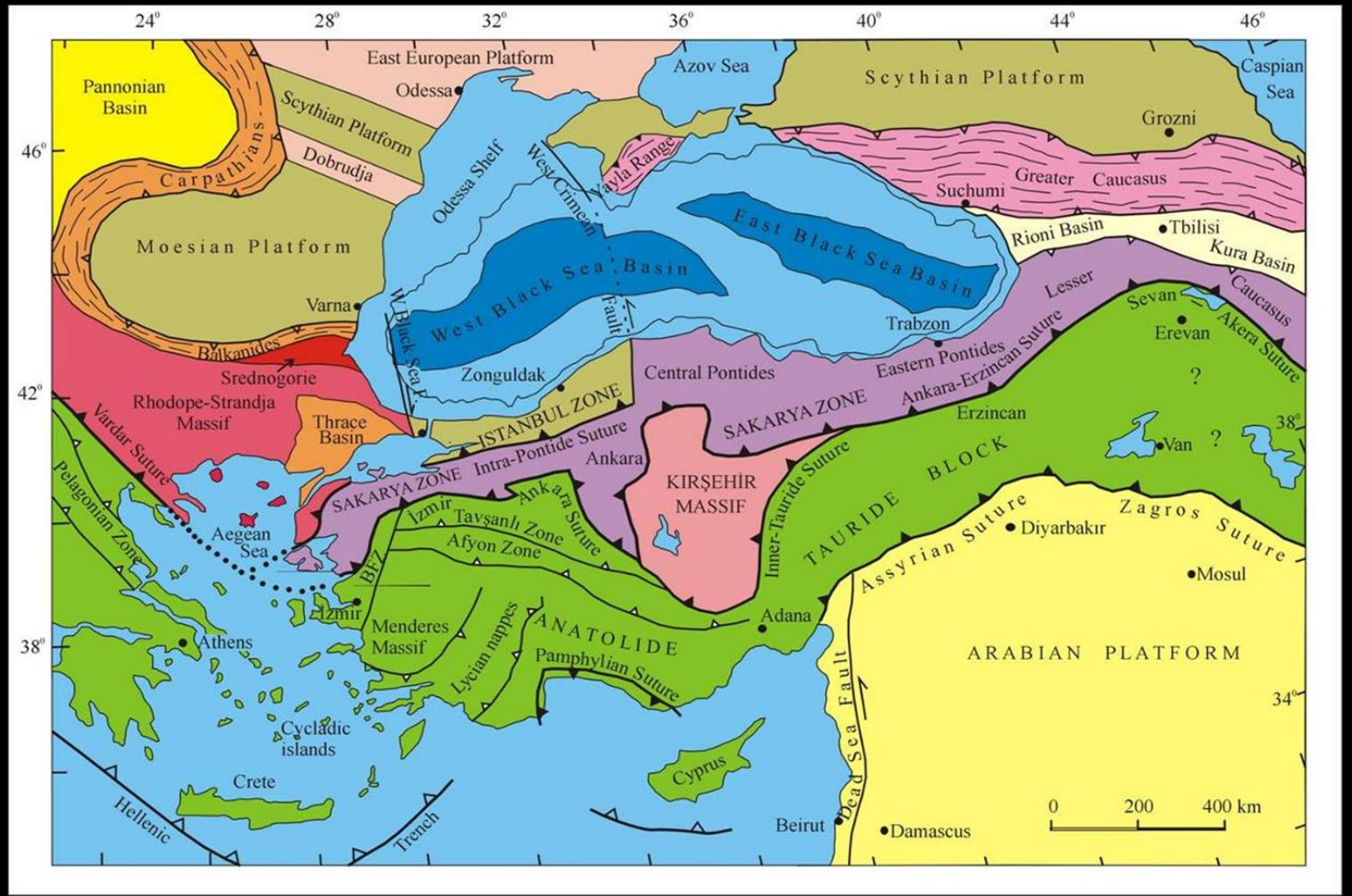
GEOLOGY OF THE KIRŞEHİR MASSIF AND THE ÇANKIRI BASIN

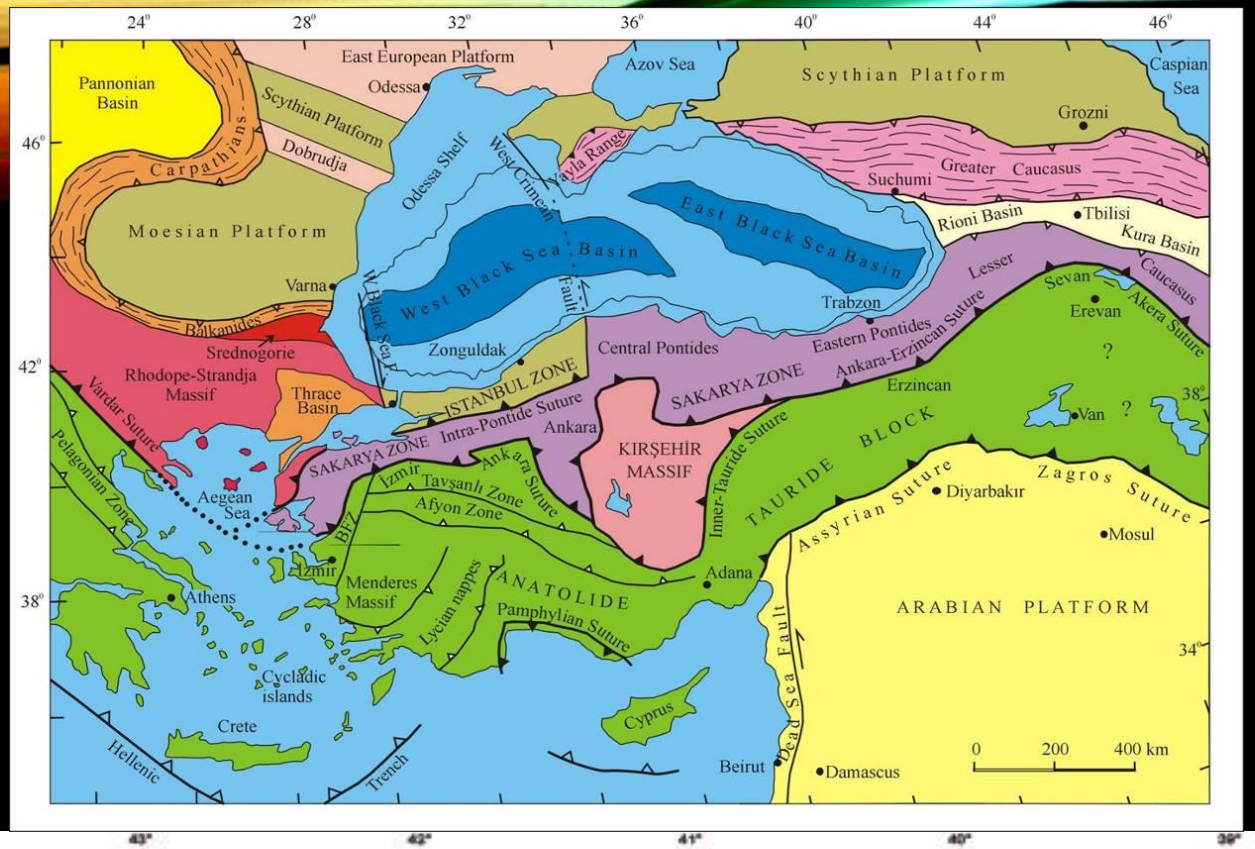
GEOLOGY OF TURKEY

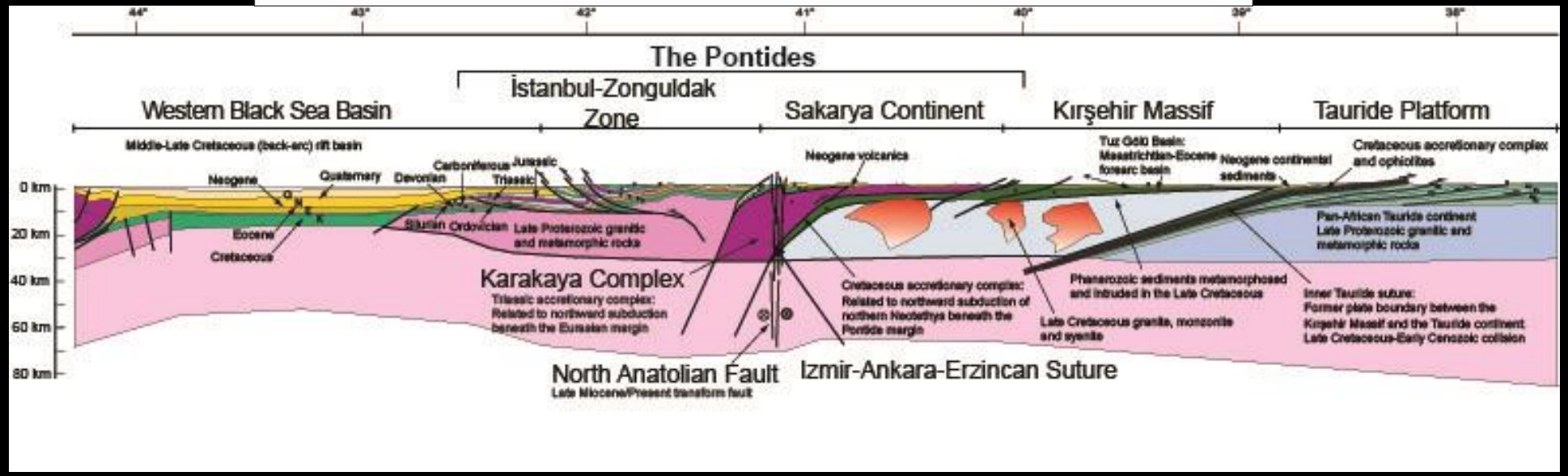
Okan Tüysüz

2018

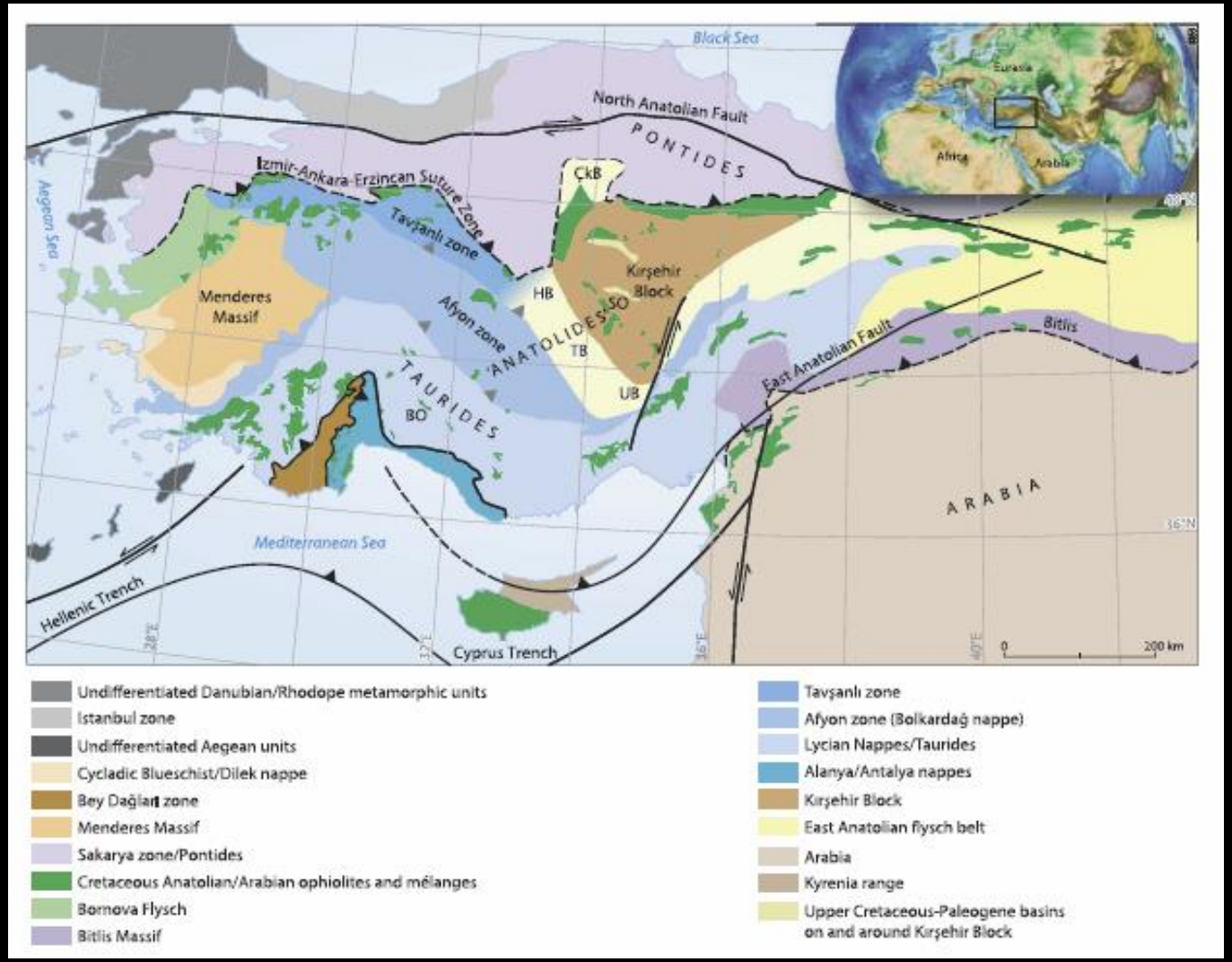
KIRŞEHIR BLOCK IS SURROUNDED BY ANKARA-ERZINCAN AND INNER TAURIDE SUTURES

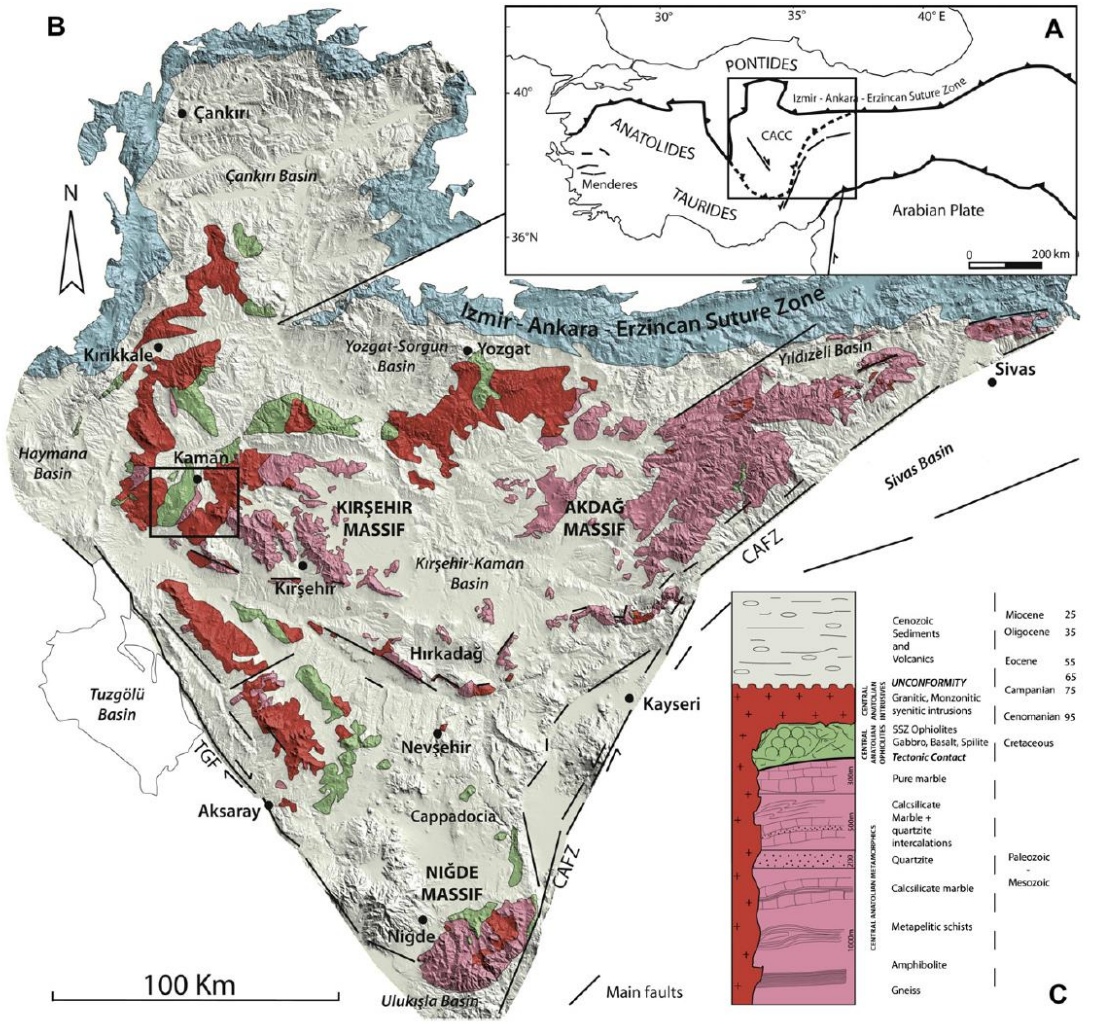



East European Platform
Azov Sea
Scythian Platform
Caspian Sea
Pannonian Basin
Odessa
Grozni
Scythian Platform
Dobrudja
Carpathians
Odessa Shelf
West Crimea
Kerch Range
Greater Caucasus
Suchumi
Moesian Platform
East Black Sea Basin
Rioni Basin
Tbilisi
Kura Basin
West Black Sea Basin
Varna
W. Black Sea F.
Fault
Trabzon
Lesser Caucasus
Sevan
Erevan
Akera Suture
Balkanides
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
Van
KIRŞEHİR MASSIF
Pelagonian Zone
SAKARYA ZONE
Izmir
Ankara Suture
Tavşanlı Zone
Inner-Tauride Suture
TAURIDE BLOCK
Aegean Sea
Afyon Zone
BEZ
Assyrian Suture
Diyarbakır
Zagros Suture
Mosul
Izmir
Menderes Massif
Adana
ANATOLIDE
Lycian nappes
Pamphylian Suture
Athens
ARABIAN PLATFORM
Cycladic islands
Cyprus
Dead Sea Fault
Crete
Hellenic Trench
Beirut
Damascus
0 200 400 km


The Pontides
İstanbul-Zonguldak Zone
Western Black Sea Basin
Sakarya Continent
Kırşehir Massif
Tauride Platform
Middle-Late Cretaceous (back-arc) rift basin
Neogene volcanics
Tuz Gölü Basin: Maastrichtian-Eocene forearc basin
Neogene continental sediments
Cretaceous accretionary complex and ophiolites
Neogene
Quaternary
Devonian
Carboniferous
Jurassic
Triassic
Eocene
Cretaceous
Silurian
Ordovician
Late Proterozoic granitic and metamorphic rocks
Pan-African Taurida continent
Late Proterozoic granitic and metamorphic rocks
0 km
20 km
40 km
60 km
80 km
Karakaya Complex
Triassic accretionary complex: Related to northward subduction beneath the Eurasian margin
Cretaceous accretionary complex: Related to northward subduction of northern Neotethys beneath the Pontide margin
Phanerozoic sediments metamorphosed and intruded in the Late Cretaceous
Late Cretaceous granite, monzonite and syenite
Inner Tauride suture: Former plate boundary between the Kırşehir Massif and the Tauride continent. Late Cretaceous-Early Cenozoic collision
North Anatolian Fault
Late Miocene/Present transform fault
Izmir-Ankara-Erzincan Suture

