

Academic Research Paper

The Descent into the Underworld and Lake Pergusa: Myth, Sinkhole and the Touristic Construction of Landscape

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Abstract:

Purpose – This paper examines Lake Pergusa as an emblematic case of interaction between classical myth, geomorphological processes and the touristic construction of landscape. Drawing on the theoretical framework of literary tourism and imaginative geographies, the article argues that the narrative sedimentation of the abduction of Proserpina – notably codified by Ovid in the *Metamorphoses* – has contributed to transforming a sinkhole lake in inland Sicily into a ‘mythical gateway’. The aim is twofold: first, to reconstruct the cultural genealogy of the katabasis and the territorialisation of the myth in Sicily; secondly, to demonstrate how this symbolic stratification may represent a resource for cultural tourism and geotourism, particularly within the framework of the Rocca di Cerere UNESCO Global Geopark. *Design/methodology/approach* – The study adopts an interdisciplinary approach combining literary analysis, historical-cartographic interpretation and geomorphological assessment. It first reconstructs the motif of the katabasis in the Western tradition (from Homer and Virgil to Dante), highlighting the progressive association between physical locations and symbolic thresholds of the underworld. It then investigates the territorialisation of the Proserpina myth in the Enna area through literary, iconographic and cartographic sources that attest to the identification of the lake as the site of the abduction. Finally, it analyses the geological features of the basin, interpreted as a piping sinkhole developed in sedimentary cover deposits over evaporitic bedrock, together with its hydro-biological dynamics (including the episodic reddening of the waters), in order to connect mythical narrative and scientific explanation within a sustainable tourism perspective.

Originality/value – The originality of the paper lies in proposing Lake Pergusa as a geomythological landscape in which myth, literature and geology jointly shape territorial identity. It contributes to the still limited debate on literary tourism in the Italian context and advances an integrated interpretation that overcomes the conventional divide between tangible and intangible heritage, framing the sinkhole as both a natural phenomenon and a narrative device. *Practical implications* – From an applied perspective, the study suggests enhancement strategies grounded in the integration of scientific interpretation and mythic narrative, supporting the design of geotourism and environmental education initiatives. Such an integrated reading may strengthen the local cultural offer, promote informed and sustainable visitation, and raise awareness of geological risk. In this respect, Pergusa may serve as a replicable model for other symbolically dense landscapes.

Keywords

Lake Pergusa; UNESCO Global Geopark; Myth and landscape; Literary tourism; Geotourism.

JEL Codes

Z32; R11; Q01

1. Literary Tourism, Mythical Landscapes and Geographies of the Imagination

Over recent decades, cultural tourism has progressively broadened its horizons to include not only the enjoyment of material heritage, but also forms of consumption grounded in narratives, myths and literary representations of place. Within this framework, literary tourism can be understood as a practice of visitation motivated by the relationship between geographical space and text, between the real territory and the narrated landscape.

The motivations underlying travel have been extensively investigated in socio-psychological research. Dann (1981) identifies among the main factors escape, regression, self-discovery, socialisation, culture/knowledge and social prestige; Crompton (1979) distinguishes between push and pull factors, a distinction subsequently taken up by Goossens (2000), showing how the choice of a destination stems from the interaction between internal drives and the destination's ability to satisfy emotional needs. From this perspective, the narrative and symbolic dimension of territories may operate as a powerful driver of attraction.

Travel literature, or odeporic narrative, has historically accompanied these processes, assuming different forms – from the epic poem to the diary, from the exploratory report to the cultural guidebook – yet consistently contributing to the construction of imaginative geographies. One need only think of the *Odyssey*, archetype of travel par excellence; of Dante's *Commedia* (the adjective “divina”, commonly associated with the title since the Renaissance, is not part of Dante's original wording. It was introduced for the first time by Giovanni Boccaccio in the *Trattatello in laude di Dante*, 1373, and definitively canonised in the 1555 Venetian edition edited by Lodovico Dolce); of Voltaire's *Candide*; of Jonathan Swift's *Gulliver's Travels*; and of works such as Marco Polo's *Il Milione* or Goethe's *Italian Journey*. In different periods, these texts have helped to orient the traveller's gaze and to transform geographical space into narrated space.

From the *Grand Tour* to contemporary tourism, literature and travel have thus developed in parallel, giving rise to forms of consumption that are now subsumed under the label of literary tourism, defined

as “travel induced by, or associated with, works of literature, authors and the places featured within literature” (Croy, 2012). Although international scholarship (Squire, 1994; Herbert, 2001; Hoppen et al., 2014; Richards, 2018) locates this phenomenon predominantly within the broader fields of heritage and cultural tourism, specific studies remain relatively limited, particularly in the Italian context.

Contemporary examples are numerous, ranging from literary parks to urban itineraries dedicated to individual authors, from routes inspired by major novels to integrated tourism products that combine visitation, experience and storytelling. This variety shows how literature can become a symbolic infrastructure of the territory, generating cultural and economic value and addressing diversified motivations.

Within this perspective, mythical landscapes constitute particularly powerful devices of attraction: they transform natural features – mountains, caves, lakes – into meaningful places endowed with temporal depth and cultural stratification. When narrative becomes deeply rooted in physical space, a distinctive form of tourism emerges that may be described as geomythological tourism, in which the narrative and natural dimensions are inextricably intertwined.

In recent studies on cultural and territorial tourism, the narrative dimension has increasingly been recognised as a core component of heritage valorisation processes. Heritage interpretation, understood as the set of discursive practices and communication devices aimed at making places understandable and meaningful (Tilden, 1977; Uzzell, 1998), is indeed grounded in the capacity to construct stories that connect material evidence, collective memories and symbolic meanings.

