

CO-EXISTENCE OF E-W AND NE-SW NEOTECTONIC STRUCTURES IN MESSARA BASIN, CENTRAL CRETE

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ABSTRACT

A detailed neotectonic study of the Messara basin in Central Crete has shown the existence of two major neotectonic trends in the E-W and the NE-SW directions.

Additionally to classical geological field work, remote sensing and G.I.S. techniques were applied (SPOT-Xi, SPOT-PAN, DEM). The result was a three-dimensional image of the Messara basin, which allows better understanding of the overall structure and locating areas of increased interest.

The E-W direction controls the major neotectonic graben structure of the Messara basin between the outcrops of the Alpine basement of Idi mt. to the North and Asteroussia mt. to the South.

The NE-SW direction is observed mainly within the sedimentary successions of the Messara basin, which are mainly of Late Miocene - Quaternary age.

The relation of the aforementioned E-W and NE-SW structures of Messara to those of the Heraklion basin to the north and to other adjacent structures as well as the development of some structures, primarily within the alpine basement, provide some arguments regarding possible changes in the subduction process of the African plate south of Crete since Late Miocene.



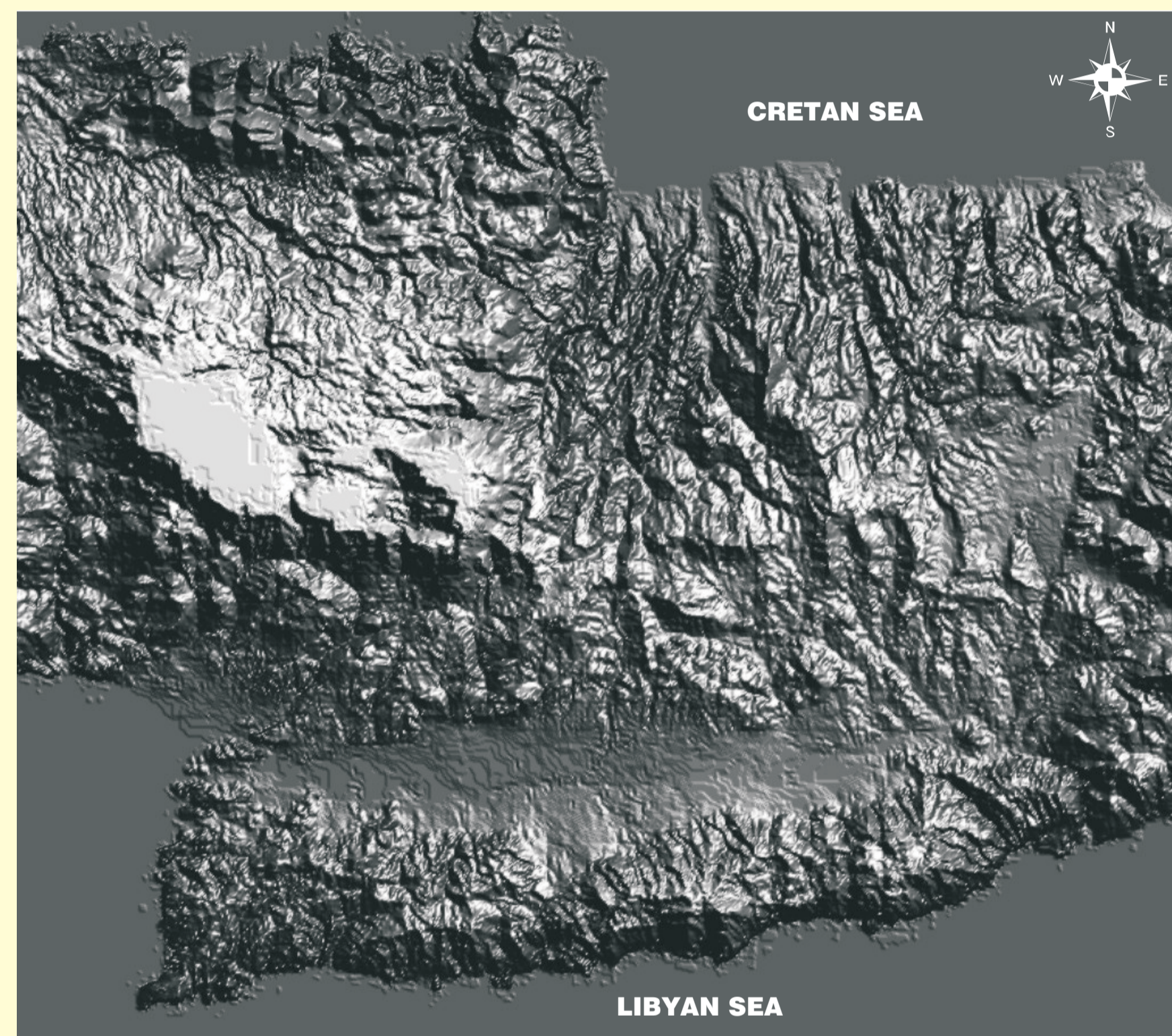
The Messara basin as viewed from the southern margin. The Idi Mt, seen at the background, consists the northern margin of the basin. The direction of the northern margin is also trending E-W.



