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Interpretation of natural disasters in Abrutian traditional culture: inferences for seismic hazard evaluation and risk mitigation after the 6 April 2009 earthquake

Interpretazione dei disastri naturali nella cultura tradizionale abruzzese: deduzioni per la valutazione del rischio sismico e la sua mitigazione dopo il terremoto del 6 aprile 2009

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ABSTRACT - The 6 April 2009 earthquake generated an argument about unpreparedness for an event which was clearly likely to occur and was instead underestimated in several ways. It has been inferred that this is due to a scarce scientific, social, and cultural perception or estimation of the seismic hazard and poor effectiveness of risk mitigation measures. This may be due to a lack of attention to long established local culture about earthquakes, which prompted instead a geo-anthropological study revealing that some ancestral behaviours and interpretative mechanisms are still active, must be considered, and, if ignored, may frustrate mitigation measures. When human interpretation of an earthquake, or other disasters, is based on the idea of a "miracle", this is called *thaumatosis*. Knowledge of the cultural and psychological pattern followed to elaborate *thaumatosis* can be of great help in understanding psychological dynamics which may be crucial for efficient preparedness and seismic risk mitigation. Geo-anthropological studies could fill the gap created between probabilistic forecasting methods (PSHA) and those unexpected geological hazards that happen in Italy. Telluric rites and temples located on active faults in region suggest a widespread awareness of the high seismicity of the area and an attempt to interpret, represent, and accept it and pass information on to descendants through symbols. Anthropologic interpretation of local feasts shows that below a thin layer of Christian religion emerges a powerful pagan base which is germane with telluric cults and their symbols such as snake-dragon/earthquake. The local saints' powers link protection, rock cult, fecundity, and earthquakes. They are thought to refer to an agricultural matriarchy related to goddesses who are mothers, nurses, and dispensers of milk and grains, the key elements of the diet of Mediterranean peoples. Gods who are patrons of thunder and earthquakes also supervise wine production and adolescents' initiation into adult life by means of a blood sacrifice to the Earth. Among those feasts "barefoot runners" and "snake charmers" are particularly instructive in demonstrating this logic. On the other hand, symbolic representation of the hazard can be combined with social organization in the attempt to optimize the mitigation of the risk. So the natural hazard problem becomes a telluric harvest (i.e. chthonian) cult related to natural renewal, which is much easier to accept and remember. In fact, these virtues are sublimated in the concept and hope of rebirth after death. Cults and rites overlap an area which is dense with monuments showing repeated seismic effects. Based on the distribution of these occurrences we confirm the strict relationship between chthonian cults and earthquakes in the province. In addition, it is deduced that a large area corresponding to the province could have an underestimated seismic potential and hazard and consequently a very high seismic risk. This is in conflict with allowing dangerous industrial plants and an unsustainable development model, which in turn aggravate the risk.

KEY WORDS: seismic hazard, L'Aquila earthquake, geo-anthropology, snake and dragoon, Abruzzo-Italy

RIASSUNTO - Il terremoto del 6 Aprile, 2009 ha generato una serie di polemiche sulla impreparazione ad un evento percepito, almeno a posteriori, come probabile che si verificasse. É stato ipotizzato che ciò sia dovuto ad una miscela di scarsa valutazione e percezione scientifica, sociale e culturale della pericolosità sismica e ad una scarsa efficacia delle misure di mitigazione del rischio. Il fatto di aver ignorato l'attenzione della millenaria cultura locale al "fenomeno terremoto" ha stimolato il presente studio geo-antropologico, che rivela che alcuni comportamenti ancestrali e meccanismi di interpretazione sono ancora attivi e devono essere presi in considerazione mentre possono vanificare, se ignorati, alcune misure di mitigazione. Quando l'interpretazione umana di un terremoto, così come di altri disastri, si basa su un "miracolo" si chiama *thaumatosis*. La conoscenza del modello culturale e psicologico seguito per elaborare la *thaumatosis* può essere di grande aiuto per capire le dinamiche psicologiche e può essere cruciale per una preparazione efficace e per la mitigazione del rischio sismico. La Geo-antropologia potrebbe colmare il vuoto tra i metodi di previsione probabilistica (PSHA) e i disastrosi eventi geologici che avvengono inaspettatamente in Italia. Culti tellurici e templi situati su faglie attive nella Regione Abruzzo indicano una diffusa consapevolezza dell'elevata sismicità della zona e un tentativo di interpretazione, rappresentazione e accettazione nel traman-