From this standpoint, landscape is conceived not merely as a physical support, but as a “text” to be read and narrated within cultural mediation processes involving practitioners, local communities and visitors (MacLeod, 2006; Timothy & Boyd, 2003). Narrative thus becomes a privileged tool for integrating tangible and intangible heritage and for fostering more reflexive and knowledgeable forms of visitation.

Parallel research on place branding and destination identity has highlighted how territories competing on the tourism market tend to construct and communicate coherent images, often based on distinctive historical, landscape or mythical features (Anholt, 2009; Pike, 2017). In this process, founding myths, legends and major literary narratives may play a crucial role in defining the “uniqueness” of a destination and in strengthening its symbolic capital (Kavaratzis & Hatch, 2013).

In the specific field of geotourism and UNESCO Global Geoparks, the enhancement of geological heritage is increasingly associated with interpretive routes that combine scientific explanation, historical narration and mythological references, with the aim of creating visitor experiences that are both engaging and educational (Dowling & Newsome, 2010; Reynard, 2012). In this sense, Lake Pergusa lends itself to being read as a “narrative geosite”, in which complex geomorphological processes, mythical stratifications and literary traditions converge into a single interpretive device.

The intersection between literary tourism, heritage interpretation and place branding therefore makes it possible to consider Pergusa not only as an object of geotouristic consumption, but also as a potential resource for identity construction and for the strategic positioning of the Rocca di Cerere UNESCO Global Geopark within the international geoparks network.

In light of these strands of research, the present contribution seeks to engage in the debate on cultural tourism and heritage interpretation in at least three directions. First, it proposes to extend the notion of literary tourism to geo-mythological contexts, in which landforms and geomorphological processes are intertwined with strongly territorialised classical narratives. Second, it investigates how myth-based landscape narratives can feed strategies of identity building and place branding in inland areas

regarded as peripheral to the main tourist flows, such as the heart of Sicily. Third, it brings together the literature on geotourism and UNESCO Global Geoparks with the analysis of a specific “narrative geosite”, Lake Pergusa, proposing an interpretive framework that connects geomorphological processes, mythical traditions and possible trajectories of tourism development.

As has been noted in international scholarship, cultural heritage and tourist experiences are increasingly structured through narrative practices that select, stage and dramatise the past (Smith, 2006; Chronis, 2012). The case of Pergusa offers an emblematic example of how geo-mythological narratives can be mobilised within such processes, contributing to the construction of heritage interpretation devices capable of integrating scientific, symbolic and identity-related dimensions.

From a methodological standpoint, the research adopts an interdisciplinary, qualitative and interpretive approach, positioned at the intersection of classical philology, historical geography and geology/geomorphology. The analysis draws on three main groups of sources, selected and integrated according to explicit criteria.

1. Literary and mythographic sources. A *corpus* of classical and late-antique texts was constructed on the basis of two main criteria: (a) the explicit presence of katabasis motifs (journeys to the Underworld) and/or the rape/abduction of Persephone/Proserpina; (b) the degree to which a geographical connection with Sicily is made explicit. Within this framework, authors such as Homer, Virgil, the Homeric Hymn to Demeter, Ovid and Claudian are included, alongside, in a comparative perspective, references to medieval and modern literature (for instance Dante) that are useful in tracing the persistence of the “gate of the Underworld” motif. The selection does not aim at philological exhaustiveness; rather, it seeks to identify those texts that have most significantly contributed to fixing the geo-mythological imagery associated with Sicily and with Pergusa.
2. Historical, iconographic and cartographic sources. The study examines documents relating to the diffusion of the cult of Demeter and Kore in Sicily (archaeological, artistic and numismatic evidence), as well as cartographic representations – particularly of the Renaissance period – in which Lake Pergusa appears under the mythical toponym *Raptus Proserpinae*. These sources were selected because they render visible the processes through which myth becomes territorialised and translated into “official” images of the landscape, allowing us to observe how the mythical dimension is incorporated into the represented geography of the island.
3. Geological and geomorphological sources. The physical characterisation of Lake Pergusa is based on the available specialist literature and on technical documentation produced within European projects devoted to desertification and paleoenvironmental studies. The sources were chosen for their relevance to the interpretation of the lake as a piping-induced sinkhole, set within the broader framework of subsidence phenomena in the Southern Apennines and inland Sicily, and for their contribution to reconstructing the hydrological and morphological dynamics of the basin.

Analytically, these different types of sources were integrated through a cross-reading that conceives the Pergusa landscape as a stratified “text”. Rather than reconstructing a linear history of the site, the article juxtaposes and puts into dialogue the various narrative, cartographic and geomorphological layers, highlighting how the same physical space has in turn been understood as a mythical threshold, a religious landscape and an object of geoscientific investigation.

The structure of the article reflects this trajectory: from narratives of katabasis to the specific mythical elaboration of the rape/abduction of Proserpina and its localisation in Sicily; from the

geomorphological description of the lake as a sinkhole to the implications for the touristic construction of the landscape and for geoscience education. The aim is not to empirically assess the actual tourist use of the site, nor to analyse visitor profiles and behaviours in detail, but rather to propose an interpretive framework capable of connecting myth, geology and tourism, and of identifying possible directions for geo-touristic and geo-mythological development for the Rocca di Cerere UNESCO Global Geopark.

2. The Gate of the Dark Abode. The Descent into the Underworld in Mythology

The descent to the Underworld, or *katabasis*, is among the most recurrent motifs in the mythologies and literatures of the world. Since antiquity, the journey of a living person into the realm of the dead, followed by a return to the light, has responded to a primary need to confront the mystery of death and the ultimate destiny of humankind. Katabatic narratives construct an otherworldly geography that is “more or less complementary to current geographical and astronomical knowledge” and follow a relatively stable narrative pattern, in which a hero or chosen figure is exceptionally granted the privilege of visiting the afterlife and reporting back to the living (Stok, 1993).

