Appendix 1 – Updated analysis of the available bibliography

N° File: 1

Authors: AKSU, A.E., CALON, T.J., PIPER, D.J.W., TARGUT, S. AND IZDAR, E.

Year: 1992

Title: Architecture of late orogenic Quaternary basins in north-eastern Mediterranean Sea

Reference: Tectonophysics 210, 191-213

Concerned area: North-eastern Mediterranean

Formation(s) affected: Basins E-W, NE-SW et NW-SE

Age of the deformation: Pliocene to Quaternary

Concerned structures: East Anatolian Transform Fault

Commentary:

Pliocene to Quaternary depocentres have formed extensional basins bounded by splays of the East Anatolian Transform Fault. This tectonic regime is superimposed on a Miocene and older back-arc environment that experienced late Miocene compression along the Misis-Kyrenia thrust, which now lies in the middle of the extensional zone. The thrust zone is now represented by a narrow horst that appears to be bounded by strike-slip faults.

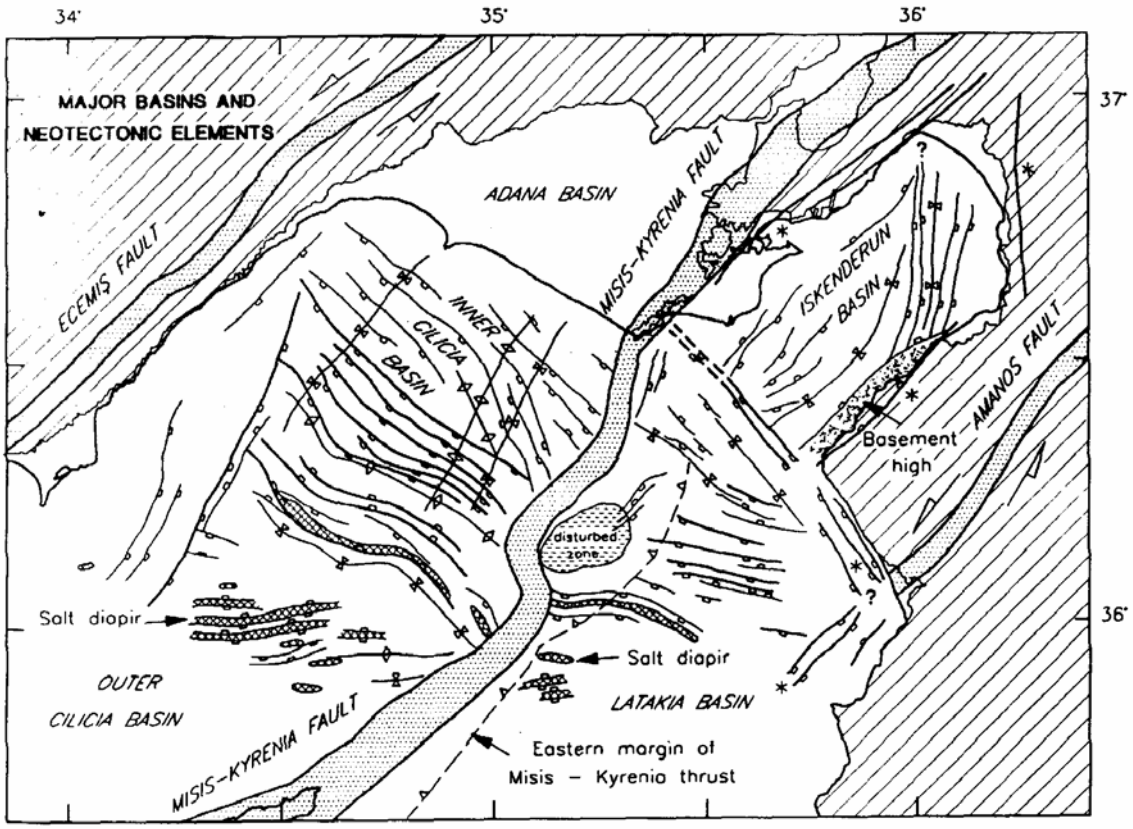
Pliocene-Quaternary extension took place on listric fault fans that are orthogonal to the bounding transform splays and sole at a Messinian evaporite horizon, and on some deeper-soling listric faults parallel to and near the bounding faults. The rapid extension has resulted in progressive landward migration or paloeshorelines and low depositional gradients. Glacio-eustatic fluctuations in shoreline positions strongly influenced sediment distribution.

Stress field: N-S, NW-SE and NE-SW extension

The North Anatolian Transform Fault move dextraly; the East Anatolian Transform Fault show a complementary sinistral motion; the Dead Sea Transform Fault show a sinistral strike slip motion.

Types of documents:

Simplified tectonic map.
Bathymetric map.
Seismic profiles.
Isopach maps.



Tectonic map of the study area

N° File: 2

Authors: AL-TARAZI, EID A.

Year: 1999

Title: Regional seismic hazard study for the eastern Mediterranean (Trans-Jordan, Levant and Antakia) and Sinai region

Reference: Journal of African Earth Sciences, vol.28, no.3, pp.743-750

Concerned area: Eastern Mediterranean, Trans-Jordan, Levant and Antakia, and Sinai

Formation(s) affected:

Age of the deformation: Present day

Concerned structures: Jordan-Dead Sea transform fault

Commentary:

Probabilistic approach: using an updated earthquake catalogue for the period 1 to 1993 AD, and using the new seismic-tectonic map, 10 linear-sources are delineated. These lines or faults zones are thought to represent the main sources for the seismic potential in the area.

Results are demonstrated as iso-contour lines of the peak-ground acceleration. The iso-acceleration contours represent 90% probability that these peak values will not be exceeded over periods of 50, 100 and 200 years, respectively.

The seismic hazard severity is highest along the Jordan Dead Sea transform fault system. Antakia in Turkey has the highest seismic potential severity (around 5 ms^{-2}) while in Cyprus the maximum hazard is expected to reach 4 ms^{-2} for the coming 50 years.

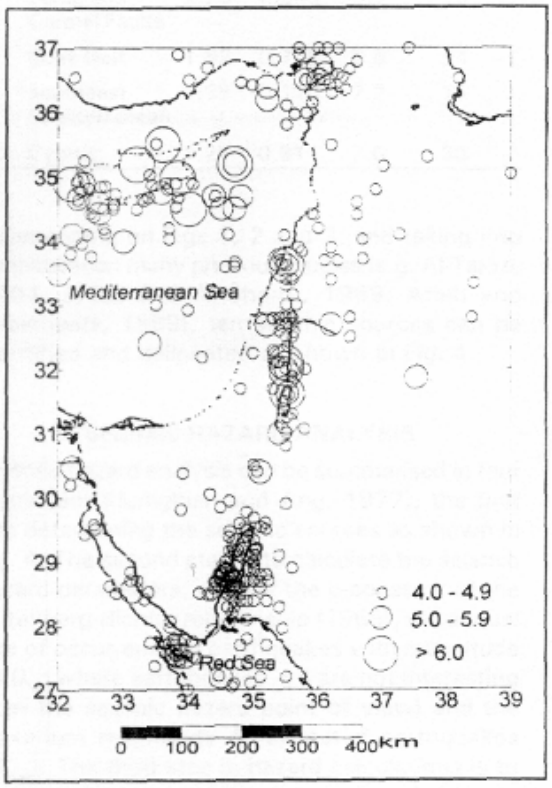
Stress Field: Main structure: sinistral strike slip fault.

Types of documents:

Epicentres of the historical earthquakes

Tectonic overview of the Jordan-Dead Sea transform fault

Maximum peak ground acceleration



The seismicity of the study area for the period 1900 to 1993 for earthquakes > 4.0

N° File: 3

Authors: AMBRASEYS N. N.

Year: 1988

Title: Temporary seismic quiescence: SE Turkey

Reference: Geophysical Journal, 96, pp. 311-331

Concerned area: a Border Zone between the Arabian and the three plates of Turkey, Eurasia and Iran to the north

Formation(s) affected:

Age of the deformation: ***historical, recent***

Concerned structures: East Anatolian Fault

Commentary:

A study of large earthquakes within the period of 1500-1988, assessment of macroseismic epicentral regions, surface-wave magnitudes and selection of the larger events ($M_s \geq 6.6$) in the Border Zone for the period 1500-1900. Magnitudes for later events were calculated from instrumental data.

Historical evidence for the Eastern Mediterranean shows that the seismicity of the East Anatolian Fault zone is in some ways similar to that of the Dead Sea system, where infrequent large earthquakes occur throughout its length, but the system has remained almost aseismic during this century. Description of earthquakes identified in the Border Zone for the period of 1500-1905 with $M_s \geq 6.6$ is provided.

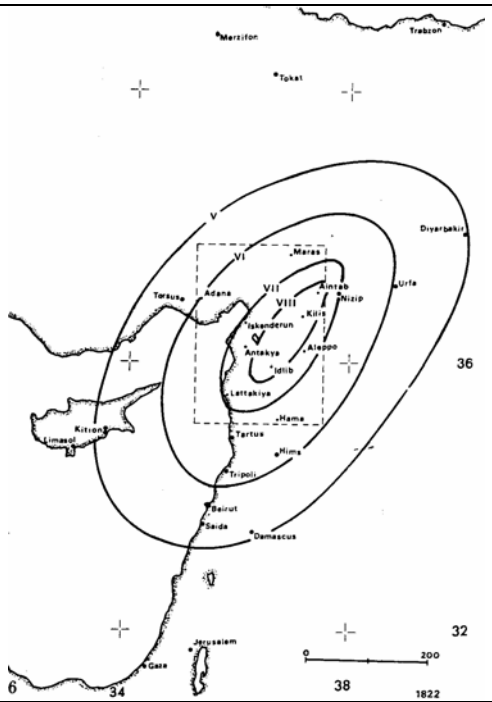
Figure 6 presents the felt area of the Afrine earthquake of 1822 that was the largest in the Border Zone in the last five centuries. This earthquake is discussed in detail.

Stress field:

Types of documents:

Seismic map of eastern Turkey with contours showing the largest earthquake magnitudes expected over a period of 75 years predicted using Gumbel's third asymptotic distribution of extreme values of the 20th century data.

Table of large earthquakes (M_s=6.6) in the Border Zone 1500-1988



Felt area of the Afrine earthquake of 1822. Lower isoseismals are approximate

N° File: 4

Authors: AMBRASEYS, N. N.

Year: 1992

Title: The Seismicity of Cyprus – Reappraisal of the seismic activity in Cyprus: 1894-1991

Reference: ESEE Imperial college, London Research report, N° 92

Concerned area: Eastern Mediterranean, Cyprus

Formation(s) affected:

Age of the deformation: Present-day

Concerned structures:

Commentary:

This paper presents a homogeneous macroseismic and instrumental record of the earthquake activity for this century.

The shocks felt in the island before 1960 for which we could find no instrumental information, are all small local events, many of them aftershocks. Excluding foreshocks and aftershocks, 74 % of these shocks were reported felt in the Limassol district, 14% in the district of Paphos, and 6% in the districts of Nicosia, Larnaka and Ammochostos. Only one shock was reported from the Kyrenia area.

In the currently active part of the region, earthquakes of magnitude in the range 6.0 to 6.5 have occurred with a frequency distribution which can be assessed from the data in Table 1, i.e. from: Log (N) = 2.35 – 0.65 (Ms) where N is the number of earthquakes per year in the region shown in the Figure of magnitude equal to or greater than Ms.

Stress field:

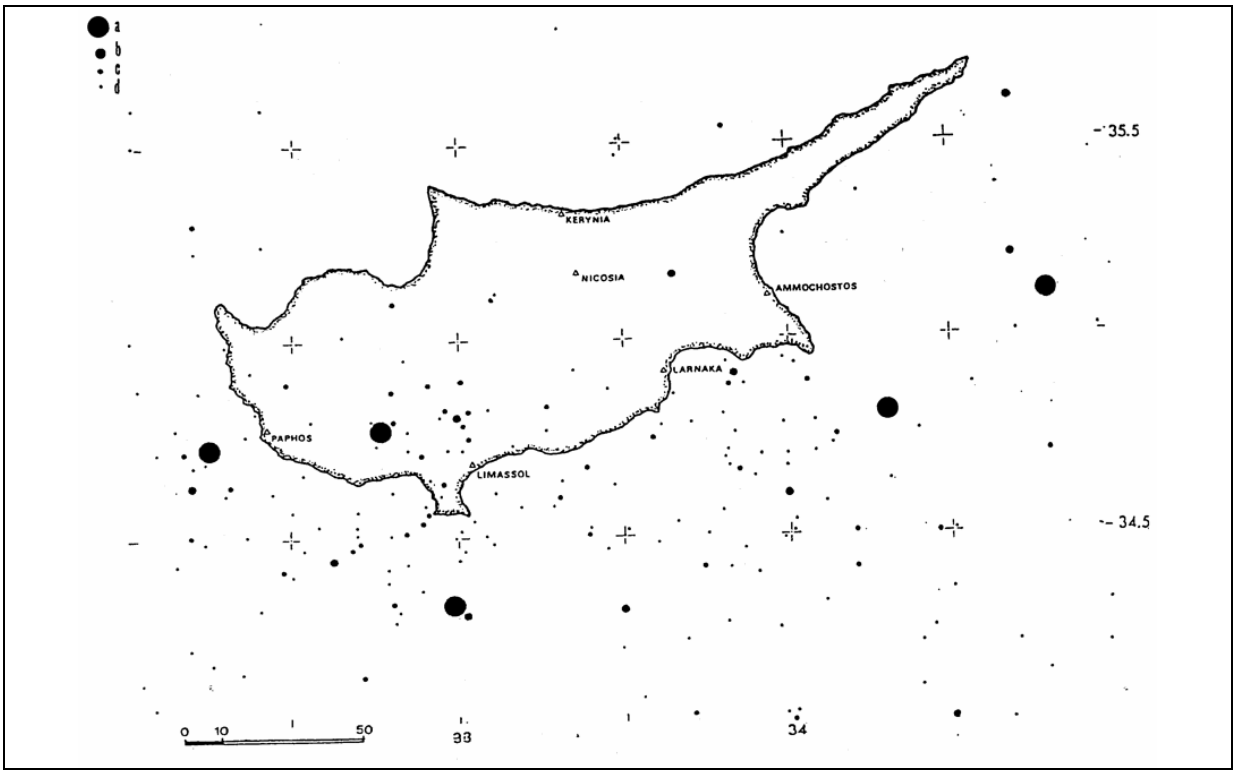
Types of documents:

Table 1: earthquakes in the region of Cyprus during the period 1890-1990.

Events id ISC files for broad region around Cyprus, 1970-1990, Ms>4.5.

Maps showing the felt area of earthquakes.

Seismicity of the Cyprus region, 1890-1990, Ms>3.0



Seismicity of the Cyprus region, 1890-1990, Ms>3.0,
a: Ms>6.0; b: 6.0>Ms>5.0; c: 5.0>Ms>4.0; d: 4.0>Ms>3.0

N° File: 5

Author: AMBRASEYS, N. N.

Year: 1965

Title: The seismic history of Cyprus

Reference: Review Union Intern. Secours, n°3, 25-48

Concerned area: Eastern Mediterranean, Cyprus

Formation(s) affected:

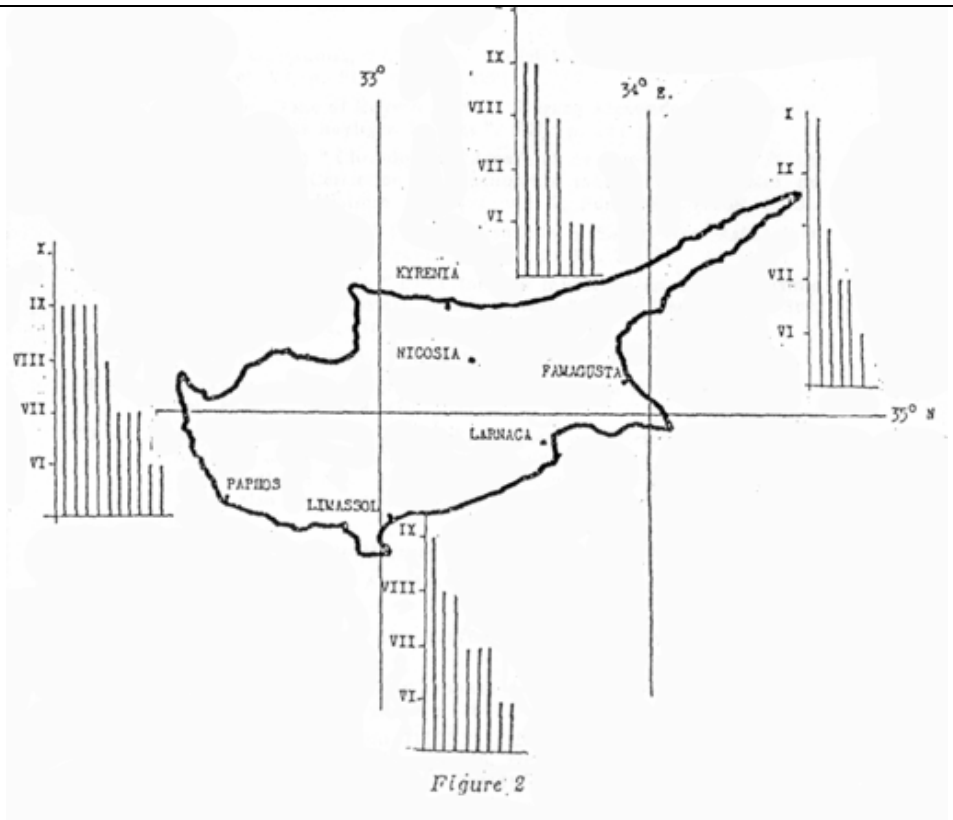
Age of the deformation: 100 BC – 1900 AD

Concerned structures:

Commentary:
The purpose of this paper is to summarise the seismic history of Cyprus and to attempt, on the basis of the written evidence prior to 1900, to assess the seismicity of the island.
The seismic activity around the island prior to 1900 appears to be concentrated along the southern coasts of Cyprus. There is no indication that the northern coasts, including the Kyrenia mountains, have ever suffered from local or distant earthquakes.

Stress Field:

Types of documents:
Earthquake intensities felt in Cyprus.
Intensity distribution in Cyprus (100 BC – 1900 AD).



Intensity distribution in Cyprus (100BC – 1900AD)

N° File: 6

Authors: AMBRASEYS, N. N., ADAMS, R.D.

Year: 1993

Title: Seismicity of the Cyprus region

Reference: Terra Nova 5, 85-94

Concerned area: Eastern Mediterranean, Cyprus

Formation(s) affected:

Age of the deformation: Present day

Concerned structures:

Commentary:

56 events which have a surface-wave magnitude (M_s) of 4,5 or greater have been identified.

Early events are located by felt effects alone, and macroseismic information is used to improve the location of many later events.

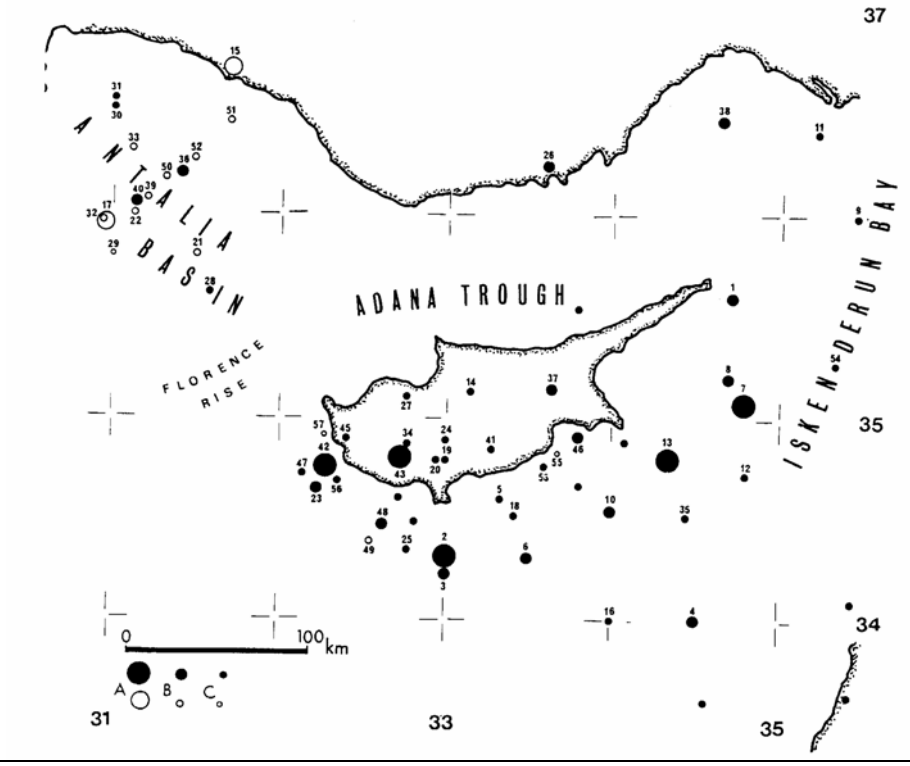
- An area of weak seismicity to the north-west of Cyprus in the Gulf of Antalia includes intermediate-depth events as are found in the Hellenic Arc to the west;
- a gap of reduce activity separates this activity from that of the main region of Cyprus, where we could find no evidence for sub-crustal foci;
- there appears to be no present seismological connection along the presume plate boundary to the north-east to the junction of the East Anatolian fault and the extension of the Dead Sea rift system.

We find a much greater level of activity in the first part of this century, up to 1963, 47 events of M_s > 4.5 have been identified.

Stress Field:

Types of documents:

Schematic configuration of plates in the eastern Mediterranean and surroundings areas.
Events in ISC files for broad region around Cyprus, 1970-1990, Ms>4.5.
Complete plot of events held in ISC files for Cyprus region, 1904-1990.
Seismicity of Cyprus region, 1890-1990, Ms>4.5.
Moment rate distribution in the Iskenderun-Cyprus area and Antalia Basin.



Seismicity of Cyprus region, 1890-1990, Ms>4.5.
A: Ms>6.0; B: 6.0>Ms>5.0 and C: 5.0>Ms>4.0

N° File: 7

Authors: AMBRASEYS N., JACKSON J.

Year: 1998

Title: Faulting associated with historical and recent earthquakes in the Eastern Mediterranean region

Reference: Geophys. J. Int., 133, 390-406

Concerned area: Eastern Mediterranean region, Middle East (Balkans, Turkey, the Caucasus and the Middle East up to west Pakistan)

Formation(s) affected:

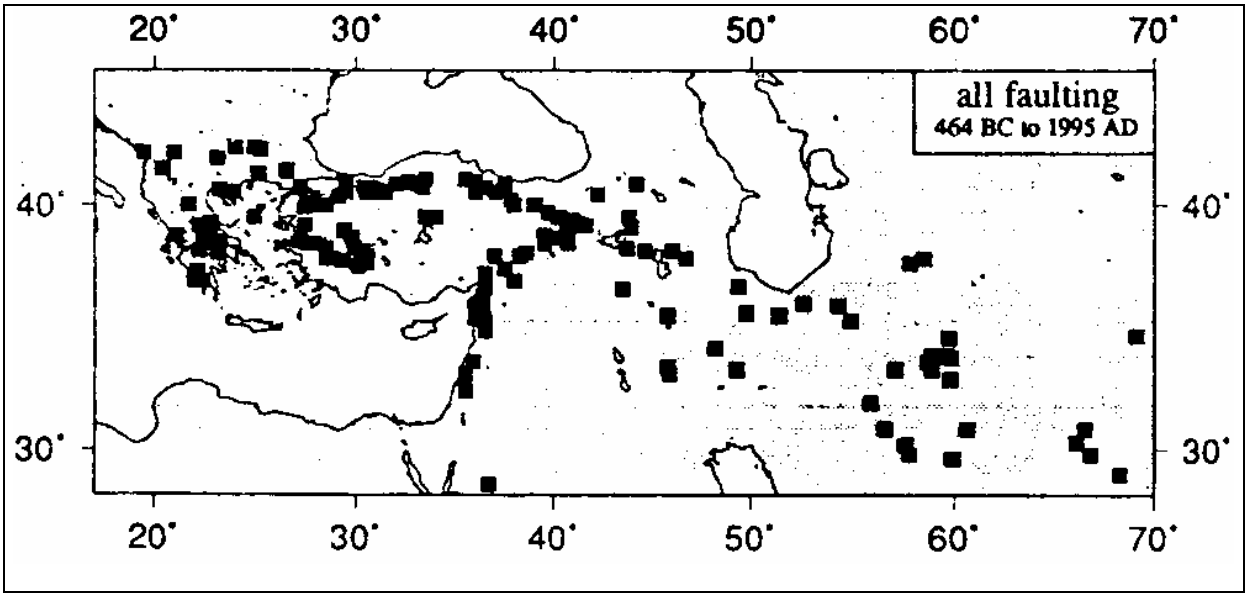
Age of the deformation: ***historical, recent***

Concerned structures: surface faults, active faults

Commentary:
Summarized evidence for surface faulting in historical and recent earthquakes in the Eastern Mediterranean region and in the Middle East. Seventy-eight (78) cases of faulting have been found for the period of pre-1990, some of which show that faults that have apparently been inactive this century had already ruptured before 1990. For some cases faulting could not have been predicted from 20th century activity, and in others it could have been expected, but has not been observed during the instrumental period. The data are sufficient to allow the derivation of relationships between magnitude and rupture length.
Figure 2 presents locations of earthquakes associated with surface faulting for the whole period of observation.

Stress field:

Types of documents:
List of earthquakes associated with surface fault break



Locations of earthquakes associated with surface faulting for the whole period of observation

N° File: 8

Authors: AMBRASEYS N. N., MELVILLE C. P.

Year: 1985

Title: An analysis of the Eastern Mediterranean earthquake of May 20, 1202

Reference: August 1985, Tokyo Ed. W. Lee, Imperial College of Science, London, 20 p.

Concerned area: Eastern Mediterranean

Formation(s) affected:

Age of the deformation: historical

Concerned structures:

Commentary:

The procedure was collection of macroseismic data from original sources and their review.

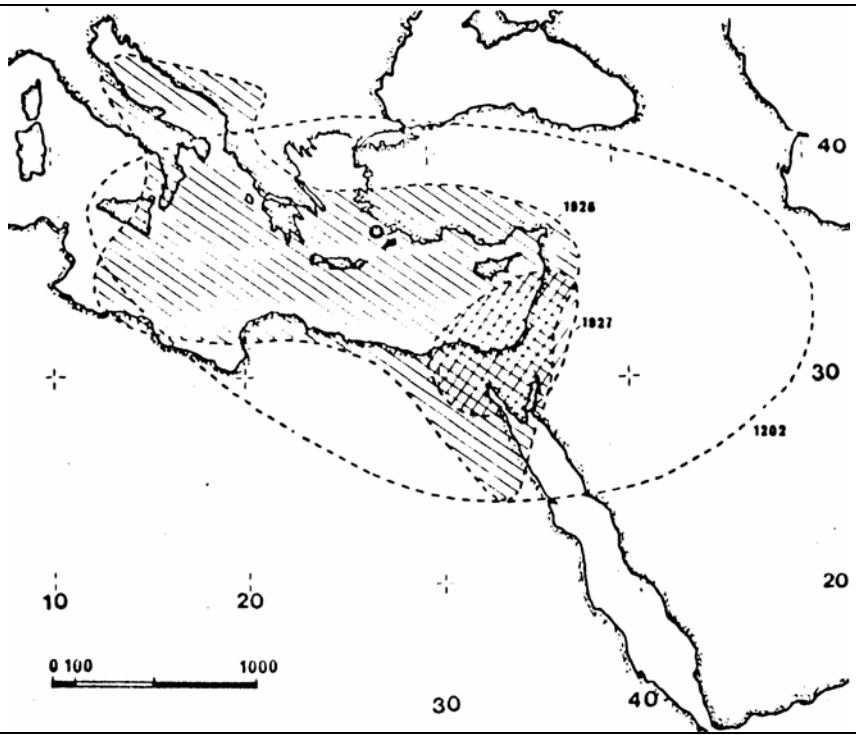
The main shock of the earthquake was catastrophic, with an on-land meizoseismal area and source dimension of about 200 km. The magnitude of the 1202 earthquake was in excess of 7.5 and it was associated with a protracted sequence of aftershocks and a damaging sea-wave that affected the coasts of Syria and Cyprus.

On Cyprus intensity of the earthquake is estimated VII by MSK scale

No earthquake of comparable felt area has occurred in the Middle East during the present century that can be used to calibrate the magnitude of the 1202 event. The nearest is the eastern Mediterranean earthquake of June 26 1926, which had an offshore epicentre near Rhodes and a radius of perceptibility of about 900 km (Fig. 3, Shebalin and Karnik, 1974). Figure 3 presents the felt areas of the earthquakes of 20 May 1202, 26 June 1926 (M_s=7.0, m=7.5) and 11 July 1927 (M_s=6.0, m=6.4).

Types of documents:

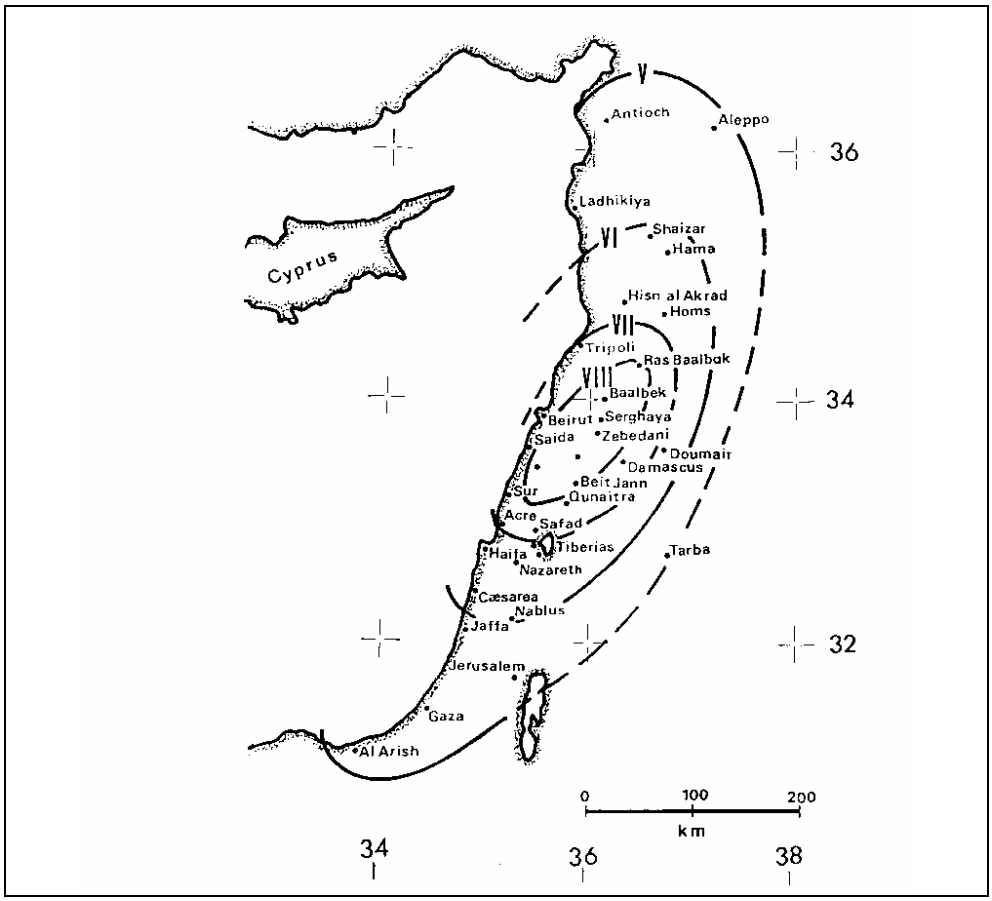
Macroseismic data and maps



N° File: 9

Authors: AMBRASEYS, N.N., BARAZANGI, M.
Year: 1989
Title: The 1759 earthquake in the Bekaa Valley: implication for earthquake hazard assessment in the Eastern Mediterranean Region
Reference: J. Geophys. Res., 94, 4007-4013

Concerned area: Eastern Mediterranean, Israel, Jordan
Formation(s) affected:
Age of the deformation: Present day
Concerned structures: Dead Sea fault system
Commentary: Analysis of macroseismic data based on primary sources for large, though infrequent, historical earthquakes (*Ms* > 6.5) that occurred along an approximately 350 km long segment of the northern part of the Dead Sea fault system primarily in Lebanon and Syria for the period 1100-1988 reveals the following: - ten events occurred in three relatively short periods (tens of years) with repeat time of 200-350 years; - the events most probably broke this north segment of the Dead Sea fault system, possibly including the westernmost segment of the East Anatolian fault system near the border between Syria and Turkey; - the lack of such large events during the past 100 years should not be interpreted to minimize potential earthquake hazard in this region; - the Ms = 7 plus earthquake on November 25, 1759, almost certainly produced surface faulting probably along the Yammouneh fault in the Bekaa valley.
Stress field: Predominantly left-lateral fault system
Type of documents: Landsat photo Intensity distribution of the main shock of November 25, 1759.



Intensity distribution of the main shock of November 25, 1759

N° File: 10

Authors: ANASTASAKIS, G. AND KELLING, G.

Year: 1991

Title: Tectonic connection of the Hellenic and Cyprus arc and related geotectonic elements

Reference: Marine geology, vol.97, p. 261-277

Concerned area: Eastern Mediterranean

Formation(s) affected:

Age of the deformation: Present day

Concerned structures: Hellenic and Cyprus arc

Commentary:

Main tectonic features of the arc:

- The Cyprus Trench, displaying evidence of underthrusting and morphostructural features typical of subduction zones.
- The Pytheus Trench, associated with right-lateral strike-slip movement and connecting the western end of the Cyprus Trench to the Strabo Trench sector of the Hellenic Trench System;
- a predominantly transtensional fault zone connecting the easternmost part of the Cyprus Trench via Baer Bassit overthrust zone in Syria to the Dead Sea Transform Fault system ;
- a zone of complex deformation, involving thrust and transform elements, running from the Misis Mountains of southeast Turkey through the Kyrenia Range in Cyprus to the Gulf of Antalaya and transacted by roughly N-S major shears, which appears to form the western boundary of the present active system of the Cyprus Arc.

The nature of shallow structures associated with the Cyprus Arc is consistent with a geotectonic model involving some post-Miocene rotation of the south Anatolian-Cyprus block, probably induced by “escape dynamics” resulting from continent-continent collision in eastern Turkey and the development of the Maras triple junction in south-eastern Turkey. The alternation of plate boundary sectors respectively characterised by thrusting strike-slip displacement suggest that the shallow crust in this part of eastern Mediterranean is in a compartmented and relatively brittle state, allowing accumulated boundary stresses to be accommodated largely by displacements and deformation along secondary features.

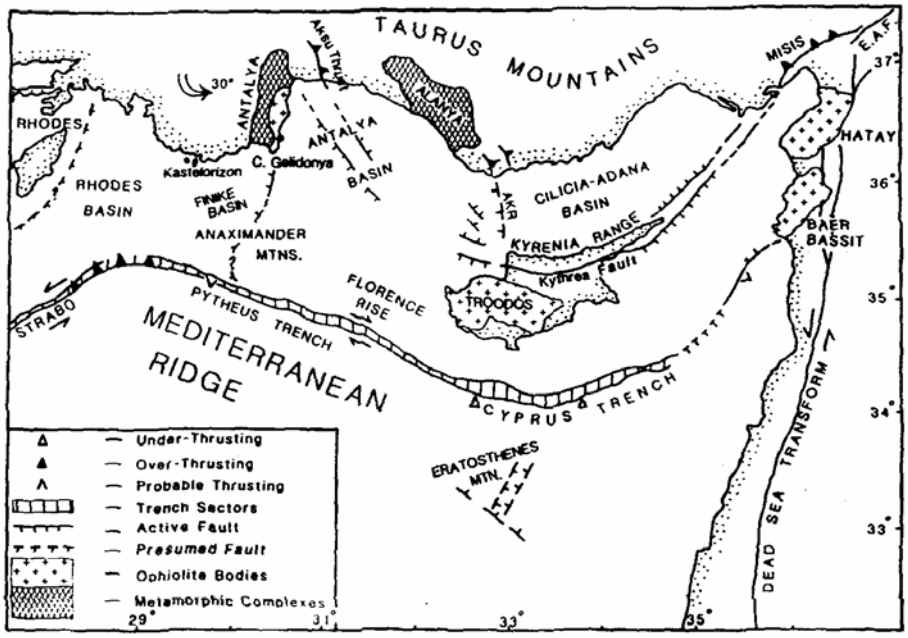
Stress field:

Type of documents:

Physiography and bathymetry map.

Seismic reflexion profiles.

Synthesis and interpretation of the major neotectonic features of the northeast Mediterranean.

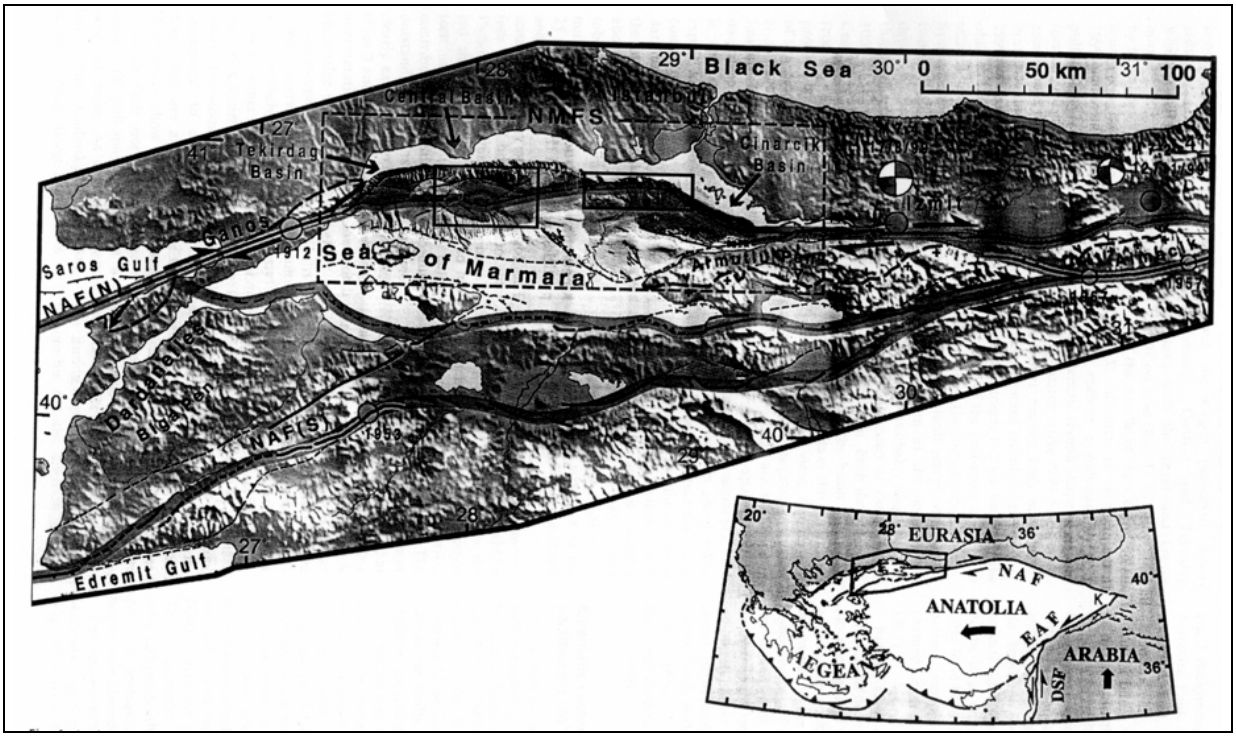


Synthesis and interpretation of the major neotectonic features of the northeast Mediterranean

N° File: 11

Authors: ARMIJO, R., MEYER, B., NAVARRO, S.,KING, G. AND BARKA, AYKUT
Year: 2002
Title: Asymmetric slip partitioning in the Sea of Marmara pull-apart: a clue to propagation processes of North Anatolian Fault ?
Reference: Terra Nova vol 14, n°2, 80-86

Concerned area: Eastern Mediterranean, Sea of Marmara
Formation(s) affected:
Age of the deformation: Late Quaternary
Concerned structures: Sea of Marmara pull-apart
Commentary: The sea of Marmara is a large pull-apart that appears to have been a geometrical/mechanical obstacle encountered by the of North Anatolian Fault during its propagation. The outstandingly clear submarine morphology reveals a segmented fault system including pull-apart features at a range of scale, which indicate a dominant transtensional tectonic regime.
Stress field: transtensional tectonic regime.
Types of documents: Structural maps (new high resolution data) Seismic reflection profile



Active tectonics in Sea of Marmara pull-apart including the new EM300 bathymetry and newly mapped submarine faults

N° File: 12

Authors: ARVIDSSON, R; BEN-AVRAHAM, Z; EKSTROM, G; WDOWINSKI, S.

Year: 1998

Title: Plate tectonic framework for the Mw = 6.8, October 9, 1996, Cyprus earthquake and the seismic energy release of the Cyprean Arc

Reference: Eos, Transactions, American Geophysical Union, vol.78, no.46, Suppl., pp.480

Concerned area: Eastern Mediterranean, Cyprus

Formation(s) affected:

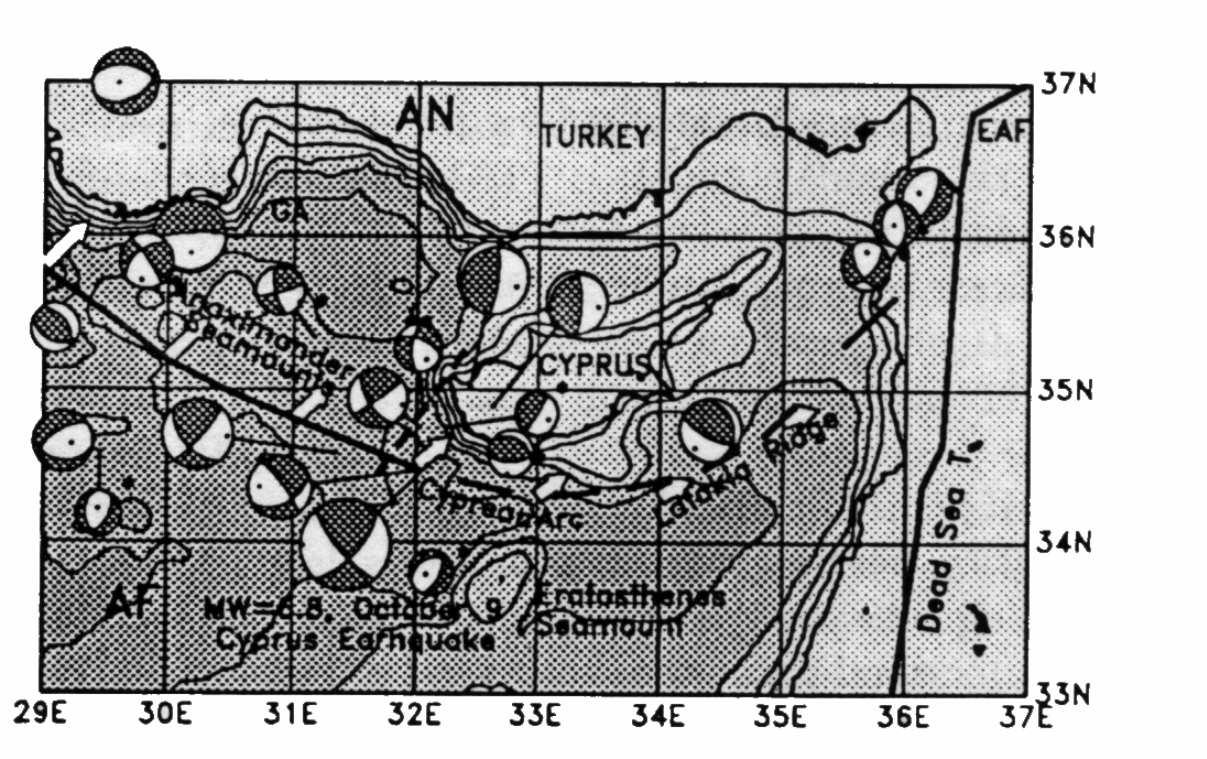
Age of the deformation: Present day

Concerned structures: Cyprean Arc

Commentary:
Centroïd depths for this earthquake and its largest aftershock: 32 to 27 km respectively, by modelling P and SH waveforms. These depths are consistent with shallow subduction as the African plate, west of Cyprus, penetrates beneath the Anatolian plate.
Along the Cyprean Arc, convergence between the African and Anatolian plate, in agreement with the observed seismicity, decreases from west to east.
The faulting geometry suggests the emergence of strike-slip tear fault within the African plate separating the continental Eratosthenes Seamount south of Cyprus from the oceanic African lithosphere that subducts west of Cyprus.

Stress Field: oceanic African lithosphere subducts west of Cyprus

Type of documents:
Map of Cyprus and eastern Mediterranean showing Harvard CMT solutions for earthquakes occurring in the period 1976-1996 and with depth less than 50 km.



Map of Cyprus and eastern Mediterranean showing Harvard CMT solutions for earthquakes occurring in the period 1976-1996 and with depth less than 50 km

N° File: 13

Authors: ARVIDSSON, R., BEN-AVRAHAM, Z., EKSTROM, G; WDOWINSKI, S.

Year: 1997

Title: Plate tectonic framework for the MW=6.8, October 9, 1996, Cyprus earthquake and the seismic Energy Release of the Cyprean Arc

Reference: Geophysical Research Letters, vol.25, no.12, pp.2241-2244

Concerned area: Eastern Mediterranean, West of Cyprus

Formation(s) affected:

Age of the deformation: Present day

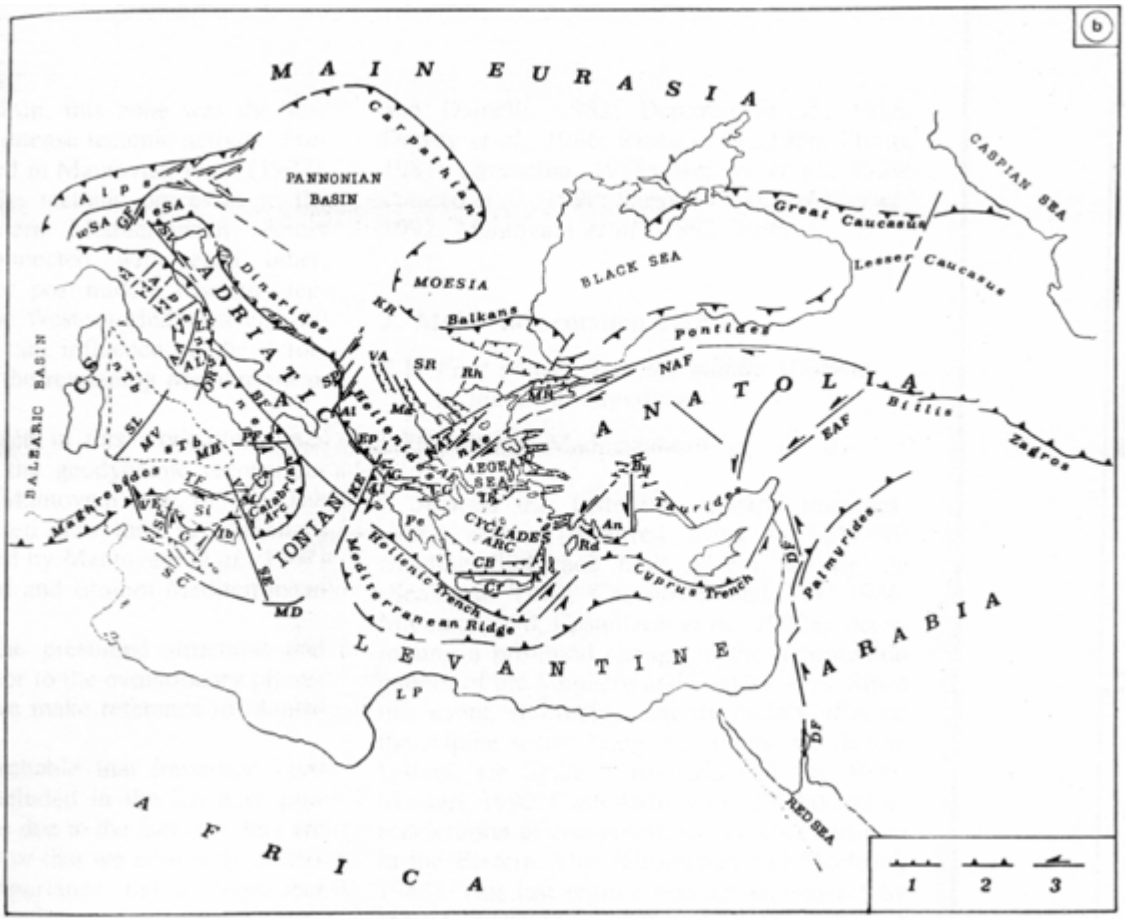
Concerned structures: Cyprean Arc

Commentary:
Largest earthquake in the eastern Mediterranean during the past 15 years.
Centroïd depths for this earthquake and its largest aftershock: 32 to 27 km respectively, by modelling P and SH waveforms. These depths are consistent with shallow subduction as the African plate, west of Cyprus, penetrates beneath the Anatolian plate.
Along the Cyprean Arc, convergence between the African and Anatolian plate, in agreement with the observed seismicity, decreases from west to east.
The strike slip mechanism, unusual for a subducting plate, may be caused by locking of subduction south of Cyprus, where the Eratosthenes seamount underthrust Cyprus.
The result appears to be emergence of strike-slip tear fault separating the continental Eratosthenes seamount south of Cyprus from the oceanic African lithosphere that subducts west of Cyprus.

Stress Field: oceanic African lithosphere subducts west of Cyprus

Type of documents:
Poster

N° File: 14
Authors: BABBUCI, D., TAMBURELLI, C., MANTOVANI E., ALBARELLO, D.
Year: 1997
Title: Tentative list of major deformation events in the Central-Eastern Mediterranean region since the middle Miocene.
Reference: Ann. Geofis. 40, 645-670
Concerned area: Central-Eastern Mediterranean
Formation(s) affected:
Age of the deformation: Middle Miocene to present day
Concerned structures:
Commentary: General document
Stress Field:
Type of documents: Tectonic sketch of the Central Mediterranean area



Tectonic sketch of the Central Mediterranean area

N° File: 15

Authors: BAILEY, W R; HOLDSWORTH, R E; SWARBRICK, R E

Year: 2000

Title: Kinematic history of a reactivated oceanic suture; the Mamonia Complex suture zone, SW Cyprus

Reference: Journal of the Geological Society of London, vol.157, Part 6, pp.1107-1126, 01 Nov 2000

Concerned area: Eastern Mediterranean, SW Cyprus

Formation(s) affected: passive margin sequence

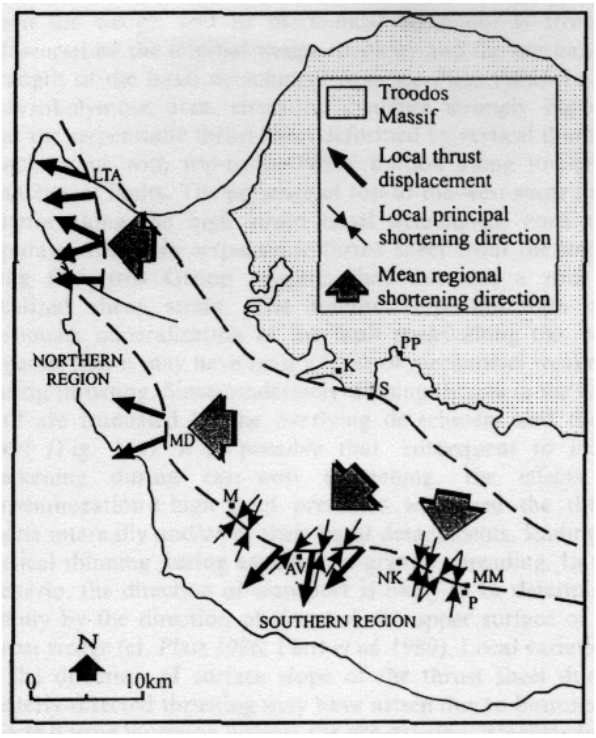
Age of the deformation: Upper Cretaceous, Triassic and latest Maastrichtian

Concerned structures: The Mamonia Complex Suture Zone

Commentary:
The present day structural geometries are interpreted as the result of Maastrichtian contractional reactivation of a pre-existing, steep and irregular structural architecture formed during transtention.
The resultant orientation of the finite train axes and thrust displacements display a radial distribution, documenting near fault normal contraction along the whole length of the arcuate suture zone. This pattern of displacements suggests a model whereby the Troodos microplate impinged on the Mamonia Complex during westerly to south-westerly-directed plate motion, contractionally reactivating the mechanically weak suture zone.

Stress Field: reactivation of a pre-existing suture zone

Type of documents:
Geological map of SW Cyprus
Map of the fault zone, located 1500 m west of Mamonia village
Geological map of the Ayia Varvara area
Schematic three dimensional block diagram summarizing the cross-section exposed at Loutra tis Aphroditis
Structure of the Akamas area
Geological map of the Mavrokolymbos area
Cross-section along Katarrakhitis Potamos valley
Cross-section and data from Mavrokolymbos valley



Regional strain pattern along the Mamonia Complex Suture Zone, which has resulted from Maastrichtian compression

N° File: 16

Authors: BARKA, A., REILINGER, R.

Year: 1997

Title: Active tectonics of the Eastern Mediterranean region: deduced from GPS, neotectonic and seismicity data

Reference: Ann. Geofis. 40, 587-610

Concerned area: Eastern Mediterranean

Formation(s) affected:

Age of the deformation: Present day

Concerned structures:

Commentary:

This paper reviews the main tectonic features combining the recent information obtained from GPS measurements, seismicity and neotectonic studies.

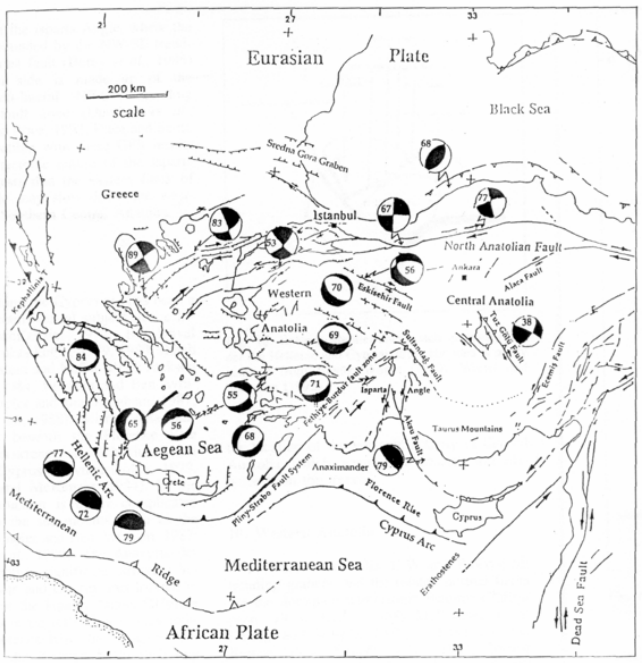
The Arabian plate moves northward with respect to Eurasia at a rate of 23 ± 1 mm/yr, 10 mm/yr of this rate is taken up by shortening in the Caucasus. The internal deformation in Eastern Anatolian by conjugate strike-slip faulting and E-W trending thrust, including the Blitis frontal thrust, accommodates approximately a 15 mm/yr slip rate. The Northeast Anatolian fault, which extends from the Erzican basin to Caucasus accommodates about 8 ± 5 mm/yr of left-lateral motion. The Eulerian rotation pole indicates that slip rate along the North Anatolian fault is about 26± 3 mm/yr. GPS measurements reveal that the East Anatolian fault accommodates an 11 ± 1 mm/yr relative motion. The western flank of the Isparta angle, the Fethiye-Burdur fault zone appears to be a major boundary with a slip rate of 15-20 mm/yr. The Western Anatolian grabens take up a total of 15 mm/yr NE-SW extension.

The fact that motions in Central Anatolia relative to Eurasia, are 15-20 mm/yr while in Western Anatolia and Aegean Sea they are 30-40 mm/yr could suggest that Western Anatolia decouples from Central Anatolia and the Isparta Angle by the Fethiye-Burdur fault zone and Eskisehir fault. It is also hypothesized that the differentiation of tectonic styles and velocities in the Anatolian-Aegean block are related to differences between the slabs lying under the Cyprus and Hellenic arcs.

Stress field: the North Anatolian fault is dominantly dextral and Western Anatolia and the Agean have dominant extension.

Types of documents:

Seismic activity of the Anatolian region between 1963-1988
Distribution of fault plane solutions
Distribution of GPS velocity vectors measured between 1988-1994 in the Eastern Mediterranean region
Distribution and extents of surface rupture of large earthquakes
Neotectonic structures in the Eastern Mediterranean region
Distribution of earthquakes ruptures in the Anatolian region between 1800-1995
Neotectonic sub-division of the Anatolian block

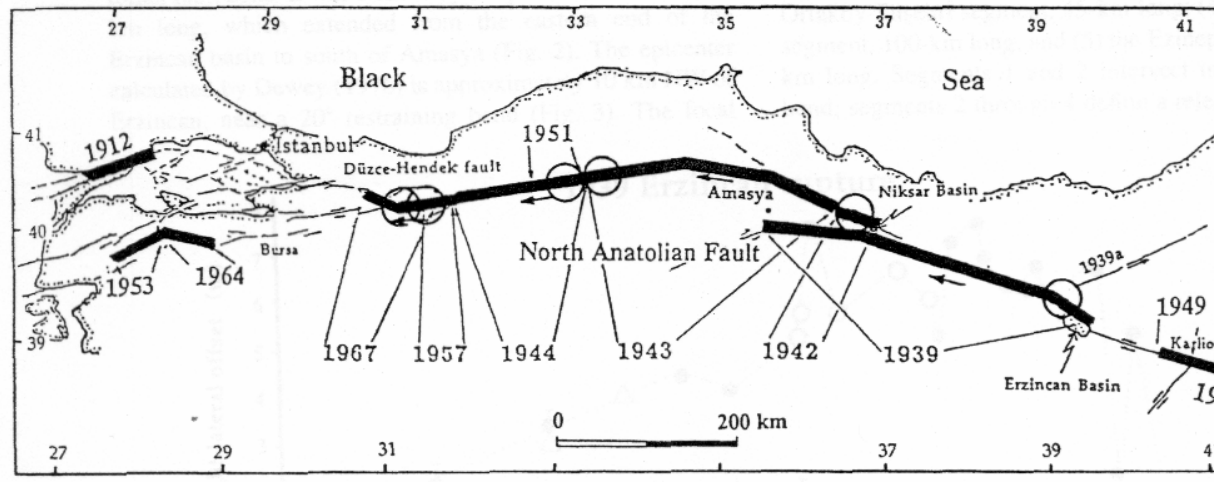


Neotectonic structures in the Eastern Mediterranean region. Fault plane solutions of major earthquakes, M > 6.5 showing that motion along the North Anatolian fault is dominantly dextral and Western Anatolia and the Agean have dominant extension

N° File: 17

Authors: BARKA, A.A.
Year: 1996
Title: Slip distribution along the North Anatolian fault associated with the large earthquakes of the period 1939-1967
Reference: Bull. Seism. Soc. AM, 86, 1238-1254

Concerned area: Eastern Mediterranean, Turkey
Formation(s) affected:
Age of the deformation: Present day
Concerned structures: North Anatolian fault
Commentary: Six large fault ruptures formed a westward migrating sequences of events along a 900-km-long nearly continuous portion of the North Anatolian fault. These data indicate that the amount of slip is irregularly distributed along the 1939 to 1967 rupture zone. The maximum slip, 7.5 m, occurred during the 1939 earthquake in the eastern 150 km of the 900-km-long rupture zone. Dextral offsets diminish very abruptly eastward but very gradually westward.
Stress field: dextral slip
Types of documents: Slip distribution along the rupture zone

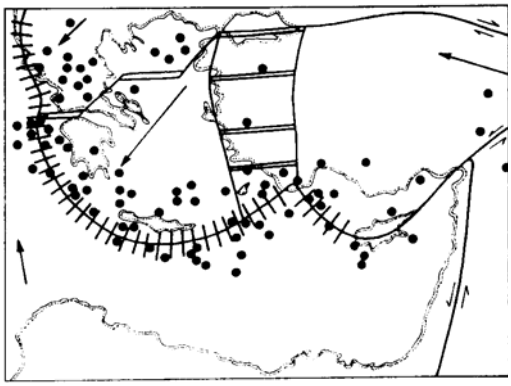


The rupture zone of the 1939 to 1967 earthquakes along the North Anatolian fault during the twentieth century

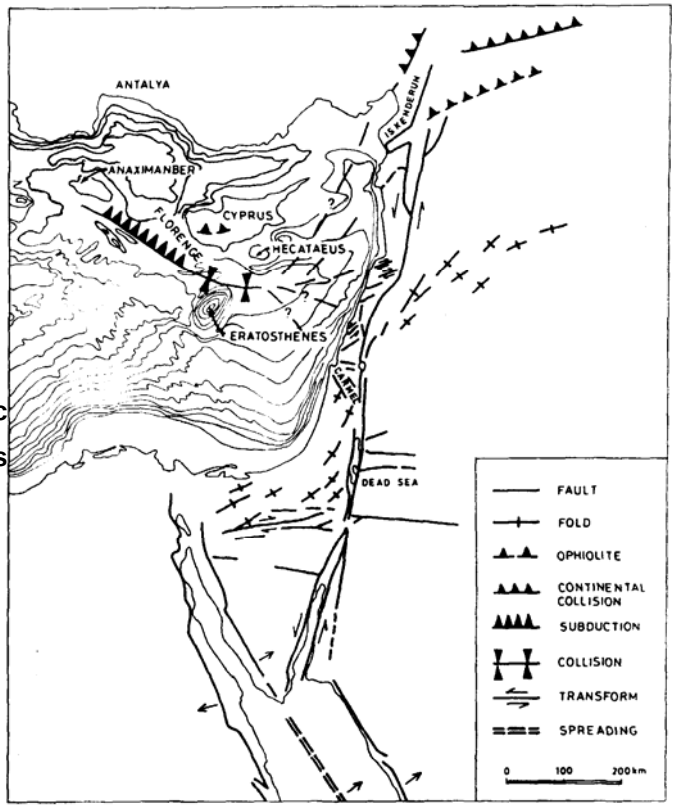
N° File: 18

Authors: BEN-AVRAHAM, Z., KEMPLER, D. AND GINZBURG, A.
Year: 1988
Title: Plate convergence in the Cyprean Arc
Reference: Tectonophysics, 146, 231-240

Concerned area: Eastern Mediterranean, Cyprean Arc
Formation(s) affected:
Age of the deformation: Present day
Concerned structures: Cyprean Arc
Commentary: Seismic activity and a gravity anomaly indicate that a northward subduction of oceanic material related to the African Plate beneath the Turkish plate is the mode of convergence along the western segment of the Cyprean Arc. Subduction is interrupted due to the collision with the Eratosthenes Seamount at the central segment of the Cyprean Arc, which form a zone of intense deformation. The zone of deformation spreads away and disappears in the eastern segment of Cyprean Arc. The change in the mode of convergence in the type of deformation along the Cyprean Arc is induced by crustal differences in the underthrusting plate.
Stress field: Plate convergence
Types of documents: The tectonic setting of the Cyprean Arc zone and earthquake epicentres Seismicity profiles across the Cyprean Arc Modes of convergence along the Cyprean Arc



The tectonic setting of the Cyprean Arc zone and earthquake epicentres in this area between 1961 and 1970



Modes of convergence along the Cyprean Arc

N° File: 19

Authors: BEN-AVRAHAM, Z; TIBOR, G; LIMONOV, A F; LEYBOV, M B; IVANOV, M K; TOKAREV, M YU; WOODSIDE, J M

Year: 1995

Title: Structure and tectonics of the eastern Cyprean Arc

Reference: Marine and Petroleum Geology, vol.12, no.3, pp.263-271

Concerned area: Eastern Mediterranean**,** eastern Cyprean Arc

Formation(s) affected:

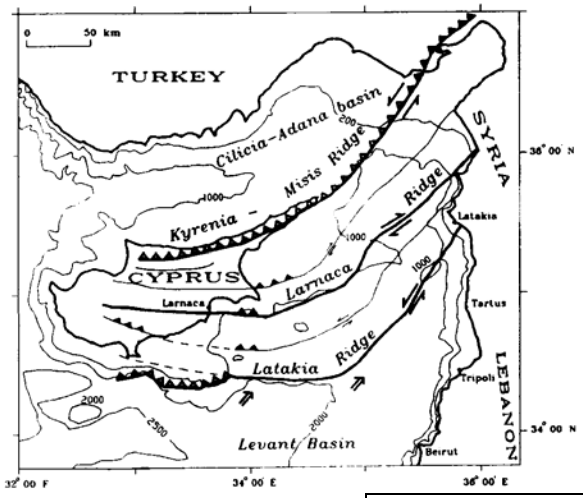
Age of the deformation: Present day

Concerned structures: Cyprean Arc, Latakia ridge

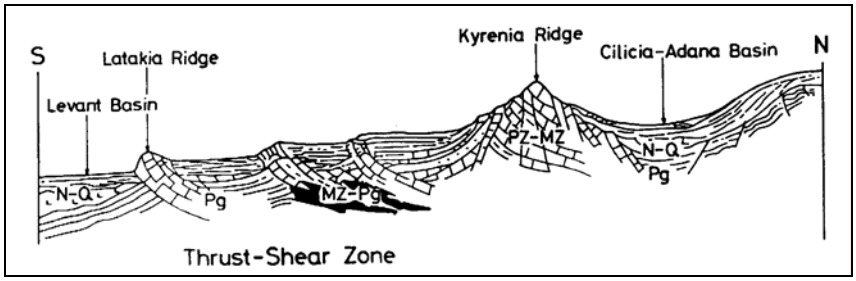
Commentary:
Recent marine geophysical data mapped several deep and shallow structural elements. The most prominent element is a ridge, the Latakia Ridge, which extends from the Syrian coast near Latakia south-westward, to meet with an east-west trending bathymetric escarpment east of the Hecateus ridge. The new seismic profiles suggest that these two elements mark the present plate boundary along the eastern Cyprean Arc. The Latakia Ridge is a young and still active feature. It was formed by southward migration of the plate boundary. The ridge is still forming today and serves as a dam to the sediments north of it. The wrench faulting activity is more pronounced in the eastern segment of the ridge.

Stress field: Plate convergence

Types of documents:
Bathymetric map.
Seismic reflection profiles.
Magnetic anomaly map of the study area.
Bouguer gravity map of the study area.
Main morphological and structural elements in the study area.
Schematic geological cross section of the Cyprean Arc.



Main morphological and structural elements in the study area. The 200, 1000 and 2000 m bathymetric contours are shown.



Schematic geological cross-section of the Cyprean Arc along 34° 40'E.

N° File: 20

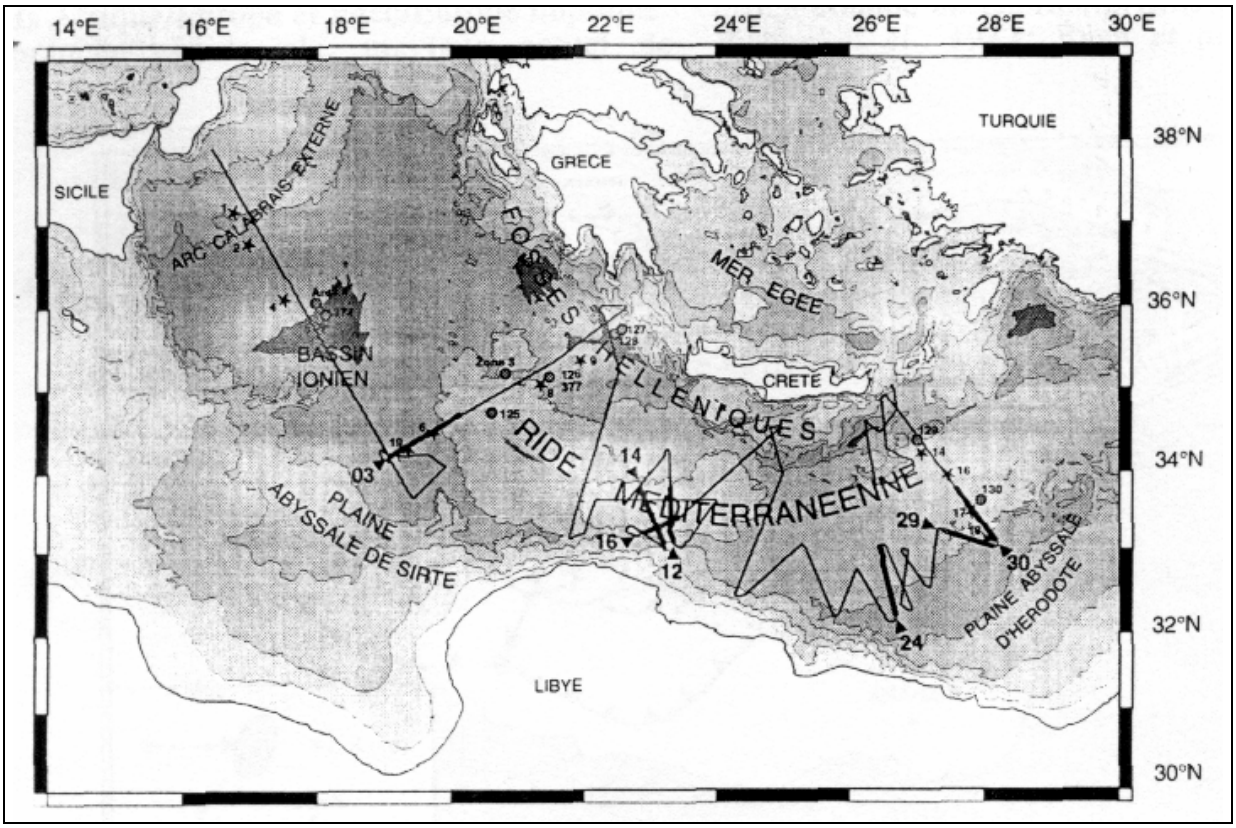
Authors: BENKHELIL, J., MART, Y., MASCLE, J., WOODSIDE, J.
Year: 1998
Title: Recent Morphostrucutral Evolution of the Eratosthenes Seamount: New Data from the prism II Cruise
Reference: Marine Geology and Geophysics, 005/2A, p.756

Concerned area: Eastern Mediterranean, south Cyprus
Formation(s) affected:
Age of the deformation: Present day
Concerned structures:
Commentary: The Eratosthenes Seamount is a large (120x80 km) submarine plateau which dominates the Nile Deep sea fan to the South and separated to the North from Cyprus by a narrow East-West trending flat abyssal plain. The seamount is slightly inclined northward and sliced by a series of East-West trending normal faults which affect both the thin Plio-Quaternary sediments and the underlying strong reflectors attributed to Miocene or older. The Eratosthenes Seamount interpreted as a continental fragment of the African Craton constituted by Mesozoic carbonates overlain by a thin Plio-Quaternary sedimentary blanket is pushed northward and thrusted beneath the Southern Cyprus margin. The intense normal faulting which affect its northern flank is a reaction to its downward pull under Cyprus while the compressional deformation attests of the present thrusting along the Cyprus margin.
Stress field: The Eratosthenes Seamount is pushed northward and thrusted beneath the Southern Cyprus margin
Types of documents: Abstract

N° File: 21

Authors: CHAUMILLON, E., MASCLE, J.
Year: 1995
Title: Variation latérale des fronts de déformation de la Ride méditerranéenne (Méditerranée orientale)
Reference: Bull. Soc. Géol. Fr. 166, 463-478

Concerned area: Eastern Mediterranean
Formation(s) affected:
Age of the deformation:
Concerned structures: The Mediterranean Ridge
Commentary: Very general Not exactly about the study area
Stress field:
Types of documents: Seismic profiles

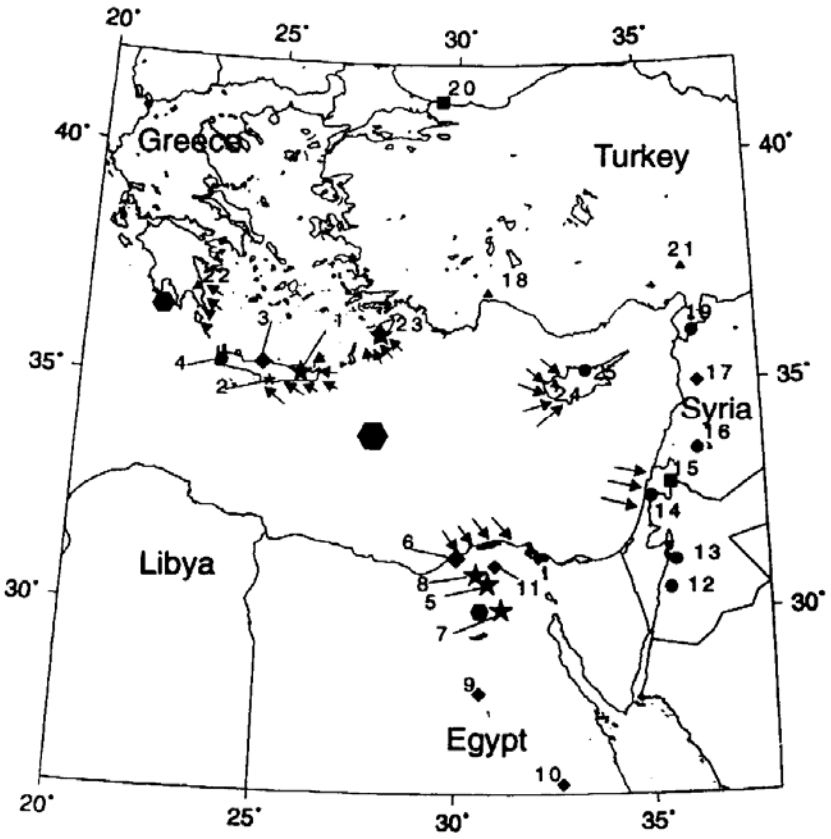


Position of the seismic profiles during the PRISMED cruise (march 1993) on the eastern Mediterranean.

