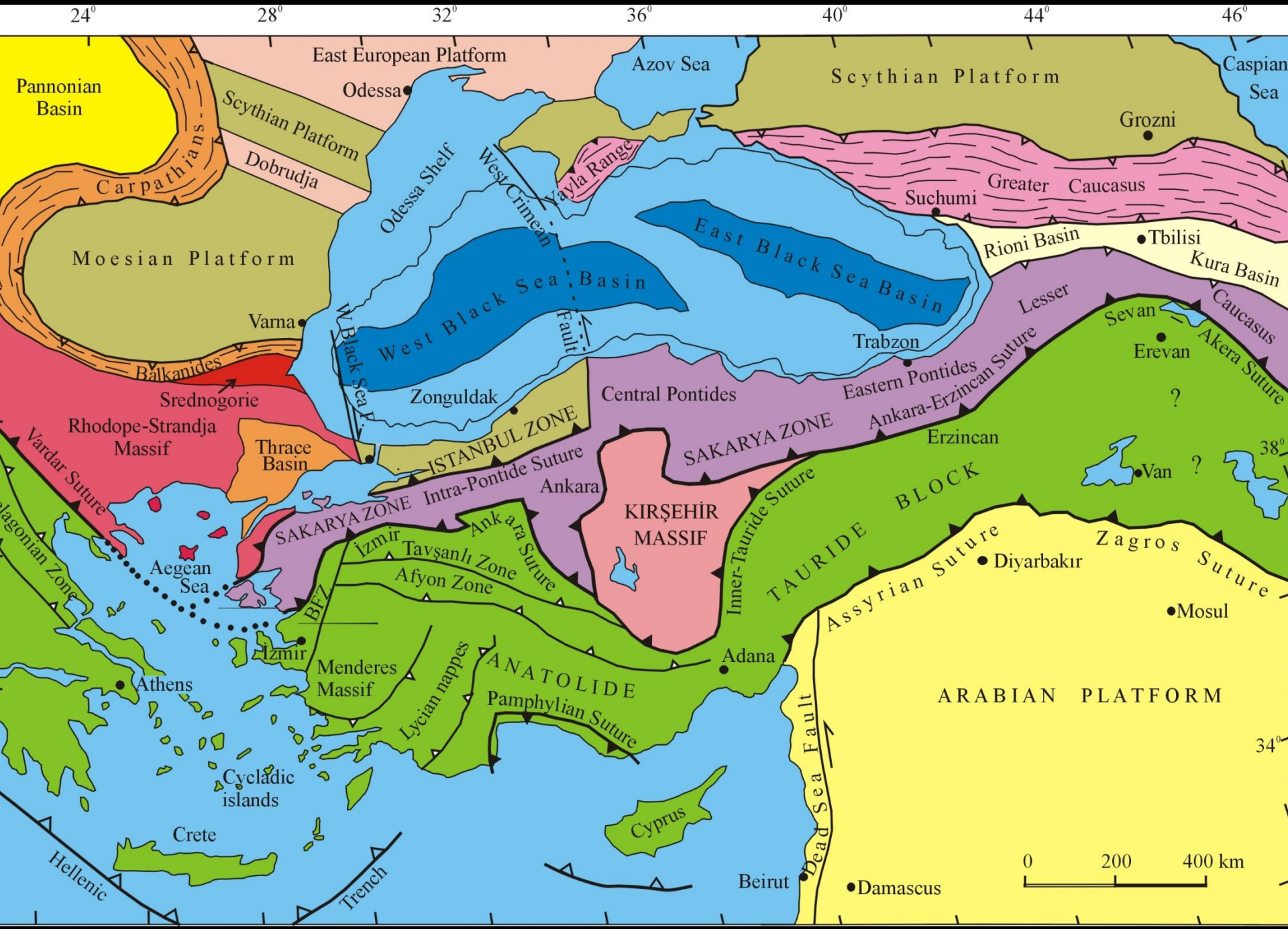
Seas around Turkey

Aral I. Okay

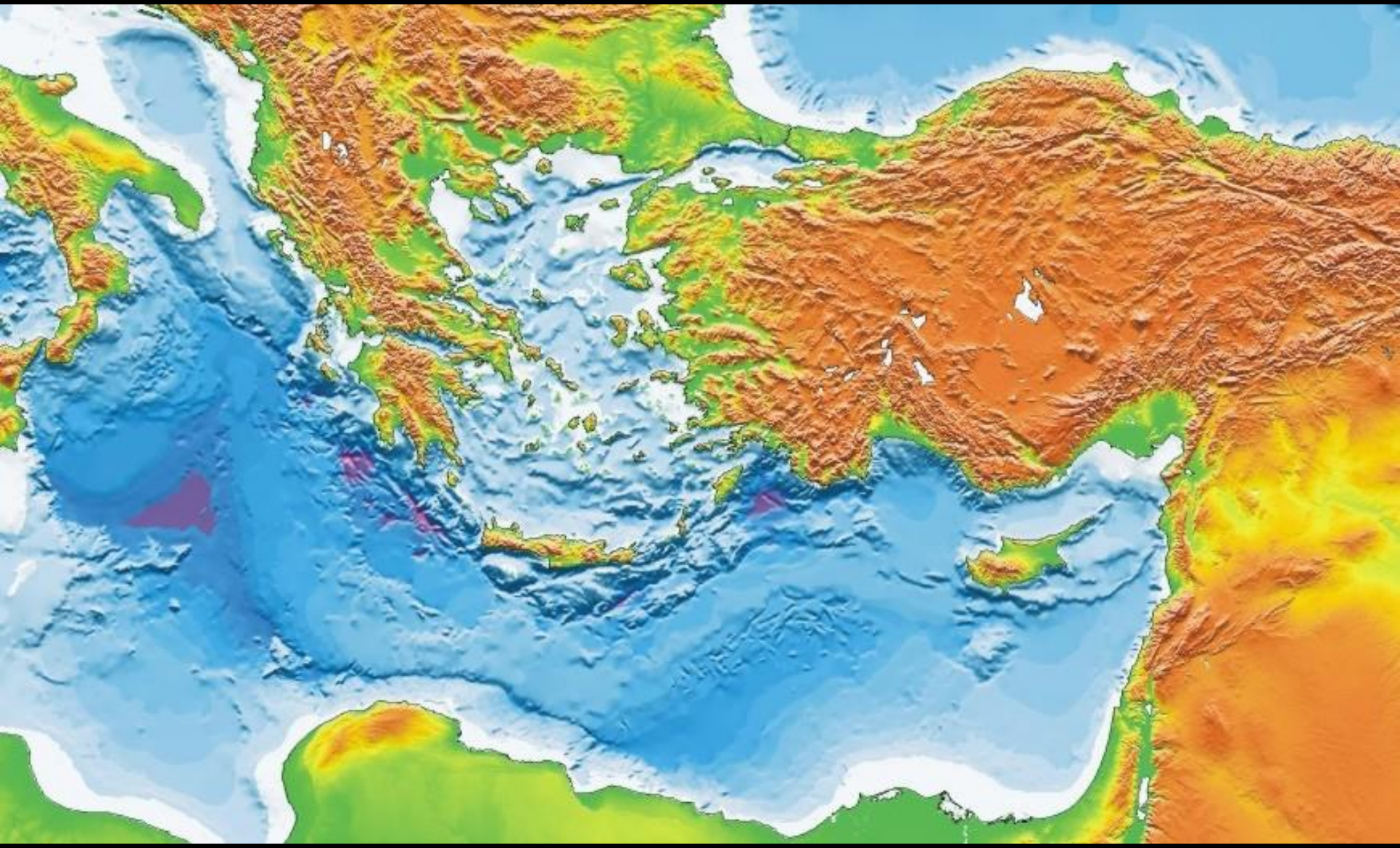
İstanbul Teknik Üniversitesi

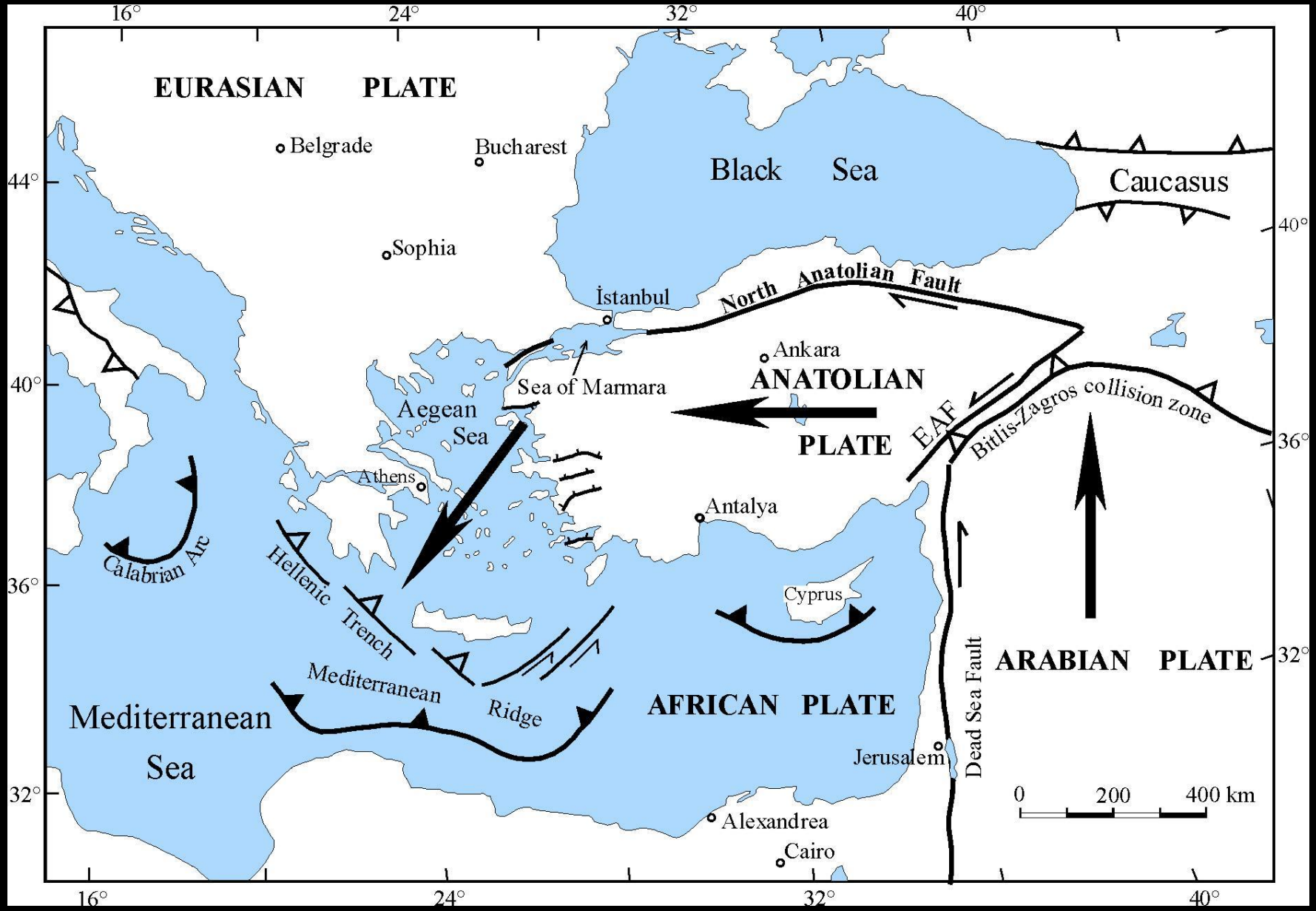

24°
28°
32°
36°
40°
44°
46°
East European Platform
Azov Sea
Scythian Platform
Caspian Sea
Pannonian Basin
Odessa
Grozni
Carpathians
Scythian Platform
Dobrudja
Odessa Shelf
West Crimean Fault
Yayla Range
Greater Caucasus
Suchumi
Moesian Platform
East Black Sea Basin
Rioni Basin
Tbilisi
Kura Basin
West Black Sea Basin
Lesser Caucasus
Varna
W Black Sea F.
Fault
Trabzon
Sevan
Akera Suture
Balkanides
Erevan
Srednogorie
Zonguldak
Central Pontides
Eastern Pontides
Ankara-Erzincan Suture
?
Rhodope-Strandja Massif
Thrace Basin
ISTANBUL ZONE
SAKARYA ZONE
Erzincan
Vardar Suture
Intra-Pontide Suture
Ankara
38°
Van
?
KIRŞEHİR MASSIF
Inner-Tauride Suture
TAURIDE BLOCK
SAKARYA ZONE
İzmir
Ankara Suture
Tavşanlı Zone
Afyon Zone
Assyrian Suture
Zagros Suture
Diyarbakır
Aegean Sea
BFZ
Mosul
İzmir
Menderes Massif
Lycian nappes
ANATOLIDE
Adana
Athens
Pamphylian Suture
ARABIAN PLATFORM
Dead Sea Fault
34°
Cycladic islands
Cyprus
Crete
Hellenic Trench
Beirut
Damascus
0
200
400 km

