

# Strength and Weakness in Geotourism: The case study of Irpinia (Campania, Italy)

Russo Filippo, Sisto Michele, Magliulo Paolo & Valente Alessio

Dipartimento di Scienze e Tecnologie, Università degli Studi del Sannio (Benevento)

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## Abstract

*The territory of Irpinia (Campania, Italy) has been largely preserved by the “Great Transformation” of the territory followed by the Second World War. Its environmental peculiarities and its historical-cultural aspects have integrated into the landscape; therefore they represent attractive places for the new directions of environmental and cultural tourism. The advantages derive from the proximity to the coast of Campania, where the global value of tourist attractions has been known for centuries. The strengths of these internal areas of our peninsula are represented by the numerous places capable of divulging the “geological culture” and therefore to highlight how around them have developed stories, cultures and traditions of quality. However, there are weaknesses in the conservation and uses by tourists of these areas, as highlighted by the spread of certain geological and geomorphological hazards (landslides, floods, fumes, etc.). Geotourism would, therefore, be fundamental to recall the public interest on this internal area of Campania and to encourage protection and enhancement initiatives.*

## Introduction

In Italy, tourism is an important part of the economy, accounting for more than 13% of GDP, as reported for the year 2017 by the World Travel and Tourism Council, which analyses the economic impact of the travel and tourism sector in the world and in the individual countries (WTTC, 2018). Statistical data show an increase both in the presence in the hospitality establishments and in the arrivals in our peninsula with rates higher than the European average.

The southern regions, even if they are not yet in the very first places, show substantial increases in terms of presences, which in any case in the northern regions still absorb the majority (Veneto: 16.5%, Trentino Alto Adige: 11.9%, Tuscany: 10.9 %). Considering the revenue left on the territory by the tourists, instead, Campania succeeds among all those of the south in attracting a meaningful percentage that immediately puts it behind the Lazio, the Lombardy, Veneto, and Tuscany (ISTAT, 2018). Even going back in time the economic value of tourism in Campania and its provinces has always been fundamental, even if the statistics show that it is concentrated almost exclusively in coastal areas. In these areas, the tourist flows prefer not only the holidays at sea (Cilentan coast, Ischia Island, Capri Island and Sorrento Peninsula), the archaeological sites (Pompeii, Paestum, Herculaneum) and

the cities of art (Naples with its museums and palaces, the Royal Palace of Caserta) (MiBAC, 2018). Each of these places, today chosen by the majority of tourists, both Italian and foreign, presents a seductive and sometimes almost uncontaminated landscape, or a geological context, unique and characteristic, like that of the Campania volcanoes (Vesuvius in the Campania coast, Mount Epomeo in Ischia, Campi Flegrei in Pozzuoli) or that of the coasts with its many evocative forms (the limestone cliffs of Capri, the terraces of the Sorrento Peninsula, the caves of Palinuro in the southern Cilento). These choices testify to the approach of tourism toward new categories of value, such as the natural environment and culture. Through them the experience lived by the tourist can contribute to increasing his “sense of attachment” towards the place visited or the appropriation of the “identifying products and/or attributes” of that territory (Gross & Brown, 2008). This includes the flourishing development of cultural tourism and its varieties (sustainable tourism, ecotourism, geotourism, eno-gastronomic tourism, etc.), which as shown in various surveys conducted on samples of tourists from Veneto, Tuscany and Puglia, is associated to cultural heritage as well as to more identity-naturalistic aspects (trekking, crafts, wine and food production, etc.) (MiBAC, 2010). In this

direction, it is possible to consistently insert the need to enhance the internal areas of the peninsula, such as Irpinia (Bencardino & Marotta, 2004; Bencardino & Cresta, 2007; Cresta & Greco, 2010; Russo & Sisto, 2012). In the enhancement actions of a territory, it is evident how these can be developed around strengths represented by the spread of large uncontaminated natural areas and by a close relationship between the territory's resources and human activities. However, these actions cannot be ignored those situations of the danger inherent in the territory, which could prevent the promotion and enjoyment of these places.

## Geotourism in Irpinia

Irpinia is a region of the southern Apennines, located in the eastern part of Campania (figure 1). It corresponds to the province of Avellino (2,792 km<sup>2</sup>, 440,000 inhabitants) and its territory is divided between mountain, which makes up most of it (67.9%), hill (25.1%) and plain (7.0%). Its sparsely inhabited landscapes are largely preserved by the "Great Transformation" (Turri, 2002) followed in the Second World War. They are characterized by their natural architectures and the singularities of the environment, which have received the imprint of many ancient civilizations.