N° File: 22

Authors: EL-SAYED, A; ROMANELLI, F; PANZA, G
Year: 2000
Title: Recent seismicity and realistic waveforms modelling to reduce the ambiguities about the 1303 seismic activity in Egypt
Reference: Tectonophysics, vol.328, no.3-4, pp.341-357

Concerned area: Eastern Mediterranean, Hellenic arc
Formation(s) affected:
Age of the deformation: Present day
Concerned structures:
Commentary: The seismic activity was strongly felt in lower Egypt for about 15 min and caused a widespread damage in Crete, Egypt, Rhode, Jordan, Syria, Palestine, Turkey and Cyprus. One earthquake was a shallow event with small to moderate size, located in Egypt, probably to the south of Cairo, beneath the Nile valley. The other earthquake had a relatively larger size and occurred in the Hellenic arc at a shallow depth.
Stress field:
Types of documents: Proposed locations of the events of August 8, 1303 and of the damaged cities Bathymetry Focal mechanism solutions in the Hellenic arc



Proposed locations of the events of August 8, 1303 and of the damaged cities.
Star = extensive damage or total collapse, diamond = heavy damage, circle = low damage, triangle = generic damage, and square = felt.

N° File: 23

Authors: ERDIK, M; ALPAY BIRO, Y; ONUR, T; SESETYAN, K AND BIRGOREN, G

Year: 1999

Title: Assessment of earthquake hazard in Turkey and neighbouring regions

Reference: EUG 10 - Journal of Conference Abstracts, vol.4, no.1, pp.543 + internet

Concerned area: Eastern Mediterranean , Turkey and neighbouring regions

Formation(s) affected:

Age of the deformation:

Concerned structures:

Commentary:
The seismicity database is compiled from numerous sources, and the tectonic setting of the region has been studied in detail.

Stress field:

Types of documents:
Tectonic Features
Neotectonic setting of the Alpine System
Major Tectonic Features of the Region
Historical Seismicity with the Major Tectonic Features
Instrumental Seismicity with the Major Tectonic Features

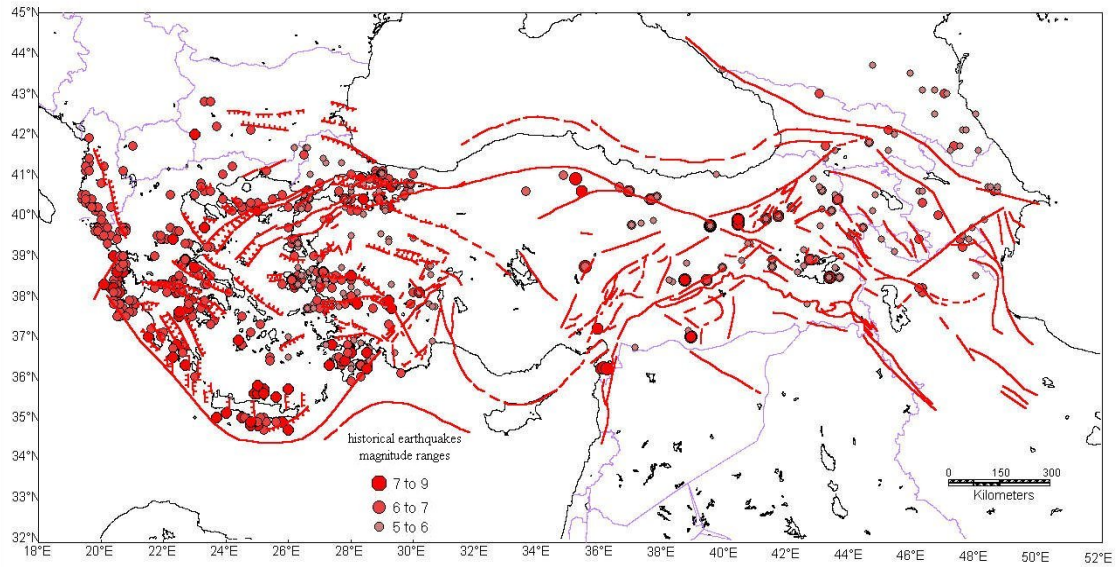
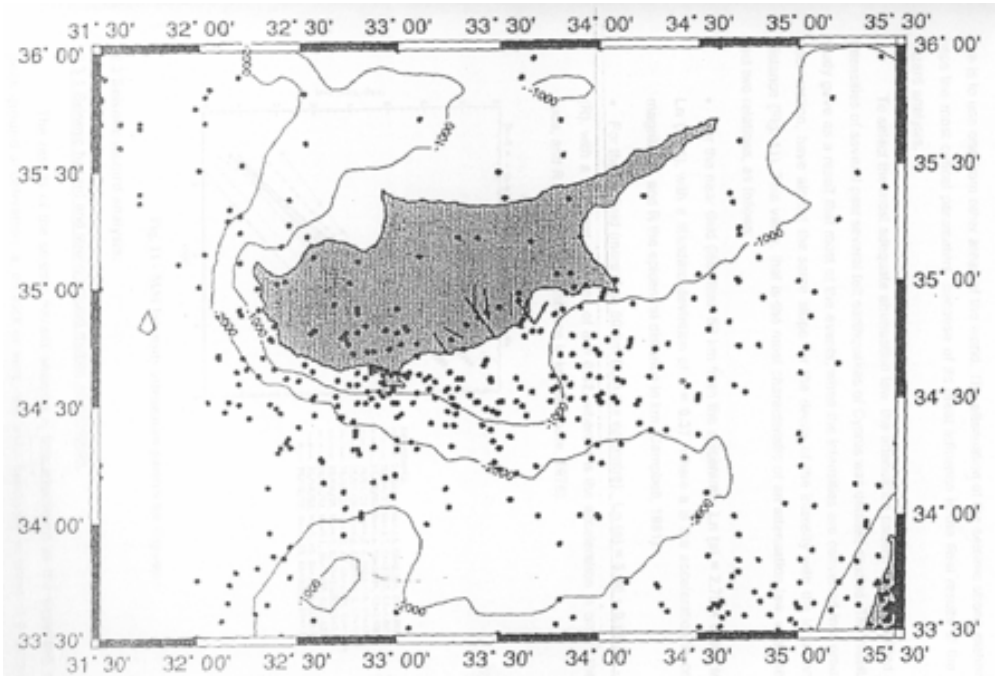


Figure 3a. Historical Seismicity with the Major Tectonic Features

N° File: 24

Authors: GAJARDO, E., FRANKE, M., AND QUIJADA, P.
Year: 1996
Title: Seismic hazard and design conditions for Vasilikos Power Plant
Reference: GeoPro GmbH, Preliminary Executive summary, pp.28

Concerned area: Eastern Mediterranean, Cyprus, Vasilikos
Formation(s) affected:
Age of the deformation:
Concerned structures:
Commentary: The results of the recent microseimicity study had clearly shown the existence of some active tectonic faults, in particular the one located about 5 km west of the site following a NNW-SSE trend (Agios Giorgios – Alamanos) The seismic ground attenuation pattern of Cyprus is moderately high, compared with other areas in the world. This means that the strong ground motion is rapidly reduced with the distance from the epicentre. The expected peak ground acceleration for 50 years of service life and 10% of probability of exceedence is: 0.21 g. This value is higher than the design accelerations given at the Seismic Code for Concrete Structures in Cyprus.
Stress field:
Types of documents: Histogram of depth distribution of earthquakes in Cyprus. Seismicity of Cyprus 1894-1994. Diffuse seismicity seismic sources for depth 0-25 km / 26-40 km / greater than 40 km. Modelling of the local active faults as seismic sources. Integrated seismic catalogue of Cyprus (1894-1994).



Modelling of the local active faults as seismic sources

N° File: 25

Authors: GARFUNKEL, Z.

Year: 1998

Title: Constraints on the origin and history of the Eastern Mediterranean Basin

Reference: Tectonophysics, vol. 298. p. 5-35

Concerned area: Eastern Mediterranean

Formation(s) affected:

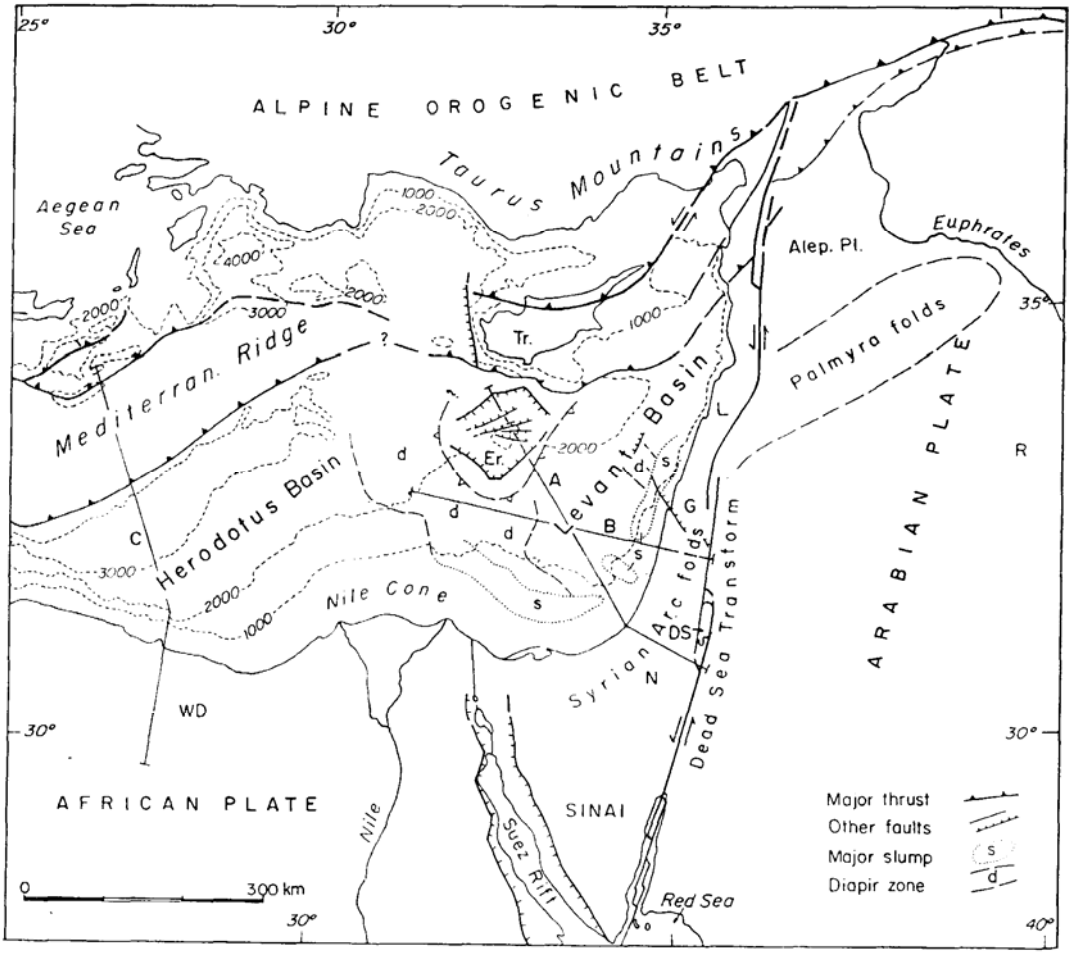
Age of the deformation: Permian to Cretaceous

Concerned structures:

Commentary:
The Eastern Mediterranean and its passive margins are interpreted to have formed a result of several faulting and continental break-up phases from early Permian to Middle Jurassic times, before Pangaea's complete disintegration.

Stress field:

Types of documents:
Main structural elements of the Eastern Mediterranean basin
Schematic cross-sections



Main structural elements of the Eastern Mediterranean basin. Abbreviations: B = Baër-Bassit complex; DS = Dead Sea basin; Er = Eratosthenes Seamount; G = Galilee; N = Negev; Tr = Troodos complex of Cyprus; WD = Western Desert of Egypt.

N° File: 26

Authors: GASS, I. G., MACLEOD, C.J., MURTON, B.J., PANAYIOTOU, A., SIMONIAN, K.O., AND XENOPHONTOS, C.

Year: 1994

Title: The geology of the Southern Troodos Transform Fault Zone

Reference: Cyprus Geological Survey Department, Mem. 9, 218 p., 2 maps.

Concerned area: Eastern Mediterranean, Cyprus, Troodos

Formation(s) affected:

Age of the deformation: Upper Cretaceous to Present day

Concerned structures: Southern Troodos Transform Fault Zone

Commentary: (summary of part of the 4th and 6th chapters)

There is abundant evidence in the form of a very youthful drainage pattern radiating away from Mt Olympus, extensive river terraces flanking these drainage course, raised beaches around the island of Cyprus and an extensive erosional bevel over Mt Olympus that indicate these has been extensive, geologically recent uplift of the Troodos Massif, centred on Mount Olympus. Although it has long been recognized that the uplift was probably produced by the emplacement of a low density, serpentinite diapir under the summit region of Mt Olympus, the style, the age and rate of uplift has not yet been satisfactorily resolved.

The available evidence suggests that the STTFZ remained essentially passive during the rotation of the Cyprus Microplate. Instead, in the vicinity of the Limassol Forest Complex (LFC), it was the transform-oblique WNW to NW-striking structures that were reactivated as dextral strike-slip faults, presumably because of their favourable orientation relative to the regional stresses responsible for the initiation of rotation.

The boundary transgressed obliquely across the transform fault, dismembering fragments of it to the west of the LFC along a broad arcuate shear zone that encloses the southwest of the Troodos massif. The dominant WNW-ESE to NW-SE trending structural grain of the microplate boundary, which is oblique to the E-W trend of the STTFZ, is manifest in the eastern LFC as major extensional (and thence dextral strike-slip) faults, are the controlling basement structure beneath the Yerasa fold and thrust belt and as extensional/dextral strike-slip faults along the south-western margin of the main Troodos massif. Because of this obliquity, the STTFZ was truncated to the present-day west of the LFC by the Statos-Kannaviou-Limassol lineament.

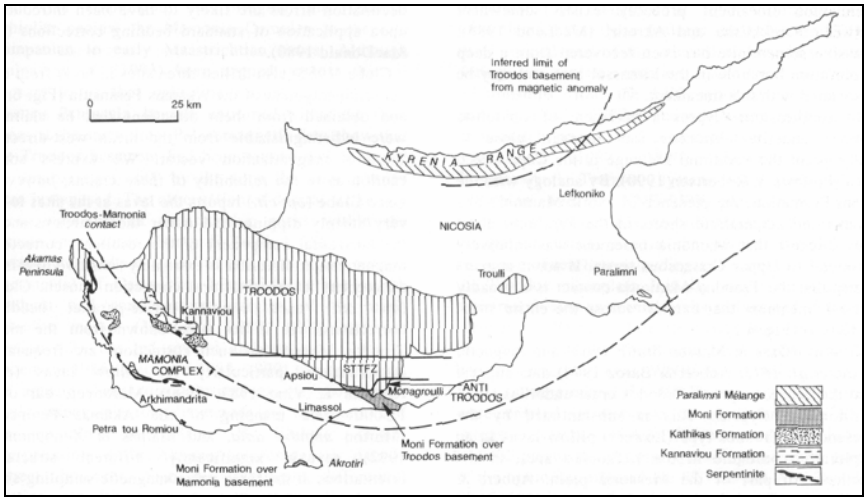
Stress field:

Types of documents:

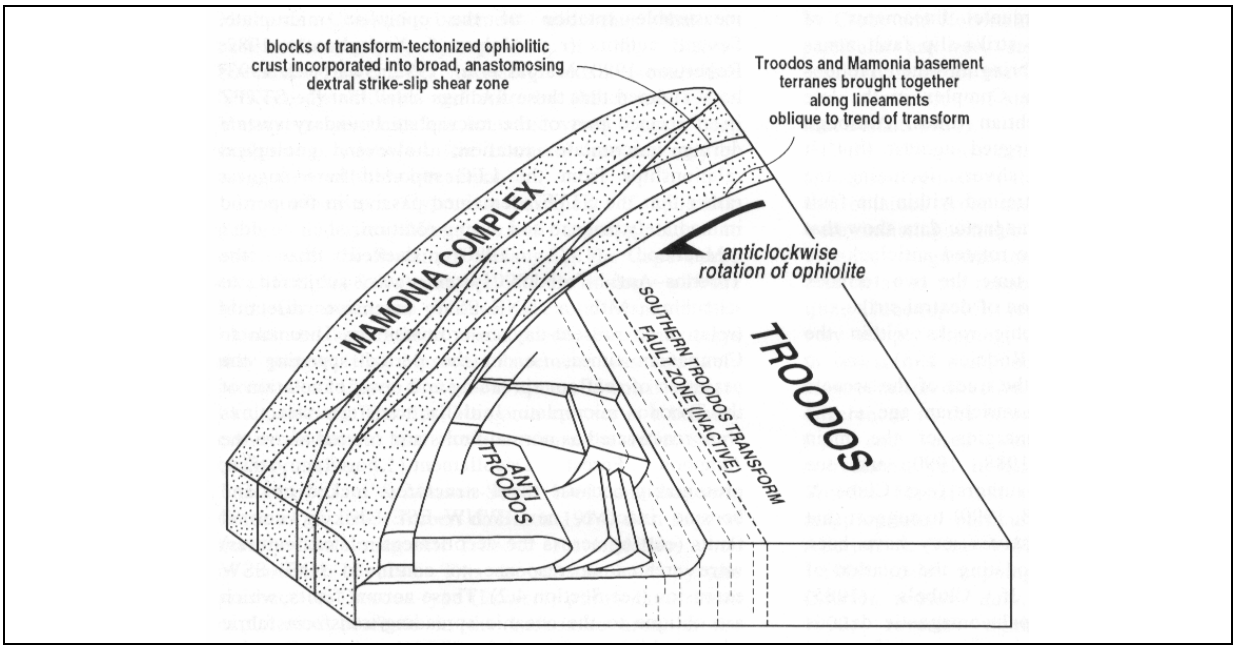
Physiographic zonation of the STTFZ.

Outcrops of Troodos ophiolite and serpentinite in western and south-western Cyprus.

Map of the Troodos ophiolite microplate boundaries showing the relationship between the Troodos ophiolite and the Mamonia Complex.



Map of the Troodos ophiolite microplate boundaries showing the relationship between the Troodos ophiolite and the Mamonia Complex

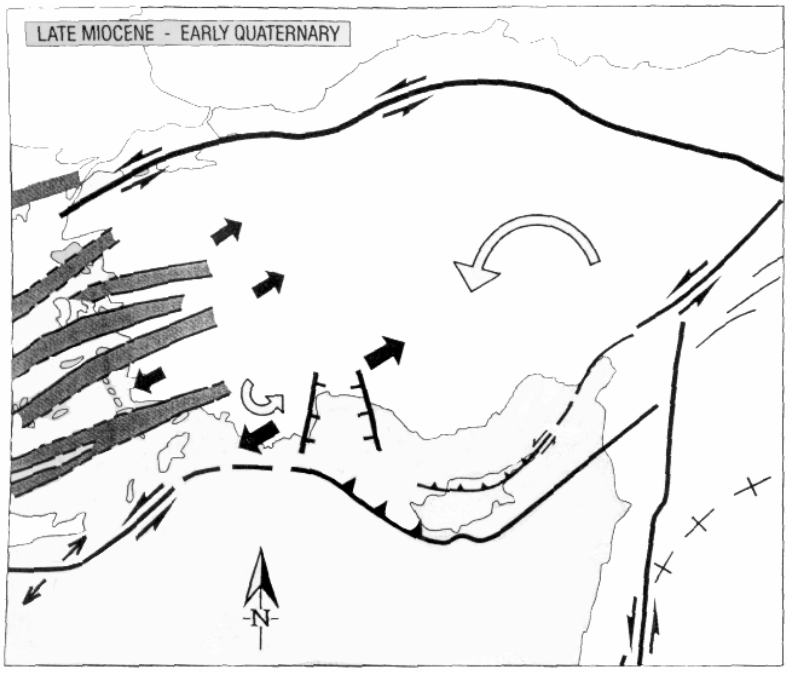


Suggested configuration of the southern Troodos margin in the early Maastrichtian

N° File: 27

Authors: GLOVER, C; ROBERTSON, A H F
Year: 1998
Title: Neotectonic intersection of the Aegean and Cyprus tectonic arcs; extensional and strike-slip faulting in the Isparta Angle, SW Turkey
Reference: Tectonophysics, vol.298, no.1-3, pp.103-132

Concerned area: Eastern Mediterranean, SW Turkey
Formation(s) affected:
Age of the deformation: Late Miocene – Early Pliocene, Late-Pliocene-Recent
Concerned structures: Aegean and Cyprus tectonic arcs
Commentary: Some recent tectonic maps show the Isparta Angle as a NW-SE compressional lineament extending eastwards into the Kyrenia Range of northern Cyprus. However, fault data from the onshore Isparta Angle, together with offshore shallow seismic reflection data, show that the present morpho-tectonic setting is dominated by extension. An interpretation of shallow seismic reflection data shows that Antalaya Bay is characterised by a NW-SE trending asymmetrical graben system that has continued to be active. The Isparta Angle is the link between: the extensional province of western Turkey bounded to the south by the actively subducting Hellenic arc; and uplifted Anatolian plateau bounded to the south by the Cyprus subduction zone.
Stress field: NW-SE extension
Types of documents: Tectonic map of the easternmost Mediterranean area. Geological map of the Isparta Angle. Fault data from the Isparta Angle. Fence diagram of the fault structure and bathymetry within Antalaya Bay. Seismic reflection profiles. Model of interaction between the extending Aegean region and the rotating Anatolian block (eastern Turkey) during Late Miocene-Early Pliocene time.

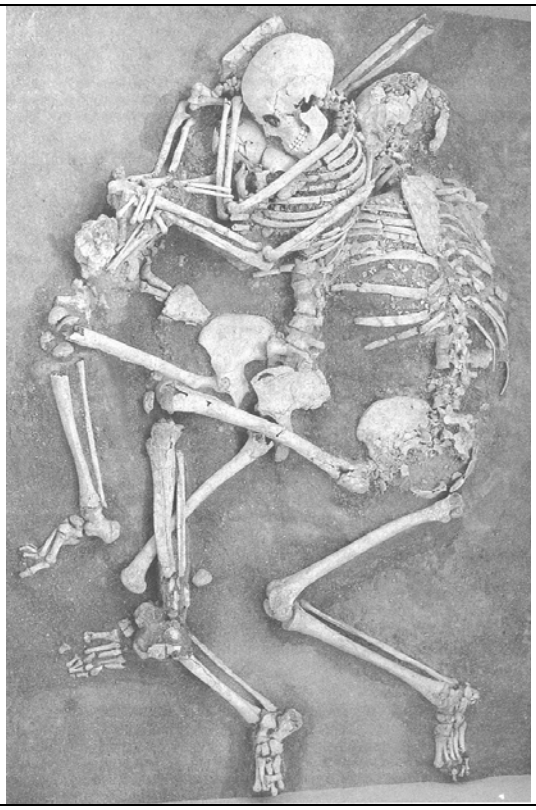


Tectonic regime during the Late Pliocene to early Quaternary

N° File: 28

Authors: GUIDOBONI EMANUELA with the collaboration of ALBERTO COMASTRI and GIUSTO TRAINA
Year: 1994
Title: Catalogue of ancient earthquakes in the Mediterranean area up to the 10th century
Reference: Instituto Nazionale di Geofisica, editorial production of SGA Storia Geofisica Ambiente, pp. 504

Concerned area: Mediterranean
Formation(s) affected:
Age of the deformation:
Concerned structures:
Commentary: The book presents historical evidence on strong earthquakes in the Mediterranean and on Cyprus for the period till the 10th century A.D. Written sources are cited, analysed, and compared. The book contains illustrations and photographs of the locations affected, along with the original-language excerpts from the historical sources.
Stress field:
Types of documents: Catalogues, maps, photographs, illustrations



Kurion (Cyprus). Skeletons found during excavation of the large house between 1984 and 1987. The three members of the family were probably victims of the earthquake, which struck several towns in Cyprus in about 370, including Paphos, which is about 50 km from Kurion (Marta Cooper)

N° File: 29

Authors: GULEN, L.
Year: Unknown
Title: Seismic activity in the Cyprus region preceding major earthquakes in Turkey
Reference: Geoscope, 57 Edgewater Drive, Framingham, MA 01702-5612 USA / Internet

Concerned area: Eastern Mediterranean , Cyprus and Turkey
Formation(s) affected:
Age of the deformation: Present day
Concerned structures:
Commentary: Within one week span preceding the Izmit Earthquake an intense seismic activity occurred in the Cyprus region which consist of eight earthquakes with Mb>4. Six of them occurred on August 11, 1999 (Mb=4.1, Mb=4.5, Mb=5.4, Mb=4.6, Mb=4.2, Mb=4.1), and two of them occurred on August 13, 1999 (Mb=4.0, Mb=4.8). Investigation of previous major earthquakes in Turkey reveals that precursory nature seismic activity in Cyprus is a quite common phenomenon especially since the Cyprus earthquake of October 9, 1999 (Mb=6.9).
Stress field:
Types of documents: Abstract

N° File: 30

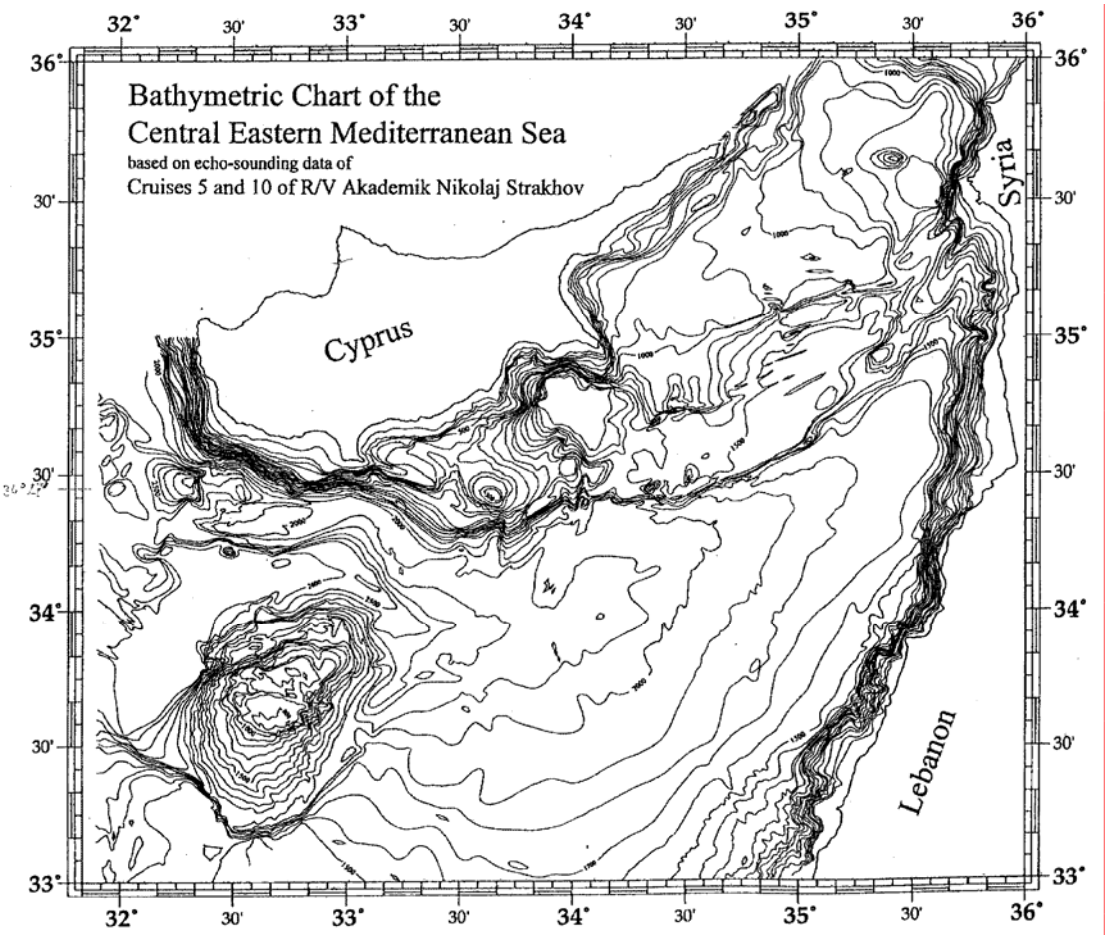
Authors: HALL, J., AKSU, A. AND CALON, T.
Year: 1999
Title: Neogene tectonics of the Cyprus arc regions: ophiolite-cored piggy-back basins
Reference: Journal of Conference abstracts, European Union of Geosciences, N° 10, v.4 (1), p.407.

Concerned area: Eastern Mediterranean, the Cyprus arc regions
Formation(s) affected:
Age of the deformation: Neogene
Concerned structures:
Commentary: The arc has only diffuse seismicity and no active volcanism: subduction is being overtaken by collision. 4500 km of multi-channel seismic reflection data collected, integrated with a database of 10000 km of additional seismic profiles. Interpretation focuses on the Iskenderum-Latakia-Mesaoria basins. Each has a distinctive Neogene History. Oblique convergence is partitioned between compressional and strike-slip faulting in different ways, and extensional fault systems accompany shelf and crestal collapse. The broadly asymmetric of the basins attests to their evolution as piggy-backs on the underlying thrust ophiolitic basement.
Stress field:
Types of documents: Abstract

N° File: 31

Authors: HALL, K.J.
Year: 1994
Title: The Bottom Relief of the Levantine Sea
Reference: Geological structure of the North-Eastern Mediterranean. Krasheninnikov and Hall edit., Jerusalem, p.5-32

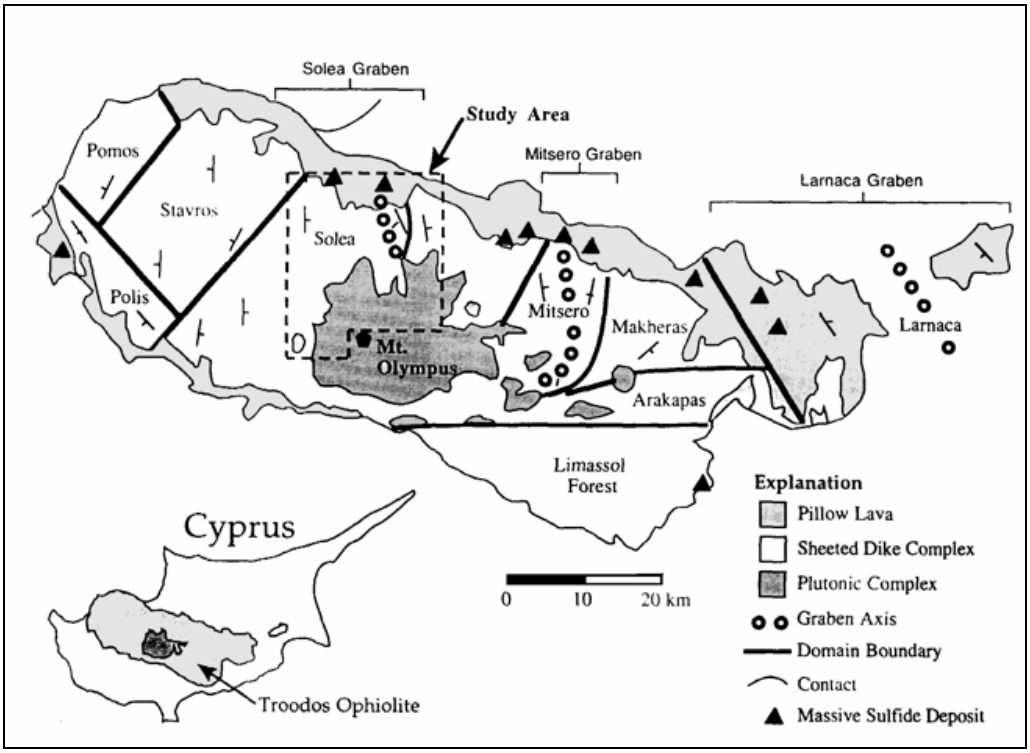
Concerned area: North-Eastern Mediterranean, Levantine Sea
Formation(s) affected:
Age of the deformation:
Concerned structures:
Commentary: Of particular interest was the underwater morphology of the Cyprean Arc, the largest positive feature in the Eastern Mediterranean, and of the prominent Eratosthenes Seamount. The geomorphology of Eratosthenes Seamount could help define the northern limits of the submarine continuation of the African platform, and shed light on its behaviour at the time of the Alpine events.
Stress field:
Types of documents: Profiles of the seafloor in the Eastern Mediterranean Bathymetric chart of the Central Eastern Mediterranean Sea Three dimensional block diagrams



N° File: 32

Authors: HURST, S D; MOORES, E M; VARGA, R J
Year: 1994
Title: Structural and geophysical expression of the Solea Graben, Troodos Ophiolite, Cyprus
Reference: Tectonics, vol.13, no.1, pp.137-156, Feb 1994

Concerned area: Eastern Mediterranean, Cyprus
Formation(s) affected:
Age of the deformation:
Concerned structures: Solea Graben, Troodos Ophiolite
Commentary: Field studies shows that extensional structures in the north-central part of the Troodos Ophiolite, including steep normal faults, grabens, dikes, and low angle detachment faults are related to E-W spreading. Timing of the uplift of the central part of the Troodos Ophiolite is uncertain but is probably related to the tectonic thinning of the upper-crust by low angle normal faulting. The Solea graben spreading centre provides a model for the structure of modern mid-ocean ridges that are spreading amagmatically.
Stress field: E-W spreading
Types of documents: General map of the Troodos Ophiolite Location map for Solea Graben Solea cross-section

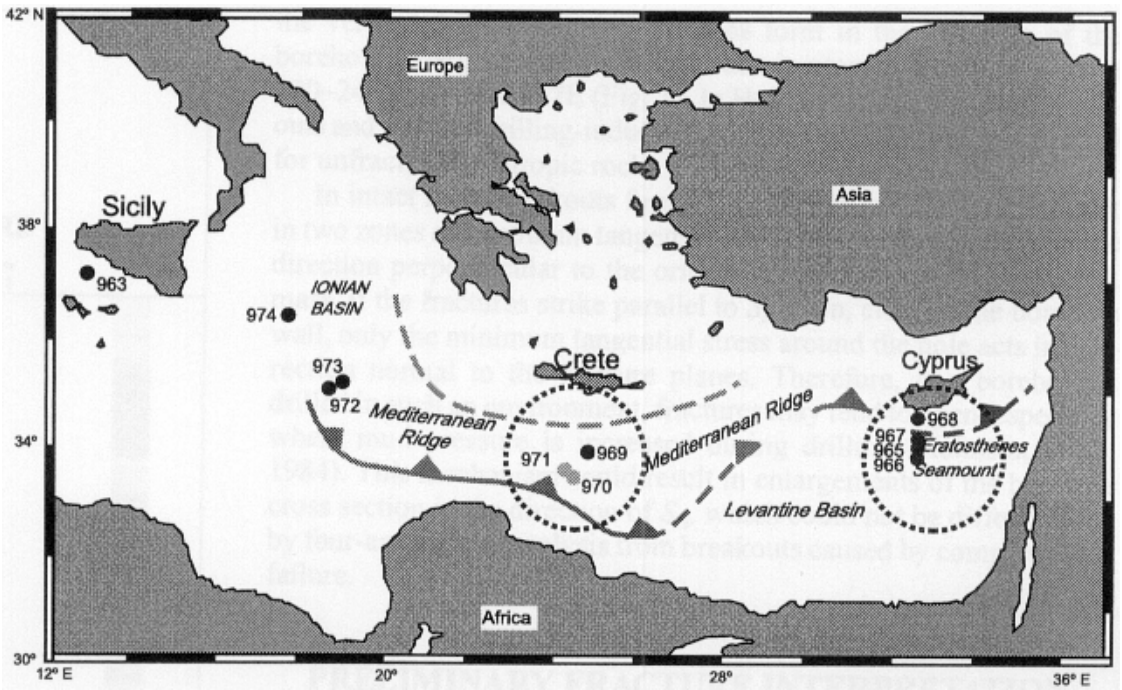


Generalized map of the Troodos Ophiolite showing dike domains, graben axes, and major structures

N° File: 33

Authors: JURADO-RODRIGUEZ, M.J. AND BRUDY, M.
Year: 1998
Title: Present-day stress indicators from a segment of the African-Eurasian plate boundary in the eastern Mediterranean sea: results of formation microscanner data.
Reference: Proceedings of the Ocean Drilling Program, Scientific Results, Vol. 160, pp. 527-533.

Concerned area: Eastern Mediterranean
Formation(s) affected: Cretaceous to Pliocene
Age of the deformation: Present day
Concerned structures: African-Eurasian plate boundary
Commentary: For Hole 966F and 967E at the Eratosthenes Seamount, the enlargements and the drilling-induced fractures show the same orientation. If both were stress induced and representative of the present-day stress orientation, they would be 90° off. A comparison of the strike of the inferred borehole enlargements with the observed paleostress-related fracturing suggests the possibility that borehole enlargements might be aligned with the strike of some of the structures. Thus, the stress orientation at the Eratosthenes Seamount sites from drilling-induced fractures alone, has been derived.
Stress field: The orientation of the maximum horizontal principal stress, S_H, is about N50°E for hole 966F, located on the seamount plateau, and N30°E for Hole 967E, located on northern slope of the Eratosthenes Seamount. For hole 965A, also on the slope but at a shallower depth, the orientation obtained is about N70°E. The stress orientations obtained from borehole enlargements and from the vertical drilling-induced fractures in Hole 970A, on the eastern flank of the Milano mud volcano, show consistent, nearly north-south, orientation of S_H.
Types of documents: Location map of leg 160 site Drilling induced fractures in Formation MicroScanner (FMS) images Orientation of borehole enlargements and vertical drilling-induced fractures

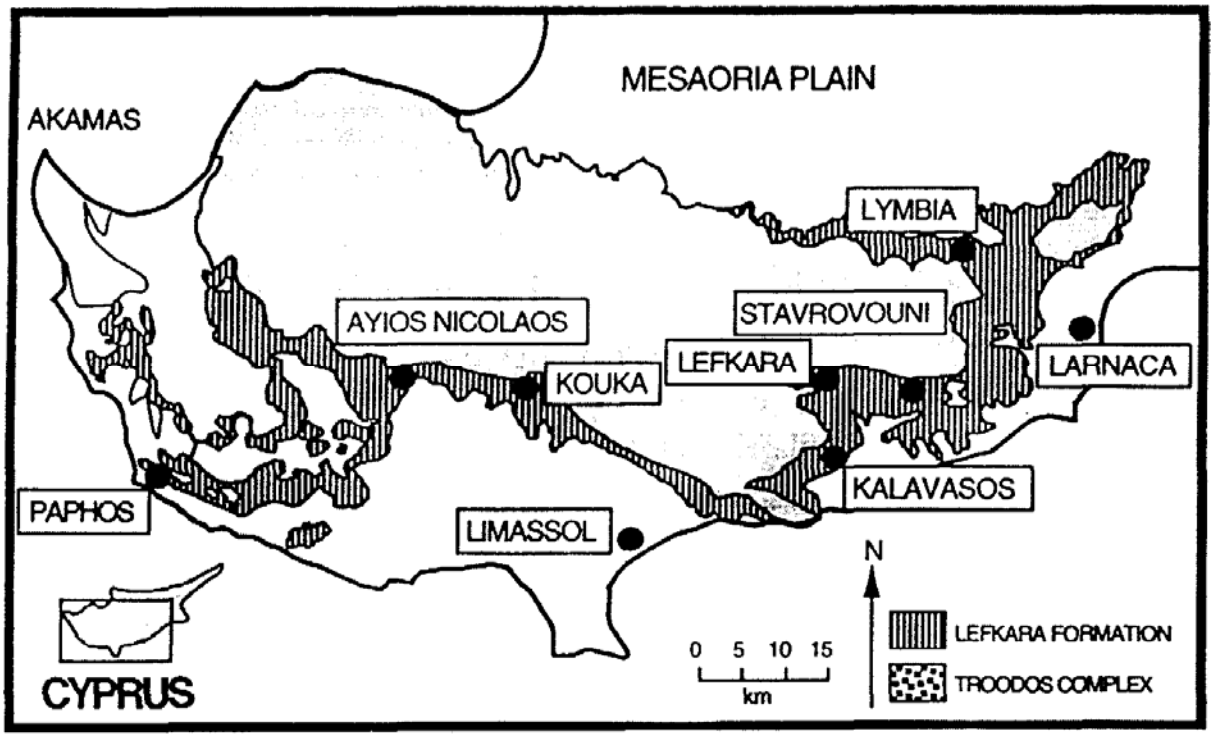


Location map of Leg 160 sites. The dashed circles indicate the sites analysed in this study

N° File: 34

Authors: KAEHLER, G; STOW, DAV
Year: 1998
Title: Turbidites and contourites of the Palaeogene Lefkara Formation, southern Cyprus
Reference: Sedimentary Geology, vol.115, no.1-4, pp.215-231, Jan 1998

Concerned area: Eastern Mediterranean, southern Cyprus
Formation(s) affected: Turbidites and contourites
Age of the deformation: Early and Middle Miocene
Concerned structures: Lefkara Formation
Commentary: The early phase of sedimentation directly overlying ocean crust, ridge-derived volcaniclastics and chemogenic sediments, was dominated by pelagic deposition. This was followed by a gradual increase in the influx of biogenic turbidites from the north during the Early and Middle Miocene period, primarily as a response to tectonic uplift of the Kyrenia Range. A combination of subtle features and supporting evidence allows the recognition of contourites in all the sections studied, together with the interaction of turbidity current and bottom-current processes in parts of Lefkara Formation.
Stress field:
Types of documents: Simplified geological map of southern Cyprus Photograph of typical sediment facies Schematic depositional models

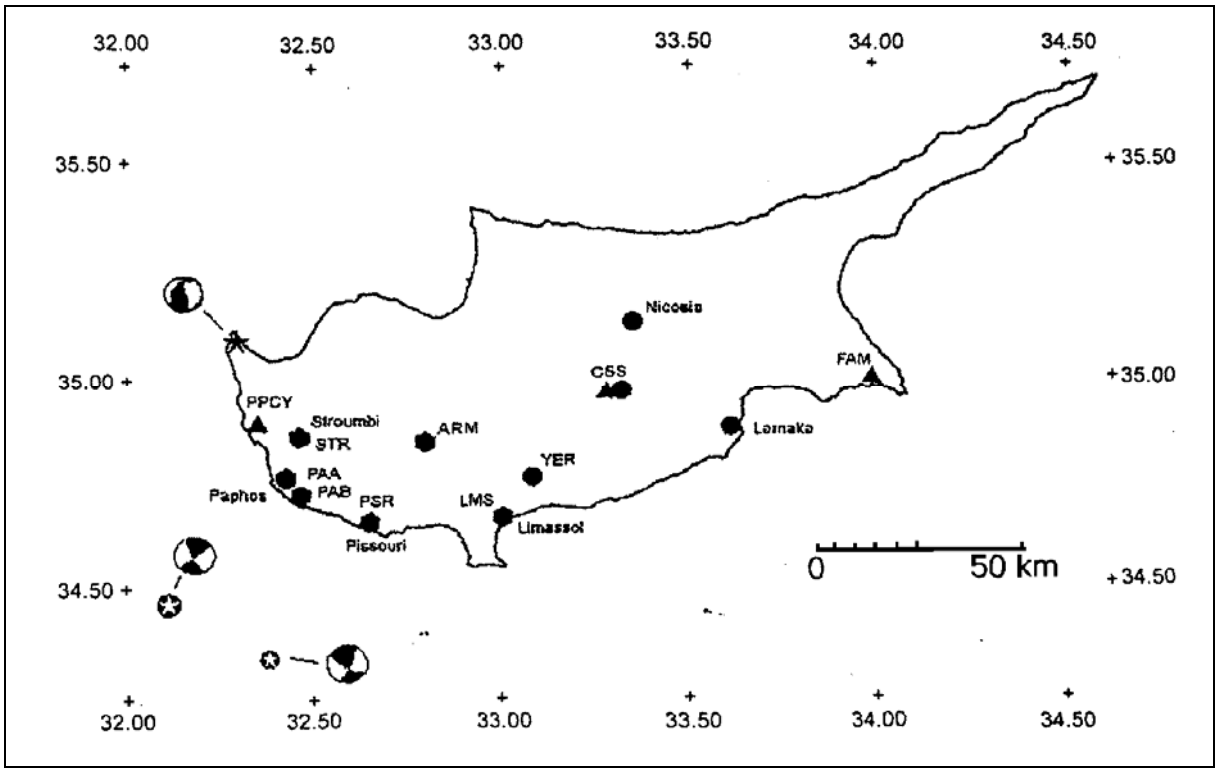


Simplified geological map of southern Cyprus showing the location of the six sections studied in detail as well as principal towns along the south coast

N° File: 35

Authors: KALOGERAS, I; STAVRAKAKIS, G; SOLOMI, K
Year: 1999
Title: The October 9, 1996 earthquake in Cyprus; seismological, macroseismic and strong motion data
Reference: Annali di Geofisica, vol.42, no.1, pp.85-98

Concerned area: Eastern Mediterranean, sea area SW of Cyprus (Paphos and Limassol)
Formation(s) affected:
Age of the deformation: Present day
Concerned structures:
Commentary: On October 9, 1996 an earthquake of magnitude 6.8 occurred in the sea area SW of Cyprus. Although the aftershock activity lasted over four months and included a large number of earthquakes with magnitudes 4.5 and greater, only the largest aftershock of January 13, 1997, having a magnitude of 5.9, triggered two accelerographs. Although a general fitting to the attenuation curves for subduction events and strike-slip/reverse fault events was found, the calculate peak ground accelerations were found to be lower than others. Unfortunately, due to the lack of data from previous Cyprean earthquakes, it was not possible to conclude to precise attenuation relationships for the area.
Stress field:
Types of documents: Map showing the active tectonics Seismicity map of Cyprus and adjacent areas Seismic parameters and the focal mechanism solutions Summary of the observed damage Predicted peak ground acceleration values



Map showing the location of the instruments, the location of the epicentres and the respective focal mechanism

N° File: 36

Authors: KEMPLER, D.

Year: 1998

Title: Eratosthenes Seamount: the possible spearhead of incipient continental collision in the eastern Mediterranean.

Reference: Proceedings of the Ocean Drilling Program, Scientific Results, Vol. 160, pp.709-721.

Concerned area: Eastern Mediterranean, Eratosthenes Seamount

Formation(s) affected:

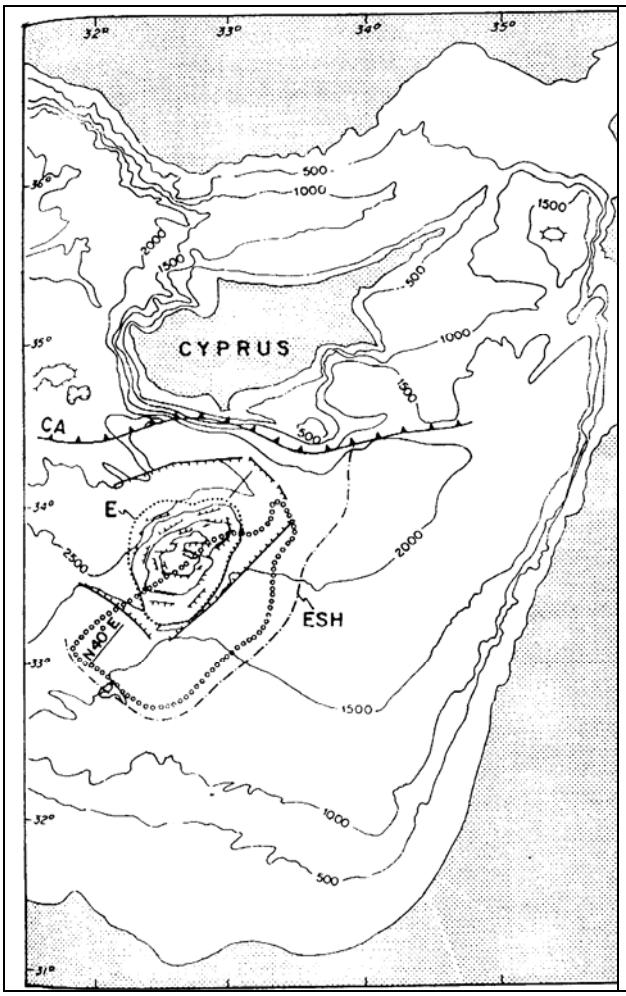
Age of the deformation: Miocene-Pliocene

Concerned structures: Cypriot Arc

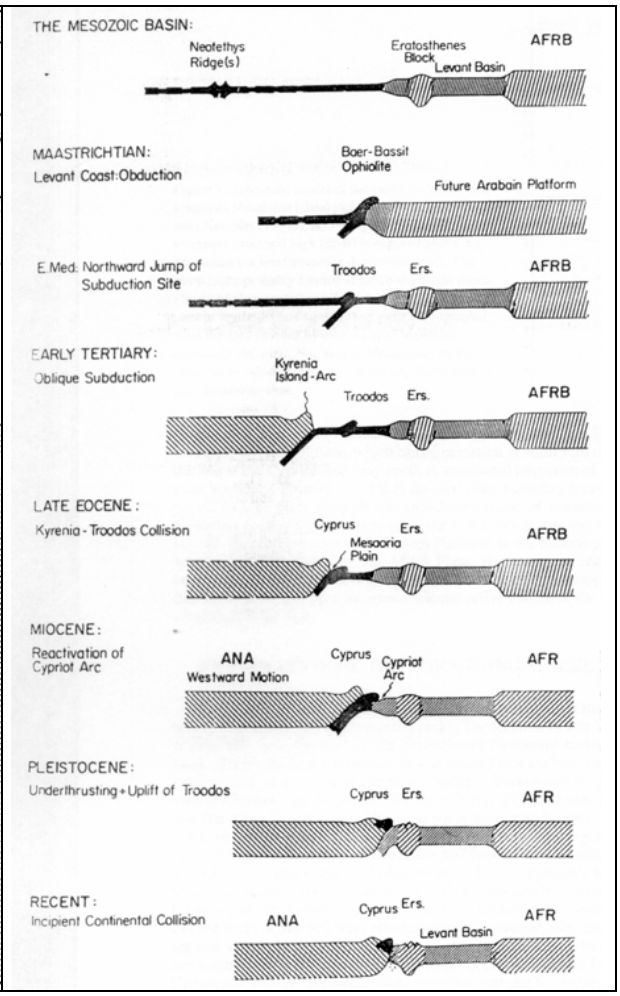
Commentary:
The deep structure of the Eratosthenes Seamount originated in early Mesozoic time. The ODP data confirm that the Eratosthenes structure, which was located a few hundred kilometres away from the Late Cretaceous/early Tertiary active plate boundary was not affected by the major tectonic effects of this period. The data also reflect the existence of the Eratosthenes structural high already in Late Cretaceous and Eocene times. The ODP data corroborate that the Africa-Anatolia plate boundary was reactivated as the Cypriot Arc and the Eratosthenes structure, in the late Miocene, through subduction of remnant oceanic lithosphere of the Mesozoic Neotethys beneath Cyprus.
This area form a Messinian island, the post-Messinian subsidence shape the seamount and surrounding natural moat, which in turn are superimposed on the Eratosthenes structural high. The Miocene-Pliocene subduction along the Cypriot Arc changed into collision between Cyprus and the Eratosthenes structure after the elimination of oceanic lithosphere from this junction. The Cyprus-Eratosthenes collision triggered the extreme uplift of southern Cyprus at about 1.5-2 Ma. Pulsed uplift of Cyprus, apparently accompanied by pulsed subsidence of the Eratosthenes area, marks incipient collision in the Eastern Mediterranean. The Eratosthenes Seamount, therefore, is the possible spearhead of incipient continental collision and is the best candidate for the study of collisional processes in this area.

Stress field: subduction - collision

Types of documents:
Bathymetry of the Eratosthenes area
Structural element in the Eratosthenes area
Compiled cross-sections
Schematic model of the tectonic evolution of the Eastern Mediterranean



Structural elements in the Eratosthenes area



Schematic model of the tectonic evolution of the Eastern Mediterranean

N° File: 37

Authors: KEMPLER, D. AND BEN-AVRAHAM Z.

Year: 1987

Title: The tectonic evolution of the Cyprean arc

Reference: Annales Tectonicae, 1, 58-71

Concerned area: Eastern Mediterranean, Cyprean arc

Formation(s) affected:

Age of the deformation: Present day

Concerned structures: Cyprean arc

Commentary:

In the western segment, a zone of deformation that coincides with the Giermann fault extends from north of the Eratosthenes Seamount to the northwest along the Florence rise. This zone represents the actual plate boundary in this area and the disturbed bathymetry above it reflects active tectonism there. The mode of convergence in the western segment of the Cyprean arc is a northward subduction of the Eastern Mediterranean oceanic crust beneath the Turkish plate.

In the central segment, the collision of the Eratosthenes Seamount with the Cyprean arc interrupts the processes of subduction.

The nature of the eastern segment of the Cyprean Arc remain unclear.

Stress field:

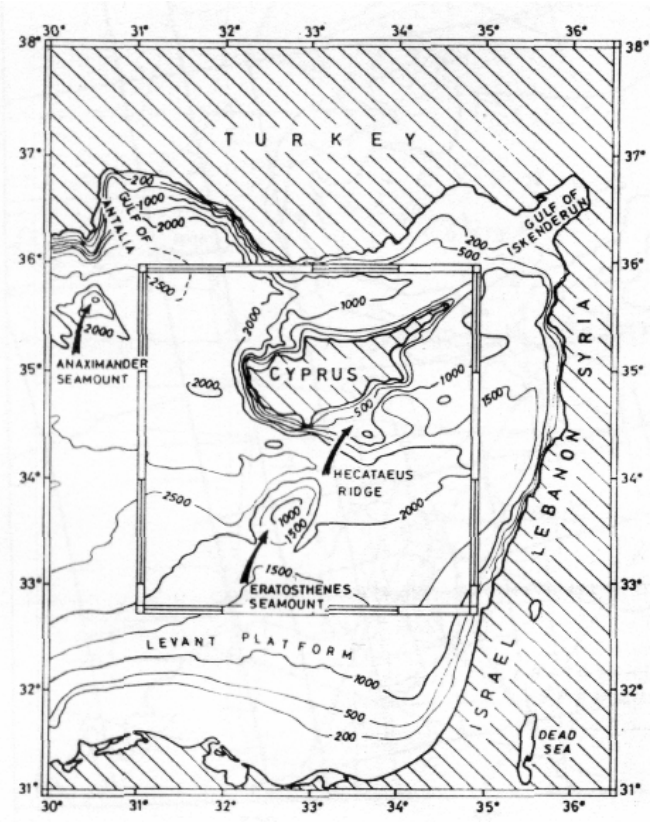
Types of documents:

Regional geophysical profiles showing bathymetry, free-air gravity, and magnetics across the Cyprean Arc.

Earthquakes hypocenters

Seismic reflection profiles

Structural element in the vicinity of the Cyprean arc

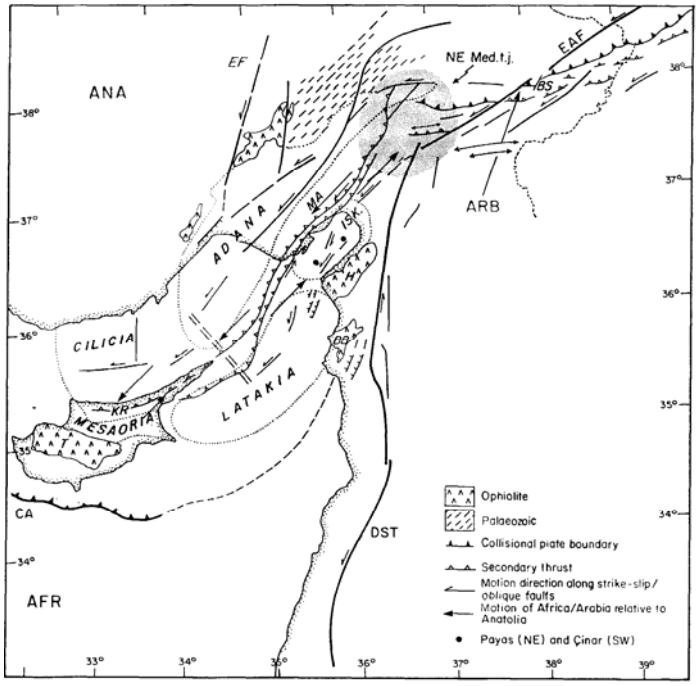


Location map. Inset limits the study area

N° File: 38

Authors: KEMPLER, D; GARFUNKEL, Z
Year: 1994
Title: Structures and kinematics in the north-eastern Mediterranean; a study of an irregular plate boundary
Reference: Tectonophysics, vol.234, no.1-2, pp.19-32

Concerned area: North-eastern Mediterranean
Formation(s) affected:
Age of the deformation: Upper Cretaceous to present-day
Concerned structures: plate boundary
Commentary: Offshore multichannel seismic reflection profiles and onland geology show that the structural settings are different on the two side of the north-eastern Mediterranean region triple junction (AFR-ARB-ANA). On the east, structures controlled by strike-slip and by compressional coexist, whereas on the west, compression is not very conspicuous. We interpret the ridge, which comprise the Kyrenia-Misis-Andirin Unit at its core, as a large flower structure which extends from south-eastern Turkey to Cyprus; the Adana-Cilicia and the Iskenderum-Latakia-Mesaoria Basins on its flanks are interpreted as due to extension. Analyses of the local plate kinematics reveals that the strike-slip predominates along the southern boundary of the Anatolia plate in this region, as a result of Anatolia's westward escape. East of the triple junction, the motion is associated with comparable shortening transverse to the plate boundary, whereas west of the triple junction, the motion transverse to the plate boundary varies between slight compression to extension, depending mainly on the local strike of the plate boundaries. The structural kinematic analyses explain both the lateral change in the deformation style and the existence of local extension in the north-eastern Mediterranean.
Stress field:
Types of documents: Sedimentary basin, positive structures and ophiolites along the Africa-Anatolia plate boundary. Line drawing of multichannel seismic reflection profiles. Structural element of the northeast Mediterranean. Motions in the study area calculated after previous kinematic studies.



Sedimentary basins, positives structures and ophiolites along the Africa-Anatolia plate boundary

N° File: 39

Authors: KIRATZI ANASTASIA A

Year: 1993

Title: A study of the active crustal deformation of the North and East Anatolian Fault Zones

Reference: Tectonophysics, 225, pp. 191-203

Concerned area: Anatolia, Mediterranean Sea

Formation(s) affected:

Age of the deformation: ***Recent***

Concerned structures: North Anatolian Fault Zone, East Anatolian Fault Zones

Commentary: Active crustal deformation in the North Anatolian Fault Zone (NAFZ) and the East Anatolian Fault Zone (EAFZ) is examined based on seismicity data. The analysis is based on information on the seismicity parameters of the area and on the moment tensors of well-studied earthquakes. The results show that the deformation in the NAFZ is taken up by extension on an azimuth of 59^0 at a rate of 27 mm/yr and as compression on as azimuth of 149^0 and a rate of 20 mm/yr. The average dextral motion on the NAF is about 23 mm/yr. This motion in the western part of the NAF is 16 mm/yr; while it increases in the eastern part of the fault to 27 mm/yr. In the EAFZ the deformation is taken up as nearly N-S-compression ($N7^0E$) at a rate of 5 mm/yr and as nearly E-W extension ($N97^0$) at a rate of about 9 mm/yr. The average sinistral-lateral motion has a rate of about 6 mm/yr. The expected slip rates, from plate motions, along the North Anatolian Fault are of the order of 38 mm/yr. The predicted slip rates for East Anatolian Fault are 19 mm/yr or 29 mm/yr. The seismicity of the last 140 years can account for the expected deformation along the NAFZ: for the EAFZ, it is possible that part of the total deformation has been expressed aseismically.
The results show that the deformation along the EAF is mainly attributed to the westward motion of the Anatolian block to the west, due to the northward movement of Arabia. Although the motion of Arabia is the cause of the movement of the Anatolian block to the west, maximum velocities obtained in the work do not point to compressional velocity prevailing as one might expect. The extension in the Aegean area and the subduction along the Hellenic trench is playing the role of a buffer in the entire system. The slip rate along the EAF estimated in the present work is less than the expected rates. This could be attributed either to aseismic expression of some part of the total deformation or to incomplete records of seismicity.
The fault plane solutions used are shown in Figure 5, using a lower hemisphere equal area projection. It can be seen that all focal mechanisms along the entire length of the NAF indicate dextral strike-slip faulting. The pattern changes east of the junction of the fault with EAF, near Karliova, and the fault plane solution of the Varto earthquake of 1966 shows mainly thrusting associated with dextral-lateral strike-slip.

Stress field:

Types of documents:
The tectonic setting of the area and the segments of the North Anatolian and the East Anatolian Fault Zones studied.
The complete seismicity data for the North and East Anatolian Fault Zones for the period 1850-1992 and 1785-1992, respectively.
Schematic illustration of the deformation pattern of the North and East Anatolian Fault Zones.
The Gutenberg-Richter relation for the North-Anatolian Fault Zone as a whole (NAF), its western part (NAF-W), its eastern part (NAF-E) and for the East Anatolian Fault Zone (EAF)
Information on the seismic moments and on the fault plane solutions of the earthquakes that were used in the calculations
Deformation of the East Anatolian Fault Zone (strain rate tensors, velocity tensors, Eigen values, azimuth, plunge, velocity tensors in the direction of the zone)

N° File: 40

Authors: KOCYIGIT, A; BEYHAN, A

Year: 1998

Title: A new intracontinental transcurrent structure; the Central Anatolian Fault Zone, Turkey

Reference: Tectonophysics, vol.284, no.3-4, pp.317-336

Concerned area: Eastern Mediterranean, Turkey

Formation(s) affected:

Age of the deformation: Present day

Concerned structures: the Central Anatolian Fault Zone

Commentary:

The CAFZ is a large sinistral intracontinental transcurrent structure, approximately 730-km-long, 2 km to 80-km-wide, NE-trending, active sinistral strike-slip fault that cuts across the Anatolian plateau between Düzyayla in the northeast and Anamur County in the southwest. It continues onward beneath the Eastern Mediterranean Sea and determines the boundary of the Antalaya and Adana basins as far as to the west of Cyprus.

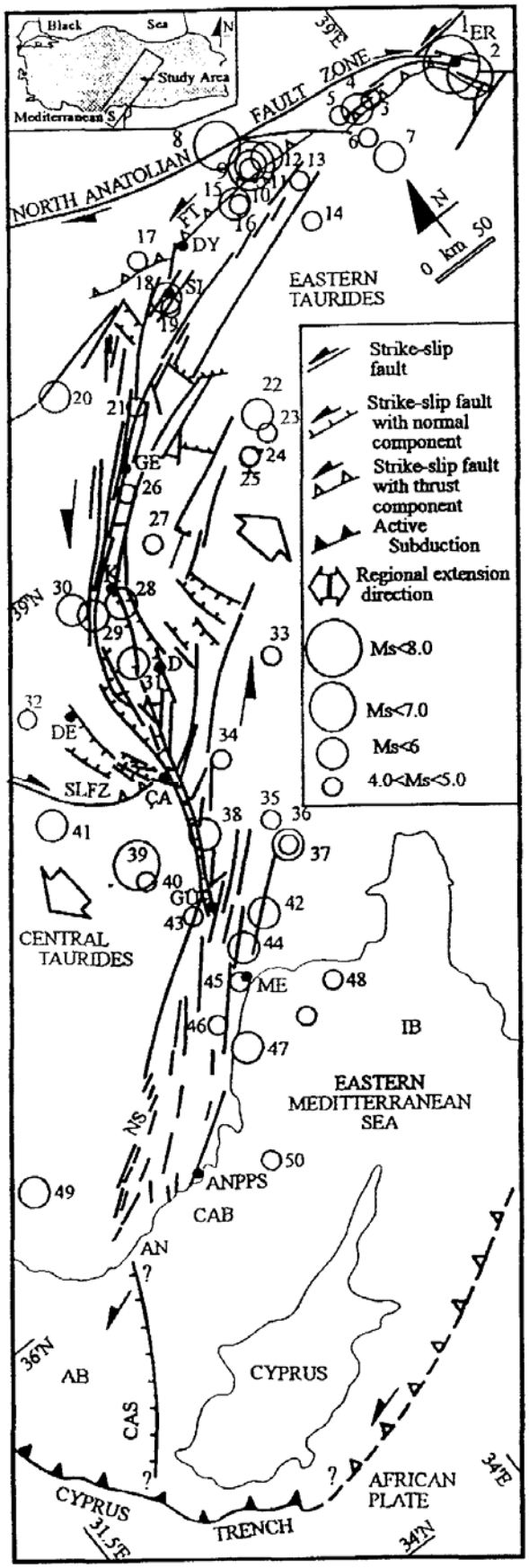
The CAFZ is divided into 24 segments. Each of them is characterized by a number of strike-slip morphotectonic features reflecting recent motions. The easternmost part of the Anatolian Platelet is being deformed internally by several dextral to sinistral intraplate strike-slip faults.

However, present-day structural pattern of all these intraplate faults and boundary faults indicates a regional strain pattern of NNW-SSE directed shortening and ENE-WSW directed extension, and they seem to have developed to accommodate northward motion of the Arabian Plate since late Early Pliocene time.

Stress field: NNW-SSE directed shortening and ENE-WSW directed extension

Types of documents:

Simplified map showing major neotectonic structures of Turkey and adjacent areas
Simplified map of Central Anatolian Fault Zone
Simplified seismotectonic map of the CAFZ



Simplified seismotectonic map of the CAFZ.
Numbers 1 through 50 show epicentres of earthquakes.

N° File: 41

Authors: KOGAN, L.F. AND STENIN, A. M.

Year: 1994

Title: Multichannel MOV-OCT (CDP) Seismic Profiling during cruise 5 of R/V Akademic Nicolaj Strakhov (Preliminary results) in: Krasheninnikov

Reference: V.A., Hall. J. K., eds., Geological Structure of the Northeastern Mediterranean, Cruise 5 of the Vessel "Akademic Nikolai Strakhov" pp. 99-113

Concerned area: Eastern Mediterranean, south Cyprus.

Formation(s) affected:

Age of the deformation: Mesozoic and Cenozoic

Concerned structures:

Commentary:

The purpose was to study the structure of the sedimentary sequence of the Phoenician Sea and the character of the junction of the geological structures of Cyprus and the north-western coast of Syria, using the MOV-OGT (Method of Reflected Waves based upon Common Deep-seated Point) or common Depth Point (CDP) method as it is known in the west.

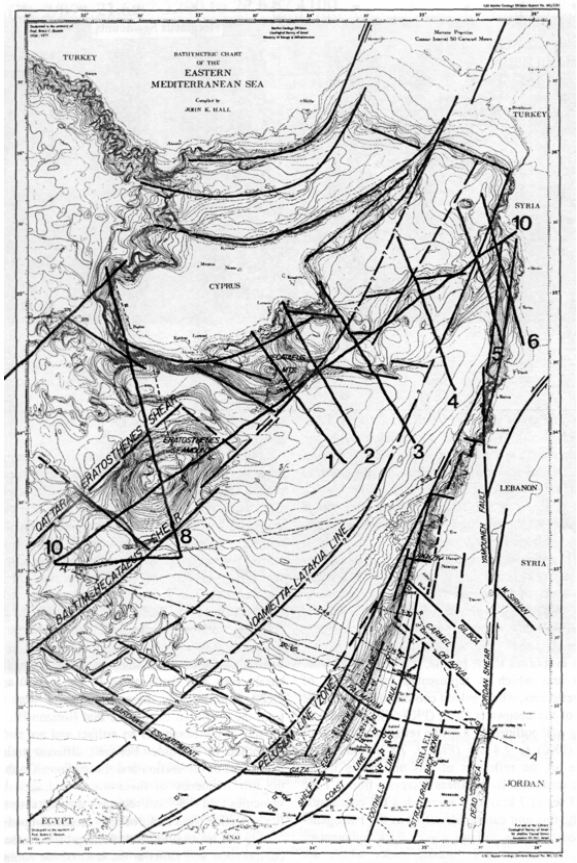
On the basis of the preliminary CDP data it is possible to say that complicated processes of deformation have acted on the different sedimentary sequences over several intervals of time in the Mesozoic and Cenozoic. We can speculate that with time the character of deformation changed from extension to compression.