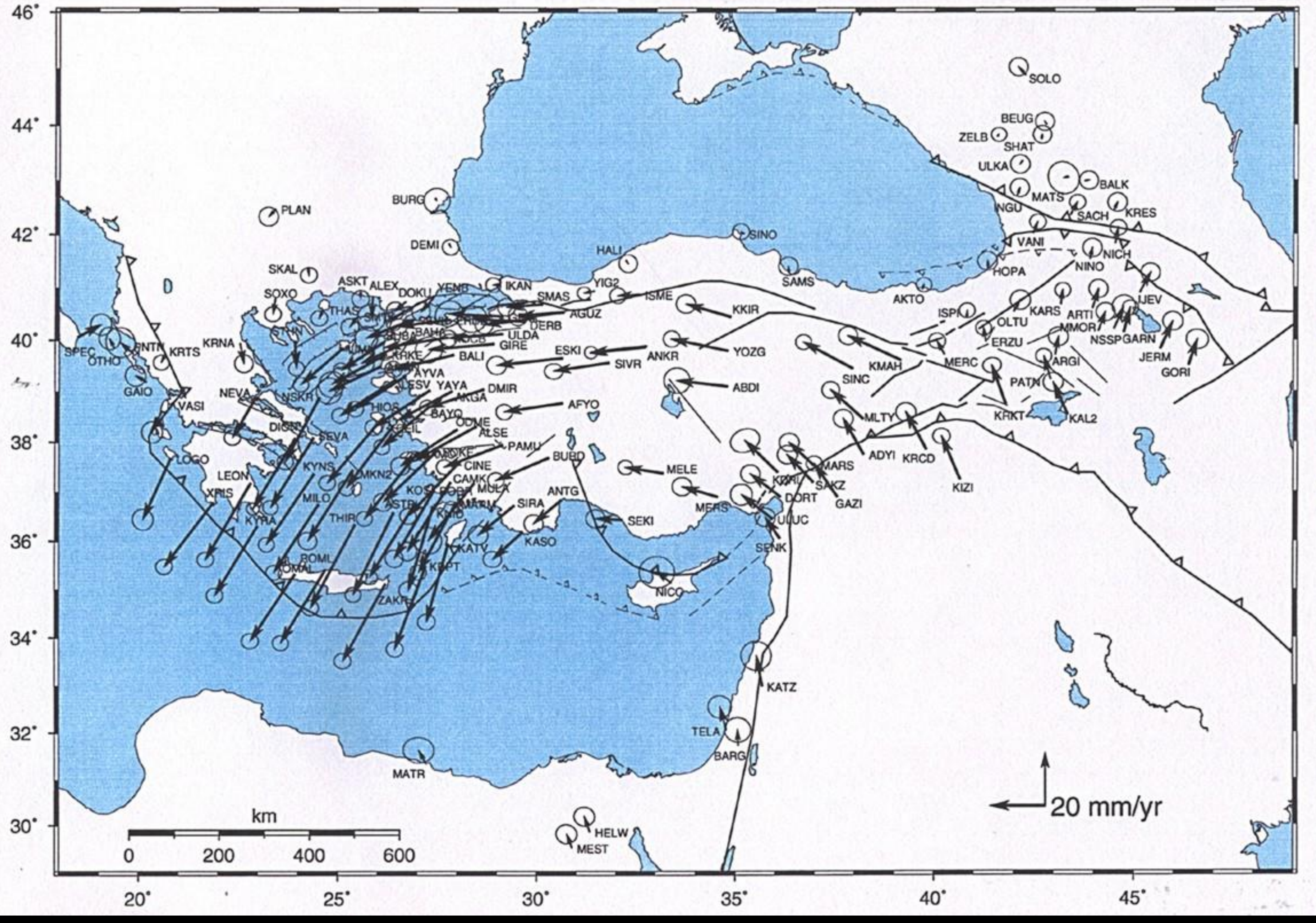
Eastern Mediterranean and Cyprus

Aral I. Okay

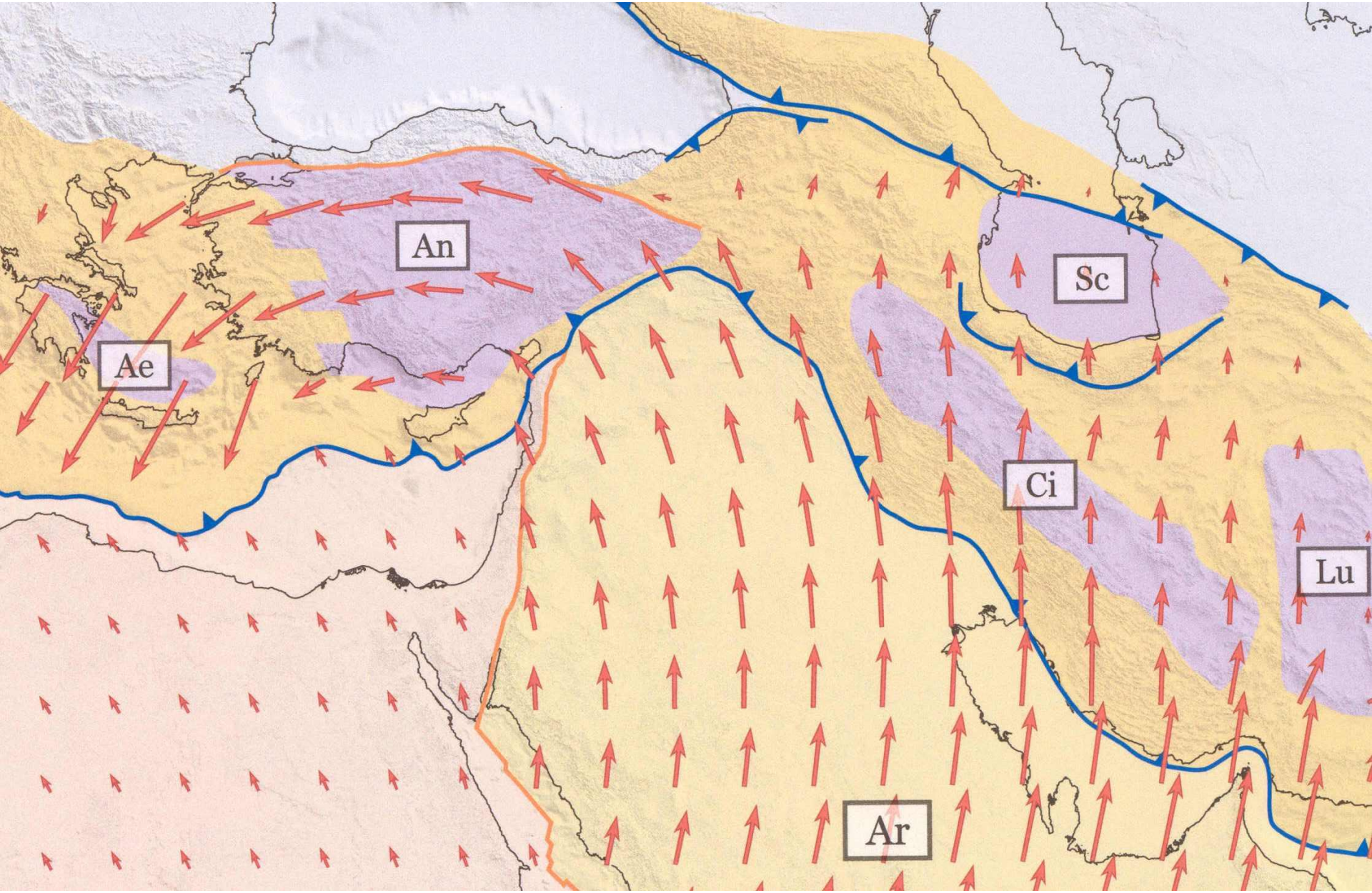
İstanbul Teknik Üniversitesi



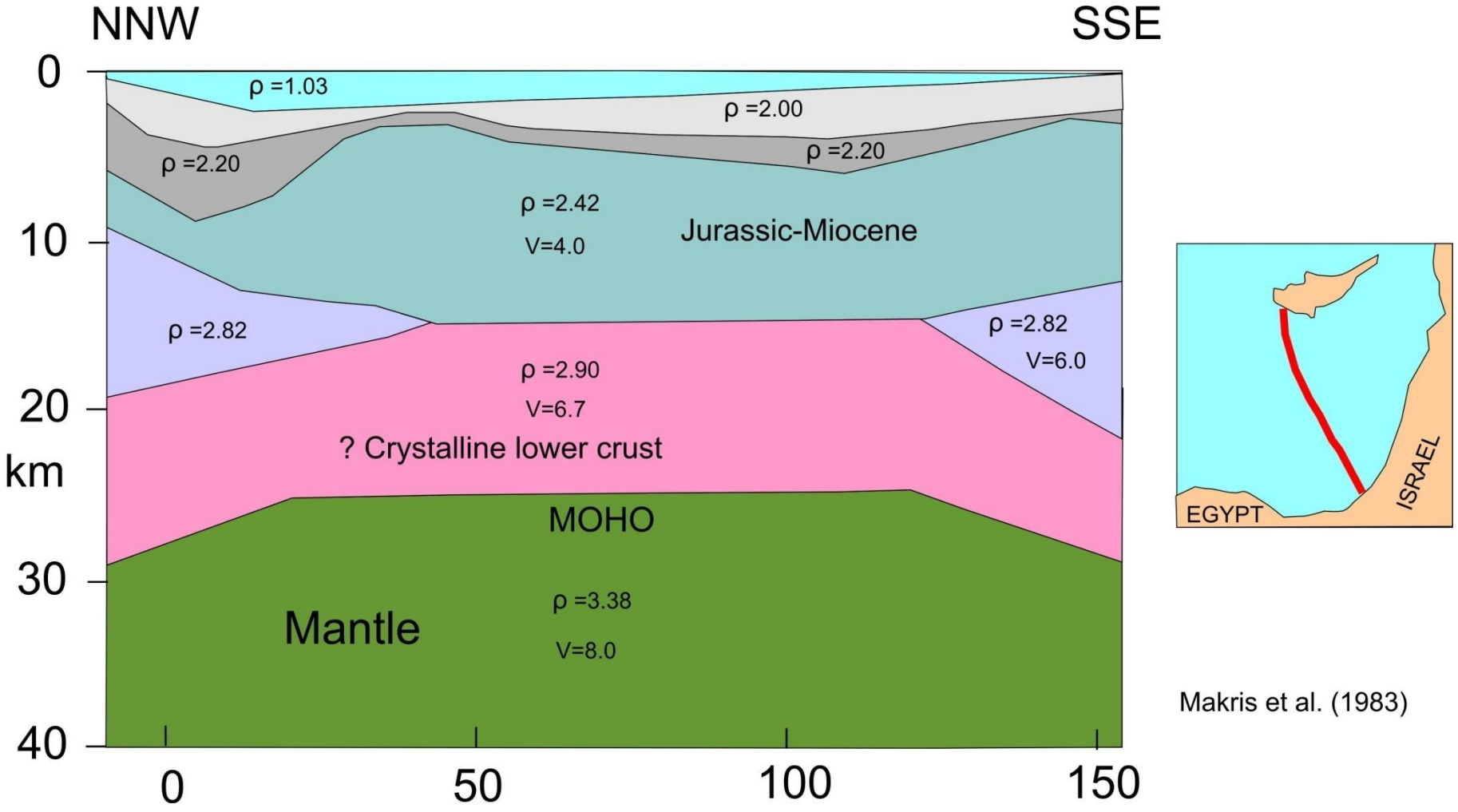

16°
24°
32°
40°
EURASIAN PLATE
Belgrade
Bucharest
Black Sea
Caucasus
44°
Sophia
İstanbul
North Anatolian Fault
40°
Ankara
ANATOLIAN
PLATE
Sea of Marmara
Aegean
Sea
EAF
Bitlis-Zagros collision zone
Athens
Antalya
Calabrian Arc
Hellenic Trench
Cyprus
36°
Mediterranean Ridge
ARABIAN PLATE
32°
Mediterranean
Sea
AFRICAN PLATE
Dead Sea Fault
Jerusalem
0 200 400 km
Alexandrea
Cairo



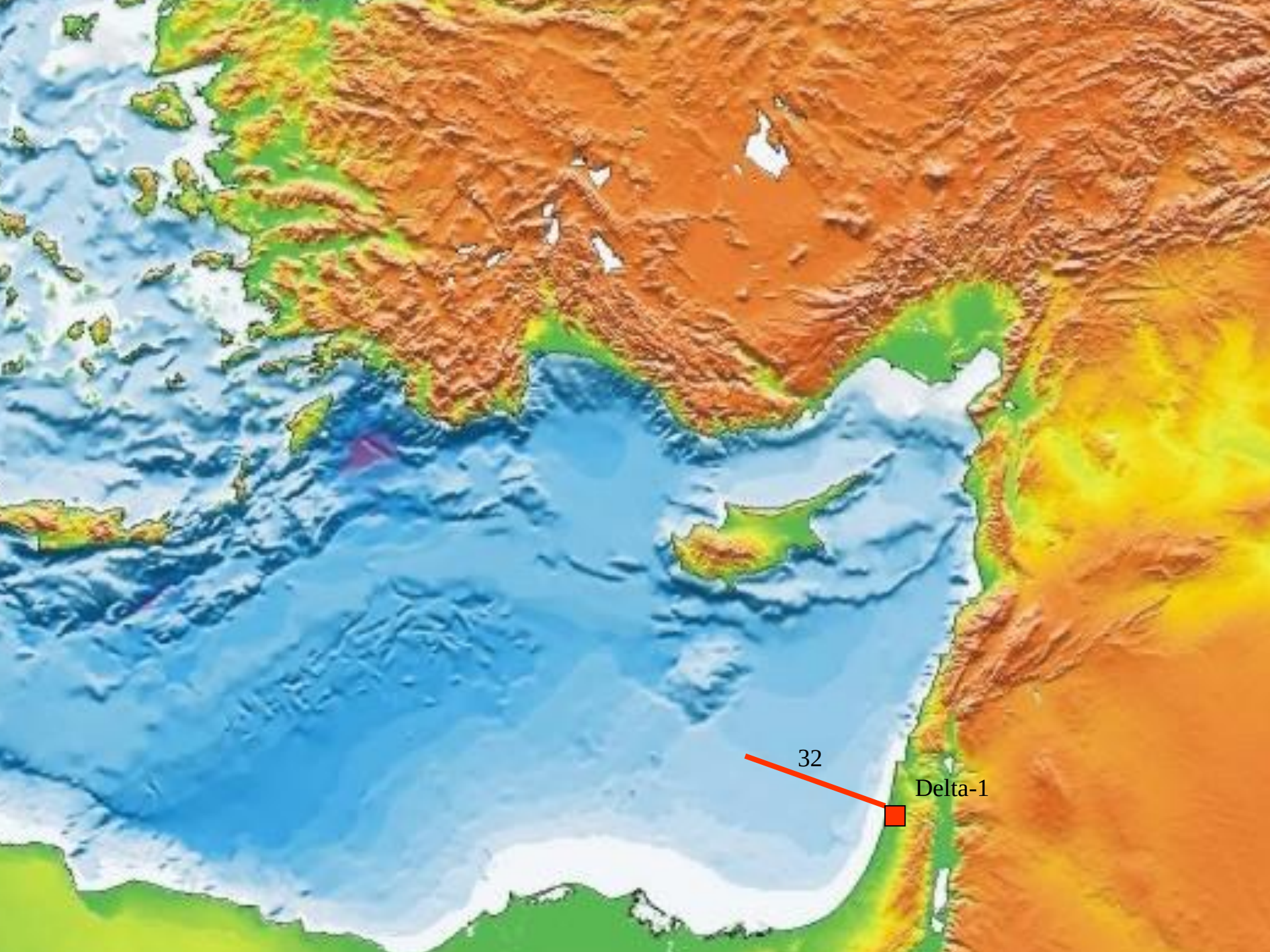
46°
44°
42°
40°
38°
36°
34°
32°
30°
20°
25°
30°
35°
40°
45°
SOLO
BEUG
ZELB
SHAT
ULKA
BALK
MATS
SACH
KRES
VANI
NICH
NINO
HOPA
SINO
SAMS
AKTO
HALI
BURG
DEMI
PLAN
SKAL
SOXO
ASKT
ALEX
DOKU
YENB
IKAN
YIG2
ISME
SMAS
AGUZ
DERB
ULDA
GIRE
BALI
KKIR
YOZG
ANKR
ESKI
SIVR
ABDI
AFYO
DMIR
YAYA
AYVA
AKGA
BAYO
ODME
ALSE
PAMU
BURD
CINE
CAMK
MULA
ANTG
SIRA
KASO
SEKI
MELE
MERS
NICO
KATV
KRPT
ZAKR
ROML
KOMAL
THIR
MILO
KYNS
KYRA
LEON
XRIS
LOGO
SEVA
VASI
NEVA
KRNA
KRTS
SPEC
OTHO
GAIO
THAS
SINC
KMAH
MLTY
ADYI
KRCD
KIZI
MARS
SAKZ
GAZI
DORT
ULUC
SENK
ISPI
OLTU
ERZU
MERC
KARS
ARTI
MMOR
NSSP
GARN
IJEV
JERM
GORI
ARGI
PATN
KRKT
KAL2
KATZ
TELA
BARG
MATR
HELW
MEST
km
0
200
400
600
20 mm/yr

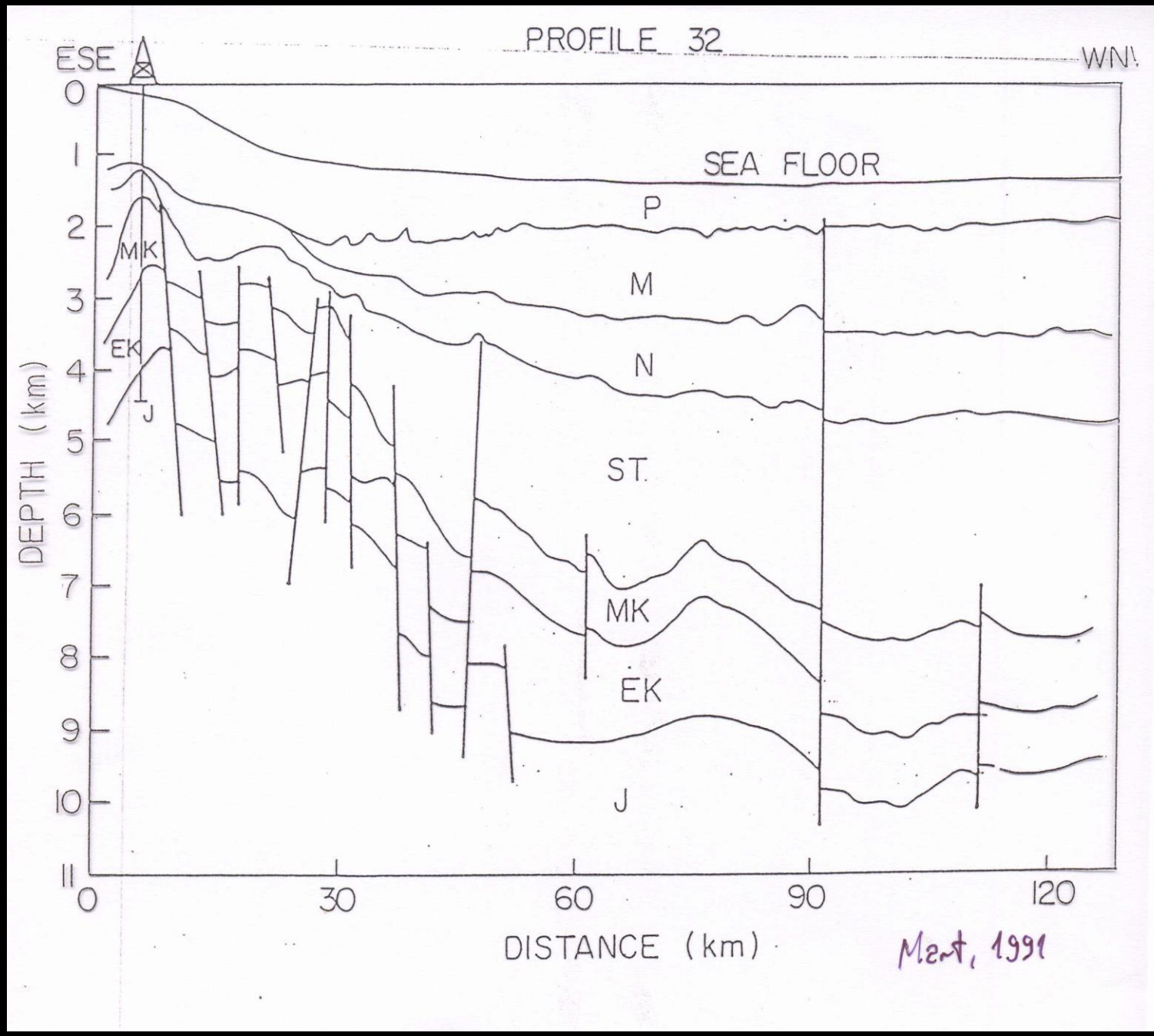

An
Ae
Sc
Ci
Lu
Ar


Levant
Basin
Herodot
Plane



Makris et al. (1983)

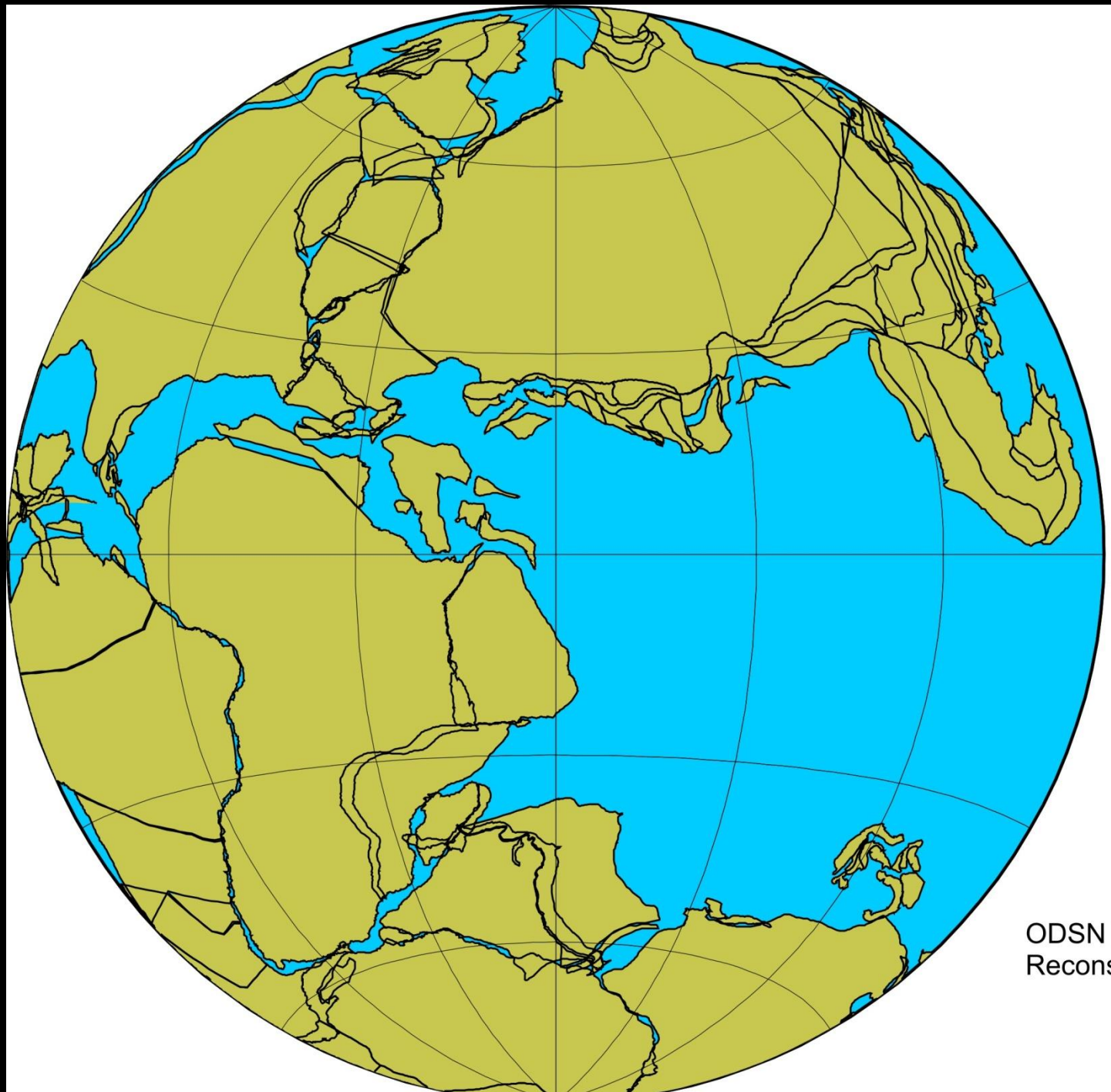

32
Delta-1


PROFILE 32
ESE
WNW
SEA FLOOR
P
M
N
ST.
MK
EK
J
DEPTH (km)
0
1
2
3
4
5
6
7
8
9
10
11
0
30
60
90
120
DISTANCE (km)
Mart, 1991

The Levant basin has thinned continental or oceanic crust:

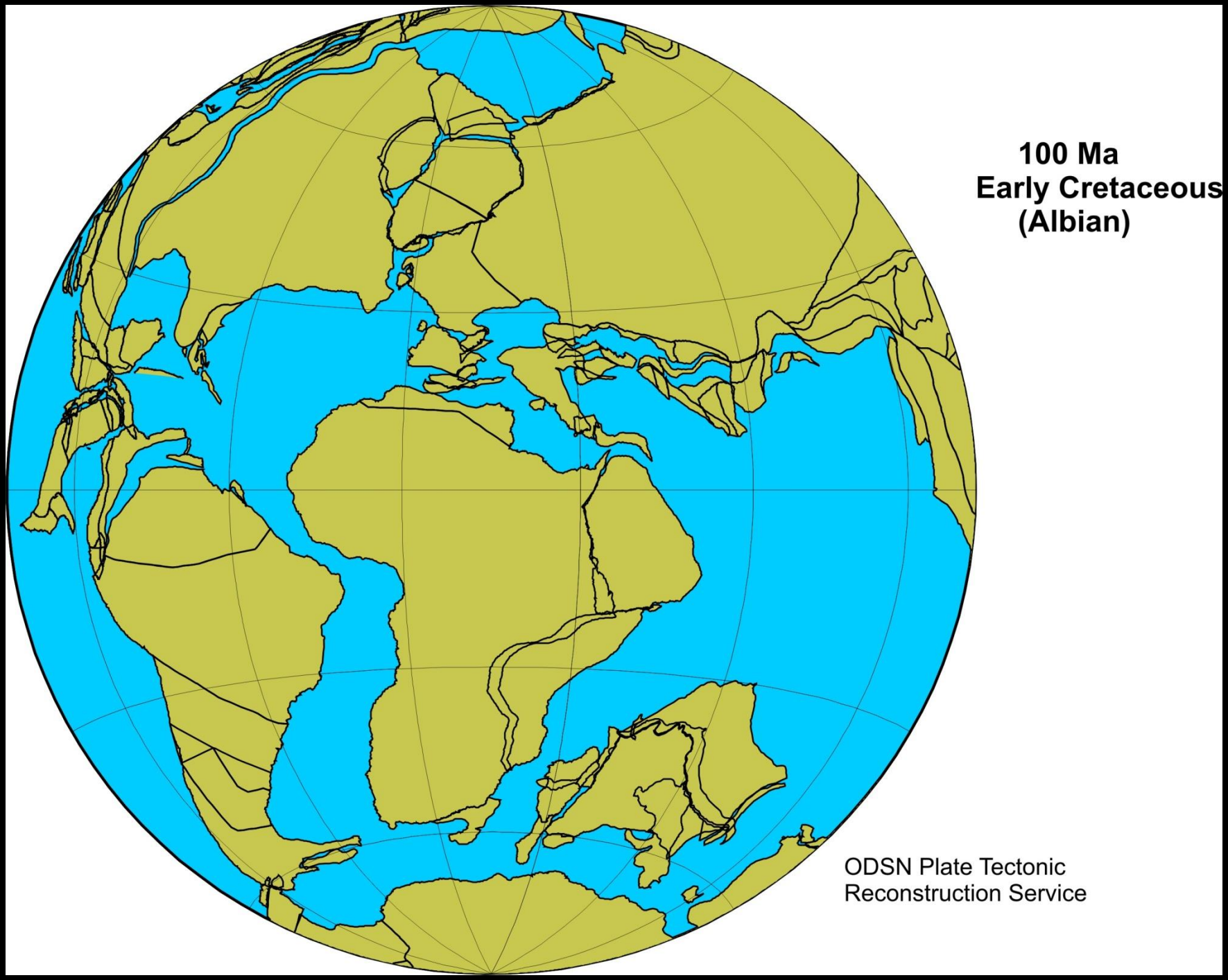
1. 1500-2000 m water depth
2. Data from seismic refraction
3. Levant continental margin – an old passive margin

