NEEDS ANALYSIS

On

Raising Earthquake Awareness

and

Coping Children's Emotions

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INTRODUCTION

In order to prepare and schedule the products and the outcomes of the project, it was essential to first study the existing knowledge and to identify the needs of each partner in the topics of prevention and awareness raising, as well as in coping children's emotions in case of earthquake and volcanic disaster. The objectives of the needs analysis are:

• to bring together the project officers and individual specialists or experts in the considered topics, in order to exchange knowledge and develop studies;

• to report on the seismic and volcanic risk in the participants' countries;

• to identify, analyze, share and implement the best practices and methodologies on awareness procedures and approaches for children, gained from previous EU projects and partners' activities;

• to define the needs in respect to raising awareness and coping children's emotions.

The partners have worked together in compiling the needs analysis, aiming to the identification of the existing situation, in order to find solutions for furthering the RACCE programme's aims.

In the following needs analysis, the existing situation in the partners' countries concerning the identification of Earthquake and Volcanic risk in each territory and the initiatives taken so far on the handling of children's emotion in case of a major event is being presented.

GENERAL TERMS

According to the EU guidelines for national risk assessment and mapping, the definitions of the relevant terms are given below:

Risk is a combination of the consequences of an event (hazard) and the associated likelihood/probability of its occurrence (ISO 31010). Risk = hazard × vulnerability

Risk identification is the process of finding, recognizing and describing risks (ISO 31010). It is a screening exercise and serves as a preliminary step for the subsequent risk analysis stage.

Hazard is a dangerous phenomenon, substance, human activity or condition that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage.

In technical settings, hazards are described quantitatively by the likely frequency of occurrence of different intensities for different areas, as determined from historical data or scientific analysis (UNISDR, 2009).

Vulnerability describes the overall characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of a hazard (UNISDR, 2009). In probabilistic/quantitative risk assessments, the term vulnerability expresses the part or percentage of exposure that is likely to be lost due to a certain hazard.

In order to analyze the seismic risk in a certain area, it is necessary to know the seismic hazard and also the vulnerability. In case of an earthquake, the vulnerability depends on the urban earthquake vulnerability and social vulnerability.

Based on the theoretical model, vulnerability is a function of exposure, susceptibility and coping capacity, focusing on social, economic and environmental dimensions. On the other hand, risk is related to hazard and vulnerability, such as: Risk = Hazard * Vulnerability.

In the scope of reducing the seismic risk in an area, of mitigating the effects of a strong earthquake, vulnerability should be minimizing as much as possible. The urban vulnerability can be reduced by increasing the performance of buildings, thereby reducing the damage expected in earthquakes. There are two methods by which this is typically accomplished:

- Reduce the response of buildings to earthquake shaking;
- Increase the capacity of buildings to resist earthquake forces.

As concern the social vulnerability, this is relying on a system that build up a seismic culture towards a resilient society, that means a society who consists of well informed, well educated and well prepared citizens.

Some general conclusions of assessing the vulnerability, in total, are the following:

- Natural disasters in megacities often lead to human tragedies
- Those living on the fringes of society are the most vulnerable
- Cultural behavior strongly affects social vulnerability
- Assessing vulnerability requires sufficient knowledge for appropriate action
- Structural measures are clearly important but not the key to success

1. IDENTIFICATION OF EARTHQUAKE AND VOLCANIC RISK AND EXPERIENCES IN EACH PARTNER's COUNTRY

1.1. GREECE

1.1.1. Geotectonic setting of Greece

The geotectonic setting of Greece is governed primarily by the motion of the African lithospheric plate that subducts beneath the Eurasian one along the Hellenic arc, from the western Peloponnesus through Crete and Rhodes to western Turkey. The most recent model that has been proposed to account for the present-day active tectonics of Greece is shown in Figure 1.1. It is based on a large number of studies of fault plane mechanisms (McKenzie, 1972, 1978; Shirokova, 1972; Ritsema, 1974; Papazachos, 1975; Soufleris and Stewart, 1981; Papazachos et al., 1983, 1984, 1988, 1991; Dziewonski et al., 1984; Scordilis et al., 1985; Eyidogan and Jackson, 1985; Christodoulou, 1986; Anderson and Jackson, 1987; Kiratzi et al., 1987, 1991; Lyon-Caen et al., 1988; Pedotti, 1988; Ekstrom and England, 1989; Kiratzi and Langston, 1989; Ioannidou, 1989; Taymaz et al., 1990, 1991; Besnard, 1991; Amorese, 1993; Papadimitriou, 1993; Karakaisis et al., 1993; Baker et al., 1997; Louvari et al., 1999), deformation (Eyidogan, 1988; Jackson and McKenzie, 1988a, 1988b; Ambraseys and Jackson, 1990; Papazachos et al., 1991; Kiratzi, 1991, 1993; Papazachos and Kiratzi, 1992, 1996; Jackson et al., 1992; Kiratzi and Papazachos, 1995), paleomagnetic (McKenzie, 1978; Le Pichon and Angelier, 1979; Kissel and Laj, 1988; Kondopoulou, 2000), conventional geodetic (Billiris et al., 1991), the emerging after the 1990 GPS information (e.g. Oral et al., 1991, 1995; Oral, 1994; Kahle et al., 1995, 1998; Reilinger et al., 1997; McClusky et al., 2000), as well as on the combined interpretation of the previous data (e.g. McKenzie, 1972, 1978; Taymaz et al., 1991; Jackson, 1994; Papazachos, 1999).

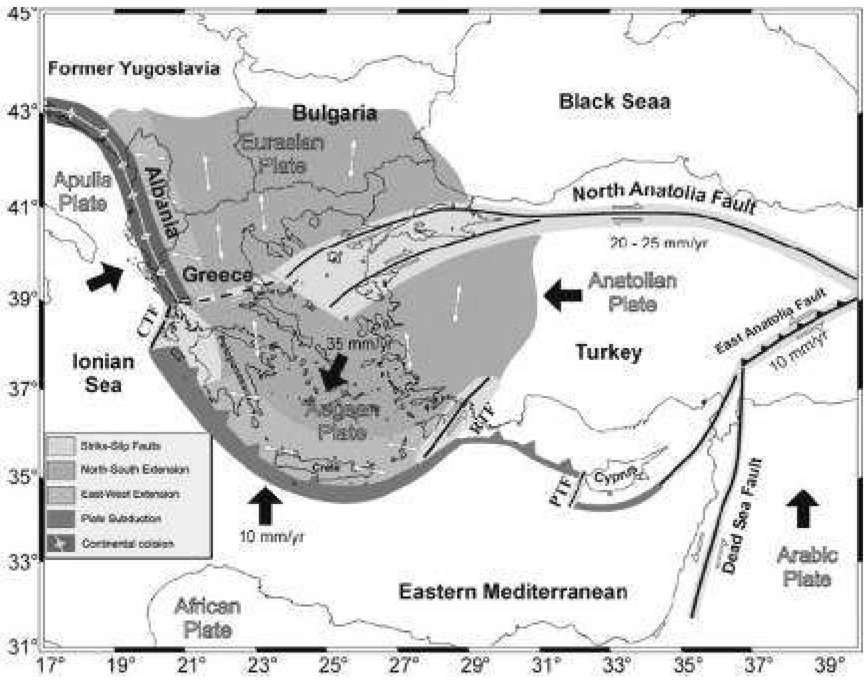


Figure 1.1. The most recent geotectonic model of Greece (after Karakaisis and Papazachos, 2002)

The very high seismic activity along the Hellenic arc is mainly attributed to the convergence of the Aegean lithosphere (front part of Eurasian lithospheric plate) and the eastern Mediterranean lithosphere (front part of the African lithospheric plate) in an about north-south direction in the Ionian Sea area and west-east in the area south of Crete (Papazachos, 1999; McClusky et al., 2000).

1.1.2. Seismic risk identification

1.1.2.1. General overview of seismicity in Greece

Looking at the historical and instrumental data of seismicity in Greece, it is generally recognized by the scientific community that earthquake is one of the main hazards in the country. Greece is the country of the highest seismicity in Europe (Bath, 1983) (Fig. 1.2) and at the sixth position in the the world.

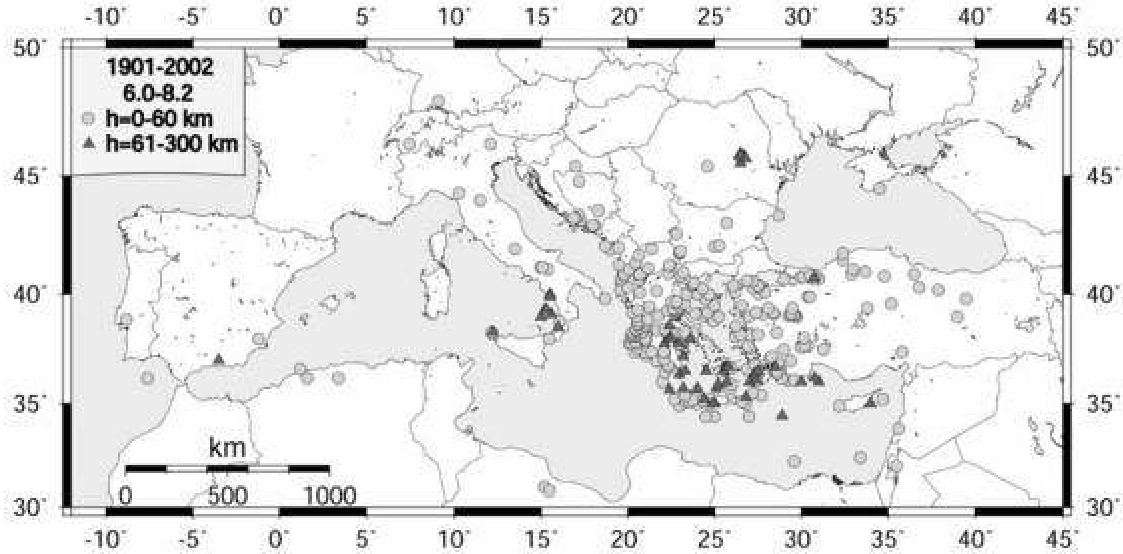


Figure 1.2. Epicenters of all known strong (with magnitude (M) over or equal to 6 degrees in the Richter scale) earthquakes that occurred in the Mediterranean area during 1901-2002 (h: focal depth) (after Karakaisis and Papazachos, 2002).

1.1.2.2. Historical and Instrumental Seismicity

According to the available literature, the first historically documented information on an earthquake in Greece dates back to the 6th century BC. Before then, there is no historical (literary) information on effects of strong earthquakes in the country. One of the first references belongs to Cicero who wrote that a strong earthquake occurred in around 464 BC that ruined Sparta city and a section of the summit of Mt. Taygetos broke off (Fig. 1.3).

Figure 1.3. The city of Sparta destroyed by the earthquake of 464 BC, according to the [painting or description] by Egisto (book illustration, Images of Historical Earthquakes, The Jan T. Kozak Collection, available online: http://nisee.berkeley.edu/kozak)

One important notice is that information on earthquakes up to the middle of the 19th century comes from non specialists on the subject (philosophers, historians, travellers, etc). For this reason, information on seismic events originates mainly from macroseismic effects of these large shocks, such as destructions of buildings, ground changes, tsunamis, casualties, etc.

Based on these data, the total number of known strong historical earthquakes that occurred in Greece during the period 550 BC - 1995 AD is about 600 (Karakaisis and Papazachos, 2002). The authors in this report have spitted this period into three main intervals, according to the number of earthquakes reported during each one:

- **Period 550 BC - 1550 AD**

About 150 strong earthquakes (M ≥ 6.0) were reported (Fig. 1.4), with an average frequency of about 7 per century.

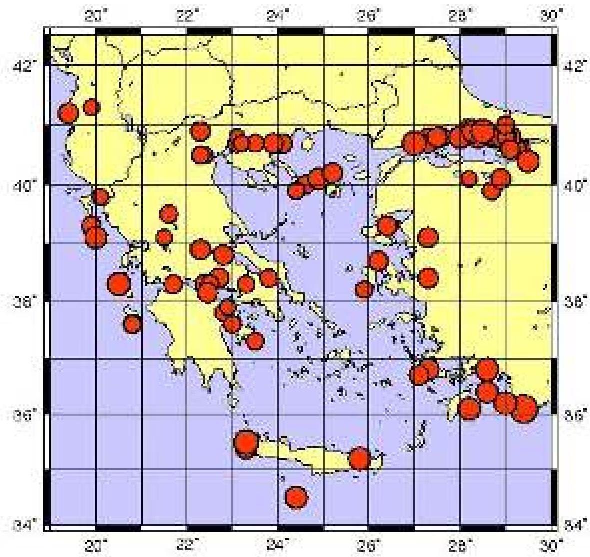


Figure 1.4. The historical earthquakes that occurred in Greece during the period 550 BC-1550 AD, as generated on http://geophysics.geo.auth.gr/ss/

- **Period 1550 - 1845 AD**

The total number of reported strong earthquakes (M ≥ 6.0) that occurred during this interval is about 170 (Fig. 1.5), with an average frequency of about 60 per century.

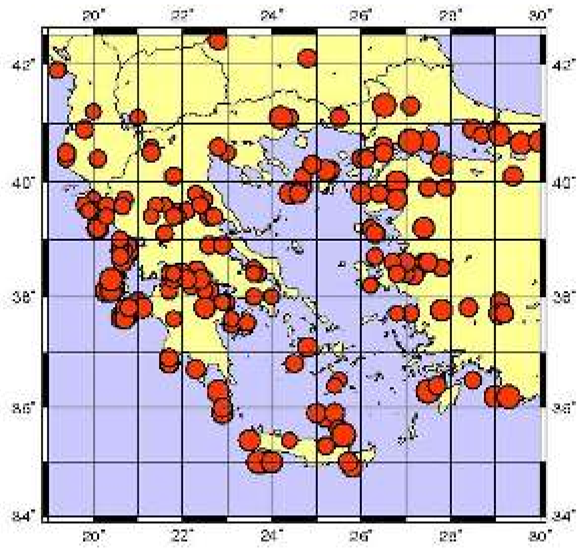


Figure 1.5. The historical earthquakes that occurred in Greece during the period 1550 BC-1845 AD, as generated on http://geophysics.geo.auth.gr/ss/

- **Period 1845 –Present Day**

The total number of strong earthquakes (M ≥ 6.0) reported during this period is 270 (Fig. 1.6); the present mean rate of strong earthquake generation is about 200 earthquakes per century.

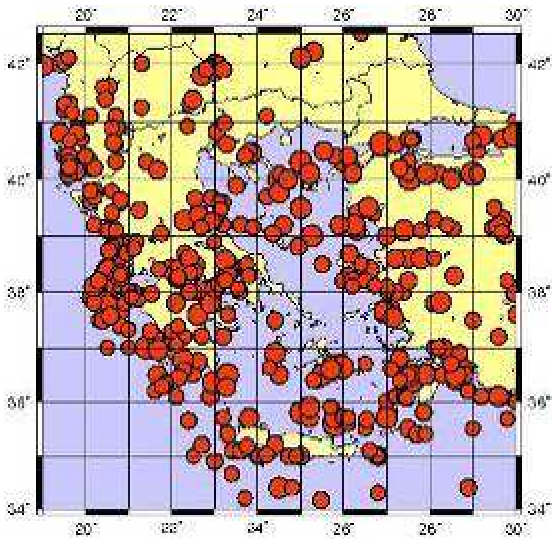


Figure 1.6. Epicenters of the strong earthquakes (M ≥ 6.0) for the period 1845 to present day in Greece, as generated on http://geophysics.geo.auth.gr/ss/

In any case, for many researchers, the last destructive historical events in Greece were the Atalanti earthquakes in the year 1894. A few years later, the installation in the National Observatory of Athens of the first seismograph of «Agamennone» type in 1898 and of the seismometer of «Mainka» type in 1911 was a fact. Like this, the period of Greek historical earthquakes ended and the time of instrumental records started in Greece.

During this instrumental period, many earthquakes have been recorded, many of which were devastating. Some of the most important earthquakes for the seismic safety history of the country were the following:

The Kefalonian earthquake, 1953

On the 12th August 1953, the largest earthquake of the century, with M=7.3, struck the southern Ionian Islands, Zakynthos, Kefallonia, Ithaki. In mid-August 1953, starting on the 8th August, there were over 113 recorded earthquakes in the region between Kefalonia and Zakynthos, but the most destructive one was the earthquake of the 12th August.

The Kefalonia Island is situated just east of a major tectonic fault, where the European lithospheric plate meets the Aegean one at a slip boundary. This 1953 disaster caused huge destruction, with only the northern regions escaping the heaviest tremors and houses there remaining intact. Damage was estimated to run into tens of millions of dollars, equivalent to billions of drachmas. Hundreds were killed and thousands were injured. An estimated 100,000 of a population of 125,000 left the island soon afterwards, seeking a new life elsewhere.

This earthquake was the main motivation of starting building earthquake resistant constructions in the country. The first seismic building code was implemented in the year 1959. The affected Ionian Islands were reconstructed according to the new building code.

Thessaloniki earthquake, 1978

For the first time in the modern history of Greece, a large urban center of about 800 thousand residents, with modern high-rise buildings, was hit by an earthquake without the adequate preparedness of the state. What followed was helpful to address the immediate problems and also was the catalyst for radical changes in the seismic policy of the country.

The earthquake occurred on the 20th of June 1978, at 0:30 a.m. local time and had a magnitude of 6.5 degrees on the Richter scale; its epicenter was 20 km east of Thessaloniki city. It caused the death of 49 people, injuries on 220 and about 800,000 left their houses, either because the latter were destroyed or because of their fear to get into them. This event was a proof that a reinforced concrete construction was not resistant enough to large seismic events.

Based on the consequences of the Thessaloniki earthquake and in accordance with the recovery measures applied in the city, the national legal framework of earthquake recovery was formed, which has remained almost unchanged until the present day.

Four years after the Thessaloniki earthquake, in 1983, and after two other major events that hit two other big cities in Greece (Volos in 1980 and Athens in 1981), the Greek government decided to establish the Earthquake Planning and Protection Organization (E.P.P.O.), as the competent authority of drawing the seismic policy in the country.

Attica earthquake, 1999

On the 7th September 1999, at 14:56 p.m. local time, a moderate earthquake of magnitude 5.9 degrees on the Richter scale occurred in Athens. The Greater Athens area is part of Attica and has a population of about 3 million people. The administration structure in Attica reflects the fact that about 35% of the country's population lives there and that it accounts for around 50% of its GDP (Gross Domestic Product). The earthquake affected mainly the west part of Attica, where the industrial zone, as well as a series of critical facilities for all Attica, is located.

After a week of search and rescue, a number of 143 people were confirmed dead, either inside collapsed buildings or due to falling elements of buildings or due to heart attacks, whereas 85 were extricated alive from the ruins by the SAR teams. About 750 people were injured. Hundreds of thousands of people became homeless, but a much greater number stayed outdoors for some days after the earthquake due to fear for aftershocks. The Attica earthquake was the costliest earthquake that has ever occurred in Greece. According to an early estimation published by the Government (November 1999) the total cost was approximately 3.8 million Euro. That corresponds to about 3% of the GDP of Greece.

Athens, the capital of Greece, as a metropolis, posed various particularities that should have been taken into consideration in earthquake emergency planning. These particularities had to do with the complexities in the administration structure of metropolitan areas and the actual continuity in space (functions, networks, flows, etc.) regardless of the official limits of responsibility and administrative boarders between municipalities, prefectures and regions. The special features of such areas still remain a challenge in emergency planning and it is necessary to make the existing plans and actions compatible with them.

The increase of the population in seismic prone areas, close to active faults, and the weak disaster preparedness for emergency situations in megacities (lack of interoperability in disaster management) increase the seismic vulnerability and, consequently, the seismic risk.

1.1.2.2.1. Earthquakes in the area of Crete

Crete Island is situated just over the Hellenic subduction zone and is thus affected by the plate convergence that takes place south of it and results in deep, moderate and swallow earthquakes. Moreover, existing seismicity onshore and offshore at the Cretan Sea results in many surface earthquakes some of which have appeared very hazardous (Table 1.1).

Table 1.1. A list of the most important earthquakes in the broader area of Crete, both historic and instrumental; their fault mechanisms are shown in Figure 1.7

Id	Year	Area	Magnitude	Intensity	Depth (km)
1	62-65	S. Crete (Lendas)	7	9	-
2	9/7/251	Crete	7.5	10	-
3	21/7/365	SW. Crete (Gortis)	8.3	8	-
4	12/7/375	N. Crete	7.8	10	-
5	6/11/448	S. Crete	7.2	8	-
6	4/796	S. Crete	7.2	-	-
7	1246	Chania, W. Crete	7	7	-
8	1/7/1494	W. Crete	7.2	8	-
9	29/5/1508	E. Crete (Hierapetra)	7.5	10	-
10	22/11/1595	Heraklio	6.8	8	-
11	1604	N. Herakleio	7	8	-
12	8/11/1612	SW. Crete (Herakleio)	7	8	-
13	9/3/1629	SW. Crete	7.3	9	-
14	1/1665	Herakleio	7	8	-
15	5/5/1673	NE. Herakleio	7	7	-
16	10/1780	Hierapetra	7	10	-
17	16/2/1810	N. Herakleio	7.8	9	90
18	28/3/1846	N. Herakleio	7.7	7	90
19	30/9/1856	NE. Agios Nickolaos	8.2	9	90
20	17/7/1887	NE. Agios Nickolaos	7.5	7	100
21	18/2/1910	N. Chania	7	8	90
22	1/8/1923	C. Crete (Anogia)	6.8	4	90
23	26/6/1926	S. Rhodes	8	11	100
24	14/2/1930	S. Milos	6.7	10	130
25	25/2/1935	N. Herakleio (Anogia)	7	8	100
26	17/12/1952	S. Crete	7	6	-
27	9/7/1956	Amorgos	7.5	9	-
28	23/5/1994	Herakleio	6.1	7	80
29	21/5/2002	Milos	6.1	-	35
30	8/1/2004	NW. Crete	6.9	-	40
31	17/3/2004	SW. Crete	6.3	-	30
32	8/1/2006	Kithera	6.9	-	40

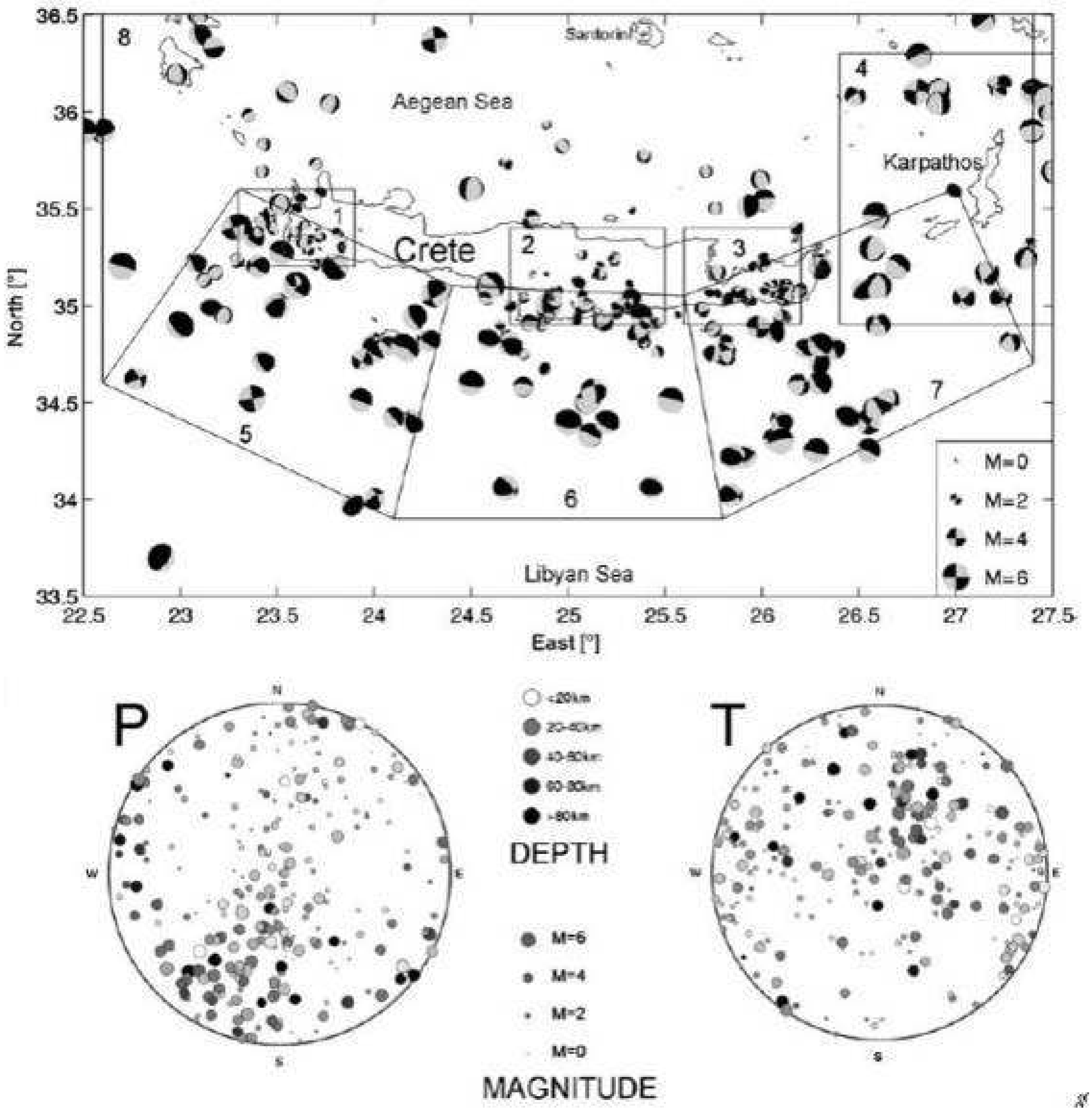


Figure 1.7. Fault mechanisms of the earthquakes in the area of Crete (Table 1.1) in respect to depth and magnitude (after Bohnhof et al., 2005)

365, July 21, M = 8.3, Crete (IIX, Gortis)

One of the strongest earthquakes in the Mediterranean, with estimated magnitude of 8.3 R, affected Crete in 21 July 365. The epicenter is considered to be just southwest of the island and its intensity in the roman town of Gortis was estimated at about 8 Mercali. Although reports on the effect in humans do not occur, the damage is considered to be very important.

This was possibly a subduction related earthquake and was followed by a big tsunami. Both seismic waves and tsunami caused great damages all over the central and eastern Mediterranean. The western part of the island was instantly uplifted from 9 m in west to 1 m in the central part. Alexandria in Egypt, Sicily and Cyprus were also hardly affected. Reports of this period speak about a strong tsunami that followed: “Some great ships were hurled by the fury of the waves on the roofs, as happened in Alexandria, and others were thrown up to two miles from the shore”

(Ammianus). “The sea flowed over the shore, causing suffering to countless people in Sicily and many other islands.” (Jerome).

Figure 1.8. The raised harbor of Falasarna

1780, October, M = 7, Hierapetra (X)

A very strong earthquake of 7.0 R magnitude, probably of swallow depth, related to the Hierapetra fault, took place in October 1780. Intensity of 10 Mercalli was estimated in Hierapetra town. The earthquake affected mainly the eastern Crete and especially the town of Hierapetra that was heavily damaged. The fortress was pulled down and 300 Ottomans were killed. Similarly, 13 villages near Hierapetra with their inhabitants were devastated.

1810, February 16, 22:15, M =7.8, Heraklion (IX)

A very strong earthquake of 7.8 R magnitude, focal depth 90 km and intensity 9 Mercalli, took place near the city of Heraklion at 22:15 on February 16, 1810. The whole area of southern Greece and eastern Mediterranean was affected but mainly central Crete and the city of Heraklion. In Malta, the same earthquake had duration of 2 min and in Naples one of 1 min.

The earthquake destroyed mainly buildings, monasteries and mosques in Heraklion city, whereas it also resulted in 2000 – 3000 casualties in the area of Heraklion. In respect to infrastructure, two thirds of the buildings in Heraklion were totally destroyed. The same happened in many nearby villages. Houses, most of the monasteries and the mosques of the city collapsed. The majority of the Venetian and older monuments of the city, such as the old dockyards Arsenali and Antichi were destroyed. Only some parts remain till our days.

1856, October 12, 02:45, M = 8, Heraklion

A very strong earthquake of 8.0 R magnitude and intermediate depth, probably related to the subduction zone, affected the city of Heraklion at 02:45 of October 12, 1856. The earthquake had duration of about 25 sec in Zante, and 70 sec in Corfu and 90 sec in Izmir, Damaskos, Cairo and Alexandria. The whole eastern Mediterranean area was strongly affected. In Cyprus and in cities of the coast of Syria it caused serious damages. It was felt in Izmir, Damaskos, Cairo, Alexandria, Avlona, Byrout and Haifa. However it was more destructive mainly in Crete and Rhode islands. 538 people were killed and 637 were injured in Crete.

Heraklio and the surroundings suffered the largest destruction. Of the 3620 houses, only 18 remained standing and were inhabitable. The palace of Moustafa Passa, made of wood, suffered no damage and was used as a hospital. Also, a part of the 1314 shops of the city was saved because they were made of wood. However, 48 shops were burnt by fires. The city was changed to a shapeless pile of ruins. Nearby villages of Kalessa, Pentamodi, Aghios Myron, Kitharida and Assites were entirely pulled down (Papazachos and Papazachou, 2003). Many Venetian churches that were turned into mosques suffered serious damages and many of them were totally destroyed. Bezir Tzami Mosque (present Saint Titus church) was ruined and rebuilt afterwards. The same happened with the Saint Francis monastery, which had already been hit by many former earthquakes. The present cathedral of Saint Minas that was built during that period suffered many damages, but it was repaired soon afterwards. At the same earthquake many other Venetian buildings, such as the Saint George barracks, the Venetian port Actarica, the Dukes house and the old Voltone, collapsed (Andrikakis,).

<u>Damages in rest of Crete:</u> In Chania city, at the west of Crete, all houses were damaged but few collapsed. The barracks, the military hospital and the Turkish temple Chounkiar suffered large damage. The town of Kissamos in Chania was sunk and a lake was formed. In Rethymno, all houses were damaged but there were no casualties. Hierapetra, at the eastern part of the island, suffered serious damages, as did the town of Sitia.

<u>Damages in other areas:</u> In Rhodes Island 8 villages were affected, 2000 houses became inhabitable and 60 people were killed. It mainly affected Palati in the town of Rhodes, the castles, the temples and houses. In Karpathos Island, 8000 houses were destroyed and 20 people were killed. In Santorini, large damages occurred and pulled down famous churches up to their foundations, houses and palaces, while 7 people were killed.

1926, June 26, 19:46, M = 8, Rhodes (XI, Archagelos)

A very strong earthquake of 8.0 R magnitude, 100 km focal depth, and 11 Mercali scale at Archagelos village of Rhodes Island, probably related to the subduction zone, took place at 19:46 on June 26, 1926. The earthquake affected seriously the whole eastern Mediterranean area. It caused serious damage in Asia Minor and Egypt and minor damage in the Middle East. In the city Makre of Asia Minor it pulled down 10 state buildings and a minaret. It caused numerous collapses in Alexandria and in Cairo, where 8 peopled were killed and 4 were injured. In the Hill of Olives in the Dead Sea many fissures occurred in houses. It was also felt up to Luxor and Low Egypt, Palestine, Cyprus, the largest part of Asia Minor, the whole southern Italy, Albania and Cyrenaica (Papazachos and Papazachou, 1997).

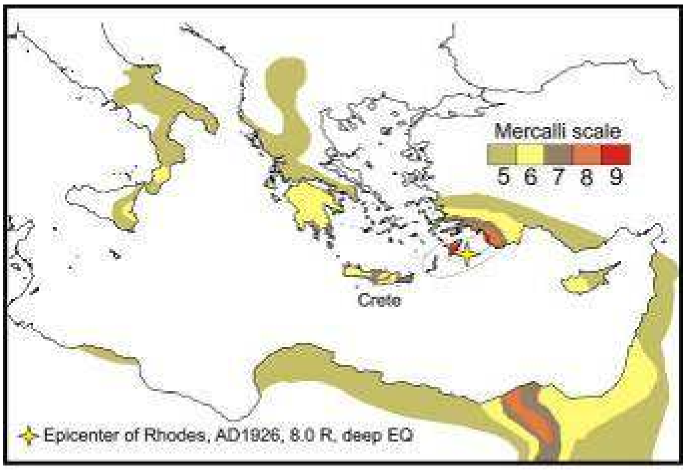


Figure 1.9. Hazard distribution of the 1926 Rhodes earthquake (after Sieberg, 1932)

The earthquake destroyed mainly buildings, monasteries and mosques. Isoseismal maps were published by Sieberg (1932) (Fig. 1.9). In Archagelos (Rhodes), 600 houses collapsed, whereas 3000 houses were destroyed in Rhodes town. The great lighthouse in Rhodes town collapsed too. In Heraklion, it caused large damage in the state buildings and houses. 200 houses collapsed and 550 suffered dangerous damage. The coastal area near Heraklion was risen up to 20-30 cm. Four people were killed in Rhodes Island and many were injured. In Egypt, 8 people were killed and 4 were injured. In Heraklion many people were injured (Papazachos & Papazachou, 1997).

1930, February 14, 18:30, M = 6.7, Milos Island (X, Aitania)

An earthquake of 6.7 R, 130 km focal depth and intensity 10 Mercalli in Aitania village of Heraklion occurred near Milos Island at 18:30 on February 14, 1930. The earthquake affected all southern Crete and N. Africa but was more distractive in northern and central Crete. It caused collapse of buildings and chimneys, fissures in buildings, and damaged archaeological exhibits in the Archaeological museum of Heraklion (Fig. 1.10). However the nearby villages of Aitania and Vatheia were totally destroyed. The largest part of the villages Episkope, Gouves and Tyllisos collapsed. In the city of Rethimnon many houses collapsed and fissures appeared in town walls. In Chania plasters fell in almost all houses, whereas old houses and the town walls were fissured.

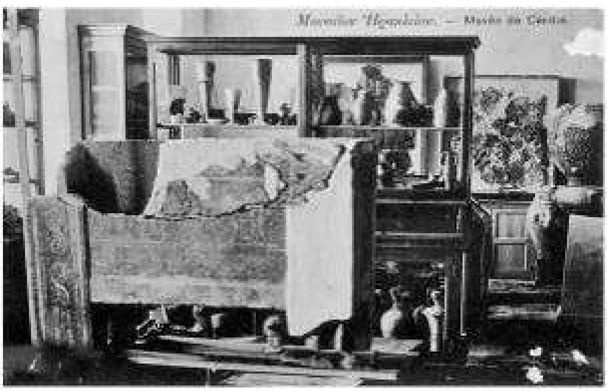


Figure 1.10. The archaeological Museum of Heraklion after the 1930 Milos earthquake (after Dimopoulou-Rethimiotaki, 2005)

1935, February 25, 02:51, M = 7, Cretan Sea

A very strong earthquake of 7 R magnitude, focal depth 100 km and intensity 8 Mercalli in Anogia village of Crete took place at 02:51 of February 25, 1935. The earthquake affected the whole eastern Mediterranean area but mainly northern and central Crete. It was reported that 8 people were killed, 204 injured and 374 families became homeless. In Heraklion and surroundings the Electric Power station, the Gymnasium and Aghios Minas church, many schools and houses suffered serious damages. The villages of Skalani, Anopoli, Epano, Vatheia, Kainourio and Gournes collapsed up to their foundations. The villages Episkopi, Tylissos, Sampas, Voni, Kamari, Arckalochori were heavily damaged and the majority of their buildings collapsed. The cities of Rethimnon and Chania suffered several damages.

1956, July 9, 03:11, M = 7.5, Amorgos Island

A very strong earthquake of 7.5 R magnitude, swallow focal depth and intensity 9 Mercalli in Potamos of Amorgos Island and strong aftershocks took place near Amorgos at 03:11 on July 9, 1956. The earthquake affected mainly the southern Aegean and especially the islands of Crete, Amorgos, Santorini, Anafi, Astypalea. It caused serious damages in the islands of Santorini, Amorgos, Anafi, Astypalea, Ios, Paros, Naxos, Kalymnos and Leipsoi. Totally, 529 houses were destroyed, 1482 suffered serious damage and 1750 light damages (Fig. 1.11; Papazachos & Papazachou, 1997). It was followed by a strong tsunami:

- in Amorgos, Potamos village suffered the greatest damages with maximum intensity; the tsunami reached the height of 25 m;
- in Astypalea the tsunami reached 20 m in height;
- in Follegandros the tsunami was 10 ms in height;
- in Santorini the 35% of the houses was totally destroyed, while the 45% faced serious damages; all public buildings collapsed.

In Heraklion the coastal area and infrastructure in the Venetian harbour were hardly affected both from the earthquake and the tsunami which was 2 m high. It is reported that 53 people were killed and 100 injured.

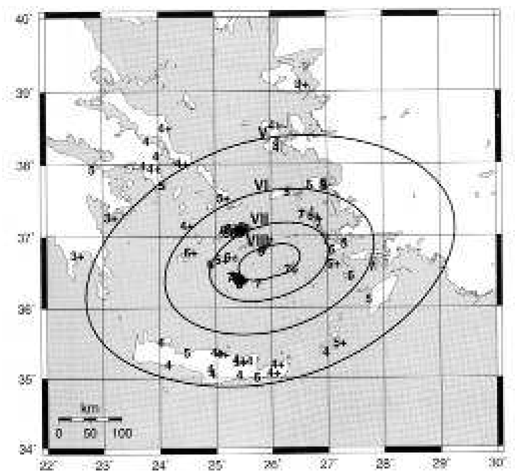


Figure 1.11. Isoseismal map of the Amorgos 1956 earthquake (after Papazachos et al., 1997)

1.1.2.2.2. Earthquakes in Lesvos and the North Aegean area

The area of the North Aegean is very well known for its very active seismicity. Table 1.2, published in the book “The earthquakes of Greece” (Papazachos and Papazachou, 2003), presents the most significant earthquakes of the wider North Aegean region (shown also on Fig. 1.12).

Table 1.2. The most significant historical and instrumental earthquakes in the wider region of the NE Aegean (the magnitudes in brackets are rough estimations); the epicenters are shown on the map of Figure 1.12.

No	Year	Date - Time	Longitude (°)	Latitude (°)	M	Wider area (Intensity in more specific area)
1	[496] BC	-	38.4°	26.2°	(6.0)	Chios (VIII)
2	360 BC	-	40.4°	26.5°	(6.8)	Minor Asia (IX Ophrynio)
3	287 BC	-	40.5°	26.7°	(6.7)	Minor Asia (IX Lyssimacheia)
4	[231] BC	-	39.2°	26.3°	(6.8)	Lesvos (X Pyrra)
5	(198) BC	-	38.4°	23.7°	(6.4)	Euboia
6	[197] BC	-	40.0°	25.4°	(7.0)	Lemnos
7	17 AD	Night	38.63°	27.59°	7.0	Minor Asia (X Sardes)
8	47 AD	-	38.1°	27.5°	7.0	Samos (VIII)
9	105 AD	-	38.9°	27.0°	6.4	Minor Asia (VIII Elaia)
10	178	-	38.4°	27.1°	(6.5)	Izmir (VIII)
11	478	-	40.4°	26.6°	7.0	Kallipolis (IX)
12	597	Night	40.7°	24.1°	(6.7)	Amphipolis (VIII)
13	620	-	40.7°	23.9°	(6.8)	Thessaloniki (VII)
14	677	-	40.7°	23.5°	(6.4)	Thessaloniki (VII)
15	700	-	40.7°	23.1°	(6.5)	Thessaloniki (VII)
16	926	-	40.8°	27.3°	(6.6)	Thrace (VIII)
17	1040	February 2	38.4°	27.3°	(6.8)	Izmir (VIII)
18	1265	August 11	40.7°	27.3°	(6.6)	Prikonissos
19	1296	July 17	39.1°	27.3°	(6.8)	Chliara (IX)
20	1354	March 1	40.7°	27.0°	7.4	Kallipolis (IX)
21	1366	June 1	40.0°	24.6°	(6.6)	Athos (VII)
22	1383	August 6 - Night	39.3°	26.4°	(6.8)	Mytilini (IX)
23	1389	March 20	38.7°	26.2°	6.7	Chios (VIII)
24	1417	August	38.4°	23.8°	(6.4)	Euboia (VIII)
25	1420	July	40.8°	23.1°	< 6.0	Thessaloniki
26	1430	March 26 - Night	40.7°	23.2°	(6.0)	Thessaloniki (VI)
27	1437	September 4	40.8°	27.5°	(6.8)	Chersonisos (VI)
28	1456	November 12	39.9°	24.4°	(6.2)	Athos (VI)
29	1471	-	40.1°	24.9°	(7.0)	Lemnos (VIII)
30	1511	May 26	40.2°	25.2°	(6.8)	Athos (VII)
31	1546	-	38.2°	25.9°	(6.3)	Chios (VII Mastichochoria)
32	1564	August 12	39.9°	24.7°	(6.4)	Athos (VI)
33	1572	April 12	39.9°	24.6°	(6.4)	Athos (VII)
34	1585	June 28 - 02h	39.8°	24.4°	(7.0)	Athos (VIII)
35	1625	May 18	39.2°	27.4°	(7.0)	W. Turkey (VII Manisa)
36	1636	February 27	39.2°	26.2°	(6.2)	Lesvos (VII)
37	1654	Μαΐου 20	38.5°	27.1°	(6.4)	Izmir (VIII)
38	1659	February 17	40.7°	27.5°	7.2	NW Turkey (VIII Rethestos)
39	1664	June 2	38.5°	27.3°	(6.2)	Izmir (VIII)
40	1669	October 26	40.2°	25.3°	(7.0)	N. Aegean
41	1672	February 14	39.8°	26.0°	(7.0)	Tenedos (IX)
42	1674	January 23	38.7°	26.3°	(6.2)	Chios (VII)
43	1677	-	40.5°	23.0°	(6.2)	Thessaloniki (VIII Vassilika)
44	1680	February 14	38.4°	27.2°	(6.2)	Izmir (VII)

45	1684	-	38.2°	26.2°	(6.0)	Chios (VI)
46	1688	July 10	38.38°	27.17°	6.8	Izmir (X)
47	1688	September 10	39.9°	27.5°	(6.6)	NW Turkey
48	1690	January 13	38.6°	27.4°	(6.4)	Izmir (VII)
49	1707	June 1	40.6°	26.5°	(6.8)	Dardanelia (VII)
50	1719	July 23	40.4°	26.0°	(6.7)	NW Turkey (VII Enez)
51	1723	September	38.4°	27.0°	(6.4)	Izmir (VIII)
52	1730	June 10	40.4°	26.1°	(6.5)	NW Turkey (VI Everse)
53	1737	March 6	40.0°	26.8°	7.2	NW Turkey (IX Ezine)
54	1739	April 4	38.6°	27.0°	6.8	W Turkey (IX Phokaea)
55	1756	November 26	40.5°	26.4°	(6.7)	NW Turkey (VII Everse)
56	1765	November 15	40.2°	25.2°	(6.9)	Athos (VI)
57	1766	August 5	40.7°	27.1°	7.6	NW Turkey (X Chora)
58	1772	November 24	38.6°	26.7°	(6.4)	NW Turkey (VIII Phokaea)
59	1776	December 5	39.8°	24.6°	(6.7)	Athos (VIII)
60	1778	July 3	38.4°	26.8°	(6.4)	Izmir(IX)
61	1779	February 3 - 03h	40.1°	24.7°	(6.3)	Athos (VI)
62	1797	March	40.3°	24.9°	(6.6)	Athos (VI)
63	1809	February 7	39.7°	26.8°	6.9	NW Turkey (VIII Eskistanbul).
64	1820	March	38.2°	26.2°	(6.0)	Chios (VII)
65	1826	February 8 - 20h	39.8°	26.4°	6.6	NW Turkey (VIII Ezine)
66	1845	June 23	38.6°	27.5°	(6.7)	W Turkey (IX Magnesia)
67	1845	October 11 - 02:	39.1°	26.3°	6.7	Lesvos (X Lisvori)
68	1856	November 13	38.2°	26.1°	(6.3)	Chios (VIII)
69	1860	August 6	40.4°	25.8°	(6.2)	Samothrace (VII)
70	1862	November 3 - 03:	38.6°	27.8°	6.9	W Turkey (X Turgutlu)
71	1863	August 16	38.3°	26.1°	(6.2)	Chios (VIII)
72	1865	February 23	40.2°	26.2°	(6.2)	NW Turkey (VIII Midili)
73	1865	July 23 - 21:30	39.4°	26.3°	6.6	Lesvos (IX Mythimna)
74	1865	November 11	38.2°	26.2°	(6.1)	Chios (VIII)
75	1866	February 2	38.2°	26.0°	(6.4)	Chios (VIII)
76	1867	March 7- 18:	39.20°	26.25°	7.0	Lesvos (X Kloumidados)
77	1868	October 3	39.2°	23.6°	6.3	Skiathos (VIII)
78	1874	March 18 - 05:00	38.5°	23.75°	(6.0)	Euboia (VII Eretria)
79	1877	October 13	40.7°	27.6°	(6.2)	NW Turkey (VIII Marmaras)
80	1880	July 29 -04:40	38.6°	27.2°	6.7	W Turkey (IX Menemeni)
81	1881	April 3 - 11:40	38.2°	26.2°	6.5	Chios (X Nenita)
82	1883	October 15 - 15:30	38.4°	26.6°	6.8	W Turkey (IX Cesme)
83	1887	May 14 - 05:30	40.1°	25.2°	7.0	Lemnos (VII)
84	1889	October 25 - 22:56	39.2°	25.9°	6.8	Lesvos (IX Chidira)
85	1890	May 26	38.5°	25.5°	(6.2)	Psara (VII)
86	1890	December 14	38.0°	27.4°	(6.2)	Efessos (VIII)
87	1893	February 9 - 18:	40.49°	25.53°	6.8	Samothrace (IX)
88	1893	March 12	38.0°	27.2°	(6.6)	Samos (VII)
89	1902	July 5 - 14:56:30	40.82°	23.04°	6.5	Thessaloniki (IX Assiros)
90	1905	November 8 - 22:30:30	40.0°	24.5°	7.5	Athos (X)
91	1912	August 9 - 01:29:00	40.62°	26.88°	7.6	NW Turkey (X Miriophyto)
92	1919	November 18 -21:54:50	39.1°	27.4°	7.0	W Turkey (IX Soma)
93	1923	December 5 - 20:56:35	39.9°	23.5°	6.4	Chalkidiki (VIII Valta)
94	1928	March 31 - 00:47:	38.2°	27.5°	6.5	W Turkey (IX Torbali)
95	1932	September 26 - 19:20:42	40.45°	23.86°	7.0	Chalkidiki (X Ierissos)
96	1935	January 4 - 14:41:30	40.7°	27.5°	6.4	NW Turkey (IX Erdek)
97	1939	September 22 - 00:36:32	39.0°	27.0°	6.6	W Turkey (VIII Dikili)
98	1941	July 13 - 15:39:28	38.1°	26.2°	6.0	Chios (V)
99	1947	June 4 - 00:29:48	39.7°	24.2°	6.1	Chalkidiki
100	1953	March 18 - 19:06:16	40.02°	27.53°	7.4	NW Turkey (IX+ Genise)
101	1964	October 6 - 14:31:23	40.10°	27.93°	6.9	NW Turkey (IX Manyas)
102	1965	March 9 - 17:57:54	39.16°	23.89°	6.1	Alonissos (IX+ Patitiri)
103	1967	March 4 - 17:58:09	39.2°	24.6°	6.6	Skyros (V+)

104	1968	February 19 - 22:45:42	39.5°	25.0°	7.1	Aghios Eustratios (IX)
105	1975	March 27 - 05:15:08	40.4°	26.1°	6.6	NW Turkey (VII+ Kallipolis)
106	1978	June 20 - 20:03:21	40.61°	23.27°	6.5	Thessaloniki (VIII+ Stivos)
107	1981	December 19 - 14:10:51	39.00°	25.26°	7.2	Lesvos (VIII Ippios)
108	1982	January 18 - 19:27:25	39.78°	24.50°	7.0	N Aegean (VI Thasos)
109	1983	August 6 - 15:43:	40.0°	24.7°	6.8	Lemnos (VI Aghios Dimitrios)
110	1992	November 6 - 19:08:10	38.09°	27.00°	6.2	Doganbey area (VII)
111	2001	July 26 - 00:21:41	39.05°	23.35°	6.4	Skyros (VII)

Figure 1.12. Map showing the epicenters of the historical earthquakes of Table 1.2 in the wider NE Aegean region (Papazachos and Papazachou, 2003).

231 BC, M = (6.8), Lesvos (X, Pyrra)

Stravon refers that the town of Pyrra (today's location of Achladeri) was destroyed and, according to Plinious, it was submerged under the sea. Many more recent writers comment the destruction of this ancient city of Lesvos island and some of them believe that this destruction is connected with a major earthquake.

1383, August 6, Night, M = (6.8), Mytilini (IX)

Information about this earthquake is provided in a code of The Holy Monastery of Andros. References are also in other sources (Lampros, 1910; Maravelakis, 1983; Wirth, 1966; Schreiner, 1975; Ambraseys and Finkel, 1991; Evaggelatou-Notara, 1993). Before the main event, several smaller earthquakes occurred, that did not result in major damage. The main quake destroyed the town of Mytilene and killed most of its citizens. The lord of the town, Francesco Gateluzo, who commissioned the construction of the acropolis of the town, was buried under the debris together with his wife (the sister of the emperor of Byzantine Ioanni the 5th Paleologos), his two sons (Andronikos and Domenikos) and 50 men of his guard. His two younger children (Iakovos and Lukinos) survived and Iakovos ruled the island. The aftershocks continued for a long period of time and completed the destruction.

1636, February 27, M = (6.2), Lesvos (VII)

In the memoirs of a monk of the Lemonos monastery, is referred that on the night of the 16th to the 17th of February (old calendar) a major earthquake occurred that destroyed houses and scared the villagers (Lampros, 1910).

1845, October 11, 02:00, M = 6.7, Lesvos (X, Lisvori)

In the early morning of the 9th of October, two weak earthquakes happened in Mytilene. On the same day and the next one the earthquakes continued. At 2 am a stronger earthquake occurred that was followed by another one, extremely violent. During the day and the night that followed, the trembling continued almost every half an hour. The aftershocks continued for almost one year and the biggest ones were those of the 12th and 13th of October and one that occurred during the night of the 23rd of October. During the night between the 14th and 15th of October, rocks slid from the mountain near Vrissa village, resulting in the destruction of 60 houses and the death of one woman.

In the village of Akrasio, 9 houses collapsed. In Agiassos, the church and some houses suffered on cracks and a significant amount of rocks tumbled from Mount Olympus. On October 11 two branches of an enormous plane tree in the square of Mytilene broke down. Many residents stayed in their boats or under tents. In Plomari, 8 houses collapsed, 40 houses and 20 or 25 shops suffered damage. In Vivari, many houses and the church nearly collapsed. In Lisvori, which up to then had 70 or 80 houses, only two were left standing. In the countryside many springs were giving salty water (sea water). Mineral springs, which had dried up for weeks, gave water with a strong smell of sulfur after the earthquake. In Samos, the fortification walls collapsed. The strongest tremor was felt on the island of Karampournou and in Istanbul. At the same time, similar phenomena were observed in Izmir. On October 11, at 11h and 30sec in the evening, trembling was felt for more than 30 seconds. The trembling continued (in Izmir) the following week (Perrey, 1848; Schmidt, 1867a; Stamatiadis, 1887).

