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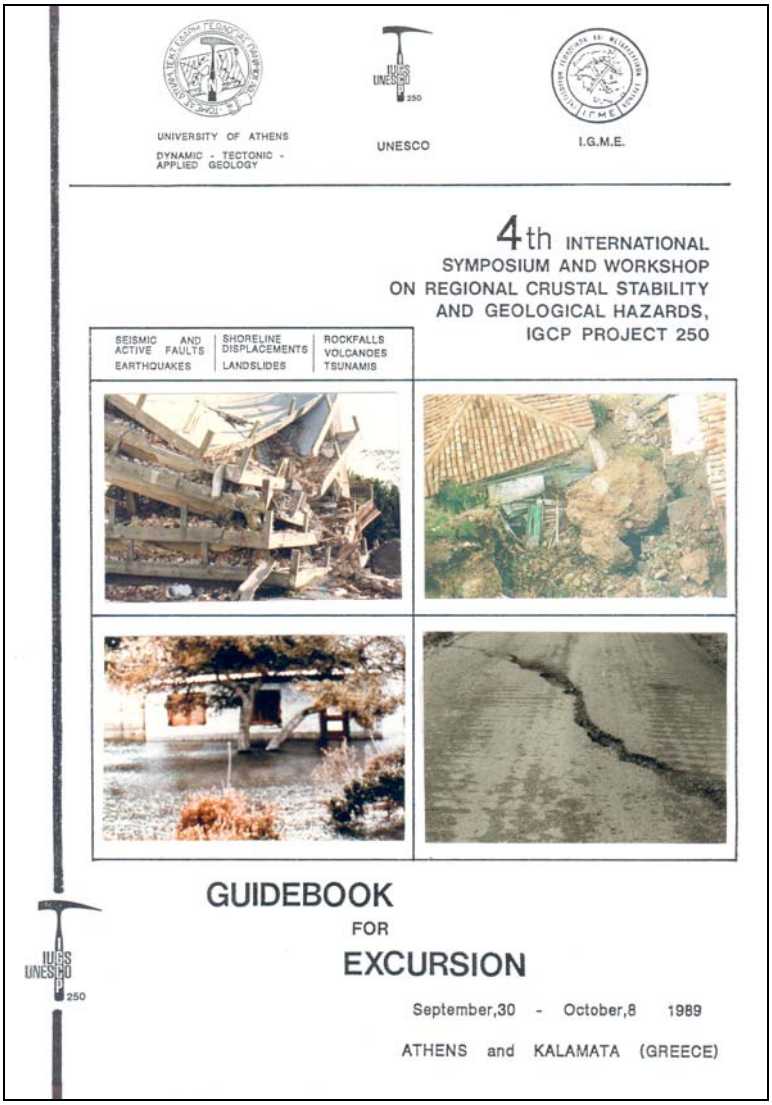

FOUNTOULIS, I. (1989). - The present Geodynamic regime of the Hellenic territory. In: *Guidebook for Excursion για το IGCP Project No 250.* Αθήνα-Καλαμάτα, 30 Σεπτ. - 8 Οκτωβρ. 1989, p. 8-15.

THE PRESENT GEODYNAMIC REGIME OF THE HELLENIC TERRITORY

by

I.FOUNTOULIS *

The present Hellenic orogenic arc is restricted only at the southern part of the Hellenic territory, in contrast with all the previous ones, which were developed throughout the whole length of the Hellenides.

During Middle Miocene, a part of the Hellenic arc, which today is active, was cut from the Tethyan chain and, since then, it followed its own evolution.

To the north, this part is bounded by the prolongation of the so-called Anatolian fault, which shows a dextral horizontal component of movement. In the northern Aegean region, this fault coincides with the northern limit of the active part of the Hellenic arc, for which the term **Aegean microplate** has been used (McKENZIE 1970, 1972, 1978, GALANOPOULOS 1972).

The Hellenic arc reaches gradually its present geometry since the Late Miocene. The back-arc basin, as well as the volcanic arc, are restricted at the **Aegean plate** region i.e. southern of the Sperchios graben and western of the Turkish coast (fig. 1).

