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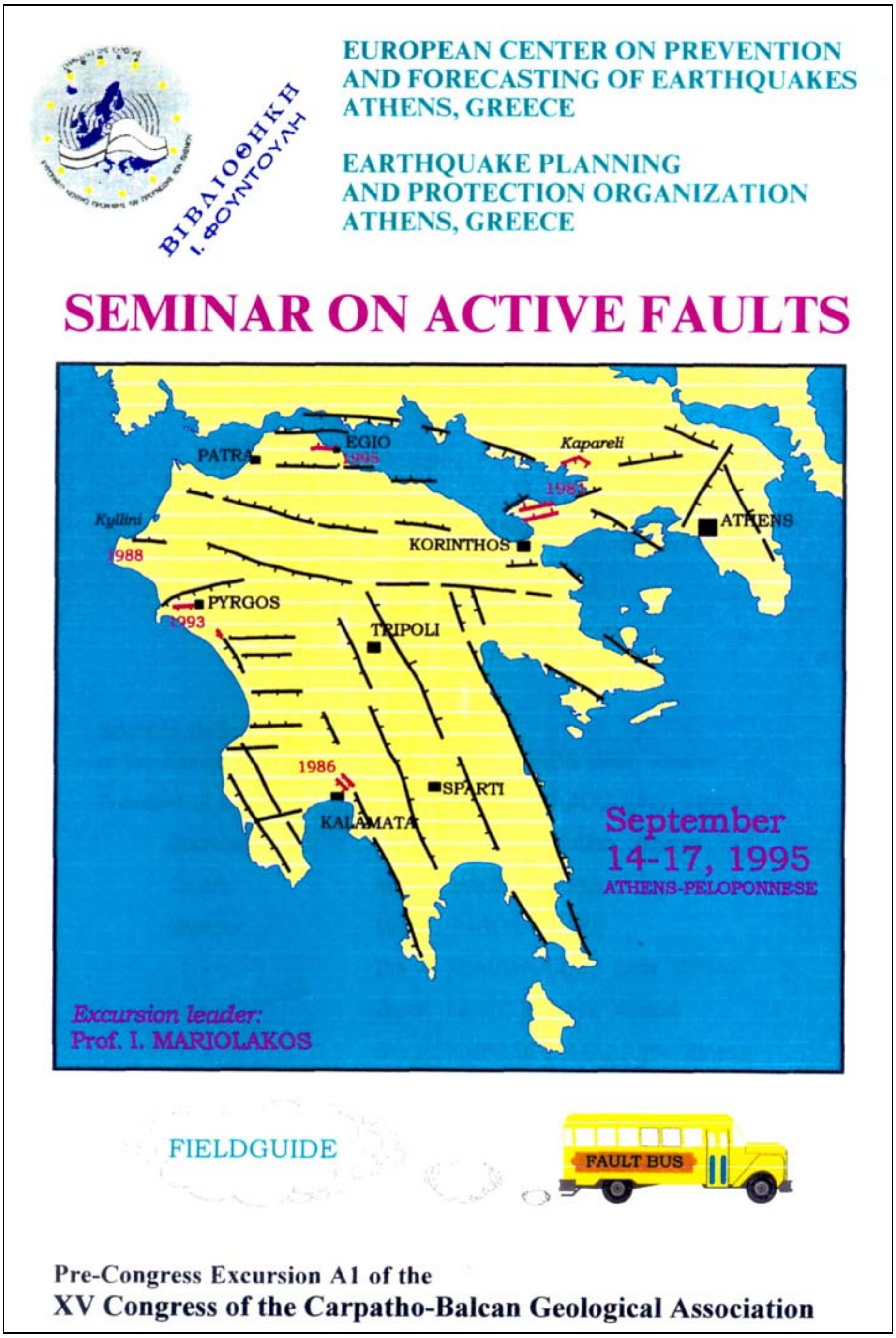

MARIOLAKOS, I. & FOUNTOULIS, I., (1995). - Description of the itinerary. . *In Field-guide for the Pre-Congress Excursion of the XV Congress of the Carpatho-Balcan Geological Association, Athens, Sept. 1995,* p. 60-80.

SEMINAR
on
ACTIVE FAULTS

Athens, Peloponnese, September 13-17, 1995

ORGANIZING COMMITTEE

Scientific Coordinator of the Seminar	:	Prof. I. MARIOLAKOS (Univ. Athens)
President of E.C.P.F.E.	:	Prof. D. PAPANIKOLAOU (Univ. Athens)
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The Orginizing Committee would like to thank the following Post-graduate students for their assistance in the preparation of the fieldguide for the Fieldtrip:

- Kranis H.
- Theoharis D.
- Zeri S.
- Badekas I.
- Tzavaras M.

DESCRIPTION OF THE ITINERARY

by

I. MARIOLAKOS* and I. FOUNTOULIS*

INTRODUCTION

The five days "Seminar on Active faults" includes four days excursion and field work and one day lectures. The four days excursion will cross the geological formations and the neotectonic structures of Peloponnese from East to West and from North to South. (Fig. 1).

1st day THURSDAY September 14, 1995

THE AREA AFFECTED BY THE EARTHQUATES OF FEBR 1981

Stop 1.1. Caparelli

A case of two neotectonic intersected faults partly reactivated by the earthquakes of February - March 1981. The maximum observed net-slip was about 1.20 m but in average is 0.60-0.70 m. The movement is composite. The dip-slip component dominates bat a strike-slip component with a dextral sense of movement is also present. The ratio between the horizontal and normal slip is 30/70.

– Small grabens and horsts created by the earthquakes.

– Compressional and extentional domans at the side and along the fault surface.

Stop 1.2 Platees

The village was destructed by the earthquakes of 1981.

Stop 1.3. Isthmus of Korinthos - Canal

Unconformity between Pleistocene and Neogene deposits, Pleistocene and recent faulting. A neotectonic graben transformed partly to an apparent horst. A case of a neotectonic antitilted multiblock macrostrecture caused by a stress-field of torsional character crossing the canal.

Stop 1.4 Kenchrees

Shorelines displacement (subsidence) in historical times. The shorelines has been subsided by 2.2 m since 200 B.C. The study of the area showed that during the period from 200 B.C. until 400 C the shorelines have been subsided 1.4 m, whereas during the period from 400 AC up to the present there has been a subsidence of 0.80 m.

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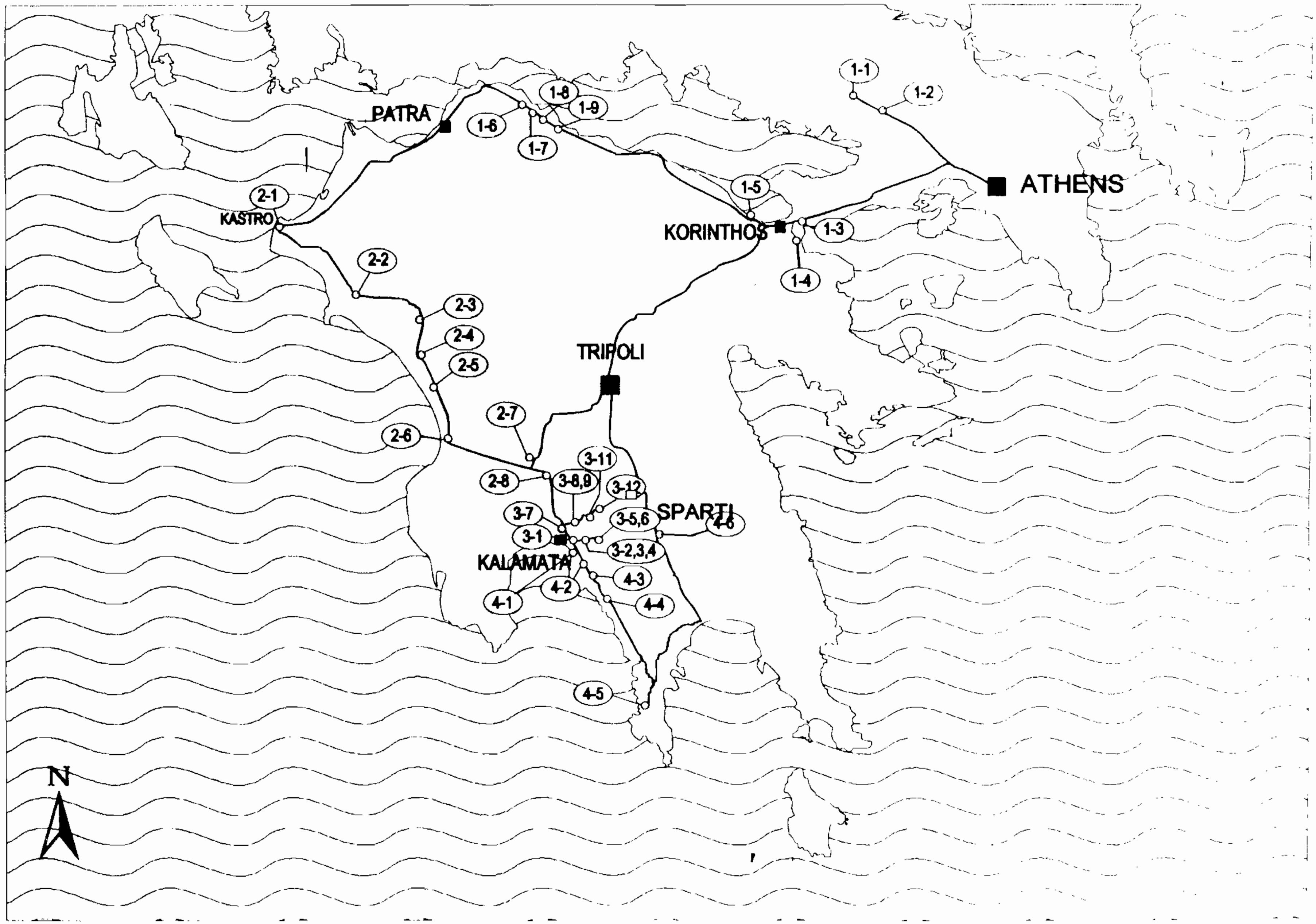
ATHENS
1-1
1-2
1-3
1-4
1-5
KORINTHOS
PATRA
1-6
1-7
1-8
1-9
KASTRO
2-1
2-2
2-3
2-4
2-5
2-6
2-7
2-8
TRIPOLI
3-11
3-8,9
3-12
3-7
3-1
3-5,6
3-2,3,4
SPARTI
4-6
KALAMATA
4-1
4-2
4-3
4-4
4-5
N

Fig. 1

Stop 1.5 Lecheon

An auncient harbor entrance older than 2000 years (Roman) has been uplifted by 1.2 m above the present sea-level, as it is proved by the presence of hithodomus shells in the building material of the harbor.