1865, July 23, 21:30, M = 6.6, Lesvos (IX, Mythimna)

In Mythimna, most buildings collapsed. In neighboring villages, 100 homes were destroyed and many people were killed. The area of destruction stretched from the Mamas Cape to the area of Achirona (Kalloni). Damages were also caused in Turkey, north of the island of Lesvos, where in Bechram people were killed. It was very strong in the Dardanelles, at Gallipoli and in other parts of the Hellespont, as well as in Raidestos and Istanbul. The quake was also felt in Izmir (Ambraseys and Finkel, 1991).

1867, March 7, 18:00, M = 7.0, Lesvos (X, Kloumidados)

Twenty five earthquakes occurred at the night between the 23 and 24 February (old calendar) that were accompanied by noises and destroyed the capital (Mytilene) and many villages of the island. In Mytilene, 2498 houses were almost completely destroyed and 3122 partially, while in rural areas 2248 were completely destroyed and 2407 suffered partial damage. 550 people were killed and 816 injured. Kloumidados (Napi) suffered the greatest damages, since it was completely destroyed, and Afalonas, because after the earthquake a fire finished up almost everything that had remained standing. Of the 70 villages, only 5 or 6 built in the mountains suffered no damage. Apart from the capital, also the villages of Molyvos, Petra, Kalloni and Parakila were destroyed, as did also the Limonos Monastery. Cracks on the surface occurred in different places, but the most important one was the one which started from the Gulf of Kalloni up to Aghia Paraskevi village along a small river. The crack's width was 1.5 feet and had a depth of several metres. Liquefaction phenomena were also observed, as well as landslides. In a boat that was in the port of the capital, fish were found after the earthquake. An observer in Mytilene saw immediately before the earthquake the sea in the port raising and foaming as due to an underwater explosion. Also cities of Asia Minor, such as Adramytio (Edremit) and Ayvalik suffered extensive damage due to the earthquake, whereas cities located in the Plain of Troy suffered minor damage. The quake was felt in Edirne, Gallipoli and Istanbul. It is said that the earthquake was preceded by premonitory phenomena. A flock of sheep stood with their heads looking up to the sky, dogs were screaming and fled away from their villages in Mesagros and Gera, oxes and a dog cut themselves loose and survived the earthquake as their barn was demolished by the vibration. A glow was observed in the sky, which then disappeared. The strong tremors were three, of which the first weaker. This earthquake is still being considered as a chronological starting point for the inhabitants of Lesvos. The aftershocks lasted until March 1868 and some of them were felt in Chios and Izmir (Schmidt, 1879a; Sieberg, 1932a, b; Kleomvroutos, 1934; Kambouris, 1978).

1889, October 25, 22:56, M = 6.8, Lesvos (IX, Chidira)

The earthquake destroyed the villages of Chidira, Eressos, Agra, Tzithra and Vatousa, in the western part of the island. Serious damages were caused in Sigri, Mesotopos and Mytilene. Many farm houses were destroyed and rocks collapsed in Skala Eressos. Damages were caused also in other parts of the island. Altogether, 1800 houses were destroyed or were made uninhabitable, 36 people were killed and 27 injured. Also, many animals were killed. Some damages were caused in Ayvalik and fewer in Sultanije. The earthquake was strongly felt in Izmir, Chios and the Hellespont and lighter in Raidestos, Mouggla, Istanbul and Rhodes. A strong aftershock on November 21 completed the destruction of Vatoussa (Mitsopoulos, 1980; Galanopoulos, 1953; Karnik, 1971; Kambouris, 1978; Ambraseys and Finkel, 1999).

1981, December 19, 14:10:51, M = 7.2, Lesvos (VIII, Ippios)

This was a major earthquake in the north Aegean. The epicenter was west of the coast of Lesvos. It caused some damage on Lesvos and especially in the villages of Ippios and Pamphila (VIII), where 7 houses collapsed and 236 suffered cracks, 9 of which became uninhabited. Damages were observed in Skyros, where 2 houses collapsed and 2 churches, 1 monastery and 1 school were severely damaged (BGINOA, 1981, Newspaper. Macedonia 12/20/1981). A lot of aftershocks followed, the largest of which occurred on December 27 (17:39, M = 6.5).

1.1.2.3. General Review of the Active Faulting in Greece

In the following map (Fig. 1.13), it is clearly shown that many active structures are accommodated in Greece. The active faults of Greece can be divided into two very broad groups, according to their size and seismic potential (according to Pavlides et al., 2007):

1. <u>Mainland (or onshore) faults.</u> These faults are predominantly normal or oblique-slip ones, with lengths that typically range from a few to a couple of tens of km. They generate shallow earthquakes with epicentre depth of no more than 12-15 km (seismogenic layer). They commonly bound fault valleys (grabens), in which the largest percentage of Greece’s population lives. Therefore, their size is not such an important factor for seismic hazard assessment, as their proximity to populated places. A characteristic example is the 5.9 degrees on the Richter scale Athens earthquake in 1999, which was produced by the relatively small Fili (Parnitha) fault; it did however inflict severe and fatal damages to hundreds of buildings in the broader Athens area (Pavlides et al., 2002; Papadopoulos et al., 2002).

   <u>In Crete,</u> onshore active faults are mainly related with extensional tectonic and basin development (Fig. 1.14; Fassoulas, 2001). These are mainly the Hierapetra, Spili and Messara faults.

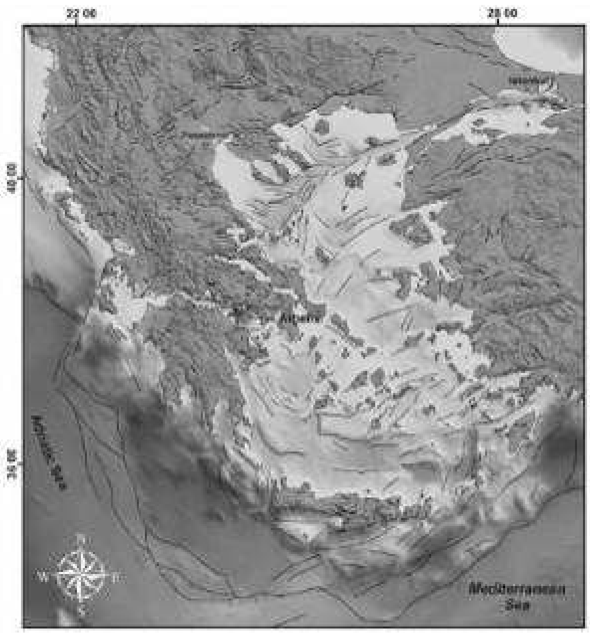


Figure 1.13. Map of capable faults (seismically active and possible faults) of the broader Aegean region (Greece and surrounding countries) (Pavlides et al., 2007).

2. <u>Offshore faults.</u> These faults can be of any kind, tending to be reverse or strike slip in the Ionian Sea and normal or strike slip in the Aegean Sea. Depending on their type, they can be from a few to several tens of km long. The largest

earthquakes in magnitude in Greece are related to these structures. These are commonly directly or indirectly associated with either the Hellenic Arc, i.e. the subduction zone of African plate below the Eurasian one, or the Aegean Trough, i.e. the extension of the great North Anatolian Fault Zone into the Aegean. An example of an active offshore fault that caused extensive earthquake damage is the fault that bounds the southern shores of Amorgos Island, associated with the strong 1956 shock (Papadopoulos and Pavlides, 1992), as well as the fault west of the island of Kefalonia, associated with the destructive Kefolonia earthquake in 1953.

In Crete, the most important offshore active faults are those at the western coast (Armijo et al., 1992), as well as the faults in the Cretan Sea. The extension of the Hierapetra fault north and south of the island often gives strong earthquakes.

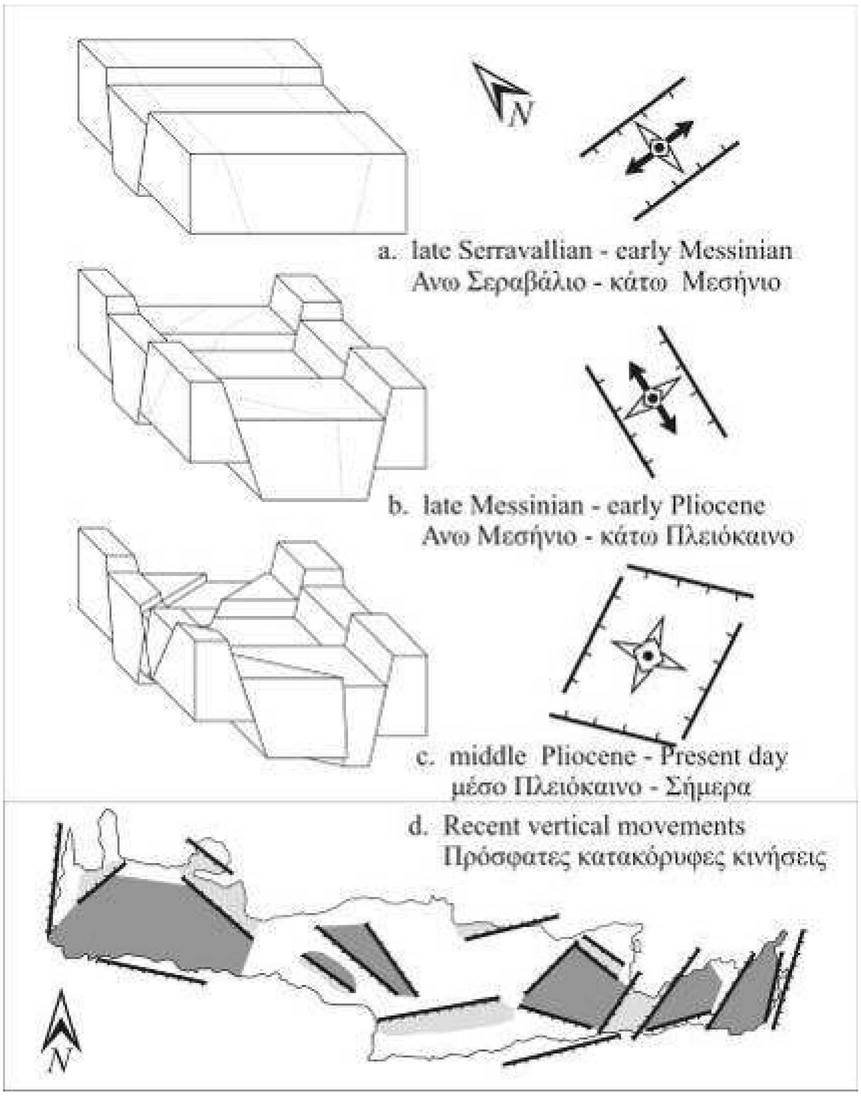


Figure 1.14. The development of Cretan Basins and major onshore faults (after Fassoulas, 2001)

Geodynamics of the North Aegean Area

From geological, neotectonic, seismotectonic and geophysical point of view, the North Aegean and its surroundings have attracted much attention during the last decade. The 300-km long North Aegean Trough (NAT), with a maximum depth around 1900m, is well defined by the 400-m isobath. It extends from the narrow Saros Trough to the east, as a continuation of the North Anatolian Fault through the Marmara Sea, as far as the Sporades basin in the west. The trough is controlled by en echelon faults, which show normal character, as shown through seismic profiles (Biju-Duval et al., 1972; Lalechos and Savoyar, 1979; Brooks and Ferentinos, 1980; Lyberis, 1985; Roussos and Lyssimachou, 1988) and there is also evidence for important dextral strike-slip movement. Lesvos Island, laying in the North – East Aegean area, has a key role in understanding the geodynamics of the area.

Seismological data concerning the spatial distribution of the earthquakes and focal mechanisms in the North Aegean area were correlated with volcanism and ore genesis by Papazachos (1976), who showed that there is a possible Benioff zone in the Northern Aegean. This plate is dipping northwards and controls the morphology and neotectonics of the region as a back-arc domain. Riazkov and Stanov (1989), using seismological, gravitational and magnetic field investigations, assumed that a fragment of oceanic type crust exists beneath the North Aegean. They supported as well the idea for a weakly active paleosubduction zone.

According to the converging views of many workers, the tectonic regime of the region is mainly extensional, accompanied by strike-slip movements (e.g. Papazachos, 1976; Lyberis, 1985; Simeakis et al., 1989). McKenzie (1972), Dewey and Sengor (1979), Sengor et al. (1985) emphasise the importance of a “Grecian” shear zone, which they think runs along the NAT, Central Aegean and Central mainland Greece. Mountrakis et al. (1993) gave evidence that the Southern Thessalia highly active fault zone, which is in the Central mainland Greece, is probably the continuation of this fault system.

Pavlides et al. (1990) claimed that the recent deformation conditions of the North Aegean area are not very different from those required for a right-lateral transtension. Additional evidence for strike-slip faulting on the NAT comes from recalculated focal mechanisms (Kiratzi et al., 1989) and the study of seismic sequences of the last decades (Papazachos et al., 1984, 1995; Rocca et al., 1985; Kiratzi et al., 1989). These focal mechanisms show horizontal or subhorizontal P (compressional) stress axes directed E-W and T (extensional) axes oriented N-S. They show pure dextral strike-slip motions with normal or reverse componets.

Geological information relevant to the timing of the onset of the NAT arises from published information on the main neotectonic subsidences of Northern mainland Greece (Psilovikos and Sotiriadis, 1983; Koufos and Pavlides, 1988). Information comes also from the Neogene stratigraphical and neotectonic studies of the North Aegean islands (Lalechos and Savoyar, 1979; Lyberis and Sauvage, 1983; Mercier et al., 1989; Simeakis et al., 1989) and from the analogy of similar basins of the Western edge of the North Anatolian Fault (Sengor and Catinez, 1982; Barka and Kadinsky-Cade, 1988). Conclusively, the NAT and the basins of the broader North Aegean region have originated sometime between Middle (?)-Late Miocene and Pliocene.

Mercier et al. (1982) have shown that the North Eastern Aegean (Thrace and the island of Lesvos) has been affected mainly by extension since the Late Miocene.

Lyberis (1985) has also shown that the whole North Aegean area has been affected by a prevailing tectonic regime of extension coupled with strike-slip since the Late Miocene, and that it is still active. Simeakis et al. (1989) opined that the NE-SW to E-W striking North Aegean Trough fault zone absorbs the dextral strike-slip motion of the North Anatolian Fault at its western termination. According to Lyberis (1985) and Mercier et al. (1989), the extension that characterizes the area could be distinguished into three tectonic regimes (or phases). These are: (1) a Late Miocene phase with NW-SE direction of extension, (2) a Pliocene-Early Pleistocene phase with NE-SW extension and (3) a Middle-Late Pleistocene phase with N-S extension. These extensional phases are mainly responsible for the creation of the NAT and the surrounding basins.

1.1.2.4. Seismic Hazard map of Greece

The earthquake ground shaking hazard for a given region or site can be determined in two ways: deterministically or probabilistically. A deterministic hazard assessment estimates the level of shaking, including the uncertainty in the assessment, at the building site for a selected or scenario earthquake. Probabilistic hazard assessment expresses the level of ground shaking with a specific, low probability of being exceeded in a selected time period, for example 10% probability of being exceeded in 50 years, where 50 years is commonly chosen as the building design life. The seismic loading criteria in current Greek Seismic Design Code define design force levels based on ground motions specified in probabilistic seismic hazard maps. Such maps include those showing expected peak ground acceleration and those showing expected peak spectral acceleration response at different building periods of vibration. Figure 1.15 illustrates a probabilistic seismic hazard map showing the regional variation of ground shaking hazard in Greece.

The Seismic Hazard map of Greece is a result of the active faulting and the seismicity of the country. According to this map, Greece is divided into three seismic hazard zones I, II and III. The Seismic Hazard Map is part of the Greek Seismic Design Code (EAK-2000), as it has been revised in the year 2003 - National Law (YA D17a/115/9/FN275/12-08-2003, Gov. Gaz. B'/1154). To every Seismic Hazard Zone there is a corresponding value of ground seismic acceleration. Thus, in zone I, as it is shown in the legend of Figure 10, the ground seismic acceleration is estimated to be 0.16g, in zone II 0.24g and in zone III 0.36g. These values of the ground seismic accelerations are estimated to have a 10% probability of exceedance in 50 years according to the seismological data.

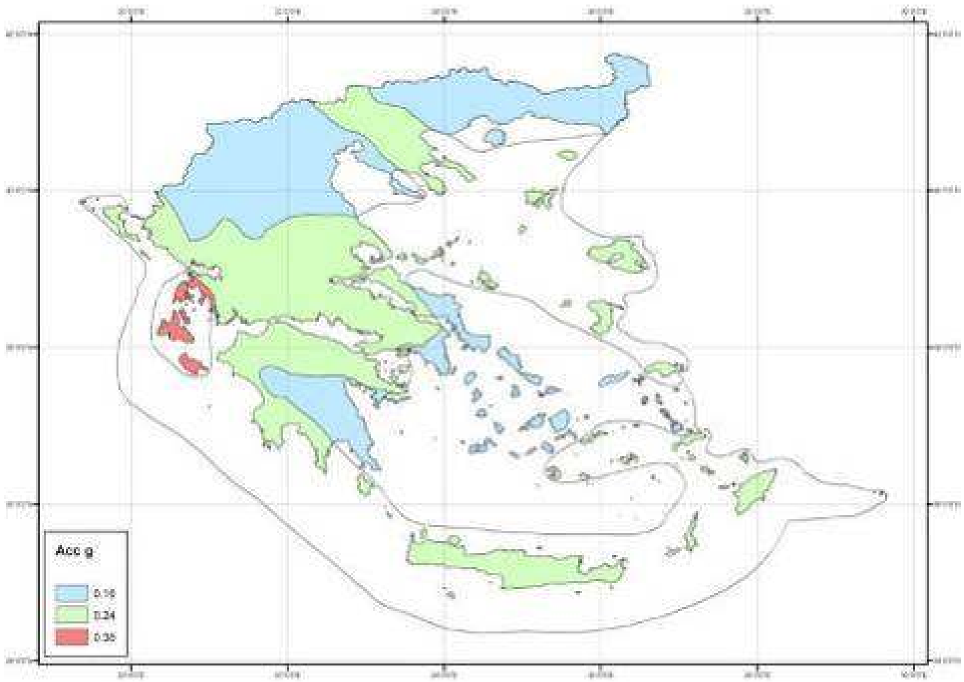


Figure 1.15. Seismic Hazard Map of Greece (EAK-2000) – Gov. Gaz. B' 1154/2003

1.1.3. Volcanic risk identification

The Hellenic Arc is the surface expression of the subduction of the African plate beneath the Eurasian one. The arc is approximately 500 km long and 20–40 km wide and extends from the eastern coast of mainland Greece to western Turkey. This arc, so-called South Aegean Active Volcanic Arc (SAAVA), lies 250 km behind the trench system and includes the volcanic islands of Aegina, Methana, Poros, Milos, Santorini, Kos, Yali and Nisyros (Fig. 1.16).

Figure 1.16. Map of major volcanoes of Greece (from USGS/CVO, 2003)

Along the SAAVA, two subaereal volcanic fields host known active volcanic centers: 1. Methana, with an historic eruption registered in ~230 BC, and 2. Santorini, with 10 registered historic eruptions, the last one in 1950. Two other volcanic fields are considered as potentially active volcanoes: 1. Nisyros, with historic hydrothermal explosions, the last one in 1887, and 2. Milos, with probable historic hydrothermal explosions during the 1-2nd centuries AD.

1.1.3.1. Volcanic Activity and Hazard Estimation of the various active centres

Methana

The main part of the Methana peninsula consists of calc-alkaline volcanic products of andesitic - dacitic composition. Volcanic activity started at about 0.9 Ma (Fytikas et al., 1986a; Pe-Piper and Piper, 2002 in Vougioukalakis & Fytikas, 2005). The last eruption was registered at 230 BC (Strabo, Geographica): relatively calm, effusive and extrusive activity build up the lava domes and flows of Kameno Vouno, at the NW edge of the peninsula (Fig. 1.17). During all the eruptive periods, volcanic activity at Methana was mainly extrusive and effusive, producing lava domes and flows with subordinate explosive activity. A few outcrops of block and ash flows as well as related surge deposits, indicate that hazardous events have been manifested in the area.

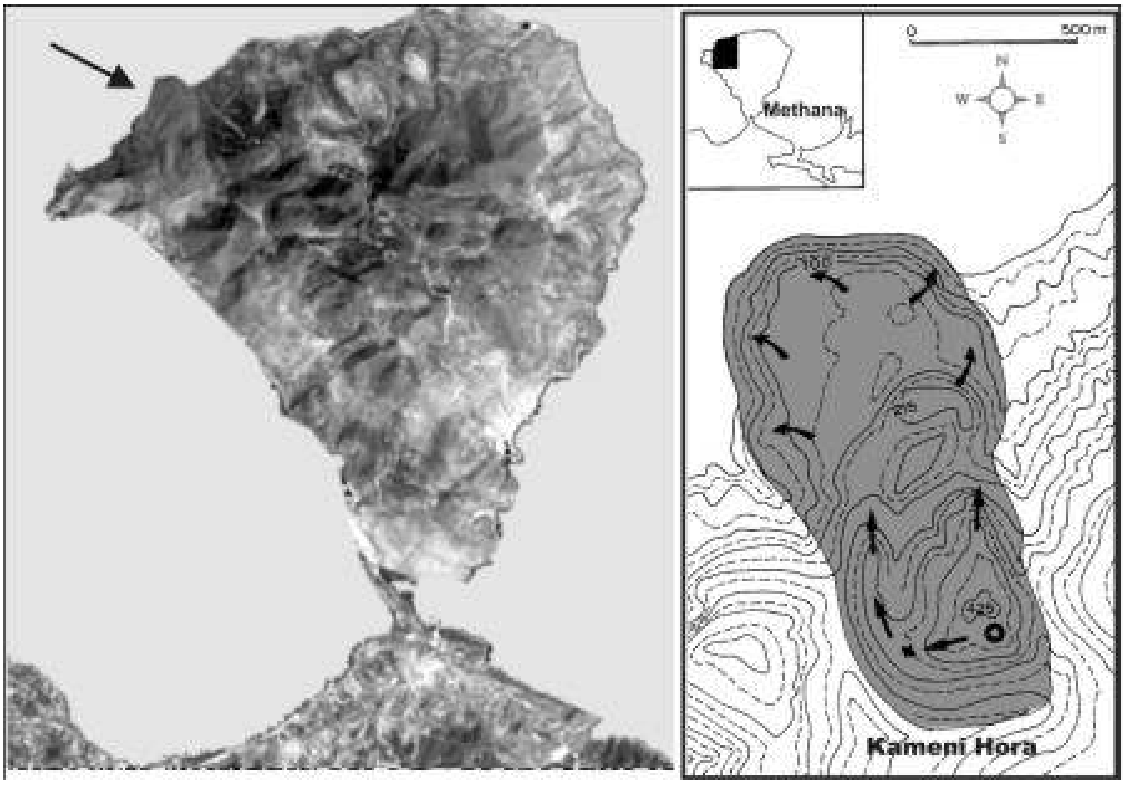


Figure 1.17. Methana peninsula from Landsat 5 satellite image (left: arrow shows the area of the detailed map on the right) and the historic eruption products in Kameni Hora area (right: dark grey area). The star indicates the vent and the arrows the flow directions.

According to the present estimation, based on the existing knowledge of the volcanic activity in the area, the volcanic hazard in the area is low. Volcanic risk is also low as the inhabitants of the peninsula are few (about 2000); social and economic activity is also relatively low. The NW coast (Fig. 1.17: left, arrow), where historic volcanic activity was manifested, is quite uninhabited. From June to October the population increases considerably because of the presence of well-known Spas in the SE shore of the peninsula where the relative important touristic center is found.

Milos

Since 3.5 Ma, volcanic activity has been manifested in the area of the Milos volcanic field, fed by typical calc-alkaline magmas (Fytikas et al., 1986b; Fytikas and Vougioukalakis, 1993; Francalanci et al., 1994, 2003; Stewart and McPhie, 2003 in Vougioukalakis and Fytikas, 2005).

The most recent magmatic events are two big explosive phreatomagmatic eruptions that built up Trahilas and Fyriplaka tuff rings (Fig. 1.18). These events have been dated at 380 and 90 ka, respectively (Fytikas et al., 1986b in Vougioukalakis and Fytikas, 2005). New data (Principe et al., 2003 in Vougioukalakis and Fytikas, 2005) indicate a much younger age for the Fyriplaka eruption (19 ka). Historic magmatic eruptions have not been registered.

Considering that the future behaviour of the volcano is conditioned by the last volcanic activity cycle, and the repose time periods will continue to have the same duration, the reactivation of the volcano with hazardous explosive hydromagmatic eruptions is not improbable. Both the intensive shallow seismicity and the high heat flow registered in Milos area argue for an active region and lead us to consider Milos volcano as a potentially active volcanic centre.

Another serious volcanic hazard at Milos is that of the hydrothermal explosions. A high enthalpy geothermal field has been explored in central Milos (Zefiria and Adamas areas), confirming the presence of overheated steam (320^{o} C) at a depth of less than 1 Km. This argument, besides the presence of a large number of relatively young hydrothermal craters nearby the geothermal area, and the presence of historic hydrothermal explosions (80-200 AD, Traineau and Dalabakis, 1989 in Vougioukalakis and Fytikas, 2005) indicates that triggering of these explosions is probable, thus consisting a serious hazard for this area.

Volcanic risk in Milos Island is relatively low, considering the low probability of occurrence of volcanic events in the near future. The permanent population of the island is 5000 persons, and during summer time population increases to 10000 – 12000 due to tourism. Social and economic activity is relatively low, even though quarrying is really intense.

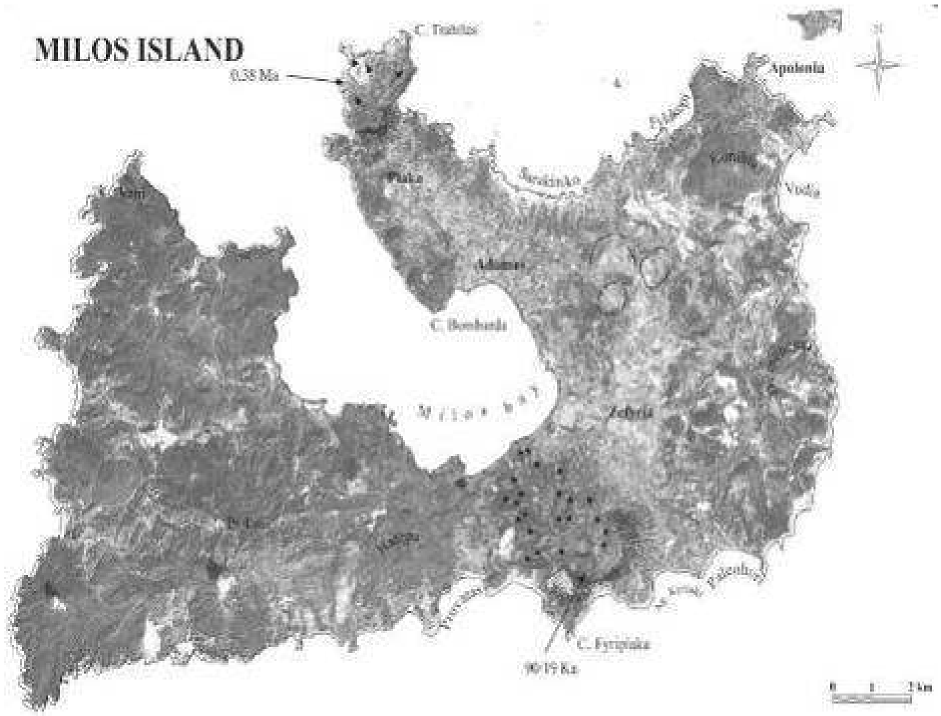


Figure 1.18. Milos Island from Landsat 5 satellite image. Trahilas (380 ka) and Fyriplaka (90 or 19 ka) centers, as well as the large hydrothermal craters rim are indicated.

Nisyros

Nisyros Island is a very young stratovolcano with a central caldera (Fig. 1.19). Volcanic activity was feed by typical calc-alkaline magmas, ranging in composition from basaltic andesite to rhyolite. The oldest sub-aerial volcanic products have an age of less than 160 Ka (Keller, 1971, 1980; Di Paola, 1974; Vougioukalakis, 1989, 1993; Seymour and Vlassopoulos, 1989; Keller et al., 1989, 1990; Limburg and Varekamp, 1991; Francalanci et al., 1995a; Smith et al., 1996 in Vougioukalakis and Fytikas, 2005).

Two main eruptive cycles are distinguished in the evolutionary model of Nisyros volcanic activity: the first cycle includes the cone-building eruptive activity and the second one the caldera forming eruptive activity. The second cycle consists of two different phases. Each phase commenced with a low intensity - low magnitude phreatomagmatic eruption fed by rhyolitic magmas. This triggered a central calderic collapse that was followed by extrusion of rhyolitic-dacitic domes and lava flows.

The existing radiometric ages (K-Ar and 14C) are contrasting but they show that the major part of Nisyros was built up during the last 160000 years, and the two catastrophic explosive events occurred less than 40000 years ago, with a considerable time gap between them. This imposes to consider Nisyros as a potentially active volcano. The high shallow seismicity and the high geothermal anomaly argue for this estimation also (Sachpazi et al., 2002).

A serious volcanic hazard present at Nisyros is that of the hydrothermal explosions. In the 19th century two periods of reactivation with hydrothermal explosions have been registered into the Nisyros caldera depression (1871-1873 and 1887) (Gorceix, 1873, 1874; Martelli, 1917 in Vougioukalakis & Fytikas, 2005). More than 20 older hydrothermal explosion craters in the caldera floor, ten of them well preserved with a maximum diameter of 300 m, indicate that this type of activity was frequent in historic and prehistoric times (Marini et al., 1993; Vougioukalakis, 1998 in Vougioukalakis & Fytikas, 2005). This registered activity and the presence of a high enthalpy geothermal field at Nisyros (fluids with >450^{o}C at 1800 m depth) makes probable the manifestation of hydrothermal explosions in the near future.

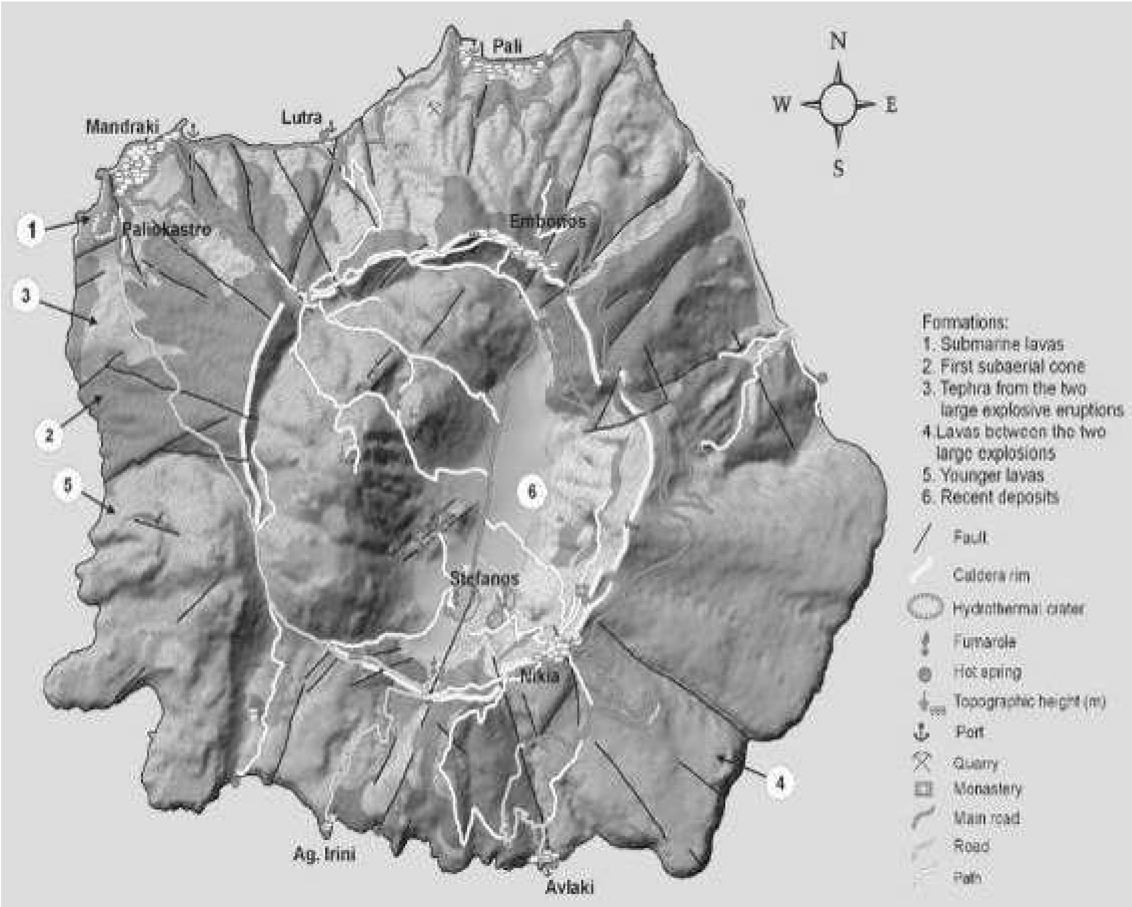


Figure 1.19. Simplified 3D geological map of Nisyros volcano.

Regarding the risk evaluation, it is not possible to estimate the volcanic risk in the area regarding a phreatomagmatic eruption, as it is not possible to estimate with the existing data, the probability of occurrence of such an eruption. In the case of the manifestation of a phreatomagmatic eruption not only Nisyros inhabitants (about 1000 people) but even the nearby area of Kos and the neighbouring coasts of Turkey could be in great danger. The risk during a hydrothermal explosion is relatively high. Nisyros caldera is being visited by thousands of tourists during the summer time (about 60000 people per season nowadays). In the case of an outburst in this period, the human losses could be too heavy.

Yali islet is the youngest volcanic centre of Nisyros island group. This is an Upper Quaternary rhyolitic volcanic edifice. Two volcanic cycles are distinguished, each with an initial explosive eruption that deposited rhyolitic pumice, followed by an extrusion of obsidian-perlitic lava domes and flows (Vougioukalakis, 1989). The very young age (probably Neolithic) of the last explosive eruption of Yali (Yali 3-4 of Keller 1980 stratigraphy) lead us to consider even this centre as a potentially active volcano.

Santorini

Santorini volcanic field is the most active of the South Aegean volcanic arc. It comprises two of the three active volcanic Aegean centres, these of Kameni and Kolumbo (Fig. 1.20) (Fouqué, 1879; Washington, 1926; Ktenas, 1927; Reck, 1936; Georgalas, 1953; Georgalas and Papastamatiou, 1953; Druitt et al., 1989, 1999 in Vougioukalakis and Fytikas, 2005).

Santorini, a multi-centre volcanic field dissected by a flooded caldera, is one of the world's most violent caldera volcanoes. During the past 400,000 years over a hundred explosive eruptions have been manifested. Twelve of these discharged volumes of magma exceeding a few cubic kilometres and triggered at least four caldera collapses (Druitt et al., 1989; Druitt and Francaviglia, 1992 in Vougioukalakis and Fytikas, 2005). The last one of them was the Minoan eruption of late Bronze Age (~3600 BP) (Bond and Sparks, 1976; Doumas, 1983; Heiken and McCoy, 1984, 1990; Sparks and Wilson, 1990; Pyle, 1990; Cioni et al., 2000, in Vougioukalakis and Fytikas, 2005). It discharged about 30 km^3 of rhyodacitic magma, destroying the advanced civilisation of the island, and distributed ash over a large area of the eastern Mediterranean and Turkey. The effects of tsunamis and ash fallout were hardly felt on Crete, 120 km to the south.

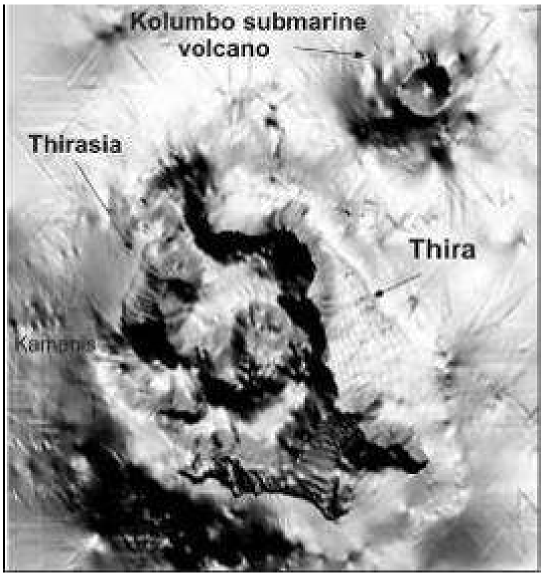


Figure 1.20. 3D topographic representation of the Santorini volcanic field with the Kameni and Kolumbo centres

The position of the vents during the last 600 ka was largely controlled by two NE-SW volcanotectonic lines, the Kameni and Kolumbo lines, which acted as path for the magma. At least five major explosive eruptions were focused on the Kameni line as well as Aspronisi tuff ring. The Kolumbo line controlled the vent position of two major explosive events, as well as dyke swarm, cinder cones and Cape Kolumbo tuff ring on north Thira.

After the Minoan eruption, volcanic activity continued, localizing mainly in the intracaldera area. Extrusive, effusive and slightly explosive activity produced the lava domes, flows and pyroclasts that built up Palea and Nea Kameni islets, between 197 BC and 1950 AD. All the volcanic centres are distributed along a zone 600 m wide of NE direction, the so-called Kameni line (Fytikas et al., 1990). Even though intracaldera activity has been mild and has not threatened human lives, an explosive event occurred in 726 AD, causing considerable destruction in Santorini.

Outside the caldera, depression volcanic activity was manifested only once, during 1649-1650 AD (Fytikas and Vougioukalakis, 1995; Vougioukalakis et al., 1994, 1995 in Vougioukalakis and Fytikas, 2005). Initial extrusion, of about 2 km^3 dacitic-andesitic magma, built up Kolumbo submarine volcano, an edifice with ellipsoid shape, 300 m high and 8 km max. axis long, on the extension of Kolumbo line. Consequent hydromagmatic and magmatic explosive activity discharged about 1 km^3 DRE of rhyodacite to andesite pumice and ash, triggering a caldera collapse (3 km diameter and 500 m deep) and a large tsunami that devastated Santorini's coasts and caused damages within a radius of 150 km. Magmatic gases and ash fallout caused serious problems on Santorini inhabitants during this volcanic unrest. More than 70 people lost their lives and more than 1000 animals were killed, most probably by the hydrogen sulphide produced (Fouqué, 1879 in Vougioukalakis and Fytikas, 2005).

The ring island of Santorini is heavily populated (14000 inhabitants on ca 90 km^2). A continuously increasing amount of people (about 1000000 persons per year nowadays) visit Santorini annually. More than 1/3 of them visit Nea Kameni islet and walk on the historic craters. Santorini contributes to the national income millions of dollars yearly (Vougioukalakis, 2002 in Vougioukalakis and Fytikas, 2005). That imposes an accurate evaluation of the volcanic hazard and risk.

The maximum expected event on Santorini is a catastrophic paroxysmal eruption like the Minoan event. The probability of occurrence of such an event is very low, as geological and radio dating indicates that major explosive events on Santorini are separated by more than 20,000 years time gap. The second magmatic cycle of Santorini lasted about 200 ka and comprises 7 major events. The repose time between the two late major explosive events, (Cape Riva and Minoan eruptions) is 17.4 ka. So, it is improbable that a major event will occur after only 3.6 ka. Furthermore, recent seismic data argue against the presence of a big magmatic chamber underneath the Santorini area.

In the case of occurrence of the maximum expected eruption, the most probable location of the vent is along the Kameni or the Kolumbo line. The caldera walls are of great importance in the distribution of the pyroclastic flow and surge deposits, which are controlled by the topography. Anyway, the pyroclastic fall and surge deposits would cover all the area and devastate the Santorini Island. In this case, there is no reason for plotting a volcanic hazard zonation map. What should be interesting is an ash fallout distribution modelling and the evaluation of the expected tsunami effects, as they both interest a vast area of the Eastern Mediterranean.

In the case of repetition of a post-Minoan type volcanic activity, the radius of the hazardous effects can be traced with relative precision, based on the already known effects of this activity type. Based on this and other probable scenarios, a volcanic hazard zonation map has been plotted (Fig. 1.21) reporting:

- the probable position of the future eruptive centres,
- the phreatic explosions hazard zones
- the ballistic ejecta hazard zones,
- the tsunamis hazard zones,
- the toxic gases and ash fallout exposed zones,
- the hydroclastic ejecta hazard zones,
- the lava flows and scoriae cones hazard zones,

- the landslides hazard zones.

It is needed to point out that a large number of sub-plinian events are registered in the Santorini stratigraphy. Very few are known about the periodicity and the magnitude of these potentially destructive events. This is a subject that needs more accurate study, aiming at a complete hazard evaluation of the area. Regarding the *possibility to forecast* the next eruption on Santorini, the data available on the post-Minoan activity do not permit an accurate *long-term* forecasting of the next volcanic unrest. Precursory phenomena, which have been registered since the post-Minoan activity lead to the conclusion that a short-term forecasting for the onset of such a type of activity is possible with an integral and efficiently operating monitoring network (Vougioukalakis, 1994; Fytikas et al., 1990, 1998 in Vougioukalakis and Fytikas, 2005).

*Table 1.3. Major volcanic events in the geological history of the Santorini island group (adapted from Druitt et al., 1989) Note: * BP means years before present*

DATE	EVENT	SECONDARY EVENT
1700 BC	Major eruption	Caldera collapse + tsunami
18,000 BP*	Major eruption	Caldera collapse + tsunami (?)
79,000 BP	Major eruption	
100,000 BP	Major eruption	Caldera collapse + tsunami (?)

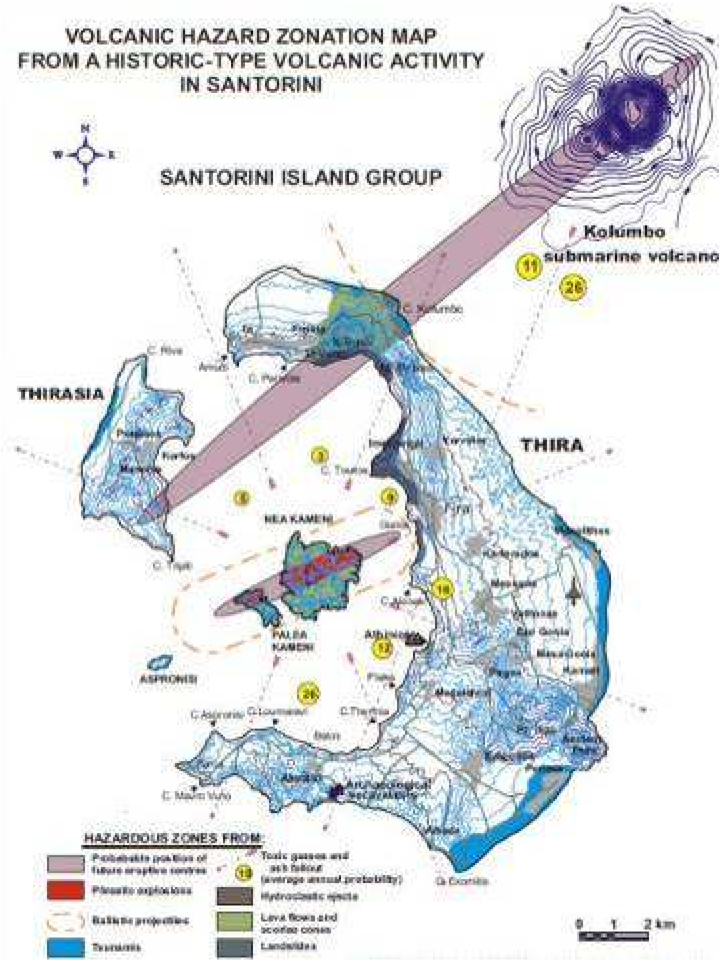


Figure 1.21. Volcanic hazard zonation map of the Santorini island group.

Past Volcanism on Lesvos Island

In the geological time period of Early-Middle Miocene, 22.5 to 13 million years ago, the volcanic activity due to the collision and subduction of the African lithospheric plate below the Eurasian one (which nowadays occurs in the region of the Greek trench south of Crete) occurred in the region of the northern and central Aegean, extending to Asia Minor. Evidence of this is to be found on the islands of the north-eastern Aegean, Imvros, Lemnos, Agios Efstratios and Lesvos, preserved due to the subsequent submergence of the area among the islands during the Quaternary. There are less volcanic products of that period on Chios, Psara, Antipsara, Skyros and Euboea.

Volcanic activity was very intense on Lesvos Island at the period 21.5 to 16.5 million years ago. Enormous volcanic eruptions took place due to the activity of three main volcanic centres, namely the Vatoussa, the Lepetymnos and the Agra volcanic centres (Fig. 1.22). These eruptions resulted in the shaping of the volcanic landscape of western Lesvos, where lava, volcanic ash and pyroclastic flows produced volcanic material that covered the geological basement of the island. Today, impressive volcanic domes, veins, volcanic necks and other volcanic geotopes are to be found at many locations on Lesvos. In the Odrymnos area and at Eressos, erosion of the volcanic ash has revealed large volcanic structures and geomorphs, which dominate the landscape and draw the gaze of the visitor. The most important result of this volcanic activity was the creation of the world famous Lesvos Petrified Forest, where volcanic ash covered the dense subtropical forest that was covering the area 20 million years ago, isolating it from the external conditions and leeding to its petrification.

Figure 1.22. Map of the island of Lesvos, showing the most important volcanic centres that were active 21.5 - 16.5 million years ago and the Lesvos Petrified Forest, main result of the past volcanic activity.

1.2. ITALY

1.2.1. Seismic risk identification

Italy is one of the countries in the Mediterranean with the highest seismic risk, due to its particular geographic position at the convergence of the African and Eurasian lithospheric plates. The highest seismicity is concentrated in the central-southern part of the peninsula, along the Apennine ridge, in Calabria and Sicily and in some northern and western areas (Fig. 1.23). Only Sardinia is not particularly affected by seismic events. Over the past 2,500 years, Italy has been hit by over 30,000 medium to strong earthquakes measuring more than grade IV-V on the Mercalli scale, and by around 560 events of an intensity equal to or higher than grade VIII on the Mercalli scale. In the 20th century alone, 7 earthquakes had a magnitude of 6.5 R or more, with intensity of X and XI. Disastrous earthquakes like the one in Val di Noto (Sicily), in 1693 (XI on the Mercalli scale), or the long seismic period in 1783 in Calabria (which peaked at XI on the Mercalli scale), have deeply scarred the land and left recognizable signs of recovery and reconstruction. In the last forty years, the economic damage caused by seismic events has been assessed at around 80 billion euro, to which must be added damage to historical, artistic and monumental assets. In Italy, the relationship between the damage caused by earthquakes and the energy released during the events is much higher than in other countries with high seismicity, such as California or Japan. For example, the earthquake in 1997 in Umbria and Marche was responsible for damage (homeless: 32,000, economic damage: approximately 10 billion euro) comparable with that caused by the 1989 earthquake in California (14.5 billion dollars), despite it having around 30 times less energy. This is mainly due to the high population density and considerable fragility of the buildings.

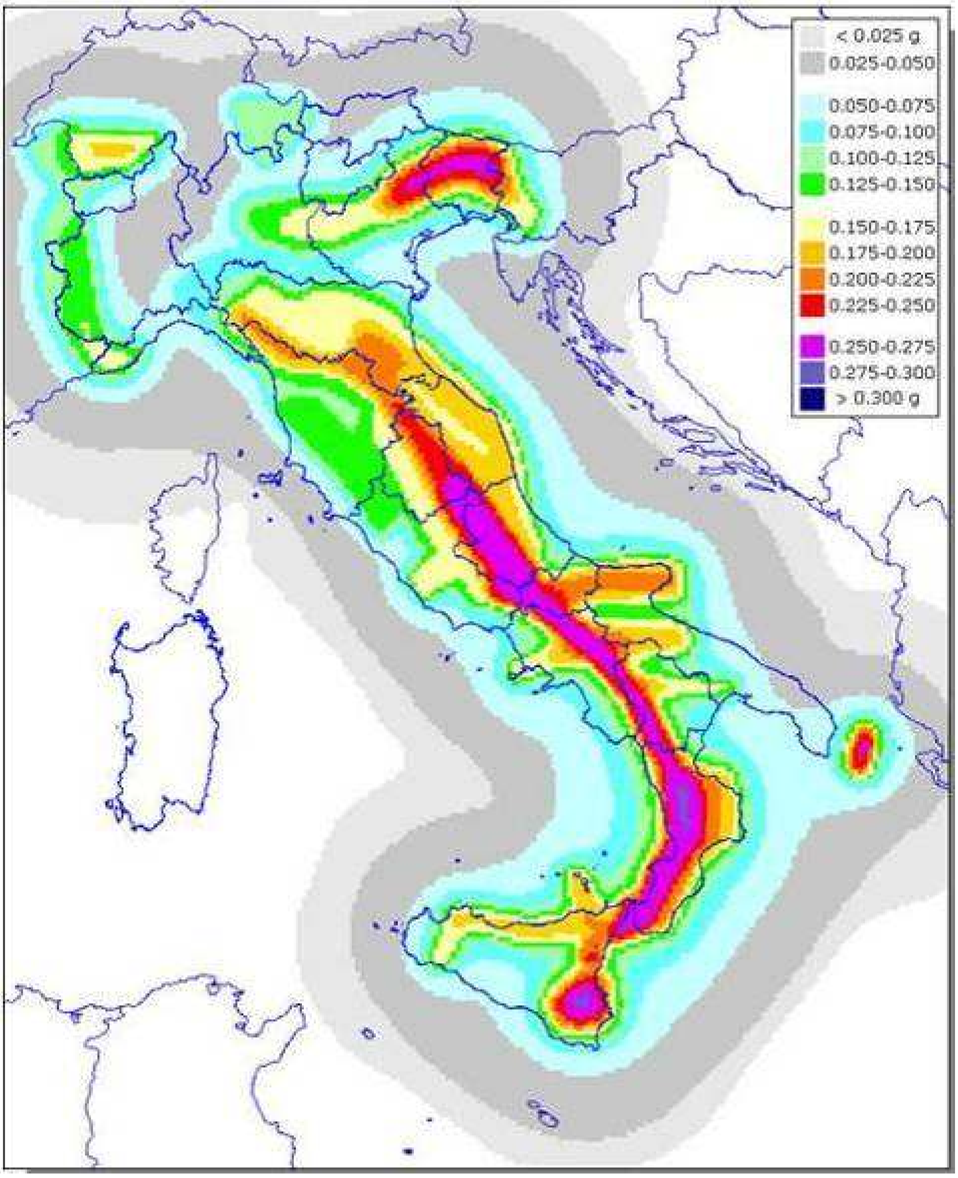


Figure 1.23. Map showing the earthquake hazard in Italy (in zones with the same gravity acceleration force during an earthquake).