According to LE PICHON et al (1981), the present geodynamic regime of the Hellenic arc is characterized by an assymetry of its movement: along the Ionian trench the direction is NE-SW and the regime is purely compressional, which is in accordance to the fault plane solutions while, in the Pliny and Strabo trenches, the direction of movement is composite, featuring a substantial dextral horizontal component along a NNE-SSW direction (fig. 2).

In the region behind the arc, extensional structures exist, which usually are apparent and a very important horizontal component of movement coexists.

Many geodynamic models have been proposed for the Hellenic arc and especially for Peloponnesus. These models accept that Peloponnesus is under extensional stress field, accompanied by tectonic grabens which have created by normal faulting in the back arc basin (RITSEMA 1974, McKENZIE 1978, MERCIER 1979, LE PICHON & ANGELIER 1979, DEWEY & SENGOR 1979 and others).

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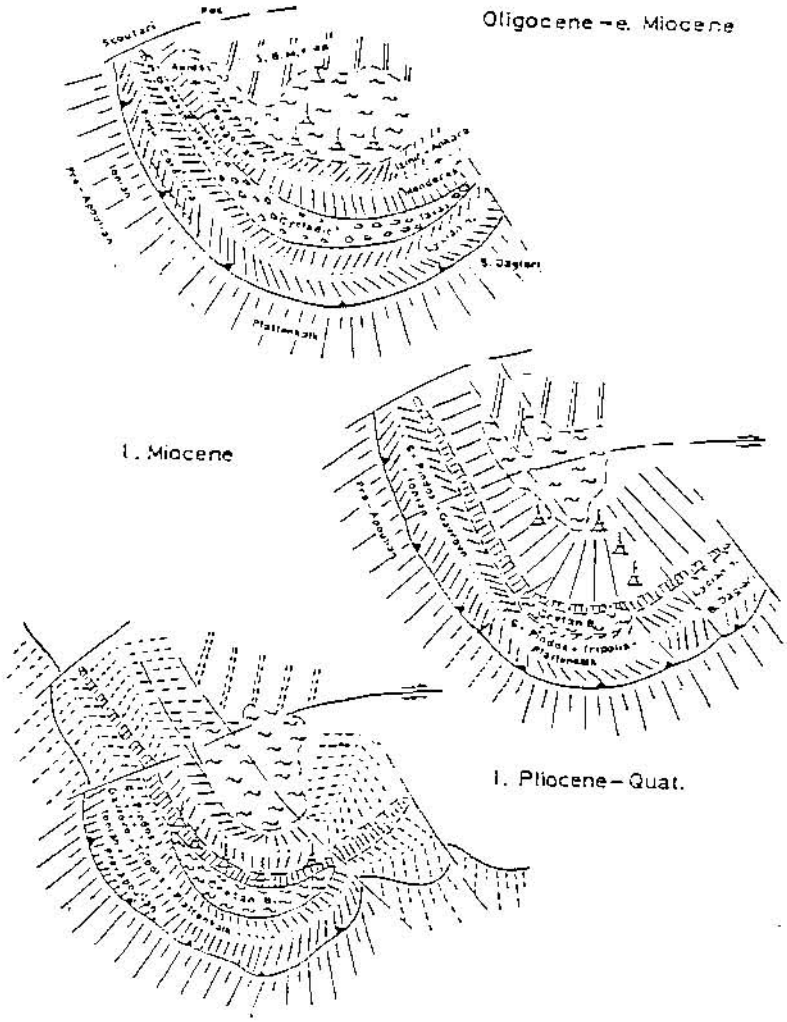

Fig.1 Schematic reconstruction of the Hellenic orogenic arc during Oligocene–Quaternary. (after PAPANIKOLAOU and DERMITZAKIS, 1981)