METAMORPHIC ROCKS, OPHIOLITES, GRANITES, SEDIMENTARY BASINS





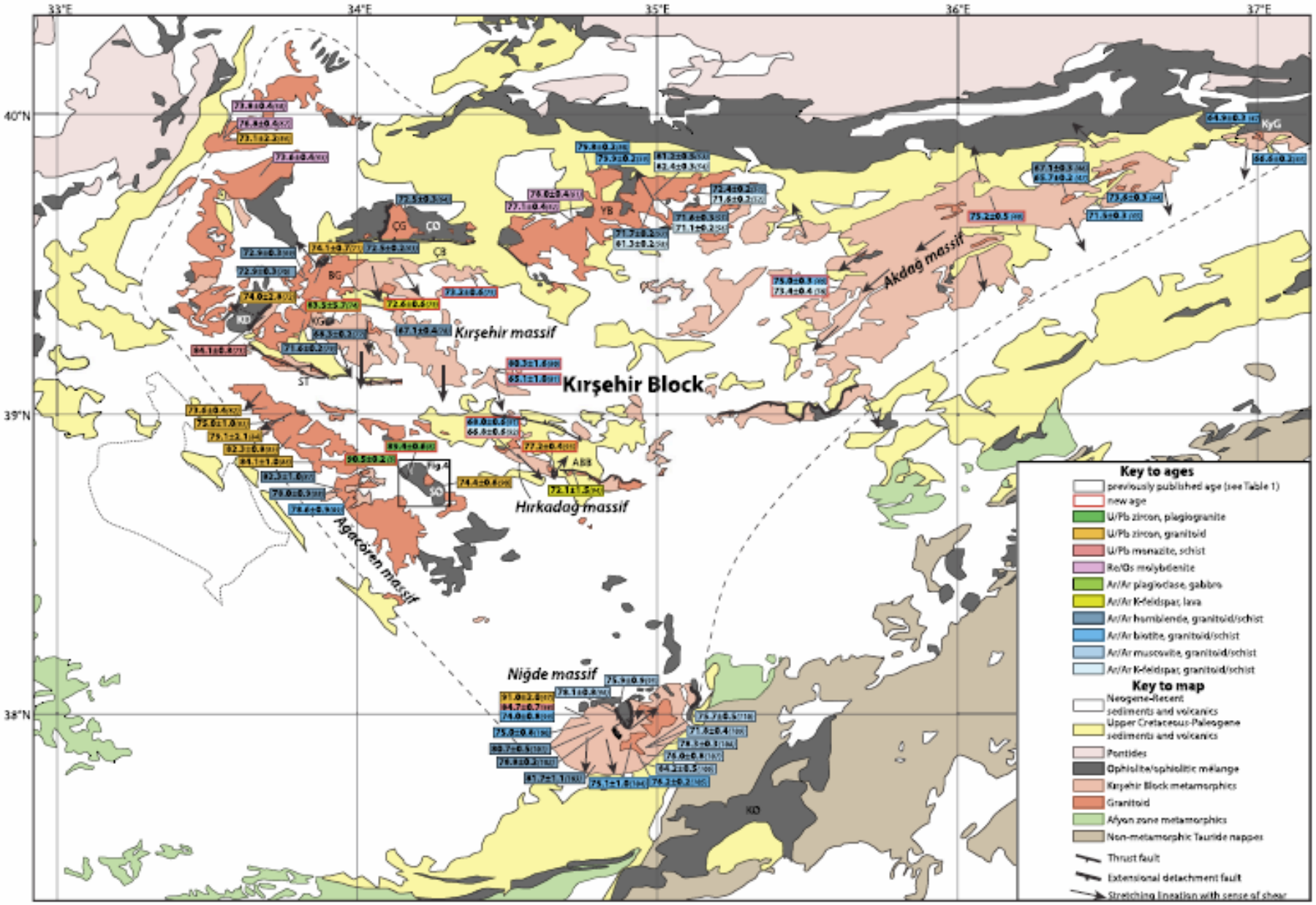
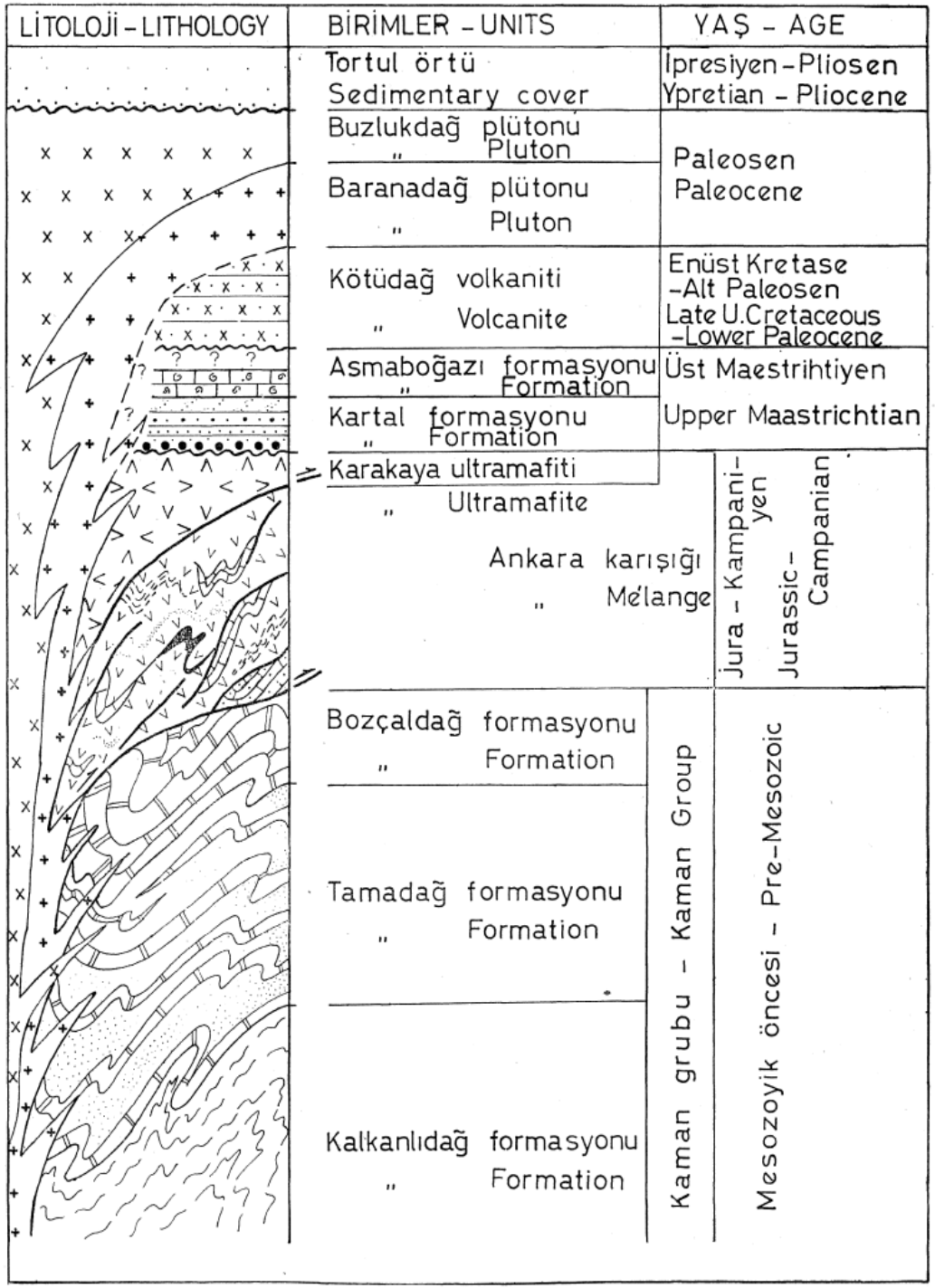
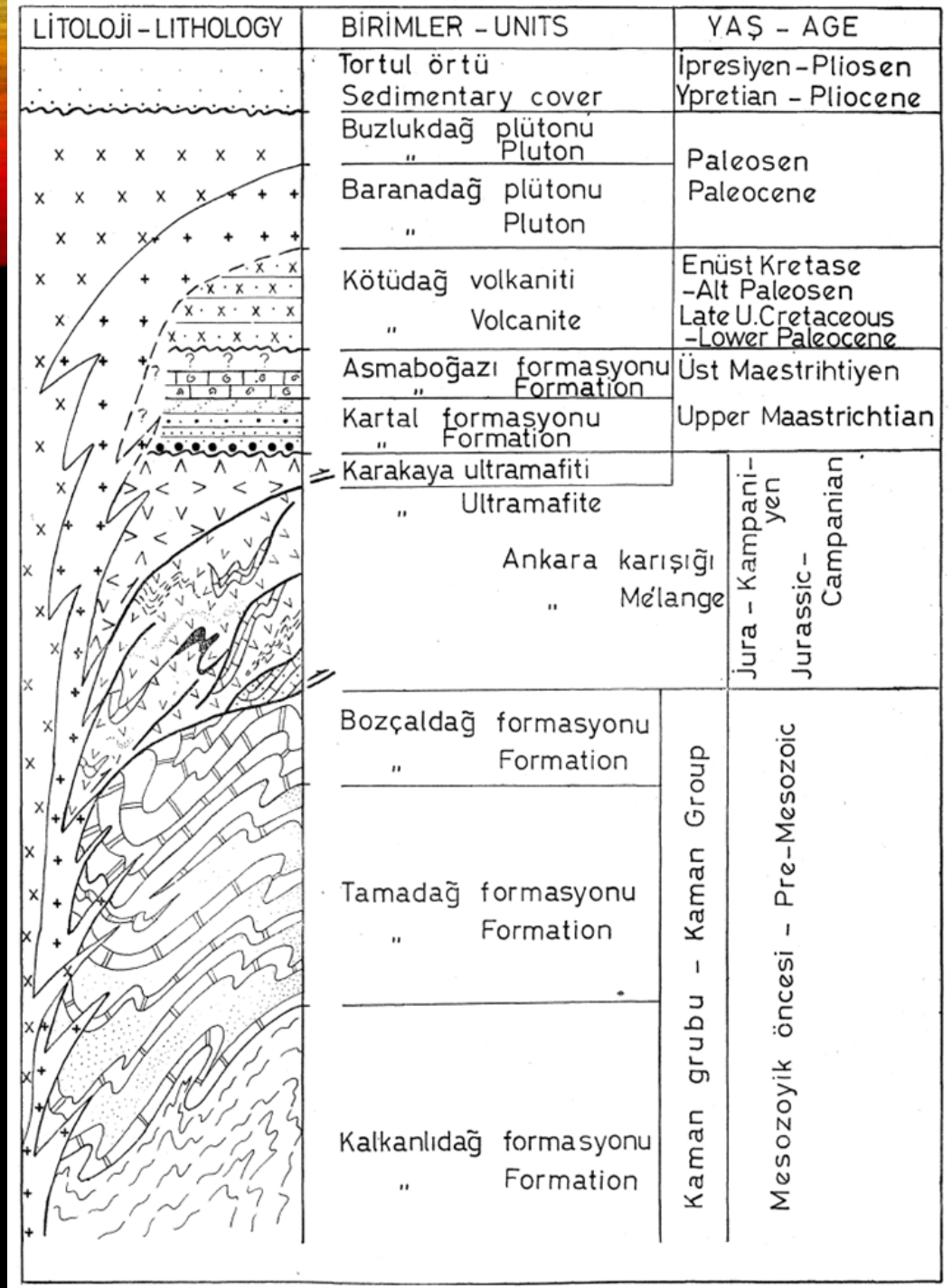


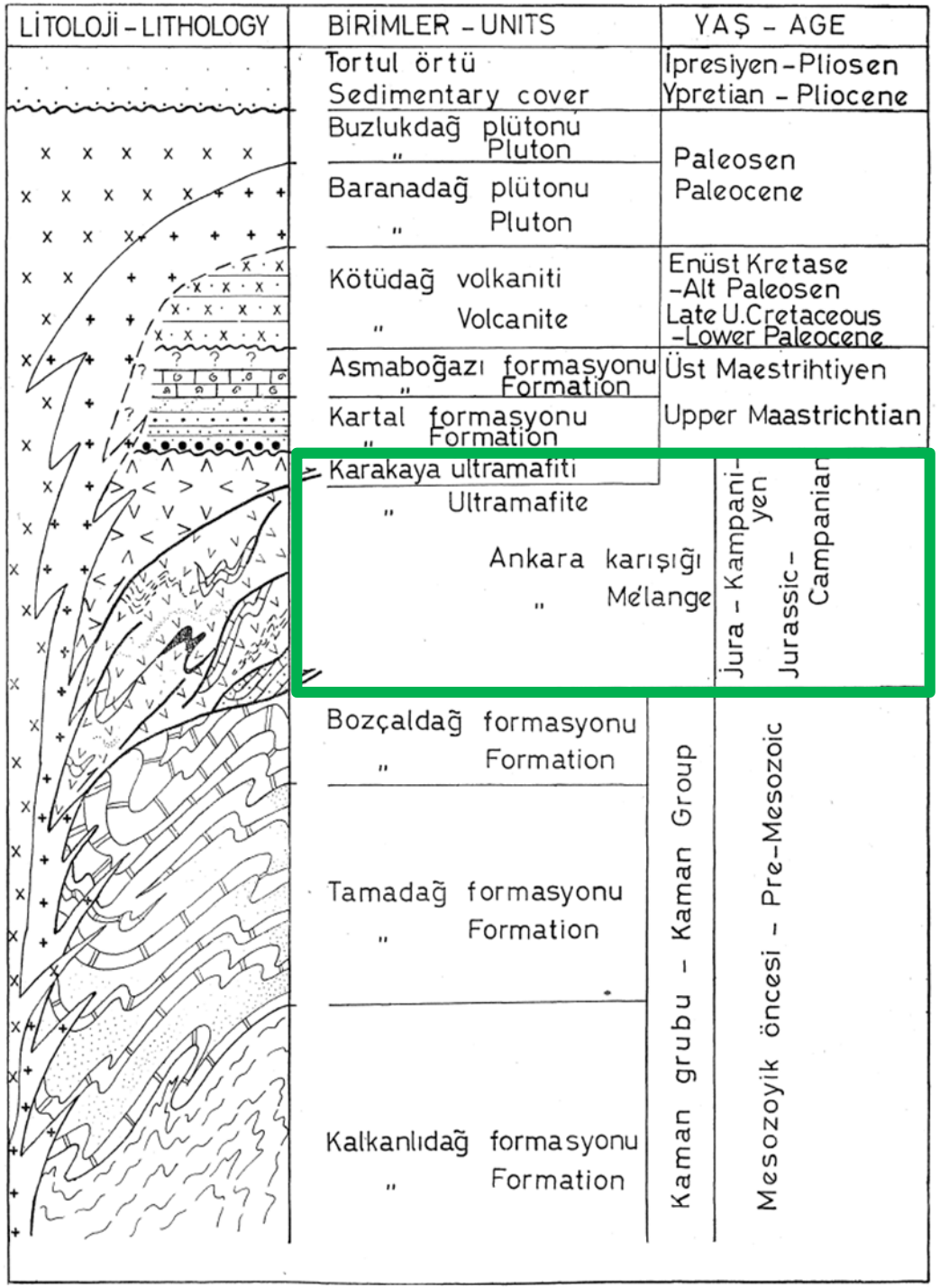
Figure 2. Geological and tectonic map of the Kırşehir Block modified after *MTA* [2002]. Stretching lineation orientations and shear senses are simplified after *Gautier et al.* [2002, 2008], *Işık et al.* [2008], *Işık* [2009], *Lefebvre* [2011], and *Lefebvre et al.* [2011, 2015]. Locations of extensional detachments come from *Gautier et al.* [2008], *Lefebvre* [2011], and *Lefebvre et al.* [2011, 2015]. Locations of thrust faults based on *Köksal and Göncüoglu* [1997], *MTA* [2002], *Yürür and Genç* [2006], *Gülyüz et al.* [2013], *Advokaat et al.* [2014], and *Işık et al.* [2014]. ABB = Ayhan-Büyükkışla Basin; BG = Baranadağ granitoid; ÇB = Çiçekdağı Basin; ÇG = Çiçekdağı Granitoid; ÇO = Çiçekdağı Ophiolite; KD = Kaman Detachment; KG = Kurancalı Gabbro; KO = Karsantı Ophiolite; KyG = Karacayır Granitoid; SO = Sarıkaraman ophiolite; ST = Savcılı Thrust; and YB = Yozgat Batholith. Numbers behind ages refer to listings in Table 1, which also provide the details and references of the ages.



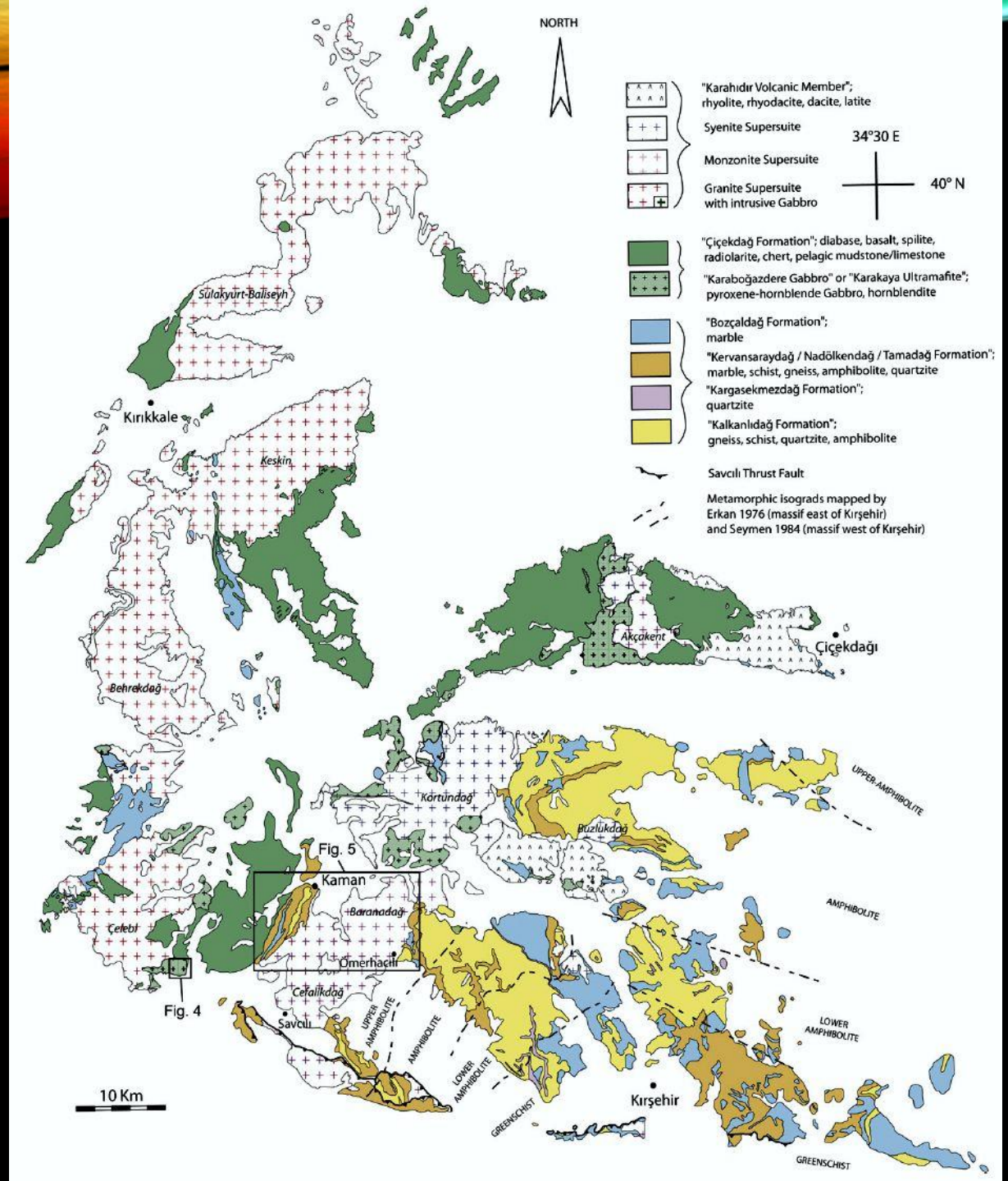
- The metamorphic rocks of the Kırşehir Block were subjected to regional high-temperature, medium-pressure conditions and consist of greenschist to upper amphibolite-facies marbles, calcsilicates, metapelites, and quartzites.
- The P-T estimates in the Kırşehir massif reach 6.5–7.5 kbar/ 700–770°C.
- Those are overprinted at 3–4 kbar/800°C during granite intrusion.

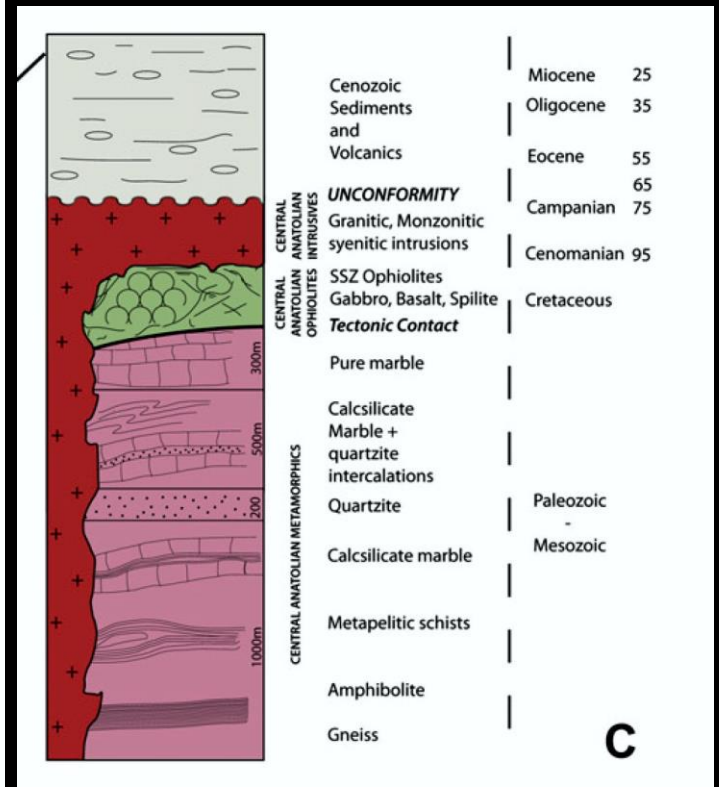


- The regional foliation was cut by a prominent belt of granitoids.
- The granitoids' geochemistry shows that they were derived from a mantle source enriched by subduction-related fluids, further contaminated by partial melts of continental crust
- The granitoids are largely undeformed, clearly postdating the regional foliation, and intruded at pressures varying from 2.6 to 5.3 kbar.
- The granitoids intrude not only the Kırşehir Block but also the overlying ophiolites and ophiolitic mélange
- A detachment fault that accommodated exhumation of the Kırşehir massif relative to ophiolitic mélange was intruded
- The Kırşehir Block was buried below oceanic lithosphere represented by the ophiolite remnants and was then intensely deformed and metamorphosed.
- The block was subsequently intruded by the granitoid belt.