In the Greek tradition, Book XI of the *Odyssey* represents the foundational text for early conceptions of the realm of the dead. Odysseus, having reached the limits of the known world, performs a sacrifice to summon the shades and to receive from Tiresias the oracle concerning his fate. This is not yet a systematic description of Hades, but rather a liminal encounter with the world of the dead, populated by heroic figures and great damned souls (Maspero, 1957). Odysseus’ journey provides the model for many subsequent elaborations, in which the descent to the Underworld becomes an opportunity for knowledge and revelation.

Another paradigmatic example is that of Orpheus, musician and poet, who descends into the realm of Hades to bring back to life his beloved Eurydice. Thanks to his song he exceptionally obtains permission to lead her back to the light, on the condition that he does not turn to look at her along the way. The failure to respect this prohibition entails the definitive loss of his bride. In this story, *katabasis* becomes at once an extreme proof of love and a meditation on the fragility of the boundary between life and death, reinforcing the idea of the afterlife as an exceptional place of passage, accessible only at the cost of risk and sacrifice (Vannucci, 1863).

Beyond the Greco-Roman area, the theme is already fully developed in the Mesopotamian poem *The Descent of Inanna to the Underworld*, one of the most significant myths of the ancient Near East. The goddess descends into the “Land of No Return”, undergoes a temporary death, and returns to life through the intervention of the god Enki, at the price of substituting her consort Dumuzi in the subterranean world (Kramer, 1937; Alster, 1983). In this account, *katabasis* assumes a clear agrarian significance, alluding to the cyclicity of vegetation and the seasonal rhythm of fertility, and anticipating some central motifs of the myth of Demeter and Kore.

Among the heroic figures who confront the Underworld is also Heracles, whose *katabasis* forms part of the cycle of the Twelve Labours. At Eurystheus’ command, the hero must descend into the realm of the dead to capture Cerberus, the three-headed dog guarding Hades, passing through the entrance that tradition locates at Cape Tainaron, a promontory of the Peloponnese considered a physical gate to the Underworld. Heracles’ return to the light together with the monster, followed by its restitution to

the subterranean world, confirms the role of specific concrete places – such as Tainaron – as geographical thresholds between the world of the living and that of the dead (Compagnoni, 1826).

In Latin culture, the most complete model of katabasis is offered by Book VI of the *Aeneid*, in which Virgil recounts Aeneas' descent into the Cumaean Underworld. Guided by the Sibyl, the hero passes through the entrance of Lake Avernus, traverses the realm of the shades, encounters infernal monsters and finally reaches the Elysian Fields, where his father Anchises reveals to him the future of the Roman people. This katabasis, besides constituting the direct antecedent of Dante's journey, establishes a relatively precise topography of the afterlife: rivers, gates, places of punishment and of bliss, which would become enduring models for the European imagination (Vivaldi, 1981).

Dante Alighieri, in turn, reprises and transcends this pattern in the *Commedia*, choosing Virgil as his guide in the descent to Hell. Dante's Inferno, structured as a vast funnel-shaped chasm plunging towards the centre of the Earth, translates into spatial form a complex theological and moral system. The choice of a morphology akin to a doline or large sinkhole, interpreted in the light of current geological knowledge, suggests a possible dialogue between observation of the real landscape and literary construction (Amirante & Nisio, 2023).

Despite cultural and theological differences, these narratives share some constant features: the existence of a "threshold-place" separating the world of the living from that of the dead; the presence of guides, guardians and initiatory trials; and the revelatory function of the journey in redefining the identity of the hero and of the reference community. Above all, they contribute to fixing in cultural memory certain physical features – caves, chasms, lakes, craters – as potential access points to the afterlife.

In all these narratives, the Underworld is not an abstract, disembodied realm, but is anchored in tangible geographical markers: caves, chasms, lakes, craters, promontories. The recurrence with which particular geomorphological singularities are interpreted as thresholds to the beyond constitutes an important key to reading the case discussed here. As will be shown in the following sections, the sub-circular morphology of Pergusa, its nature as a deep depression within the surrounding hilly landscape, the periodic occurrence of the "red waters" phenomenon, and the long tradition linking the lake to the rape/abduction of Proserpina have all contributed to transforming it into one of the most persistent "gates of the Underworld" in the Mediterranean imagination. The motif of katabasis thus provides not only a general mythological backdrop, but also a conceptual grid for interpreting the ways in which specific landscape features are invested with liminal and symbolic functions.

When a myth of descent to the Underworld becomes rooted in a specific territory, that place does not remain a mere narrative backdrop, but is endowed with a strong symbolic charge, to the point of becoming a threshold between visible and invisible, human and divine. In the modern and contemporary periods, such places are often reinterpreted as identity-forming elements and, progressively, as potential tourist attractions, especially within landscapes regarded as "mysterious" or "sacred". It is from this perspective that Lake Pergusa can be read not only as a natural setting, but as a narrative landscape in which the classical imaginary acquires a concrete geographical location, providing a symbolic basis for destination identity construction and for future practices of touristic landscape interpretation.

3. The Rape of Proserpina

Sicily is a land densely woven with myths handed down from time immemorial through the voices of ancient writers. These myths are inscribed in the archaeological remains scattered across the territory and survive in popular traditions. Some possess an exclusively local dimension; others, known to numerous authors and absorbed into cults and ritual contexts beyond the island, attained a recognised importance and circulation throughout the classical world. All of them, albeit in different forms, articulate the complex relationship between human beings and the reality in which they live, tracing the trajectory of their earthly history, so that we are not far from the truth in considering them as metaphors of the human condition.