THE EARTHQUAKE - AFFECTED THE AREA OF EGION

On June 15, 1995 the major area of Egion was affected by an earthquace of magnitude Ms=6.1. The main shock as well as the after shock (Ms=5.6) caused many damages at Egion and the Surrounding

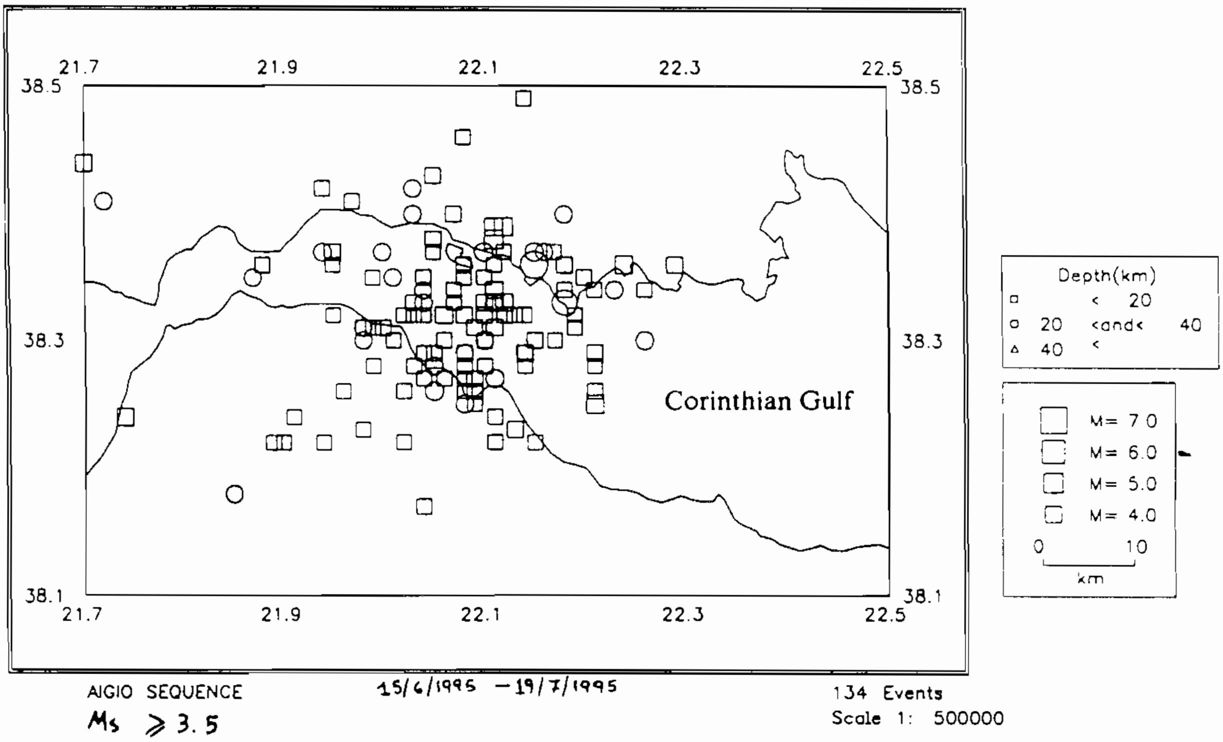

Fig. 2. The distribution of the earthquake epicenters at the major area of Egion (NW Peloponnese) for the period of Jne, 15 - July 19, 1995. (after G. Stavrakakis 1995).

area. Twenty six people lost their lives and some hundrends people were wownded.

The Egion earthquake, except the destractions to the buildings caused death of 26 people while hundrends people were wownded Furthermore several other geodynamic phenomena such as liquefaction phenomena followed by sand water's shaking off, landslides, soil fractures, seismic fractures etc., were observed.

THE AREA AFFECTED BY THE EASTHQUAKES OF JUNE 1995.

Stop 1.6 Egion

a) The Marginal fault zone L4 of Egion (Fig. 3).

b) **Harbor:** Seismic fractures related to the sediment compaction

c) **City-center:** The Collapsed building.

Stop 1.7 Valimitica

- The partly collapsed Hotel Eliki
- The ancient city of Eliki vanished by an earthquake in the 4th century B.C.
- Sport-place at the sea-shore. Seismic fractures.

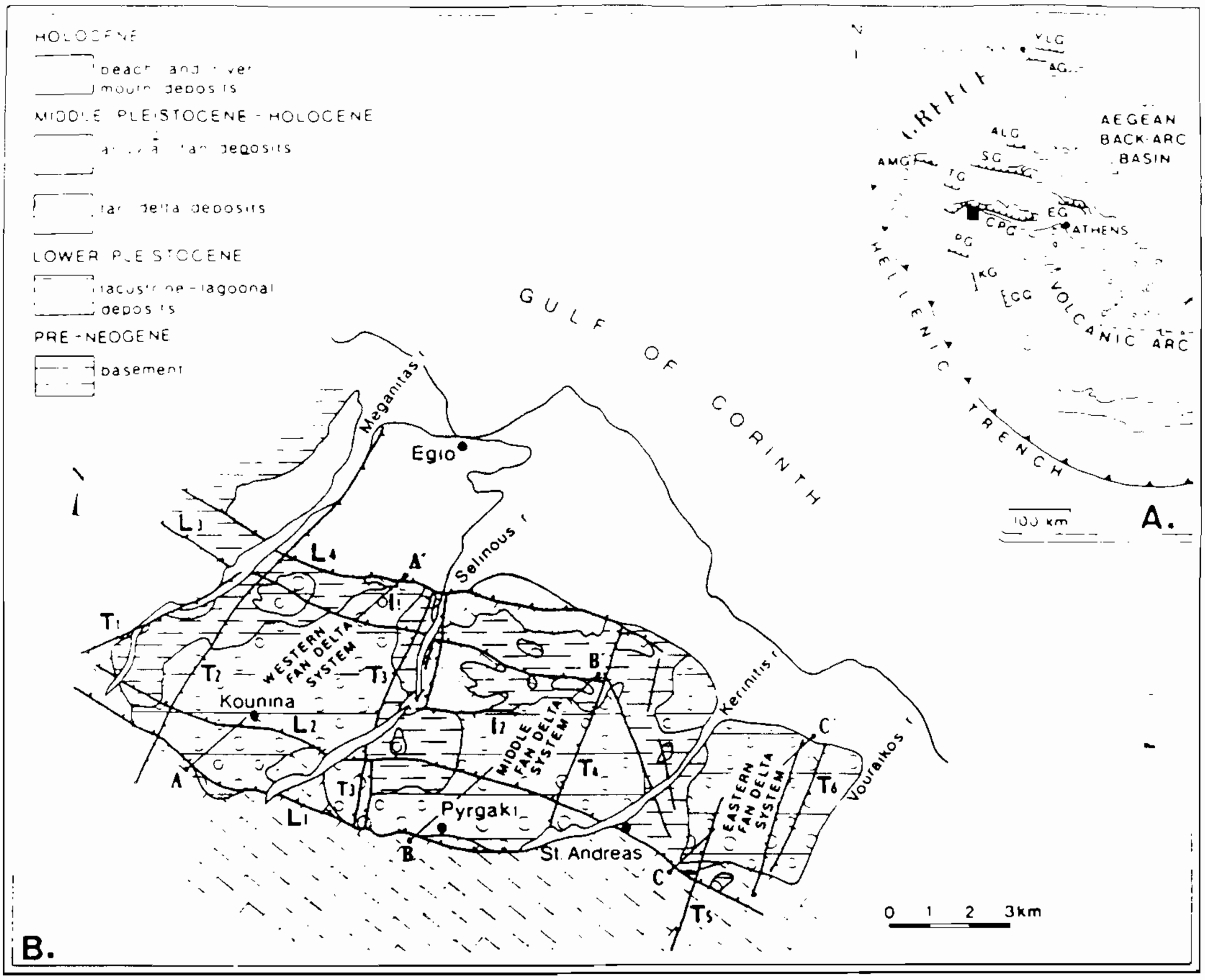

Fig. 3. Geological setting. (A) Tectonic sketch map of Greece showing the studied area (black box) and the post-Miocene WNW-trending rift belts (VLG, Volvi-Langada graben; AG, Anthemounta graben; ALG, Almyros graben; AMG, Amvrakia graben; TG, Trichonis graben; SG, Sperchios graben; EG, Evia graben; CPG, Corinth-Patras graben; PG, Pirgos graben; GG, Gythio graben; KG, Kalamata graben). (B) Geological map of the south-western end of the Corinth graben, showing the Quaternary sediment facies distribution and the principal WNW extensional faults (L_1-L_4 master faults; l_1-l_2, antithetic faults) and NNE transfer faults (T_1-T_6) (after POULIMENOS et al., 1993).