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dare le informazioni ai posteri attraverso simboli. L'analisi antropologica delle feste locali, rivela che sotto di un sottile strato di religione cristiana emerge una potente base pagana che è pertinente ai culti tellurici e ai loro simboli come il serpente-dragone simbolo del terremoto. Le prerogative dei Santi locali includono e coniugano la protezione, la litoterapia, la fecondità e terremoti. Si pensa che tali culti derivino da un matriarcato agricolo che adorava dee madri e curatrici, dispensatrici di latte e cereali, gli elementi chiave della dieta dei popoli mediterranei. Dei che sono patroni dei tuoni e dei terremoti e supervisionano la produzione del vino e l'iniziazione degli adolescenti alla vita adulta per mezzo di un sacrificio di sangue alla Terra. Tra queste feste citiamo "*coloro che corrono a piedi nudi*" e "*dei serpari*" che sono particolarmente istruttive per dimostrare questa logica. D'altra parte, la rappresentazione simbolica del pericolo può essere combinata con l'organizzazione sociale nel tentativo di ottimizzare la mitigazione del rischio. Quindi il problema dei rischi naturali diventa un culto tellurico legato al raccolto (ctonio) ispirato al rinnovamento vegetale che è molto più facile da accettare e ricordare. In realtà, queste virtù sono sublimate nel concetto e nella speranza di rinascita dopo la morte. Tali culti e riti si sovrappongono in una zona densa di monumenti che mostrano ripetuti effetti sismici. Basandosi sulla distribuzione di questi eventi possiamo confermare la stretta relazione tra i culti ctoni e i terremoti in Abruzzo. Inoltre, si deduce che una vasta area corrispondente alla provincia di Chieti potrebbe avere una pericolosità sismica sottovalutata e di conseguenza un alto rischio sismico. Questo è in conflitto con progetti di impianti industriali pericolosi e con un modello di sviluppo non sostenibile che a sua volta non fa che aggravare il rischio.

PAROLE CHIAVE: rischio sismico, terremoto di L'Aquila, Geo-antropologia, serpente e drago, Abruzzo-Italia

1. - INTRODUCTION

The 6 April 2009 earthquake of caused 308 fatal casualties but it has been calculated that it would have left at least 3000 victims if it had happened during the daytime, due to the high number of public buildings and schools which collapsed and the daylight road traffic. In spite of its moderate magnitude of 5.8 on the Richter scale, hundreds of concrete reinforced new buildings suffered heavy damage and experienced partial collapses (fig. 1). The population was not specifically alerted or informed about the local seismic hazard. Instead, population was invited to stay "at home" by the authorities even after an increase in the frequency and magnitude of foreshocks, their clustering, and some damage (PAPADOPOULOS *et alii*, 2010). There was a clear vulnerability to an event which was likely to occur (e.g. LAVECCHIA *et alii*, 2009). A scarce attention to mitigation planning and the sustainable use of the territory is at the base of the severe impact of the earthquake. As a consequence a strong argument developed about the unpreparedness of administrators and was echoed in investigations by Italian scientists and officials, especially considering that L'Aquila is a highly seismic area which experienced destructive earthquakes in 1349, 1461, 1703, and 1791 and damaging ones in 1646, 1762, 1786, 1791, 1809, 1916, 1950, and 1958 (BOSCHI *et alii*, 1995; CAMASSI & STUCCHI, 1997). It is clear that there is extreme divergence between the opinions of the public (including administrators and politicians) and scientists, which generates a conflict and prevents effective earthquake risk mitigation (LUCANTONI *et alii*, 2001). The maximum effort is required to understand and interpret the naive theories developed by the public before and after a natural disaster which interfere with more scientific assumptions, which in turn seem too optimistic. On the other hand, risk mitigation has to deal with a "cultural" approach, as it is apparent that a merely "scientific" one is unsuitable and unable to diminish the risk efficiently. In fact, the effectiveness of the measures taken to decrease the risk passes through the sharing of communities to which they are addressed.

The influence of earthquakes on Abruzzi cultural heritage is impressive and deserves a better insight with the aim of understanding why a symbolic representation of the earthquake is constructed instead of a rational approach being chosen. This mechanism extends to the present and involves mass media and political authorities. In addition, there is a possibility that seismic events, which are not easily measurable, quantifiable, or reproducible, determine reminiscences that could lead

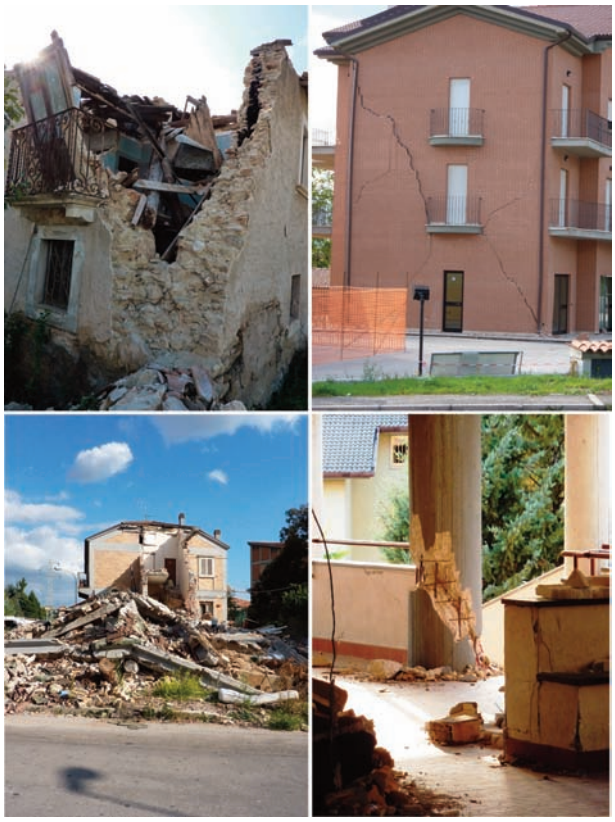

Fig. 1 - 6 April 2009 earthquake damage in private and public buildings of different kinds in L'Aquila, Abruzzi, reflecting the social vulnerability due to poor acceptance of living in a very seismic area.
- 6 Aprile 2009 i danni del terremoto in edifici pubblici e privati di vario genere a L'Aquila, Abruzzo, riflettono la vulnerabilità sociale dovuta alla scarsa accettazione (e/o consapevolezza) di vivere in una zona fortemente sismica.

to unexpected contributions to the definition and risk mitigation of seismic hazards. This possibility would fill the gap created between merely probabilistic forecasts and those disasters that happen in Italy. There are several intrinsic factors which may produce underestimations in PSHA (Probabilistic Seismic Hazard Analysis) calculations (ANDERSON & BRUNE, 1999). In fact, results from PSHA have been proved inadequate in recent damaging earthquakes in Italy, such as in San Giuliano di Puglia, where 27 children died in the collapse of a school on 30 October 2003.