Among the most evocative myths with which Sicily is particularly endowed, one stands out: that of Kore (or Persephone, later called Proserpina by the Romans) and her abduction, which, according to the most established version, took place in a marvellous meadow stretching at the foot of the hill on which the city of Enna stands, near the shores of Lake Pergusa, at the hands of Hades, the sombre god of the dead (fig. 1).



Figure 1. Luca Giordano, *The Rape of Proserpina*, 1682, Florence, Palazzo Medici Riccardi, Galleria.

The story of the goddess Demeter and her daughter Kore represents one of the oldest agrarian myths, elaborated in Greek culture and transmitted to the Latin world.

The origins of the myth, which recede into the night of time, are closely linked to the discovery and cultivation of wheat, the cereal that underpins the diet of Mediterranean peoples. Demeter is almost certainly a pre-Hellenic divinity, perhaps to be identified with the “Earth-Mother”, the goddess venerated under different names and forms throughout the Mediterranean area.

The importance and diffusion of the cult of this goddess in the ancient world were immense, as attested by a wide range of evidence. Leaving aside the references in Homer (to Demeter as goddess of the harvest and to Persephone as queen of the Underworld) and Hesiod (to Hades who abducts Persephone with Zeus’ consent), the earliest literary document is the *Hymn to Demeter*, which Pausanias attributes to Musaeus, the mythical pre-Homeric poet. The manuscript tradition, however, has transmitted it within a corpus of thirty-three Hymns, called “Homeric” because, although composed in different periods, they all belong, in tone, narrative mode and formal features (language and metre), to the epic genre, intended more for recitation than for singing. The Hymn contains two main themes: the

rape/abduction of Persephone and the institution of the Eleusinian Mysteries, which has led scholars to suppose that its author was affiliated with the Eleusinian sanctuary. Persephone, daughter of Zeus and Demeter, abducted by Aidoneus (Hades), lord of the dead, is carried off to his subterranean realm, of which she will become queen.

Persephone (“she who brings destruction”) originally bore the name Kore (“maiden”) and was later called Proserpina (“the formidable”), and perhaps also identified with Hecate (from hekaton, i.e. “the ancient one”).

Kore, Persephone and Hecate represent the goddess in her threefold aspect of Virgin, Bride (nymphē) and Crone, at a time when only women participated in the mysteries of agriculture. Kore symbolises the green grain, Persephone the ripened grain, and Hecate the harvested grain. The abduction and transfer of Persephone to the Underworld thus express, in mythical form, the necessity for the grain to go underground and “die” in order to be reborn (Graves, 1983).

The place of the abduction is indicated, in the same Hymn (vv. 1-38), as the plain of Nysa (*Nýsion pedion*). Humbert considers this a mythical locality near Oceanus, since the event occurs while Persephone is playing with the Oceanids, the daughters of Oceanus, gathering “roses, crocuses and lovely violets on a soft meadow”, as well as irises, hyacinths and narcissi (Arrighetti, 1989). Subsequent tradition, as usual, attempted to identify this place with various real locations: thus Pausanias, for example, states that Pluto abducted Kore near Eleusis, while in a scholion to Hesiod – which also reports a testimony from the Orphic corpus – we find an echo of this topographic uncertainty: “Some say that Persephone was abducted from Sicily, Bacchylides from Crete, Orpheus from the regions near Oceanus” (Arrighetti, 1989).

Among the regions mentioned, therefore, Sicily already appears, which over the centuries had appropriated the myth and consolidated the conviction that it was indeed the land of the abduction.

The progressive territorialisation of the myth found expression not only in literary sources and artistic tradition, but also in historical cartography. In some Renaissance representations of Sicily, Lake Pergusa in fact appears under the name *Raptus Proserpinae*, testifying to the extent to which the mythical identification had by then become consolidated also within official geographical perception. An emblematic case is the map of Sicily frescoed in the Gallery of Maps in the Vatican, where the mythological toponym replaces the local one, enacting a genuine symbolic transposition of the narrative into cartographic space (fig. 2).