Stress field:

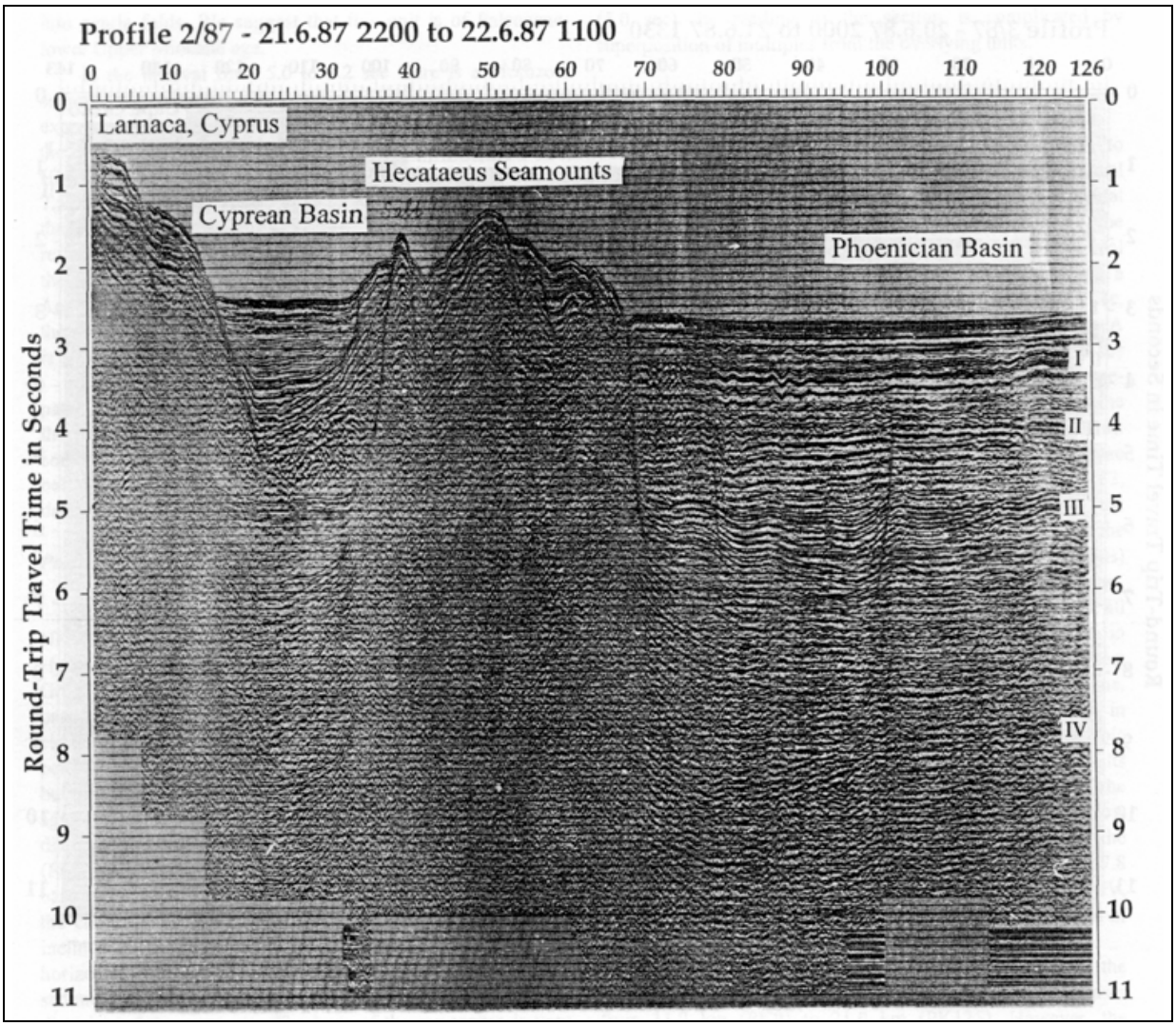
Types of documents:

Location map for the multichannel MOV-OGT (CDP) profiles presented in this chapter.

Sections along the MOV-OGT (CDP) profiles.



Location map of the seven multichannel MOV-OGT (CDP) profiles

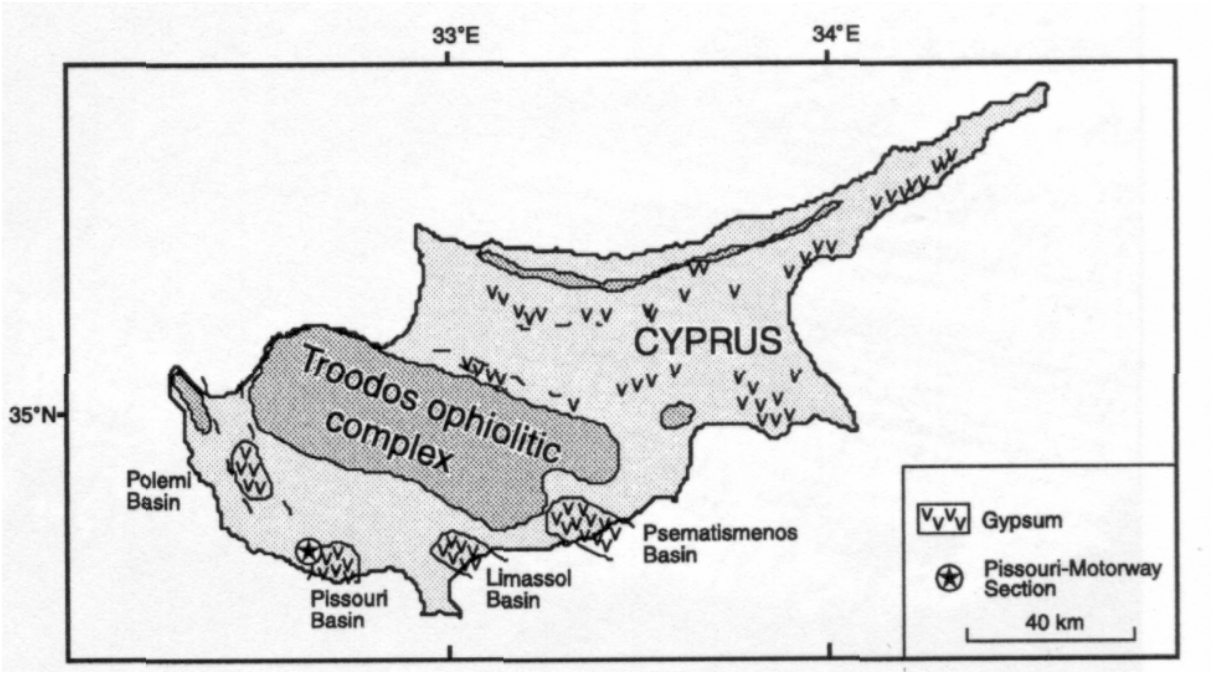


Section along the MOV-OGT Profile 2/87

N° File: 42

Authors: KRIJGSMAN, W., BLANC-VALLERON, M.M., FLECKER, F.,HILGEN F.J., KOUWENHOVEN, T.J., MERLE, D., ORZAG-SPERBER F., ROUCHY, J.M.
Year: 2002
Title: The onset of the Messinian salinity crisis in the Eastern Mediterranean (Pissouri Basin, Cyprus)
Reference: Earth Planet. Sci. Lett., 194: 299-310.

Concerned area: Eastern Mediterranean, Cyprus
Formation(s) affected: evaporites
Age of the deformation:
Concerned structures: Pissouri Basin
Commentary: Exposures along the new Paphos-Limassol motorway near Pissouri exhibit distinct cyclic bedding which permits the construction of a chronology based on orbital tuning. Astronomical tuning of the succession shows that the first gypsum bed at Pissouri overlies a 40-60 Kyr stromatolite-bearing transitional interval and correlates with the amplitude increase in insolation at 5.96 Ma, as in the western Mediterranean. This indicates that the onset of evaporite precipitation was synchronous right across the entire Mediterranean Basin.
Stress field:
Types of documents: Photographs Diagrams showing IRM acquisition



Location of the Pissouri Motorway Section and the Messinian gypsum deposits on Cyprus

N° File: 43

Authors: KYTHREOTI, S. AND PILAKOUTAS, K.

Year: 2000

Title: Earthquake Risk Assessment Case Study: Cyprus

Reference: Proceedings of the Second EuroConference on Global Change and Catastrophe Risk Management: Earthquake Risks in Europe. IIASA, Laxenburg, Austria, 6-9 july 2000.

Concerned area: Eastern Mediterranean, Cyprus

Formation(s) affected:

Age of the deformation: Present-day

Concerned structures:

Commentary:

Period of intense seismic activity have been separated by tranquil periods, typically twelve years duration.

On average, the seismic energy release for the area of Cyprus is 4.32 x 10^{19} ergs per year.

The distribution could indicate a seismic gap centred on the point 33.2°E, 34.2°N. On the other hand, if the structure of the Cyprian Arc is a double fault or a broad zone of thrusting then the lack of seismic activity in this zone is less significant.

Once the accelerations and intensities caused by each earthquake to each area were calculated it was possible to estimate their frequency of occurrence and therefore the individual seismic hazard of each town and village.

For the vulnerability of the buildings to be realistic, a vast range of building parameters are required.

The verification of the results proved very promising with a small difference in the actual damage costs and the predicted ones.

Stress field:

Types of documents:

Map of the Cyprian Arc

Earthquake Recurrence Relationships for Cyprus

Seismic energy release (1894-1998)

Spatial distribution of energy released

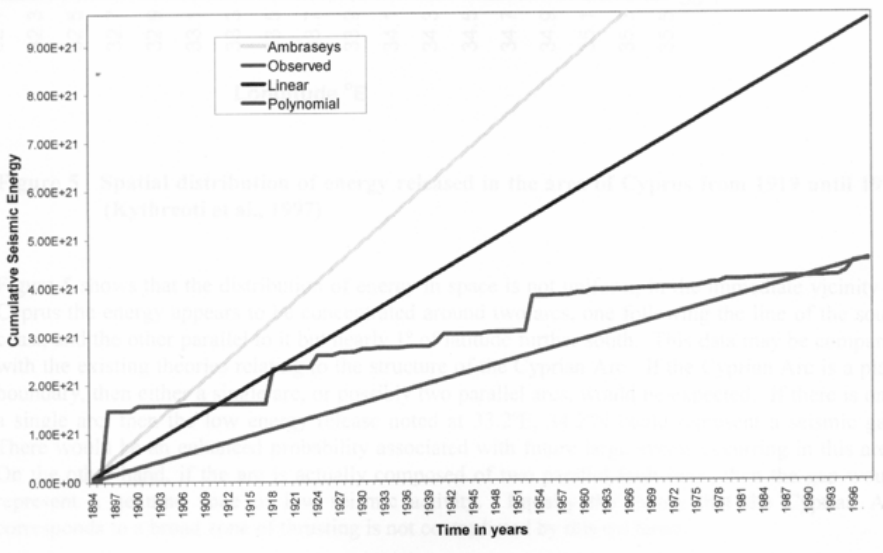
Felt and predicted Intensities in various area

Mean Damage Ratios selected for Cyprus

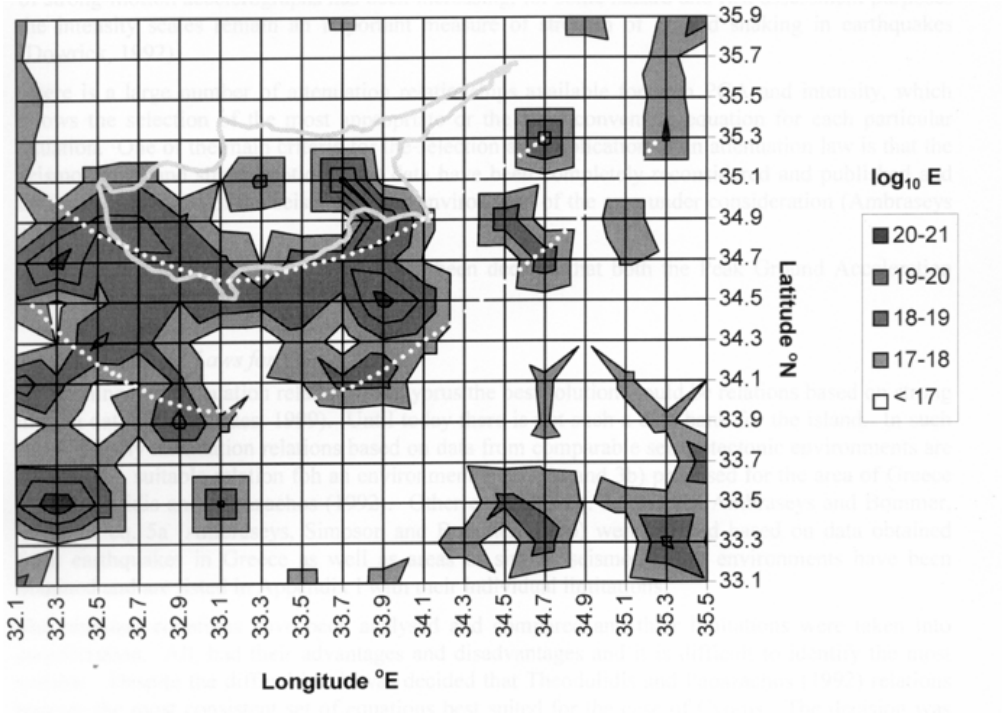
Spatial distribution of the building stock – conventional dwelling of Cyprus

Predicted damaged buildings with 100% damage

Calculation of the epicentral distances, accelerations and intensities caused by the earthquake which occur on the 23rd of February 1995 with Ms=5.7. + Estimation of damage cost.



A comparison of the observed energy release and the energy release predicted by recurrence relationships

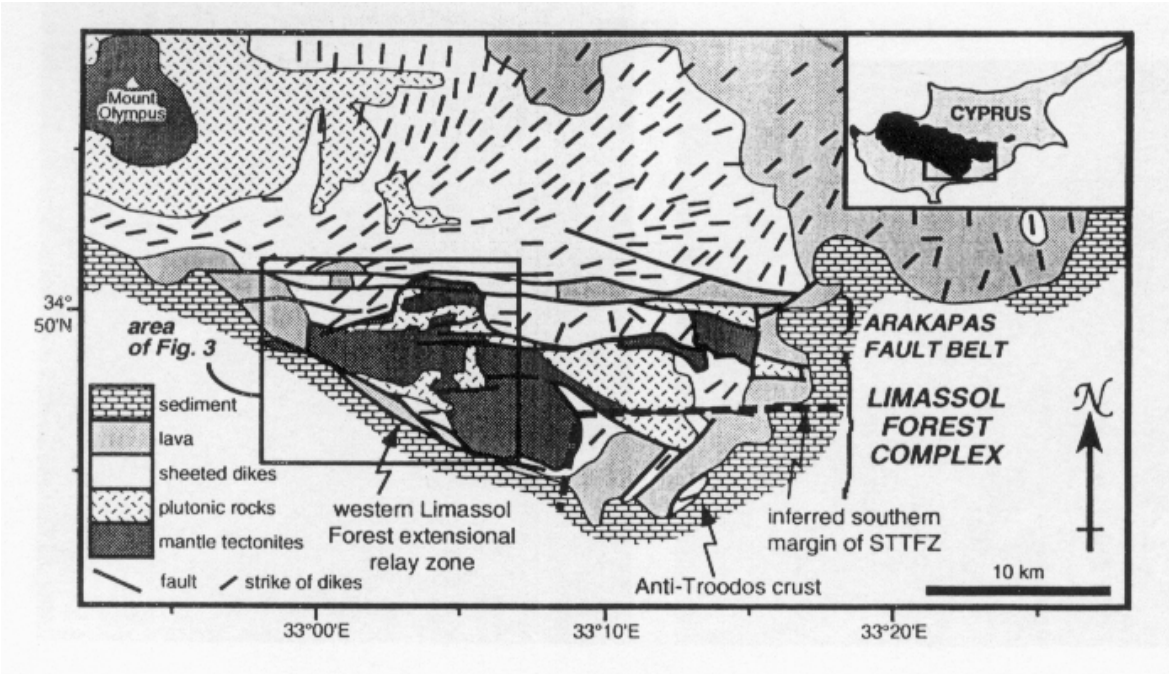


Spatial distribution of energy releases in the area of Cyprus from 1919 until 1995

N° File: 44

Authors: MACLEOD, C.J., MURTON B.J.
Year: 1995
Title: On the sense of slip of the southern Troodos Transform Fault Zone, Cyprus
Reference: Geology, vol.23, p. 257-260

Concerned area: Eastern Mediterranean, Cyprus
Formation(s) affected:
Age of the deformation:
Concerned structures: Troodos Transform Fault Zone
Commentary: We find evidence for both sinistral and dextral shear along the fault zone while in an oceanic environment, the overwhelming indications are for dextral slip. Genuine sinistral slip indicators are restricted to a few mylonitic shear zone, of limited extend, which can be related to local geometrical complexities associated with intrusion of gabbroic plutons into the transform zone.
Stress field: both sinistral and dextral shear.
Types of documents: Simplified geological map of southern and eastern part of the Troodos ophiolite. Simplified geological map of western part of Limassol Forest.



Simplified geologic map of southern and eastern part of Troodos ophiolite

N° File: 45

Authors: MAKRIS, J, STÄCKER, J., ROSENKRANZ, C AND KRAMVIS, S.

Year: 1998

Title: A Microseismicity Survey of the Nicosia Area, Cyprus

Reference: Report, University of Hamburg

Concerned area: Eastern Mediterranean, Cyprus, Nicosia Area

Formation(s) affected:

Age of the deformation: Present day

Concerned structures:

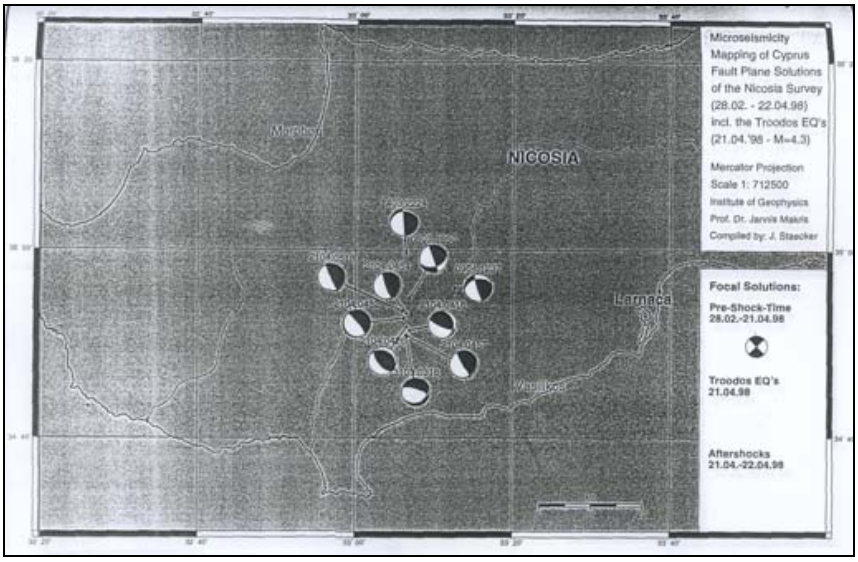
Commentary:

The Nicosia/Troodos survey from February to April 1998 covered the last unobserved area in the north of Cyprus between Nicosia and the central Troodos mountains. A complete dataset now consists of 690 days of observation and more than 6000 earthquakes that have been located: including the shocks and aftershocks of Paphos'95, Paphos'96 and Troodos'98. Several on/offshore active faults trending NW-SE were identified and characteristic fault plane solutions were evaluated. The Nicosia/Troodos survey confirms the previous results and shows also some active lineaments of clear focal mechanism. The fault plane solutions show a vertical west dip-slip movement on the eastern side of the Troodos mountain, together with the east dip-slip movements evaluated by the other arrays. The results indicate that western Cyprus has undergone significant uplift. It is probable that these are old zones of weakness that have been reactivated by the presently active subduction, crustal shortening and underthrusting with some transform faults west and southwest of Cyprus. The Troodos event of 21.04.'98 which occurred during the last two days of our observing period, was also recorded. The evaluation shows more than 20 aftershocks of magnitude 1.0-2.5 and more than 120 aftershocks during the following 24 hours after the occurrence of the main shock. The location of the main shock as defined by our array shifted to the east compared to that of the USGS and GSD of Cyprus. The present location is better than these, since it was detected at all 18 locations that were still recording at this time.

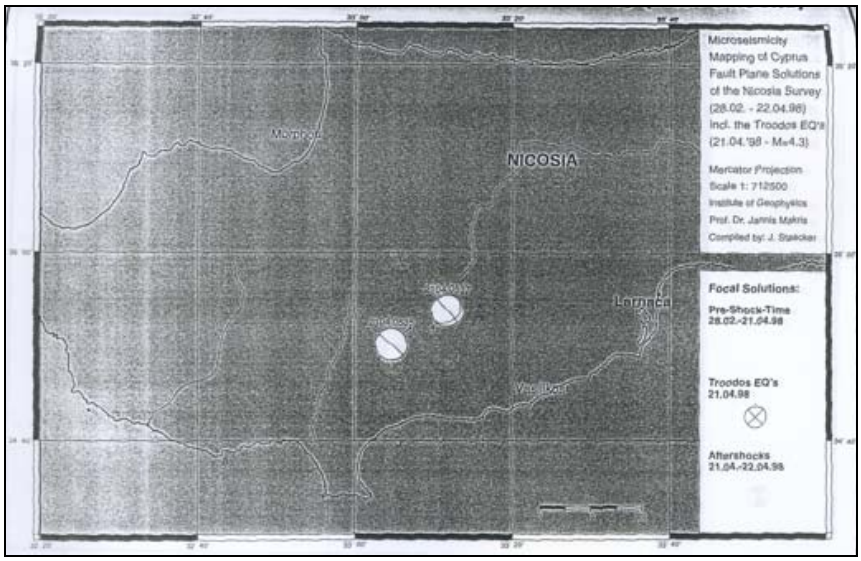
Stress field:

Types of documents:

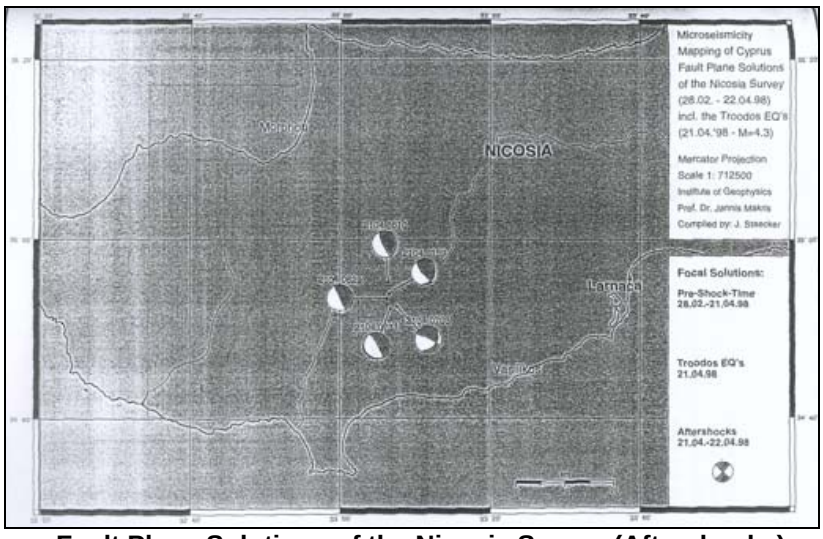
Microseismic arrays (1994-1998).
Distribution of all microseismic events.
Destructive EQ of Cyprus 1995-1998.
Schematic Tectonic Map offshore Cyprus.
Location of the Nicosia Survey.
Daily number of events of the Troodos/Nicosia area before the occurrence of the Troodos event.
Daily seismicity of different surveys.
Increase in the number of events in the Troodos-near field.
Normal Seismicity of the Nicosia Survey.
Pre-shocks and aftershocks of the Troodos EQ'S.
Fault plane solutions of the Nicosia Surveys.
Magnitude-Frequency-Relation of different Cyprian surveys.
Distribution of microseismic Events and characteristic Fault Plane Solution for the Areas of Paphos, Limassol, Vasilikos, Larnaka, Ayia Napa and Nicosia.
Selected microseismic Events and characteristic Fault Plane Solution for the Areas of Paphos, Limassol, Vasilikos, Larnaka, Ayia Napa and Nicosia.



Fault Plane Solutions of the Nicosia Survey (Pre-Shocks)



Fault Plane Solutions of the Nicosia Survey (Main-Shocks)



Fault Plane Solutions of the Nicosia Survey (Aftershocks)

N° File: 46

Authors: MAKRIS, J. BENAVRAHAM, Z., BEHLE, A., GINZBURG, A., GRIESE, STEINMEITZ A., WHITMARSH, R.B., ELEFTHERIOU, S.

Year: 1983

Title: Seismic refraction profiles between Cyprus and Israel and their interpretation

Reference: Geophys. J.R. astr. Soc., vol.75, p.575-591

Concerned area: Eastern Mediterranean, Cyprus and Israel

Formation(s) affected:

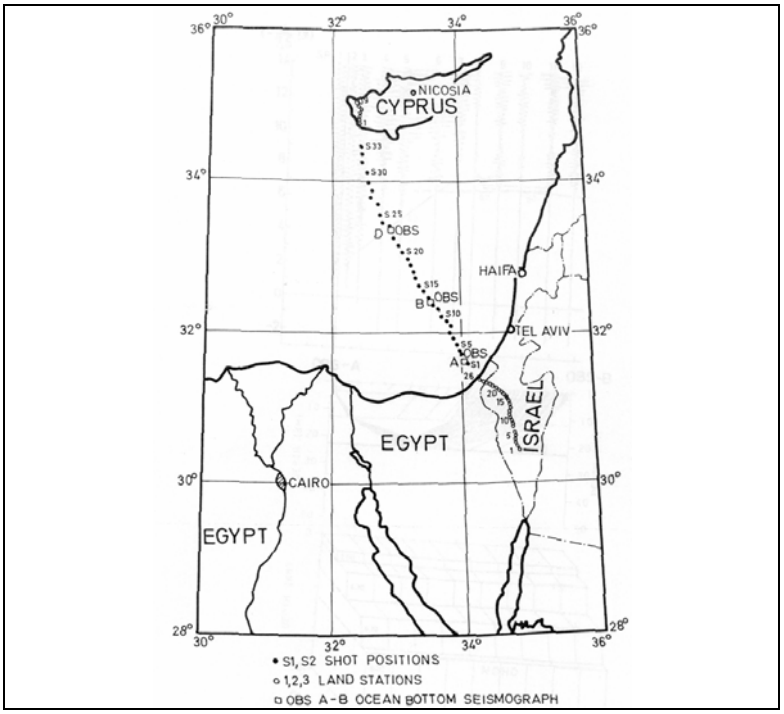
Age of the deformation: Present day

Concerned structures:

Commentary:
The results showed that the continental crust of southern Israel thins towards the Mediterranean underneath a northward thickening sedimentary cover. Cyprus is underlain by a 35 km thick continental crust thinning southwards and extending to Mt Eratosthenes. Between Mt Eratosthenes and the Israel continental shelf the crystalline crust is composed of high velocity (6.5 km/s) material and is about 8 km thick. It is covered by 12-14 km of sediments and may represent a fossil oceanic crust.

Stress field:

Types of documents:
Distribution of shots and stations between Israel and Cyprus.
Travel-time plot and model developed by ray-tracing.
Seismogram section and crustal model of the Levantine Basin.
Seismogram section and velocity-depth distribution developed by ray-tracing.
The ocean-continent transition between the Levantine Basin and Israel.
Travel-time plot of seismic recording obtained in Cyprus.
Travel-time plot and velocity-depth model of the Eratosthenes Seamount and the deep Levantine sea.
A composite crustal model between Cyprus and Israel based on gravity data and constrained by seismic velocities and discontinuities.



Distribution of shots and stations between Israel an Cyprus

N° File: 47

Authors: MAKRIS, J., STÄCKER, J., AND REICHERT, B.

Year: 1997

Title: A Microseismicity Survey of the Limassol Area, Cyprus

Reference: Report, University of Hamburg

Concerned area: Eastern Mediterranean, Cyprus

Formation(s) affected:

Age of the deformation: Present day

Concerned structures:

Commentary:

The results obtained from the microseismicity study of the Limassol area have identified one major active fault northwest of Limassol with an on-offshore extension of approx. 60 km. We have shown that the main seismic activity is aligned along the NW-SE trending fault with known geological and morphological expressions. Smaller faults, also NW-SE orientated, are located offshore and near the west coast of Limassol with obvious shallow depth of foci. The lineaments are related to the tectonic units of the Troodos Massif and the Mamonia Complex.

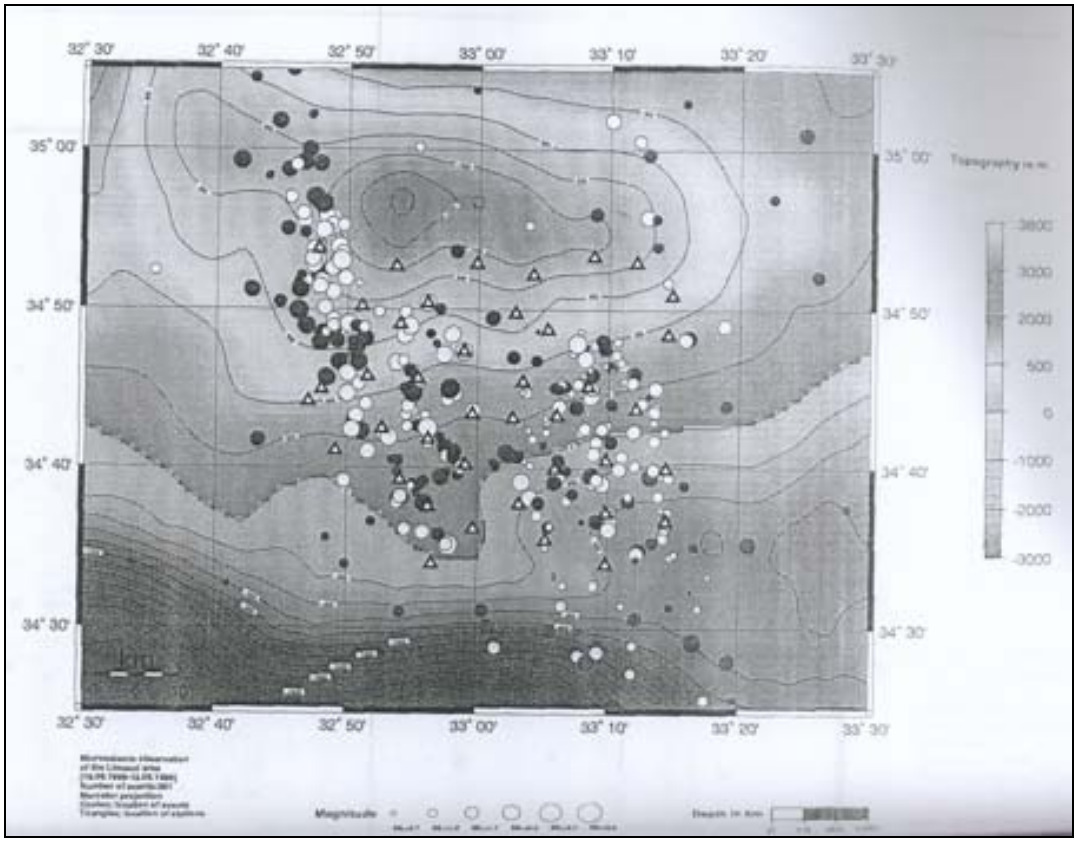
The active faults located in the Limassol area tend to produce events of small magnitudes. The largest one observed was only Ml=2.4. however, the fact that the active faults are very close to the city, clearly indicate the vulnerability and exposure of Limassol to seismic hazard. The integration of geophysical and geological studies with the microseismicity will establish acceleration factors that have to be considered in designing in future the construction and installation in this area.

All results indicate that the orientation of the activity along the major faults systems referred to the several microseismicity surveys on-offshore Cyprus are NW-SE aligned. It seems that the faults associated with zones of weakness that have been reactivated by the subduction processes, crustal shortening and uplift of western and south Cyprus. The NW-SE trend seems to continue to the Israel-Lebanon coast, across the Levantine Sea.

Stress field: NW-SE trending fault

Types of documents:

Location of Seismic Stations in the Limassol area.
Correlation of Events detected by at least 4 stations.
Quality of localisations.
Accuracy of the Epicentre Locations.
Epicentral map of the Limassol Survey and Microseismic and Topographic map.
Combined map of instrumental seismicity and results of this study.
Microseismic Surveys (1994-1996): Location of Events.
Depth of foci.
Magnitude Frequency Distribution for the Limassol observation.
Return periods.
Bulletin of Microseismicity.



Cyprus'96: Limassol-area / Topographic map of Stations and Events

N° File: 48

Authors: MAKRIS, J., STÄCKER, J., ROSENKRANZ, C AND KRAMVIS, S.

Year: 1996

Title: A Microseismicity Survey of the Larnaka Area, Cyprus

Reference: Report, University of Hamburg

Concerned area: Eastern Mediterranean, Cyprus, Larnaka Area

Formation(s) affected:

Age of the deformation: Present day

Concerned structures:

Commentary:

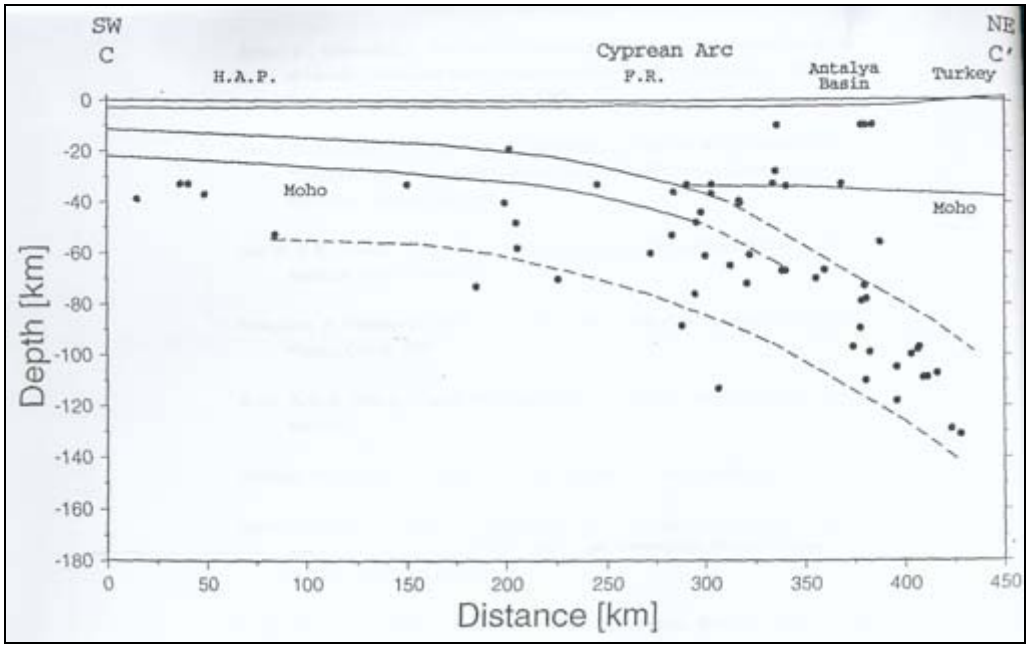
We have seen that the main seismicity activity is aligned in NW-SE trending faults that continue onshore from offshore active systems. The NW-SE system is truncated at nearly right angles by faults NE-SW orientated. The first mentioned system is associated with transcurrent movements of the crust in order to accommodate crustal shortening caused by subduction of the oceanic lithosphere of the Levantine Sea below the Cyprean arc.

In fact, most of the area under discussion is situated on very young geological formations of soft, unconsolidated sediments and even on man-made fill zones where also the water table is very high. As a consequence, even events of moderate magnitude, which can easily occur as we have seen from the statistical evaluation, can easily cause liquefaction and major destruction on constructions built in the Larnaka area. This fact should be taken into consideration when applying building codes for major constructions and engineering projects.

Stress field: NW-SE trending faults truncated by faults NE-SW orientated

Types of documents:

Location of stations Larnaka 1994.
Instrumental seismicity 1904-1994.
Located Events Larnaka 1994.
Epicentral mad of Events Larnaka 1994.
Combined map of instrumental seismicity and results of this study.
Return period and earthquake probability in the Larnaka Area.
Vertical distribution of seismic foci (M>3) from Strip CC'.
Bulletin of Microseismicity.



Vertical distribution of seismic foci (M>3) from Stripp CC'

N° File: 49

Authors: MAKRIS, J.AND STÄCKER, J.
Year: 1996
Title: A microseismicity survey of the Vasilikos area, Cyprus
Reference: Report, University of Hamburg

Concerned area: Eastern Mediterranean, Cyprus, Vasilikos area
Formation(s) affected:
Age of the deformation:
Concerned structures:
Commentary:
Stress field:
Types of documents:

NOT AVAILABLE (03 September 2002)

N° File: 50

Authors: MAKRIS, J; STAECKER, J. AND GAYE, M.

Year: 1998

Title: A Microseismicity Survey of the Ayia Napa Area, Cyprus

Reference: Report, University of Hamburg

Concerned area: Eastern Mediterranean, Cyprus, Ayia Napa Area

Formation(s) affected:

Age of the deformation: Present day

Concerned structures:

Commentary:

Several active faults have been identified. These faults are well known from the Larnaca Survey'94 and were also detected from the Ayia Napa array. The seismicity level in the coastline and village of Ayia Napa itself is widely scattered over a broad area and cannot be associated to an existing fault system.

Fault plane solutions of 8 different events show oblique faults striking north-northwest with almost vertical dip, left lateral and reverse slip.

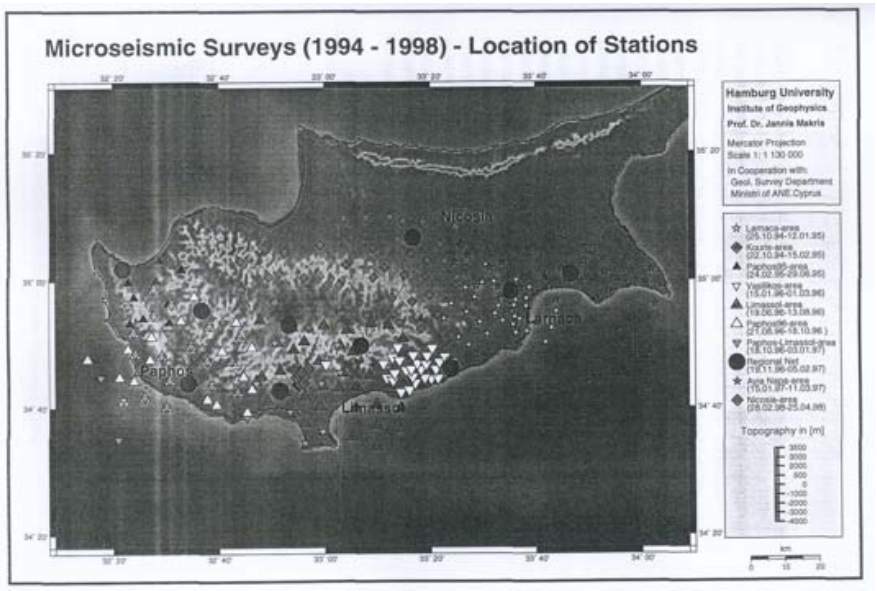
The normalized daily number of events with a value of 0.7 per day is the lowest on Cyprus, the probabilistic recurrence rate of 50% of an magnitude 5 earthquake in the next 100 years is of low size.

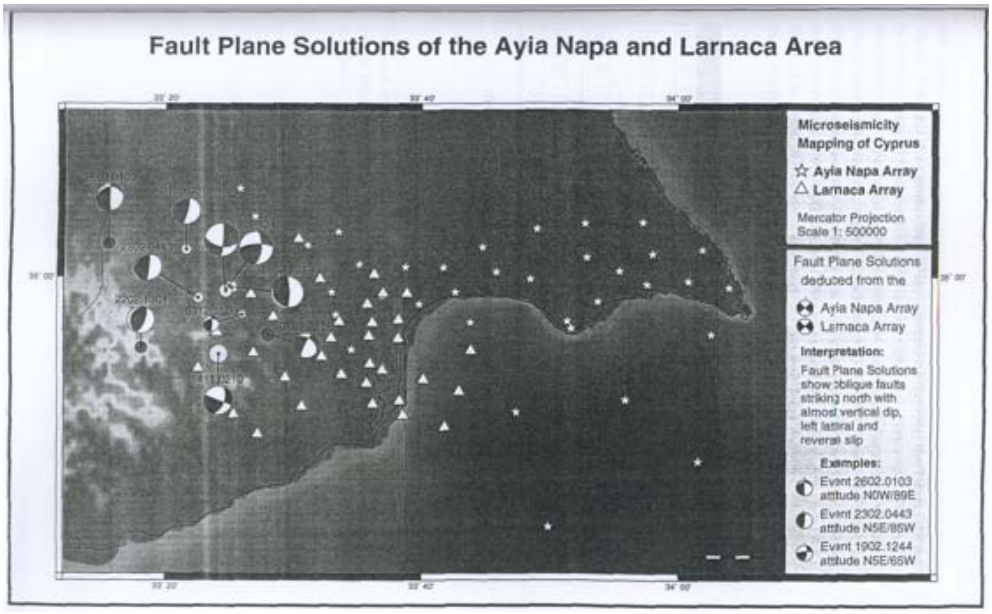
The microseismic activity of the island seems to decrease eastwards. The summary of the results define the location and orientation of the activity in association to the major faults of northwest orientation and also with the subduction of the oceanic Herodotus Lithosphere below western Cyprus. Probably, these are old zones of weakness that have been reactivated by the subduction process, crustal shortening and uplift of western Cyprus. The active faults have onshore a predominant NW-SE trends. The offshore Larnaca survey mapped faults indicate strong NE-SW trends that intersect the NW-SE alignments.

Stress field: predominant NW-SE trends onshore, strong NE-SW trends offshore

Types of documents:

Microseismicity Mapping of Cyprus – Results of local arrays (1994-1998).
Tectonic Map offshore Cyprus.
Microseismicity of the Ayia Napa Area.
Daily seismicity of the Ayia Napa area.
Microseismicity Map of the Larnaca - Ayia Napa Surveys.
Fault Plane solutions of the Larnaca - Ayia Napa Area.
Aftershocks of the Paphos (09.10.96) event – Detected by the Ayia Napa Array.
Magnitude-Frequency-Relations of different Cyprian surveys.
Bulletin of microseismicity.


Microseismic Surveys (1994 - 1998) - Location of Stations
Hamburg University
Institute of Geophysics
Prof. Dr. Jannis Makris
Mercator Projection
Scale 1: 1 130 000
in Cooperation with:
Geol. Survey Department
Ministri of ANE.Cyprus
Nicosia
Larnaca
Paphos
Limassol
Topography in [m]
km


Fault Plane Solutions of the Ayia Napa and Larnaca Area
Microseismicity
Mapping of Cyprus
Ayia Napa Array
Larnaca Array
Mercator Projection
Scale 1: 500000
Fault Plane Solutions
deduced from the
Ayia Napa Array
Larnaca Array
Interpretation:
Fault Plane Solutions
show oblique faults
striking north with
almost vertical dip,
left lateral and
reversal slip
Examples:
Event 2602.0103
attitude N0W/89E
Event 2302.0443
attitude N5E/85W
Event 1902.1244
attitude N5E/65W

N° File: 51

Authors: MAKRIS, J; STAECKER, J. AND GAYE, M.

Year: 1996

Title: A study of aftershock sequence of the Paphos 23 February 1995 earthquake

Reference: Report, University of Hamburg

Concerned area: Eastern Mediterranean, Cyprus, Paphos

Formation(s) affected:

Age of the deformation: Present day

Concerned structures:

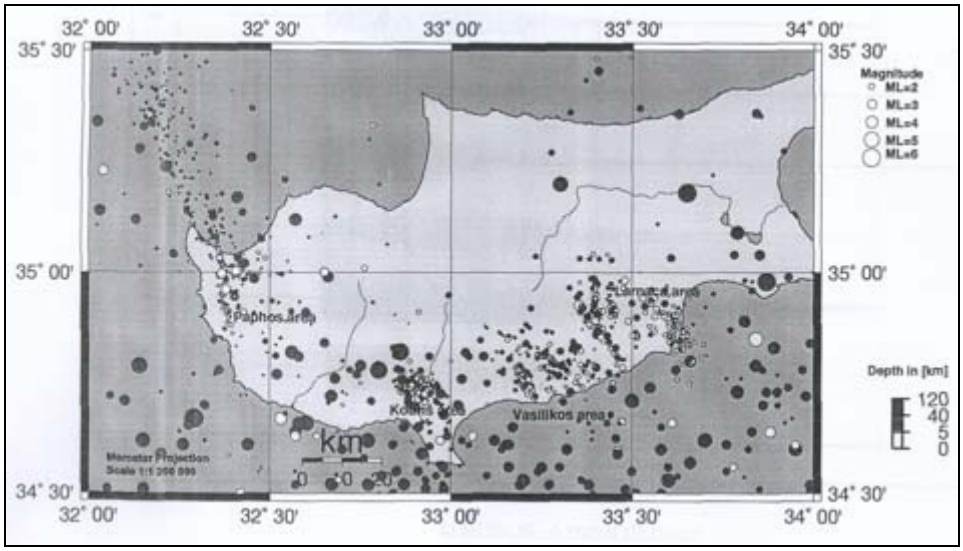
Commentary:

The evaluation of the aftershock seismicity of the 'Paphos-Event' indicates that the main event has been mislocated to the west by some 20 to 30 km and that its location is within the western flank of the Polis Graben or its extension to the north – offshore the 'Loutra of Aphrodite'. The energy release occurred in several steps of larger events, smaller than the main one, of distinct higher magnitude than the 'normal level' microseismicity activity. The activated area is of large extent covering onshore the Polis Basin and offshore the western part of the Cilicia-Adana Basin. The activated zone shows a systematic deepening from the Polis basin to the NE below the Cilicia-Adana continental basin, that is presently being subducted by the Herodotus oceanic lithosphere.

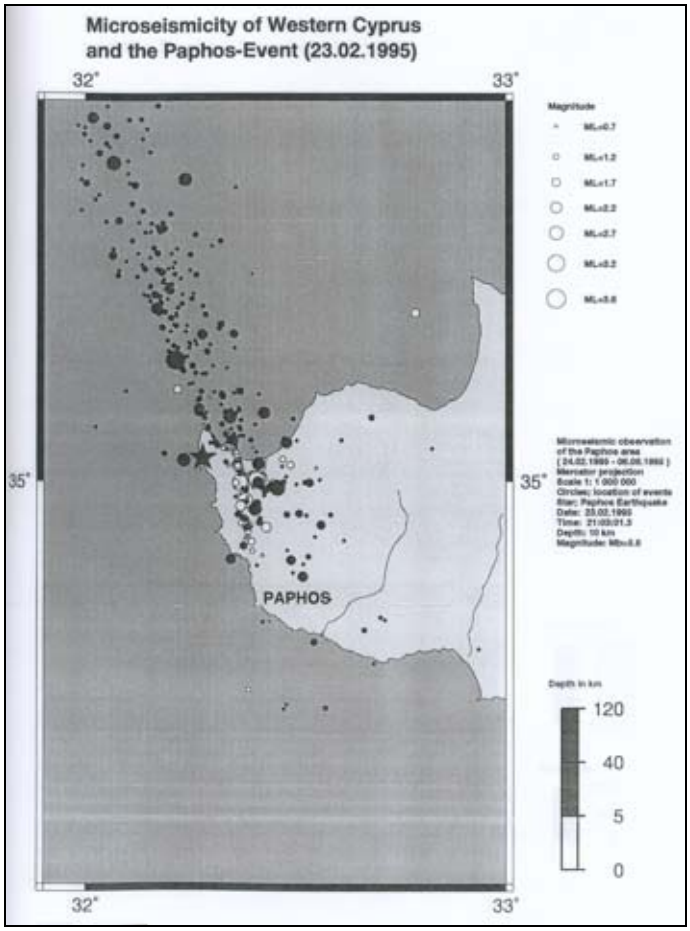
Stress field:

Types of documents:

Location of the Paphos earthquakes (23.02.95, 21:03) and its aftershocks (23.02.95 – 27.02.95).
Geological map of southwest Cyprus and the Polis Basin.
Paphos'95 – correlated events per day.
Magnitude-Frequency Distribution of the aftershock seismicity and of the normal seismicity level.
Located events for aftershock and normal seismicity.
Daily seismicity recorded by microseismicity arrays on-and offshore by the IFG and GEOPRO recently.
Microseismicity of Western Cyprus and the Paphos-Event.
Location of Events in the Polis-Graben and the Morphou Bay.
West-East profile of hypocenters at Latitude 35°N.
Comparison of the Aftershock determination.
Instrumental seismicity 1904-1994 and results of surveys.
Foci depths of the aftershock and normal seismicity.
Magnitude-Frequency relation of the aftershock and normal seismicity.
Return periods of the aftershock and normal seismicity.
Bulletin of Microseismicity.



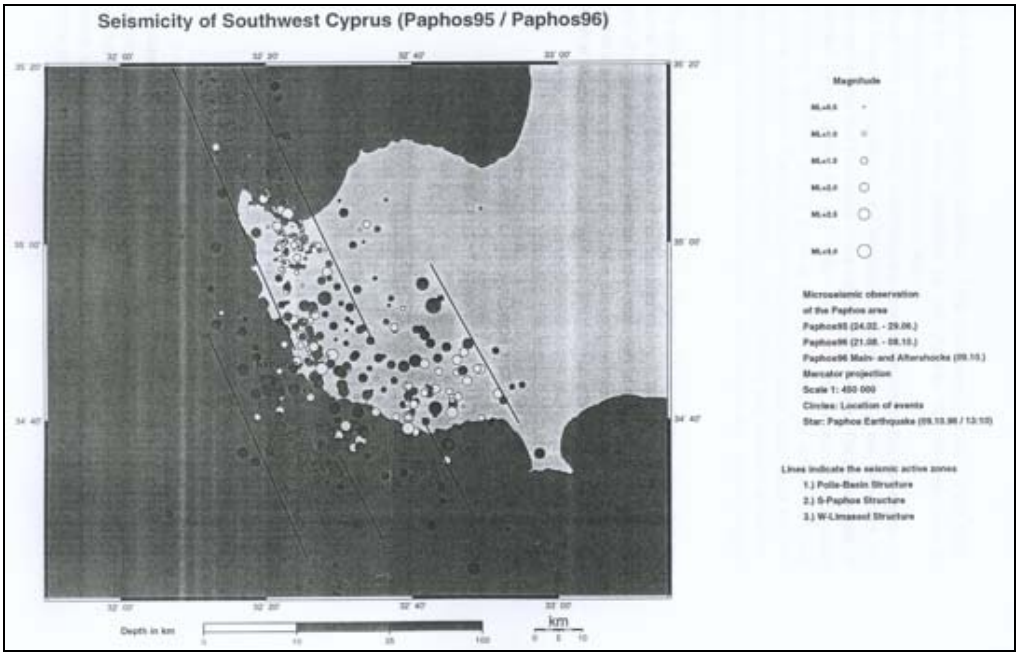
Instrumental seismicity 1904-1994 and results of surveys

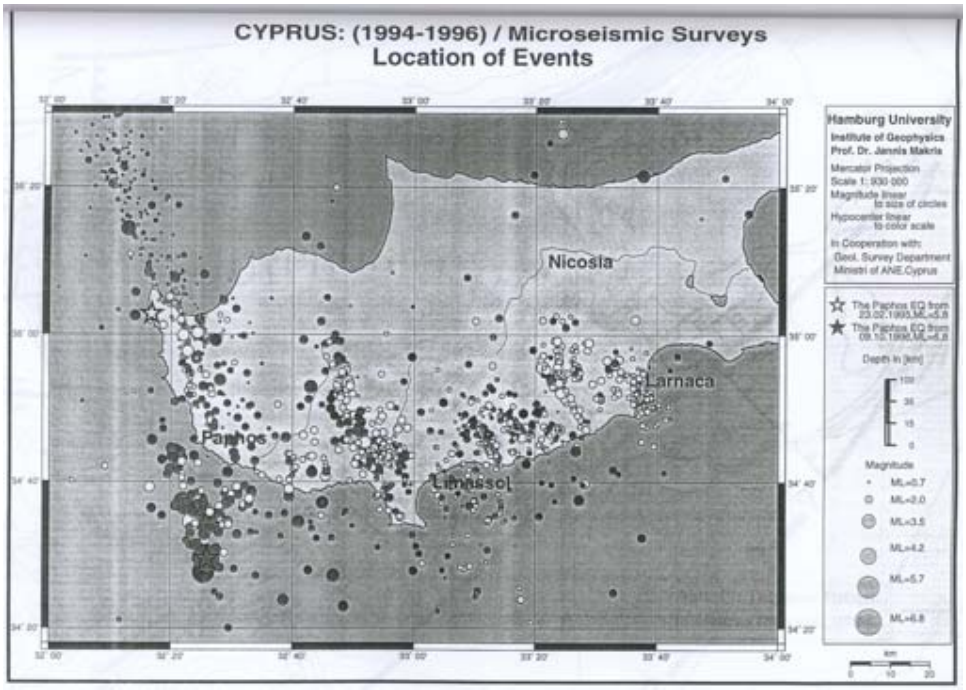

Microseismicity of Western Cyprus
and the Paphos-Event (23.02.1995)
32°
33°
35°
35°
PAPHOS
Magnitude
Depth in km
120
40
5
0
32°
33°

N° File: 52

Authors: MAKRIS, J; STAECKER, J. AND GAYE, M.
Year: 1997
Title: The Normal Seismicity of the Paphos Area
Reference: Report, University of Hamburg

Concerned area: Eastern Mediterranean, Cyprus, Paphos Area
Formation(s) affected:
Age of the deformation: Present day
Concerned structures:
Commentary: The seismic activity is aligned on-and offshore along the N-S trending “W Limassol Structure”, along the NW-SE orientated “Polis-Basin Structure” and “S Paphos Structure”. The normalized daily number of events with a value of 1.4 per day is the lowest on Cyprus, the probabilistic recurrence rate of 40% of a magnitude 6 earthquake in the next 60 years is of medium size. It seems that a major tectonic system of faults from onshore in the Polis-basin to its offshore extension is associated with the subduction of the oceanic Herodotus Basin Lithosphere below western Cyprus. Probably, these are old zones of weakness that have been reactivated by the subduction process, crustal shortening and uplift of western Cyprus. The active faults have onshore a predominant NW-SE trends. The offshore Larnaca survey mapped faults indicate possible NE-SW shearing that intersects the NW-SE thrusts.
Stress field: predominant NW-SE trends onshore, possible NE-SW shearing offshore
Types of documents: Cyprus (1994-1996) / Microseismic Surveys Location of Stations and events. Microseismicity-Survey Paphos 96. Daily seismicity of the Paphos area. Location of Events and Seismic Stations. Seismicity of the Southwest Cyprus. Distribution of foci depth. Accuracy of the epicentre determination. Magnitude-Frequency-Relations of different Cyprian surveys. Tectonic pattern of Cyprus. Instrumental seismicity 1904-1995. Bulletin of microseismicity.


Seismicity of Southwest Cyprus (Paphos95 / Paphos96)
Magnitude
Microseismic observation
of the Paphos area
Paphos95 (24.02. - 29.06.)
Paphos96 (21.08. - 08.10.)
Paphos96 Main- and Aftershocks (09.10.)
Mercator projection
Scale 1: 400 000
Circles: Location of events
Star: Paphos Earthquake (09.10.96 / 13:10)
Lines indicate the seismic active zones
1.) Polis-Basin Structure
2.) S-Paphos Structure
3.) W-Limassol Structure
Depth in km
km


CYPRUS: (1994-1996) / Microseismic Surveys
Location of Events
Nicosia
Larnaca
Paphos
Limassol
Hamburg University
Institute of Geophysics
Prof. Dr. Jannis Makris
Mercator Projection
Scale 1: 930 000
Magnitude linear
to size of circles
Hypocenter linear
to color scale
In Cooperation with:
Geol. Survey Department
Ministri of ANE,Cyprus
The Paphos EQ from
23.02.1993,ML=5.8
The Paphos EQ from
09.10.1996,ML=6.8
Depth in [km]
Magnitude
ML=0.7
ML=2.0
ML=3.5
ML=4.2
ML=5.7
ML=6.8
km

N° File: 53

Authors: MAKRIS, J; STAECKER, J. AND GAYE, M.

Year: 1996

Title: The Induced Seismicity of the Kouris Dam, Cyprus

Reference: Report, University of Hamburg

Concerned area: Eastern Mediterranean, Cyprus, Kouris Dam

Formation(s) affected:

Age of the deformation: Present day

Concerned structures:

Commentary:

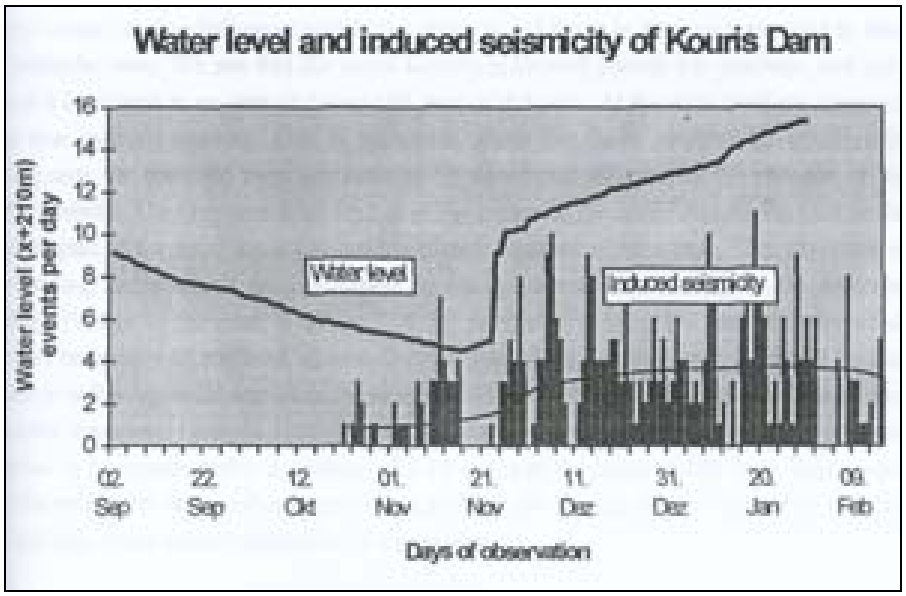
During the 103 days recording (22.10.'94 – 15.02.'95) 363 events were located. It was observed that a very close correlation exists between the rate of water loading of the artificial lake and the daily seismicity. The local seismicity is doubtless triggered and induced by the water load of the Kouris reservoir. The epicentres are concentrated in two active areas: one with 6% of the events is located in the middle of the lake and a second one is located, with 20% of the seismicity, 1.5 km to the west, along a N-S orientated lineament. This second area indicates a pre-existing fault reactivated by the additional stresses due to the reservoir loading. At the immediate vicinity of the dam however, no seismic events were recorded.

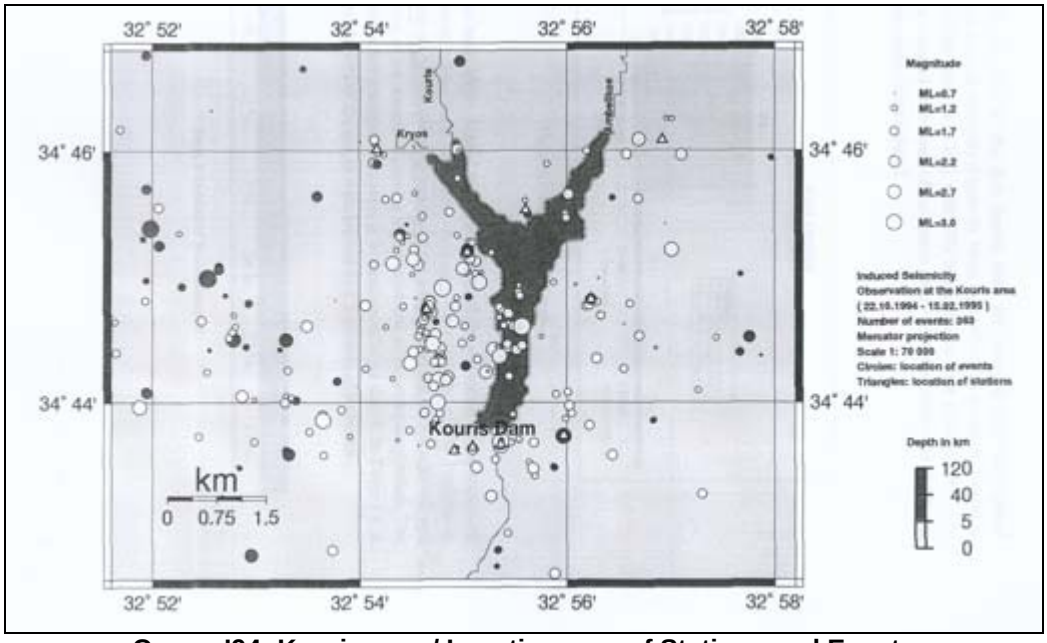
The Ml-magnitudes of the induced seismicity ranges from 1.3 to 3.0 and the focal depths are accumulated at shallow depths in the upper most part of the crust. The highest possible magnitude however, that could be induced by the waterload to the level observed in autumn'94 was determined by using the Benioff-Curve and it is Ml=4.5. Since the dam is constructed for magnitudes up to 6 and the main fault of induced seismicity is outside the Kouris reservoir and of limited length, the seismic risk for the dam construction is negligible.

Stress field:

Types of documents:

Water level of the Kouris dam in the period 02.09'94 to 15.02'95.
Location of the Kouris dam.
Detected events during the operation of the Kouris Dam array.
Daily seismicity and water level of the Kouris reservoir.
Location map of Stations and Events.
Distribution of foci depth.
Cyprus (1994-1996) / Microseismicity Surveys – Location of events.
Regional tectonic pattern offshore Cyprus.
Bulletin of Microseismicity.





Cyprus'94: Kouris area / Location map of Stations and Events

N° File: 54

Authors: MAKRIS, J; STAECKER, J; KRAMVIS, S

Year: 2000

Title: Microseismic studies and tectonic implications of Cyprus

Reference: Proceedings - … International conference on the geology of the eastern Mediterranean, vol.3, pp.137-145

Concerned area: Eastern Mediterranean, Cyprus

Formation(s) affected:

Age of the deformation: Present day

Concerned structures:

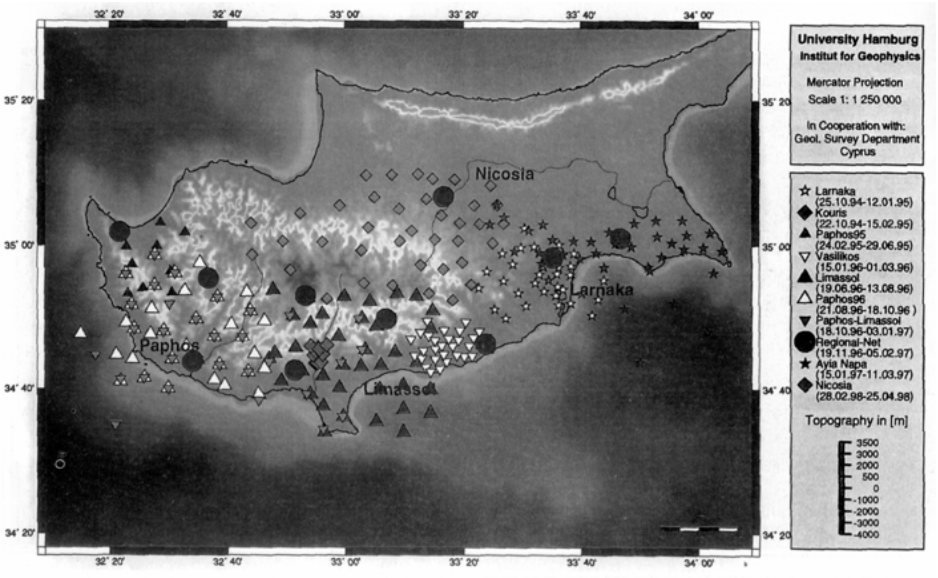
Commentary:

We deployed successively in different areas – Larnaca'94, Kouris-Dam'94, Polis-Basin'95, Vasilikos'96, Limassol'96, Paphos'96, Ayia Napa'97, Regional Net'97 and Nicosia'98 – land and marine operating digital 3-component seismic stations and observed the on- and offshore seismicity for a total period of 690 days. Locations were obtained for more than 1700 micro earthquakes, 4500 aftershocks activated by the two destructive Paphos shocks (23.02.95, ML=5.8; 09.10.96, ML=6.8) and the Troodos Event (21.04.98, ML=4.3). Furthermore, 370 water-induced events by water-inflow to the Kouris-Dam were recorded. The results show that the recorded epicentral distribution is concentrated along major faults on- and offshore Cyprus and are not statistically distributed over the island. These faults of NNW-SSE orientation are strongly affected by the convergence of the oceanic lithosphere of the Herodotus abyssal plain to the west with the continental crust and lithosphere of the Cyprian Arc to the east. The normal seismicity along these faults and the two Paphos main shocks with their intensive aftershock seismicity are controlled by the collision and express the ongoing intense tectonism.

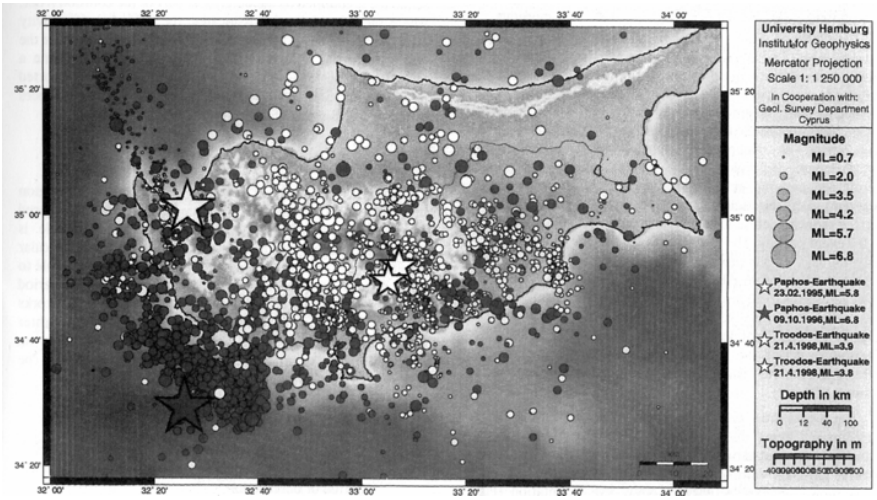
Stress field:

Types of documents:

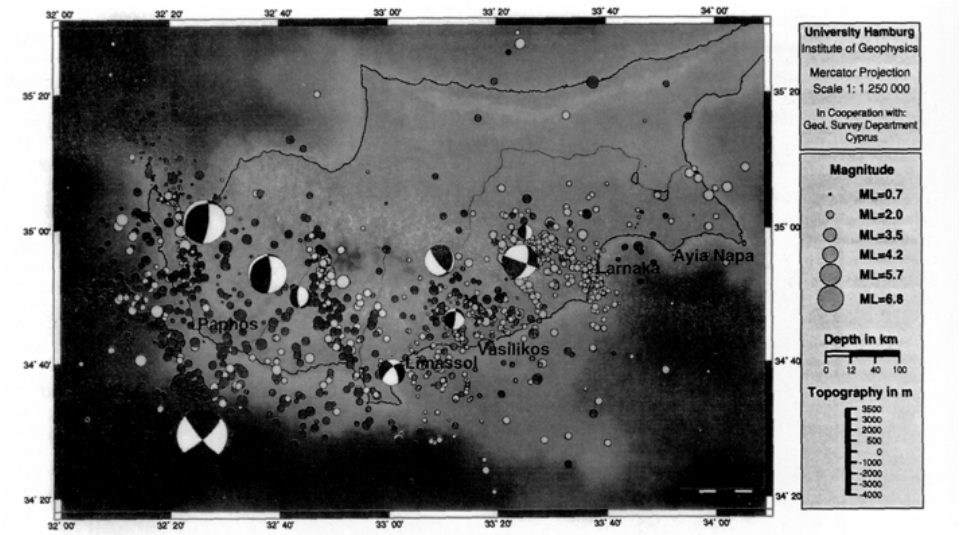
Microseismic arrays (1994-1998).
Distribution of all Microseismic events.
Cyprus 1994-1998. Distribution of microseismic events and characteristic fault plane solutions for the Areas of Paphos, Limassol, Vasilikos, Larnaca, Ayia Napa and Nicosia.
Schematic Tectonic Map offshore Cyprus.
Paphos 96 – Aftershock seismicity located by lfg HH.
Magnitude-Frequency Relations of Cyprus.