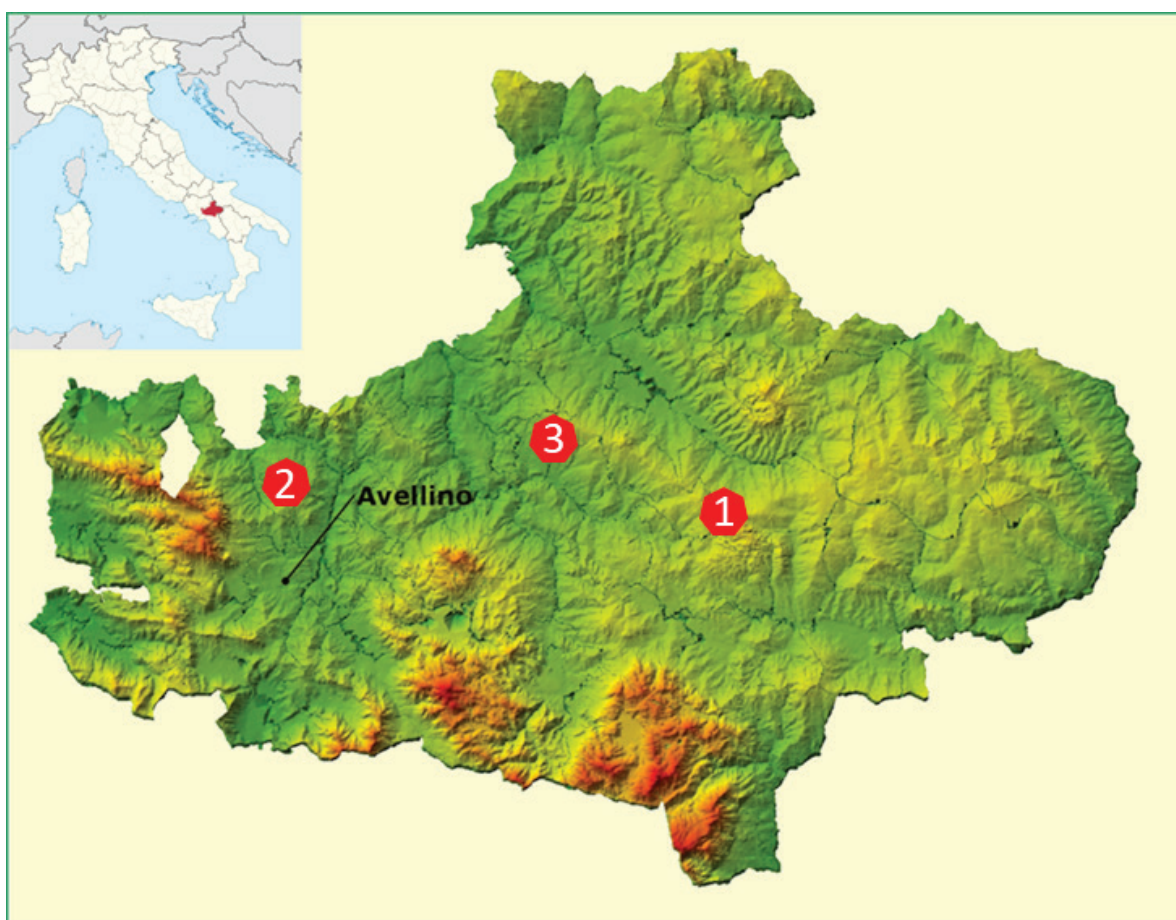


Figure 1 – DTM of Irpinia in Campania: from green (lower) to brown (higher) the altimetric range. Numbers in red polygons indicate representative geosites: 1. The Mephite in the Ansanto Valley; 2. The Mulino-garden of the sulphur mine; 3. The quarry of "Breccia Irpina" in Serro della Serpa.

To the west and south, there are the Mesozoic carbonate massifs (D'Argenio et al., 1973; Bonardi et al., 2009): thanks to their karst nature they have developed the largest underground water reserves in southern Italy and also show a wide range of landforms in the mountain landscape such as polje, uvala, dolines, lapiés. In the underground, an intricate system of fissures, connected to the surface forms, can open up in correspondence of caves with stalactites and stalag-

mites (Sestini, 1963). From their peaks, covered by dense forests, but also engraved by tectonics and shaped by erosion, you have the opportunity to have panoramic views at 360°. On other peaks, less elevated, we find medieval castles still surrounded by intact villages in their original configuration. To the east, the Cenozoic clastic sediments form hills (Bonardi et al., 2009), whose slopes are frequently characterized by strong instability with landslides of all types and sizes. How-

ever, they have also developed valuable crops (vines, olives, hazel groves, etc.) increasingly growing in quality and quantity (Bencardino & Marotta, 2004; Cresta & Greco, 2010). These hills are crossed by a dendritic hydrographic network, which then flows in rivers with rather copious flow rates, such as Calore, Sabato, and Ofanto. However, the plains adjacent to these rivers, where they are slightly wider, have been filled with important thicknesses of alluvial deposits and pyroclastics during the Quaternary (Brancaccio & Cinque, 1988). The first sediments were deposited from the main rivers and the latter came from the Tyrrhenian volcanic centres of Somma-Vesuvius and Campi Flegrei.

This description is rather brief compared to the number of physiographic types that distinguish Irpinia. This assumes a greater value because the populations and their activities have respected these places for years, preserving their original appearance. In this effort even the secular traditions and flavours of food seem not to have been contaminated by modernity and sophistication. Moreover, the vegetation has taken advantage of these conditions so as to extend its naturalness with native species of value, which are protected by the Natura 2000 network (20 between SIC and SPA) and by two regional parks (Parco del Partenio and Parco dei Picentini). For these aspects, Irpinia is a privileged place for the development of environmental and cultural tourism (Regione Campania, 2008; Di Lisio et al., 2016a).