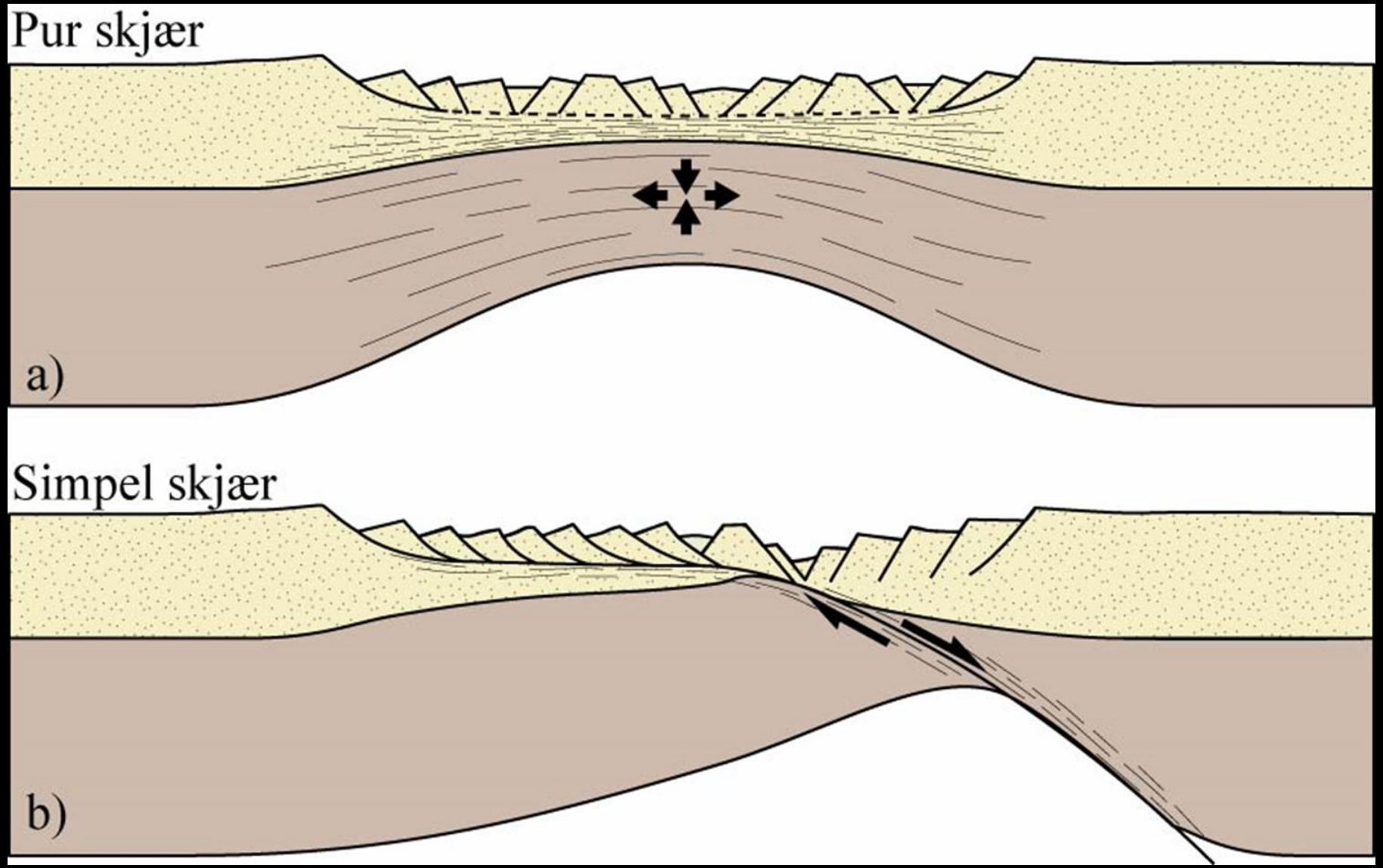


OPHIOLITE EMPLACEMENT AND GRANITE INTRUSIONS

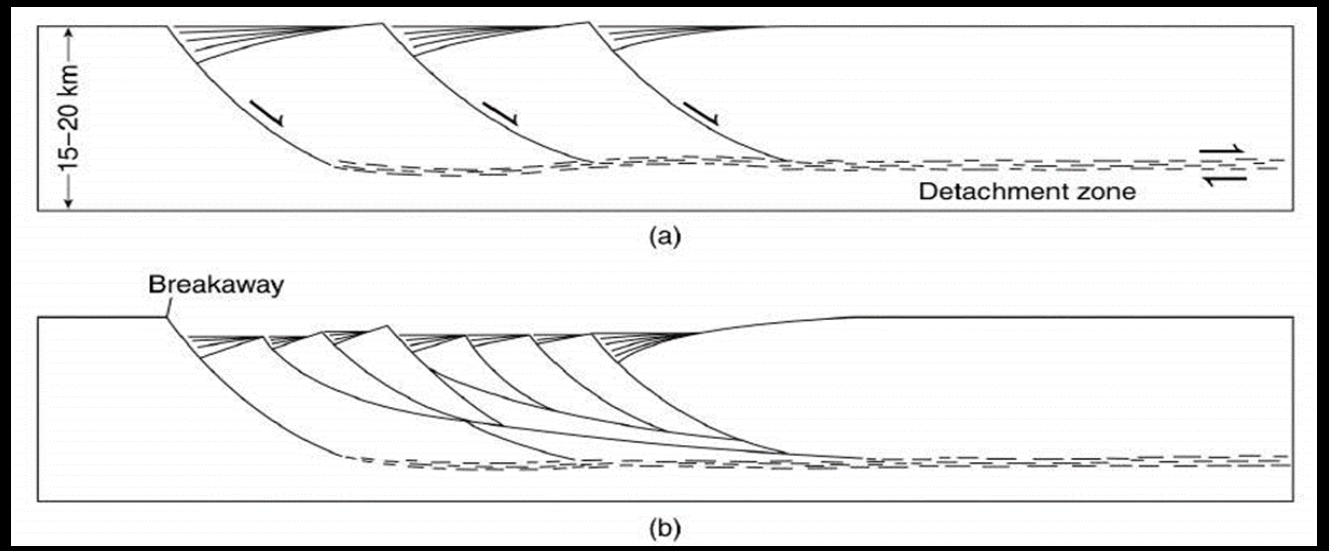

NORTH
"Karahıdır Volcanic Member"; rhyolite, rhyodacite, dacite, latite
Syenite Supersuite
Monzonite Supersuite
Granite Supersuite with intrusive Gabbro
34°30 E
40° N
"Çiçekdağ Formation"; diabase, basalt, spilite, radiolarite, chert, pelagic mudstone/limestone
"Karaboğazdere Gabbro" or "Karakaya Ultramafite"; pyroxene-hornblende Gabbro, hornblendite
"Bozçaldağ Formation"; marble
"Kervansaraydağ / Nadölkendağ / Tamadağ Formation"; marble, schist, gneiss, amphibolite, quartzite
"Kargasekmezdağ Formation"; quartzite
"Kalkanlıdağ Formation"; gneiss, schist, quartzite, amphibolite
Savcılı Thrust Fault
Metamorphic isograds mapped by Erkan 1976 (massif east of Kırşehir) and Seymen 1984 (massif west of Kırşehir)
Sulakyurt-Balışeyh
Kırıkkale
Keskin
Akçakent
Çiçekdağı
Behrekdağ
Kortundağ
Büzlükdağ
UPPER AMPHIBOLITE
Fig. 5
Kaman
Baranadağ
AMPHIBOLITE
Çelebi
Ömerhacılı
Fig. 4
Cerallıdağ
Savcılı
UPPER AMPHIBOLITE
AMPHIBOLITE
LOWER AMPHIBOLITE
LOWER AMPHIBOLITE
GREENSCHIST
Kırşehir
GREENSCHIST
10 Km

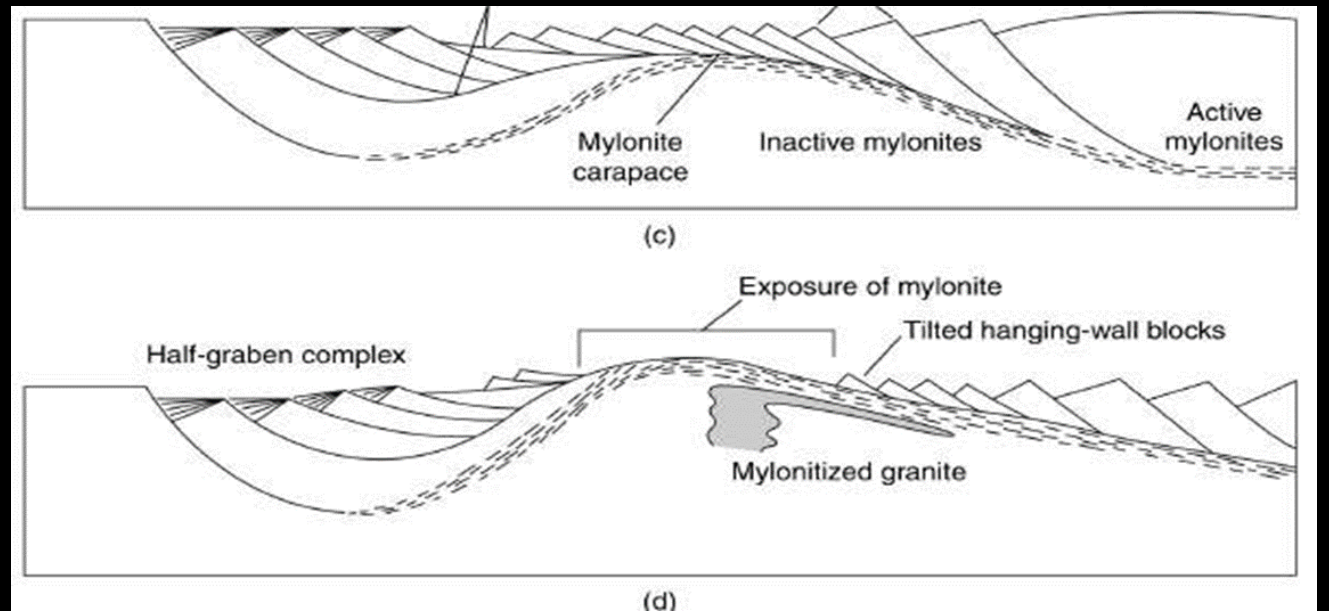

Cenozoic Sediments and Volcanics
Miocene 25
Oligocene 35
Eocene 55
65
Campanian 75
UNCONFORMITY
CENTRAL ANATOLIAN INTRUSIVES
Granitic, Monzonitic syenitic intrusions
Cenomanian 95
CENTRAL ANATOLIAN OPHIOLITES
SSZ Ophiolites Gabbro, Basalt, Spilite
Tectonic Contact
Cretaceous
CENTRAL ANATOLIAN METAMORPHICS
300m
Pure marble
500m
Calcsilicate Marble + quartzite intercalations
200
Quartzite
Paleozoic - Mesozoic
Calcsilicate marble
1000m
Metapelitic schists
Amphibolite
Gneiss
C

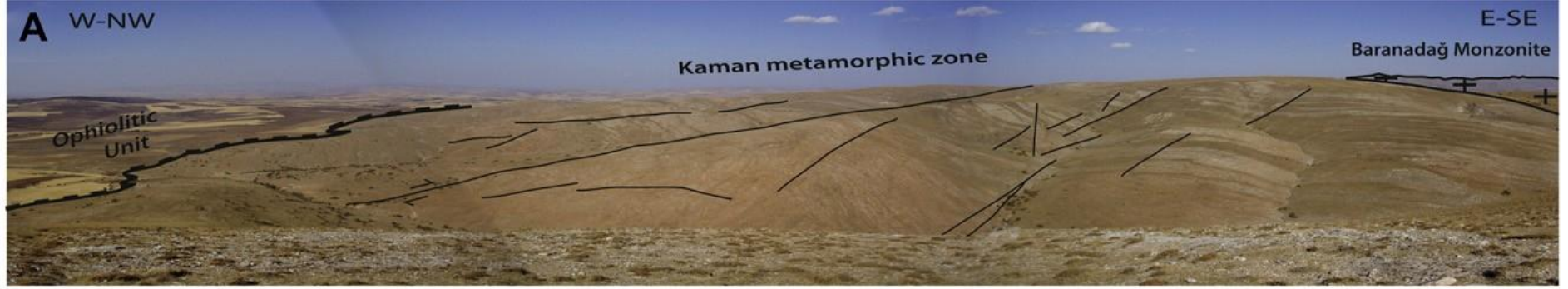
EXHUMATION OF METAMORPHIC MASSIFS

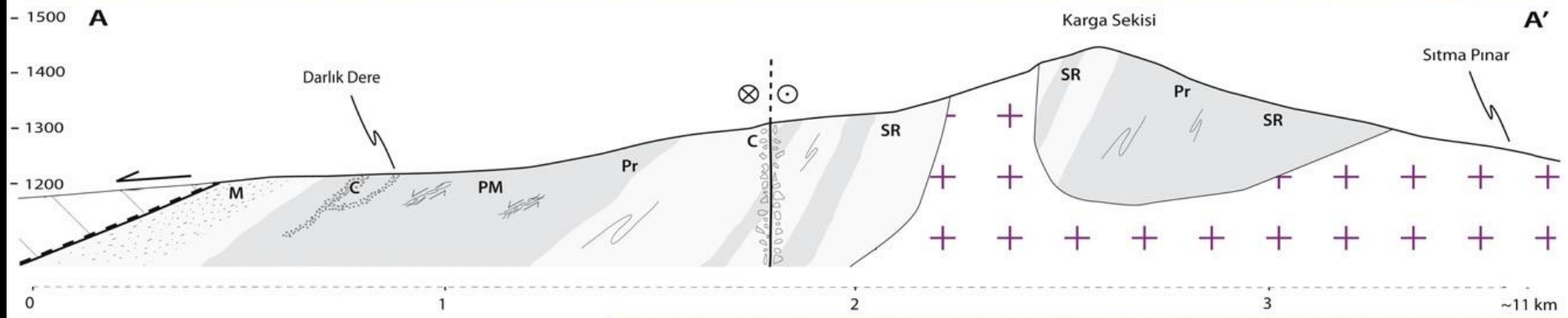


EXHUMATION OF METAMORPHIC MASSIFS









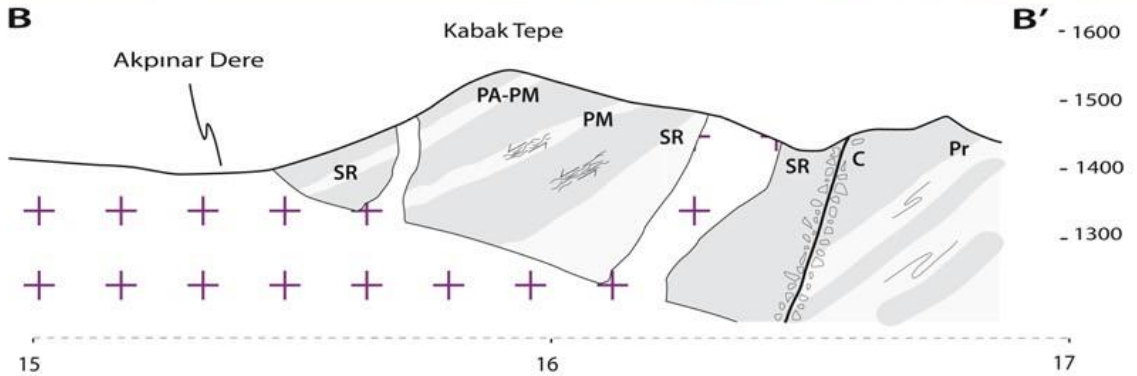
Baranadağ Monzonite

Ophiolitic Unit

Marbles

Amphibolites, calcsilicates, schists

B



Calcite Micro-fabrics :

