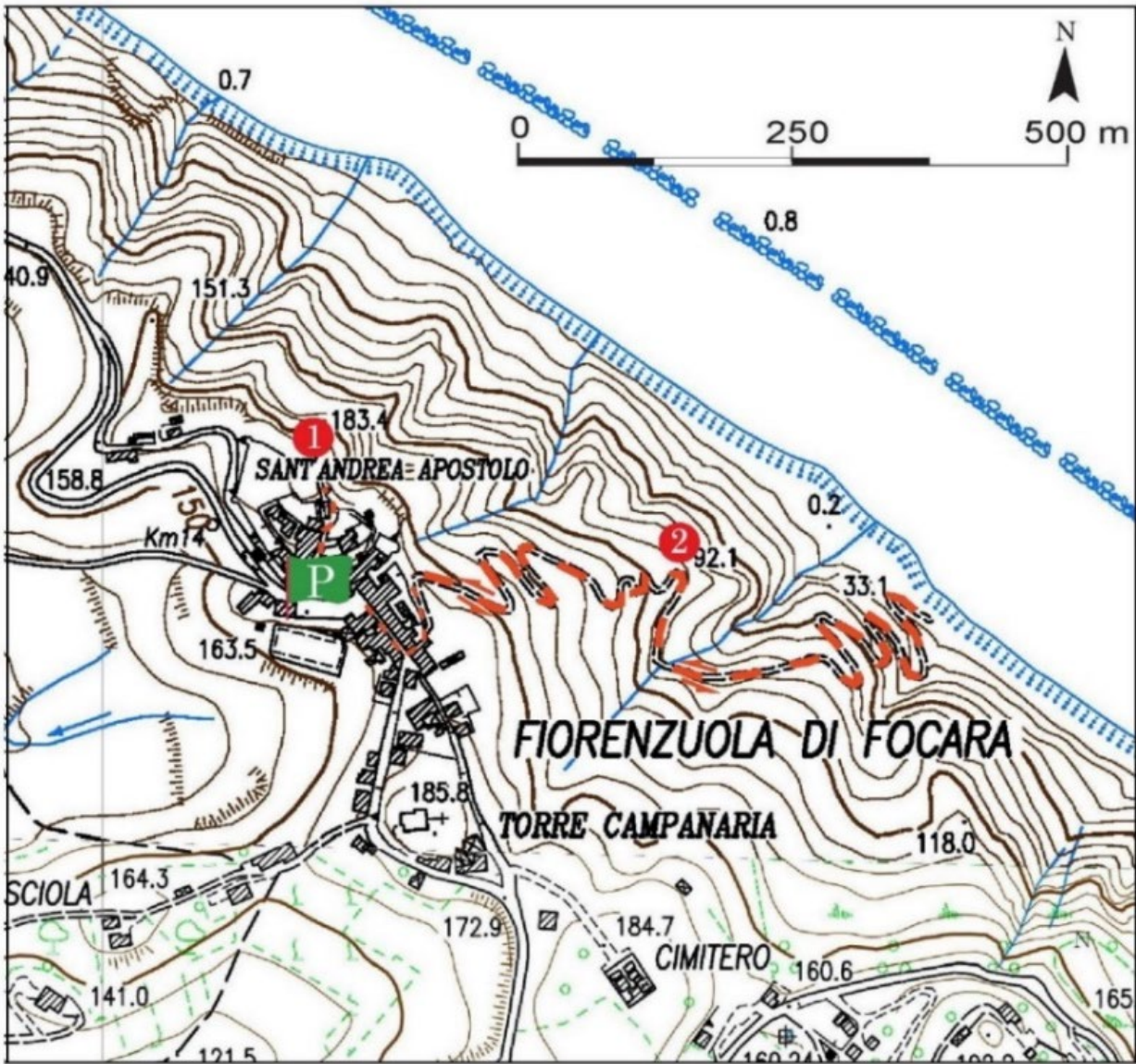
Figure 4: Panoramic view of the active cliffs of Mount San Bartolo. The cliff is oriented NW (on the right) – SE (on the left); the small village of Fiorenzuola di Focara (on the top of the cliff) is 177 m asl. The arrows indicate the landslide scarps.