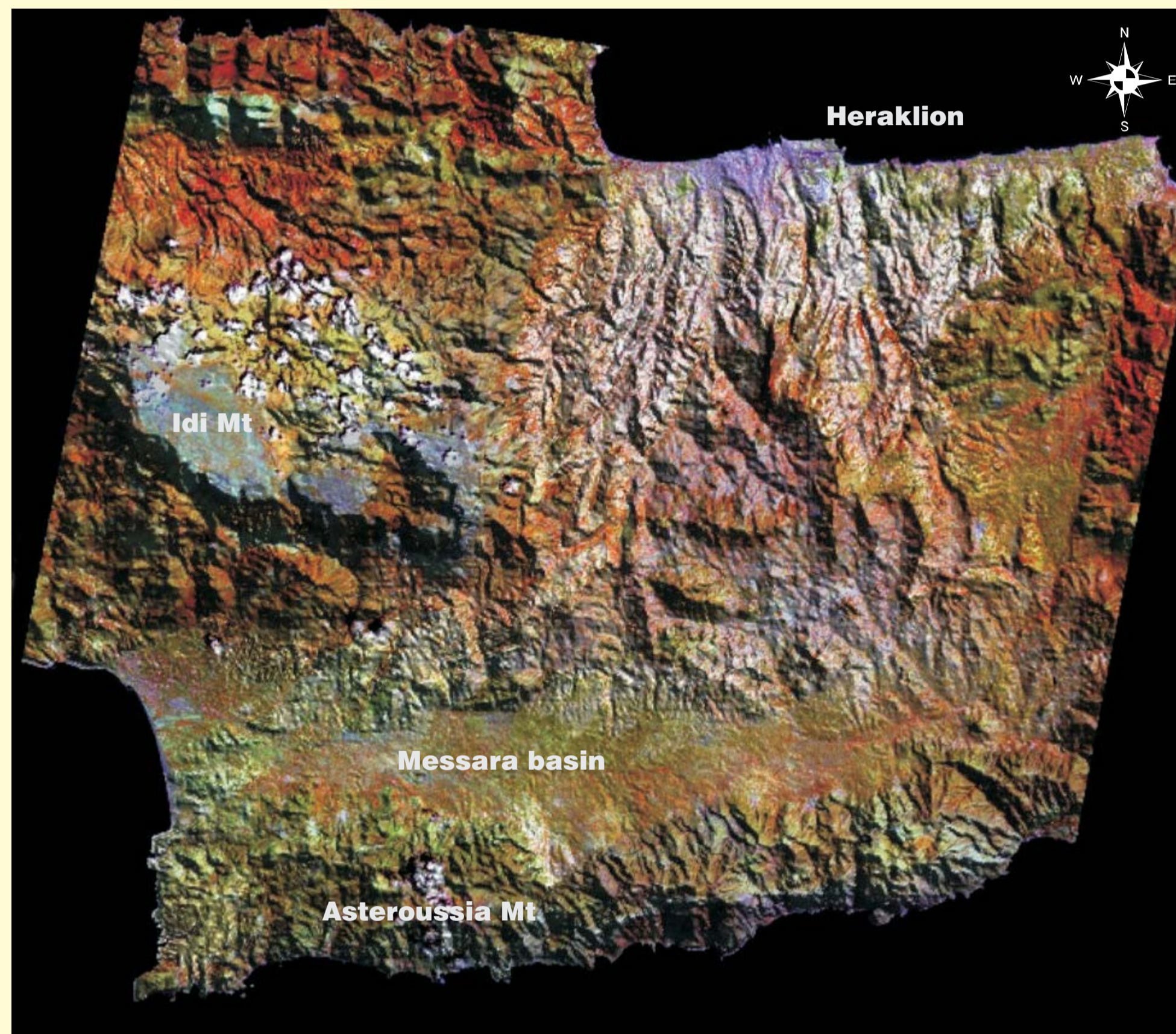
The Messara basin as viewed from the northern margin. The Asteroussia Mt, seen at the background, marks the southern margin of the basin. Its direction is trending E-W.