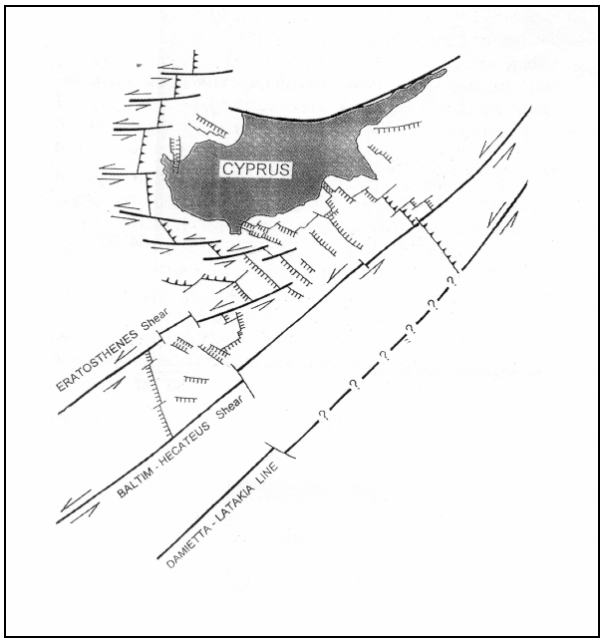
Microseismic Arrays (1994-1998)



Distribution of all Microseismic Events



Cyprus 1994-1998. Distribution of microseismic events and characteristic fault plane solutions for the area of Paphos (95/96), Limassol, Vasilikos, Larnaca, Ayia Napa and Nicosia

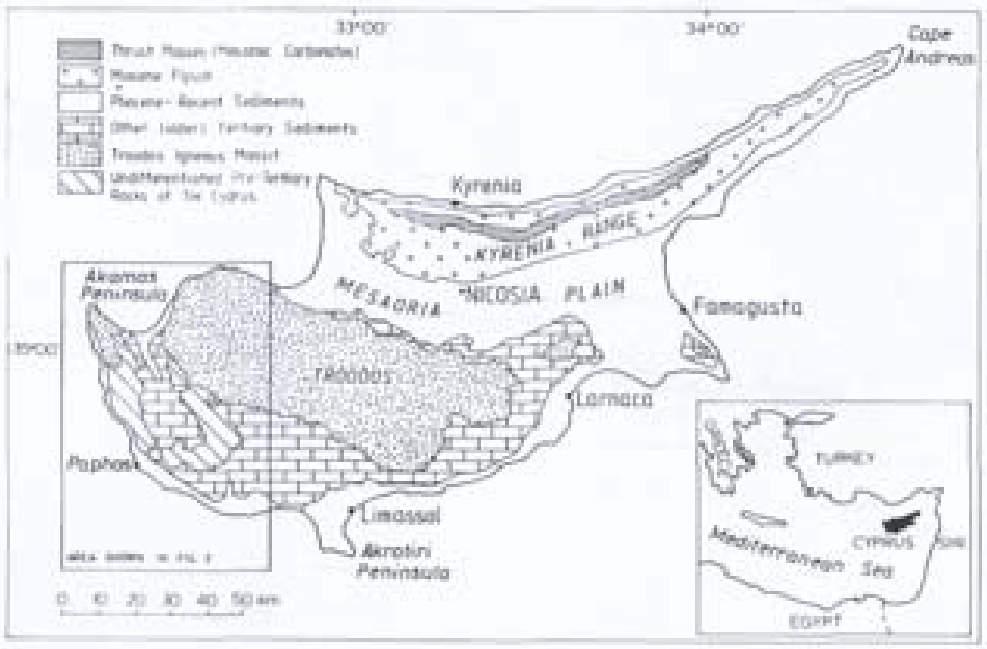


Schematic Tectonic Map offshore Cyprus

N° File: 55

Authors: MALPAS, J., XENOPHONTOS, C. AND WILLIAMS, D.
Year: 1992
Title: The Ayia Varvara Formation of SW Cyprus: a product of complex collisional tectonics
Reference: Tectonophysics 212, 193-211

Concerned area: Eastern Mediterranean, SW Cyprus
Formation(s) affected: Ayia Varvara Formation
Age of the deformation: Upper Triassic
Concerned structures:
Commentary: The Ayia Varvara Formation is a wedge of amphibole schists and intercalated metasediments within the intensely deformed pre-upper Maastrichtian volcanosedimentary Mamonia complex.
Stress field:
Types of documents: Geology of SW Cyprus. General stratigraphic column of the Circum-Troodos sedimentary succession. Geochemistry diagrams. Interpretative cross-section across the Mavrokolymbos Dam region. Tectonic history of microplate rotation in SW Cyprus.



General geology of Cyprus

N° File: 56

Authors: MART, Y.
Year: 1997
Title: Salt Diapirs south of Eratosthenes Seamount: Structural Extension in a Zone of Tectonic Collision
Reference: EUG, 9th conference, Abstract Volume, Strasbourg, March 1997: 395.

Concerned area: Eastern Mediterranean, South of Cyprus
Formation(s) affected:
Age of the deformation: mid-Cretaceous / Present day
Concerned structures: Salt Diapirs
Commentary: Salt diapirs were encountered at the seafloor between the Eratosthenes Seamount (ESM) and the Nile deep-sea fan. They are several kilometres long and less than 1km wide, forming elongated piercement arches and dissolution rifts. They ascend along two conjugate fault systems, trending NE-SW and NW-SE. Most of the faults are normal. The structural characteristics of the boundary between ESM and Cyprus were studied in the Ocean Drilling Program, Leg 160. It was suggested that the ESM was at shallow depths in the mid-Cretaceous, subsided in the Senonian, was uplifted in the Miocene, and subsided again in the early Pliocene. Collision between ESM and Cyprus in the Pliocene.
Stress field:
Types of documents: Abstract

N° File: 57

Authors: MART, Y., WOODSIDE, J.
Year: 1994
Title: Preface: tectonics of the Eastern Mediterranean
Reference: Tectonophysics 234, 1-3

Concerned area: Eastern Mediterranean
Formation(s) affected:
Age of the deformation:
Concerned structures:
Commentary: Cyprus represents one of the best outcropping examples of the ocean floor of the Tethys ocean. Very general.
Stress field:
Types of documents: Preface

N° File: 58

Authors: MC CALLUM, J.E., ROBERTSON, A.H.F.

Year: 1990

Title: Pulsed uplift of the Troodos Massif: evidence from the Plio-Pleistocene Mesaoria Basin

Reference: In:Malpas, J., Moores, E.M., Panayiotou, A. and Xenophontos, C. (Eds). Ophiolites: Oceanic crustal analogues. Proc. Symp. "Troodos 1987": Nicosia, Cyprus (Geol. Surv. Dep., Minist. Agric. Nat. Resour.), 217-229

Concerned area: Eastern Mediterranean, Cyprus

Formation(s) affected:

Age of the deformation: Pliocene-Early Pleistocene

Concerned structures: Mesaoria Basin

Commentary:

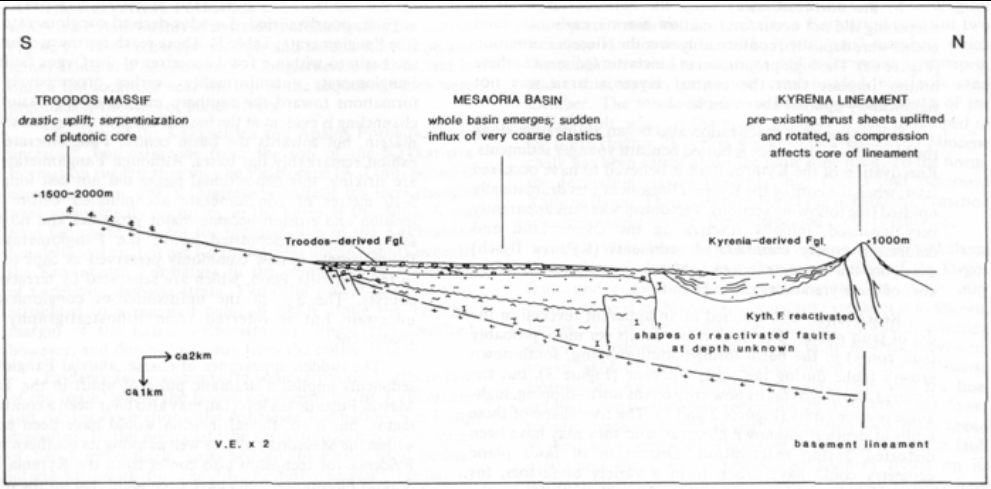
The evolution of the Mesaoria basin, located along the northern margin of the Troodos ophiolite, is documented by studies of three formations of Pliocene-Early Pleistocene age. The base of the Nicosia Formation, the overlying Kakkaristra Formation, the Apalos Formation. Finally, the Pleistocene Fanglomerate unconformably overlie all lower units.

Facies and borehole data for the Nicosia Formation indicate that the Mesaoria basin subsided in the Pliocene as a half-graben, with the maximum subsidence (900 m) occurring along growth faults located near the northern margin. Simultaneous relative uplift along the southern margin resulted in progradation of small fan-deltas. Subsidence declined toward the end of the Pliocene and the basin shallowed to become a narrow, sandy platform. A switch to regional compression then gave rise to a large conglomeratic fan delta system prograding northward from the Troodos (Kakkaristra Formation). The southern side of the basin rapidly emerged and evolved into an alluvial plain (Apalos Formation), dominated by fine-grained sediments as uplift waned. Along the northern basin margin, earlier extensional faults were apparently reactivated as high angle reverse faults that influenced local deposition. These faults and much of the western Mesaoria, were then transgressed by undeformed shallow marine to coastal carbonates (Athalassa Formation), probably as a result of eustatic sea level rise. In the Pleistocene, Troodos was again strongly uplifted. Large volumes of very coarse sediments were shed into the Mesaoria basin as a number of huge, overlapping alluvial sheets (Fanglomerate). This latest uplift may relate to a combination of compression due to underthrusting of a silver of continental crust and large scale serpentinization of the Troodos ultramafic core.

Stress field:

Types of documents:

Generalized geological map of Cyprus.
Summary logs for the Plio-Pleistocene sediments of the Mesaoria Basin.
Pliocene-Pleistocene structural settings.
Schematic paleogeographic reconstructions of the Mesaoria basin.



Pleistocene structural setting: thickness of Kakkaristra, Apalos and Athalassa Formations, and Fanglomerate, exaggerated

N° File: 59

Authors: MC CALLUM, J.E., ROBERTSON, A.H.F.

Year: 1995

Title: Sedimentology of two fan-delta systems in the Pliocene-Pleistocene of Mesaoria Basin, Cyprus.

Reference: Sediment. geol., 98: 215-244

Concerned area: Eastern Mediterranean, Cyprus

Formation(s) affected: two fan-delta systems

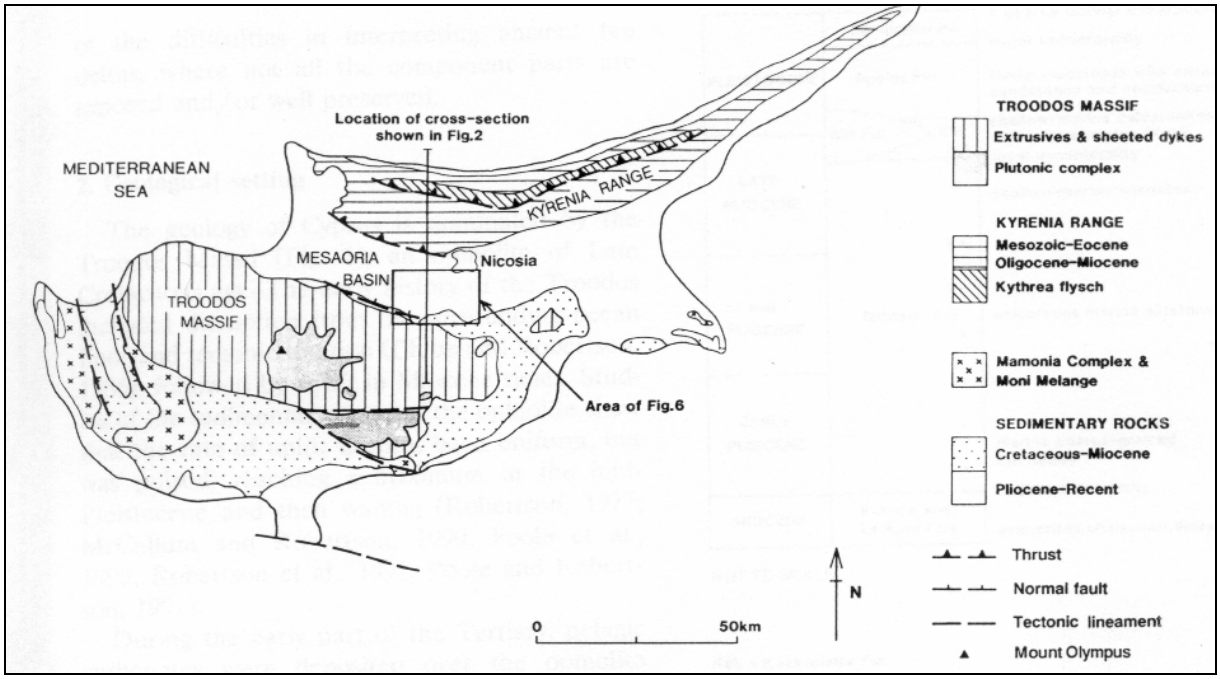
Age of the deformation: Pliocene-Pleistocene

Concerned structures: Mesaoria Basin

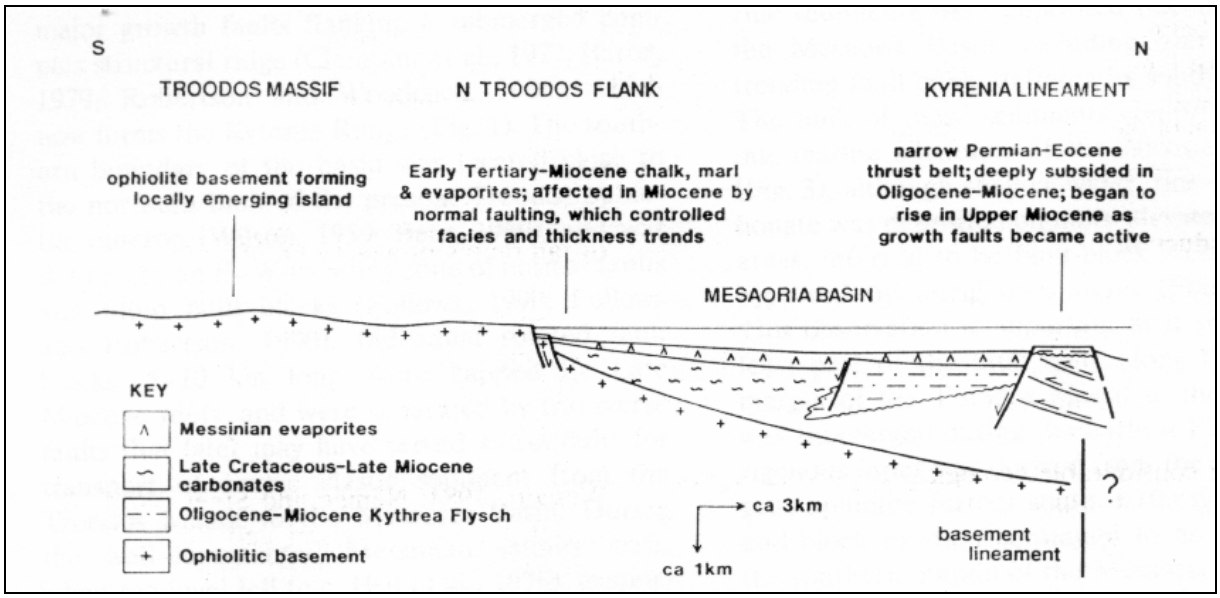
Commentary:
Mesaoria Basin is an asymmetrical half-graben located on the northern side of the Troodos ophiolite. The older fan delta system, the Pliocene Nicosia formation, was deposited when the Mesaoria Basin was actively subsiding. In contrast, the much thinner (<20m), younger (Late Pliocene-Pleistocene) fan delta system of the Kakkaristra Formation was deposited when basin subsidence had virtually ceased and the Mesaoria seaway had filled to become a shallow, sandy platform.
This renewed fan-delta sedimentation was initiated by uplift of the Troodos ophiolitic massif. Coastal fan-delta deposition was terminated by renewed uplift of the Troodos Massif, initiating deposition of the Pleistocene fanglomerate unit.

Stress field:

Types of documents:
Structural elements and major geological units of Cyprus.
Schematic section.
Facies distribution map for the Nicosia Formation.
Schematic block diagram showing the depositional setting of the lower part of the Nicosia Formation, along the southern margin of the Mesaoria Basin.
Field photographs



Structural elements and major geological units of Cyprus

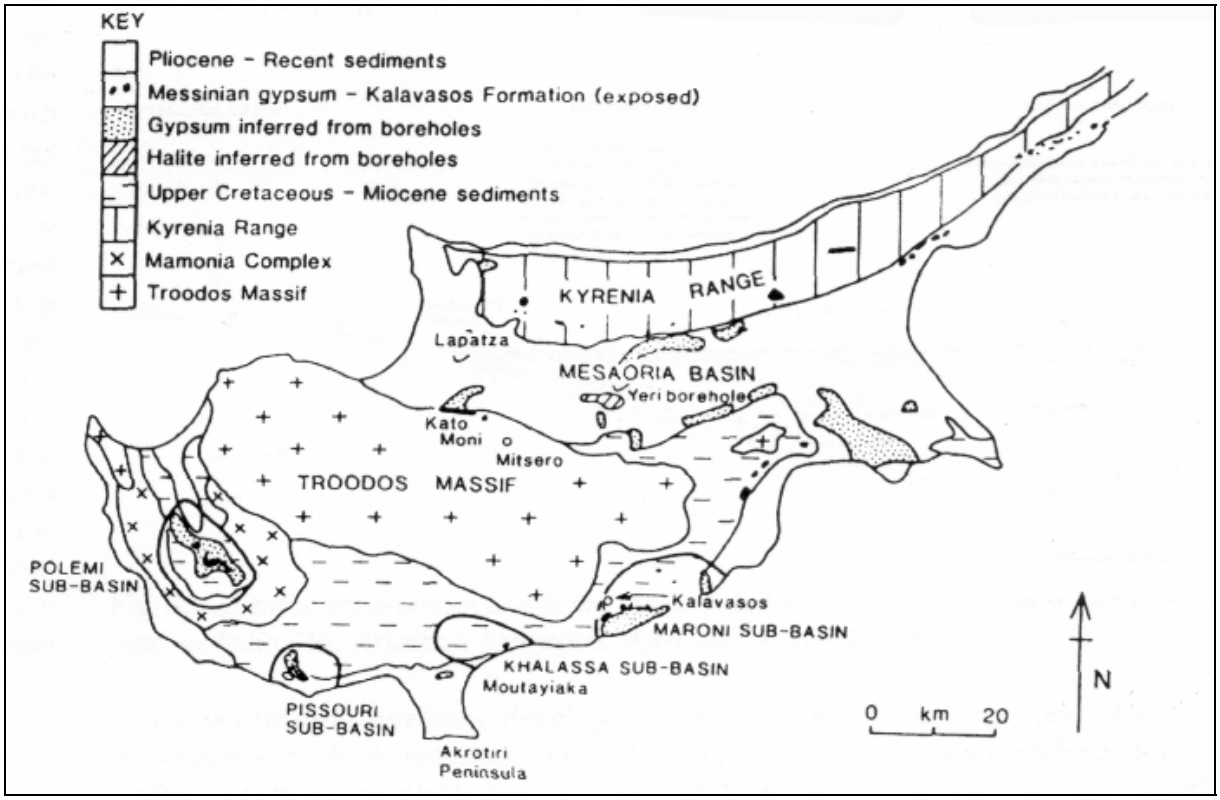


Schematic section showing the pre-Pleistocene setting of the northern flank of the Troodos Massif

N° File: 60

Authors: MC CALLUM, J.E., ROBERTSON, A.H.F.
Year: 1995
Title: Late Pleistocene-early Pleistocene Athalassa Formation, north-central Cyprus: carbonates sand bodies in a shallow seaway between two emerging landmasses.
Reference: Terra Nova, 7: 265-278

Concerned area: Eastern Mediterranean, north-central Cyprus
Formation(s) affected: Athalassa Formation
Age of the deformation: Late Pleistocene-early Pleistocene
Concerned structures: carbonates sand bodies in a shallow seaway between two emerging landmasses
Commentary: The late Pleistocene-early Pleistocene Athalassa Formation accumulated within the Neogene Masaoria basin of northern Cyprus, bordered by two subdued, but rising, landmasses, the Kyrenia range to the north and the Troodos ophiolitic massif to the south. Strong winds and other factors influencing deposition of the formation include minor tectonic instability, a probable eustatic sea-level changes.
Stress field:
Types of documents: Outcrop area of the Athalassa Formation. Sedimentological logs of the Athalassa Formation. Field photographs.



Geological map of Cyprus, showing the Mesaoria basin

N° File: 61

Authors: MC CALLUM, J.E., SCRUTTON, R.A., ROBERTSON, A.H.F., FERRARI W.

Year: 1993

Title: Seismostratigraphy and Neogene-Recent depositional history of the south central continental margin of Cyprus

Reference: Marine and petroleum geology, vol.10, p. 426-438

Concerned area: Eastern Mediterranean, south Cyprus

Formation(s) affected: Neogene-Recent deposits

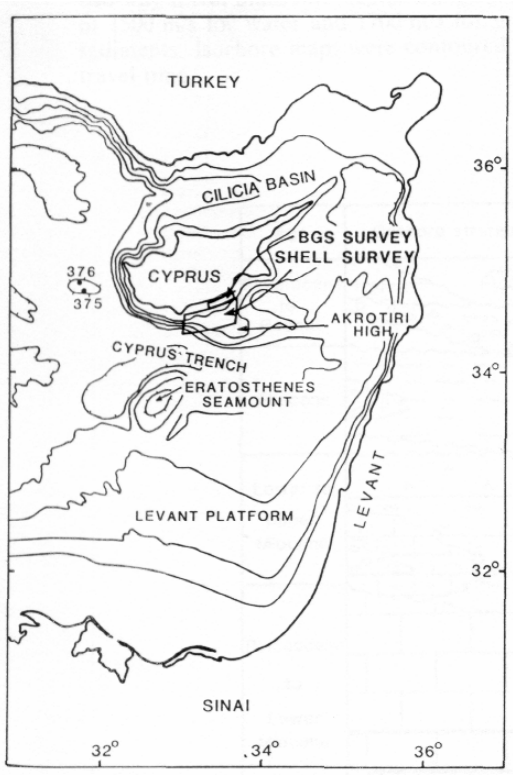
Age of the deformation: Miocene-Pliocene

Concerned structures: south central continental margin

Commentary:
The well known top Messinian reflector is recognized over the slope and western part of the shelf. To the east, an inferred Quaternary, ?eustatically-induced erosion surface, has been cut into lithified Miocene sediments. Zones of folding in the offshore Miocene sequence can be traced onshore, where they correlate with several WNW-ESE trending structural lineaments of Miocene age. The formation of the lineaments is attributed to compression resulting from northwards subduction to the south of Cyprus. The thin distribution of the Plio-Quaternary sediments is consistent with evidence from onshore which indicates an end to deformation on southern Cyprus around the close of the Miocene, relative inactivity in the Pliocene and relative uplift in the Quaternary. The end of deformation in the Pliocene may relate to southwards “roll-back” of the inferred subduction zone trench.

Stress field:

Types of documents:
Bathymetric map of the Eastern Mediterranean showing the location of the seismic surveys.
South Cyprus statigraphy.
Seismic reflection profiles and interpretation.



Bathymetric map of the Eastern Mediterranean showing the location of seismic surveys

N° File: 62

Authors: McCLUSKY S., S. BALASSANIAN, A. BARKA, C. DEMIR, S. ERGINTAV, I. GEORGIEV, O. GURKAN, M. HAMBURGER, K. HURST, H. KAHLE, K. KAASTENS, G. KEKELIDZE, R. KING, V. KOTZEV, O. LENK, S. MAHMOUD, A. MISHIN, M. NADARIYA, A. OUZOUNIS, D. PARADISSIS, Y. PETER, M. PRILEPIN, R. REILINGER, I. SANLI, H. SEEGER, A. TEALEB, M. N. TOKSOZ, AND G. VEIS

Year: 2000

Title: Global Positioning System constraints on plate kinematics and dynamics in the eastern Mediterranean and Caucasus

Reference: Journal of Geophys. Research, vol. 105, no. B3, pp. 5695-5719, March 10

Concerned area: Eastern Mediterranean

Formation(s) affected:

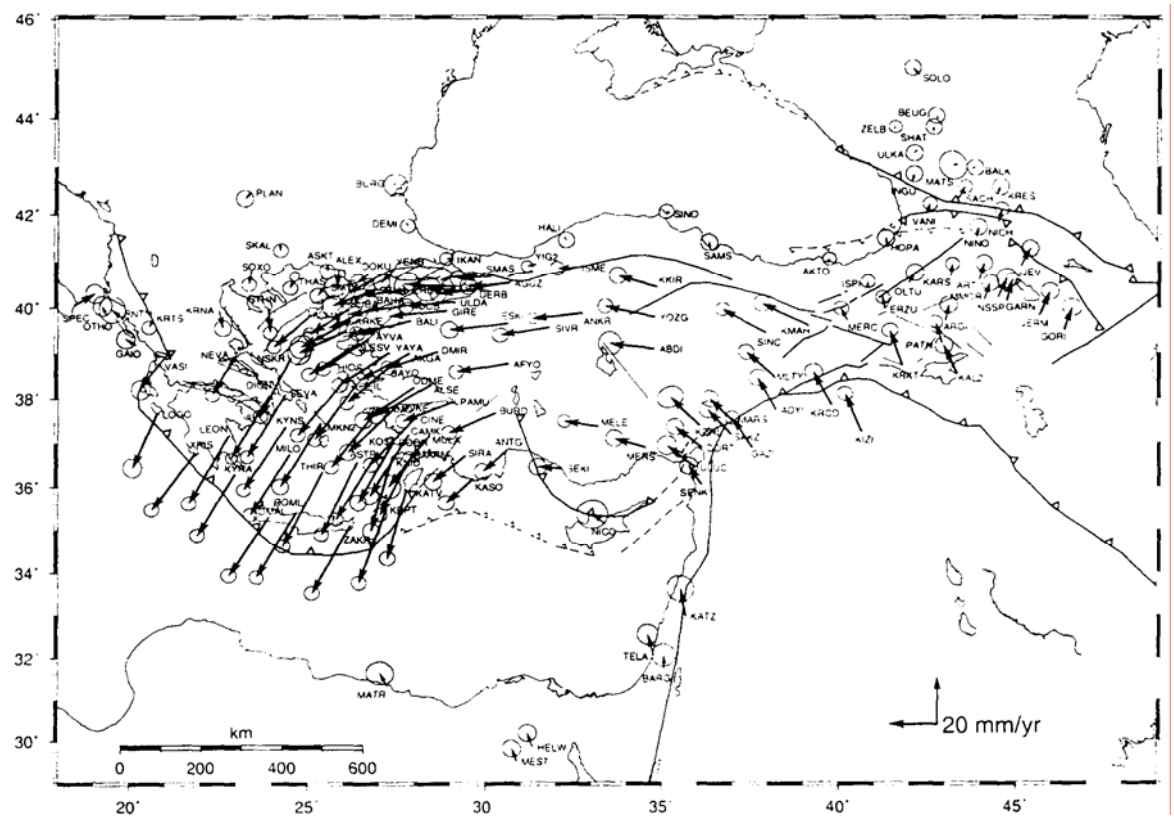
Age of the deformation: Present-day

Concerned structures: Zone of collision of the African and Arabian plates

Commentary: Global Positioning System (GPS) measurements of crustal motions for the period 1988-1997 at 189 sites extending east-west from the Caucasus mountains to the Adriatic Sea and north-south from the southern edge of the Eurasian plate to the northern edge of the African plate are presented and interpreted. Sites on the northern Arabian Platform move 18±2 mm/yr at $N25^0\pm5^0W$ relative to Eurasia, less than NUVEL-1A circuit closure rate (25±1 mm/yr at $N21^0\pm7^0W$) Eastern Turkey is characterized by distributed deformation, while central Turkey is characterized by coherent plate motion (internal deformation of < 2 mm/yr), involving westward displacement and counter-clockwise rotation of the Anatolian plate. The Anatolian plate is de-coupled from Eurasia along the right-lateral, strike-slip North-Anatolian Fault (NAF). The best fitting Euler vector for Anatolian-Eurasian motion is derived $30.7^0\pm0.8^0N$, $32.6^0\pm0.4^0E$, 1.2 ± 0.1^0/Myr. The Euler vector gives an upper bound for NAF slip rate of 24±1 mm/yr. A preliminary GPS Arabia-Anatolia Euler vector is determined as $32.9^0\pm1.2^0N$, $40.3^0\pm1.1^0E$, $0.8^0\pm0.2^0$/Myr and an upper bound on left-lateral slip on the East-Anatolian Fault (EAF) is determined as 9±1 mm/yr. The central and southern Aegean is characterized by coherent motion (internal deformation of < 2 mm/yr) toward the SW at 30±1mm/yr relative to Eurasia. Stations in the SE Aegean deviate significantly from the overall motion of the southern Aegean, showing increasing velocities toward the trench and reaching 10±1 mm/yr relative to the southern Aegean as a whole.
Figure 9 provides a schematic illustration of the principal results of this study. Hatching shows areas of coherent motion and zones of distributed deformation. Heavy arrows indicate generalized regional motions. NAT: North Aegean trough.

Stress field:

Types of documents:
Map of Earthquake Focal Mechanisms (lower hemisphere projection) for shallow (depth of < 100 km), major earthquakes (M> 5.0) (Dziewonski et al., 1981; Jackson and McKenzie, 1988) in the eastern Mediterranean region.
GPS horizontal velocities and their 95% confidence ellipses in an Arabia-fixed reference frame.
GPS horizontal velocities and their 95% confidence ellipses in an Anatolia-fixed reference frame.
Expanded view of the GPS velocities for Eastern Turkey and the Caucasus and their 95% confidence ellipses in an Eurasia-fixed reference frame superimposed on a map of active faults (from Avanessian and Balassanian [1998]).

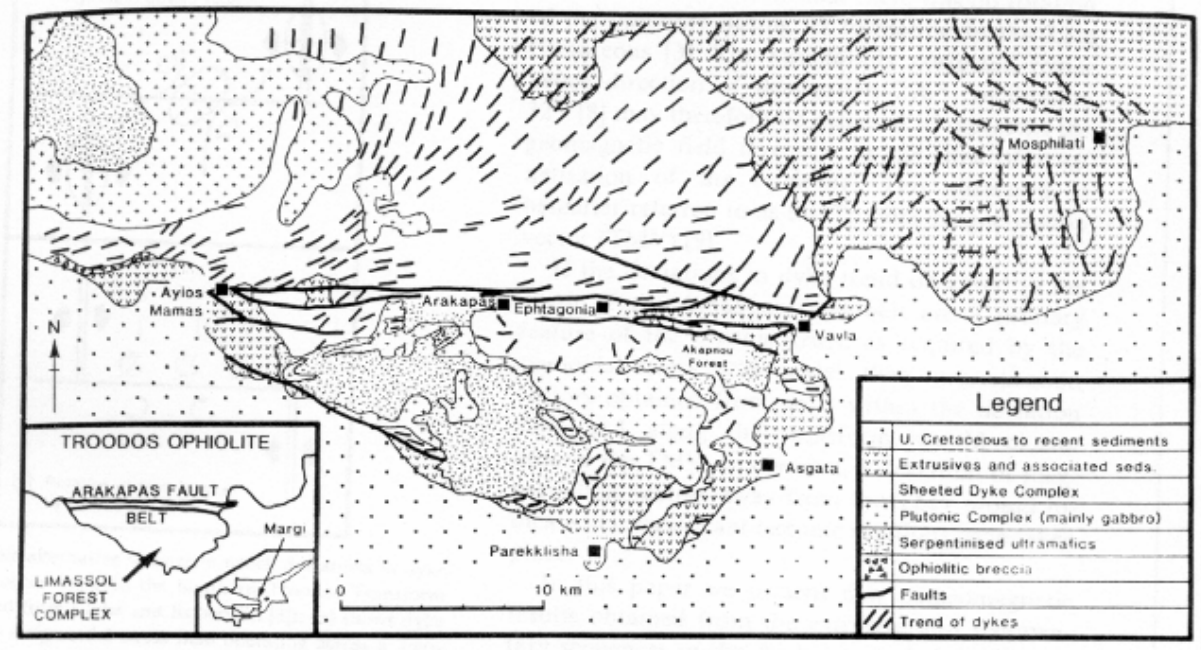


Schematic illustration of the principal results of this study: hatching shows areas of coherent motion and zones of distributed deformation. Heavy arrows indicate generalized regional motions. NAT: North Aegean trough

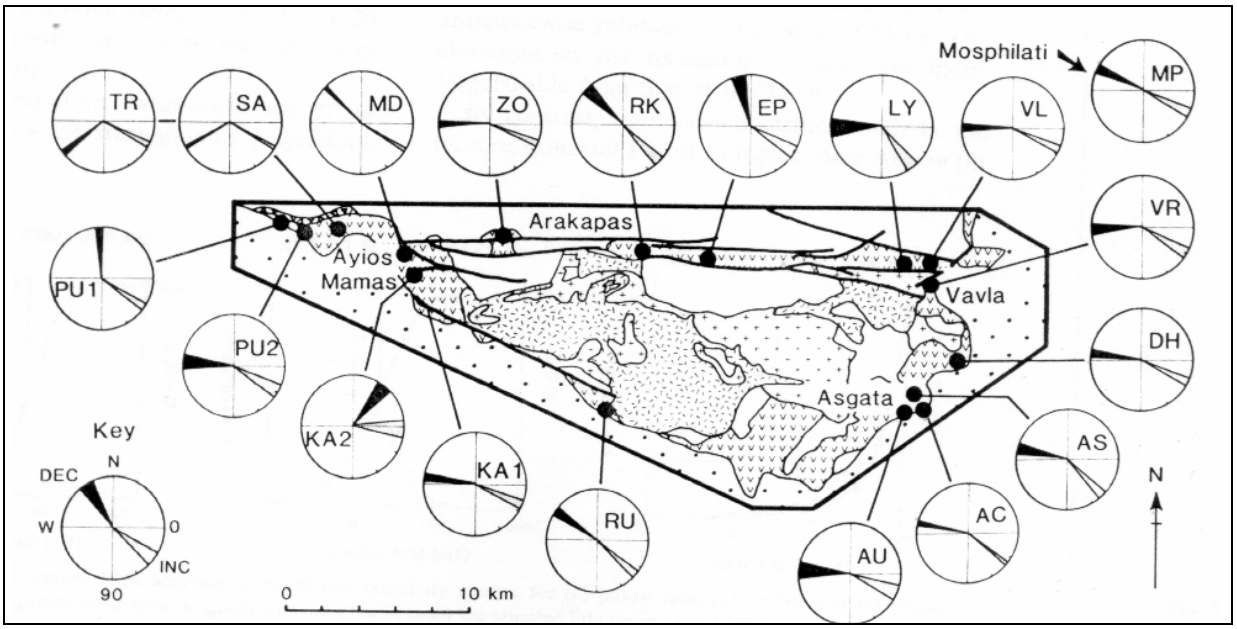
N° File: 63

Authors: MORRIS, A., CREER, K.M. AND ROBERTSON A.H.F.
Year: 1990
Title: Paleomagnetic evidence for clockwise rotations related to dextral shear along the Southern Troodos Transform Fault, Cyprus.
Reference: Earth Planet. Sci. Lett., 99: 250-262.

Concerned area: Eastern Mediterranean, Cyprus
Formation(s) affected:
Age of the deformation: Miocene
Concerned structures: The Southern Troodos Transform Fault
Commentary: The Southern Troodos Fault represents a late Cretaceous oceanic fracture zone which was locally disrupted during late Cretaceous-Eocene paleorotation of the Troodos microplate. At seven sites clockwise rotation of fault blocks has occurred about steeply inclined axes. The overall clockwise sense of block rotation and initial dyke strikes calculated at three sites are consistent with right-lateral slip along the transform. These rotation took place during crustal genesis and are not a product of post-spreading disruption of the fracture zone. The entire area lay within a complicated zone of localised and predominantly clockwise block rotations produced by dextral slip along the transform. The whole area was later subjected to a bulk 90° anticlockwise rotation along with the Troodos microplate. Data indicate that at least 30°, and possibly up to 45°, of this 90° rotation took place over a maximum of 15 Ma.
Stress field: dextral shear
Types of documents: Simplified geological map of the Limassol Forest Complex and the southern margin of the main Troodos ophiolite. Geological map showing the location of the 19 paleomagnetic sites.



Simplified geological map of the Limassol Forest Complex and the southern margin of the main Troodos ophiolite



Geological map showing the location of the 19 paleomagnetic sites

N° File: 64

Authors: MORRIS, A; ANDERSON, M W; ROBERTSON, A H F

Year: 1998

Title: Multiple tectonic rotations and transform tectonism in an intraoceanic suture zone, SW Cyprus

Reference: Tectonophysics, vol.299, no.1-3, pp.229-253

Concerned area: Eastern Mediterranean, SW Cyprus

Formation(s) affected:

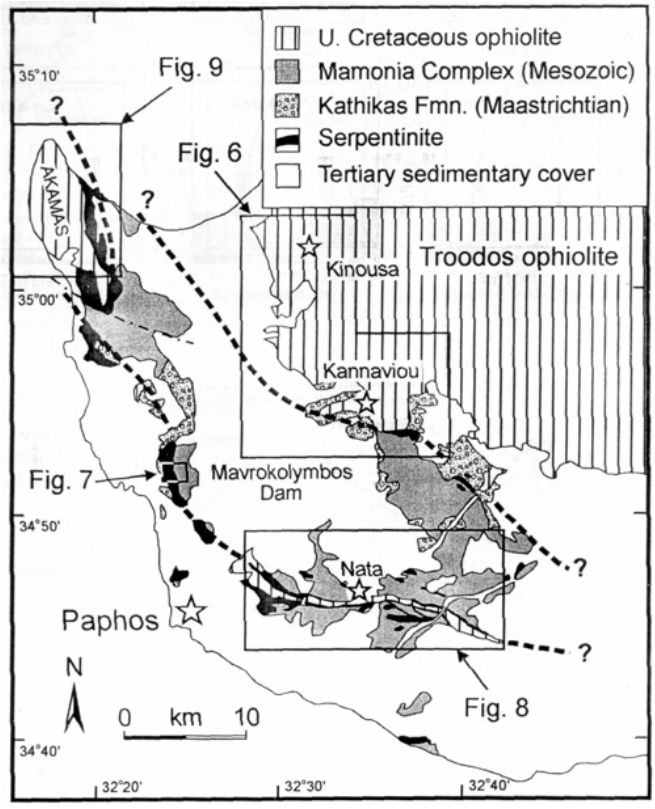
Age of the deformation:

Concerned structures: The Southern Troodos Transform Fault Zone

Commentary:
Early transform-related rotations are consistently clockwise, in agreement with all other studies of rotations associated with the Southern Troodos Transform Fault Zone (STTFZ) further to the east. Late rotations and the net rotations derived at localities were cross-cutting relationships were not present are regarded as composite in origin.
The overall distribution of transform-related rotations (steeply and shallowly plunging rotation axes) and spreading axis-related rotations (sub-horizontal rotation axes) is comparable with that along the STTFZ and adjacent part of the Troodos massif. This is most readily explained by simple along-strike extension of the primary spreading axes and transform fabrics into SW Cyprus, with minor late disruption by high-angle dextral shear zones and neotectonic graben systems.

Stress field:

Types of documents:
Geological map of Cyprus.
Net tectonic rotation parameters.



Geological map of SW Cyprus showing the outcrop patterns of the Troodos and Mamonia Complex terranes and intervening high-angle arcuate fault lineaments

N° File: 65

Authors: ORZAG-SPERBER, F., ROUCHY, J.-M.

Year: 2000

Title: The Messinian-Zanclean transition in the Pissouri area (Cyprus): a well documented section in the Eastern Mediterranean

Reference: Proceedings - ... International Conference on the Geology of the Eastern Mediterranean, vol.3, pp.243-247

Concerned area: Eastern Mediterranean, Cyprus

Formation(s) affected: Pissouri area

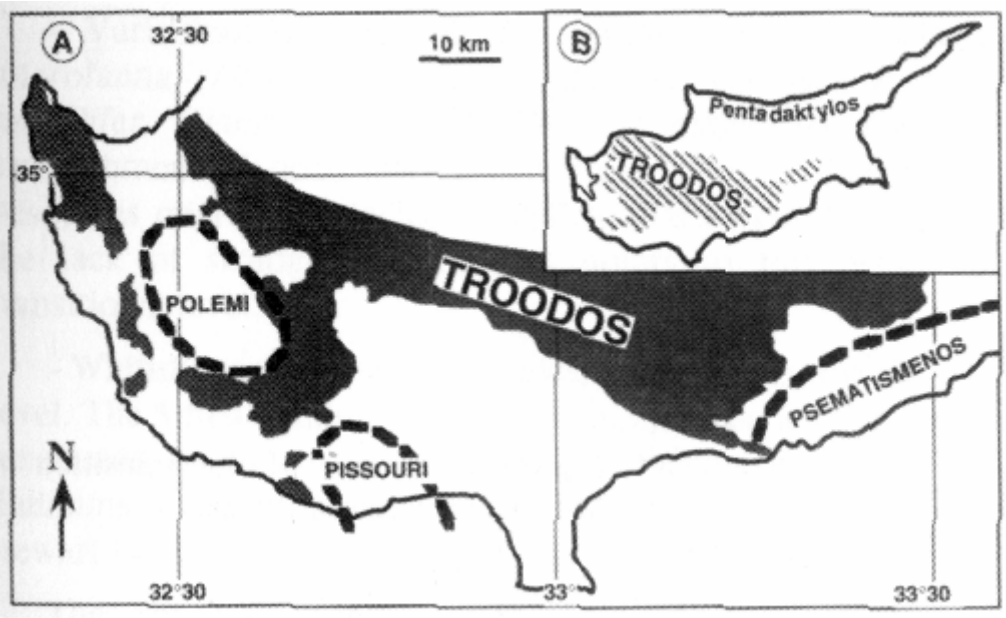
Age of the deformation: Messinian-Zanclean transition

Concerned structures:

Commentary:
The study of the Miocene-Pliocene transition in the Pissouri basin, shows an emersion phase which occurred after the Messinian evaporite deposition and prior to the very early Pliocene marine transgression. A lago Mare assemblage with *Cyprideis* and *Ammonia beccari tepida* is also present. A detailed analysis of sediments and microfauna documents the sedimentary development of the area and the changes of the climate during this interval.

Stress field:

Types of documents:
South Troodos area.
Section of the transition Messinian-Pliocene, Pissouri.
Schematic sections in the Polemi, Pissouri and Psematismenos Basins

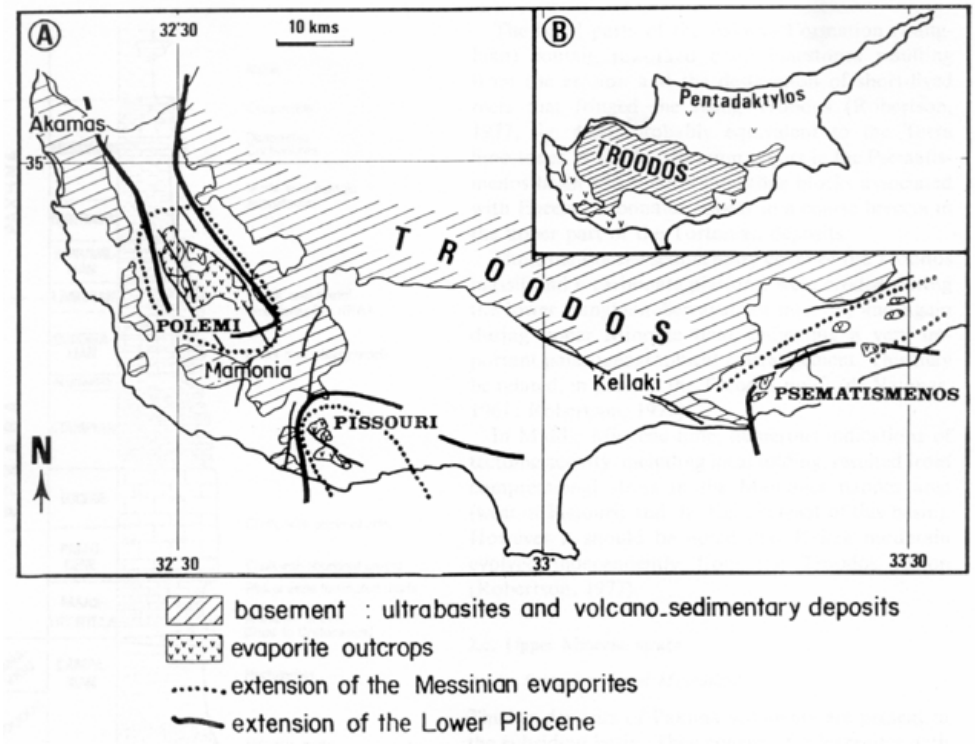


South Troodos area: localization of the three Neogene Basins, and the extent of the Messinian evaporites and the lower Pliocene strata

N° File: 66

Authors: ORZAG-SPERBER, F., ROUCHY, J.-M., AND ELION, P.
Year: 1989
Title: The sedimentary expression of regional tectonic events during the Miocene-Pliocene transition in the southern Cyprus basins.
Reference: Geol. Mag., 126: 291-299

Concerned area: Eastern Mediterranean, Cyprus
Formation(s) affected: Southern Cyprus basins
Age of the deformation: Miocene-Pliocene transition
Concerned structures:
Commentary: The Tortonian-Lower Pliocene period is marked by a stress involving a N20 extension in the Polemi and Pissouri basins and by a N100 extension in the Psematismenos basin. Sedimentological studies have demonstrated three tectonic pulsations during Messinian time, prior to the Pliocene transgression. These are expressed by two episodes of seismic brecciation, and a paleo-emersion is indicated by paleosols and detrital discharges. This phenomena suggest brief tectonic instability during Messinian time. Microtectonic studies in the South Troodos basin of Cyprus reveals that the main change in tectonic stress does not coincide with the Miocene-Pliocene contact but occurs at the end of Lower Pliocene time. The authors conclude that the so called Miocene-Pliocene “event”, in reality, is a series of subtle tectonic pulsations recorded clearly by sedimentary parameters.
Stress field:
Types of documents: Sketch of the south Troodos area. General stratigraphical sequence of sediments in Cyprus. Schematic sections of the Polemi, Pissouri and Psematismenos basins. Field photographs

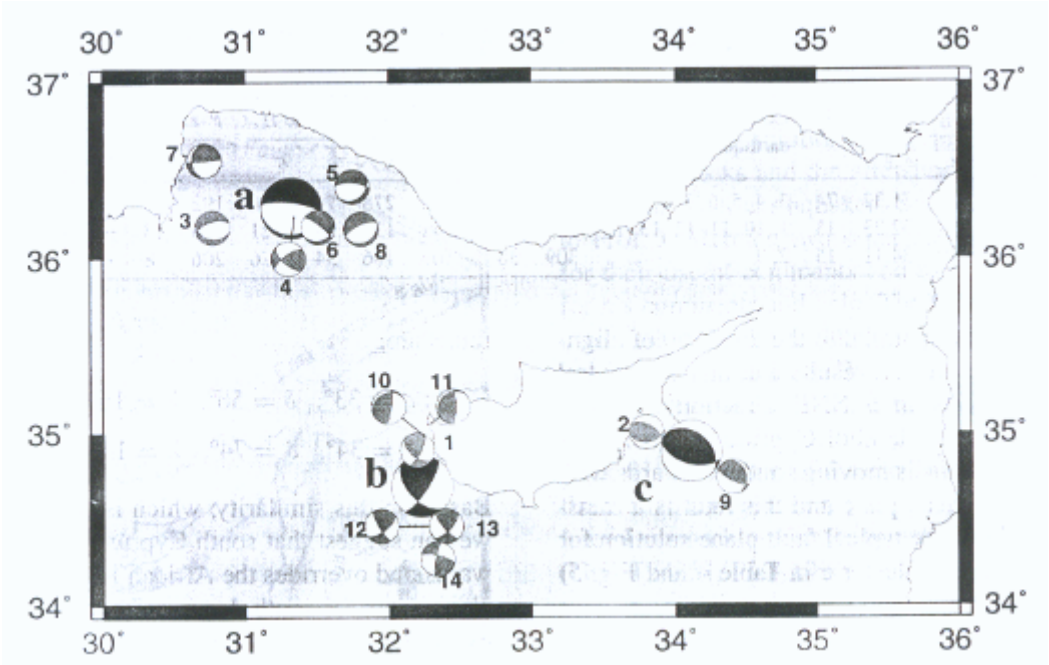


Sketch of the South Troodos area showing the localization of the three basins studied, and the extent of the Messinian evaporites and Lower Pliocene strata

N° File: 67

Authors: PAPAZACHOS, B C; PAPAIOANNOU, C A
Year: 1999
Title: Lithospheric boundaries and plate motions in the Cyprus area
Reference: Tectonophysics, vol.308, no.1-2, pp.193-204

Concerned area: Eastern Mediterranean, Cyprus
Formation(s) affected:
Age of the deformation: Present day
Concerned structures: boundary between the Eurasian and the African lithospheric plates
Commentary: Spatial distribution of shallow and intermediate depth earthquake define a continuous boundary between the Eurasian and the African lithospheric plates in this area. This boundary is formed of two arcuate structures, the eastern and the western, which have their concave side to the north and are connected by a NNE striking transform dextral fault, the Paphos Transform Fault (PTF), just west of Cyprus. The African plate is slowly subducted under the Eurasian plate from south to north but in the Cyprean arc, the Cyprean microplate overrides also the Levantine lithosphere in a SW direction.
Stress field:
Types of documents: Topographic features of tectonic origin in the Cyprus area. Epicentres of shallow earthquakes (h<60km) in Cyprus and surrounding area. Epicentres of intermediate depth earthquakes (60km<h<130km) in Cyprus and surrounding area. Graphical representations or the fault plane solutions of earthquakes.



Graphical representation of the fault plane solutions of earthquakes

N° File: 68

Authors: PAYNE, A S; ROBERTSON, A H F

Year: 2000

Title: Structural evolution and regional significance of the Polis graben system, western Cyprus

Reference: Proceedings - ... International Conference on the Geology of the Eastern Mediterranean, vol.3, pp.45-59

Concerned area: Eastern Mediterranean, western Cyprus

Formation(s) affected:

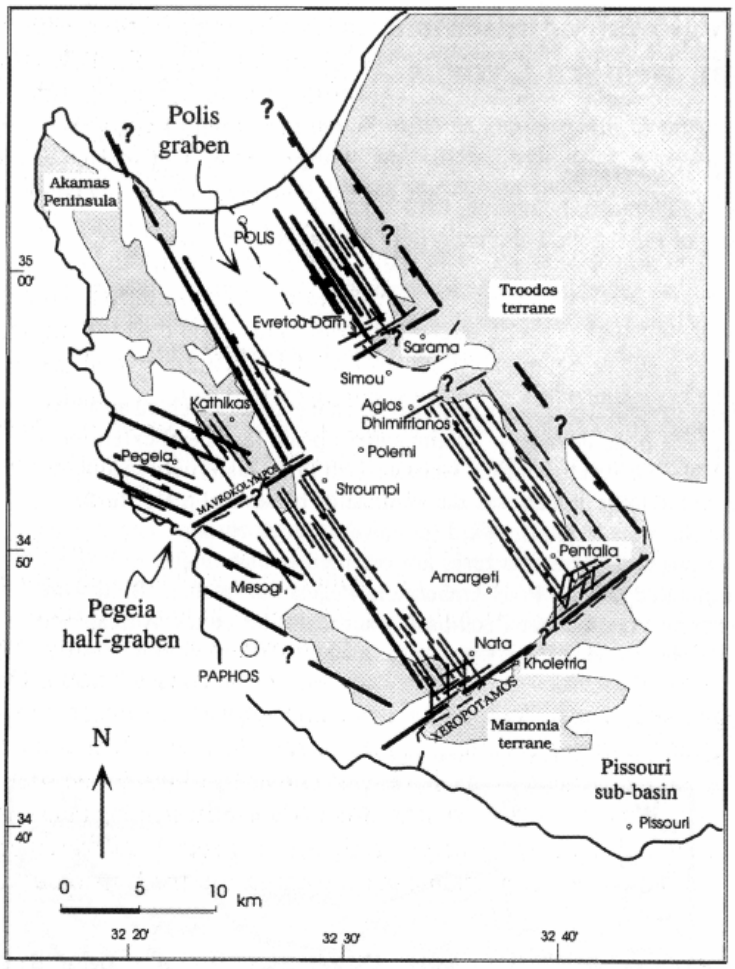
Age of the deformation: Neogene

Concerned structures: Polis graben system

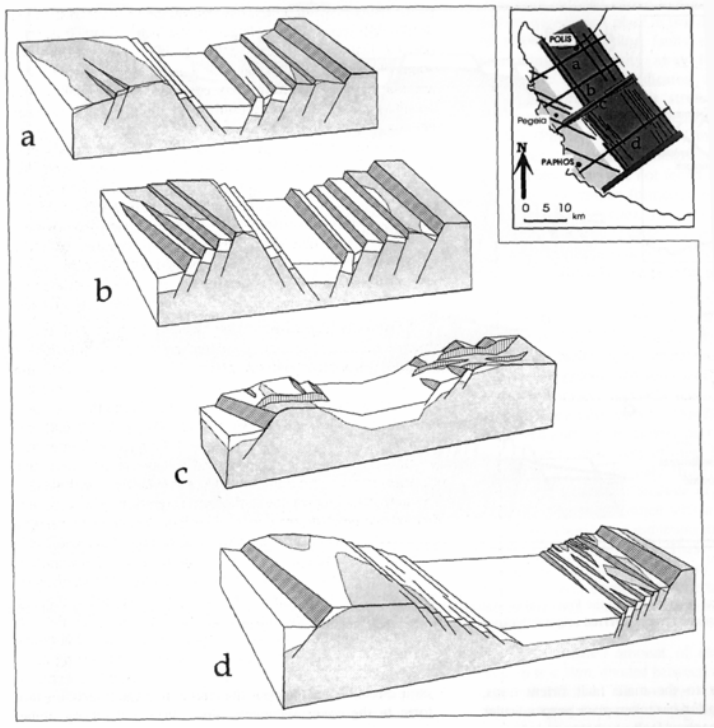
Commentary:
The Neogene-Recent Polis graben and Pegeia half graben, further west, exemplify structural processes related to crustal extension behind an active subduction zone, which dips beneath Cyprus as part of the regional Africa-Eurasia plate boundary. Dominantly dip-slip faults and extensional structures in the Miocene and older units trend NNW-SSE. By contrast, mainly WNW-ESE striking normal faults also cut Plio-Quaternary sediments.
On the east flank, fault blocks are mainly back-rotated, while on the west flank, forward (basinward) block rotation and 'forced folding' are observed, resulting in an overall asymmetrical structure. In addition, transverse structures are oriented at high angles to graben-bounding structures. Extensional beta factors of 1.07 and 1.1 or less are estimated for the Polis graben and Pegeia half-graben. Both were influenced by inherited basement structures (i.e Mamonia Complex), subduction zone retreat ('roll-back') and collision of the African and Eurasian plates (i.e. impingement of the Eratosthenes Seamount).

Stress field: NE-SW extension

Types of documents:
Tectonic elements of the Easternmost Mediterranean.
Outline map of major structures in the Polis graben system.
Small-scale structural data from the Polis graben.
Small-scale structural data from the Pegeia half-graben.
Compilation of structural data from the entire Polis graben system.
Constructed structural sections across the Polis graben system.
Block diagrams showing different segments of the Polis graben system.
Tectonic model for the Late Miocene (Messinian), early Pliocene.



Outline map of major structures in the Polis graben system



Block diagrams showing different segments of the Polis graben system

N° File: 69

Authors: PAYNE, A S; ROBERTSON, A H F

Year: 1993

Title: Stages in the evolution of the Neotectonic Polis graben, west Cyprus

Reference: Terra abstracts: Abstract Supplement n°1 to Terra Nova, 5, 281-282

Concerned area: Eastern Mediterranean, west Cyprus

Formation(s) affected:

Age of the deformation: Early Miocene-Late PLiocene

Concerned structures: Polis graben

Commentary:
The development of the Neotectonic Polis graben is related to subduction to the south and west of Cyprus and coeval uplift of the Troodos ophiolite complex which, bounds the graben on its eastern side.
Four stages in the development can be recognise:
- Early Miocene initiation
- Late Miocene graben formation, this major phase of NW-SE orientated normal faulting was accompanied by transfer faults, producing offsets to the main graben trend.
- Pliocene relative quiescence
- Late Pliocene recent renewal of extension, regional uplift was accompanied by renewed normal faulting, especially along the outer west flank of the graben and locally in the graben axis, where Quaternary sediments are cuts by faults.

Stress field: NE-SW extension

Types of documents:
Abstract

N° File: 70

Authors: PAYNE, A.S; ROBERTSON, A.H.F.

Year: 1995

Title: Neogene supra-subduction zone extension in the Polis graben system, West Cyprus

Reference: Journal of the Geological Society of London, vol.152, Part 4, pp.613-628

Concerned area: Eastern Mediterranean, west Cyprus

Formation(s) affected:

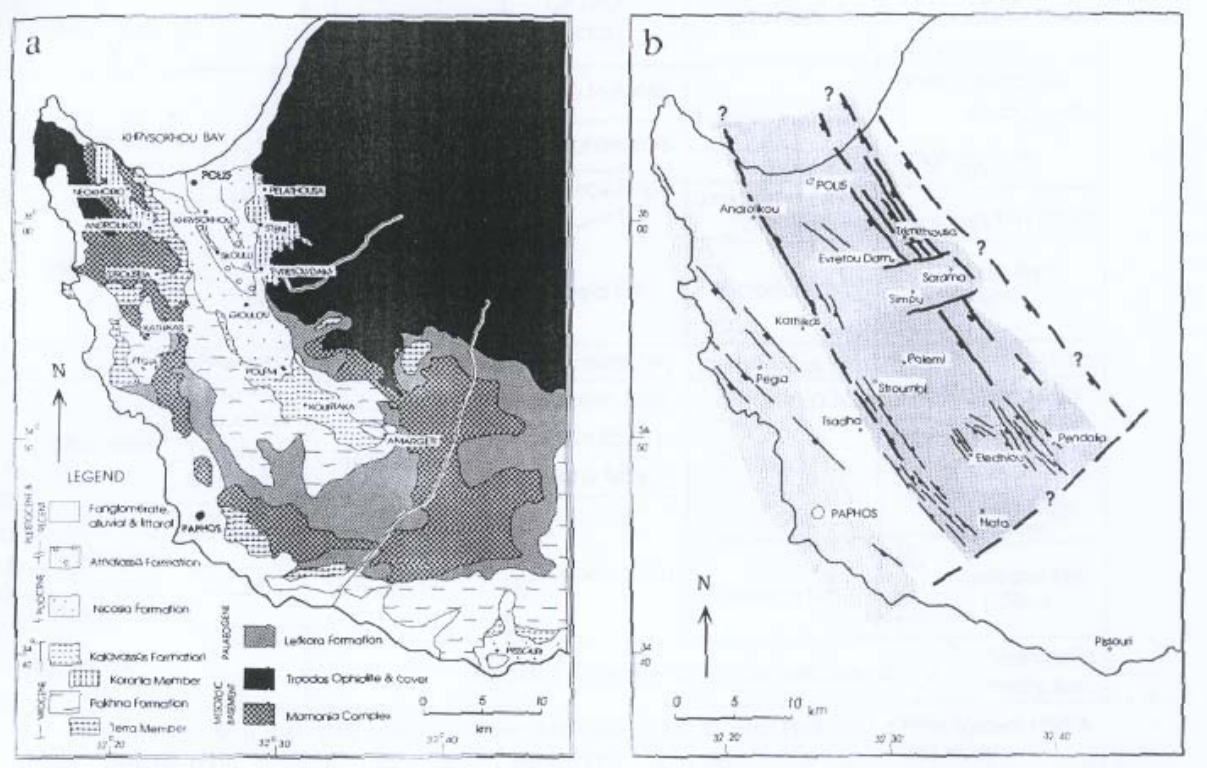
Age of the deformation: Neogene

Concerned structures: Polis graben

Commentary:
Messinian extension, oriented ENE-WSW, produced the asymmetrical faulted polis graben structure. Plio-Pleistocene to Recent sediments record regional uplift of Cyprus. Contemporaneous NNE-SSW orientated extension formed the Pegia half-graben and renewed minor faulting in the Polis graben. The Polis graben may provide a model for the early stages in development of major suprasubduction zone extensional areas such as the Aegean region.

Stress field: NE-SW extension

Types of documents:
Outline tectonic map of the easternmost Mediterranean.
Tectonostratigraphic terranes and major structural features of Cyprus.
Geological map of west Cyprus.
Comparative stratigraphy of Neogene basins on Cyprus.
Structural sections across the Polis graben.
Equal area stereonet showing fault orientations.
Paleogeographic reconstitution.
Chronostratigraphic relationship within the Polis graben and the Pegia half-graben.



(a) Geological map of west Cyprus showing the area of the Polis graben system. (b) Outline structural map of the Polis graben (dark stipple) and Pegia half-graben (light stipple) showing major fault distribution

N° File: 71

Authors: PERINCEK DOGAN, CEMEN IBRAHIM

Year: 1990

Title: The structural relationship between the East Anatolian and Dead Sea fault zones in the south-eastern Turkey

Reference: Tectonophysics, 172, pp.331-340

Concerned area: Eastern Turkey, eastern edge of the Mediterranean Sea

Formation(s) affected:

Age of the deformation:

Concerned structures: East Anatolian Fault zone, Dead Sea fault zone, Amanos Fault, Hatay Graben

Commentary:

The complex structural relationship between the East Anatolian and Dead Sea fault zones is examined, mostly based on field observations in south-eastern Turkey, where the two fault zones are close together. Several faults previously poorly documented can be traced to connect either to the East Anatolian fault zone or to the Dead Sea fault zone. The Dead Sea fault zone may joint the East Anatolian fault zone at three locations: (1) at the south-eastern edge of the Amik basin through a NW-trending fault, which connects the Dead Sea fault zone to the N-trending Amanos fault; (2) northeast of the town of Narli where the Dead Sea and East Anatolian fault zones are very close to each other (although they can not be traced to join on the surface there, they may join in the subsurface); and (3) north-east of the Hazar Lake where the Adiyaman fault, which may be considered extension of the Dead Sea fault zone, joins the East Anatolian fault zone.

The region between the main and southern strands of the East Anatolian fault zone contains structural features indicative of a south-westward extension. These structures are: (1) the NW-trending normal faults in the area between Iskenderun and Osmaniye, and (2) a well-developed graben structure underneath the Iskenderun Bay.

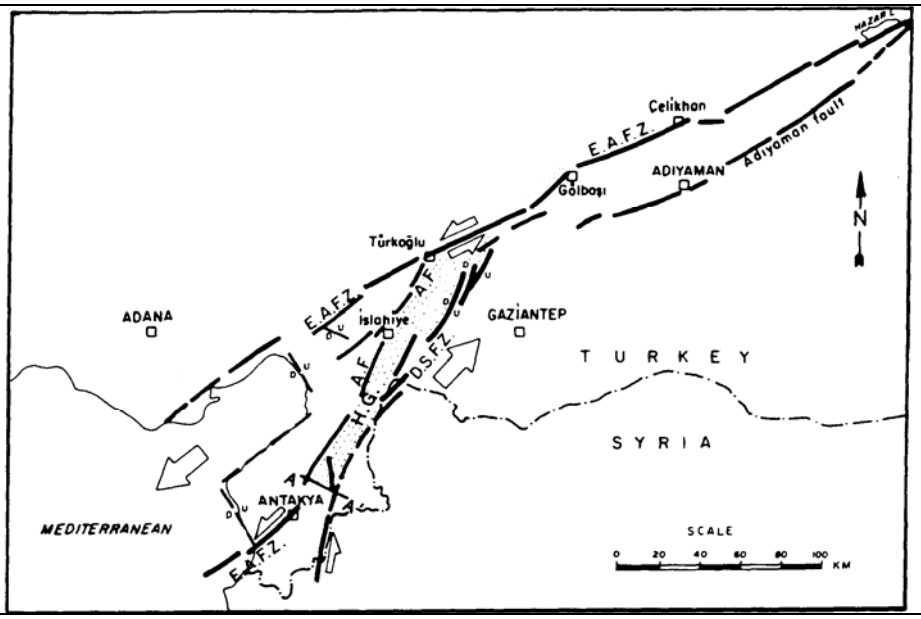
Seismic reflection profile across the Amik Basin, which occupies the southern part of the Hatay graben shows several down-to-the-west normal faults in its eastern and central parts. The basin fill contains sediments Middle Miocene (?) to Recent in age (Seismic line courtesy of O. Sungurlu). Figure 5 presents a map showing kinematic interpretation of the major structural features for the same area.

Stress field:

Types of documents:

Scheme of structural features of the area traversed by the East Anatolian and Dead Sea fault zones in south-eastern Turkey

Map showing kinematic interpretation of the major structural features of the area.



Map showing kinematic interpretation of the major structural features.

N° File: 72

Authors: PINAR, A; KALAFAT, D

Year: 1999

Title: Source processes and seismotectonic implications of the 1995 and 1996 Cyprus, eastern Mediterranean region, earthquakes

Reference: Tectonophysics, vol.301, no.3-4, pp.217-230

Concerned area: Eastern Mediterranean, Cyprus

Formation(s) affected:

Age of the deformation: Present day

Concerned structures:

Commentary:

The 1995 and 1996 events took place to the northwest and southwest of Cyprus, they were multiple events associated with subevents taking place on different faults located nearby the source regions.

Three subevents were necessary to explain the waveforms of the 1995 earthquake. The first showed a predominantly normal faulting mechanism while the second subevent, located 20 km to the north of the first subevent, had a strike-slip mechanism with dip-slip component. Despite the difference in mechanisms both the subevents had slip vectors orientated nearly E-W. The last subevent was located in the proximity of the first one and had a normal faulting mechanism with a slip vector in N-S direction.

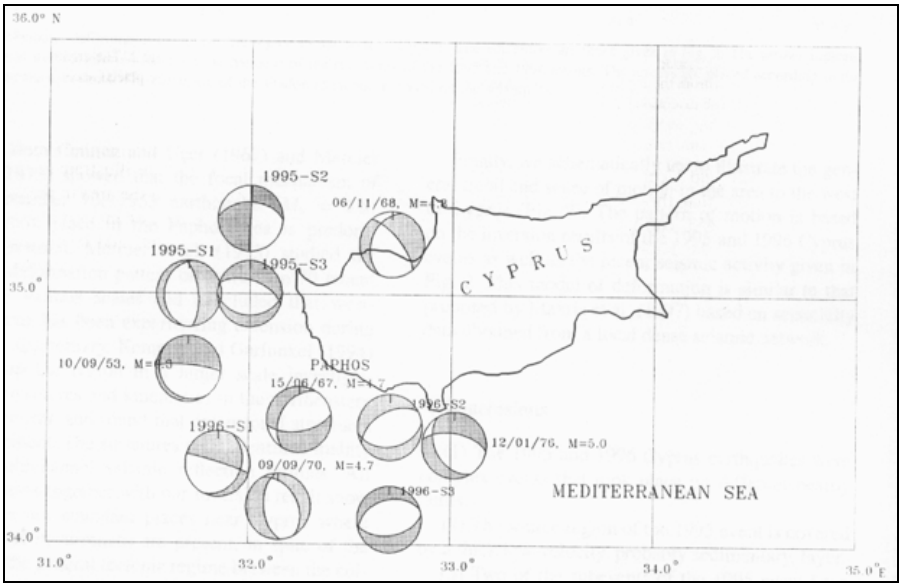
The complex waveforms of 1996 earthquake were model with three subevents, too. The first took place on a fault plane dipping about 20° to the east-southeast, the sense of motion was right-lateral strike-slip and unilateral rupture propagation. We estimate from major subevent a slip rate of 10 mm/year for the African plate. The second and third subevents were located 35 km to the southeast of the main shock and had a predominantly normal faulting mechanism slip vectors in north-northwest direction.

The rupture process analysis of the 1995 and 1996 events suggests that the region to the west of Cyprus experiences extensional tectonics.

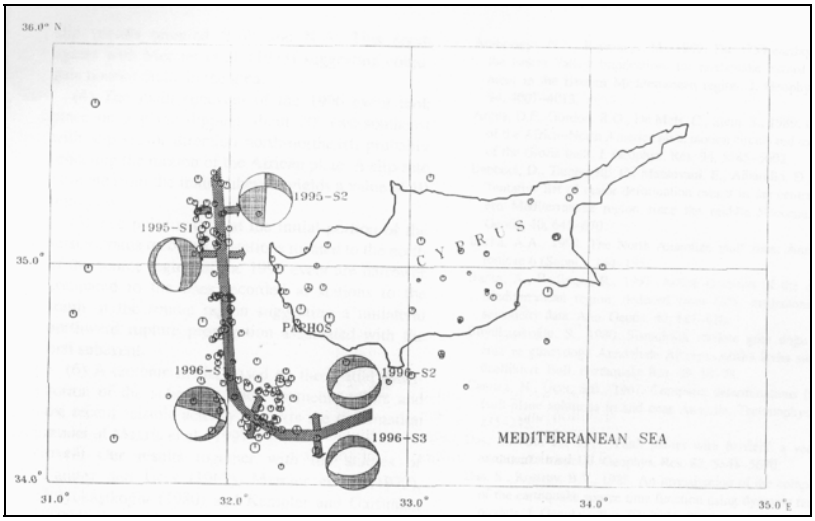
Stress field:

Types of documents:

Tectonics of the north-eastern Mediterranean region and seismicity (M>3.5) in the period 1970-1995.
Seismic activity in the vicinity of Cyprus in the period 1 April 1997 – 31 January 1998.
3D distribution of aftershocks.
The focal mechanism of the subevents of the 1995 and 1996 Cyprus earthquakes.
Schematic deformation model for the region to the west of Cyprus.



The focal mechanism of the subevents of the 1995 and 1996 Cyprus earthquakes, and the predominantly normal faulting mechanism.



Schematic deformation model for the region of the west of Cyprus

N° File: 73

Authors: PIRAZZOLI, P., LABOREL, J., STIROS, S.