1.2.1.1. Recent earthquakes in Italy

1997, September 26, 11:40, M = 6.1, Umbria and Marche (VIII-IX)

An initial earthquake tremor of magnitude 5.5 R. and intensity VIII, hit a vast area of central Italy, localized along the axis of the mountain ridge of the Apennines, between Umbria and Marche (Fig. 1.24). The strongest second tremor at 11:40 am worsened the damage already caused by the previous shake. This was the start of a seismic sequence that continued for several months in Umbria and Marche, with thousands of tremors in a wide area that extended for 50 km north west and south east. A dozen or so of these tremors had a magnitude higher than the damage limit (M≥4.5 R.), causing further serious damage to these regions with their wealth of art and history. Forty-eight municipalities were hit by the quake, including Assisi. Losses or damages to historical-artistic heritage were huge: the top of the bell tower of the cathedral in Foligno, the historical tower in Nocera Umbra, many local museums and historical theatres that abound in these regions. The Franciscan complex in Assissi was the most famous damaged monument, visited every year by millions of tourists from all over the world. The most serious damage was to the upper basilica which lost most of its frescoed ceiling (Fig. 1.25). The earthquake caused 11 victims and 32,000 homeless.

Figure 1.24. The epicenters of recent earthquakes in Italy.

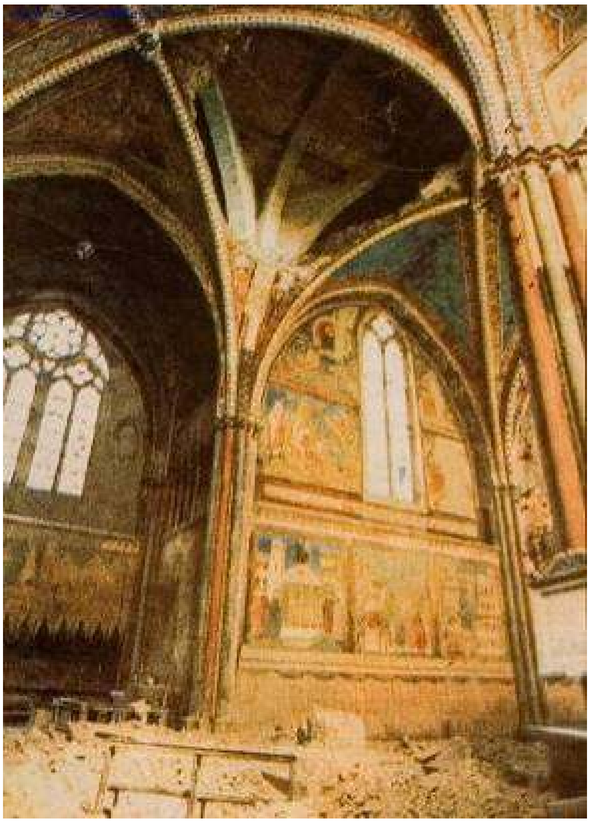


Figure 1.25. Damage cause to the upper basilica of the Franciscan complex in Assissi, due to the Umbria and Marche earthquake in 1997.

2002, October 31, 11:32, M = 5.8, Molise (VII-VIII)

Between the 31st October and 2nd November 2002, Molise and a part of Puglia were struck by various earthquake tremors. The epicentre was in the province of Campobasso (Fig. 1.24). This area had, until that moment, been considered as a low seismic risk zone. The most violent tremor, of magnitude 5.8, was recorded at 11:32, on the 31st October, in the southern part of Molise, north-east of the province of Campobasso. It lasted 60 seconds and was felt quite distinctly through Molise and partially in Puglia and Marche Region, but also in Rome and Naples. The event caused 30 deaths, including 27 children, approximately 100 injured and at least 2,295 people ended up homeless in the most struck area. In San Giuliano di Puglia, the strong shaking caused the collapse of the roof of a building that was housing a nursery, primary and middle schools (Fig. 1.26). 57 children, 8 teachers and 2 caretakers were trapped under the rubble. Of them, 27 children and one teacher lost their lives. Today that school has been rebuilt using innovative technique and, above all, ensuring the building is seismic proof. The new school features so-called seismic insulation, in other words a technique that manages to guarantee almost total protection even in the case of very violent earthquakes. This technique has already been tested in Japan and China during violent earthquakes and the buildings protected with this insulation were hardly damaged at all despite being close to the epicentre.

Figure 1.26. The school in San Giuliano di Puglia that collapsed during the Molise 2002 earthquake, causing the death of 27 pupils and one teacher.

2009, April 9, 3:33, M = 6.2, L'Aquila (IX-X)

The event with a magnitude of 6.3 R. was felt throughout central Italy and partially in the south (Fig. 1.24). This earthquake was preceded by a seismic sequence that started in December 2008, and the main shock of the night of the 9th April was followed by more than 15,000 aftershocks with magnitudes up to 5.6 R.

The effects of the seismic sequence, including 308 casualties and dozens injuries, were particularly dramatic for the city of L'Aquila and nearby towns. The enormous damage to historical buildings was accompanied by more severe damage to modern buildings, which thus revealed a widespread severe shortage in construction techniques and quality of materials used (Fig. 1.27).

L’Aquila and many other small towns are still flooded in rubble, and many residents still live in very difficult conditions, causing their psychological stress.

Figure 1.27. Teams searching for survivors in the ruins of buildings after the L’Aquila 2009 earthquake.

1.2.2. Volcanic risk identification

Many Italian volcanoes have erupted during the past 10,000 years, but are currently in a period of quiescence. Among these are (Fig. 1.28): Colli Albani, Phlegraen Fields, Ischia, Vesuvius, Lipari, Vulcano, Ferdinandea Island and Pantelleria. Not all these volcanoes present the same risk level, both for the hazard of expected phenomena, as well as for the differing extent of population under exposure. Some have secondary volcanic phenomena (ground deformation, fumaroles, etc.), which may well cause situations of risk. Etna and Stromboli volcanoes have erupted over the last few years. These volcanoes frequently erupt and represent a reduced hazard at short term, due to their open conduit activity.

Submarine volcanic activity is concentrated in the Tyrrhenian Sea and in the Canale di Sicilia. Several volcanoes are still active; others represent true and proper submarine mountains.

The highest volcanic risk is concentrated in the Neapolitan area, just because of the huge urbanization of the area. In particular, for the Vesuvian area, according to the volcanic hazard map, three different zone with increasing risk have been defined, of which the red is exposed to the most dangerous volcanic phenomena (such as pyroclastic currents), and at the same time is densely populated, with more than 50,000 inhabitants. To those people, a complete evacuation plan, the Vesuvio Emergency Plan, is provided.

Figure 1.28. The most important volcanoes in Italy.

1.2.2.1. Volcanic activity and hazard estimation of the various active centres

Vesuvio

Type of volcano: stratovolcano
Main type of activity: phreatomagmatic, plinian, effusive
Beginning of eruptive activity : >300.000 years
Last eruption: 1944
State of activity: quiescent
Hazard: high

Vesuvius is a young volcanic cone grown within the caldera of an older edifice, the Mt.Somma. The Great Cone of Vesuvius, that reaches a maximum height of 1,281 m a.s.l., ends with a crater about 500 meters in diameter and about 300 m deep. The Somma-Vesuvius volcanic history is characterized by long periods of rest with obstructed closed conduit, interrupted by violent explosive eruptions of either Plinian or Sub-Plinian type. The eruption ends usually with phreatomagmatic phase originated by explosive interaction of the magma with groundwater. Dangerous lahars, are generated by rain mobilization of loose ashes on the steep slopes of the cone and of the downwind Apenninic relieves. Since the last Sub-Plinian eruption of 1631, Vesuvius entered in such an open-conduit phase that lasted until 1944. Since then the volcano is in a new phase of quiescence. Vesuvius, is perhaps the volcano with the highest risk in the world. In fact over 550,000 people are here exposed to pyroclastic flows and, in case of crisis, should be evacuated before the eruption onset; in addition hundreds of thousands of more people are exposed to severe ash fallout and lahar hazards.

Campi Flegrei

Type of volcano: caldera
Main type of activity: Phreatomagmatic, Plinian, strombolian, fumarolic
Beginning of eruptive activity: >80,000 years
Last eruption: 1538
State of activity: quiescent
Hazard: high

The Campi Flegrei volcanic system was active from more than 80,000 years BP, and is presently characterised by a peculiar landscape including different volcanic landforms, plains, lakes, coastline. The main volcanological feature is represented by a caldera structure formed during the two main events of the Campanian Ignimbrite and Neapolitan Yellow Tuff eruptions, occurred at 40 and 15 ka, respectively. During the last 15 ka within the caldera several volcanic edifices grew and destroyed as results of about 70 eruptions. Volcanism was mainly concentrated in discrete periods which alternates to quiescence periods of variable lengths. After about 3,500 years of rest occurred the last eruption of Monte Nuovo (1538 AD). The caldera was affected by ground deformation phenomena in its central part, during the last 10.5 ka. Recent slow ground movements events, named bradiseism, periodically occurred. Two significant unrest crises (1970-72 and 1982-84), accompanied by hundreds earthquakes and 3.5 m of ground uplift forced people of Pozzuoli to be evacuated. Currently about 300.000 people live in the zone exposed to the highest risk

Ischia is the top of a volcano which rises for more than 1,000 m from the sea bed in the north-western part of the Gulf of Naples. The island covers an area of about 46 km2 and reaches a maximum height of 787 m a.s.l. (Mt. Epomeo). The volcanic rocks found on the island were produced by both effusive and explosive eruptions, which formed lava flows and domes, and widely dispersed pyroclastic deposits. Volcanism at Ischia started more than 150,000 years ago and continued, alternating with long periods of quiescence, until the most recent eruption (1302) which formed the Arso lava flow. Around 55,000 years ago, the violently explosive Mt. Epomeo Green Tuff eruption was responsible for the creation of a caldera in the central part of the island. Recent volcanism has been particularly intense, with over 46 effusive and explosive eruptions concentrated mainly in the last 3,000 years. Since the last eruption, the island's volcanic system has continued to manifest its activity by means of intense seismicity, culminating in the disastrous Casamicciola earthquake of 1883, and through widespread fumarole and hydrothermal activity.

Ischia

Type of volcano: caldera
Main type of activity: sub-plinian, strombolian, effusive, phreatomagmatic, fumarolic
Beginning of eruptive activity: >150.000 years
Last eruption: 1302
State of activity: quiescent
Hazard: low-intermediate

Etna, Europe's largest active volcano, is 3,330 m high at the summit and covers a surface area of about 1,200 km2. Etna is a stratovolcano composed of variable superimposed volcanic edifices; the formation of the main structure began around 100,000 years ago. The rocks of which Etna is composed are mainly lavas, with a lesser quantity of ash and scoria produced by eruptions varying from effusive to highly explosive, some of which, such as the Plinian eruption of 122 BC, have generated calderas. During recent centuries the volcano's activity has been more or less continuous, with frequent low-energy explosive eruptions and effusions of lava issuing from both the summit craters and lateral vents. These eruptions, lasting from several days to several years, have many times damaged urban areas along the volcano slopes with ash and scoria fallout and lava flows. Of particular note is the lateral eruption of 1669, when the city of Catania was partly destroyed by a lava flow.

Etna

Type of volcano: stratovolcano
Main type of activity: effusive, strombolian, fumarolic
Beginning of eruptive activity: 550,000 years
Last eruption: 2011
State of activity: semipersistent
Hazard: low-intermediate

Stromboli, the northernmost island in the Aeolian archipelago, covers an area of circa 12 km2 and reaches a maximum height of 924 m above sea level. It is quite regularly cone-shaped with steeply-sloping sides that rise from a depth of 1500-2000 m below sea level. The active craters, at about 700 m a.s.l., are situated on the upper portion of the Sciara del Fuoco , a collapse structure on the volcano's north-eastern flank.

The outcropping rocks are mainly lavas and pyroclastic deposits less than 100,000 years old. Typical Strombolian activity consists of mild intermittent explosions ejecting scoria 'bombs', lapilli and ash from an open eruption conduit in which magma is present at shallow depth. The explosions last for several seconds and occur repeatedly every 10-20 minutes; they are accompanied by continuous degassing of the magma. This type of activity is periodically interrupted by lava flows down the Sciara and more violent explosions which eject m-sized blocks across several hundred metres from the eruption vent; during the most violent explosions these blocks may travel several kilometres from the crater, sometimes reaching the settlements of Stromboli or Ginostra.

Stromboli

Type of volcano: stratovulcano
Main type of activity: strombolian, effusive, fumarolic
Beginning of eruptive activity: 200.000 years
Last eruption: in course
State of activity: persistent
Hazard: low-intermediate

Vulcano is the most southern island in the Aeolian archipelago; its surface area is about 22 km2 and maximum height 500 m a.s.l. The island's morphology is complex, due the superimposition of variable volcanic structures; it was created by an alternation of constructive phases, associated with effusive or low-energy explosive eruptions, and destructive phases characterized by violent explosive eruptions. The oldest structure (from 120,000 years ago) is a regular stratovolcano and was truncated around 100,000 years ago by a caldera. A second caldera, to the north-west of the oldest structure, is surrounded by a series of lava domes and contains the La Fossa tuff-cone. The most recent feature, formed in the last 2,000 years, is the Vulcanello peninsula at the north-eastern end of the island. The most recent eruption at Volcano took place at La Fossa in 1888-90. At present the island exhibits widespread fumarole activity; the intensification of which, between 1985 and 1994, together with seismic activity and deformation of the La Fossa cone, caused alarm and the fear of a new eruption.

Vulcano

Type of volcano: stratovolcano
Main type of activity: phreatomagmatic, plinian,
effusive, fumarolic
Beginning of eruptive activity : >120.000 years
Last eruption: 1888-90
State of activity: quiescent
Hazard: low-intermediate

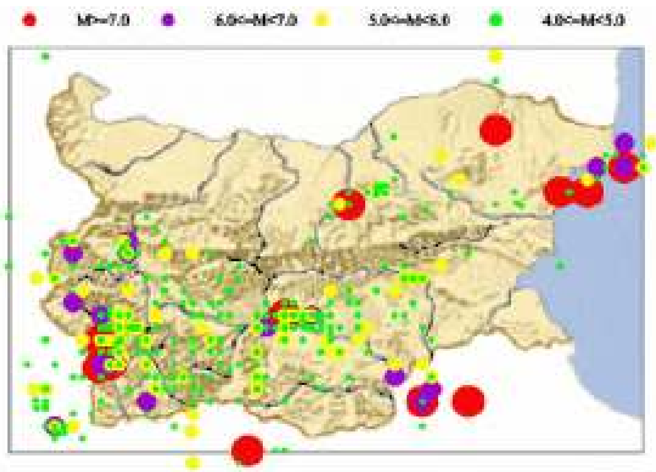
1.3. BULGARIA

The earthquake zone of the Balkans has its own specific. Most of the earthquakes are shallow with earthquake focus of 60km in the earth crust, which intensifies the effects on the surface. When population density is high, and the number of buildings is as well, there is a threat of significant consequences even when the earthquake is relatively weak.

1.3.1. Seismic risk identification

The seismic activity in Bulgaria is high – 97 of 100% of its territory is under earthquake threat.

The map (of the Geophysical Institute of the Bulgarian Academy of Science) shows recent earthquake epicenters, with those of magnitude 7.0 and higher shown with red colour. They have occurred in:



- South-West Bulgaria
- Central South Bulgaria
- Central North Bulgaria
- North-East Bulgaria (in the sea)
- Central North-East Bulgaria (the magnitude is controversial)

1.3.2. Brief historical account of the seismic activity in Bulgaria

The first written accounts of earthquakes in Bulgaria are in the 1 century A.D. According to ancient authors such as Strabon, Pomponii Mela and Plinii, an earthquake has ruptured the plateau of Chirakman and has buried in the Black sea the ancient town of Bizone (near Kavarna).

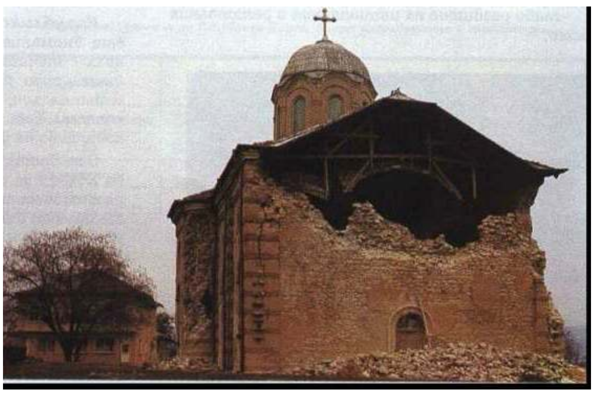
Big earthquakes have occurred in I, IX, XVI, XVII, XVIII and in the beginning of the XX century. The event on 4 April 1818 has to be noted with intensity 8-9 degrees in the Mercalli scale and Magnitude 6.0 degrees in the Richter scale. It happened near Sofia. The hardest documented earthquake in Sofia and its surroundings is the one on 30 September 1858, of magnitude 6.0-6.5 and intensity 9-10 degrees, which destroyed a big part of the city. The number of buildings destroyed and casualties is unknown (there is only partial data).

In the beginning of the XX century, in the area of Bulgaria a number of disastrous earthquakes occurred. Only for the first 3 decades there have been 11 earthquakes with magnitude over 6.

1904 - In the South-West Bulgaria (near v. Kroupnik and v. Kresna) an earthquake occurred with magnitude of 7.8 and epicentre intensity 10-11. This was the worst and most famous earthquake in Bulgaria and one of Europe's strongest shallow earthquakes. It was forerun (25 minutes earlier) by another hard shake-up with magnitude of 7.1-7.3. Heavily damaged were Kroupnik, Brejzane, Simitly, Kresna and many other villages. It was felt on 1 400 000 km^2 of the surface.

1913 - Near the town Gorna Oriahovica an earthquake occurred with magnitude of 7.0 Richter degrees and epicenter intensity 9-10 Mercalli degrees. The villages Gorna Oriahovica (95%), Veliko Tarnovo, Liaskovec and Dolna Oriahovice (up to 80%) were destroyed. Other places were also seriously damaged. The earthquake was felt on 400 000 km^2 of the surface.

1928 - 3 catastrophic earthquakes strike in Marica river's valley, the second one being the hardest – magnitude 7.0 and intensity 9-10. These events caused serious destruction in the towns of Plovdiv, Chirpan and Parvomai. 74 000 buildings were completely demolished, 150 people were killed and there were more than 1000 wounded. As a result, 2 cracks were formed on the surface, each one tens of kilometers long. The territory the earthquakes was felt on was respectively 470 000 km^2, 500 000 km^2 and 195 000 km^2. This marks the beginning of the earthquake insurance in the country.



After this year there have not been any other so catastrophic earthquakes in Bulgaria. The strongest one was the second of the pair of earthquakes in 1986, with magnitudes of 5.3 (February, intensity 7-8) and 5.7 (December, intensity 8), near the town of Strazhica. It was devastating for Strazhica, Asenovo and Markovo (nearly 80% was destroyed). The second earthquake multiplied the effects of the first one and led to serious damages, including in more recent and massive buildings. Partly or fully demolished were 15 000 buildings, casualties 2 people, wounded 60. The earthquake was felt on 180 000 km^2.

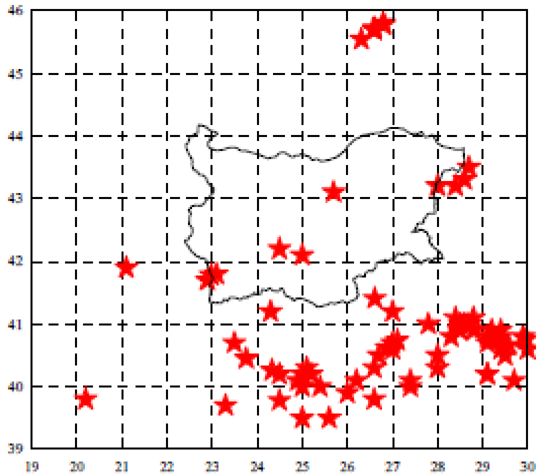


Figure 1.29. Documented earthquakes with magnitude 7.0 and higher

1.3.3. Development of preventive seismology in Bulgaria

The beginning of the Bulgarian seismology is the year of 1892 when Spas Vacov, director of the Central Meteorological Station in Sofia, organized a corresponding web for monitoring and description of the earthquakes in Bulgaria. The first seismograph was installed in Sofia in 1905. During 1970-1980 there were 7 working seismological stations. The modern Bulgarian seismological web, NOTSSI (National Operative Telemetric System for Seismic Information, Fig. 1.30), was launched in action in 1980. In 2005 the web was further modernized and currently it is spread among 14 permanent digital stations, 2 local webs and Center for gathering data and data analyses, located in Sofia. The data are submitted in real time since 1980.

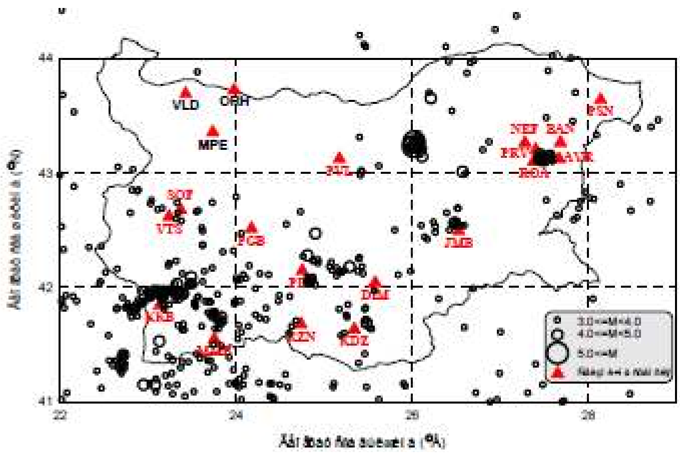


Figure 1.30. The modern Bulgarian seismological web, NOTSSI

1.3.4. Earthquake danger in Bulgaria

According to the Geophysical institute of BAN, as a whole, 98 % of the territory of Bulgaria will be subjected to seismic impact with intensity of 7th and higher degree. 51% will be of 7th degree, 28% of 8th degree, and 19% of 9th degree or higher. 6 340 000 people, which is about 80% of the country's population, live in these areas. The damages in the regions could be partial or full – 26% of the buildings. In areas where the intensity could get 8th or 9th degree on the scale of MSK-64 live around 5 900 000 people, which is 74% of the country's population (Analyses of the seismic risk in: National program for protection from natural disasters (2009-2013), passed by the Government of Bulgaria, 2009, http://www.strategy.bg/StrategicDocuments/View.aspx?lang=bg-BG&Id=550).

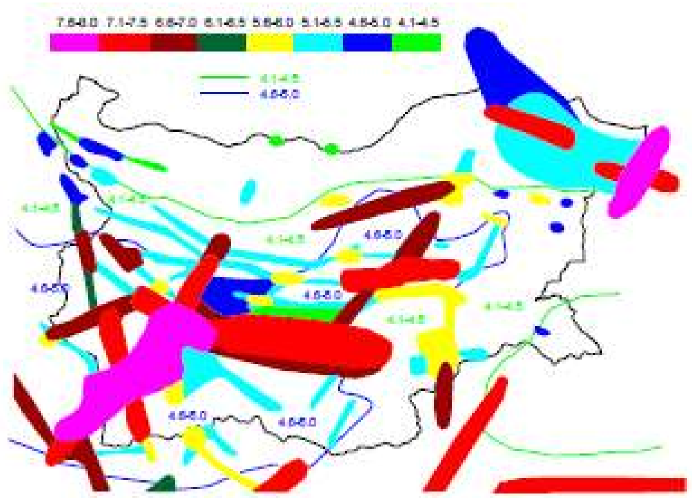


Figure 1.31. Map of possible seismic focus in Bulgaria (PSF)

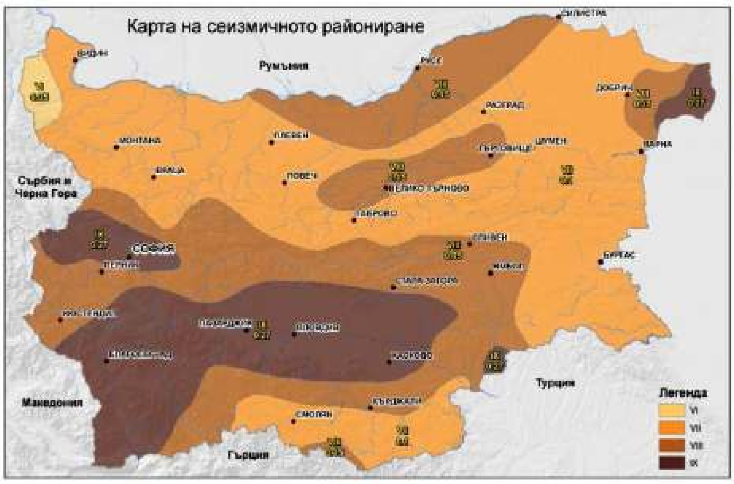


Figure 1.32. Seismic zoning in Bulgaria

Seismological researches prove beyond any doubt the real earthquake treat in Bulgaria. Science gives warning about the danger and evaluates the consequences of it. The earthquakes in the beginning of the 20th century are already forgotten and people live in perception of safety. Experience of past quakes here and around the world shows that regretfully the society takes measures post-factum, after the disaster happens.

Table 1.4. Distribution of area in% of the territory of Bulgaria with different seismic level

Map type	Seismic degree on MSK degree				
	VI	VII	VIII	IX	≥VII
distribution of earthquakes 100	35	65	-	-	65
distribution of earthquakes 1000	2	51	28	19	98
distribution of earthquakes10 000	0	22	44	34	100
Regulations 1961 – 1964	78	17	4	1	22
Regulations - corrected map from 1977	60	34	5	1	40
Maximum observed levels of intensity	36	49	11	4	64

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2. National Policies and Actions

2.1. Competent authorities on earthquake protection in Greece

The competent authorities in Greece on earthquake protection issues are the following:

2.1.1. Earthquake Planning and Protection Organization

The Earthquake Planning and Protection Organization (EPPO) is a Legal Entity of Public Law under the supervision of the Greek Ministry of Infrastructure, Transport and Networks. Since its foundation, in 1983, the EPPO has been contributing substantially towards the formulation of the national earthquake policy and consequently the reduction of seismic risk.

According to its founding law 1349/83, the Organization is directed by the Chairman and the Administration Board, which exercises every administration and management act, as well as by the General Manager, who supervises the three directorates. The Organization's actions are supplemented by Permanent Scientific Committees and Advisory Work Groups staffed by well - known scientists and experts.

The Objectives of the EPPO

The Organization is the competent body to plan and implement effectively the national policy for earthquake protection.

a. Increasing knowledge of seismic risk

It provides valid and timely notification to the State Authorities regarding seismic risk, thus enabling planning and confrontation. For this reason, it supports:

- the development and modernization of the National Network of Seismographs and Accelerographs,
- the production – update of the Greek Seismic Hazard Map and
- the production and publication of the Neotectonic Maps of Greece (scale 1:100000).

b. Improving the seismic capacity of structures

The earthquake resistant construction of buildings and other infrastructure projects is the major factor for the protection of citizens' life and properties in case of an earthquake. In this direction, the EPPO assigns special scientific committees to monitor, adapt and support modern European construction regulations, as well as to process special issues of seismic technology.

c. Planning preparedness measures

The EPPO participates in the planning of State earthquake preparedness measures, in order to ensure prompt mobilization, sufficiency of forces and means, coordination of involved bodies and effectiveness and success of actions taken in case of emergency, due to an earthquake. More specifically, the EPPO:

- participates in the development of a respective Special Plan for the Confrontation of Emergencies due to Earthquakes;
- provides directions to Regional and Local Authorities for the design of Special Plans and Action Plans concerning emergencies due to earthquakes;
- composes and publishes Technical Handbooks in relevant issues;
- informs relevant bodies by constant visits of EPPO delegations.

d. Supporting applied research

The support of applied research in Greece in sectors relevant to seismic design and protection is a major concern of the policy of EPPO that aims at the production of modern knowledge and its exploitation for the reduction of seismic risk. To this direction, the EPPO:

- announces projects or studies in the sectors of seismic technology, seismotectonics and social seismic defence;
- assigns specialized studies or research programs relevant to the confrontation of earthquake consequences in areas of the country that have been affected;
- participates in research programs that are completely or partly funded by the European Union, etc.

e. Public information

The active participation of the public is a prerequisite for the reduction of seismic risk and the minimization of the destructive consequences of earthquakes. For the EPPO, public information is a basic priority. The Organization contributes substantially to the development and the understanding of earthquake consciousness and behaviour of the population. Therefore, the EPPO:

- organizes training seminars for teachers;
- organizes informative speeches for students, business staff, people with special needs, etc.;
- participates in training seminars for volunteers;
- composes and publishes informative material (booklets, posters, books, CD-ROM, website);
- participates in preparedness drills in schools and working places.

f. Confrontation of earthquakes

The scientific personnel of the EPPO (geologists, engineers) contribute to the confrontation of earthquake consequences in areas of the country that have been affected. More specifically, the EPPO:

- is immediately activated and cooperates with other involved parties for the confrontation of emergencies in the area that has been affected;
- publishes and distributes printed material with guidelines for the safety of people that have been affected by an earthquake;
- participates in national delegations for the provision of help abroad.

2.1.2. General Secretariat for Civil Protection

The General Secretariat for Civil Protection (GSCP) was established in 1995 (Law 2344/1995), under the Greek Ministry of Interior, Public Administration and Decentralization. Today it is under the Ministry of Civil Protection.

Since 1995, a series of legislative regulations has shaped the present framework of the GSCP In 2002, the Law 3013/2002 upgraded the role of GSCP, emphasizing the importance of citizen protection and assigning roles to the local authorities. According to this law (article 1), the aim of the Secretariat is being defined as to protect citizens' life, health and property from natural hazards, technological accidents (including biological, chemical and nuclear threats) and other disasters, causing emergency situations during peace period. Based on the above, this aim covers also the protection of the cultural heritage, historical buildings and monuments, the productive resources and the country's infrastructure.

The Secretariat is structured along the pillars of prevention, preparedness, response and recovery of natural and technological disasters. The law defines the authorities and resources at national, regional and local level that are involved in the Civil Protection system and that are called to respond to emergency situations: the fire brigade, the police force, the coast guard, the Emergency Medical Care Service, the armed forces, the EPPO, the competent agencies at the Regional and local level, the Public Power Corporation, the Hellenic Telecommunications Organization, the Water & Sewage Company and the Hellenic Meteorological Services. The law also refers specifically to the involvement of voluntary organizations. Finally, the law stipulates the establishment of a Civil Protection Unit in all the involved Ministries and public corporations.

The Objectives of the GSCP

The main areas of activity of the Secretariat include:

- the coordination and support of the Civil Protection Authorities for all actions and programs on prevention, preparedness, response and recovery,
- the monitoring and control of the Annual National Planning implementation at regional and local level in cooperation with competent authorities,
- the coordination of the distribution of State funds for Civil Protection to the local authorities,
- the preparation of special reports for every major disaster, including revisions and improvement of existing planning proposals,
- operation of the Civil Protection Operation Centre on a 24 hours basis,
- advising the Minister of Interior regarding declaration of a disaster,
- providing information regarding “warning messages” to the Regions, Prefectures on forthcoming events (e.g. weather forecasting and other precursory phenomena related with natural hazards),
- the enhancement of public information and awareness (leaflets, posters, videos, etc, with prevention measures and self protection guidelines),
- the support and promotion of voluntarism,
- cooperation with authorities towards preparing circulars, guidelines, codes and legislation in the field of prevention,
- programming, based on the annual national civil protection planning, of the necessary annual provisions of means and human resources in cooperation with competent authorities,

- preparation and participation in Civil Protection exercises,
- promotion of the country's relations with International Organizations and Civil Protection authorities,
- coordination of the international assistance provided to Greece and assistance provided to other countries,
- elaboration of the available scientific information for the mobilization of resources in case of emergencies and
- support of research and development projects in the field of Civil Protection.

2.2. Civil Protection in Crete

Civil Protection Policy in Crete is implemented through the regional and local authorities, mainly through the Civil Protection departments. These have to maintain and implement the “Xenokratis” National Plan for Civil Protection.

Additionally, many Municipalities (like Heraklion, Rethimno, Chersonissos, Chania) have contacted special seismotectonic studies to analyse the seismic risk and vulnerability of their territories that have resulted in certain Land Use and Planning regulations. In most big cities local volunteer groups and other NGOs are acting to inform public and act in case of emergency.

Many European or National Projects have been also implemented by the Region of Crete under various European and National instruments. Most recently, the Region of Crete implements the European Project “Poseison” that focuses on the tsunamis and the preparedness measures to be taken.

However, no certain action, or policy exists in respect to palliate children’s emotions in case of serious seismic hazard.

2.3. Information – Education: Actions in Greece

In Greece, numerous efforts have been made towards the education of different target groups on seismic protection issues. These target groups are the following: School Community, Public, Officials, Volunteers, People with Disabilities, Tourists.

The relative education procedure includes:

- the implementation of seminars and lectures on earthquake protection for the different target groups,
- the elaboration of specific educational projects and
- the publication of educational material for pupils and teachers.

2.3.1. Educational Projects of EPPO

2.3.1.1. Seismic safety at schools: The educational project "Earthquake protection at schools"

This project, which started right after the 1999 earthquake in Athens, aims to train the Directors of elementary and high schools, as well as of highest education institutes, on earthquake protection. Each educational seminar lasts two days.

EPPO's experts trained 600 Directors of Athens elementary schools during the first phase of the project (2000 – 2001). The project had been funded by the Pedagogical Institute / Ministry of Education.

The EPPO is responsible for the implementation and the funding of the second phase (2002 – today) of this project. Approximately 8000 Directors of elementary and high schools and of highest education institutes from all over the country have been trained till today.

2.3.1.2. Project "Protect Myself and Others"

Since the beginning of 2001, the educational project "Protect Myself and Others" has been in progress and aims to train citizens to develop skills for risk and crisis management and emergency response, as volunteers in a local level. The subjects of this project are earthquakes, fires, sea accidents, protection of sea environment and floods. The duration of the training sessions comes up to 100 hours within 3 months. The EPPO is responsible for the session of the earthquakes, which lasts for 13 hours.

In the frame of this project, during the past 9 years, 6000 volunteers from all over the country have been trained in their region. At the end of the project, the volunteers receive a certificate of attendance.

2.3.1.3. "Seismopolis" Centre

In the frame of the joint research project "Seismopolis" of public, private and academic partners (EPPO was one of them), a versatile and dynamic pilot centre has been developed, in order to inform and educate the public regarding the earthquakes and the earthquake safety, through new tools, such as earthquake simulator and virtual reality systems.

The "Seismopolis" Centre addresses to pupils, teachers, volunteers, etc. It is situated in Athens (2006 – today) and consists of the following departments:

- earthquake simulation area: a shaking room (3m x 6m planar triaxial shaking table) designed as a house kitchen;
- virtual reality area: visitors, wearing stereoscopic glasses and using navigation tools, have the opportunity not only to experience an earthquake but also to virtually travel through a house or an earthquake – stricken city and take action as in a real-life situation;
- information and education area: visitors in different target groups (children 7-12 years old, teenagers 13-18 years old, teachers, public) have the opportunity to learn about earthquake protection with the use of printed or electronic material (3 books, 2 CD-ROMs), to participate in interactive programs-games, to surf the website of Seismopolis (www.seismopolis.org)

2.3.2. Educational Programmes at the Natural History Museum of the University of Crete

The Natural History Museum of the University of Crete, as an educational and research institution, plays an important role in raising earthquake awareness and informing the public on protection measures. For years, the staff of the Museum performs public talks, presentations and other activities to sensitize children and adults on the phenomenon and its consequences.

Within its permanent exhibition, a special hall has been used to offer reliable information on the seismicity of the eastern Mediterranean area and Crete, the earthquake phenomenon and protection measures. Information is combined with real earthquakes that are implemented in a modern and innovative simulator, which is used by more than 25000 visitors per year (Fig. 2.1.).

Figure 2.1. The "Engelados" earthquake table in the exhibition hall for earthquakes at NHMC

2.3.3. Educational Programmes at the Natural History Museum of the Lesvos Petrified Forest

The Natural History Museum of the Lesvos Petrified Forest implements the educational programme for children and teachers "Natural processes on our planet – Let's learn about earthquakes". The aim of the programme is to sensitize, inform and educate students and educators on prevention and preparedness of seismic risk.

The programme is realized by using various educational activities adjusted each time to the age and the level of knowledge of the participants. Several activities have been developed, such as the educational game "The hunt of Enceladus' treasure", "The word-search of Enceladus", "The Interactive Crossword on Enceladus" and relevant card games. Students participating in the training program have the opportunity to observe real-time recording of earthquakes, through the educational seismograph recently installed at the Museum in Sigri. With the use of maps, the students learn the seismic active regions of the country and the effects of earthquakes on the urban environment. Moreover, they learn about the global distribution of earthquakes, the effects of seismic activity, the accompanying destructive effects and the importance of creating the museum's seismological station in Sigri and how this works.

The report accompanying the training program includes the presentation of cartographic material on the seismic hazard in the North Aegean and, in particular, the area of Lesvos island, with the presentation of geological and seismological data, the results of research on the seismicity of the island in relation to data on the urban environment and historic earthquakes recorded in the region.

Finally the participants have the opportunity to experience an earthquake by the use of the museum's earthquake simulator. The function of the simulator in the Museum gives a new opportunity for information and education of visitors, especially the young ones. It has a size of 12 m^2 and is designed as a classroom with desks, bookshelves, a large projection screen etc. The participants have the unique chance of experiencing the movement of the earth through the simulation of an actual earthquake.

2.3.4. Educational Material

In Greece, the educational material on earthquake protection issues has been developed mainly by the EPPO. This material aims to inform and educate different target groups of the population. More specifically, the educational material for students includes brochures, posters, books, CD-ROMs and EPPO's website specific unit under the name: "For kids and adults", for two target groups (7-12 years old and 13-18 years old) (Figs. 2.2, 2.3).

The students have been asked through an evaluation survey to assess the EPPO's website and the leaflets. The results of this study were satisfactory. 60-80% of the students that took part in this evaluation study found the website and the leaflet useful, comprehensible and attractive.

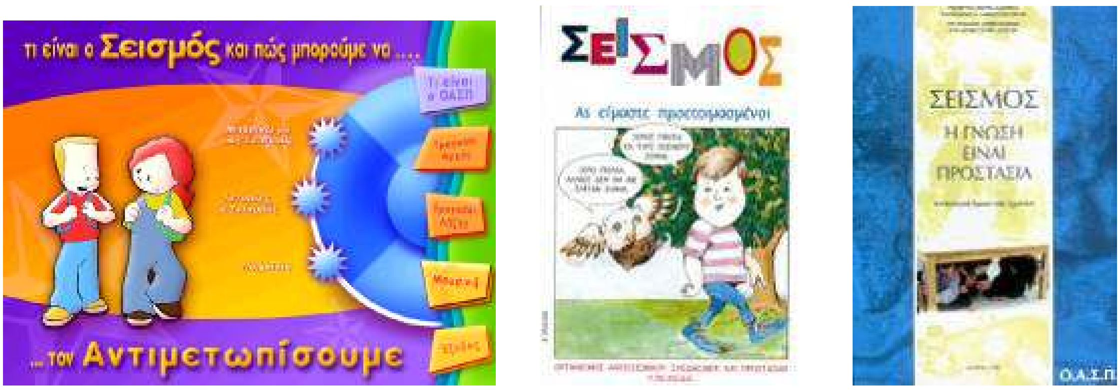


Figure 2.2. Educational material of the EPPO: a. The CD-ROM "What is an earthquake and how can we confront it?"; b. leaflet "Earthquake: Let's be prepared"; c. the book "Earthquake-Knowledge is protection".

Also, the EPPO has developed the useful handbook “Prevention and Mitigation of the Psychosocial Consequences of Earthquakes", which aims to offer a short description of the current knowledge to the essential prevention and confrontation of psychological repercussions of earthquakes (Fig. 2.3a&b).

Figure 2.3. Educational material of the EPPO: a. the interactive website “For kids and adults” (in www.oasp.gr); b. the book “Prevention and Mitigation of the Psychosocial Consequences of Earthquakes"; Educational tools on the page “Unit for Kids” of the website of GSCP: c. Hercules is guiding children to his anthill and teaches them how to avoid damage due to natural hazards (through interactive games on the website of GSCP, www.gscp.gr/ggpp/site/home/ws/units/pedia/pedia.csp)

Some educational activities can also be found on the website of the GSCP, mainly addressed to children (Fig. 2.3c).

The Natural History Museum of the Lesvos Petrified Forest has produced educational material for the participants in the programmes on earthquake preparedness (Fig. 2.4).

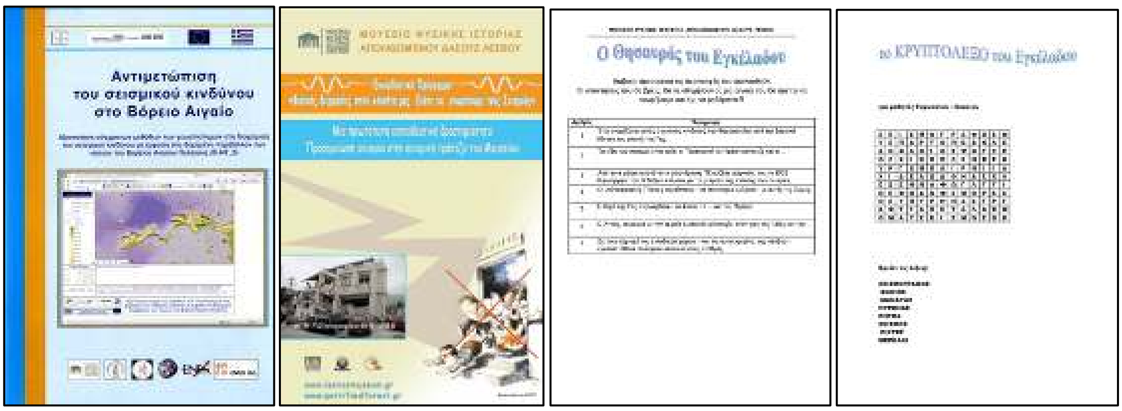


Figure. 2.4. Educational material on earthquakes by the Natural History Museum of the Lesvos Petrified Forest: a. a booklet summarizing the seismic Hazard in the North Aegean and how to prevent it; b. a booklet for the educational programme “Natural processes on our planet – Let’s learn about earthquakes”; c & d. worksheets for the educational programme on earthquakes.

2.4. The Greek Legal Framework for prevention and mitigation of psychosocial impact of disasters

Articles in the Law 3013/2002 (Update of Civil Protection), added during the last decade, concern Prevention and Mitigation of the Psychological Impact of Disaster issues. More specifically, this law designates representatives of social services to the Prefecture Coordinating Body and to the Municipality Coordinating Body to deal with these issues.

Additionally, the Circular 4648/6-7-2009 (Planning and policy actions for protection against earthquake events) mentions that "After an earthquake the National Centre for Social Solidarity may set in motion intervention teams, made up primarily of psychologists and social workers to provide direct counselling and short-term psychological support to individuals, groups and communities".

2.4.1. National Centre for Social Solidarity

The National Centre for Social Solidarity (NCSS) is a State Organization based in Athens under the authority of the Ministry of Health and Social Solidarity (www.ekka.org.gr). It was established with the article 6 of the Law 3106/2003, with the name “National Centre for Emergency Social Aid” and was renamed as NCSS with the article 20 of the Law 3402/2005. The tasks of the NCSS are specified in the Presidential Decree 22/2006. The Centre is administered by a seven member Council, the President works full-time and also acts as the Managing Director (par. 4, art. 6, Law 3106/2003).

The objective of the NCSS is the coordination of the network that provides social support services, care and solidarity to individuals, families, groups and populations experiencing crisis situations or in need of emergency social aid (par. 2, art. 6, Law 3106/2003). In particular, NCSS provides the following:

- counselling, as well as information, regarding welfare issues at a personal, group and community level,
- emergency and short-term psychological support to individuals, families and groups experiencing crisis situations,
- emergency intervention “on the spot” in situations of crisis due to social problems or physical phenomena and mass disasters for the provision of psychological and social support,
- guarded temporary hospitality and care at Shelters for emergency social care to individuals being in need of emergency social aid, are vulnerable and are in great danger of being harmed,
- connection and mediation to facilitate access to social welfare and solidarity services for individuals and groups being in need of emergency social aid
- coordination and implementation of social solidarity and volunteer programmes to treat the social needs for emergency situations and to prevent social hazards and the procedures of social exclusion.

The NCSS Units Network of services mainly addresses and aims at the following individuals and groups:

- citizens in need of information on social welfare issues as well as connection with the NCSS Network of Services,
- children and adolescents that are abused, neglected or abandoned,
- minors who have disappeared or abandoned their home,
- minors and women victims of domestic violence,
- minors and women victims of trafficking with the purpose of sexual or/and financial exploitation and victims of illegal acts,
- handicapped individuals in need of emergency social aid and in great danger of being harmed,
- elderly in need of emergency social aid, in great danger of being harmed and unable to protect themselves,
- adults and families in a crisis situation and in danger of being harmed that need emergency psychological and social support and
- victims of emergency situations, natural phenomena and mass disasters.

The Crisis Management Service intervenes in cases of natural disasters and accidents involving a great number of victims, in order to provide social as well as psychological support to injured individuals or the victims' relatives. It is staffed with specialized personnel and owns a mobile unit, which acts as an administrative operational centre.

The above teams are ready for immediate treatment of the psychosocial needs of affected population. Installed directly on the affected area, they take the following actions:

- identification of the problems,
- assessment of the needs,
- mobilization of local organizations - associations, social services etc,
- provision of psychosocial support to victims and their families for as long as needed and
- participation in multidisciplinary teams and management committees.

The onsite intervention is further complemented and supported by the wider network intervention and the Telephone Line for Emergency Social Aid.

2.5. Italian Best practice analysis: experiences on awareness procedures and approaches for children

Programmes for seismic safety in schools should recognise the safety of kids as a basic human right. Earthquakes can be scary for people of any age, but especially for children. For children, the things they do not understand can be the scariest and can make them anxious. On the other hand, kids can find the topic of earthquakes fascinating. But their fascination may contain an element of fear. That fear can be reduced by reminding them that they can learn how to take care of themselves if an earthquake happens.

Of course, nothing can be done to prevent earthquakes, but children can be prepared to cope with them. The most important way to keep the kids safe during an earthquake is to teach them about earthquakes, prepare them and let them know that fear is a normal reaction to any danger.

It’s important to collect good practices in this field, trying to put in evidence the elements that can be easily transferred and enforced. In Italy, there are several educative programs about how to behave in case of an earthquake. Some of them are ministerial and institutional projects, other are experimental ones.

In any case, putting information into action can be difficult. To help kids or adolescents understand how to keep safe, lots of the Italian projects about earthquakes are interactive, highly engaging and adaptive and also easy to follow and implement in the classroom to ensure that students can apply the knowledge they've gained. The programmes “put the power in kids’ hands” by helping them learn about natural phenomena like earthquakes, by easing their fears through understanding and at the same time by creating an interest in their world.

Some of the Italian recent projects are analyzed below, in order to give a general overview of some good practices.

2.5.1. EDURISK

Financed by the Civil Protection Department and the National Institute of Geophysics and Volcanology, EDURISK Project (EDUcational itineraries for RISK reduction), with the innovative multi hazard and multidisciplinary approach, has focused on three very important and related issues: Knowledge, Consciousness and Preparedness (Table 2.1).

The Project started with a training course for teachers focused on: seismicity (general and local), seismic hazard, seismic risk, volcanoes, volcanic hazard and risk, volcanoes as a resource, behaviours and psychological implications. Afterwards, with the aid of educational laboratories and suggested activities, each class develops new activities and original material. From 2003 up to 2010, EDURISK has involved more than 43,000 students from all over Italy (Fig. 2.5).

In order to enable experiences sharing among teachers and students and also to provide for downloading all the educational material produced by the EDURISK researchers and translated in the main European languages, the website www.edurisk.it has been developed (Fig. 2.6a).

Within EDURISK, the travelling exhibition/laboratory “All Fall down” has been also set up (Fig. 2.6b&c). It is an earth dynamic and earthquake knowledge itinerary, but it is also a discovery itinerary, that helps users to find meaning and improve correct attitudes in respect with seismic hazard, through a strongly interactive approach.

Furthermore, EDURISK has recently published a product: a few months after the earthquake occurred in central Italy on April 2009, that hit the city of L'Aquila, some 12-year-old pupils, seismologists, film makers and volunteers have made the Docu-Film "Non Chiamarmi Terremoto" (Don't call me earthquake). It tells, with a vivid and touching manner, the emotional impact of the earthquake on boys and girls, their fear and anxiety.

Table 2.1. The three interconnected aspects of the EDURISK Project.

KNOWLEDGE	CONSCIOUSNESS	PREPAREDNESS
Scientific informations	Behaviours and human values	Competences and capabilities
history, geology, physics, engineering, observations	beliefs, fears, anxiety, confidence	seismic vuln. reduction techniques, emergency plans, civil protection

Year	Region	Teachers	Classes	Students
2003-04	3	185	121	2.367
2004-05	3	116	136	2.122
2005-06	3	129	156	2.887
2006-07	9	516	575	11.044
2007-08	11	452	420	8.050
2008-09	12	637	550	11.032
TOTALE	12	2.035	1.958	37.502
2009-10	Abruzzo	568	470	6.657

Figure 2.5. The areas and total numbers of participants in the EDURISK Project.

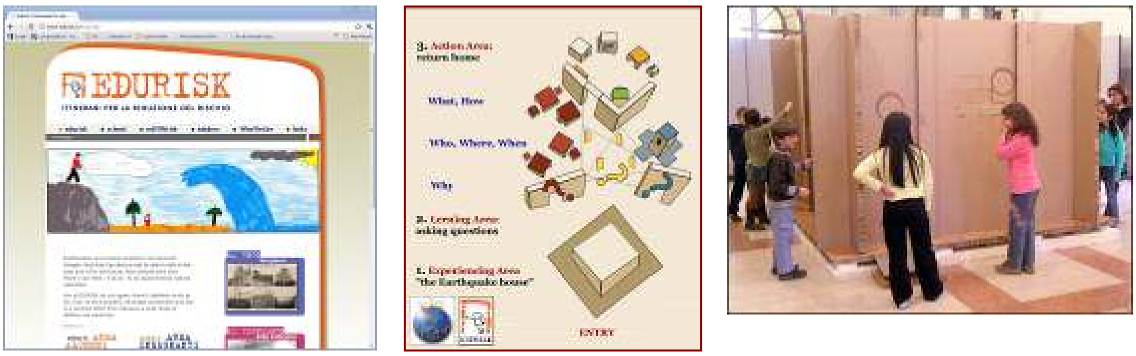


Figure 2.6. Tools developed through the EDURISK Project: a. the website www.edurisk.it; b. a map showing the main halls of the travelling exhibition/laboratory "All Fall down"; c. children visiting the exhibition.

2.5.2. Initiative promoted by the National Civil Protection Department

2.5.2.1. “Protezione civile in famiglia”, Vademecum (Civil Protection for families)

“Civil Protection for families" is a publication which describes, with a few simple concepts, all risks linked to the Italian national territory and shows correct criteria, methods and actions to take in case of small and great emergencies (Fig. 2.7).