Pr: Protolith

M: Mylonite

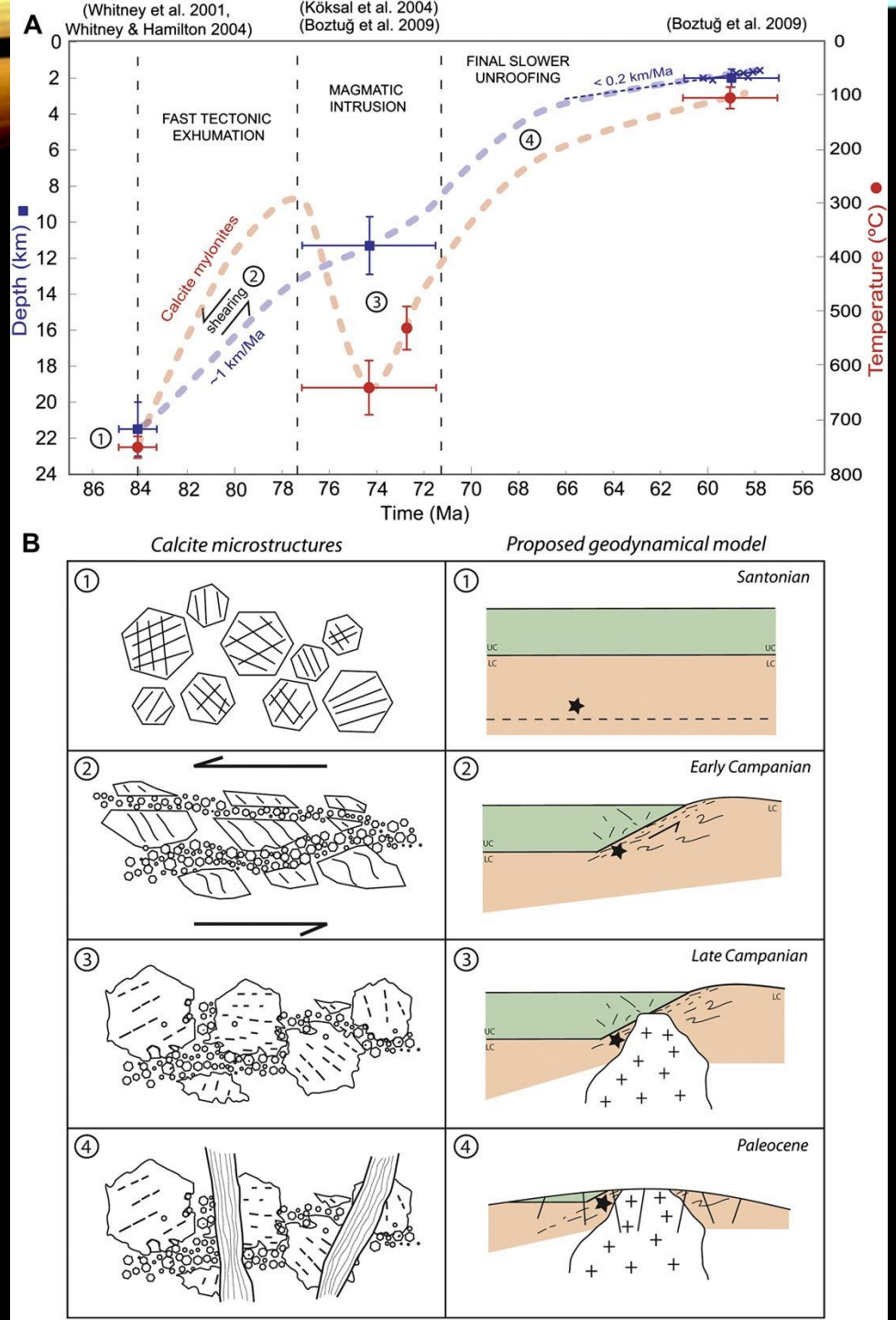
PM: Proto-mylonite

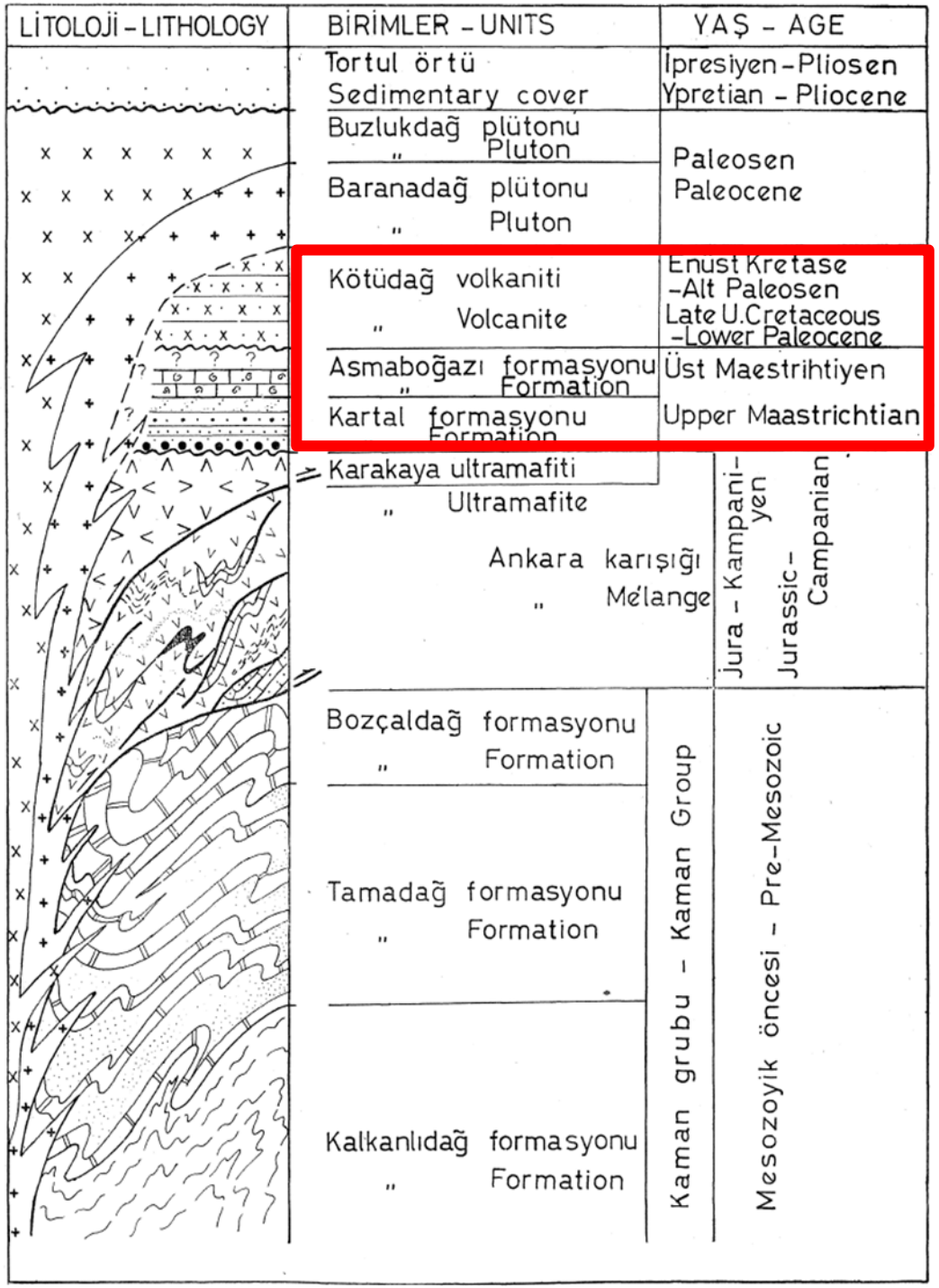
C: Cataclasite

PA-PM: Partially Annealed Proto-mylonite

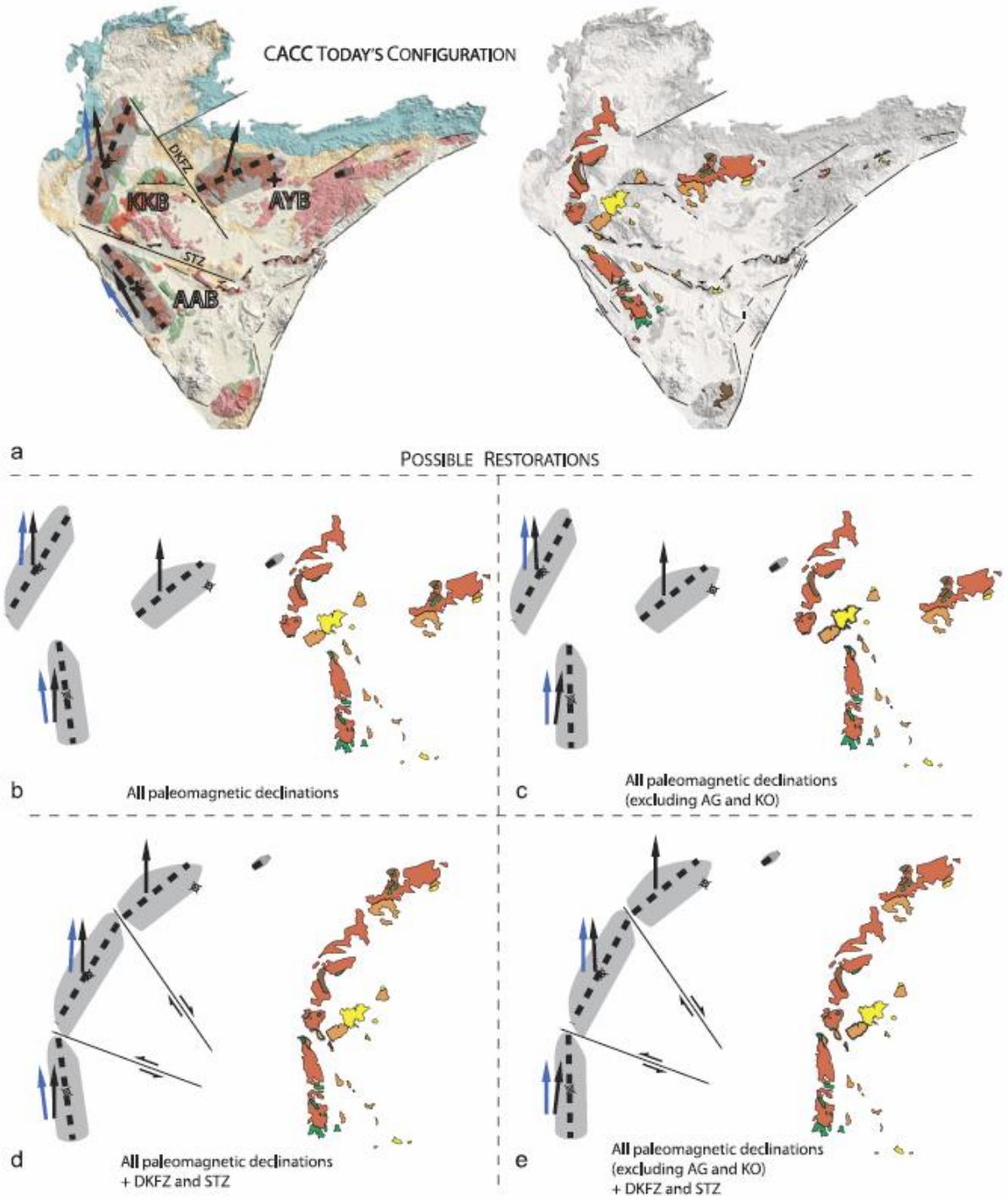
SR: Statically Recrystallised marble

A) Isoclinally folded calcsilicates.
B) Crosscutting relationship between the main foliation plane and the protomylonitic shear bands.
C) Protomylonitic and mylonitic marble types involved in a brecciated zone.
D) Cataclastic corridors affecting protolith-type marble.
E) Tectonic breccias in the vicinity of a major strike-slip fault crossing the section.
F) Vertically oriented and folded very coarse-grained marble cut by oblique veins in the vicinity of Baranadağ pluton.

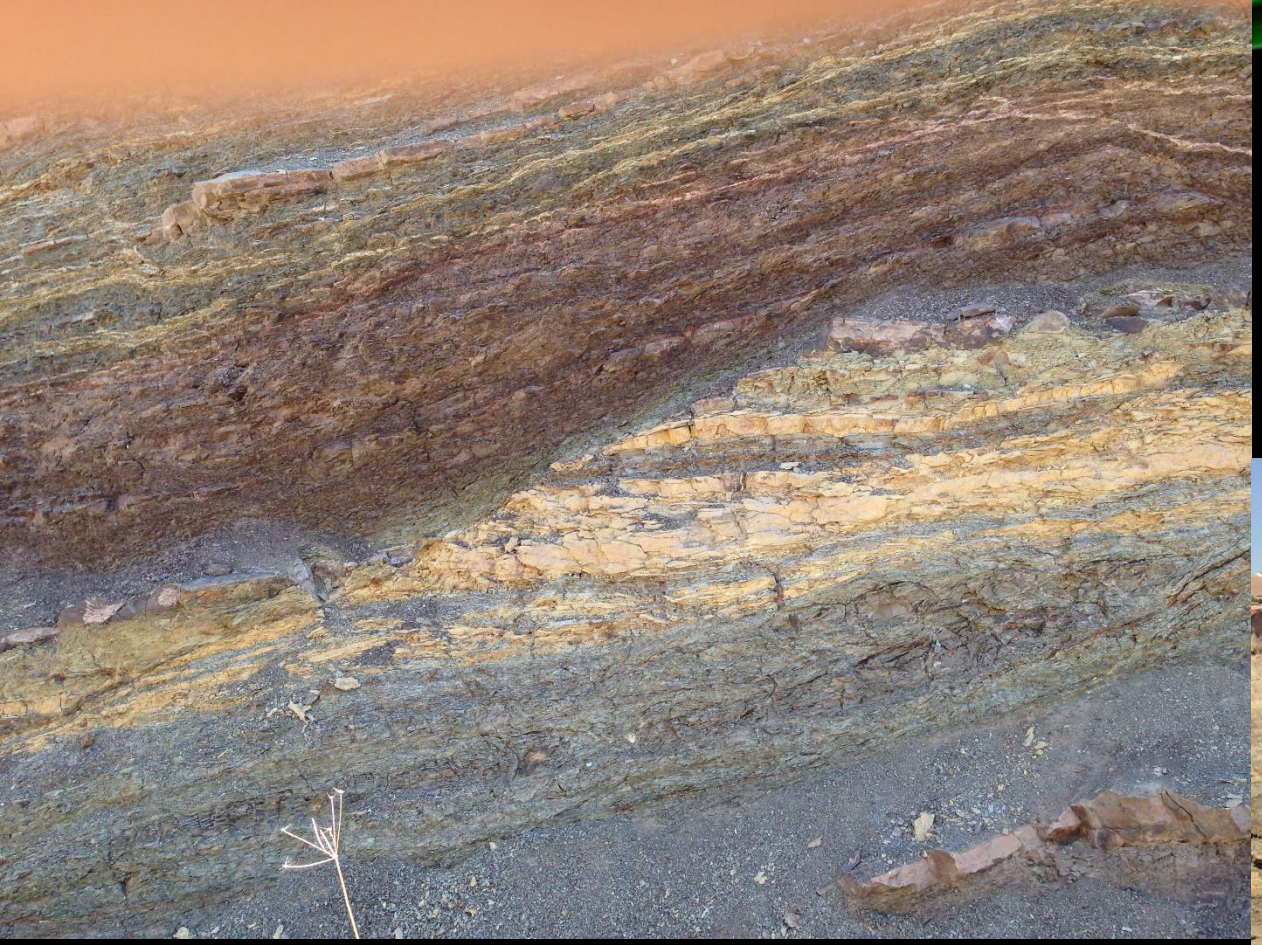

A
(Whitney et al. 2001,
Whitney & Hamilton 2004)
(Köksal et al. 2004)
(Boztuğ et al. 2009)
(Boztuğ et al. 2009)
FAST TECTONIC EXHUMATION
MAGMATIC INTRUSION
FINAL SLOWER UNROOFING
< 0.2 km/Ma
Calcite mylonites
shearing
~1 km/Ma
Depth (km)
Temperature (°C)
Time (Ma)
B
Calcite microstructures
Proposed geodynamical model
Santonian
Early Campanian
Late Campanian
Paleocene
UC
LC



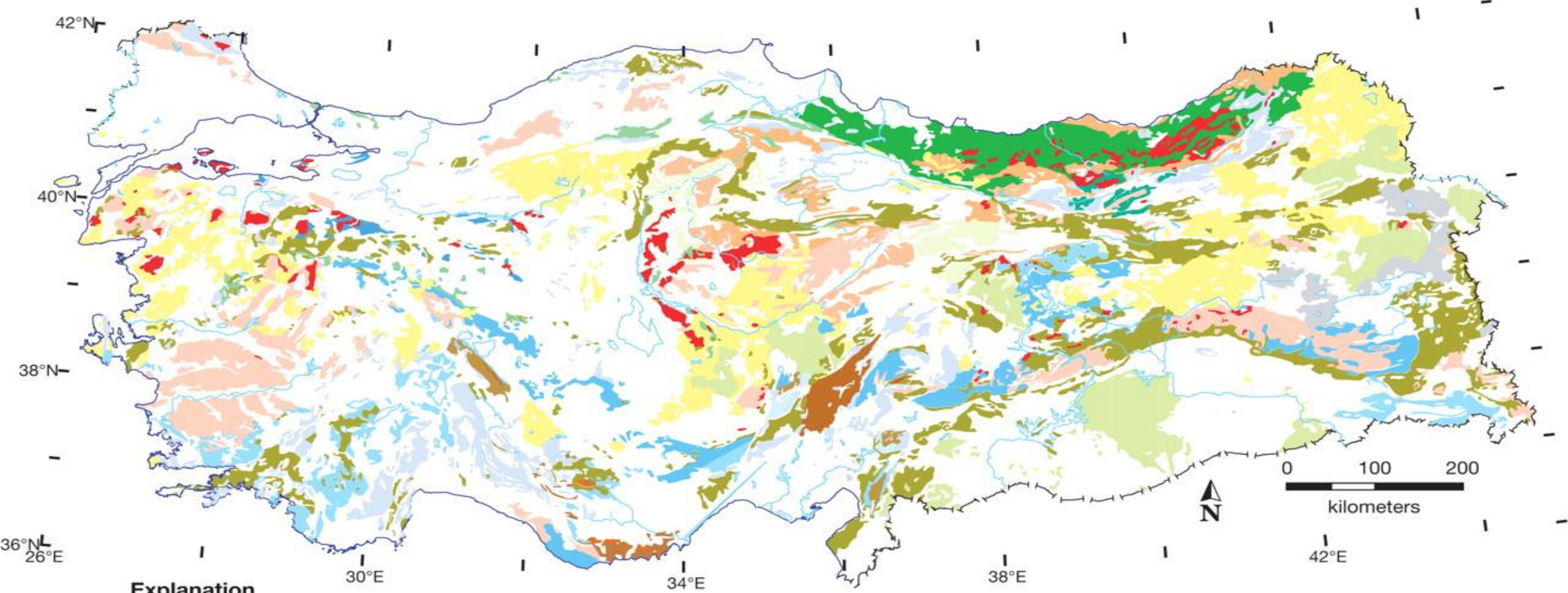
CRETACEOUS SEDIMENTARY COVER



FOLDING OF THE GRANITE BELT DEVELOPMENT OF THRUSTS



GEOLOGY OF THE ÇANKIRI BASIN



Explanation

Submarine Volcanic Rocks
- Eocene
- Upper Cretaceous-Eocene
- Upper Cretaceous
- Jurassic-Cretaceous

Subaerial Volcanic Rocks
- Quaternary
- Plio-Quaternary
- Tertiary [Mainly Neogene]

Carbonate Rocks including recrystallized Limestones
- Jurassic-Cretaceous [Mainly]-Jurassic
- Triassic-Jurassic
- Mesozoic
- Paleozoic-Mesozoic [Mainly Triassic]
- Permo-Triassic
- Permo-Carboniferous
- Devonian
- Ordovician-Silurian-Devonian-Carboniferous
- Paleozoic

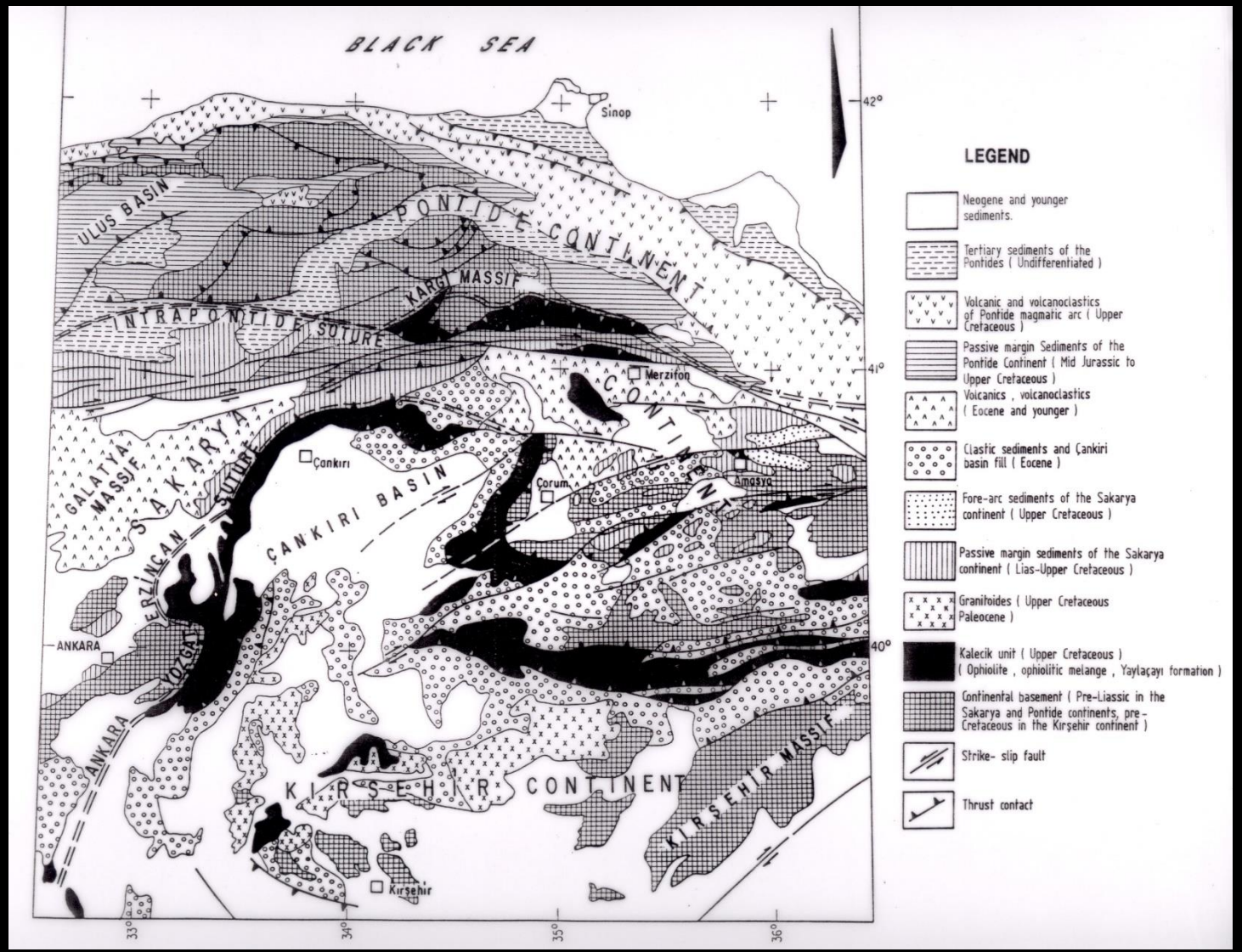
Acidic to Intermediate Intrusives
- Mesozoic to Miocene [Mainly Tertiary]

Ophiolite and Ophiolitic Melanges
- Mainly Jurassic-Cretaceous

Metamorphic Rocks
- Pre-Mesozoic
- Undifferentiated

Evaporitic Sedimentary Rocks
- Miocene
- Oligo-Miocene

The Çankırı Basin is one of the largest sedimentary basins of Central Anatolia. It is surrounded by Ankara-Erzincan suture separating the Sakarya and the Kırşehir Continental fragments.