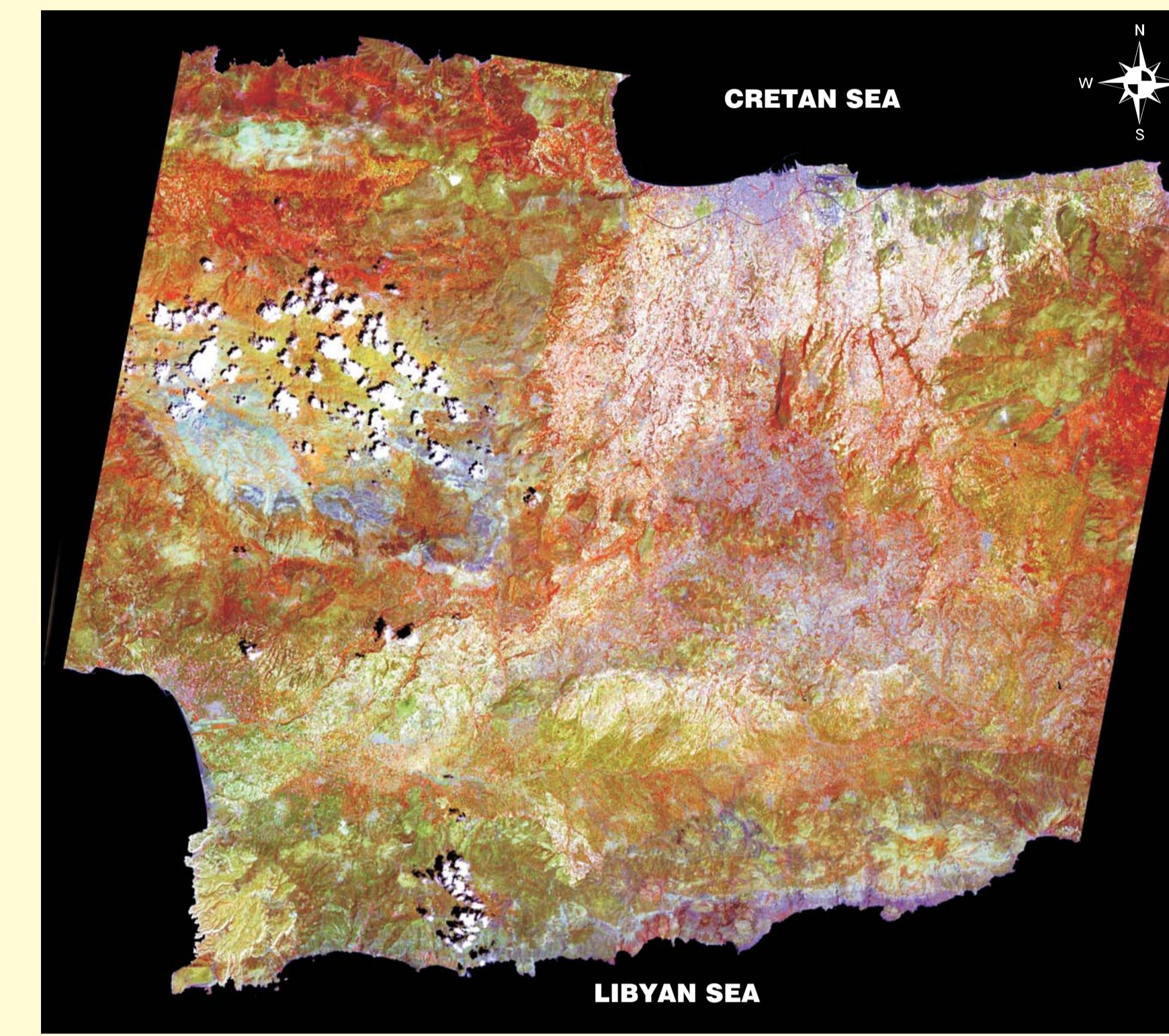
Mirror surface at the northern margin of the Messara basin. The direction of this fault, which is part of the main fault zone, is E-W dipping to the south.