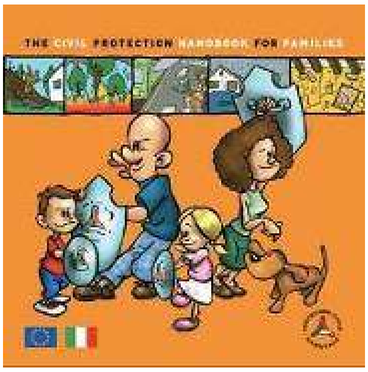


Figure 2.7. The publication “Civil Protection for families"

2.5.2.2. “Terremoti d’Italia” (Earthquakes of Italy) Traveling Exhibition (in collaboration with the INGV and Some Universities)

Starting from September 2007, the anniversaries of some significant events that modified the structure of the national territory have occurred, the Department of Civil Protection with the Ministry of Cultural Heritage and Activities, promoted the traveling exhibition “Terremoti d’Italia” (Earthquakes of Italy), aiming at awaking the public opinion and the school audience, in particular, on the problems connected to seismic risk that dramatically affects a significant portion of Italy (Fig. 2.8).

The traveling exhibition moves through the territories damaged by some of the most relevant events in the last century of the Italian history. Documents, images, scientific instruments, technical anti-seismic devices coming from record offices, libraries, public and private agencies all over Italy are shown in the exhibition. Special attention is paid to the learning activities for pupils, which are organized in a dedicated didactic laboratory.

Figure 2.8. A poster advertising the traveling exhibition “Terremoti d’Italia” (Earthquakes of Italy)

2.5.2.3. “Impararesicuri” – National School Safety Day (since 2007)

Safe learning is a National campaign of information and awareness about school safety in respect with seismic hazard. Its objectives are to contribute to Italian schools buildings safety to work for the entrenched culture of safety and to create stable links between schools and territory for the joint management of risks related to the specific territory (Fig. 2.9).

Figure 2.9. The logo of the "Imparareasicuri" - National School Safety Day

2.5.2.4. Exercises on seismic and volcanic risk

Education and Outreach activities and training courses are organized in occasion of National or local exercises, in order to inform people on the scientific bases of the Vesuvio Emergency Plan, involving teachers, public administrators, Civil Protection volunteers and citizens. In particular, three exercises have been set up in relation to the Vesuvio Emergency plan, testing also the population evacuation procedures (Fig. 2.10).

Figure 2.10. Reports on the exercises of the Vesuvio Emergency plan, organised in the years 1999, 2000 and 2001.

2.5.2.5. Project "A scuola di terremoti" - "At school of earthquakes"

The project, organized by Umbria Region – Civil Protection Department and the Seismic Observatory "A. Bina", aimed to make children aware of the seismic risk and to disseminate prevention activities for children. The related activities were:

- Earthquake school lessons by volunteers and civil protection operators,
- Drill with the children and
- Didactic materials (Fig. 2.11a).

More than 6,000 children were involved in the project in about ten years of work (Fig. 2.11b). A DVD was disseminated in all the Umbrian schools, the book and e-book “At school of earthquakes” was disseminated in all the Italian schools and there was further diffusion through the project “Civilino and the earthquake” (see below) (to know more go to http://www.protezionecivile.regione.umbria.it)

Figure 2.11. a. Educational material created in the frames of the project “A scuola di terremoti”; b. children participating in the project.

2.5.2.6. Project “Civilino e il Terremoto” - “Civilino and the earthquake”

It was realized by the Civil Protection Department of the Umbria Region and the Pixel Cartoon production. It’s a 13 minutes cartoon short-film to teach children how to behave on the occasion of an earthquake. It’s realized in 3D animation. The website address is www.civilino.it.

Civilino is the mascotte of the Civil Protection of the Umbria Region (Fig. 2.12) and, together with Marco, shows the procedure to avoid risks in many dangerous situations during and after an earthquake. It is a useful and funny tool to teach children how to cope an earthquake with less fear and more responsibility. It was awarded as Disaster Manager of the year 2010. It is possible to freely watch it on the site www.youtube.com/watch?v=f_TuvDSz9yk.

Figure 2.12. Civilino, the mascotte of the Civil Protection in the Umbria Region (www.civilino.it).

2.5.2.7. Decalogue with rules to protect children from the earthquakes traumatic disorders

This project was realized by the NGO Save the Children - Italy. Its aims were the dissemination of a set of rules in order to support and help children to cope with earthquake post-traumatic disorders. The guide consists of information reviewing the psychological responses to trauma, intervention options and handouts for parents and others who deal with children.

The main rules of the Decalogue are the following:

1. Prevent children from watching TV after the seismic event
2. Listen to them
3. Give them support and brighten them
4. Accept the help of the experts
5. Pay a lot of attention to the children's behaviours
6. Devote time and attention
7. Teach them how to face the difficult situation
8. Make them aware that they have learnt something more
9. Help the children to go back to their everyday activities
10. Encourage the children to give help to others

Wide dissemination of the Decalogue in Italy and all over the world, through the NGO Save the Children - International, followed the completion of the project (if you want to know more about the project, visit the website http://www.savethechildren.it/IT/Tool/Press/Single?id_press=326).

2.5.2.8. Project "Safe school"

This project was realized by the Ministries of Home Affairs, Education, Environment, the National Department of Civil Protection, the Italian Red Cross, the National Department of the Fire Brigades, Siemens, Telecom, ANCI - Italian municipalities and Volunteer Organizations. Its aim was to add the “Civil Protection” curriculum in the didactic programmes of the primary and secondary schools. All the Italian country and municipalities were involved in this project.

An integrated method was implemented, in order to:

- give children information about how to behave in case of seismic hazard and
- give pupils some values based on solidarity, cooperation and self control.

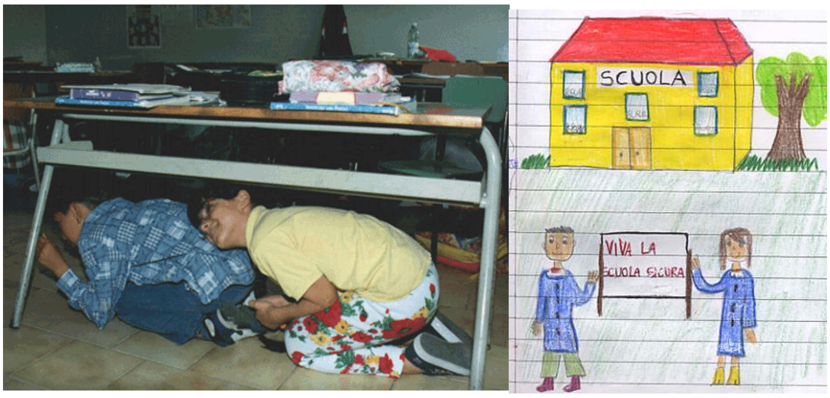


Figure 2.13. a. Children participating in an earthquake simulation exercise; b. drawing made by a pupil that participated in the project “Safe school”.

The project contained:

- a didactic path for teachers,
- study visit to local organizations operating in the civil protection,
- simulation (Fig. 2.13a),
- evacuation drill from the school buildings,
- definition of an evacuation plan of all the Italian schools involved in the project and
- teaching material for children (Fig. 2.13b).

The project started in 1992 and it is still ongoing. More than 1 million pupils have been involved in it till now (to know more about this project, go to the site www.vvfpn.it/scuolasicura.htm).

2.5.2.9. Project “Nido Sicuro” - Safe Day-care Centres

The project was realized by the Città di Castello Municipality, the Civil Protection Department of Città di Castello and the Fire Brigades of Città di Castello and focused on children from 0 to 3 years old. It aimed to the dissemination of the prevention culture also in a very delicate educational environment, to the definition of a training path for parents and children educators, to the realization of emergency plans in the day-care centres of Città di Castello and to the implementation of evacuation exercises for children and educators with the support of operators (Fig. 2.14).

The project was followed by the elaboration of its guidelines and the methodologies applied to other daycare centres in Italy, aiming to the diffusion of the experience. An informative flyer was also created for a further diffusion of the evacuation exercises (to know more on the project, visit www.cdcnet.net).

Figure 2.14. Children of a day-care participating in the project “Nido Sicuro”.

2.6. National policy in Bulgaria

2.6.1. Policies in relation to earthquake education

Before starting the analyses of specific activities/products, we have to turn our attention to the normative base giving the parameters of the earthquake related education. First off, we have to point out that it is part of the whole natural disasters protection problem.

There are two main documents here. The first one is The Law for disasters protection (passed in 2006; last change in State gazette, issue №39, May 2011, http://lex.bg/laws/ldoc/2135540282). Article 16 of the law says:

“Training for protection during disasters and giving first aid is being carried out in the national education system and in the higher education schools.

(2) Basic knowledge of the risks of disasters and ways to behave and act are being taught during primary school, and during secondary school and higher education – knowledge of protection relative to the profile and the specialty of the education

(3) (...) The Secretary of Education, Youth and Culture after coordination with the Secretary of Internal affairs has implemented programs for training, educational materials and manuals for kindergartens and schools and plans for training and preparation for disasters of the leading personnel and the teachers in the system of national education.

The second document is The National Program for disaster protection (2009-2013, data from the Geophysical institute of BAN), where in section IV.3. the accents related to “Disaster protection education in the national education system” are described. We will mark a few important moments:

- The education will be carried out in a few forms: class system (in a special weekly period dedicated to the class), after class and extracurricular
- The education model has to be based on modern methods using interactive forms, methods and means.

- Insuring and expending the possibilities for education of people with disabilities and chronic diseases.

2.6.1.1. Education in kindergartens

The disaster protection training is carried out (according to a normative document issued by the Ministry of Education, Youth and Culture in 2004, http://www.kadedaucha.com/?id=1316&aid=994) in the 3rd and the preparatory group. Annex 2 to this document is Program for preparation for action during disasters, accidents, emergencies and fires for children under school age from national, regional, private and foreign kindergartens. Here the earthquake related subject is formed as “Earthquake – behavioral rules” (III Group). However, it is not a separate subject, but rather a part of another subject –“Familiarizing with the work of specialists protecting people from natural disasters”. It is all repeated in the preparatory group, the subject being “Expanding children’s perception of the work of specialists protecting people from natural disasters. Earthquake – behavioral rules”.

2.6.1.2. Education in primary, middle school and high school

Guidelines for training for disasters, accidents, emergencies and fires and applying first aid (2002), approved by Ministry of Education and Science and applied 2002/2003 academic year.

The guideline contains an organizational part, when basic conditions for the training’s conducting, the deadlines and the responsibilities and cooperation between the responsible institutions and the officials are being settled. The creation of School committee for action during disasters, accidents and catastrophes is being enacted ad the school principal, being the committee chairman, is entrusted with the organization of the training process.

Training schedule

The guideline also puts forward “Training schedule”, prepared with and coordinated with National agency “Civil defense”, National service “Fire and accidents safety” (Ministry of internal affairs) and the Bulgarian Red Cross. The training schedule contains explanatory notes, distribution of the training material (prepared in a table mode for classes and subjects), as well as description of the activities in any subjects for any of the classes.

The subjects are worked out for 5 academic hours yearly and have to be conducted by the head teaches of the class in the in a special weekly period dedicated to the class – for students of I to IX class including. For students of X to XII class the activities are also again planned for 5 hours yearly, but will be done in one day – during the conduct of 2 school lessons planned in the program (in the days stipulated as a cushion of school) when the school plans for actions during disasters, accidents, emergencies and fires will be studied and practically mastered.

The earthquake related subject is part of the Training program initially (in II, III and IV grade) and in middle school (in VI grade). As to the problems with children’s emotions we could point out the Psychological help included in all 3 steps of the (initially – in I,II and III grade; middle school – VI; high school – in VIII, IX and X grade).

National educational requirements for educational contents

In the educational system under Regulation № 2/2000 for the educational contents the former have been approved (on the basis of this National educational requirements for educational contents the school programs for the different subjects are being prepared). National educational requirements for educational contents for civil education regulations related to the purposes for disaster protection training can be found only in the initial stage:

National educational requirements for educational contents for civil education (initial stage – I-IV grade)	
Main body of the educational content:	**Standards:**
V. Life protection and reaction in critical situations	1. Knows the rules of road safety and keeps them 2. Knows what to do and who to ask in life-threatening situations (disasters, fires, incidents) 3. Builds up elementary skills to deal in critical situations and conflicts.

2.6.1.3. SWOT Analysis – normative base

SWOT Analysis	
Strong sides	**Weak sides**
Availability of normative base (mostly School timetable) related to the training for protection during disasters	The school timetable differs significantly from the accepted by MOMH format for a school timetable for a certain subject – it lacks basic elements, concrete parameters of the learning process and it is not correlative to the system of established national educational requirements and standards for a learning content.
Stipulated education for children from kindergartens, as well as for students in primary and secondary	The time earmarked for teaching is absolutely insufficient.
Talking about subjects related to earthquakes and dealing with children's emotions on the level of School timetable.	The ill-founded distribution of these subjects to the corresponding steps of education/grades. Problems and vagueness in content plan. The subjects in not taught as separate in kindergartens.
	The training is done by the head teachers, who do not have special experience in this area.

2.6.2. Market research-Educational Products in Bulgaria

In Bulgaria, there are only a few educational products within the framework of earthquake and volcanic risk knowledge and protection. These are the result of previous projects and their dissemination is free (with the exception of the book "Psychological Assistance and Support for Children and Adolescents in Situations of Natural Disasters – a Guide for Teachers, Parents and Relative Specialists" by Yordanka Eneva, which however has long gone out of circulation). The national market survey conducted clearly indicated a lack of expert educational products on this topic for children and for teachers and parents as well. The general literature on the topic that can be used for the project purposes includes the following titles, which are still available on the domestic book market, but in severely limited quantity.

Заглавие (Title): **Страховитото в географията: Унищожителни земетресения (The formidable side of Geography: Devastating Earthquakes)**, *автор:* Анита Ганери, *издателство:* Егмонт България, *година на издаване:* 2007, *цена:* 2,99 лв;

Заглавие (Title): **Страховитото в географията: Врящите вулкани (The formidable side of Geography: The seething Volcanoes)**, *автор:* Анита Ганери, *издателство:* Егмонт България, *година на издаване:* 2007, *цена:* 2,99 лв;

Заглавие (Title): **Земетресенията - опасност и противодействие (Earthquakes: Danger and Counteraction)**, *автор:* Людмил Христосков; Димчо Солаков , *издателство:* Академично издателство "Проф. Марин Дринов", *година на издаване:* 2009, *цена:* 5 лв;

Заглавие (Title): **Разрушителните исторически земетресения в София (Significant destructive earthquakes in Sofia)**, *автор:* Стоян Авдев, *издателство:* Бесике, *година на издаване:* 2007, *цена:* 8 лв;

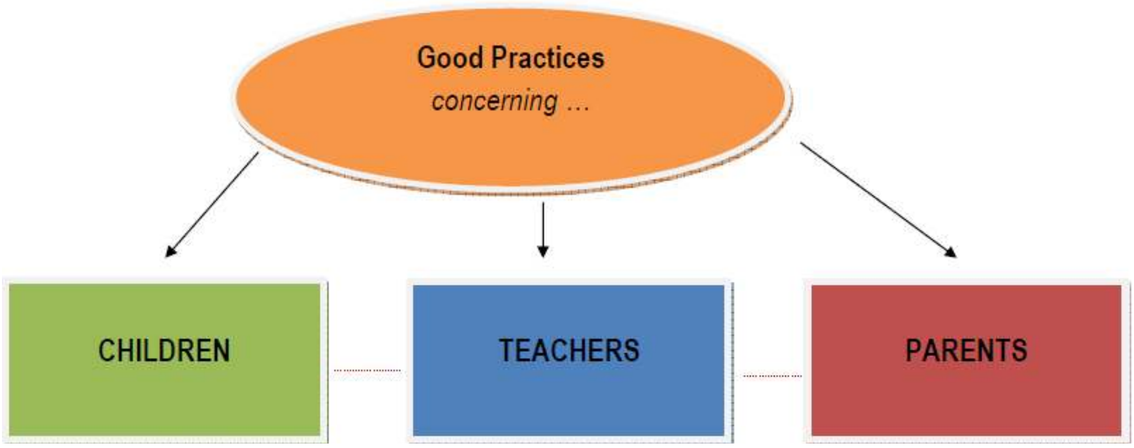
Заглавие (Title): **Вулкани/Top Resders. Земята - Ниво 4 (Volcanoes/Top Readers. Earth-Level 4)**, *автор:* колектив, *издателство:* АлексКидс, *година на издаване:* 2010, *цена:* 4,99 лв;

Заглавие (Title): **Вулканите** (енциклопедия) (**Volcanoes (encyclopedia)**), *автор:* колектив, *издателство:* Фют, *година на издаване:* 2004, *цена:* 14,90 лв;

Заглавие (Title): **Искам всичко да знам: Вулканите (Know-it-all: Volcanoes)**, *автор:* Саймън Адамс, *издателство:* Прес, *година на издаване:* 2004, *цена:* 5 лв.

2.6.3. Selected Good Practices in Bulgaria

Keeping in mind the project's aims, the presentation of the good practices related to increasing information flaw about earthquakes and dealing with children's emotions caused by such disasters will be structured as 3 main groups:



Of course, it is about selected good practices (consequently for selected bad practices as well) whose purpose is not thoroughness, but marking of the main guidelines of development. It is possible a good practice to refer to more than one group (then it will be counted to its main target group); such links between the 3 groups are very important, as they show the inclusion of the main actors in the educational process and are usually a guarantee for the quality of the product/the activity.

2.6.3.1. Good Practices Concerning Children

The good practices related to children could be divided in two main types: contests and competitions, as well as educative materials and resources. The children could be divided into age limit groups (as we will see, there is a good practice with kindergarten children too). Provided that children in disadvantaged situation are one of the main target groups of the project, the good practices related to them will be presented in a separate rubric. Same goes to practices in relation to coping with children emotions.

a. National drawing competition for children: "Mission: Rescuer”

Mission rescuer is a continuation of the competition for children’s painting “I saw the trouble with my eyes…”, first held in 2002 by initiative of National agency “Civil defense”. From then till 2009 is lead by the Ministry of Emergency Situations. After the closing of the ministry the competition is taken up by the “Fire Safety and Rescue" Directorate General (Ministry of Interior). The competition is held with the partnership of The Ministry of Education, Youth and Culture and National Palace of Children.

Thematically the competition covers what is taught at schools about actions during disasters and emergencies, giving first aid, helping yourself and others, taught at classes during High school. In addition to assessing children’s knowledge – what they visualize when they hear the word disaster, it also showed their artistic skills.

In the competition participate children from the entire country from age 6 to 18, separated into 3 groups by age:

• I group – from 6 to 9 years old;
• II group – from 10 to 14 years old;
• III group – from 15 to 18 years old;

and in 3 categories:

• pupils from specialized classes and art schools;
• pupils with specialized educational needs and homes for children deprived of parental care;
• pupils from all schools in the educational system, not fitting in the first 2.

The competition is held in 3 phases:

• municipal competition;
• regional competition;
• national competition.

In their essence the kids’ paintings express the preparation and the adequate response to emergencies and show the image of the rescuers that fight disasters, help victims and save human life every day. Of course, there are all sorts of prices for the winners. And from 2007 they win a 4-day work shop at the National School of Fine Arts “Iliq Petrov” as well, which gives them an opportunity to study in specialized workshops on painting, sculpture and graphics.

To promote the competition are undertaken a series of actions – printing of posters and albums with pictures, conducting an official ceremony for the winners at certain public places (National theater “Ivan Vazov”, National gallery of art, Sofia university and etc.), involvement of multiple partners and sponsors, conducting international edition of the competition in 2008 under the auspices of the European and Mediterranean Major Hazards Agreement (EUR-OPA) at the Council of Europe (received are over 1400 paintings from Russia, Turkey, Hungary, Croatia, Slovenia and Indonesia).

For the increased popularity of the contest talks the increase of participants:

• 2006 – 325 paintings;
• 2007 – 419 paintings;
• 2008 – 426 paintings.

The goal of the competition is not only about demonstrating knowledge on the subject, but also about helping to form in the children’s mind a positive image of the rescuer and volunteer, and to raise a desire in them to become rescuers and volunteers one day.

b. Student Competition “Protection in Case of Disasters and Accidents”

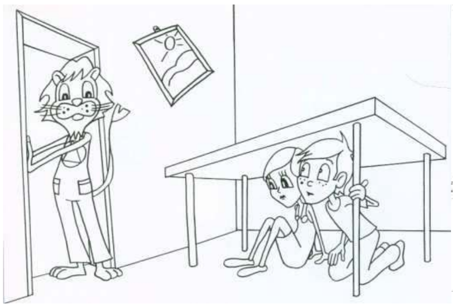
The competition is focused on safety in emergency situations and its basic goal is to check the level of the knowledge, skills and habits, gained in the basic training course, as well as to motivate the participants for further preparation for acting in case of emergency situations. The competition is held every year and ran in several rounds – at a municipal, regional and national level. 28 teams with 4 team-members participate in every round, which has a theoretical and a practical section. The theoretical section consists of a test to assess students’ knowledge about correct reactions in emergency situations. During the practical part students show their skills in acting in case of an earthquake and also in case of chemical and radiation accidents.

The competition is held since 1998, and the organizers are the same as mentioned above.

c. Educational materials and resources

• Children’s Coloring Book “Disasters – important rules for little children”

A painting book, developed in 2007 by the National Training Center (part of the Ministry of Emergency Situations) is designed for the smallest – kids from kinder garden (can also be used with younger pupils). This is the first helping tool in this area, designed for the smallest. With it children learn the basic rules for reaction in case of different types of disasters in simple way. The book is published in circulation 20 000 numbers (followed by an additional because of the huge interest) and is distributed for free in kinder gardens across the whole country.



• **Training set of boards and cards**

The same year, again the National Training Center, and again for the smallest is developed a set of boards and cards about 5 types of disasters, and there are included 4 situations to each of the cards that represent illustrated basic rules for reaction in case of different types of disasters and the set of boards represents the algorithm for actions in case of different disasters.

• **Practical classes and open lessons**

Regularly the National Training Center was leading practical classes and open lessons in the kindergartens where the children showed their knowledge and skills for reaction in case of emergency situations.

• **Open door day in the Ministry of Emergency Situations**

Experts and rescuers are showing the necessary equipment in case of emergency situations.

• Kids site of the Ministry of Emergency Situations

The site (www.zadeca.mes.bg) starts in the middle of 2008 and was designed for children from 5 to 14 years, and the individual columns were consistent with the age of the audience. The idea was the site to develop in 2 directions- first, as a tool for edutainment (envisaged is the development of various educational logic and situational games), and the second – materials, that can be used in the educational process at school. The idea was this difficult subject to be showed to a children’s audience in a more interesting, attractive and assessable way.

The past sense of the paragraph above, unfortunately, is dictated by the fact that, with the closure of the Ministry, the site ceased to exist as well. A fate that, as we will see, comes upon most good practices.

d. Good practices related to disadvantaged children

The first and only step in this direction is realized again by the National Training Center (part of the Ministry of Emergency Situations) in 2008 - Information Campaign for disaster protection training of people with disabilities and/or chronic diseases. As a part of the campaign called "CLOSE TO YOU", are realized actions aimed at kids in disadvantage:

• Printed brochures with the most important rules for defense against common disasters in our country - in Braille and in audio format as “talking brochures”, as well as recordings of noises accompanying disasters;

• 4 video clips (aired on BNT), one of which is devoted to the theme earthquake and shows the undertaking of adequate defensive actions done by children with cerebral paralysis, without vision, with damaged hearing and asthmatic, assisted by their friends;

• Specialized section on Internet – the Ministry of Emergency Situations site (no longer active – the reasons for which were mentioned above).

e. Good practices related to coping children emotions

Unfortunately, there are not enough sufficiently qualified experts in this domain and most of all there is lack a coordination unit. As only positive step in this direction can be given the book “Psychological help and support for children and youths in a disaster” (Guide book for parents, teachers and specialists) written by Iordanka Eneva, published in 2006 and has a content of theoretical and practical guidance. Unfortunately, the book has long been exhausted on the market, and from talks with teachers we know the book is not available at schools' libraries either.

2.6.3.2. Good Practices Concerning Teachers

a. Prevention – Protection – Security. Education on Protection against Disasters and Accidents (Teachers manuals for I to IV, V to VIII and IX to XII grades)

In 2008, as a result of the project "Prevention of Natural Disasters and Accidents through the Secondary Education System in Bulgaria" (within the Ministry of Emergency Situations and United Nations Development Programme; developed by Paideia Foundation), was published the first of its kind Teacher's Manual that represented a methodology of introducing effective and up-to-date methods of protection-against-disasters-and-industrial-accidents training. The total circulation of the manuals was 44 000 numbers and they were distributed for free among schools from the whole country.

The methodology, designated for teachers, includes 3 Manuals – for each level of education (primary, secondary and upper secondary). The themes are structured in 3 modules: I.Protection against Disasters and Industrial Accidents; II. Fire Safety and Rescue; III. First Aid cover all topics, being part of the curriculum in classes by which the head teachers should conduct training for disaster protection within the hours of class. The connected with earthquake topic is studied in an earlier phase (1-4 grade). Each one of the topics is subdivided into several main sections:

1. The section IN HELP OF THE TEACER presents in a table the met standards, the expected results and leaning objectives, the overlapped ideas, concepts and skills, the suggested methods, interactive techniques for learning, and also possible cross-curricular links. Opportunities are presented about how learning about protection of disasters and emergencies can be held not only in the hours of class, but also be included in the free elective subjects, extracurricular activities, and separate topics to be integrated into other curriculum classes.
2. In the section TO LEARN TOGETHER detailed instructions are given on how to take on a given class. The section includes not only theoretical material, but also suggesting how to use different methods and techniques of teaching, tasks for the pupils and opportunities to integrate the parents in the learning process.
3. The section FOR ADDITIONAL INFORMATION is on a disk, added to the Book for the teacher for high school phase, and consists of: annotated useful links structured both into topics and into phases of the education; a list of publications in Bulgarian language, which can be used in the learning process – not only for preparation, but also during teaching; main normative acts, linked with protection of disasters; a list of titles of films and documentaries, which can also help the learning process.
4. The last section TO LEARN PLAYING given the teachers multiple games by which to diversify the learning process.

In these teachers manuals covers not only the need theoretical material, but also a multiple number of suggestions for interactive methods and techniques (including also techniques for dealing with stress and emotions after having survived a disaster). The main goal is to provide training by active learning, based on the (teacher - pupil - parent) principle of participation. As an additional activity under the prepared teachers manuals needs to be mentioned the 2 undertaken learning seminars with teachers from the country, representing the products and giving the common directions for work with them.

It is important to say that during the past 3 years (since publishing the manuals) there was an opportunity for feedback and evaluation of the product. The responses given from teachers show that the manuals truly fulfill their goals and for the first time education, connected with disasters and emergencies, are conducted thoroughly and raise interest in pupils. A proof for that are also the many conducted open lessons, based on the manuals. The problem is that the given by the curriculum time is highly insufficient, even though the methodical works give opportunity and show how the material should be taught in other classes as well or as extracurricular activity.

2.6.3.3. Good Practices Concerning Parents

Unfortunately, noteworthy and geared to parents activities/materials do not exist. We can only note indirect aspects - the integrating of parents in the described above Teachers Manuals, as well as the mentioned book about the problem of psychological help and support.

2.6.3.4. SWOT Analysis - GOOD PRACTICES

SWOT Analysis	
Strong sides	**Week sides**
	Now the lack of a coordinate center, responsible for the teaching and preparing of materials; highly insufficient partnerships of nongovernment and city organizations;
	Most of the good practices are common – linked with all kinds of disasters and emergencies, and not specifically with earthquakes;
	Highly insufficient time for teaching the topic at school;
Available materials for the smallest (children in kinder garden);	The lack of manuals for pupils;
The presence of competition;	the lack of interactive games in Bulgarian language for children/teachers/parents; Even though they still take place, holding these competitions is more a habit than a attempt to magnify their range, popularity and etc.
	Insufficient resources connected with coping children's emotions;
наличие of a good and tested product or teachers;	Insufficient number of teaching seminars to prepare the teachers;
	The lack of platform, where to present the available resources and to publish new ones;
	The lack of specialized and specifically orientated to parents materials and activities;

2.6.3.5. Selected Bad Practices or How good practices ended

As it was shown by the mentioned above good practices, most of which are realized (coordinated, created and organized) by the Ministry of Emergency Situations. One of the reasons for that was that there was a specialized department - Directorate National Training Center and Preparation of the Private Sector – whose main goal was to improve the quality of disaster protection, preparedness and response education of different target groups (with main focus on children, teachers and parents). Unfortunately, this structure was shut down in the end of 2009, it existed for only three years. The functions and initiatives of that special unit (and also as a whole of the ministry) should be taken by the "Fire Safety and Rescue" Directorate General of the Ministry of Interior. It is also important to mention the fact that the mentioned unit “shelters”, as well as “Civil Defense” – the leading governmental service for civil protection, the cultural values of Bulgaria for disasters, emergencies, terrorist attacks and military attacks against the country, that has existed under different names during the period 18 of July 1936 – 1 of January 2011. Unfortunately, the uniting of everything into a single unit (at the expense of a whole ministry) does not lead exactly to the needed one focal point, simply because the goals of that directory are others – priority associated with fire safety, lacking an accent on educational politics and etc.

It was mentioned above that the undertaking of the competition for a children’s painting “Mission: Rescuer”, as well as the school’s competition do go on, but more as a stall practice. This is obvious by a series of scars – the lack of any information on the site of the "Fire Safety and Rescue" Directorate General, the lack of promoting materials or the highly insufficient information for these events in the internet space. Maybe the reason that they keep taking place is that they are a traditional part of the National calendar for extra curriculum activities of The Ministry of Education, Youth and Culture.

The publishing of teaching materials, connected with disasters and emergencies, is shut down. That is how the good practices were turned into bad ones... Another similar case – “one of the experts’ biggest successes was the inclusion in the network of training centers at the European and Mediterranean Major Hazards Agreement (EUROPA) at the Council of Europe whose main goal is prevention. Those experts worked purposefully and even developed a project for interactive games aiding the training of children for action in emergency situations. But with the closing of the Ministry its’ realization ceased and it didn’t work out”. Unfortunately, that list might continue...

2.7. References

Bergiannaki-Dermitzaki, I. (2007). Prevention and Mitigation of the Psychosocial Consequences of Earthquakes, Handbook No. 4, EPPO, Athens, p. 103.

www.cdcnet.net

www.civilino.it

www.ekka.org.gr (National Centre for Social Solidarity - NCSS)

www.gscp.gr (General Secretariat for Civil Protection - GSCP)

www.oasp.gr (Earthquake Planning and Protection Organization - EPPO) www.protezionecivile.regione.umbria.it

www.savethechildren.it/IT/Tool/Press/Single?id_press=326

www.youtube.com/watch?v=f_TuvDSz9yk

www.vvfpn.it/scuolasicura.htm

3. Recognition of Earthquake and Volcanic Disasters' impact on children

In the past, the psychological needs resulting from a natural disaster were considered to be secondary. The modern approach recognizes the importance of psychological consequences and points out the need for timely prevention, as well as the short and long-term psychological care of the people affected.

Almost everybody who is exposed to a frightening event will present certain psychological, physical or psychosomatic symptoms. This is considered a "normal" reaction to an "abnormal" event, out of the ordinary and dramatic experience.

3.1. General issues of disasters' psychological impact

Natural disasters (such as earthquakes and volcanic eruptions), which are occasional crises, are experiences that everyone at some point will face. A crisis is a temporary condition that causes extreme anxiety and disorganization, characterized by the inability of individuals to control and handle the event. Each type of crisis has specific characteristics and is experienced differently by each one, mainly affecting the sense of stability, security and control, and the natural and social environment (family, friends, neighborhood and community).

It is certain that almost all the people (and the children) exposed to such a traumatic incident as a destructive earthquake will develop some symptoms. In some people the symptoms will be overcome and forgotten, but in some others they will persist and will constitute a source of chronic suffering. According to Taylor (1987), after a disaster there are four types of victims:

a. primary victims, which are directly exposed to the disaster,

b. secondary victims, which are relatives or friends of the primary victims,

c. tertiary victims, which are professionals or people who are called to help,

d. quaternary victims, which consist the wider community that offers help and supports the affected population.

The earthquakes are unexpected, occurring suddenly and can affect a person, a family, a social cycle, or the whole community. The effective management in a case of a strong earthquake, including a strengthening of confidence and resilience of every one, is a necessary prevention measure. Major natural disasters are events that mark the beginning of a crucial period for both the direct and indirect victims, and have particularly severe impacts on vulnerable population groups (e.g. children or elderly people). The way in which one can deal with the natural disaster and the impact of psychological stress depends on:

- individual factors such as: individual characteristics of victims and their relationships,
- social factors, such as the social structure of the affected region and the general cultural framework,
- environmental factors.

In a case of a destructive earthquake, the quality, the intensity and the duration of psychological reactions are determined by the following factors:

- the extent and duration of the destruction,
- the degree of human losses (number of victims and the extent of the damage),
- the personality traits and the previous experiences of victims,
- the level of readiness and effectiveness of actions taken by local authorities,
- the organization of the afflicted group,
- the expected support and external help actually provided.

In a case of a strong earthquake the most common reactions of the victims are the following: shock, fear, anger, guilt, sadness, shame, anxiety, despair, weakness and emotional "freeze". At the immediate post-destructive earthquake period the dominant feelings are the shock and the denial of the event.

The survival of people experiencing a catastrophic event often depends on maintaining composure and application of appropriate protective measures. It is observed that in cases of emergencies, a part of the population remains calm, another is shocked and fearful, while another is in a state of panic. Other behaviors in that period are: indecision, extreme calmness and imitative behavior, selflessness and altruism.

The prevailing emotions during the disaster are: helplessness, weakness, exposure to frightening threat, fear, anxiety, stress, grief, anger and disbelief. The adaptive behavior of the people who have experienced an earthquake disaster event is related to the characteristics of the individual (education level, previous experiences, etc.).

3.1.1. Key concepts on disasters' psychological impact

The following guiding principles form the basis for disaster mental health intervention programs. Not only do these principles describe some departures and deviations from traditional mental health work; they also orient administrators and service providers to priority issues.

- No one who sees a disaster is untouched by it.
- There are two types of disaster trauma—individual and community.
- Most people pull together and function during and after a disaster, but their effectiveness is diminished.
- Disaster stress and grief reactions are normal responses to an abnormal situation.
- Many emotional reactions of disaster survivors stem from problems of living brought about by the disaster.
- Disaster relief assistance may be confusing to disaster survivors.
- They may experience frustration, anger, and feelings of helplessness related to Federal, State, and non-profit agencies' disaster assistance programs.
- Most people do not see themselves as needing psychological services following a disaster and will not seek such services.
- Survivors may reject disaster assistance of all types.

- Disaster mental health services must be uniquely tailored to the communities they serve.

- Mental health workers need to set aside traditional methods, avoid the use of mental health labels, and use an active outreach approach to intervene successfully in disaster.

- Survivors respond to active, genuine interest, and concern.

- Interventions must be appropriate to the phase of disaster.

- Social support systems are crucial to recovery.

3.1.2. Common needs and reactions

Some thoughts, feelings, and behaviours common to all who experience a disaster are the followings:

- Concern for basic survival
- Grief over loss of loved ones and loss of valued and meaningful possessions
- Fear and anxiety about personal safety and the physical safety of loved ones
- Sleep disturbances, often including nightmares and imagery from the disaster
- Concerns about relocation and related isolation or crowded living conditions
- Need to talk about events and feelings associated with the disaster, often repeatedly
- Need to feel one is a part of the community and its disaster recovery efforts.

Each stage of life is accompanied by special challenges in coping with the aftermath of a disaster and age-related vulnerabilities to disaster stress. For children, their age and development determine their capacity cognitively to understand what is occurring around them and to regulate their emotional reactions. Children are more vulnerable to difficulty when they have experienced other life stresses in the year preceding the disaster, such as a divorce, a move, or the death of a family member or pet.

3.2. Psychological impact of disasters on children

A lot of children develop psychological reactions to disasters, which are individually-based and vary according to age, developmental level, proximity to family members, specifics of their situation, losses during and after the disaster, and the responses of the family and community. Treatment should be individualized since children's improvement is not determined by parental response.

There is a wide range of mental and behavioral sequel in children following disasters, which can last long. Proportions of children having posttraumatic symptoms or syndrome diagnoses vary depending on various factors like nature and severity of disaster, diagnostic criteria used, cultural issues regarding meaning of trauma, support available, etc.

According to the literature, the expected reactions of children in disaster are:

- Regression: The child exhibits behaviors that do not match its age, but younger children;
- Physical symptoms: The child shows signs of illness or incapacitation;
- Emotional difficulties: The child exhibits a behavior that the environment usually perceives as "bad" or “unreasonable", because it is usually thought that there is no apparent reason for this reaction.

The common psychological and behavioral symptoms of the children after catastrophic events are physical and emotional, such as: sleep disorders, headaches, loss of appetite, persistent thoughts about the disaster, certainty that another disaster will occur, avoidance of any reminiscent of the destruction. Younger children can also be seen reciprocating symptoms such as reflux in urinating, finger sucking and more dependent behavior.

The list of Frederick (1985) refers the following, suggesting the need for supportive intervention:

- sleep disturbances, which continue for more than a few days, which may appear or not, dreams about the traumatic event;
- separation anxiety and attachment behavior, such as reluctance to go to school;
- fears of stressful stimuli (e.g. an image on TV) that remind the child the disastrous event;
- conduct disorders, including problems arising at home or at school, which operate in response to stress and frustration;
- doubts about itself, including comments relating to the physical confusion, self-worth and desire withdrawal.

3.2.1. Symptoms of the children

For children, their age and development determine their capacity cognitively to understand what is occurring around them and to regulate their emotional reactions. Children are more vulnerable to difficulty when they have experienced other life stresses in the year preceding the disaster, such as a divorce, a move, or the death of a family member or pet.

According to the data of the Institute for the study of Destructive Behaviors and the Los Angeles Suicide Prevention Center (1978) the symptoms of the children after catastrophic events are the following:

<u>Regression Symptoms</u>

1-5 years old: Nocturnal enuresis, fear of the dark, sucking the thumb.

5-11 years old: Increasing competition between brothers for parental attention.

11-14 years old: Increased competition among younger brothers for parental attention, school phobia.

14-18 years old: Taking previous behaviors and habits, decline to: previously responsible behavior - effort independence from parental control - sexual interests.

Physical Symptoms

1-5 years old: Loss of appetite, indigestion, vomiting, gastrointestinal problems (e.g. diarrhea, constipation).

5-11 years old: Headaches, complaints about vision or hearing problems, skin diseases, persistent itching, sleep disturbances.

11-14 years old: Display-head pain and gastrointestinal problems, headaches, complaints of vague pains, skin rashes appearance, sleep disturbances.

14-18 years old: Gastrointestinal problems, skin rashes, disturbed sleep and digestion.

Emotional Symptoms

1-5 years old: Nervousness, irritability, disobedience, tics (muscle spasms), stuttering, clinging to parents.

5-11 years old: School phobia, isolation from family contacts - friends, abnormal social behavior (bickering with friends or brothers), and loss of interest for favorite activities, inability to concentrate and decline in school performance.

11-14 years old: Loss of interest in favorite activities, increased difficulty in relationships with friends or brothers, a sharp increase in resistance to parental or school authority.

14-18 years old: Marked increase or decrease in physical activity, increased difficulty in concentrating on planned activities, frequent feelings.

Preschool (ages 1-5)

Small children view their world from the perspectives of predictability, stability, and the availability of dependable caretakers. Disruption in any of these domains causes distress. Preschool age children often feel powerlessness and fear in the face of a disaster, especially if they are separated from parents. Because of their age and small size, they are unable to protect themselves or others. As a result, they may feel considerable anxiety and insecurity.

In the preschool years, children generally lack the verbal and conceptual skills necessary to understand and cope effectively with sudden unexpected stress. They typically look to parents and older siblings as behavior models, as well as for comfort and stability. Research has shown that children’s reactions are more related to how their family or caregiver is coping than the actual objective characteristics of the disaster itself (Green et al., 1991).

Children who have lost one or both parents are especially in need. Loss of a relative, a playmate, or a pet is also a disturbing event for children. They will need opportunities to express their grief. One of the major fears of childhood is abandonment, so children need frequent reassurance they will be cared for.

Preschoolers express their upset through regressive behaviors such as thumb sucking, bed-wetting, clinging to their parents, a return of fear of the dark, or not wanting to sleep alone. They often have sleep problems and frightening dreams. These problems are best understood as normal expressions of anxiety about the disruption of their familiar routines and previously secure worlds.

In the natural course of events, small children will try to resolve traumatic experiences by reliving them in their play activities. They may re-enact the earthquake or volcanic eruption repeatedly. Children should be encouraged to verbalize their questions, feelings, and misunderstandings about the disaster so that adults can listen and explain. Relief of disaster fears and anxiety is attained through re-establishing the child's sense of security. Frequent verbal reassurance, physical comforting, more frequent attention, comforting bedtime rituals, and mealtime routines are helpful. As much as possible, young children should stay with people with whom they feel most familiar.

Childhood (ages 6 - 11)

School age children are developing the cognitive capacity to understand the dangers to family and environment inherent in disasters. They are more able to understand the disaster event and the mitigating role of disaster preparedness. This awareness can also contribute to preoccupation with weather and disasters, and fears about family members being killed or injured. School age children have a great need to understand what has happened and the concrete steps that they can take for protection and preparedness in the future.

Children often have special bonds with playmates or pets. When the disaster causes loss of significant others due to death or relocation, the child may grieve deeply. They experience the full range of human emotions, but may not have the words or means to express their internal experience. Adults can assist children to express these powerful emotions through talking, play, art, and age-appropriate recovery or preparedness activities.

School age children also manifest their anxiety through regressive behavior. Returning to behavior appropriate for a younger age is trying for parents, but serves an initially functional purpose for the child. These behaviors include: irritability, whining, clinging, fighting with friends and siblings, competing with younger siblings for parents' attention, or refusing to go to school. Bedtime and sleep problems are common due to nightmares and fearfulness about sleeping alone or in the dark.

Sometimes children's behavior can be "super good" at home, because they are afraid of further burdening their parents or causing more family disruption. They may show disaster stress at school through concentration problems, a decline in academic performance, aggression toward classmates, or withdrawal from social interactions. Some children may have somatic reactions and seek attention from the school nurse for stomach aches, headaches, nausea, or other complaints.

Pre-adolescence and Adolescence (ages 12 - 18)

This age group has a great need to appear competent to the world around them, especially to their family and friends. They struggle with the conflicts inherent in moving toward independence from parents on the one hand and the desire to maintain the dependence of childhood on the other. Approval and acceptance from friends are of paramount importance. Adolescents need to feel that their anxieties and fears are both appropriate and shared by their peers.

Disaster stress may be internalized and expressed through psychosomatic symptoms such as gastrointestinal distress, headaches, skin problems or vague aches and pains. Sleep problems such as insomnia, night terrors or sleeping excessively may signal internal upset. Adolescents may turn to alcohol or drugs to cope with their anxiety and loss.

Social or school problems may also occur. Acting out or rebellious behavior may involve fighting with others, stealing, or power struggles with parents. Other adolescents may express their distress through withdrawal from friends and family and avoidance of previously enjoyed activities. School performance may decline. When the disaster causes major destruction of home and community, an older adolescent may postpone the developmental step of moving away from home.

3.2.2. Which children are most vulnerable?

Each child reacts differently to a crisis situation. There are some factors that make some children more affected than others by such events. Most vulnerable children are:

- children who have experienced previous trauma or loss (e.g. death of parent),

- children who are already experiencing a mental health problem,

- children who do not have enough internal forces and appropriate support from their environment,

- children who are worried about the mental health of their own person and

- children who experienced significant losses in this crisis.

The abovementioned reactions of the children are normal and expected. They are displayed by a child for some time after the crisis and should not cause particular concern. Indications of more severe impairment that may require the provision of specialized assistance are:

- The onset of many of these symptoms in a child for a long time. Generally, after about 8 weeks the child is expected to surpass the first sufficiently strong reactions and be able to handle more effectively the impact of the crisis.

- The high intensity of symptoms, which remains unabated or increases over time.

- Serious adverse effects of these symptoms in everyday life of the child (e.g., games, activities, relationships with family or friends, adjusting to school).

3.2.3. The needs of children in case of natural disaster

The needs of children who have experienced natural disasters are the followings:

- Need for cognitive understanding. Children need to understand the fact that causes their upset, with discussions with other people. This will familiarize them with the object of fear.

- The need to express their feelings. A basic need of children is to talk about the stressful event. That way, they will recognize and accept as soon as possible their emotions and understand that they are normal and expected.

- Need for emotional support. Children need a good listener in order to process their feelings. They must accept all their feelings "pleasant" or "unpleasant", "positive" or "negative".

According to data from the literature, the adults who are in the immediate environment (family, school, etc.) can support their children taking into account the following principles:

- Giving to the children the opportunity to tell their story (e.g. where they were when the event occurred, what they did at that time, etc.)

- Devoting time to children, answering their questions and explaining to them what happened, repeatedly if necessary

- Using physical contact (hug or caress) to reassure and console the children

- Encouraging children to express their feelings in their own way

- Recognizing that children's feelings are normal and expected and describing their own experiences and their own feelings

- Limiting the exposure of children to that shown on television about the disaster

- Giving to the children activities at home and at school to keep as much as possible the normal rhythm of life

- Giving to the children the opportunity to mourn any losses they have experienced (e.g. home, toys, school, injury or death of loved ones) and to participate in memorial events if they wish

- Helping children to achieve their potential and realize the ways in which they overcame difficult situations in the past

- Teaching the children how to cope with new demands

- Encouraging the development and maintenance of relationships of children with their friends

- Urging children to participate in events that signal the continuation of life.

3.3. Age-specific interventions for children in disaster - Practices

Nowadays a lot of discussions have been done on related disasters' reactions of the children and the appropriate interventions. The main psychological tasks for recovery are the acceptance of the disaster and losses, the identification and expression of emotions, the regaining sense of control and the resumption of age-appropriate roles and activities.

If a high prevalence of serious post-disaster stress among children is anticipated because of the dynamics of the disaster (e.g., high death rate, large numbers of children witnessing grotesque scenes of destruction), a systematic program strategy for assessing children needs to be developed. Since children tend not to disclose the extent of their post-disaster stress to parents, alternate strategies should be included in collaboration with the schools, counsellors and nurses, other organizations serving children etc. Possibilities include: day care programs, expressive and commemorative school projects, church youth programs, community centers, or summer camps.

More specifically following disaster, systematic screening for psychological problems in children is suggested. An integrated approach using psycho-socio-educational and clinical interventions is expected to be effective. Most of the post-disaster mental health interventions can be provided in the community by the local disaster workers. Supportive counselling, cognitive behaviour therapy, brief trauma/grief-focused psychotherapy, and play therapy are the commonly utilized methods of psychological intervention, which can be given in groups.

According to the literature, the main Age-Specific Interventions for Children in Disaster are the summarised in the following Table.

Age Group	*At Home*	*At School or Other Ogranization for Children*
PRE-SCHOOLERS	- Maintain family routines - Give extra physical comfort and reassurance - Avoid unnecessary separations - Permit child to sleep in parents' room temporarily - Encourage expression of feelings through play - Monitor media exposure to disaster trauma - Develop disaster safety plan - Draw expressive pictures	- Tell stories of disaster and recovery - Use coloring books on disaster - Read books on disaster and loss - Use dolls, puppets, toys, blocks for reenactment play - Facilitate group games - Talk about disaster safety and self protection - Absenteeism outreach to families and children* - Teachers, school nurses, and providers identify stressed children for assessment and referral* - In-service training on children and disaster* - School-based crisis hotline* - Provide educational brochure for parents* - Encouragement to eventually resume normal roles as students*

ELEMENTARY AGE CHILDREN	- Give additional attention and consideration - Set gentle but firm limits for acting out behavior - Listen to child's repeated telling of disaster experience - Encourage verbal and play expression of thoughts and feelings - Provide structured but undemanding home chores and rehabilitation activities - Rehearse safety measures for future disasters	- Free drawing after discussion of disaster - Free writing after discussion of disaster, complete a sentence exercise - Tell stories of disaster and recovery - Read books on disaster and loss - Role-play games about disaster - Create a play about disaster - School study or science projects to increase understanding and mastery - Talk about disaster safety, family protection, family preparedness* - Teach calming techniques (i.e., deep breathing, visualization)* - Field visit to disaster-affected area* - Small group or individual interventions for high risk children* - Group "debriefing" discussion to express and normalize reactions, correct misinformation, and enhance coping and peer support*
PRE-ADOLESCENTS AND ADOLESCENTS	- Give additional attention and consideration - Encourage discussion of disaster experiences with peers, significant adults - Avoid insistence on discussion of feelings with parents - Suggest involvement with community recovery work - Encourage physical activities - Encourage resumption of regular social and recreational activities - Rehearse family safety measures for future disasters	- *All interventions starred above apply. - School programs for assisting community with recovery, helping others - Projects to commemorate and memorialize disaster gains and losses - Encourage discussion of disaster losses with peers and adults - Resume sports, club, and social activities when appropriate

According to the data of the Institute for the study of Destructive Behaviors and the Los Angeles Suicide Prevention Center (1978), the techniques for intervention after catastrophic events are the following:

1-5 years old: Provide verbal and physical verification (e.g., hugs, cuddling), setting reliever hours of sleep, encouraging emotional expression in the game.

5-11 years old: Providing care and understanding, reducing the requirements for maximum performance in school and at home, encouraging expression of thoughts and feelings, providing opportunities for structured but not demanding chores, training on preventive measures to protect any future incidents.

11-14 years old: Providing care and understanding, reducing the requirements for maximum performance in school and at home, encouraging verbal expression of feelings, providing opportunities for structured, not demanding responsibilities, encouraging participation to activities with friends, training on protection measures.

14-18 years old: Encouraging discussion with friends and outside the family or if he chooses family members, reducing the requirements for maximum performance in school and at home, encouraging involvement in planning restoration or social activities with friends, training in pre-protection measures to be taken.

3.4. Case studies of children reactions after an earthquake

3.4.1. 1988 Armenian earthquake

One and a half years after the devastating earthquake in Armenia in 1988, 231 children from three cities at increasing distances from the epicentre were randomly screened in their schools, to determine the frequency and severity of post-traumatic stress reactions, using the Children's Post-traumatic Stress Disorder Reaction Index (CPTSD-RI).

A strong positive correlation was found between proximity to the epicentre and overall severity of post-traumatic stress reaction, as well as severity of core component symptoms of Post-Traumatic Stress Disorder (PTSD). High rates of chronic, severe post-traumatic stress reactions were found among children in the two most damaged cities, Spitak and Gumri.

Analyses controlling for exposure revealed that girls reported more persistent fears than boys. These findings indicate that after catastrophic natural disaster, post-traumatic reactions in children may reach epidemic proportions, remain high for a prolonged period, and jeopardise the well-being of the child population of a large region.

3.4.2. 1995 Hanshin earthquake (Japan)

Children who experienced the Hanshin-Awaji earthquake disaster in Japan were followed to determine changes in psychological and physical conditions after the disaster. Changes observed in the symptoms of children at one and two years after the earthquake were compared between those who had lived in severely damaged area (level 7 on the Japan Meteorological Agency intensity scale) and those who had lived in mildly damaged area (<5 on the same scale). Surveys were conducted using a questionnaire filled out by the children's parents.