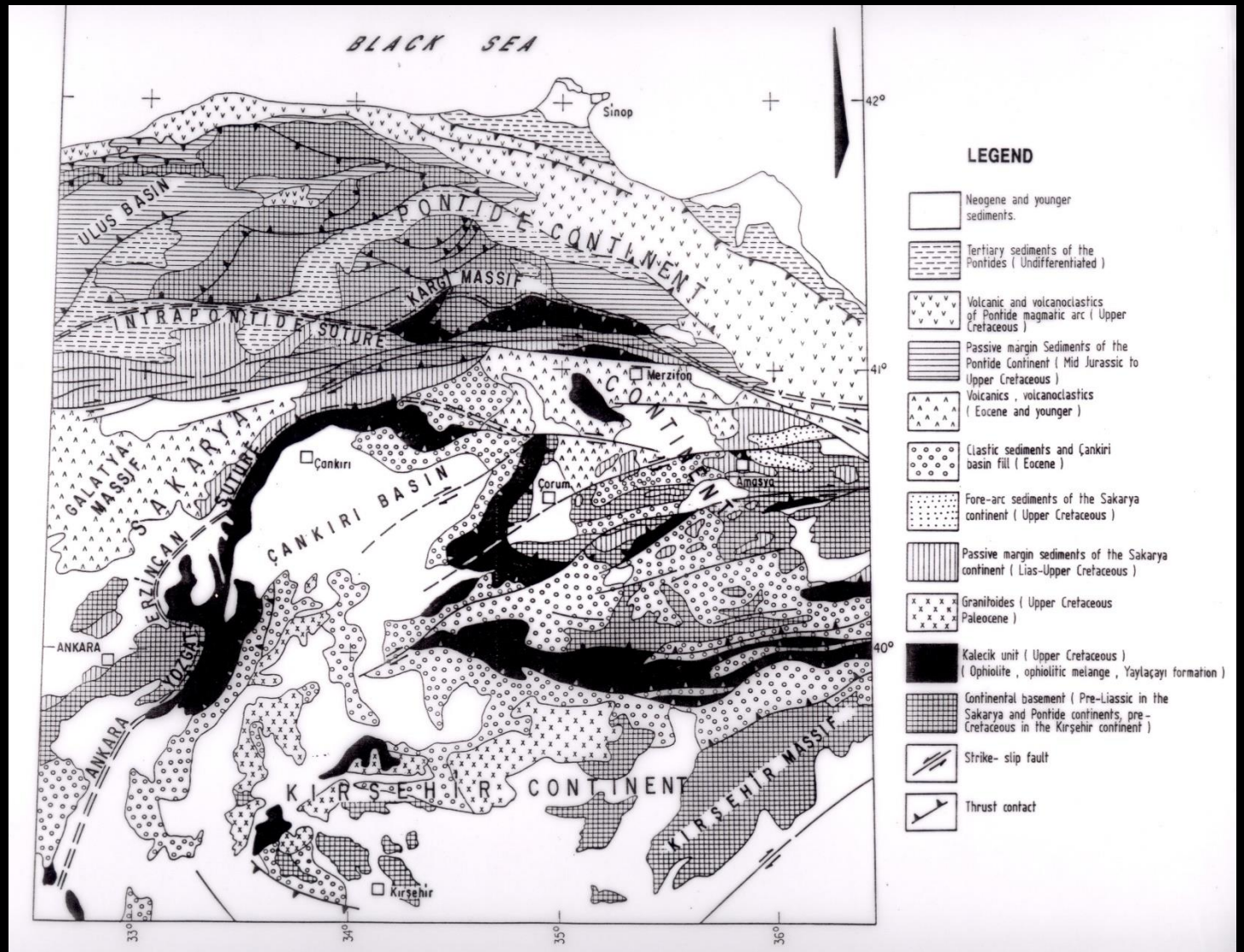


6 TECTONOSTRATIGRAPHIC UNITS HAVE BEEN DIFFERENTIATED IN AND AROUND THE ÇANKIRI BASIN:

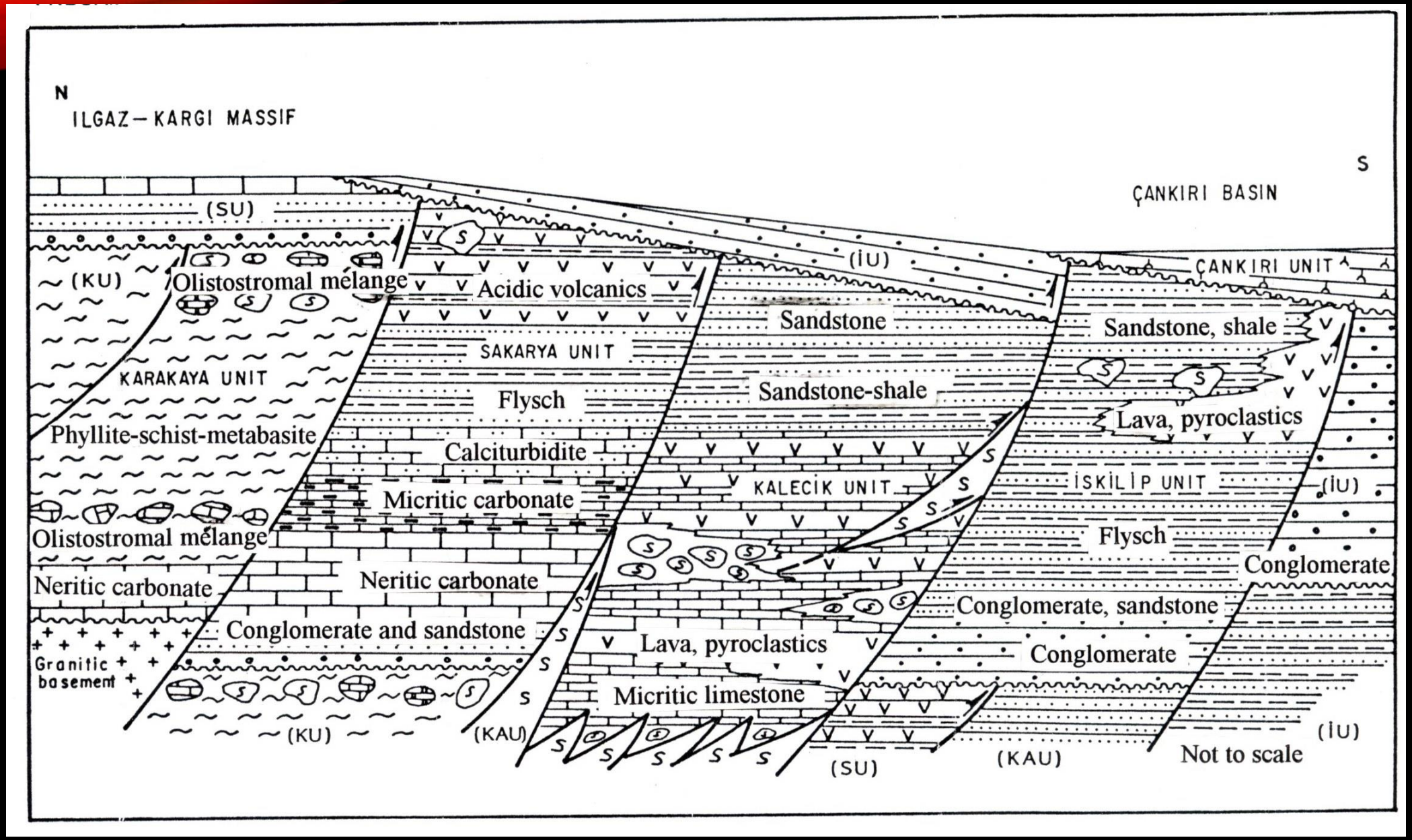
- Kırşehir Unit (Mesozoic ?)
- Karakaya Unit (Triassic)
- Sakarya Unit (Liassic-Cretaceous)
- Kalecik Unit (Upper Cretaceous)
- İskilip Unit (Eocene-Oligocene)
- Çankırı Unit (Miocene)

TIME	TECTONIC UNIT	LITHOLOGY	TECTONIC SETTING	TECTONIC EVENTS
LATE MIOCENE	ÇANKIRI UNIT	Terrestrial clastics and evaporites	Inter-mountain basin	Neo-tectonic phase
OLIGOCENE-EOCENE	İSKİLİP UNIT (İU)	Terrestrial clastics Regressive clastics and volcanics Flysch and volcanics Transgressive clastics	Post-collisional molasse basin	Closing of Çankırı basin Opening of Çankırı basin
LATE MAAST. CENOMANIAN	KALECİK UNIT (KAU)	Regressive clastics Flysch Pelagic sediments and volcanics Ophiolite and ophiolitic melange	Inter-arc basin Ensimatic arc	Closing of Neo-Tethys - Ophiolite obduction onto the Kırşehir M. - Ensimatic arc-continent collision
CENOMANIAN LIAS	SAKARYA UNIT (SU)	Flysch and volcanics Calciturbidite Pelagic carbonate Neritic carbonate Transgressive clastics	Ensialic arc Passive margin Carbonate platform Rift-related basins	Subduction - Under ocean floor - Under continent Opening of Neo-Tethys
TRIAS PERMIAN	KARAKAYA UNIT (KU)	Olistostromal melange Lava, tuff, clastics and carbonates Olistostromal melange Neritic carbonate	Back-arc basin Carbonate platform	Regional metamorphism Closing of Karakaya basin Opening of Karakaya basin
PRECAMB.(?)		Granitic basement		

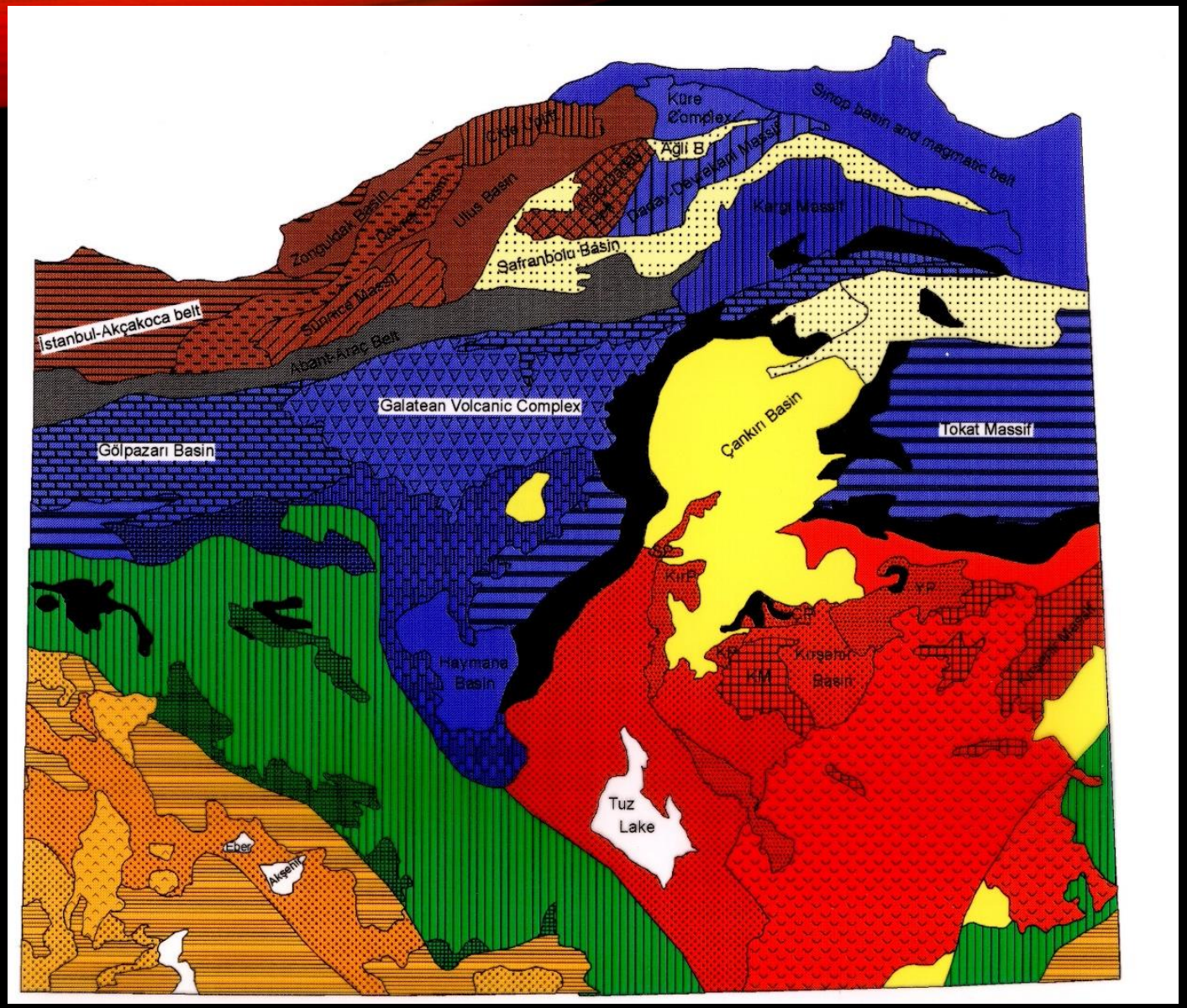
The Çankırı Basin has a omega shape and imbricated structure. The tectonic units forming this omega shape thrust over each other toward the basin center. Branches of the North Anatolian Fault cut all these structures



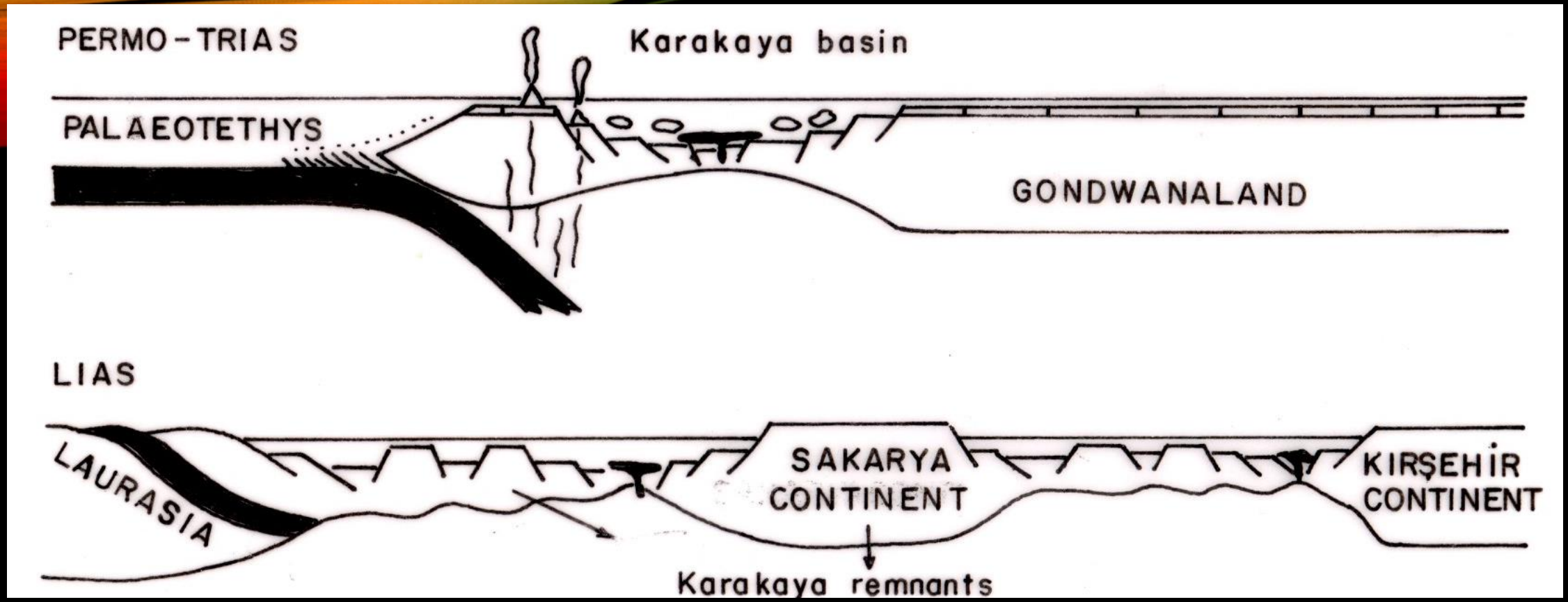
Tectonostratigraphic units and their interrelations



KARAKAYA UNIT

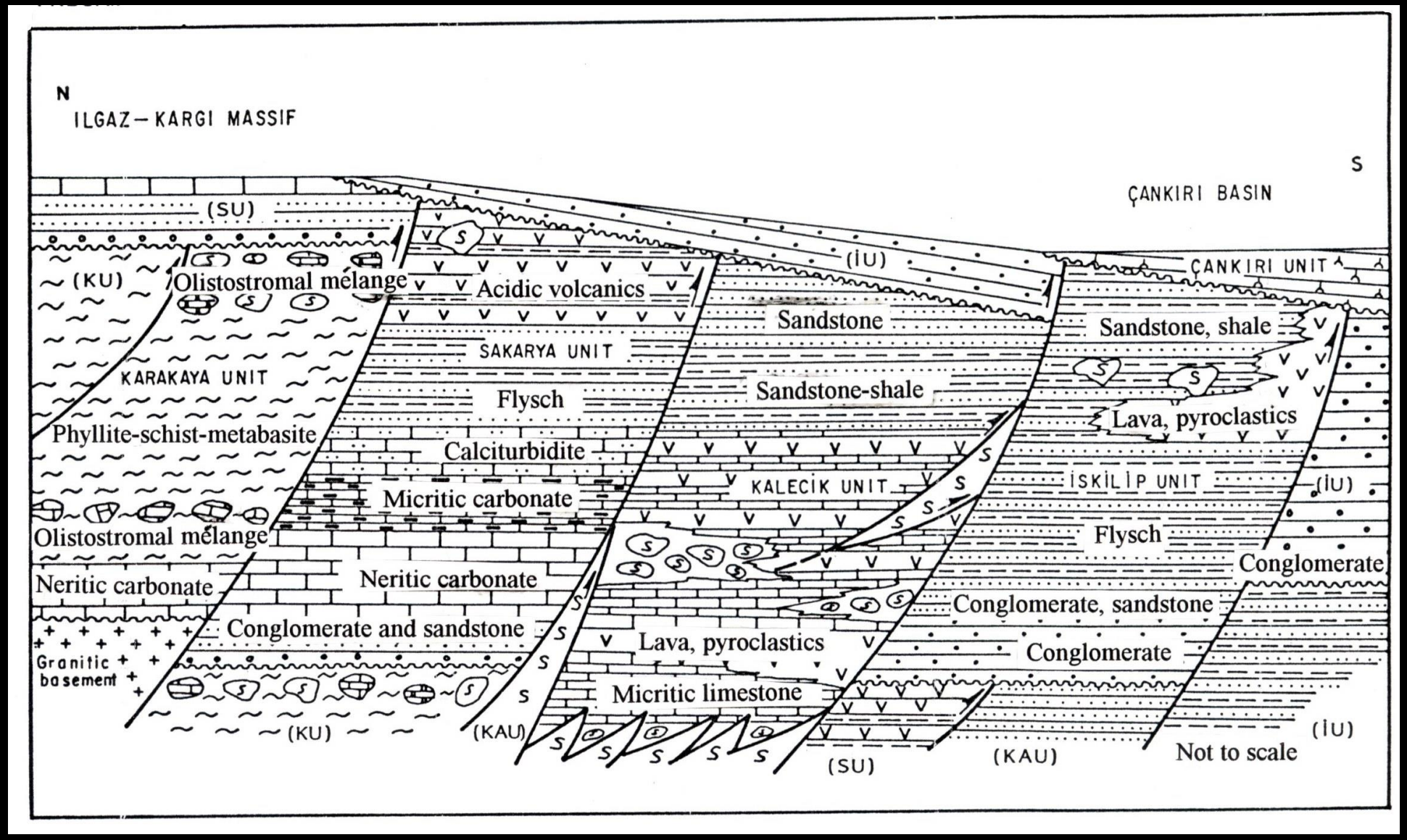


- The Sakarya Continent has metamorphic basement formed from phyllites, metabasalts, cherts with marble and ophiolite blocks of Upper Paleozoic to Triassic age. This unit was affected by greenschist and blueschist metamorphism.
- These strongly deformed rocks are unconformably overlain by the Sakarya Unit.



The Karakaya Unit has been regarded as a remnant of an accretionary complex associated with fore-arc deposits of the Karakaya Ocean, a branch of Palaeo-Tethys. This Ocean closed at the end of Triassic and amalgamated into the basement of the Sakarya Continent

THE KARAKAYA UNIT IS UNCONFORMABLY OVERLAIN BY THE SAKARYA UNIT AND ALSO THRUST OVER THIS UNIT



TIME	TECTONIC UNIT	LITHOLOGY	TECTONIC SETTING	TECTONIC EVENTS
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LATE MAAST. CENOMANIAN	KALECİK UNIT (KAU)	Regressive clastics Flysch Pelagic sediments and volcanics Ophiolite and ophiolitic melange	Inter-arc basin Ensimatic arc	Closing of Neo-Tethys - Ophiolite obduction onto the Kırşehir M. - Ensimatic arc-continent collision
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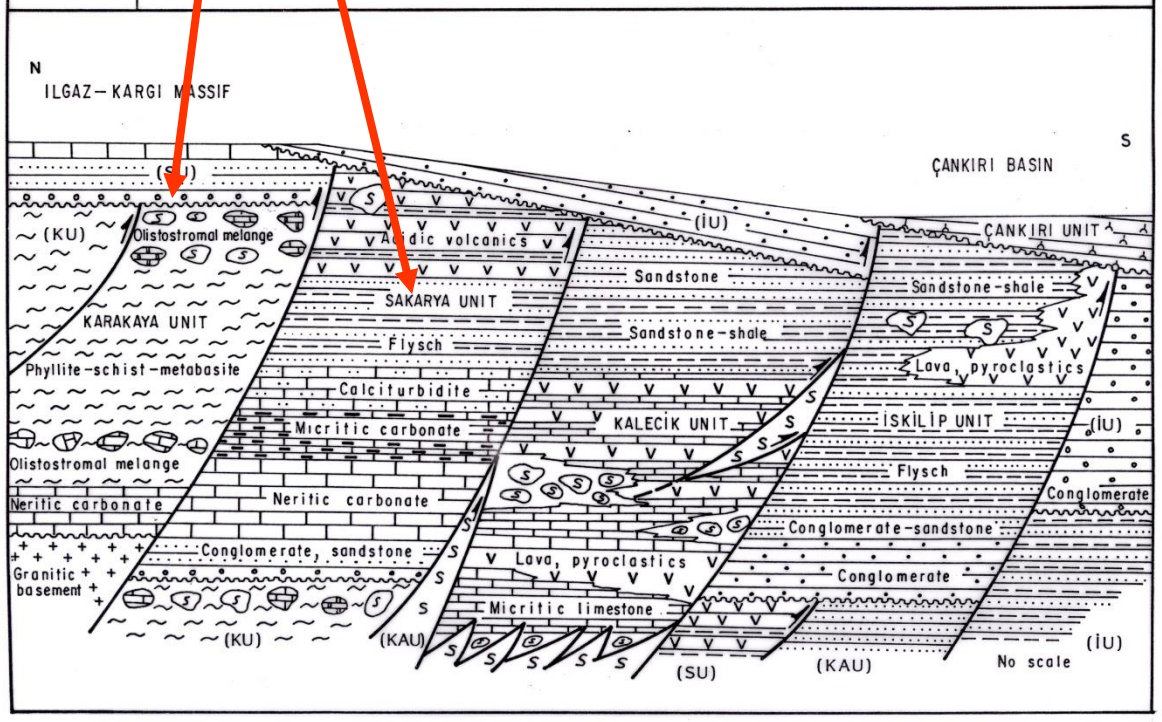
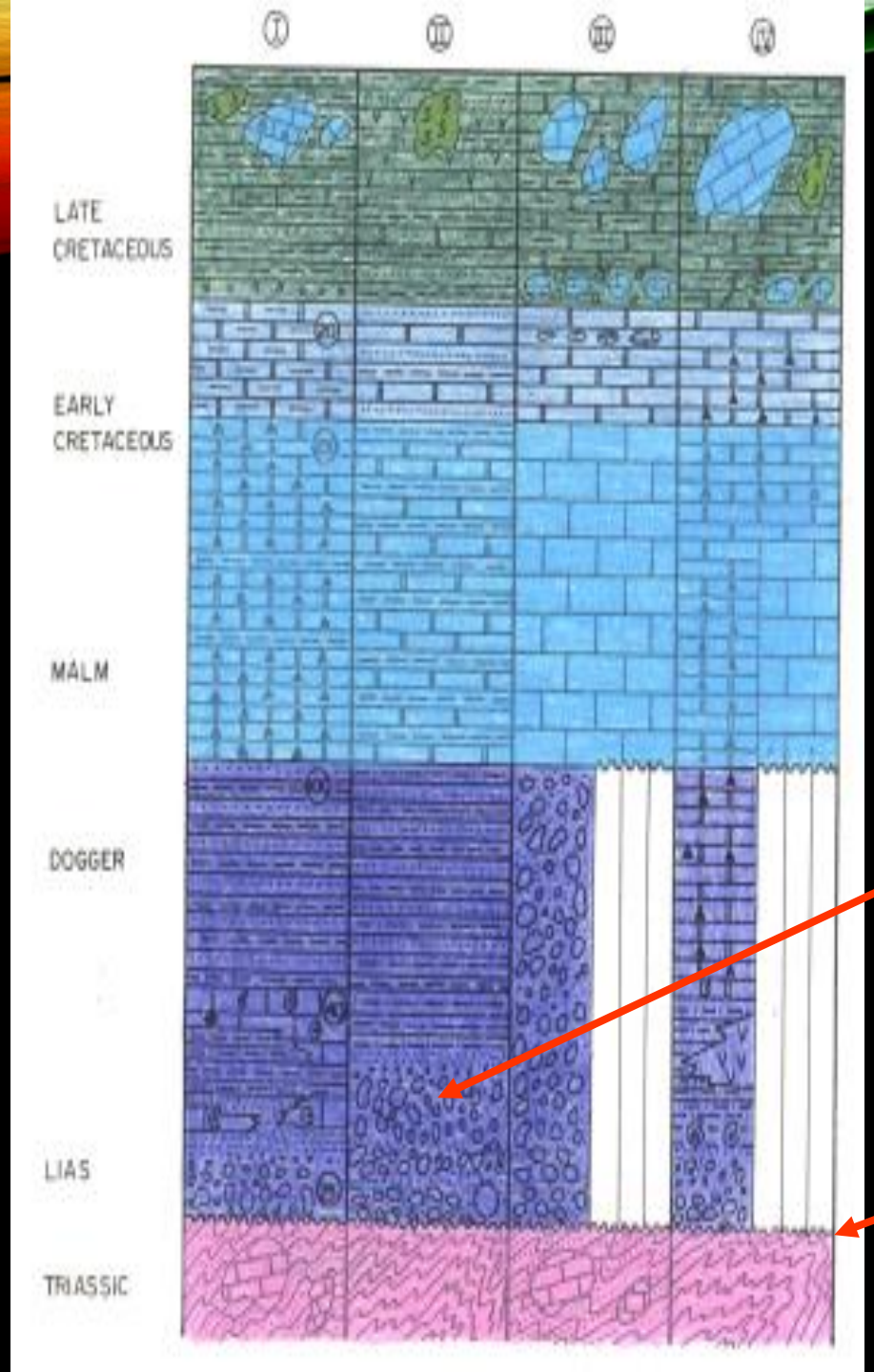
PRECAMB.(?)		Granitic basement		

