ISSN: 2687-8402

DOI: 10.33552/OAJAA.2020.02.000548

Open Access Journal of Archaeology and Anthropology

Iris Publishers

Review Article

Ten Years of Geo-Archeo-Mythological Studies in the Abruzzo Region –Central Italy: An Updated Review

Francesco Stoppa*

Department of Psychological, Health and Territory Sciences, University G.d'Annunzio Chieti-Pescara, Italy

***Corresponding author:** Francesco Stoppa, Department of Psychological, Health and Territory Sciences, University G.d'Annunzio Chieti-Pescara, via dei Vestini 30, 66 100 Chieti, Italy.

Received Date: October 08, 2020

Published Date: October 28, 2020

Abstract

Abruzzo region, in eastern-Central Italy, is an area undergoing active tectonics. It is prone to earthquakes, tsunamis, landslides, flooding, rapid coastal modification, mud volcanoes, and sinkholes. These natural phenomena, recorded since the Roman age, have impressed the local population, conditioning society, economy, and territory use and giving birth to myths (mythopoiesis). Mythopoiesis is an interpretation of natural phenomena, which produce abrupt changes of the territory and human settlements, linked to the appearance of a god (theophany, miracle). Myths, with time, syncretize in elaborate rituals perpetuated in specific traditional feasts and places of worship. This culture forms a precious heritage of oral tradition. What is the utility of such a research? A possible answer would be that myths are an account of dangerous endogenous phenomena that can repeat in a near future. This study reports three representative case histories.

I. Destructive earthquakes in the Majella mountain area generating widespread chthonic worship,

II. A massive tsunami and earthquake occurred in 1627 along the Chieti province seacoast, which produced changes in the use of the coastal region due to fear of the Sea and

III. Relationship between mud volcanoes/sinkholes with eschatological belief. Notably, naïve interpretation of natural phenomena continued up to recent times and now channelizes into social media perpetuating this psychological/social process.

Keywords: Abruzzi Central Italy, Geomithology, Earthquake-Tsunamis, Mud volcanoes-sinkholes, landslides, Chthonic worship

Introduction

Rites and legends in the Abruzzo may orally hand down the memory of past destructive events poorly accounted for in geologic catalogues. Geomythology is the discipline that attempts to decode the symbols, rituals, legends, and archaeological data related to these phenomena, allowing a rational reading of the phenomenon itself, possibly not documented by objective chronicles or other scientific data [1]. Geomythology has to do with history and even with the finite sciences. Geomythology encourages the hypothesis that a given culture develops its long-term disaster awareness, based on abrupt environmental changes, producing a complex phenomenon of thaumatosis. Thaumatosis is the process of interpreting a natural phenomenon through a miracle or appearance of a god (theophany). Temples and ritual feasts perpetuated memory in the sites where the god gave a sign of itself, generating chthonic worships and rites related to the harvest and Mother Earth fecundity. Most of the Saints involved are typical of the agro-pastoral Samnite culture, Italic Mars, Hercules and Demetra [2]. Roman Saints then replaced the Italic ones and, finally, Catholic religion syncretized them, accepting the damages at a fair price to pay for an abundant harvest, a personal benefit or protection. This association/transposition ameliorates the grief and trauma caused by a past disaster as far as possible. It is not a matter of representation or compensation and instead is

a symbol that contains an assessment of the geological hazard and risk and the awareness of natural cyclic processes.

The decoding of symbols and rites has a parallel in the naïve theories, which are common among ordinary people and reduce scientific communication efficacy, but is not, per se, just the result of a subculture, owing a complex psychological feed-back. A metaphysical system incorporates the awareness of the risk associated with catastrophic geological phenomena that somehow predicts future catastrophes in more acceptable terms to traditional cultures. Eventually, the statement of worship is invariably associated with the presence of imminent danger. Rite translates in a prediction, which leads to the inspirations of a supernatural phenomenon or clairvoyance. Prediction or a prophecy follows a circular system of perception of the past and the future for example, the Costantino's dream and the Sirente mud volcano [3]. Actualizing the past to forecast the future is very close to Lyell's theories, the base of modern geology [4].

Very frequently, archaeologists and anthropologists miss the broader link to geological structures and events with which they are unfamiliar and prefer to relate worship location to the presence of a minor feature (e.g., a water spring, a peculiar rock, and peculiar geomorphology). On the other hand, geologists ignore data concerning symbolic representations of natural reality, preferring descriptive chronicles of phenomena, the geological datum, seismogenic structures, hydrogeological instability, and endogenous manifestations. The archaeological datum, destruction, rebuilding, and dedication, and the anthropological datum, traditional oral culture, must dialogue to fill the gaps linked to the poor knowledge of past and events distant in the time of which no other material traces remain. Therefore, to increase risk awareness and efficiency of mitigation measures, it is crucial to make communicators and scholars aware of the real dimension of these mechanisms [5]. This paper updates a decade of research on the territory through selected representative examples and several new data and figures.

Study area

Majella-Morrone area comprises high mountains, up to ~3000 m.a.s.l., formed in the Pliocene age, that separates the southern Abruzzo coastal area to the east -Chieti province- and Peligna intermountain valley -L'Aquila province- to the west. The Mesozoic limestone mountains chain degrades towards the seacoast through Tertiary sandstones and clays, rugged hills, and badlands. The coastal area is involved in a compressive tectonic stress field and has high relief energy (1-2 mm per year) [6]. The extensional stress field dissected the mountain area and articulated it in horst and graben structure bordered by active normal faults [7,8]. These geological structures are associated with neotectonic basins, favourable, despite seismicity, to settlements and viability of the Italic Abruzzo tribes of Peligni, Marrucini, and Frentani. The active geology progressively moves to east (~1-2 cm per year) [9]. This specific concourse of geological causes makes this area very prone to rapid modification of the territory, also evident in human-life scale time. Seismicity is very high, and destructive earthquakes are frequent as those recently occurred in 2009 and 2016-17 [10]. Seacoast suffers cliff collapse and submarine landslides and intense erosion, as well as tsunamis. The hilly area undergoes to rapid erosion and mud volcanoes and sinkholes are frequent. Sulphur springs and gas emissions, including flammable methane and soil liquefaction are equally widespread. Fig. 1A shows the geography, geology and cited toponyms of the study area.

Earthquakes

We know little about the study area's prehistoric seismicity, probably similar to that observed in the historical period, based on the area's seismic potential [11]. There are no doubts about the frequency and the considerable energy released by earthquakes in this area. Catastrophic earthquakes of magnitude (M) ~7 repeat about once every 500 years, while destructive earthquakes (M 6-6.5) repeat once every 50 years. Long-term return events (> 2000 years, M>7) may be underestimated. Pre-historical earthquakes may have produced devastating landslides not observed in historical time but accounted by legends and geological evidence (e.g., Pacentro, Scanno catastrophic large-volume landslides). Suddenly ground collapse, such as sinkholes of La Quaglia Lake at Rajano and Sirente Lake at Secinaro, may also relate to old earthquakes [12]. Additional evidence of these earthquakes is underground karst structures showing stalagmite-stalactite collective collapse, tilting, and change of growing angle [13]. In more recent times, the Majella area and Chieti province suffered the most significant destruction and loss of lives in the I and IV century AD, 990-1088 (?), 1209, 1315, 1349, 1456, 1706, 1777, 1841, 1881, 1905, 1915, 1933 (Figure 1B). All municipalities in the area have received at least one shock of IX-X on the Mercalli scale (MCS), thus disastrous, or very disastrous, and up to a maximum of XI degrees MCS of intensity [14]. Geologic information on the geometric, kinematic, and energetic parameters of the major active faults in these areas defines discrete seismogenic structures (normal faults) of about 25-30 km in length [15], but many others remain poorly known, especially in the coastal area. In fact, the Majella area has a deep seismic source (thrust faults) extending towards the Adriatic coast with scarce evidence of superficial rupture but linked to destructive historical earthquakes (e.g., 1881-1882 Orsogna e Chieti, 1933 Taranta Peligna) [16,17].