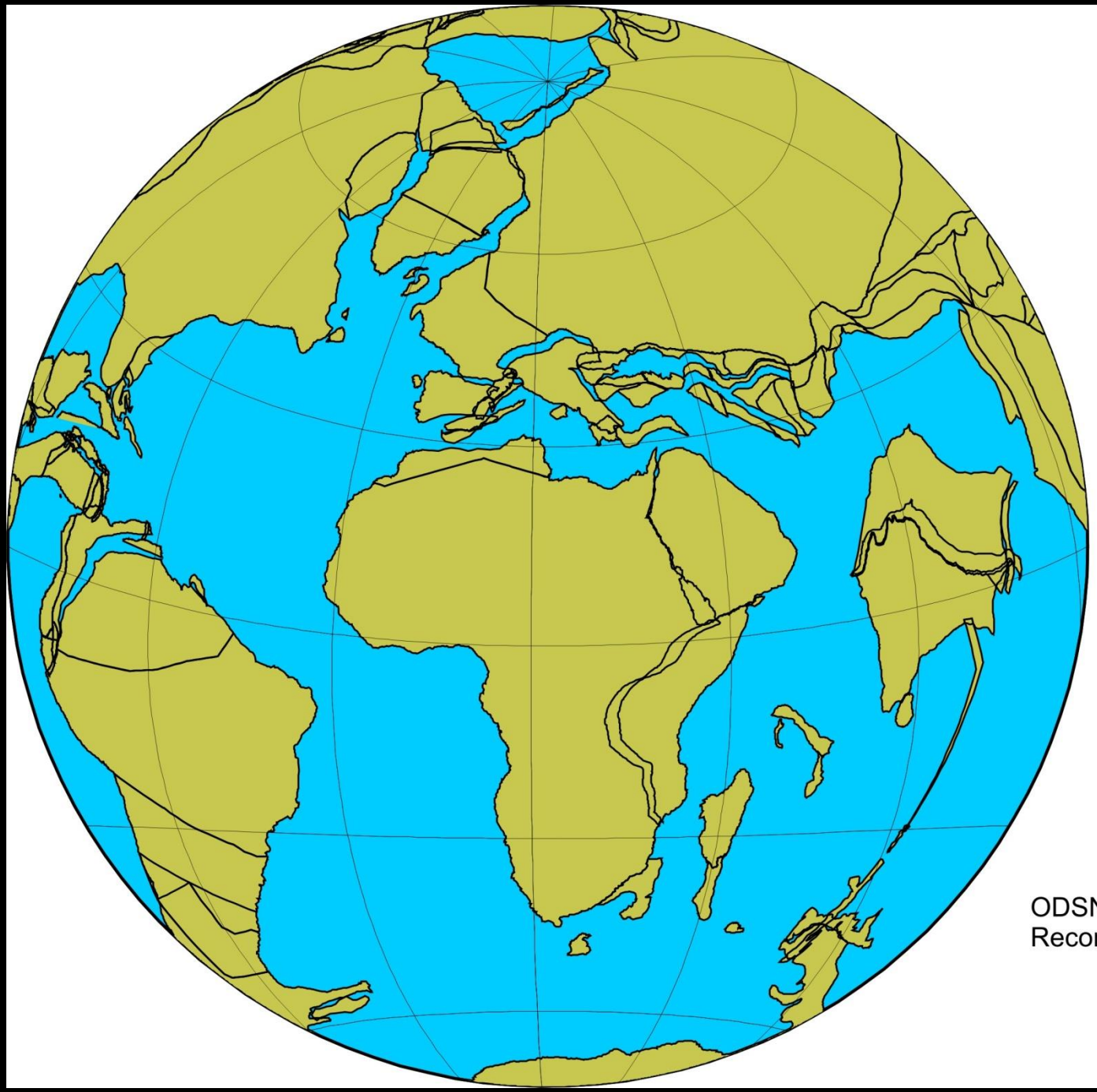
The Levant basin probably represents a relict of the Triassic-Jurassic Neo-Tethyan ocean



150 Ma
Latest Jurassic

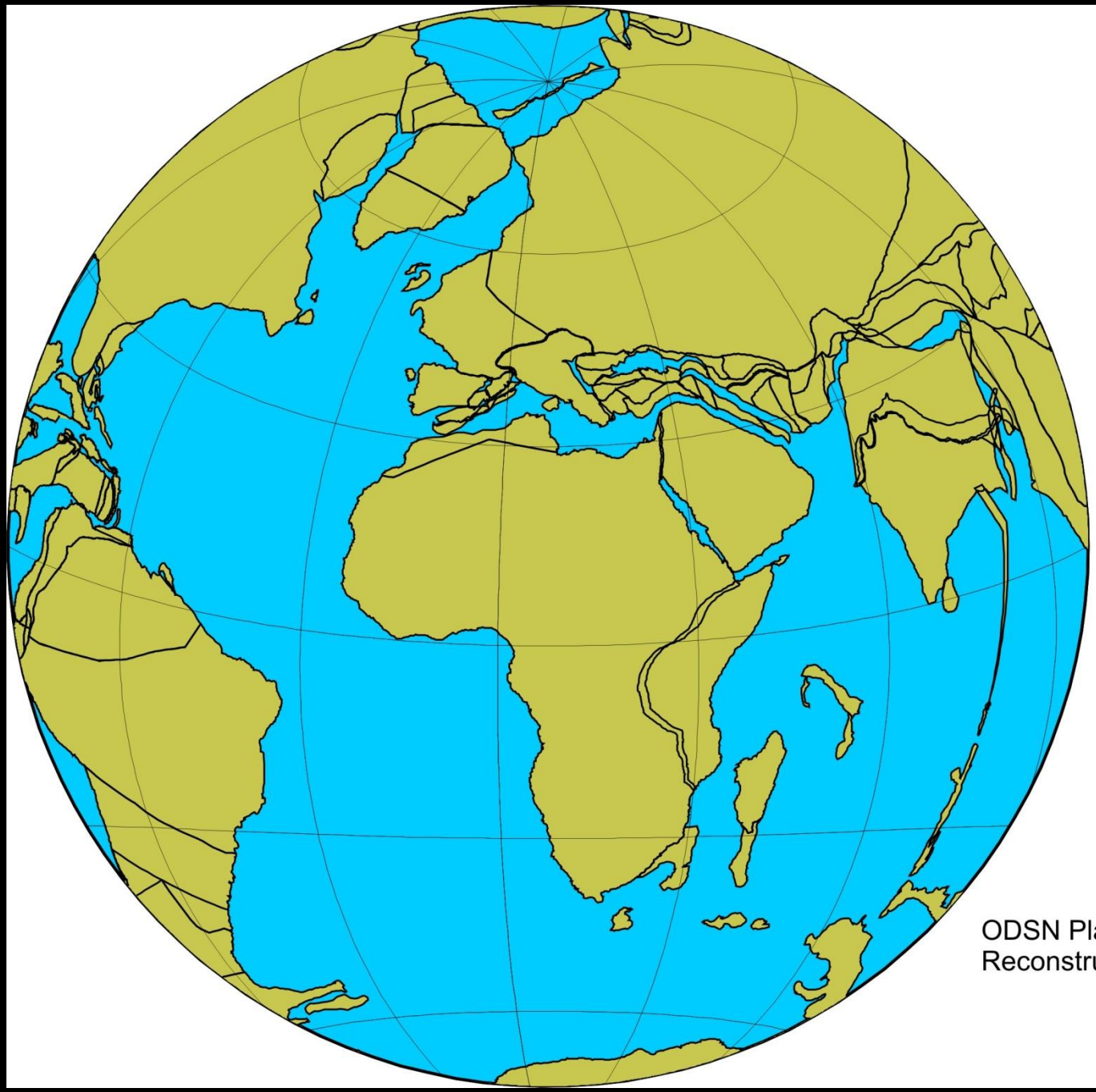
ODSN Plate Tectonic
Reconstruction Service


100 Ma
Early Cretaceous
(Albian)
ODSN Plate Tectonic
Reconstruction Service



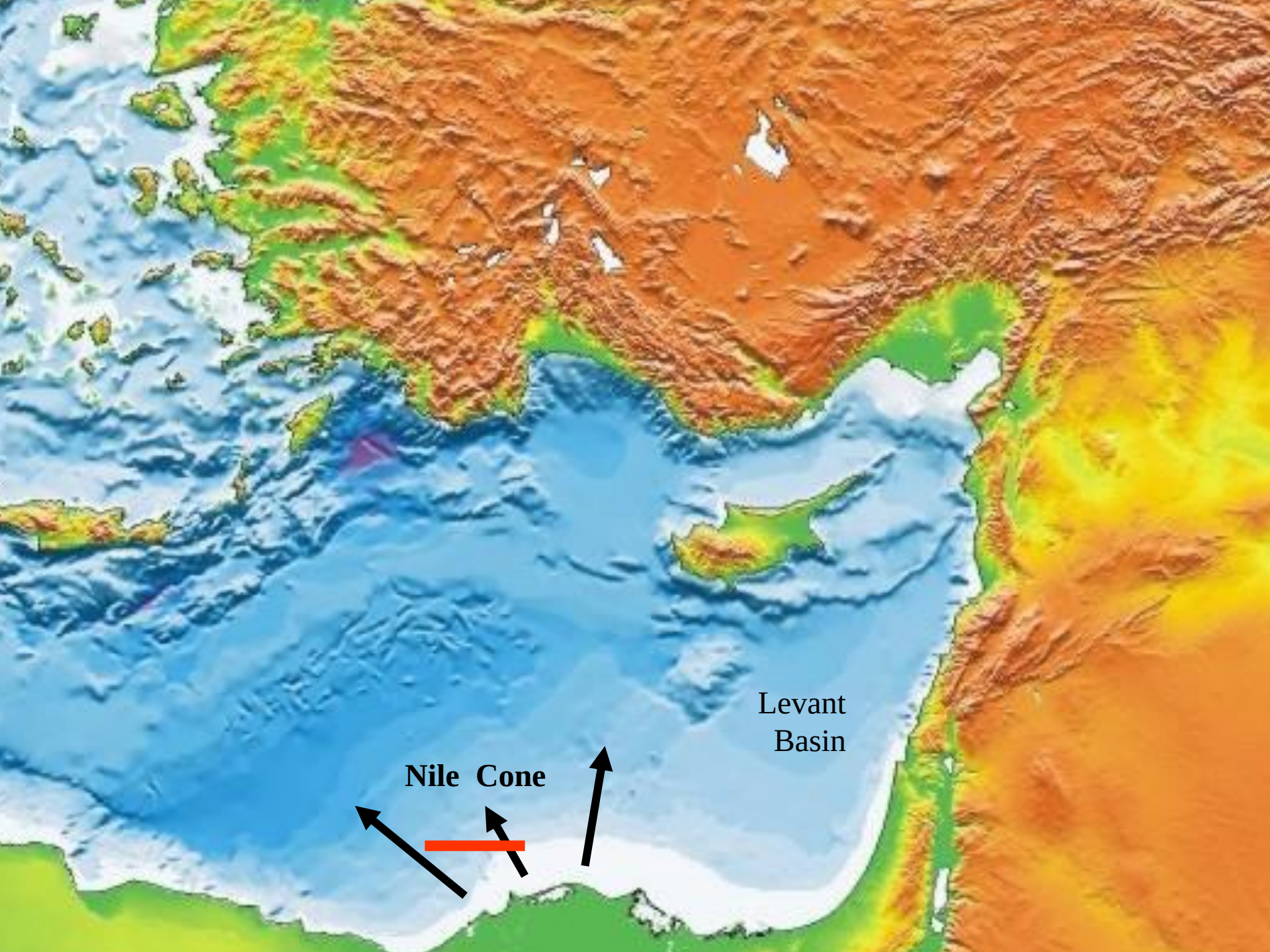
50 Ma
Eocene

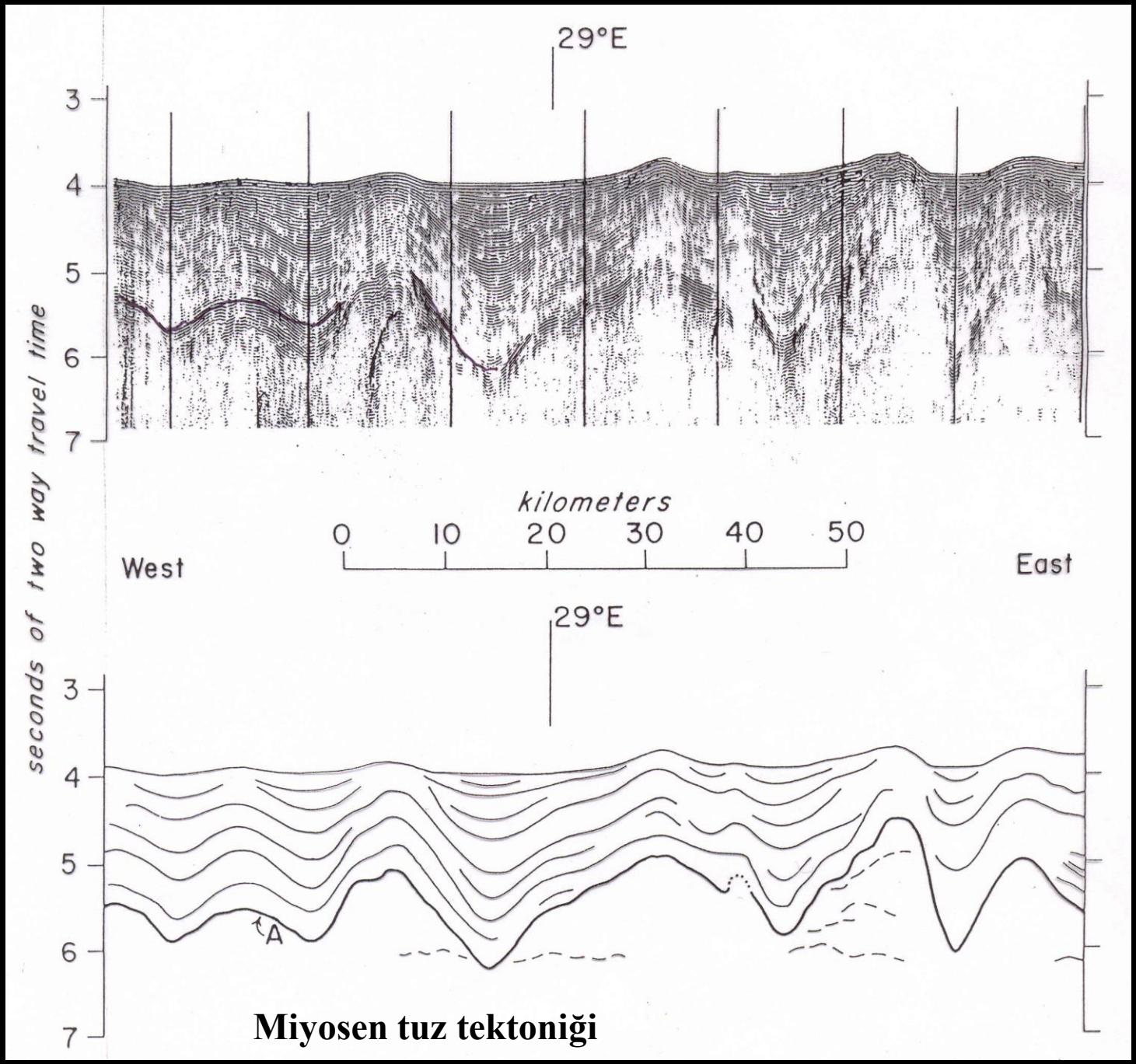
ODSN Plate Tectonic
Reconstruction Service