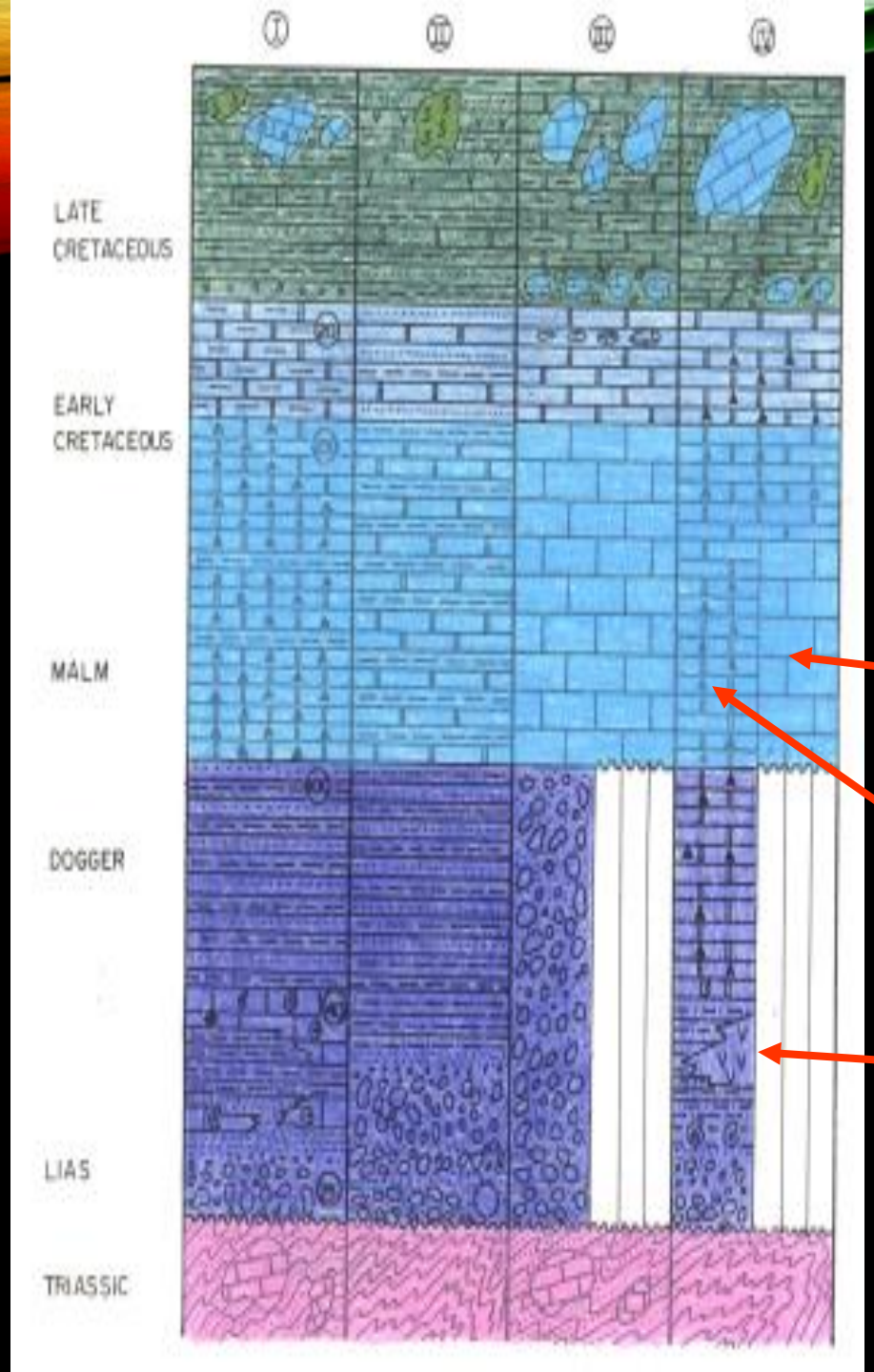


SAKARYA UNIT

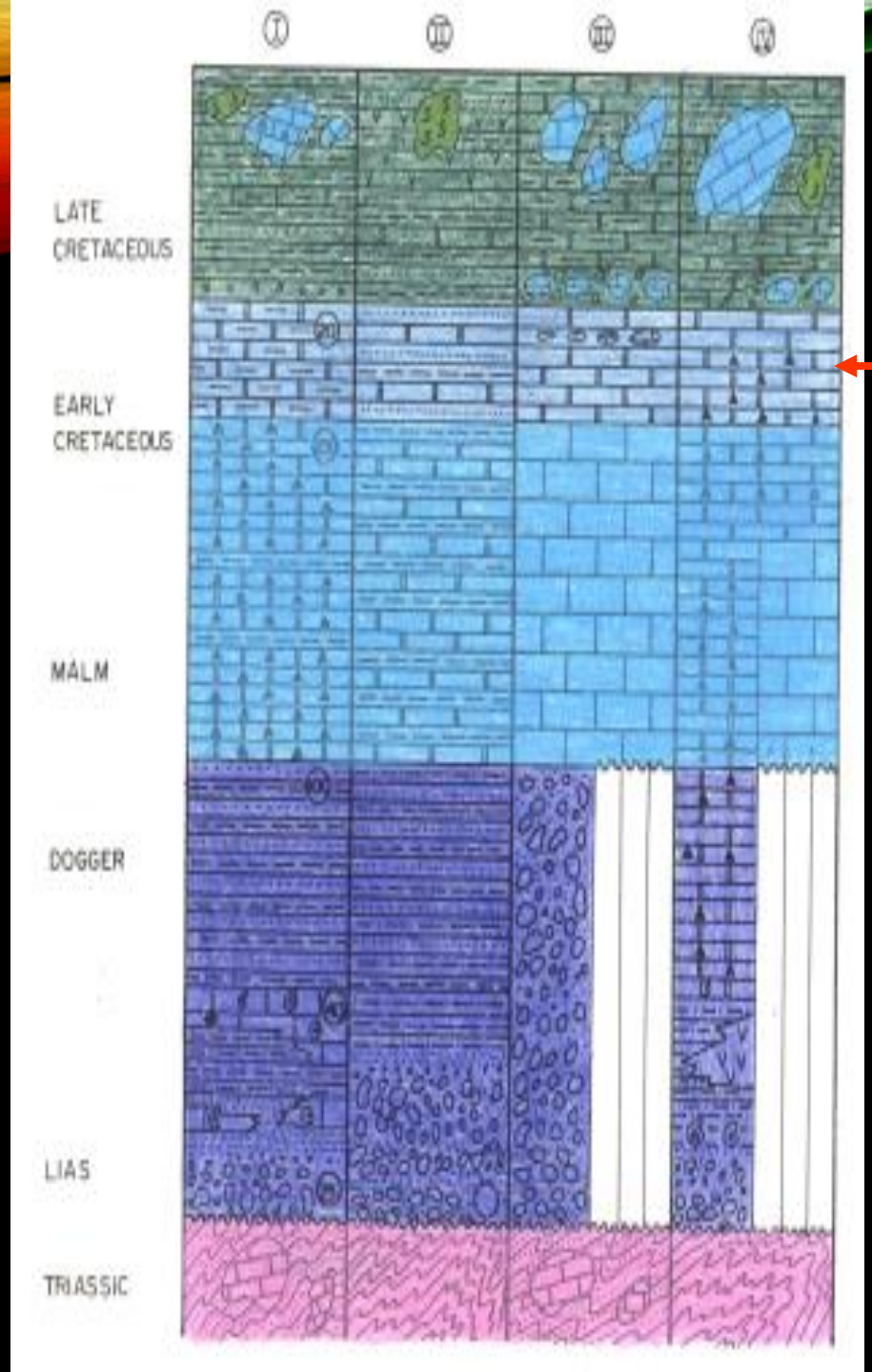
- It is represented by Liassic to Lower Cretaceous passive margin sediments which in turn pass into volcanic-bearing Upper Cretaceous flysch and associated magmatic arc units.
- This arc developed during the Late Cretaceous in response to north-dipping subduction of the northern branch of the Neo-Tethys Ocean.



The Sakarya Unit starts at the base with coarse clastics of Liassic, deposited in an horst-graben topography. In places, thick rift volcanics associate these clastics.

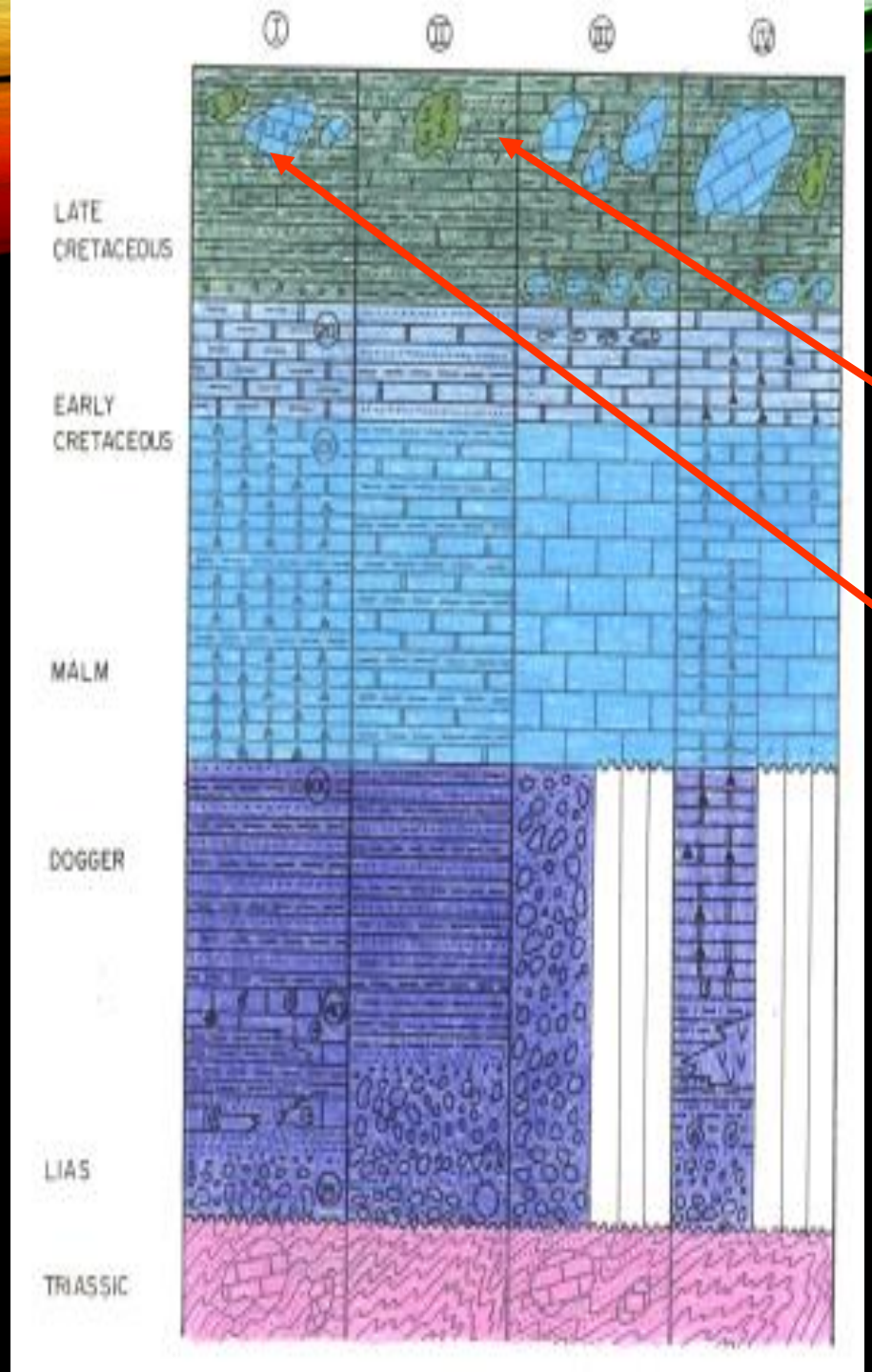


Up the section are thick carbonates of Malm age. They are neritic in character on the horsts and pelagic within the grabens.



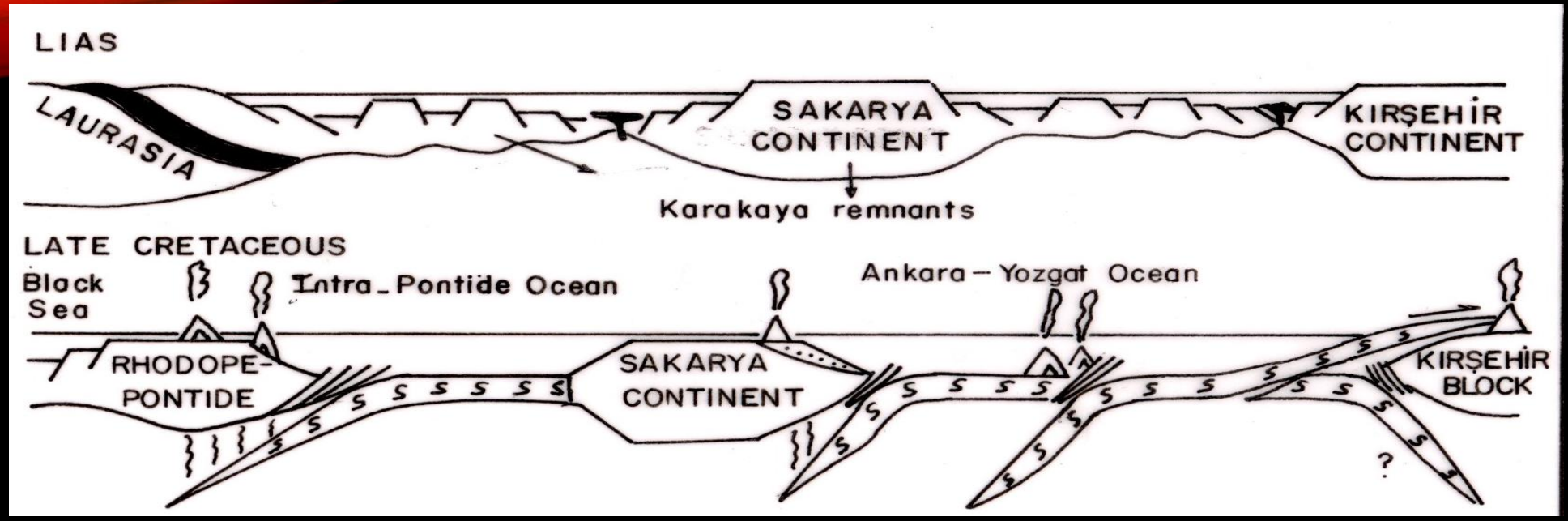
During the Early Cretaceous all the region subsided and thinly-bedded pelagic limestones deposited.

Liassic-Early Cretaceous period of the Sakarya Unit indicates the developement of a south facing passive margin sedimentary prism along the southern margin of the Sakarya Continent.



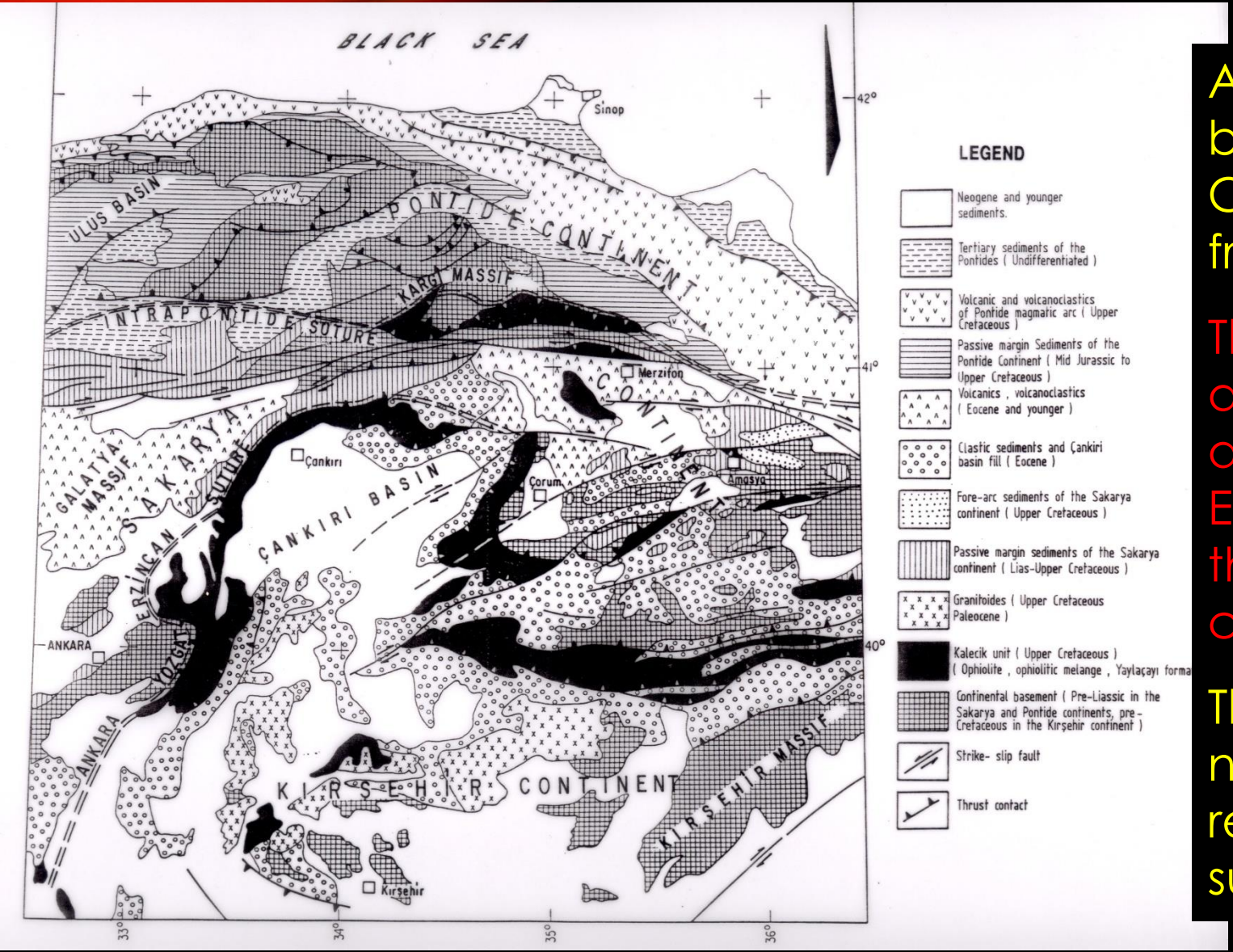
Uppermost part of the Sakarya Unit is represented by flysch-type sediments. Ophiolite and limestone blocks are common within this unit.