Tsunamis

The historical seismicity associated with the Adriatic coast is an energy power from 5.5 to 6.2 (± 0.2) M with some exceptions of greater energy (M~7). High magnitude earthquakes generate

massive tsunamis, i.e., VI intensity on the Papadopoulos Imamura scale, but smaller tsunamis, ~1 meter high are more frequent. However, underwater landslides, related to medium-sized earthquakes (M 5-5.5), may trigger massive tsunamis. Landslides may also occur in the absence of a noticeable seismic disturbance and relate to turbidity currents descending in the Tremiti trench slope and the collapse of the Holocene muddy pro-delta accumulated along the Abruzzo Coast [18]. Tsunami and seismicity have a repetitive nature and there is evidence of significant tsunamis along the Abruzzo coast, as in the nearby Apulia region [19,20].

An obvious geological example is from the three 'fan' forms generated from other tsunamis entering the Lesina Lagoon, immediately South of Abruzzi area. They are dated to about the V century BC, VIII century AD, and 1627. The study by [19] testifies the presence of boulders accumulation along the southern coast of Apulia placed there by the tsunami of 1743 triggered by an M 7 earthquake offshore of southern Apulia. This fact poses the problem of historical, unrecognized tsunamis along the Adriatic coast. The propagation models indicate that tsunamis from the lower Adriatic Sea, Croatia / Montenegro coast and the Ionian Sea may also affect Abruzzo's coast [20].

Mud Volcanoes / Sinkholes and Landslides

Mud volcanoes are widespread along the Adriatic coast [21]. Two main active mud-volcano fields are in Pineto (Pescara province, Figure 1A), with many smaller ones disseminated in the Chieti province (Figure 1B) and the Marche area, near Monteleone di Fermo, just at North of Abruzzi area. They produce mudflows and form a few meters high mud-cones terminated by a crater. The main difference between sedimentary volcanism and magmatic volcanism is heat. The volcanic mud emissions are cold. The mud volcanoes originate from deep levels, rich in fluids and natural gases under pressure generated by tectonic stress related to the same causes that originate local seismicity. Intense eruptions occurred before, during, and in the aftermath of an earthquake. Sinkholes are impressive catastrophic soil subsidence producing deep conduit flooded by gas-rich (CO_2, sulphur) waters; they can also erupt mudflows upon some specific geological conditions and are often related to the earthquake.

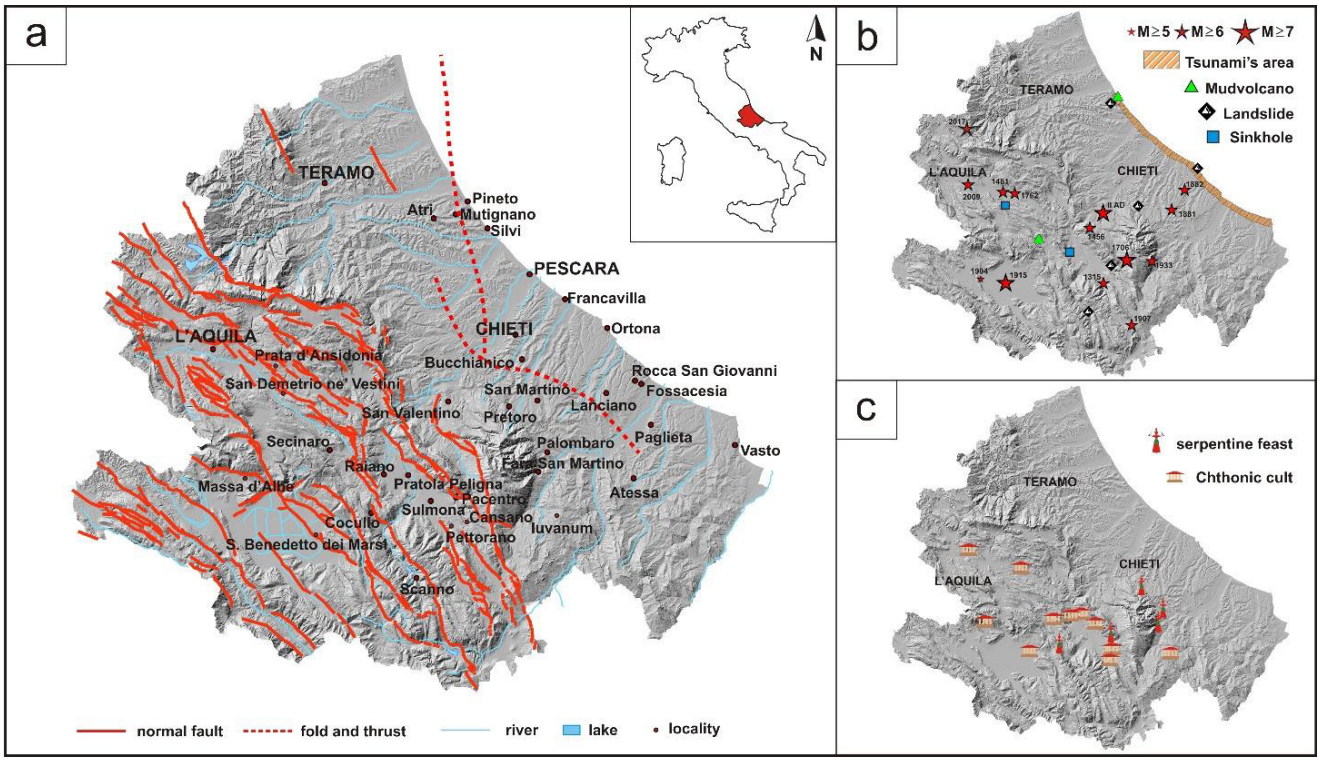

Figure 1. a- Physiography and active faults of the Abruzzo Region. Toponyms cited in the text are indicated; red lines = active normal faults dashed lines active compressive faults. b- Epicentres of major historical Earthquakes, sinkholes, mud volcanoes, and landslides cited in the text. c- Location of the main chthonic temples and still active snake-feasts In Abruzzo Region.

Particularly catastrophic landslides occurred in pre-historical and historical times. Active faulting is one of the main factors that induce deep-seated gravitational slope deformations. Gigantic landslide relates to the tectonic activity of the NW–SE extensional fault system along Mt. Morrone (Figure 1A & B), considered to be the source of M 6.5–7 earthquakes. This event geologically is dated as post-Holocene [22]. Historical notable landslides occurred in 1506 in Ortona and 1765 in Roccamontepiano (Figure 1B). They caused many hundreds of fatal casualties, and the first one erroneously classified in old catalogues as an earthquake.

Roman age

The first earthquake that associates remarkable chronicle and archaeological data on the whole area covered by this study is the 100 AD (M ~6.2, IX M intensity, probably underestimated). It caused the collapse of buildings of the territorial district of Interpromium, near the San Valentino in Abruzzo Citeriore city (now province of Pescara, FIG1A). The account is in a carved stone recycled to build the abbey of San Clemente da Casauria (871 AD) (Figure 2). The inscription bears the commemoration of restoration by two magistrates of Sulmona.

