Brittle tectonic, sedimentation and morphological alteration of Megara basin

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Keywords: Stratigraphy, geomorphology, morphotectonics, neotectonics, fault, stress field

The Megara Basin is a NW-SE neotectonic structure, located in the western Aegean Arc. It lies between the eastern part of the Corinth Gulf which is the most rapidly extending graben system in Greece, the Gulf of Alkyonides to the north and the Saronic Gulf to the south.

The basin contains a thick, faulted sequence of Neogene sediments (Theodoropoulos, 1968) their age of which is poorly constrained. It contains mostly Plio-Pleistocene lacustrine, deltaic to fluviatile deposits and is bounded by a NW active normal fault (Jackson et al., 1982).

At the eastern end of the Gulf of Corinth, ENE-WSW to E-W coastal faults cut the NW-SE trending normal fault system bounding the Megara basin (figure 1). The Plio-Pleistocene sediments of this basin dip northeast towards the bounding fault, but the geomorphology is clearly dominated by the coastal faults, which uplifted and tilted the basin towards the north-east (Bentham et al., 1991; Leeder et al., 1991; Leeder & Jackson, 1993).

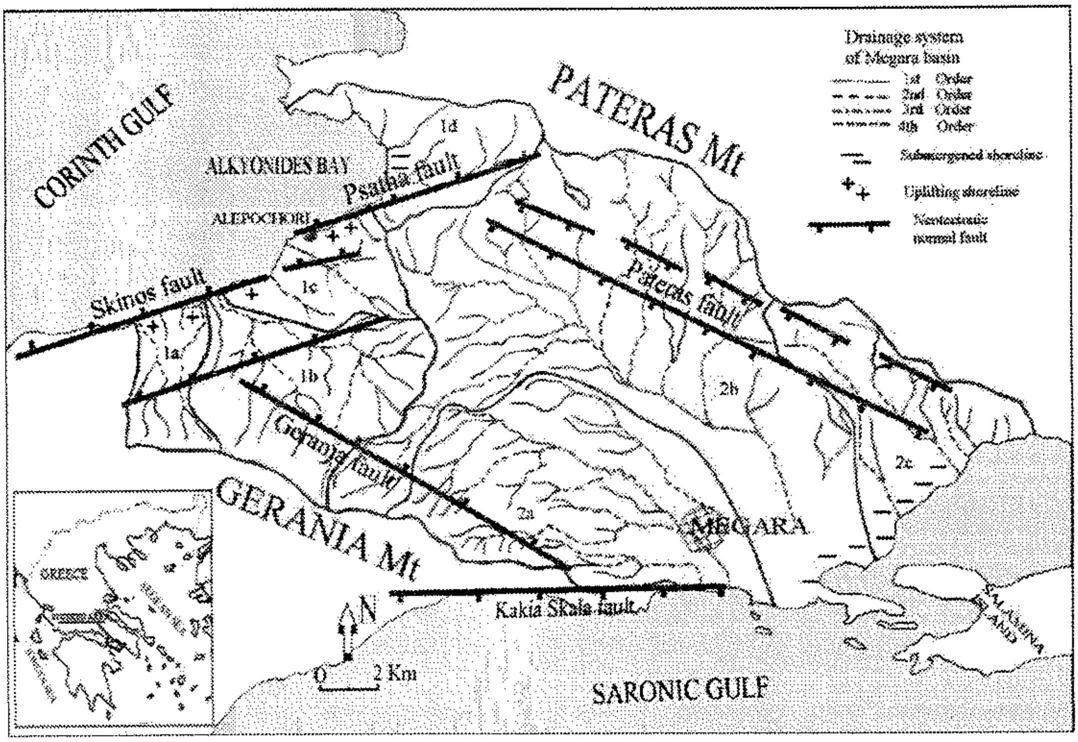


Figure 1. Neotectonic and drainage system map of Megara basin.

According to Bentham et al. (1991), the sedimentary fill of the Megara Basin has been affected throughout its deposition by tectonism. Four lithostratigraphical groups have been distinguished, the Pliochori Group which consists of breccias and conglomerates succeeded by sandstones, the Agio Ioannou Group consisting of marls, marly siltstones and marly sandstones, the Tombes Koukies Group consisting of pebbly sandstones and conglomerates and the Alepochori Group (figure 2) which comprises a series of red/brown pebbly sandstones.