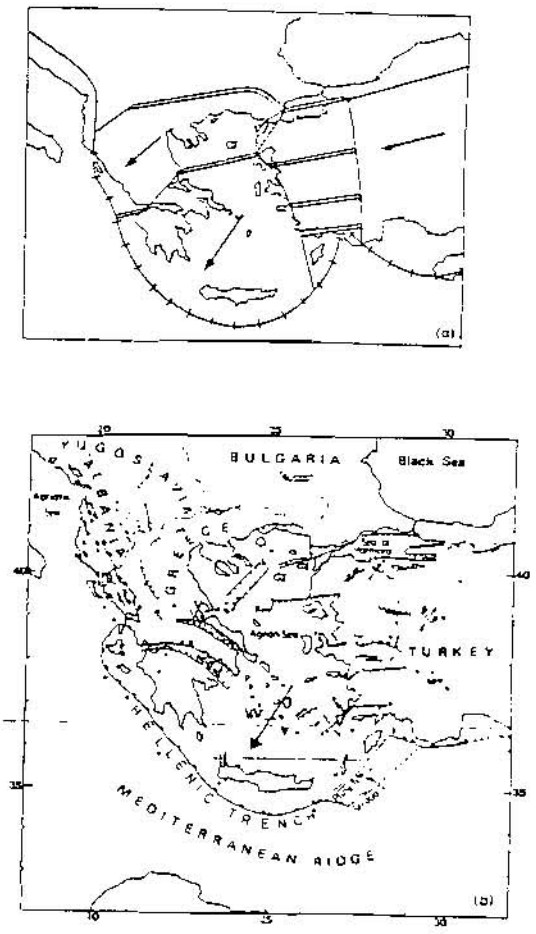

Fig.1a McKenzie's models for the Aegean

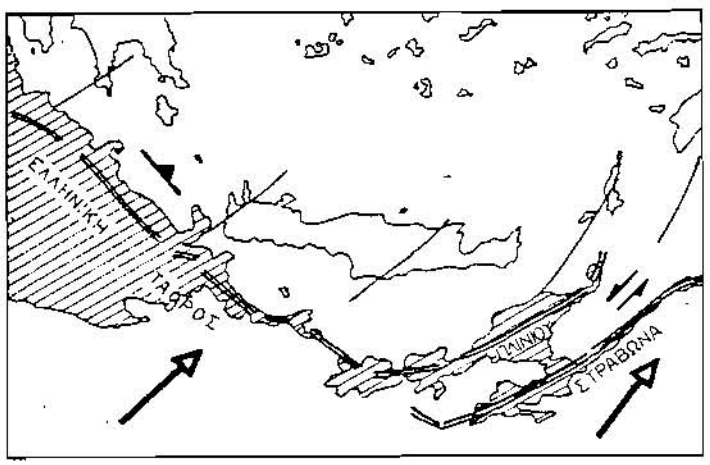

Fig. 2 Schematic reconstruction of the kinematic in the Hellenic arc, in the western part of which subduction – obduction dominates, while in the eastern part sinistral horizontal movement dominates (based on data of LE PICHON & ANGELIER, 1979, LE PICHON et al, 1979). The thin lines indicate the direction of the principal compression based on the fault plane solution of the big earthquakes (after PAPANIKOLAOU, 1986).

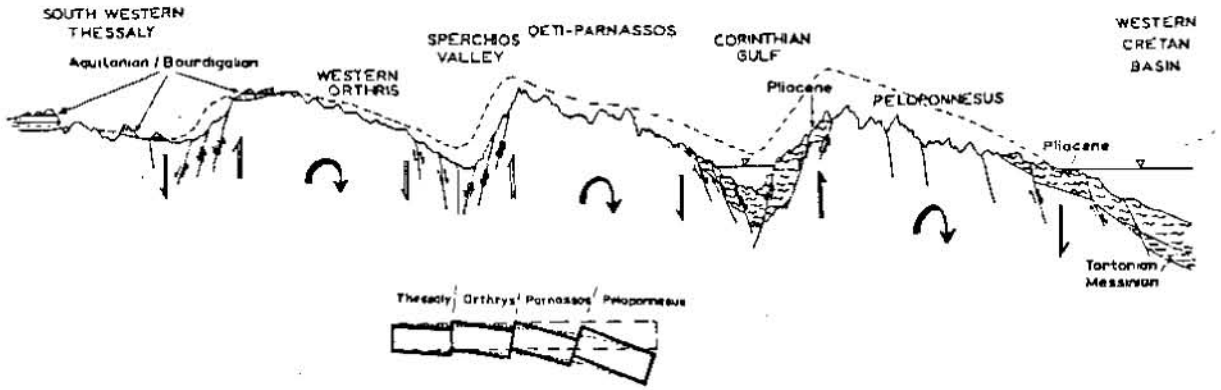

Fig. 3 The neotectonic structure of the Aegean Region in longitudinal to the Alpine chain section. The tectonic dipoles with their tilting towards the SE are briefly illustated (after PAPANIKOLAOU and DERMITZAKIS, 1979)