Stop 1.8 Nikoleika —

- Subsidence of the coastel area during the earthquakes of June 1995.
- Seismic fréctures.
- Liquefaction phenomena.

Stop 1.9 Eleonas

Subsidence of the coastal related to submarine sliding area during the earthquakes of June 1995 - Seismic fractures - Liquefaction phenomena.

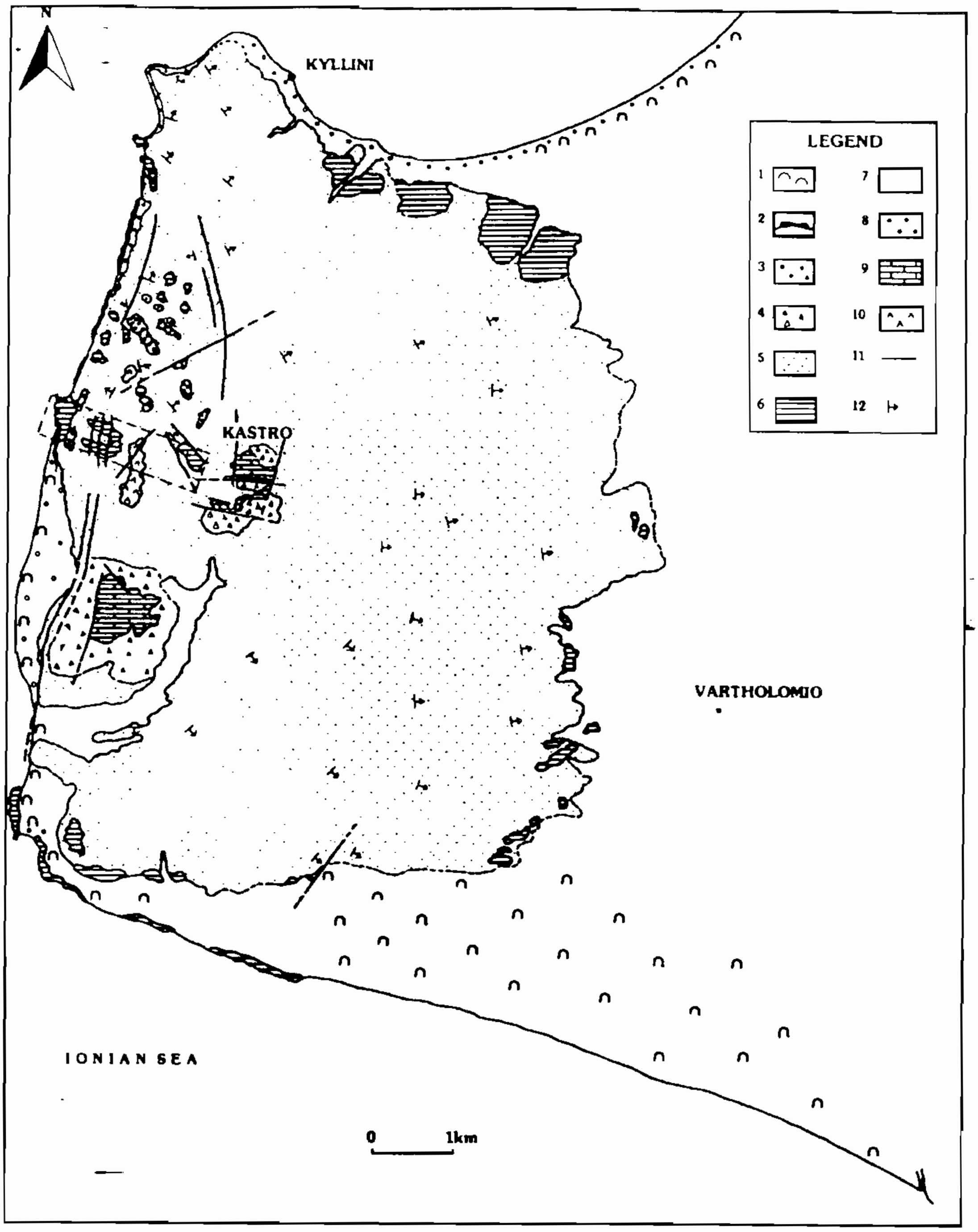

Fig. 4. Geological map of Kyllini peninsula. (Based on the maps of CHRISTODOULOU 1969, KOWALCZYK & WINTER 1979 with some changes and completions). 1: Dunes, 2: Beach rocks, 3: Coastal deposits, 4: Scree. 5: Alluvial deposits, 6: Glossa Formation, 7: Lygia formation, 8: Psili Rachi Formation, 9: Kastro limestones, 10: Kastro evaporites Formation, 11: fault, 12: strike and dip of strata. (after MARIOLAKOS et al 1990).

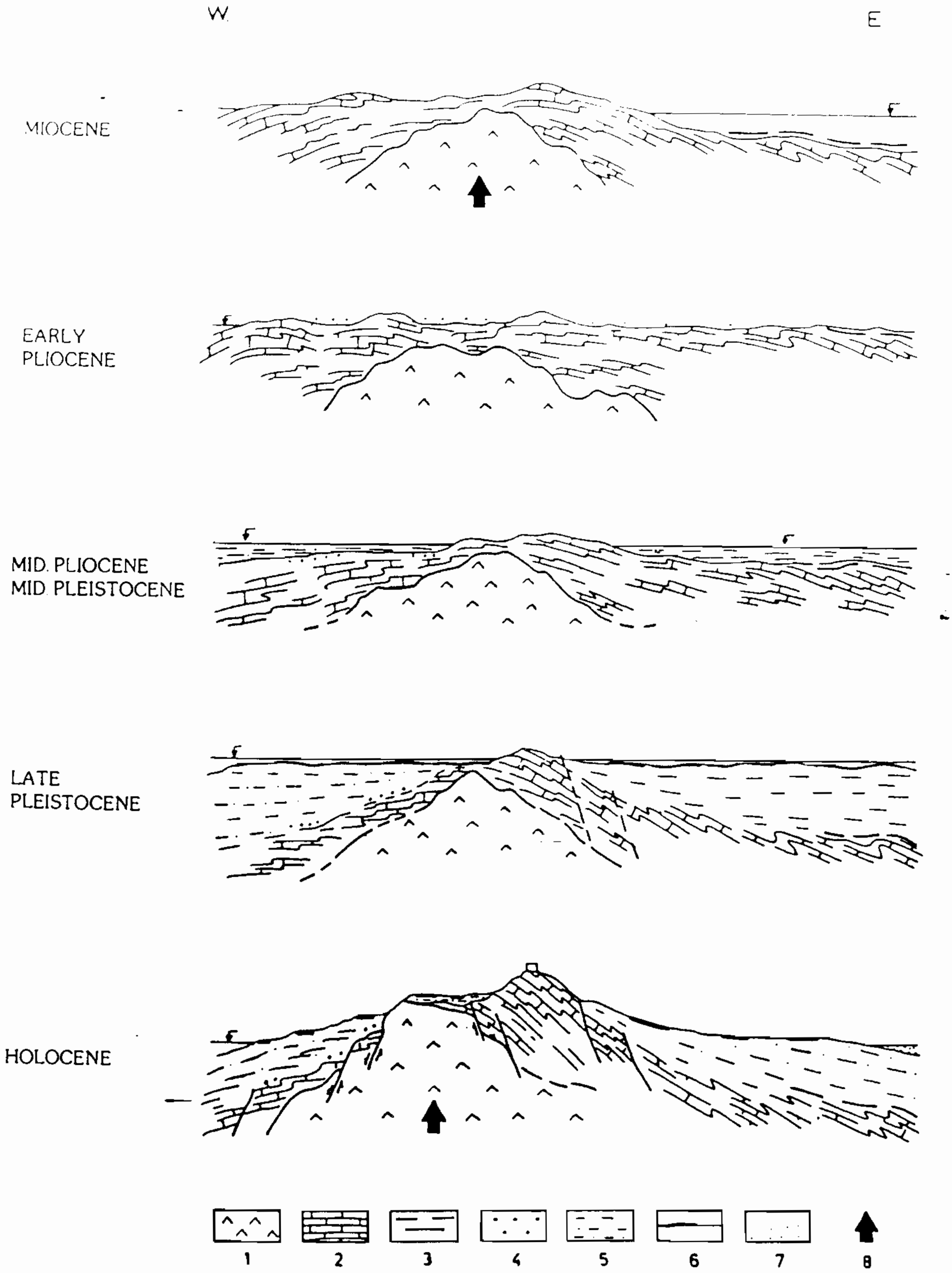

Fig. 5. Schematic represemtation of the neotectonic structure and evolution of the Kyllini peninsula. 1: Evaporites, 2: Kastro limestones Formation, 3: Middle-Upper Miocene deposits, 4: Psili Rachi formation, 5: Lygia Formation, 6: Glossa Formation, 7: Hilocene Tyrken deposits, 8: Uplifting-Diapyrism. (after MARIOLAKOS et al 1990).

2nd day FRIDAY, September 15, 1995

THE AREA AFFECTED BY THE EARTHQUAKES OF OCTOBER 1988

Stop 2.1 Kastro

- Geological structure - diapirism brittle - ductile type of deformation (Fig. 4, 5)
- Reactivated faults during the carthquakes of October 1988.