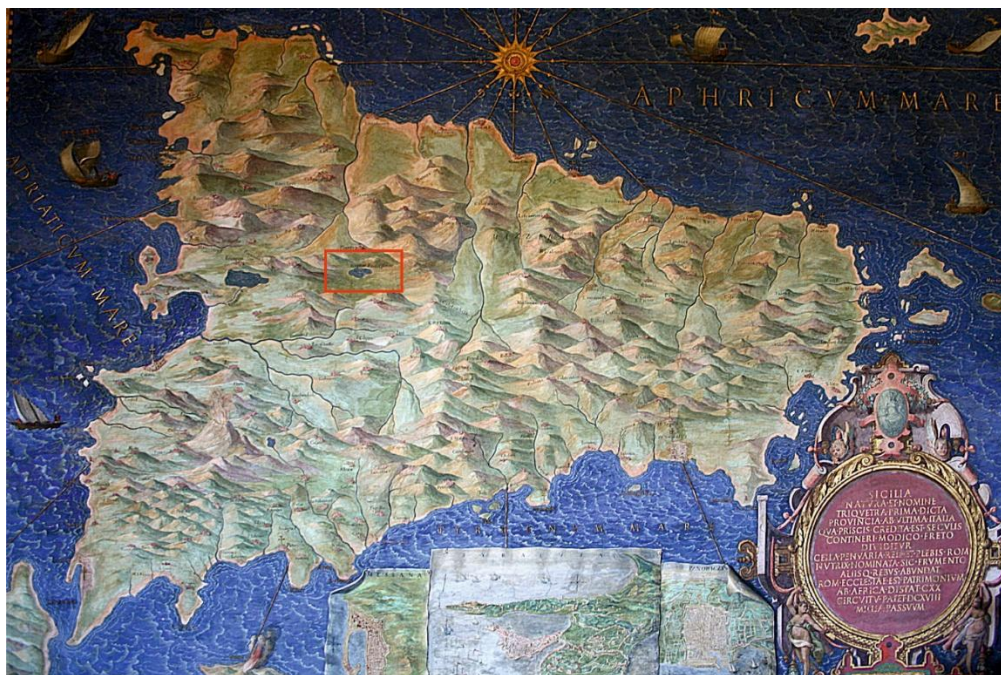


Figure 2. Ignazio Danti, *Sicily*, 1581, Vatican City, Vatican Museums, Gallery of Maps.

Far from merely describing the territory, cartography shapes its cultural image, crystallising myth into geographical fact and turning Lake Pergusa into a symbolic node of the island's geography. Its dense iconographic and toponymic stratification not only attests, on a historical-cultural and symbolic level, to the *longue durée* of the link between the myth of Proserpina and the representation of Sicily, but also offers a strategic resource for the contemporary design of interpretive routes and geo-mythological tourism products grounded in storytelling, capable of combining identity construction, heritage valorisation and the staging, in a contemporary key, of this imaginative legacy.

In particular, the overlap between mythic toponym and physical site provides a robust basis for territorial branding strategies that take the rape/abduction of Proserpina as a central narrative element. Through thematic maps, outreach materials and digital media, the lake can be presented as a “threshold-place” where natural landscape, classical memory and contemporary identity intersect, thereby helping to differentiate the destination's image from that of other inland areas of Sicily.

In this respect, numerous testimonies of various kinds – literary, archaeological, artistic and numismatic – can be cited. Some votive terracottas from the sanctuaries of Gela and Agrigento, for example, depict Demeter and Kore, although in this case it is not easy to determine which figurines represent one goddess or the other; similarly, on the Selinuntine metopes there are figures reproducing the triad Demeter-Kore-Hecate, and temples dedicated to them exist in almost every part of the island (including the ancient and famous temple of Ceres at Enna mentioned by Cicero).

At Raffadali there is even preserved a sarcophagus of considerable artistic and archaeological interest portraying the moment when Proserpina is abducted by Pluto. The end panel shows Mercury holding the infernal horses with one hand and the sceptre with the other. The tomb, dating to the Roman period, was discovered in the sixteenth century on Monte Grotticelle, one of the hills surrounding the town of Raffadali, and subsequently donated to the parish church, where it is still kept (Caminnecci, 2013).

The cult spread very early, from the arrival in Sicily of the first Greek colonists, who, faced with the fertility of the island (remarkable for the time, especially when compared with the poorer lands from

which they came), were convinced that they had reached a land favoured by the gods and, in particular, by the two goddesses of vegetation, also in view of the mildness of the climate and the beauty of the landscape. Thus there became firmly fixed, in the mind of the believer as in the imagination of the poet, one of the most beautiful legends of the ancient world, celebrated, among others, by Ovid with the musical sweetness of his verses, and by Claudian, the last great poet of a dying paganism, who chose it as a symbol of what was most sublime in the religious sensibility of the ancients.

From the standpoint of contemporary cultural tourism, this same legend may be reread as a form of “narrative capital” available to local communities and – with due caution – mobilised to construct landscape interpretation routes that weave together religious, literary and environmental dimensions. As Ovid recounts in the *Metamorphoses* (vv. 341-571), Dis (Pluto), king of the Underworld, feared that the telluric movements caused by the giant Typhon, buried beneath Sicily, might allow light to penetrate his dark realm. While he was surveying that region, Venus, having caught sight of him, urged Cupid to extend his dominion also over the infernal kingdom by striking its sovereign with one of his arrows. In “a lake of clear and deep waters, / Not far from Enna’s walls, called Pergusa”, Proserpina was playing in the woods, gathering flowers with her companions. Struck by Cupid’s dart, Pluto fell in love with her, abducted her and carried her off to the Underworld. The nymph Cyane witnessed the abduction and, in a vain attempt to prevent the outrage, dissolved into the spring that bears her name. Demeter, realising her daughter’s disappearance, launched into a frantic search: “Every land and every sea she explores”, carrying in her hands two pine-torches lit from the fires of Etna. At last she recognised, on the rippling surface of the water, Proserpina’s girdle, which Cyane had brought back to the surface to reveal the abduction. Blinded by wrath against Sicily, which she held responsible for the loss of her daughter, the goddess unleashed famine and devastation. Only the intervention of Arethusa, who reported having seen Proserpina in the whirlpools of the Styx, persuaded Jupiter to act. Since the young girl had already eaten several pomegranate seeds, she could not be restored entirely to the world of the living, but she was allowed to spend part of the year on earth and part in the realm of shadows. The explanation of the seasonal cycle thus intertwines, in Ovid’s account, with Sicily’s mythical geography and with the specific localisation of the abduction at Lake Pergusa (Vannucci, 1863).

4. Lake Pergusa: An Example of a Sicilian Sinkhole

Lake Pergusa is thus the infernal chasm in which classical mythology situates the abduction of Proserpina in Sicily. According to legend, the closure of the conduit gave rise to a sub-circular cavity. Its ancient toponym appears to derive from the pre-Aryan term “Pergo”, meaning “height, rock, tower”. Before the name “Pergusa” came to prevail, this term was widely used both by Latin authors, including Ovid (as noted above), and by later writers, particularly those distinguished in odeporic literature – among them, besides the Italians Vito Amico and Giuseppe De Luca, numerous foreign travellers.