25 Ma
Oligocene

ODSN Plate Tectonic
Reconstruction Service


Levant
Basin
Nile Cone

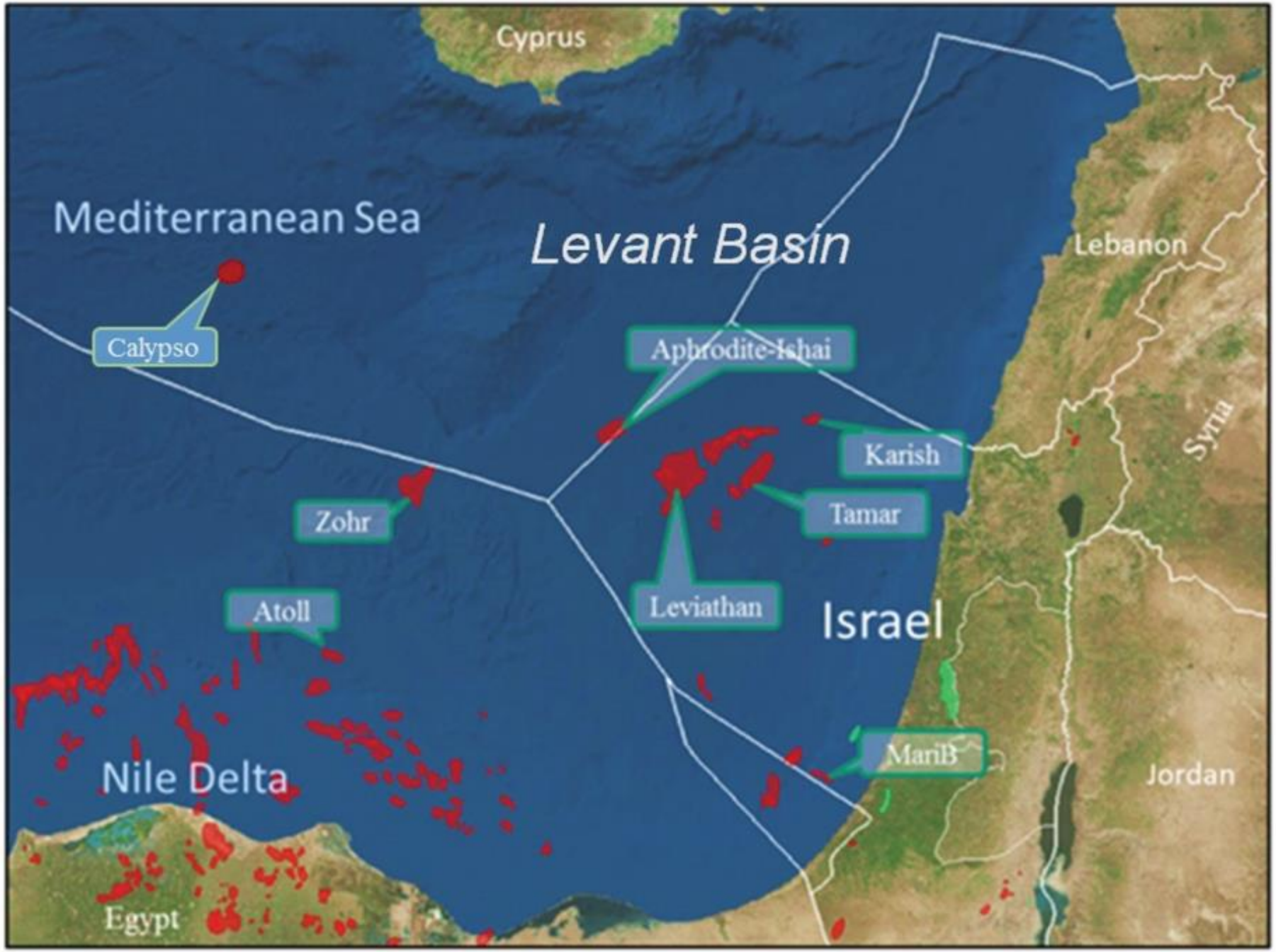


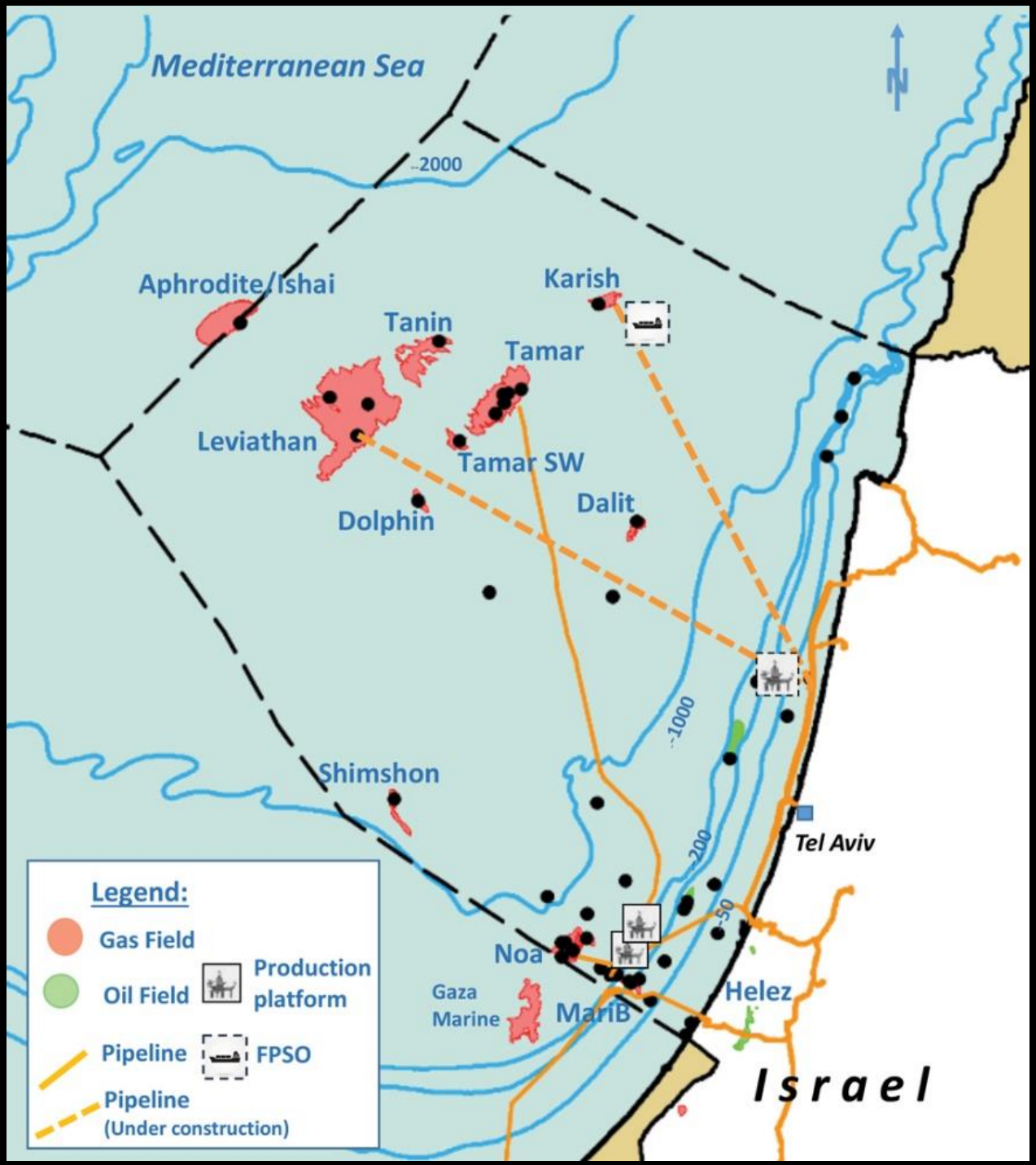
Miyosen tuz tektoniği

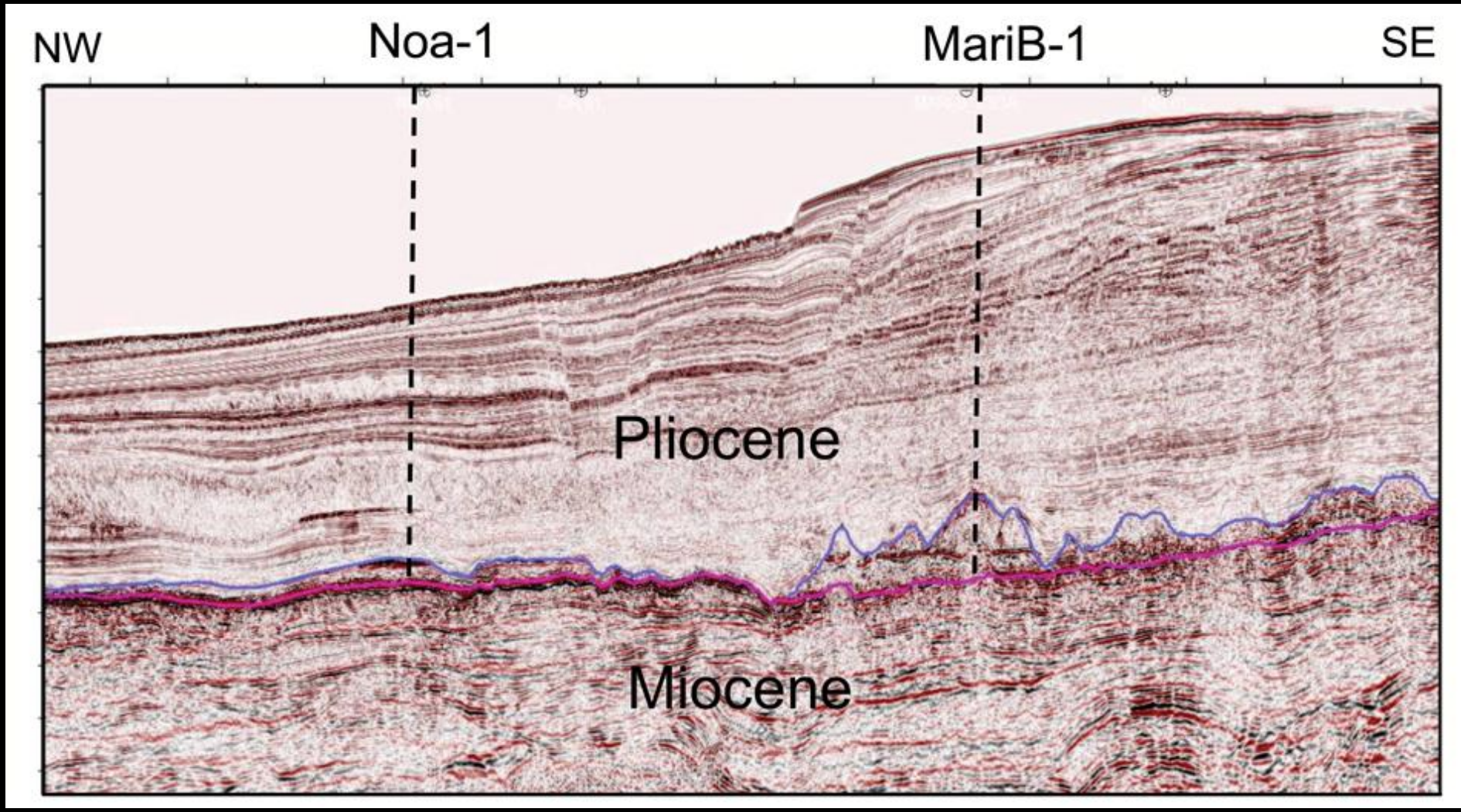
During the latest Miocene (Messinian) Mediterrenean became dry and large thicknesses of salt was deposited at several kilometers below sea level.

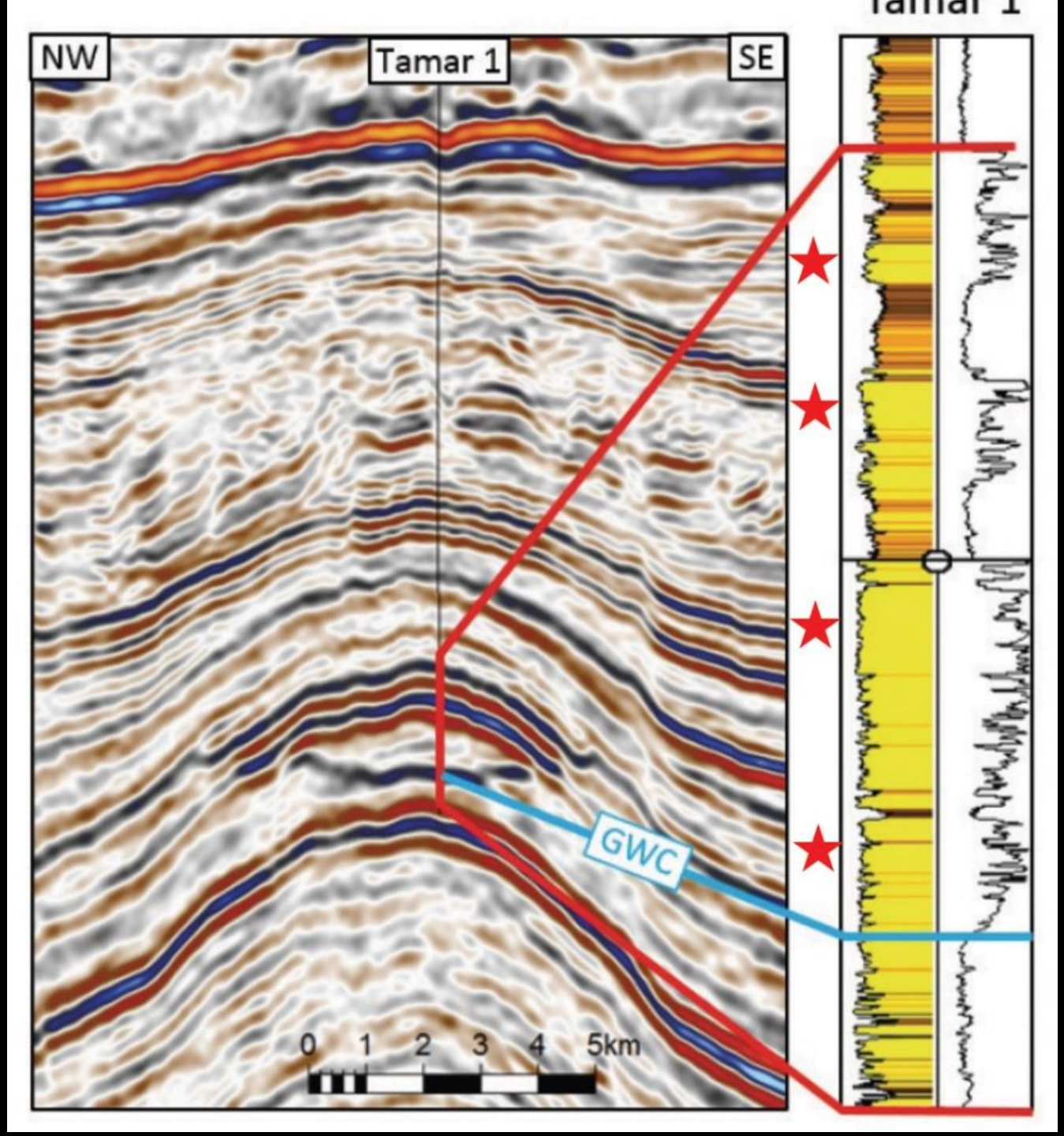
Mediterranean was a desert!

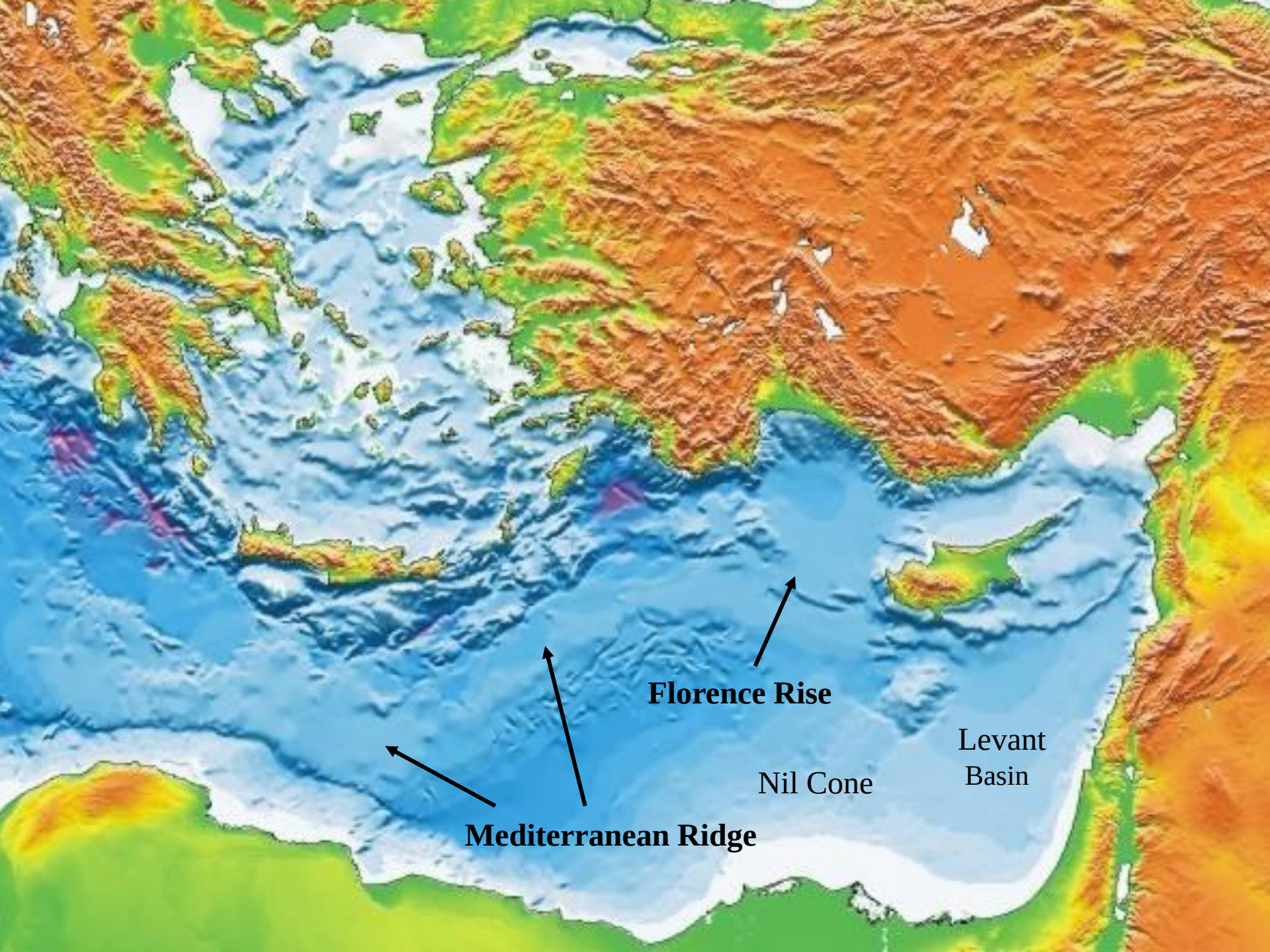
Messinian crisis

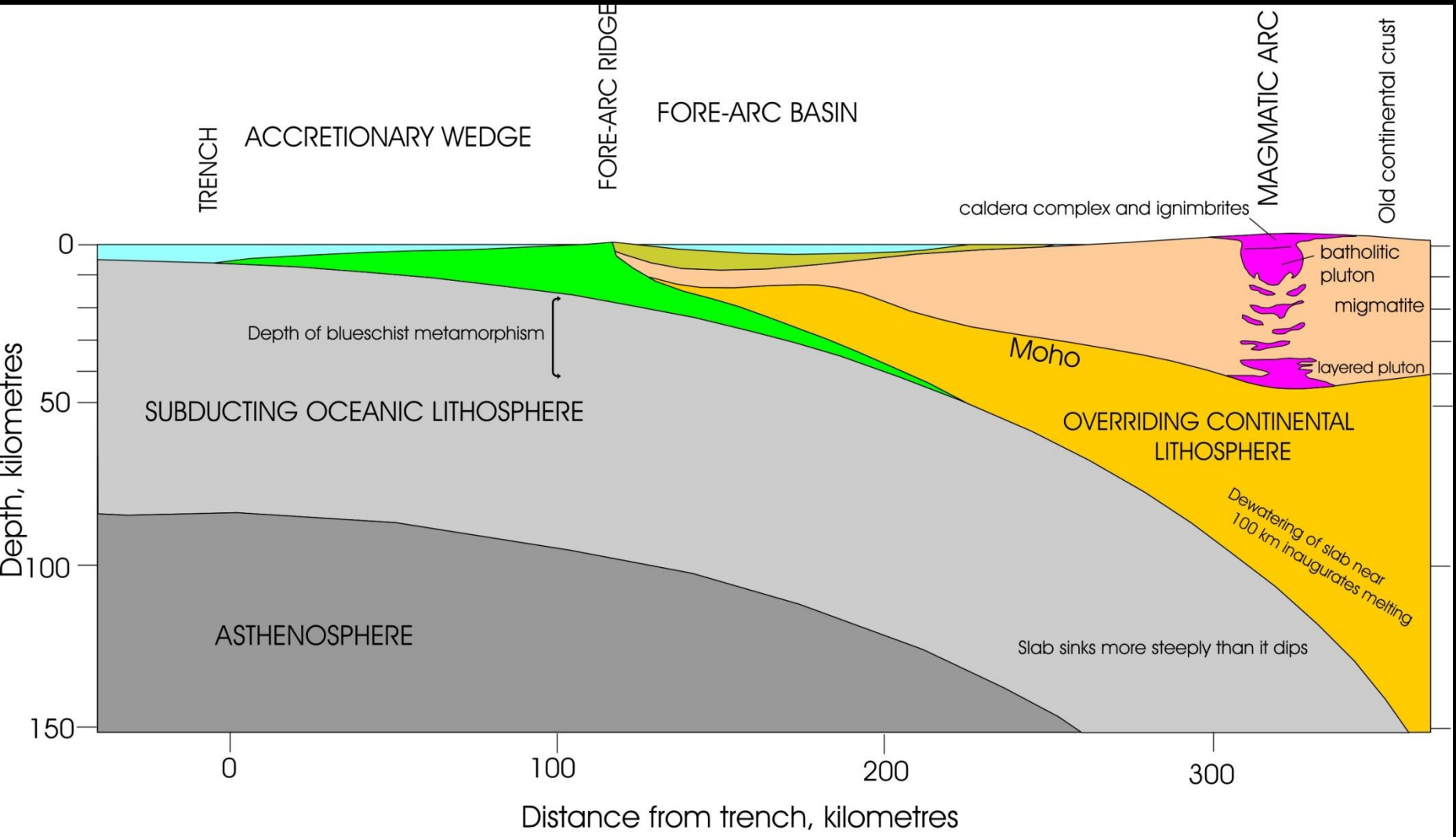

Cyprus
Mediterranean Sea
Levant Basin
Lebanon
Calypso
Aphrodite-Ishai
Karish
Syria
Zohr
Tamar
Atoll
Leviathan
Israel
Nile Delta
MariB
Jordan
Egypt
Gas Field
Oil Field


Mediterranean Sea
-2000
Aphrodite/Ishai
Karish
Tanin
Tamar
Leviathan
Tamar SW
Dolphin
Dalit
Shimshon
-1000
-200
-50
Tel Aviv
Noa
Gaza
Marine
MariB
Helez
Israel
Legend:
Gas Field
Oil Field
Production platform
Pipeline
FPSO
Pipeline
(Under construction)