THE AREA AFFECTED BY THE EARTHQUAKES OF MARCH 1993

Stop 2.2 Pyrgos

- Panoramic view of the Vounargon active fault zone.
- Pyrgos fault zone reactivated during the earthquakes of March 1993.

Stop 2.3 Olympia (archaeological site).

The archaeological site of Olympia is situated on an active neotectonic graben at the northwestern Peloponnesus. At the foot of the Kronion Hill stretches the space formed by the wedge of land between the converging rivers of the Alfios and the Kladeos. This was the site called the Sacred Grove of the Altis, regarded as belonging to Zeus in which, in historically recorded times, the most famous of Greek sanctuaries was established.

Formerly it had been a place of worship of pre-Hellenic deities. Every four years, athletic contests were organized here in honour of Zeus, lasting seven days. According to legend, the Olympic Games began after a victory by Pelops against Oenomaos, King of Pissa. Historically, the Olympic Games began in 776 B.C. Up to the 5th century B.C., the sacred enclosure contained the Heraion (Temple of Hera), the Prytaneion, the Pelopeion and the Hippodameion while, at the foot of the Kronion hill the twelve Greek city treasures stood. Outside the enclosure to the West was the Stadium with a 45.000 seating capacity (men only were allowed in). Access to the stadium was along a Vaulted passage and, to the South, was the Bouletririon where the Olympic Senate met.

From the 5th century onwards, the sanctuary assumed its final form with the impressive Temple of Zeus (peripteral in the Doric style), the Metroon, the Arcades (Stoa of Echo and the southern Stoa), the Gymnasium and the Palaestra the living quarters of the priests, the large Leonidaion Hostel and the Filippeion. To the south of the dwellings of the priests, excavations revealed the studio of the sculptor Phideias in which he carved the gold and ivory statue of Zeus, one of the seven Wonders of the world. Finally, in Roman times, the villa of the Roman emperor Nero was added, also the Exedra of Herod Atticus and Roman baths.

The Olympic Games ceased in 393 A.D. after the edict issued by Theodosius the Great, which forbade all the pagan festivals. They were revived for the first time after 15 centuries, in 1896 in the marble stadium in Athens. Today, an international Olympic Academy functions at Olympia.

Stop 2.4 Lapithas Mt

- Panoramic view of Lapithas f.z.
- The deformation of the Early-Middle Pleistocene marine deposits.
- Morphotectonic interpretation.

Stop 2.5 Neda river

- Neda f.z.
- Panoramic view of Lepreon f.z.

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- Neda f.z.
- Panoramic view of Lepreon f.z.

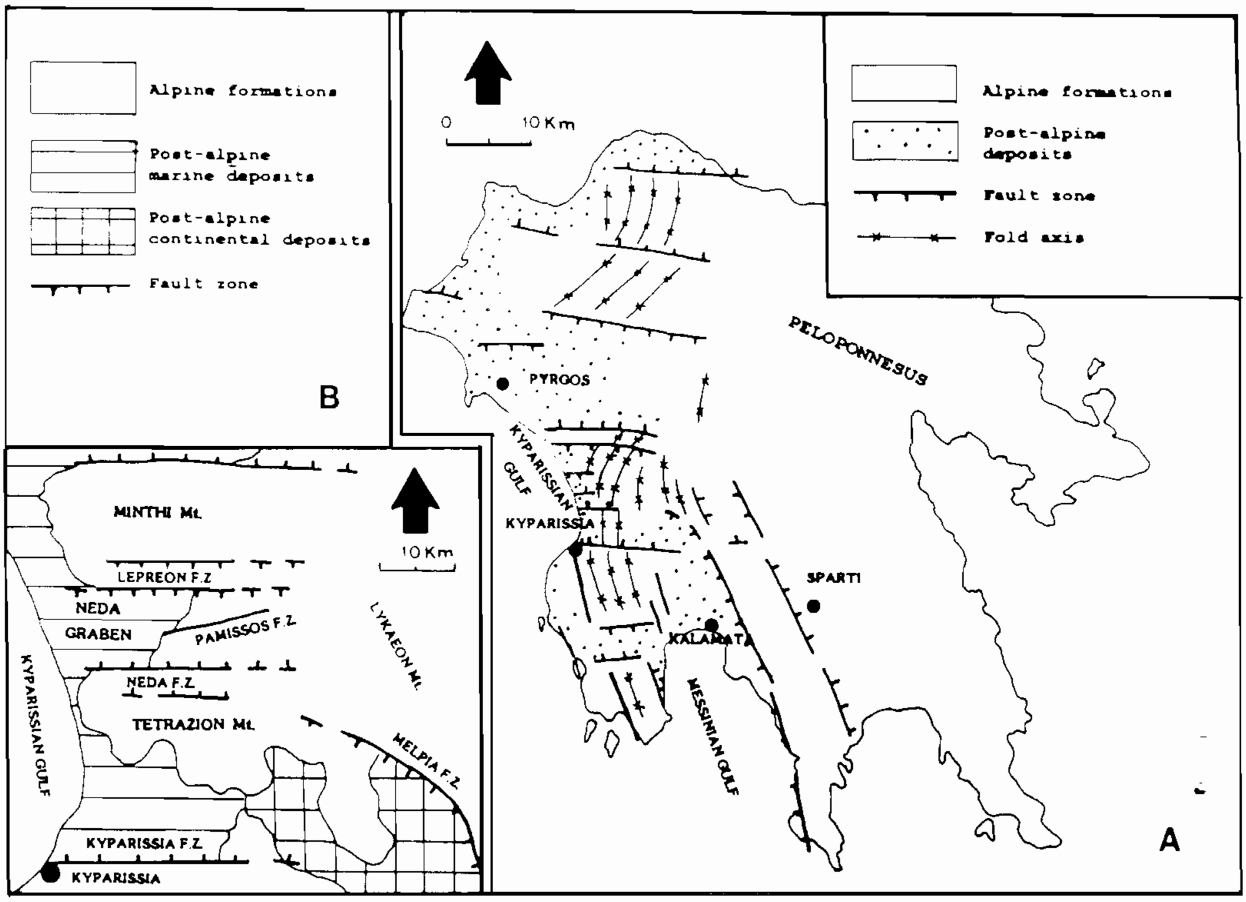

Fig. 6. The neotectonic macrostructures of the:
A: Western Peloponnese
B: Major area Neda f.z. (after FOUNTOULIS 1994).

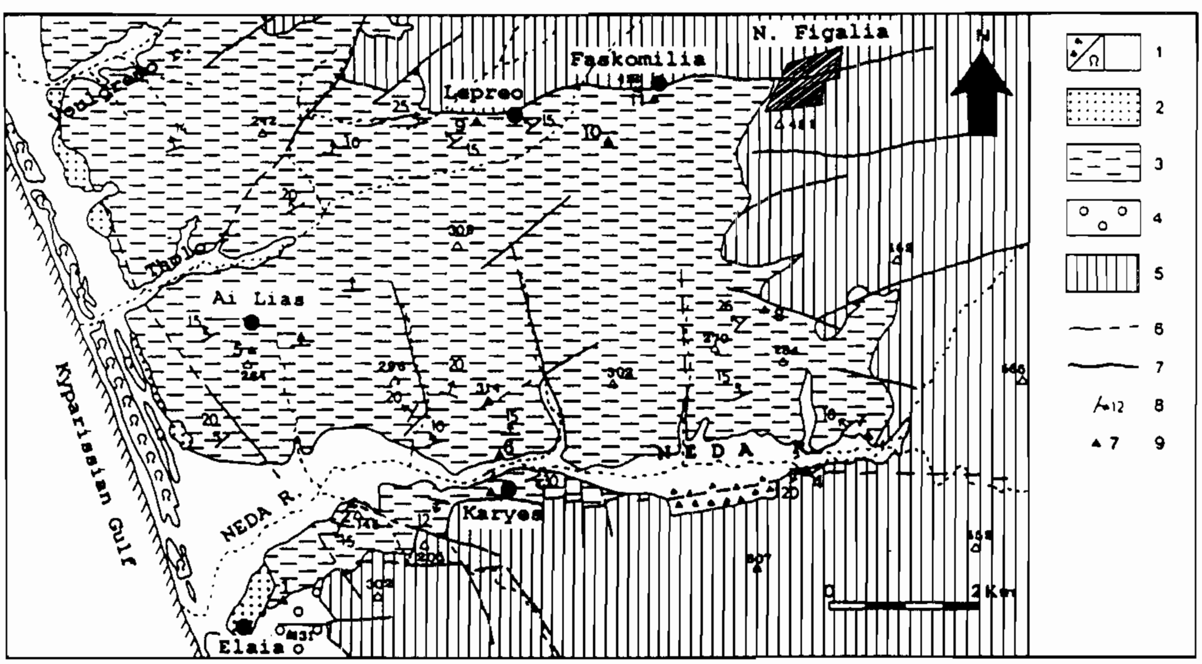

Fig. 7. Geological map of Neda graben (after FOUNTOULIS 1994). 1: Alluvial Dunes, Scre, 2: Red-colored siliceous clastic formation, 3: Neda formation (Early-Middle Pleistocene) 4: Elaia formation (Pliocene), 5: Pindos Unit, 6: Geological bombary, 7: Fault, 8: Strike and dip of strata, 9: Site of observation and sampling.

* Neda graben, Minthi horst, Tetrazion horst. (Fig. 6).
* The deformation of the Early-Middle Pleistocene marine deposits since Middle Pst (Fig. 7, 8).