Year: 1996

Title: Earthquake clustering in the Eastern Mediterranean during historical times

Reference: Journal of Geophysical Research 101, 6083-6097

Concerned area: Eastern Mediterranean

Formation(s) affected:

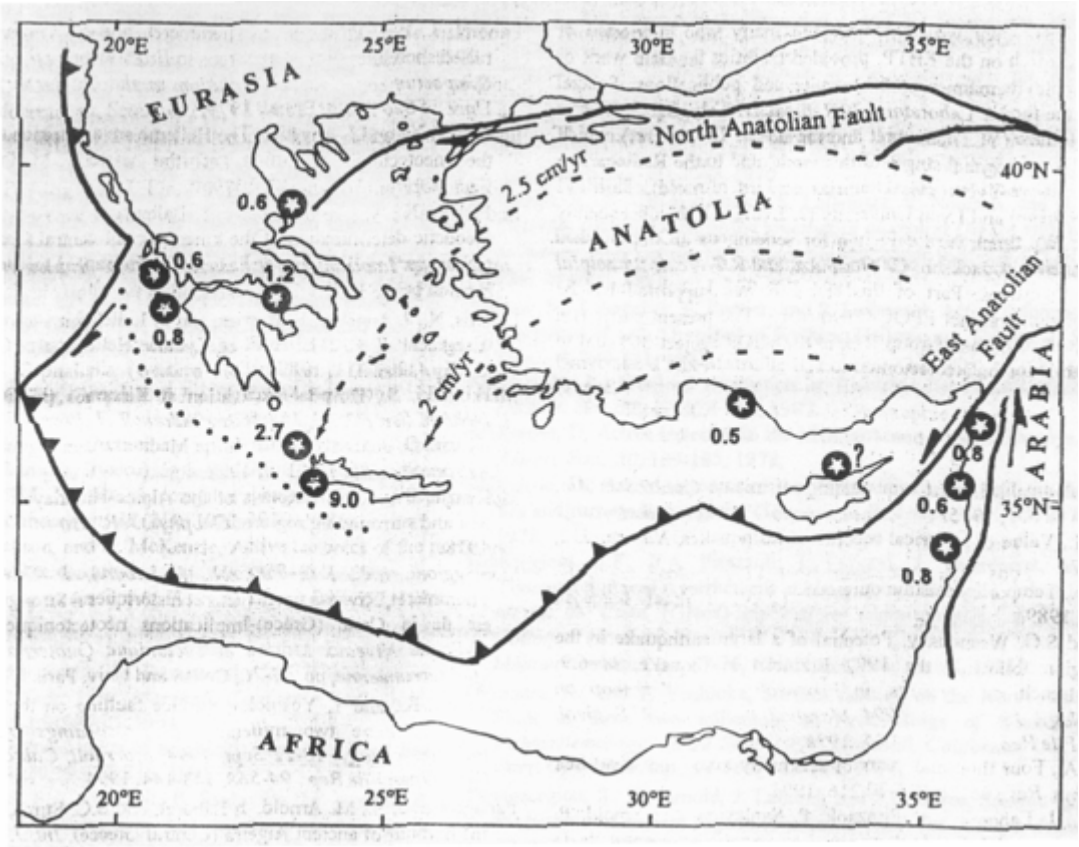
Age of the deformation: between the middle of the 4th and the middle of the 6th century

Concerned structures:

Commentary:
The amount of the Early Byzantine tectonic paroxysm (EBTP) uplift was generally between 0.5 m and 1.0 m but reached maximum of about 9 m in south-western Crete. In several areas, the EBTP uplifted shoreline is the only evidence of Holocene emergence. The EBTP uplift was preceded by a series of about 10 co seismic small subsidence movements, each measuring some tens of centimetres, which took place in the preceding 3000 years. No evidence was observed of post seismic vertical displacements.

Stress field:

Types of documents:
Location map and sketch of plate boundaries and motions in Eastern Mediterranean.
Lists of radiocarbon data Sea Level Indicators.



Location map and sketch of plate boundaries and motions in the eastern Mediterranean area

N° File: 74

Authors: PLASSARD J. and KOGOJ B.

Year: 1962

Title: Catalogue des seismes ressentis au Liban

Reference: Annales-Memoires de l'Observatoire de Ksara, vol. IV (Seismology), Observatory of Ksara, Liban, pp. 1-12

Concerned area: Levant, Eastern Mediterranean

Formation(s) affected:

Age of the deformation:

Concerned structures:

Commentary:
A catalogue of earthquakes felt in Lebanon is provided, which sets up dates, locations, and intensities for ancient events, and is added with epicentres for the more recent ones.

Stress field:

Types of documents:
Catalogue

N° File: 75

Authors: POIRIER J.P. and TAHER M.A.
Year: 1980
Title: Historical seismicity in the Near and Middle East, North Africa, and Spain from Arabic Documents
Reference: Bulletin of the Seismological Society of America, vol. 70, no. 6, pp. 2185-2201

Concerned area: Middle East, North Africa, Spain
Formation(s) affected:
Age of the deformation:
Concerned structures:
Commentary: Authors compiled a catalogue of historical seismicity from the 7th to the 18th century A. D based on Arabic documents (many of which are unpublished manuscripts) for the near and Middle East, and in a lesser measure, for North Africa and Spain. In most cases, the detailed descriptions have allowed assignment of the Modified Mercalli Intensities to the shocks for the localities where they were reported.
Stress field:
Types of documents: Catalogue (a chronological list of events) that sets up dates, felt areas, geographic coordinates, intensities and sources.

N° File: 76

Authors: POOLE, A., ROBERTSON, A.H.F.

Year: 2000

Title: Quaternary marine terraces and aeolianites in coastal south and west Cyprus: implication for regional uplift and sea-level change

Reference: Proceedings - ... International Conference on the Geology of the Eastern Mediterranean, vol.3, pp.105-123.

Concerned area: Eastern Mediterranean, Cyprus

Formation(s) affected: marine terraces and aeolianites

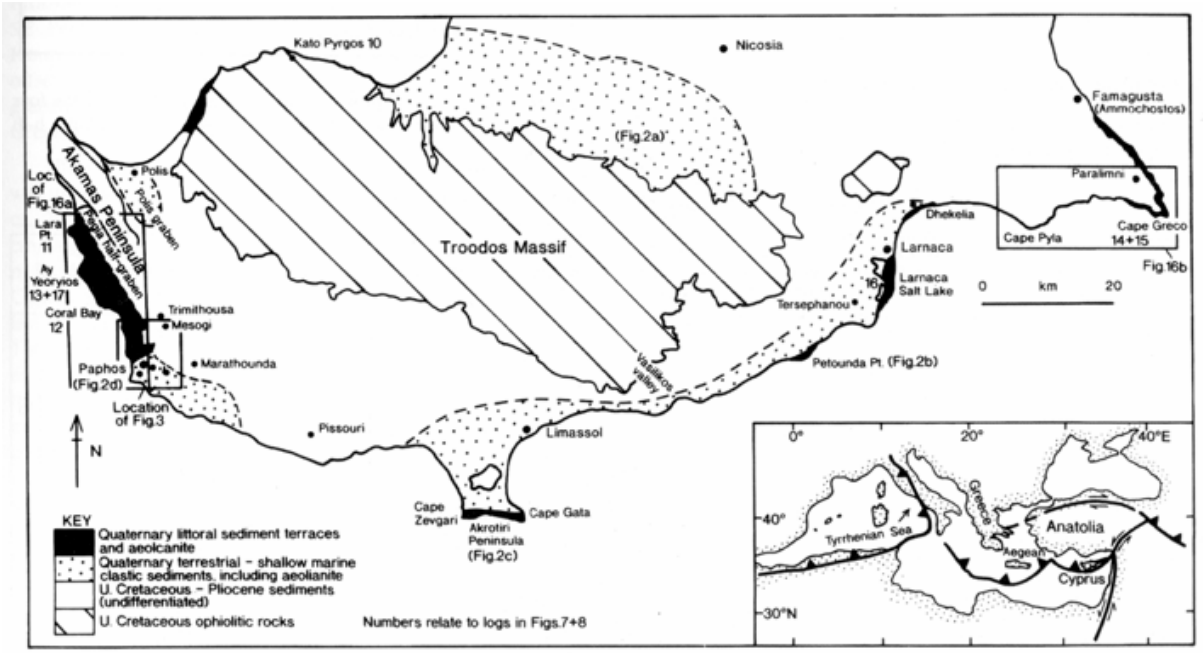
Age of the deformation: Pleistocene

Concerned structures:

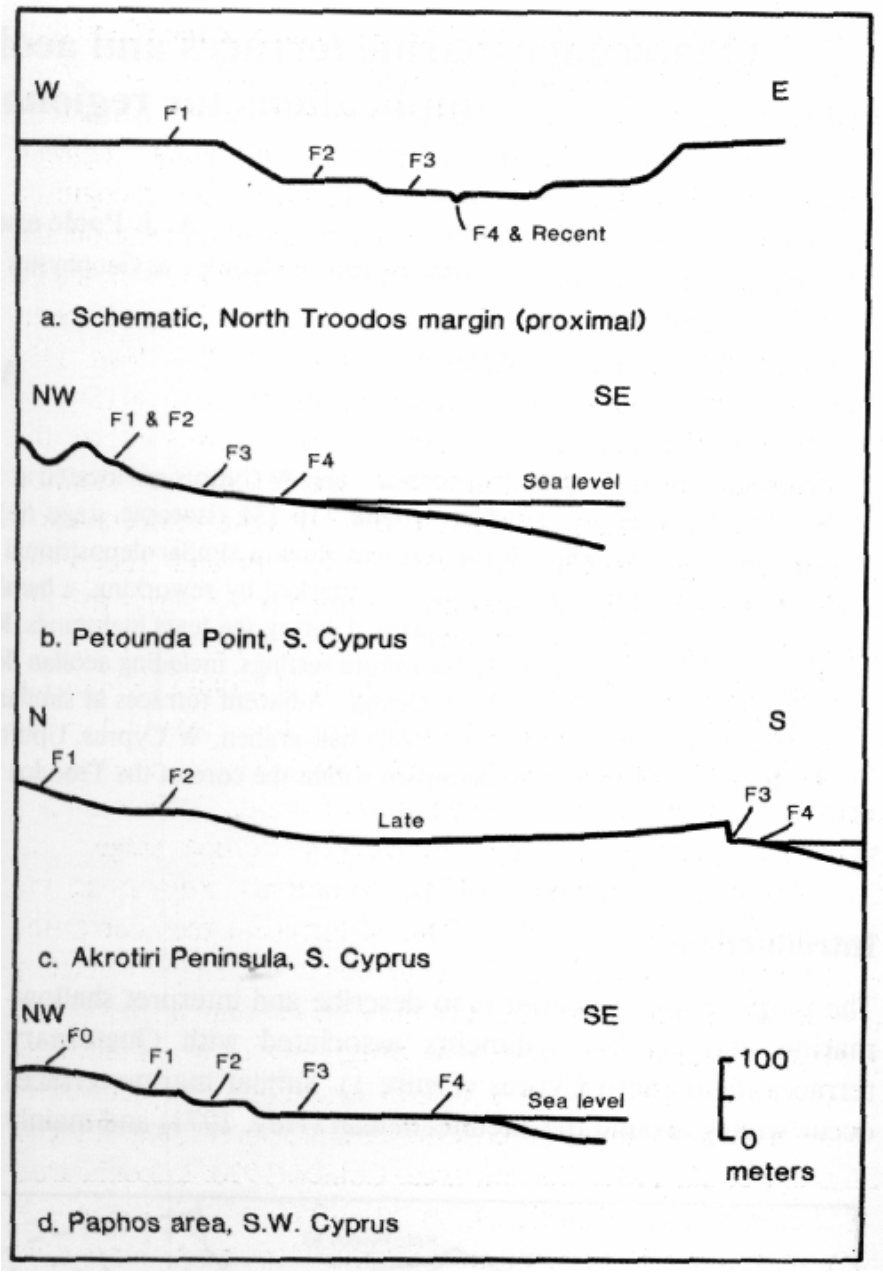
Commentary:
Pleistocene marine terraces in coastal S and W Cyprus are located at 350-360 m, 110-100 m, 60-50 m, 11-8 m and 2-3 m above present sea-level. The last two terraces are dated at around 116-134 and 185-204 Ka. All the terraces show a similar depositional history, with initial abrupt marine transgression, maximum flooding, then gradual regression. During the Pleistocene, littoral deposits were tectonically uplifted, punctuated by eustatic sea-level change. Adjacent terraces at similar altitudes are coeval, indicating that S Cyprus was uplifted as a single unit, except for the Polis and Pegia half-graben, W Cyprus. Uplift is attributed to the combined effects of underthrusting of the Eratosthenes Seamount and serpentinite diapirism within the core of the Troodos Massif.

Stress field: uplift

Types of documents:
Outline map of southern Cyprus showing the occurrence of marine terraces and other quaternary deposits.
Topographic profiles indicating the occurrence of the four main erosion surfaces.
Measured sedimentary logs.
Field photographs, field sketches.
Paleocurrent data for cross bedded aeolianites exposed in S and SW Cyprus.
Rose diagram of joints and fractures cutting the Quaternary Neogene sediments of coastal southern Cyprus.



Outline map of southern Cyprus showing the occurrence of marine terraces and other quaternary deposits



Topographic profiles indicating the occurrence of the four main erosion surfaces associated with a) fluvial incision inland; b-d) terraced littoral deposits in southern Cyprus

N° File: 77

Authors: POOLE, A.J., ROBERTSON A.H.F.

Year: 1992

Title: Quaternary uplift and sea-level change at an active plate boundary, Cyprus

Reference: Journal of the geological society, London, vol. 148, p.909-921

Concerned area: Eastern Mediterranean, Cyprus

Formation(s) affected:

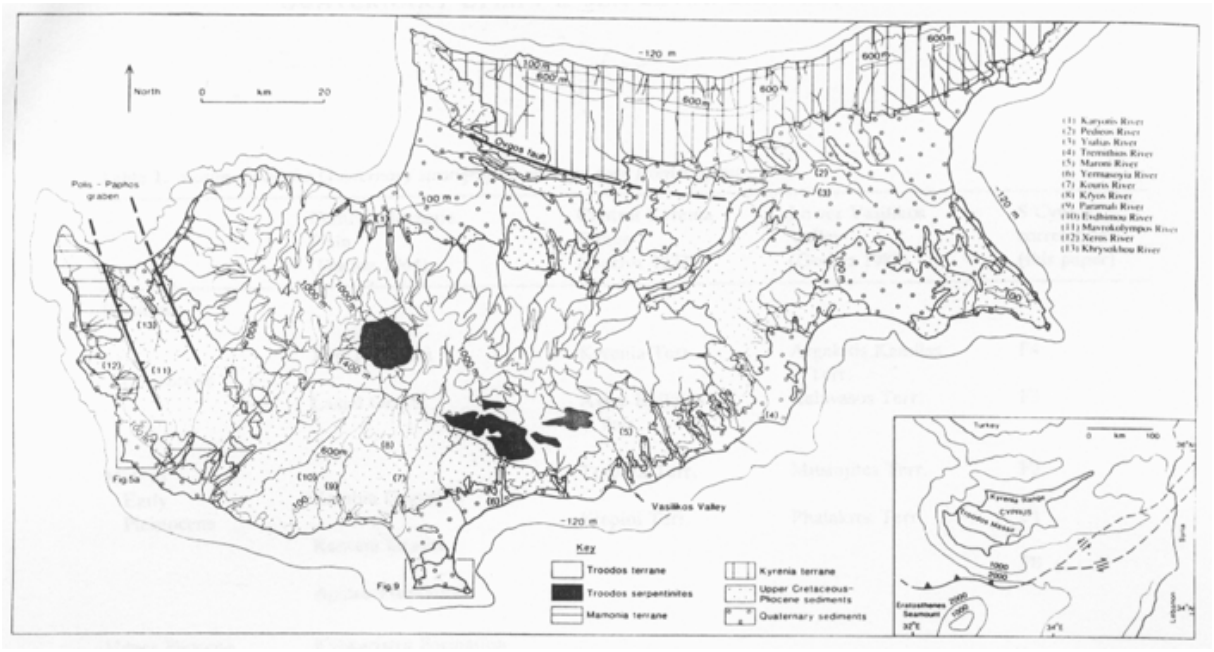
Age of the deformation: Quaternary

Concerned structures:

Commentary:
The uplift was associated with the development of succession of alluvial fans and marine terraces. Marine terraces in coastal southern Cyprus are developed at 350-360 m, 110-100 m, 60-50 m, 11-8 m and 2-3 m above present sea-level. Later uplift resulted in the formation of channel fans and river terraces. Provenance studies indicate that uplift and resulting erosion of Cyprus was centred on the Troodos Massif. Radiometric dates indicate that uplift was rapid in the early and mid-Pleistocene. In the late Pleistocene-Holocene, eustatic sea-level changes and anthropogenic effect dominated, while the rate of uplift was reduced, with local submergence of southern coastal areas.

Stress field: uplift

Types of documents:
Geological, topographic and drainage map of Cyprus.
Histograms of clast provenance.
Composite sedimentary logs.
Paleocurrent data.

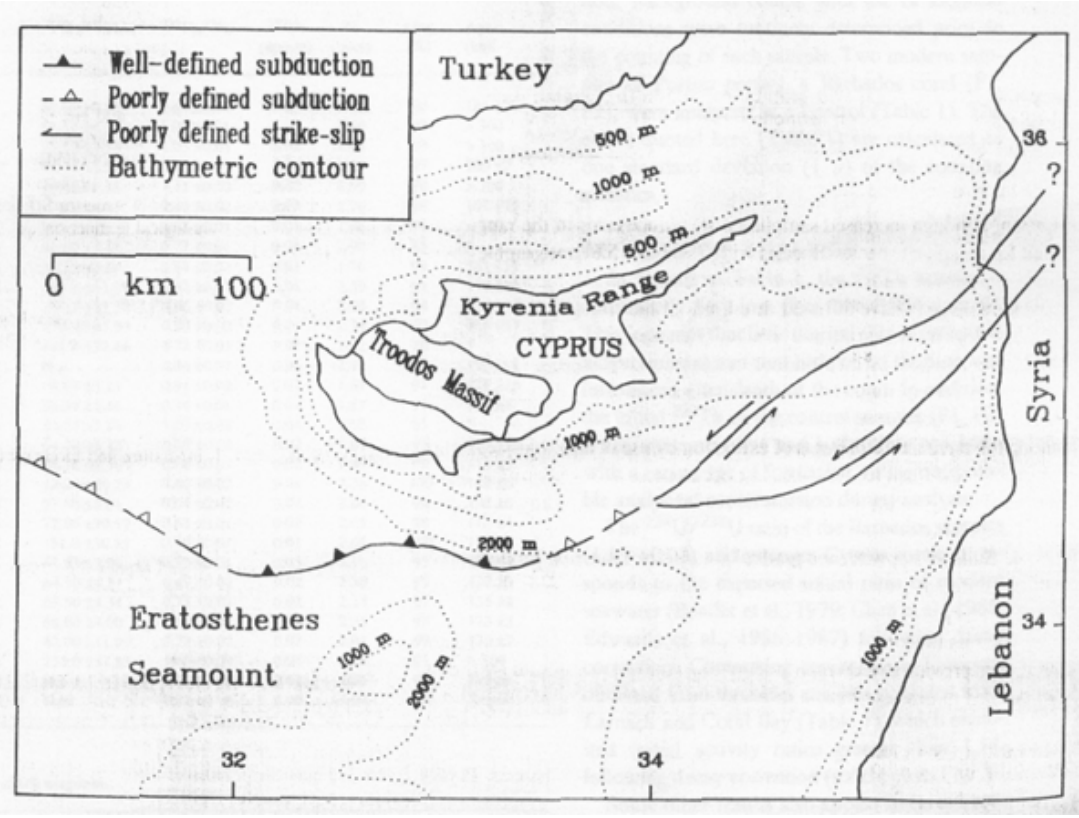


Geological, topographic and drainage map of Cyprus

N° File: 78

Authors: POOLE, A.J., ROBERTSON A.H.F., AND SHIMMIELD, G.
Year: 1990
Title: Late Quaternary uplift of the Troodos ophiolite, Cyprus. Uranium-series dating of Pleistocene coral
Reference: Geology, vol.18, p. 894-897

Concerned area: Eastern Mediterranean, Cyprus
Formation(s) affected: Troodos ophiolite
Age of the deformation: Late Quaternary
Concerned structures:
Commentary: A total of 28 samples of *Cladocora caespisota* were collected at five localities from the 8-11 m high and < 3 m high marine terraces. The coral yield systematic ages of 185-192 ka, and 116-130 ka for the 8-11 m high and < 3 m high terraces, respectively. Southern Cyprus was uplifted by 18m during the past 185-192 ka, as a single tectonic entity. Of this uplift, 13 m took place between 130 and 185 ka (at ~24cm/ka), and a maximum of 6 m of uplift (at 5 cm/ka) took place over the past 116 ka, but with some evidence of coastal subsidence in more recent time. An exception, the extreme southeast of Cyprus (Cape Greco), was perhaps uplifted faster during the past 141 ka, at a rate of 12 cm/ka.
Stress field: uplift
Types of documents: Tectonic setting of Cyprus. Schematic sedimentary sections and location of sampling sites.



Tectonic setting of Cyprus in north-eastern Mediterranean showing relative motions along the Cyprus arc

N° File: 79

Authors: POOLE, ANDREW; ROBERTSON, A H F

Year: 1998

Title: Pleistocene Fanglomerate deposition related to uplift of the Troodos Ophiolite, Cyprus

Reference: Proceedings of the Ocean Drilling Program, Scientific Results, vol.160, pp.545-566

Concerned area: Eastern Mediterranean, Cyprus

Formation(s) affected: Fanglomerate

Age of the deformation: Pleistocene

Concerned structures:

Commentary:

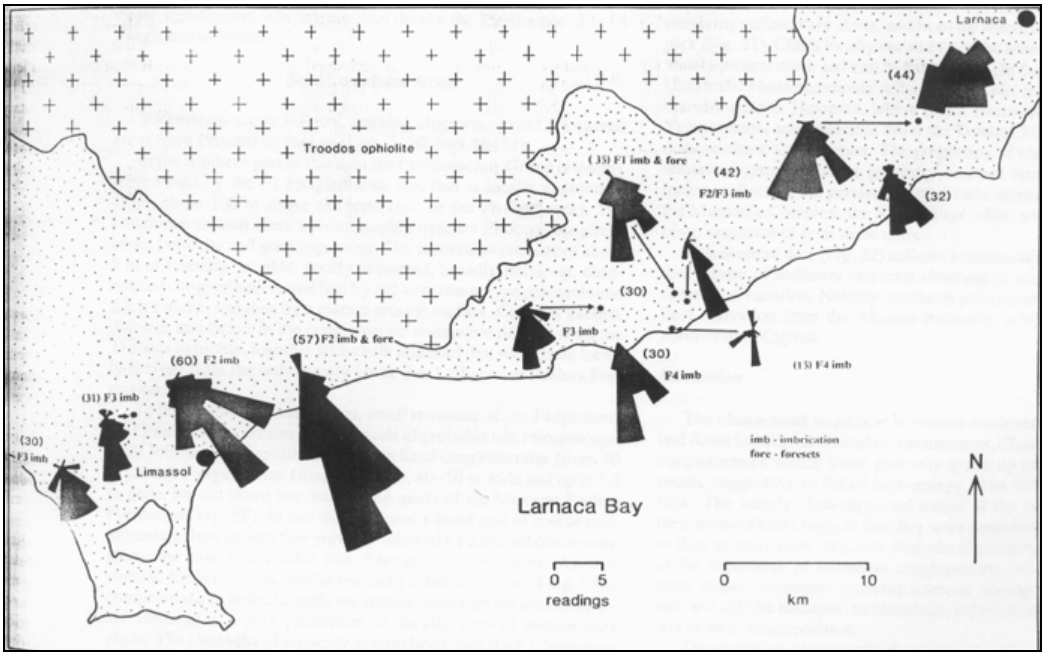
The principle variables that affected deposition of the Pleistocene Fanglomerate Group as a whole are tectonic uplift isostatic effects, glacio-eustatic sea-level change, short- and long-term climatic change, and lithology. However, the dominant control was tectonic uplift that apparently peaked during early and middle Pleistocene time. Aggradation of fluvial sediments took place at time of a relative sea-level high with associated terrace formation. This was followed by downcutting during periods of relative sea-level fall when surface uplift continued.

The dominant control on the younger units was glacio-eustatic sea-level change, during a time when littoral marine sediments accumulated, and rates of surface uplift may have decreased. Finally, the Holocene alluvial deposition was also affected by anthropogenic effects, notably deforestation.

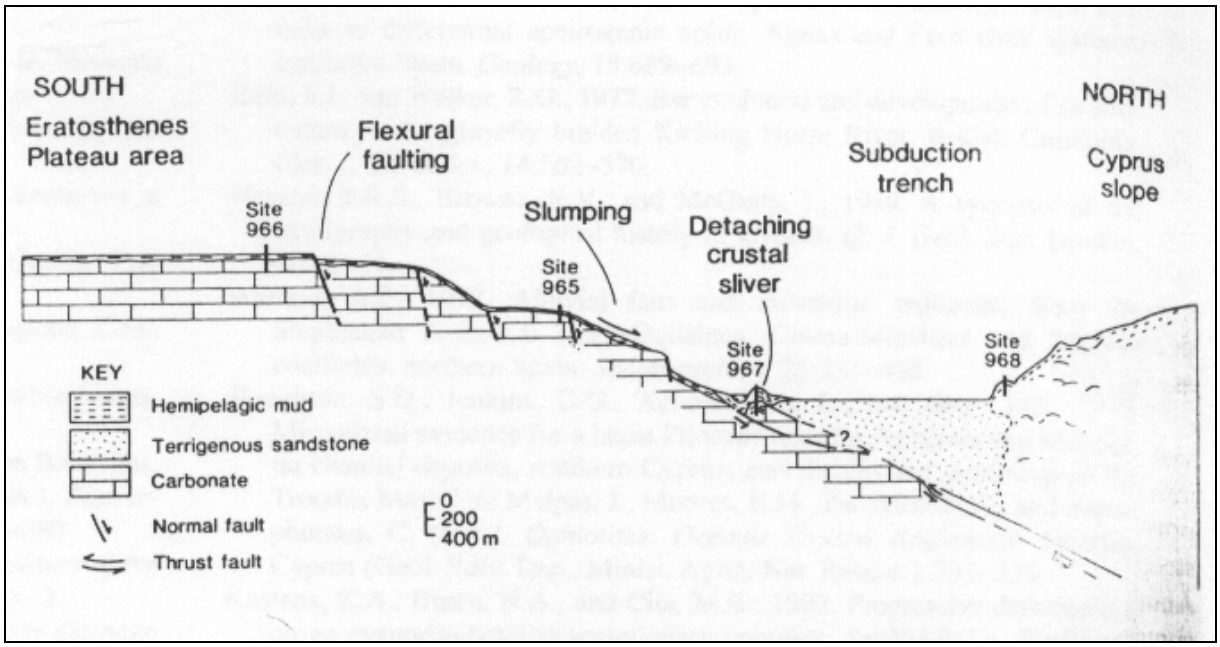
Stress field:

Types of documents:

Outline map of Cyprus showing the distribution of the Pleistocene units.
Present-day drainage of southern Cyprus.
Topographic profiles for coastal southern Cyprus.
Borehole data showing the approximate thickness of the Fanglomerate Group along the northern Troodos margin.
Facies of the Fanglomerate Group along the northern Troodos margin.
Field photographs.
Rose diagrams of paleocurrent data.



Paleocurrent data from the Fanglomerate Group along the southern coastal area of Cyprus



Sketch to show the relationship between the uplift of the Troodos massif and the collision of the Eratosthenes Seamount.

N° File: 80

Authors: RABINOWITZ, N; STEINBERG, D M

Year: 1998

Title: Aftershock decay of three recent strong earthquakes in the Levant

Reference: Bulletin of the Seismological Society of America, vol.88, no.6, pp.1580-1587

Concerned area: Eastern Mediterranean, gulf of Aqaba and Cyprus

Formation(s) affected:

Age of the deformation: Present day

Concerned structures:

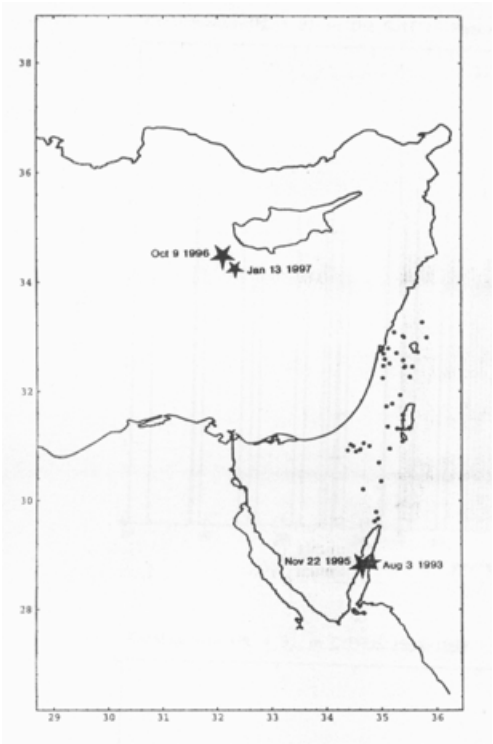
Commentary:

Aftershock sequences are studied from three recent strong earthquakes in the Levant: the Mw = 7.1 earthquake of the 22 November 1995 and the Ml = 5.8 earthquake of 3 August 1993, both in the Gulf of Aqaba, and the Mw = 6.8 earthquake of 9 October 1996 off the southwest coast of Cyprus. The modified Omori's law provides a good fit to the decay of aftershock activity for both events. The two sequences from the Gulf of Aqaba have rather low p values (0.90 in 1993 and 0.75 in 1995), reflecting slow decay of the aftershock activity. This may be attributed to law heat flow close to the epicentres. For the Cyprus sequence, the p value is 1.09, similar to that of many other sequences around the globe.

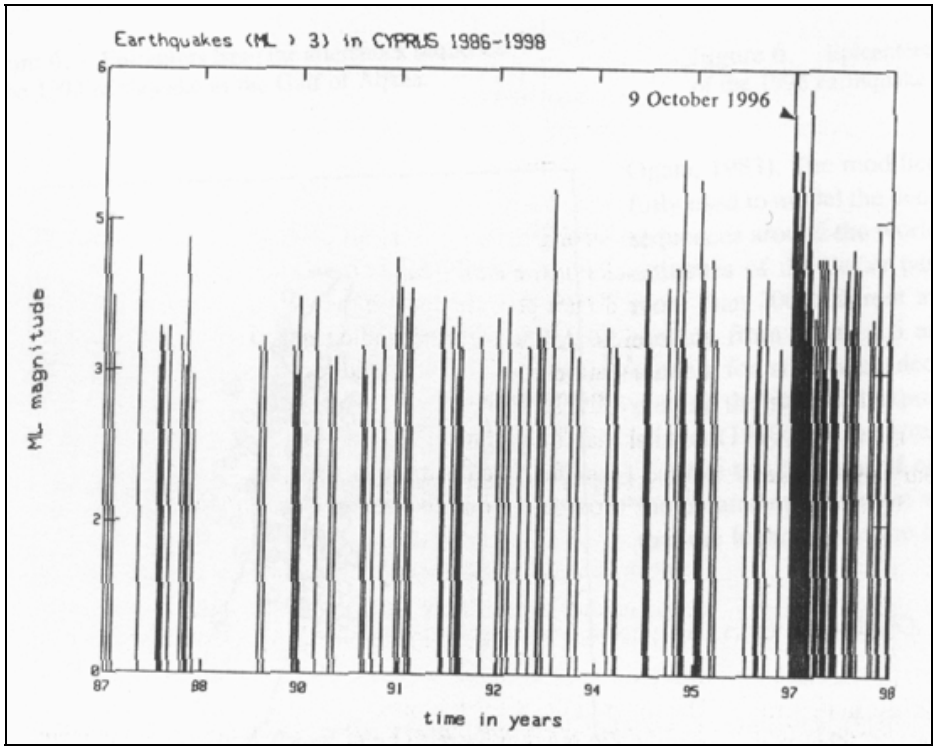
Stress field:

Types of documents:

Map of the region showing the epicentres of two major earthquakes near Cyprus.
Time line showing historical seismicity in the gulf of Aqaba and in Cyprus.
Epicentres from the aftershock sequence of the 1993 and the 1995 earthquakes in the Gulf of Aqaba.
Epicentres from the aftershock sequence of the 1996 earthquake off the coast of Cyprus.
Frequency-magnitude plots for aftershocks.
Interevent times versus adjusted time from the main shock for the three aftershock sequences.
Residual plots for the three aftershock sequences.



Map of the region showing the epicentres of two major earthquakes near Cyprus, the 1993 and 1995 earthquakes in the Gulf of Aqaba and the station locations of the Israeli Seismic Network

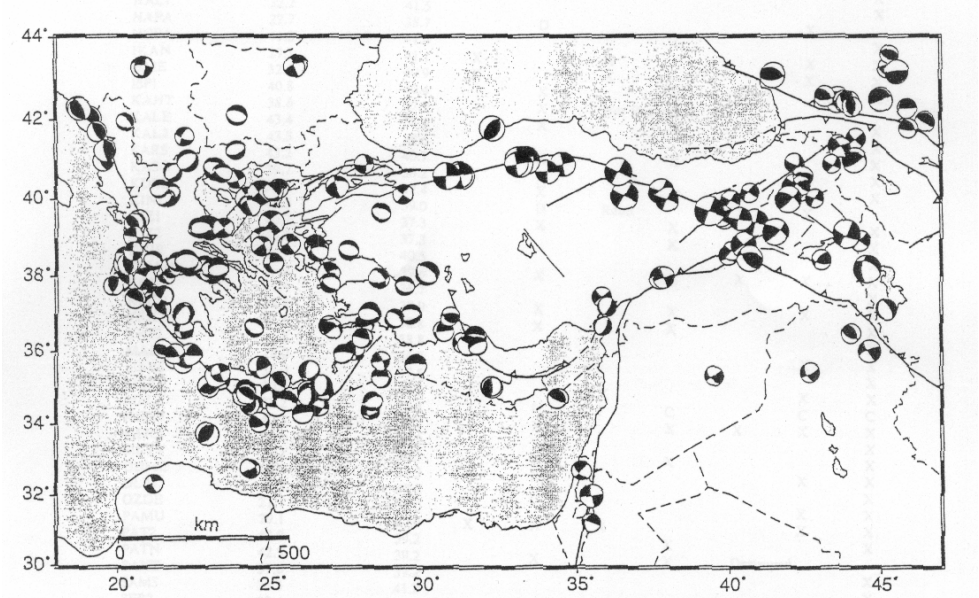


Time line showing historical seismicity (Ml>3) near Cyprus from January 1987 through March 1998

N° File: 81

Authors: REILINGER R.E., S.C. MCCLUSKY, M.B. ORAL, W. KING AND M.N. TOKSOZ
Year: 1997
Title: Global Positioning System measurements of present-day crustal movements in the Arabian-Africa-Eurasia plate collision zone
Reference: J. Geophys. Res., 102, 9983-9999

Concerned area: Eastern Mediterranean
Formation(s) affected:
Age of the deformation: Present day
Concerned structures: North Anatolian fault
Commentary: GPS measurements of crustal motions for the period 1988-1994 at 54 sites. Sites on the northern Arabian platform move N38 ± 13 W at 20 ± 3 mm/yr, roughly consistent with the velocity implied by NUVEL 1A circuit closure (N23 ± 7°W at 24 ± 2 mm/yr). The motion of Arabia appears to be transferred directly to the region of Turkey north of the suture. However, eastern Turkey is characterised by distributed deformation while central/western Turkey is characterized by coherent plate motion involving westward displacement and counterclockwise rotation of the Anatolian plate. Internal deformation within the central part of the Anatolian plate is less than 2 mm/yr. We derive a best fitting Euler vector for Anatolia-Eurasia motion of 29.2 ± 0.8°N, 32.9 ± 0.4°E, 1.3 ± 0.1°/m.y. The new Euler vector implies an upper bound for NAF slip rate of 30 ± 2 mm/yr. We determine an Arabia-Anatolia Euler vector of 31 ± 2°N, 45 ± 2°N, 0.9 ± 0.1 °/m.y. In addition to rotating with Anatolia, this region shows roughly N-S extension at a rate of 14 ± 5 mm/yr. The contemporary pattern of deformation indicates increasing motions toward the arc, suggesting that the westward displacement and counterclokwise rotation of Anatolia is driven both by “pushing” from the Arabian plate and by “pulling” or basal drag associated with the foundering African plate along the Hellenic subduction zone.
Stress field: right lateral strike-slip North Anatolian fault (NAF)
Types of documents: Simplified tectonic map of the Eastern Mediterranean region. Focal mechanism for major earthquakes in the Eastern Mediterranean region. Global Positioning System and satellite laser ranging horizontal velocities and their 95% confidence ellipses in a Eurasia- fixed reference frame for the period 1988-1994.



Focal mechanisms (lower hemisphere projection) for major earthquakes in the eastern Mediterranean region

N° File: 82

Authors: RIHM, R; ROSENKRANZ, C; STAECKER, J; EGLOFF, F; MAKRIS, J; KRAMVIS, S
Year: 1999
Title: Monitoring seismicity with an onshore/offshore seismic array
Reference: European Union of Geosciences EUG 10 - Journal of Conference Abstracts, vol.4, no.1, pp.760

Concerned area: Eastern Mediterranean
Formation(s) affected:
Age of the deformation:
Concerned structures:
Commentary: A large campaign has been performed in Cyprus. Since 1994 ten local on-/offshore arrays of 10-40 units operated over 2 - 3 months periods. Instrument spacing was 3 – 8 km resulting in a coverage of 300 - 1800 km^2. Hundred of events magnitudes between 0.7 and 6.8 (Paphos earthquake 9 Oct. 1996) were recorded and their hypocenters were located, allowing definition of several active faults and estimation of the seismic risk of the region.
Stress field:
Types of documents: Abstract

N° File: 83

Authors: ROBERTSON A.H.F, XENOPHONTOS C.

Year: 1993

Title: Development of concepts concerning the Troodos ophiolite and adjacent units in Cyprus

Reference: . From Prichard, H.M., Alabaster, T., Harris, N.B.W. & Neary, C.R. (eds), Magmatic Processes and Plate Tectonics, Geological Society Special Publication No. 76, pp. 85-119

Concerned area: Cyprus, Eastern Mediterranean

Formation(s) affected:

Age of the deformation:

Concerned structures: Troodos ophiolite, Mammonia Complex, Kyrenia Range

Commentary:

Different models of formation of the Troodos ophiolite and adjacent units in Cyprus are discussed since the classic geosynclinal interpretations to a more recent concept based on Plate Tectonics. Certain information concerns the sense of motion on the South Troodos transform structure (Arakapas fault zone).

Up to 1990, a popular view of the Troodos was that it had been formed above a northward-dipping subduction zone during the earlier stages of convergence within an oceanic basin. Its origin is as a marginal basin formed by spreading above a southward-dipping subduction zone is also favoured.

In whatever scenario, it is generally accepted that the spreading fabric was unstable and fed by small, multiple magma chambers. The extension outpaced magma supply and therefore favoured extensional detachment faulting, mainly near the base of the sheeted dykes. The Troodos lithosphere was also bounded an oceanic fracture zone to the present south. Studies of the Late Cretaceous-Recent sediment cover have documented deep-sea sedimentation and later uplift, related to the Africa-Eurasia convergence.

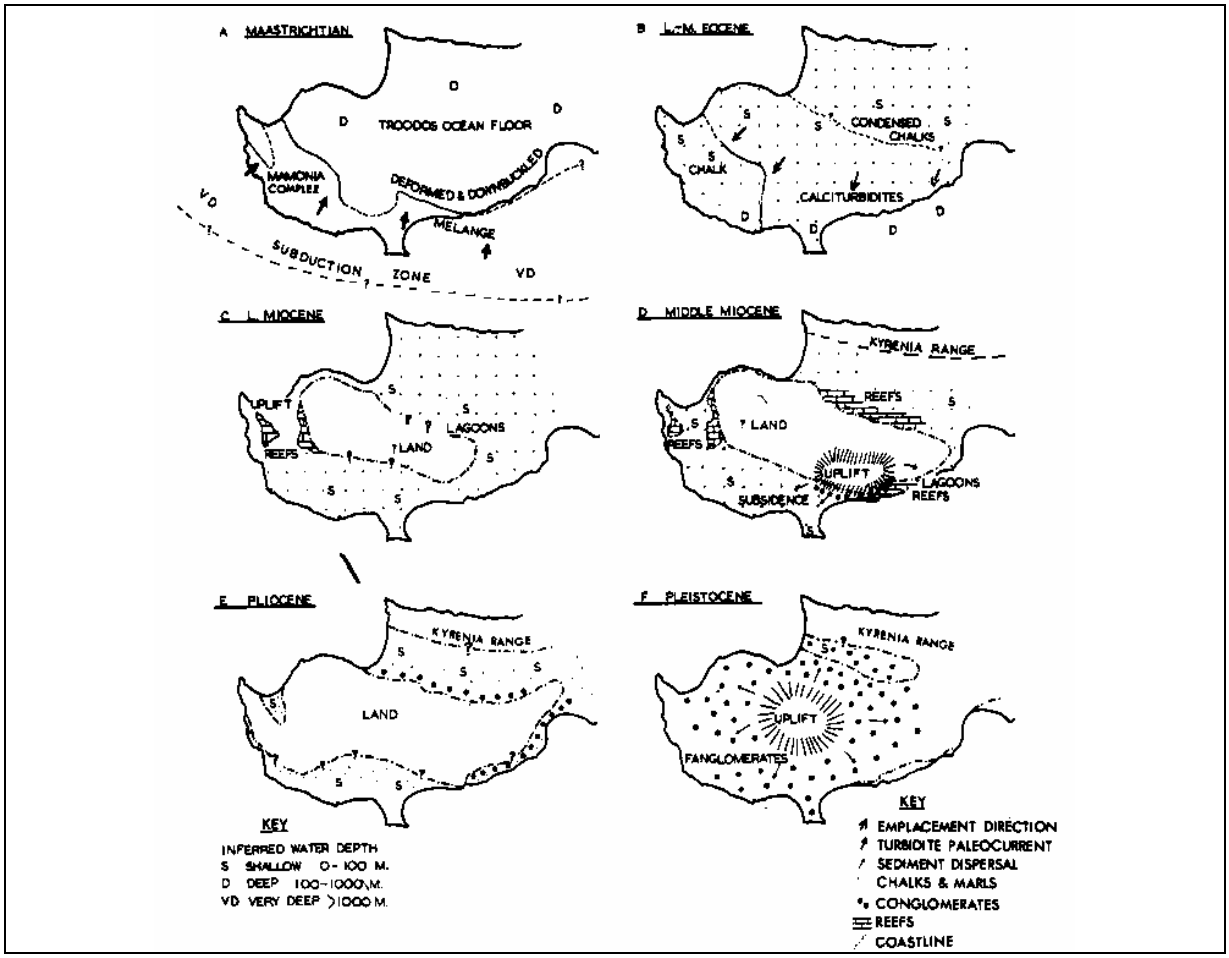
The evidence from adjacent areas suggests that Troodos represents one of a number of small ocean basins, formed by the rifting of the north margin of Gondwana, initially during the Triassic. The summary of the paleogeographic evolution of Cyprus is presented (Fig. 11). More recent work suggests the uplift took place above a N-dipping subduction/collision zone. The continental fragments were later reassembled by collision during Late Mesozoic – Early Tertiary time (Robertson et al. 1991a). The history of Cyprus can be divided into three main phases:

1. Triassic-Jurassic rifting and spreading to form a small ocean basin in the Cyprus area, bordered by passive margins. This history is documented by the evidence in the Mamonia Complex.
2. The Troodos ophiolite was formed during the Late Creataceous-Early Tertiary period and then deformed and tectonically juxtaposed with the Mamonia Complex in SW Cyprus. The Kyrenia Range was emplaced to near its present position in the Late Eocene (Baroz 1980; Robertson & Woodcock 1986).
3. Finally, there is the third, essentially neotectonic phase, dominated by northword underthrusting of the African plate beneath Cyprus.

New data sources about the South Troodos Transform Fault Zone are indicated. A comprehensive review of all relevant information and interpretations of the South Troodos Transform Fault Zone is given by MacLeod & Murton (1993).

Bramlay Murton argued that the trend of the dykes and the structural fabrics, mainly in serpentinites, indicates left-lateral (sinistral) slip (Murton 1986a). However, paleomagnetic studies in particular suggested the opposite, right-lateral sense of displacement. Tristan Club (1985) palaeomagnetically sampled sediments within the transform and identified large-scale relative clockwise rotation, suggestive of right-lateral (dextral) shear (Clube & Robertson 1986). The paleomagnetic study of dykes of the Arakapas Fault gave a similar result (Bonhommet et al. 1988). Now, based on the re-evaluation of the structural and paleomagnetic evidence, Chris MacLeod and Bramley Murton conclude in favour of the dextral strike-slip model.

Types of documents:



Summary of the paleogeographic evolution of Cyprus, as envisaged in the 1970s (from Robertson, 1977)

N° File: 84

Authors: ROBERTSON, A.H.F.

Year: 2000

Title: Tectonic evolution of Cyprus in its easternmost Mediterranean setting

Reference: Proceedings - ... International Conference on the Geology of the Eastern Mediterranean, vol. 3, pp.11-44

Concerned area: Eastern Mediterranean, Cyprus

Formation(s) affected:

Age of the deformation: Triassic to present day

Concerned structures:

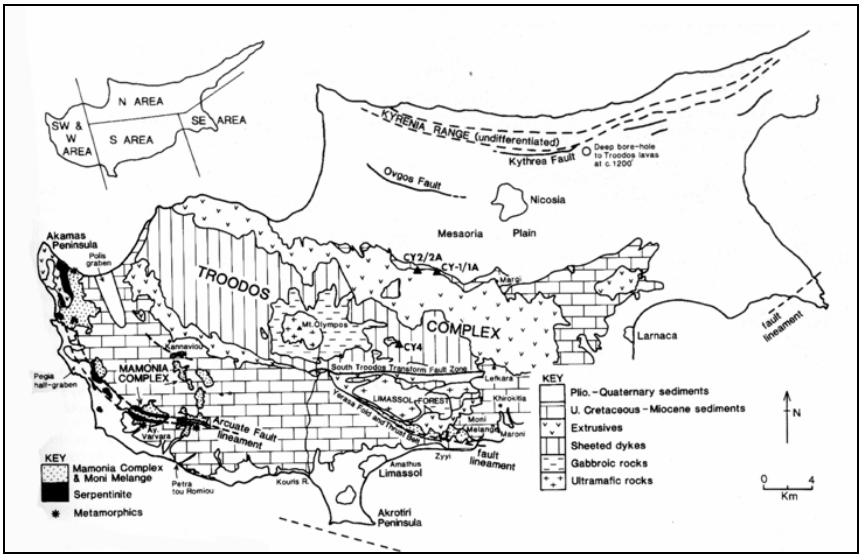
Commentary:

The oldest preserved units in Cyprus relate to Triassic rifting of a southerly strand of Neotethys to form a small Read-Sea type ocean basin, bordered by subsiding passive margins. Part of the neighbouring carbonate platform is found in the Kyrenia range, N Cyprus, whereas deformed base-of-slope and oceanic units are preserved in the Mamonia Complex, W and SW Cyprus. The Troodos ophiolite was created in the late Cretaceous, probably by spreading above a northward-dipping subduction zone within the southerly Neotethys oceanic basin, offset by dextral? transform fault. The Troodos and Mamonia Complex (also the Moni Melange, S Cyprus) were sutured by a combination of thrusting and strike-slip during the Campanian, coeval with partial paleorotation of the Troodos microplate. In N Cyprus, the Kyrenia Range was initially deformed prior to Maastrichtian time, when the area was blanketed carbonate intercalated with bimodal volcanics of rift or transtentional origin. During the Eocene, further northward subduction culminated in southward thrusting of the Kyrenia Range. Subduction then jumped southwards initiating the present subduction zone south of Cyprus in the Miocene. Extensional basins formed onshore and offshore in the late Miocene, probably related to subduction “roll-back”. Northward subduction continued during Pliocene time, until arrival of the Eratosthenes Seamount, a continental fragment that had rifted from North Africa during Early Mesozoic time. Collision, combined with serpentinite diapirism, gave rise to focused uplift of the Troodos ophiolite. Collision also influenced coeval uplift of the Kyrenian range. Away from the collision zone regional basins continue to be extensional, including the Polis graben and the Pegia half-graben onshore, and the Antalaya and Cilicia basins, offshore.

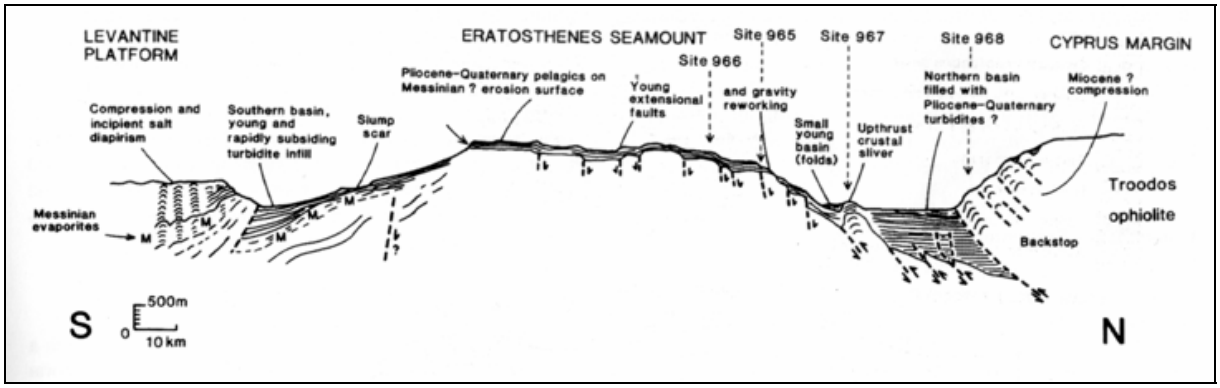
Stress field:

Types of documents:

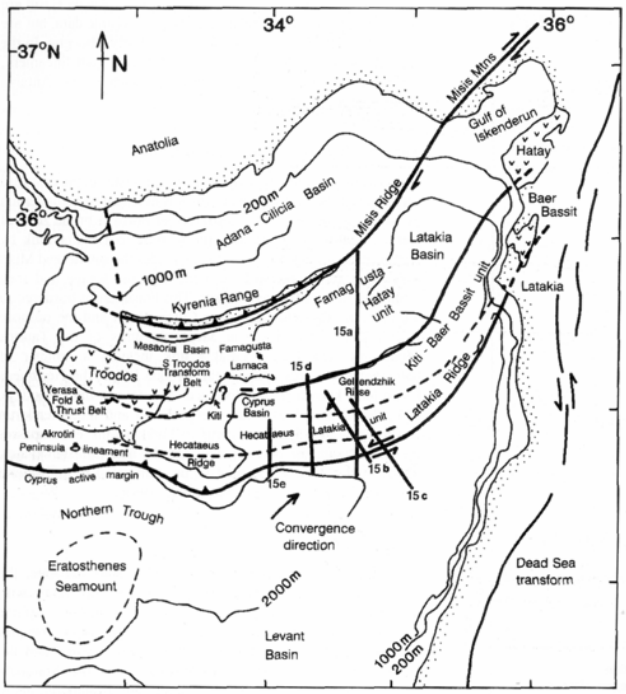
Outline tectonic map of the easternmost Mediterranean showing the main tectonic features.
Outline tectonic map of the easternmost Mediterranean area extending from SW Cyprus to south Turkey.
Outline bathymetric and geologic map of part of the easternmost Mediterranean area.
Outline tectonic map of Cyprus.
Reconstruction of the Mamonia Complex, SW Cyprus.
Sketches to show the possible tectonic development of the Mamonia complex.
Map of Miocene-Holocene main fault and sedimentation patterns in western Cyprus.
Paleogeographical sketches of the Early Tertiary to Quaternary evolution of Cyprus.
Sketch of the main features of the Eratosthenes Seamount.
Outline geological map of the central part of the Kyrenia Range.
Summary of tectonostratigraphy of the Kyrenian Range.
Tectonic map showing the main features of the Cyprus-Latakia link zone and areas to the north and south.
Interpretative line drawing based on seismic profiles across part of the Cyprus Latakia link zone.
Map of the main tectonic lineament in the north easternmost corner of the Mediterranean area.
Reconstructions from the late Triassic-Early Jurassic to the late Pliocene-Pleistocene time.



Outline tectonic map of Cyprus



Sketch of the main features of the Eratosthenes Seamount, as determined during the site survey cruise for ODP Leg 160



Tectonic map showing the main features of the Cyprus-Latakia link zone and areas to the north and south

N° File: 85

Authors: ROBERTSON, A.H.F.

Year: 1998

Title: Formation and destruction of the Eratosthenes seamount, eastern Mediterranean sea, and implications for collisionnal processes.

Reference: Proceedings of the Ocean Drilling Program, Scientific Results, Vol 160, pp.681-699.

Concerned area: Eastern Mediterranean, Eratosthenes seamount

Formation(s) affected:

Age of the deformation: Miocene, Pliocene, Pleistocene

Concerned structures:

Commentary:
Interpretation of site-survey seismic data suggests that the base of the northern slope of the Eratosthenes seamount is in the processes of detachment to form an allochtonous thrust slice, with implications for the formation of on-land melange terrains. The break-up of the Eratosthenes seamount was achieve by loading-related flexural subsidence, accompanied by high-angle normal faulting, which may have exploited pre-existing structural weaknesses. Subsidence of the Eratosthenes seamount was synchronous with rapid surface uplift of the over-riding plate, represented by the late Pliocene-mid-Pleistocene uplift of the Troodos ophiolite and its sedimentary cover. The flexural and isostatic effects of sediment loading and flooding of the Mediterranean Sea after the Messinian also influenced subsidence of the Eratosthenes seamount, to some extent. The ultimate fate of the Eratosthenes seamount is likely to be preservation as allochtonous slices, mainly limestone, within a subduction-accretion complex, forming part of a collisional suture zone.

Stress field:

Types of documents:
Outline map of the easternmost Mediterranean region.
Summary of the successions recovered from the Eratosthenes Seamount and the lower slope south of Cyprus.
Alternative models to explain the Miocene uplift of the Eratosthenes seamount.
Role of Miocene deformation in southern Cyprus.
Single channel seismic profile.
Alternative interpretations of emplacement of the Troodos ophiolite.
Plate tectonic model for the evolution of the Eratosthenes Seamount in relation to Cyprus.

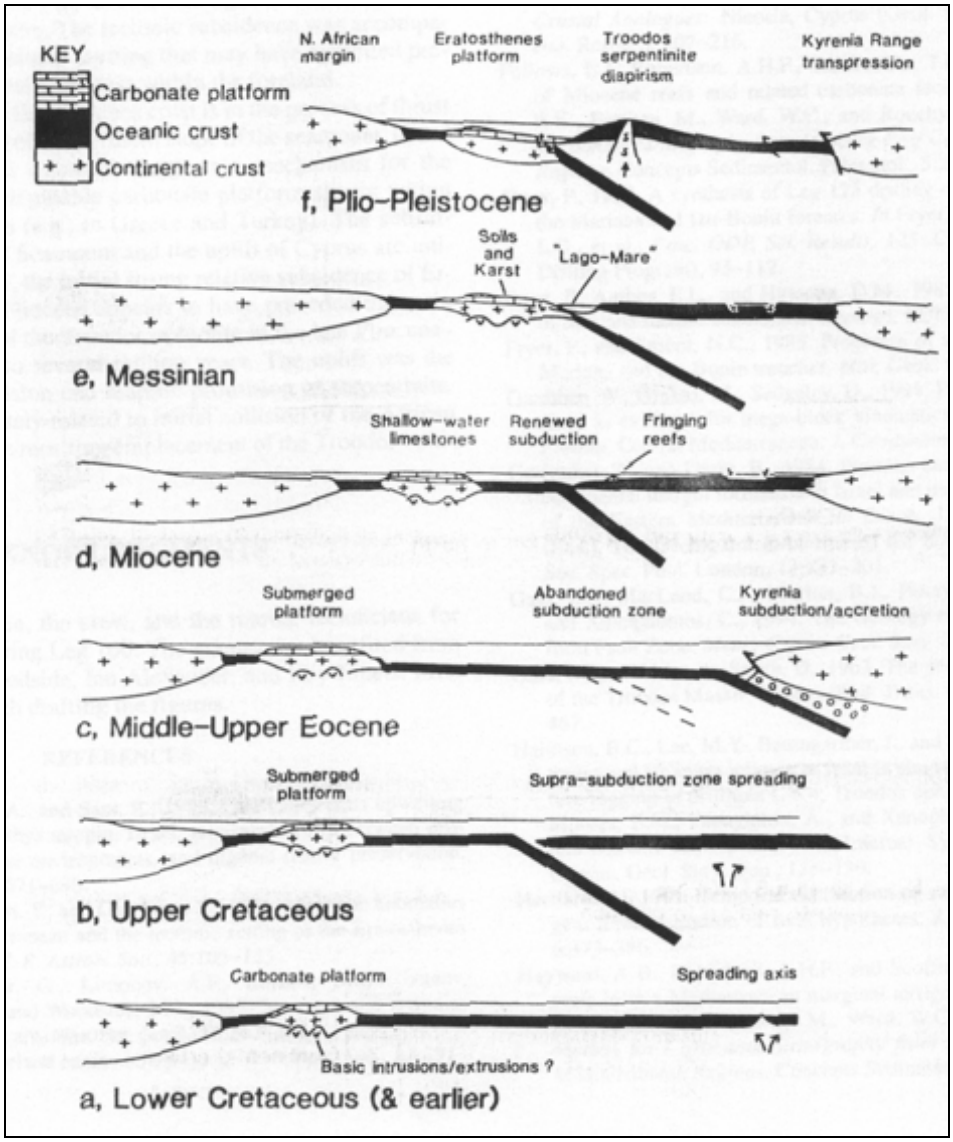
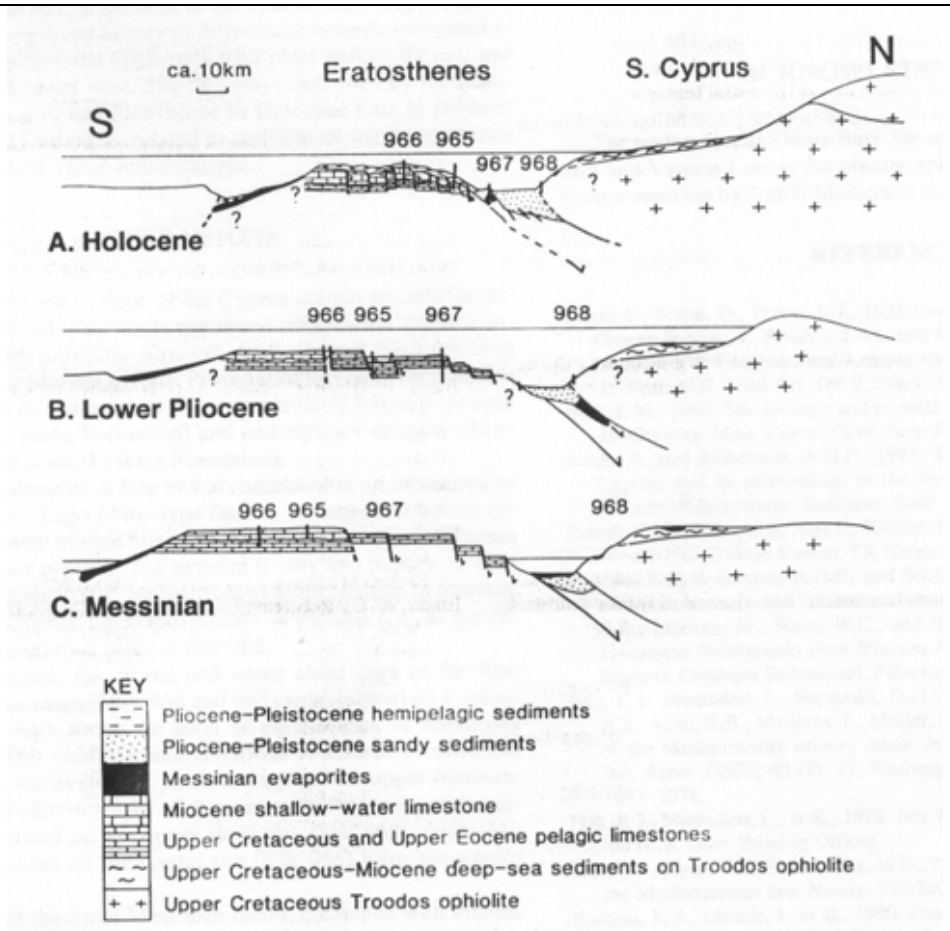


Plate tectonic model for the evolution of the Eratosthenes Seamount in relation to Cyprus.

N° File: 86

Authors: ROBERTSON, A.H.F.
Year: 1998
Title: Late Miocene paleoenvironments and tectonic setting of the southern margin of Cyprus and the Eratosthenes Seamount
Reference: Proceedings of the Ocean Drilling Program, Scientific Results, vol.160, pp.453-463

Concerned area: Eastern Mediterranean, Cyprus, Eratosthenes Seamount
Formation(s) affected:
Age of the deformation:
Concerned structures:
Commentary: Overall, the late Miocene-early Pliocene paleoenvironments document the subduction and initial states of break-up of the Eratosthenes Seamount as it began to collide with Cyprus active margin to the north.
Stress field:
Types of documents: Tectonic setting of the Eratosthenes seamount. Outline map showing the Eratosthenes Seamount in relation to the onshore geology of southern Cyprus. Inferred paleoenvironments and tectonic evolution of the Eratosthenes Seamount in relation to southern Cyprus.

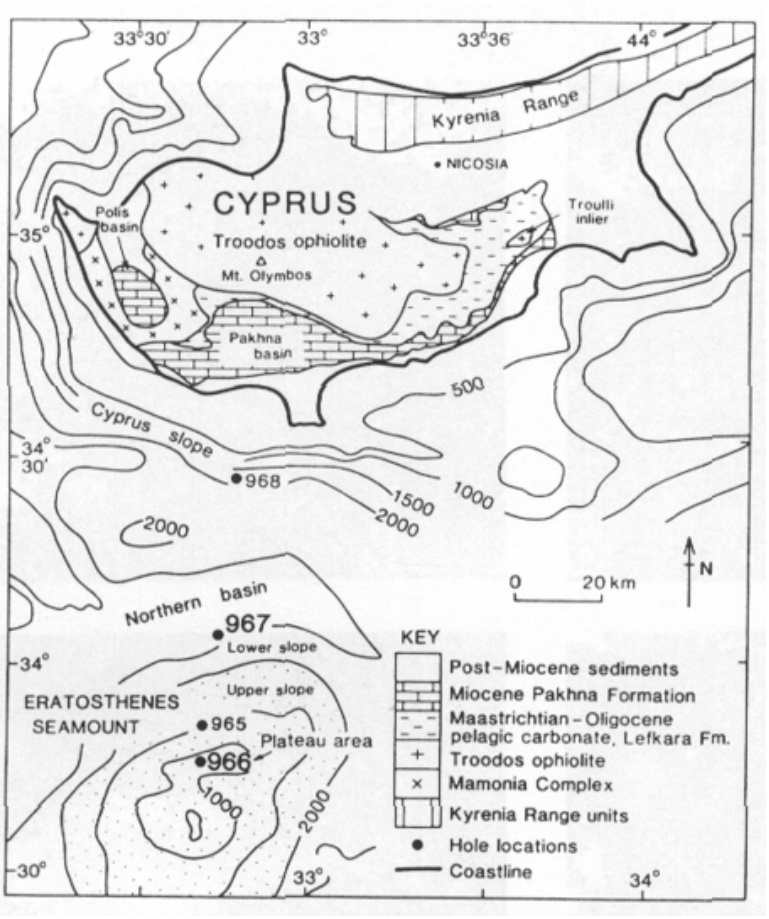


Inferred paleoenvironments and tectonic evolution of the Eratosthenes Seamount in relation to southern Cyprus

N° File: 87

Authors: ROBERTSON, A.H.F.
Year: 1998
Title: Lithofacies evidence for the Cretaceous-Paleogene sedimentary history of Eratosthenes Seamount, eastern Mediterranean, in its regional tectonic context (sites 966 and 967)
Reference: Proceedings of the Ocean Drilling Program, Scientific Results, vol.160, pp.403-417, Aug 1998

Concerned area: Eastern Mediterranean, Eratosthenes Seamount
Formation(s) affected:
Age of the deformation:
Concerned structures:
Commentary: Overall, Cretaceous and Paleogene carbonates of Eratosthenes are consistent with accumulation on an initially shallow, then submerged, carbonate platform isolated within a southern branch of the Neotethyan ocean, adjacent to the North African continental margin.
Stress field:
Types of documents: Geological map of Eratosthenes Seamount. Summary logs of stratigraphic successions in the Levant, the Eratosthenes Seamount, southern Cyprus and southern Turkey. Depositional model for the Late Cretaceous and middle Eocene successions on the Eratosthenes Seamount. Paleogeographical sketch maps of the Easternmost Mediterranean.



Geological map of Eratosthenes Seamount showing location of sites 966 and 967, in relation to Cyprus

N° File: 88

Authors: ROBERTSON, A.H.F.

Year: 1998

Title: Significance of lower Pliocene mass-flow deposits for the timing and process of collision of the Eratosthenes Seamount with the Cyprus active margin

Reference: Proceedings of the Ocean Drilling Program, Scientific Results, vol.160, pp.465-481

Concerned area: Eastern Mediterranean, Eratosthenes Seamount, Cyprus

Formation(s) affected: lower Pliocene mass-flow

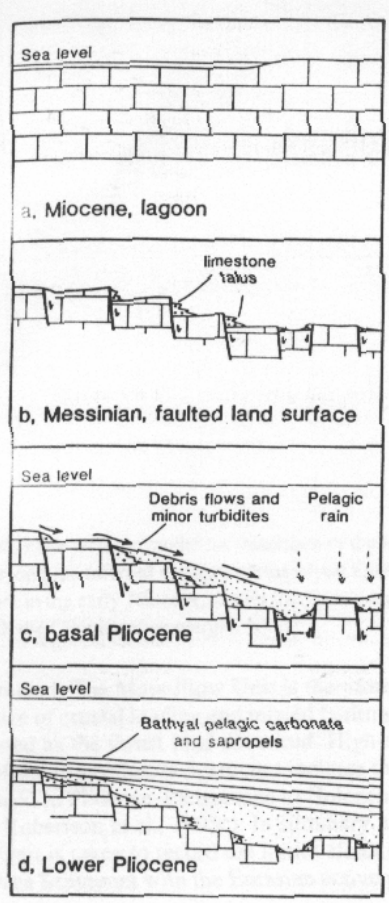
Age of the deformation:

Concerned structures:

Commentary:
Formation of the Mass-Flow Unit is interpreted to relate to the initial stages of collision of the Eratosthenes Seamount with the Cyprus active margin to the north. In this interpretation, the Eratosthenes Seamount was flexuraly loaded by the advancing plate and underwent initial block faulting, followed by collapse and subsidence.

Stress field:

Types of documents:
Location of sites 965 and 966 on the Eratosthenes Seamount in relation to the geology of southern Cyprus.
Summary of the cored intervals of the lower Pliocene mass-flow unit at site 966.
Log of lower Pliocene carbonate debris flows along the northern margin of the Troodos ophiolite (Mesaoria sub-basin).
Paleogeographical sketch maps of the Polis graben area of western Cyprus.
Fault related genesis of the Mass-Flow Unit.



Fault-related genesis of the Mass-Flow Unit

N° File: 89

Authors: ROBERTSON, A.H.F.

Year: 1998

Title: Tectonic significance of the Eratosthenes Seamount; a continental fragment in the process of collision with a subduction zone in the eastern Mediterranean (Ocean Drilling Program Leg 160)

Reference: Tectonophysics, vol.298, no.1-3, pp.63-82, 30 Nov 1998

Concerned area: Eastern Mediterranean, Eratosthenes Seamount

Formation(s) affected:

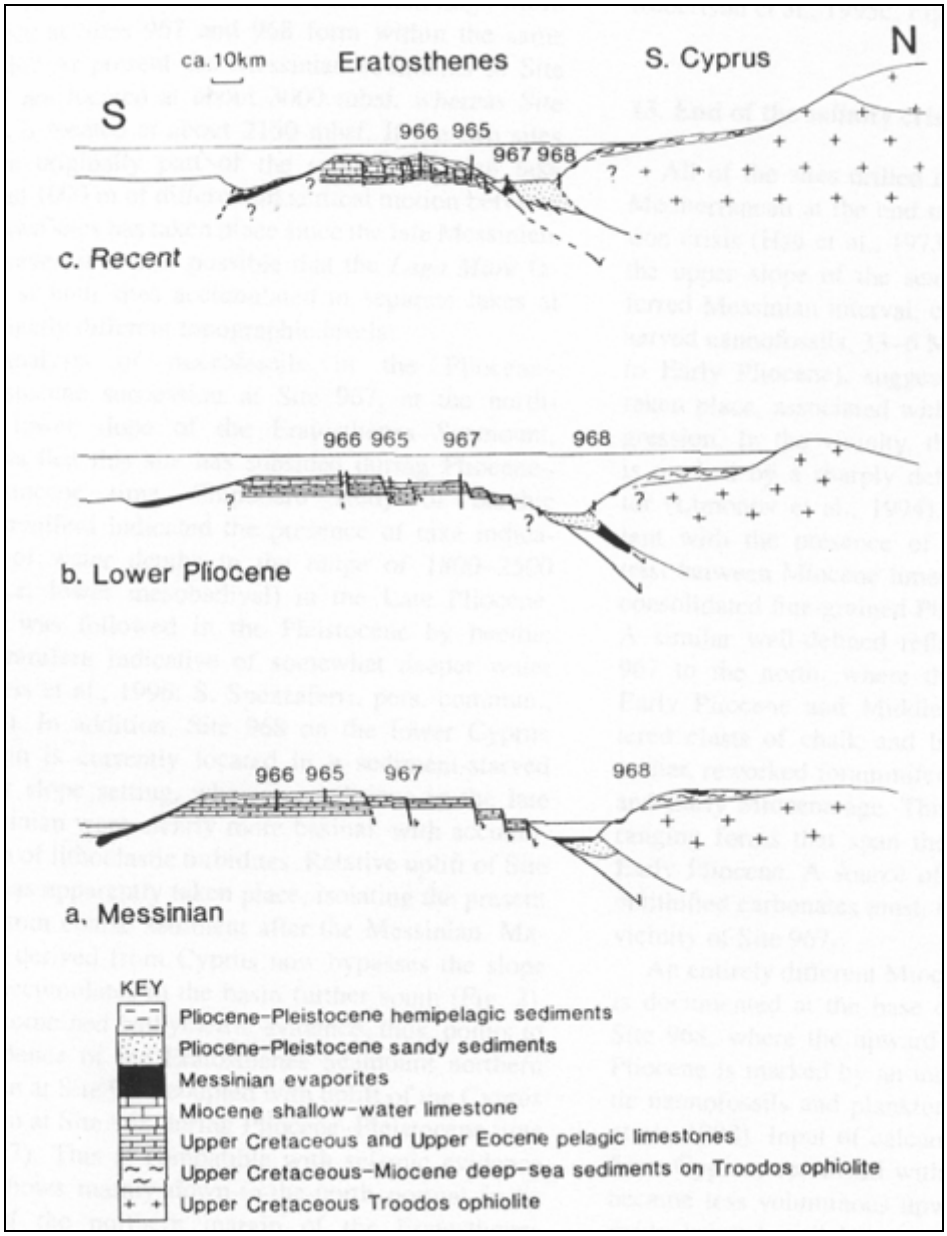
Age of the deformation:

Concerned structures:

Commentary:
Tectonic uplift (approximately 1 km) was followed by shallow-water carbonate deposition in the Early Miocene. The platform was exposed during the Messinian desiccation crisis. During the Early Pliocene the platform subsided to bathyal depths associated with localised accumulation of limestone debris flows. Subsidence accelerated in the Late Pliocene-early Pleistocene, reaching a present day maximum depth of ca. 2500 m. Deformation of the Eratosthenes Seamount resulted from crustal flexure, induced by southward overthrusting of the Cyprus active margin. Tectonic subsidence of the Eratosthenes Seamount was approximately synchronous with rapid surface uplift of the over-riding place, the Troodos Ophiolite of southern Cyprus. This uplift is explained in terms of incipient collision of an Eratosthenes continental fragment with a subduction trench, coupled with the effects of diapiric protrusion of serpentinite located within the core of the Troodos Ophiolite. The Eratosthenes drilling, thus, documented a modern analogue of subduction/collisional processes leading to accretion of continental fragments and carbonate platforms in orogenic belts.