Located in the heart of the island at 667 metres above sea level, Lake Pergusa – entirely within the municipality of Enna – is the largest natural lake in Sicily. Known for its brackish waters, it is characterised by an endorheic catchment basin – unique in Sicily – with no surface inlets or outlets. This condition results in wide fluctuations in water level, linked to rainfall patterns and evaporation, especially in summer. For many years, the lake experienced a progressive lowering of its level due to human interventions, including groundwater pumping through public and private wells, which

depleted the aquifer to the point of an almost total disappearance of the water surface in the summer of 2002, further exacerbated by a prolonged drought.

The water body opens within a hilly landscape modelled into Pliocene sandstones and clays, underlain by marls and marly limestones resting in turn on Messinian evaporitic units (Di Maggio et al., 1993). Besides its scenic value, the lake has long represented an area and biotope of high cultural and geological interest. It has a perimeter of about 4.5 kilometres and an average depth of only 2 metres. In 1896, Marinelli measured a maximum depth of just 4.6 metres and it is likely that in past periods both the depth and the surface extent were greater.

Within the framework of two European Union projects on desertification in the Mediterranean basin, sediment cores collected in 1994 and 2001 allowed the age of Lake Pergusa to be established as greater than 11,000 years (Oddo, 2018).

In addition to its naturalistic and scientific value, Lake Pergusa today plays a central role in territorial enhancement, as an integral part of the Rocca di Cerere UNESCO Global Geopark, recognised by UNESCO for its outstanding geological heritage and for integrated strategies that combine conservation, education and sustainable development.

Within this international network, the lake functions as an emblematic geosite where geomorphological, mythical and landscape dimensions converge, offering a paradigmatic example of geotourism grounded in the scientific interpretation of the territory and in the valorisation of cultural memory.

For many centuries, precisely because of the Proserpina legend, the lake was originally believed to be of volcanic origin, a sort of very deep cylindrical conduit. Today, it is understood to have formed through a subsidence process and is classified among the sinkholes of the Sicilian territory.

The underlying mechanisms of erosion from below can be likened to deep suffosion processes, driven by the mechanical effects of subsurface water flow through the ground (with grain sizes ranging from clays to gravels). These processes occur when the sediment is fractured or porous and when abundant water under high pressure is able to find preferential pathways and to flow at relatively high velocity. The passage of water induces the erosion of material and the formation of small channels and tubular conduits along hydraulic flow lines. This phenomenon is referred to in the anglophone literature as piping, and the resulting form of subsidence may be defined, in order to specify its genesis, as a piping sinkhole (Nisio, 2003).

The conceptual geological model for the development of such a sinkhole requires the presence, above a karstified bedrock, of a thick package of overlying cover deposits. The grain size of these cover sediments may vary, but they generally comprise clayey sands, silts and sands with interbedded gravels.

As a result of piping, a cavity propagates within the cover material, from the top of the bedrock upwards. The process continues until the overburden can no longer withstand shear stresses and collapses, giving rise to a sinkhole that may form within 6-24 hours. The depth at which final collapse occurs is generally on the order of 30 metres; the cavity thus migrates upwards until it reaches this distance from the ground surface, above which the collapse takes place (fig. 3).

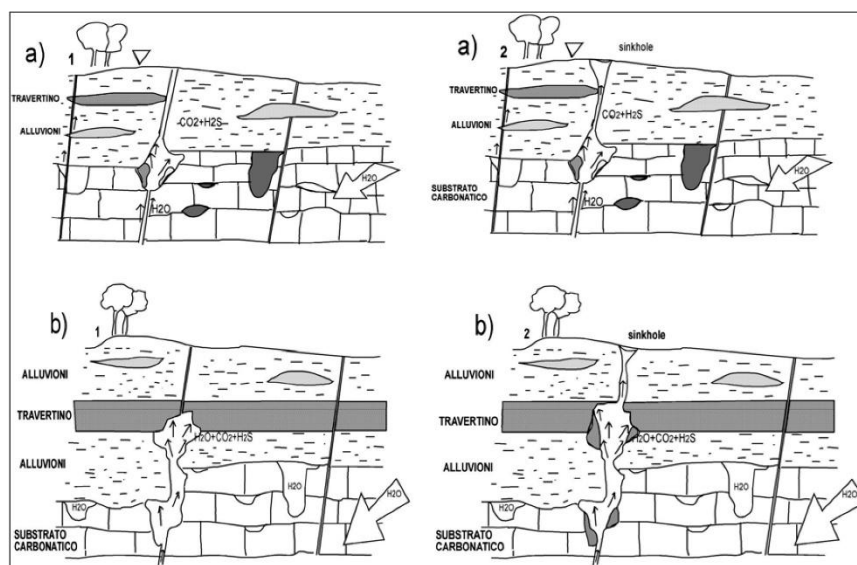


Figure 3. Evolutionary diagram of a piping sinkhole mechanism (Nisio, S. 2003, p. 128).

Lake Pergusa has – or, rather, had, since the last event dates to 1999 – the peculiar characteristic of turning its waters red due to the proliferation of algal flora, a rare phenomenon that greatly impressed earlier observers. What is most striking today is how scholars of past centuries compared the reddening of Pergusa’s waters with the biblical account of the Nile in the time of Moses. According to the biblical narrative, during the first plague of Egypt, Aaron struck the waters of the Nile with his staff and they immediately turned into blood. By analogy with the Egyptian river, Pergusa was thus nicknamed the “Lake of Blood”, and whenever the reddening recurred – roughly every ten to fifteen years – the local population interpreted it as a divine punishment and a portent of misfortune.