Rites and legends in the Abruzzi may orally hand down the memory of past destructive events not accounted for in seismic catalogues (STUCCHI & ALBINI, 2000). Geo-anthropology is the discipline that studies these phenomena. Geo-anthropology has to do with history and even with the finite sciences, it is something very complex. This encourages the hypothesis that a given culture develops its own long-term disaster awareness which is also based on more gradual environmental changes, producing a complex phenomenon of *thaumatosis*. *Thaumatosis* is the processes of interpretation of a natural phenomenon by means of a miracle. This ameliorates the grief and trauma caused by a past disaster as far as possible. It is not only a matter of representation, but rather a symbol that contains an assessment of the geological hazard and risk. An example is the feast of Our Lady of the Port of San Vito Chietino. The southern Abruzzi suffered a catastrophic earthquake (M 6.8) on 30 July 1627 AD, the date of the feast. The chronicles describe a large tsunami which struck the coast up to Pescara, in memory of which it was forbidden to put boats into the sea that day except for the procession. A church was built on the sea shore at the place where the tsunami stopped (STOPPA, this volume).

This paper combines the geo-anthropologic study of local festivals and rituals which are reminiscent of ancient disasters and environmental changes, and adds to previous palaeo-seismological and archaeo-seismological studies (GALADINI & GALLI, 1996, 1999).

2. - THEORETICAL BASES

To better assess the hypothesis about the link of chthonian cults with earthquakes it is necessary to go back to the basic facts which legitimate some assumptions. Classical philosophical sciences mixed up endogenous and exogenous phenomena and their causes. Aristotle (384–322 BC) postulated that the deep Earth, through the warming effect of the sun, generates a dry exhalation which, by blowing, expanding, and compressing air into empty ducts, finally triggers vibrations and combustion. The base of the theory is addressed by Iulius Firmicus Maternus (349 AD): "*Terram omnem circumfluunt maria, et rursus inclusa Oceani ambientis circolo stringitur, caeli etiam rotonda sublimitate operitur, perflatur ventis, aspergitur pluviis, et timorem suum assidui motus tremoribus confitetur*". He explains that the motions of the atmosphere and hydrosphere determine the tremors of the earth. This idea dominated scientific thinking until the eighteenth century, but the link between endogenous and exogenous phenomena and especially the impact of "underground voids" are still incredibly popular in the Italian cultural substrate. It is believed that earthquakes are influenced by weather conditions as well as by the presence of underground voids or, as an extension, that "soft" terrains would mitigate the seismic waves – although in fact nothing is further from the truth. Lately, the discovery of electrical phenomena gave credence to the theory that electricity and earthquakes had a relationship based on co-seismic lights or auroras. Nowadays, plate tectonics considers earthquakes as a simple consequence of the heat inside the planet due to radioactive decay and the resulting convective motions of the Earth's mantle. Movements are such that they drag and deform the rigid outer planet, the lithosphere, where most earthquakes occur. However, plate tectonics does not account for larger scale planetary phenomena such as mass extinctions, inversion of the magnetic field, resurfacing, and in general core dynamics and core–mantle interactions. 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 so on) and still develops urban legends. A study of web blogs reveals forms of neo-*thaumatosis* which have been elaborated after the 6 April earthquake perpetuating the old telluric symbol of the dragon (fig. 2). In fact, dragons and snakes are variously linked to one of four elements: earth, water, fire, and air and to natural phenomena. For example, they are used to represent veins of underground water (e.g. *dragonera* in Sardinia or *dragonara* in Abruzzo).

Fig. 2 - The dragon in the Caldora's arms at Castrovalva, near Cocullo.
- *Il drago in braccio alla Caldora presso Castrovalva, nei pressi di Cocullo.*

But what are the 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 from the earth is important. It is known that gas emission (CO_2, radon) is generally related to active tectonics and is an earthquake precursor. The concept of *thaumatosis* is allied to *theophany* (i.e. the appearance of a deity), which occurs by the action of the *spiritus*, testified by seismic flashes, roars and sudden wind, gaseous emissions, gas torches, patches where the vegetation dies and does not grow, intermittent water springs, subsidence, fractures and dislocations, and sand and mud volcanoes (fig. 3). All these effects are typical of active seismic areas and where these effects are more evident, frequent, and intense, rites were established or Italic or Roman temples were located in Abruzzi (STOPPA, 2010a). Very frequently archaeologists and anthropologists miss the broader link to geological structures and events with which they are unfamiliar and prefer to relate cult location to the presence of a minor feature (e.g., a water spring, a peculiar rock, a peculiar geo-morphology). In many case these occurrences are a consequence of the presence of an active fault, not the cause of the statement of a cult.