Stress field:

Types of documents:
Outline map of the easternmost Mediterranean region.
Tectonic interpretation of the present-day setting of the Eratosthenes Seamount.
Summary of the successions recovered from the Eratosthenes Seamount and the lower slope south of Cyprus.
Interpretation of the paleotectonic and paleogeographical setting of the Eratosthenes Seamount during Cretaceous and early Tertiary time.
Interpretation of the Messinian, Pliocene and Quaternary-Recent tectonic evolution of the Eratosthenes Seamount showing progressive stages of collision with the Cyprus margin to the north.
Detail of N-S seismic profile in the vicinity of site 967.
Alternative tectonic model for the emplacement of the Troodos ophiolite.
Plate tectonic model for the evolution of the Eratosthenes Seamount in relation to Cyprus.



Interpretation of the Messinian, Pliocene and Quaternary-Recent tectonic evolution of the Eratosthenes Seamount showing progressive stages of collision with the Cyprus margin to the north

N° File: 90

Authors: ROBERTSON, A H F; KIDD, R B; IVANOV, M K; LIMONOV, A F; WOODSIDE, J M; GALINDO-ZALDIVAR, J; NIETO, L
Year: 1994
Title: Probing continental collision in the Mediterranean Sea
Reference: Eos, Transactions, American Geophysical Union, vol.75, no.21, pp.233, 239

Concerned area: Eastern Mediterranean, Eratosthenes Seamount
Formation(s) affected:
Age of the deformation: Present day
Concerned structures:
Commentary: Effect of continental collision in the easternmost Mediterranean include the Quaternary uplift of Cyprus and the break up and subsidence of the Eratosthenes Seamount. The final results of continental collision are clearly visible as mountain belts, but because the early stages of collision often take place below sea level, they are more difficult to observe. The Indonesian and eastern Mediterranean regions are in the early stages of collision, while beneath the Mediterranean Sea, the African and Eurasian plate are inexorably converging. The Eratosthenes Seamount is far from being a “dead structure”. Instead it is being thrust beneath Cyprus, and this has probably activated the Quaternary uplift of the island. At the same time, it is being down-buckled beneath the Levantine Basin to the south. The seamount thus appears to be in the “jaws of a vice” created by Africa-Eurasia convergence.
Stress field:
Types of documents: Abstract

N° File: 91

Authors: ROBERTSON, A H F; KIDD, R B; IVANOV, M K; LIMONOV, A F; WOODSIDE, J M; GALINDO-ZALDIVAR, J; NIETO, L

Year: 1995

Title: Eratosthenes Seamount; collisional processes in the easternmost Mediterranean in relation to the Plio-Quaternary uplift of southern Cyprus

Reference: Terra Nova, vol.7, no.2, pp.254-264

Concerned area: Eastern Mediterranean, Eratosthenes Seamount

Formation(s) affected:

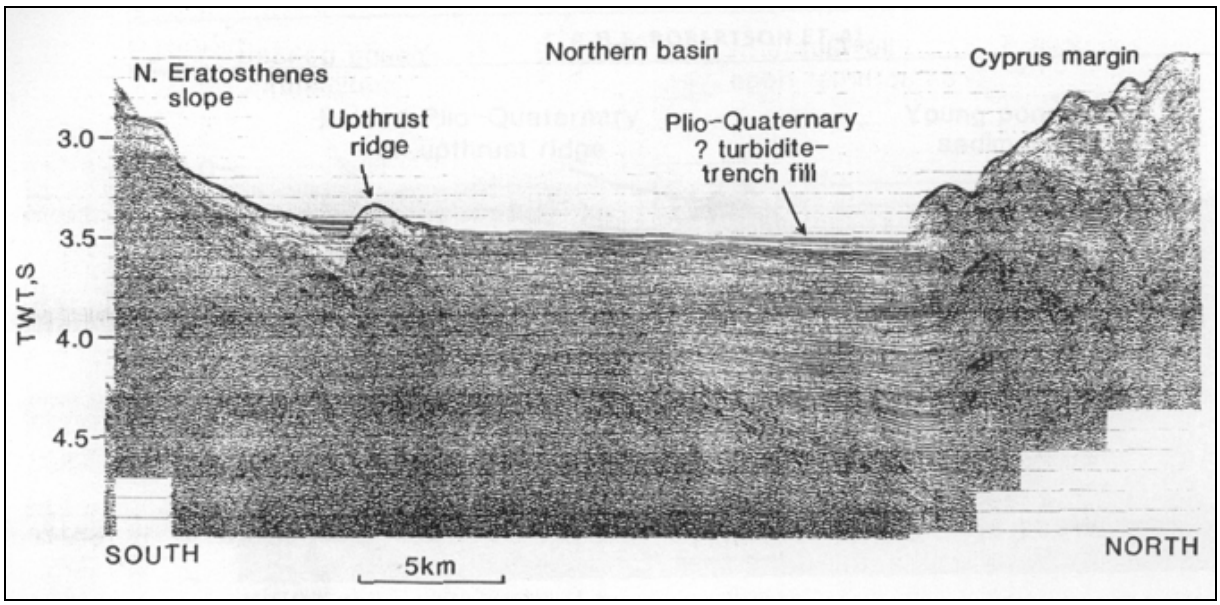
Age of the deformation: Messinian, late Pliocene-mid Quaternary

Concerned structures:

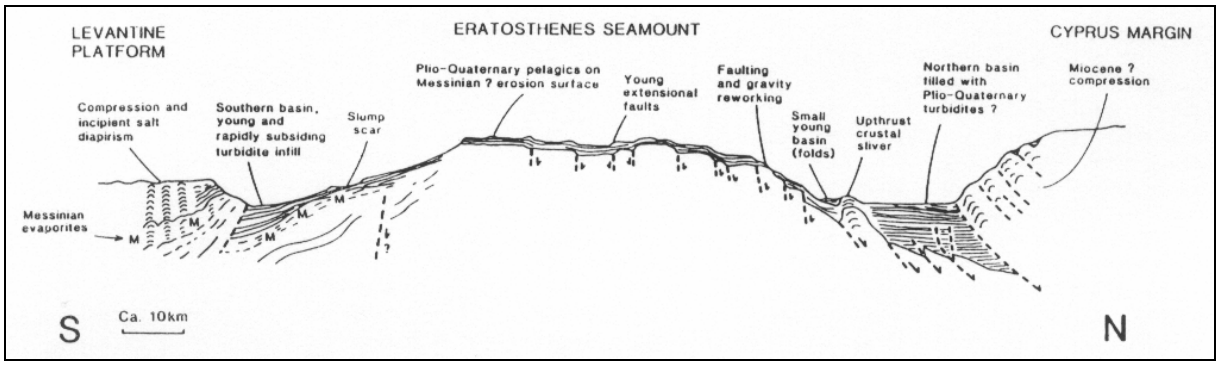
Commentary:
The Eratosthenes Seamount is in the process of actively subsiding, breaking-up and being thrust, beneath both Cyprus to the north and the Levantine Basin to the south. Northwards thrusting appears to post-date the Messinian, when evaporates accumulated around the lower flanks of a pre-existing seamount feature. Comparison with the geology of southern Cyprus and offshore areas suggests a causative link between northward underthrusting of the Eratosthenes Seamount and late Pliocene-mid Quaternary uplift of southern Cyprus, focused on the centre of the Troodos ophiolite.

Stress field:

Types of documents:
Bathymetric map of the Eratosthenes Seamount.
Airgun seismic profiles.
MAK-1 high resolution profiles.



N-S airgun seismic profile from the Cyprus southern margin to the northern slopes of the Eratosthenes Seamount across the northern basin

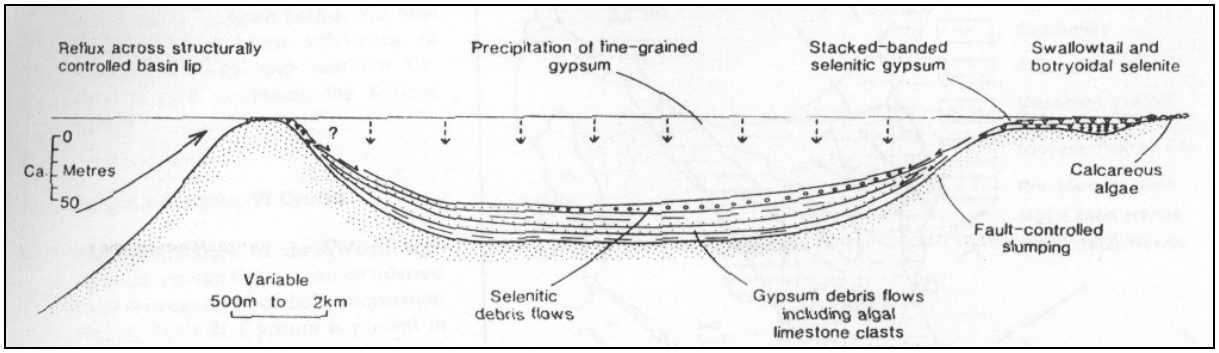


Interpretation of the N-S seismic profile in the light of evidence from other lines, showing the Eratosthenes Seamount in the process of being underthrust beneath the Cyprus margin to the north and also downwarped beneath the Levantine Basin to the south

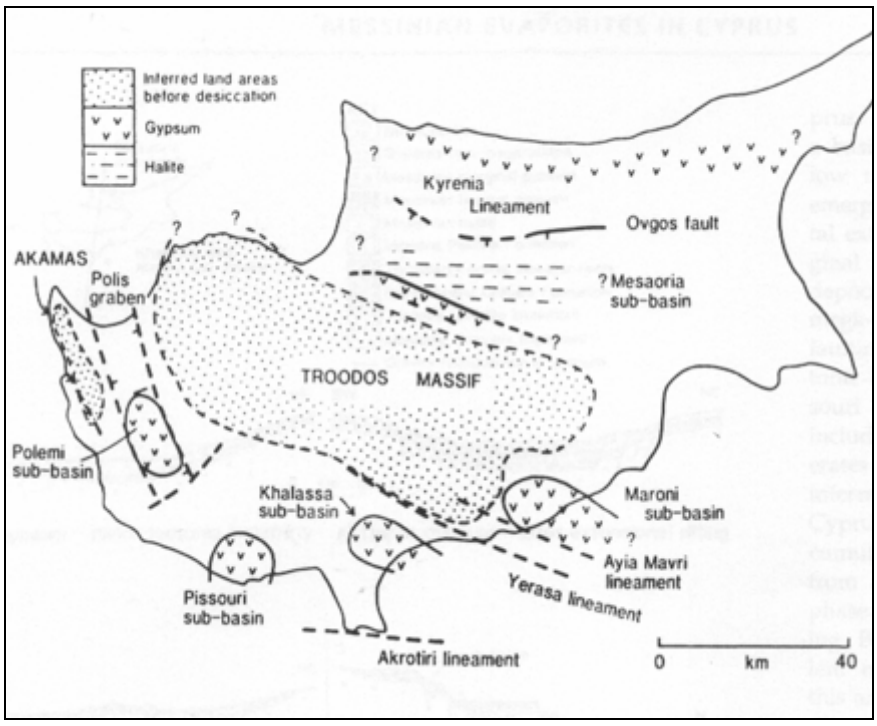
N° File: 92

Authors: ROBERTSON, A.H.F., EATON, S., FOLLOWS, E.J., AND PAYNE, A.S.
Year: 1995
Title: Depositional processes and basin analysis of Messinian evaporites in Cyprus
Reference: Terra Nova, 7: 233-254

Concerned area: Eastern Mediterranean, Cyprus
Formation(s) affected: Messinian evaporites
Age of the deformation:
Concerned structures:
Commentary: Messinian evaporites in Cyprus resulted from the interplay of Mediterranean-wide and eustatic sea-level changes and local tectonics, in an inferred above-subduction zone setting. In the sub-basin of west, south-west and south Cyprus, large-scale slumping of marginal gypsum facies took place towards depocentres (to form megarudite debris flows), triggered by one or several phases of extensional faulting.
Stress field: Extensional faulting.
Types of documents: Inferred plate tectonic setting of Cyprus during the Messinian. Simple facies model showing inferred processes of primary gypsum deposition in Cyprus. Outline map and cross-section showing the distribution of Messinian evaporates in the Polemi sub-basin of W Cyprus. Measured logs of gypsum successions in the Polemi sub-basin Field photographs. Outline geological map of the evaporites in the Maroni sub-basin. Geological map, cross-section and measured log of Messinian gypsum in the Mesaoria sub-basin. Reconstructed paleogeography of the Troodos Massif and adjacent evaporitic basins in the Messinian. Summary of the tectonic settings of Messinian evaporite deposition in Cyprus.



Simple facies model showing inferred processes of primary gypsum deposition in Cyprus, in which water depth plays an important role

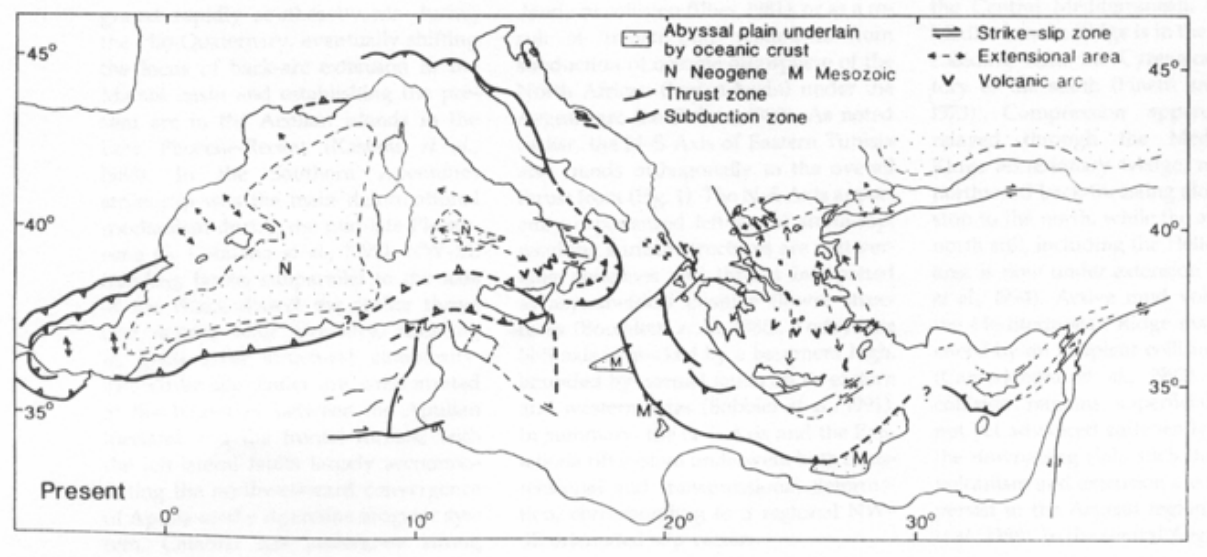


Reconstructed paleogeography of the Troodos Massif and adjacent evaporitic basins in the Messinian

N° File: 93

Authors: ROBERTSON, A.H.F., GRASSO, M.
Year: 1995
Title: Overview of the Late Tertiary-Recent tectonic and paleo-environmental development of the Mediterranean region
Reference: Terra Nova 7, 114-127

Concerned area: Mediterranean region
Formation(s) affected:
Age of the deformation: Mesozoic to Present day
Concerned structures:
Commentary: Mesozoic-Early Tertiary: evolution of Neotethys. This ocean generally widened eastwards, with a number of oceanic stands in the Eastern Mediterranean area. Late Tertiary: basin closure and continental collision. In the Eastern Mediterranean region, more northerly Neotethyan strands were closed by the Mid Tertiary, while oceanic crust remained in the south in the present Eastern Mediterranean Sea area. Late Tertiary: in the easternmost Mediterranean, only limited subduction took place, associated with supra-subduction zone extension. Today, steady state-subduction continues only locally, where vestiges of Neotethys remain.
Stress field:
Types of documents: Schematic plate tectonic setting for the Mediterranean area during Early Miocene. Schematic plate tectonic setting for the Mediterranean area during Late Miocene. Plio-Quaternary-Recent plate tectonic setting of the Mediterranean region.



Plio-Quaternary-Recent plate tectonic setting of the Mediterranean region

N° File: 94

Authors: ROTSTEIN YAIR, KAFKA ALAN L.

Year: 1982

Title: Seismotectonics of the southern boundary of Anatolia, Eastern Mediterranean region: subduction, collision, and arc jumping

Reference: Journal of Geophysical Research, vol. 87, no. B9, pp. 7694-7706

Concerned area: Anatolia, eastern Mediterranean, south-eastern Turkey

Formation(s) affected:

Age of the deformation:

Concerned structures: Cyprean Arc, Hellenic Arc

Commentary:

The pattern of seismicity and fault plane solutions of earthquakes are used to outline the tectonic features of the southern boundary of Anatolia in the eastern Mediterranean and south-eastern Turkey. The authors show that this boundary consists of two distinct parts. One, in south-eastern Turkey and Syria, is a wide and complex zone of continental collision. The other, in the Levantine basin of the Eastern Mediterranean, is a zone of oceanic subduction. In the subduction zone of the Eastern Mediterranean, the depth of the subducted slab and the rate of seismicity generally increase from south to west. The zone of present-day convergence between Africa and Turkey in the Levantine basin can be best outlined by the northern edge of the Mediterranean ridge. The subduction zone in this area sequentially jumps to the south as small continental fragments collide with existing zones of subduction. The plate boundary between Africa and Turkey at the centre of the Levantine basin appears to have shifted to the south of the Anaximander Mountains and Florence rise. Most of the focal mechanisms of the earthquakes along the entire southern boundary of Anatolia indicate that N to NNW thrusting is the dominant mode of seismic deformation. The present set of data is inconsistent with a major transform fault in the Cyprean Arc east of Cyprus and in south-eastern Turkey.

The seismicity over the period of 70 years and the tectonic elements in the region seem to indicate that the present plate boundary in the Levantine basin is as shown in Figure 10. This zone may be wider that schematically shown in Figure 10 and may also include the Mediterranean ridge, but its does not include the deep seismic zones north of the Florence rise and Anaximander Mountains.

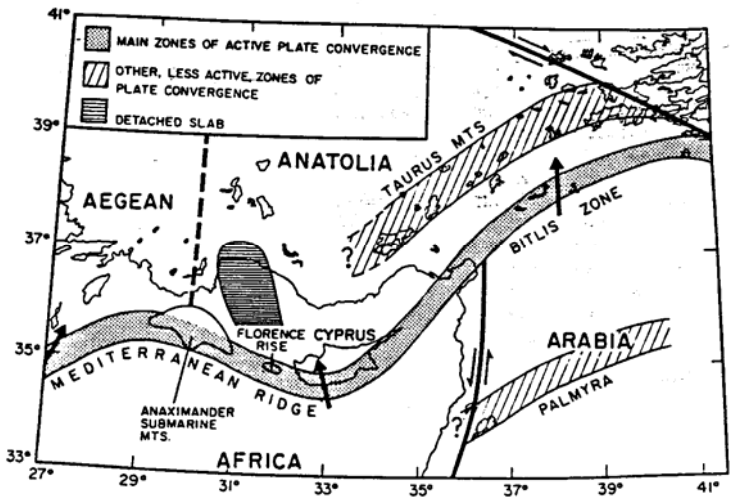
Stress field:

Types of documents:

Models of active tectonics in the Near East

Fault plane solutions for earthquakes near the southern boundary of Anatolia

Interpretation of tectonic processes associated with the southern boundary of Anatolia. Arrows indicate approximate relative motion across the plate's boundary as suggested by fault plane solutions



Interpretation of tectonic processes associated with the southern boundary of Anatolia. Arrows indicate approximate relative motion across the plate's boundary as suggested by fault plane solutions

N° File: 95

Authors: ROUCHY, J.M., ORSZAG-SPERBER, F., BIZON J.-J.

Year: 1980

Title: Mise en place d'une phase d'émersion fin-messinienne dans le bassin de Pissouri (Chypre): une modalité de passage Miocène-Pliocène en Méditerranée orientale

Reference: C.R. Acad. Sci. Ser.2, 291: 729-732

Concerned area: Eastern Mediterranean, Cyprus

Formation(s) affected:

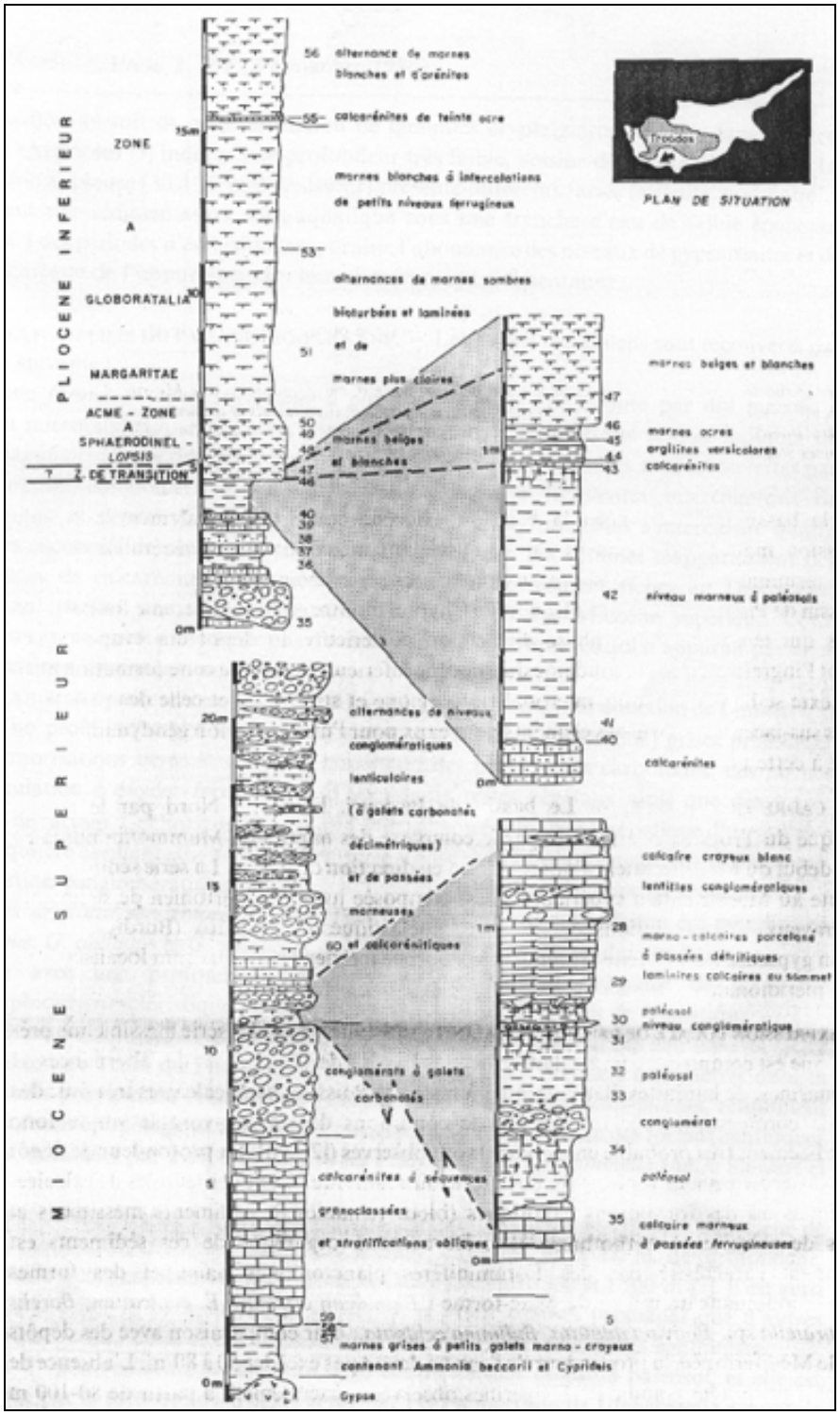
Age of the deformation: Late Messinian

Concerned structures: Pissouri basin

Commentary:
The study of the Miocene-Pliocene transition in the Pissouri basin, shows a late Messinian desiccation phase (paleosoil formation) preceding the early Pliocene marine ingression; the analyses of the sediment, microfaunistic and structural framework, and the evidence of tectonic activity at the Miocene-Pliocene boundary, allows us to specify the successive stages of the evolution of this basin, characterised by a post-Messinian deepening.

Stress field:

Types of documents:
Log of the Miocene-Pliocene transition.



Measured log of the Miocene-Pliocene transition in the Pissouri basin

N° File: 96

Authors: SANDVOL, E A; SEBER, D; BARAZANGI, M; MOHAMAD, RANDA; TURKELLI, NIYAZI; GURBUZ, CEMIL
Year: 1998
Title: Regional wave propagation in the Middle East using local seismic network data
Reference: Eos, Transactions, American Geophysical Union, vol.79, no.17, Suppl., pp.216, 28 Apr 1998

Concerned area: Eastern Mediterranean
Formation(s) affected:
Age of the deformation:
Concerned structures:
Commentary: Lg propagates efficiently between Cyprus and stations in northern Syria and in central Turkey located in the Arabian and Eurasian plates, respectively indicating that this geographic region in the north-eastern Mediterranean is underlain by continental-type crust.
Stress field:
Types of documents: Abstract

N° File: 97

Authors: SAROGLU F., EMRE O., KUSCU I.

Year: 1992

Title: The East Anatolian fault zone of Turkey

Reference: Annales Tectonicae, Special Issue, suppl. to vol. VI, pp. 99-125

Concerned area: Eastern Turkey

Formation(s) affected:

Age of the deformation:

Concerned structures: East Anatolian Fault, Dead Sea Fault zone

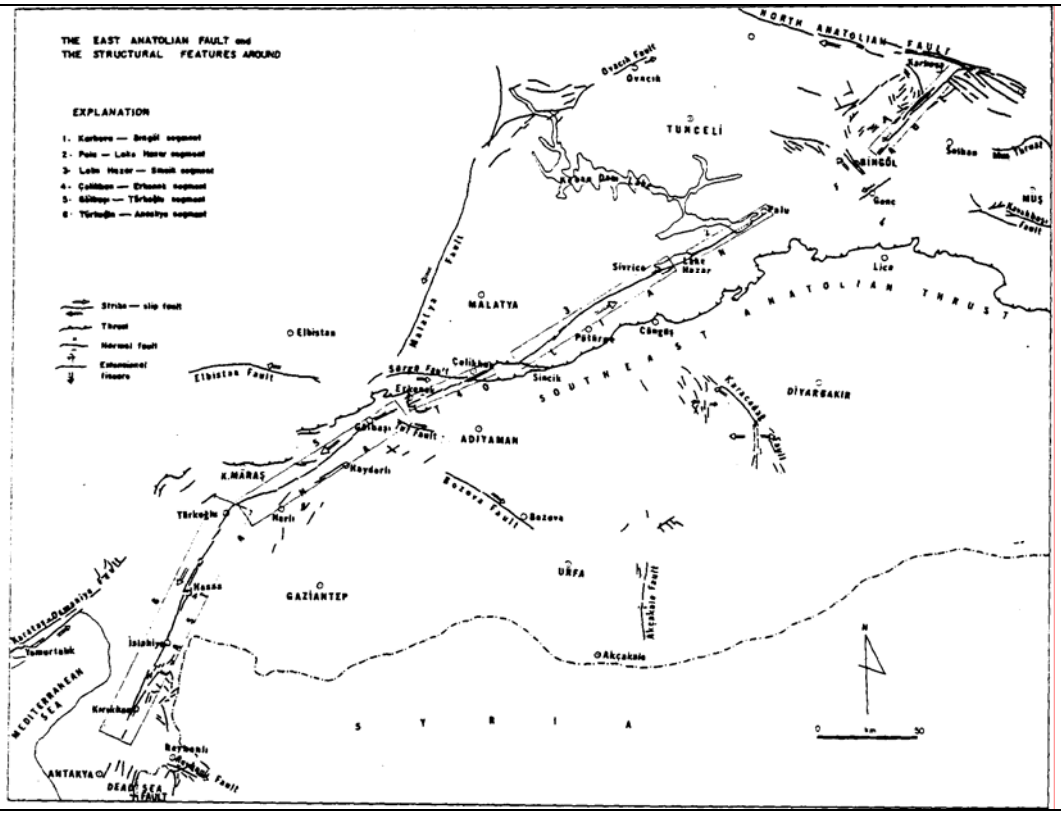
Commentary:

The East-Anatolian Fault zone is studied and described: detailed mapping covers its segments lying in a zone varying between 10 m and 4 km wide within the fault length of 580 km. The south-western extension of the fault is under discussion. During the 20th century, the only destructive earthquake recorded on this fault is the 1971 Bingol earthquake that produced surface breaks up to 38 km long. This possibility is taken to mean that destructive earthquakes in future are to be expected there. The paper discusses that some researchers are inclined to extend the fault to Cyprus in a SW direction, while others think that the fault terminates at Turkoglu. The authors opine that the East Anatolian fault continues southward after Turkoglu and is continuous until the right-lateral Reyhanli strike-slip fault, which trends E-W. This fault is thought to be the boundary between the East Anatolian Fault and the Dead Sea Fault.

Stress field:

Types of documents:

Simplified map of Turkey showing all major neotectonic structures that have been mapped in the field or established from seismic reflection profiling in marine areas.
General view of a section of the East Anatolian fault zone on Landsat MSS image
Map of the East Anatolian fault based on the authors' mapping



Map of the East Anatolian fault based on the authors' mapping

N° File: 98

Authors: SCHRIMER, W.

Year: 2000

Title: Neogene submarine relief and Troodos uplift in South-eastern Cyprus

Reference: Proceedings - ... International Conference on the Geology of the Eastern Mediterranean, vol. 3, pp.125-134

Concerned area: Eastern Mediterranean, in South-eastern Cyprus

Formation(s) affected: Miocene Pachna formation

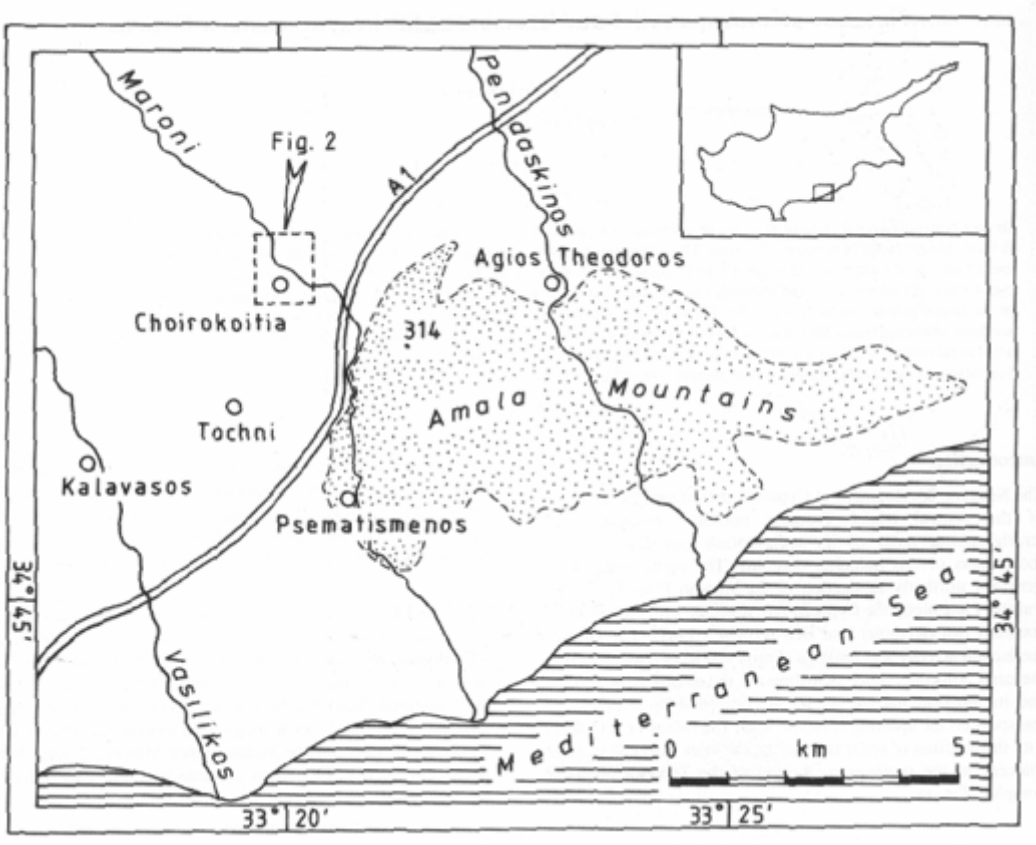
Age of the deformation: Neogene

Concerned structures:

Commentary:
In the Choirokoitia area south-eastern Cyprus there occurs within the hemipelagic Miocene Pachna formation a local coarse-detritic channel facies of terrigenous source. These channel together with their surrounding pelitic beds were formerly interpreted to be deeply incised into the Pachna beds and to be of late Pliocene age. From this a rapid Late Pliocene uplift of the Troodos hinterland was postulated.

Stress field: Troodos uplift

Types of documents:
Location of the investigations: The Amala Mountains and Choirokoitia in the southeast of Cyprus.
Schematical sketch of the configuration of the upper Pachna and Kalavasos deposits in the Amala Mountains.



Location of the investigations: The Amala Mountains and Choirokoitia in the southeast of Cyprus

N° File: 99

Authors: SENGOR A. M., GORUR NACI, SAROGLU FUAT

Year: 1985

Title: Strike-slip faulting and related basin formation in zones of tectonic escape: Turkey as a case study

Reference: The Society of Economic Paleonthologists and Mineralogists, pp. 227-269

Concerned area: Turkey, Eastern Mediterranean

Formation(s) affected:

Age of the deformation:

Concerned structures:

Commentary:

Since the Serravallian, the tectonics of Turkey has been dominated by the westward escape of an Anatolian block from the East Anatolian convergent zone onto the oceanic lithosphere of the Eastern Mediterranean Sea, Mainly along the North and East Anatolian strike-slip faults. This tectonic regime generated four distinct neotectonic provinces: (1) the East Anatolian contractional province, located mainly east of where the North and East Anatolian faults meet, and characterized by roughly north-south shortening; 2) the weakly active North Turkish province characterized by limited east-west shortening; 3) the West Anatolian extensional province characterized by north-south extension, and 4) the Central Anatolian province characterized by northeast-southwest shortening and northwest-southeast extension.

Figure 16 presents: A) tectonics of the Adana-Cilicia Basin with data added from Bilgin (1969), Evans et al (1978), and Bilin and Ercan (1981); B) Schematic large-sacle tectonic elements of the Kahramanmaras segment of the southern boundary of the Anatolian scholle. The velocity triangle on the right shows the relative plate motion rates if there were no south-east Taurus boundary thrust. In this case the rate of extension across the Cyprus-Kahramanmaras segment equals 3.2 cm/yr in a north-northwest to south-southeast orientation. Such a high rate of extension in this region is not observed today.

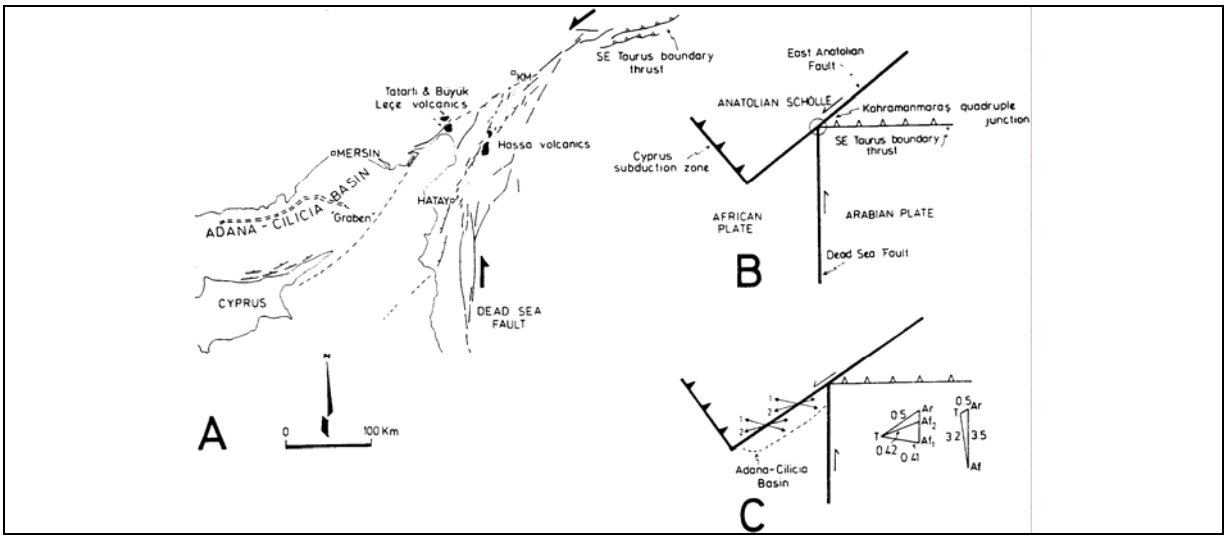
The velocity triangle on the left shows two different situations where 3.16 cm/yr (Ar-Af) and 3.4 cm/yr (Ar-Af_2) of the Arabia-Anatolia motion are absorbed by the south-east Taurus boundary thrust. In these cases, the rate of relative motion across the Cyprus- Kahramanmaras segment amounts to 0.41 and 0.42 cm/yr, respectively. Double-headed arrows designated 2 and 1 give the orientation of these extensions respectively. Because no reliable fault plane solutions exist in this region, it is difficult to choose any one of these models: both seem compatible with the known surface geology.

Stress field:

Types of documents:

Maps, focal plane solutions of earthquakes, seismic reflection profile

Summary diagram of the overall deformational pattern in the East Anatolian contractional province.



N° File: 100

Authors: SOULAS J.P.

Year: 1999

Title: Active tectonics studies in Cyprus for seismic risk mitigation: the greater Limassol area - Final report

Reference: A report to: Geological Survey Department Natural Ressources and Development. Ministry of Agriculture, Republic of Cyprus, Nicosia, pp.24, December 1999.

Concerned area: Eastern Mediterranean, Cyprus

Formation(s) affected:

Age of the deformation:

Concerned structures:

Commentary:

The systematic search of lineations, followed by a careful field survey, allowed to eliminate the possibility of NW-SE trending faults, at kilometric scale, on the sedimentary block surface.

To conclude the comparison between lineations and microseismicity, the author notes the presence of strong subrectilinear traces oriented NNW-SSE to WNW-ESE, north of the Arakapas Fault, and close to the survey zone.

The direction of maximum horizontal Quaternary stress is close to N-S, in agreement with the presence of an E-W oriented off-shore collision zone to the south of the survey region.

On the other hand, $\sigma 1$ is very oblique to the N 070 E $\pm$ 10° direction. This new orientation is nevertheless in perfect agreement with the sense of displacement on the Arakapas Fault System, situated 7 km farther to the south.

South of the surveyed area the stress field diverges strongly in the neighbourhood of the Trakhoni Fault System, where it follows a NW-SE direction as expected from a right lateral strike-slip dislocation.

Concerning Lemessol site *sensu stricto*, the author recalls the risk of tsunamis provoked by underthrusting earthquakes of the Cypriot Arc.

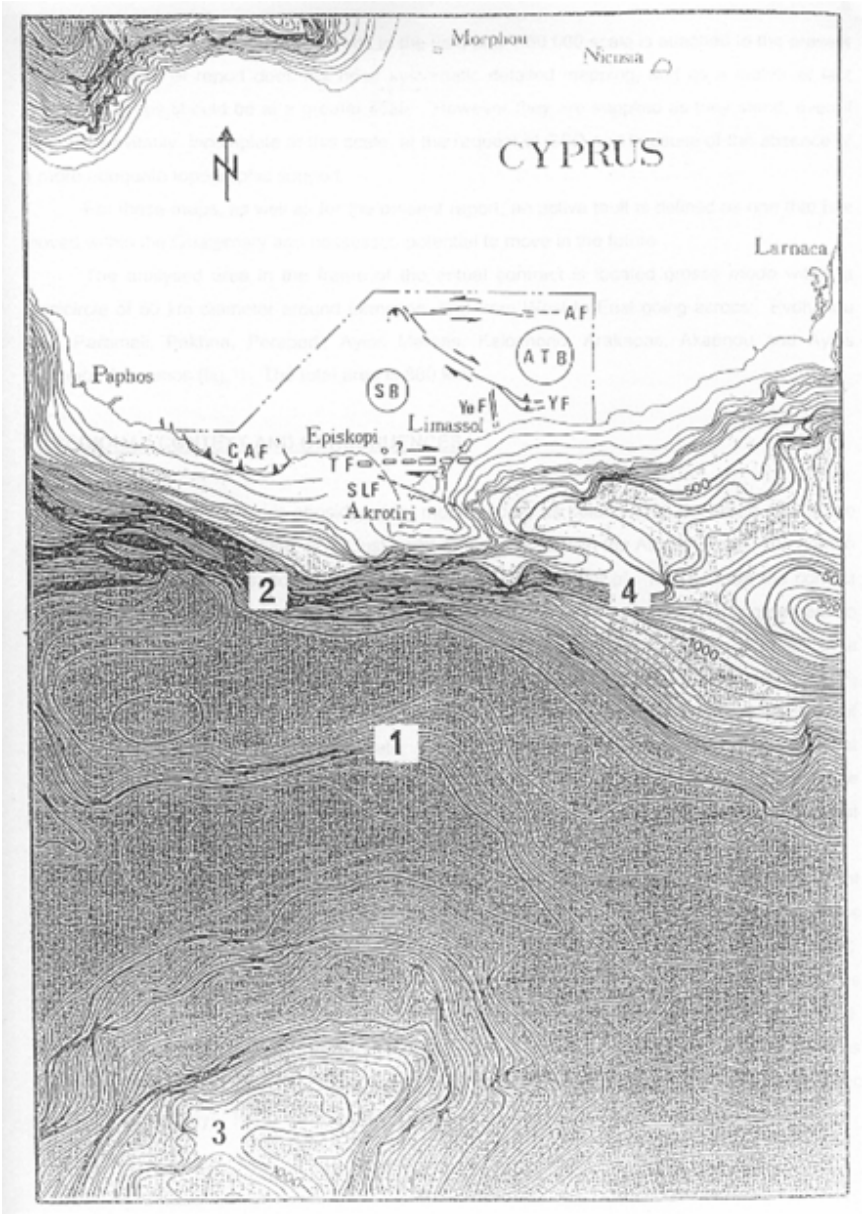
In Lemesos peripheral quarter there is also surface faulting risk:

- South, in case of event on Trakhoni Fault;
- North, in case of fault rupture from Yermasoyia valley.

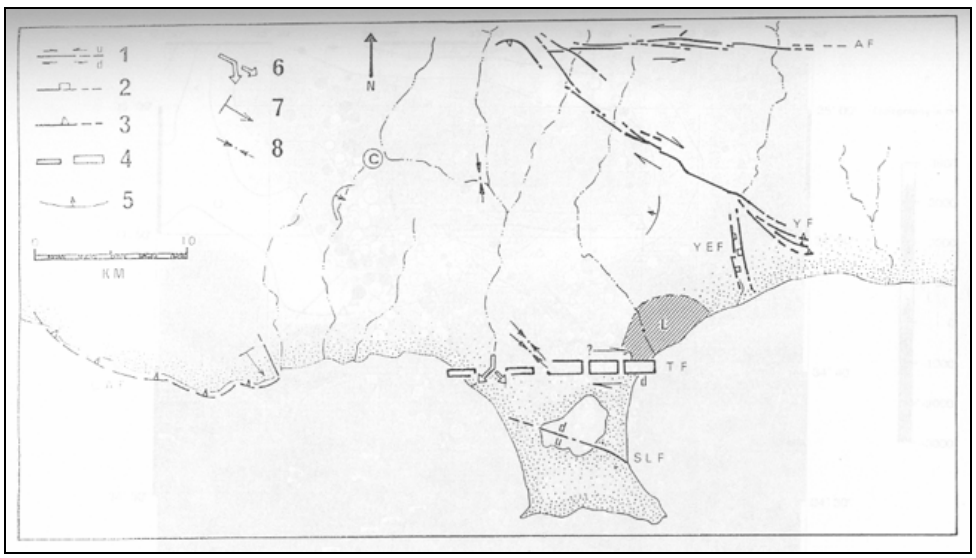
Stress field:

Types of documents:

Geotectonic situation of the studied zone.
Lineaments and lineations observed on aerial photographs.
Lineaments observed on satellite TM images.
Field draws.
Microfaults and slickenside and corresponding stress field.
Quaternary faulting, tectonic stress and other features discussed in the text.
Position of the surveyed faults.
Helicopter views.
Geological cross section of NNW-SSE orientation based on borehole records.
Seismogenic parameters.



Geotectonic situation of the studied zone



Quaternary faulting, tectonic stress and other features discussed in the text

N° File: 101

Authors: SOULAS J.P.

Year: 1999

Title: Active tectonics studies in Cyprus for seismic risk mitigation: the greater Paphos area - Final report

Reference: A report to: Geological Survey Department Natural Ressources and Development. Ministry of Agriculture, Republic of Cyprus, Nicosia, pp.28, February 2001.

Concerned area: Eastern Mediterranean, Cyprus, greater Paphos area

Formation(s) affected:

Age of the deformation:

Concerned structures:

Commentary:

There are numerous lineations of unknown origin, without any ground manifestation.

The processing by the right dihedra method shows a stress field with $\sigma 1$ oriented NE-SW: N58 E $\pm$ 22°, subhorizontal and $\sigma 3$ N158 E $\pm$ 16° inclined to the north or to the south.

The microfaults measured in an outcrop of Pliocene deposits between Amargeti and Lemona indicate a stress field with $\sigma 1$: N174E $\pm$ 4° and $\sigma 3$: N82E $\pm$ 6°, both dipping between the horizontal and 60-70°. Measurements of the third site were made in the Miocene Pakhna formation, on top of a fault-bend fold produced by the Ktima fault system underneath the front of the marine terrace of Yeroskipos. We obtain a compressional stress regime with $\sigma 1$: N14E $\pm$ 8° and $\sigma 3$ subvertical.

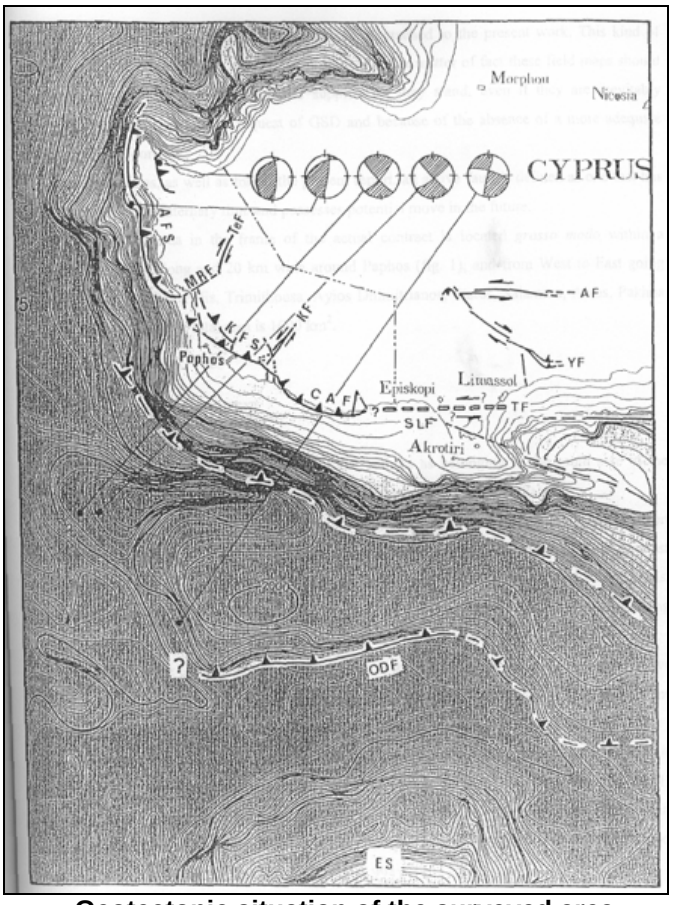
At the outcrop scale, Quaternary tectonics is not extensional. The observed microfaults are strike-slip and perhaps even reverse. They correspond to a maximum horizontal stress of NE-SW orientation.

With a slip rate of 0.5 to 0.6 mm/yr, the Paphos thrust system accommodates only 4 to 5% of the slip vector evaluates in chapter 2. With 1500 to 1800 m height, the major escarpment at 15 km offshore seems to be a very serious applicant to absorb three to four times more deformation than the faults we have described.

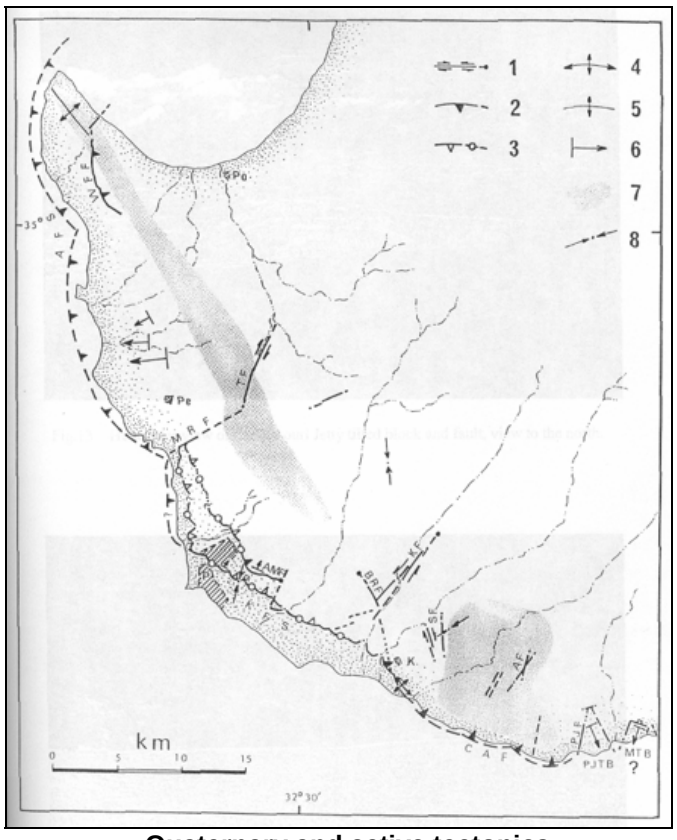
Stress field: NE-SW orientation.

Types of documents:

Geotectonic situation of the surveyed area.
Lineaments and lineations observed on aerial photographs.
Lineaments observed on satellite TM images.
Microfaults and slickenside and corresponding stress field.
Gravitational spreading evidences.
Quaternary microfaulting.
Quaternary and active tectonic.
Helicopter views.
Paphos'95 – Location of Stations and Events.
Seismogenic parameters.



Geotectonic situation of the surveyed area

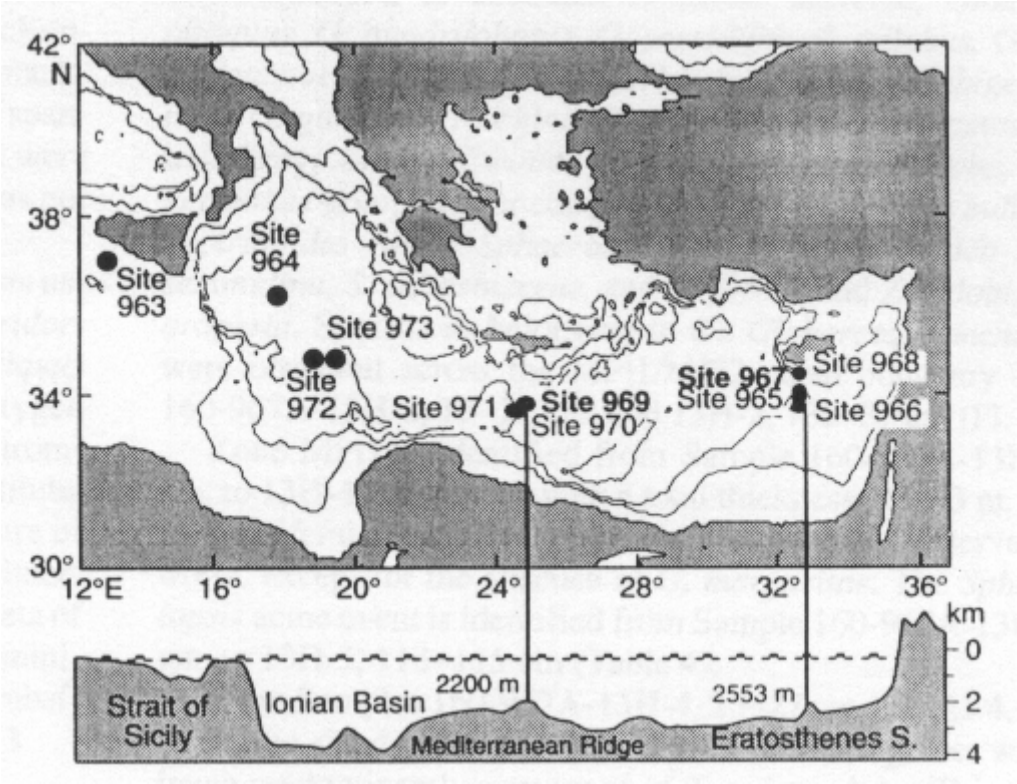


Quaternary and active tectonics

N° File: 102

Authors: SPEZZAFERRI, S., CITA, M.B. AND MCKENZIE, J.A.
Year: 1998
Title: The Miocene/Pliocene boundary in the eastern Mediterranean: results from sites 967 and 969.
Reference: Proceedings of the Ocean Drilling Program, Scientific Results, Vol 160, pp. 9-28.

Concerned area: Eastern Mediterranean
Formation(s) affected: Miocene/Pliocene boundary
Age of the deformation:
Concerned structures:
Commentary: Continuous sequences developed across the Miocene/Pliocene boundary were cored during Ocean Drilling Project Leg 160 at hole 967A located on the base of the northern slope of the Eratosthenes Seamount. At this site, the identification of the Miocene/Pliocene boundary between 119.1 and 119.4 mbsf, coincides with the lower boundary of the lithostratigraphic Unit II, where there is a shift from a high content of inorganic and non-marine calcite to a high content of biogenic calcite typical of a marine pelagic ooze.
Stress field:
Types of documents: Map of the Eastern Mediterranean showing the locations of Sites 963-973. Photograph of Core.



Map of the Eastern Mediterranean showing the locations of sites 963-973

N° File: 103

Authors: STIROS, S C

Year: 2001

Title: The AD 365 Crete earthquake and possible seismic clustering during the fourth to sixth centuries AD in the eastern Mediterranean; a review of historical and archaeological data

Reference: Journal of Structural Geology, vol.23, no.2-3, pp.545-562

Concerned area: Eastern Mediterranean, Crete

Formation(s) affected:

Age of the deformation: Present day

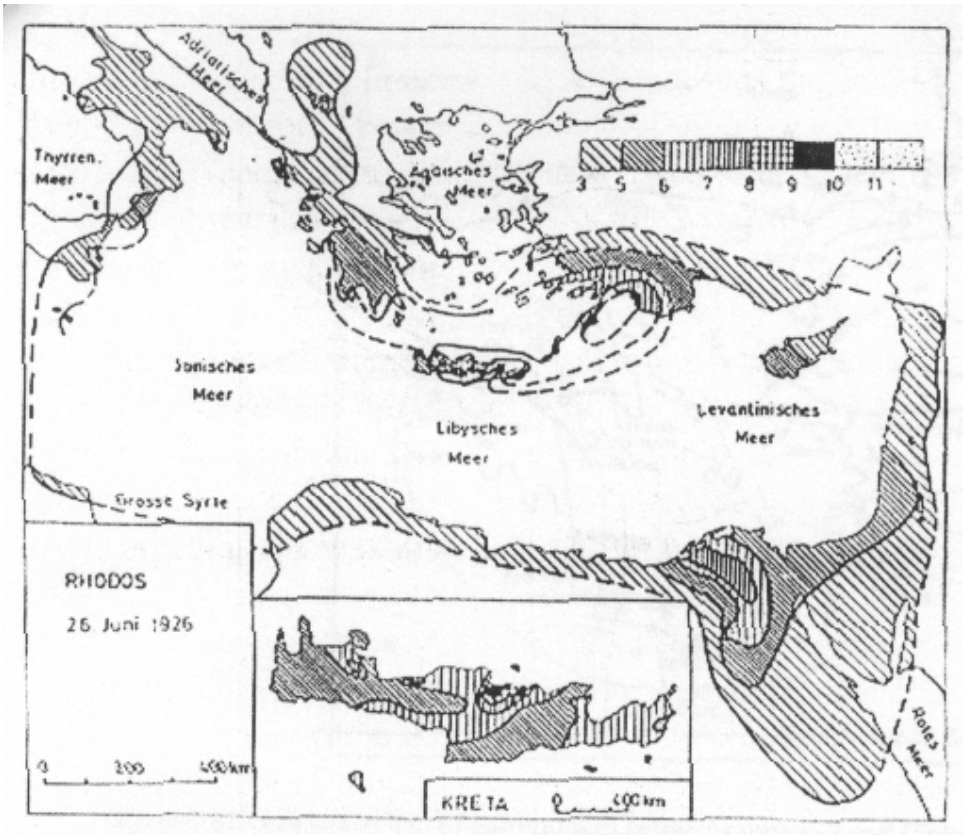
Concerned structures:

Commentary:
The AD 365 event was probably responsible for reported or observed destruction in ancient towns of west Cyprus and Lybia. This earthquake is most likely to be identified with a Hellenic Arc subduction zone-event of great (M>8) magnitude, as testified by up to 9 m of uplift in western Crete dated by previous geological studies to around this time.

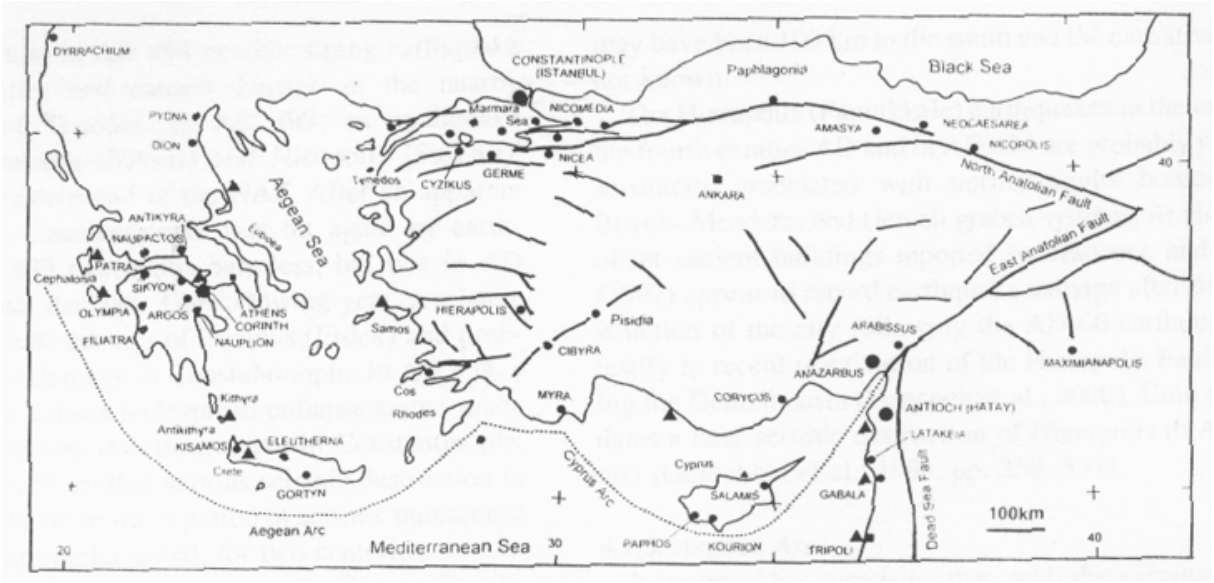
The high seismicity rates of this period may reflect a reactivation of all plate boundaries in the region.

Stress field:

Types of documents:
Fourth to sixth century AD coastal uplifts and plate boundaries in the Eastern Mediterranean.
Plot showing the frequency of earthquakes in the Eastern Mediterranean between 500 BC and AD 1000.
Isoseismal contours of the 1926 Aegean Arc earthquake.
Epicentres of earthquakes or reported seismic destructions of ancient towns during the seismic paroxysm of the fourth to sixth centuries AD.



Isoseismal contours of the 1926 Aegean Arc earthquake

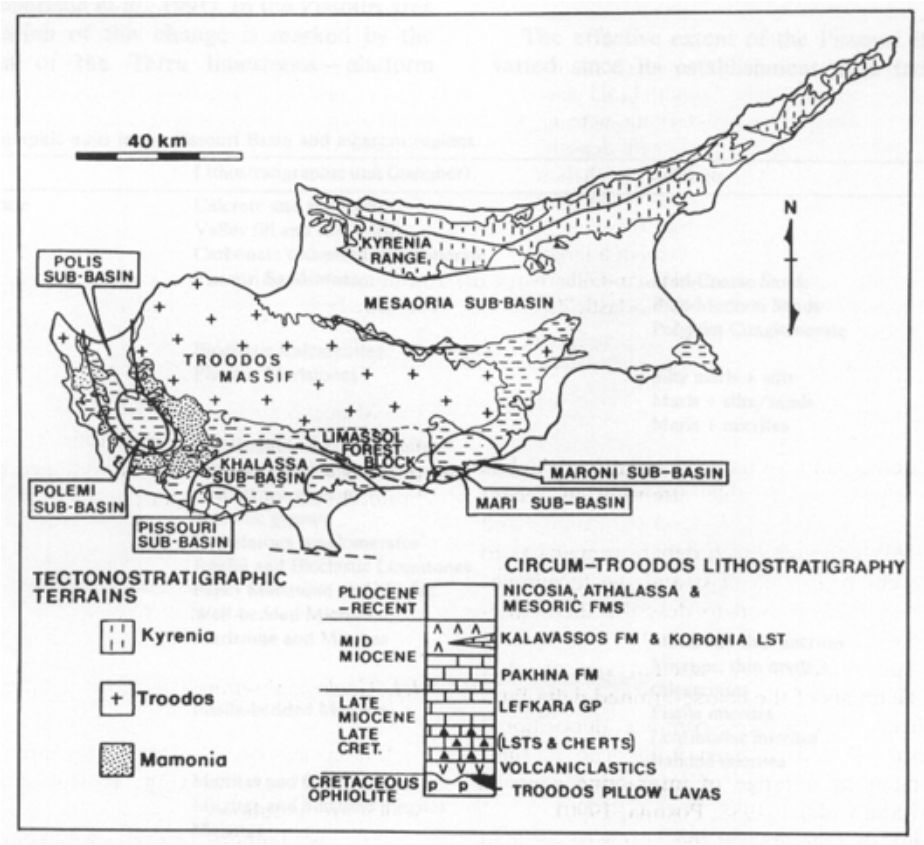


Epicentres of earthquakes or reported seismic destructions of ancient towns during the seismic paroxysm of the fourth to six centuries AD based on historical and archaeological evidence

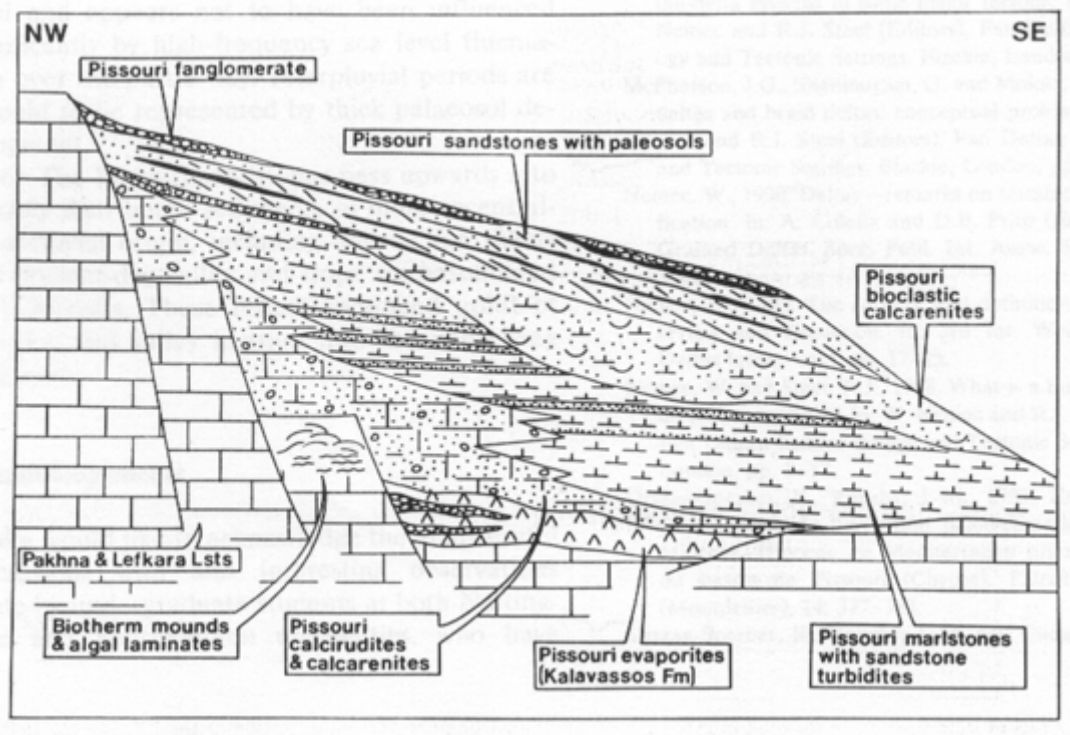
N° File: 104

Authors: STOW, D A V; BRAAKENBURG, N E; XENOPHONTOS, C
Year: 1995
Title: The Pissouri Basin fan-delta complex, south-western Cyprus
Reference: Sedimentary Geology, vol.98, no.1-4, pp.245-262, Aug 1995

Concerned area: Eastern Mediterranean, south-western Cyprus
Formation(s) affected: Pissouri Basin fan-delta complex
Age of the deformation:
Concerned structures:
Commentary: The Pliocene-Pleistocene sedimentary fill of a small (70 m2) sub-basin in south-western Cyprus is interpreted as representing a fan-delta complex with braid channels, which shows a broadly progradational sequence influenced by both sea-level fluctuation and tectonic activity.
Stress field:
Types of documents: Major structural elements and geological units of Cyprus, together with the main Neogene sedimentary basins. Lithostratigraphic units recognised in the Pissouri Basin. Summary geological map of the Pissouri Basin and adjacent area. Field photographs. A series of time-slice maps showing inferred depositional environments during evolution of the Pissouri fan delta complex. A composite NW-SE cross-section through the Pissouri fan delta complex.



Major structural elements and geological units of Cyprus, together with the main Neogene sedimentary basins



A composite NW-SE cross section through the Pissouri fan delta complex

N° File: 105

Authors: SWARBRICK, R.E.

Year: 1993

Title: Sinistral strike-slip and transpressional tectonics in an ancient oceanic setting: The Mamonia Complex, southwest Cyprus

Reference: J. Geol. Soc. London 150, 381-392

Concerned area: Eastern Mediterranean, southwest Cyprus

Formation(s) affected: The Mamonia Complex

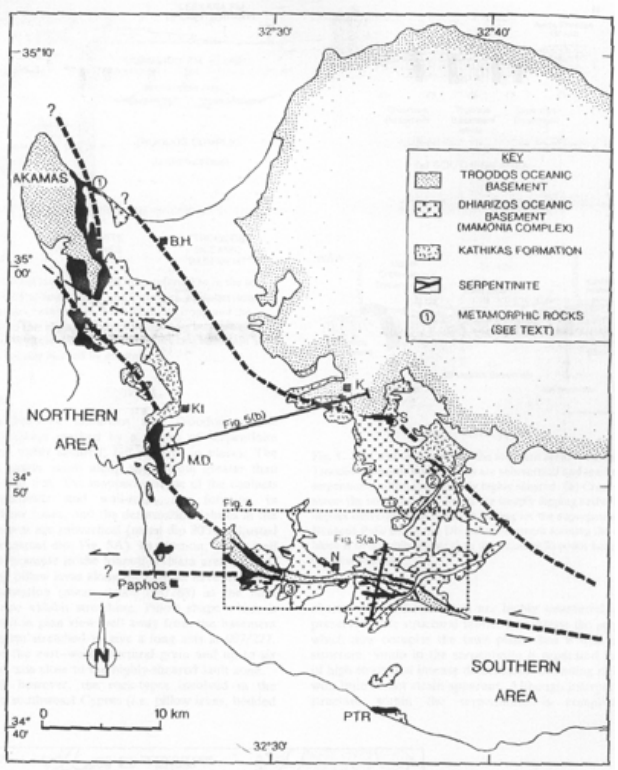
Age of the deformation:

Concerned structures:

Commentary:
Field evidence suggests that these two contrasting oceanic basement types were juxtaposed by strike-slip tectonics. During the late Cretaceous, a sinistral strike-slip fault zone was active in the southern area, whilst in the northern area a central block was uplifted at a restraining bend.
Constraints on the timing of strike-slip faulting suggests that this episode of tectonism in southwest Cyprus is coeval with the 90° anti-clockwise rotation of parts of Cyprus, indicated by paleomagnetic data. A model is proposed which reconciles anti-clockwise rotation of the Troodos complex with sinistral strike-slip displacement along its contact with the Mamonia complex.

Stress field: Sinistral strike-slip and transpressional tectonics.

Types of documents:
Geological map of southwest Cyprus.
Stratigraphical summary for all units referred to in the text.
Cross-section across the southern area, including the Troodos basement sliver.
Structural cross section at Mavrokolymbos Dam.



Geological map of southwest Cyprus, showing the outcrop patterns of Dhiarizos oceanic basement and the Troodos oceanic basement, serpentinite and the Kathikas Formation

N° File: 106

Authors: SYILANTIEV S. A.