NW
Noa-1
MariB-1
SE
Pliocene
Miocene


Tamar 1
NW
Tamar 1
SE
GWC
0 1 2 3 4 5km

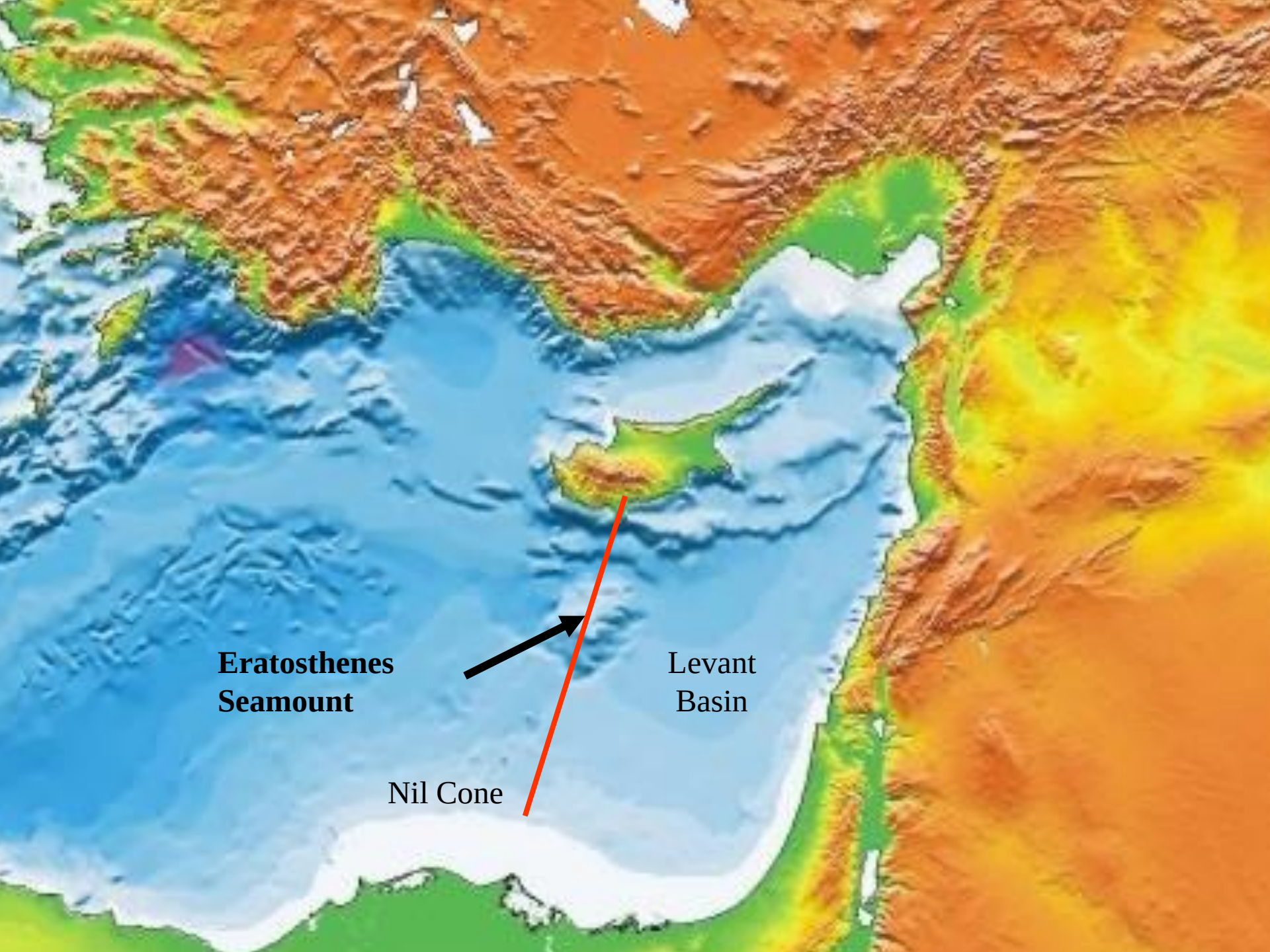

Florence Rise
Levant
Basin
Nil Cone
Mediterranean Ridge

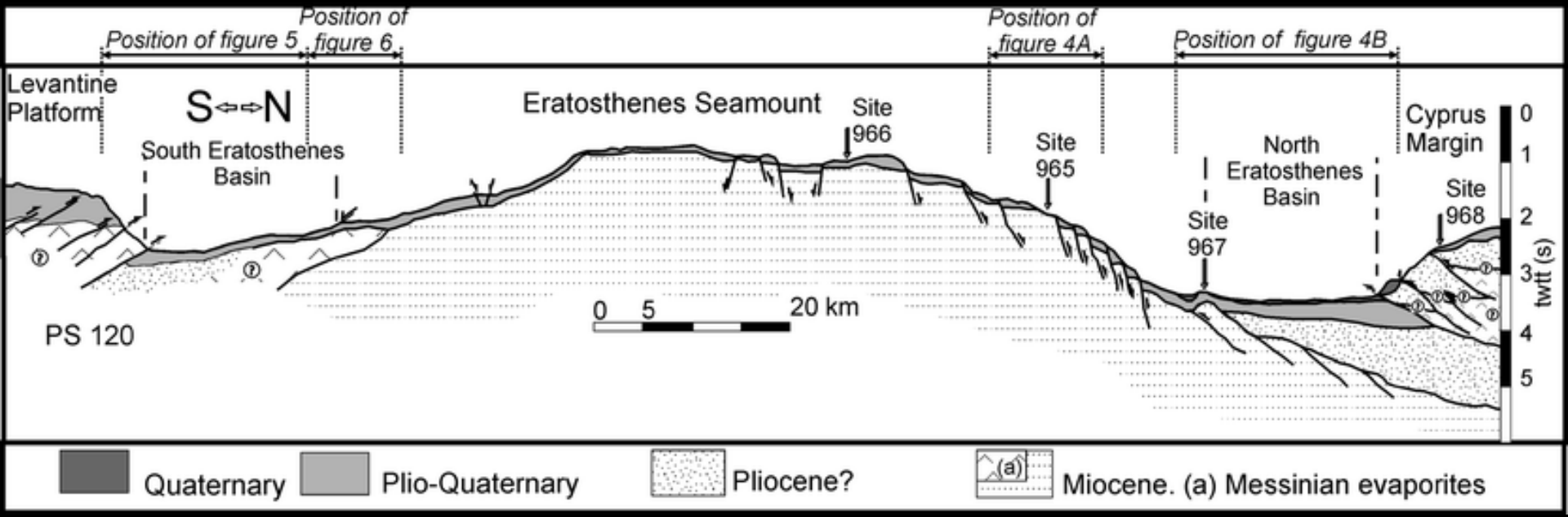


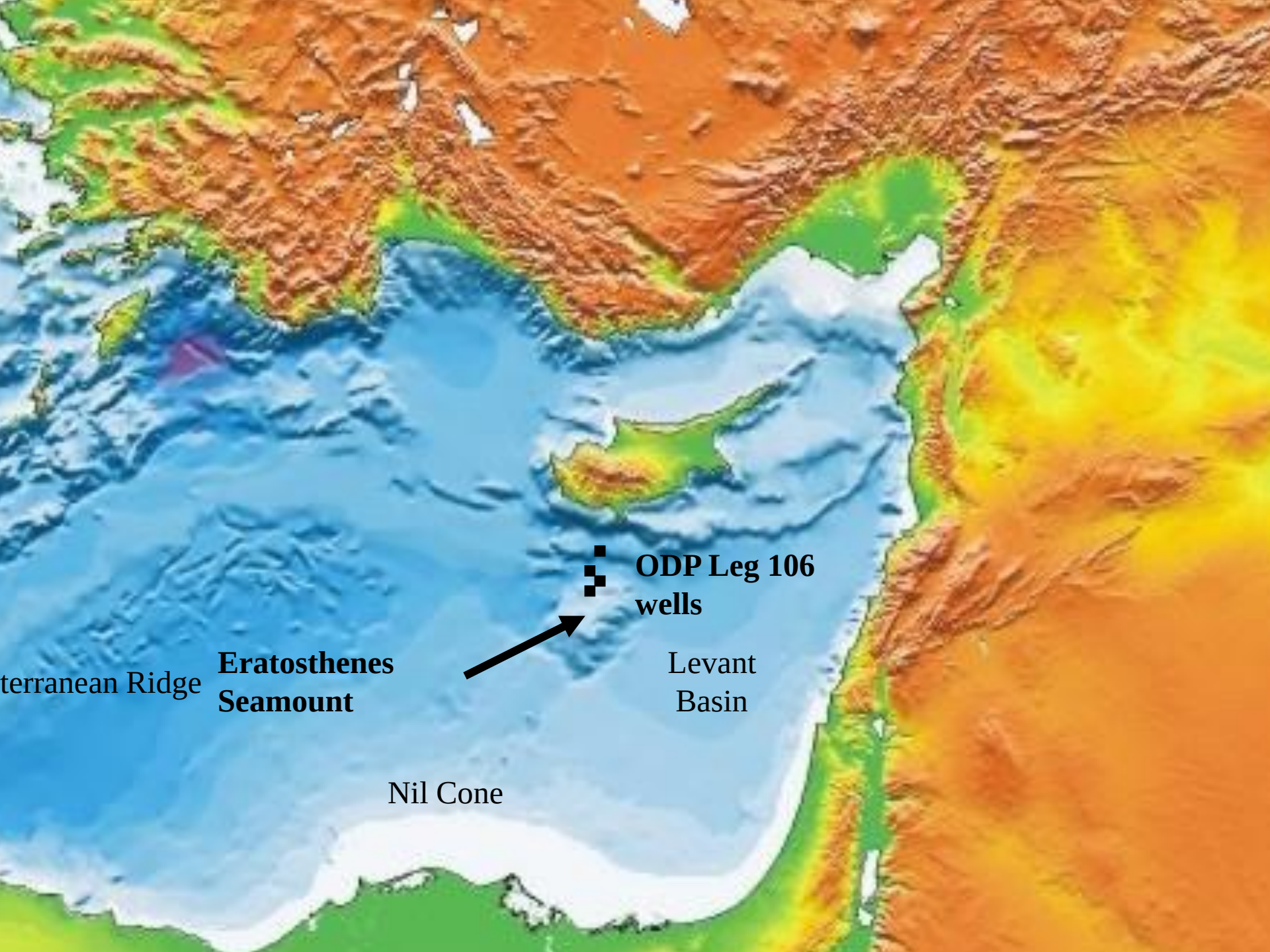
Section across a continental-margin subduction zone (Hamilton, 1988)

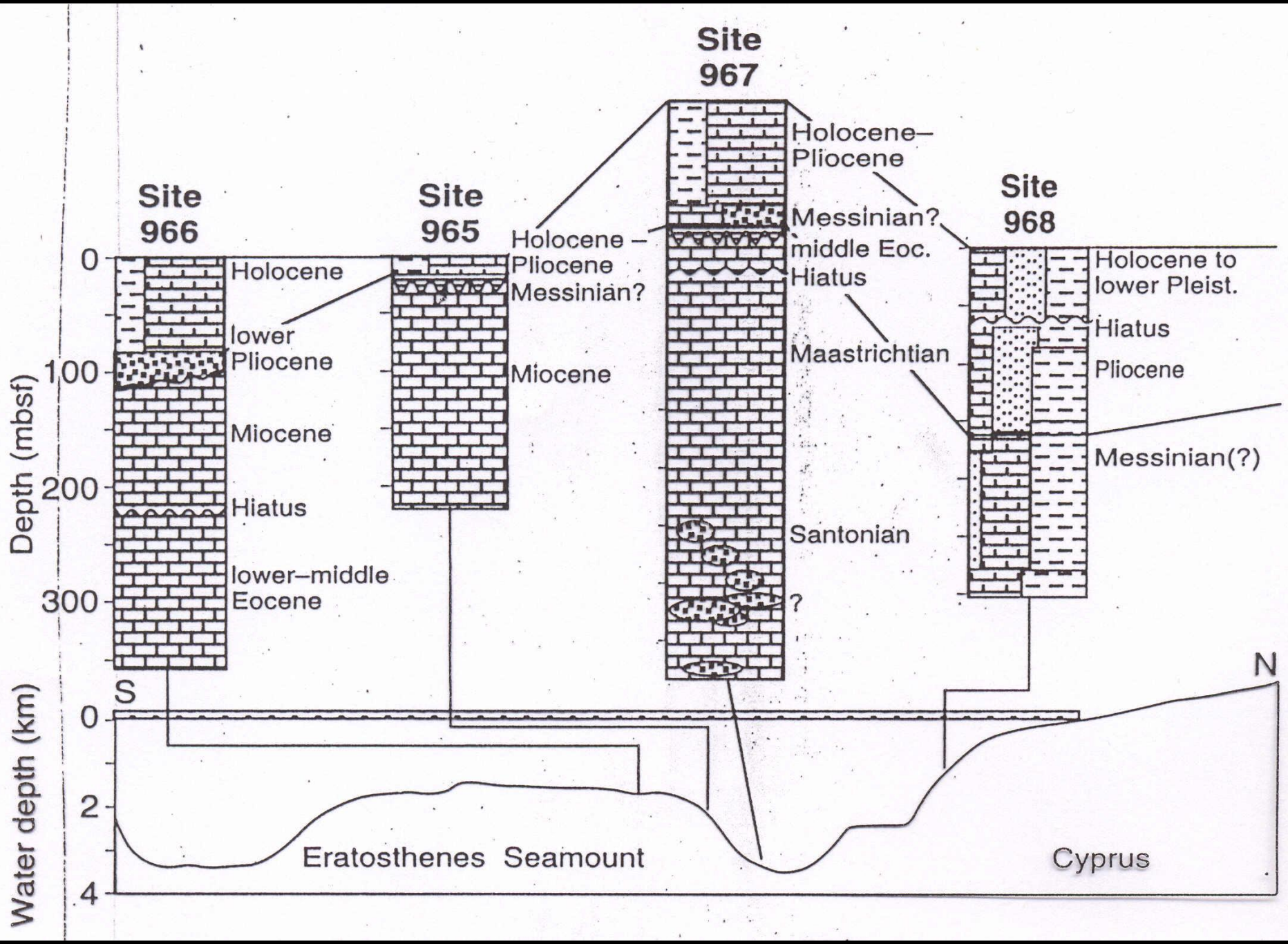
Mediterrenean Ridge

A huge accretionary complex


Eratosthenes
Seamount
Levant
Basin
Nil Cone


Position of figure 5
Position of figure 6
Position of figure 4A
Position of figure 4B
Levantine Platform
S⇦⇨N
South Eratosthenes Basin
Eratosthenes Seamount
Site 966
Site 965
Site 967
North Eratosthenes Basin
Cyprus Margin
Site 968
0 5 20 km
PS 120
0
1
2
3
4
5
twtt (s)
Quaternary
Plio-Quaternary
Pliocene?
(a)
Miocene. (a) Messinian evaporites

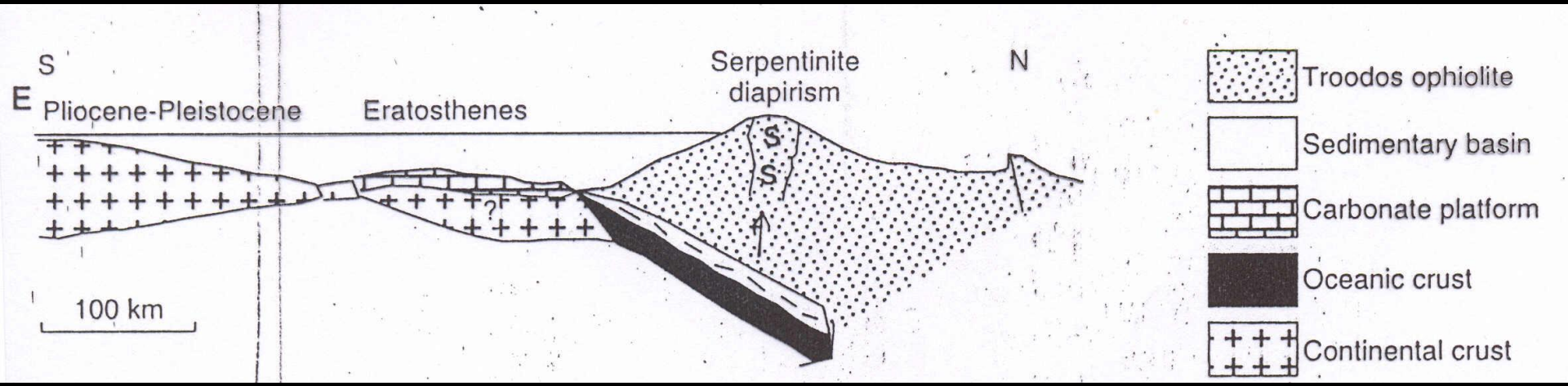

ODP Leg 106
wells
terranean Ridge
Eratosthenes
Seamount
Levant
Basin
Nil Cone

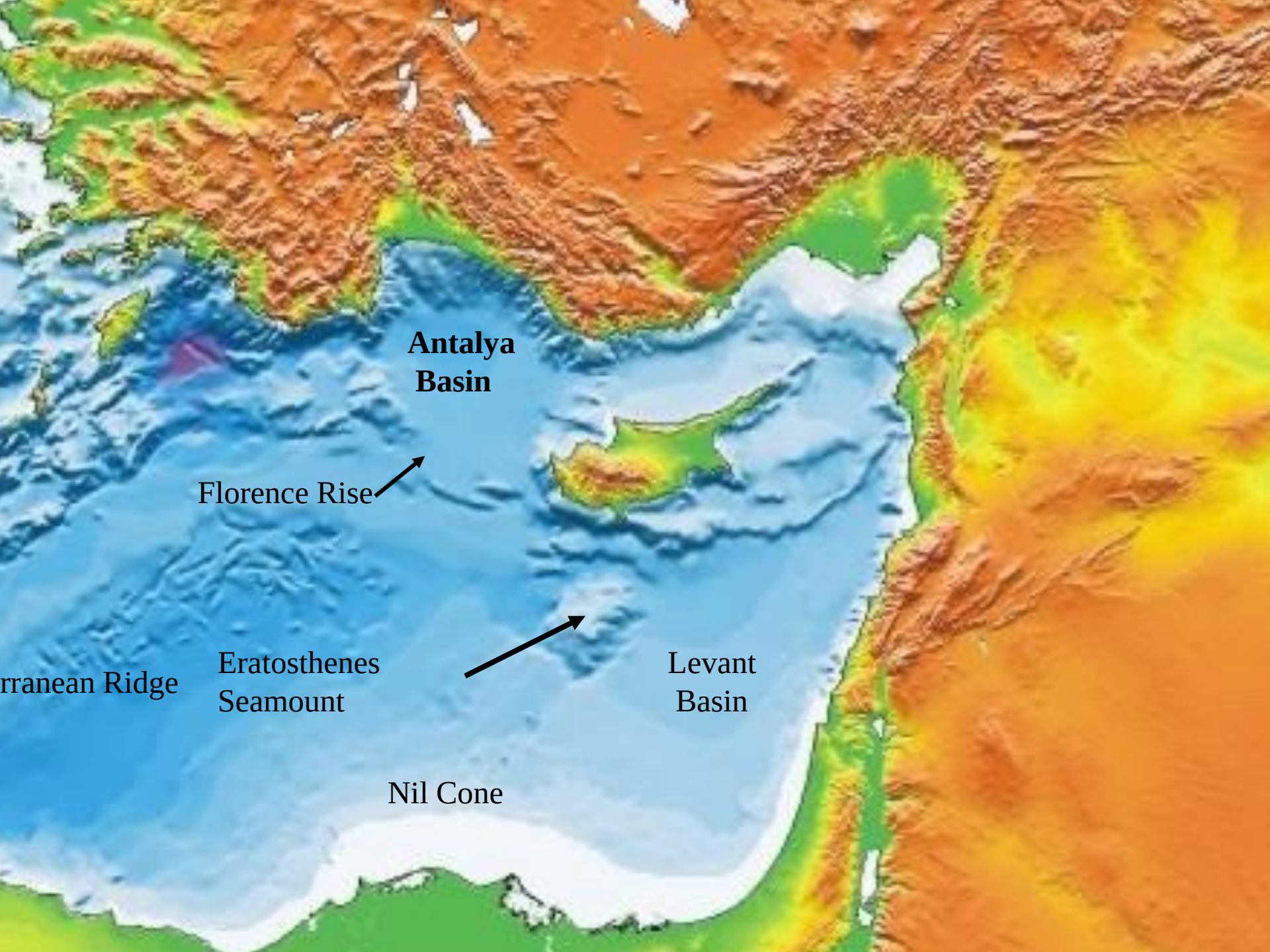

Site 966
Site 965
Site 967
Site 968
Holocene
lower Pliocene
Miocene
Hiatus
lower–middle Eocene
Holocene – Pliocene
Messinian?
Miocene
Holocene– Pliocene
Messinian?
middle Eoc.
Hiatus
Maastrichtian
Santonian
?
Holocene to lower Pleist.
Hiatus
Pliocene
Messinian(?)
Depth (mbsf)
0
100
200
300
S
N
Water depth (km)
0
2
4
Eratosthenes Seamount
Cyprus