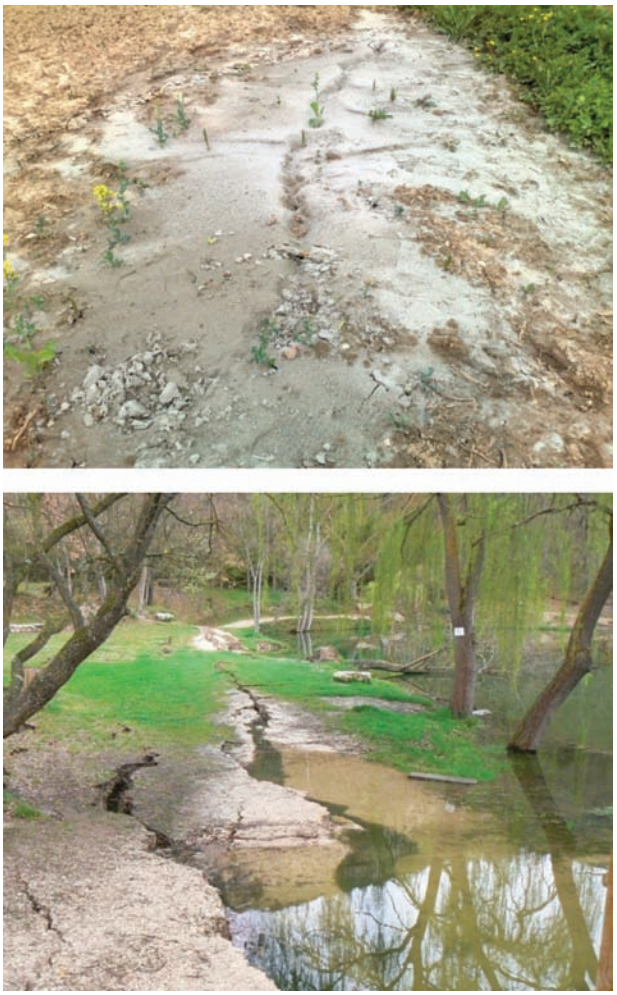

Fig. 3 - A - Sand volcano, Vittorito. B - Senizzo sinkhole collapse at San Demetrio dei Vestini, earthquake of 6 April 2009.
- A - Sabbia vulcano, Vittorito. B - Senizzo sinkhole a San Demetrio dei Vestini, terremoto del 6 aprile 2009.

Given the link between natural and supernatural, the animist and pagan deities all have physical attributes and powers in forms of worship adapted to the local seismic hazard and vulnerability. The frequency and intensity of natural disasters are the dominant factors driving the evolution and maintenance of cults. On the other hand, symbolic representation of the hazard is combined with social organization in an attempt to optimize the mitigation of the risk. So the natural hazard problem becomes a telluric (i.e. chthonic) cult related to plant renewal and exogenous fertilization, which are much easier to accept and remember. In fact, these virtues are sublimated in the concept and hope of rebirth after death. Goddesses are mothers, nurses, and dispensers of milk and grains; gods are patrons of thunder and earthquakes and supervise wine production and initiation of youths into adult life by means of blood sacrifices to the Earth. All these attributes have a propitiatory significance and are often associated with a dragon or snake, which expresses the cyclical nature of life and the renewal of the vegetation.

Angizia, the Abrutian goddess of snakes, has deep chthonic attributes and presides over a cult of "renewal and fertilization", as the ancients understood very well that life primarily depends on the active forces within the planet. Her 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. The Samnites, who venerated the telluric goodness Mephitis, had a thousand year experience of earthquakes as their territories were located in one of the most seismic areas of Italy (GALADINI *et alii*, 2004). The Abrutian populations were completely permeable to the Samnitic culture. The same applies to the seismic history of the two areas, which share destructive events that have expanded from Irpinia, Molise, and Abruzzi until recently.

3. - SELECTION OF A CASE HISTORY

The earthquake strongly influenced customs and traditions in Abruzzi, an area of ancient settlement and deep Roman penetration. The *thaumatosis* is passed on through the cults and shrines of Italic populations (i.e., Peligni, Vestini, and Marrucini-Frentani tribes), then through syncretism with the Roman gods, and finally is transferred to the Christian saints and churches. Shrines were rebuilt in the same places for a thousand years and they display not only phases of collapse and rebuilding, but also variation in the functions of use due to socio-economic and religious changes induced by earthquakes (e.g. GALADINI *et alii*, 1996). There are too many cases to be described in the Abruzzi, so it is worth focusing on a selected one which is particularly instructive for the aims

of this paper: the Majella-Sulmona area.

Majella-Sulmona is an area of high mountains surrounding a tectonic basin, the Conca Peligna. The Conca Peligna can be subdivided into a lower part, the Sulmona valley, and a higher area, the middle valley of Aterno and the adjoining valleys of Sagittarius and Subecquana. We know little about its prehistoric seismicity but it was probably similar to that observed in the historic period, based on what it is known of the seismic potential of the area (Boncio *et alii*, 2004). There are no doubts about the continuity and the large energy released by earthquakes in this area. It is believed that earthquakes of magnitude 6.5 to 6.8 can be repeated about once every 500 to 1000 years, while more limited but ruinous earthquakes ($5.5 > M < 6.5$) are repeated at least once every 50 years. We do not have evidences of larger earthquakes but their effects sometimes produced devastating landslides (Pacentro) not observed in historical time but recounted by legends (e.g. Scanno). However, this interesting topic is beyond the scope of the present study and will be treated separately in future works. A second century Roman inscription incorporated in the abbey of San Clemente a Casauria (fig. 4) contains an account of a destructive earthquake in Interpromium (now San Valentino in Abruzzi Citeriore) which corresponds to major collapses in all the archaeological sites of the Majella-Sulmona area. The abbey continued to undergo severe damage and records most of the earthquakes of the Middle Ages.