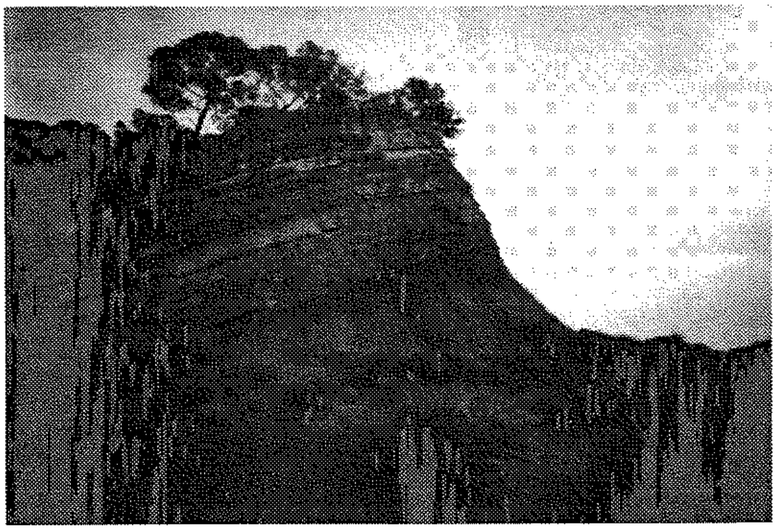


Figure 2. Typical section of Alepochori group which comprises of red/brown pebbly sandstones (Eastern of Alepochori village) .

Two crossed fault systems with NW-SE and ENE-WSW directions affect the central and northern part of the area and particularly the Megara basin. River terraces of several meters are related to uplift movement of the central and northwest part of the basin, with important vertical displacement developed from the southeast to the northwest.

The greater Megara basin is divided in seven drainage basins. Four of them (1a, 1b, 1c, 1d) are drained towards Alkyonides bay and the other three (2a, 2b, 2c) towards Saronic Gulf (figure 1). The drainage system analysis is presented in table I.

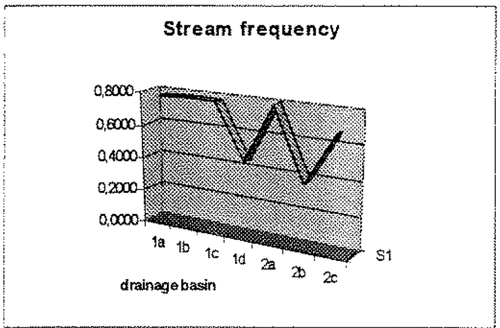
The stream frequency is high for the basins which drain towards Alkyonides bay except 1d which drains limestone rocks and also in the downthrown part of Psatha fault. High is also the stream frequency for the 2a basin but it is lower for 2b and 2c basins (figure 3).

The drainage density is high for the basins 1a, 1b and 2a which are located the western and southwestern part of Megara basin and low for the basins 1c, 1d, 2b and 2c which are located at the northeastern and eastern part of the basin (figure 3).

According to these data, the differences of stream frequency and drainage density between the western-southwestern part of Megara basin and the other northeastern-eastern part is due to the fact that the former is uplifting and the latter is submerging.

Drainage basin	Basin area (km^2)	Total number of streams	Total length of streams (km)	Stream frequency (km^{-2})	Drainage density (km^{-1})
1a	11,60	9	16,30	0,7759	1,4052
1b	34,60	27	49,00	0,7803	1,4162
1c	15,40	12	12,80	0,7792	0,8312
1d	20,00	9	16,30	0,4500	0,8150
2a	62,80	50	91,70	0,7962	1,4602
2b	165,00	63	124,30	0,3818	0,7533
2c	31,00	21	28,20	0,6774	0,9097

Table 1.



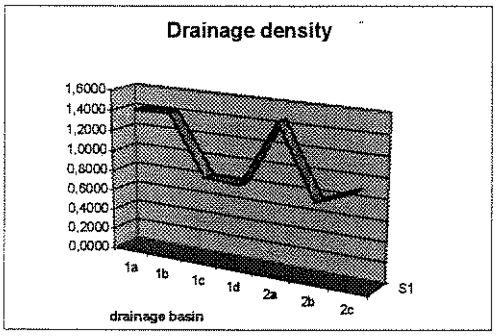


Figure 3. Chart lines of the stream frequency and drainage density of Megara basin. The lower prices define submerging areas.

The morphological differentiations of Megara basin, the drainage network and the recent landforms with morphogenic activity are controlled by the recent brittle tectonics.

The normal fault systems in the studied area controlling the geodynamic regime since Lower Pleistocene. This geodynamic regime has formed the recent morphological and morphotectonic evolution of the studied area.

Generally two neotectonic phases from the upper Pliocene up today have affected the wider area:

a. An extensional phase in a N-S direction (Plio-Pleistocene)

b. An extensional phase in a NE-SW direction (Pleistocene-up today).

The normal faults that were developed under the action of these stress fields have a ENE-WSW direction (Psatha, Alepophori and Kakia Skala faults). Considerably are also the faults with NW-SE direction which control the south-western margin of Megara basin and affect on the Pleistocene scree.