In the northern part of the Çankırı Basin this flysch alternate with thick andesitic lava and pyroclastics.



Geochemical data from the Upper Cretaceous volcanics of the Sakarya Unit indicate an ensialic arc origin. This imply that Liassic-Early Cretaceous south-facing passive margin of the Sakarya Continent turned into an active margin as a result of the northward subduction of the Ankara-Erzincan Ocean which opened during the Liassic-Early Cretaceous interval.

KALECİK UNIT



A 5-10 kilometres-wide ophiolitic belt separates the Kırşehir Continent plus the Çankırı basin from the Sakarya Continent.

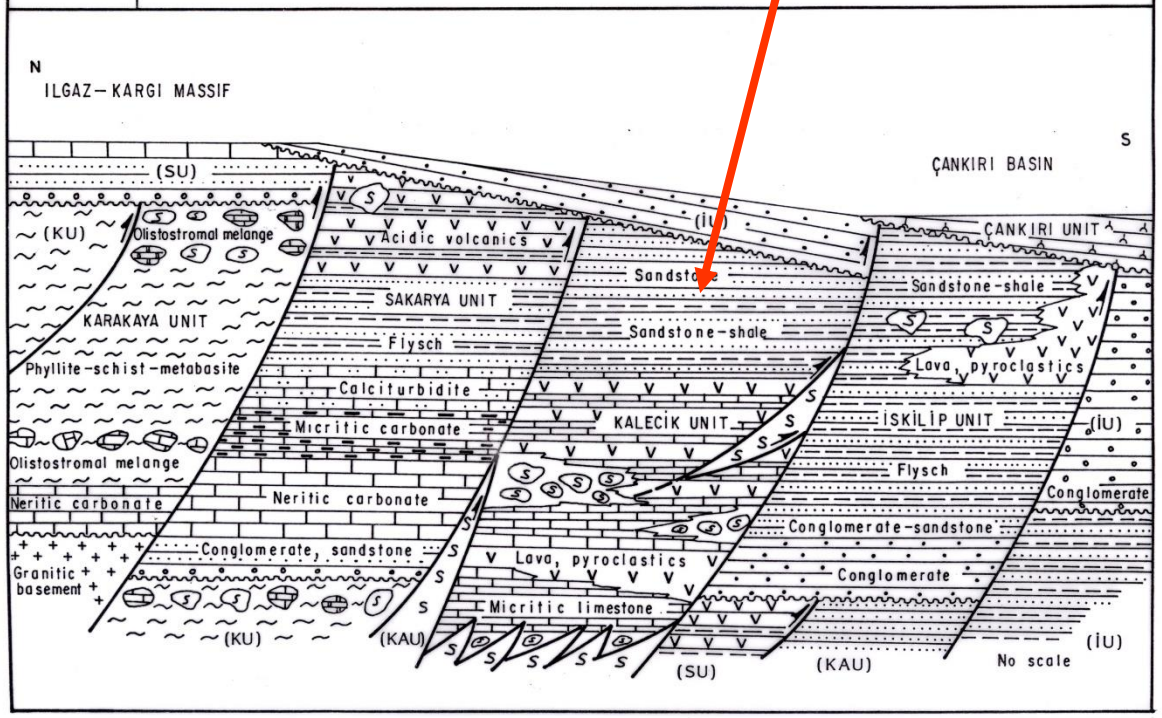
The Sakarya and Karakaya Units are thrust over this ophiolitic belt and this belt itself is thrust over the Eocene-Oligocene sediments of the Çankırı basin towards the center of the basin.

The rocks forming this belt are named as the Kalecik Unit and represent the Ankara--Erzincan suture.

KALECİK UNIT

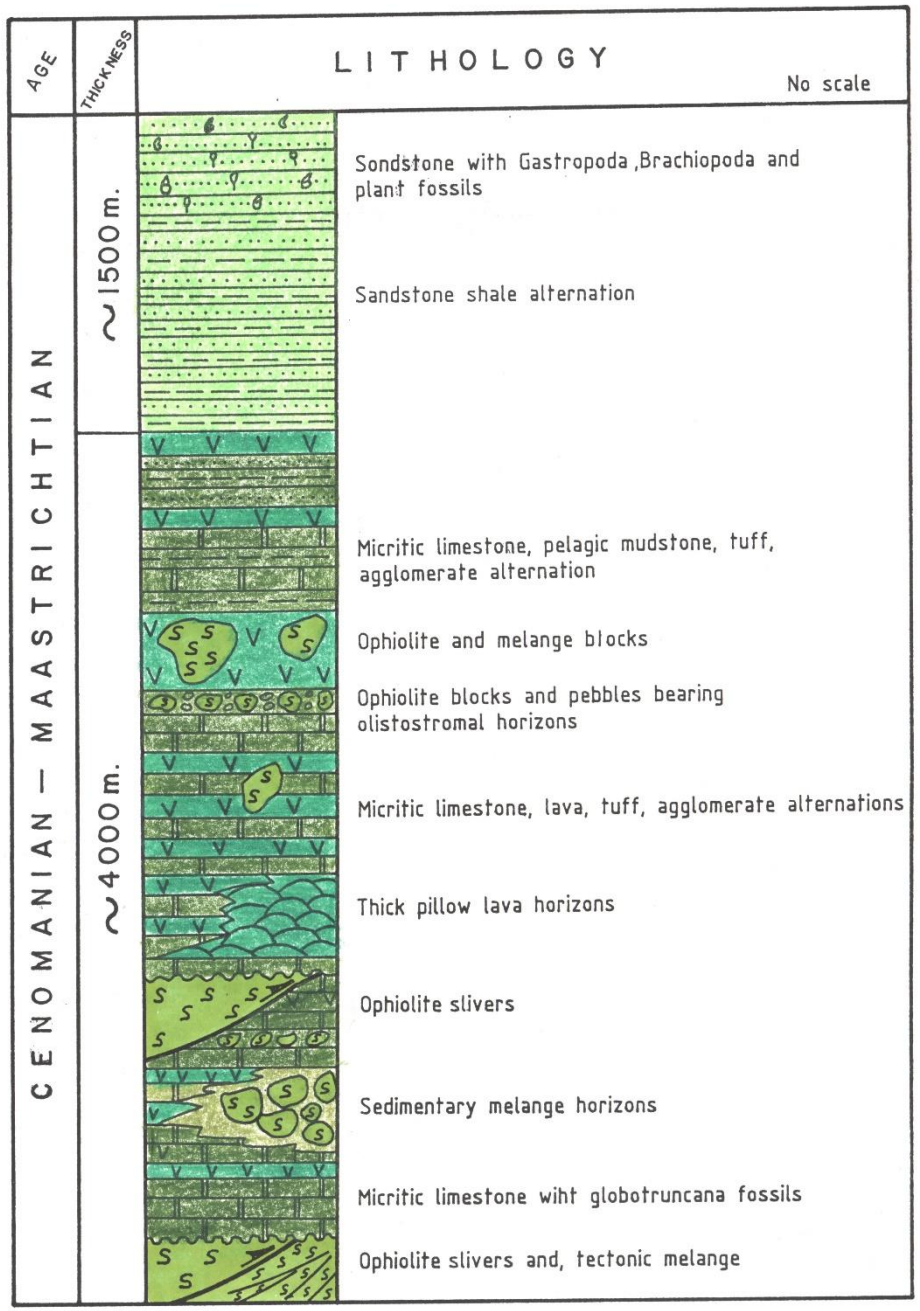
The İskilip unit unconformably overlies the Kalecik Unit.

TIME	TECTONIC UNIT	LITHOLOGY	TECTONIC SETTING	TECTONIC EVENTS
LATE MIOCENE	ÇANKIRI UNIT	Terrestrial clastics and evaporites	Inter-mountain basin	Neo-tectonic phase
OLIGOCENE-EOCENE	İSKİLİP UNIT (İU)	Terrestrial clastics Regressive clastics and volcanics Flysch and volcanics Transgressive clastics	Post-collisional molasse basin	Closing of Çankırı basin Opening of Çankırı basin
LATE MAAST. CENOMANIAN	KALECİK UNIT (KAU)	Regressive clastics Flysch Pelagic sediments and volcanics Ophiolite and ophiolitic melange	Inter-arc basin Ensimatic arc	Closing of Neo-Tethys - Ophiolite obduction onto the Kırşehir M. - Ensimatic arc-continent collision
CENOMANIAN LIAS	SAKARYA UNIT (SU)	Flysch and volcanics Calciturbidite Pelagic carbonate Neritic carbonate Transgressive clastics	Ensialic arc Passive margin Carbonate platform Rift-related basins	Subduction - Under ocean floor - Under continent Opening of Neo-Tethys
TRIAS PERMIAN	KARAKAYA UNIT (KU)	Olistostromal melange Lava, tuff, clastics and carbonates Olistostromal melange Neritic carbonate	Back-arc basin Carbonate platform	Regional metamorphism Closing of Karakaya basin Opening of Karakaya basin
PRECAMB.(?)	Granitic basement			



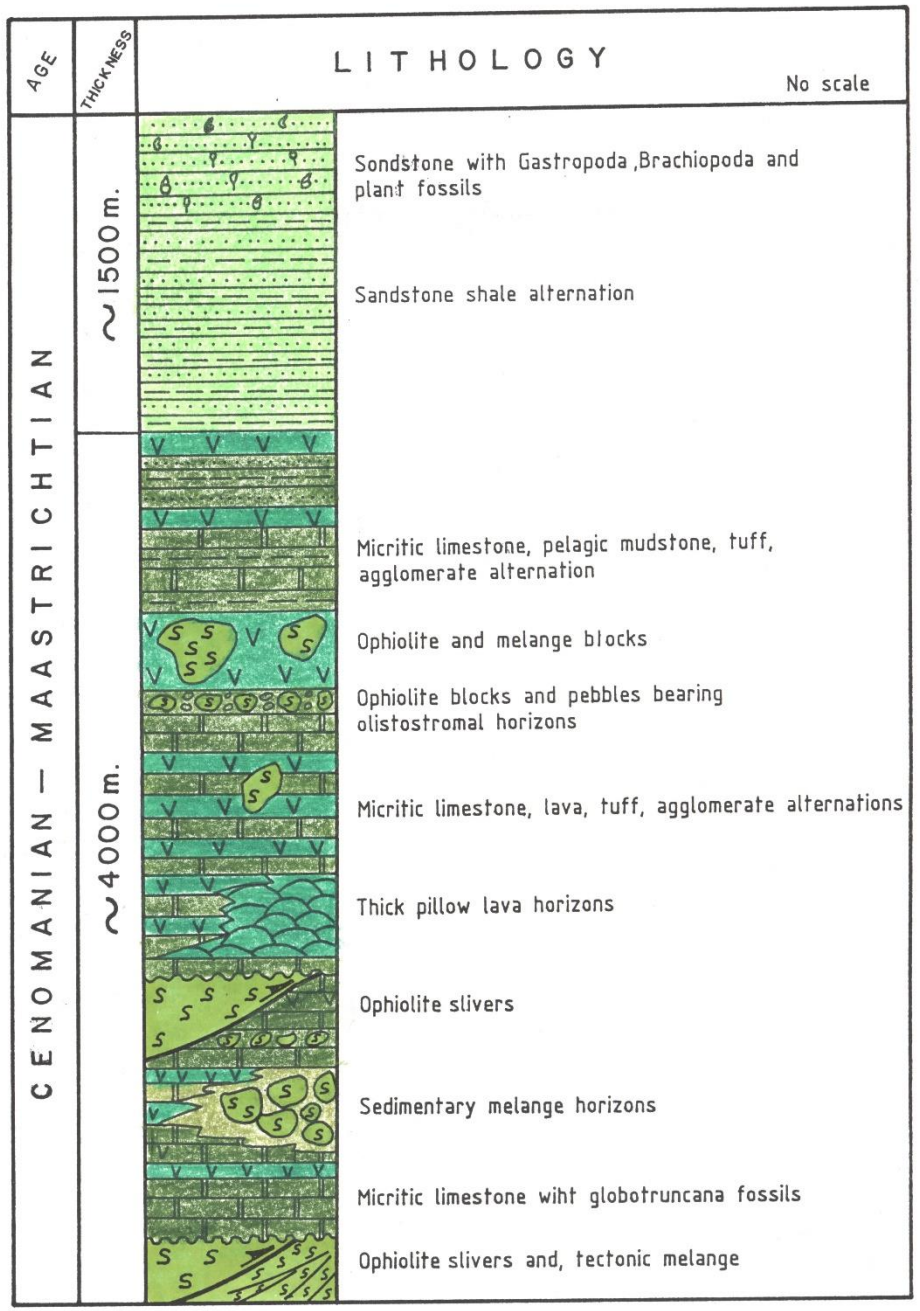
The Kalecik Unit comprises two nappes:

- The upper nappe consists of an ophiolitic mélange. This mélange is formed from blocks and tectonic slices of ophiolitic rocks, epi-ophiolitic sediments and flysch-type clastics including debris-flows and continent-derived blocks.
- In the structurally lower slices, andesitic and basaltic volcanic rocks were also added to the mélange. These volcanic rocks have the same characteristics as those of the lower nappe.
- All these lithologies were imbricated with each other and formed a south-vergent imbricate structure



The lower nappe is formed from two parts with a gradual transitional contact:

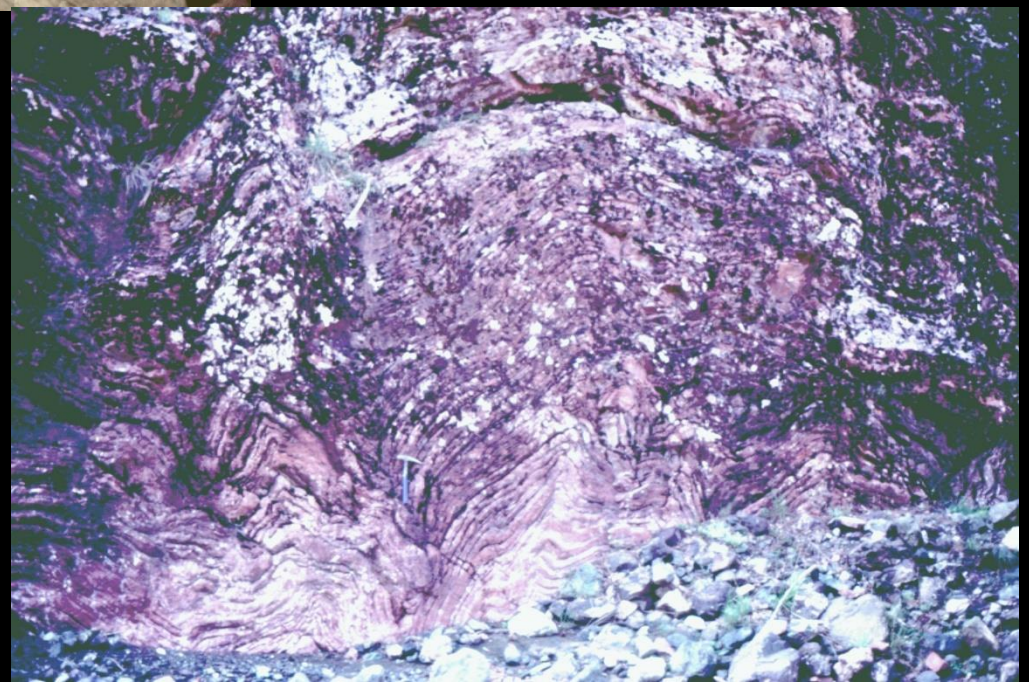
- a lower part consisting of volcanics, volcanoclastics, pelagic sediments and ophiolites, the Yaylaçayı formation,
- an upper part consisting of terrigenous clastics, the Yapraklı formation.



The Yaylaçayı formation un- or nonconformably rests on an ophiolitic substratum with a thin pelagic limestone or a thin olistostromal conglomerate of Cenomanian age. This ophiolitic substratum can be correlated with the upper nappe.

Up the section, basalts, basaltic andesites and their pyroclastic equivalents are seen. Upwards they increase and become the dominant lithology of the formation.

Basalts and cherts within the base of the Yaylaçayı Formation

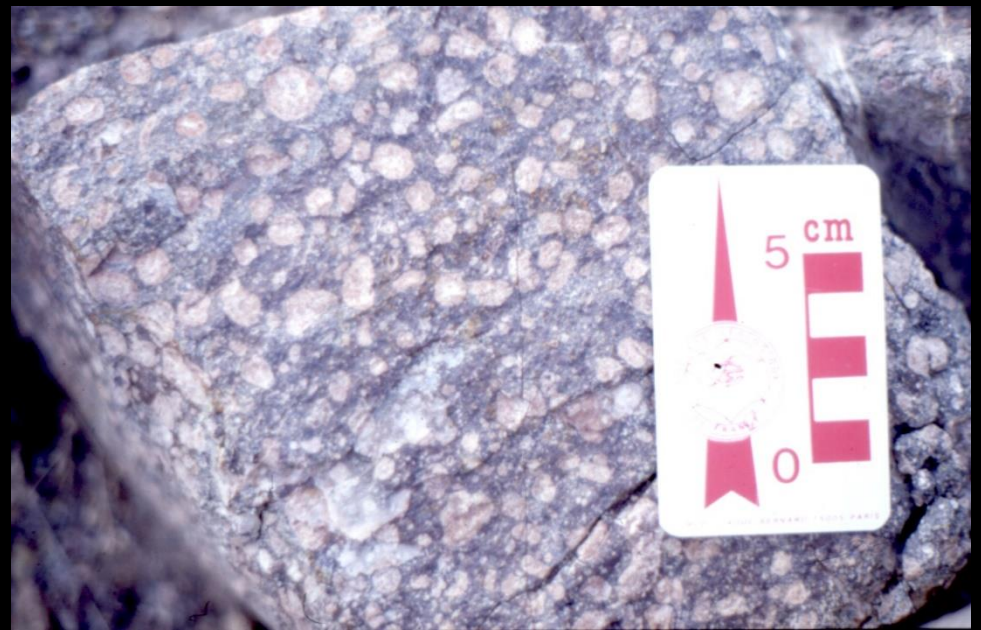


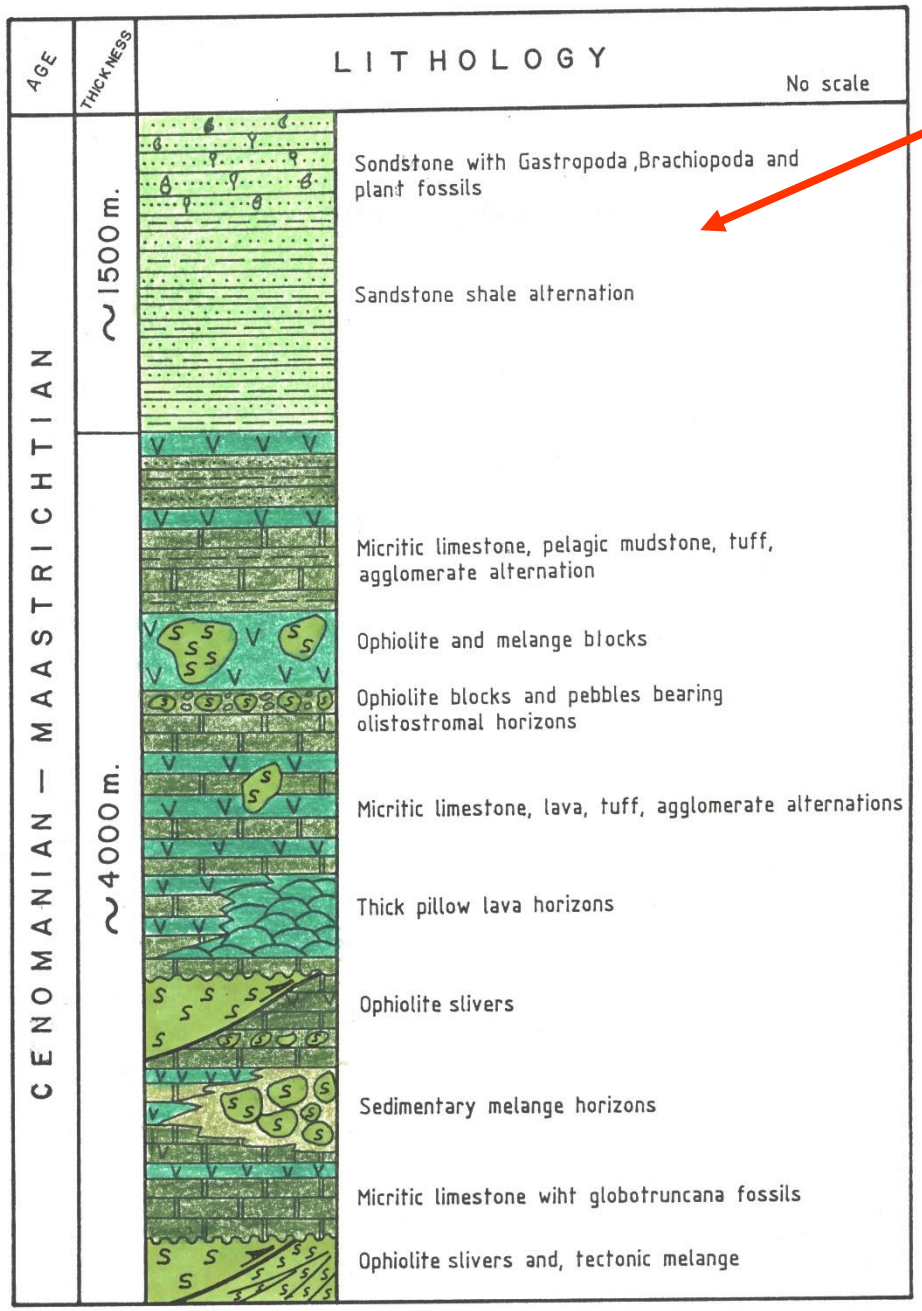
Pillow lava and pelagic limestones of the Yaylaçayı formation

Geochemical data indicate that the Yaylaçayı magmatics were produced in island-arcs and /or oceanic islands.