In more recent times the Majella-Sulmona area and Chieti province suffered the greatest destruction and loss of life in 1315, 1349, 1456, 1627, 1706, 1777, 1841, 1881, 1905, and 1933 (Boschi *et alii*, 1995; Boncio *et alii*, 2004). All municipalities in the area received at least one shock of VIII MCS degrees of intensity and a quarter of them experienced intensities of IX–X, which are very disastrous or catastrophic. Thus to establish a parallel we will first consider the Majella-Sulmona area and then the Chieti province. Geologic information on the geometric, kinematic, and energetic parameters of the major active faults in these areas defines discrete seismogenetic structures of about 20–25 km propagation of seismic rupture able to release high seismic energy ($6.5 > M < 7$), which are called seismogenic boxes (Boncio *et alii*, 2004). These geological structures are associated to neotectonic basins

Fig. 4 - Seismic monuments in Abruzzi: a - Hercules Curinum (II century AD earthquake); b - Diocleziano Bridge at Lanciano (1088 (?) earthquake); c - San Clemente a Casauria (1339, 1456, 1706, 2009); d - San Michele Arcangelo Church, San Giovanni in Venere (1456 and 1627 earthquakes).
- Monumenti interessati da terremoti in Abruzzo: a - Hercules Curinum (terremoto del II secolo d.C.); b - Ponte di Diocleziano a Lanciano (1088 (?) Terremoto); c - San Clemente a Casauria (1339, 1456, 1706, 2009); d - Chiesa di San Michele Arcangelo, San Giovanni in Venere (1456 e 1627 terremoti).

which have influenced settlements of the Italic Abruzzi tribe of Peligni and geo-anthropologic occurrences in ancient to recent times. The occurrences are particularly concentrated in middle Aterno valley, considered to be silent during historical times, and Majella, probably activated by the earthquake which affected the area130–150 AD (Galadini & Galli, 2001). So far a similar assessment for seismogenetic boxes is missing in the Chieti province, probably due to deeper seismic sources and/or poor faulting of the surface, longer return times and/or frequency of earthquake disaster, and a lack of a local seismic array to determine the focal solution for low magnitude seismic events.

3.1. - Seismic Pantheon and monuments in the Majella-Sulmona

In this area there are some important occurrences of a twin cult related to a chthonian female deity (Angizia) and Hercules. Interpretation varies in function of the hypothesis built on a selected clue but in the absence of direct dedication it is quite difficult to assess the exact nature of the deity involved. Hercules is associated with an incredible amount of telluric mythopoetic phenomena. His first cry produced an earthquake while springs sprang on his arrival in Sicily and his struggle with the Hydra seems to be the exact representation of a submarine Surtseyan volcanic eruption; according to legend, his club sank the craters of the gigantic Vulsini caldera (Central Italy). During the Middle Ages, the chthonic pagan rites adhered to the cult 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 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 cults are particularly dense in the Majella-Chieti province area: in Goriano Sicoli, Rajano, Cocullo, and Pacentro in the Majella-Sulmona area and Atessa, Fara San Martino, San Martino sulla Marrucina, Bucchianico, and Pretoro in the Chieti province. In the first area the cult of Santa Gemma and Sant'Agata is directly linked with the places where pagan snake goddesses were venerated. Saint Anne is linked to sinkhole formation, earthquakes, and grain crops and is syncretic of Demetra (Stoppa, 2009; Di Nisio, 2010). Telluric male saints are more related to weather and to initiation rites. They inherit from Mars and especially Hercules the association with the earthquake. For example: San Domenico is related to initiation, weather protection, rock cults, earthquakes, snakes; Sant'Urbano is related to weather protection, thunder; San Venanzio is related to rock cults; San Michele Arcangelo is related to male initiation, earthquake, rock cults; and Sant'Emidio is related to earthquake. The appearance of Saint Emidio coincides with an earthquake, as seen in historical iconography (fig. 5). 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 (abr. *trəttecə Sandə'Mmiddiə*, meaning "Sant'Emidio is rocking") the Abrutian people ingratiate the earthquake rather than calling on the protection of the saint. In reality, the properties of telluric pagan gods came to us through Sant'Emidio and other saints almost unchanged, while the complex rituals associated with the "positive" side of the natural renewal cycle are echoed in the customs, beliefs, and habits which serve as social glue of the community. The most important saint in the Majella area, from a seismic point of view, is definitely San Martino. 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. The same fracture is believed to be caused by the earthquake that shook the earth at the time of the death of Jesus Christ.

Concerning material seismic monuments, the term "temple" (*templum*) that we use today did not refer specifically to buildings or places of a cult and consequently is a poor indicator of the sacred bond with a deity. *Aedes* is a term that more properly defines the "home" of the deity. *Fanum* is indeed the natural sacred place where a sacrifice or devotion is made. *Aedes* and *Fanum* were well-settled by the Roman sacred law and their evidences in Abruzzi are both historical and archaeological. The Majella-Sulmona area has many pre-Roman shrines which extend towards Aesernia (Isernia). Along this path are distributed occurrences of very ancient fertility cults and *Aedes* and *Fanum*, which are linked to telluric phenomena. From north to south, shrines show evidence of sudden collapse and rebuilding and many have been converted into Christian churches.