Year: 1993

Title: Metamorphic complexes of the Eastern Mediterranean: metamorphism conditions, nature of protoliths, and geodynamic regimes of formation (in Russian)

Reference: Petrologia, Russian Academy of Sciences, vol. 1, no. 4, July-August (in Russian)

Concerned area: Eastern Mediterranean

Formation(s) affected:

Age of the deformation:

Concerned structures: Mammonia Complex, Complex Bassit

Commentary: Metamorphic complexes associating with the ophiolites of Eastern Mediterranean were formed within the interval of 180-60 mln years, and were developing mainly during the obduction of ophiolithic masses onto passive, and rarer, active-type continental margins. Indicators of the two dominating types of metamorphism are established for ophiolite spreading zones in the Eastern Mediterranean, which mostly have the same age, including: 1) ocean-type metamorphism in the ophiolitic complexes, characteristic for recent oceanic basins; 2) collision-type high-pressure metamorphism in tectonic melange blocks and sub-ophiolithic zonal complexes. Oceanic substrate rocks are found within the products of both the first, and the second type of metamorphism. Subduction metamorphism products are reliably identified only within the western segment of the Mediterranean belt. Most part of the high-pressure metamorphic rocks were formed in the interval of 95-66 mln years, corresponding to the closure of the Mesozoic Thetys ocean basin. At that time, masses of ophiolites representing crust fragments produced by the spreading and subductional magmatism, were dislocated and ophiolitic plates were thrusted on the volcanogenic sedimentary thickness of the continental margins. Most probably, the main condition for the course of ocean crust subduction metamorphism is the collisional interaction of lithosphere plates of sufficient thickness. For the Mediterranean belt, such tectonic situation was possible only in its western segment.
Figure 1 shows distribution of P-T metamorhism conditions across various tectonic blocks of metamorphites of the south-west Cyprus: 1) area taken up by the Mammonia Complex; 2) Troodos complex; 3) outcrops of metamorphite blocks. Digits in circles correspond to the following types of geo-thermal barometers used to define conditions of the metamorphism: 1 –*Hb-Pl, Grt-Hb*; 2, 4, 5, 7, 8 – *Hb-Pl*; 3 – approximated estimate on the content of aluminia in amphiboles; 6 – *Hb-Pl, Grt-Bt*.

Stress field:

Types of documents:
Tables presenting mineral compositions and contents of metamorphic rocks in the Mammonia Complex, blocks of Kepir and Tourkmanli (north-west Syria)
Table representing space and time distribution of the P-T regimes for the formation of metamorphic complexes associating with the ophiolites of the Mediterranean belt

N° File: 107

Authors: TOKSOZ, M.N., SHAKAL, A.F., AND MICHAEL, A.J.

Year: 1979

Title: Space-Time Migration of Earthquakes along the North Anatolian Fault Zone and Seismic Gaps

Reference: Pageoph, Vol. 117 (1979), 1258-1270. Birkhauser Verlag, Basel.

Concerned area: Eastern Mediterranean

Formation(s) affected:

Age of the deformation:

Concerned structures: North Anatolian Fault Zone

Commentary:

The North Anatolian fault is a well-defined tectonic feature extending for 1400 km across Northern Turkey.

First, the earthquake activity appears not to be stationary over time. Periods of high activity in 1850-1900 and 1940 to the present bracket a period of relatively low activity in 1910-1939.

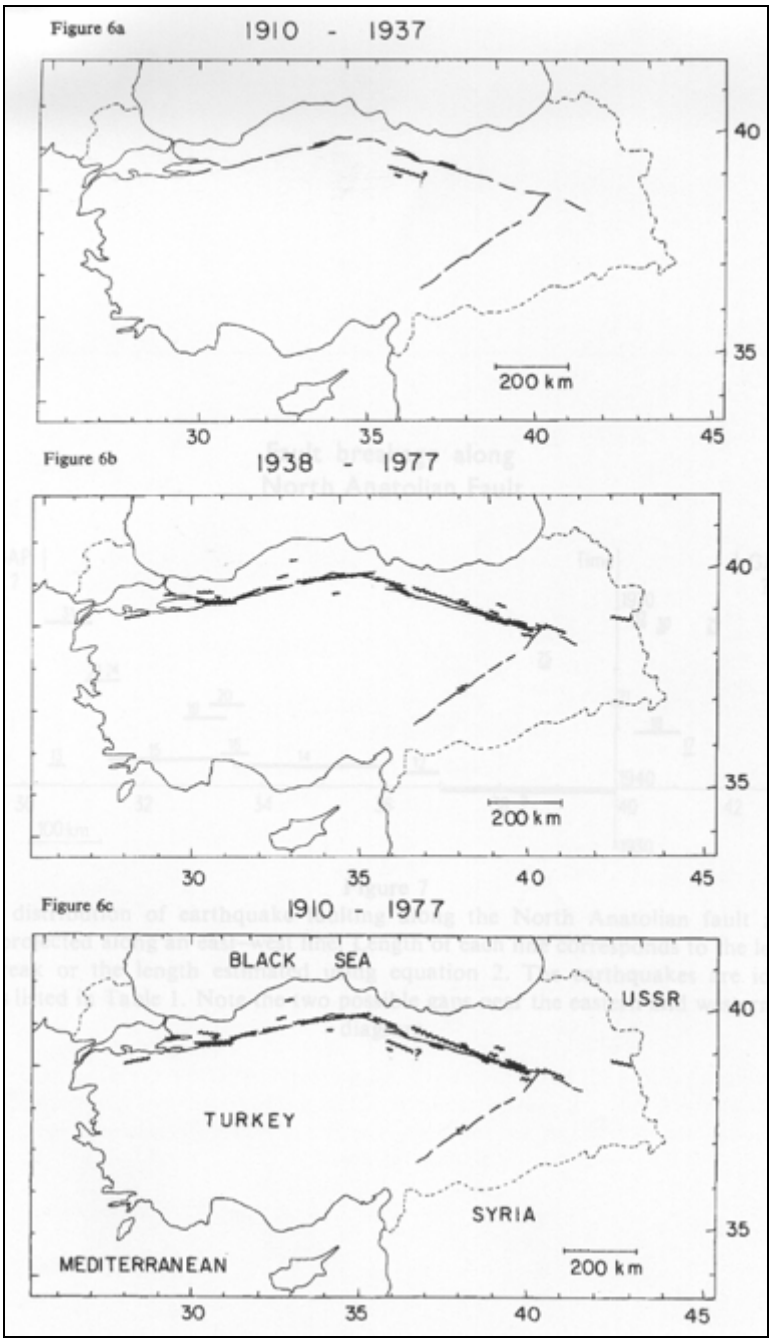
Second, there appears to have been a two-directional migration of earthquake epicentres away from a central region located about 39°E longitude. The migration to the west has a higher velocity (> 50 km/yr) than the migration to the east (< 10 km/yr).

At present there are two possible seismic gaps along the North Anatolian fault zone. One is at the western end of the fault, from about 29° to 30°E. Unless this is a region of ongoing aseismic creep, it could be the site of a magnitude 6 or greater earthquake. The other possible gap is at the eastern end, from about 42° to 43°E, to the west of the unexpected M = 7.3 event of 24 November 1976.

Stress field: dominant right-handed strike-slip component

Types of documents:

Seismotectonic map of Turkey showing earthquake epicentres and the major faults.
Seismic energy released along the Anatolian fault zone between 1500 and 1977.
Number of earthquakes per year with magnitudes M> 5, 6 and 7 in the 1913-1975 time period.
Time space distribution of earthquake epicentres along the North Anatolian fault zone in the period 1910-1970.
Fault length vs. magnitude for events of the Anatolian fault system.
Earthquake fault breaks along the North Anatolian fault zone.
Space time distribution of earthquake faulting along the North Anatolian fault zone.
Earthquake epicentres and observed faulting along the west end of the North Anatolian fault zone.



Earthquake fault breaks along the North Anatolian fault zone

N° File: 108

Authors: TUNCAY TAYMAZ, HALUK EYIDOGAN and JAMES JACKSON

Year: 1991

Title: Source parameters of large earthquakes in the East Anatolian Fault Zone (Turkey)

Reference: Geophys. J. Int., 106, 537-550

Concerned area: East Anatolia

Formation(s) affected:

Age of the deformation: ***recent***

Concerned structures: East Anatolian Fault

Commentary:

Long-period P- and SH-waveforms are used to determine the source parameters of the four largest earthquakes that occurred in, or near, the East Anatolian Fault Zone in the last 35 years (from 1964 to 1986). Only one of these actually involved left-lateral strike-slip motion on a NE-SW fault. But the other three, and the nearby 1975 Lice earthquake, all had steeply dipping nodal planes with a NNW strike: if these were the auxiliary planes then all the earthquakes had a slip vector direction within about 10^0 of 063^0. If this direction represents the Arabia-Turkey motion, then the slip rate on the North Anatolian Fault must be in the range 31 to 48 mm yr^{-1}, with a probable value of 38 mm yr^{-1}, and the overall slip rate across the East Anatolian Fault Zone must be about 29 mm $yr^{-1}$with a range of 25-35 mm yr^{-1}.

It is concluded that a significant fraction of the slip across the East Anatolian Fault zone is likely to be accommodated seismically, but whether there is a substantial contribution from aseismic deformation processes, as, for example, in SW Iran and the Hellenic Trench, is less certain.

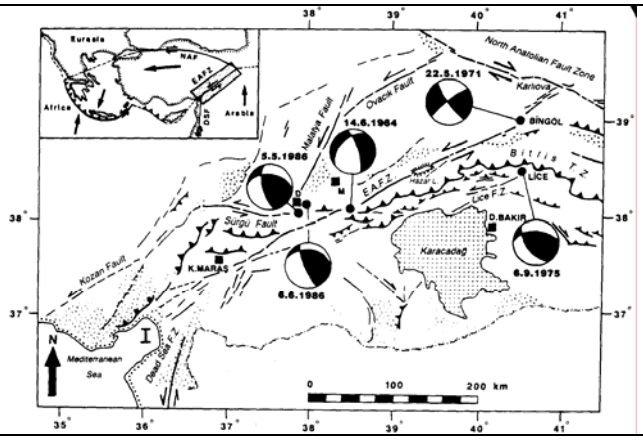
Figure 1 presents a summary map of the EAFZ, compiled from the authors' observations and those of Sengor et al (1985), Dewey et al. (1986), Perincek et al (1987) and Perincek and Cemen (1990). Lower hemisphere projections of the focal mechanisms corresponding to the minimum misfit solutions of the earthquakes studied by the authors and by Nabelek (1984) are shown. Compressional quadrants are shaded. This map shows the major structural features in the East Anatolian Fault Zone and its Arabian Foreland, showing fractures (fine lines), mapped faults (thick lines), Plio-Quaternary, Quaternary basins (dotted areas) and major volcanic fields (marked as Karacadag). D=Dogansehir; M=Malatya; I=Gulf of Iskenderun. Inset shows the motions of the Arabian and African plates, central Turkey, and the southern Aegean Sea, relative to Europe. The dashed line in the north Aegean is not a plate boundary: it joins the end of the North Anatolian Fault (NAF) to the northern end of the Hellenic Trench (shown as a thrust), and emphasizes that the westward motion of Turkey is accommodated partly by convergence along the west and southwest coast of Greece and Albania (Taymaz et al, 1991). EAFZ: East Anatolian Fault Zone (the stippled area); DSF: Dead Sea Fault.

Stress field:

Types of documents:

Horizontal projections of the slip vectors for the focal mechanisms

Velocity triangle for East Anatolia

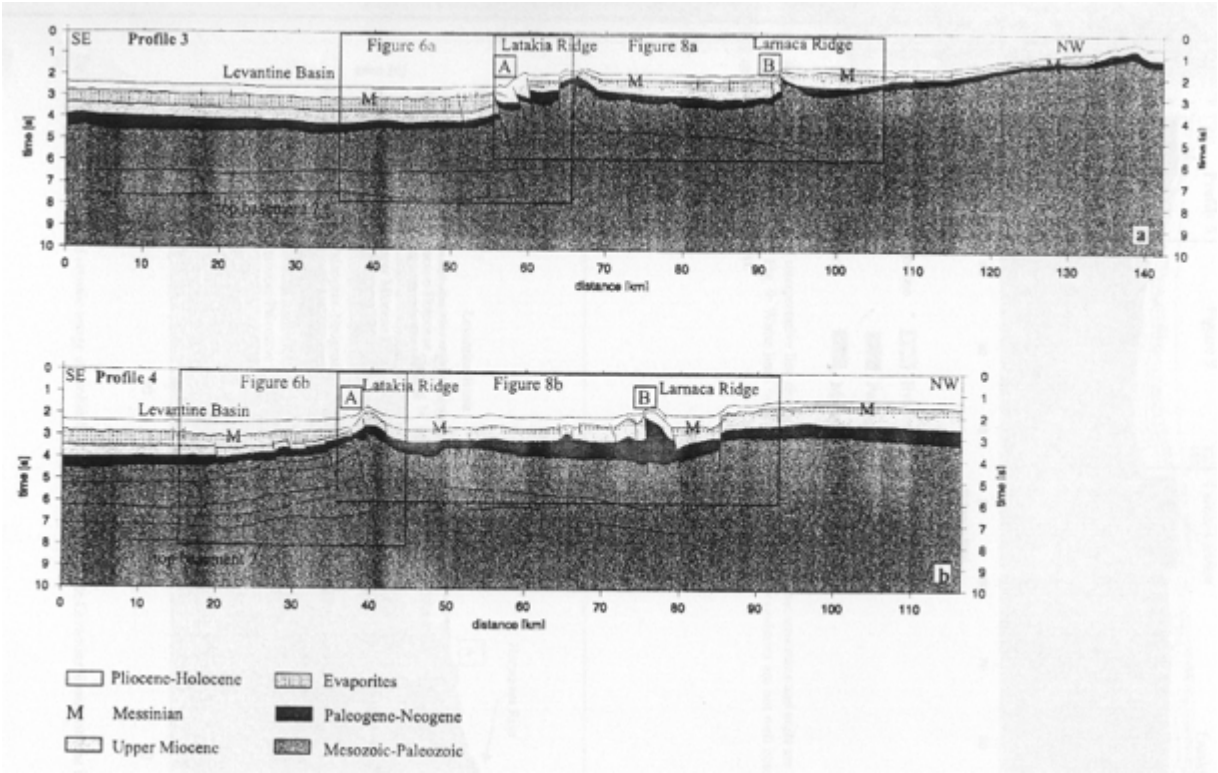


Summary map of the EAFZ, compiled from the authors' observations and those of Sengor et al (1985), Dewey et al. (1986), Perincek et al (1987) and Perincek and Cemen (1990)

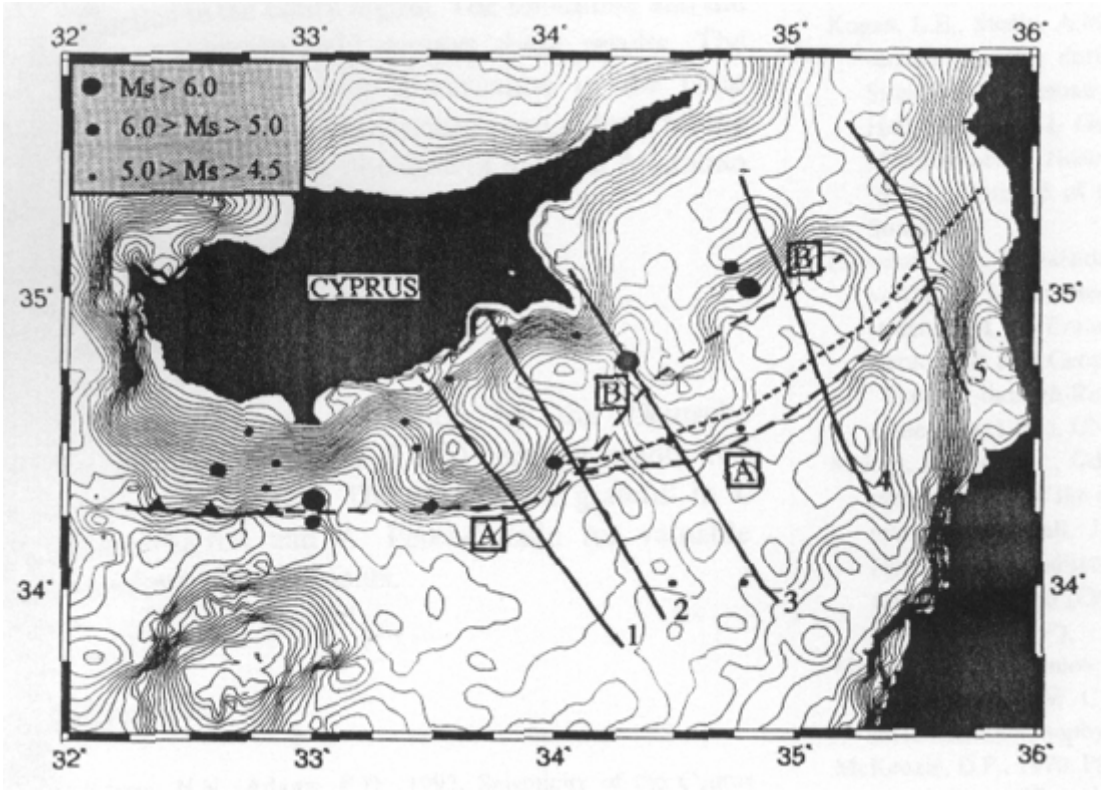
N° File: 109

Authors: VIDAL N; KLAESCHEN, D; KOPF, A; DOCHERTY, C; VON HUENE, ROLAND; KRASHENINNIKOV, V A
Year: 2000
Title: Seismic images at the convergence zone from south of Cyprus to the Syrian coast, eastern Mediterranean
Reference: Tectonophysics, vol.329, no.1-4, pp.157-170, 31 Dec 2000

Concerned area: Eastern Mediterranean, from south of Cyprus to the Syrian coast
Formation(s) affected:
Age of the deformation: Present day
Concerned structures:
Commentary: Five NW-SE trending seismic lines cross an area of active continental collision. Main tectonic structures are the Eratosthenes Seamount collision zone, the Hecateaus Rise and the Latakia-Larnaca Ridge systems. The Levantine Basin extends to the south all other the area. The Levantine Basin is observed to terminate abruptly at the junction with the Hecateaus Rise south of Cyprus. To the east and north, the deformation appears to be partitioned along two separated structures next to the Latakia and Larnaca ridge. They correspond to major oblique fault systems.
Stress field: continental collision
Types of documents: Bathymetric map of the eastern Mediterranean, including the location of the seismic reflection profiles. Poststack time migrated interpretative line drawing of the profiles. Poststack time migrated seismic image of the profiles. Simplified tectonic map



Poststack time migrated interpretative line drawing of (a) profile 1 and (b) profile 2



Simplified tectonic map

N° File: 110

Authors: VIDAL, N; ALVAREZ-MARRON, J; KLAESCHEN, D

Year: 2000

Title: The structure of the Africa-Anatolia plate boundary in the eastern Mediterranean

Reference: Tectonics, vol.19, no.4, pp.723-739

Concerned area: Eastern Mediterranean

Formation(s) affected:

Age of the deformation: uppermost Cretaceous or lowermost Paleogene times to present

Concerned structures: Africa-Anatolia plate boundary

Commentary:

Images of the upper crustal structure of the Cyprean Arc indicating that the deformation is partitioned along strike-slip fault systems distributed over a wide zone, rather than forming a sharp plate boundary between African and Anatolian plates. Three major submarine strike-slip fault systems, tens of kilometres in length, are mapped, which follow bathymetric features and merge together toward the east. These structures exhibit the three-dimensional characteristics typical of strike-slip deformation zone throughout the seven pre-stack depth migrated sections, including several sets of positive flower structures forming bathymetric ridges, and the intervening contemporaneous subbasins.

Within the eastern Cyprean Arc the K reflection corresponds to the basement-cover contact, indicating that the strike-slip tectonic scenario may have been active since the uppermost Cretaceous or lowermost Paleogene times to present. The active deformation front of the Alpine belt in the eastern Mediterranean correspond to a strike-slip fault system that forms a 110° arc and coincides at the southern slope of the Hecateaus Rise, continuing along the Latakia Ridge to the Syrian coast. The map structures fit within a general kinematic framework of left-lateral transcurrent deformation that transfers slip from the subduction zone southwest of Cyprus into the Dead Sea transform system at the east. This change in the mode of deformation at the Africa-Anatolia plate boundary occurs toward the junction between African, Anatolian, and Arabian plates.

Stress field: strike-slip deformation zone

Types of documents:

Plate boundary network and present kinematics of the easternmost Mediterranean area.

Structural map of the eastern Cyprean Arc.

Post-stack depth-migrated seismic reflexion image from profile across the Levantine Basin.

Seismic images across the Cyprean Arc deformation front illustrate the structure at the junction with the deepest trough of the Levantine Basin to the south.

Serial cross sections showing the three-dimensional structural variation along strike of the southernmost deformation front in the Cyprean Arc.

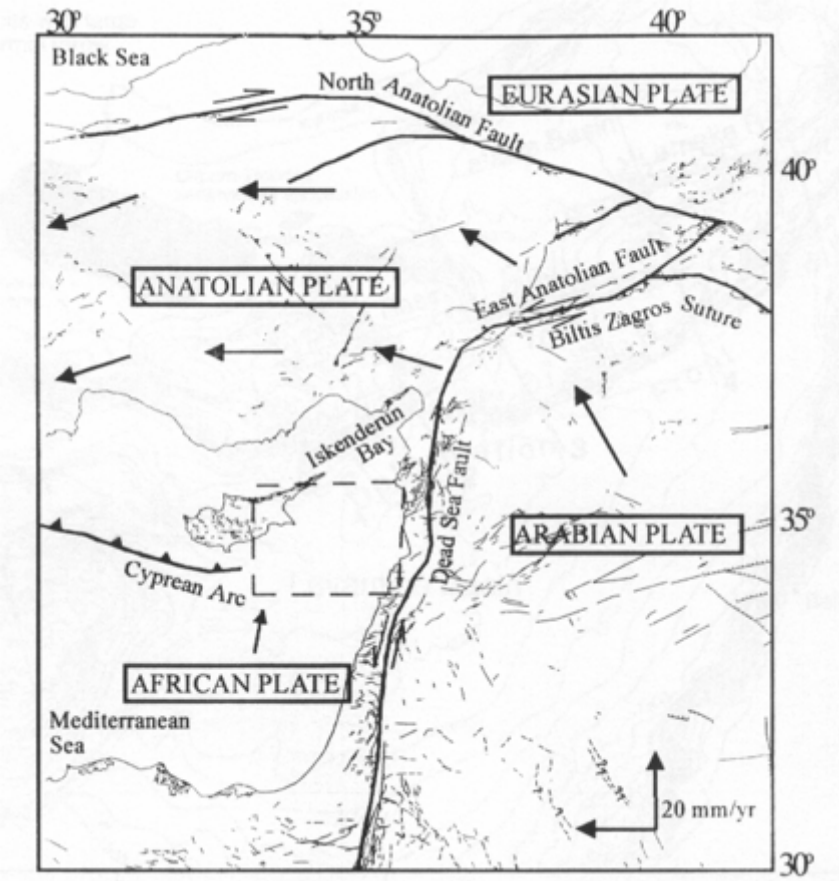
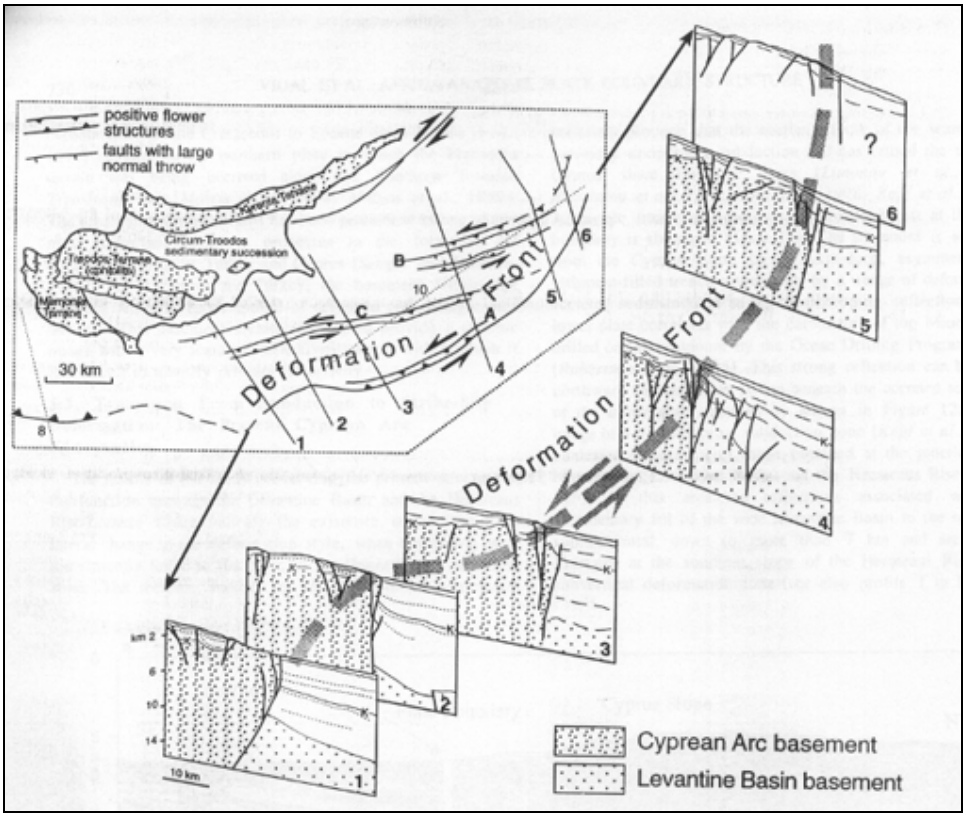


Plate boundary network and present kinematics of the easternmost Mediterranean area



Serial cross sections showing the three-dimensional structural variation along strike of the southernmost deformation front in the Cyprean Arc

N° File: 111

Authors: VITA-FINZI, C.

Year: 1990

Title: ^{14}C dating of Late Quaternary uplift in the western Cyprus

Reference: Tectonophysics, vol. 172. p. 135-140

Concerned area: Eastern Mediterranean, western Cyprus

Formation(s) affected:

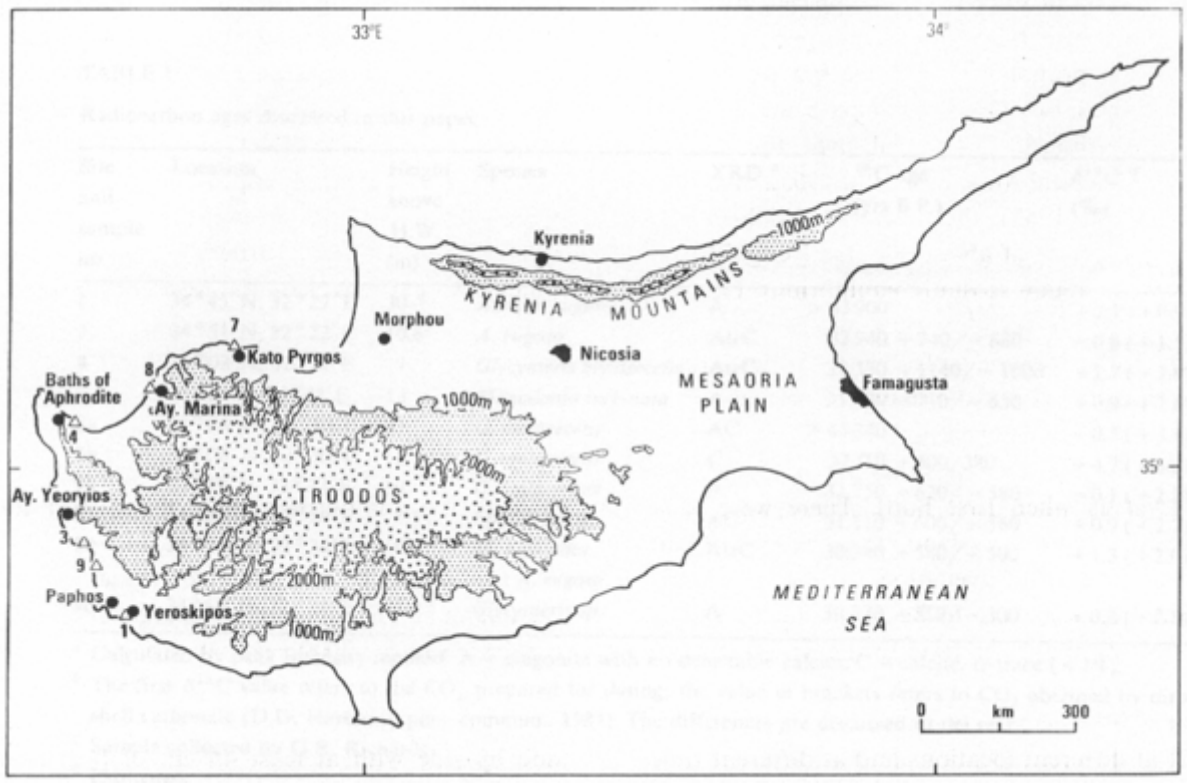
Age of the deformation:

Concerned structures:

Commentary:
Preliminary radiocarbon dating of fossil shorelines in western Cyprus indicates at least 12 m of uplift in the last 32,000 years. The geomorphological evidence points to spasmodic movements, with increments of >1.5 m and average recurrence intervals of at least 11,000 years.

Stress field:

Types of documents:
Location map.
Table with radiocarbon ages discussed in this paper.
Scanning electron micrograph.



N° File: 112

Authors: WESTAWAY, R.

Year: 1994

Title: Present-day kinematics of the Middle East and eastern Mediterranean

Reference: J. Geophys. Res., 99, 12 071-12 090

Concerned area: Middle East and eastern Mediterranean

Formation(s) affected:

Age of the deformation: Present day

Concerned structures: Dead Sea Fault Zone, North Anatolian Fault Zone, East Anatolian Fault Zone

Commentary:

Three major strike slip fault zones: DSFZ, NAFZ, EAFZ. These accommodate northward motion of the African and Arabian plates relative to Eurasia and westward motion of the small Turkish plate.

The 7 ± 0.5 mm/yr left-lateral slip rate of the DSFZ is associated with counterclockwise rotation of Arabia relative to Africa at 0.33° m/yr around an Euler pole near 33°N 23°E. The NAFZ takes up counterclockwise rotation of the Turkish plate relative to Eurasia at 0.83° m/yr (± 13%) around a pole at 31°N 35.5°E with right-lateral slip rate ≈ 15 mm/yr. The resulting prediction for the EAFZ involves ≈ 14 mm/yr left-lateral motion and ≈ 2 mm/yr of shortening between Arabia and Turkey. The triple junction of Africa, Arabia and Turkey is near the city of Kahramanmarras. This locality contains a narrow promontory, bounded be SSW-trending left-lateral faults at the edges of the Arabian and Turkish plates, which is loosely attached to the African plate, moving westward relative to its interior at ≈ 4 mm/yr.

Stress field:

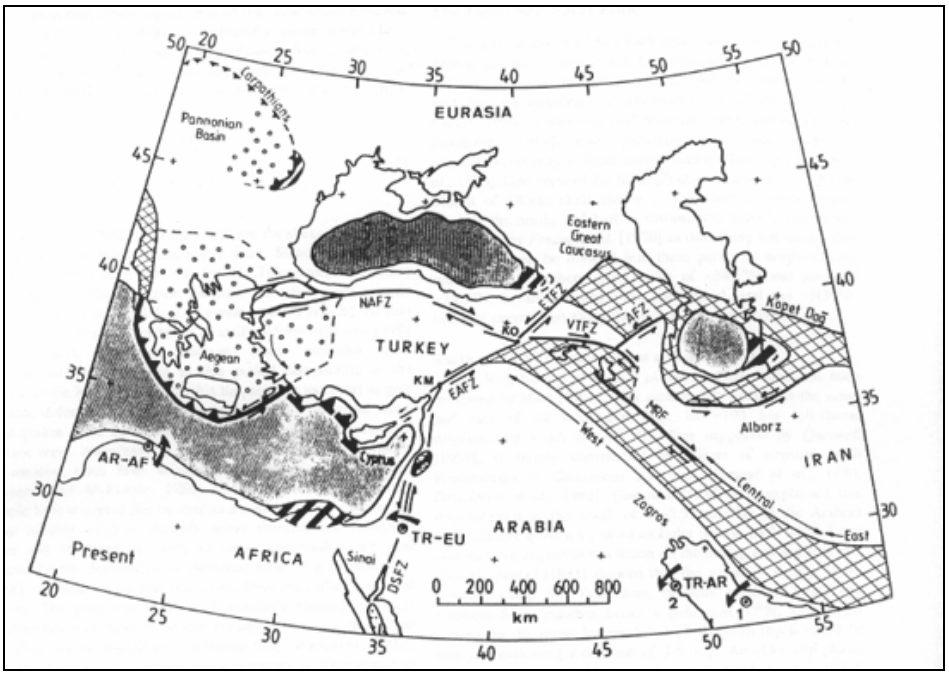
Types of documents:

Summary of present-day deformation in the Middle East and eastern Mediterranean.

Map of major strike-slip fault zones in eastern Turkey and northern Syria.

Comparison of the present-day central NAFZ, between 30°E and 37°E, with its appearance with 80 km of right-lateral displacement restored.

Comparison of the present-day western NAFZ, west of 30°E, with its appearance with 70 km of right-lateral displacement restored.

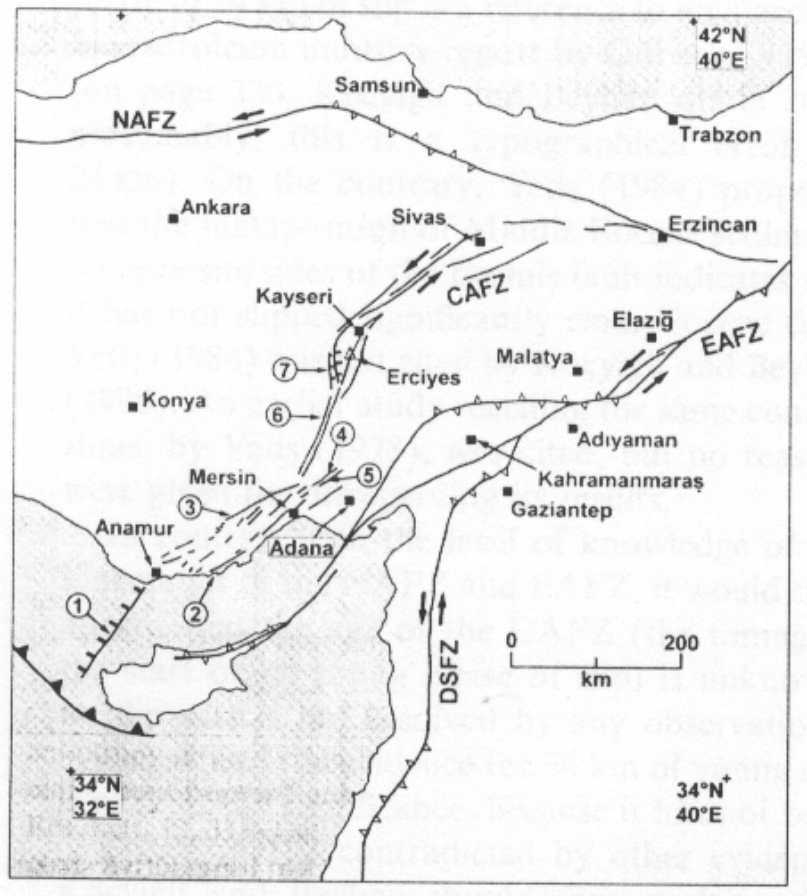


Summary of the present-day deformation in the Middle East and eastern Mediterranean

N° File: 113

Authors: WESTAWAY, R; KOCYIGIT, A; BEYHAN, A
Year: 1999
Title: A new intracontinental transcurrent structure; the Central Anatolian Fault Zone, Turkey; discussion and reply [modified]
Reference: Tectonophysics, vol.314, no.4, pp.469-479

Concerned area: Eastern Mediterranean
Formation(s) affected:
Age of the deformation:
Concerned structures: Central Anatolian Fault Zone
Commentary: The aim of this comment is to describe difficulties which arise over the published interpretation of the CAFZ, with the aim of encouraging either a retraction or a more thorough presentation of the available evidence in support of the existence of major active fault zone in the required position.
Stress field:
Types of documents: Location map showing the recognises NAFZ, EAFZ, DSFZ, in relation to the newly-interpreted CAFZ. Summary map of the Ecemis fault zone.

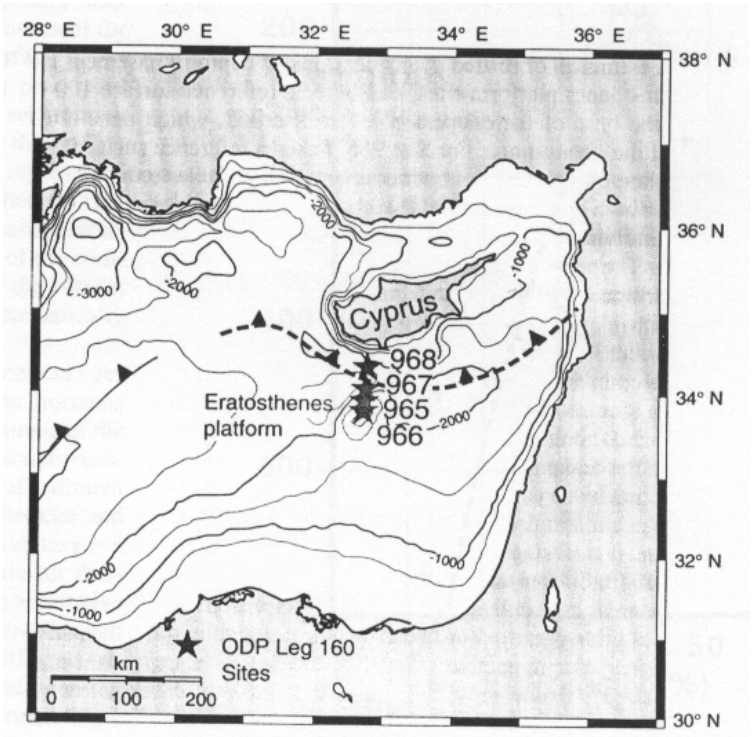


Location map, showing the recognised NAFZ, EAFZ and DSFZ, in relation to the newly-interpretated CAFZ

N° File: 114

Authors: WHITING, B.M.
Year: 1998
Title: Subsidence record of early-stage continental collision, Eratosthenes platform (sites 966 and 967)
Reference: Proceedings of the Ocean Drilling Program, Scientific Results, Vol 160, pp.509-515.

Concerned area: Eastern Mediterranean, Eratosthenes platform
Formation(s) affected:
Age of the deformation: Miocene
Concerned structures:
Commentary: The Eratosthenes platform is hypothesized to be a fragment of thinned North African crust that is about to be subducted beneath Cyprus. Incipient subduction appears to be accompanied by extensive normal faulting, indicating that the Eratosthenes platform is undergoing break-up. Taken together, the subsidence results are consistent with a model in witch the Eratosthenes platform is a part of North African passive margin that underwent exponentially decreasing thermal subsidence since at least early Cretaceous time, was uplifted during the late Oligocene or early Miocene, and then began a phase of rapid tectonic subsidence by late Miocene time, which has continued to the present day. The overall interpretation of the subsidence history presented here is that the Eratosthenes platform represents a thinned promontory of North African lithosphere that is now in the early stages of tectonic contact with the Eurasian plate. Break-up and subsidence since Miocene time may be related to bending stresses on the North African lithosphere associated with collision.
Stress field:
Types of documents: Site location map, bathymetry, and tectonic overview of Eratosthenes platform. Site 967 index properties data and least-squares exponential fit. Data summary for Sites 966 and 967, showing age, paleobathymetry, and lithology. Total subsidence for Site 966 and 967.



Site location map, bathymetry, and tectonic overview of Eratosthenes platform

N° File: 115

Authors: YURUR, M T; CHOROWICZ, J

Year: 1998

Title: Recent volcanism, tectonics and plate kinematics near the junction of the African, Arabian and Anatolian plates in the eastern Mediterranean

Reference: Journal of Volcanology and Geothermal Research, vol.85, no.1-4, pp.1-15, Oct 1998

Concerned area: Eastern Mediterranean

Formation(s) affected:

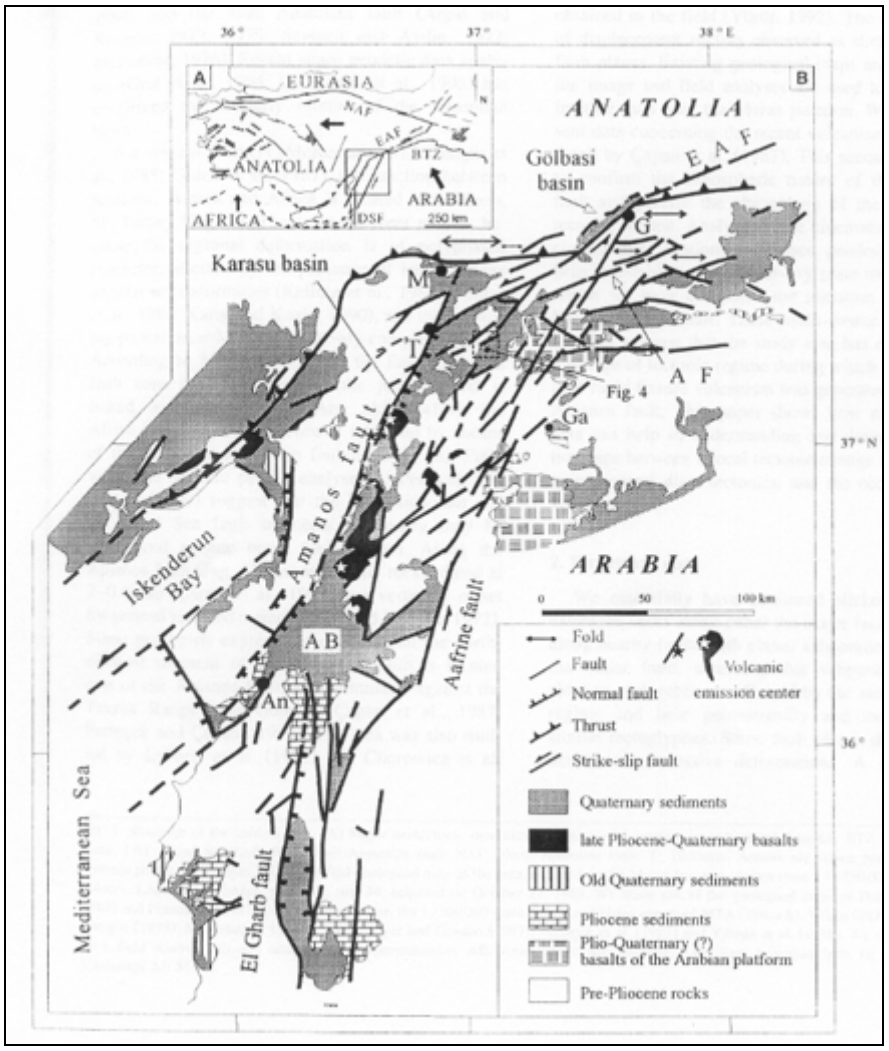
Age of the deformation: 2 Ma to 0.4 Ma

Concerned structures: junction of the African, Arabian and Anatolian plates

Commentary:
The Africa/Arabia motion is a strike slip displacement along the Dead Sea fault. The Africa/Anatolia motion is taken up by subduction south of Cyprus.
Two major tectonic phases: the older deformations are related to a N-S compression, the more recent movements are directed mainly westward and associated with strike-slip and extension tectonics.
Near the triple junction since 2 Ma, a fissure volcanism produced tholeiite followed by alkali basalt along the Amanos fault, northern end segment of the Dead Sea Fault. In addition, reconstruction of rigid-plate kinematics between Arabia, Africa and Anatolia using recent plate motion parameters and space geodesy data suggest for the East Anatolian fault a slip rate of 7.8-9 mm/year. The maximum finite displacement recognised for this structure being around 15 km, we have obtained 1.9 Ma as the maximum age for the fault formation. The volcanic, tectonic and kinematic data convergence to propose a ca. 2 Ma age for the change of local tectonic regime in the junction area. In the region of the Amanos fault, apparition of the East Anatolian fault accommodating westward motion of the Anatolia plate resulted in oblique-slip tension along the Amanos segment of the Dead Sea transform, giving rise to a fissure-fed, mantle derived alkaline volcanism at ca. 2 Ma, which lasted until recent times (0.4 Ma).

Stress field: N-S compression and then movements directed mainly westward associated with strike-slip and extension tectonics.

Types of documents:
Structure of the study area.
Map of the older motions observed along the major fault planes.
Map of the recent motions observed along the major fault planes.
Fault line and slip-vector directions of the successive motions.
Geological map showing the Narli volcanism.
Tectonic evolution of the studied area.
Velocity diagram of relative plate motions near Maras.



Structure of the study area.

Updated bibliographic files

N° File: 116

Authors: BARKA A.A. AND CADINSKI-CADE K.

Year: 1988

Title: Strike-slip fault geometry in Turkey and its influence on earthquake activity

Reference: *Tectonics*, 7, p. 663-684

Concerned area: Anatolian plate, Turkey

Age of the deformation: Recent to historical

Concerned structures: All major strike-slip fault system of Turkey

Commentary:

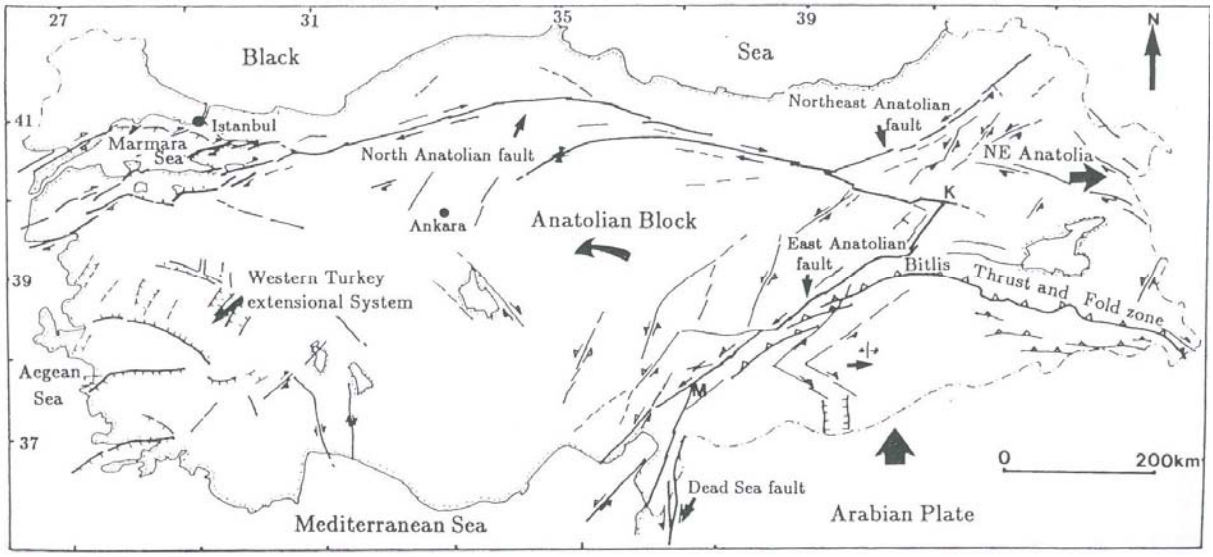
The geometry of Turkish strike-slip faults has been reviewed and described. From this data set it appears that faults geometry (the distribution of discontinuities such as bends and stepovers along the main fault trace) plays an important role in controlling the location of large earthquake rupture segments along the fault zones. Large earthquake ruptures generally do not propagate past individual stepovers that are wider than 5 km or bends that have angles greater than about 30°. More important than the size of each discontinuity, however, is the total “geometric pattern”, i.e., the distribution of adjacent bends and stepovers based not only on distance from one another but also on relative discontinuity size. Certain geometric patterns (restraining single or double bends) are particularly common and can be viewed as responsible for strain accumulation along portions of the fault zone. Fault geometry not only plays a role in the extent of earthquake rupture but also in characteristics of earthquake behaviour. For example, large earthquake epicenters often occur near restraining bends or double bends. Furthermore, aftershocks and swarm activity can often be associated with releasing areas (areas along the strike-slip fault that are undergoing a relatively large amount of extension).

Stress field:

Types of documents:

Tectonic maps of Turkey

Maps of active faults



Major tectonic elements of Turkey

N° File: 117

Authors: DEMETZ C., GORDON R.G., ARGUS D.F., STEIN S.

Year: 1990

Title: Current plate motions

Reference: *Geophys. J. Int.*, 101, p. 421-478

Concerned area: World

Formation(s) affected:

Age of the deformation:

Concerned structures:

Commentary:

The paper determines best-fitting Euler vectors closure-fitting Euler vectors, and a new global model (NUVEL-1) describing the geologically current motion between 12 assumed-rigid plates by inverting plate motion data the authors have compiled critically analysed, and tested for self-consistency. They treat Arabia, India and Australia and North America and South America as distinct plates, but combine Nubia and Somalia into a single African plate because motion between them could not be reliably resolved. The 1 122 data from 22 plate boundaries inverted to obtain NUVEL-I consist of 277 spreading rates, 121 transform fault azimuths, and 724 earthquake slip vectors. The authors determined all rates over a uniform time interval of 3.0 m.y., corresponding to the centre of the anomaly 2A sequence, by comparing synthetic magnetic anomalies with observed profiles. The model fits the data well. Unlike prior global plate motion models, which systematically misfit some spreading rates in the Indian Ocean by 8-12 mm yr^{-1}, the systematic misfits by NUVEL-1 nowhere exceed ~3 mm yr^{-1}. The model differs significantly from prior global plate motion models. For the 30 pairs of plates sharing a common boundary, 29 of 30 P071, and 25 of 30 RM2 Euler vectors lie outside the 99 per cent confidence limits of NUVEL-1. Differences are large in the Indian Ocean where NUVEL-1 plate motion data and plate geometry differ from those used in prior studies and in the Pacific Ocean where NUVEL-1 rates are systematically 5-20 min yr^{-1} slower than those of prior models. The strikes of transform faults mapped with GLORIA and Seabeam along the Mid-Atlantic Ridge greatly improve the accuracy of estimates of the direction of plate motion. These data give Euler vectors differing significantly from those of prior studies, show that motion about the Azores triple junction is consistent with plate circuit closure, and better resolve motion between North America and South America. Motion of the Caribbean plate relative to North or South America is about 7 mm yr^{-1} slower than in prior global models. Trench slip vectors tend to be systematically misfit wherever convergence is oblique and best-fitting poles determined only from trench slip vectors differ significantly from their corresponding closure-fitting Euler vectors. The direction of slip in trench earthquakes tends to be between the direction of plate motion and the normal to the trench strike. Part of this bias may be due to the neglect of lateral heterogeneities of seismic velocities caused by cold subjecting slabs, but the larger part is likely caused by independent motion of fore-arc crust and lithosphere relative to the overriding plate.

Stress field:

Global Currennt plate motions

Types of documents:

Plate spreading rates graphs, maps with slip rate vector, earthquakes and focal mechanisms

N° File: 118

Authors: DEWAY J.F., SENGÖR A.M.C.

Year: 1986

Title: Shortening of continental lithosphere : the neotectonics of Eastern Anatolia – a young collision tectonics

Reference: From Coward M.P. & Ries A.C. (eds), *Collision Tectonics, Geological Society Special Publication,* n° 19, p. 3-36.

Concerned area: Eastern Anatolia

Formation(s) affected:

Age of the deformation: Recent

Concerned structures: East Anatolian fault, North Anatolian fault, Dea Sea fault

Commentary:

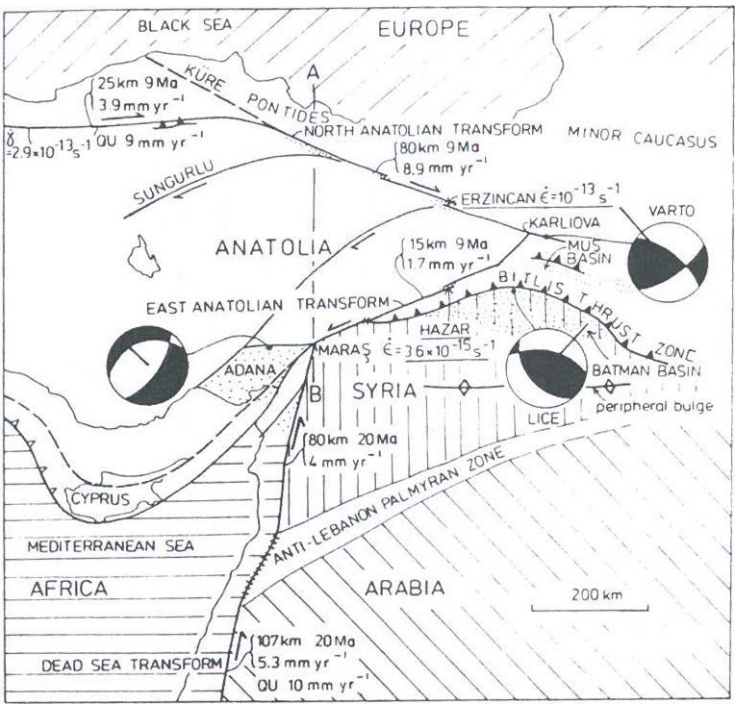
The authors use the tectonics of Eastern Anatolia to exemplify many of the different aspects of collision tectonics, namely the formation of plateaux, thrust belts, foreland flexures, widespread foreland/hinterland deformation zones and orogenic collapse/distension zones. Eastern Anatolia is a 2 km high plateau bounded to the S by the southward-verging Bitlis Thrust Zone and to the N by the Pontide/Minor Caucasus Zone. It has developed as the surface expression of a zone of progressively thickening crust beginning about l2 Ma in the medial Miocene and has resulted from the squeezing and shortening of Eastern Anatolia between the Arabian and European Plates follows the Serravallian demise of the last oceanic or quasi-oceanic tract between Arabia and Eurasia. Thickening of the crust to about 52 km has been accompanied by major strike-slip faulting on the right-lateral N Anatolian Transform Fault (NATF) and the left lateral E Anatolian Transform Fault (EATF) which approximately bound an Anatolian Wedge that is being driven westwards to override the oceanic lithophere of the Mediterranean along subjection zones from Cephalonia lo Crete and Rhodes to Cyprus. This neotectonic regime began about 12 Ma in Late Serravallian times with uplift from wide-spread littoral/neritic marine conditions to open seasonal wooded savanna with colluvial, pluvial and limnic environments and the deposition of the thick Tortonian Kythrean Flysch in the Eastern Mediterranean. Earthquake hypocenters are scattered throughout the region but large earthquakes are concentrated mainly on the major faults and are mostly shallow supporting the idea of a brittle elastic lid with hypocenters concentrated towards its base with more ductile deformation in middle and lower crust. Neotectonic magmatic suites are nepheline-hypersthene normative alkali basalts of mantle origin, and silicic/intermediate/mafic calc-alkaline suites both suites occurring in pull-apart basins in srike-slip regimes and along N – S extensional fissures, and both suites showing a strong change to central activity in the Pliocene. Upper-crustal strains appear to be discontinuous in space and time with zones of strong shortening representing shoaling of crustal detachment zones flattening between 5 and 10 km. Approximately NW. (dextral) and NE- (sinistral) trending lineaments bound less deformed wedges (low relief seismically 'dead' areas) and vary from simple strike-slip faults to complicated braided transform - flake boundaries with pull-apart and compressional segments (N and E Anatolian Transform Faults). Volcanoes lie in grabens on N - S 'cracks' that extend into the Arabian Foreland and in transcurrent pull-aparts. Major extensional basins lie at plate (Adana) and flake (Karliova) triple junctions and result from compatibility problems .

Stress field:

Types of documents:

Tectonic and seismotectonic maps

Crustal cross-sections and block diagrams



Simplified tectonic map of Central and Eastern Anatolia and the Arabian Foreland

N° File: 119

Authors: DEWAY J.F., HEMPTON M.R., KIDD W.S.F., SAROGLU F., SENGOR A.M.C
Year: 1979
Title: Aegean and surrounding regions: complex multiplate and continuum tectonics in a convergent zone
Reference: *Geol. Soc. Am. Bull*., 90, 1, p. 84-92

Concerned area: Aegean region
Formation(s) affected:
Age of the deformation: Miocene to Present
Concerned structures: Hellenic trench and Western Anatolian fault systems
Commentary: The tectonics of the Aegean region involves complex slip patterns across the boundaries of several microplates that segment the end of the Anatolian plate, which is moving in a westward direction from the Bitlis zone, an intracontinental suture zone, to consume oceanic lithosphere in the eastern Mediterranean. The segmentation of the western end of the Anatolian plate into scholles with adjacent zones of grabens, stike-slip and thrust semicontinuum tectonics results from “locking” across the two North Anatolian transform strands where they change orientation at the western end of the Sea of Marmara. This fast lateral motion of buoyant continental slivers is a transient phase of the early stages of continental collision resulting from the irregularity of colliding margins. It is, however, a tectonic phase that leaves a fundamental signature on the convergent zone by imprinting a complex widespread series of structures that mask, and make difficult the interpretation of, earlier structures.
Stress field:
Types of documents: Tectonic reconstruction maps Focal mechanisms maps

N° File: 120

Authors: GURSOY H., TATAR O., PIPER J.D.A., HEIMANN A., MESCI L

Year: 2003

Title: Neotectonic deformation linking the East Anatolian and Karatas-Osmaniye intracontinental transform fault zones in the Gulf of Iskenderun, southern Turkey, deduced from paleomagnetic study of the Ceyhan-Osmaniye volcanics

Reference: *Tectonics*, 22, 6, p. 1067-1079

Concerned area: Southeast of Anatolian plate – Adana basin and gulf of Iskenderun

Formation(s) affected:

Age of the deformation: Recent to Present

Concerned structures: East Anatolian Fault Zone and North Dead Sea Fault

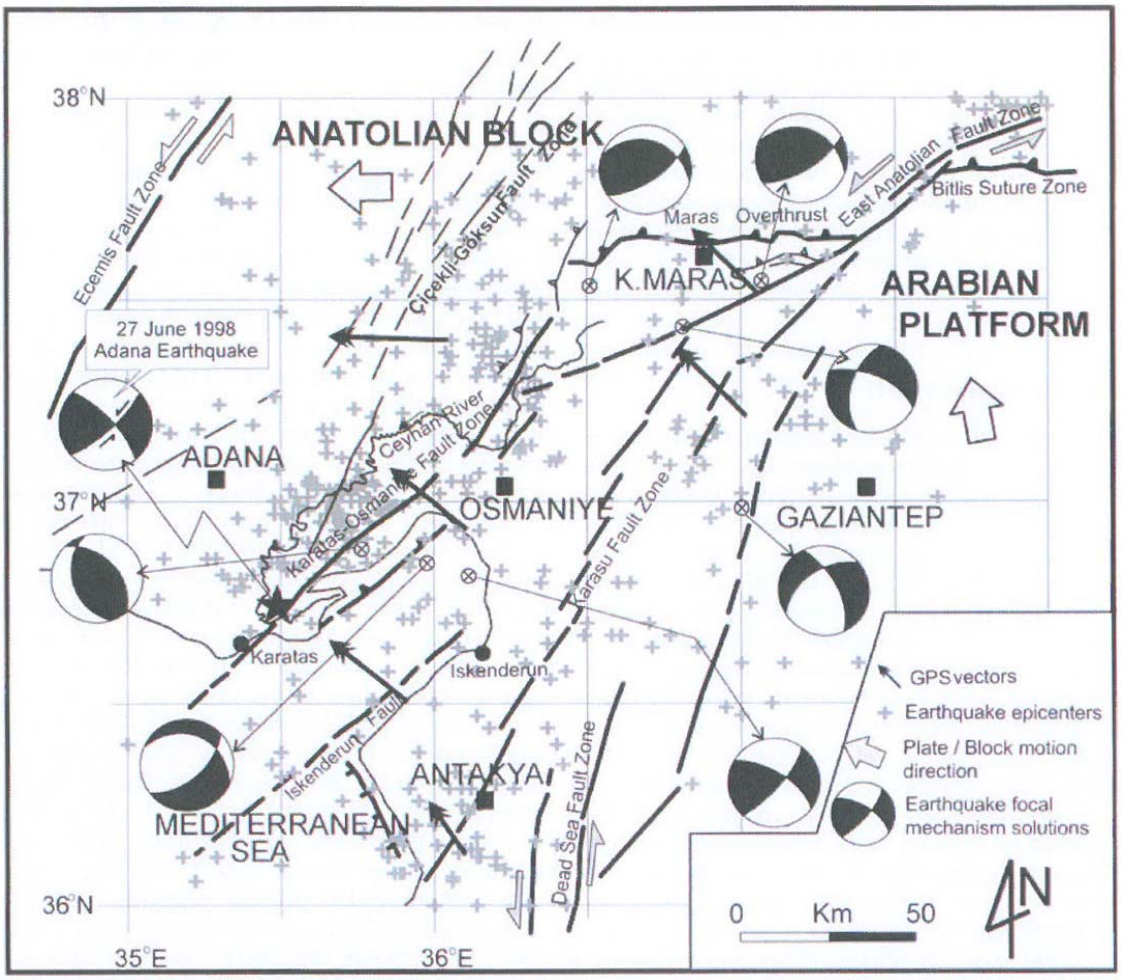
Commentary:

Left-lateral strike slip along the Dead Sea Fault Zone (DSFZ) between the African and Arabian plates is partitioned into a complex set of motions at its northern extension where Arabia impinges into the Anatolian collage. As a result, the nature of the contemporary link between the east Anatolian and Dead Sea transforms is unclear. To quantify strike slip motion expressed as tectonic rotations along the inferred southwest continuation of the east Anatolian Fault Zone (EAFZ), the paleomagnetism of Young has been investigated (<1Ma) volcanics in the Adana Basic-Gulf of Iskenderun region comprising the Ceyhan-Osmaniye volcanic suite. This volcanism is sited close to the intersection between the sinistral Karatas-Osmeniye Fault Zone (KOFZ) and the Neotethyian Suture. Nine sites from a basaltic lava field in the vicinity of Osmaniye are entirely of normal polarity and, in the context of their very young morphologies, are assigned to the Brunhes Chron; declinations are mostly clockwise from the present field. This age assignment identifies rapid Recent (<780 ka) uplift at the head of the Gulf of Iskenderun and is linked to a diversion of the Ceyhan river drainage and ongoing regional tilting. Eight sites yield a mean declination of 11.3±10°, implying clockwise block rotation on Riedel-type fractures on the northwest side of the KOFZ. Seven lavas sites from a volcanic succession near Botas at the southwestern extension of the volcanic lineament are of reversed polarity and rotated counterclockwise by 43±7° with respect to the present field. Polarity, K-Ar, and morphological evidence indicate an assignment toward the latter part of the Matuyama Chron and identify rapid Neogene block rotation of a flake within the KOFZ. An inferred maximum slip rate of 0.6 cm/year on this fault zone is comparable with lower estimates of slip on the EAFZ and suggests that most strike slip on the DSFZ is now being partitioned to the west of the Gulf of Iskenderun on a developing strike slip zone linking with the Cyprus Arc.

Stress field:

Types of documents:

Tectonic and seismotectonic maps



Regional seismotectonic map of the Adana Basin-Gulf of Iskenderun

N° File: 121

Authors: HARRISON R.W., NEWELL W.L., BATIHANLI H., PANAYIDES I., MCGEEHIN J.P., MAHAN S.A., OZHUR A., TSIOLAKIS E., NECDET M.

Year: 2004

Title: Tectonic framework and Late Cenozoic tectonic history of the northern part of Cyprus: implication for earthquake hazards and regional tectonics

Reference: *Journal of Asian Earth Sciences*, 23, p. 191-210

Concerned area: Cyprus and Eastern Mediterranean

Formation(s) affected:

Age of the deformation: Late Cenozoic to Quaternary

Concerned structures: Ovgos fault zone

Commentary:

Located near the triple junction of the Africa, Arabia and Eurasian Plate, Cyprus has had an active and complex neotectonic history, which includes devastating historical earthquakes. Investigations into the tectonic framework of the northern part of Cyprus provide important insights into regional tectonism of the Eastern Mediterranean and Middle East. The northern part of Cyprus is divided into two tectono-stratigraphic terranes, the boundary of which is the Ovgos fault zone. In the Middle Miocene, the Ovgos fault zone was a marine platform margin, which separated open-marine platform carbonates from deep-marine turbidites. Transpressive movement along easterly and northeasterly trending structures dominated the late Miocene; deposition and preservation of Messinian evaporites occurred in grabens at intersections of these trends. N-S compression began in the Early Pliocene and produced contractional tectonism along east-west trends, including major thrusting of allochthonous rocks in the Kyrenia Range. Quaternary deformation has been dominated by strike-slip faults along northeast and northwest trends; movement during the Pleistocene occurred on several of these faults; Holocene movement is documented on one of these faults. A seismic hazard is implied for the Nicosia area because its proximity to the Quaternary faults. Since the Miocene, Cyprus has been continuously uplifted, but the tectonic setting is controversial, as some researchers invoke a subduction zone setting and others ascribe to a regime of strile-slip tectonics. This neotectonic framework is consistent with a restraining bend model for Cyprus in a regional strike-slip regime.

Stress field:

Types of documents:

Generalized tectonic map of the Eastern Mediterranean and middle East
Generalized tectonic map of Cyprus
Schematic cross sections
Geologic map

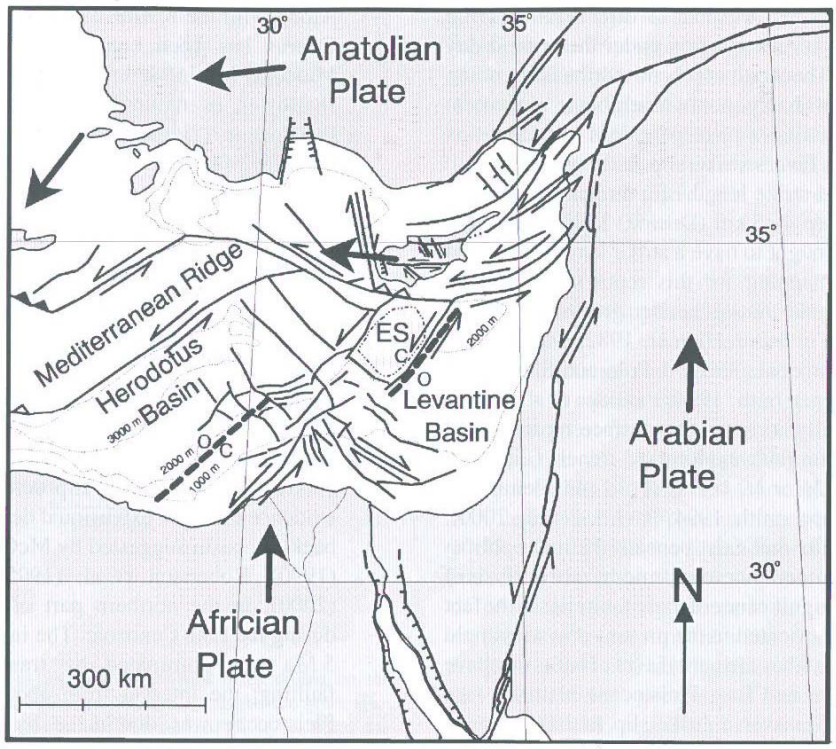
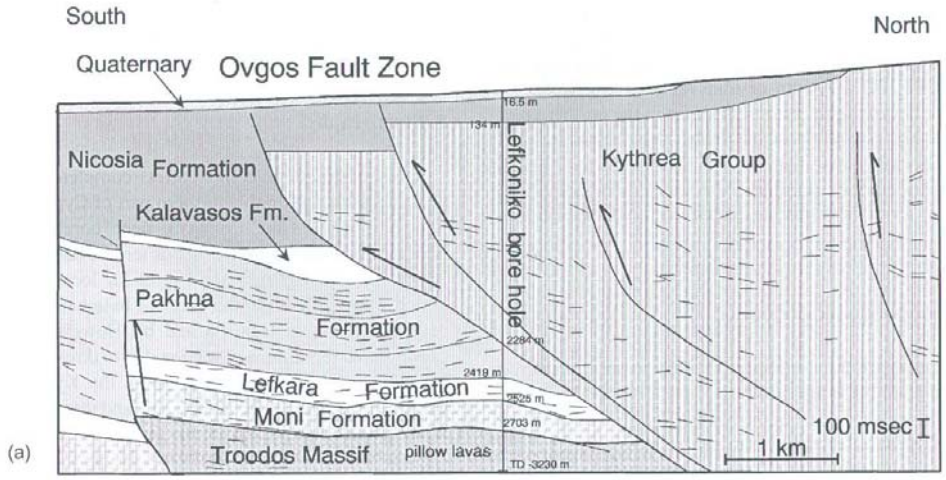
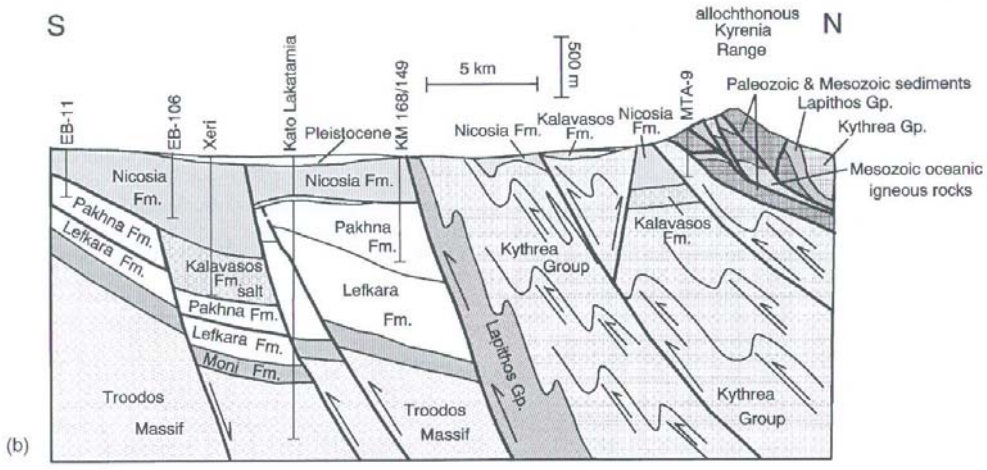


Plate tectonic model for the Eastern Mediterranean-Middle East





Schematic cross-sections of the Ovgos Fault zone

N° File: 122

Authors: HOFSTETTER A., VAN ECK T., SHAPIRA A.