Two years after the earthquake, the children had returned to normal in terms of their physical conditions, even in the severely damaged area. However, symptoms of PTSD such as persistent reexperiencing, persistent avoidance and increased arousal were more frequently found among children from the severely damaged area than those from mildly damaged area.

3.4.3. 1999 Bolu earthquake (Turkey)

Six months after the earthquake in Bolu (Turkey), forty-nine children aged between 7 and 14 and their parents were randomly chosen among 800 families in a survivor camp in Bolu. Both children and parents were assessed by trained psychiatrists and psychologists using self-report measures for PTSD, depression and anxiety symptoms. The results showed that:

- The severity of PTSD in children was mainly affected by the presence of PTSD and the severity of depression in the father.

- Trait anxiety scores of children were related to general family functioning.

The findings with earthquake survivors suggest that when fathers become more irritable and detached because of PTSD symptoms, their symptoms may affect children more significantly.

3.5. Psychological Impact - Greek Earthquakes

Natural disasters, and in the worst case earthquakes and volcanic eruptions, have serious economic and psychosocial effects on a community. When large population areas are hit by disastrous earthquakes causing tremendous material and personal losses, their social and economical support systems and resources are violently disrupted, causing major traumatic experiences (Maj et al., 1989; De la Fuente, 1990; Bland et al., 1996; Shinfuku, 1996, 1999, 2002 in Madianos and Koukia, 2010). Most of the people living in Eastern Mediterranean have felt at least one earthquake and have observed its consequences. In Greece, earthquakes are an ancient and frequent phenomenon due to the geological structure of the country and the high seismic activity (Christodoulou, 2002 in Madianos and Koukia, 2010). Thus, Greece is one of the most seismically active countries of the world. Some destructive earthquakes have caused deaths and important damages to the buildings in the country. The socioeconomic and psychosocial-psychological consequences of these natural disasters have been systematically investigated since the 1980's.

Nowadays, it is well known that apart from the damage of the buildings and the life losses or physical health problems, destructive earthquakes cause serious psychological reactions that have considerable impact on society as a whole. The extent and the impact of a serious and permanent psychopathology in the victims of an extensive disaster on the long run have not been yet studied either in Greece or elsewhere.

Several epidemiological studies have been carried out exploring psychosocial and psychological consequences of earthquakes on affected populations in the cities of Cephalonia (1953, 7.3 R), Thessaloniki (1978, 6.5 R), Kalamata (1986, 6.0 R), Aegion (1995, 6.1 R) and Athens (1981, 6.7 R and 1999, 5.9 R). The common finding of these surveys is the detection of massive acute stress reactions, Post-Traumatic Stress Disorder (PTSD) and an accumulation of depressive and anxiety symptoms (Glass, 1959; Maj et al., 1989; De la Fuente, 1990; Horovitz et al., 1991; McMillen et al., 2000; Green, 1994; Gokalp, 2002; Kilic and Ulusoy, 2003; Basoglu et al., 2004; Te-Jen Lai et al., 2004 in Madianos and Koukia).

3.5.1. 1953, M = 7.3, Kefalonia

The first study to investigate the consequences of earthquakes in Greece was carried out by Hartocolis (1955) on Kefalonia Island (Ionian Sea), following the catastrophic earthquake of 1953 (7.3 Richter) that hit and destroyed the islands of Kefalonia and

Zakynthos. The study included personal interviews with open-ended questions. The interviewees expressed fear of dying and many psychopathological symptoms.

3.5.2. 1978, M = 6.5, Thessaloniki

The second psychiatric epidemiological study was conducted 25 years later 2 weeks after an earthquake hit the city of Thessaloniki (6.5 R) in June 1978. The study was based on personal interviews of 617 randomly selected individuals using a semi-structured questionnaire (no psychopathological symptom inventories were used). A total of 64% of the sample reported symptoms of fear and anxiety.

3.5.3. 1981, M = 6.7, Athens

In February 1981 the capital city of Athens was hit by a major earthquake (6.7 R). Afterwards, most people remained for several days outdoors, returned to their homes after the intense after-shocks had ended. Some individuals, however, reported a protracted period of apprehension and remained in the tents for more than two months. This fear was named "seismophobia" and has been regarded as a specific syndrome that develops after the immediate post-disaster period in individuals who experienced severe psychopathological and psycho-physiological reactions during the earthquake that lasted over a protracted period.

The major findings of the study were:

- excess of deaths from cardiac and external causes on the days after the event but no excess of deaths from cancer or other causes;
- decrease in hospital admissions for suicide attempts during the first 2 weeks of post-event period; traffic accidents significantly higher during the post-event period;
- 85% of tent dwellers diagnosed as suffering from “seismophobia”.

3.5.4. 1986, M = 6.0, Kalamata

In September 1986, Kalamata town in southwestern Peloponnesus was hit by an earthquake causing 20 fatalities and extensive infrastructure devastation.

The psychiatric epidemiological study showed that, besides the development of the well-known psycho-physiological reactions, the quantity and quality of sleep was reduced in a part of the population. Subjects who tended to have sleep disturbances that lasted for over two months had experienced intense psycho-physiological reactions during the disaster, i.e. tachycardia, excessive sweating, shortness of breath, dizziness, and faintness.

Moreover, they exhibited increased obsessively-compulsivity, depression and anxiety, a fact that wasn't necessarily related to the pre-existing anxiety levels. Poor sleep quality in predisposed individuals among the disaster victims was not related to the presence of long-standing anxiety but presumably its development was α direct consequence of the disaster.

3.5.5. 1995, M = 6.1, Aegion

After the Egion earthquake in 1995, a significant increase in anxiety levels was observed in nearly the total population hit by the earthquake in the form of reactions of the psychosomatic type such as startle reaction, difficulties in concentrating, continuous irritability and problems of sleep; also 50% reported an intense fear of dying. Nearly 60% developed a mild to severe acute stress reaction that positively related to the intensity of the fear of dying that the individuals had experienced during the earthquake. During the late phase of the immediate post-disaster period an increase of anger and family financial and social problems was also observed. In the Egion earthquake the post-traumatic stress reaction slightly subside but was detected in 20% of the individuals assessed. This reaction was found to passively relate to the feelings of anger and wrath that an individual develops after a disaster.

3.5.6. 1999, M = 5.9, Athens

On the 7th of September 1999 an earthquake of 5.9 on the Richter scale hit Athens. The epicenter was mount Parnitha, at approximately 3 km from the municipality of Aharnae (broader Athens area). The most heavily damaged area lied within a radius of 12 km from the epicenter, which is inhabited by approximately 1 million people. The earthquake caused 143 deaths, 700 reported injuries and homelessness for approximately 40,000 families.

The earthquake that hit Athens was the second strongest earthquake over the till then past twenty years and in certain areas that caused exceptionally large material and human losses. Almost the third of the local population is located in the capital, a fact that increases any eventual psychosocial consequences caused by such a grate seismic event. In the heavier affected areas, immediately after the disaster most of the psychological support agencies of the public, university or other sector, were on the spot.

As reported in the scientific literature, similar disastrous events are followed by comparable reactions and this seems to be a universal phenomenon. Thus, one could appraise previous studies conducted in Greece after prior catastrophic earthquakes and extract correlations between their psychosocial consequences and these expected to be due to the recent earthquake in Athens.

Immediately after intense seismic events, three quarters of the population is expected to develop some psychological reactions and will notably change their daily habits as well as their living practices. The after-shocks, that last several days after the principal earthquake, are the source of severe apprehension and a large portion of the population prefer to remain in safe places outdoors for a variable time period. This is a phenomenon observed both abroad and after the 1978 earthquake in Thessaloniki and the 1981 earthquake of Athens and caused considerable damage. Several predictive factors for the development of the above syndrome have been identified such a low level of education, pre-existing high levels of anxiety and concomitant use of psychotropic medication for minor psychiatric causes.

Furthermore, these individuals exhibited a particular profile in the development of psycho-physiological reactions during and immediately after the event with increased tremor and urgency to urinate rather than tachycardia. During the first two weeks of the post-disaster period in Athens, a decrease of the number of hospital admissions for suicide attempts was recorded. On the other hand, the number of traffic accidents of all kinds did increase during that period.

3.5.6.1. Children psychological impact after the earthquake

a. Five months after the earthquake, 178 children from three districts of Athens at increasing distances from the epicentre were administered questionnaires to identify symptoms of post-traumatic stress disorder (PTSD), anxiety and the extent of personal threat experienced. It was found that:

- PTSD and anxiety symptoms were significantly related to proximity to the epicentre, exposure to threat and female gender.

- Age did not have a significant main effect on either anxiety or PTSD symptoms, but there were significant interactions between age and the other main variables.

In the region closest to the epicentre, the youngest children reported the highest PTSD and anxiety symptom scores, but in the group furthest from the epicentre the older children reported the highest PTSD and anxiety symptom scores. These findings were discussed in relation to direct and media-imparted exposure to the earthquake.

b. Six – seven months after the 1999 Athens earthquake 2037 children, aged 9–17 years, were assessed with self-completed questionnaires. The aim of survey was to exploring the differences in post-traumatic stress disorder (PTSD), anxiety and depression symptoms between a group of children exposed to earthquake with a group of children not exposed to it, but with both groups potentially exposed to the same levels of post-earthquake adversities.

- The directly exposed group (N=1752) had significantly higher anxiety and PTSD scores than the indirectly exposed group (N=284), but no significant group differences were found in depression scores.

- Girls in both groups reported significantly more PTSD, anxiety and depressive symptoms than boys.

- Younger children reported significantly more PTSD and anxiety symptoms than the older ones.

- No significant interactions were found between direct exposure to earthquake, age group and gender.

- The severity of PTSD symptoms was most strongly predicted by greater perceived threat during the earthquake, whereas depression was most strongly predicted by the level of post-earthquake adversity. The severity of anxiety symptoms was most strongly predicted by female gender.

3.6. Italian projects, studies and experiences

3.6.1. Project "Ambiente terra - Ambiente bambino", Research about Children and Post-Traumatic Stress

The project was realized by L'Aquila University and the Italian National Department of Civil Protection. This study aimed to investigate the post-traumatic stress and other factors that caused trauma to children who were victims of the L'Aquila earthquake in 2009 (Fig. 2.1). The research approach was based on the analysis of case studies to reveal the post traumatic stress and the factors that caused it.

Figure 2.1. Child playing in a camp that houses families that became homeless after the 2009 L'Aquila earthquake.

The experts studied pictures, tales and narrations of more than 1,500 children, 6 to 13 years old. The main results are the following:

- 5% of the children turned to have a complete Post-Traumatic Stress Disorder (PTSD) and

- 15% a partial PTSD;

- 57% have in any case discomfort and/or psychiatric disorders (anxiety, isolation, somatic complaints, attentional problems, aggressive behaviour, conduct disorder…).

The experts also put in evidence that children respond to a distressing or frightening experience in different ways, depending on a wide range of factors. The nature of their experience, previous experiences, their age and stage of development and the impact of their parents or other care-takers strongly affect a child's response to trauma.

As an outcome of the project, the University of L'Aquila and the National Department of Civil Protection published the "National Protocol for the psychological management and the clinic treatment of children after an earthquake", in order to help children in recovering from distressing or frightening experiences and to assist them after exposure to trauma (http://www.abruzzo.istruzione.it/sostegno_psicologico/Prof.Enzo_Sechi.pdf).

3.6.2. Rainbow project

It was realized by the Italian Medical Research (IMR), the Ospedale Pediatrico Bambino Gesù, the Caritas Italiana, the Camillian Task Force and the Ordine dei Ministri degli Infermi. It is one of the main scientific initiatives studying the PTSD in children, after the earthquake in Abruzzo. It is aimed to promptly recognize the PTSD in children, in order to face and cope with it. The research approach is based on the analysis of questionnaires done by the paediatricians from Abruzzo Region who investigated the behaviours of the children. This research has been later developed in other areas affected by natural disaster (Haiti, Cile…) and now it is supported also by other international partners (i.e. Boston Children Hospital) (to know more on the project, visit http://www.abruzzo.istruzione.it/sostegno_psicologico/Fr_Luca_Perletti.pdf)

Its main steps can be included in the following:

1) Screening of 2,000 children through ad hoc questionnaires one year after the seismic event in Abruzzo (500 children between 3 and 5 years old and 1,500 children between 6 and 14 years old), in cooperation of all paediatricians and teachers of the schools in the area, has shown that:

- 38% of the children have anxiety, somatic complaints, affectivity troubles;

- 1 in every 6 children suffers from PTSD;

- the younger a child is, the less traumatic disorders are observed.

2) Training for teachers, educators, parents and volunteers has been completed, in order to show them how to cope with the trauma of the children and to give them advice about how to provide support through an educational approach based on pro-sociality.

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4. Identification of needs of children with movement disorders

4.1. General characteristics of children with movement disorders

Research on children and disaster increasingly examines how certain characteristics, such as age and developmental levels, gender and ethnicity, intersect and affect children's experiences in disaster (La Greca et al., 2002; Peek, 2008). The characteristics of children with movement disorders refer to physical, socio-emotional, mental characteristics and their learning state and development, according to Spetsiotis and Stathopoulos (2003).

Physical characteristics: They are related to the general physical state and have been shaped by the nature and severity of the disease. There are usually difficulties in moving due to poor muscle coordination, neuromuscular distress (from simple failure to palsy) and the absence of the body, and problems in the broad and fine motor skills, with direct impact on school work and performance. This condition requires special equipment (wheelchairs, etc.). Even if children with motor disabilities happen to share the same disability, they have a wide variety of physical characteristics. For example, injuries causing damage to the spinal cord cause mobility disorders. Depending upon which areas the spinal cord is affected, different types of mobility disorders occur. Children with neck injuries experience paralysis of the extremities and trunk known as quadriplegia. Children who experience injury below the cervical spine have paralysis of the lower extremities and lower trunk called paraplegia. Causes of mobility disorders are also due to physical conditions such as amputation of one or more limbs, arthritis and back disorders.

Socio-emotional characteristics: Children usually grow up with experiences that affect significantly both their attitude and the characteristics of their personality, and they might become aggressive, hyperactive, apathetic, indifferent and lacking acceptance by their peers. In case that the physical disabilities come after an accident, injury or illness, the person creates an additional stress, it must be familiarized with new realities and changes to the lifestyle and goals. Also the characteristics of people with movement disabilities that are contrary to social standards for the physical beauty, and some adverse conditions (e.g. incontinence, salivation, difficulty in communication, machinery, etc.) prevent the development of a positive social image. Thus, these people are facing difficulties to consolidate positive relationships and attitudes, and often their rejection from others. In general, the motor disabilities also affect the communication problems in social relationships of individuals. Difficulties in the functions, which are responsible for the production of speech, restrict the ability to produce or imitate sounds, resulting in the production of incomprehensible speech or outright shortages.

Mental characteristics: Having a physical disability does not automatically imply that an individual has other health and cognitive impairments. However, it is common the physical disability to accompany to other impairments that are responsible for restrictions and obstacles in acquiring given information.

According to Cutter et al. (2003), both disaster researchers and policy makers agree that the most vulnerable groups of people to the harmful impacts of disaster are children, the elderly, women, racial minorities, the poor, persons with physical or mental disabilities, and immigrants.

4.2. Needs of children with movement disorders

"Persons with disabilities have the right to live independently and participate fully in all aspects of life on an equal basis with others in information, communications and other services, including electronic services and emergency services" (Article 9.1, UN convention on the rights of persons with disabilities). In this sense, and in case of disastrous natural event, such as an earthquake, children with motor or other disabilities are often excluded from preparedness planning at all levels of government, leaving children with disabilities especially unprepared for emergencies. Disaster response professionals commonly assume that parents will inform, warn and protect children in the event of a disastrous earthquake, even though children are frequently apart from their parents when in school, day-care, or with their friends. This lack of attention to disability-related needs in emergency management could result in children with disabilities being left behind in an evacuation or forced to evacuate without vital supports (e.g., mobility devices, respirators, medications, companion animals, etc.; Osofsky, et al., 2007; Rooney and White, 2007).

One remarkable point is that children with motor disabilities may have a more difficult time taking recommended protective actions, before, during and after a strong earthquake. For instance, children with mobility impairments may not be able to crouch under their desks or table during an earthquake, or to evacuate the building immediately after the earthquake and going to a designated meeting point and moreover, to go to a point on higher ground in case of a tsunami. All the recommended protective actions mainly are developed for people without mobility limitations. On the other hand, if a physical disability accompanied with other health or cognitive impairment then, these people may not be able to recognize signs of earthquake itself, the shaking of the ground, or to understand impending threats or may become anxious and confused in response to emergency signals (Kailes and Enders, 2007; Scotti et al., 2007).

Children with disabilities in general, may be in danger of suffering life-threatening consequences in the aftermath of disaster due to separation from parents and other caregivers. The separation of a parent and child during a disaster can be especially distressing to both the adult and child. Children who are separated from their parents after disaster are more prone to illness and disease, malnutrition and abuse, and may have difficulty in situations with prolonged deprivation associated with more chronic events such as droughts (Babugura, 2008; Bartlett, 2008).

A research that has already been carried out in the framework of a "SAFEQUAKE" EU Project for children with cerebral palsy living at home and attending a special school or a normal school has shown that: these children mainly depend on the support of others to manage their everyday life, their social support network (as it is perceived by every person) consists of their parents, friends, relatives and peers, and their basic needs can be performed only by health care staff or parents.

In case of an emergency or a destructive earthquake, children with physical disabilities may acquire additional impairments and experience health issues as a result of inadequately staffed shelters that are not prepared to meet their medical needs. Indeed, the National Organization on Disability (2005) reported that shelters often do not offer equitable access to services for people with disabilities, which may also mean this group is overlooked in the distribution of basic relief and excluded from full participation in response and recovery activities (Hemingway and Priestly, 2006).

Children are often excluded in terms of post-disaster communication and decision making (Mitchell et al., 2008), and children with disabilities may be especially prone to exclusion from information and services made available to other children in shelters such as recreation, crisis intervention, or different forms of therapy.

The "ProMyLife" EU Project is an initiative that has examined how the preparedness of the public and, in particular, of the vulnerable groups can be improved during major emergencies by the following natural hazards: floods, forest fires, heat waves, heavy snowfalls that are repeatedly observed in the broader region of Southern Europe. The outcome that addresses to people with disabilities is limited to the need of developing, maintaining and practicing specific emergency plans and the use of modern technology and telecommunication capabilities that can be critical to connecting these people with their friends and family and with the community and its resources.

4.3. Earthquake Protection Policy for Children with movement disorders in Greece

In Greece, only a few isolated efforts have been made up to now towards protection guidelines for people with disabilities. During the last four years, the Earthquake Planning and Protection Organization (EPPO) has been working towards disability equality and has developed an educational scheme for people with disabilities, in order to guide them to developing skills that will protect them, as well as to taking the appropriate safety measures before, during and after an earthquake (EPPO's editions, 2008, 2011).

The framework of EPPO's initiative includes a number of actions that can be summarized in the following:

a. "Learning about earthquakes and protection measures – guidelines for people with disabilities" is a textbook that addresses to people with disabilities. It has been published by the EPPO, in order to help people who have physical, cognitive, visual, or auditory disabilities to cope with a destructive earthquake.

b. Lectures and training seminars on earthquake protection measures for disabled people are given for students, teachers and educators in Special Schools, mainly for informing and rising their awareness about earthquakes and safety measures.

c. Earthquake drills take place in Special Schools for motor disability, in order to share good practices and lessons learned to further disaster reduction and to identify gaps and challenges (Fig. 4.1).

Figure 4.1. a. Earthquake protection measures during an earthquake for people with motor disability using wheel chair; b. Earthquake Drill in a Special School for children with mobility disorders.

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5. Investigation of needs related to children's emotions during earthquake and volcanic disaster

5.1. Greece

5.1.1. Interview with Mrs. Machi Kaspiri - Experiences from a School for disabled children

The first public school for disabled children in Rethimno city hosts children with mental, mobility and other natural disorders. The director of the School, Mrs. Machi Kaspiri, has worked for many years over the earthquake phenomenon and the best ways to raise awareness and inform these kids on earthquakes.

Applied methodologies were more or less practical and experimental as no certain methodology exists till now. Different approaches had to be applied for different group of children. No ordinary drills were used, such as the evacuation of buildings, which take place almost every year in each school in Greece and no special course or talk is developed.

All necessary information and action is part of the day life activity. Children learn about earthquakes and their effects under the ordinary educational processes in an experiential manner. Games, performs, interactions, theatrical games and behaviours are developed often in order to become biome and part of ordinary behaviour (especially to children with mental problems, such as autism, that receive every irregular situation as potential threat). In such cases, any wrong message can disturb the proper response of the whole team, putting serious dangers in case of emergency.

Major problems however can appear in case of emergency reaction with children with movement disabilities. The main problem is due to the lack of the necessary staff to accompany and support these children. To compensate situation other children are trained to play that role and overpass the problem.

5.1.2. Interview with Mrs. Zoi Livaditou - Experiences of a Greek Rescue Teem member

With the intention of investigating and estimating the needs related to children's emitions during physical disasters such as earthquakes and volcanic eruptions, contact has been made with experts in related fields in every country participating in the project. Their opinion is important and can guide us towards the correct built-up of the subsequent actions and activities. The Lesvos Petrified Forest has interviewed Mrs. Zoi Livaditou, president of the Lesvos department of the Greek Rescue Team and member of the Doctors without Borders, participant in numerous rescue teems visiting areas struck by earthquakes and volcanic eruptions since 1979. At first, she explained the role of the Greek Rescue Team in the areas where a natural disaster has occurred and the way their network operates in order to offer the maximum help to the struck populations and the local authorities. She shared experiences from recent disasters and also from visits to the destroyed areas some time after the disasterous event, to offer extra help and essential goods to poputalions who still suffer. She pointed out that most disasters occur not due to the natural phenomena but due to the lack of preparedness of the state mechanisms to cope with them. She strongly believes that the important issue for a state is not to cure the struck populations but to prevent the disaster that can follow an earthquake of a volcanic eruption. One of the key ways to lessen disaster and, consequently, the feelings of dispare and abandonment seen in most children who have such an experience, is to inform the populations on the phenomena, their possible results and the means of protection and guide them to the appropriate decisions when they organize their life in a seismic or volcanic area. According to Mrs Livaditou, since we cannot stop the phenomena, “knowledge about them is the best prevention of disaster”.

5.1.3. Interview with Prof. E. Lekkas - Experiences of Earthquake Disasters

Within the European project «RACCE», Dr Efthimios Lekkas, a Professor of Geology at the University of Athens and Vice Chairman of the Board of the Earthquake Planning & Protection Organization of Greece (EPPO) gives an interview to Dr Asimina Kourou, Head of the EPPO Department of Information and Education and coordinator of the EPPO team for this project.

At first, Professor E. Lekkas speaks about his personal experiences after 20 years of missions in specific areas within and outside Greece hit by powerful/destructive earthquakes (including Algeria, India, China, Turkey, Costa Rica, Haiti and Japan) and for the enormous experience gathered on disaster management, particularly management of emergencies in schools.

When asked what are the most common reactions of citizens in Greece in case of an earthquake and whether he has noticed a change in these attitudes in recent years, Professor E. Lekkas confesses that he was born and raised in a seismic area of Greece and his experiences on seismic events during the 1960s were particularly painful; this was mainly because at that time there were no specific guidelines for the proper reaction of the population in a case of an earthquake and this (the correct reaction) was not taught in schools. However, he believes that in recent decades, the behavior of citizens and especially students has improved greatly. This change was detected in 1986, after the earthquake of Kalamata and was due to the fact that the EPPO, that was founded in the meantime (1983), had designed and implemented a broad program of awareness and education of citizens and especially students towards earthquakes. Since then, as demonstrated by the reactions of the population in subsequent earthquakes, great strides have been made in the matter of education/information, so that the reaction of citizens and students towards an earthquake is optimal and the effects of an earthquake on the population are therefore minimized.

When asked if he detects differences in how people react after a devastating earthquake in countries like Turkey, Haiti, Japan and New Zealand relative to that of citizens in Greece, Professor E. Lekkas states that the response of citizens varies widely from country to country but also of the countries he has visited, compared to Greece. These differences, in his opinion, are due to specific factors such as the constitution of a country and the political situation, the economic situation, the predominant religion as well as living conditions and the educational level of the country. For example, when the economic, educational and cultural levels of a country are high, people are generally well educated and have the best possible response. Religion plays an important role too. In countries where religion cultivates the “divine will”, people tend to suffer the physical effects passively. At the other end are citizens of countries with more "liberal" religions. On the issue of earthquake defense, Professor E. Lekkas believes that Greece is among the top countries worldwide and may easily be compared with countries such as Italy, New Zealand and Japan. Admittedly, he adds, there is much more to be done.

Finally, he was asked to mention his experience with an example of successful management by the state of the consequences of a catastrophic earthquake. In his opinion, a shining example of successful management of an earthquake disaster is the case of an earthquake in the city of Christchurch, New Zealand in February 2011. It was successful because the individual steps that make up the management of the disaster were successful. Specifically, the stage of prevention and preparedness (before the earthquake), the stage of emergency response (in the first hours immediately after the earthquake) and the stage of recovery worked flawlessly. In the prevention stage, many attempts had been made to put in place coordinated actions of state services and local municipality, capable equipment and well-informed citizens. Naturally, the fact that the region was preceded by recent seismic events (September 2010) contributed to the activation of the residents and the State. So when the earthquake happened, the State responded immediately, rescue teams with all necessary equipment and several teams of volunteers were activated, reception of foreign aid was organized, and there were teams that guided people to safer areas. As a result, several people trapped in the ruins were successfully rescued and wounded were cared for. At the level of restoration, there was a great effort to accommodate those affected within a few days in semi-permanent accommodation, to provide food for all and financial assistance by the state to affected people. Shortly after, the rebuilding of the city commenced, based on a comprehensive plan that had been prepared beforehand. In conclusion, Professor E. Lekkas believes it was successful management of the earthquake disaster that reduced the impacts on the population to the smallest possible levels.

5.2. Italy

5.2.1. Practices on awareness procedures and approaches for children: summaries of the video interviews with experts

In order to have a more accurate and complete knowledge on the state of art, the strong and the weak or missing points, it has been decided to involve in the Need Analysis Study three National Expert Group components, through video interviews performed with: Dr. Romano Camassi, seismologist of the Istituto Nazionale di Geofisica e Vulcanologia, strongly involved in educational projects on seismic and natural risk, in training courses for technicians and volunteers and responsible for the EDURISK Project; Dr. Titti Postiglione, a Civil Protection official of the National Civil Protection Department, actually responsible for the Communication and Formation activities and for the Volunteers Office, component of the commissions appointed to prepare and update emergency plans for volcanic crises; Dr. Cinzia Russo, psychologist of emergency, who has experienced earthquake emergencies and participated in projects related to how to face with the emotional aspects of an emergency. Below, summaries of the three interviews, as well as the summaries of three additional interviews with professionals linked with the subject are presented.

5.2.1.1. Interview with Dr. Romano Camassi

Dr. Camassi, in the first part of his interview, introduced the way an emergency is managed in Italy by Civil Protection in cooperation with the scientific community, police, military and a huge network of volunteers. He pointed out that, in Italy, the preparation, information and training of population in order to make it aware of the local risk, aiming to risk mitigation, are carried out by well-structured projects, whose limit is the small diffusion, restricted to a trivial percentage of population. He highlighted also the absence of a national plan for information and training about natural risk.

Dr. Camassi reported the experience of EDURISK project, in which specific tools regarding the emotional management of children 4-5 years old have been planned for the first time in collaboration with psychologists. He concluded that the results of some surveys for risk perception showed that people do not realize that something can become a real risk depending on their own choices, so most people do nothing to reduce their self-induced risk.

5.2.1.2. Interview with Dr. Titti Postiglione

This expert official of the Italian Civil Protection Department took part, as one of the coordinators, to several earthquake and volcanic emergencies in Italy. During the interview she described the role and the organization of Civil Protection in Italy as a Function which works ensemble with public institutions and scientific community. She also explained the main activities aimed to risk mitigation, which are related to emergency planning and evidenced the work to do in the next years in order to involve citizens actively in emergency planning too. She showed some projects for risk mitigation addressed to schools whose main objective is to explain the correct behavior in case of an earthquake during lessons and how Civil Protection is planning in the next years to become a core subject in the schools' courses of study. Other projects, actually in course, are aimed to produce comics in which is reported a sort of vade mecum of civil protection for children. Work is also done in the field of risk prevention by training volunteers to be trainers and informers of knowledge to population as they can use a simpler language than the scientific community or authorities and could be more integrated in the territory. The Italian Civil Protection efforts are also aimed to involve population more frequently in emergency drills by forcing Mayors of any single town to plan every year almost a small drill in which simple notions and a few instructions and rules of behavior in case of natural risk should be given. In summary, she concluded by declaring the two frontiers of the Italian Civil Protection in the future: prevention in schools and emergency drills in every town.

5.2.1.3. Interview with Dr. Cinzia Russo

She is an emergency psychologist, who, in particular, has experienced the emergency during the last earthquake at L'Aquila in Abruzzo Region. After explaining the role of an emergency psychologist during a natural disaster, Dr. Russo noted the absence in Italy of specific plans for emergency prevention designed for children. She pointed out that many studies were carried out on managing children emotions after a disaster, but the results are not largely diffused. For example, near L'Aquila (a territory at high seismic risk) there is a lack of preventive education for management of children emotions and the risk of a strong impact on the emotional sphere is very high after an earthquake. Concerning the Vesuvian area, a diffuse defense mechanism of population is to let the volcano out of sight, but this approach exposes population to bigger risk, as they act a form of resistance to information about risk prevention. A lot of work should be done on the way the information about volcanic risk is diffused: actually it is often not linear and homogenous and causes in the population false ideas and loss of trust.

5.2.1.4. Interview with Dr. Mauro Luciani

(Psychologist, University of Perugia)

He stated that when children experience an earthquake, there is usually a strong emotion linked to a mysterious event. In terms of psychological and post-traumatic consequences in children who have been through such an experience, generally strong consequences at psychological level are registered and this stress can influence future life and adulthood. This post-traumatic outcome can be prevented and there are experiences in this field. In this perspective, scientific projects about natural phenomena linked to earthquakes are useful in primary schools in order to prevent post-traumatic consequences. In this case, a specific knowledge can help to better face the phenomena and reduce the emotional negative effects, especially for those children living in seismic areas.

5.2.1.5. Interview with Dr. Maurizio Fattorini

(Fire Brigade responsible for Civil Protection in Umbria Region)

According to the Umbria specific experience, there are organisational issues related to the presence of children in a post-earthquake scenario. Many have been the strategies carried out in Italy in post-seismic scenarios in order to have schools immediately operational again.

The Umbria and L'Aquila experience show that in the immediate aftermath of the event the re-opening of schools is one of the most relevant public goal. However, some problems have arisen. As the experiences show, the role of volunteers in re-organizing the educative place is essential.

5.2.1.6. Interview with Dr. Lauredana Biccheri

(Educator, responsible of the services for children in Città di Castello and involved as expert in many projects addressed to face the post-seismic organization and the seismic prevention)

She stated that there are currently numerous projects carried out in Italy, especially in Umbria, to ‘teach’ children how to behave during an earthquake. There are many strong points, but also some problems. Teaching children how to behave during an earthquake focuses mainly on the immediate procedures after the event.

However, some believe that children find it difficult to relate the seismic event with the actions. It is difficult for them to ‘believe’ an earthquake could happen and understand its possible effects. However there is a way to explain what could happen in the case of an earthquake in a non traumatizing way. The most successful projects are related to a “game” approach and are related also to scientific thinking.

Children can be getting used to the earthquake as something even though not predictable, but at least of which effects can be predicted and damages prevented.

5.2.2. Questionnaire results

The National Institute of Geophysics and Volcanology - Vesuvius Observatory (INGV-Osservatorio Vesuviano) has given its contribution in RACCE questionnaire development, above all, in its integration with volcanic topic questions. The intention was to make as many comparisons as possible with the other RACCE Countries’ survey results, both for earthquake and for volcano issues.

In order to have a respondents’ sample from Italy as well-balanced as possible, INGV has chosen three channels for questionnaire distribution: a primary school in Ercolano (Vesuvian area), the science center “Città della Scienza” in Naples and a secondary school in the town of L’Aquila, while the Centro Studi e Formazione Villa

Montesca has worked with two primary schools in the Centre of Italy and with cultural and environmental associations operating in the Umbria Region.

Together, the Centro Studi Villa Montesca and the INGV-Osservatorio Vesuviano have recollected 282 filled questionnaires; the format developed by EPPO (Greece) has been used for the data analysis. 110 of the 282 questionnaires were filled by adults and 162 by pupils between 8 and 13 years old. The main results indicate, for the adult participants, a general low knowledge of seismic topics, whereas most people are aware that experiencing an earthquake can result in an emotional burden for children. Children responses reflect their curiosity and a good knowledge of both earthquake and volcano topics. Very interesting is the indication of "volcanic eruption" as earthquake origin, together with Earth dynamics.

In general, all participants showed a quite high rate of fear in respect to these natural hazards, and quite low level in preparedness and, furthermore, they pointed out the lack of exercises on how to cope with a seismic or volcanic emergency.

5.2.2.1. Needs in respect with awareness raising and coping children emotions

After having performed the subsequent steps of the Need Analysis study, we have identified some missing or weak points in the Italian educational venture, in respect with the seismic and volcanic risk, and above all with strategies aimed to cope with children emotional response to a severe natural event, such as an earthquake or volcanic eruption. These points can be useful to identify the needs in the educational approach and methodology for the next RACCE steps.

A synthesis of the findings is presented below:

1. In spite of the EDURISK and other experiences, Italy does not have a policy on information and risk education. National initiatives (excluding the EDURISK project for the last 10 years) are rare and lack continuity. There is NO contribution from the Ministry of Environment and, above all, the Ministry of Education, is completely absent on these issues. In conclusion, Italy does not have information and education strategy on the topic of natural hazards.
2. Exercises should be more frequent and focused on local experiences, such as a past earthquake. Even though Civil Protection is planning to give to volunteers a key role connecting scientific knowledge of a natural hazard and emergency management, it is an impending need to make people more and more involved in the emergency planning and procedure to mitigate or face with risk.
3. Regarding action aimed to cope the emotional impact on children involved in a severe event, Civil Protection has a procedure that involves some emergency psychologist in order to provide suffering population with psychological support. But that seems to be not adequately designed for children needs.

Any action should aim to cope the emotional aspects related to natural risk before the occurring of the events and the following emergency. This would be particularly important for people living close to quiescent volcanoes, as in the Neapolitan area.

5.3. Bulgaria

5.3.1. Interviews

In relation to the interviews the following activities were executed in the period May-June 2011:

- work meetings for identification of national experts, who were going to be interviewed
- preliminary meetings with the experts, selected by established criteria
- writing down questions for the interviews
- organizing and recording
- translation in English, assembling and subtitling the two interviews
- publishing the two interviews in the Facebook web page of Center for Educational Initiative (http://www.youtube.com/watch?v=NhRA29VeiW0& feature=relmfu – Interview with Ms. Deyana Zarkova, http://www.youtube.com/watch?v=UUyaLKnANWs&feature=channel_video_ title – Interview with Alexandar Dimitrov MD, PhD)

After the work meetings (aiming to identify the suitable for the purposes of the project national experts that are to be interviewed) were conducted, two interviews were held. Presenting two different points of view – the standpoints of experts from various fields that have an opinion about the problems of the project – gives an opportunity of a good comparative perspective, which is indisputably useful for detecting the needs and issues in this area. It should be paid attention that before assembling them, the interviews lasted about 1 hour; this complete version, as well as the preliminary conversations with the experts, will also be used for the purposes of the present report.

5.3.1.1. Interview with Ms. Deyana Zarkova

Presentation

Ms. Deyana Zarkova was a Chief Expert at the former National Training Centre at the former Ministry of Emergency Situations, with extensive experience in training related to disasters, emergency situations and accidents (including EQ)

Ms Zarkova's master dissertation topic was: Institutional subject of national policy to protect populations in disasters and emergency situations (problems and changes).

Considering all the mentioned above, it was decided to be interviewed exactly that expert.

Highlights from the interview

Main topics discussed during the preliminary meeting and the interview, were:

• national policy to protect populations in disasters and emergency situations (2007-2009);

• Good Practices (including associated with disadvantaged children); coordinated or conducted by the former Ministry of Emergency Situations;

• inclusion in the network of training centers at the European and Mediterranean Major Hazards Agreement (EUR-OPA) at the Council of Europe;

• how good practices ended; (closing the Ministry of Emergency Situations in the end of 2009 year)

• shortages (needs): insufficient products and activities, particularly orientated toward disadvantaged parents and children; teachers need to develop a more serious approach to this topic in those hours, dedicated to disaster prevention; experts, specially trained to cope with children emotions after surviving the disaster (including and EQ); a long-term, functioning and coordinated national policy for reaction in case of an earthquake.

5.3.1.2. Interview with Alexandar Dimitrov MD, PhD

Presentation

Alexandar Dimitrov is a doctor, member of the Military Medical Detachment for Emergency Response since 1992, when the department was established. For 15 years, he specialized in rehabilitation of spinal cord injuries. Thereafter, with 20 years of experience with medical security in cases of natural and technological disasters and major accidents with many casualties and victims, who need medical treatment during the acute stage, rehabilitation and later often many years of social adaptation. He has attended many rescue operations following disastrous earthquakes in many countries (for examples – in Spitak, Armenia 1988; in Turkey 2003).

The expert's personal choice was dictated by his willing of seeing the perspective of a man, who has practice, has taken part in rescue missions and has specific experience with kids in emergency situations following an earthquake and also having theoretical knowledge, as far as his PhD is connected with c medical help during earthquakes and terrorist attacks.

Highlights from the interview

During the preliminary meeting and while recording the interview, Dr Dimitrov has outlined some not only interesting but also important for the purposes of the project aspects related to:

- observation of reactions of children, survived earthquakes;
- preparedness for reaction of the responsible Bulgarian authorities during and after an earthquake;
- problems and needs in this area.

Some of the main topics mentioned in the meetings and the interview will be outlined here:

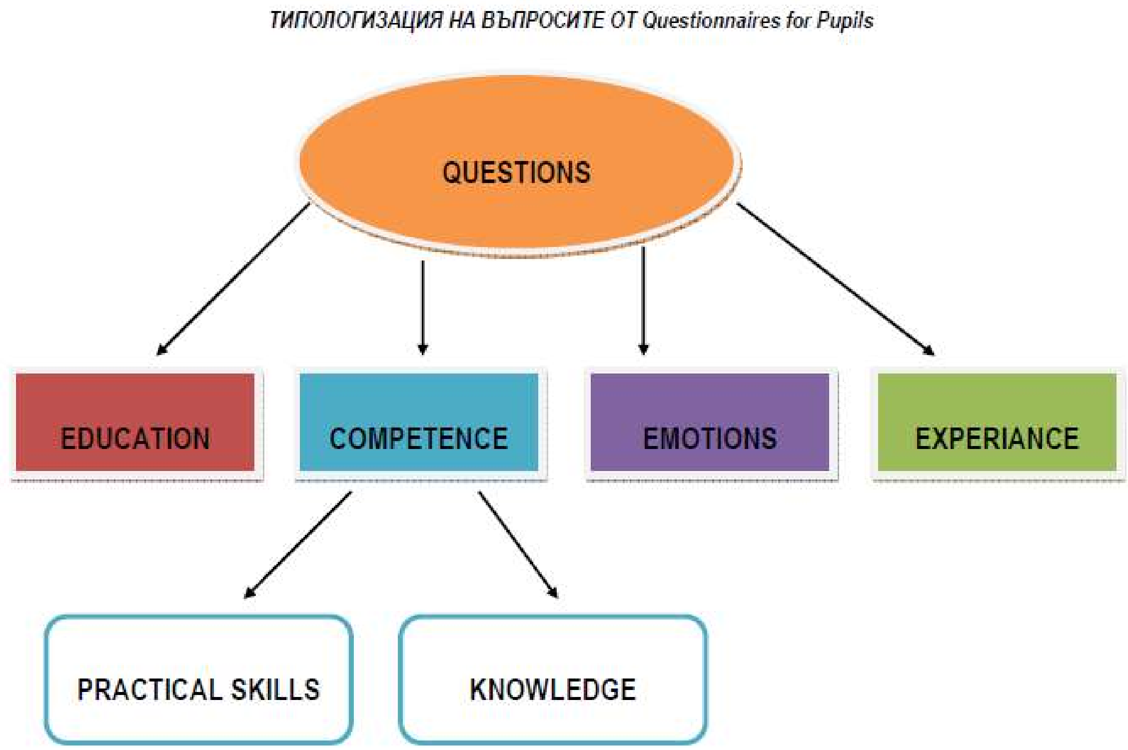
- Observed reactions of children after earthquake – panic, stupor, faster biological needs (because biological processes are faster);
- children are capable of handling emergency situations following an earthquake faster than adults;
- specifics of the earthquake as a disaster – everybody is traumatized at the same moment;
- Armenia (1988) and the so-called Survivor syndrome (a story about a child);
- sometimes the absence of physical trauma leads to stronger psychological shock;
- the great importance of helpers with pedagogical and psychological background knowledge;
- to have both a psychologist (trained in overcoming emotional trauma) and a psychiatrist in the medical crew;
- the great importance of first aid and so called „golden hour"; dealing with panic and shock reaction;
- shortages (needs): well prepared volunteer paramedical teams locally; a long-term, functioning, coordinated and well-maintained infrastructure for reaction in case of an earthquake; a coordination center on national level; some form of extracurricular education for children to react adequately in case of emergency;
- common mistakes or misbelieves in relation to earthquakes;
- the importance of preparation on all levels.

5.3.2. Questionnaires

In relation to the 2 types of questionnaires – for pupils and for adults, the following was realized in the period Mai/July 2011:
- Translation of the questionnaires in Bulgarian;
- The conduct of the inquiries in 2 Bulgarian cities – Sofa and Brezovo (the choice of the cities allows for comparative analyses between the results in the capital and the small town11);
- Processing and summing up of the data;
- Graphic presentation of the data;
- The conduct of structural and comparative analyses of the results;
- Drawing main conclusions about the needs – during the training, in relation to the increasing of the information flow about earthquakes, as well as dealing with children's emotions.

5.3.2.1. Questionnaires for pupils

The survey is done among 86 pupils. The first step related to the structural analyses of the answers is directed to the typology of the questions – illustrated graphically by the following figure:



On the basis of this structure the questions of this survey are subdivided to the respective kind, which gives opportunity for structural analyses of the results.

Main conclusions on the basis of the structural analyses of the surveys

- In relation to the no doubt most important competence – practical skills – it could be concluded that students have such;
- Good results are seen to the overwhelming in the survey questions about knowledge;
- The results are a bit unexpected in the part related to emotions. First off, it is not about the little number of answers describing the feeling related to EQ as„happiness" and / or "excitement". To try and interpret these answers, 2 things have to be pointed out – first, it must not be forgotten that a big part of the participants are teenagers and answers like theirs could be translated as a desire to be "cool". The second conclusion, however, is far more important – there is a big probability that the children have never (or extremely rare) had any kind of result-oriented activities, related to understanding and commenting on their feelings.
- The alarming result is related to the part education, covered by the question: Have you ever taken part in an earthquake drill at school?. At first sight, the almost equal division of the answers "Yes („every year" + „one time") and "No" ("never"), is a paradox when it is about students from 2 different school from 2 towns (as is obvious from the applied chart, the differences are not based on location or age). This paradox could be explained with the so-called "legitimate answer" ("Yes") – this explanation is supported by the normative regulation. Indeed, in Bulgaria according to the educational plan there is supposed to be a lesson twice a year, related to studying the plan for exiting the school during a disaster. Unfortunately, based on conversations with teachers across the country, we could say that this activity is

more of a formality – it may not be conducted at all, but if it is conducted it is too formal. What is more, the plans in question are not modernized.

Main conclusions on the basis of structural analyses of the surveys

The almost equal number of participants form the two towns gives the opportunity for comparing the results (similarities and differences) between the capital and the small town (the population in Sofia is 1 million and 400 hundred thousand people, whereas Brezovo's is less). However, as could be seen from the applied comparative graphics, the expected difference (in so far as children from the capital have access to much more educational resources) is barely noticeable, there is even a bit superiority in favor of the small town. We commented above the more or less lack education about EQ and in the meantime the presence of competence (both practical skills and knowledge). One of the conclusions, which could be drawn here, is that knowledge and skills in this important area do not come from the school. Eventually, during the analyses of the survey for the adults (parents and teachers being the priority) we will see that they as well do not bear "guilt" for these skills (Of course, it must not be forgotten, that the surveyed parents are not the parents of these children, but still the results from the surveys for the adults are quite indicative). Unfortunately, as long as it is about the "origin" of this knowledge and skills, we could only speculate.

A note related to the comparative analyses of the answers

There are no observable differences based on age or gender in any of the questions.

5.3.2.2. Questionnaires for adults

The survey is done among 50 adults. The same typology of the question may be used in relation to the structural analyses17. In this case it is appropriate to add a fifth type of – concerning children18. Of course, in this case it is possible that some type of questions will overlap, meaning that a question affiliated to emotions could be included in concerning children as well. This kind of structuring gives the opportunity for an interesting observation. The mentioned above overlapping, as is clearly observed in the applied figure, is seen between the areas emotions - concerning children (all 4 questions!) and practical skills - concerning children (1 question).

Main conclusions on the basis of the structural analyses of the questionnaires

- The bigger part of the questions are about knowledge (6 questions) and emotions (4 questions), as well as concerning children (5 questions). The results related to knowledge are more or less equally distributed between "right" and "wrong", respectively presence/lack of knowledge. An exception here is the "relieving" result demonstrating knowledge of the. Special attention has to be paid to two more results. The first one is related to the question "Is the earthquake phenomenon frequent in your country?" where the opposing in character answers are strangely equally distributed. Unawareness like that is frightening, provided that earthquakes in Bulgaria are neither rare, nor "weak" (namely the interpretation that "large earthquake" is understood as "recurring phenomenon" is not applicable in this case).

Here we could also incorporate the results related to experience, since both questions of this type (chart 622) are related to personal experience, where those who lived through earthquakes are overwhelming. This, however, is not according to them a frequent event (comparing with the results we commented upon above).

- The second result deserving special attention is again the equally distributed opposing in type answers to the question “Are you aware of the earthquake protection measures in your country?” (especially the very important sub-question: What are your main sources of information?). First off, it has to be pointed out that this dangerous lack of knowledge could reflect on the lack or the small number of national protection measures. Meanwhile, the “knowing people” acquire this information mainly through the media, where it could easily cut both ways. What is more, this is the only question directly related to education. Here we have to point out that the lack of education is also visible from the unawareness that Bulgaria is an earthquake zone, where this phenomenon is frequent and dangerous (as is shown above).
- When it comes to the important competence – practical skills – the conclusions seem contradictive. While the adults posses such skills, the bigger number have not taken any personal protection measures. The last one corresponds with the analyzed above result, related to the idea that earthquakes are not a real threat to Bulgaria.
- The questions, respectively the answers, that reflect to emotions (reminder that all 4 questions are also concerning children, so they are one of the most important for the purposes of the project) are not for analyses, but more for an “opinion” and there is no “wrong” answer, except for “I don’t know”, but it is not often (in the meantime, however, the presence of an answer like that, even though not often, is worrying!). An exception is may be the most important question - Do you know how to comfort a child that is traumatised from an earthquake?– where the bigger part of the participants do not know what to do. We must not forget that the “knowing people” other than really having such skills could also give a “legitimate” answer or put a sign of equality between calming down the child in a normal situation and in a situation after an earthquake (meaning the specific post-earthquake trauma is seen as resembling others daily problems which parents or teachers have to deal with every day).

A note about the lack of a comparative analysis of the answers

Unlike the results of the questionnaires for students, for the adults it is not possible to make a comparative analysis in relation to residence, since almost all participants are from one city (and all have higher education). Differences on the basis of gender, age or occupation are not observable here as well.

5.3.2.3. Compared Conclusions (pupils: adults)

The conclusions drawn above about the results of the two types of questionnaires allow for comparison (of course, with a little bit of catch, since the questions are different) between the two types of participants - pupils and adults:

- The students show better competences – up to the standards of practical skills, as well as knowledge;
- There are problems with both groups in relation to education and emotions.

5.3.3. Needs

On the basis of the research, some conclusions can be drawn about the needs (resp. the shortages) related to increasing earthquake information flaw and dealing with children’s emotions caused by such disasters. We tried to summarize and plan basic, of significant priority and of course executable (real and adequate) measures for increasing the education in this area. (SWOT Analysis)

5.3.3.1. Needs Concerning Children

a. A main necessity is the drawing up of manuals (educational materials and recourses) for pupils – for each of the stages of their education and adequate with their age, as well as stimulating team work and based on modern, attractive and multimedia methods.

b. Continuing the policy related to the drawing up of manuals and executing events for children in a disadvantaged position.

c. Continuing the policy related to the drawing up of manuals and executing events for kindergarten children.

5.3.3.2. Needs concerning Teachers

Organization and conduction of educative seminars for the head teachers.

5.3.3.3. Needs concerning Parents

Parents' integration in the educative process through increasing their knowledge on the subject, as well as organizing and conducting events in this direction.

5.3.3.4. Needs concerning Children - Teachers - Parents

a. Maybe the most important need is related to the so called education through participation, where children + teachers + parents take part. In this direction, extracurricular activities and events have to be organized to increase the knowledge and to test the practical skills for reaction during and after an earthquake.

b. Creation of products related to coping with children's emotion;

c. Design and creation of an online platform where the old and the new resources can be published.

d. Creation of a partnership network including government organs (on a local, district and national level), non-governmental organisations, schools and private partners who will contribute for the realization of the above mentioned needs.

5.4. France

The needs analysis is based on the experts' interviews and the research made on the subject of how to increase awareness of adults and children on seismic risk and how to deal with children's emotions caused by earthquake events on national level.

The following conclusions can be drawn:

5.4.1. Needs in the school context

a. Implementation of crisis management exercises in schools at the academy level (Regional education authority). Actions targeted on:

- behaviour to be held during and just after an earthquake;
- testing the crisis management (DICRIM = Municipal document of information on the major risks) in contact with the mayors.

b. Spreading of the DICRIM (municipal document of information on the major risks), in order to notify on the orders that must be followed (types of risks, means of alert, routes of evacuation, hurt by grouping);

c. Organizing seminars to inform different kinds of actors at schools: school parents' federations, head-teachers, school nurses…

d. Creating educational suitcases on the knowledge of seismic hazard;

e. Developing the network SISMO at school and others kinds of tools on the web for children at primary school.

SISMO at school: the global principle of the program SISMO at school is to create a network of schools equipped with seismometers with educational vocation. Pupils (from the middle school (college) to the high school) are in charge of installing in their establishment a seismic sensor. The registered signals feed an on-line database which becomes the point of departure of educational and scientific activities using the new technologies of information and the communication.

f. Training the nurses and the psychologists of schools in the management of the feelings of the children after a natural crisis;

g. Sensitisizing children on earthquake-resistant construction so that they are vectors of raising awareness for their parents;

h. Developing training in the first aids in association with civil security.