In fact, geodiversity, like biodiversity, is of primary importance for new tourism, based on the need for environmental protection and the concept of sustainable development (Baker, 2006). Milestones of its concepts are the Brundtland Report (1987), the European Landscape Convention (2000) and the Council of Europe's Recommendation on the conservation and enhancement of geological heritage (Council of Europe, 2004). Moreover, the action of the UN system on the Millennium Development Goals, by 2015, has set among the commitments of the Objective 15 of "Protect, restore and promote sustainable use of the terrestrial ecosystem, sustainably manage the forests, fight desertification, stop and reverse the degradation of the land, and stop the loss of biological diversity", and more "increase the capacity of local communities to pursue sustainable livelihood opportunities" (United Nations, 2013). Tourism in Irpinia has the opportunity to do so by choosing in the environment and in the culture the guidelines of the development. This territory can offer, in fact, very different landscapes, but also a rich cultural heritage (Panizza & Piacente 2003). It appears not contaminated, pleasant, not involved in criminal actions. That's why, in the last decade, arrivals and presences in all types of accommodation have recorded marked growth. Moreover, visiting the Irpinia villages, many tourists often buy holiday homes. Along these routes, tourists are likely to feel attracted by the

values and relationships of territory, but also by landscapes and forms capable of amazement for their beauty and at the same time to tell the story of the formation of those places (Cosgrove & Daniels, 1988; Poli, 1999). They are related to different aspects of geology, even if they then unfold popular traditions and dark mysteries. In these places, we find the typical landscapes of the inner areas of the Apennines (karst, terrigenous, fluvial, lacustrine, etc.), that have been the background to the secular historical events of these areas. Therefore, talking about geotourism in Irpinia means supporting and amplifying the "geographical character of a place, its environment, culture, aesthetics, heritage and well-being of its residents" (NGS, 2009). In these territories the trip allows you to visit places where winter sports and trekking are practiced, or to enjoy the wonders of architecture: from rock churches to castles and monastic complexes, or to taste typical gastronomic products with high-quality olive oil and wines, now exported all over the world. It should be noted that Irpinia has received the DOCG (Denomination of Controlled Origin and Guarantee) for three wines: Taurasi, Greco di Tufo, and Fiano di Avellino. This label demonstrates the achievement of quality and renowned product, with characteristics associated with the natural and anthropic environment (Bencardino & Greco, 2007; Cresta & Greco, 2010; Di Lisio et al., 2016b).

### Strength

In a correct assessment of human actions, there is the need to highlight the resources that the system is equipped with. In this case, the strengths in geotourism in Irpinia are represented by the numerous geosites surveyed in the Regional Cadastre of Geosites since 2008 (figure 2). Such a registry was created by the Campania Region making a specific reflection on the value of geoconservation in its Territorial Strategic Plan (Regione Campania, 2008). Within it, a little more than 50 locations were included, surveyed on the basis of a prevailing geological-stratigraphic characterization. In the following years, thanks also to the reformulations of the concept of geosite (subjected to continuous revisions in a well-established specific literature), also extended to that of geomorphosite *sensu* Panizza (2005), the total of the deserving Irpinia geosites has been raised at 70 (Di Lisio et al., 2018).

The geosites to be considered as witnesses of time, according to a fortunate definition (Poli, 1999), are places, areas or territories in which it is possible to identify a geological or geomorphological interest for conservation (Wimbledon, 1996). Moreover, they are the basic prerequisite for discussing geoconservation strategies and developing products to disseminate the geological and geomorphological characteristics of the landscape to a wide public (Brilha, 2002). This assumes



Figure 2 – Excerpt from the Regional Cadastre of Geosites in Irpinia (from Regione Campania, 2008).

more value since there is a growing interest in geosites (and related geotourism, a happily sustainable form of leisure/learning in the conceptual framework of the landscape): such interest is finally reflected in the planning acts of local authorities, regions, and states, and this not only in economically more advanced countries but also in developing countries. In the case of Irpinia, many sites reach the definition of geomorphodiversity proposed by Panizza (2009) and the Principles of Geotourism (NGS, 2009), which refer to “the integrity of the places, the respect of the international codes, the participation of the community to the benefits, the satisfaction of tourists, the conservation and enhancement of resources, the planning and use of the territory, the educational / interactive fun, and finally the assessment procedures”. Among those surveyed in Irpinia, in this work, three geosites are proposed as they are representative for scientific quality (Panizza, 2005) and for geological, historical and archaeological importance (Pereira et al., 2007).