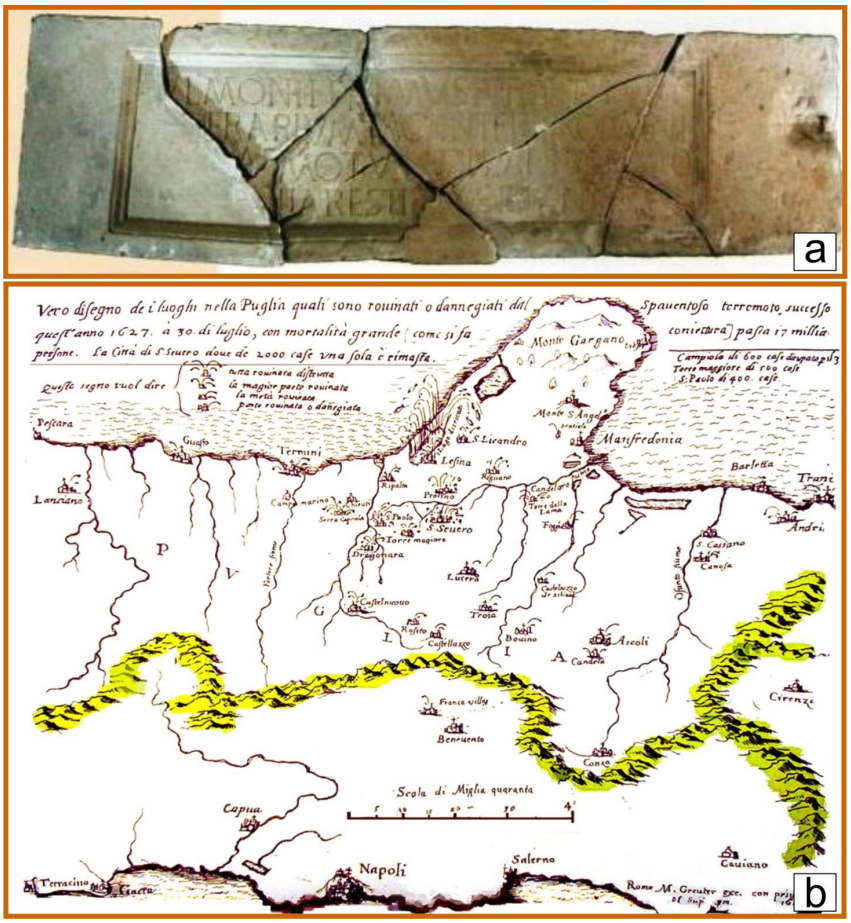

Figure 2. Roman inscription from Interpromium in memory of the Majella earthquake of the I-II century; b- Greuter's map of earthquake and tsunamis of 1627 (35).

-AD [C. C.] SVLMONII PRIMVS ET FORTVNATVS / [P] ONDERARIVM PAGI INTERPROMINI / [VI] TERRAEMOTVS DILAPSVM A SOLO / [S]VA PECVNIA RESTTVERVNT-.

-PRIMO AND FORTUNATO OF SULMONA REBUILT AT THEIR OWN EXPENSES THE PUBLIC WEIGHS OF THE CITY OF INTERPROMIUM DESTROYED BY THE EARTHQUAKE-.

Additional information derives from Plinius -SUPER OMNIA, QUAE UMQUAM AUDITA SUNT, ERIT PRODIGIUM IN NOSTRO AEVO NERONIS PRINCIPIS RUINA FACTUM IN AGRO MARRUCINO, VETTI MARCELLI E PRIMIS EQUESTRIS ORDINIS OLIVETO UNIVERSO VIAM PUBLICAM TRANSGRESSO ARVISQUE INDE E CONTRARIO IN LOCUM OLIVETI PROFECTIS-, Plinius Secundus C., Naturalis Historia Liber XVII 245. ".

-ABOVE ALL THE EXTRAORDINARY CASES THAT HAS NEVER HEARD OF, THE PRODIGY THAT OCCURRED IN OUR TIMES WAS AT THE TIME OF THE FALL OF THE EMPEROR NERO [IN AD 68], IN THE MARRUCINO TERRITORY. AN OLIVE GROVE OF VEZIO MARCELLO, ONE OF THE FIRST OF THE EQUESTRIAN ORDER, CROSSED IN A BLOCK THE PUBLIC ROAD TO THE OPPOSITE SIDE, SOME FIELDS CAME TO TAKE THE PLACE OF THE OLIVE GROVE-. The inscription is a landslide description, but we do not know if it is consequent to the earthquake.

The 100 AD earthquake corresponds to major collapses or damages in all the archaeological sites of the Majella-Sulmona area, for example, the shrine complex of Ocriticum, in the territory of Cansano [23]. Inside its τέμενος, the holy place related to the sanctuary and his fence, there is a complex layering of buildings

from the Italic to the Hellenistic Roman ages. Excavations found female worships and small statues depicting Demeter (Ceres) and Kore (Persephone). Ocritucum is near Hercules Curino, San Leopardo, and all together testify an exceptional concentration of shrines with chthonic worships along the active faults of the Morrone-Sulmona-Porrara (Figure 1A). The substructure of the Hercules Curino temple's terraces preserves signs of dislocation and restoration, related to this earthquake. Earthquake traces are in Sulmona, where a domus of the first imperial age, found beneath the SS. Annunziata monastery, was abandoned after the earthquake, and its construction materials were reused to construct later buildings. Even not thoroughly investigated, other possible evidence is the tilting of the thermal area of the Villa Rustica of Santa Maria Arabona (Figure 1A) and the collapse of other residential buildings in the surrounding area (unpublished excavation report by Manuela Rosati, archaeological superintendence of Chieti). An earthquake postquam term is the previous roman villas' pillage to build buildings for agricultural use and oil mills. Bricks, stones, and even large oil mill fragments incorporated in V-VI century buildings (Author unpublished data).

Middle age

Middle Ages abbeys San Clemente da Casauria (871 AD) and Santa Maria Arabona (1197 AD), located near the Interpromium area (now San Valentino in Abruzzo Citeriore, Fig. 1A), are very sensitive indicator because built on a seismic high-amplification site, had suffered significant damages during 1209(?), 1349, 1456, 1703-6 up to 2009, and 2016-17 earthquakes [16,24]. Santa Maria Arabona may stand on the remains of a Roman temple dedicated to the worship of the Bona Dea. Arabona may derive from the Latin "altar" and Bona Dea. Both the abbeys reuse a part of the materials of previous Roman buildings and temples. The 1209 earthquake case is also an excellent example of poorly known earthquakes [25]. The first source of information about this earthquake is the coeval Annales Casinenses. Under this title, various compilations made by the Benedictine monks of the abbey of Montecassino near Frosinone, in Latium region, cover the chronological arc from the year 1000 to 1212.

[...] TERRE MOTUS MAGNI PER LOCA IN VALVIS ET TETE PROVINCE SAMNII MUNITIONES DIRUUNTUR, PLURA EDIFICIA ET CASTELLA-.

-[...] GREAT EARTHQUAKES IN [DIFFERENT] PLACES. IN VALVA AND TETE IN THE PROVINCE OF SANNIO RUINED FORTRESSES, MANY BUILDINGS AND CASTLES-.

The authoritativeness of the source allows us to believe that there is attested a powerfully destructive event. The chronicle reports that the earthquake destroyed many fortresses and castles in Valva's dioceses (Sulmona) and Theate (Chieti) that correspond to this study area. Recent archaeological excavation (F.Stoppa et al., unpublished data), in the Romanesque church of Sant'Angelo near Palombaro city (Figure 1A), on the east flank of Majella mountains, shows evidence of the collapse of a previous building occurred in the XIII century. The investigation is ongoing. However, the collapse is likely due to an earthquake, probably the 1209 event. If we know a little about medieval earthquakes, we know a lot about the large earthquakes of 1703 and 1706. The latter devastated the Majella area, with the collapse of most of the region's churches and buildings.