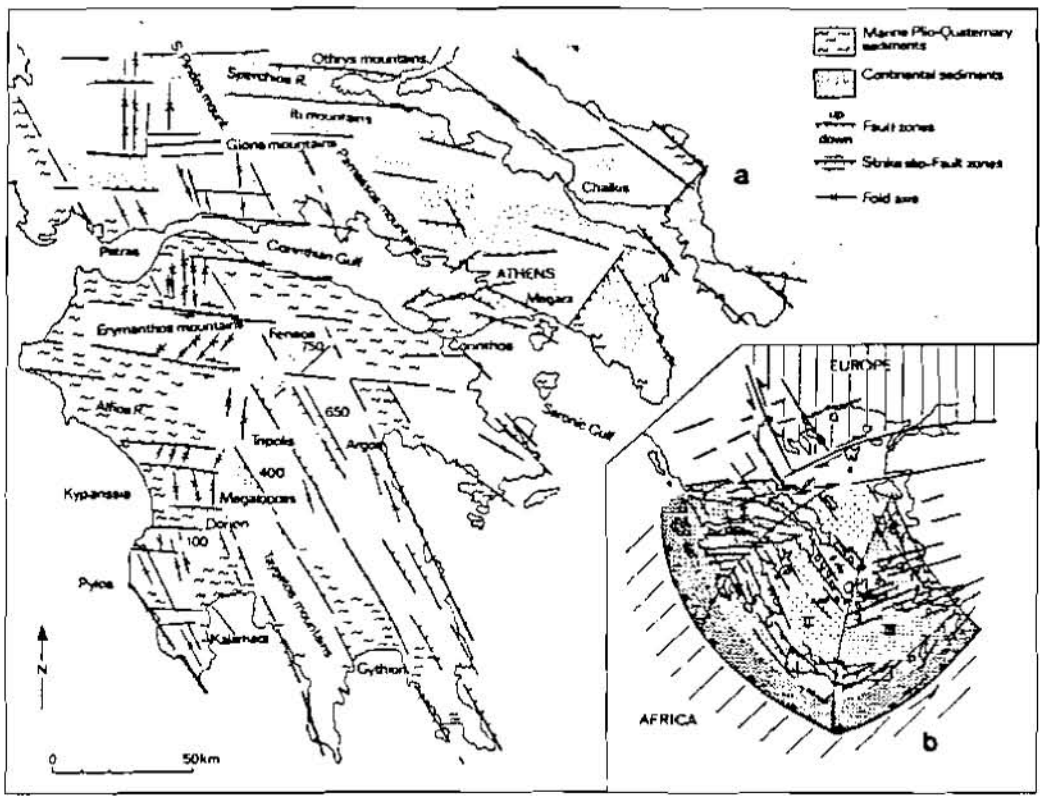

Fig. 4 The neotectonic map of the main marginal fault zones of the post-alpine basins in the southern continental Greece (a) and the neotectonic fault pattern of the Hellenic arc (after MARIOLAKOS et al, 1985).