#### The Mephite in the Ansanto Valley

This geoarchaeosite (*sensu* Lena, 2009) is one of the flagships of Irpinia’s geological heritage (Di Lisio et al., 2010; Di Lisio et al., 2014), is known and frequented for millennia, so as to be worthy to receive important literary quotations. Over the centuries it has been variously interpreted as the mouth of Hell (Latin literature of the classical age), as an extinct volcano arranged on the Vulture-Vesuvius alignment (seven-nineteenth-century naturalistic literature), as a manifestation of resurgences of deep fluids enriched by contact

with Messinian evaporites and/or as the epicentre of the 1980 earthquake (contemporary geological literature). The phenomenon has recently been linked to deep degassing processes, in the context of the articulated crustal subduction underway in the central Mediterranean. However, this *situ* shows the world’s largest non-volcanic emission of CO<sub>2</sub> (Chiodini et al., 2010). The characteristic of the site (figure 3), located between the towns of Rocca San Felice, Frigento and Villamaina, is a pond of about 50 meters in diameter in which it boils grey and muddy water and from which violent poison gases are released (Duchi et al., 1995). Around the pond there are other small pools, mud banks and clayey slopes without vegetation from which crystals of gypsum and sulphur emerge (Di Lisio et al., 2011; Di Lisio et al., 2014). In the area a shrine to the Goddess Mephite was built around the seventh century BC, now completely destroyed, but the discovery of remains and findings (amphorae, terracotta, etc.) testifies its great attendance (Rainini et al., 1976; Mele, 2008). For this archaeological value, it is considered among the 101 archaeological sites of Italy, a place in which to go at least once in life (Ardito, 2013), however, the Mephites does not hide its intrinsic dangers (exhalations, active or quiescent landslides on the surrounding slopes) that may not favour the full enjoyment of this geosite. Despite this, it indirectly confers added value to all the crops and dairy production in the area, which have already obtained recognition and protections regarding typical local products. The happy union between the spectacular geological phenomenology, the high historical-archaeological value and the agro-food typicality make it a true



Figure 3 – The Mephite of the Ansanto Valley.

paradigmatic example of how a geosite can trigger virtuous paths of sustainable tourism, acting as a driving force for the economic growth of an entire territory (Di Lisio et al., 2014).

The Mulino-garden of the sulphur mines (figure 4)

The Altavilla and Tufo (AV) mines exploit sulphur deposits present in the arenaceous-clayey-chalky succession of the Upper Messinian (Altavilla Formation: Bonardi et al., 2009), approximately built up 5.5 million years ago. At that time the waters of the Mediterranean evaporated almost completely, due to the closure of the Strait of Gibraltar, for which the conditions of deposition of this mineral were created. Its discovery in these areas and its subsequent cultivation dates back to 1860, and since then this mining activity has played a role of great importance for the Irpinia economy (Di Lisio et al., 2014). The extraction of the mineral, taken from a man-power until then exclusively peasant, allowed the flourishing of

an economy based on sulphur, so as to recall on the spot emigrants from Abruzzo, Molise, and Romagna: the precious resource was used both in commerce and in agriculture, with transport on cart or rail in all the neighbouring regions. In 1971 the crisis began and the number of workers was drastically reduced. At the beginning of the Nineties, the mining activity ended up leaving an industrial complex, which preserves the main elements of the factory from the milling and refining of the raw ore to the internal transport with trolleys to the storage and preparation for the shipment of the mineral ready for use (Del Prete, 2011). In recent years the public administrations of the area have started the recovery of the industrial and mining complex of the Mulino-Giardino di Tufo, also because in this area the lands are widely used for the rows of DOCG Greco and Fiano wines. For tourists visiting there is the opportunity to recover a close relationship between resources and human activity (Amato et al., 2010).



Figure 4 – The sulphur mines of Tufo (Avellino); on the left the monumental buildings before restoration and on the right the entrance to the underground galleries.

The quarry of “Breccia Irpina” in Serro della Serpa (figure 5) The well-known lithotype commercially called “Breccia Irpina” has long been of considerable appeal, and not only locally (Allocca et al., 2010). Furthermore, for centuries it has constituted one of the most sought-after ornamental stone for the production of precious pieces and decorations, present in the most famous historical buildings and sacred buildings of Irpinia and outside it (Ciarcia et al., 2013). From the authorized quarries of Sant’Andrea di Conza and Pescopagano it is extracted in a compact form, with a granulometry typical of the breccias in carbonate matrix, whose market price is directly proportional to the size of the clasts and the variety of coloration. According to the sites, in fact, this material is identified as “favaccia, favaccino, brecciato, stone of Fontanarosa, stone of Gesualdo” (Ciarcia et al., 2013). More specifically, these are sedimentary deposits affecting a structurally complex formation, which is presented in layers and banks

of ruditic limestone of varying thickness, sometimes crossed by laminated layers of clays (Flysch Rosso: Cretacico Inferiore – Oligocene, Bonardi et al., 2009). Today the extraction of this precious material proceeds at alternate rhythms, both because many quarries are about to run out, and because many are closed or difficult to open for reasons of environmental protection. However, there is the willingness of some of these workers to pass on this centuries-old ability of man to work an important stone resource in these lands through the promotion of their “shops”. Its easy workability, its high wear resistance and sliding friction (Del Gaudio & Vallario, 2007), makes a stone widely used in construction and for the construction of internal and urban furnishings. Recognizing these geological materials in the historical heritage built in Irpinia contributes to establishing interdisciplinary approaches and even imagining prospects for social and economic re-evaluation.



Figure 5 – Example of a slab of Breccia Irpina (on the left) and a worker of the stone (on the right).