Shaded Relief of the study area, derived by extracting a 20-meters pixel size Digital Elevation Model, created by using SPOT-PAN stereo-pairs, and illuminating it by the NE direction. This azimuth of the lighting source, allows the observer to notice the E-W morphological discontinuities forming the Messara basin. The margins of the Heraklion basin, located to the north, can be also observed.



The combination of shaded relief and SPOT-Xi images resulted in an image of enhanced morphological information than a simple satellite one. The two faulting directions bounding the Messara basin between Idi Mt. and Asteroussia Mt. are clearly portrayed.



SPOT-4 Xi rectified satellite image of central Crete, with 3,4,1 band combination in R,G,B. The Red colour indicates vegetated and forested areas, the Green indicates bare soil while the White and light Blue colours indicate eroded areas.



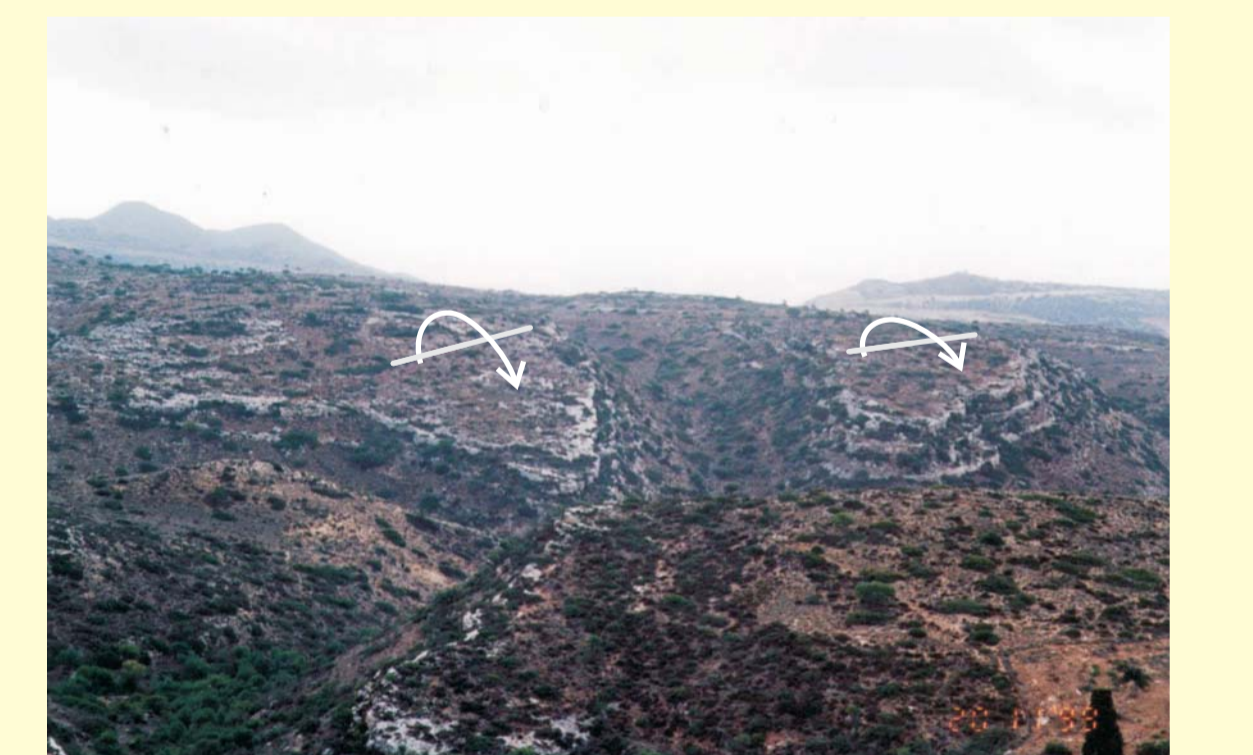
Close view of the eastern part of the southern margin of the Messara basin. The impressive marginal normal fault of SW-NE direction, can be clearly seen along with striations dipping to the NW. Deeply incised valleys are developed perpendicular to the direction of faulting.