Fig. 5 - Earthquake saints and earthquakes in Chieti. Top: San Giustio appears on the shaking city during the 1706 earthquakes of the Majella, and Sant'Emidio appears on Trinità Church during the 1881 earthquake.
- *Santi e Terremoti a Chieti. A sinistra San Giustio appare sulla città durante il terremoto del 1706 della Majella, a destra Sant'Emidio appare sulla Chiesa Trinità durante il terremoto del 1881.*

3.1.1. - *Middle Aterno river valley*

The shrine of Corfinio was frequented from at least the third century BC until the first century AD. It consists of two large terraces at different heights on the hillside, similarly to the shrine of Hercules Curino near Sulmona. Many fragments of terracotta were found there with the representation of Potnia Theron (goddess of animals) as well as numerous *ex-votos* representing parts of the human body and about one hundred bronze statues of Hercules. The place of worship is on the lower terrace, where a sulphurous spring is still in use for ritual ablution. A block reports an inscription about an offering to Hercules. There is therefore no doubt that the practices are linked to the cult of Hercules. Until a few years ago a pilgrimage reached the spring on 13 August, the day of the *Ides* dedicated to Hercules and Diana-Hecate in the Roman calendar.

A notable occurrence in the area is the church of San Michele Arcangelo in Vittorito, whose age ranges from pre-Roman to medieval times. There is a sulphur spring at the foot of the shrine, similarly to the Hercules shrine of Corfinio, and the place is a venue for spectacular co-seismic phenomena.The medieval church was built using some elements from an older building, which was perhaps just in the same place and went back to the seventh/eighth or ninth/tenth centuries. The presbytery and part of the nave stand on the ruins of a Roman temple which had the same orientation as the church (northwest–southeast) and dates back to the second century BC. The western corner of the podium of the temple is in fact under the first pillar of the right aisle, and the ancient stone blocks appear to have been reused in the façade (Bencivenga, 2006).

Castel di Ieri complex is a sacred Italic area in the municipality of Castel d'Ieri (AQ), along the road to Goriano Sicoli. Here, in 1882 a votive stone devoted to a goddess of snakes (Angizia?) was found. The shrines are at the foot of a cliff where there was a spring in ancient times. Excavations have unearthed the remains of two temples. The oldest temple (temple "B"), dated to the fourth century BC, was a wooden building on a stone platform (*podium*). At a higher level a second temple (temple "A") was built, dating from the second century BC and probably abandoned in the second century AD. The second temple has a polygonal podium covered with slabs of limestone and accessible from a front staircase. The tripartite cell was preceded by a deep portico with four ionic columns. The three rooms were paved with a mosaic and retained traces of painted plaster on the walls. At the bottom of the cells were some small rooms enclosed by gates, which were intended to keep the objects of worship or archives and the treasure. The central cell on the bottom has the base for the cult statue to which some marble pieces of robe decorated with snakes may refer (fig. 6). Votive bronzes comprise a figure of Hercules. The centre of the floor shows a black and white mosaic whose corners display solar symbols alternated with a horizontal hourglass or the "symbol of infinity" (Campanelli, 2007).

The survival in this area of a snake cult, which is a symbol of the earthquake and infinity, is astonishing (Stoppa, 2010b). It is worth mentioning the ritual of the feast of St. Domenico in Cocullo, held on the first Thursday of the month. 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 they are finally irresistibly attracted by the snakes. For many it is a "first time" 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, which is covered with snakes (fig. 7). 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. Cocullo rites can be interpreted as a ritual reminiscent of telluric fertilization, which is expressed through a male initiatory sacrifice generated by the bite of harmless reptiles. Blood is also offered in another feast, "the race of the barefoot runners", in Pacentro. The theophanic symbol is in both cases the dragon-serpent, which in Pacentro dwells in the valley of Vella and remains in the stone from which the sacrificial path starts. The idea that such cults are located 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 role and status of the teenager through a struggle with the "dragon".

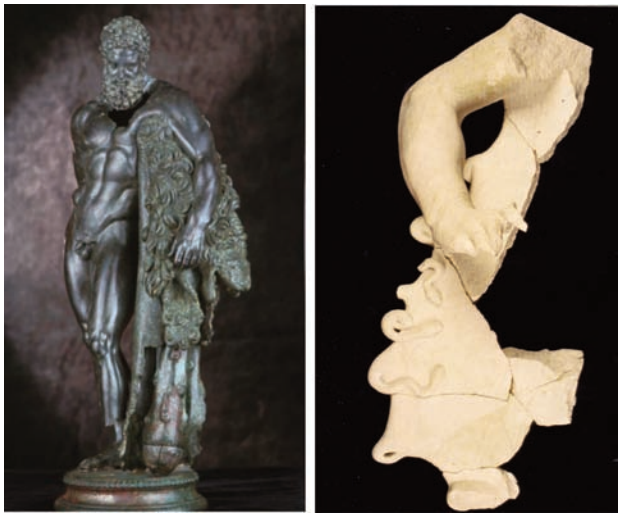

Fig. 6 - Statue of Hercules from the shrine of Sulmona and serpentine mantle of the divinity of Castel di Ieri.
- *Statua di Ercole del santuario di Sulmona e mantello con serpenti della divinità di Castel di Ieri.*