## Weakness

If the structure of Irpinia with its geodiversity makes it possible to emphasize the nature of the trip and the visit to a place, it is equally true that there is a relationship between the geotourist use of a site and its natural or induced dangerousness human activity (Panizza, 2005; Brandolini et al., 2007; Reynard et al., 2016). This danger is linked to the conformation of the place, which can be accentuated by human behaviours not suitable for the natural processes that develop there, to the point of triggering or accelerating its occurrence. Therefore, even in a geosite, there is the probability that a potentially destructive event occurs in an area (e.g. crags collapse, poison fumes, etc.) with a certain intensity that can damage the user and/or the consistency of the place.

Recent and painful news stories have shown how the use of a geological and environmental asset can be risky, as evidenced by the Italian tragedies of the Solfatara di Pozzuoli

(NA) and the Maccalube di Aragona (AG) occurred in 2017 and 2014, respectively. Such events are terrible testimonies of how the underestimation of intrinsic dangers can then be turned into manifest damage to people, to cultural/environmental asset or to natural resource (water, soil, forest, etc.), to property (land, buildings, etc.) and to the productive capacity of an activity (industry, farm, etc.).

The concept of risk has been repeatedly defined and is still the subject of reflection in various fields of application, not least those of technical regulations. But referring to the well-known proposal of the UNESCO report by Varnes D.J (1984), the risk is expressed by the relationship between different components, all probabilistically linked to the interaction between phenomenon/event and human society (people, buildings, infrastructures, economic activities).

According to this interaction, geotourism could be weakened

if it did not consider the nature of the possible risks to which a geosite or geomorphosite could be subjected. It could be damaged at the point of its complete destruction but, at the same time, the estimated risk could potentially compromise its own function in the coincidence of a particular danger (for example, poisonous fumes, explosions, collapse, floods, etc.). Moreover, the lack of consideration of risks or observance of the safeguard rules would detract from the prestigious magazine National Geographic Traveler, which claims that geotourism represents the evolution of "sustainable tourism", that is to guarantee future generations to enjoy that environmental good (NGS, 2009).

To highlight these weaknesses in geotourism, the three Irpinia geosites, previously described, have been taken. These places of extreme geological interest are proposed among others for the particular combination created between natural and human resources, but also for their marked exposure to the dangers that are present in them.

In this choice, we wanted to investigate situations with levels of probability of occurrence more marked than relatively less critical situations. The identified risks have been distinguished in natural and anthropic types. For the natural risks, the vari-

ous elements of danger have been highlighted, which for the various geosites can show common characters or peculiar characteristics (Table 1). For anthropic risks, a further distinction is proposed between risks connected to the commercial exploitation of the georesource available in the geosites and risks inherent to geotourist use of the same places (Table 2). As it is possible to read the natural phenomena, which can determine a risk condition, they also develop around the site. For example, the Mefite is placed in an area at high risk of landslide due to the physical-mechanical conditions of the outcropping land (figure 6), while the sulphur mines of Tufo are on the right embankment of the river Sabato and therefore subjected to a possible flood (figure 7). In the latter case, it should be said that as the river in its engraving allowed the cultivation of the ore body in the same way it could remove the possibility of visiting these places where man has been able to extract a resource for more than a century. Also in the Sant'Andrea di Conza geosite the alteration of the calcareous breccias could determine instability conditions on unused walls. The degree of danger of these risks, as well as others, could find suitable mitigation if there was careful and responsible management of the site and of the territory.