Stop 2.6 Kaló Nero

The western part of the Kalamata - Kyparissia mega-graben (1st order)

The Kyparissia - Kalo Nero graben (2nd order)

The Kyparissia f.z.

The Paristeras active f.z.

Stop 2.7 On the road from Kalamata to Megalopoles (Tsakona)

Panoramic view of the Ano Messinia basin an active neotectonic graben. Cross-point of the two major fault zone strikings E-W and NW-SE. (Fig. 9). A closed hydrogelogicaly and open hydrologicaly system.

Stop 2.8. Meligalas-Neochori

The recent break of the Ano Messinia through the small river Mavrozoumena.

3rd day SATURDAY, September 16, 1995

MAJOR AREA OF KALAMATA

Under the opportunity of two days staying at Kalamata city, some observations concerning the September 1986 earthquakes and the caused damages, can be done.

The city of Kalamata is located at Southwestern Peloponnesus, at the northern margin of Messinian gulf. It is traversed by the Nedon river (Striking NNE-SSW) and it is built at the Southeastern margin of Kalamata-Kyparissia big graben, mainly consisting of Pliocene (marls, conglomerates and sandstones), Pleistocene (sandstones and non cemented conglomerates) and Holocene formations (alluvial, scree, ferraces and loose material).

The exent of the city is about 3 km and the population is about 42.000 people. The constructions are represented by old buildings (1-3 floors from masoury), as well as by new ones (reinforced concrete buildings with 4-7 floors).

The damages caused by the September 1986 earthquakes are the following:

i) 20 people have been killed and 180 people have been wounded.

ii) 33% from the city constructions was totally destroyed and in 76% of them more or less destructions have been caused.

iii) Destructions in the water supply and sewage system and fires in the electric light wires, also have been caused after the shock.

iv) Tsunamis or other damages along the coasts have not been observed, except the western part of Kalamata harbor, where a horizontal movement of the top of the quay-wall occured.

v) Changes to the quality of the drinkable water have not been caused by the earthquake shock.

From the detailed geotechnical studies that had been taken place under the supervision of ΚΕΔΕ (Research center of public works ministery), the narrow area of Kalamata city can be separated in 3 (three) distinct zones, according to fandamental periods of elastic soil protile, which are the following: (BOUKOUVALAS and SABATAKAKIS 1987)

By all mentioned above, the following observations, concerning the damages and destructions of Kalamata city, can be done.

i) The main feature is that the damages caused by the September 86 earthquakes was not evenly distributed over the city or over the epicenter (MARIOLAKOS et al 1987, 1989, GAZETAS 1987, BOUKOUVALAS and SABATAKAKIS 1987).

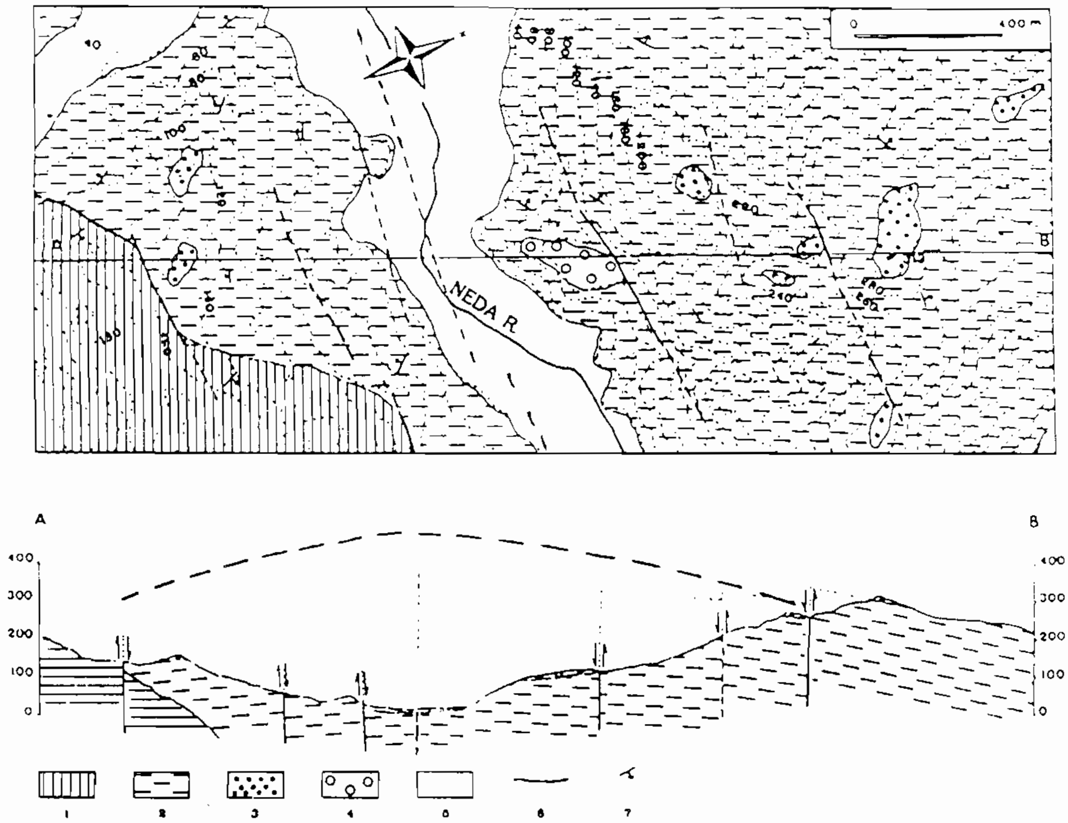

Fig. 8. Detailed geological map of a part of the Fig. 7. 1: Pindos Unit, 2: Alternation of marls and sandstone, 3: Polymit conglometals, 4: Oligometric conglomerates (terrace), 5: Alluvial deposits, 6: Fault, 7: Strike and dip of strata. (after FOUNTOULIS 1994).

ii) Along the coastal zone of Kalamata city the damages and the destructions were very small, although the geomechanical conditions were very bad (loose and unconsolidated material, water table level 1,5m) (MARIOLAKOS et al 1987,1989, BOUKOUVALAS and SABATAKAKIS 1987).

iii) There is not a very close relation between the ground and soil mechanical properties and the damages which are very well combined and correllated (like the rockfalls) with the presence of seismic fractures or reactivated microfaults (MARIOLAKOS et al 1987,1989).

iv) Indepedently from the ground foundation and the number of floors the most damages was observed in the buildings from masonry. In contrast to this only a relative small number of reinforced concrete buildings was damaged. (BOUKOUVALAS and SABATAKAKIS 1987).

v) Indepedently from the type of buildings, in zones II and III the most damages were observed in the high buildings (4-7 floors) (BOUKOUVALAS and SABATAKAKIS 1987).

vi) The seismic fatiguing in zone I at the northern part of the city was normaly distributed indepedently from the number of floors (BOUKOUVALAS and SABATAKAKIS 1987).

Stop 3.1

About 2 km after Kalamata city, to the roadcut towards Eleochori, the Xerilas torrent and the Xerilas fault zone exist. This fault belongs to the transition fault zone between the Dimiova-Perivolakia graben and the Kalathion horst.

Linear erosion, due to the block movements, and conglomerates, paleosoild and cones of different age indicators for the palaeogeographycal conditions and the morphotectonic evolution, are observed and discussed.