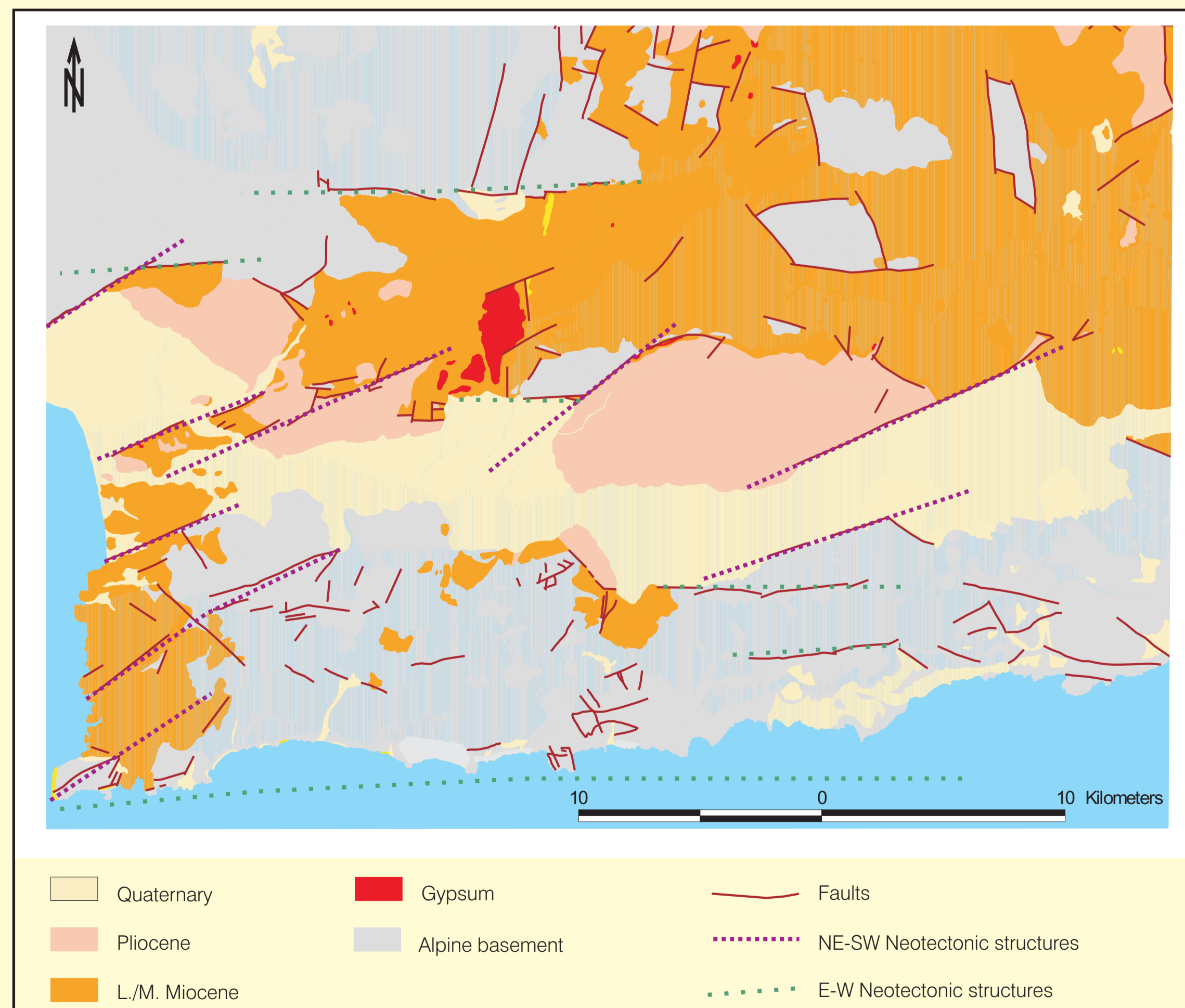
View of Cape Kefali at the SW tip of Asteroussia Mt. The alpine basement, at the background, is in contact with Miocene sediments, seen at the foreground, through a fault of SW-NE direction.



Part of the southern marginal fault of E-W direction, bringing in contact Miocene marls to the left (north) with Alpine basement to the right (south).