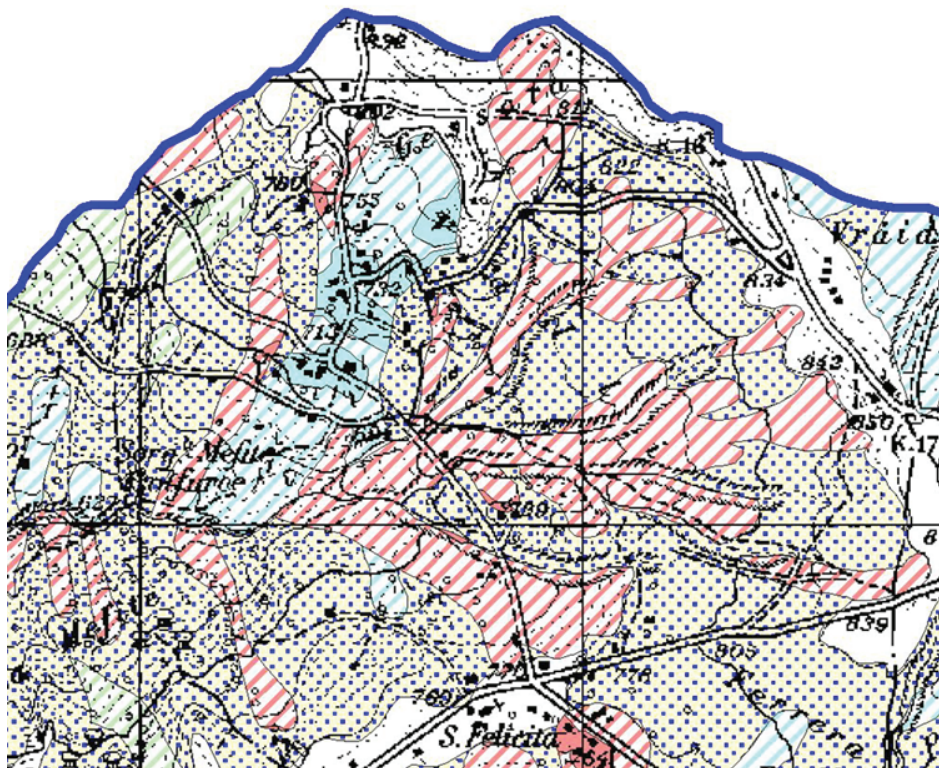


Figure 6 – Excerpt of the map of the Landslide Risk in the Mephite of the Ansanto Valley (from the Authority of the Liri Basin Garigliano Volturno, 2006). Note that the areas with pink diagonal lines are affected by triggering, transit and landslide invasions with the probability of maximum intensity; areas with celestial diagonal lines are areas that fall within quiescent landslides with the probability of medium intensity; the areas dotted on a yellow background are area of possible expansion of landslides.

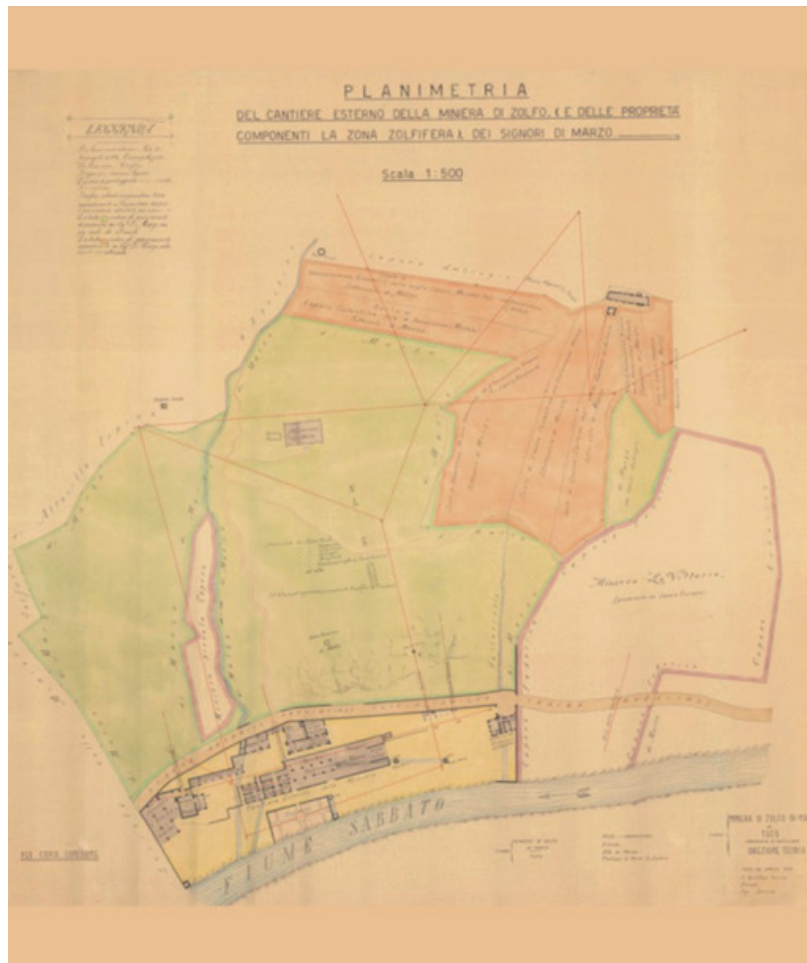


Figure 7 – Planimetry of the external site of the sulphur mines of Tufo (AV) developed on the right bank of the Sabato River and therefore in an area at risk of flooding.



Figure 8 – Processing area of the Irpinia Breccia adjacent to the exhibition sites.



Table 1 – Natural Risks

Geosite	Municipality	Risks related to various dangers.
<i>The Mephites in the Ansanto Valley</i>	Rocca San Felice (Avellino)	<ul style="list-style-type: none"> <li>• potentially deadly exhalations;</li> <li>• landslides due to high instability of terrigenous deposits around the site (damage to access roads, inadequate settlement of the surrounding slopes).</li> </ul>
<i>The Mulino-garden of the sulphur mines</i>	Tufo (Avellino)	<ul style="list-style-type: none"> <li>• falls in the tunnels;</li> <li>• exhalations in the mines area;</li> <li>• sudden explosions in the mines area;</li> <li>• Sabato river floods.</li> </ul>
<i>The quarry of “Breccia Irpina” in Serro della Serpa</i>	Sant’Andrea di Conza (Avellino)	<ul style="list-style-type: none"> <li>• stone elements falls on abrupt and unequipped walls;</li> <li>• alteration phenomena in the quarry area.</li> </ul>

Another category of risks concerns the anthropic action that takes place on the site and in its immediate surroundings, as illustrated in Tab. 2. In order to better intervene on the anthropic risk, as already mentioned, it has been preferred to distinguish it in that linked to the exploitation of the geo-resources available on the sites (i.e. stone processing in the quarry), and the one connected to the geotourist use of the same places (i.e. visit to the “exhibition shop” of the stones annex to the quarry) (figure 8).