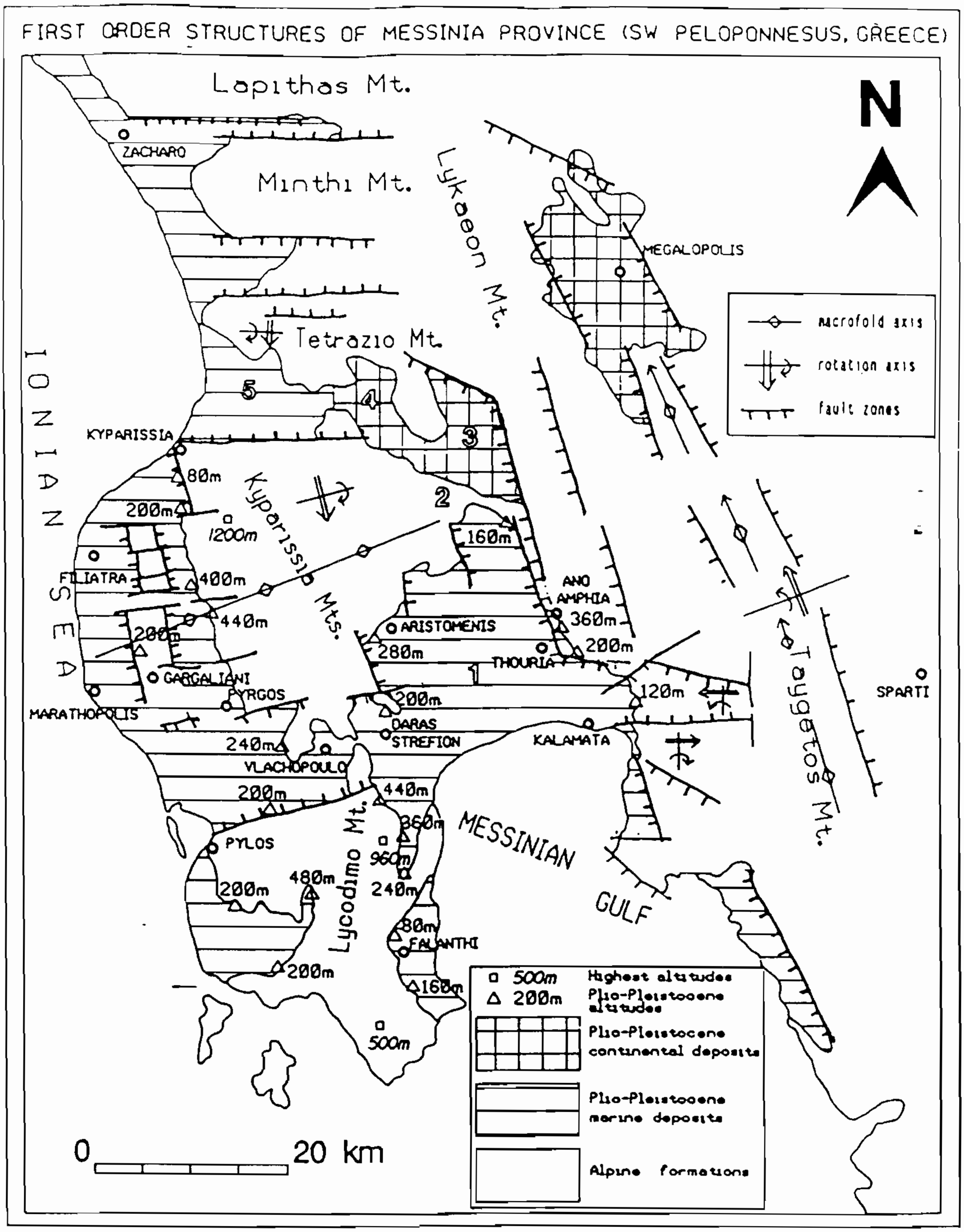

Fig. 9. Sketch map of 1st and 2nd order neotectonic macrostructures. The 2nd order neotectonic macrostructure of Kalamata - Kyparissia graben are: 1: Kato Messinia graben, 2: Meligala horst, 3: Ano Messinia graben, 4: Dorion basin, 5: Kyparissia-Kalo Nero graben.(after MARIOLAKOS et al 1994).

Stop 3.2

About 1 km before Eleochori village, there is a reactivated fault by the earthquakes of September 1986. The fault plane strikes NNE-SSW and the total displacement, due to the earthquakes, was about 15 cm to WNW. Along the fault zone rockfalls also have been observed.

Stop 3.3

The Eleochori village, built on the Tripolis unit neritic limestones, was totally distroyed by the earthquakes of September 1986. It represents one of the most typical places where a very close relation, between the seismic fractures or reactivated microfaults and the destructions, is revealed. Some other subjects that can be also discussed are the following: i) the relationship between the age and the type of the constructions and the damages (i.e. the remains of the ancient construction of the mycenian wall wasn't destroyed by the September earthquakes, in contrast to the other younger buildings in the surrounding area, ii) the behaviour of the foundation basement, iii) the neotectonic deformation of the Pindos nape surface and iv) the rate of the erosion and the relation between the morphotectonic evolution and the tectonoisostatic movements.

Stop 3.4

About 1 km after Eleochori village, towards Dimiova Monastery there is an outcrop of the contact between the limestones and the flysch of the Tripolis unit. This contact is a typical normal fault, known as Zimbeli fault surface. The fault plane strikes NE-SW and dipping 65 to the NW. A recent landslide at the slope of the road revealed a big part (20x6m), of the fault surface. On this part, not yet erroded, a great number of small brittle structures can be seen. These structures give information about the evolution of the concrete fault (reactivations...etc), as well as about the deformation type of this surface. The shape of the fault surface is not plane, but curve, convexe and concave .The main minor structures on this surface are the following: a) Many generation (at least 6) of slickensides, plunging in different directions whereas the slickensides of the 3rd set they are almost horizontal, b) Four different categories of tectonic breccias can be distinguished taking into consideration the material they consist of and their relative age , c) Small scale fractures and microfaults in en echellon arrangement cut the fault surface and they seem to be connected with the slight curvature of this surface. The younger sets of these microfaults which are the bigger ones (0,5-7m), show the maximum displacement (3-4cm). Also a "gap" (opening) of about 10 cm in the central part of the fractures is observed. The block displacement on both sides of the fractures hasn't always the same direction. So, in some microfaults the NW block (footwall) uplifted and the SE block (hangingwall) subsided, whereas, in a few cases the opposite is observed.

Taking into account the above mentioned minor structures and the curved shape of this surface, we discuss the type of the stress field and the kind of structures that can be created, always taking into account the lithology, the conditions and the type of deformation.

Stop 3.5

About 500 m before Dimiova's Monastery there is an outcrop of the transitional beds to the flysch of the Tripolis unit. The main lithologies are sandstones, marls, pelites with intercalations of tourbiditic microbrecciated limestones (calcarenites). The Alpine structure is represented by closed or isoclynal folds with an axis striking mainly in the NW-SE direction. In contrast to this the younger structures (neotectonic) represented by normal type faults striking in the NW-SE and NE-SW direction and building conjugate sets of faults. In the mesoscopic scale, the kinematic of these faults, as it is expressed by the en echellon arrangement and the rotational movements of the microblocks, coincides with the kinematic type of the neotectonic macrostuctures in this region (i.e. Dimiova-Perivolakia graben, Kalathion horst).

Stop 3.6

At the Dimiova-Perivolakia Monastery there is an outcrop of the tectonic contact (overthrust) between the Pindos nape (consisting mainly of limestones) and the flysch of the Tripolis unit. Along the tectonic contact a lot of springs are existing because of the favourable hydrogeological conditions. As it is obvious, the location of the springs, along the tectonic contact, depents on the "morphology" and structure of the overthrust surface, which is the result of the alpine and post alpine (neotectonic) tectonism. From this place also, a discussion can be done concerning the Dimiova-Perivolakia graben which is a 2nd order neotectonic macrostucture at the eastern margin of Kalamata-Kyparissia graben. The study of the tectonic and geomorphological elements shows that the endogenetic proccesses - responsible for its creation - are complex, both from the kinematic and the dynamic point of view and they are expressed on the relief through concrete landforms, such as the formation of intense ravines and the planation surfaces. The marginal faults, the structural map of the Pindos nape, the formation of intense ravines, the planation surfaces and the recent geodetic data, prove that the graben is the result of rotational movements, with one N-S principal rotation axis and another secondary in the E-W direction, so that the western and more especially the southwestern part of the graben is the most subsiding area.

Stop 3.7

Thouria. Plio-Pleistocene (Hyalinea baltica) and faulting. We are at the eastern margin of the Kato Messinia graben. The Pleistocene deposits have a visible thickness of about 400 meters.

way to village Ano Amphia.

Marls with intercalations of sands and sandstones can be found there.

Stop 3.8

MOMA workfield on the way to Ano Amphia. 2,5 km after the village Thouria the palaeorelief developed on alpine formation is revealed by erosion. Over this palaeorelief, marine sediments of Pleistocene age have been unconformably deposited.

At this locality two generations of relief have been identified. a. The older one was formed before the deposition of Lower Pleistocene sediments began b. The younger relief began after the deposition of the Pleistocene sediments and the uplift of the region.

Stop 3.9

Ano Amphia (Potis Tavern). Remnants of the Pleistocene deposits on the alpine basement can be clearly observed at this locality. The transgrenion is indicated by the presence of coral fossils identified as Cladocora. Remnants of Pleistocene sediments can be found on hillsides up to a present altitude of 400m.

Stop 3.10

The entrance of Girorema gorge: Systematic study of the neotectonic structures - reactivation of the faults - erosion to the depth relative to the Quaternary Kinematic correlation between. Rockfalls and the reactivation of faults - Seismic erosion. Changes of the rocks properties because of the intensive fracturing. Active and nonactive faults. Fracturing and carstification.

Stop 3.11

The polye of Poliani: The polye Poliani is the largest carstic basin on the mountainous area at the eastern margin of Kato Messinia basin (graben). The polye Poliani developed on neritic carbonates of the Tripolis unit - which are generally jintensively carstified - with an area of almost 2.25 km^2, is structurally controlled, although the faults are not expressed on the landscape.

The polye is filled with coarse clastic river sediments (max. thickness 50-70m) of different lithology. Interesting is the presence of bebbles of metamorphic rocks, which today outcrop actually outside the catchmant area of the basin.

The polye could be considered - from tectonically point of view - as a relatively "inactive" area, located between two large tectonic grabens, namely this of Kato Messinia and that of Megalopolis.

The polye behaved - for some time - as a closed geomorphological and hydrological system, whereas from hydrological point of view as an open system because of the carstification. Later on it has been transformed into an open system. Discussion of the cinematic of the tectonic macroblock.

Stop 3.12

Dirrachi: The watershed between Alfios and Pamissos river. Interesting and remarkable the presence of conglomerates (Pleistocene) consisting exclusively of metamorphic rocks although the adjacent area consist of carbonates.

The Pindos overthrust. The strike contour map of the overthrust surface indicates rotational phaenomena.

The large fault zone Dyrrachi - Leontari, the western margin of the Taygetos horst.

4th day, SUNDAY September 17, 1995

Stop 4.1 Kato Verga

About 5 km from the town of Kalamata, the Kato Verga village is situated with a panoramic view to the Messinian gulf and the Kalamata graben. From this place, an introduction to the alpine geotectonic units and structures and their relation to the neotectonic deformation, will be presented. Some other subjects for discussion are the neotectonic macrostructures of 1st, 2nd,.. order, such as the Messinian gulf, the Kalamata - Kyparissia graben and the Kalathion horst, the marginal fault zones (active or non active), the succesive generations of talus and screes along the western margin of Kalathion horst and finally the damages in the Verga village during September 1986 earthquakes and their relation to the block movements.