5.4.2. Out of school context

a. Informing the citizens of the contents of the PPR (prevention risks plan) developed in every department and spread the DICRIM (municipal document of information on the major risks);

b. Motivating the implementation of simulators of earthquakes in each region;

c. Organizing conferences and Round Tables for the networking of the actors of the building to inform them about the earthquake resistant construction (the new European standards);

d. Creation of regular events on major risks;

e. Creation of itinerant, playful and interactive exhibitions on seismic risks;

f. Development of itinerant actions like caravan of the prevention of the seismic risk;

g. Motivating the creation of free and traveling theatrical plays for raising awareness on seismic risks. This would allow access to an unwilling population with the scientific information;

h. Developing training in the first aids in collaboration with the civil security;

i. Developing the partnership network (which includes governmental and non governmental organisations) created in PACA region in each region.

6. Summary - Conclusions

The present Needs Analysis was necessary in order to further produce and develop the deliverables of the RACCE project. Each participating organization has collected the available information from its country, related with:

- the existing earthquake and volcanic risk,
- the historical and instrumental strong earthquakes and volcanic eruption and the experiences gained in each country,
- the national policies on protection from earthquake and volcanic disasters and
- the actions in each country for awareness raising and prevention of large-scale disasters.

Based on the given information, and because of their position on the world geotectonic map between liphospheric plates that collide, the countries with the highest seismicity among the participant countries are Greece and Italy, with a very long database of historical earthquakes, reported in written works since the antiquity, as well as instrumental earthquakes, for which there are very detailed information. These two countries also have a very long record of volcanic eruptions that started millions of years ago and are ongoing. Several times in the past, both have suffered devastating results of earthquakes and volcanic eruptions, with many casualties, injuries, demolitions of buildings, loss of properties and complete distruction of any infrastructure. Because of these, a large number of studies in both countries has resulted in the construction of seismic hazard maps and the hazard estimation of the various active volcanic cetres (see Chapter 1).

In these two countries, Greece and Italy, during the past decades and usually right after a large destructive incidence, numerous national and also local authorities and organizations have been created that deal with earthquake and volcanic protection, emergency planning and awarness raising. Two of these organizations are the Greek Earthquake Planning and Protection Organization and the Italian Istituto Nazionale di Geofisica e Vulcanologia - Osservatorio Vesuviano, both participant members of the RACCE project. These organizations and also other institudes, such as the Natural History Museum of the University of Crete and the Natural History Museum of the Lesvos Petrified Forest, have until now designed and materialized a large variety of educational programmes, mostly aiming at informing and raising awarness of children on issues related with the phenomena of earthquakes and volcanic eruptions, the damages they can cause and the protective measures that have to be taken both in school and home context. Several drills are organized, some with the help of earthquake simulation tables in the premises of the institutes that organize the drills or in schools, aiming at the preparedness of children but also of their teachers and care-takers in case of an earthquake or volcanic eruption. A large variety of educational material has been created, mostly in the framework of previous European-funded projects, which is distributed for free and informs on these natural phenomena but also gives rules of behaviour during forecoming events (see Chapter 2).

In contrast with Greece and Italy, the other two countries that participate in the RACCE project, Bulgaria and France, cannot exhibit equally rich variety of relevant organizations, educational programmes and material. A few publications are available to buy in Bulgaria, most of them in limited number of copies. The rareness of these natural phenomena in the two countries has led to the unfamiliarity of the largest part of the population on their consequences and the protection measures against large-scale disasters triggered in case of an earthquake or a volcanic eruption (see Chapter 2 and also Annex).

Just like any other disaster, also an earthquake or a volcanic eruption, can have a huge psychological impact on a large part of the affected population. Several studies have proved that the reactions of the population in case of a seismic or volcanic incident are similar, regardless of the country. In the same way, the needs of the affected populations are the same and are usually more age-related than country-related. The psychological impact of disasters is usually age-related and can be exhibited through several symptoms; the symptoms of children after catastrophic events can be behavioural (e.g. nocturnal enuresis, fear of darkness, school phobia), physical (e.g. loss of appetite, indigestion, vomiting, headaches, disturbed sleep) or/and emotional (e.g. irritability, disobedience, abnormal social behavior, loss of interest for favorite activities, increased difficulty in concentrating). The psychological impact of disasters on children can be huge and decisive for their further life and development of their personality, especially when they have been directly affected by the disaster (e.g. through the loss of a relative/friend, the distruction of their home and subsequent transfer to a new place of temporary residence), when they had experienced a trauma or loss before the incident, when they already suffer from a mental health problem when the incident happens, or when they do not hace the appropriate support in their environemt. Any type of symptoms is to be expected, but specialized assistance should be seeked if the symptoms continue for a period longer than 8 weeks after the incident, if they increase through time or if they cause very serious disturbance of the everyday life of the child. The needs of children who have experienced natural disasters have to be well understood by their environment and their care-takers (parents, teachers). Most of the children will need to express their feelings, whether these are pleasant of unpleasant, to trusted people. The persons in their immediate environment will have to learn how to listen and support the children, how to devote time, recognize their feelings and use physical contact and other means to reassure and encourage them (see Chapter 3 and also Annex).

Most of the current knowledge on children's reactions after a natural disaster comes from studies conducted on children that experienced a strong earthquake, such as the ones of 1988 in Armenia, of 1995 in Hanshin (Japan) and of 1999 in Bolu (Turkey). In Greece, the first studies of the psychological impact of an incident on the affected populations were conducted after the 1953 earthquake in Kefalonia Island, and continued with the earthquakes of Thessaloniki (1978), Athens (1981), Kalamata (1986), Aegion (1995), without however a specific focus on the impact on children. The first studies of the childrens' reactions were conducted after the earthquake that occurred in Athens in 1999. Likewise, in Italy, two projects were realized, the one aimed to investigate the post-traumatic stress of children that had experienced the L'Aquila earthquake (2009) and the other one aimed to promptly recognize the Post-Traumatic Stress Disorder (PTSD) in children, in order to face and cope with it. Significant knowledge and experience has been gained in both countries due to the above studies (see Chapter 3 and also Annex).

A very special group of children that has to be studied independently is the children with moving disorders. These children have very specific characteristics, which refer to physical, socio-emotional, mental characteristics and their learning state and development. These characteristics may sometimes lead to difficulties in following recommended protective actions before, during and after a strong earthquake, which are usually developed for people without mobility limitations (e.g. children with mobility impairments may not be able to crouch under tables during an earthquake or to evacuate a building immediately after an earthquake). The needs of these children differ significantly from the needs of children without moving disorders, since the former may acquire additional impairments and experience health issues as a result of inadequate shelters, in case of a destructive earthquake or volcanic eruption. A few only EU-funded projects have examined how the preparedness of the public and, in particular, of the vulnerable groups can be improved during major emergencies. In Greece, a few isolated efforts have been made towards protection guidelines for people with disabilities (e.g. EPPO's initiative to develop an educational scheme for people with disabilities, in order to help them develop skills that will protect them and to teach them appropriate safety measures before, during and after an earthquake). This group of children, therefore, has to be thouroughly examined in terms of management and coverage of their physical, apart from their emotional needs in case of natural disasters (see Chapter 4).

The partners of the RACCE project, taking into account all the already gained knowledge and experience from previous studies, and using guidelines agreed among them during their meetings, investigated further the needs related to children's emotions during earthquake and volcanic disaster. After interviewing experts on emergency psychology, civil protection officers and educators, the partners gained a more accurate understanding of the strong and weak or missing points regarding the response to children's emotions in each of the four countries. Furthermore, they used questionnaires (developed by the EPPO), which they distributed to several schools, in order to test the knowledge of both adults and children on issues related with earthquakes and volcanic eruptions and their understanding of protective measures against the related risk. The results mainly indicate general low knowledge of seismic topics among adults, but much better knowledge among children. Most people seem to be aware that experiencing a natural disaster can cause great psychological impact on children, but they lack both the knowledge and the experience of coping with seismic or volcanic emergencies and children's emotions triggered by them. The RACCE partners realized that there is a serious lack of continuity on natural risk education and strategy development in the occasion of natural hazards, both in national and in local level. Furthermore, even though there are some initiatives on providing psychological support to suffering populations in the mostly affected areas, these are not adequately designed to meet children's needs. Even though in Greece and Italy the percentages of the population aware of seismic and volcanic risk is somewhat high, the percentages of the populations in Bulgaria and France that understand the phenomena and the risk related with them are very low. In those countries, the design of educational material and strategies of dissemination of relevant information is a much stronger necessity than in the other two countries, for both children and grown-ups that act as care-takers (parents and teachers) (see Chapter 5 and also Annex).

ANNEX

“RACCE”

COMPLETE EVALUATION OF THE QUESTIONNAIRES

<u>INDEX</u>

1. Introduction

Within the Needs Analysis of the European Project “RACCE” and the assessment requirements, the current situation had to be determined, specifically the state of knowledge and preparedness in the countries participating in the project, regarding natural disasters, especially earthquakes and volcano eruptions. The instrument chosen to assess the current situation was questionnaires tailored to the objective, which were prepared with the elaboration of all participants countries. The target group, according to the objectives of the program, to implement these questionnaires was determined to children at the age of 6-13 years, including children with moving disorders, and to adults who have a relevant position as an educator, a parent or a rescuer in case of a natural disaster.

According to Educational Experts, younger children at the age of 6-7 years needed a different approach instead of a typical form of questionnaires. In addition, another feature that had to be acknowledged is that the countries that participate have different environmental issues when it comes to natural disasters. For example, the region of Vesuvius in Italy needed to gather information for both earthquakes and volcanoes, but on the other hand the Organization in Bulgaria is only concerned with earthquakes.

Thus, in the final creation of the questionnaires, these were divided in the following categories, in order to cover the needs of all four countries:

For Adults:

- Questionnaires regarding Earthquakes
- Questionnaires regarding both Earthquakes and Volcanoes

For Children:

- Questionnaires for children 8-13 years old regarding Earthquakes
- Questionnaires for children 8-13 years old regarding Volcanoes
- Questionnaires in the form of a graph for children 6-7 years old regarding Earthquakes

In detail, the participants who used the adult’s questionnaires regarding only the Earthquake phenomenon were: *CEI, Lesvos, Montesca, EPPO, Reserve, NHMC*

The participants who used the children's questionnaires 8-13 years old, regarding only the Earthquake phenomenon were: *CEI, Lesvos, Montesca, Reserve, NHMC*

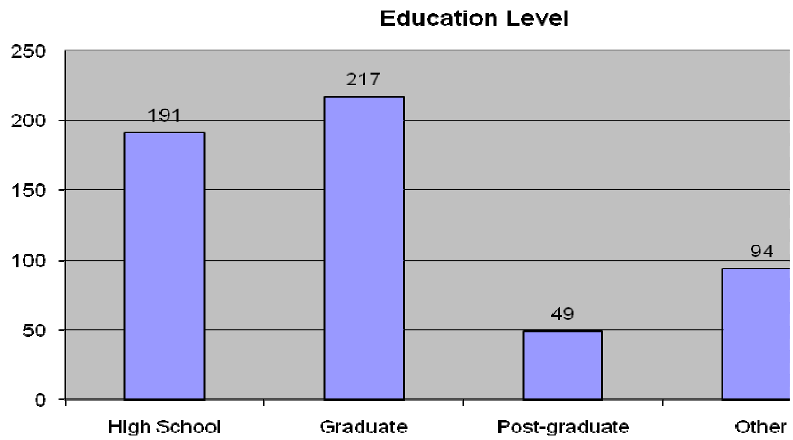
The participants who used the adult's questionnaires regarding the Earthquake phenomenon and the Volcanic eruptions were: *NHMC and INGV*

The participants who used the children's questionnaires 8-13 years old, regarding the Earthquake phenomenon and the Volcanic eruptions were: *NHMC and INGV*

The participant who used the children's questionnaire graph for children 6-7 years old, regarding only the Earthquake phenomenon was the *NHMC.*

Overall, the number of the respondents was 1449 from all four countries; of these, 567 were adults, 833 children 8-13 years old, 47 children 6-7 years old and 2 were children with moving disorders.

The educational level of the adult responders was also an issue of research.



Analysis of the questionnaire was divided into three main themes (categories), so that real needs can be identified and supported through education, awareness and knowledge of these phenomena. The categories are: 1. *Technical/Academic knowledge*, 2. *Behavior*, and 3. *Psychology*.

2. Technical/Academic knowledge

The Technical questions were related to the scientific knowledge that the broad public (adults and children) might have on these natural phenomena. These questions are important for one simple reason. We mainly produce the possibility to create educational practices, regarding these natural disasters, according to the deficiencies in the basic knowledge that has to be covered in order for people to understand the natural processes and protect themselves from their consequences.

At first, questions had to combine simple knowledge with experience, without assumption that everyone knows what these phenomena are or how they affect human lives. So, the questionnaires both for adults and children begin with the simple question: *"Are you aware of the earthquake phenomenon? Do you have personal experience? " or "What is a volcanic eruption?"*.

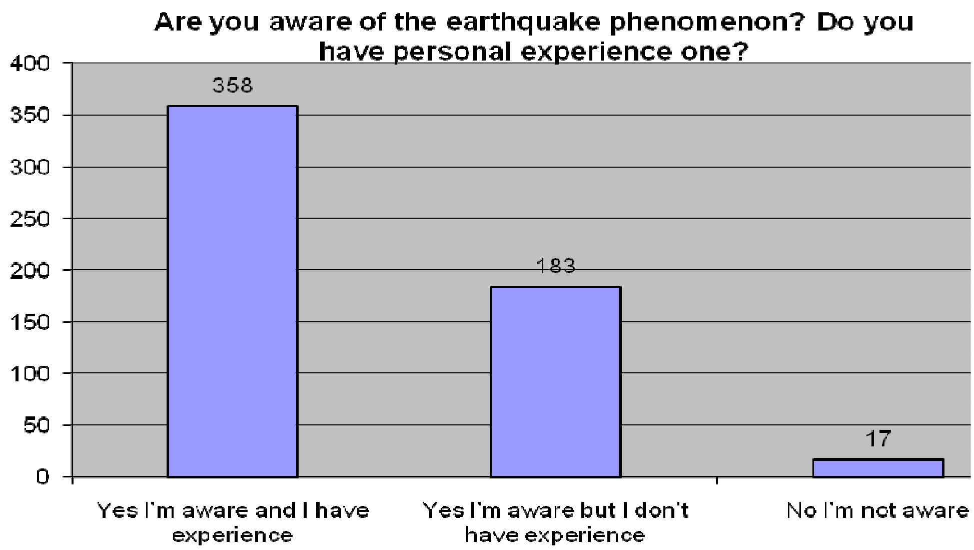
2.1 Adults – Earthquakes

The questions regarding the scientific knowledge are presented below.

<u>*Questions regarding seismic activity:*</u>

1. *Do you know what the Richter scale measures?*
2. *Do you know what causes an earthquake?*
3. *Do you believe that scientists can predict an earthquake or prevent its effects?*
4. *Do you know which the European Emergency Number is?*

Processing the completed questionnaires, it is realised that almost every citizen from all participant countries does know the earthquake phenomenon and most of them have a personal experience.



Graph 1

Of course the percentages in Greece and Italy, which are more active in such phenomena, were really high (average 80%), unlike France and Bulgaria where people that know about natural phenomena and have an experience are less, 62% and 66% respectively. Table 1 shows the difference between a seismic country, Greece, and a not seismic one, France.

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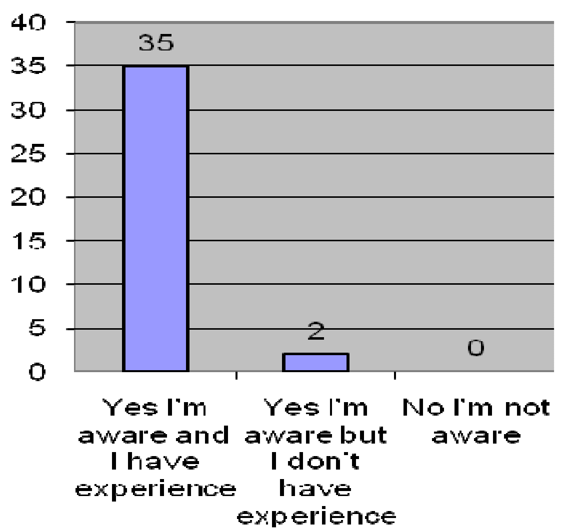
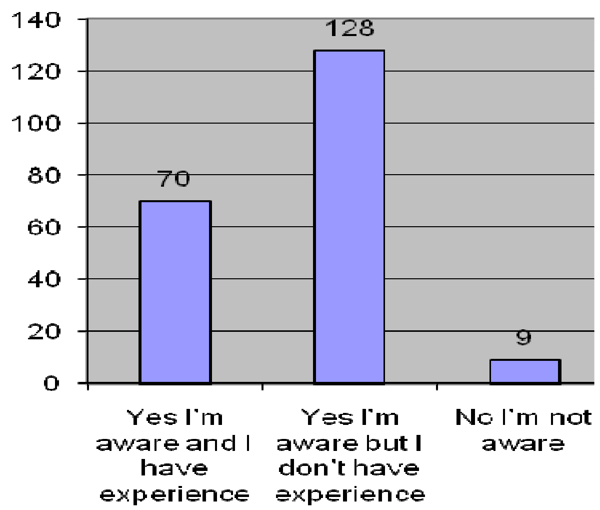
<tr><th>Crete – Greece</th><th>Reserve – France</th></tr>
<tr><td>
</td><td>
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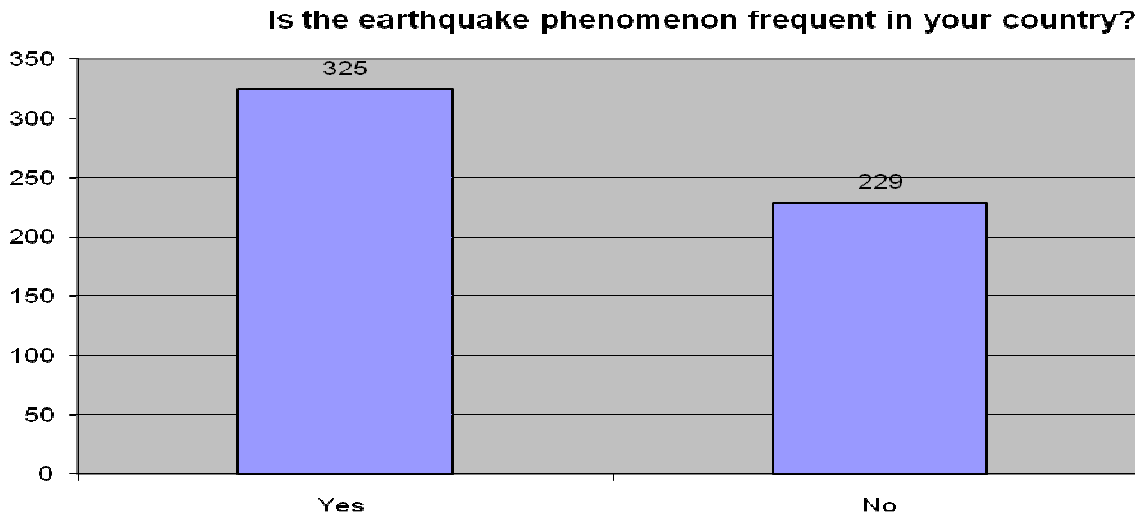
Table 1

Graph 2 presents the percentages of responders that come from a seismic country. It should be underlined that the number of the responders in each country was not equal. Specifically, the number of questionnaires for each country was: 50 for Bulgaria, 196 for Greece, 106 for Italy and 207 for France. Even though the participant countries are four, only two of them are strongly seismic and have volcanic activity.



Graph 2

As it is presented in Table 2, where two seismic areas are presented (Lesvos and Vesuvius), most responders acknowledge the fact that they live in a high risk location, but still there is a percentage that needs to be aware of that in order to take the appropriate measures to reduce the negative effects in case of a natural disaster.

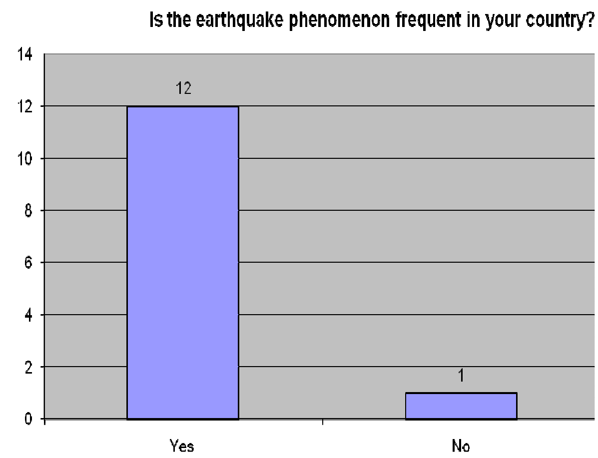
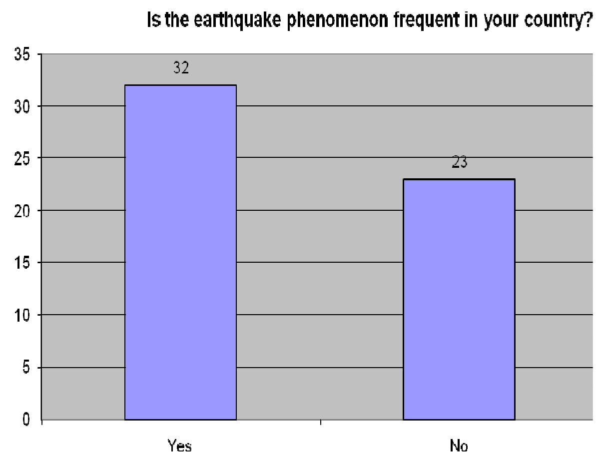
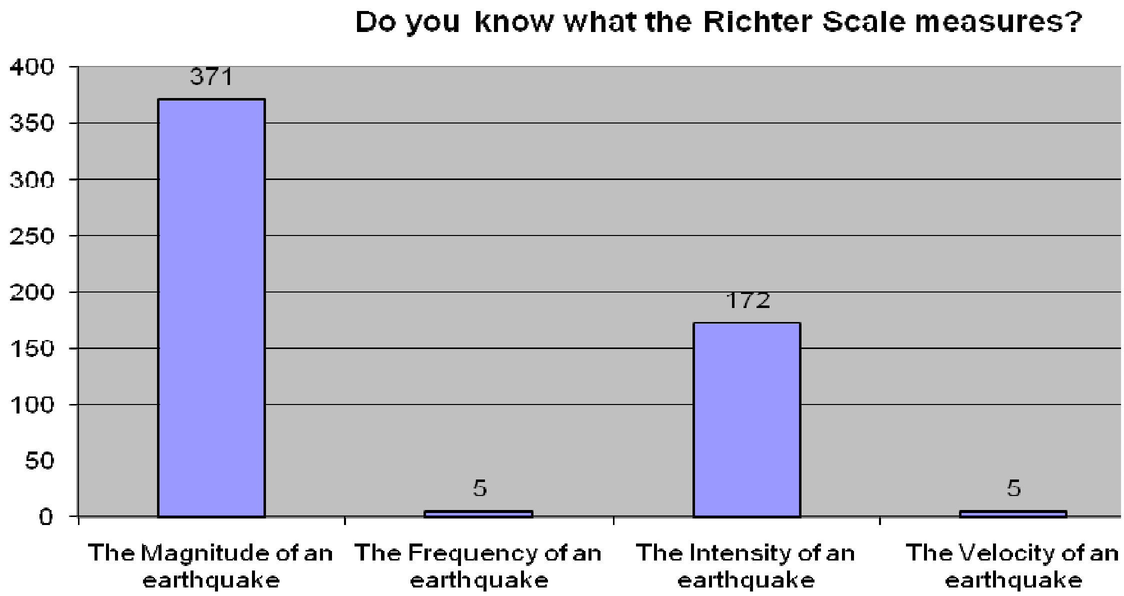
Lesvos – Greece	***Vesuvius – Italy***
	

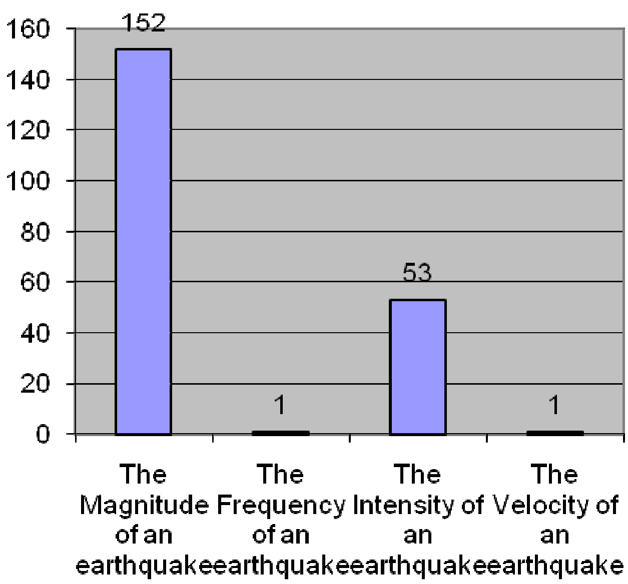
Table 2

Regarding the first question, most adults claim to know what the Richter scale measures (*Graph 3*). But the percentages were not that high concerning the correct answer. Only half of the responders have this knowledge about the earthquake phenomenon and realize how it is developed. The unexpected data collected, regarding this question, is that in France and Bulgaria, which are countries not familiar with such phenomena, people were more informed about the Richter scale, in contradiction with the countries were the earthquake phenomenon is more frequent (Greece, Italy). The percentage for these countries (France, Bulgaria) is 73 and 74% respectively, but on the other hand the percentage for Greece and Italy is very low, if we consider the frequency of the phenomenon, 50-60% (*Table 3*).



Graph 3

Reserve – France



Athens – Greece

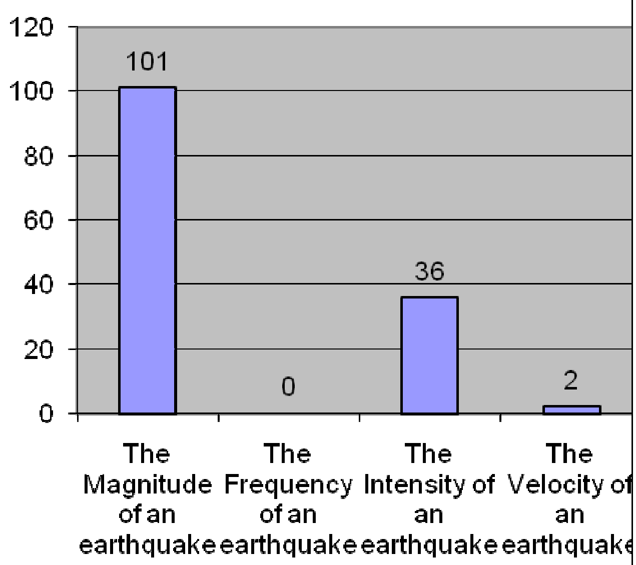
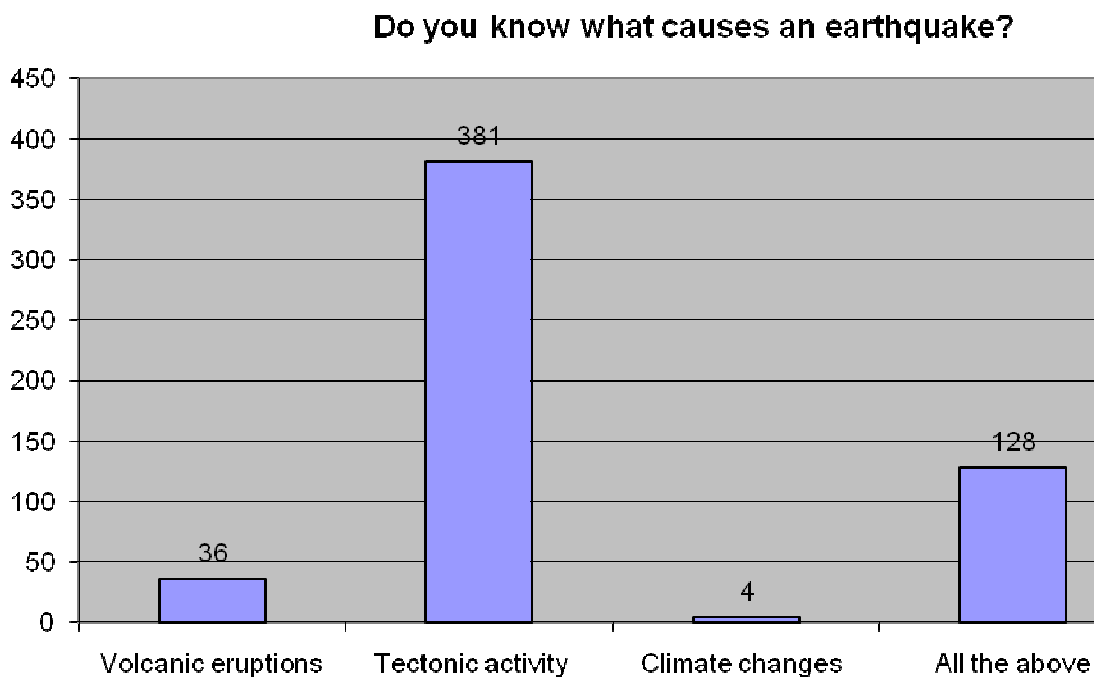


Table 3

Regarding the reasons for which an earthquake occurs (question 2), again the percentage for the right answer in France is really high, 89% (*Table 4*), considering the relation of the citizens with this phenomenon. In Greece the percentages are lower, but there are differences between the areas of the country. More specificaly, in Athens the percentage of responders that have the knowledge about the causes of an earthquake is really low (*Table 4*), only 44%, which is not logical since many times the earthquake phenomenon has caused catastrophic damages in the particular area. In Lesvos, again we have a really low percentage, 58%, considering the history that this Island has concerning earthquakes and volcano eruptions. In Crete, the percentage goes up to 79%. The result was expected because Crete is a really seismic Island and the citizens are really familiar with the phenomenon. So, there is diversity in Greece among the concerned areas which need to be taken under consideration. The Italians have shown that their majority is informed on the causes of earthquakes, but the percentages are not as high as they should be in a seismic country. More specifically, the percentage is higher in Vesuvius (79%) than in Montesca (62%). Of course, most answers relate to tectonic movements and it is clear that most responders do not know that there are more causes that produce an earthquake.



Graph 4

Reserve – France	Athens – Greece

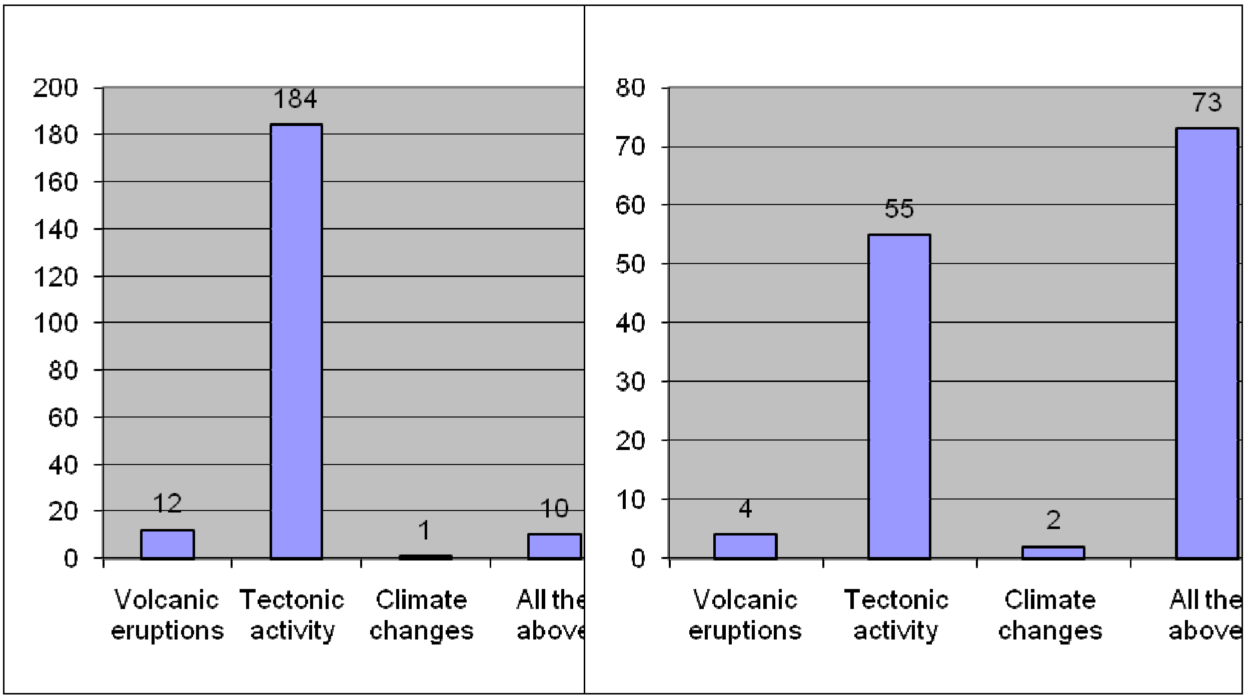
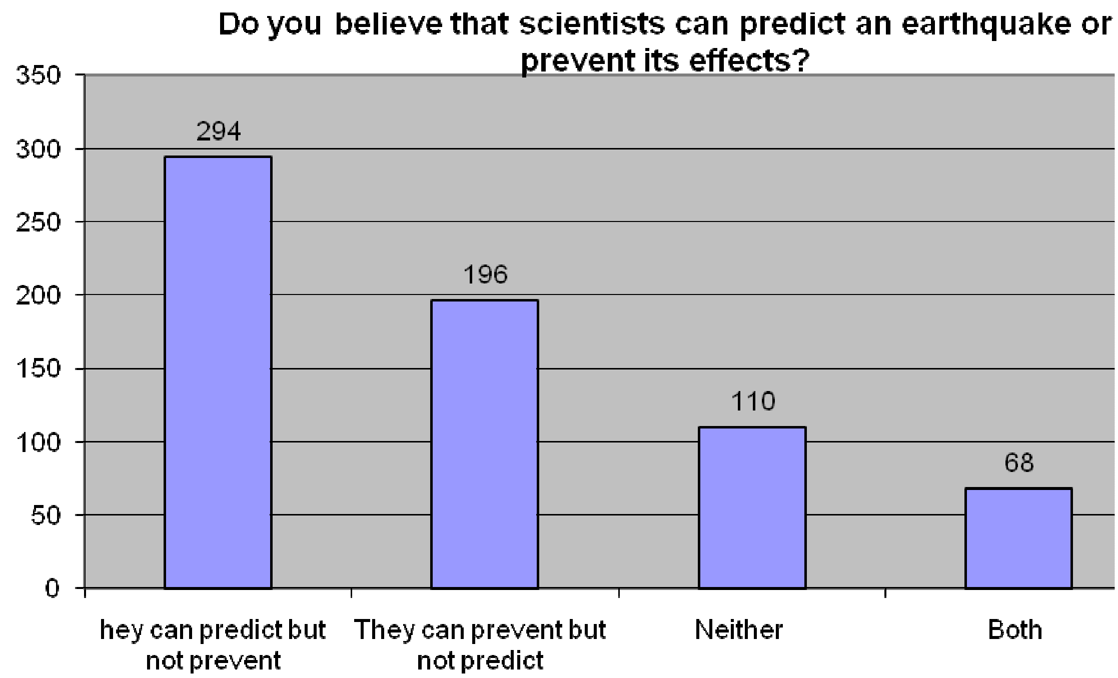


Table 4

In relation to the prediction and the prevention, the responds are not that clear. Many people confuse the meaning of the terms and what scientists are able to do. Most of the responders suppose that the prediction of an earthquake is possible but there is no way that we can prevent the consequences of catastrophic phenomena like earthquakes and volcano eruptions. This is untrue, since the prediction of the exact moment when an earthquake will occur is impossible. But, on the other hand, the scientists with the help of the community can minimize the hard consequences, just by being prepared, taking the right measures for the structured environment and educating people for the suitable behavior in order to avoid getting harmed. A small difference appears in Crete especially, where there is a 37% of the correct answer. An exception is the area of Montesca in Italy, where the correct answer reaches 50% (*Table 5*), which is satisfying compared to the other seismic areas participating.



Graph 5

Montesca – Italy

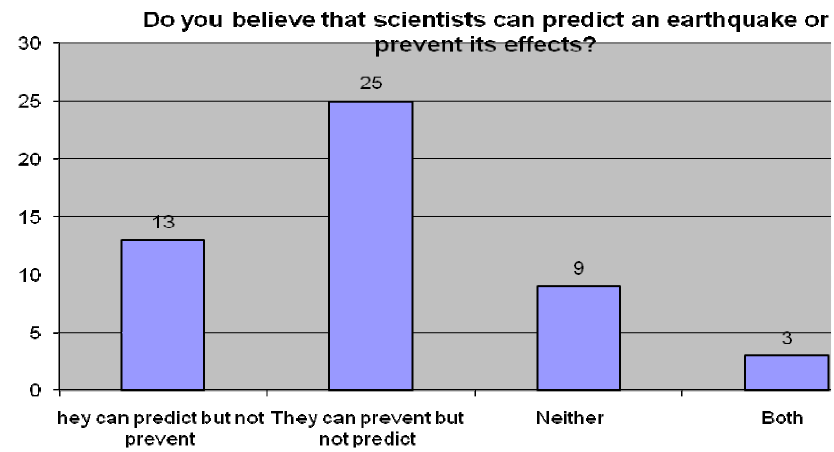
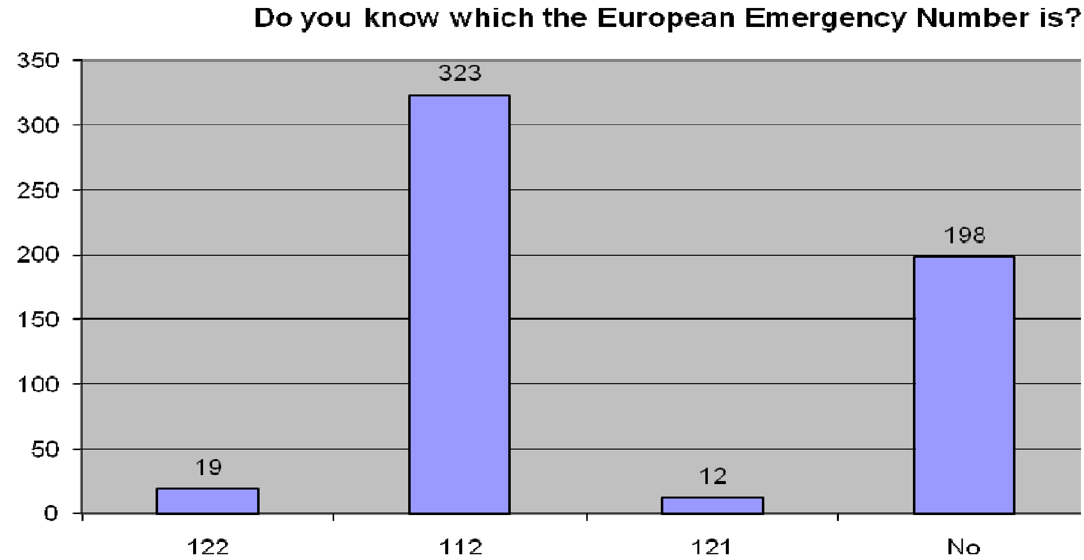


Table 5

The really curious thing about the European emergency number, 112, is that since the technology is so advanced and almost everyone has access to this kind of information, the percentage for the correct response was not as high as it was expected. As shown in Graph 6, there is a respective percentage that is not aware of the emergency number.



Graph 6

More analytically, in each case, most responders gave a wrong answer or a negative one as it is shown in Table 6. An exception to that is France, where most people gave the correct answer, but also there was a notable percentage which responded negatively in this question.

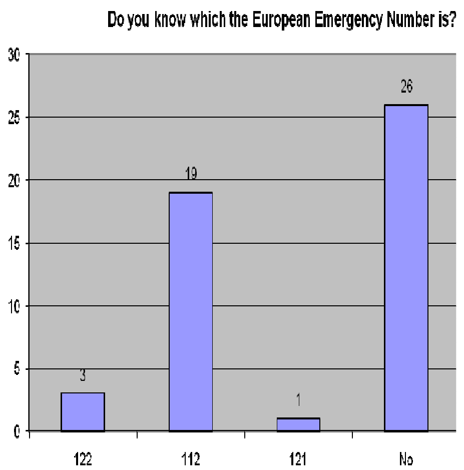
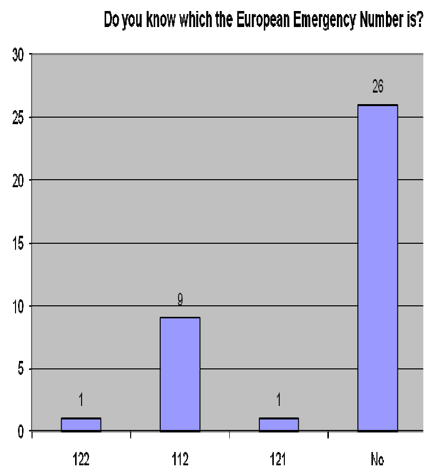
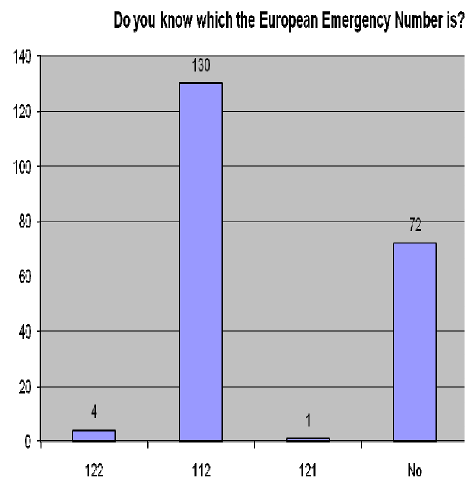
Montesca-Italy	***Crete-Greece***	***Reserve-France***
		

Table 6

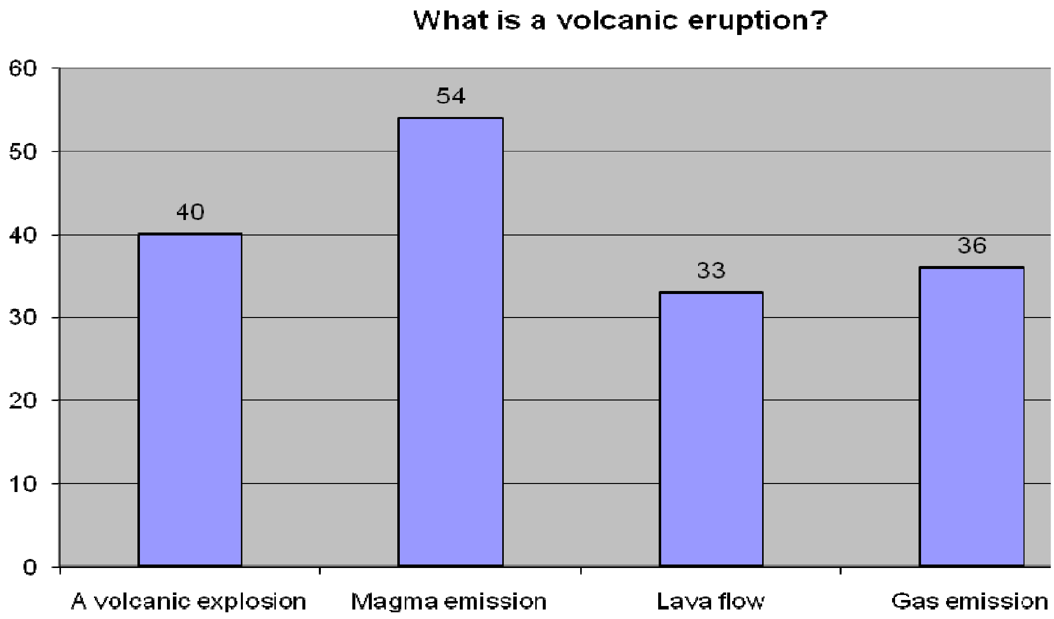
2.2 Adults – Volcanoes

<u>Questions regarding volcanic activity:</u>

1. *What is a volcanic eruption?*
2. *A volcanic eruption happens because?*
3. *A volcanic eruption is dangerous because?*
4. *Can scientists forecast a volcanic eruption?*

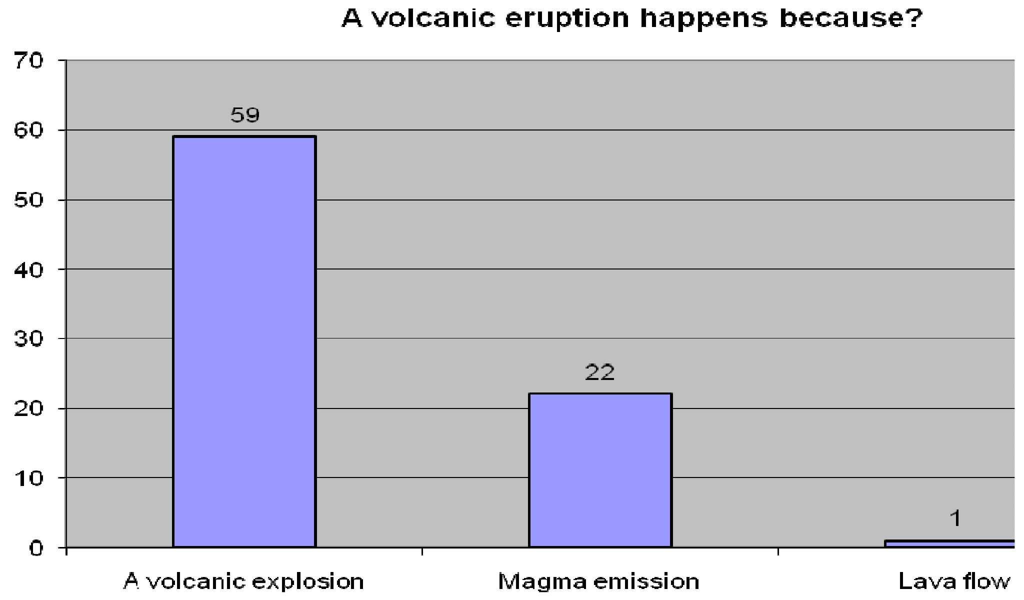
Questions related to volcanic activity and eruptions are really important not only because volcanic eruptions are earthquake-generating mechanisms, but also because the protection measures from volcanic eruption are different from those for earthquakes.

Questionnaires for Volcanoes were implemented only from two of the participants, Vesuvius-Italy and Crete-Greece. These two countries are more concerned with volcanic activity and already have a long history of volcanic impacts in the past.



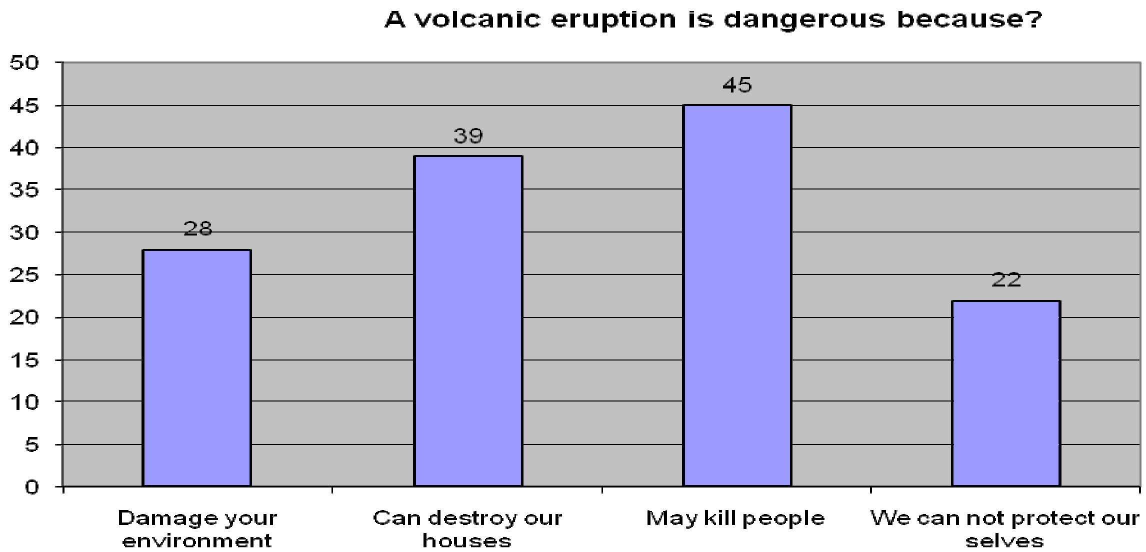
Graph 7

Although most people do not have an experience for such an eruption, they are aware of the causes (*Graph 7*). In addition, the responders are informed of the phenomenon but the percentage that gave the right answer is 71% (*Graph 8*). The participant area that is more concerned with this phenomenon is Vesuvius, where they have the actual possibilty of a volcanic eruption and it is really substancial to inform and educate citizens.



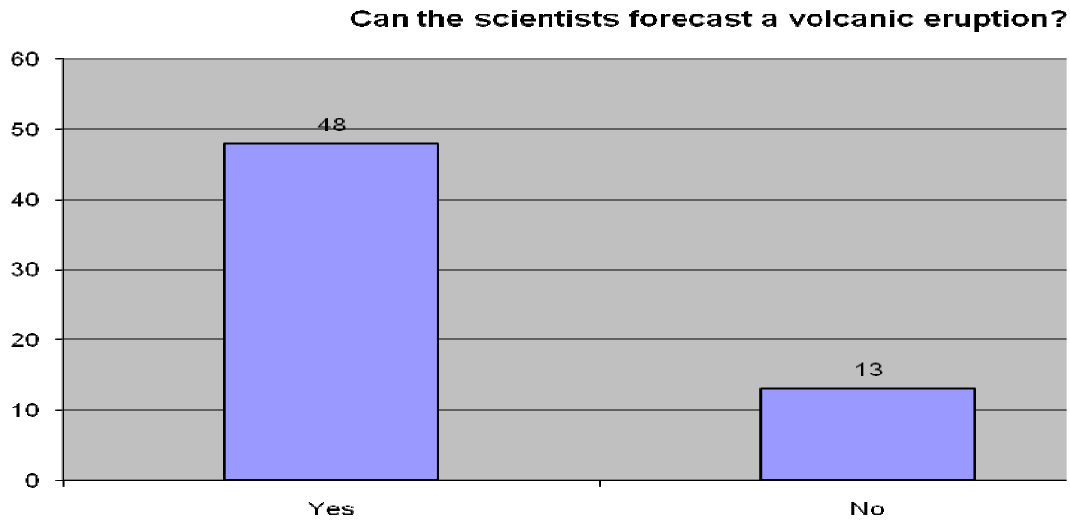
Graph 8

Responders from both countries are aware of the risks and the hazards when it comes to volcanoes. Graph 9 presents an overview of the responses on what makes a volcano dangerous.



Graph 9

Concerning volcanoes, the predictions are more possible in contrast to earthquakes. So the responders are better informed in this case and the Graph 10 shows that most of them believe that scientist are able to forecast a volcanic eruption. Though, it should be taken into account at all times that most responders come from a really active volcanic area.



Graph 10

Table 7 is given in order to identify that the responders that support that scientists cannot forecast a volcanic eruption are only from the area of Vesuvius which is unexpected since it is a really volcanic active area.