Chronicles of 1627 earthquake, tsunami, and landslide

If geological data about tsunamis occurrence in the Abruzzo area are little, the chronicles are abundant even challenging to decipher precisely [26]. The oldest observations, possibly related to tsunamigenic events, are solely reported by chronicles of the mainland's localized effects and isolated buildings such as castles and monasteries operated by concomitant earthquakes. In addition, storm surges, floods, coastal landslides, and tsunamis probably overlap in the old chronicles and legends. Less than 50% of the events recorded on the western coast of the Adriatic were earthquake-triggered tsunamis, while the others are sea effects attributed to meteorological forcing and submarine landslides [27,28]. Transformations to the human settlements along the coast often relate to these phenomena, but these events' exact nature remains uncertain. On July the 30th, an earthquake of M ~7 struck the Capitanata (Northern Puglia region) and hit the Abruzzo Citeriore, corresponding to the present Termoli area (Molise region) and the Chieti Province. Mercalli's intensity varied in the Chieti province from IX to VII-VIII. Lanciano and Vasto reported damage having -la metà rovinata- -half-destroyed- according to the Matteo Greuter map and De Poardi (1627) report, the damage reported up to the present Pescara province (Figure 2). The historian Antinori [29] says -Il giorno 30 luglio, verso mezzogiorno, un grande tremito portò sgomento nell'Abruzzo inferiore. La fascia adriatica e l'entroterra furono scosse violentemente. Lanciano, Ortona a Mare, Francavilla, Vasto, Termoli, Paglieta e Fossacesia patirono danni gravissimi-.

-On July the 30th, about noon, a large shaking feared southern Abruzzo. The Adriatic coast and the hinterland shaken violently. Lanciano, Ortona a Mare, Francavilla, Vasto, Termoli, Paglieta, Fossacesia, suffered severe damage-.

The earthquake badly damaged the castle of Montazzoli, and a landslide destroyed the nearby village of Baselice (Figure 1A).

From the summaries of Corrado Marciani (1899-1972), we assume the amount of destruction using the acts of sale, renovation, and construction in the affected areas.

-Per tutti i disastri patiti, molti, da ricco stato caddero in miseria ... Forse intere città-.

-For all the disasters suffered, many who were rich fell into poverty... Perhaps entire cities-.

For example, Lanciano's city claimed an extra amount of money to renovation of the damaged/collapsed walls. In the local literature, the 1627 earthquake is among the major catastrophic events, together with 1088 and 1456, since the city's founding.

In Rocca San Giovanni, near Fossacesia (Figure 1A), the 1627 earthquake brought death and destruction, damaged the eastern wall, and committed inhabitants to reconstruct it. The Benedictines did their utmost for the restoration of buildings owned by them. The nearby monastery of San Giovanni in Venere, had its cloister and part of the church demolished. Initially, the facade was all-stone but because of repeated earthquakes (1456 and 1627), the top that had suffered the most was rebuilt in bricks.

Important marine ingression occurred in the southern Abruzzo coast, where flat areas corresponding to the Val di Sangro valley were flooded, causing extensive damage to crops – for example, near the village of Paglieta (Figure 1A). Sea retreat of up to 90 meters occurred at the Pescara and Saline river mouths before the tsunami. Both locations were estuary ports. An upstream wave of about 1 meter high marked the tsunami ingression.

-A breve distanza, nella pianura tra Silvi e Mutignano, un colle arborato e sparso di abitazioni campestri che - come una penisola - entrava nel mare - si staccò per lo scuotimento della terraferma e disparve inghiottito dalle acque procellose che, ribollendo, invasero il lido fino alla notte del giorno seguente per oltre cento passi addentro- [20].

-At a short distance in the plain between Silvi and Mutignano, a hill with trees and scattered rural dwellings, as a peninsula, went into the sea, broke away to the shaking of the land and disappeared, swallowed by stormy waters that seethed and invaded the shore for more than a hundred yards until night the next day-.

This event probably relates to the sudden sinking of the coastline that caused the submersion of the Roman port of Atri "Hatrium" (Figure 1A), whose ruins, still standing, are submerged several meters deep into the Sea. The chronicles tell that Termoli and cities of Chieti's province (Vasto, Ortona), sank into the Sea. Probably in this last case, the chronicles refer to the effect of the tsunami.

There are few chronicles concerning the eruptive episodes of mud volcanoes, viewed with superstitious fear and regarded as points of access to the underworld. A notable exception is the 16th-century fresco cycle by Orfeo Presutti (1527-1556) in the Church of the Madonna della Misericordia in Monteleone di Fermo (Figure 3). It depicts the universal judgment in whose detail we see human beings swallowed by mud volcanoes that communicate with the infernal chambers of torture. In the church appears the Patron Saint Marone in the act of bringing a dragon to the chain. In the local dialect, the term Sdrahu indicates the great mud volcanoes present along the Ete Morto River faithfully reproduced together with the mud volcanoes in the fresco. The fresco is both a geographical and a geological map, as it shows precisely the conformation of the places and the presence of mud volcanoes. Instead, at the oral tradition level, the mud volcanoes, have produced a very dense legends bloom. In particular, they have swallowed people and animals, especially if they violated some religious taboos such as working on holidays dedicated to some Saint and, in particular, in Sant'Anna day (Rajano sinkhole). In fact, in popular interpretation mud volcanoes and sinkholes are united and confused.

Snake rites and chthonic Saints

In the study area, there are some notable occurrences of worship related to chthonian deities. Interpretation varies in function of the hypothesis built on a selected clue, but in the absence of direct dedication, it is quite challenging to assess the exact nature of the deity involved. In other cases, the statement is only epigraphic, so we do not know the exact location of the geological place of worship [30,2]. The Abrutian god/goodness of snakes presides over renewal and fertilization, as the ancients understood very well that life primarily depends on the planet's active forces. Snake, which is round like the universe and infinitely winding like the Greek river Meander, changes its skin, renews itself year after year, and lives underground. It is, therefore, the best personification of endogenous phenomena. During the Middle Ages, the chthonic pagan rites adhered to the worship of local Christian Saints with some adjustments typical of intellectual Christian centralism: the fusion of religious and civil power, the predominance of male over female, and the human right to dominance over Nature. However, the need for a link with Mother Earth remains, and indeed remains primarily at the level of popular religiosity. These worships are incredibly dense in the study area. Snake-related divinity worship or ritual feasts are at Pacentro in the Majella-Sulmona area and Atessa, Palombaro, and Pretoro in the Chieti province (Figure 1C).

The local abundance of toponyms related to San Martino, i.e., Fara San Martino, San Martino sulla Marrucina, and the fact that this Saint is the patron Saint of particularly seismic places such as the city of San Valentino (I century, 1209, 1456 and 1706 earthquakes) indicate a close affinity with the cult of Mars. Martino means dedicated to Mars. His relationship with the faults and earthquakes is direct and immediate. Legend says that he opened a wide crack called "Stretta di San Martino" with his elbows. Telluric male Saints are more related to rocks and initiation rites, whereas female Saints are linked to the water and harvest.