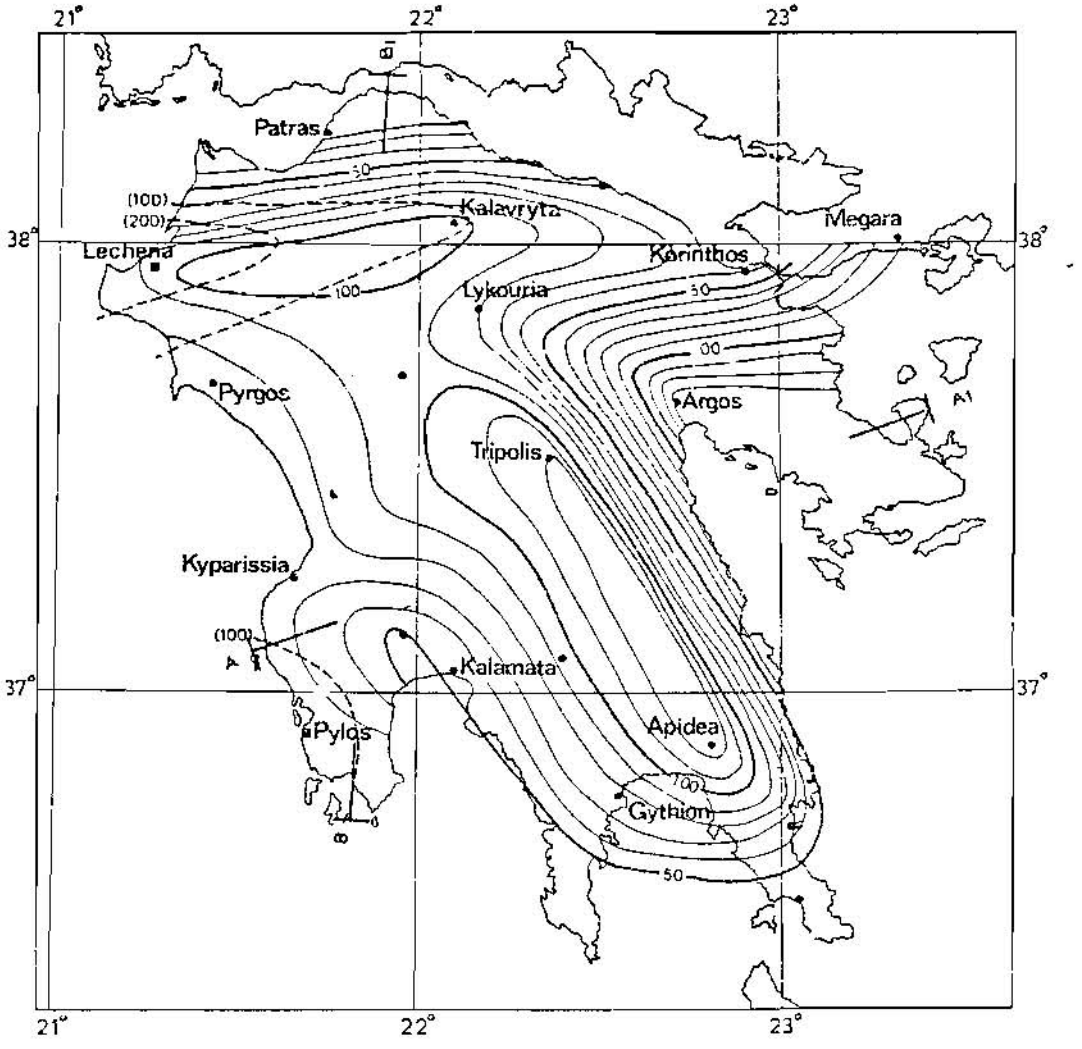

Fig. 5 Gravity difference map o Peloponnesus for the period 1968 to 1981; contour interval 10 µgals (after MARIOLAKOS et al, 1985).