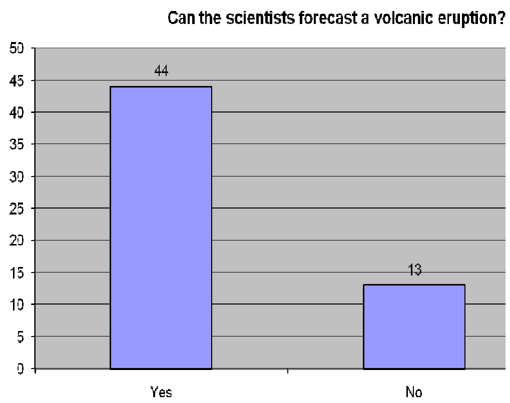
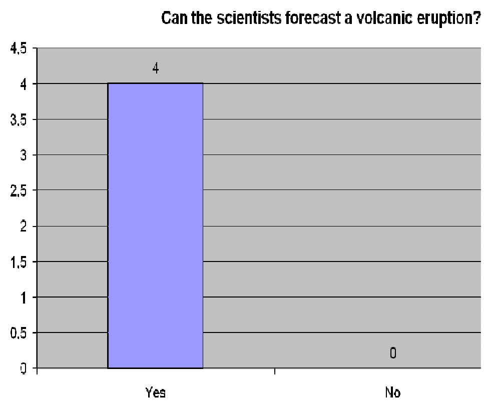
Vesuvious – Italy	***Crete – Greece***
	

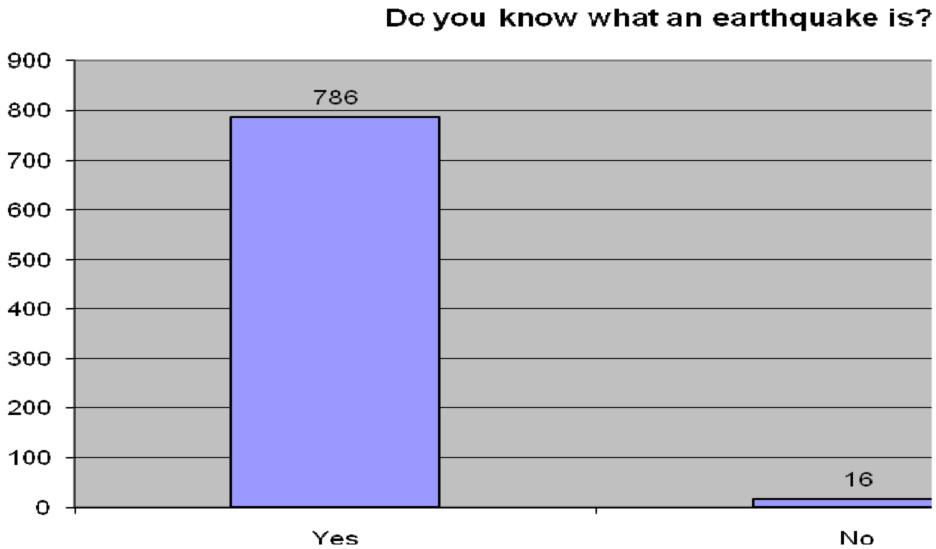
Table 7

2.3 Children - Earthquakes

Respectively, the questions asked to children were:

1. *Do you know what an earthquake is?*
2. *Do you know why earthquakes happen?*
3. *Have you ever felt an earthquake?*
4. *Do you believe that scientists can predict an earthquake or prevent its effects?*

When it comes to children, there is no difference among the countries. All children at the age of 8-13 years know the earthquake phenomenon (all percentages for the positive answer are more than 96%, graph 11). The reason probably is that children at that age are educated in school about the natural phenomena, even when their country is not active in such phenomena, like Bulgaria. However, regarding the experience the answers are distinctively different between the countries.



Graph 11

The following Table 8 shows that there is no difference between a seismic and a not seismic area regarding the knowledge that children have concerning earthquakes.

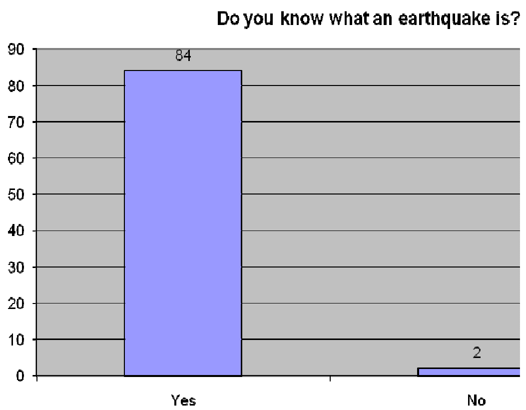
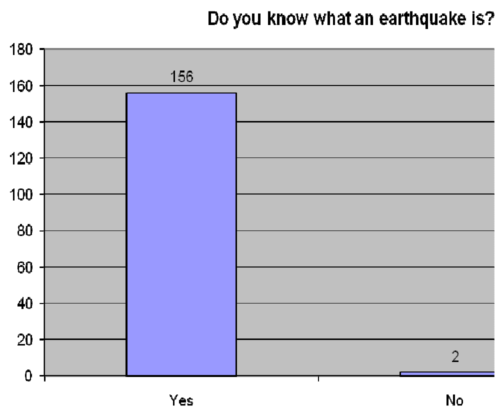
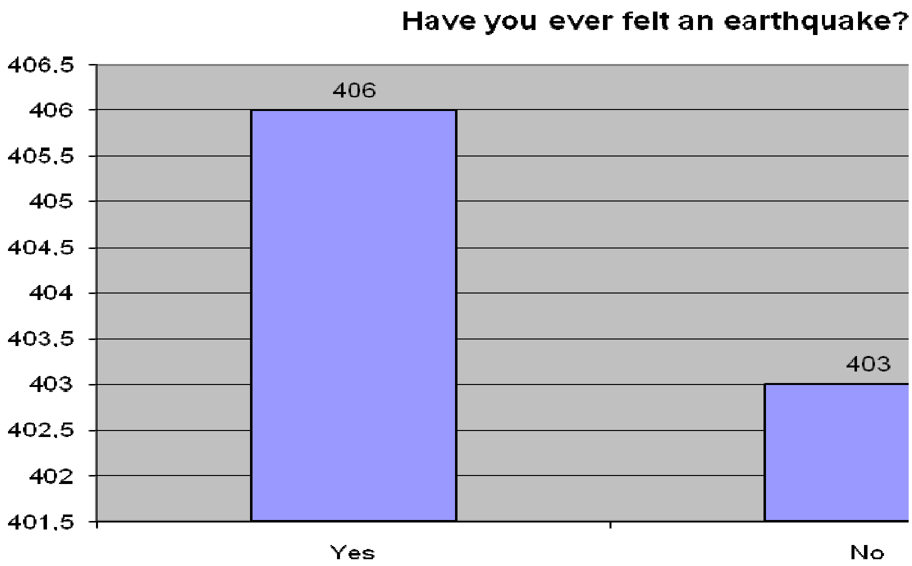
CEI – Bulgaria	***Lesvos – Greece***
	

Table 8

As it was expected, in Greece the percentage of the responders that have experienced such a phenomenon is pretty high, 76% in Lesvos and 94% in Crete. In Italy, also a seismic country, children that have experienced an earthquake are less than in Greece, only 45% and 60% in Vesuvius and Montesca respectively. Not surprisingly, in France almost every child has never felt an earthquake, since 92% respond negative, and in Bulgaria most of them (62%) have also never felt an earthquake.



Graph 12

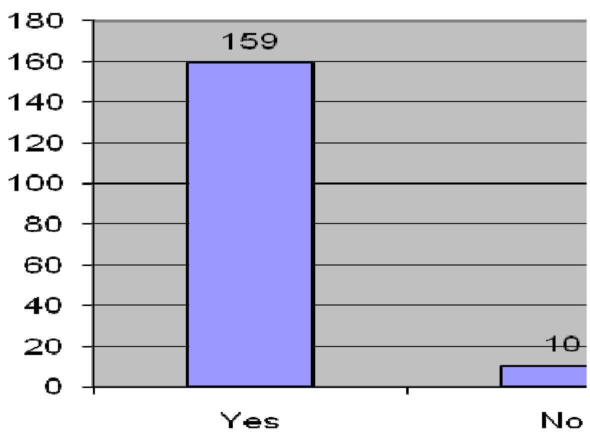
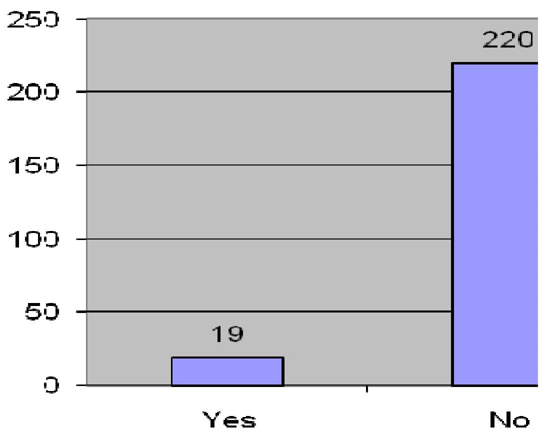
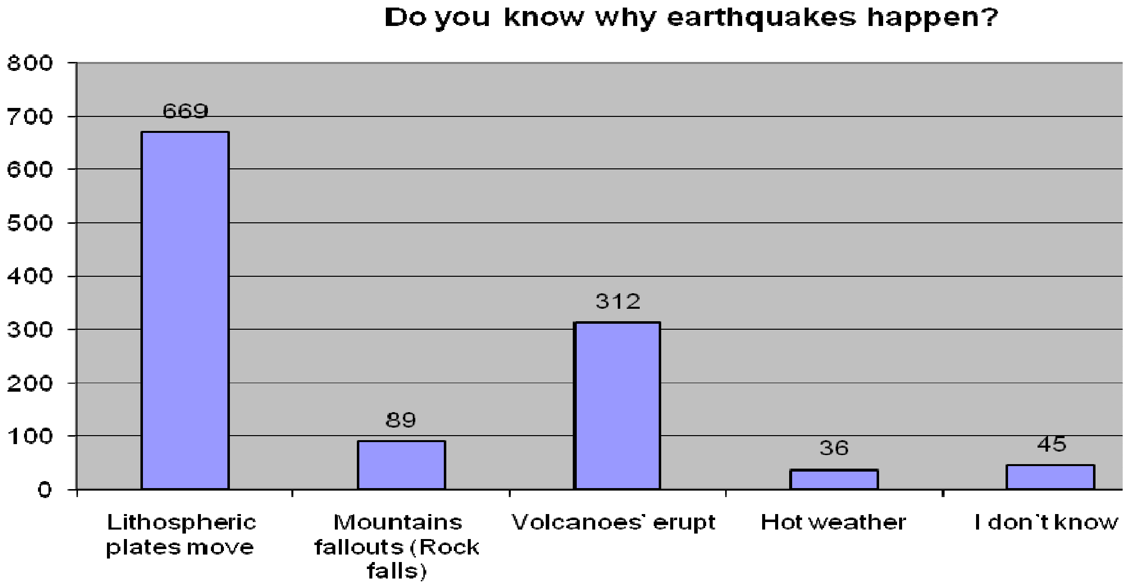
Crete – Greece	***Reserve – France***
	

Table 9

It is really promising that children in that age have the knowledge for the causes of an earthquake. The responses are almost all correct. The children correctly recognize the movement of the lithospheric plates and the eruption of volcanoes as the two basic reasons that produce an earthquake (graph 13). The percentages for these two answers are all over 82%, except in France, where there is a decrease, 76%, which is also really high.



Graph 13

Compared to adults, children make the same mistake of thinking that scientists can predict earthquakes, but cannot protect us from its consequences (graph 14). This has a basis because, first of all, children learn what adults teach them and, additionally, children are more inexperienced and for that they cannot make the simple thought that if we could predict the earthquakes it would be easier to protect ourselves.

Graph 14

On Table 10 it is shown that even in each participant's area indepedently, most children believe that scientists can predict but not prevent; in Lesvos there is a small precentage that supports the reality, preventing and not predecting, which show that these kind of information is rather widespread there, in contradiction with Bulgaria (not a seismic area) where only 6 children from a total of 86 children gave the right answer.

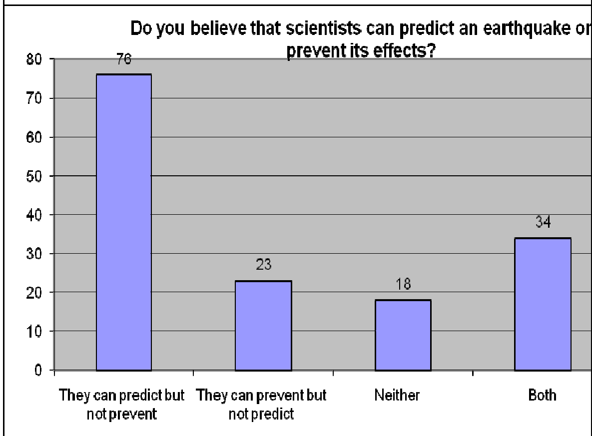
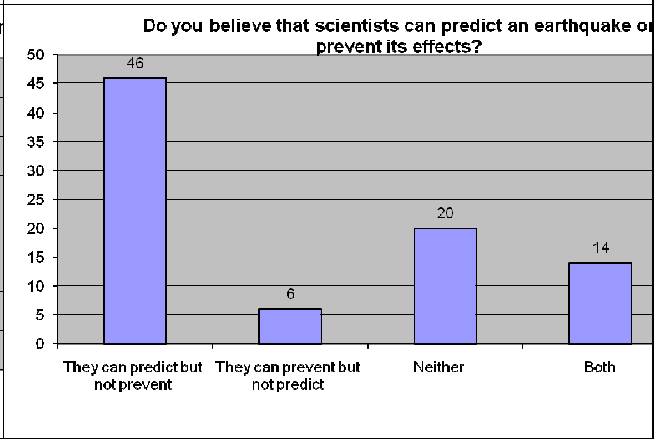
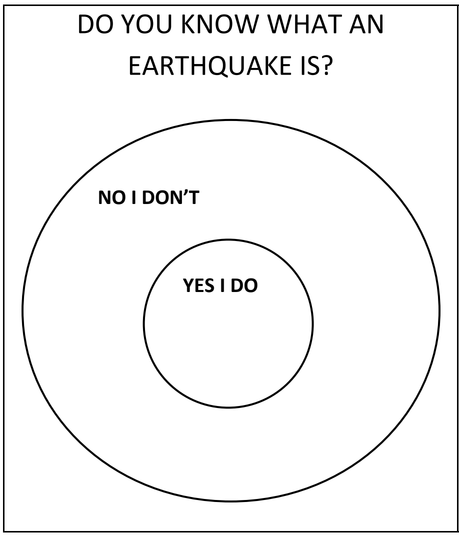
<table>
<tr><th>Lesvos – Greece</th><th>CEI – Bulgaria</th></tr>
<tr><td>
</td><td>
</td></tr>
</table>

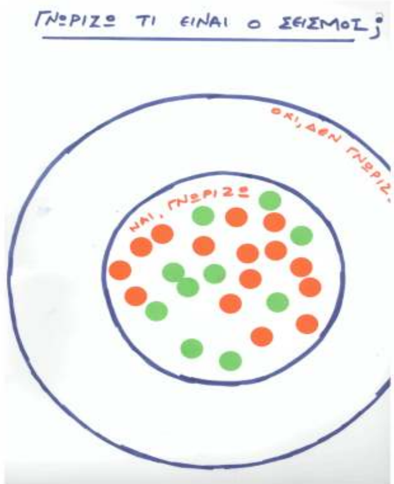
Table 10

Children 6-7 years old – Earthquakes

As it was mentioned, there was a different approach for children of the age of 6-7 years. The children had to choose the right cycle which represented an answer for the question above. Boys gave their answer with a green sticker and girls with an orange one.

The figure below shows that even children of that age have an idea of what an earthquake is. Of course that can not be taken for granded for all countries, because the specific approach was implemented only in Crete – Greece, where children are already familiar with the phenomenon.



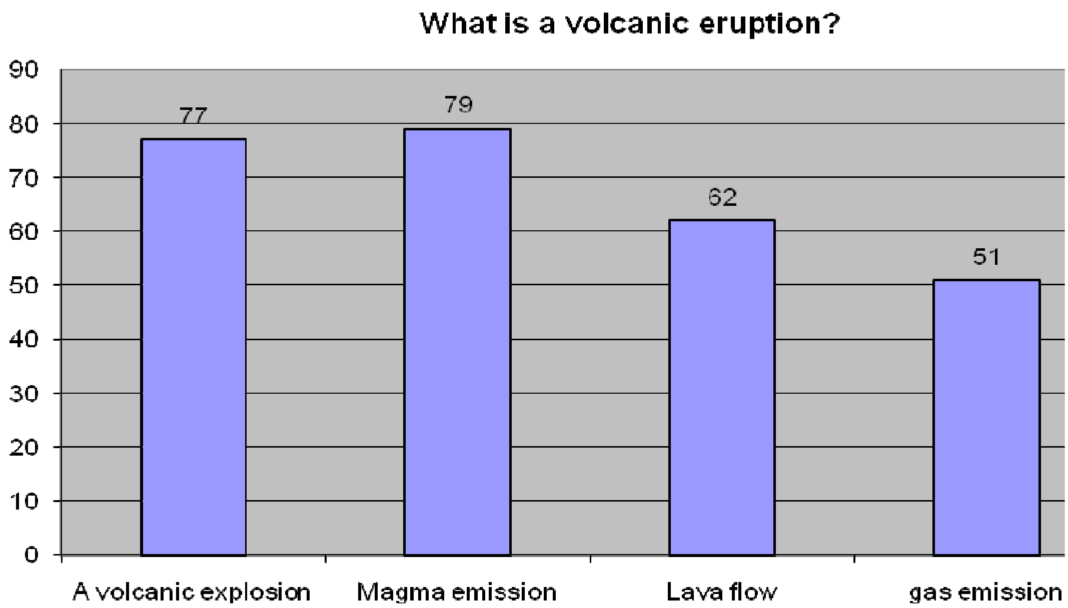


2.4 Children – Volvanoes

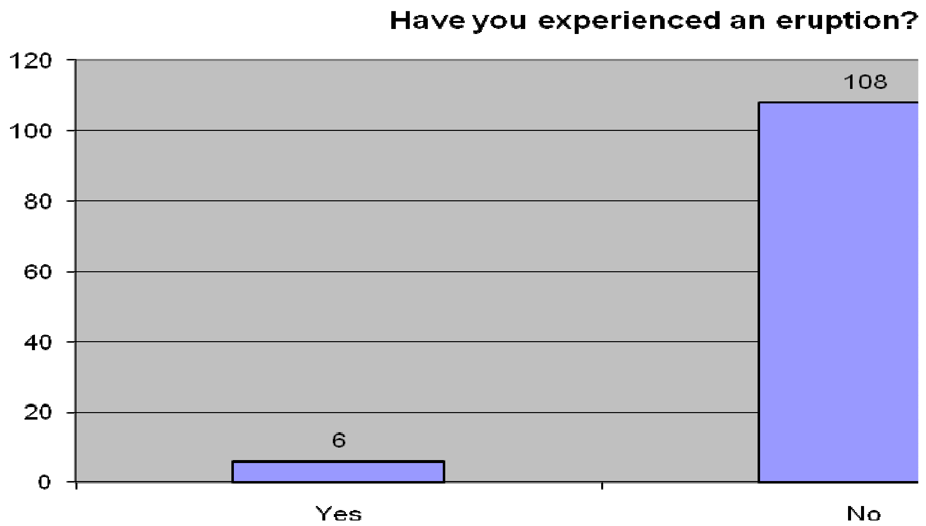
Respectively, the questions asked to children for volcanoes were:

1. *What is a volcanic eruption?*
2. *Have you experienced an eruption?*
3. *A volcanic eruption happens because?*
4. *A volcanic eruption is dangerous because?*

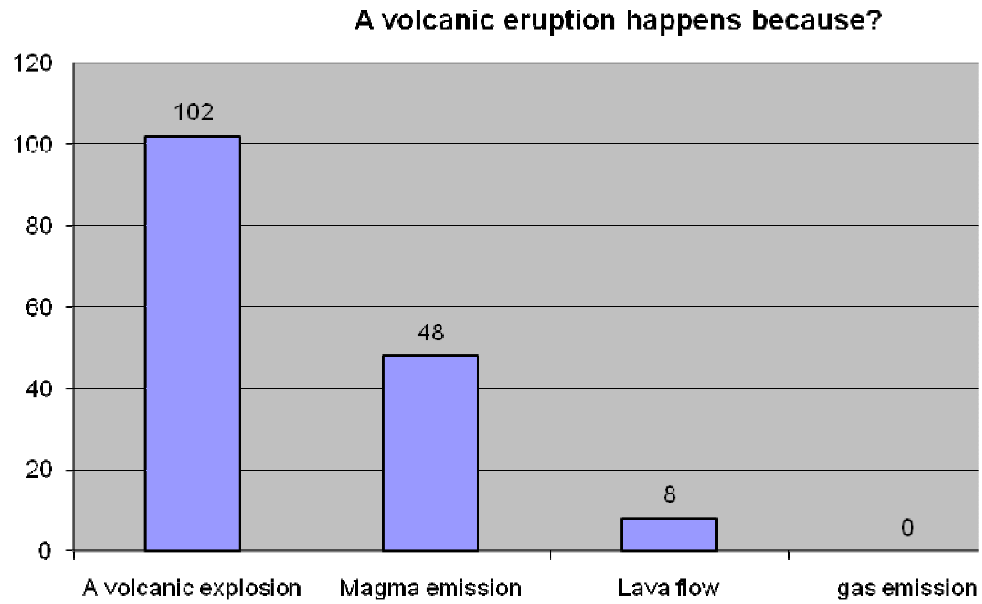
Children are more unexperienced (graph 16) than adults, but in contradiction to that, they do have the knowledge about this phenomenon. As it is presented in the graphs below, their responces are similar to those of the adults.



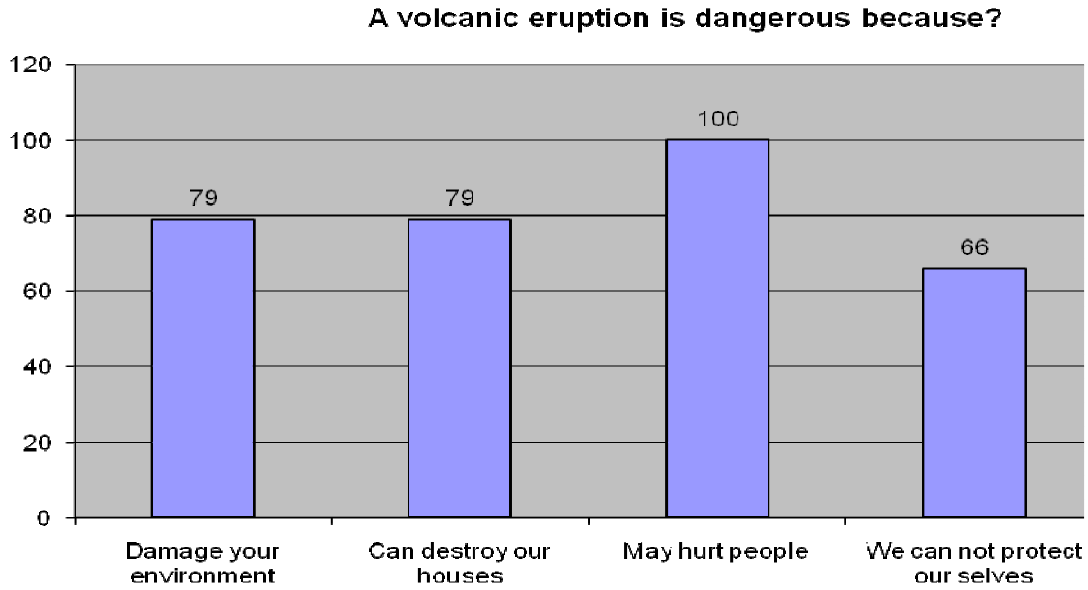
Graph 15



Graph 16



Graph 17



Graph 18

Children from different areas, Italy and Greece (table 11), gave quite similar responces and their main concern for Volcanoes is that people might get hurt. From thereafter they worry about the environment and buildings and the fact that we can not protect ourselves. The last one is a relly important observation because within Racce project this can be changed and people may understand the ways to protect themselves through additional actions.

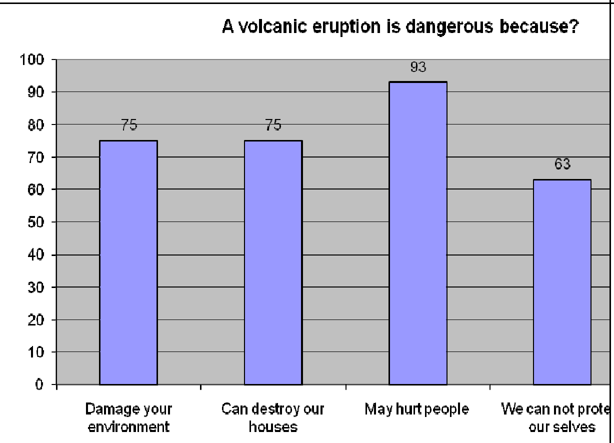
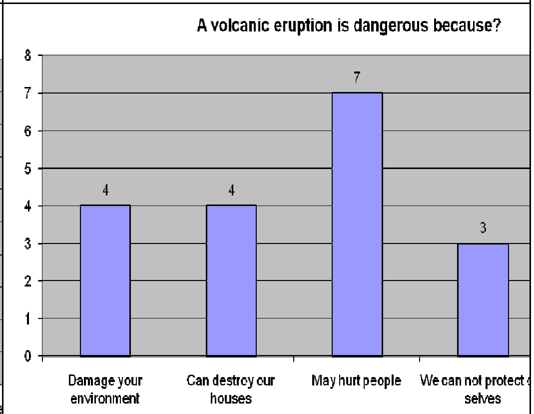
Vesuvius – Italy	***Crete – Greece***
	

Table 11

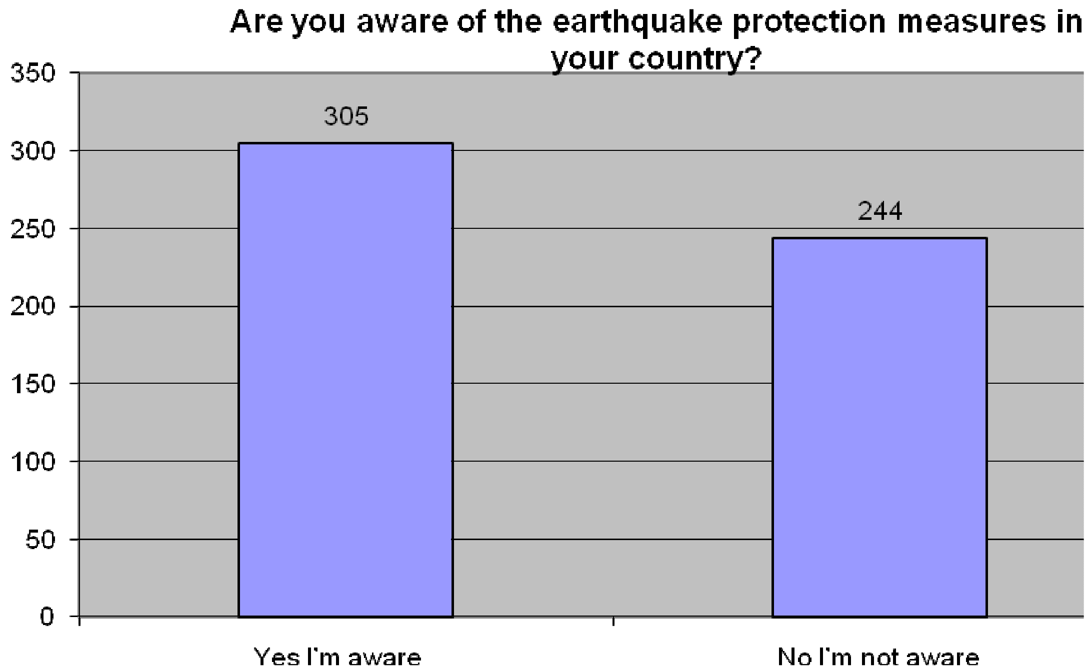
3. Behavior

3.1 Adults - Earthquakes

Respectively, the questions asked to adults were:

1. *Are you aware of the earthquake protection measures in your country? What are your main sources?*
2. *What prevention measures have you taken with your family in case of an earthquake?*
3. *What are you supposed to do after an earthquake outdoors?*

To protect ourselves we have to know and follow the protection measures of each country and behave accordingly. Still we do not have a uniform image for all participant countries regarding the knowledge of the suitable behavior in case of a natural disaster, as it is shown in graph 19.



Graph 19

Crete – Greece	*Lesvos – Greece*

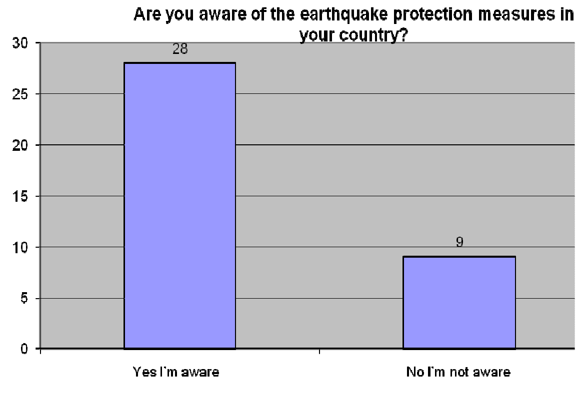
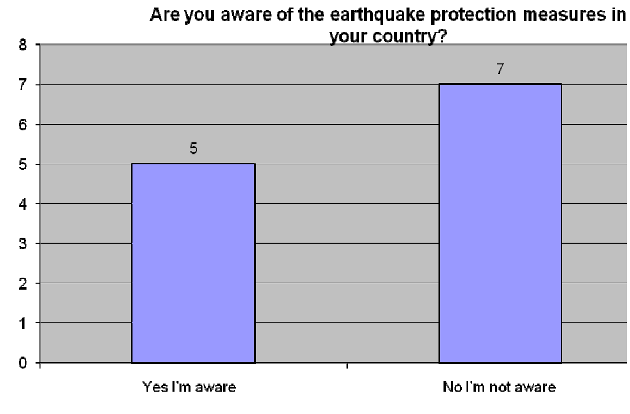
	

Table 12

Again in Greece, the most knowledgeable people were in Crete where the percentage was 77%, but in Lesvos and Athens was lower, 64% and 58% respectively. In France and Bulgaria the protection measures are a bit of a mystery, since only 35% and 56%, respectively, are aware of them. On the other hand, citizens in Italy are more informed on the protection measures, as 73% responded positively in Vesuvius and 84% in Montesca. Almost everyone was informed on the measures through the media. It is a surprise that in Athens the percentage is low, especially compared to Italy.

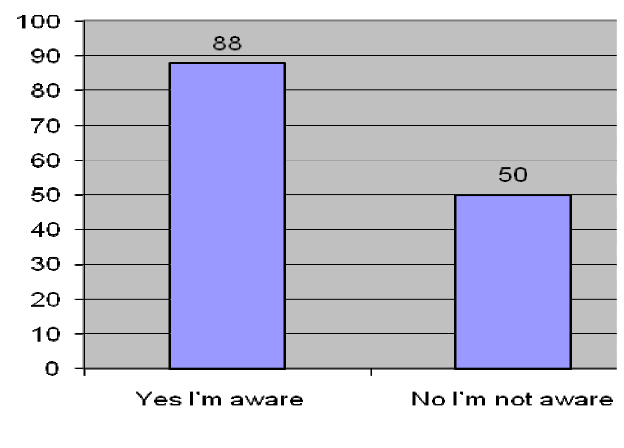
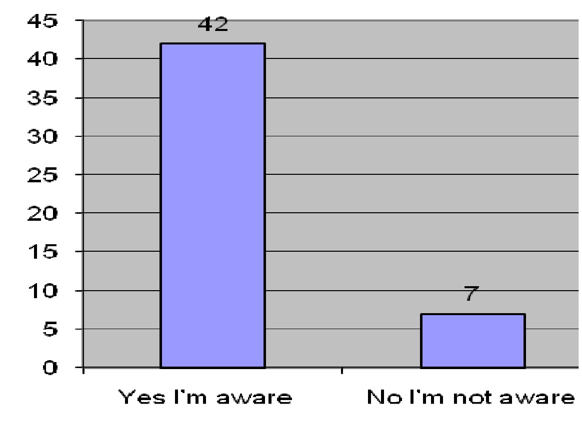
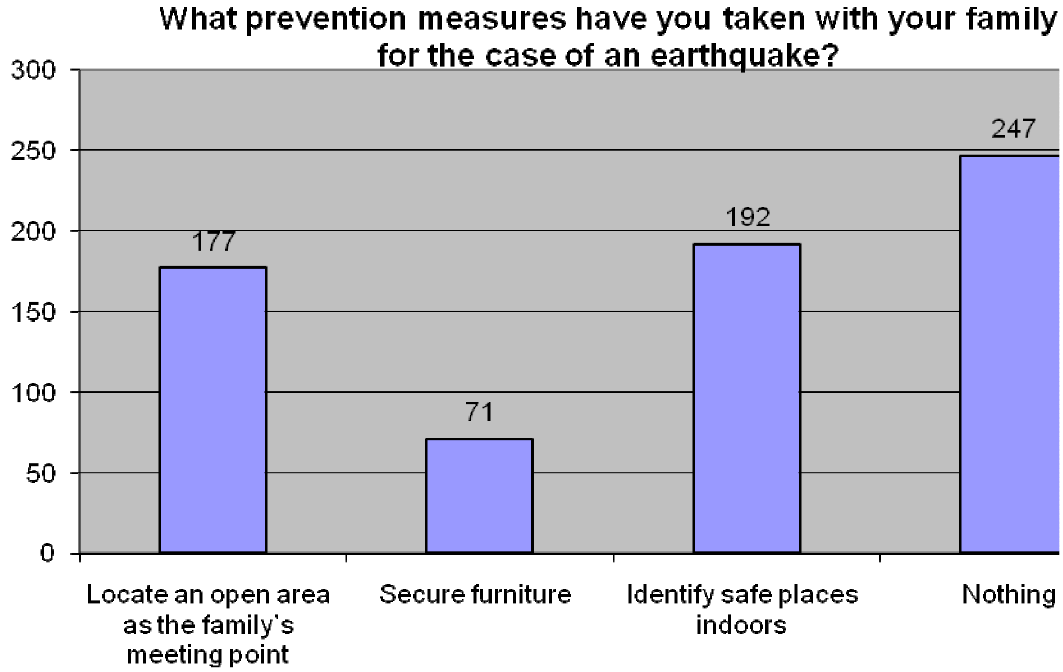
Athens – Greece	***Montesca – Italy***
	

Table 13

Excluding France and Bulgaria, most of the responders have done something to prepare themselves and their family (graph 20). Most of them have specified an open area to meet with their family or the safe places inside the house. But the percentage is still not that high if we consider the relation that Greece and Italy have with earthquakes and volcanoes. In Crete the responders are more prepared with a percentage of 72%. All others areas have percentages between 48 - 58%. In France, where these catastrophic phenomena never occur, it is reasonable that 80% have done nothing on these maters. In Bulgaria, the answers are more distributed (table 14), but the 56% of the responders have also done nothing on the preparation needed with their family!



Graph 20

Crete – Greece	***CEI – Bulgaria***

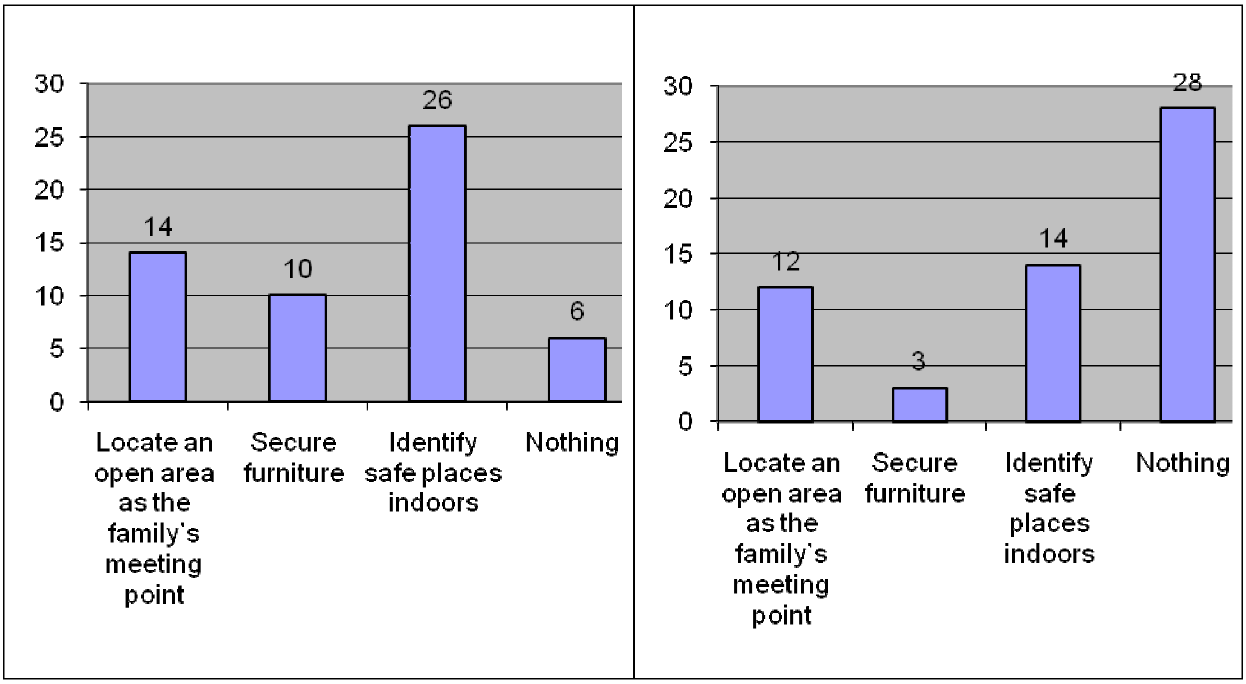
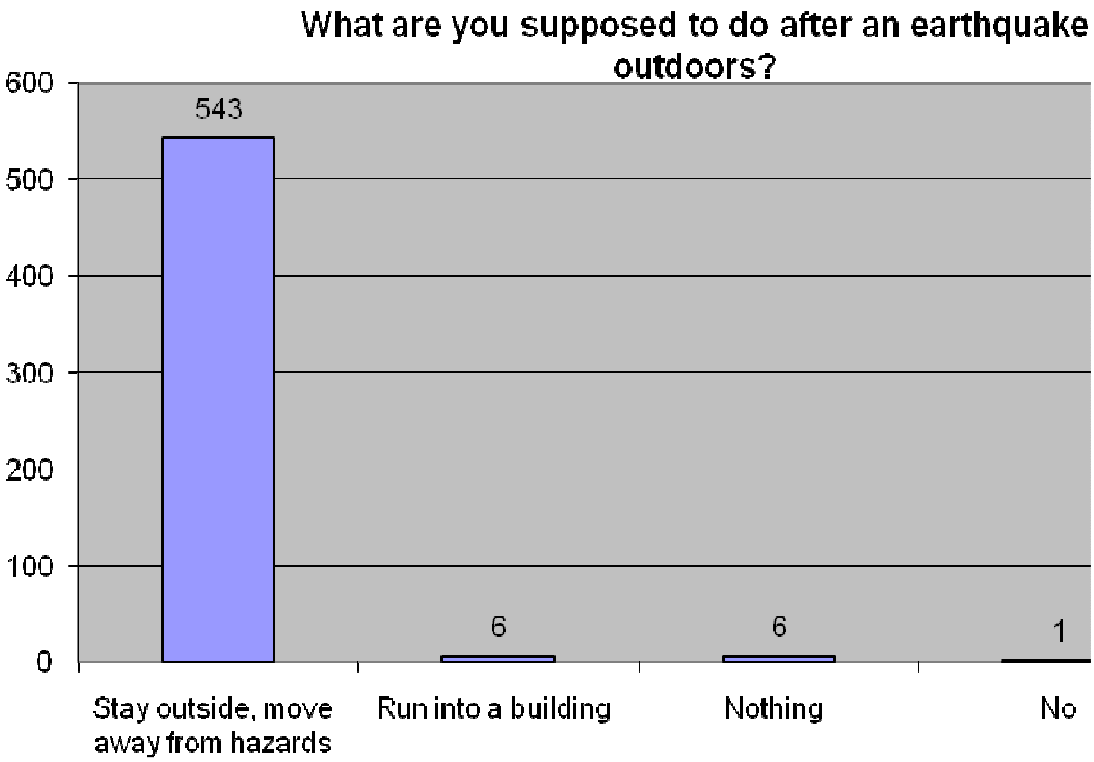


Table 14

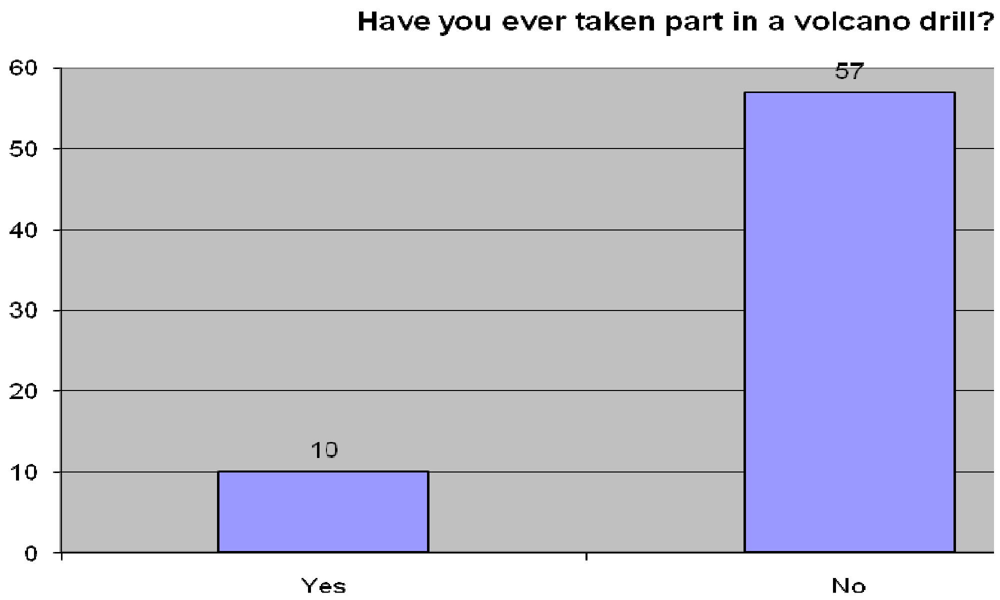
On the other hand, it is really important, regarding the behavior during the earthquake, that most of the responders in all countries do know what they are supposed to do. All percentages concerning the right answers are more than 92% (graph 21).



Graph 21

3.2 Adults – volcanoes

Apart from the theoretical background, to practice and be prepared for the right behaviour is really essential. So in order to specify the experience that responders have when it comes to volcanoes the following question was included in the questionnaires: "*Have you ever taken part in a volcano drill?*"



Graph 22

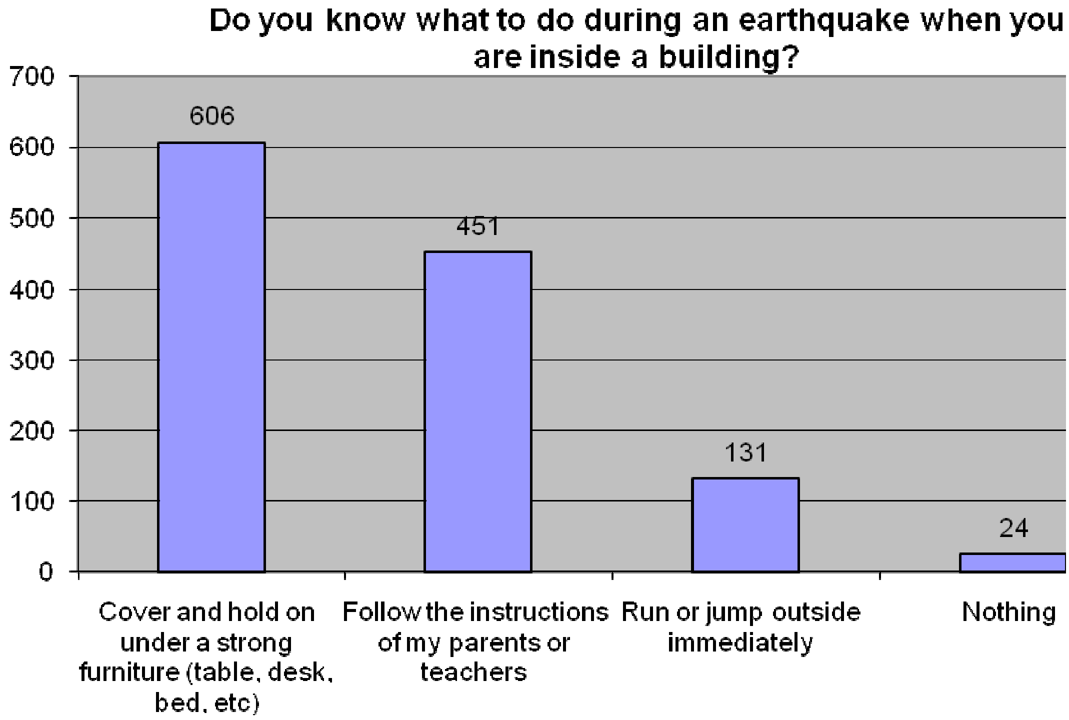
From the graph 22 it is obvious that most of them do not have experience on volcano drills, which is really expected because there in not too much attention paid to volcanic risk.

Particularly, in the area of Vesuvius, with intense volcanic activity, people should be aware and prepared in case of a volcanic eruption and this is a mater of great importance.

3.3 Children – earthquakes

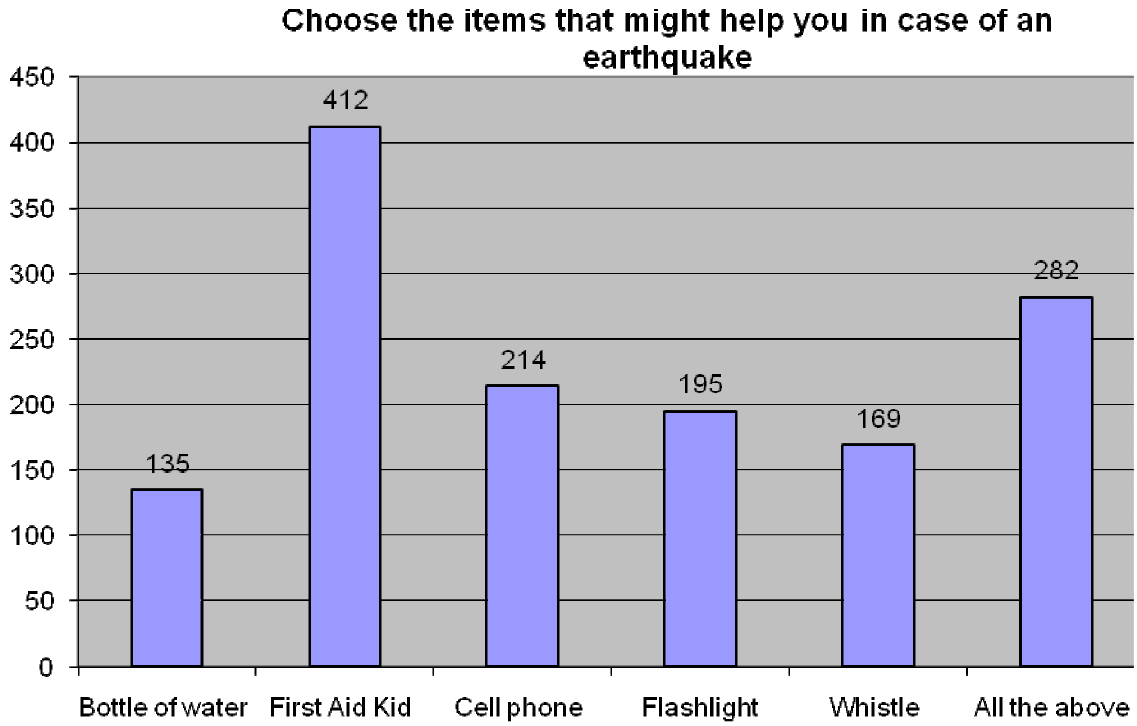
1. *Do you know what to do during an earthquake when you are inside a building?*
2. *Choose the items that might help you in case of an earthquake.*
3. *Do you know why we have to protect ourselves when an earthquake happens?*
4. *Have you ever taken part in earthquake drill at school?*

Children are also informed of the right behavior during an earthquake and that is really promising. Greece and Italy have really high percentages, over 78% know what to do. The same apply for France and Bulgaria.



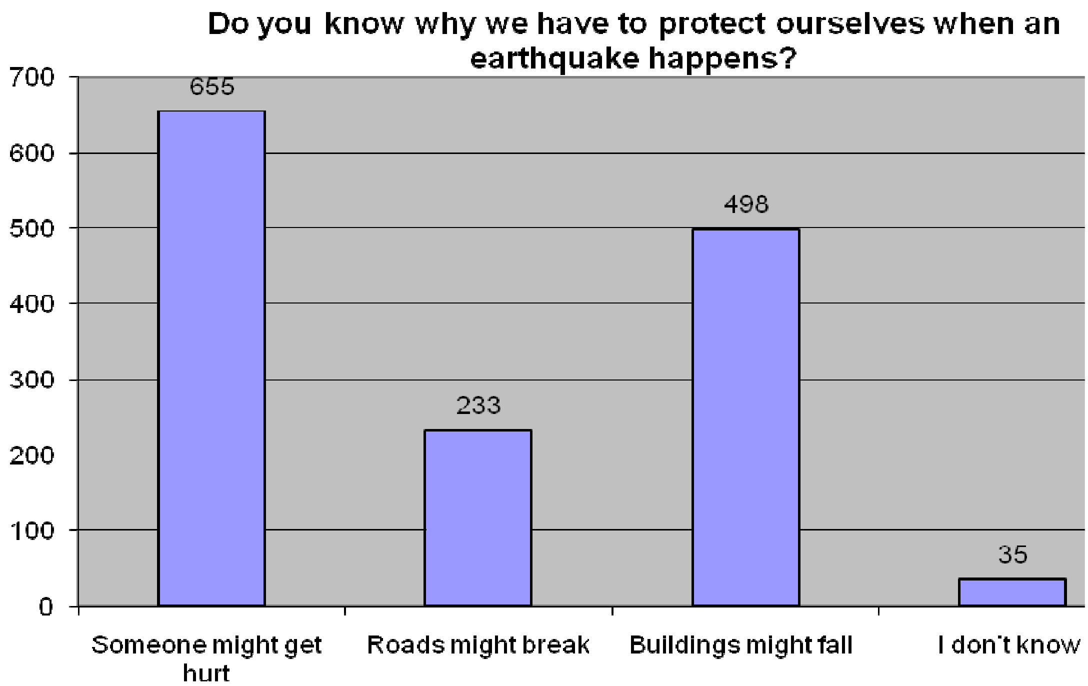
Graph 23

Regarding the question about the necessary items that will help in case of an earthquake, children need to clear up that there is more than one thing that we can and should use for our safety. They had the option to choose more than one item but those that just chose one and mostly the first aid kit are almost half of the responders (graph 24).