Year: 1996

Title: Seismic activity along fault branches of the Dead Sea-Jordan Transform System: The Carmel-Tirtza fault system

Reference: *Tectonophysics*, 267, p. 317-330

Concerned area: Galilee

Formation(s) affected:

Age of the deformation:

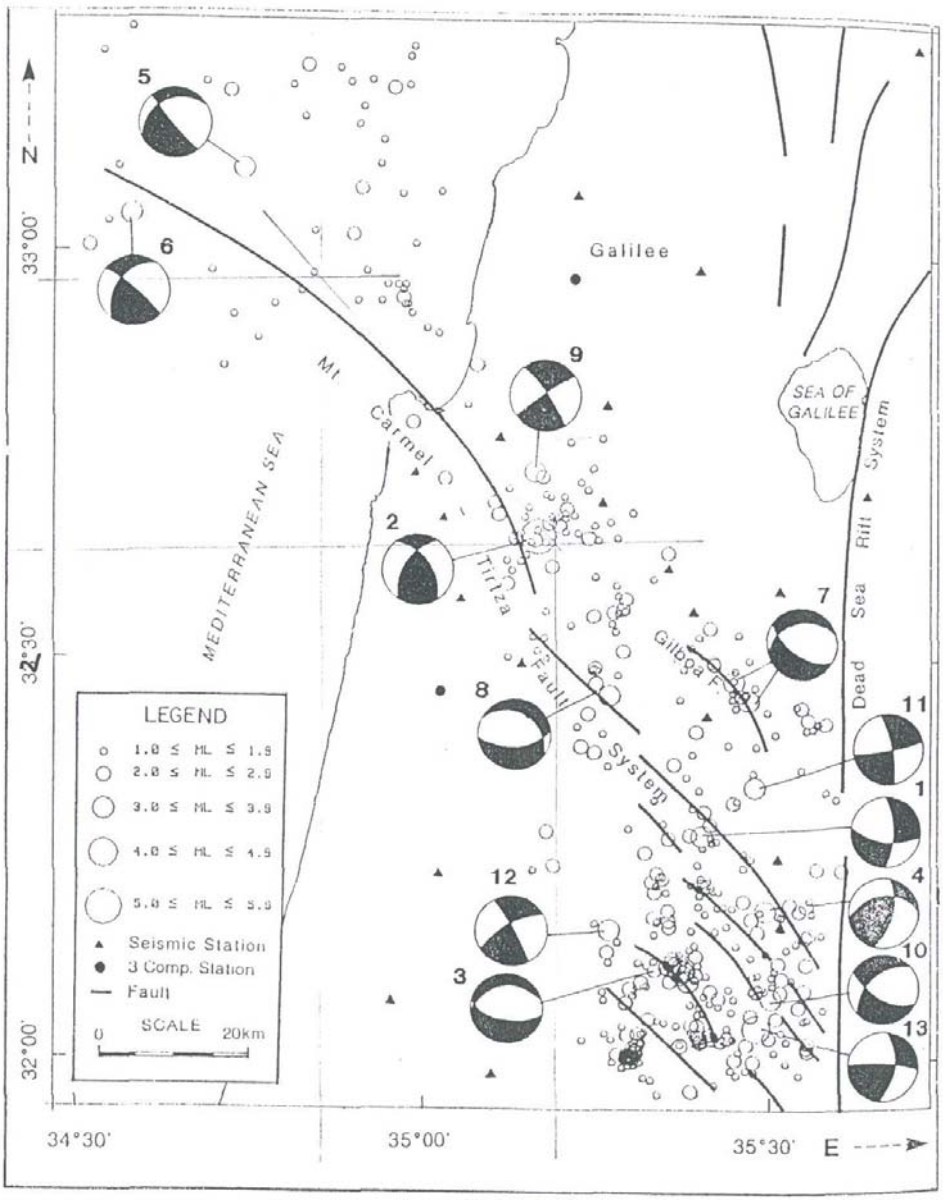
Concerned structures: Mt. Carmel-Tirtza fault system and Dead Sea Fault

Commentary:

About 550 earthquakes (l.0 ≤ M_L ≤5.3) along the Carme-Tirtza fault a branching fault of the Jordan-Dead Sea
Transform System recorded by the Israel Seismograph Network (lSN) between 1984 and 1994 were analyzed. The seismicity pattern reveals significant activity often confined to known surface traces of active faults or within local grabens.
Earthquake clusters are also observed. The seismicity pattern within the Mediterranean seems more diffuse, possibly due to observational inaccuracies and insufficient knowledge of how the Carmel-Tirtza fault system extends towards the northwest.
The seismicity along the Carmel-Tirtza fault system since the beginning of this Century is characterized by a *b* value of about 0.9. For l 5 events with 3.1 ≤ M_L ≤ 5.3 the authors found seismic moment estimates. M_o of 0.7 x 10^{14} ≤ M_0 ≤10^{17} Nm and Brune stress drop estimates. $\Delta\sigma$, between 0.9 and 16.4 MPa. These characteristics are comparable to those for events occurring on the main Dead Sea-Jordan Transform fault.
Ten individual earthquake focal mechanisms and three joint focal mechanisms for earthquake clusters have been obtained. Towards the northeastern part of the Carmel-Tirtza fault system a left-lateral motion seems to dominate. while the seismicity pattern and the focal mechanism solutions near the branching of the Carmel-Tirtza fault and the Dead Sea-Jordan Rift suggest the present-day existence of a complicated tectonic regime. Stress inversion assuming one stress tensor for the whole region indicates NNE-SSW extension and WNW-ESE compression.

Stress field:

Types of documents:
Seismicity map with focal mechanisms
Focal mechanisms table



Seismicity map along the Mt. Carmel-Tirtza fault system

N° File: 123

Authors: JACKSON J. AND MCKENZIE D.

Year: 1984

Title: Active tectonics in the Alpine-Himalayan belt between western Turkey and Pakistan

Reference: *Geophys. J. R. Astr. Soc.*, 77, p. 185-264

Concerned area: Alpine belt between Turkey and Pakistan

Formation(s) affected:

Age of the deformation: Recent

Concerned structures: Alpine-Himalayan belt

Commentary:

Over 80 new fault plane solutions, combined with satellite imagery as well as both modern and historical observations of earthquake faulting, are used to investigate the active tectonics of the Middle East between western Turkey and Pakistan. The deformation of the western part of this region is dominated by the movement of continental material laterally away from the Lake Van region in eastern Turkey. This movement helps to avoid crustal thickening in the Van region, and allows some of the shortening between Arabia and Eurasia to be taken up by the thrusting of continental material over oceanic-type basement in the southern Caspian, Mediterranean, Makran and Black Sea. Thus central Turkey, bounded by the North and East Anatolian strike-slip faults, is moving west from the Van region and overrides the eastern Mediterranean at two intermediate depth seismic zones: one extending between Antalya Bay and southern Cyprus, and the other further west in the Hellenic Trench. The motion of northern Iran eastwards from the Van region is achieved mainly by a conjugate system of strike-slip faults and leads to the low angle thrusting of Iran over the Southern Caspian Sea. The seismicity of the Caucasus shows predominantly shortening perpendicular to the regional strike, but there is also some minor elongation along the strike of the belt as the Caucasus overrides the Caspian and Black Seas.

The deformation of the eastern part of this region is dominated by the shortening of Iran against the stable borders of Turkmenistan and Afghanistan. The north-east direction of compression seen in Zagros is also seen in north-east Iran and the Kopet Dag, where the shortening is taken up by a combination of strike-slip and thrust faulting. Large structural as well as palaeomagnetic rotations are likely to have occurred in NE Iran as a result of this style of deformation. North-south strike-slip faults in southern Iran allow some movement of material away from the collision zone in NE Iran towards the Makran subduction zone, where genuinely intermediate depth seismicity is seen.

Within this broad deforming belt large areas, such as central Turkey, NW Iran (Azerbaijan), central Iran and the southern Caspian, appear to be almost aseismic and therefore to behave as relatively rigid blocks surrounded by active belts 200-300 km wide. The motion of these blocks can usefully be described by poles of rotation. The poles presented in this paper predict motions consistent with thos observed and also predict the opening of the Gulf of Iskenderun NE of Cyprus, the change within the Zagros mountains from strike-slip faulting in the NW to intense thrusting in the SE, and the relatively feeble seismicity in SE Iran (Baluchistan). This description also explains why the north-south structures along the Iran-Afghanistan border do not cut the east-west ranges of the Makran. Within the active belts surrounding the relatively aseismic blocks a continuum approach is needed for a description of the deformation, even though motions at the surface may be concentrated on faults. The evolution of fault systems within the active zones is controlled by geometric constraints, such as the requirement that simultaneously active faults do not, in general, intersect.

Many of the active processes discussed in this paper, particularly large-scale rotations and lateral movement along the regional strike, are likely to have caused substantial complexities in older mountain belts and should be accounted fro in any reconstructions of them.

Stress field:

Types of documents:
Seismic maps

N° File: 124

Authors: JACKSON J. AND MCKENZIE D.

Year: 1988

Title: The relationship between plate motions and seismic moment tensors and the rate of activite deformations in the Mediterranean and Middle-East

Reference: *Geophysical Journal*, 93, p. 58-71

Concerned area: Mediterranean and Middle-East

Formation(s) affected:

Age of the deformation: Present Day

Concerned structures:

Commentary:

This paper is concerned with the relationship between the overall motion across a zone of distributed continental deformation and the seismic moment tensors of earthquakes that occur within it. The overall deformation in the zone is described by the deformation gradient tensor **L**, which may be split into a symmetric part, **S** and an antisymmetric part, **A**. **S** is the strain tensor, and can always be determined from the sum of the moment tensors, following the result of Kostrov (1974). **A** corresponds to a rigid body rotation, and is in principle unobservable seismically: the moment tensors contain no information about **A**, regardless of whether the ambiguity between fault and auxiliary planes is resolved. From **S** the integrated rates of motion normal and parallel to the zone boundary, as well as vertically, can be calculated. Of these, only the motion normal to the zone is specified by the motion across its boundaries. In general, **S** (and hence **L**) is not spewed by the motion of the plates bounding the zone. Only if some *a priori* assumptions about **L** are made, can information about **A** be recovered from the seismic moment tensors. Otherwise **A** must be determined independently from paleomagnetic or geodetic measurements.

These results are applied to the Mediterranean region to see whether the motion between the relatively rigid regions of central Iran, Turkey, Arabia, Africa, the Adriatic Sea and Eurasia is accommodated seismically within the upper crust of the wide deforming zones that bound these regions. In NE Iran, the North Anatolian Fault Zone and the Aegean Sea all or most of the deformation is probably taken up seismically. In the Zagros, Caucasus, Hellenic Trench and western Mediterranean probably 10 per cent or less of the upper-crustal deformation is seismic and the rest must be accommodated by creep. The Cyprus arc, the East Anatolian and Dead Sea Fault Zones have had insufficient seismicity this century for any conclusions to be drawn. The seismicity in central Italy and Yugoslavia accounts for velocities of about 2 mm yr^{-1} normal to the deforming zones, but there is no independent estimate of the velocities on the borders of the Adriatic Sea with which to compare these. The seismicity in the Aegean region indicates very high stretching velocities (c. 60 mm yr^{-1}) and strain rates (c. 4 x 10^{-15} s^{-1}) These in turn require correspondingly high subjection rates (c. 100 mm yr^{-1}) in the Hellenic Trench. If these rates have been constant in time, it is unlikely that the tip of the sinking slab beneath the southern Aegean began to be subdected more than 5 Ma ago. These high-stretching rates in the Aegean, if extrapolated back to the Pliocene, are compatible with observed finite strains and paleomagnetic rotations. They are also likely to have raised to a shallower depth the isotherm corresponding to the seismic-aseismic transition in the crust, perhaps accounting for the relatively shallow focal depths of normal faulting earthquakes in the Aegean compared with those in other areas of continental extension where strain rates are lower.

It is possible that the reason for the dominantly aseismic deformation in the Zagros and Hellenic Trench is related to the great thickness of sediments, partly decoupled from the basement by salt, in both places. This may lead to elevated basement temperatures and inhibit upward fault propagation, thus restricting the size of seismogenic fault planes (and hence seismic moment) and causing the sedimentary cover to deform independently from the basement, partly by folding. However, this explanation has serious drawbacks and is not easily applicable to other areas, notably the western Mediterranean.

Stress field:

Types of documents:

Maps of earthquakes and focal mechanisms

N° File: 125

Authors: KLINGER Y.

Year: 1999

Title: Sismotectonique de la faille du Levant

Reference: *Thèse Université Louis Pasteur,* Strasbourg I

Concerned area: Israel and Jordan

Formation(s) affected:

Age of the deformation:

Concerned structures: Dead Sea Fault System

Commentary:

The Levantine strike-slip fault connects the collision zone of Taurus-Zagros to the Red Sea spreading centre. This study deals only with the Dead Sea segment, from Lake Tiberias to the Gulf of Aqaba. The Dead Sea closed basin, due to its arid climate, is well adapted to determine the different parameters dealing with the morphogenesis of the alluvial fans and to establish the time history of the emplacement of alluvial surfaces during the Quaternary. A map of active faulting in Wadi Araba has been established. Fault offsets in an alluvial fan, and in alluvial terraces, have been measured and also dated, either directly or using the quaternary deposition history. The author derive a slip rate of 4 ± 1 mm/yr. Systematic measurements of landform offsets across the fault show that it moves during large earthquakes, with an average incremental offset of about 1.5 m., in good agreement with the size of historical events. Locally, offset seems to be constant through time. The rupture process of the Aqaba earthquake (22/11/95) of magnitude 7.3 is derived from wave form modelling and aftershock distribution. The land deformation observed from radar interferometry is in agreement with our source model. The author show that the ground ruptures observed all around the Gulf of Aqaba are not primary ruptures but rather gravitational collapse of part of the coastal plate-form. The author collects all regional seismic catalogues in order to relocate the background seismicity since 1987. Using available polarities the author determines focal mechanisms and the regional stress tensor. The author also determine a new pole of rotation Arabia/Africa from recent geodetic and morphotectonic data that is also compatible with pole obtained from global plate tectonic models.

Stress field:

Types of documents:

Maps of earthquakes, focal mechanisms
Geomorphologic maps
Seismotectonic maps

N° File: 126

Authors: KLINGER Y., RIVERA L., HAESSLER H. ET MAURIN J.C.

Year: 1999

Title: Active faulting in the gulf of Aqaba: New knowledge from the Mw 7.3 earthquake of 22 November 1995

Reference: *Bull. Seis. Soc. Am.,* 89, p. 1025-1036

Concerned area: Gulf of Aqaba

Formation(s) affected:

Age of the deformation: Present Day

Concerned structures: Dead Sea Fault

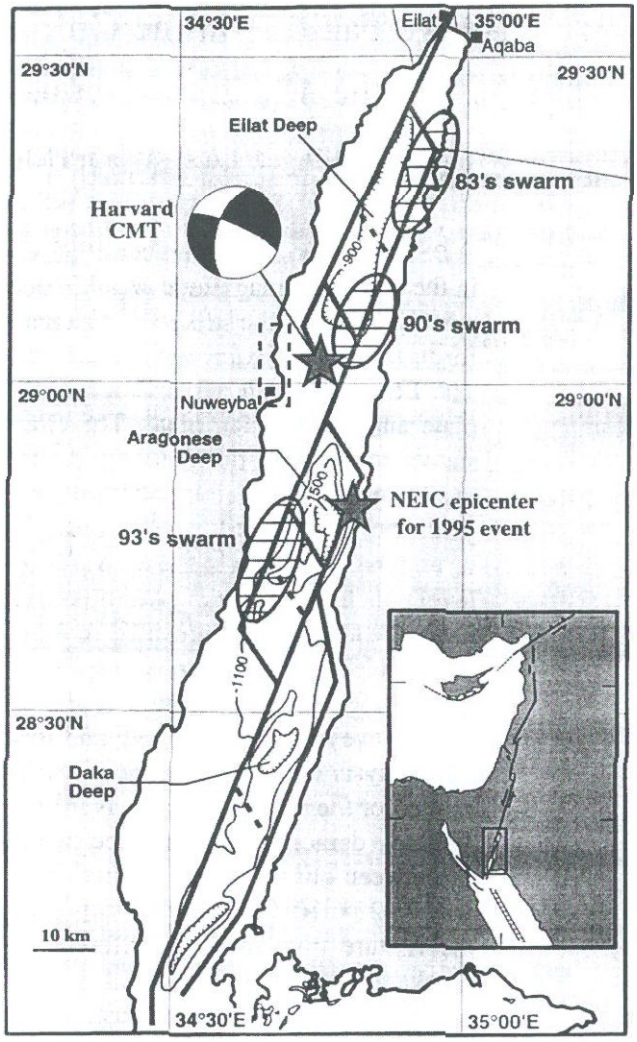
Commentary:

On 22 November 1995 the largest earthquake instrumentally recorded in the area, with magnitude *Mw* 7.3, occurred in the Gulf of Aqaba. The main rupture corresponding to the strike-slip mechanism is located within the gulf of Aqaba, which forms the marine extension of the Levantine fault, also known as the Dead Sea fault. The Levantine fault accommodates the strike-slip movement between the African plate and the Arabian plate. The Gulf of Aqaba itself is usually described as the succession of three deep pull-apart basins, elongated in the N-S direction. Concerning historical seismicity, only two large events have been reported for the last 2000 years, but they are still poorly constrained. The seismicity recorded since installation of regional networks in the early 1980s had been characterized by a low background level punctuated by brief swarm like activity a few months in duration. Three swarms have already been documented in the Gulf of Aqaba in 1983, 1990, and 1993, with magnitudes reaching at most 6.1 (M_w). The authors suggest that the geometry of the rupture for the 1995 event is related to the spatial distribution of these previous swarms. Body-wave modeling of broadband seismograms from the global network, along with the analysis of the aftershock distribution, allows the authors to propose a well-constrained model for the rupture process, Northward propagation of the rupture has been found. The authors have demonstrated that three successive subevents are necessary to obtain a good fit between observed and synthetic wave forms. The total seismic moment released was 7.42 X 10^{19} N-m. The location of the subevents shows that the three stages of the rupture involve three different segments within the gulf. Substantial surface breakage showing only normal motion (up to 20 cm) affecting beachrock was observed along the Egyptian coast. The authors show that these ruptures are only a secondary feature and are in no case primary ruptures. The stress tensor derived from striations collected in quaternary sediments shows radial extension. This result supports land-sliding of the beach terraces under the action of the earthquake shaking.

Stress field:

Types of documents:

Seismotectonic maps with earthquake epicentres, focal mechanisms, active faults
Field photographs and interpretative sketches



The location of the swarms of 1983

N° File: 127

Authors: KLINGER Y., AVOUAC J.P., ABOU KARAKI N., DORBATH L., BOURLES L., REYSS J.L.

Year: 2000

Title: Slip rate on the Dead Sea transform in northern Araba valley (Jordan)

Reference: *Geophys. J. Int.*, 142, p. 755-768.

Concerned area: Araba valley, Jordania

Formation(s) affected:

Age of the deformation: Quaternary

Concerned structures: Dead Sea Fault

Commentary:

Between the southern tip of the Dead Sea and the Gulf of Aqaba lies the Araba valley. This depression blanketed with alluvial and lacustrine deposits is cut along its entire length by the Dead Sea fault. In many places the fault scarp is well defined and evidence for left-lateral strike-slip faulting is abundant. The slip rate on the fault could be constrained from geomorphic features displaced by the fault. The authors show for example that a large fan at the mouth of Wadi Dahal was displaced by about 500m since the bulk of the fanglomerates were deposited 70 to 120 kyr ago, as indicated from cosmogenic dating (^{10}Be in chert) of pebbles collected on the fan surface and the age of transgressive lacustrine sediments caping the fan. Holocene alluvial surfaces are also clearly offset. By correlation with similar surfaces along the Dead-sea lake margin, The authors propose a chronology for their emplacement. Altogether, these observations suggest a slip rate over the Late Pleistocene between 3 and 9mm/yr with a preferred value of 4 mm/yr. This slip rate is shown to be consistent with other constraints on the kinematics of the Arabian plate, assuming a rotation rate of about 0.396°/Myr around a pole at 31.1°N, 26.7°E.

Stress field:

Types of documents:

Geomorphological maps

N° File: 128

Authors: KLINGER Y., AVOUAC J.P., DORBATH L., ABOU KARAKI N., TISNERAT N.

Year: 2000

Title: Seismic behaviour of the Dead Sea fault along Araba valley (Jordan).

Reference: *Geophys. J. Int.*, 142, p. 769-782.

Concerned area: Gulf of Aqaba

Formation(s) affected:

Age of the deformation:

Concerned structures:

Commentary:

The Dead-sea fault is a major left-lateral strike-slip fault. South of the Dead Sea basin the Wadi Araba fault extends over 160 km to the Gulf of Aqaba. The Dead Sea fault is known to present a relatively intense historical seismicity. However the historical events are unequally distributed along the fault and only four events are reported in the Araba valley over the last thousands years. Historical record magnitudes are probably slightly smaller than that of Mw ~7.3 earthquake that stroke the Gulf of Aqaba in 1995. The fault cuts straightly across Pleistocene to Holocene alluvium and shows morphologic evidence for essentially pure strike-slip motion. Regional seismic monitoring reveals little microseismicity along the fault excepted around the Dead Sea and Gulf of Aqaba where the fault splay into complex pull-apart basin fault systems. The authors investigate the fault zone at a few sites selected from SPOT images and aerial views. At the site of the now destroyed Tilah Castle, a well preserved wall, dated to be about *ca* 1200 yr. B.P. (^{14}C age on charcoal) is cut by the fault and offset by 2.2 m.

Comparison with offset gullies at a nearby site 3 km to the north and at three other sites respectively 25, 50 and 65 km to the south reveals that this fault displacement is probably related to the last seismic event that ruptured that fault segment, probably in 1458 A.D. The offset gullies moreover suggest characteristic slip behaviour with recurring slip event of 1.5 m on average. Given the 4±1 mm/yr. slip rate derived for that fault segment the author infers that the fault must produce Mw -7 earthquakes in the Araba valley every about 190 yr. The historical period would thus correspond to a relative quiescence with a 20% deficit of Mw ~7 earthquakes. However our data does not exclude the possibility for larger Mw ~7.6 earthquakes or time clustering of earthquakes over large span of time. An alternate seismic behaviour is involving Mw ~7.6 earthquakes about every 3500-7000 yr. and Mw ~7 earthquakes about every 250 yr. The historical catalogue would then appear to be complete as to Mw ~7 earthquakes.

Stress field:

Types of documents:

Seismic maps

Geomorphologic field photographs and interpretative sketches

N° File: 129

Authors: MC CLUSKY S., REILINGER R., MAHMOUD S., BEN SARI D., TAELEB A.

Year: 2003

Title: GPS constraints on Africa (Nubia) and Arabia plate motions

Reference: *Geophys. J. Int.*, 155, p. 126-138

Concerned area: African (Nubia), and Arabian plates

Formation(s) affected:

Age of the deformation: Present Day

Concerned structures: Global tectonics

Commentary:

Continuously recording GPS (CGPS) and survey-mode GPS (SGPS) observations has been used to determine Euler vectors for relative motion of the African (Nubian), Arabian and Eurasian plates. This paper presents a well-constrained Eurasia-Nubia Euler vector derived from 23 IGS sites in Europe and four CGPS and three SGPS sites in the Nubian Plate (-0.95±4.8°N, -21.8±4.3°E,0.06±0.005° Myr^{-1}). No significant (>1 $mmyr^{-1}$ internal deformation of the Nubian Plate were observed. The GPS Nubian-Eurasian Euler vector differs significantly from NUVEL-1A (21.0± 4.2°N, -20.6 ± 0.6°E, 0.12 ± 0.015° Myr^{-1}), implying more westward motion of Africa relative to Eurasia and slower convergence in the eastern Mediterranean. The Arabia-Eurasia and Arabia-Nubia GPS Euler vectors are less well determined, based on only one CGPS and three SGPS sites on the Arabian Plate. The preliminary Arabia-Eurasia and Arabia-Nubia Euler vectors are 27.4 ± 1.0°N, 18.4 ± 2.5°E, 0.4 ± 0.04° Myr^{-1}, and 30.5 ± 1.0°N, 25.7 ± 2.3°E, 0.37 ± 0.04° Myr^{-1}, respectively. The GPS Arabia-Nubia Euler vector differs significantly from NUVEL-1A (24.1± 1.7°N, 24.0 ± 3.5°E, 0.4 ± 0.05° Myr^{-1}), but is statistically consistent at the 95 per cent confidence level with the revised Euler vector reported by Chu & Gordon based on a re-evaluation of magnetic anomalies in the Red Sea (31.5 ± 1.2°N, 23.0 ± 2.7°E, 0.40 ± 0.05° Myr^{-1}). The motion implied in the Gulf of Aqaba and on the Dead Sea fault (DSF) by the new GPS Nubia-Arabia Euler vector (i.e. ignoring possible Sinai block motion and possible internal plate deformation) grades from pure left lateral strike-slip in the Gulf and on the Southern DSF with increasing compression on the central and northern DSF with relative motion increasing from 5.6 to 7.5mm yr^{-1} (±1mm yr^{-1}) from south to north. Along the northern DSF (i.e. north of the Lebanon restraining bend) motion is partitioned between 6±1mm yr^{-1} left-lateral motion parallel to the fault trace and 4±1mm yr^{-1} fault-normal compression. Relative motion on other plate boundaries (including the Anatolian and Aegean microplates) derived from the GPS Euler vectors agree qualitatively with the sense of motion indicated by focal mechanisms for large crustal earthquakes (M>6). Where data are available on fault-slip rates on plate boundings faults (North Anatolian fault, East Anatolian fault, Dead Sea fault, Red Sea rift), they are generally lower than, but not significantly different from, the full plate motion estimates suggesting that the majority of relative plate motion is accommodated on these structures.

Stress field:

Types of documents:

GPS velocities slip vector maps

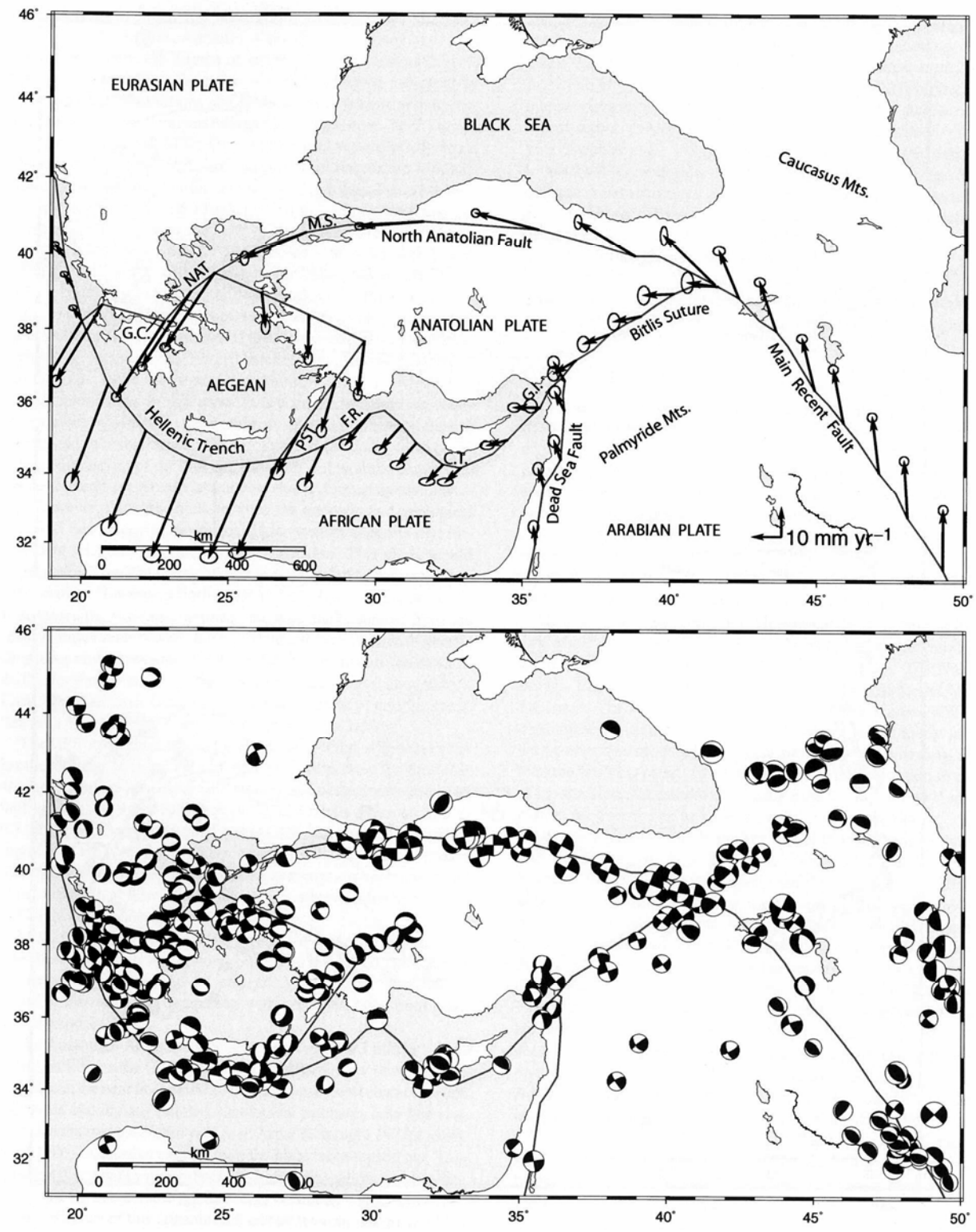


Fig 5a: Relative motions and 95 percent confidence ellipses on schematic plate boundaries in the eastern Mediterranean.
Fig 5b: Earthquake focal mechanisms of Anatolian Plate

N° File: 130

Authors: OVER S., OZDEN SUHA, UNLUGENC U.C., YILMAZ H.

Year: 2004

Title: A synthesis: Late Cenozoic stress field distribution at northeastern corner of the Eastern Mediterranean, SE Turkey. *C. R.*

Reference: *Geoscience*, 336, p. 93-103

Concerned area: Southeastern Turkey, Adana basin and Iskenderun gulf

Formation(s) affected:

Age of the deformation: Mio-Pliocene to present day

Concerned structures: Karatas-Osmaniye Fault and Amanos Fault

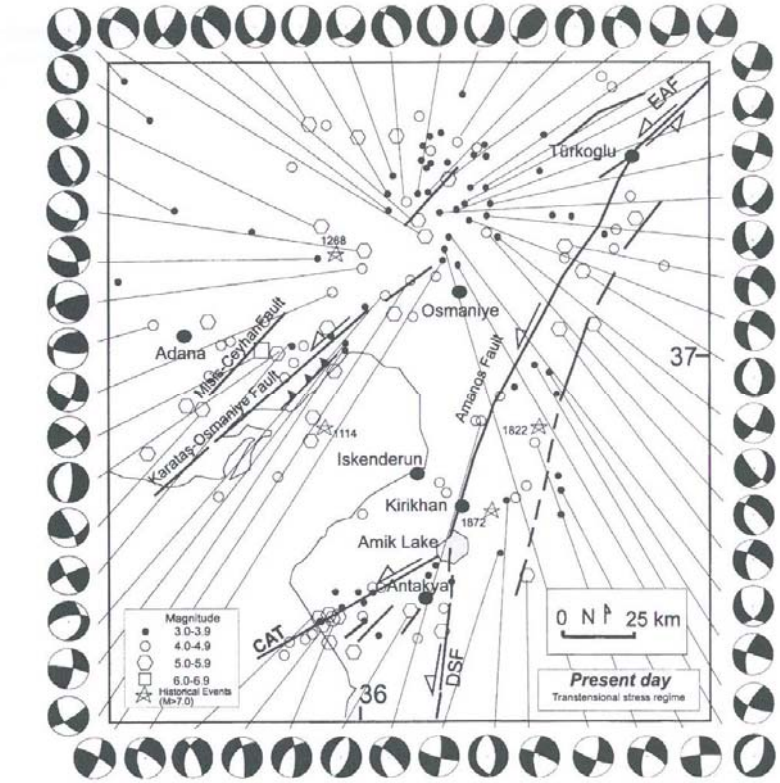
Commentary:

Fault kinematic analysis and inversion of focal mechanisms of shallow earthquakes reveal significant evolution of the regional stress regime in the northeastern most corner of the Eastern Mediterranean region since the Mio-Pliocene to the present time. This study was carried out in the interaction area between the Arabian/African plates and the Anatolian block. The evolution of stress regimes consists of a change from older transpression to younger transtension. Both strike-slip stress regimes having a NNW-to northwest-trending σ_{Hmax} (σ_1) and ENE- to northeast-trending σ_{Hmax} ($\sigma 3$) axes induce a sinistral component of displacement on the major intra-continental Karatas-Osmaniye and Misis-Ceyhan faults elongated with the northeast-trending Misis Range between Adana and Osmaniye provinces (sub-area *i*) and by a NNE-trending plate boundary Amanoos fault running along Amanos Range between Antakya and Kahramanmaras provinces (sub-area *ii*). The inversion results show that the transtensional stress regime is dominantly strike-slip to extension, with an ENE- to northeast-trending σ_{Hmax} ($\sigma 3$) axis for sub-aeas (*i*) and (*ii*), respectively. The inversions of earthquake focal mechanisms indicate that the transtensional stress regime is still active in the whole study area since probably recent Quaternary time.

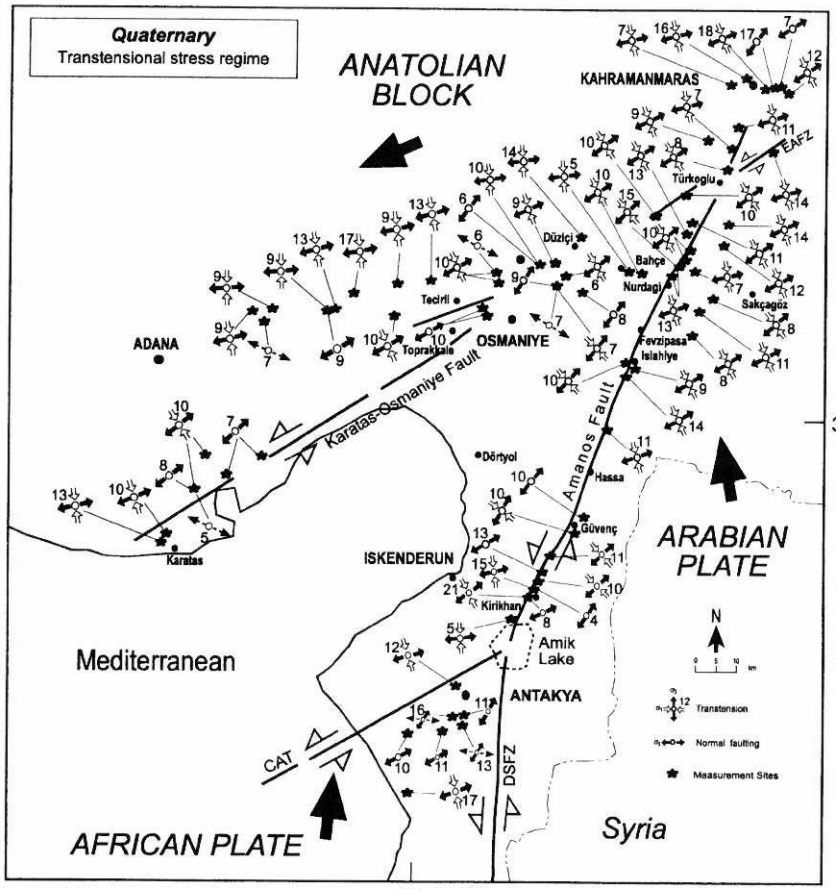
Stress field: Different stress field at the triple junction between Anatolian block, Arabian plate and African plate

Types of documents:

Tectonic and seismotectonic maps



Seismotectonic map of the study area and focal mechanisms of shallow earthquakes



Quaternary stress field regime

N° File: 131

Authors: PILIDOU S., PRIESTLEY K., JACKSON J., MAGGI A.

Year: 2004

Title: The 1996 Cyprus earthquake: a large, deep event in the Cyprean Arc.

Reference: *Geophys. J. Int.*, 158, p. 85-97.

Concerned area: Cyprus and eastern Mediterranean

Formation(s) affected:

Age of the deformation: Present Day

Concerned structures: Cyprean subduction

Commentary:

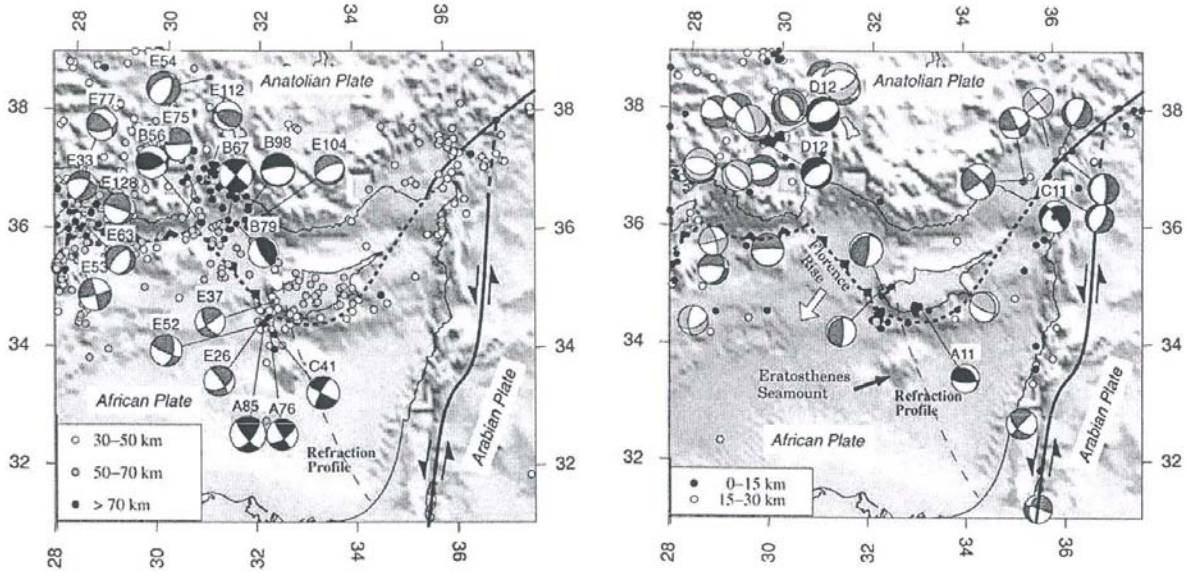
The paper examines the source mechanisms and depths of the largest earthquake that has occurred in the vicinity of Cyprus in the last 50 years, the 1996 October 9 earthquake (M_w = 6.8) and its principal aftershock on October 10 (M_w = 5.8). Being the first large event in the area for which seismic data from the global digital network are available, it provides an excellent opportunity to study the complex tectonic processes of the eastern Mediterranean. The source mechanisms and depths of the earthquakes were modelled by a least-squares body waveform fitting procedure. The waveform fits resulting from our minimum-misfit solutions are considerably better than those predicted by previous studies. The paper shows strong evidence that both events were at depths of 76-85km rather than 20-30km, as has been suggested by other studies. These earthquakes form a group indicating that the Mediterranean lithosphere south of the Hellenic and Cyprean arcs is in east-west compression as it is subducted to the north and northeast. The paper additionally examines the source mechanism and depth of the 1999 August 11 earthquake (M_w = 5.6), which occurred at about 11 km with a reverse dip-slip mechanism. It probably reflects crustal shortening between the African and Turkish plates.

Stress field:

Stress field around the Cyprean Arc deduces from formal mechanisms

Types of documents:

Earthquakes maps with focal mechanisms

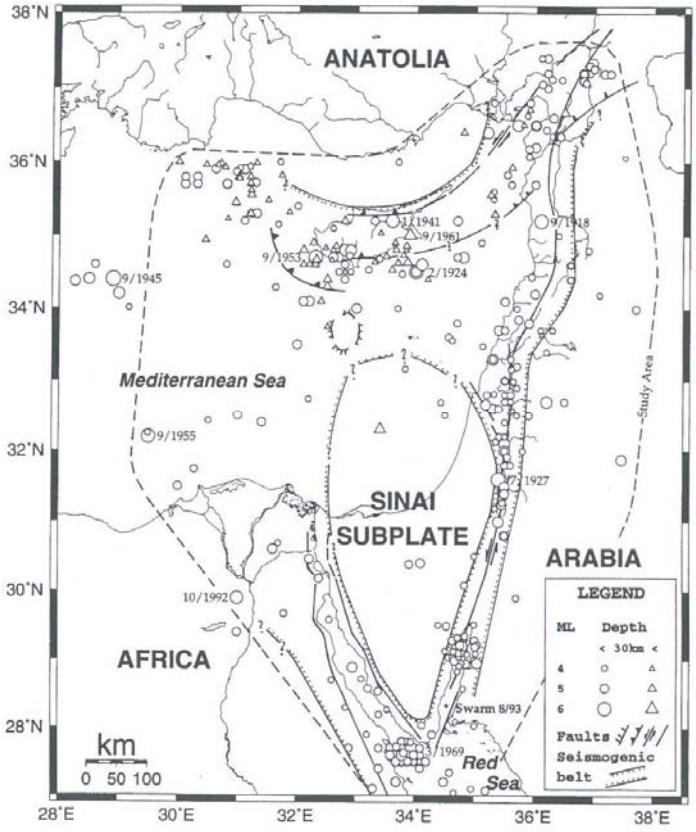


a) Earthquakes reported as deeper than 30 km. **b)** Shallow earthquakes (0-30km depth)

N° File: 132

Authors: SALAMON A., HOFSTETTER A., GAFUNKEL Z., RON H.
Year: 1996
Title: Seismicity of the eastern Mediterranean region: perspective from the Sinai subplate
Reference: *Tectonophysics*, 263, p. 293-305

Concerned area: Eastern Mediterranean
Formation(s) affected:
Age of the deformation: Present Day
Concerned structures: Dead Sea Fault, Cyprean Arc, Gulf of Suez graben, Aqaba Gulf graben
Commentary: The paper shows a list (based on various published catalogs) of $M_L \geq 4$ earthquakes which were recorded during the years 1900-1991 and represents most of the seismic moment released in the area over this period. *b*-values are 1.02, 1.0 and 1.07 for the whole Sinai subplate, the Dead Sea transform and the Cypriot arc, respectively. Seismic efficiency of the Dead Sea transform is very low (about 7%!), stressing the role of aseismic deformation in that plate border. Most of the major and moderate events, $M_L \geq 5$, occur in belts associated with the geologically documented borders of the Sinai subplate : the Cypriot convergent arc in the north, the Dead sea transform in the east and the rift of Suez in the southwest (the latter, like the Gulf of Eilat, Aqaba, was considered aseismic during the first half of the century). The northwestern border, however, could not be delineated. Low-level activity appears within the subplate, especially north of latitude 32°N, reflecting the breakdown of this part of Sinai as it approaches the Cypriot convergence zone. Though most of the seismic moments tend to concentrate along the subplate borders, some moderate activity spreads out in wide belts which reflect the complexity of deformation accompanying motion along the subplate borders;
Stress field:
Types of documents: Seismicity map Earthquake catalogs



Seismicity map of the Sinai subplate

N° File: 133

Authors: SALAMON A., HOFSTETTER A., GARFUNKEL Z., RON H.

Year: 2003

Title: Seismotectonics of the Sinaï subplate, the eastern Mediterranean region.

Reference: *Geophys. J. Int.*, 155, p. 149-173.

Concerned area: Eastern Mediterranean

Formation(s) affected:

Age of the deformation: Present Day

Concerned structures: Dead Sea Fault, Cyprean Arc, Gulf of Suez graben, Aqaba Gulf graben

Commentary:

The paper defines the Sinai subplate, from a seismotectonic perspective, as a distinct component in the plate tectonics of the eastern Mediterranean region. This is based on the tectonic characteristics of a comprehensive listing of all $M_L \geq 4$ recorded seismicity in the region during the 20th century, on newly calculated and recalculated fault plane mechanisms of first P-wave arrivals and on published solutions based on waveform inversion of broad-band data. The low seismicity level and scarcity of strong events in the region required a thorough search for useful data and a careful examination of the reliability of the focal solutions. The paper lists all available records of first *P*-wave onsets from the ISS and ISC Bulletins and the local seismic networks. and calculates 48 new focal mechanisms and 33 recalculated ones of events that occurred during the years 1 940-1992. With the increasing number of teleseismic and regional broad-band stations in the later years, 37 solutions were added, based on teleseismic and regional waveform inversions of events that occurred during 1 977-2001 . These mechanisms enabled us to examine the seismotectonic character of the Sinai sibilate.

The strike and rake directions of the calculated mechanisms usually reflect the geometry and the large-scale type of deformation observed along the boundaries of the Sinai subplate-the Dead Sea Transform, the Cypriot Arc convergent zone and the Suez Rift. Nevertheless, along each of these boundaries anomalous solutions wer found that attest to the complexity of the deformation processes along plate margins.

Earthquakes along the Dead Sea Transform exhibit mainly sinistral transmission and trans-pression, reflecting its leaky manner and local change in the transform geometry. The presence of other unexpected mechanisms near the transform however reflects the heterogeneous deformation it induces around. As expected, thrust mechanisms along the Cypriot Arc mirror its convergent nature and typical curved geometry. Transtension and transpressional solutions in the eastern segment of the arc reflect the sinistral shear motion between Anatolia and Sinai there. However shear mechanisms found between Cyprus and the Eratosthenes Seamount pose a problem regarding its collision process.

Most intriguing of all are $M_L \geq 4$ thrust and shear solutions found in the Gulf of Suez.

They are associated with predominantly normal mechanisms within a rift zone and therefore constitute a unique phenomenon, yet to be deciphered.

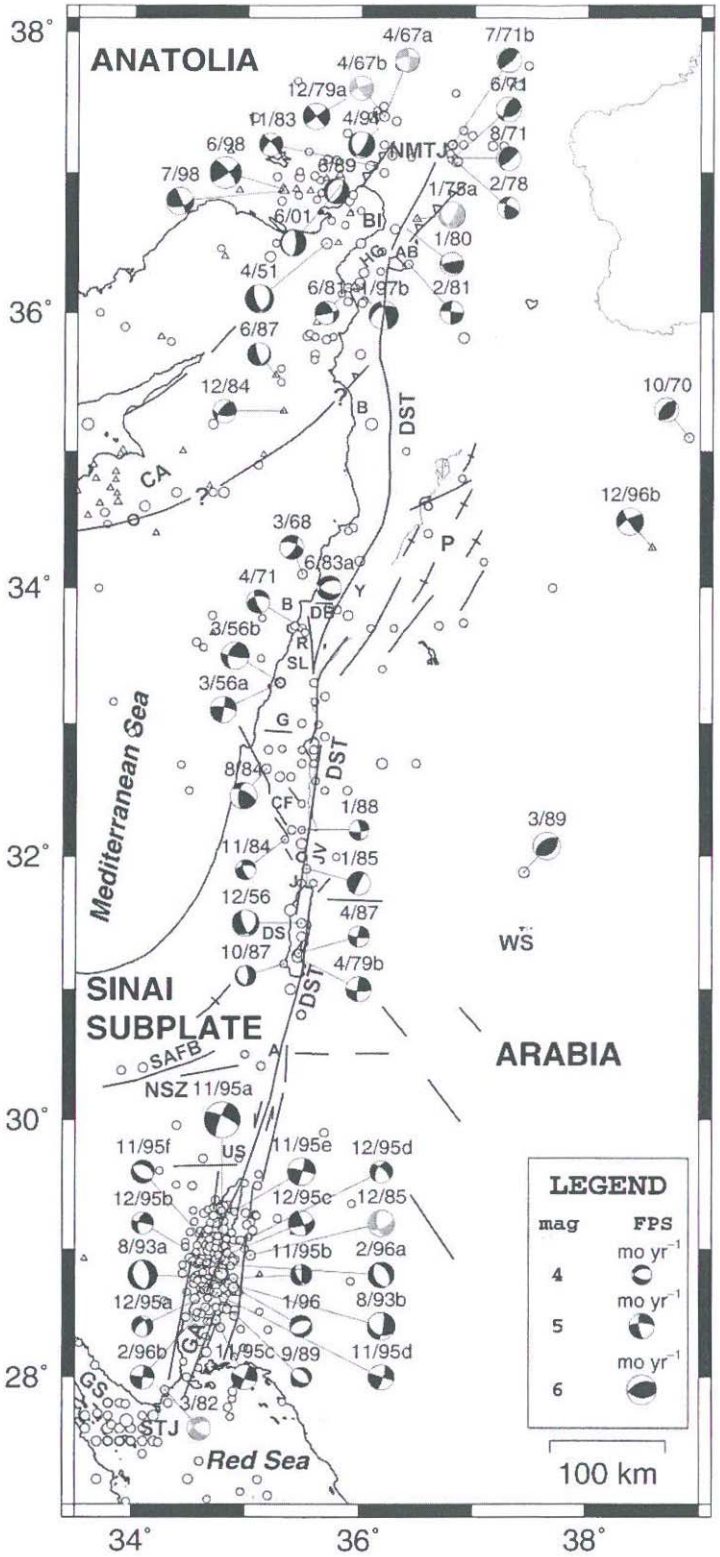
Stress field:

Stress field of eastern Mediterranean deduced from focal mechanisms

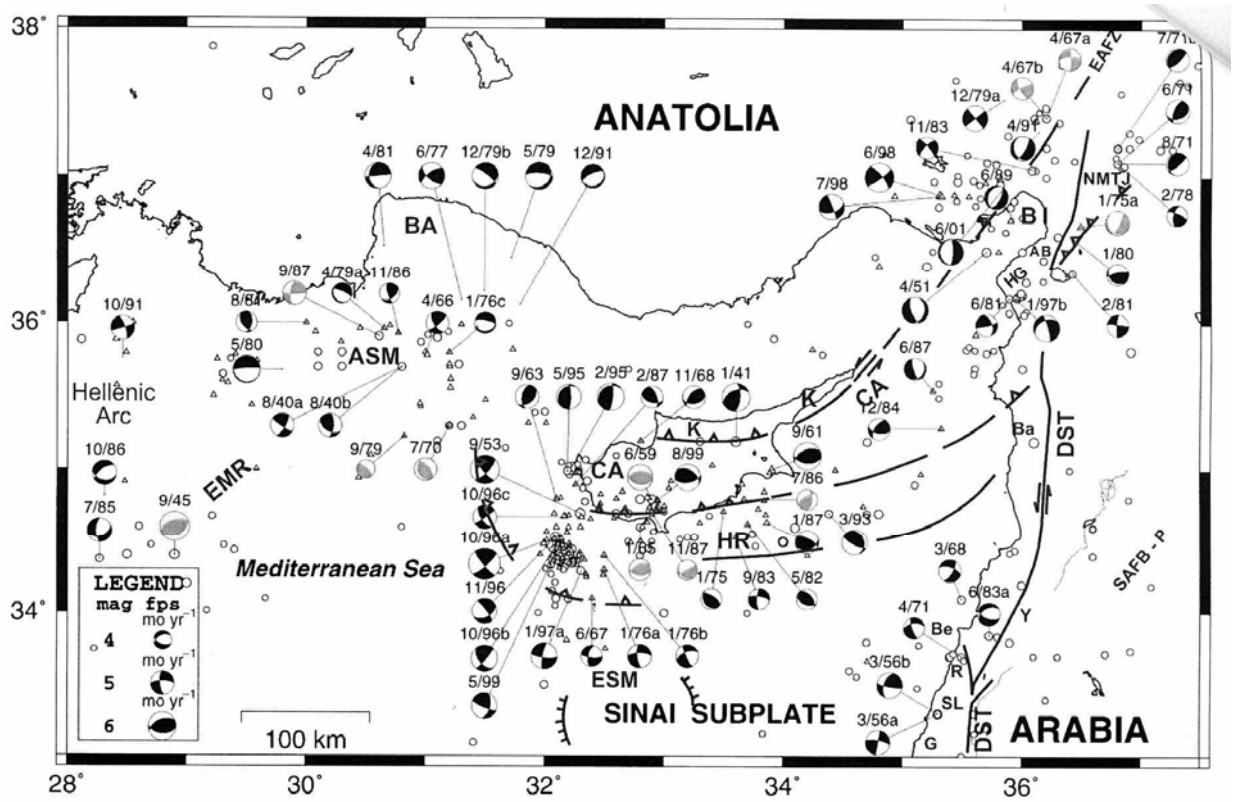
Types of documents:

Seismotectonic maps with focal mechanism

Earthquake catalogs with fault plane solutions



Seismotectonic map of the Dead Sea Transform



Seismotectonic map of the Cyprean Arc

N° File: 134

Authors: TAYMAZ T., EYIDOGAN H., JACKSON J.

Year: 1991

Title: Source parameters of large earthquakes in the East Anatolian Fault Zone.

Reference: *Geophys. J. Int.*, 106, p. 537-550

Concerned area: Southeast Turkey

Formation(s) affected:

Age of the deformation:

Concerned structures: East Anatolian Fault Zone

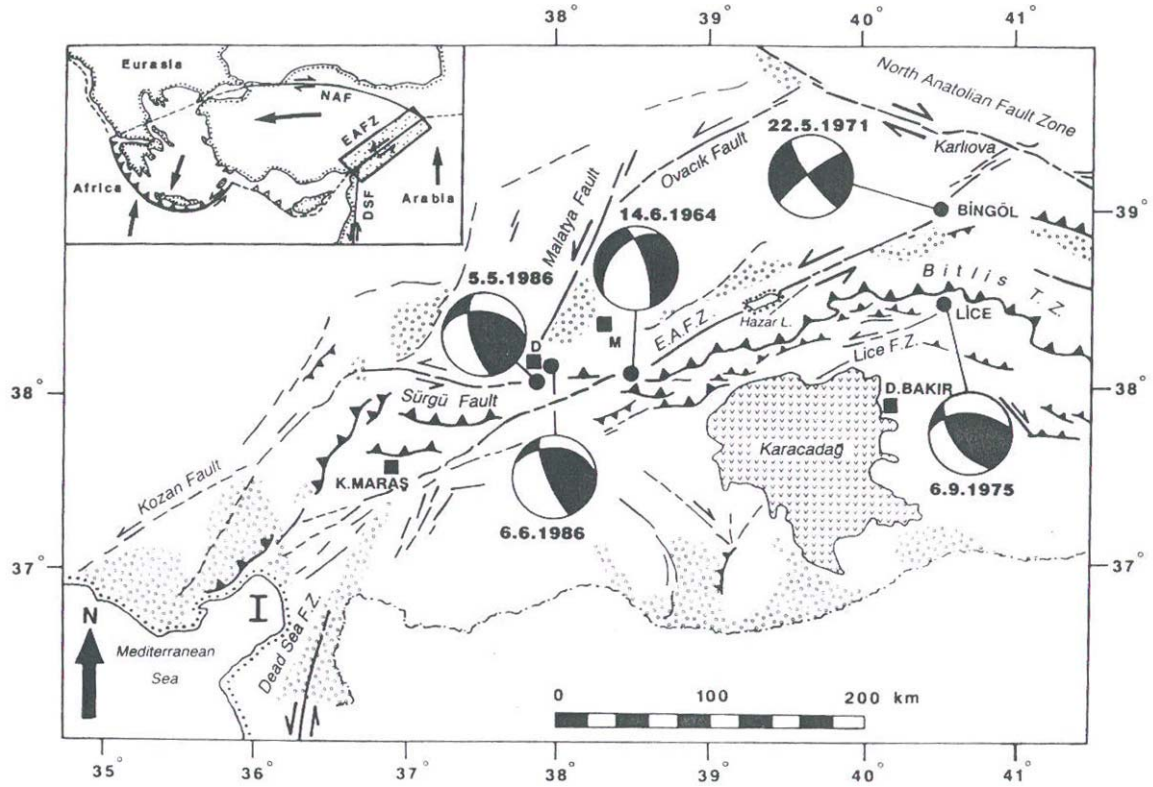
Commentary:

The East Anatolian Fault Zone accommodates most of the motion between the Arabian plate and the apparently little-deforming interior of central Turkey. The direction of overall slip across this zone is crucial to the determination of the slip rate on the North Anatolian Fault. The authors use long-period *P*- and *SH*-waveforms to determine the source parameters of the four largest earthquakes that occurred in, or near, the East Anatolian Fault Zone in the last 35 years. Only one of these actually involved left-lateral strike-slip motion on a NE-SW fault. But the other three, and the nearby 1975 Lice earthquake, all had steeply dipping nodal planes with a NNW strike: if these were the auxiliary planes then all the earthquakes had a slip vector direction within about 10° of 063°. If this direction represents the Arabian-Turkey motion, then the slip rate on the North Anatolian Fault must be in the range 31 to 48 mm yr^{-1}, with a probable value of 38 mm yt-1, and the overall slip rate across the East Anatolian Fault Zone must be about 29mm yr^{-1} with a range of 25-35mm yr^{-1}.

Stress field:

Types of documents:

Seismotectonic maps with focal mechanisms



Summary map of the East Anatolian Fault Zone

N° File: 135

Authors: TAYMAZ T., TAN O., YOLSAL S.

Year: 2004

Title: Active tectonics of Turkey and surroundings and seismic risk in the Marmara sea region.

Reference: The proceedings of the 1st International Workshop on "Active Monitoring in the Solid Earth Geophysics" IWAM04, Mizunami, Japan, June30-July 3, 2004

Concerned area: Eastern Mediterranean, Turkey, Caucasus

Formation(s) affected:

Age of the deformation: Present Day

Concerned structures: Caucasus belt, Turkey plate and Aegean subduction

Commentary:

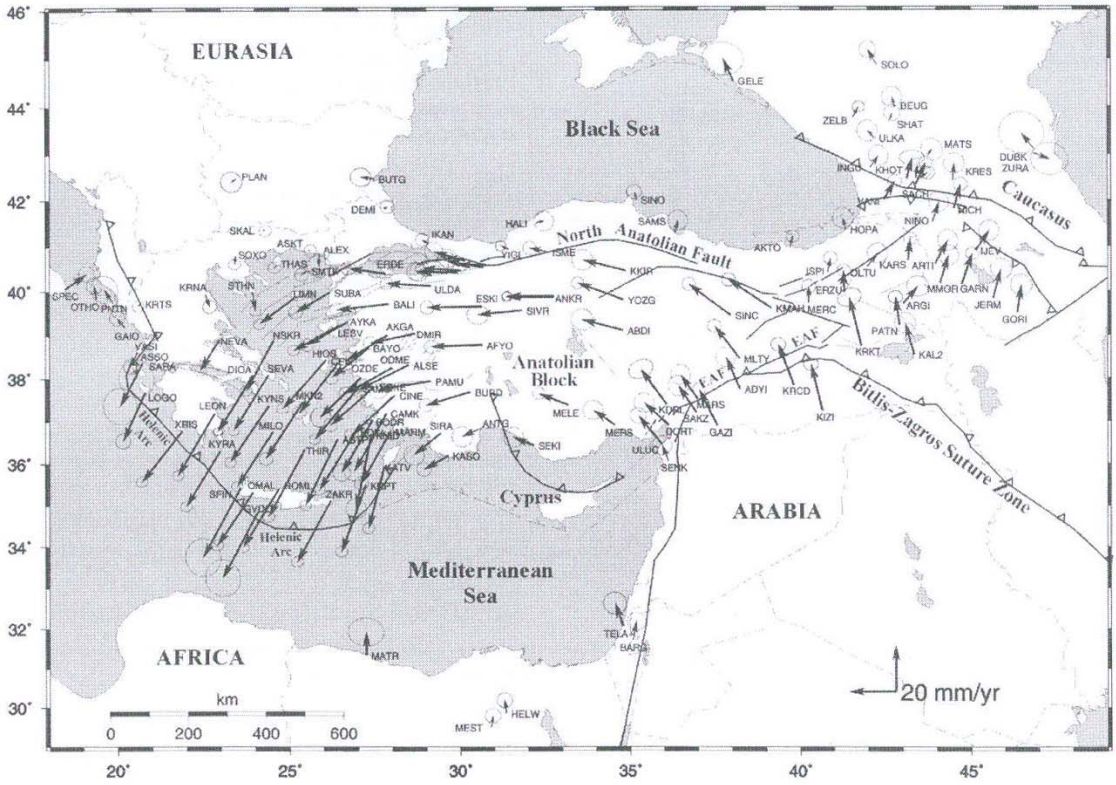
Body waveform inversion methods of [1] and [2] was used to resolve source mechanisms and rupture histories of the recent eastern Mediterranean region earthquakes. The shapes and amplitudes of teleseismic long-period P-, SH-, and broadband P-waveforms recorded by GDSN stations in the distance range of 30-90°were compared, for which signal amplitudes were large enough with synthetic waveforms. The solutions were also constrained by P-wave first motion polarities for near-field stations. The authors found strike, dip, rake, centroid depth, seismic moment, and source time functions and rupture history of each event. Hence, the authors observed rupture process as a spatio-temporal slip distribution on the fault plane determined. The fault plane then was divided into MxN sub-faults and rupture history (source time function) of every sub-fault is described by L, triangles. Strike, dip, rake and centroid depth already obtained were used for initial model for slip distribution inversion. Total fault area, rupture propagation in time, slip directions of each sub-fault and overall source time function were found from the minimum misfit solution of inversion. Other individual earthquake source parameters such as stress drop, rupture velocity were also calculated using the results of both inversion methods. The seismic risk and intensive scientific efforts devoted to the Marmora Sea region are further summarized

Stress field:

Stress field deduced from GPS horizontal velocities measurements

Types of documents:

Seismicity map
GPS horizontal velocities map

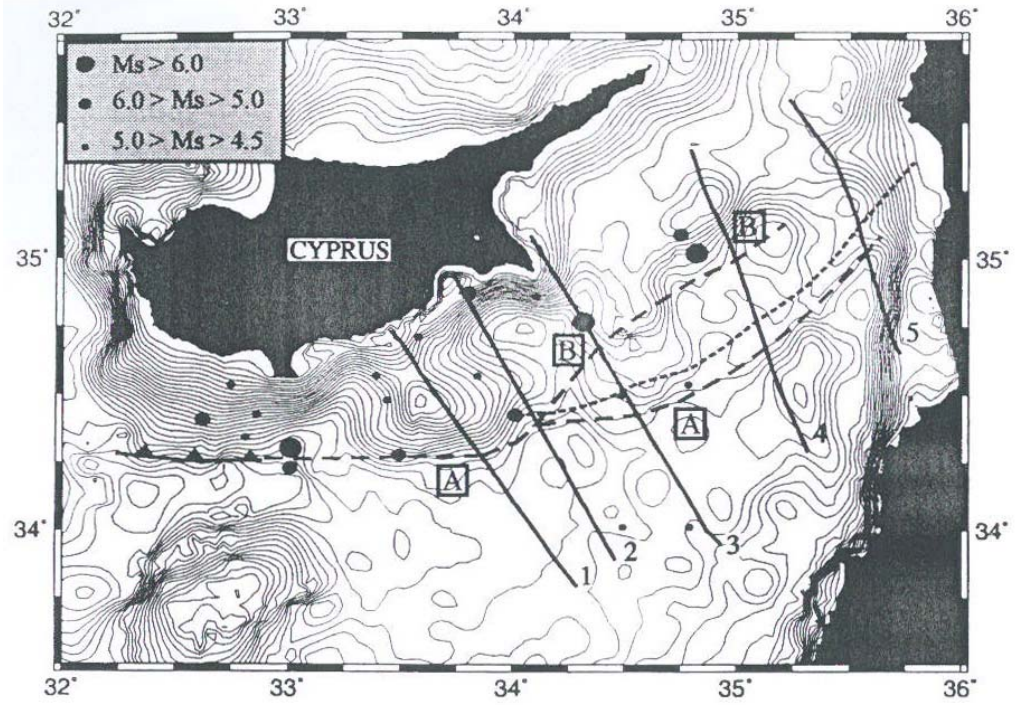


GPS horizontal velocities

N° File: 136

Authors: VIDAL N., KLAESCHEN D., KOPF A., DOCHERTY C., VON HUENE R., KRASHENINNIKOV
Year: 2000
Title: Seismic images at the convergence zone from south of Cyprus to the Syrian Coast, eastern Mediterranean.
Reference: *Tectonophysics*, 329, p. 157-170.

Concerned area: Eastern Mediterranean, Levantine basin
Formation(s) affected:
Age of the deformation: Cenozoic to quaternary
Concerned structures: Eastern Cyprean Arc, Eratosthenes Seamount, Hecateaus Rise and Latakia-Larnaca Ridge systems
Commentary: Multichannel seismic profiles from cruise 5 of the R/V *Akademik Nikolaj Strakhov* provide the first deep seismic reflection images and extensive coverage south and east of Cyprus. Five NW-SE-trending seismic lines cross an area of active continental collision. Main tectonic structures are the Eratosthenes Seamount collision zone, the Hecateaus Rise and the Latakia-Larnaca Ridge systems. The Levantine Basin extends to the south all over the area. The data required careful processing due to the low-fold coverage, the reverberatory character of the signal and the strong multiple energy. The seismic results clearly image the thick sedimentary sequence of the Levantine Basin. This basin is observed to terminate abruptly at the junction with the Hecateaus Rise soul of Cyprus. To the east and north. the deformation appears to be partitioned along two separated structures next to the Latakia and Larnaca Ridges. They correspond to major oblique fault systems.
Stress field:
Types of documents: Bathymetric maps, Seismic profiles, interpretative line drawing

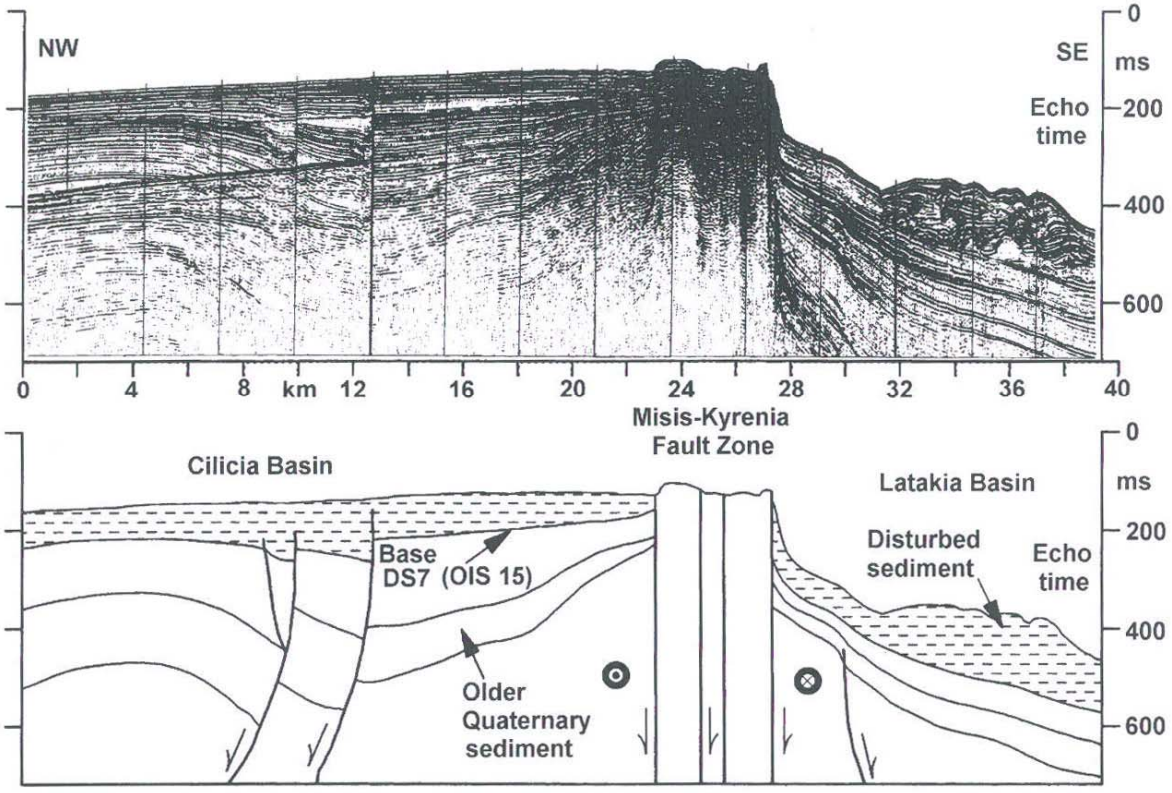


Simplified tectonic map of the Hecateaus Rise and Latakia-Larnaca Ridge systems

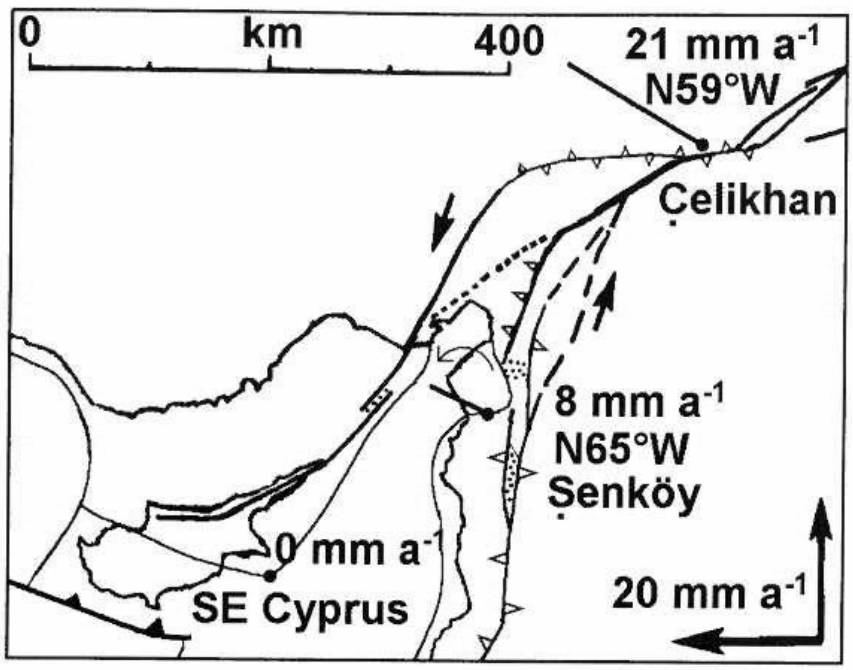
N° File: 137

Authors: WESTAWAY R.
Year: 2003
Title: Kinematics of the Middle East and Eastern Mediterranean updated
Reference: *Turkish Journal of Earth Sciences*, 12, p. 5-46

Concerned area: Middle East and Eastern Mediterranean
Formation(s) affected:
Age of the deformation:
Concerned structures: East Anatolian Fault Zone
Commentary: For the East Anatolian Fault, the predicted rate of left –lateral relative motion on the boundary between the Turkish and African plates is estimates as ~8mm a^{-1}. However, the rate of localisation left-lateral slip on the onshore part of this boundary is estimated as only ~2 mm a^{-1}, on the Yakapina-Göksun Fault: the difference being taken up by distributed deformation within the northern "promontory" of the African plate, which appears to involve a combination of anticlockwise rotation and distributed left-lateral simple shear. The revised slip rate on the East Anatolian Fault Zone (EAFZ) is estimated as ~8mm a^{-1}.
Stress field:
Types of documents: Tectonic and geological maps Geological Cross-sections Seismic profiles and there interpretative cross-sections



Seismic reflection record section and interpretation of a profile crossing the Misis-Kyrenia Fault Zone



Kinematic model for the "triple junction" region between the Turkish, African and Arabian plates