In the three geosites, it is possible to underline how the anthropic action has modified the natural order of the places. For example, in the sulphur mines of Tufo, now inactive, the construction of tunnels in the underground for four levels and 3 km in length, all armed with timber due to the construction of the extraction routes, may have led to a “loosening” of the compactness of the rock mass. On the other hand, in the narrow valley of the Mefite sulphur, mud, and gypsum

sulphate, even if now ceased for a few decades, has certainly partially altered the morphological profile triggering the instability phenomena highlighted. For the active quarry of Serro della Serpa (figure 8), the cultivation takes place on a limited stone body of “breccia irpina”, likely with the current withdrawal rates will result in the disappearance of the lithotype and, jointly, the disfigurement of the area, in absence of adequate environmental restoration measures.

As far as geotourist use is concerned, all the sites considered could be subject to unsustainable behaviour, if not subject to monitoring and surveillance, as well as to documentary information, containing rules aimed at safeguarding the site. In particular, in the case of the Mefite one could even imagine predators of archaeological material, or improper disposal or guilty of waste of any kind. In the other two sites, since the entire area has not been visited, it will be better to avoid access to the former gypsum mine or near the working area.

Table 2 – Anthropic Risks

Geosite	Municipality	Risk types	
		linked to commercial exploitation	linked to geotourist use
<i>The Mephites in the Ansanto Valley</i>	Rocca San Felice (Avellino)	<ul style="list-style-type: none"> <li>• quiescent risk for previous quarry exploitation;</li> <li>• triggerable risk for unsuitable maintenance and site protection.</li> </ul>	<ul style="list-style-type: none"> <li>• unsustainable and / or predatory behaviour (removal of archaeological and numismatic heritage, abandonment of waste, etc.)</li> </ul>
<i>The Mulino-garden of the sulphur mines</i>	Tufo (Avellino)	<ul style="list-style-type: none"> <li>• quiescent risk for previous mines exploitation;</li> <li>• triggerable risk for unsuitable maintenance and site protection.</li> </ul>	<ul style="list-style-type: none"> <li>• collapse of the underground extraction system;</li> <li>• risk deriving from the rests of the extraction plants still present in the area</li> <li>• unsustainable behaviour.</li> </ul>
<i>The quarry of “Breccia Irpina” in Serro della Serpa</i>	Sant’Andrea di Conza (Avellino)	<ul style="list-style-type: none"> <li>• exhaustion of the outcropping lithotype;</li> <li>• landscape degradation of the area.</li> </ul>	<ul style="list-style-type: none"> <li>• incompatibility with extractive use still active;</li> <li>• unsustainable behaviour.</li> </ul>

The knowledge and estimation of the risk linked to that phenomenon, however, makes it possible to identify the priorities of intervention to be implemented to reduce the likelihood that the risk will turn into damage. This mitigating action is strictly fitting with the use of an environmental resource, as a geosite, which preserves intact its geological and geomorphological characteristics more than any other place. The managing assets of the environmental resource

should keep in mind this priority, so that it can be enjoyed in safety, without underestimating for incapacity or worse, for bad faith, the possible consequences of its fruition, more or less massive.

Finally, possible standard proposals have been made to mitigate the risks identified in the specific areas of study, but which can be adopted in any context in order to avoid dangerous situations that could lead to probable damage.

## Discussion and Conclusion

Geotourism in Irpinia would allow the dissemination of the “geological culture”, highlighting the values and relations of territory and highlighting the criticalities and vulnerabilities for its protection. The knowledge of the elements constituting the geological heritage is the starting point, as it would make it possible to present to the curiosity of tourists the different lithological and morphological forms of the territory, as well as their formation (Poli, 1999; Dowling & Newsome, 2008; Alberts & Hazen, 2010). This informative and documental aspect, perhaps with the installation of particular panels and visual supports, becomes essential for the promotion of geotourism. Immediately afterwards the connections with the other natural and anthropic aspects that make up the territory are to be considered. This will allow us to discover

the relationships that bind living beings with the features of the Earth, even using pre-established routes or taking advantage of celebratory manifestations (Panizza & Piacente, 2003; Russo & Sisto, 2012; Di Lisio et al 2016a).

These considerations can be applied in Irpinia for three essential conditions: a) the growth of cultural demand and tourist flows, even beyond financial availability; (b) the presence of millions of tourists on the coast of Campania, and therefore the possibility of reaching the internal areas of the Apennines with a short trip; c) the existence of a large number of qualified geosites near other high quality attractions (biodiversity, castles and monumental palaces, DOCG and DOC wines, DOP gastronomic products, etc.) (figure 9).



Figure 9 – Geotourism map of the province of Avellino (proposed in Di Lisio et al., 2014) in which are identified geosites close to other high-quality attractions of the territory.

However, in order to achieve significant feedback in geotourism, there is a need to develop cultural and tourism marketing, which satisfies the demand of tourists through an adequate and sustainable offer. An approximate or incorrect promotion of these itineraries and an absent or complex use of these resources cannot guarantee the result and not even the protection from possible risks (Brandolini et al., 2007; Alberts & Hazen, 2010).