Apart from the large vertical movements that took place during Plio-Pleistocene, sediments slumping were observed due to action of gravity faults. These are the result of a rapid rise of the north-western part of the region (region southern of Alepochori).

Intense of erosion in depth is present in the north and central part of the studied area including the part of Megara basin that flows towards the Corinthian gulf.

In these places the streams have eroded their watercourses and flow in V shaped valleys (figure 4) thus in many cases gorges are formed, while at places the existence of remains of rivers terraces are also observed.

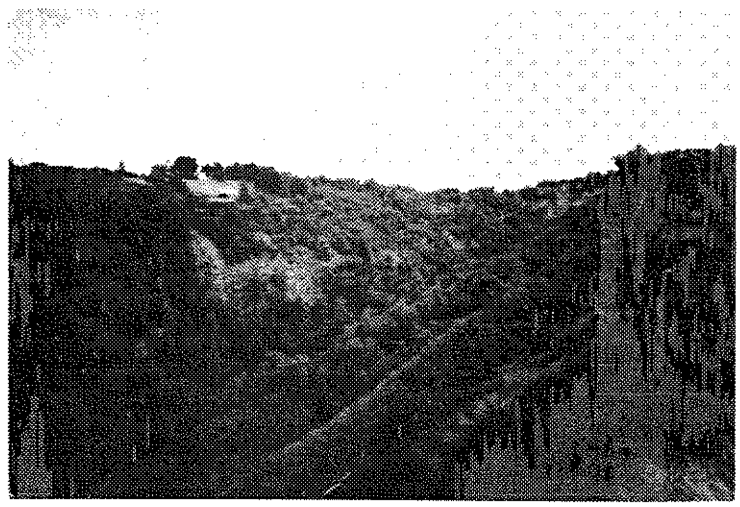


Figure 4. V shaped valley, as a result of uplifting movements, formed in red/brown pebbly sandstones (Alepochori group) developed in a rift zone where control the north-western part of Megara basin.

On the contrary, the soft morphology it is filling of the south-eastern part of Megara basin by alluvial fans shows that this part is influenced by subsidence.

In conclusion, the wider region of Megara basin is affected by rotation movement (tilting) around an horizontal axis having a N-S direction (figure 5) as a result the uplifting movements of the north-western part and the simultaneous of the subsidence of the south-eastern part.

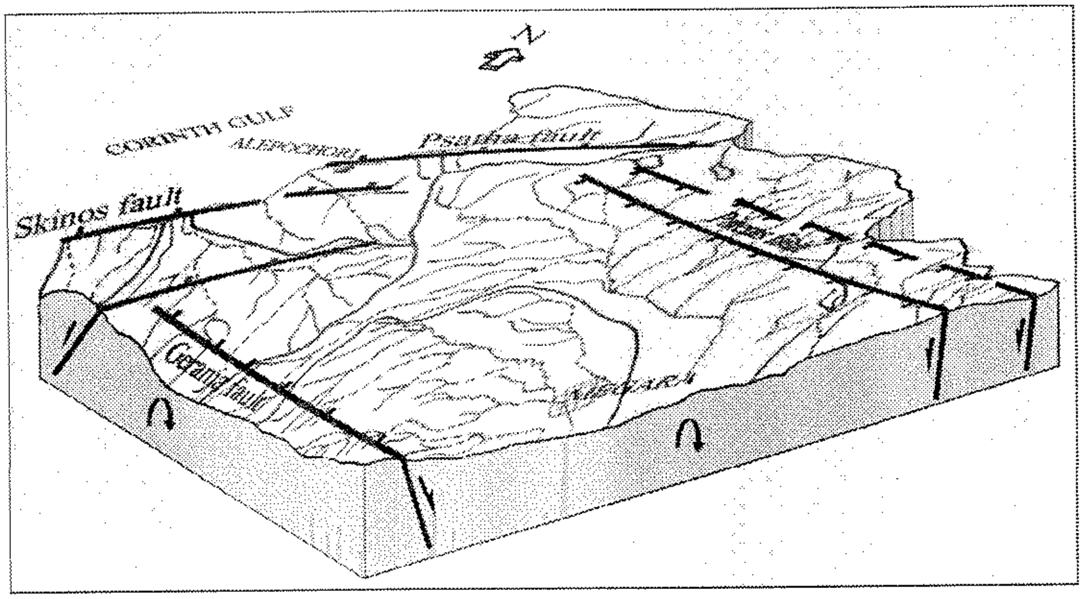


Figure 5. Schematic representation of the neotectonic structure, drainage system and the rotation movement (tilting) round horizontal axis of north direction

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