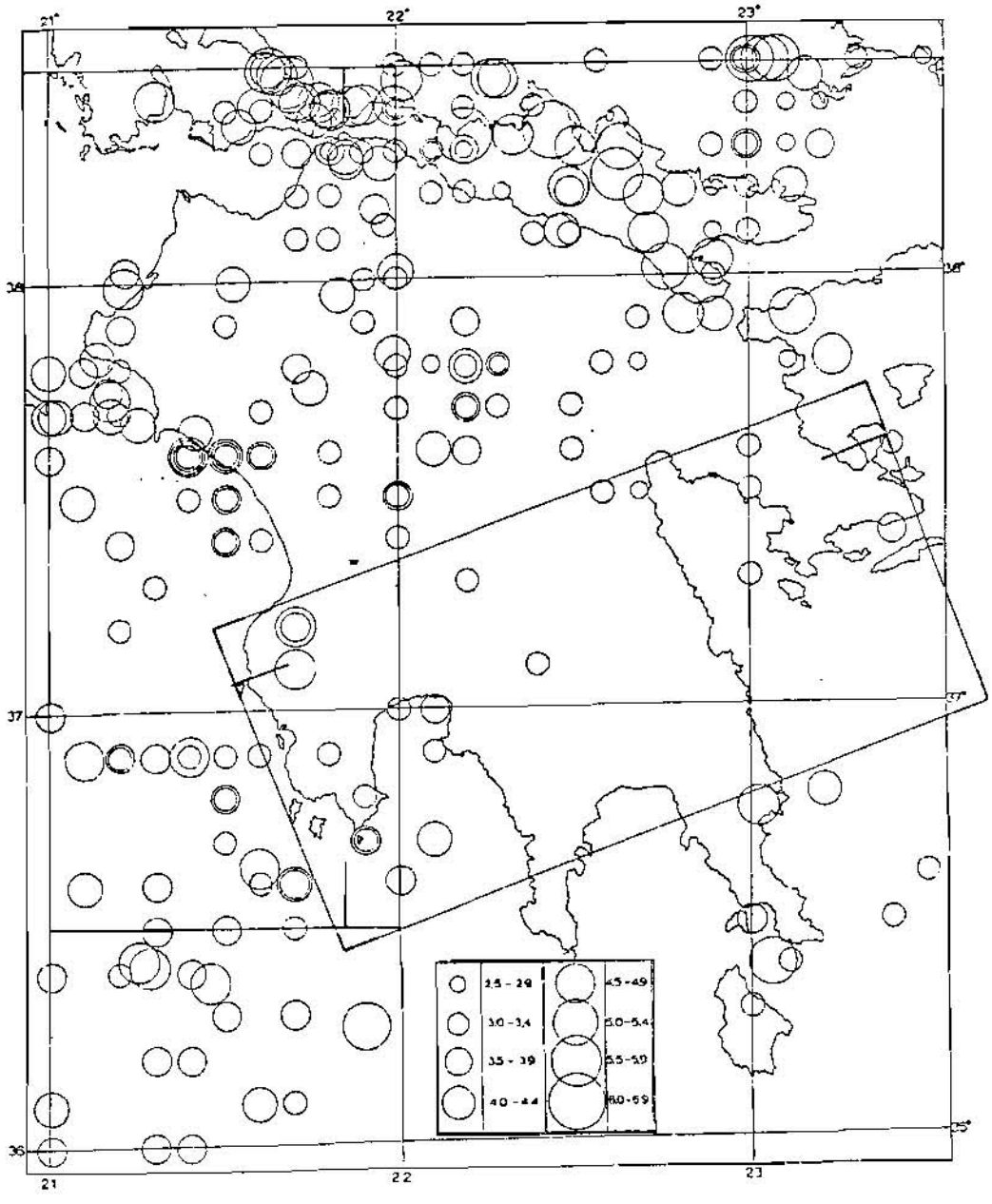

Fig. 6 Map showing the shallow seismicity of Peloponnesus and adjacent areas for 1968 to 1981. Rectangles outline the areas where the epicenters have been calculated for the histograms in Figure 7d (after MARIOLAKOS et al, 1985).