595 **Figure 5: The proposed itinerary starting from Fiorenzuola di Focara to the beach below. P = parking area; 1 and 2 = stop. ©2020 Marche Region.**

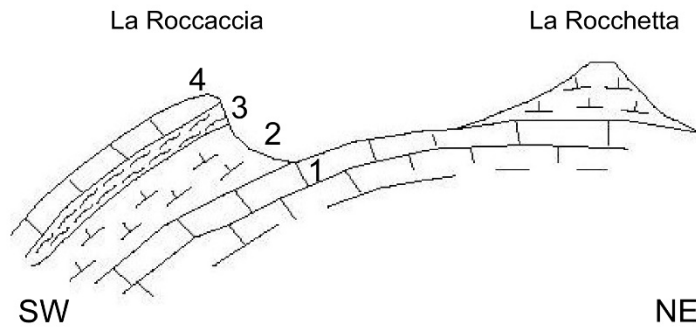
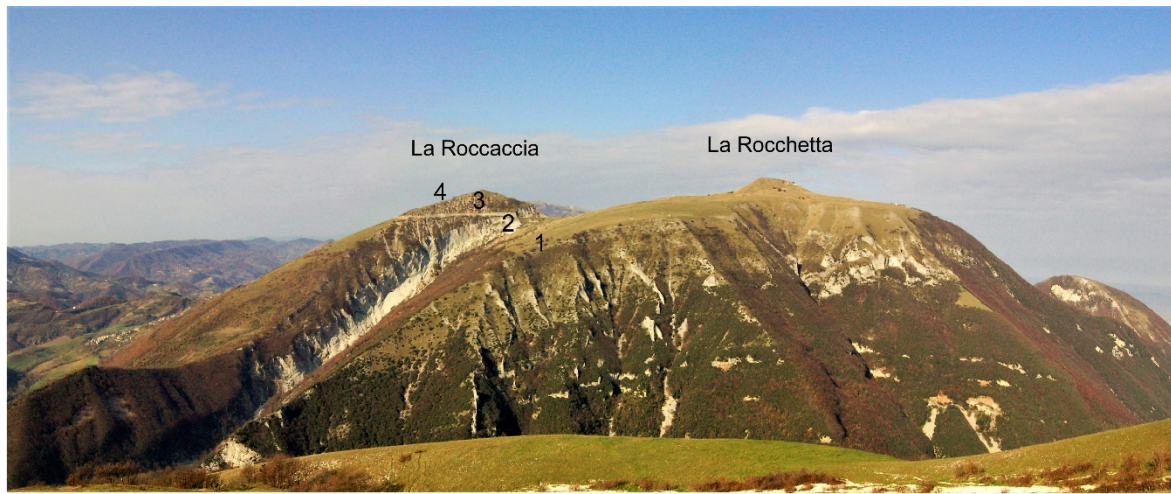
Figure 6: The Mount Catria-Mount Nerone anticline ridge (oriented NW-SE), view from the Mount Nerone (NW). A = Mount Petrano (1162 m), B = Catria Massif (1701 m).

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Figure 7: Panoramic view of the Mount Petrano (1162 m) anticline and illustrative sketch of the geomorphological features caused by selective erosion. 1. Maiolica Fm.; 2. Marne a Fucoidi Fm.; 3. Scaglia Bianca Fm.; 4. Scaglia Rossa Fm.; bottom right: aerial view of "La Roccaccia" (1065 m) Flatiron (Map data ©2018 Google).