Eratostenes seamount:

a small continental fragment in collision with Cyprus

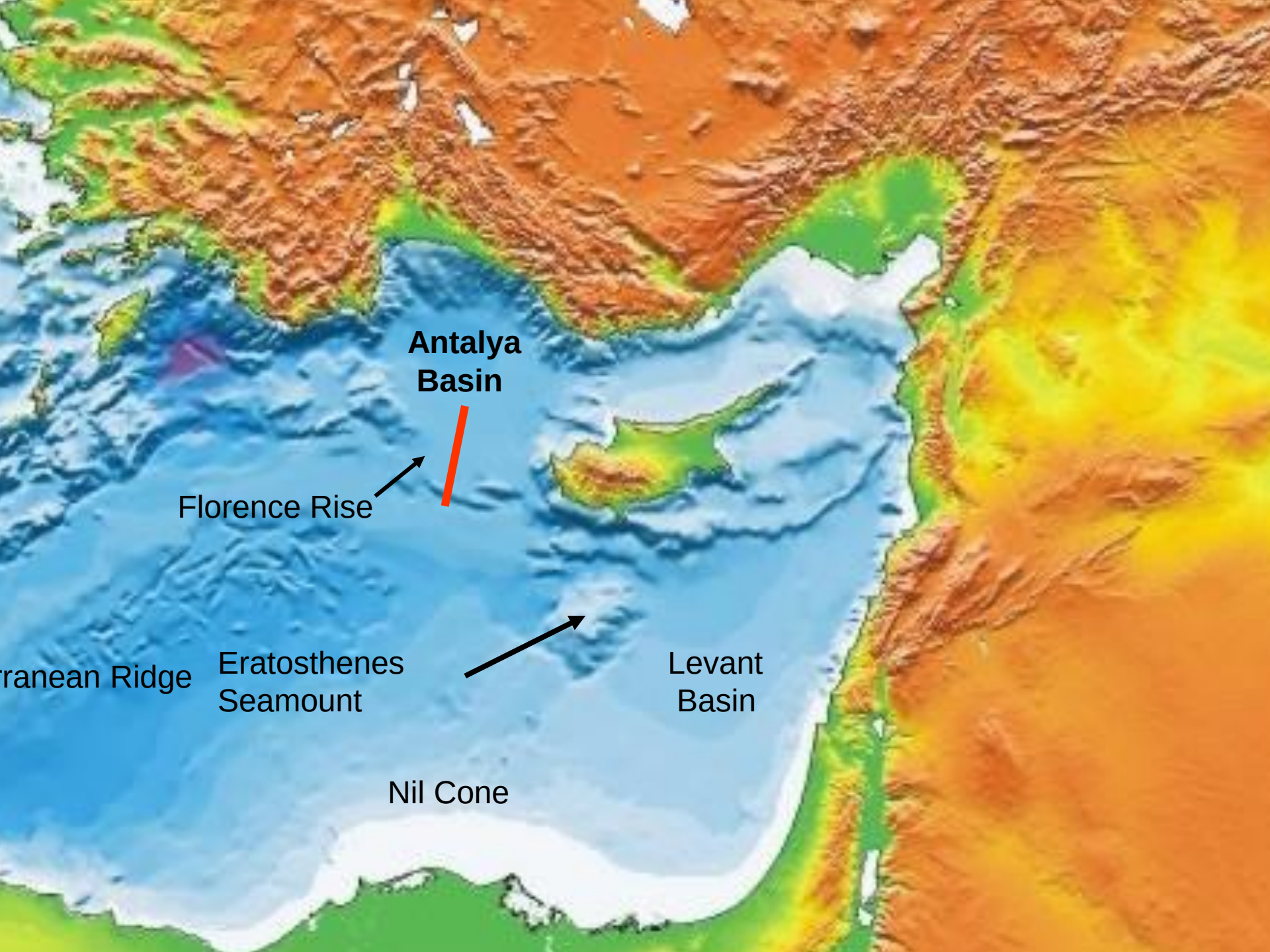
The Miocene uplift of Cyprus is related to this collision

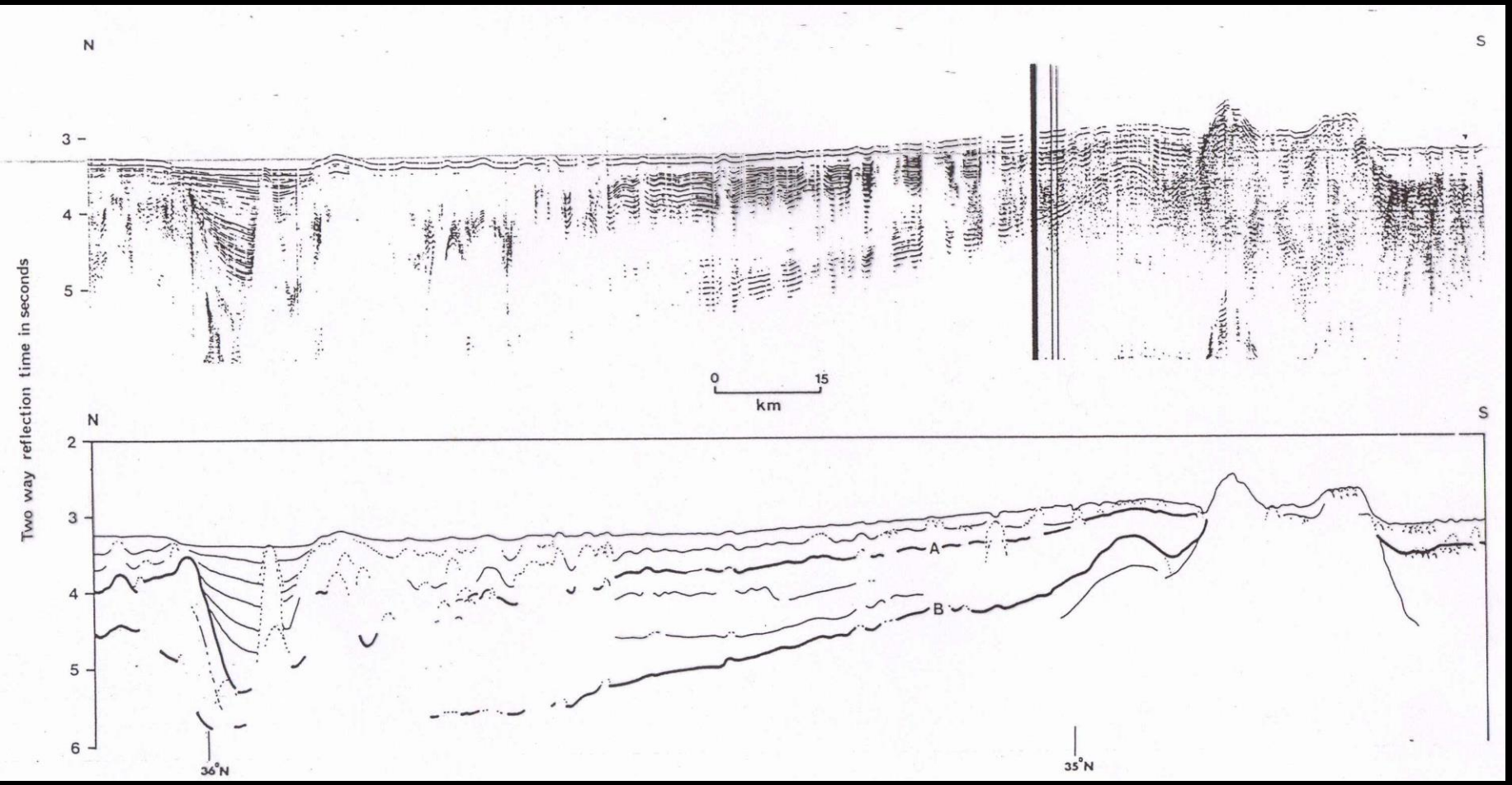

S
E
Pliocene-Pleistocene
Eratosthenes
Serpentinite
diapirism
N
S
S
?
100 km
Troodos ophiolite
Sedimentary basin
Carbonate platform
Oceanic crust
Continental crust

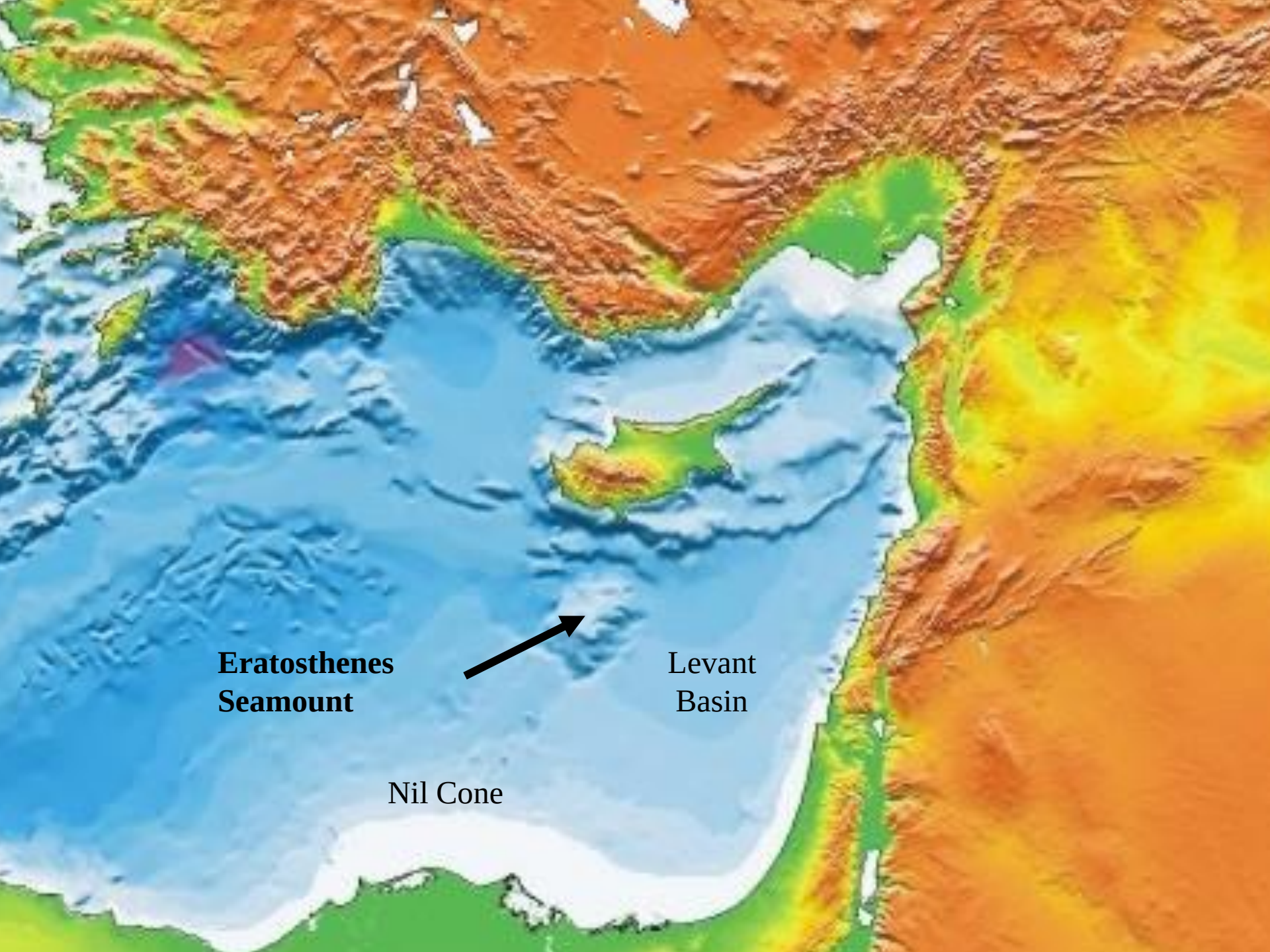

Antalya
Basin
Florence Rise
rranean Ridge
Eratosthenes
Seamount
Levant
Basin
Nil Cone

Antalya Basin:

A north-tilted «back-arc» basin behind the Florence Rise


Antalya
Basin
Florence Rise
rranean Ridge
Eratosthenes
Seamount
Levant
Basin
Nil Cone


N
S
3
4
5
0
15
km
Two way reflection time in seconds
N
S
2
3
4
5
6
A
B
36°N
35°N


Eratosthenes Seamount
Levant Basin
Nil Cone

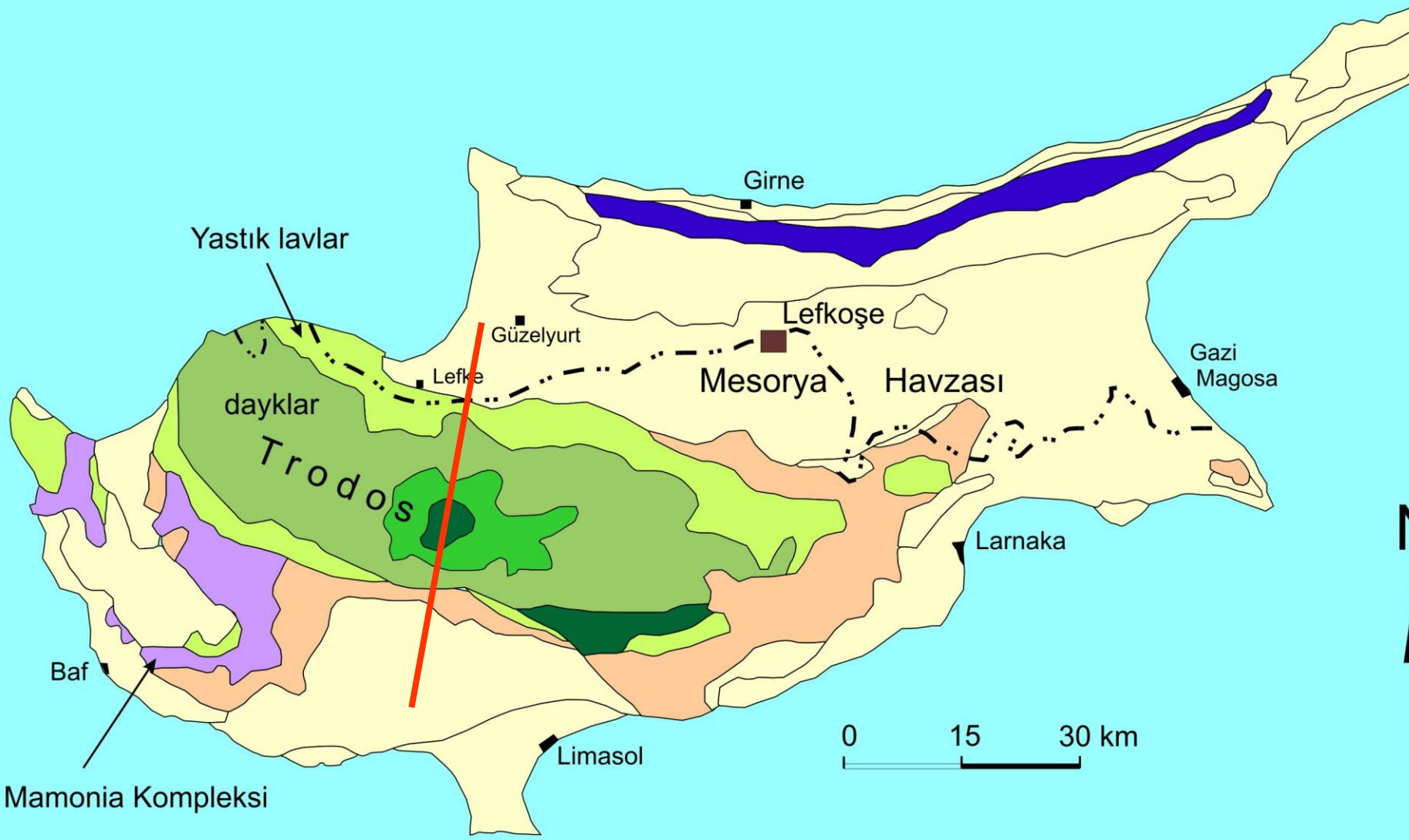

Beşparmak Dağları
Girne
Lefkoşe
Güzelyurt
Lefke
Mesorya
Havzası
Gazi
Magosa
Trodos
Larnaka
Baf
Limasol
0
15
30 km
N

Three major tectonic units of Cyprus:

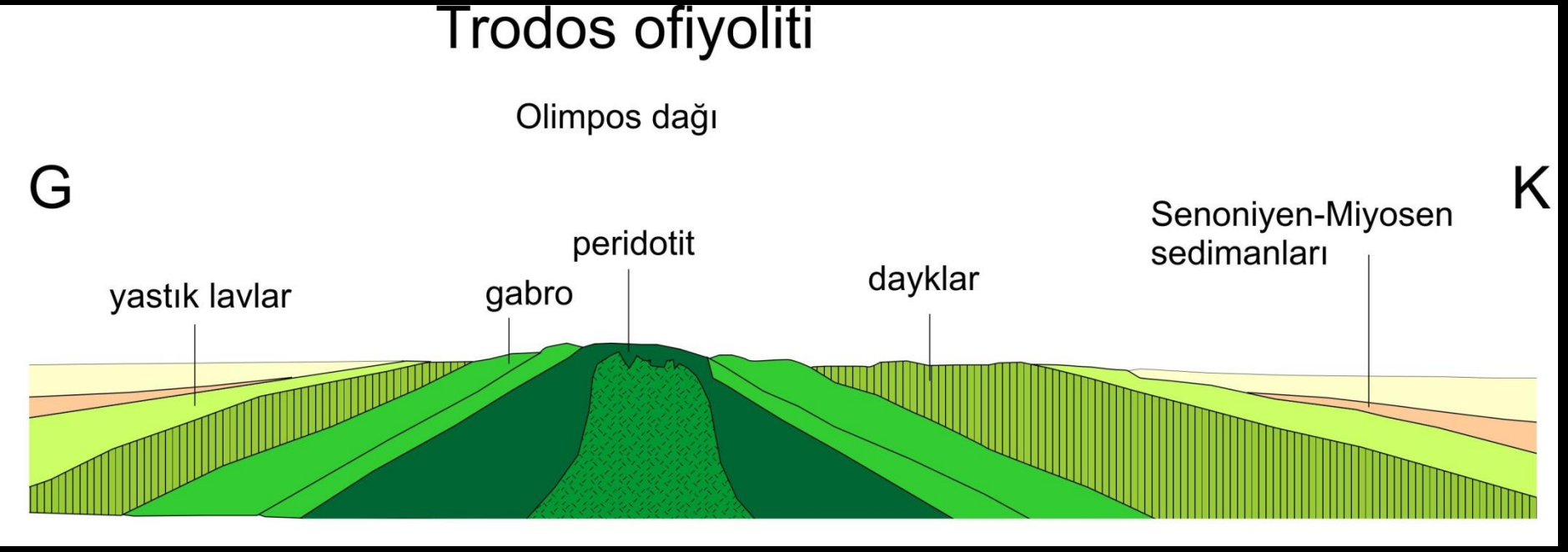
1. Troodos ophiolite and related units

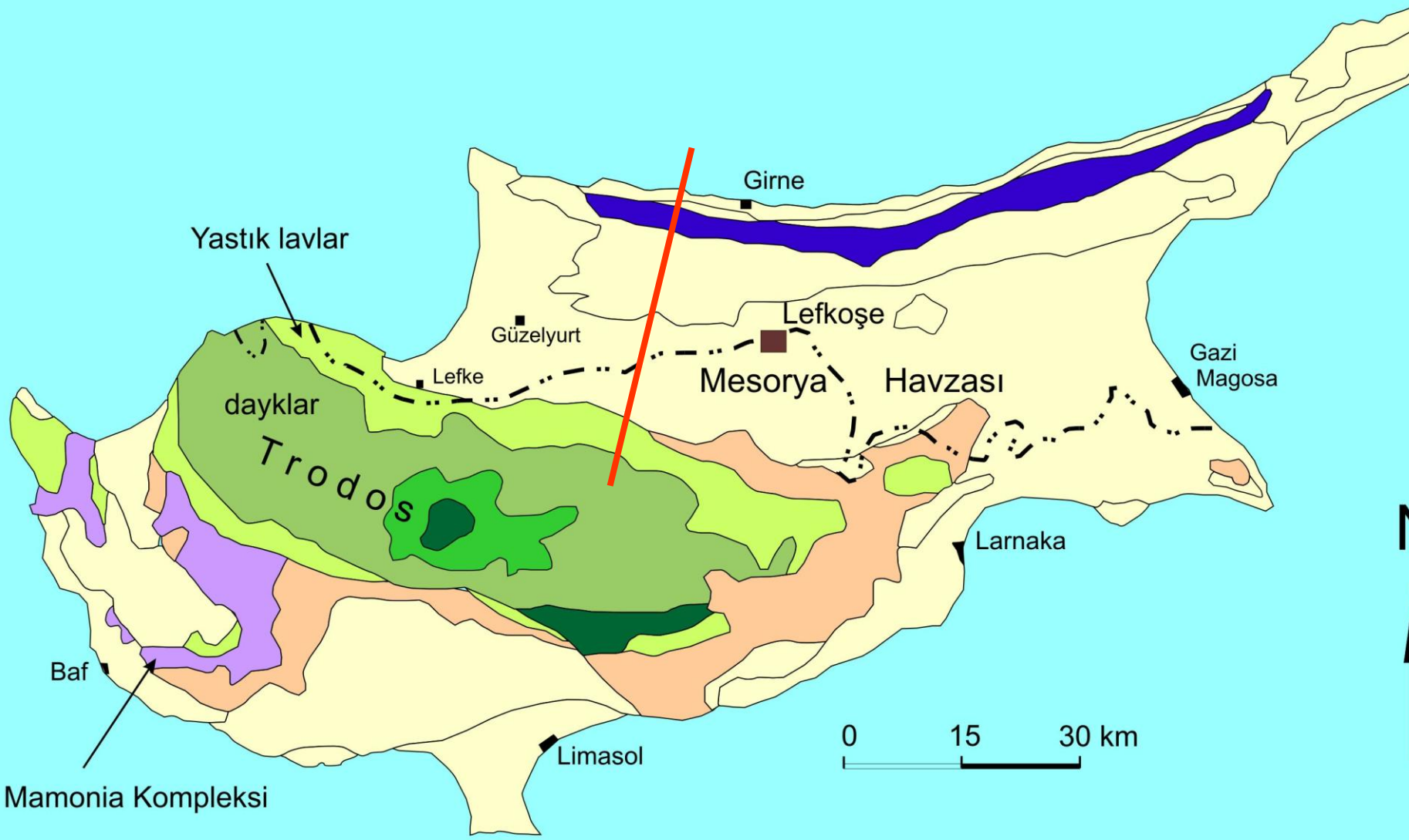
2. Mesoira basin

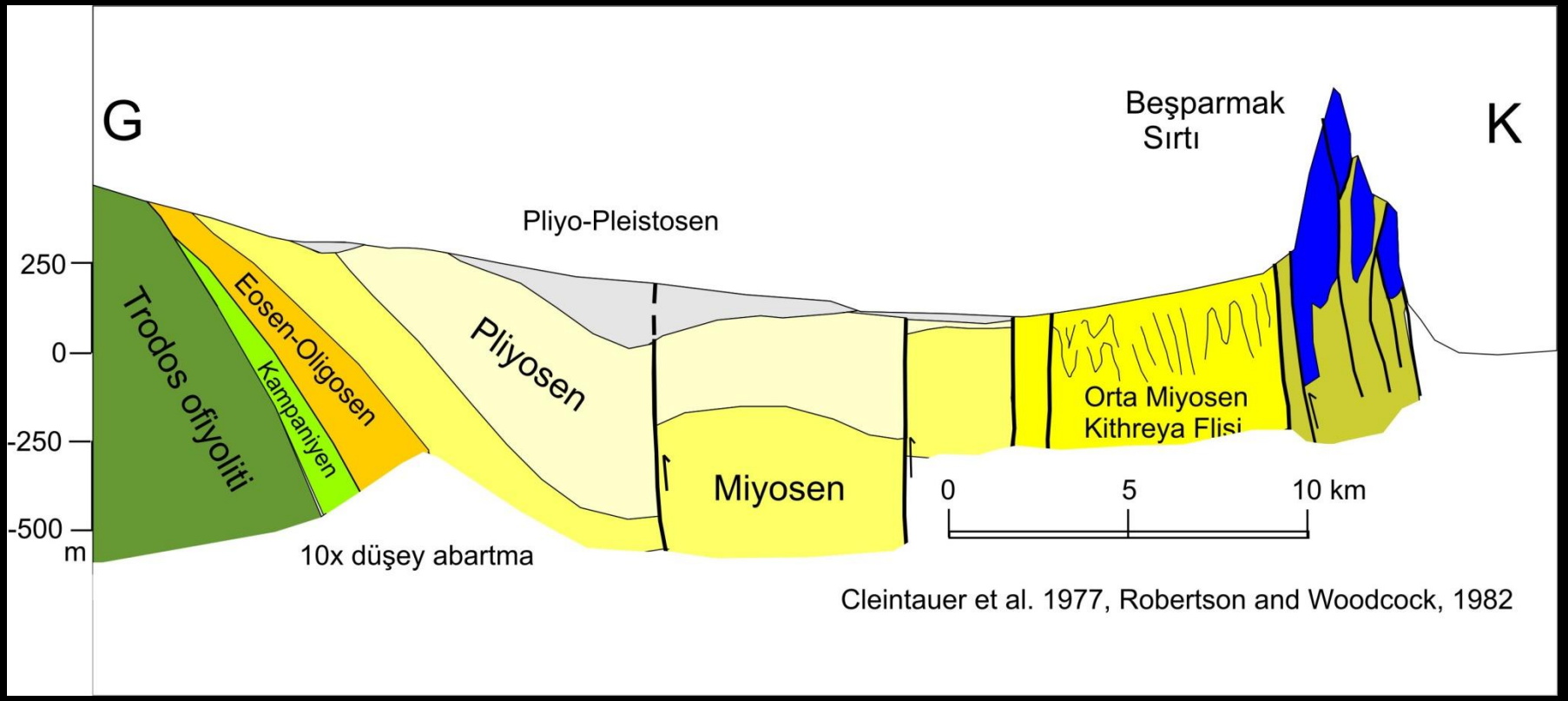
3. Beşparmak (Kyrenia) mountains

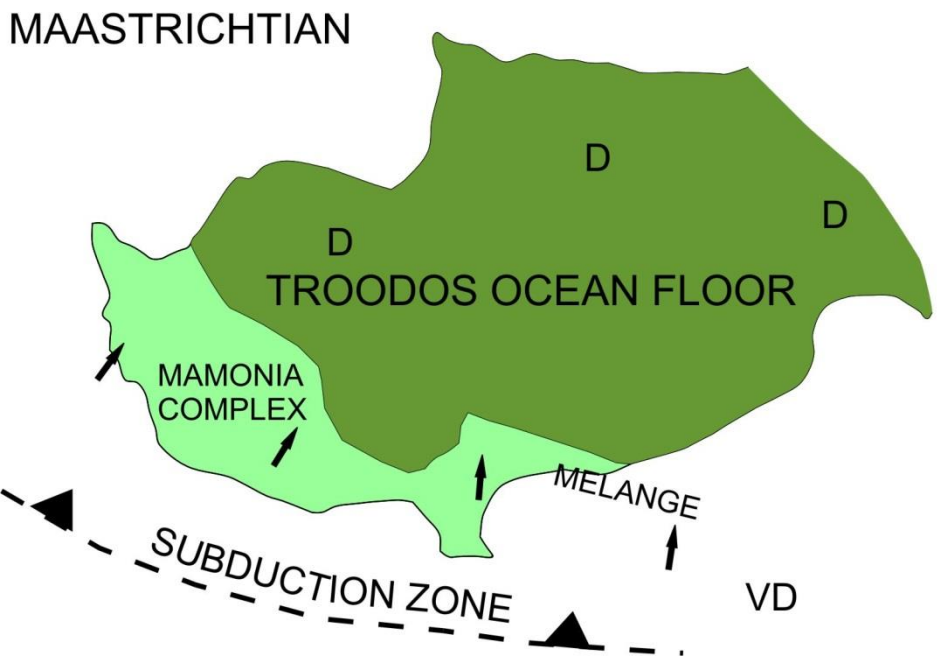

Girne
Yastık lavlar
Güzelyurt
Lefkoşe
Gazi
Magosa
Lefke
Mesorya Havzası
dayklar
Trodos
Larnaka
Baf
0 15 30 km
Limasol
Mamonia Kompleksi

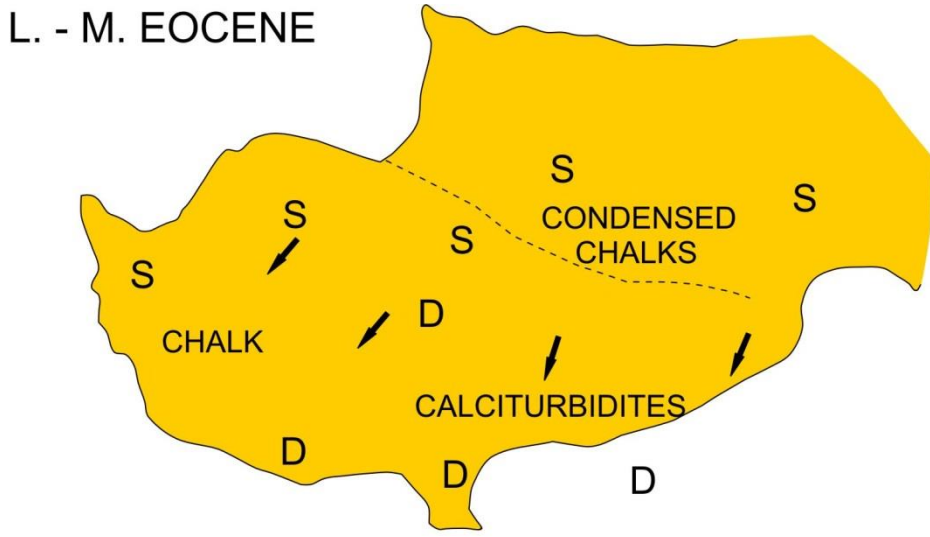
Trodos ofiyoliti



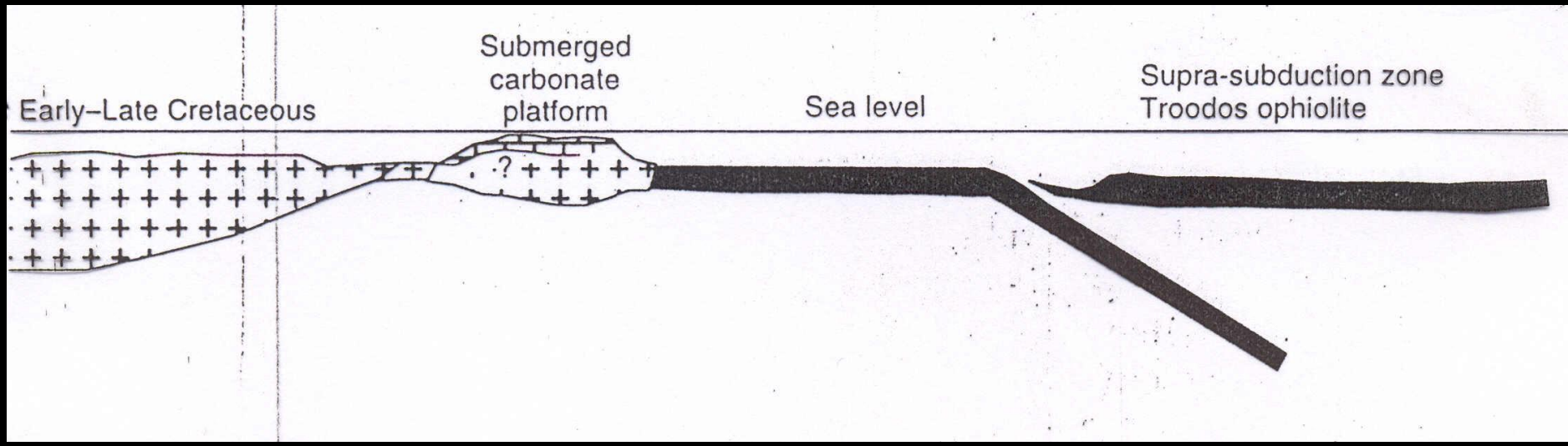

Girne
Yastık lavlar
Güzelyurt
Lefkoşe
Lefke
Mesorya Havzası
Gazi Magosa
dayklar
Troodos
Larnaka
Baf
0 15 30 km
Limasol
Mamonia Kompleksi

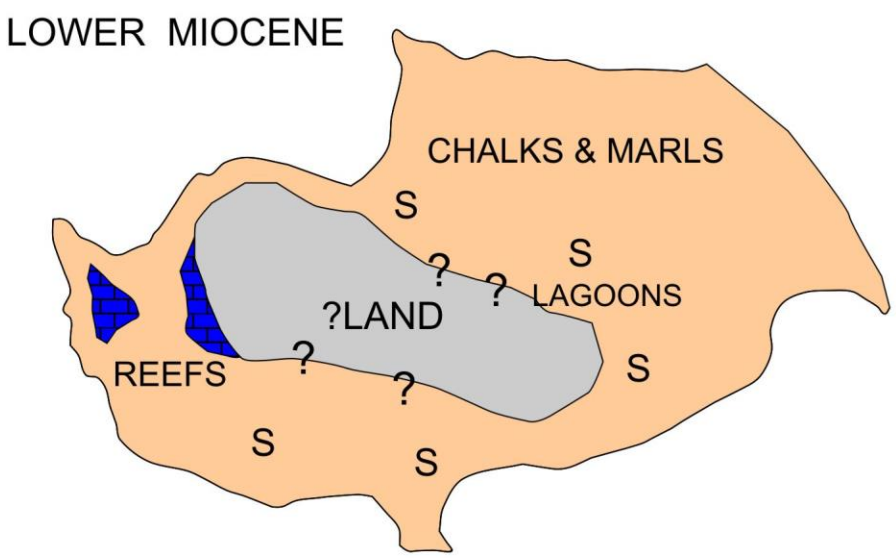

G
Beşparmak
Sırtı
K
Pliyo-Pleistosen
250
0
-250
-500
m
Trodos ofiyoliti
Eosen-Oligosen
Kampaniyen
Pliyosen
Miyosen
Orta Miyosen
Kithreya Flisi
0
5
10 km
10x düşey abartma
Cleintauer et al. 1977, Robertson and Woodcock, 1982

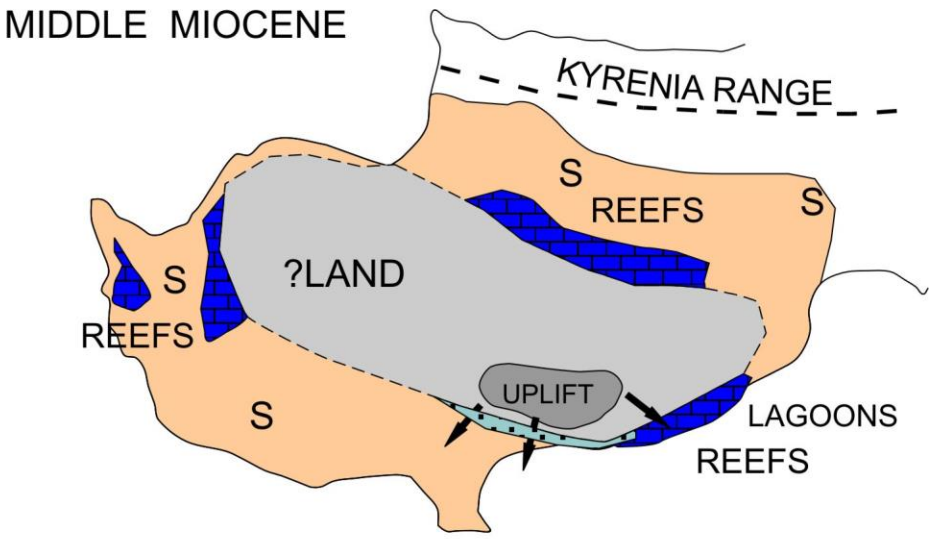




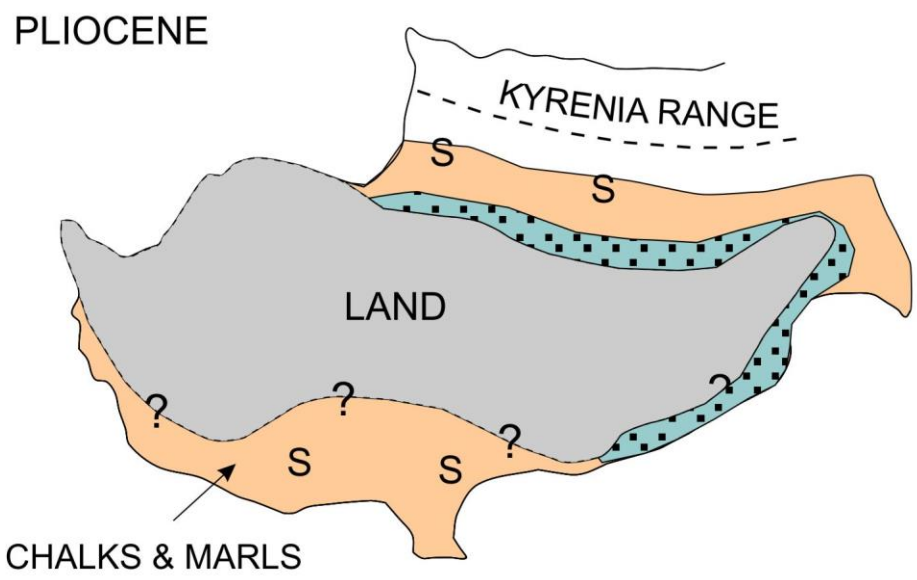
Robertson 1977

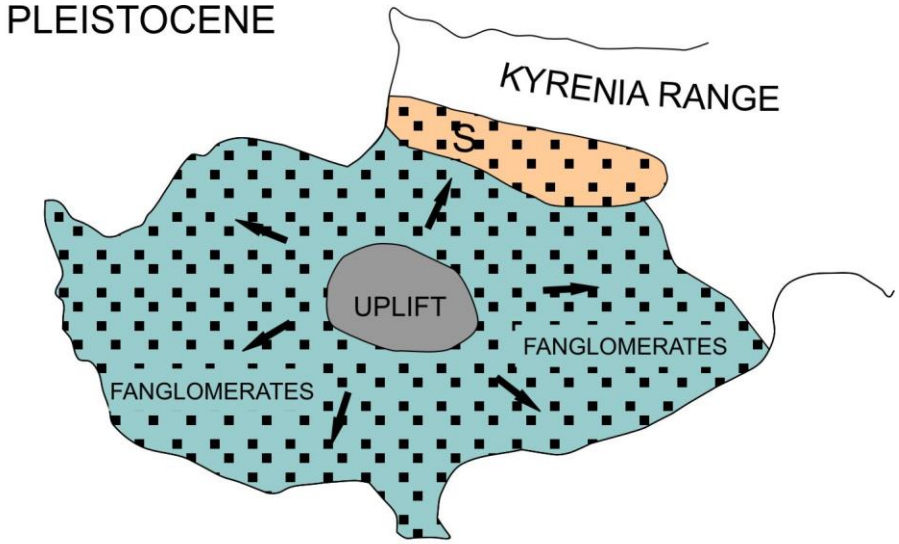

Early–Late Cretaceous
Submerged
carbonate
platform
Sea level
Supra-subduction zone
Troodos ophiolite
?