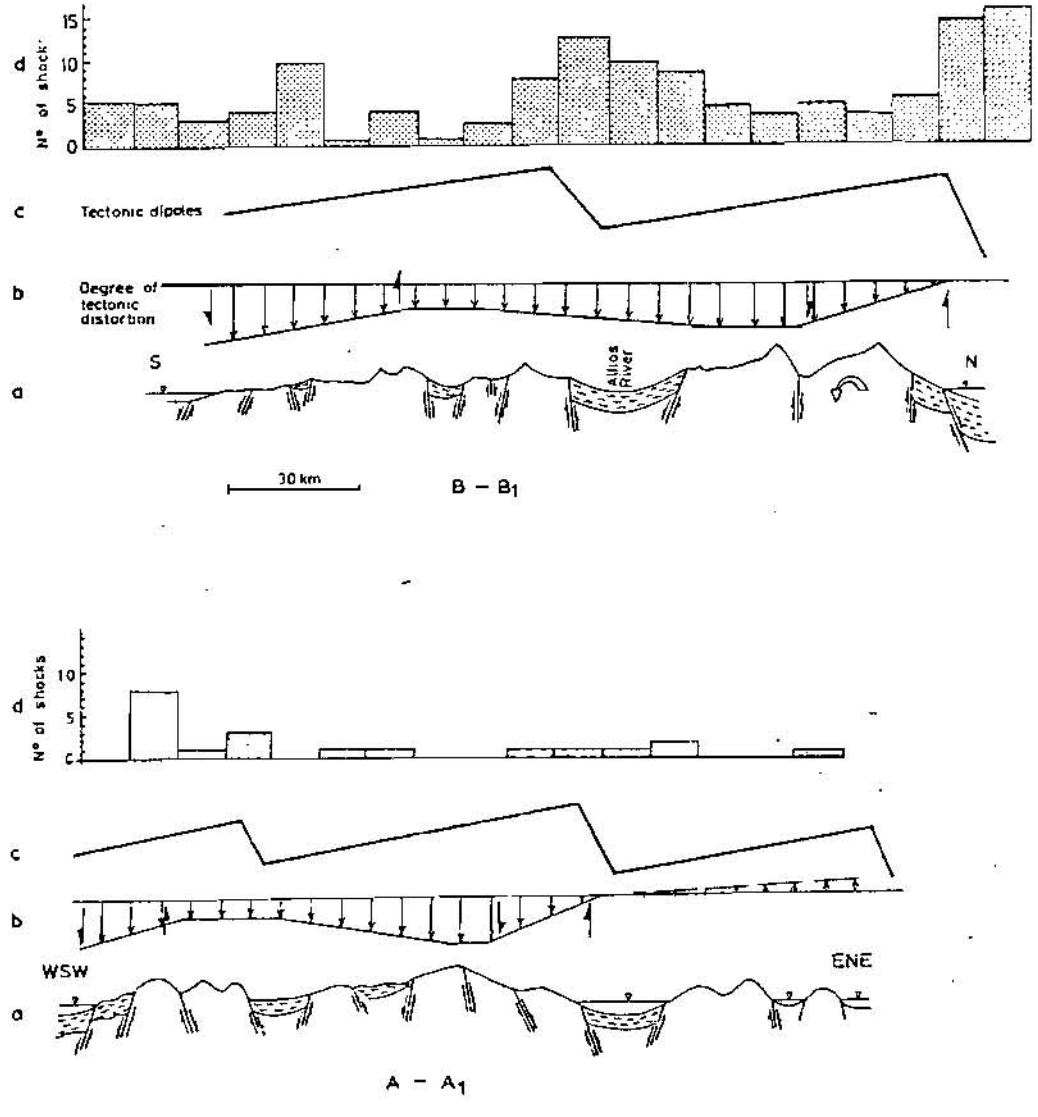

Fig. 7 Cross sections along the N–S ($B-B_1$) and ENE–WSW ($A-A_1$) profiles correlating geological and geophysical data.

a) Morphotectonic section.
b) Variation of the tectonic distortion deduced from the map of Figure 5.
The scale of the degree of the tectonic distortion has been taken as proportional to the gradient of the gravity differences along the profile.
c) Representative movements of the tectonic dipoles.
d) Distribution of the earthquake focus deduced from the map of Figure 6.