Stop 4.2 Koskaraka river

- The marginal fault zone of Kambos graben (Fig. 10).

Stop 4.3 Stavropigi

- The marine sediments which overlie the continental ones of the Kambos graben (fig. 11)
- The Kambos graben. Neotectonic interpretation of the par alpine sedimentary sequances (Fig. 12).

Stop 4.4

Kardamilli: The palaeocoasts. The structures of the alpine basement. The rate of the erosion. Discussion on the beachrocks and the relief energy. Discussion on the tectonoisostatic movements of the area.

Stop 4.5

Dyros (Lakonia) - Mani area: Two caves of Diros village i. the "Alepotrypa" and ii. the "Glyphada" cave.

The caves have been formed in upper cretaceous marbles of the Mani Unit along joints striking NNE-SSW, E-W and occasionally NE-SW.

A. Cave "Alepotrypa"

Cave Alepotrypa is located in Portarakia at an elevation of 20 m just above Dyros bay. The cave was discovered by Anna Petrochilou in 1958.

In the cave the following rooms are successively encountered 1. the "Olive tree chamber", 2. the "Crystal rain" chamber, 3. the "Curred staircase" chamber, 4. the "balcony", 5. the "Chamber of the Rocks", 6. the "Second filled" chamber, 7. the "Worship heality", 8. the chamber "Joints", 9. the "Royal Balcony", 10. the "Large Hall" in which the "Great Lake" is situated, 11. the "Upper floor".

The following objects have been found from time to time in the cave a. Human ... and Sculpts. b. Many pieces broken vessel. c. Marble statuettes of Tools made of stone (Palaeolithic stone age) e. Miscellaneous tools made of Opsidian, clay, copper and iron h. Bracelets made of and earnings made of silver.

B. Cave Clyphada

Cave Clyphada is located at an elevation of 0,10 m. Just above Dyros bay. This cave was known even before 1900. An underground river circulates through the cave and flows into the sea.

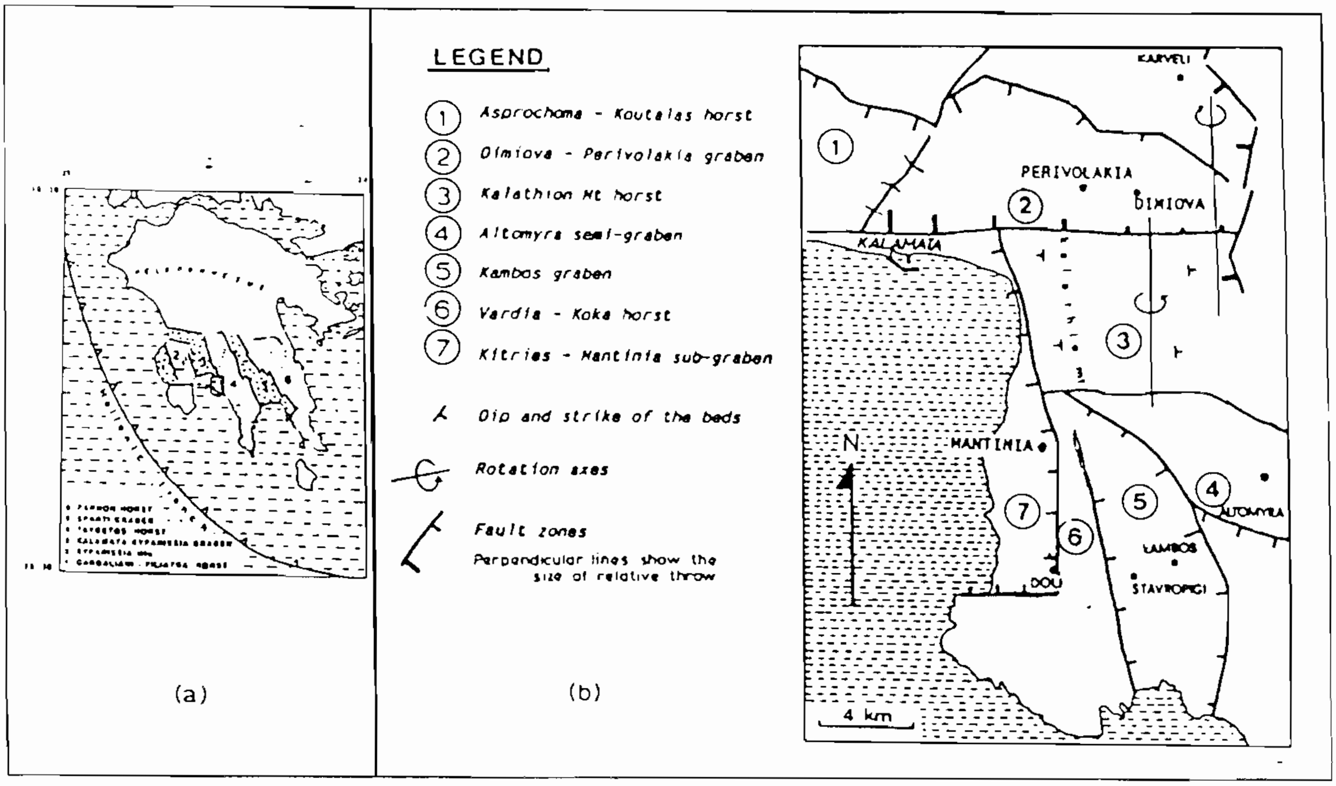

Fig. 10: Sketch maps of the:

(a) Neotectonic megastructures of southern Peloponnesus

(b) Smaller order neotectonic macrostructures of the Kato Messinia sub-graben

(after MARIOLAKOS et al, 1992).

The natural entrance to the cave is almost at the sea level so that when the sea is rough, the access to the cave is not possible. For this reason a new entrance has been constructed at a higher level.

The following rooms are encountered when visiting the cave.

1. the "First staircase", 2. the "first lake" where visitors get on boats, 3. the "Dead City", 4. the "Crossroad" 4 galleries begin at this point. Two of these are directed to the NW and two to the NE.

The NW gallery goes through the part of the cave which is dry. Here the waters of the river go through a siphon and flow into the sea. Visiting the dry part of the cave one can find the "Posidon Palace". The NE gallery takes us to as "Picturesque lake" and then to the "Corridor of the large plate" and from this point to the large Ocean where a recently excavated corridor takes us to the chamber of the "Tower of Piza". We find then the "chamber of the Dragon", the "Red Staircase", the "Chocolate staircase", the chamber of the "goldtin Rain" and the "Sea of the Shipwreckes" beginning from the "White isle" and via "The white Corridor" goes to the "artificial Tunnel" which join the NE and NW galleries.

In the NW gallery one finds the chamber "6happel" the "White Rooms", the "Tower of Dyros" rooms, the "Cathedral", the "Corridor of miracles" and the "Oceanide lake". Bones attributed to Prohippopotamus and Provous have been found in the cave.

Shoreline displacements

Older shorelines can be observed in the area. The first is found at an elevation of 14.5 metres above sea level. It is identified by traces of Lithodomus lithophagus as having a Tyrenian age (J. Petrochilos). The second is found at an elevation of 8m above sea level and is identified by many small caves which exists there. The third is found 5-15m, below sea level and is identified by the existence of ancient buildings.