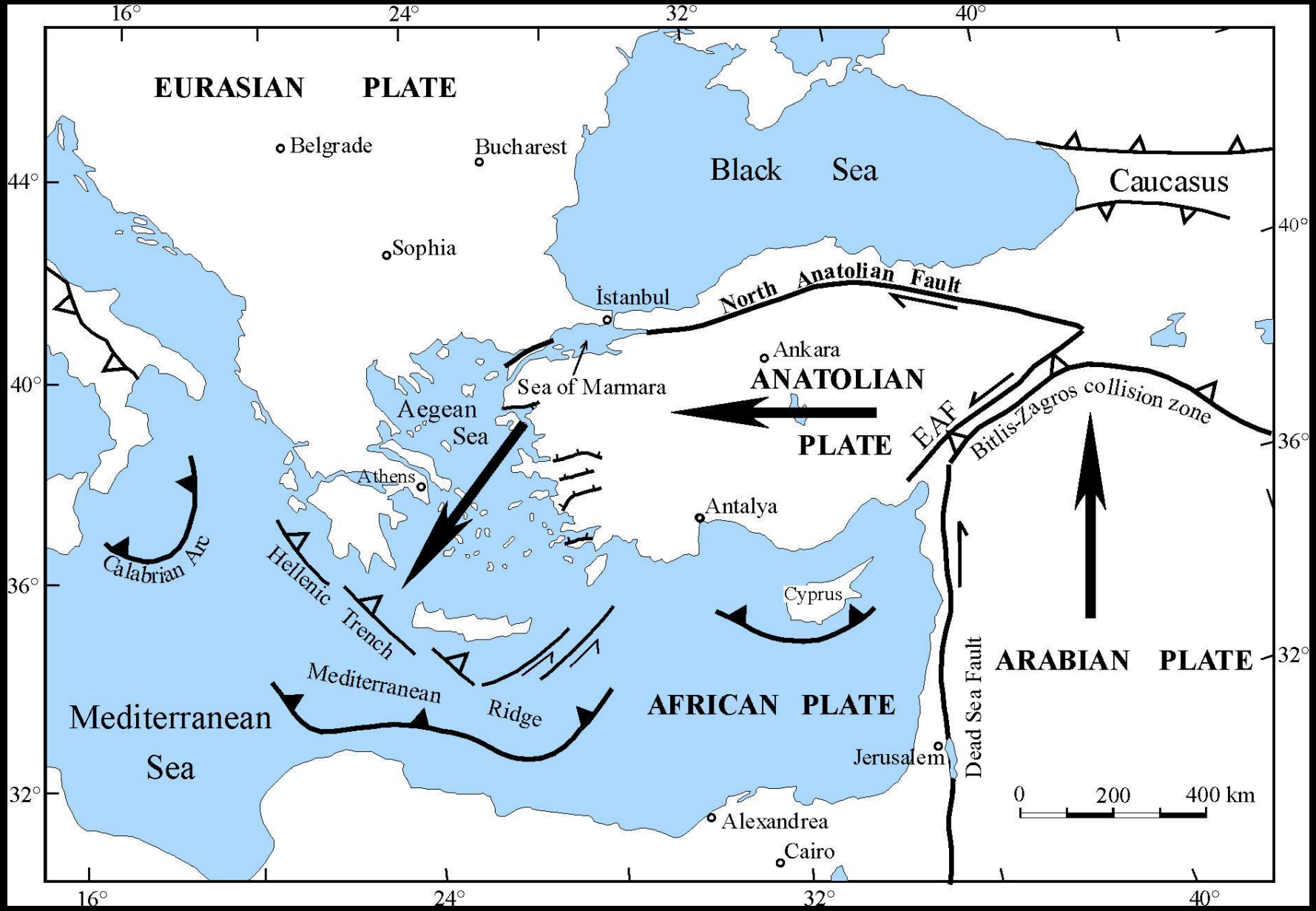


Robertson 1977



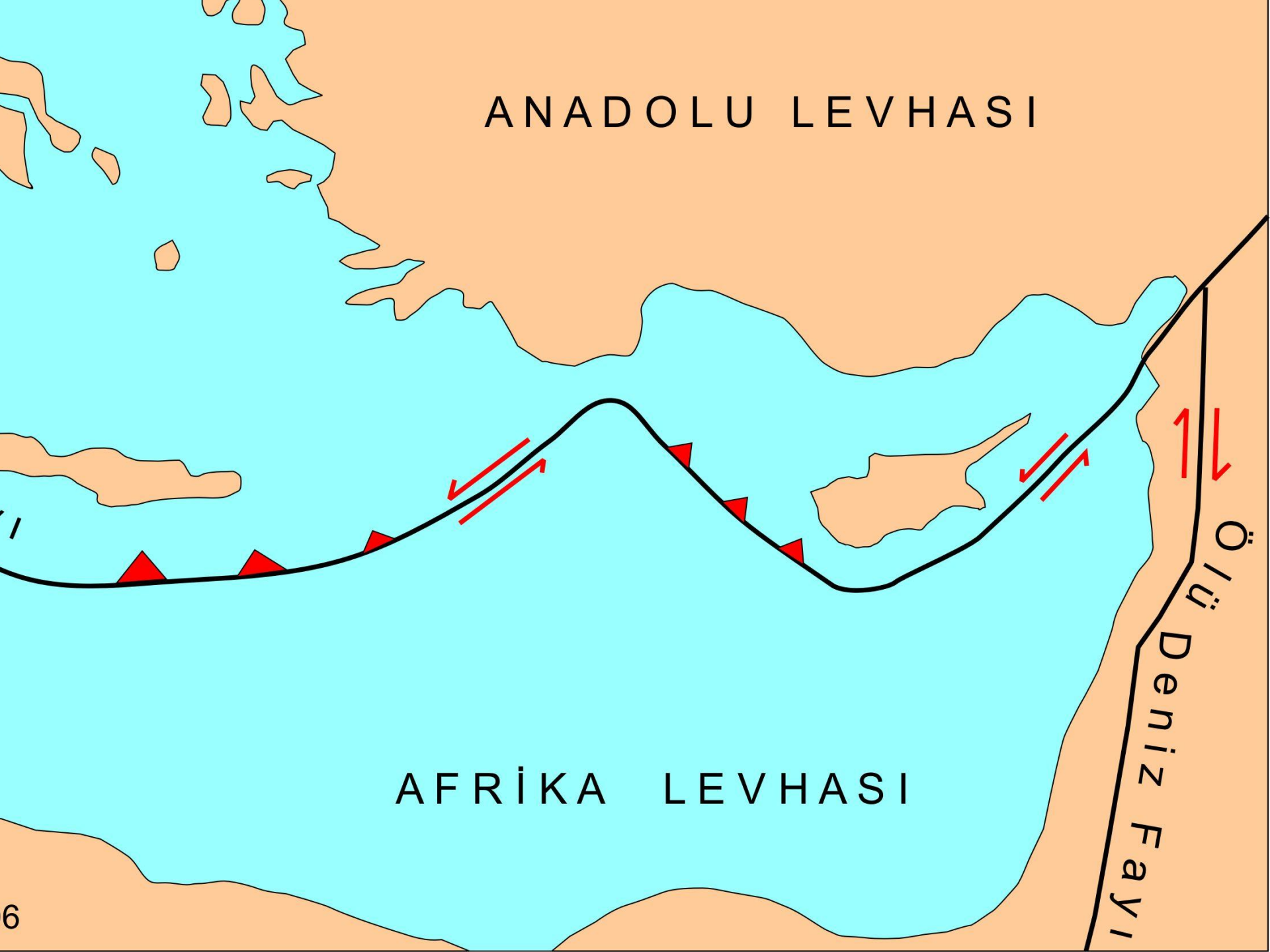


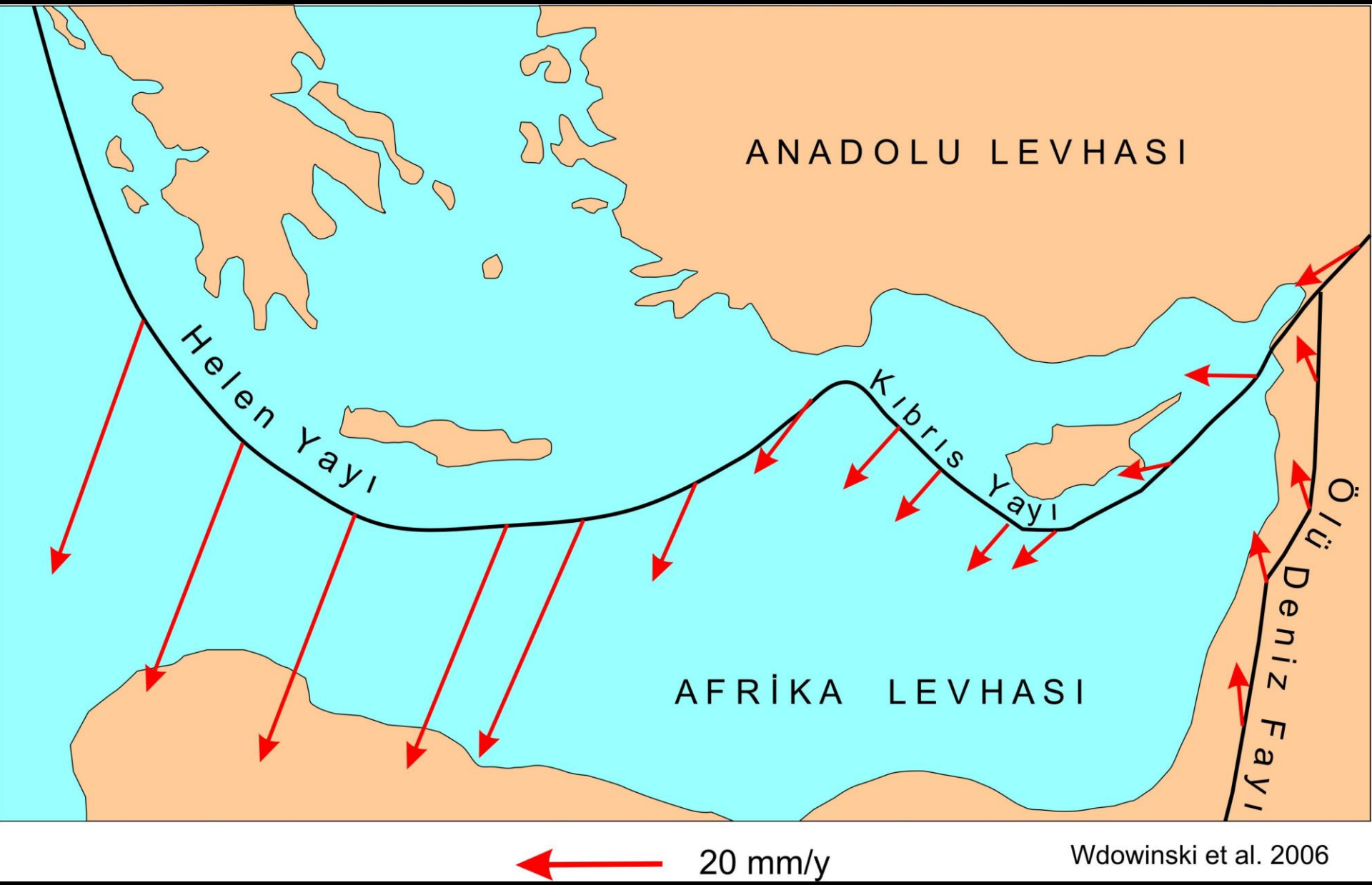
Robertson 1977

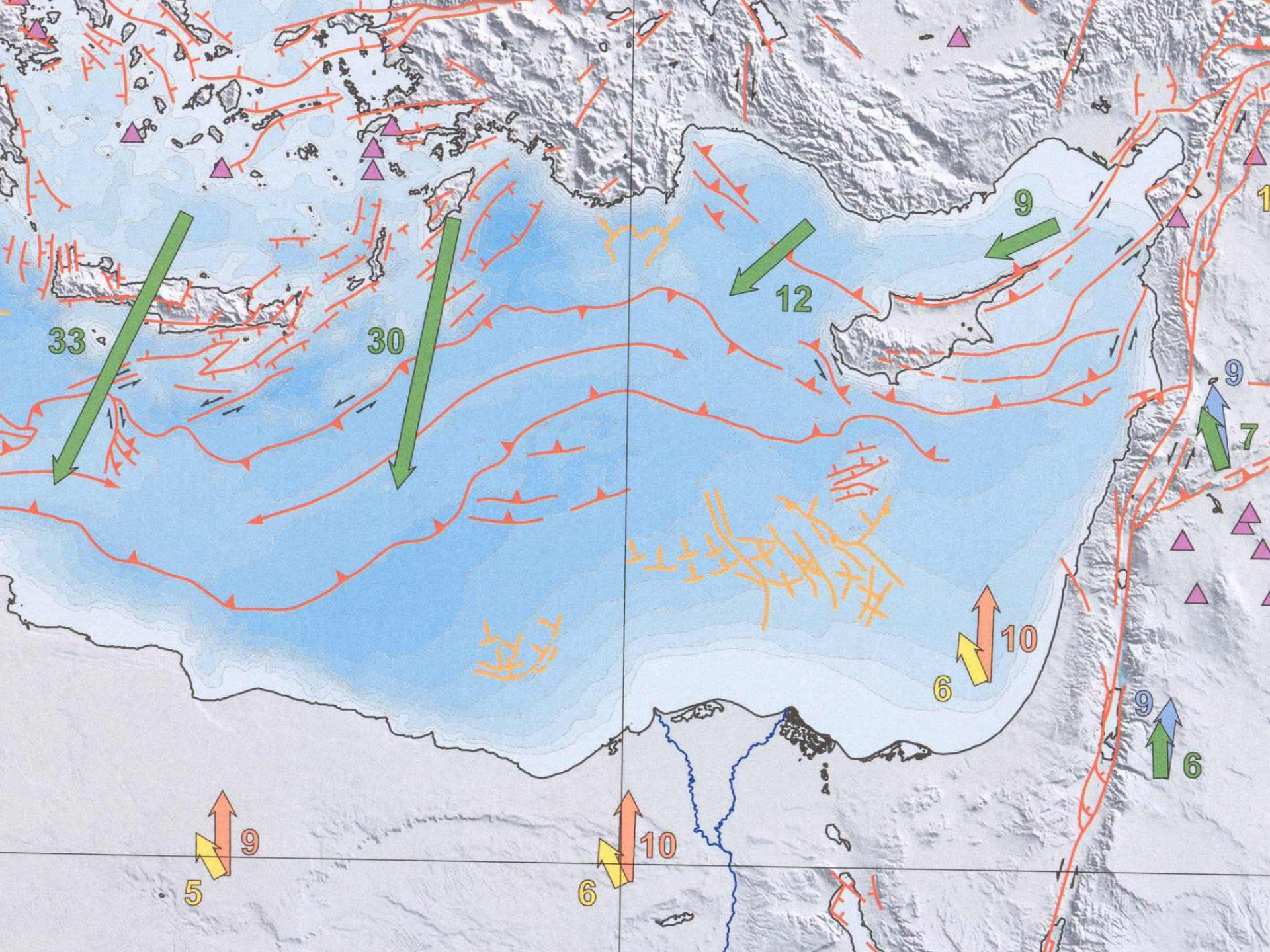

16°
24°
32°
40°
EURASIAN PLATE
Belgrade
Bucharest
Black Sea
Caucasus
44°
Sophia
İstanbul
North Anatolian Fault
40°
Ankara
ANATOLIAN
PLATE
Sea of Marmara
Aegean
Sea
EAF
Bitlis-Zagros collision zone
Athens
Antalya
Calabrian Arc
Hellenic Trench
Cyprus
36°
Mediterranean Ridge
ARABIAN PLATE
32°
Mediterranean
Sea
AFRICAN PLATE
Dead Sea Fault
Jerusalem
0 200 400 km
Alexandrea
Cairo

Conclusions:

1. The Levant and Herodotus basins in the southern Eastern Mediterranean probably have oceanic crust. The oceanic crust is Triassic or Jurassic in age and constitutes a relict of the Neo-Tethyan ocean.
2. The Eastern Mediterranean Ridge is a immense accretionary complex formed during the northward subduction of the Eastern Mediterranean oceanic lithosphere.
3. The Beşparmak Mountains in the northern Cyprus constitute the southern extension of the Taurides, the Mesoira basin is an unusual type of «fore-arc» basin, and the Troodos ophiolite is a Late Cretaceous oceanic crust.
4. In the present tectonics, Cyprus lies within the Anatolian plate just north of the plate boundary; the plate boundary is transform to subduction type.
5. Cyprus is undergoing active collision with the Eratosthenes seamount in the south.


ANADOLU LEVHASI
AFRİKA LEVHASI
Ölü Deniz Fayı


ANADOLU LEVHASI
Helen Yayı
Kıbrıs Yayı
Ölü Deniz Fayı
AFRİKA LEVHASI
20 mm/y
Wdowinski et al. 2006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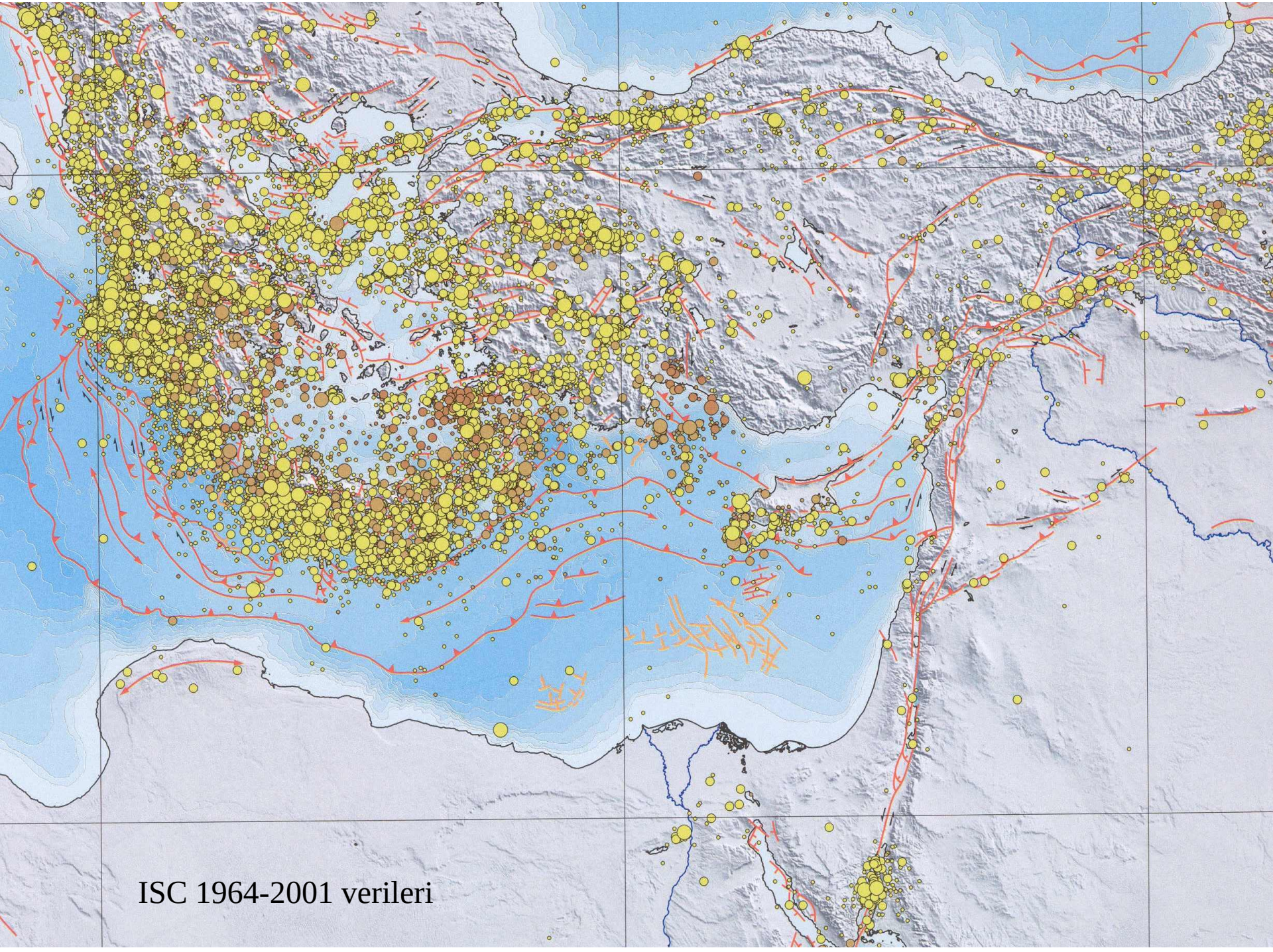
6


ISC 1964-2001 verileri