As documented by rites still active among the people, Cristian Saints inherit from Mars and Hercules the association with the earthquake (Figure 1C). For example, San Domenico (Cocullo,

Palombaro and Pretoro cities) is related to initiation, weather protection, rock worships, earthquakes, snakes. Sant'Urbano (Bucchianoco city) is related to weather protection, thunder. San Venanzio (Rajano city) is related to rock worships. San Michele Arcangelo (many places) is related to male initiation, earthquake, rock worships. Sant'Emidio is related to an earthquake (many places). The appearance of Saint Emidio coincides with an earthquake, as seen in historical iconography in Chieti churches (Figure 4). It would be a mistake to consider Sant'Emidio a protector from earthquakes: he is indeed the incarnation of the phenomenon itself, and by invoking him during a shake (Abruzzi dialect, -trəttecə Sandə'Mmiddiə-, -Sant'Emidio is rocking-) the Abrutian people ingratiate the earthquake rather than calling on the protection of the Saint. In reality, telluric pagan gods' properties came to us through Sant'Emidio and other Saints almost unchanged. Simultaneously, the elaborate rituals associated with the positive side of the natural renewal cycle echoed in the customs, beliefs, and habits that serve as the community's social glue.

The barefoot runners

As an example, drawing from a survey conducted by the writer about the race of the gypsies (also called the race of barefoot runners) in Pacentro, it is possible to highlight certain assumptions about a surprising layer linked to ancestral chthonic worships agglutinating the telluric phenomena with rituals of male initiation. Not many modern rituals consist of ritual human-blood sacrifice, and it is surprising that this rite, common in antiquity and among primitive peoples, is still active. Pacentro is a medieval fortification where the landowners have the emblem of the dragon-snake. Pacentro is notably placed on an active fault system that also produced a catastrophic rockslide (Figure 1A & B). On the first Sunday of September, the Pacentro people honour Our Lady of Loreto with a race of barefoot runners. The village youth reach an area halfway up the Scipione hill, gathering in front of split stone, a large block of limestone painted green, red, and white to be readily identifiable. During the race, the runners rush off onto different paths and come to the Vella river and through it and then up the path leading to the church, where they arrive wounded and tested, leaving bloody footprints on the ground. After washing the wounded feet, the villagers carry the first arrival, leading him in triumph while waving lu 'bbalie, a blend of wool cloth suitable for making a suit. The winners sit on the doorstep, displaying the wounds on their feet, to receive family and friends' tributes. The first observation about the race rules is that it is reserved for the youth of the village, but the eldest are also admitted. However, the winners are always teenagers who come prepared for this race from an early age. The winner's prize has a vital symbolic attribute; in fact, the first suit is undoubtedly a sign of male emancipation, a status symbol recognized as the adult clan's entry. This is a collective rite: all participants share the pain and are acknowledged; all are encouraged and applauded even if they arrive very late compared to the winner. Therefore, a collective rite of passage repeated over time. The female element sides with the opposite gender, and young admirers, perhaps future girlfriends cheer wildly. Having seen the feast, we have no reason to doubt that it was the same in the past.

What is more important to note is the link with the dragon or snake, which is fully justified by Vella's valley's geological nature and coseismal phenomena observed here during the seismic activity (e.g., in 1706, 1933, and 2009). Pacentro's youth blood is offered to the deity who spreads it on the sacrificial path, with the path mimetic being linked to the earthquake spirit manifestation. The winding route of the valley covered by coseismal phenomena will certainly have aroused witnesses to the evocation of a fiery dragon-snake.

The survival in this area of snake worship, which is a symbol of the earthquake and infinity, is astonishing. It is worth mentioning the feast ritual of St. Domenico in Cocullo and Palombaro and Pretoro. The snake charmers (serpari) offer their reptiles to people who want to encircle the snakes devotionally. Nobody hesitates to flaunt their courage over natural disgust and fear of the snakes, resisting frequent bites, and the snakes finally irresistibly attract them. For many, it is a first-time experience and form here derives a unique attachment to the feast and the rite. Young people of the village parade ritually, handling snakes, behind the statue of San Domenico covered with snakes. The magic of the divine snake power passes through St. Dominic to them, and this explains why the ritual is felt strongly by younger generations who do not renounce the practice of culturally distant traditions. Snake rite can be interpreted as a reminiscent of telluric fertilization, expressed through a male initiatory sacrifice generated by the bite of harmless reptiles. In all these cases, the theophanic symbol is the dragon-serpent, which in Pacentro dwells in Vella's valley and remains in the stone from which the sacrificial path starts; in other places consist in the manipulation of real snakes (Fig. 5). The idea that such worships are where the earthquake or the divinity manifested itself physically by the earthquake is fascinating. The size of the sacrifice and suffering is sublimated into a "game" that strengthens the teenager's role and status through a struggle with the dragon. Another interesting link between underground rivers, snakes, and sulphur springs is the local belief that the Sulphur rivers (called Petogna) can protect against poisonous snake bites. It is no surprise that the Petogna Rivers are in Abruzzo's most seismic areas, such as Conca del Fucino and L'Aquila.

People migration after the 1627 event

Chronicles and legends describe mountains and cities that plunged into the Sea, people migration, persistent fear of the Sea, and acts of faith of the people who invoke the sea and earth gods' protection. While many of these legends are probably exaggerated

and overstated, however, it is correct that historical changes occurred. There was a drastic change in land use, habits, socio-economic change in the pattern in the historical context in which these legends had formed. These changes are supported by direct and indirect quantification of the repair costs in the acts of sale and registration of trade and travel community changes. Historical references and mythopoetic interpretation of these phenomena can be broadly associated with the effects of the earthquake and, above all, the tsunami of 1627. After that date, a terrestrial coastal economic system was introduced, and the previous commercial and political system was abandoned or dismembered and redistributed. A substantial underestimation of the possible effects of this earthquake and tsunami comes from two factors. The first is that historians generally have a low sensitivity to the influence of physical phenomena on human society and, second, the amplitude of the geological phenomenon is still uncertain. In Vallevò, a small village of country anglers, a legend has developed about the formation of the cliff during the 1627 tsunami, as told by a resident, Rinaldo Verì.

-Lo tsunami ha solcato le colline che si affacciano sul mare creando le falesie visibili ancora oggi dalle quali si sono staccati gli scogli che si ritrovano a riva-.

-The tsunami has crossed the hills that overlook the Sea, creating the cliffs still visible today from which came off the rocks that are found on the shore-.

A corollary of this legend is the fear of the Sea, for which local people were said never to go boating in high water, preferring to fish from trabocchi as they are shocked by the memory of the tsunami. It was also claimed that sailors from Jewish settlers from the Veneto and Liguria repopulated the coast after the tsunami. On the other hand, the Jewish are not known to be sailors but are often associated by antonomasia to the concept of migrants. We know that the earthquake of 1456, no stronger in Frentania if compared to that of 1627, provoked a wave of migration of Albanians and Slavic people (local name: Schiavoni) to restore and repopulate the villages and the country farms destroyed by the earthquake in the province of Chieti, and in particular in the Frentana area. A common surname for Frentania trabbocanti families is Verì or Larà, which are very common among the 4 letter surnames of Albanian origin and those of the sci, vla, sca phonetic groups.

The fear of the Sea

The psychological mechanism that binds a culture is usually disaster thanksgiving for having received less damage than other communities [24].

-Years ago, working on my thesis, I came across historical documents on the earthquake of 1627. But most interesting to me that I was living in a seaside town was the fact that the authors spoke of a strong tsunami that took many lives on the coast of Frentana July the 30th, 1627, the date coincides with the most important religious feast of the Navy of St. Vito, the procession of Madonna del Porto- (Nicola d'Angelo pers. com.2009).