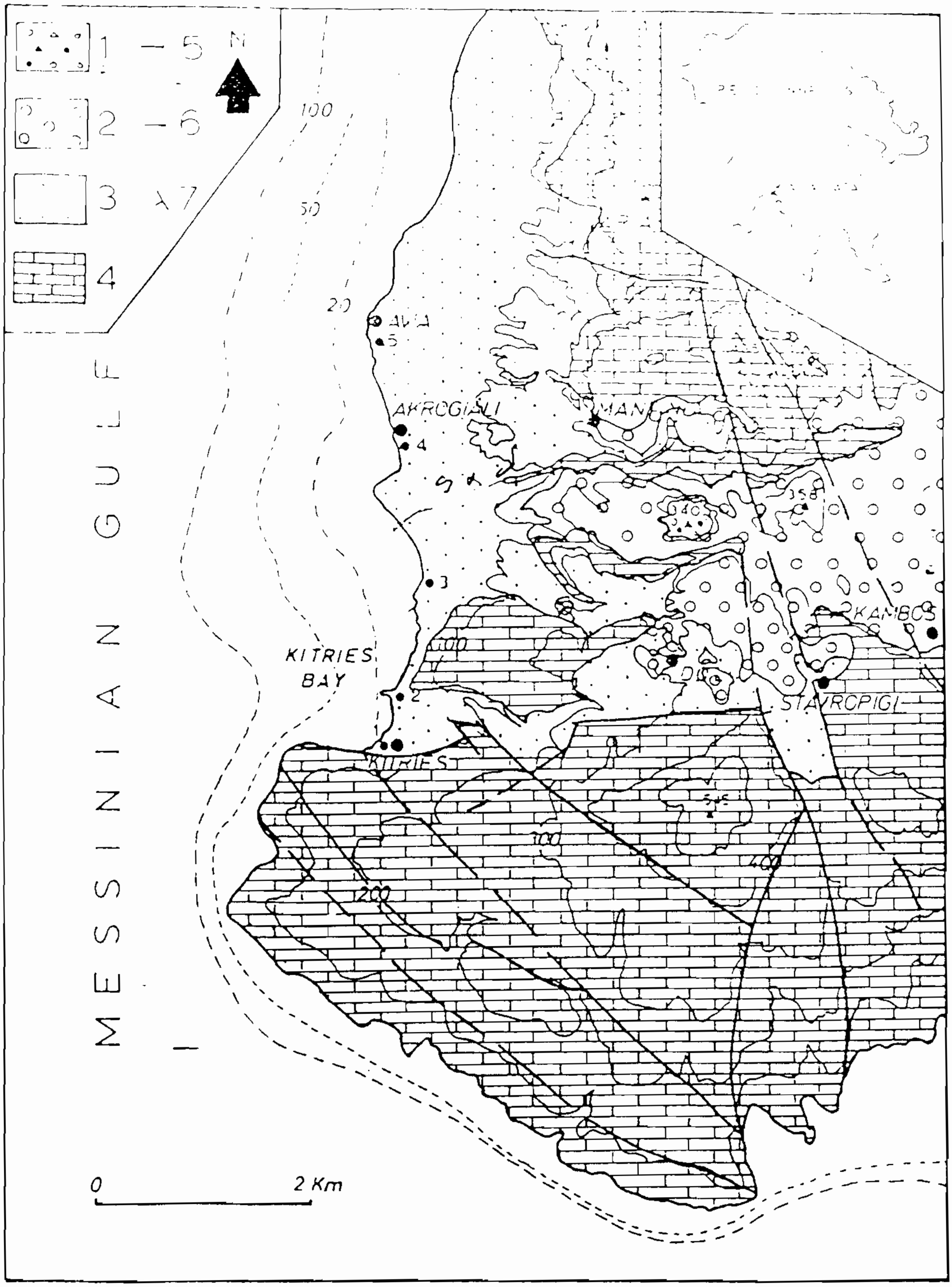

Fig. 11. Geological map of the study area. 1: polymictic conglomerates; 2: oligomictic conglomerates; 3: marls, marly sandstones and sandstones; 4: carbonates and flysch of the Tripolis geotectonic unit; 5: fault; 6: geological boundary; 7: dip and strike of the beds. See text for further details. (after MARIOLAKOS et al 1992).

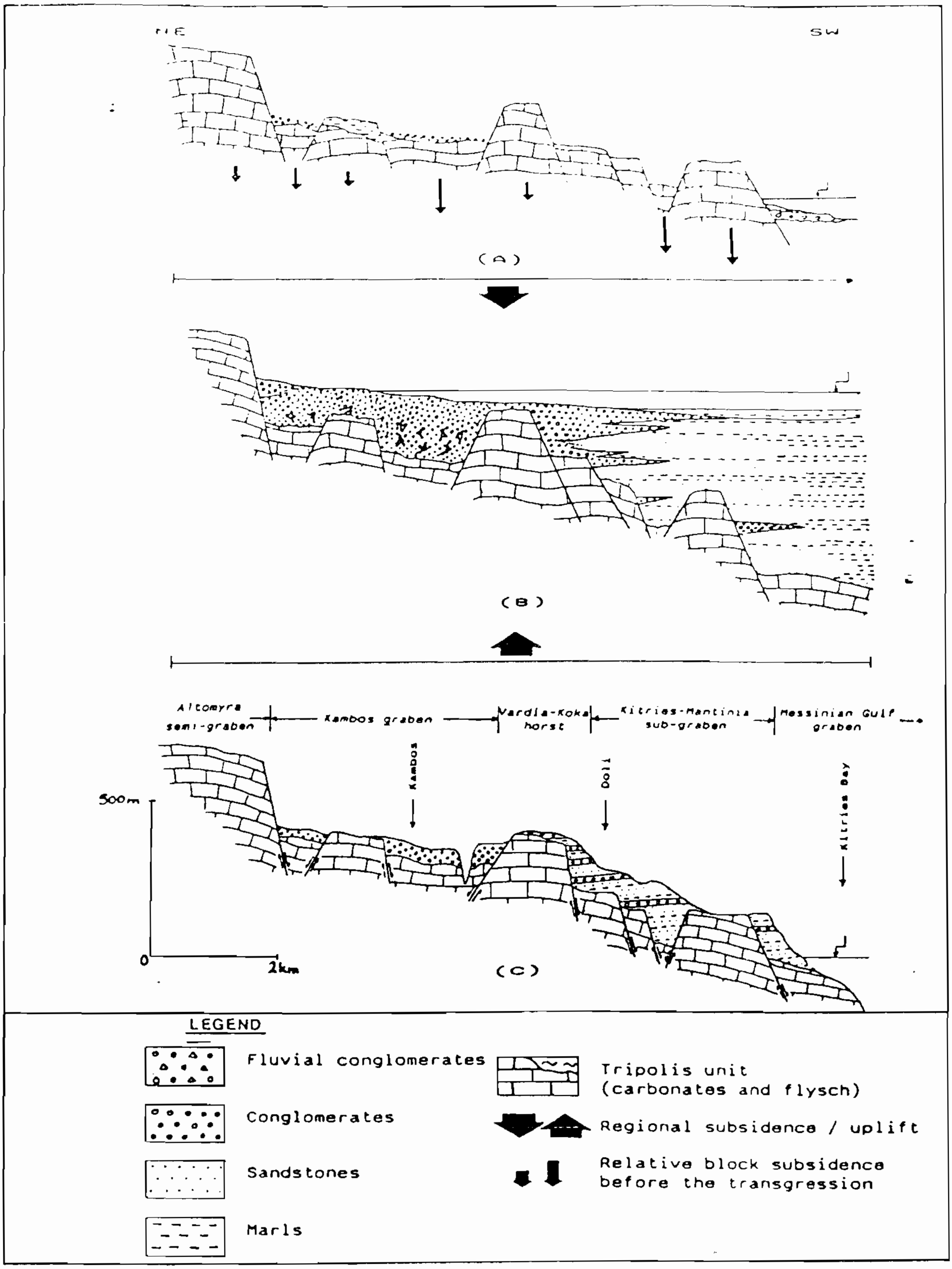

Fig. 12: Schematic depiction of the three main stages of the neotectonic evolution of the study area. (A) At the beginning of the deposition of the oldest pleistocene sediments. (B) Filling up with pleistocene marine deposits, when the uplift started. (C) The present geological and morphotectonic status. (after MARIOLAKOS et al, 1992).

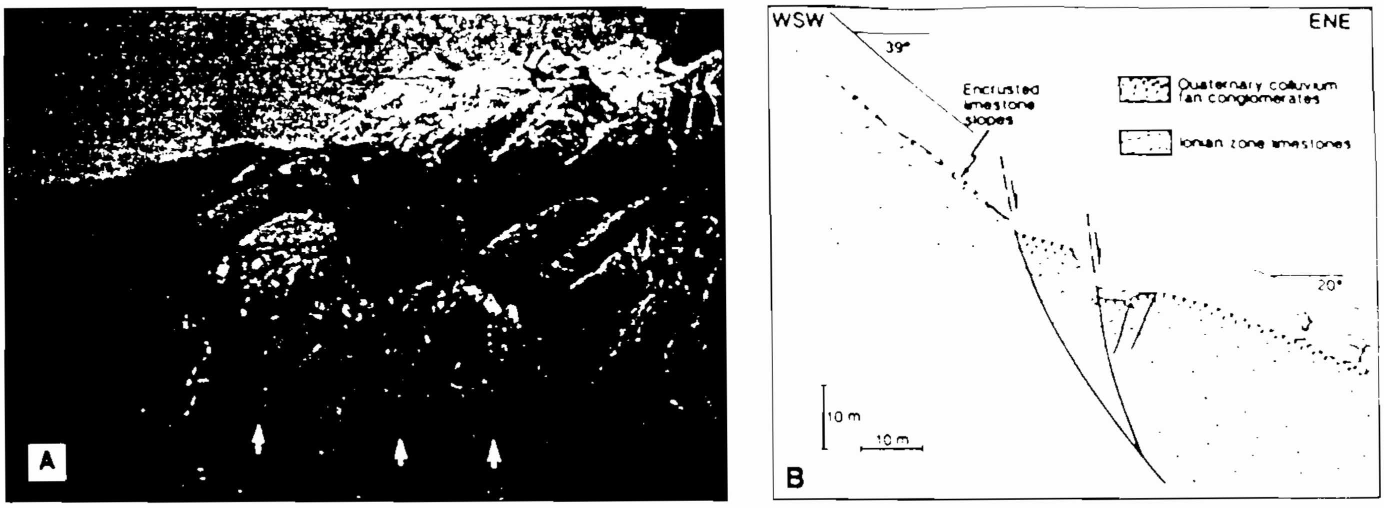

Fig. 13. Sparta fault. A: Taygetos Mountain front, looking southeast. Arrows indicate scarp. B: Section across scarp.

AREA OF SPARTI

Stop 4.6 Sparti

As already have mentioned the neotectonic structure of southern Peloponnese is characterized by the presence of mega-horsts and grabens.

Very characteristic is the part of the Sparti fault zones which is the bocudary between the Taygetos Mt horst to the west and the Sparti graben to the east (Fig. 12). I strikes NNW-SSE and is constituded by a large number of faults in enechelon arrengement.

By combining historical and morphological evidence Armijo et al (1991) proposed that rupture of this NNW-SSE striking normal fault is the most probably source of the earthquake that destroyed aucient Sparti in 464 B.C. The earthquake could have head magnitude Ms = 7.2, corresponding to au average slpi of -3-4 m along a 20 km long surface break. The total searp height implies a maximum throw of about 10-12 m (Fig. 2b) and might correspond three events with slip comparable to that of the 464 B.C. events (ARMIJO et al. 1991).

The most continuous and better preserved parts of the searp are along the base of distinct triangular faceted spurs and they Marx the main contact between the bedrock and the Quaternary colluvium and alluvium filling the Sparti graben (Fig. 12A).

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