605 **Figure 8: "La Roccaccia" flatiron (1065 m); view from "La Rocchetta".**
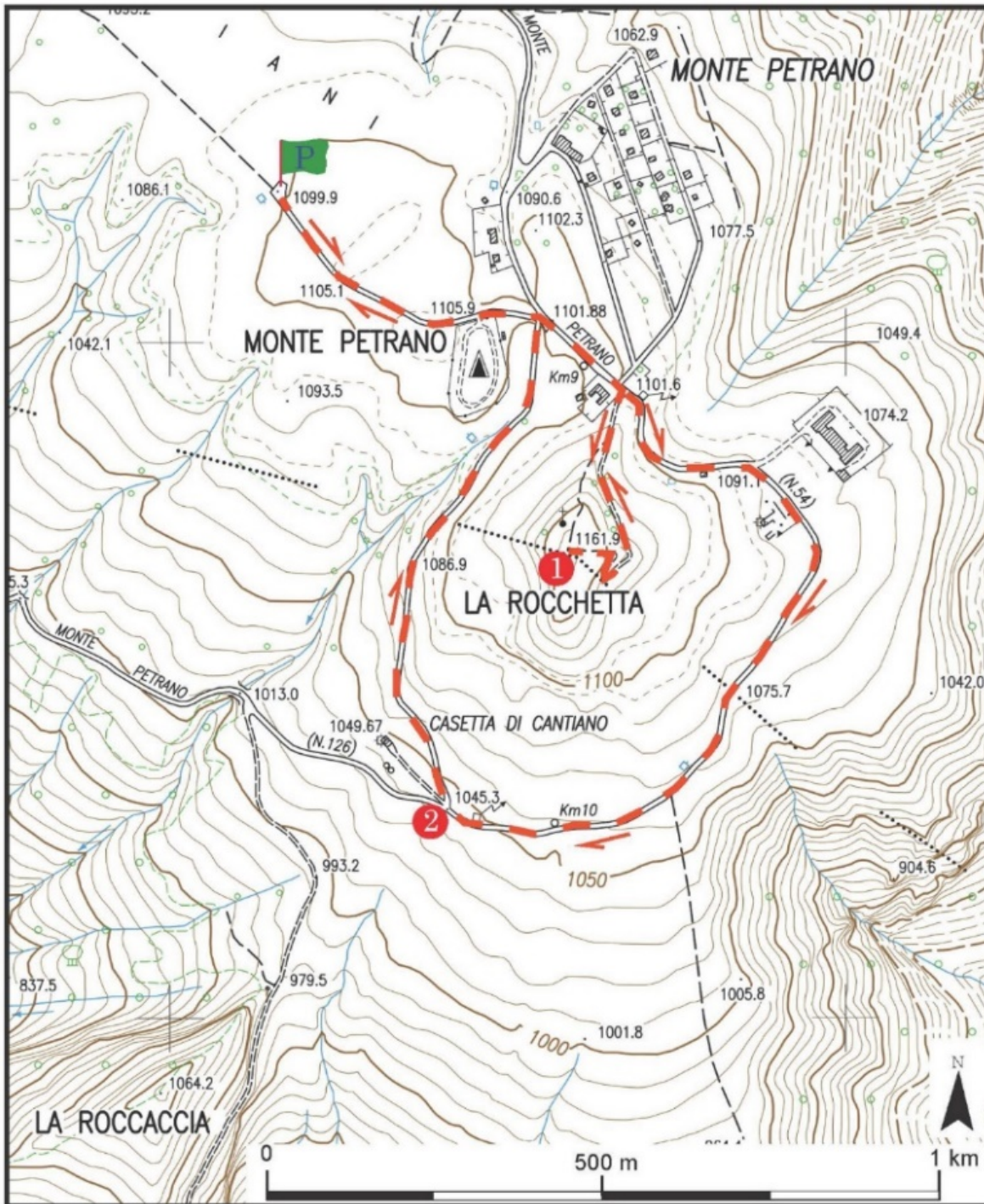
Figure 9: The proposed itinerary at the top of Mount Petrano. P = parking area; 1 and 2 = stop. ©2020 Marche Region.

Figure 10: The town of Pescara del Tronto razed by the earthquake of 24 August 2016.

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Figure 11: View of Pian Grande. The plain has N-S direction and mean elevation of 1300 m.