The last Saturday of July each year (for example, July the 30th, 2011), the Madonna del Porto is taken from the church and placed in a boat designated for the sea parade. The celebration's date is remarkable, as this kind of procession on the Sea (i.e. San Basso, San Nicola, Nostra Signora di Punta Penne) is usually celebrated in May and not July. The day of rest for the fishermen, if we exclude the main Saints days, were only those known as star points, unlucky days for those who wanted to go boating: the All Soul's Day and the days when storms resulted in a considerable number of dead and missing among the sailors, such as on November the 16th and on July the 30th (tsunami) are star points. The boat carrying the Madonna statue reaches the open Sea and is surrounded by fishing boats from Ortona and Pescara, that, in a circle, receive the blessing from the priest. In the afternoon, the boat with the Virgin Mary and other boats, call to the beach for the authorities and the faithful to come on board, who have come in procession along the pier. At 21.30, the boats return, the Madonna is presented in a procession, adorned with gems and gold donated by the faithful for the grace received. The foundation of the myth, or rather the strengthening of Our Lady of the Sea's cult, is linked to the legend that the tsunami breached the door of the church and stopped at the foot of the statue of the Madonna.

As for the church, the original S. Maria del Porto, and then Our Lady of the Port, there are letters following the visits of the priors of the Abbey of San Giovanni in Venere from which those Churches depended. The reports follow one another from year to year until 1624. Then there are no other data until 1710. The church of Our Lady of the Harbour was built after the earthquake of July the 30th 1627, replacing an earlier chapel on the beach, according to [31]. The same Antinori speaks about this in the "Annals of the Abruzzo" manuscript in the library of Tommasi di L'Aquila [29].

Earthquakes, sinkholes, and harvest

Saint Anne/Demetra's syncretic worship is widespread and locally linked to sinkhole formation, earthquakes, and grain crops [32,12]. On the evening of July the 26th, 1805, an earthquake (M ~ 7) hit Molise area and was associated with significant changes of hydrology [33]. The earthquake was felt in the Chieti province and Majella-Sulmona area and was rapidly associated with the Santa Anna worship. The earthquake took place during the grain harvest. At Rajano near La Quaglia sinkhole, which is believed to have formed during the earthquake (obviously much older due to the presence of Roman ruins in it), and the adjoining sulphur springs, the memory of this earthquake is renewed with the sound of bells at 10 pm, along with the worship of Saint Anna, to whom people

offer grains. On the other hand, even before 1805, there were myths about Saint Anne, which link well to the grain harvest feast with sinkholes and earthquakes, a sign of previous heritage [12].

However, these phenomena' obvious connection with a gateway to the underworld has predominantly conditioned their interpretation in the Middle Ages. The eschatological theme became dominant over the chthonic one, as seen in the Monteleone di Fermo XVI century frescos (Figure 3). The sinkholes and the mud volcanoes divined infernal places, to be avoided with purely terrifying legends [34,35].

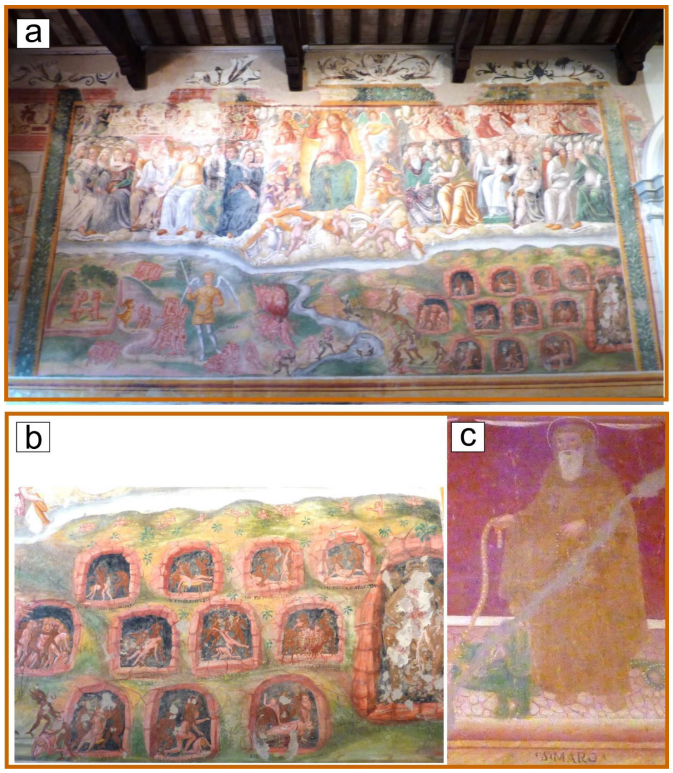

Figure 3. a- Monteleone di Fermo, a 15th-century fresco depicting the universal judgment; b- Mud volcanoes as hell doors (details of a), c- San Marone appears holding a dragon on a leash, a symbol of the mud volcanoes in the local dialect and culture. (author's pictures).

Discussion

The study of miraculous interpretation of natural phenomena (thaumatosis) implies a remarkably complex multidisciplinary approach that ranges from geology to archaeology to anthropology. The principal assumption is that thaumatosis leads to specific forms of worship and to the construction of material and virtual monuments that preserve the symbols of their motive of being. If it is relatively easy to hypothesize the link between thaumatosis and the causal phenomenon, it is less easy to reconstruct the logical sequence of symbols and attributions of miraculous properties that derive from it. At the base of thaumatosis, there is the conviction that there is a direct relationship between Earth and surface, between Earth and sky, between human and divine. Thus, the link between spiritual beings and natural phenomena invests, in particular, the relationship between man and divinity. However, what is the specific natural characteristics of the phenomena that triggered this type of worship and kept it alive in various forms for thousands of years? In any ancient or new form of thaumatosis any sign of exhalation (water, gasses), modification (landslides, mud volcanoes, sinkholes) of the Earth is essential. These phenomena are generally related to active tectonics and an earthquake. The concept of thaumatosis is allied to theophany (i.e., the appearance of a deity).

Aristotle (384-322 BC) assimilates atmospheric and geological processes in the Meteorologica, postulating the need for a dry exhalation, or breath, the principle of winds, earthquakes, and volcanic eruptions, arises from the warming of the Earth by the Sun. The Aristotelian link between endogenous and exogenous phenomena and, in particular, the presence of "voids or subterranean canals" is incredibly still present in traces even in the current Italian popular substrate. The search for the theophany cause is linked to the manifestation of the telluric spirit: subterranean noises, coseismal flash, gaseous or water emission, wind turbines, CO_2 explosions and gaseous hydrocarbons, mud and sand volcanoes, torches, subsidence, collapses, fractures and dislocations, formation and disappearance of springs of sulphurous mineralized water, springs characterized by the bubbling of gas, patches in which the vegetation dies and does not grow. All

these effects are typical of active seismic areas. In Abruzzo, these effects are frequent and intense; consequently, Saint worship was established, and a temple or ritual feast was located where they are more frequent.

The endogenous phenomenon becomes chthonic theophany through whish of Nature cyclic renewal. This virtue is, then, sublimated in the hope of rebirth after death. The concept is always associated with the snake/dragon, which expresses the cyclical nature of life and the seasonal cycle. Dragons and snakes are variously linked to one of four elements: Earth, water, fire, and air and to natural phenomena. For example, they represent veins of underground water (e.g., dragonera in Sardinia or dragonara in Abruzzo). In the same way, mud volcanoes are called 'dragoon' in some Italian areas (for example sdrahu, drahu in the Marche area at Monteleone di Fermo.