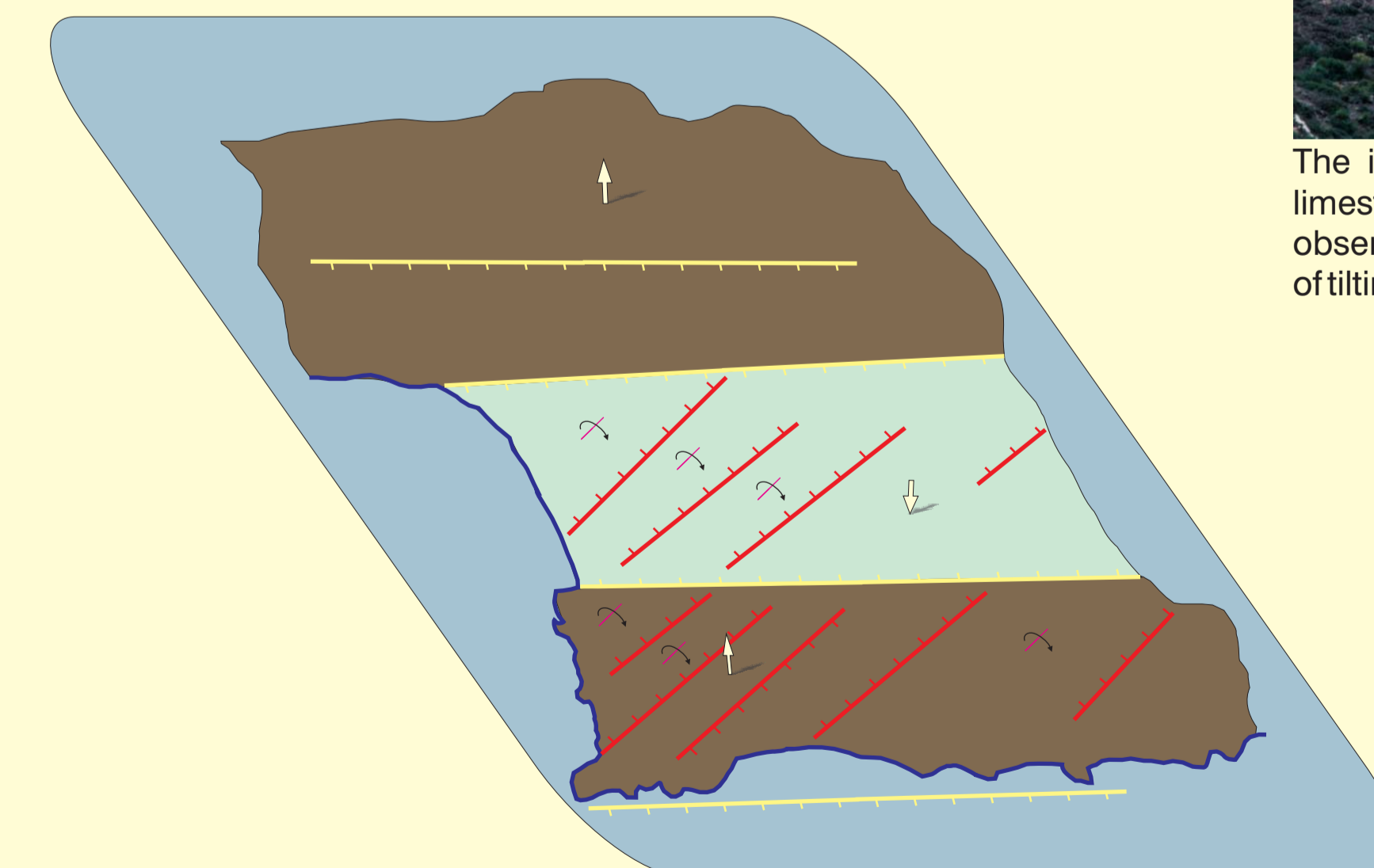
The initial stratigraphic layering of these Miocene marly limestones, located at the Asteroussia Mt, allows the observation of block tilting as a result of uplift. The direction of tilting, indicated by arrows, is towards the NW.



Simplified geological map of Messara basin, showing the main neotectonic structure directions as they are expressed through active faults. There is also a hypothetical E-W structure under the sea, south of Asteroussia Mt.



Three dimensional perspective model of the Messara basin. The shaded relief - satellite image combination was further processed by means of artificial illumination. This figure allows the easy identification of co-existing E-W (yellow) and NE-SW (red) neotectonic structures.



The general conclusion of the existing tectonic state of the study area, is appearing in this figure. The mountains Idi and Asteroussia (brown) are rising relatively to the Messara basin (light green) in the middle. The movement is happening through the faults of E-W direction (yellow). Along with the uplift of the two main blocks, a tilting of smaller blocks towards the NW is also observed, through the faults of NE-SW direction.