Today, this intertwining of natural observation, archaic fear and scientific explanation could become a powerful theme for visitor itineraries and outreach activities, illustrating how collective interpretations of environmental phenomena change over time.

The question of the unusual and sudden biological causes that periodically transformed Lake Pergusa into a “Lake of Blood” was raised by Professor Ramiro Fabiani, who on 16 and 17 September 1932 happened to be on site as an “astonished” observer of the rare phenomenon, and was so struck by it that he wished to reproduce it in colour by means of a watercolour (fig. 4).



Figure 4. Lake Pergusa coloured by bacteria as it appeared on 16 September 1932. Watercolour by Professor Ramiro Fabiani (Forti, A., 1933, pl. I).

In his diary he noted:

I have seen nearby Lake Pergusa entirely violet and red-violet-marvellous. I attempted to collect that sort of foam... (Forti, 1933, p. 69, own translation).

Later that same day, writing from Caltagirone, he described the:

water as appearing violet-copper-red (beneath the blue sky), bluish-turquoise-grey in the shadow cast by clouds; with truly marvellous effects. [...] The light wind pushed towards the marshy banks a kind of multicoloured floating turbidity. The part further from the shore appeared as a pinkish-violet turbidity; nearer the bank the colour thickened like must, with darker and whitish patches and gelatinous masses dark beneath and red-violet above, like certain viscera... Could they be bacteria? (Forti, 1933, pp. 69-70, own translation).

The scientific enigma was solved after centuries of hypotheses and myths. Fabiani collected water samples and analysed them in his laboratories in Verona. His research revealed that the phenomenon was caused by bacteria typical of sulphurous waters. He identified two types of turbidity: that along the shore, formed by *Thioplycoccus ruber*, and that in the central part of the lake, formed by *Thiopedia rosea* and *Lamprocystis roseo-persicina*. As Fabiani observed:

it was not surprising that multiple species coexisted in an environment favourable to each of them, all contributing to the anaerobic biological sulphur cycle generated by the decomposition of sulphates originating in subterranean strata (Forti, 1933, p. 71, own translation).

The proliferation of these bacteria is a natural process that occurs under specific environmental conditions, such as low oxygen levels and the presence of sulphates. The process has long been known to humankind, but in antiquity there were no adequate instruments with which to investigate it microscopically.

It is also worth noting that the choice of a circular lake as an entrance to the Underworld had already been proposed by Virgil in Book VI of the *Aeneid*. The poet locates the mythical entrance to Hades by a chasm, a sub-circular form, a volcanic lake – Lake Avernus – where the hero Aeneas must go to begin his journey. Strikingly, this lake too presents, in particular seasons, a similar reddish coloration (Franco, 2024). Dante, like Virgil, probably associates a sub-circular lake with access to the infernal realm. Dante's Hell, analysed today from a geomorphological perspective, resembles a large funnel-shaped doline, a rock depression that narrows downward. It is therefore plausible that the poet combined scriptural and popular traditions with features he had actually observed in nature, drawing inspiration from landforms frequent in his own territory and, in all likelihood, from an epigeal karst morphology (Amirante & Nisio, 2023).

5. Conclusions

Many small lakes have long aroused curiosity and wonder, not only among local populations but also among poets, artists and scientists of every era. Despite their diversity, these water bodies often share

a number of features: an origin perceived as obscure or linked to paroxysmal events that, for the ancients, had something miraculous or prodigious; a frequently sub-circular form; the properties of their mineral waters; the presence of gaseous emissions. Some of these lakes appeared suddenly and were then filled in and disappeared over the course of a few decades or centuries; for others, the origins recede into protohistoric times.

Almost all of them have, through natural processes, altered their depth or diameter over time and are still evolving today. Some have been remodelled by human action to such an extent that it is now impossible to recognise their original shape and size; others have been completely drained. They enrich the Italian territory and landscape and are the source of traditions, myths and legends. Yet the true element they share is the presence of certain geological hazards that can translate into actual risks when land use or even simple tourist enjoyment of these lakes does not respect the limits imposed by their nature. One such geological hazard factor is associated with subsidence (sinkhole). Lakes originating from sinkhole processes – as in the case of Lake Pergusa – have long fuelled imaginings of subterranean worlds and chthonic myths among ancient peoples. These features could be used effectively in environmental outreach, as spectacular witnesses to natural processes that may generate geological risk even in territories that appear safe.

Such sites, as geomorphological features of scientific significance and at the same time spaces of high symbolic density, in which myth has contributed to shaping the collective perception of the landscape, constitute a fundamental resource for broadening geological culture and increasing awareness of the risks associated with our marvellous yet fragile territory. In this sense, Lake Pergusa, an emblematic example of a sinkhole basin, can be regarded as a model for environmental education and geotourism, through initiatives aimed at its conservation, valorisation and cultural interpretation of the landscape. In the case of Pergusa (fig. 5), the superimposition of a natural phenomenon and the narrative of Proserpina's abduction has generated a persistent imaginary that runs through classical, medieval and modern literature, transforming the lake into a veritable “mythical gate” of the Enna territory.



Figure 5. Lake Pergusa (Enna, Sicily), an endorheic basin of tectonic origin set within the Enna plateau, represents a unique geomorphological and natural feature of the Sicilian hinterland, renowned for its high ecological value and for the layered mythological and literary traditions associated with the cult of Demeter and Kore (<https://orbs.regione.sicilia.it/aree-protette/riserve-naturali-siciliane/213-riserva-naturale-lago-di-pergusa.html>).