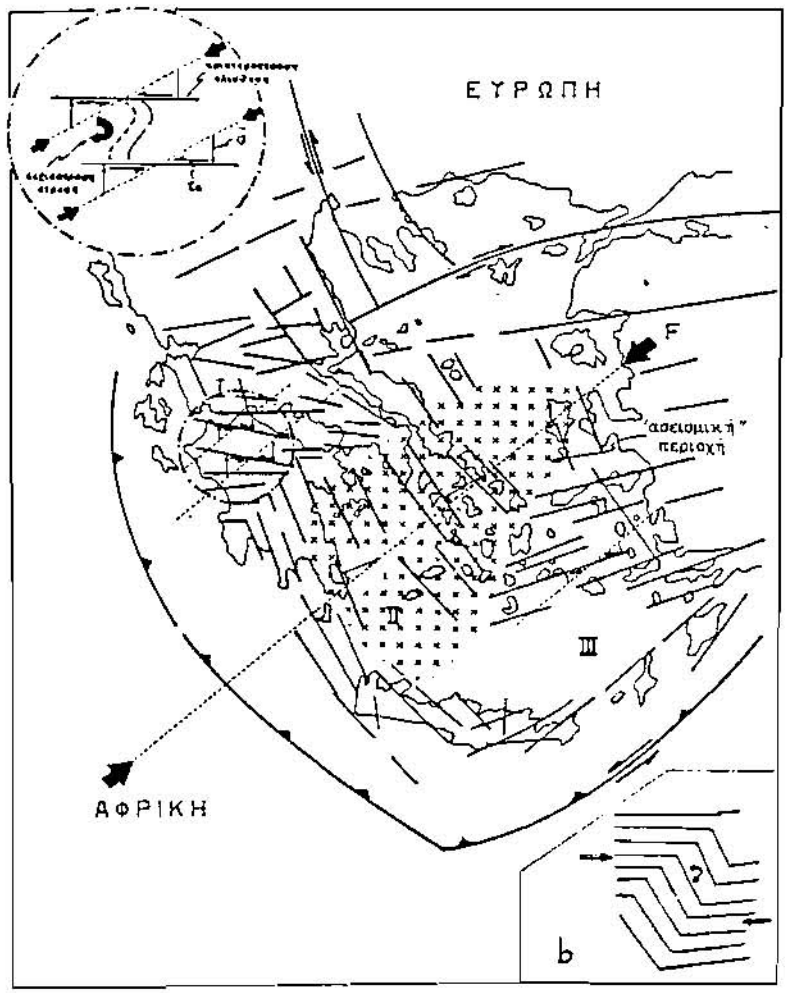

Fig. 8 Analysis of the general stress field F based on the faults of the three parts (I, II, III) of Figure 4 pure (σ) and shearing (T_τ) components. In the upper left part of the picture the NW Peloponnesus region is analyzed (under magnification). The faults are developing with a substantial horizontal sinistral component and a dextral rotation of the part in between. The relatively non-seismic Cyclades region is dominated by NW-SE oriented faults. In these faults, the shear component (T_τ) of the general stress field is negligible.

MARIOLAKOS (1976, 1979) proposed the **tectonic dipole**: a tectonic multiblock which has differential movement at its edges (fig. 3).

MARIOLAKOS & PAPANIKOLAOU (1981) suggest that the configuration of the Neogene basins is controlled by marginal fault zones. These fault zones create an assymetry to the deposits, the relief and the structure, in every basin. According to them, the Hellenic arc is seperated in three large parts (fig. 4). In part I the big fault zones have an E - W direction. In part II the direction is NW - SE and in part III the direction changes to NE - SW. This arrangement shows that only parts II and III have apparent dynamic relation to the Hellenic arc and trench system, while part I has its own peculiarity.

Concerning the present deformational pattern, there are new data like:

i) in situ measurements of the stress field in no dip drillings (<10m), (PAQUIN et al., 1982)

ii) paleomagnetic investigation of the Neogene and Quaternary sediments (LAJ et al., 1982)

iii) fault plane solutions (McKENZIE 1972, 1978, RITSEMA 1974 DRAKOPOULOS & DELIBASIS 1982, PAPAZACHOS et al., 1984.

iv) Gravity difference map of Peloponnesus for the period 1968 to 1981 (Mariolakos et al 1985), (fig. 5).

v) Map showing the shallow seismicity of Peloponnesus and adjacent areas for 1968 to 1981 (Mariolakos et al 1985), (fig. 6).

vi) Cross sections along the N - S (B–B_1) and ENE - WSW (A–A_1) profiles correlating geological and geophysical data (Mariolakos et al 1985), (fig. 7).

MARIOLAKOS & PAPANIKOLAOU (1987) taking into account all these new data proposed a present (active) deformation model (fig. 8).

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