This symbolic animal expresses

I. The underground movements (lives and circulates underground);

II. Cyclicity and infinity (circle, spiral, meander);

III. Annual plant renewal (changes the skin). Through a series of symbolic logic passages, natural events are first identified with divinity and then with an equal and contrary effect to the natural phenomenon's danger, neutralizing it by a sort of sympathetic magic. Water / Air / Ground / Fire ⇒ spring / gas emission / stone / earthquake (landslide, mud volcano, sinkhole) ⇒ snake / dragon ⇒ renewal (passage, initiation) and fertility (cult). This concatenation may vary according to specific miraculous attributes of the Saints. Although this issue is out of the scope of the present work, this psychological mechanism is still active as can be seen in the plethora of urban legends relating to dragons, metaphysical and alien present as occurred following the 2009 Abruzzo earthquake and easily traceable on social media.

Consequently, global society continues to amplify the "representation" of large-scale geological disasters by invoking deus ex machina triggers (solar flares, core rotation inversions, meteorites) and still develops urban legends. A study of web blogs reveals forms of neo-thaumatosis, which have been elaborated after April the 6th earthquake, perpetuating the dragon's old telluric symbol (Figure 6). In a post by [34]. A big dragoon between the Abruzzo Mountains is seen as represented by the geomorphology of the Fucino basin (previously Fucino Lake). The dragoon would be 50 km long (grossly the same length of the 1915 fault rupture), and age is assessed "1000 times the age of God, that is 365.000 years ago". The dragoon is represented as partially submerged by the previous lake and partly emerged in Fig. 6. The dragon would bear numerous diabolical symbols, thus responding to a logic strongly influenced by Catholic doctrine. Notably, this dragon also has a chain or leash on its neck, precisely as in the XVI century fresco present at Monteleone di Fermo (Figure 3). In this case, this symbolic animal's positive interpretation is bypassed by a conception of the underworld as unfavourable; the link with the Nature's forces is missing. However it is, the perpetuation of the reading of the geological landscape as impressed by the divine hand is surprising, and this is not far from the interpretation of the ancient Italics who also populated this region, dotting it with chthonic sanctuaries.

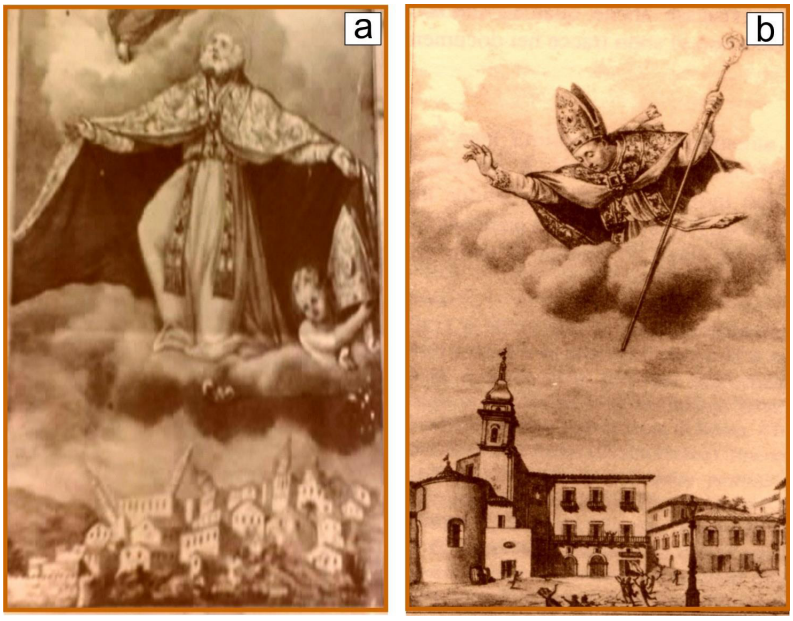

Figure 4. a- San Giustino e b- Sant'Emidio appears to protect Chieti's city shaken by the earthquakes of 1706 and 1881-82, respectively. (author's picture).

Figure 5. A rare picture of women carrying snakes during San Domenico feast at Palombaro.

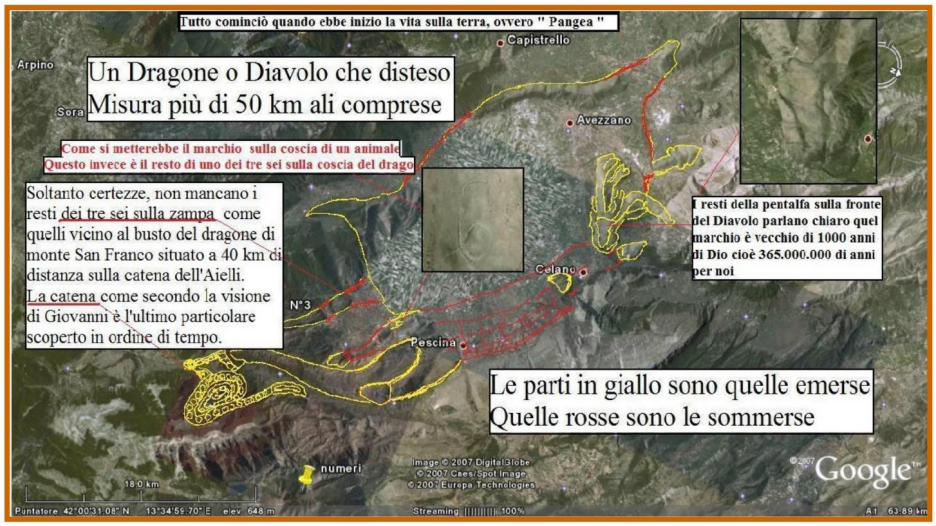

Figure 6. The big dragoon of the Fucino as imagined in urban legends (34).

Conclusion

The Majella area is an exciting field for the study of the ancestral interpretation of endogenous phenomena. It is possible to superimpose the conformation of the territory and the geological structures with a dense network of places of chthonic worship and festivals that contain rituals linked to symbols, particularly the serpent/dragon, which represent the active forces of the Earth. Besides, this cultural corpus could provide valuable information on ancient catastrophes not accounted for by pure geological data or chronicles from an anthropological perspective. On the other hand, the psychological functions performed by the repetitive impact of such catastrophes on a community help understand all the modern naïve theories, the urban legends that often confuse social media users after a strong earthquake. There is no theory on converting geomythlogical data into deterministic data that can complete the existing seismic catalogues. Indeed, this type of study tells us that, overall, modern society is less prepared to accept the consequences of natural catastrophes and that, unlike the ancient populations, substitute with, it does not succeed in elaborating it positively.

Any form of seismic risk acceptance would be better than denial and pave the way for greater awareness of seismic risk. Geomythology may be more effective and understandable to ordinary people, compared to an overly rational scientific datum. However, geomythlogical content needs mediation, interpretation, and explanation. In the absence of this, it would be easy to interpret the geomythological data as a series B culture, while the importance and social function of this approach for millennia have maintained a substantial balance between human beings and Nature. This is the most powerful message that this and other similar studies auspicate to reach.

Conflict of Interest

I wish to confirm that there are no known conflicts of interest associated with this publication and there has been no significant financial support for this work that could have influenced its outcome. I confirm that I have given due consideration to the protection of intellectual property associated with this work and that there are no impediments to publication, including the timing of publication, with respect to intellectual property. In so doing I confirm that I have folloId the regulations of our institutions concerning intellectual property. I understand that the Corresponding Author is the sole contact for the Editorial process (including Editorial Manager and direct communications with the office). I confirm that I have provided a current, correct email address which is accessible by the Corresponding Author and which has been configured to accept email from fstoppa@unich.it

Acknowledgment

I am deeply grateful to the countless witnesses who have passed on to me their traditional knowledge of orally transmitted myths and legends. This work was carried out using funds made available by the DiSPUTer - U.d'A.