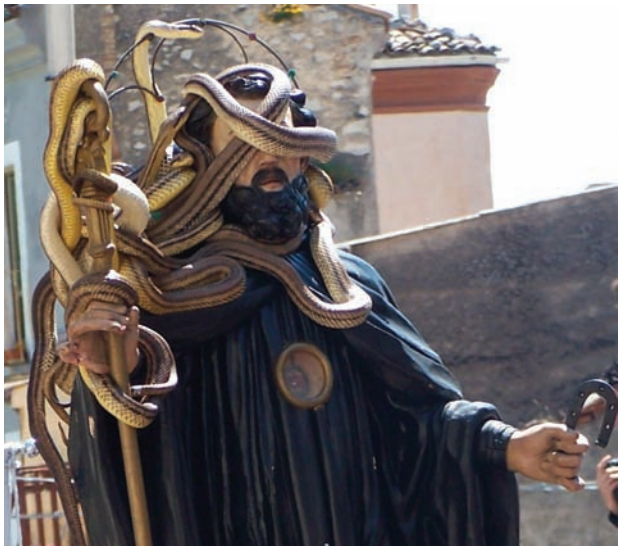

Fig. 7 - San Dominic statue covered by snakes.
- *San Domenico statua coperta dai serpenti.*

Another interesting link between underground rivers, snakes, and sulphur springs is the local belief that the water of the Sulphur rivers (called Petogna) can protect against poisonous snake bites. It is no surprise that the Petogna rivers are in the most seismic areas in Abruzzi such as Conca del Fucino and L'Aquila.

Other seismic reminiscences in the area are found in the crop feast of Saint Anne (Demeter). In fact, on the evening of 26 July 1805, an earthquake (M ~ 7) hit Molise area and was associated with significant changes in hydrology (Fortini, 1805). The earthquake was felt in the Chieti province and Majella-Sulmona area and was rapidly associated with the Santa Anna cult. In fact the earthquake took place during the grain harvest. At Rajano near La Quaglia sinkhole, which is believed to have formed during the earthquake, and the adjoining sulphur springs, the memory of this earthquake is renewed with the sound of bells at 10 pm, along with the cult 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 (Di Nisio, 2010).

3.1.2. - *Sulmona area*

More to the south, near Sulmona, there is a spectacular concentration of cult sites and festivals. Some shrines are built directly on the Morrone-Porrara faults and the most famous is dedicated to the Italic Hercules Curino (fig. 4). The shrine was probably expanded from a purely local temple to a large terraced structure in the first century BC. God is worshiped here with the significant epithet Curinus or Quirinus, an epithet that also appears alongside other deities in the region of Peligna, especially the Jupiter Quirinus of Superaequum. Quirinus means founder, in itself the mythical "father" of the Italics. The shrine is built on two terraces, which are relevant to each of the two phases. The lower, in cement work, is the most recent, and is a great platform 71 m long, topped by 14 rooms covered with vaults. The upper terrace was closed on three sides by a portico with columns whose bases are still in place. In the centre stood the offices of worship, an altar covered, unusually, with bronze plates, and the small chapel that was to be the real place of worship. From inside the chapel, it is worth remembering, come the most important materials of the complex: two highly refined statuettes of Hercules, one bronze (now in the Museum of Chieti) and the other in marble. The upper part of the sanctuary was buried by a landslide in ancient times, perhaps as a consequence of the second century AD earthquake. The substructure of the terraces has signs of dislocation and restoration which may be related to previous seismic events. Traces of the earthquake have also been found in Sulmona, where a *domus* of the first imperial age (first century BC – second century AD was found beneath the SS. Annunziata monastery. The house of the Roman period was abandoned after the earthquake and its construction materials were reused for the construction of later buildings.

The adjacent territory of Pacentro (*pagus Pacinus*) presents evidence of prehistoric settlements as well as continuity of fertility cults up to Roman times, and in its territory there are a number of Italic shrines. At Colle San Leopardo there are the remains of a terraced building of the first century BC, which given the location and structure seems to be a little shrine. On a block of the building an apotropaic double phallus surmounted by a small figure of a man was visible, a symbol found commonly in Hercules' sanctuaries. The environment was reused in the Middle Ages as the church of San Leopardo and abandoned after an earthquake (1315 or 1349). In San Leopardo there is also a small cave with a water spring which has evidence of cult frequentation in pre-Roman time. Not far away is Colle Scipione, where there is also a second cave evidencing the cult of St Michael the Archangel, which is syncretic to Hercules. This situation is similar to that of the nearby shrine of Hercules Curino, although smaller in size. South of Pacentro and in continuation of the fault of Morrone, there is the most important shrine complex, Ocriticum, in the territory of Cansano. 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 age. Excavations found objects of female cults, as well as small statues depicting Demeter (Ceres) and Kore (Persephone). Taken together, the Hercules Curino, San Leopardo, and Cansano shrines testify to an exceptional concentration of shrines with chthonic cults

along the active faults of the Morrone-Sulmona-Porrara. The Morrone and Sulmona fault system, which is traceable for more than 25 km, and Mt Porrara are capable of a potential Mw 7 earthquake.