For this reason, in the management of geosites, it is strategically useful to consider measures or interventions aimed at mitigating the reported risks. If for all the sites it seems obvious a protection of the area, to be implemented in the forms provided for by law to protect natural and landscape assets, we also propose installations of video surveillance systems and fence areas, with appropriate reporting of existing risks and boundary of equipment for tourism purposes (Dowling, 2008).

More burdensome but strictly necessary interventions are also those concerning the regulation of the outflow rods, adoption of containment systems with naturalistic engineering techniques (in particular the Mefite) and the removal, where possible, of pylons (visual pollution/landscape). At the same time, in the Apennine areas, already unfortunately largely subject to this type of installation, it would be to propose a total prohibition of further wind power plants, so widespread on these Apennine reliefs.

For the sulphur mines, in part already providentially implemented, the recovery and restoration of the entire industrial and mining complex would be accelerated, with the creation of a centre for tourism and, in the vicinity, a museum of eno-gastronomy. In fact, a very high-quality wine like, as the Greco di Tufo DOCG, could be developed from the characteristics of the land. Such interventions could be accompanied, as in many examples of similar geosites, by partial recoveries of the mining tunnels, as well as partly looted furniture and machinery, to create a Museum of industrial archaeology (figure 10).

Finally, for the active quarry of Serro della Serpa, it is suggested a partial halt of the extraction activity or, as a safeguard measure, an isolation for geo-tourism purposes of a more or less extensive part of the quarry areas, as a testimony in

situ of the outcrop of the known stone material extracted therein.

The above descriptions are only proposals to make the three representative geosites of Irpinia more accessible and safer to the "general public". However, giving space to the geological culture also means diversifying the offer, including various activities suitable for schools, families, sports enthusiasts, lovers of traditions and so on. To this end it will be good to produce information material suitable for the public to which it is addressed, giving priority to the graphics part (Di Lisio et al., 2016b). Alongside this promotion of knowledge with scientific criteria, it will be possible to develop geotourist-cultural itineraries aimed at enhancing the resources of the territory through educational-educational paths. This type of tourism generally requires longer stays, because the times of the discovery of the mountain and hilly landscape are slower, as indicated by research by CENSIS (2003). Therefore, this consideration could also incentivize accommodation businesses and allow travel agents to find new job opportunities (Bencardino & Marotta, 2004; Cresta & Greco, 2010). All this will make Irpinia become a tourist reference pole, and consequently a flywheel for the entire economic system, but it is necessary that the territory should not be found unprepared (Baker, 2006; Raynard et al., 2016).

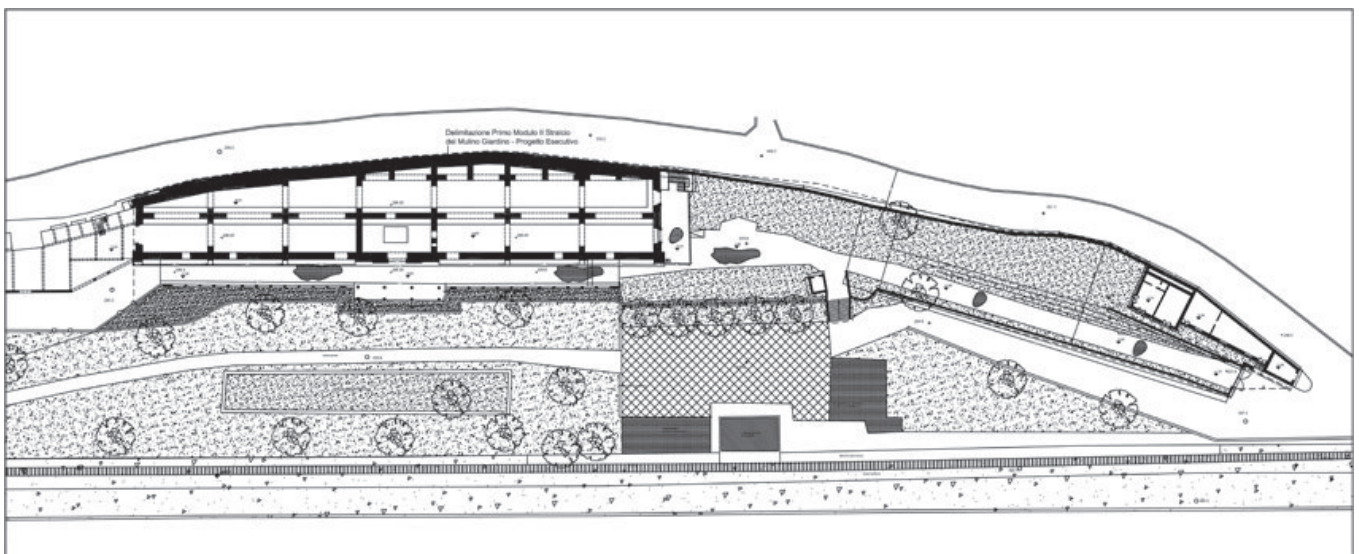


Figure 10 – Example of restoration project of the Mulino Giardino of the sulphur mines in Tufo (Avellino).

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