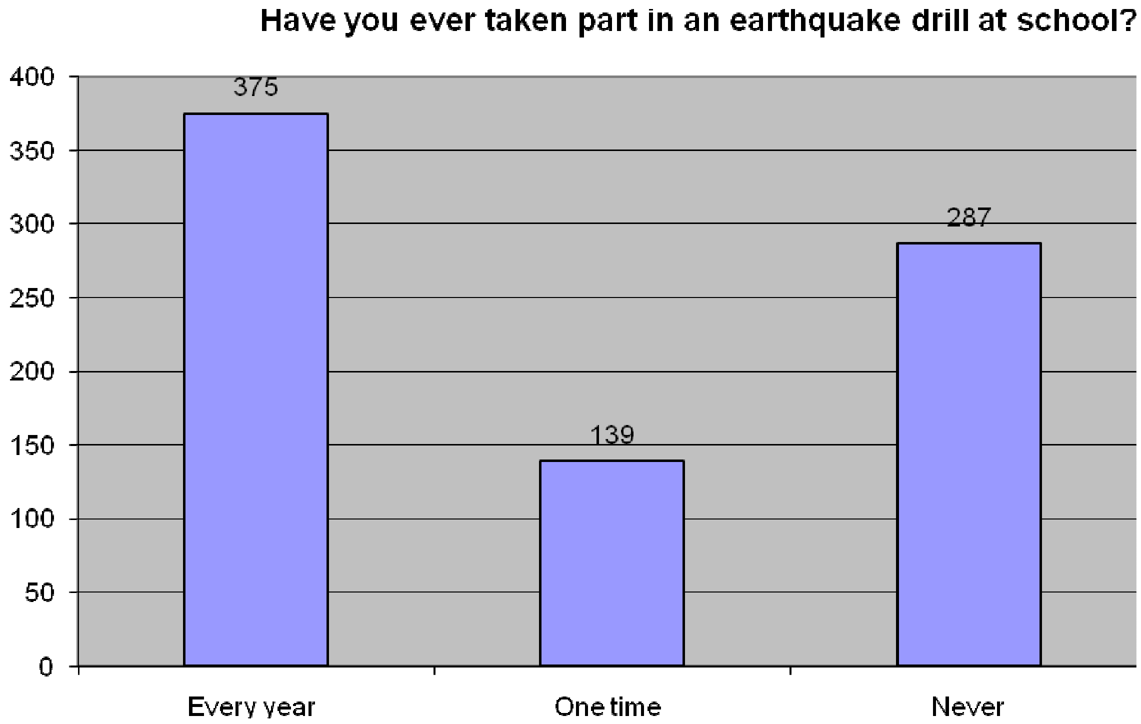


Graph 24

Children do recognise that a phenomenon like this could be really harmful for people and also it can damage our houses and building. They did respond to this question wisely. In graph 25, it is demonstrated that children do realize that this kind of natural phenomena may have negative consequences to human lives.



Graph 25



Graph 26

In the general graph above, most of children in the participant countries have taken part in a drill for earthquakes, but when it is presented below (table 15) with two examples, one of a seismic country and one of a country where earthquakes do not occur, the children with experience in such drills come from seismic areas.

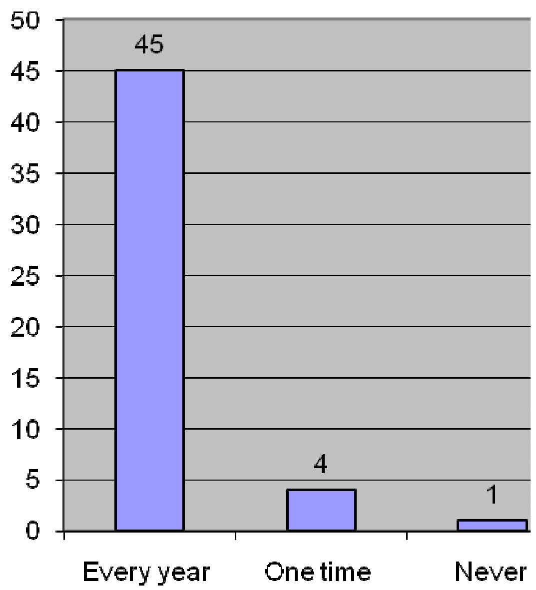
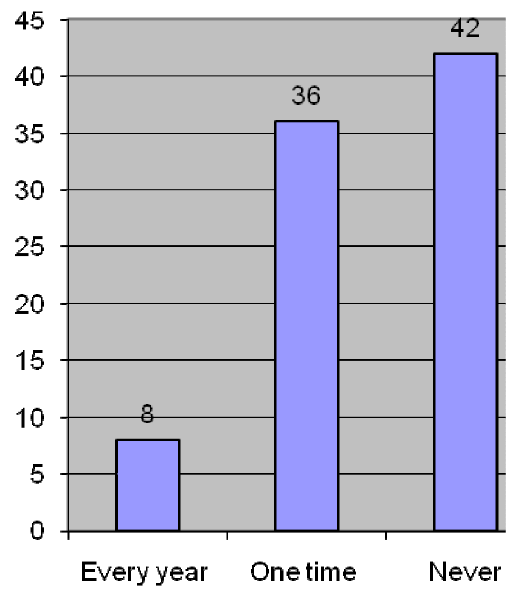
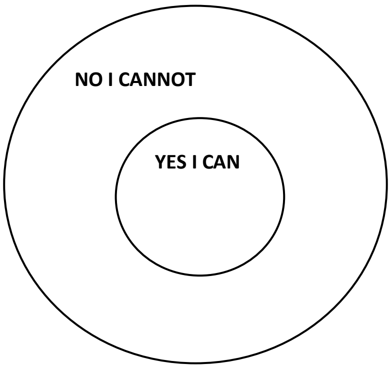
Montesca – Italy	***CEI – Bulgaria***
	

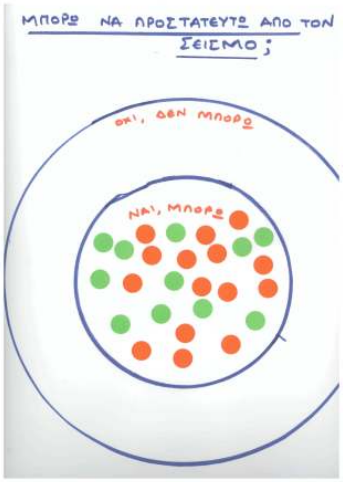
Table 15

Children 6-7 years old – Earthquakes

According to the table below, children at that age can understand that we are able to protect ourselves from earthquakes. Perhaps they do not know the way but this is what they have to know through education.

CAN I PROTECT MYSELF IN CASE OF AN EARTHQUAKE?



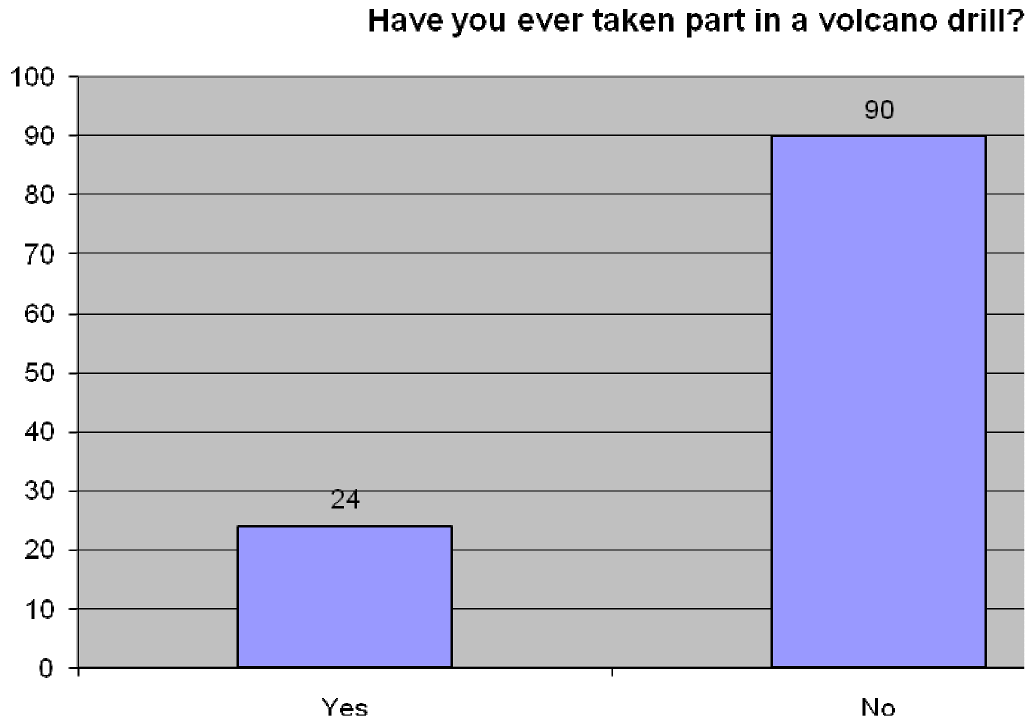


3.4 Children – Volcanoes

1. *Have you ever taken part in a volcano drill?*
2. *Have you talked with your family about volcanic protection measures? (only from Crete)*

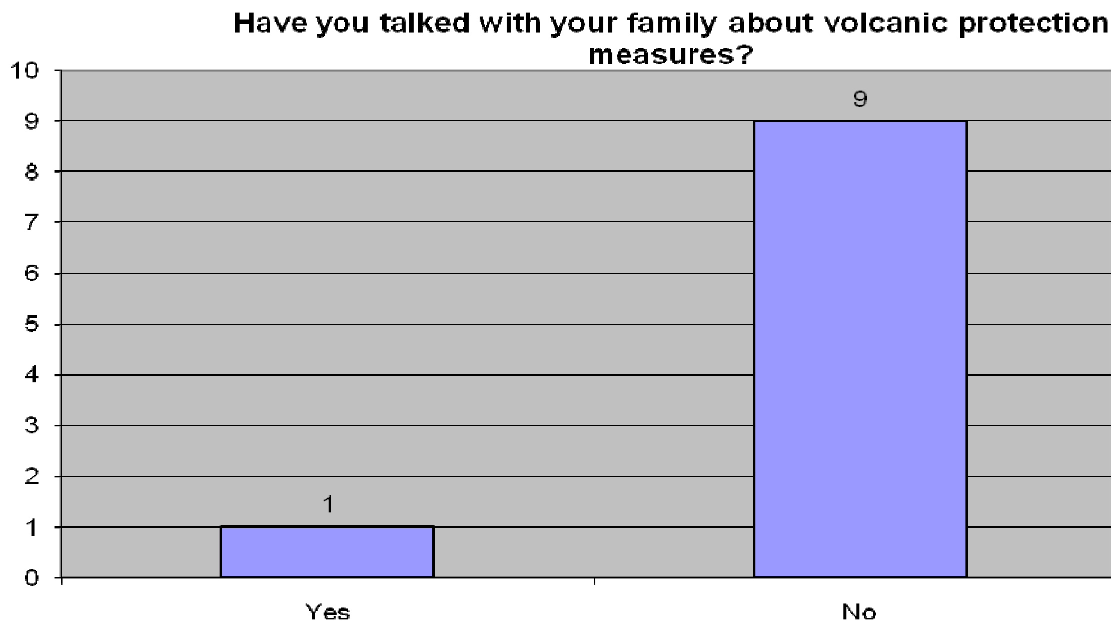
The preparation for a volcanic eruption is absent. As it is presented in graph 27, most of the children have never taken part in a volcano drill. Again it is proven that too little attention is paid on this phenomenon.

Again, even in the case of Vesuvius, it is observed that although the Institute of Vesuvius has educational programs over volcanic risk, somehow children are not well informed.



Graph 27

The second question in these maters was included only in the Greek version of questionnaires over volcanic protection measures. It is pretty clear that almost every child is uninformed and ignores this kind of protection measures.



Graph 28

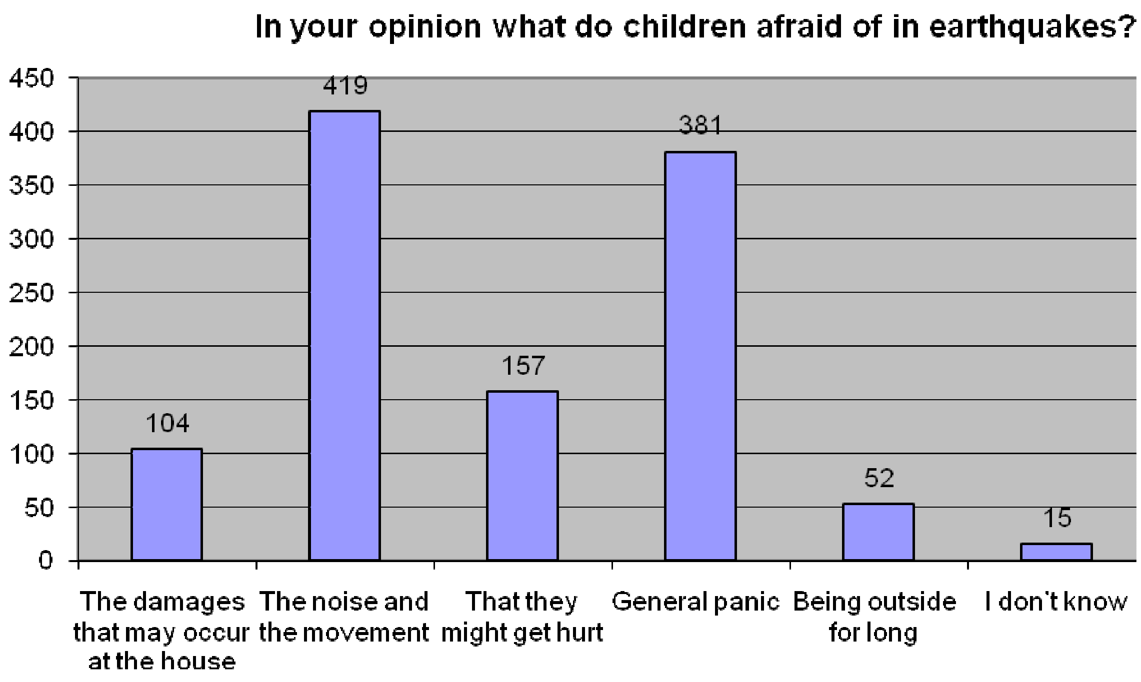
4. Psychology

Because the project is focused on the psychology of children regarding natural disasters, earthquakes and volcanic eruptions, some questions were prepared to determine how the children feel about these phenomena and the opinion that adults have over this.

4.1 Adults – earthquakes

1. *In your opinion, what are children afraid of in earthquakes?*
2. *In your opinion, what may children need in order to feel comfort in case of an earthquake?*
3. *In your opinion, how does a catastrophic earthquake affect children?*
4. *Do you know how to comfort a child that is traumatised due to an earthquake?*

According to parents, educators and rescuers, children fear earthquakes/volcanoes because of the strong vibrations, the noise and of course the panic that prevails during such phenomena (graph 29).



Graph 29

Athens – Greece	***Lesvos - Greece***

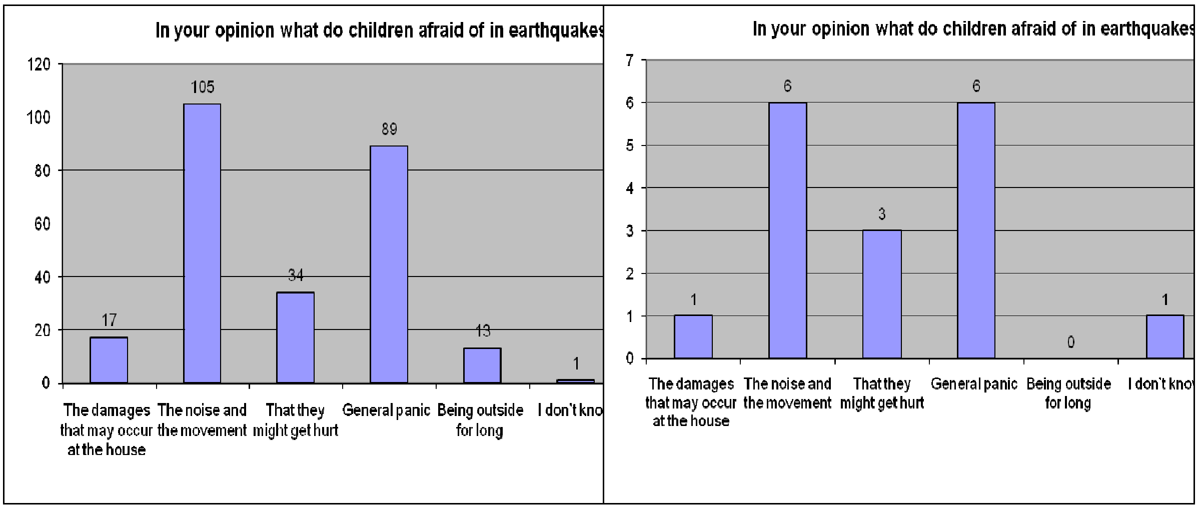
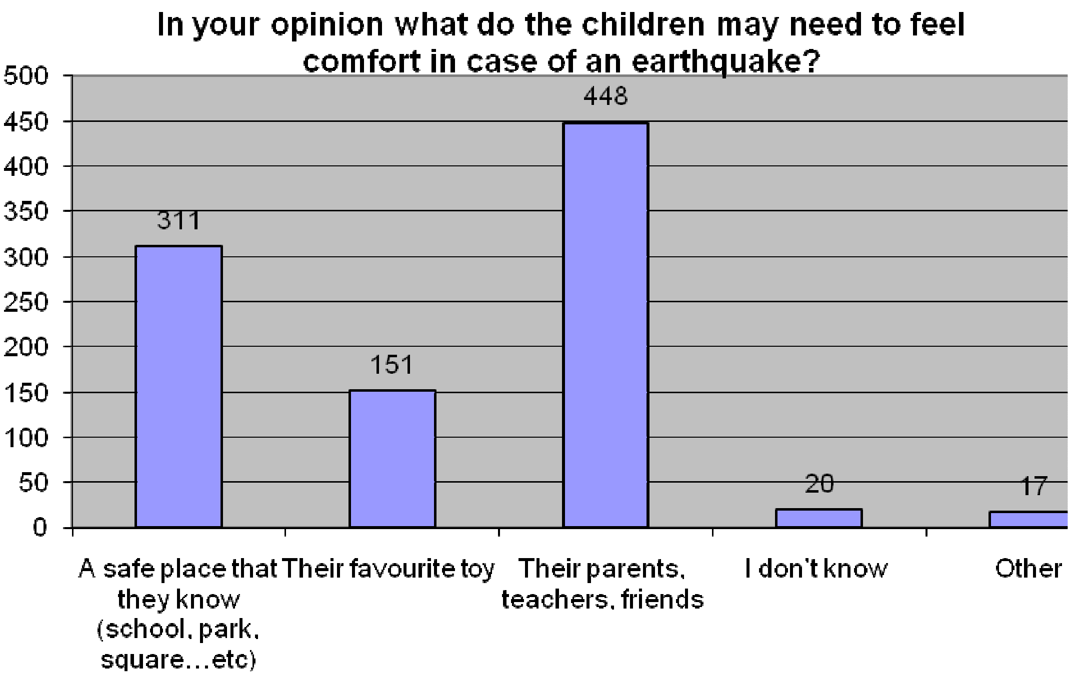


Table 16

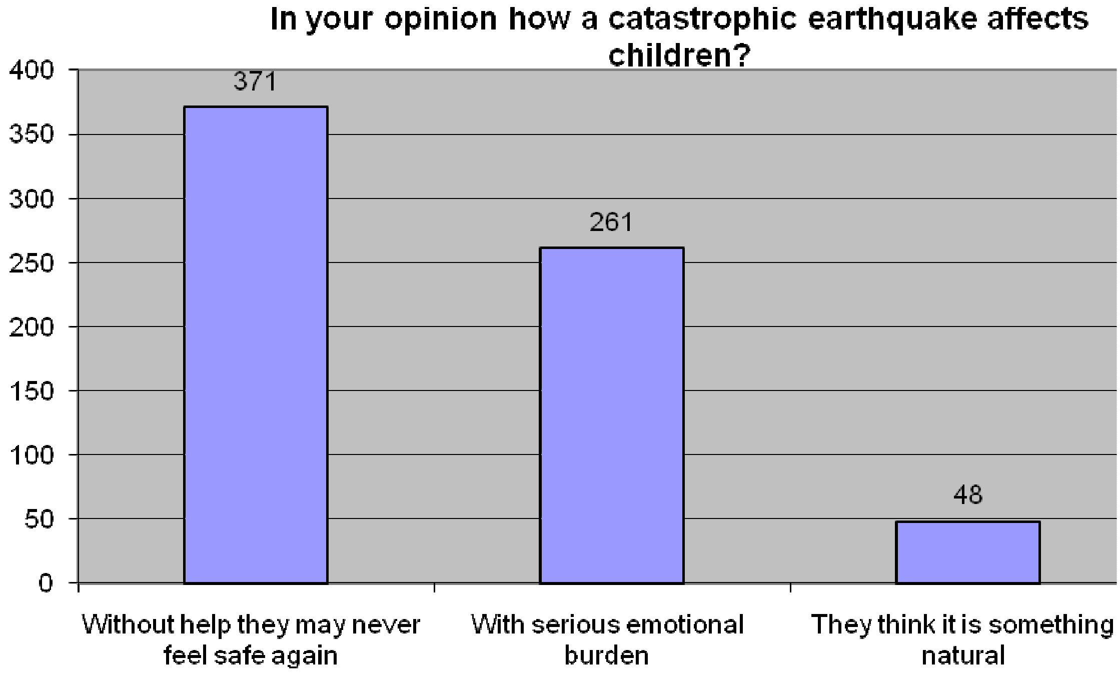
In all countries the responders agree in this matter and their answers agree with the above. Crete, Bulgaria and Vesuvius support that they are afraid mostly because of the panic and the chaotic situation, and the rest agree that the unexplained for children noise and vibrations is what makes them be mostly afraid of such phenomena.

For children to feel safe, adults support the idea that they need their parents, teachers and friends, the people that they love and share their lives with. Some do think that children can also feel safe when they find themselves in a safe and familiar place, like their school (graph 30).



Graph 30

All responders agree that children after a strong and catastrophic earthquake might lose the feeling of safety and/or have an emotional burden, which will have consequences in their life (graph 31). Particularly, in Italy and Bulgaria responders support that the emotional burden is what children have to deal with after such a sock and in Greece and France most adults think that their feeling of safety is what they need the most after a traumatic situation.



Graph 31

In general, the percentage that knows what to do to comfort a traumatized child after a strong earthquake is pretty low. This is the most important part of the questionnaires because it’s the goal of the project.

Within RACCE it is recognized that we do not give the necessary attention to children’s emotions and psychological effect concerning disasters, because at the time it is more important to reconstruct and restore the damages so that everything will be back to normal. More specifically, in Greece, and more particularly in Athens and Crete, only the 53% -58% knows what to do, and in Lesvos we have a really low percentage of 22% that are informed about the ways to comfort a child. In Montesca-Italy, the percentage of adults that are aware of how to offer concrete relief to children goes up to 74%, but when it comes to Vesuvius only the 63% are informed. As it was expected, in France and Bulgaria the percentages of the informed responders are low, 21% and 36% respectively.

Graph 32

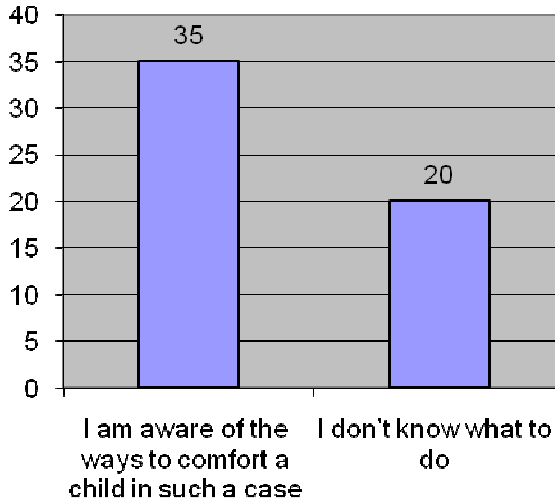
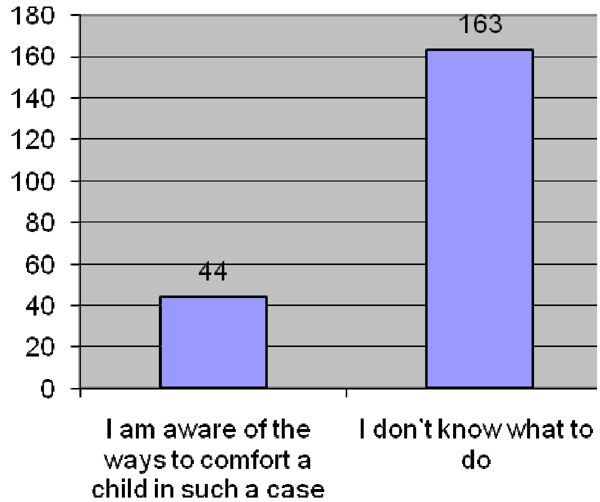
<table>
<tr><th>Vesuvius – Italy</th><th>Reserve – France</th></tr>
<tr><td>
</td><td>
</td></tr>
</table>

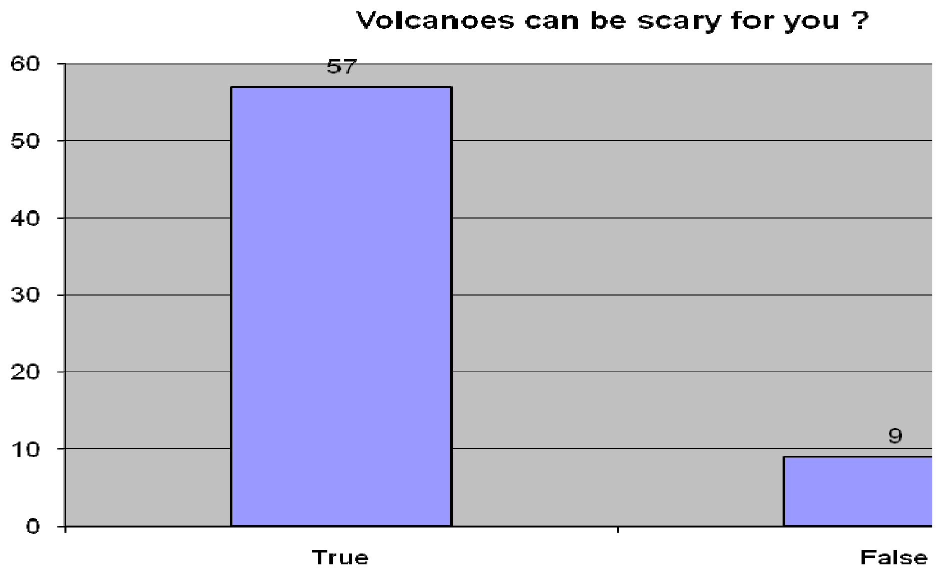
Table 17

4.2 Adults – volcanoes

In Greece and Italy people are more used to experiencing earthquakes than volcanic eruptions.

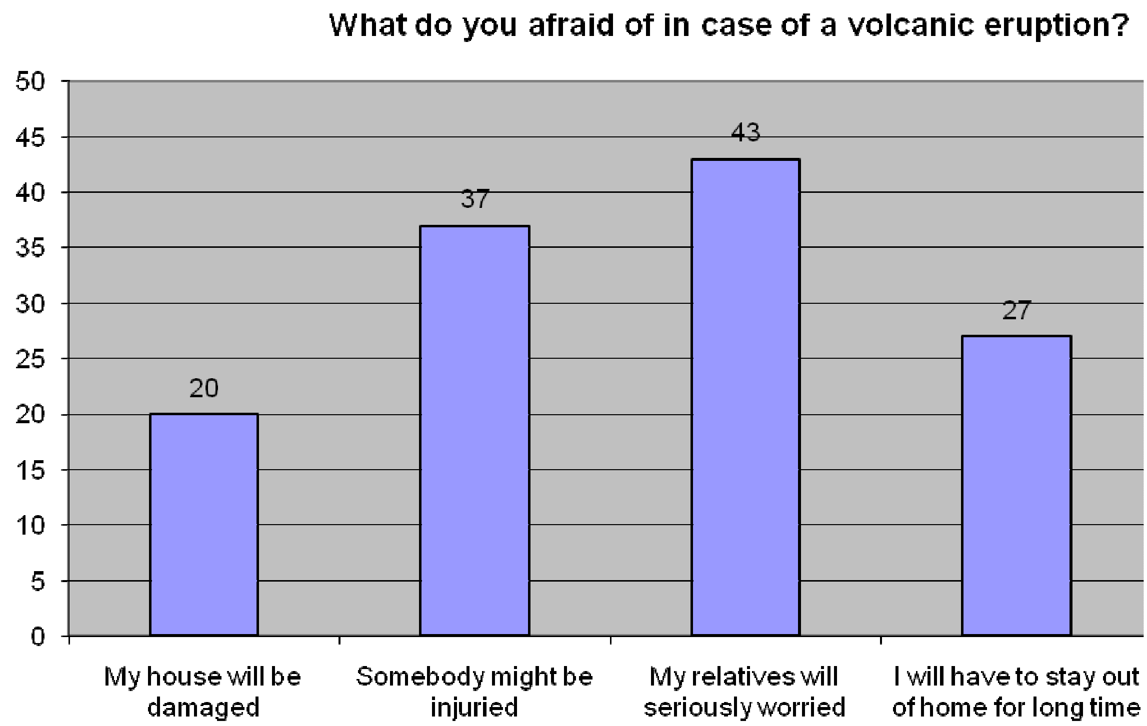
1. *Can volcanoes be scary for you?*
2. *What are you afraid of in case of a volcanic eruption?*

The existing knowledge on volcanoes is low in comparison to the relation that the two countries, Greece and Italy, have with volcanic activity. Graph 33 shows that when people are uninformed, panic and fear are the consequences.



Graph 33

The fears that adults show in case of a volcanic eruption are similar to the childrens responces (graph 34).

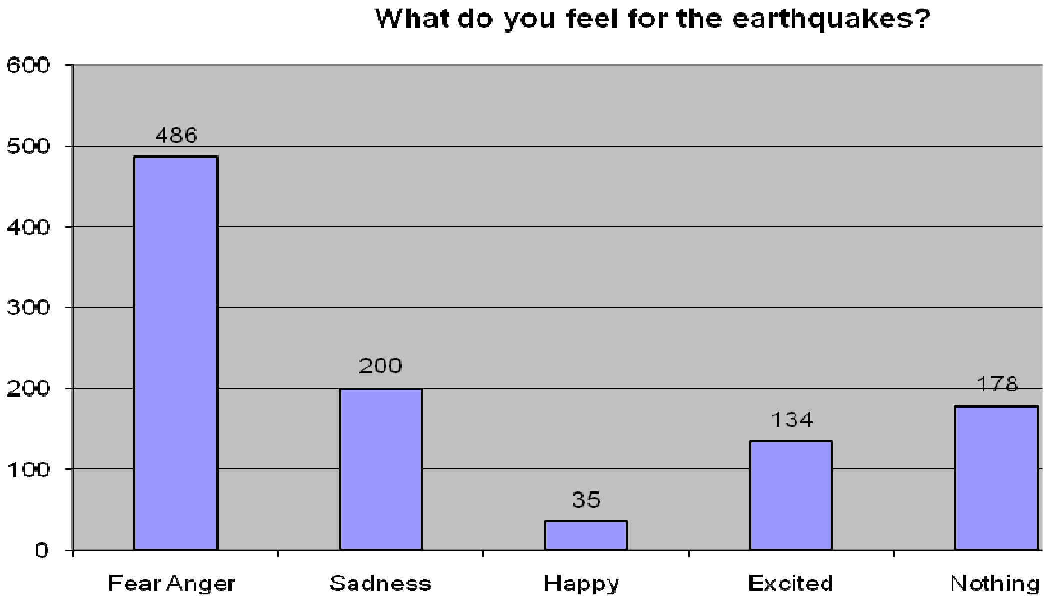


Graph 34

4.3 Children – earthquakes

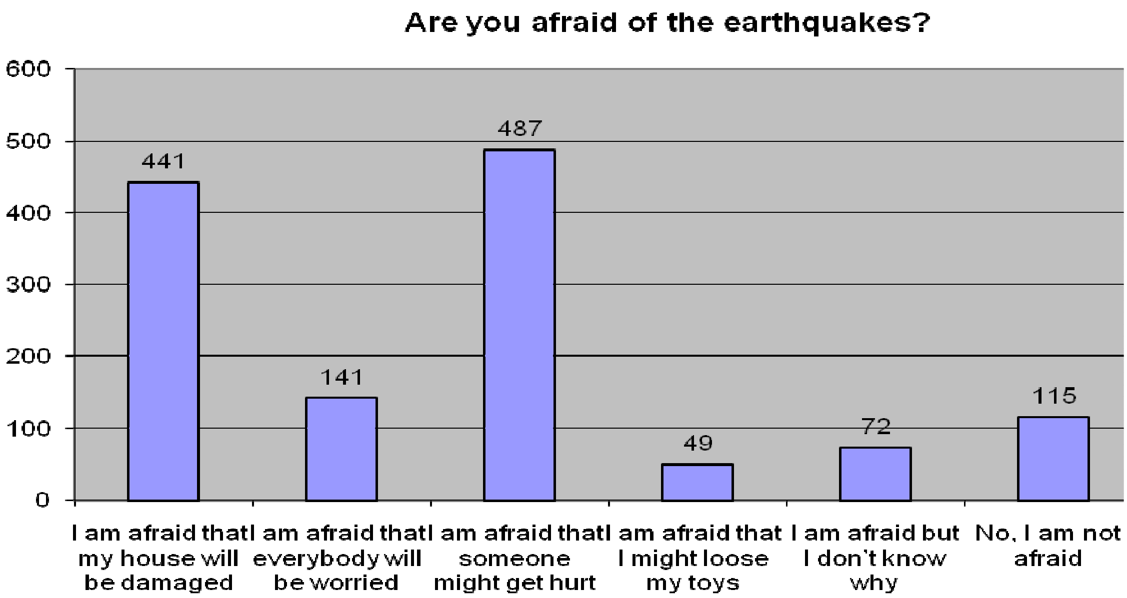
1. *What do you feel for the earthquakes?*
2. *Are you afraid of the earthquakes?*

Most children fear earthquakes, according to their answers, and feel sad when it comes to earthquakes. Of course the answers are shared between emotions like anger and sadness (graph 35). There is a distinctive percentage of children that feels excited over earthquakes which is not that surprising when it comes to children that are informed for natural phenomena and have learned not to fear them. In the graph 35 it is shown that there is a considerable number of children that do not really have an emotion when it comes to earthquakes. Perhaps the reason is the absence of knowledge and experience.



Graph 35

Most of the children that have felt an earthquake live in a seismic country and have done many earthquake drills. On the other hand, many children do not feel something specific and they respond to earthquakes without any feeling of fear or excitement. In Greece the percentages are distributed between strong unpleasant feelings, fear, sadness and anger, 53-59% and in those that have no feelings concerning earthquakes, 25%. In France, as well, the responses differ like in Greece, 38% fear, 35% sad, 35% nothing. The same in Bulgaria, where 67% of children fear and feel anger for earthquakes and 41% feel excited. In contrast with all other countries, in Italy almost every child responded to the unpleasant feelings, fear-anger-sadness, with really high percentages of 85%.

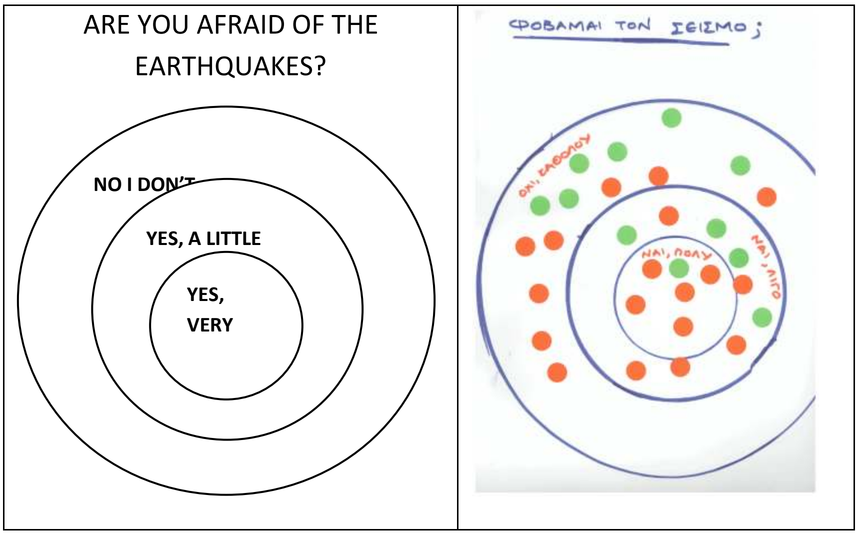


Graph 36

As we can conclude from the graph 36, most children are afraid of something in case of an earthquake. But there is a small percentage of children that are not really afraid of this phenomenon, which is in fact one of the objectives of the RACCE project.

Children 6-7 years old – Earthquakes

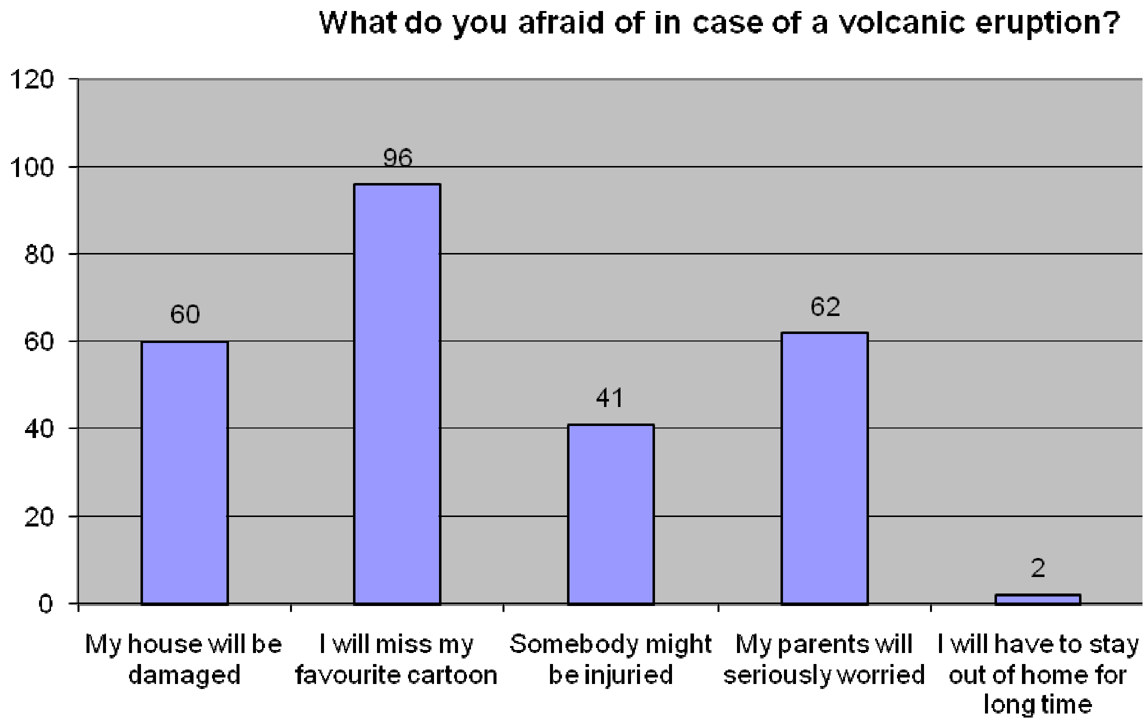
One of the most important question concerning this program is the emotional burden or the feelings that children have, especially when it comes to children at that age when they are still unable to express themselves very well like older children. This is why a great emphasis has to be given to these ages, because as it is presented in the table below the emotions of children when it comes to earthquakes are not mutual. Their responces are devided to children that fear earthquakes and others that do not have any fear.



4.4 Children – volcanoes

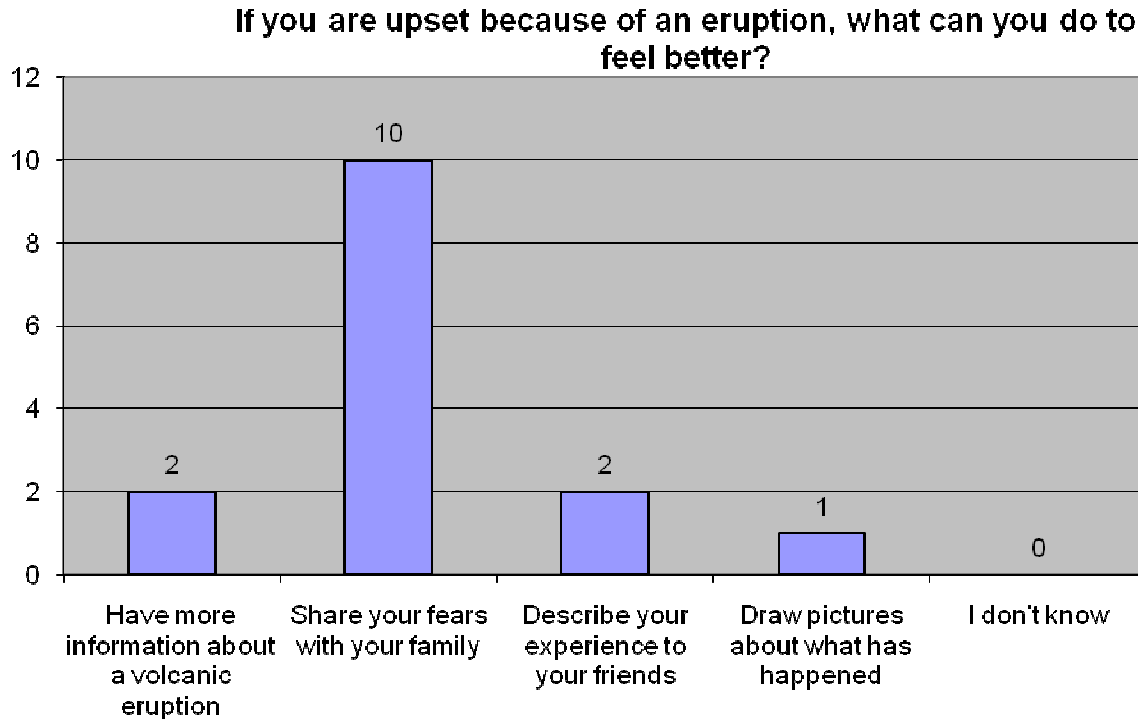
1. *What are you afraid of in case of a volcanic eruption?*
2. *If you are upset because of an eruption, what can you do to feel better?*
3. *Can volcanoes be scary for you and your parents?*

The response of children, when asked what they are afraid of in case of a volcanic eruption, is distributed among all possible answers. But there is a high percentage of children that do not realize the impacts of an eruption and are only concerned about their favourite TV show (graph 37). In any case, the Racce project has now an important challenge. The participants have to prepare educational practices, programs and activities that will make children realize the risks from a volcanic eruption but also and most important not to spread panic during this realization.

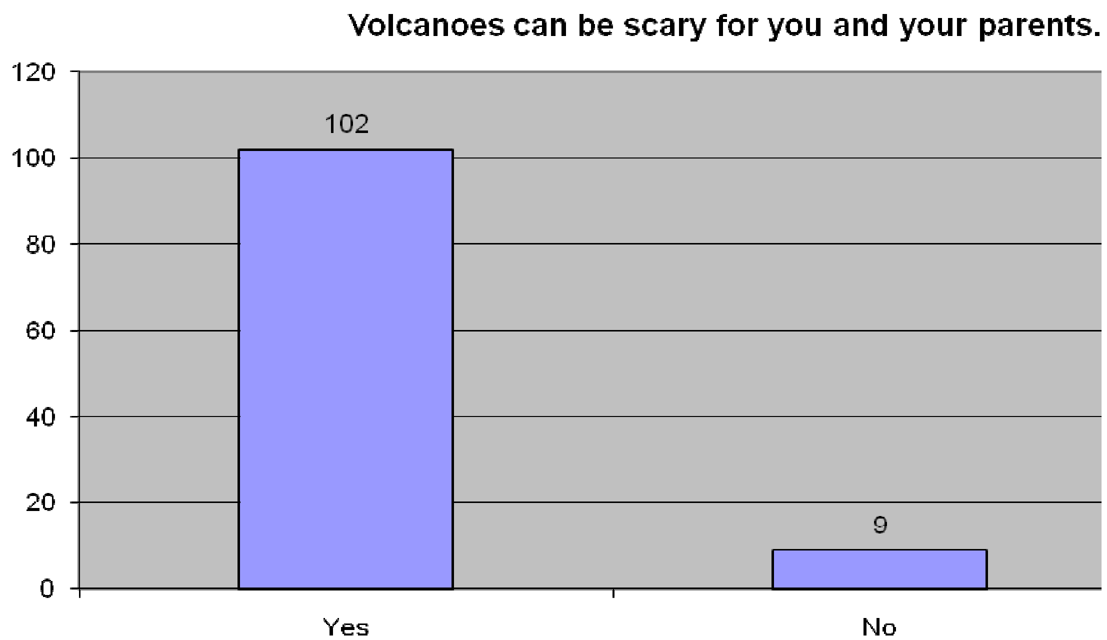


Graph 37

As in a case of a strong and catastrophic earthquake, children need their family when they are upset due to volcanic erutpions. They are not afraid to discuss their fears with a familiar person which is a prosedure that can make them feel better (graph 38). This information is very promising, since a way to cope childrens emotions and fears is by expressing them and discussing them with their close environment. And the fact that children feel comfortable with such an approach make it easier for specialists to prepare relevant educational practices and guides. But not only that, when it comes to children that already have an emotional burden from such an event, their willingness to talk over it is a way to cure themselves.



Graph 38



Graph 39

5. Conclusions

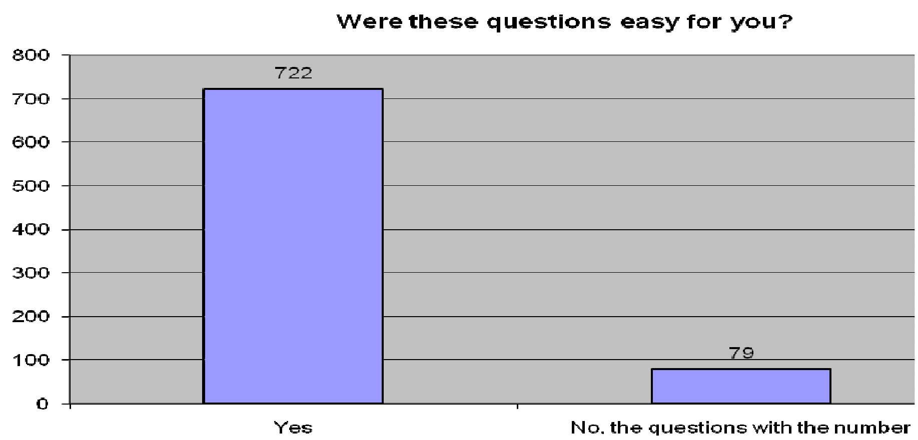
The main conclusion that can be extracted from the questionnaires analyses are summarized below:

General

- When it comes to children, the differences between the countries are not that distinctive like in adults. There is an exception concerning the experience they have, which is very logical because only two of the participating countries are more seismically active.
- In general, most of the citizens from the specific participants' countries do not have a plan for them and their family regarding natural disasters.
- Only half of the population is informed on the protection measures and most of them by the media and not by the state. That has to be stressed and further considered.
- Tools like emergency phone numbers must become more familiar so that people can take advantage of the state official emergency support, even if this is not related to a catastrophic phenomenon.
- The knowledge does not come necessarily with experience. But when experience is gained, if it is not supported by a theoretical background it might produce traumas to children and adults as well.

Earthquakes

- The perception of children over earthquakes made these questions easy for them, which for children of this age is really important, so that they can deal with it calmly without panicking.

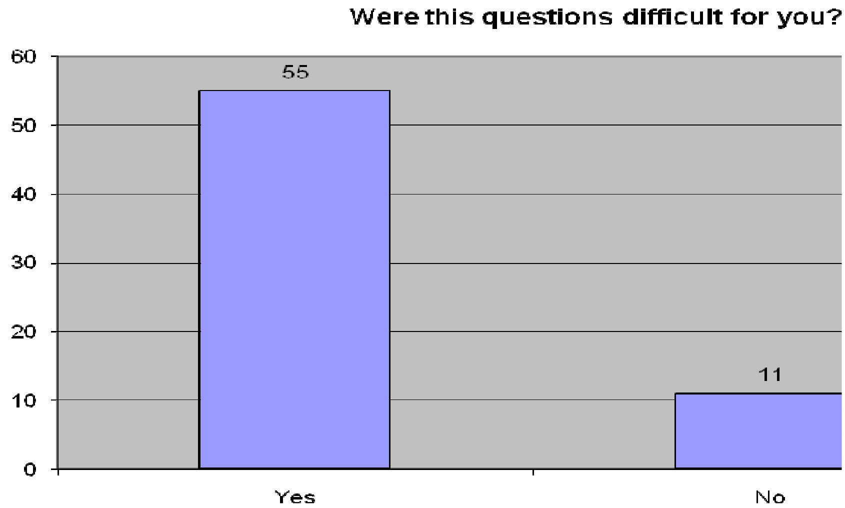


Grpah 40

- Better understanding is needed among children that an earthquake is caused not only due to tectonic movements and volcanoes but also other reasons.
- Adults have a misleading perception of what children really fear when it comes to earthquakes. Most of them attach fear to destruction, noise and the general panic, but when children respond to that question, their biggest fear is that people and themselves might be injured. For a child this is a reasonable fear because children do not attach to materials like adults. The most important issue for them is the people they love.
- In countries that are seismic, people are so familiar with the phenomenon that sometimes they ignore it, which is a terrible mistake and leads to injuries.

Volcanoes

- From the graph 41, that refers to adults concerning volcanoes, the conclusion is that even adults have difficulties to answer questions regarding volcanic activity since the information, knowledge and awareness are almost absent.



Graph 41

- An observation has to be made especially when it comes to volcanoes where we see adults fear and react as children. This can be explained because of the low information and experiences in this mater.
- Especially Vesuvius needs to feel the gap that was concluded from the questionnaires, to the educational practices over volcanic risk and educate children for that possibility.

Children with movement disorders

- Concerning children with moving disorders it was really hard to approach them in order to complete some questionnaires. After many tries we only collected two questionnaires from Crete – Greece. As a conclusion, these children needed the double time to complete the forms and the questions were not that easy for them. They need special approach in these matters in order to be educated and mostly they need to be part of a group of children and not stand off of the rest of the group.

Final conclusion

Overall, the cognitive level for both children and adults is satisfactory but for sure it is a real need for all of them to take these phenomena under consideration because there is the belief that dealing with it is not that important. The methods to inform and educate people to be prepared for all emergency situations should not be misleading or spread panic. The key factor after this evaluation that should be consider while processing new preparation methods is to make people understand that these phenomena are a part of our life, of our everyday life, and we do not need to panic or fear them, only to cope them with the necessary preparation and the composure needed.