Drawing from a survey conducted by the writer in relation to the "race of the gypsies" (i.e. the party of barefoot runners) in Pacentro, it is possible to highlight certain assumptions about a surprising layer linked to ancestral chthonic cults, and the direct binding of the latter, hitherto concealed by syncretism and the subsequent accretion, with the telluric phenomena and rituals of male initiation. As an example, a brief comparison can be drawn between the party and the feast of St Dominic of Cocullo, where the element of the "snake" is present and the properties of the telluric and initiatory rite are combined. Pacentro is a medieval fortification where the landowners have the emblem of the dragon-snake (fig. 2). On the first Sunday of September, the Pacentro people honour Our Lady of Loreto with a race called "the race of barefoot runners". The youth of the village reach an area halfway up the Scipione hill, gathering in front of a split stone, a large block of limestone painted green, red, and white so as to be readily identifiable. We already cited this locality as the site of an old Earth cult. 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 the washing of 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 are put on the doorstep, displaying the wounds on their feet, to receive the tributes of family and friends. The first observation about the rules of the race 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 since an early age. The winner's prize has a strong symbolic attribute; in fact, the first suit is certainly a sign of male emancipation, a status symbol recognized as the entry into the adult clan. 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. It is therefore a collective rite of passage that is repeated over time. The female element sides with the opposite gender and young admirers, perhaps future girlfriends, cheer wildly. Having seen the festival 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 the geological nature of the valley of Vella and co-seismic phenomena regularly observed here during the seismic activity (e.g. in 1706, 1933, and 2009). Pacentro blood is offered to the deity who spreads it on the sacrificial path, with the path mimetic being linked to the manifestation of the *spiritus* earthquake. The winding route of the valley covered by co-seismic phenomena will certainly have aroused witnesses to the evocation of a fiery dragon-snake.

4. - PROBABILISTIC APPROACH AND SEISMIC RISK

It is clear that ancient and folk culture does not remove the memory of the disasters and links the local effects to cults and rituals. Abruzzi preserves a surprising amount of anthropological evidence that the Italic civilization elaborated its own recognition and acceptance of the seismic hazard. The link of cults and related buildings with the seismogenic structures, precursory phenomena, and co-seismic changes in groundwater and gas emissions is astonishing. In the worship of the snake/dragon, physically and virtually present in many festivals, the Abruzzi tradition preserved a unique evidence of the relationship between earthquake and natural renewal as well as a mitigation of seismic risk through its function as a means of awareness. Historical evolution created an inextricable link between Christian places of worship and festivals of magic and religious nature which are distributed in clusters with an identity possibly related to an evaluation of the seismic hazard. This complex and varied phenomenon therefore requires a special study of the links among earthquakes, weather, snakes, cycles, infinity, crops and harvest, adult life initiation and fertility, chthonian deities, and syncretic saints who offer protection from earthquakes and thunder storms and who heal with rock contacts and sulphur waters.

It is possible to compare the distribution of seismic monuments and rites as a function of the seismic hazard intensity modelled by a probabilistic approach. The maximum hazard may correspond to the cropping out of active seismogenetic structures while buried ones may be not recognized. Historical seismicity has had a good definition only for the last five or six centuries; all the rest is very uncertain or limited to the bigger events ($M \geq 6.5$). This problem extends to the seismic hazard identified by PSHA, which may be dramatically wrong for this specific area. It is evident that if in the inner part of the Abruzzi the seismic monuments and rites show a good match with the geological structures and hazards, this is not the case in the southern Abruzzi (Chieti province). The abundant occurrence of seismic monuments and rites suggests that it is likely that some unrecognized seismic source may be able to produce strong earthquakes. The Roman city of Iuvanum bears signs of reconstruction after a major earthquake, perhaps that of Sannio-Matese in 346 AD (Gabardella, 2001). In fact, the southern part of the Chieti province suffered a lot from earthquakes with epicentres in Molise and the northern Puglia area. It is more difficult to establish

the chronology of damage at the Roman baths of Chieti and at the north entrance of the amphitheatre at Civitella in the same city (CAMPANELLI A. & AGOSTINI S., pers. com.). Chieti experienced the worst damage during the 1706 Majella earthquake but damaging local earthquakes also occurred. Isolated shakes also indicate seismic activity, for example those of M 5.2 in 1882 and M 4.3 in 1992 near Chieti. Concerning the Chieti province, medieval chronicles of the destruction of the Monasteries of Santo Stefano in *rivo maris*, San Liberatore a Majella, San Giovanni in Venere, and that of Diocletian Bridge in Lanciano (MAMMARELLA, 1990) indicate poorly defined, locally intense earthquakes.

5. - CONCLUSIONS

The human interpretation of earthquakes may prepare us to give priority to the mitigation of seismic risk rather than to other socio-economic factors. Consideration of *thaumatosis* may lead to a more severe assessment of geological hazards. If one compares the seismic hazard established with conventional probabilistic methods it is very clear that the density of "seismic monuments" does not fit with calculated hazard. This would indicate the possibility that probabilistic forecasts (PSHA) may be insufficient.

Large uncertainties exist in the PSHA in Chieti province, including the active faults and seismicity parameters. This paper introduces the status and issues related to the distribution of geo-anthropological features in the Chieti province, making a comparison with the better known Majella-Sulmona area. Even if research in seismology, geology, and earthquake engineering may significantly reduce uncertainties in the future, a considerable further reduction will take several years. The geo-anthropologic data suggest rejecting the idea that the Chieti province is an area of minor seismic hazard that may be suitable for a nuclear power plant or other major hazardous industries as recently suggested. Geo-anthropologic data are sufficient to consider this area as having high seismic risk and requiring a prudent approach to elicit expertise and investigation of still neglected seismogenetic sources.

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