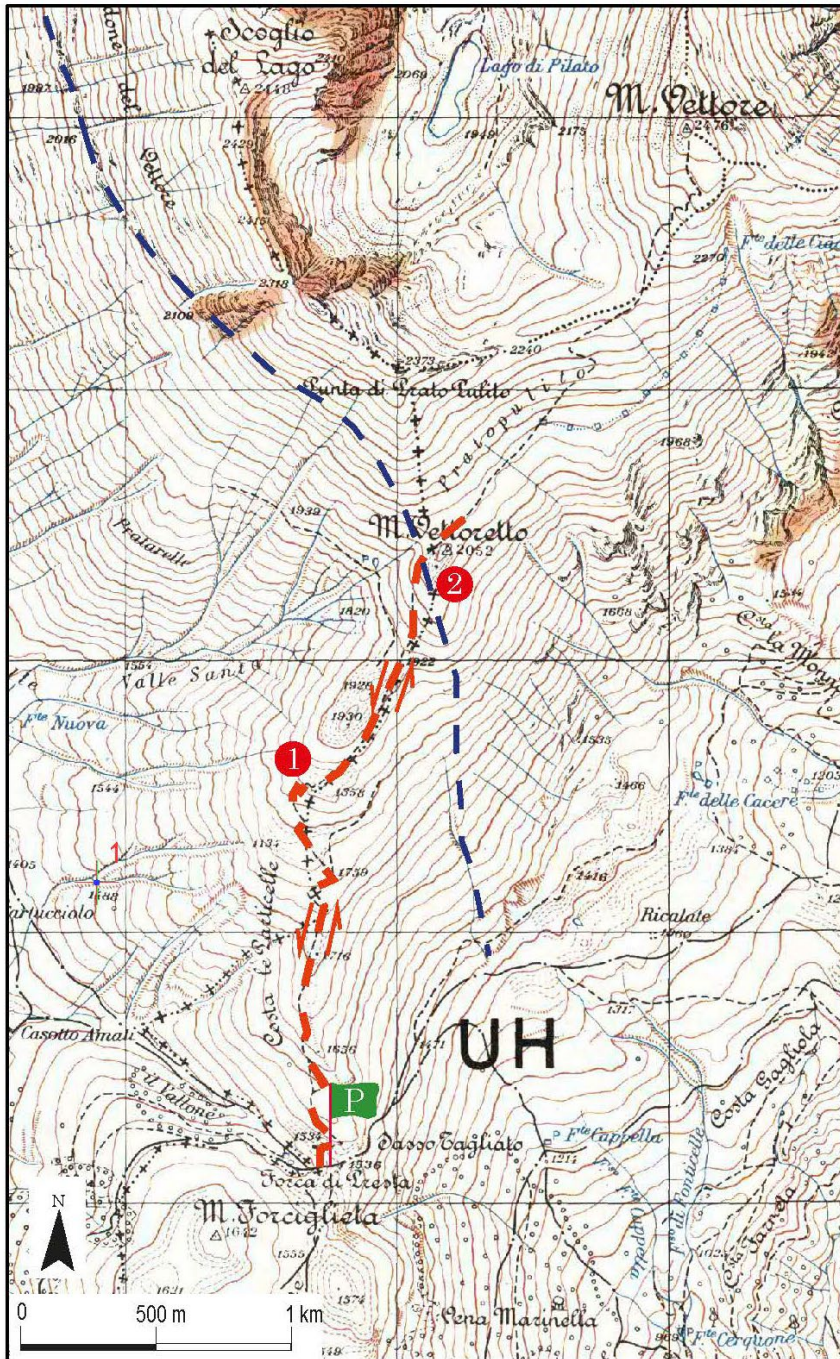
Figure 12: Vettore Massif (2476 m) in a view from S-W: the fault (A; Corniola Fm.) at the base of L'Aquila rock (B; Calcare Massiccio Fm.).

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Figure 13: The proposed itinerary crossing the fault plain at the southwestern side of Mount Vettore. P = parking area; 1 and 2 = stop. Blu dashed line = the fault. ©2020 Marche Region.

Figure 14: The fault plain (NNW-SSE) exposed for about 2.5 m and visible in the southwestern side of Mount Vettore.

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Figure 15: Some fractures (NNW-SSE) related to the 2016 earthquake. They are about 40 cm wide, located on debris in the southern side of Mount Vettore.

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Figure 16: Live show in the theatre of the prominent Renaissance Fortress of Sassocorvaro (PU).