From a sustainable tourism perspective, this intangible heritage can be integrated with the scientific dissemination of geomorphological processes, fostering forms of informed visitation and risk education. The inclusion of the lake within the Rocca di Cerere UNESCO Global Geopark further strengthens this perspective, laying the groundwork for valorisation strategies that combine protection, landscape interpretation and local development.

A useful comparison in this regard is provided by Lake Como, where the lacustrine landscape has been progressively reinterpreted through the lenses of literature and historical memory. The Manzonian itineraries, the routes devoted to the settings of the novel *I Promessi Sposi*, and the many cultural initiatives that link the territory to the figure of Alessandro Manzoni show how a natural context can be transformed into a narrative landscape and, at the same time, into a qualifying element of destination identity. In this case, as in Pergusa, it is the literary plots that offer a privileged key for reading the place, orienting visitors' gaze and contributing to the construction of a recognisable tourist image.

The fundamental difference lies in the fact that, whereas Como is grounded predominantly in a major modern literary narrative, Pergusa intertwines a long-standing mythical heritage with high geological significance. This makes the Enna lake a particularly fertile laboratory for experimenting with forms of narrative geotourism, in which the story of Proserpina's abduction and the scientific recognition of the sinkhole jointly contribute to the touristic construction of the landscape.

In operational terms, the interpretive framework proposed here lends itself to translation into various valorisation strategies. A first domain concerns on-site interpretation: panels and narrative installations around the lake perimeter could integrate the geomorphological explanation of the sinkhole with the story of Proserpina's abduction and references to the classical (Ovid, Virgil) and medieval (Dante) literary traditions. Geo-mythological theme trails, guided or self-guided through digital media, would make it possible to connect points of naturalistic interest (wildlife observation points, geological features, lake-level fluctuations) with symbolic locations of the myth.

These interpretive devices could be developed in collaboration with the Geopark managing bodies and with local cultural and voluntary associations. One possible example is the design of a "Persephone Trail", an annular path around the lake equipped with physical signage integrated with QR codes linking to short audio-narratives, 3D reconstructions of historical maps and visualisations of the main evolutionary stages of the lake basin. Seasonal events – such as guided night walks focused on the theme of the descent to the Underworld, or storytelling performances that relate the myth of Proserpina to contemporary environmental issues – could further enhance visitor engagement while remaining low-impact and compatible with conservation objectives.

A second domain concerns the design of educational experiences for schools and universities, using Pergusa as an open-air laboratory for addressing, in an integrated manner, topics in geology, literature, history of religions and geological risk management. Educational workshops focused on sinkhole phenomena, on the hydrological dynamics of endorheic basins and on the "red waters" of the lake could be complemented by guided readings of classical texts and by participatory storytelling activities involving local communities. In this way, students and visitors would be invited not only to "read" the landscape from a scientific point of view, but also to re-elaborate it through their own narratives, reinforcing the idea of Pergusa as a living natural and cultural heritage, subject to continuous reinterpretation. The intertwining of direct observation, hands-on activities and storytelling could help to develop critical awareness both of ongoing geomorphological processes and of collective responsibilities in geological risk management.

Finally, Pergusa's location within the Rocca di Cerere UNESCO Global Geopark offers the opportunity to develop destination-management initiatives that integrate the lake into broader itineraries dedicated to the mythical and sacred landscapes of the Sicilian hinterland. The construction of a geo-mythological "product" – linking, for example, sites of the cult of Demeter and Kore, key geosites of the Geopark and nearby historic centres – could contribute to strengthening the overall identity of the destination and diversifying the tourist offer beyond traditional coastal resorts.

The framework outlined here nonetheless presents certain limitations that should be acknowledged. The analysis is predominantly qualitative and based on an interpretive reading of literary, historical and geological sources, without recourse to systematic empirical data on current tourist demand or visitor perceptions. Moreover, Pergusa is treated as a single, exemplary case study and is not systematically compared with other similar sites. Consequently, the proposals advanced in terms of interpretive and geotouristic strategies should be understood as operational hypotheses rather than as models already validated from a managerial or market perspective.

Despite these limitations, the interpretive framework developed for Pergusa does exhibit elements of transferability. Many geological and mythical landscapes, in Sicily and elsewhere, are associated with foundation myths, infernal legends or sacred narratives (one might think, for example, of volcanic lakes and craters traditionally conceived as "gates of the Underworld", of mythic caves or of sacred sites found in various UNESCO Global Geoparks). In the Sicilian context, one could cite – by way of illustration only – the craters and adventitious cones of Etna associated with legends of giants or chthonic deities, or certain karst and volcanic cavities traditionally identified as dwellings of demons or hermit saints. On a broader scale, numerous European and Mediterranean UNESCO Global Geoparks include crater lakes, dolines, caves or gorges that local traditions interpret as openings to subterranean worlds or as sites of epiphany of the sacred. These are spaces in which a geo-mythological approach similar to that outlined here could be tested in the design of integrated interpretive routes, provided that specific cultural sensitivities are duly respected. In such contexts, close attention to the narrative dimension of the landscape could contribute not only to reinforcing the sense of place and the identity of resident communities, but also to differentiating the tourist offer from standardised models, promoting slower, more reflective forms of visitation compatible with conservation objectives.

In these settings, the approach proposed here – based on the integration of geosciences, the humanities and tourism design – can be adapted to construct interpretive devices that bring scientific knowledge into dialogue with collective imaginaries, on the condition that the cultural and environmental specificities of each site are respected. Future research developments may deepen these aspects by comparing different cases and integrating empirical analyses of the actual use and perception of geo-mythological landscapes.

Conflict of interest

The author declares no conflicts of interest in this paper.

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