References

1. Mayor A (2005) Enclopedia of Geology, Geomythology. In: Selley R, Cocks R, and Palmer I (Eds.), pp. 2750.
2. Van Wonterghem F (1999) Il culto di Ercole e la pastortizia nell'Italia centrale. In: Petrocelli E, (eds.), La civiltà della Transumanza, Isernia.
3. Stoppa F (2005) The Sirente crater, Italy: impact versus mud volcano origins. Meteoritics and Planetary Sciences 41: 467-477.
4. Murray J (1830) Principles of geology, being an attempt to explain the former changes of the Earth's surface, by reference to causes now in operation. London 1.
5. Stoppa F, Berti C (2013) Reducing seismic risk by understanding its cultural roots: inference from an Italian case history. Natural Sciences 5(8A): 78-91.
6. Lavecchia G, De Nardis R, Visini F, Ferrarini F, Barbano MS (2007) Seismogenic evidence of ongoing compression in eastern-central Italy and mainland Sicily: A comparison Bollettino della Societa Geologica Italiana 126(2): 209-222.
7. Boncio P, Lavecchia G (2000) A structural model for active extension in Central Italy. Journal of Geodynamics 29: 233-244.
8. Boncio P, Tinari DP, Lavecchia G, Visini F, Milana G (2009) The instrumental seismicity of the Abruzzo Region in Central Italy (1981-2003): Seismotectonic implications. Italian Journal of Geosciences 128(2): 367-380.
9. Visini F, de Nardis R, Lavecchia G (2010) Rate of actice compressional deformation in Central Italy and Sicily: evaluation of the seismic budget. Int. J. Earth Sci. (Geol. Rundsch) 99(1): 243-264.
10. Castaldo R, R de Nardis, V DeNovellis, F Ferrarini, R Lanari, et al. (2018) Coseismic Stress and Strain Field Changes Investigation Through 3-D Finite Element Modeling of DInSAR and GPS Measurements and Geological/Seismological Data: The L'Aquila (Italy) 2009 Earthquake Case Study. Journal of Geophysical Research: Solid Earth 123: 4193-4222.
11. Boncio P, Lavecchia G, Pace B (2004) Defining a model of 3D seismogenic sources for Seismic Hazard Assessment applications: The case of central Apennines (Italy). Journal of Seismology 8: 407-425.
12. Di Nisio S (2010) Geologia storica per lo studio dei fenomeni di sinkhole. In: Geomotologia. Dei, Uomini e Natura tra Geologia e Storia. Quaderni di Rivista Abruzzese, Lanciano 86: 37-74.
13. Agostini S (1994) Caratteri geologici e strutturali dell'anticlinale e del bacino di Pietrasecca (AQ). L'area carsica di Pietrasecca (Carsoli, Abruzzo). Studio multidisciplinare, Chieti 2: 13-21.
14. Rovida A, Camassi R, Gasperini P, Stucchi M (Eds.) (2011) CPTI11, the 2011 version of the Parametric Catalogue of Italian Earthquakes. Milano, Bologna.
15. Romano MA, R de Nardis, M Garbin, L Peruzza, E Priolo, et al. (2013) Temporary seismic monitoring of the Sulmona area (Abruzzo, Italy): a quality study of microearthquake locations.Nat. Hazards Earth Syst. Sci 13: 2727-2744.
16. MA Romano, de Nardis R, M Garbin, L Peruzza, E Priolo, et al. (2011) A temporary seismic monitoring of the Sulmona area (Abruzzo, Italy) for seismotectonic purposes. Bollettino di Geofisica Teorica ed Applicata 52: 651-666.
17. Di Giulio, G Giuseppe Di Giulio, Rita de Nardis, Paolo Boncio, Giuliano Milana, et al. (2016) Seismic response of a deep continental basin including velocity inversion: The Sulmona intramontane basin (Central Apennines, Italy) Geophysical Journal International 204: 418-439.
18. Ridente D, Trincardi F (2006) Active foreland deformation evidenced by shallow folds and faults affecting late Quaternary shelf-slope deposits (Adriatic Sea, Italy). Basin Research 18: 171-188.
19. Mastronuzzi G, Pignatelli C, Sansò P, Selleri G (2006) Boulder accumulations produced by February the 20th, 1743 tsunami along the coast of southeastern Salento (Apulia region, Italy). Mar Geol 242: 191-205.
20. PM De Martini, P Burrato, D Pantosti, A Maramai, L Graziani, et al. (2003) Identification of tsunami deposits and liquefaction features in the Gargano area (Italy): Paleoseismological implication. Annals of Geophysics 46(5): 883-902.
21. Martinelli G, Judd A (2004) Mud volcanoes of Italy. Geol J 39: 49-61.
22. Gori S, E Falcucci, F Dramis, F Galadini, P Galli, et al. (2014) Deep-seated gravitational slope deformation, large-scale rock failure, and active normal faulting along Mt. Morrone (Sulmona basin, Central Italy): Geomorphological and paleoseismological analyses. Geomorphology 208: 88-101.
23. Ceccaroni E, Ameri G, Gomez Capera AA, Galadini F (2009) The 2nd century AD earthquake in central Italy archaeoseismological data and seismotectonic implications, Natural Hazards 50: 335-359.
24. Lavecchia G, R Castaldo, R de Nardis, V De Novellis, F Ferrarini, et al. (2016) Grolund deformation and surce geometry of the August the 24th 2016 Amatrice earthquake (Central Italy). Investigated through analytica and numerical modelling of DInSAR measureament. Geophysical Research Letters 43(24): 389-398.
25. Guidoboni E (2018) CFTI5Med, Catalogo dei Forti Terremoti in Italia (461 a.C.-1997) e nell'area Mediterranea (760 a.C.-1500). Istituto Nazionale di Geofisica e Vulcanologia (INGV).
26. Stoppa F (2014) Reminiscences of the great tsunami of July 1627 in the Frentana coast: the case of Lanciano - San Vito Chietino. Atti Conferenza Nazionale ISPRA, Policoro (MT), pp.349-356.
27. Tinti S, Maramai A, Graziani L (2004) The new catalogue of Italian Tsunamis. Natural Hazards 33: 439-465.
28. Zecchi R (2006) The tsunamis in the seas of Italy. Bollettino A.I.C 126: 127-128.
29. Antinori AL (1790) Antichità storico critiche dei Frentani. Ed. Romanelli. Napoli.
30. Bencivenga A (2013) Places, Occasions and Methods of the Worship of Hercules among the Paeligni, Regio IV - Sabina et Samnium. In: Los lugares de la Historia, Colección Temas y Perspectivas de la Historia 3: 931-950.

31. Antinori AL (1781-3) Raccolta di memorie storiche delle tre provincie. Napoli.

32. Stoppa F (2009) Il culto Demetra – sant'Anna e gli sprofondamenti catastrofici: La Quaglia (Rajano) e Lago Scuro (Manciano). I sinkoles gli sprofondamenti catastrifici nell'ambiente naturale ed antropizzato. ISPRA, Roma, Abstracts.

33. Fortini P (1805) Delle Cause de' terremoti e loro effetti, danni di quelli sofferti dalla Città d'Isernia fino a quello de' 26 luglio 1805, a cura di T. Sardelli, Marinelli editore. Isernia. p. 55.

34. Rasthafari (2007). http://viaveritavita-rasthafari.blogspot.it/

35. De Poardi GV (1627) Nuova relatione del grande e spaventoso Terremoto successo nel regno di Napoli, nella Provincia di Puglia, in venerdì alli 30 di luglio 1627. Roma.