Radial cooling structure (rose structure) within the Yaylaçayı basalts

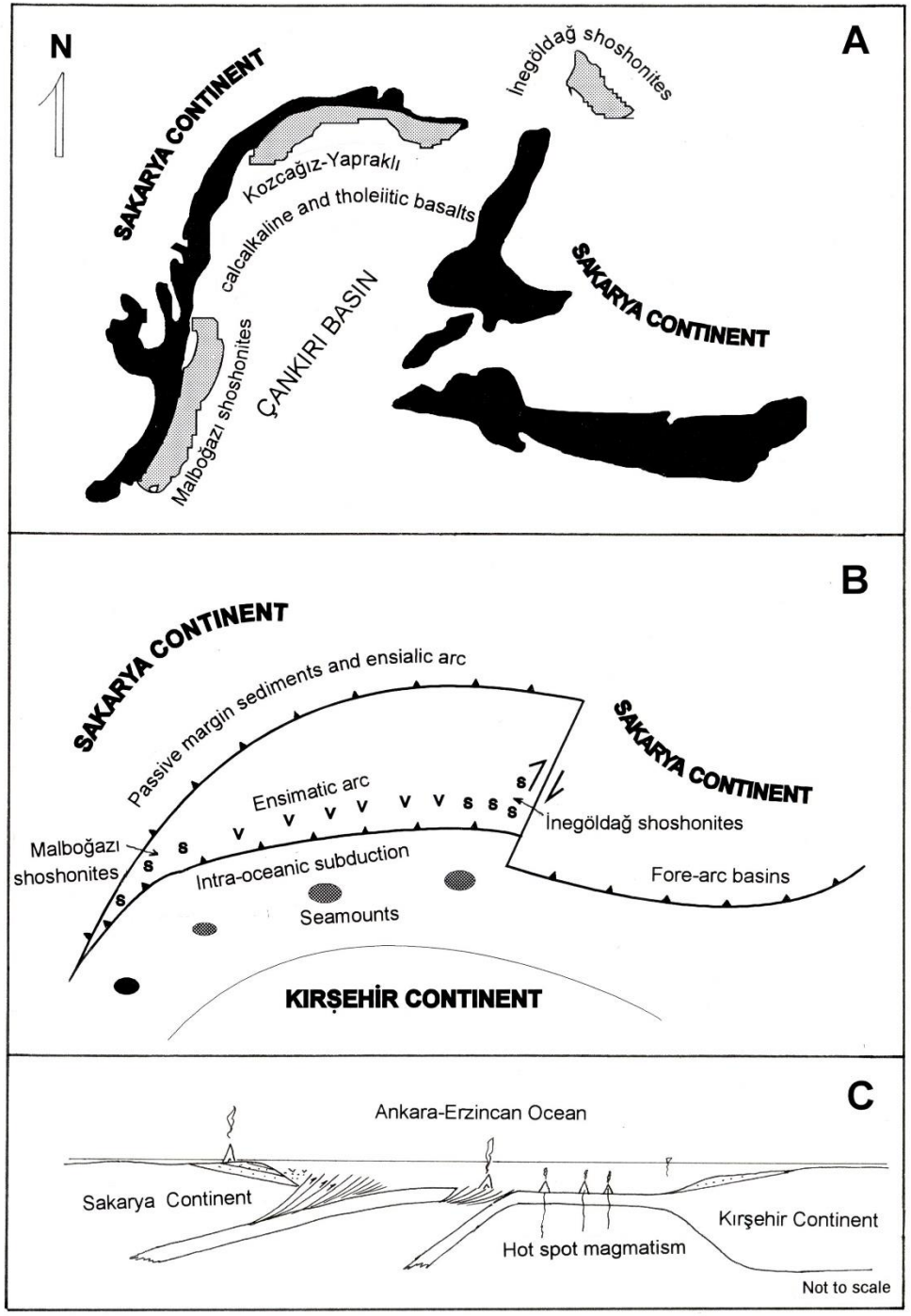
Leucite basalt dykes





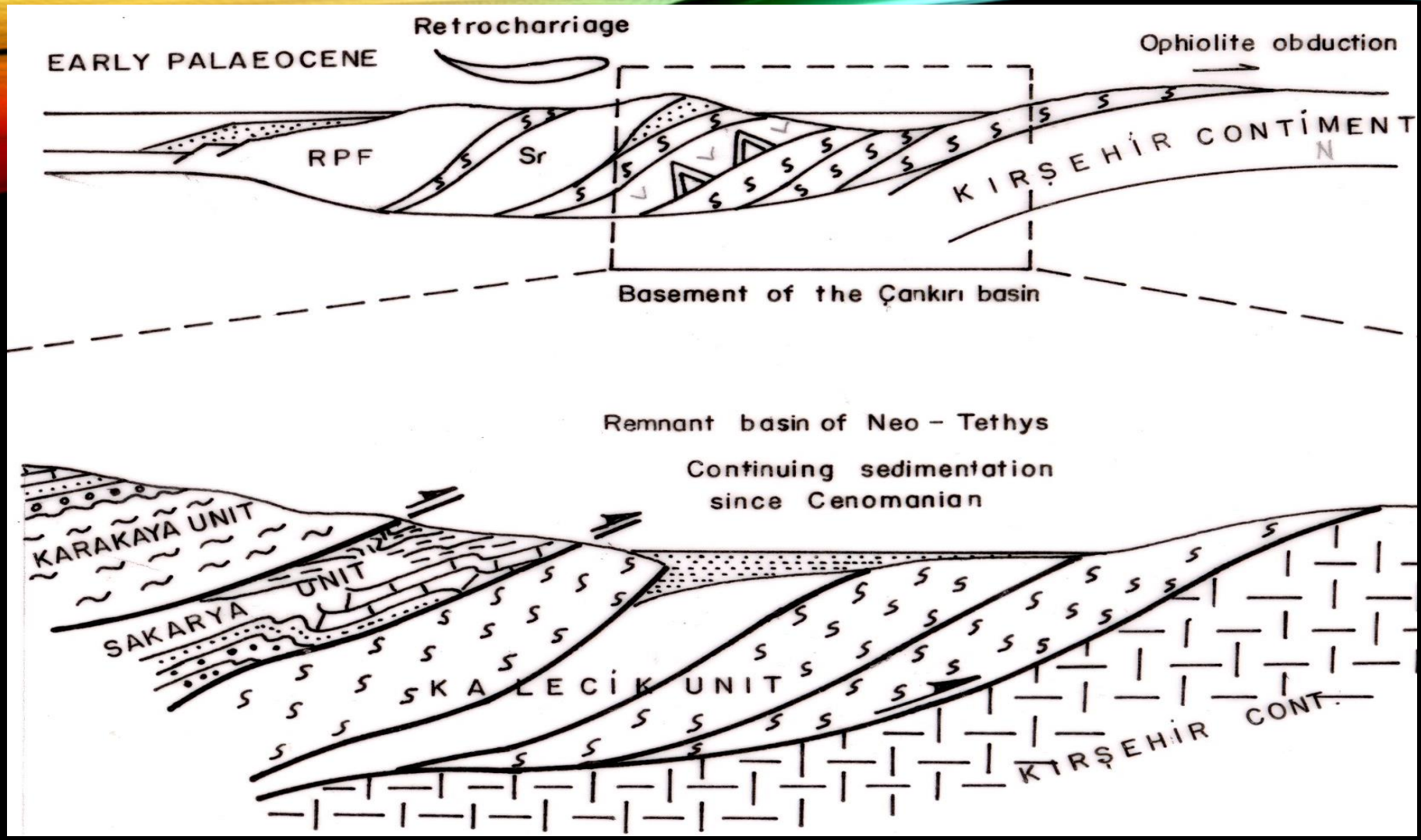
The Yapraklı formation is represented by regressive clastics. In this succession, some neritic limestone blocks and lenticular turbidite and debris-flow channels also occur. Pebbles of these channels are mainly continent-derived clastics.

They grade upward into a sandstone-marl alternation with shallow-water fossils indicating a Maastrichtian age. There are also some coal measures within the upper parts.



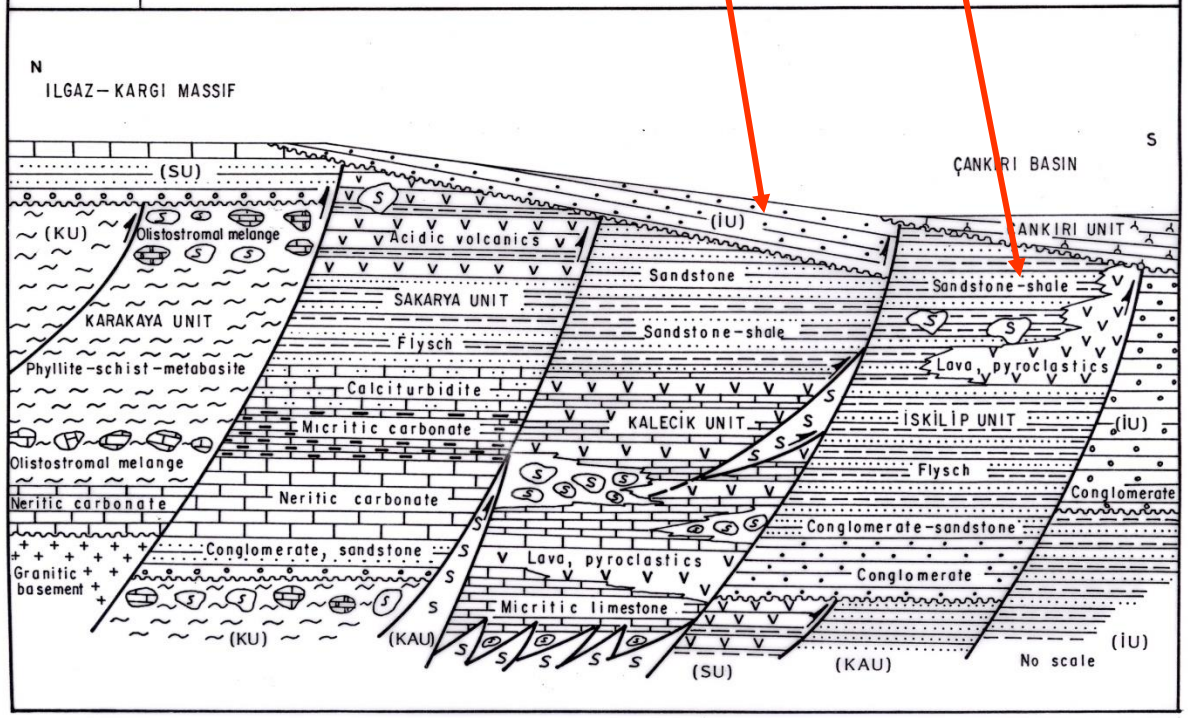
The Kalecik Unit represents the Ankara-Erzincan suture and consists of two different mélange belts which developed along different subduction zones contemporaneously.

The northern mélange developed along the southern border of the Sakarya Continent, while the southern one was a product of an intra-oceanic subduction.



After the closing of the Ankara-Yozgat Ocean most of the area uplifted but a small basin remained in the place of the latter Çankırı basin. Some Maastrichtian-Palaeocene sediments deposited within this remnant basin.

TIME	TECTONIC UNIT	LITHOLOGY	TECTONIC SETTING	TECTONIC EVENTS
LATE MIOCENE	ÇANKIRI UNIT	Terrestrial clastics and evaporites	Inter-mountain basin	Neo-tectonic phase
OLIGOCENE-EOCENE	İSKİLİP UNIT (İU)	Terrestrial clastics Regressive clastics and volcanics Flysch and volcanics Transgressive clastics	Post-collisional molasse basin	Closing of Çankırı basin Opening of Çankırı basin
LATE MAAST. CENOMANIAN	KALECİK UNIT (KAU)	Regressive clastics Flysch Pelagic sediments and volcanics Ophiolite and ophiolitic melange	Inter-arc basin Ensimatic arc	Closing of Neo-Tethys - Ophiolite obduction onto the Kırşehir M. - Ensimatic arc-continent collision
CENOMANIAN LIAS	SAKARYA UNIT (SU)	Flysch and volcanics Calciturbidite Pelagic carbonate Neritic carbonate Transgressive clastics	Ensialic arc Passive margin Carbonate platform Rift-related basins	Subduction - Under ocean floor - Under continent Opening of Neo-Tethys
TRIAS PERMIAN	KARAKAYA UNIT (KU)	Olistostromal melange Lava, tuff, clastics and carbonates Olistostromal melange Neritic carbonate	Back-arc basin Carbonate platform	Regional metamorphism Closing of Karakaya basin Opening of Karakaya basin
PRECAMB.(?)		Granitic basement		

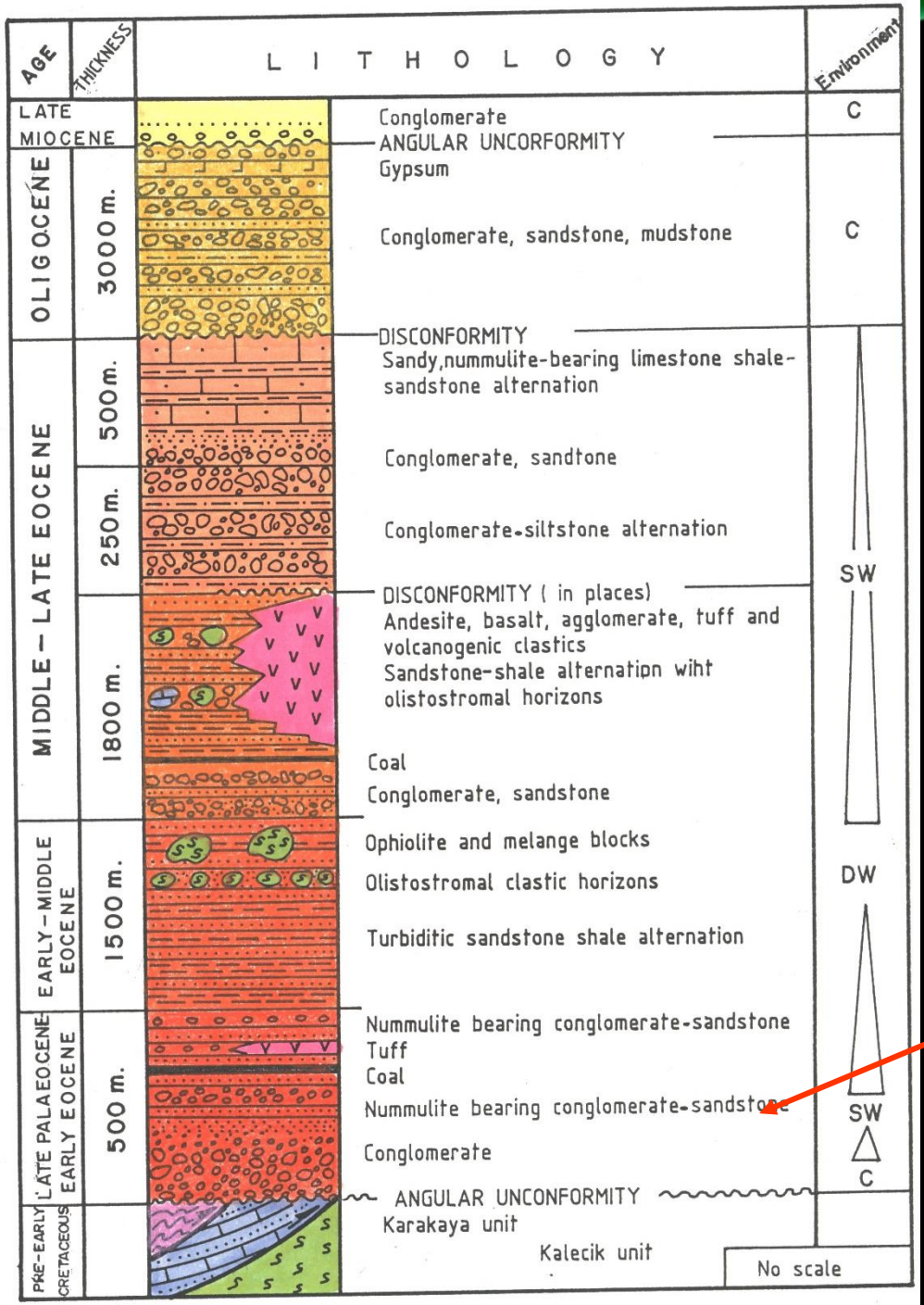


İSKİLİP UNIT

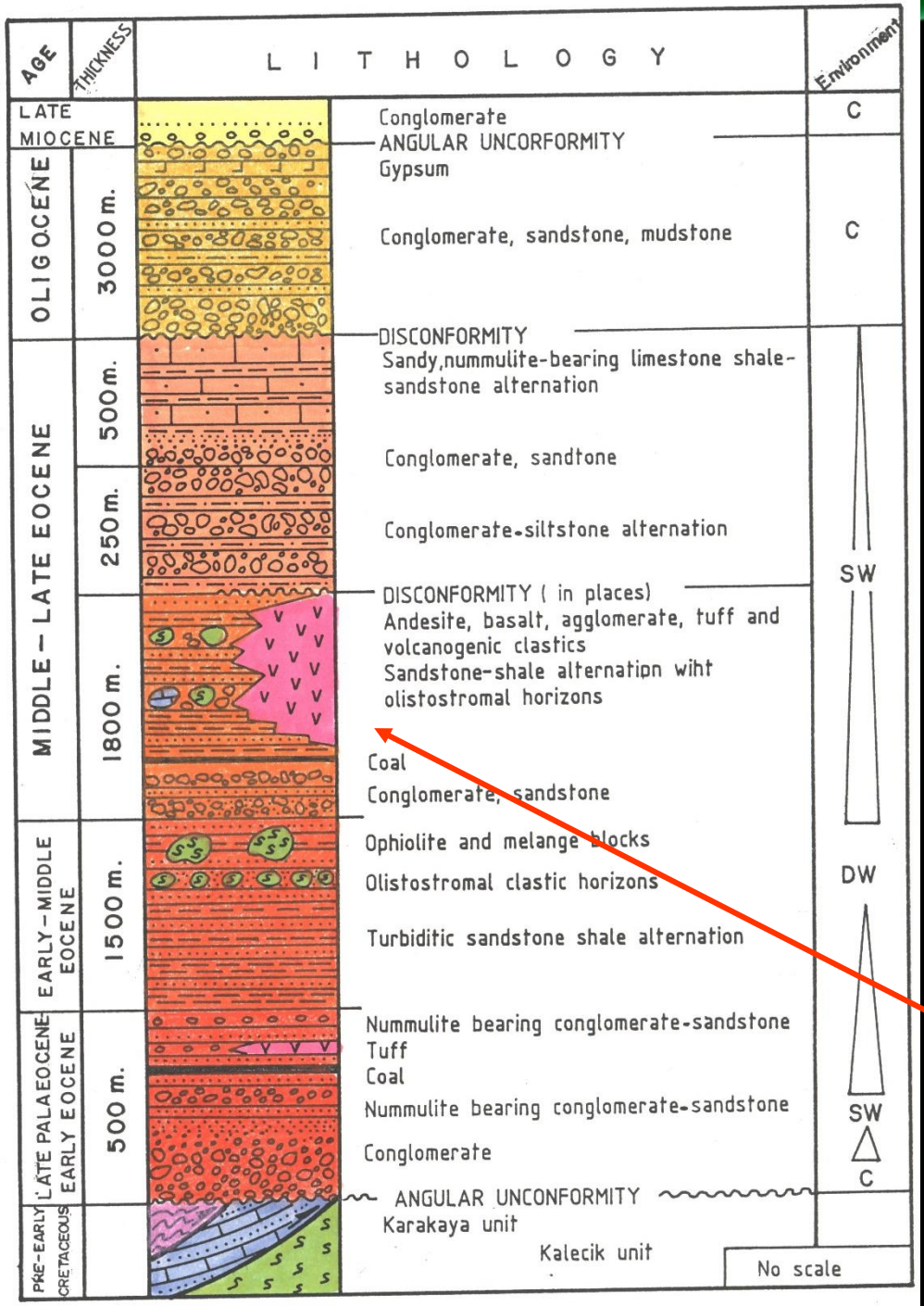
It is a sedimentary succession of Eocene-Oligocene age.

It rests unconformably on the Late Cretaceous and older units.

This unit has also an imbricated structure.



The İskilip Unit starts at the base with alluvial fan deposits of Upper Palaeocene-Lower Eocene and grades upward into nummulite-bearing clastics with thick coal measures.

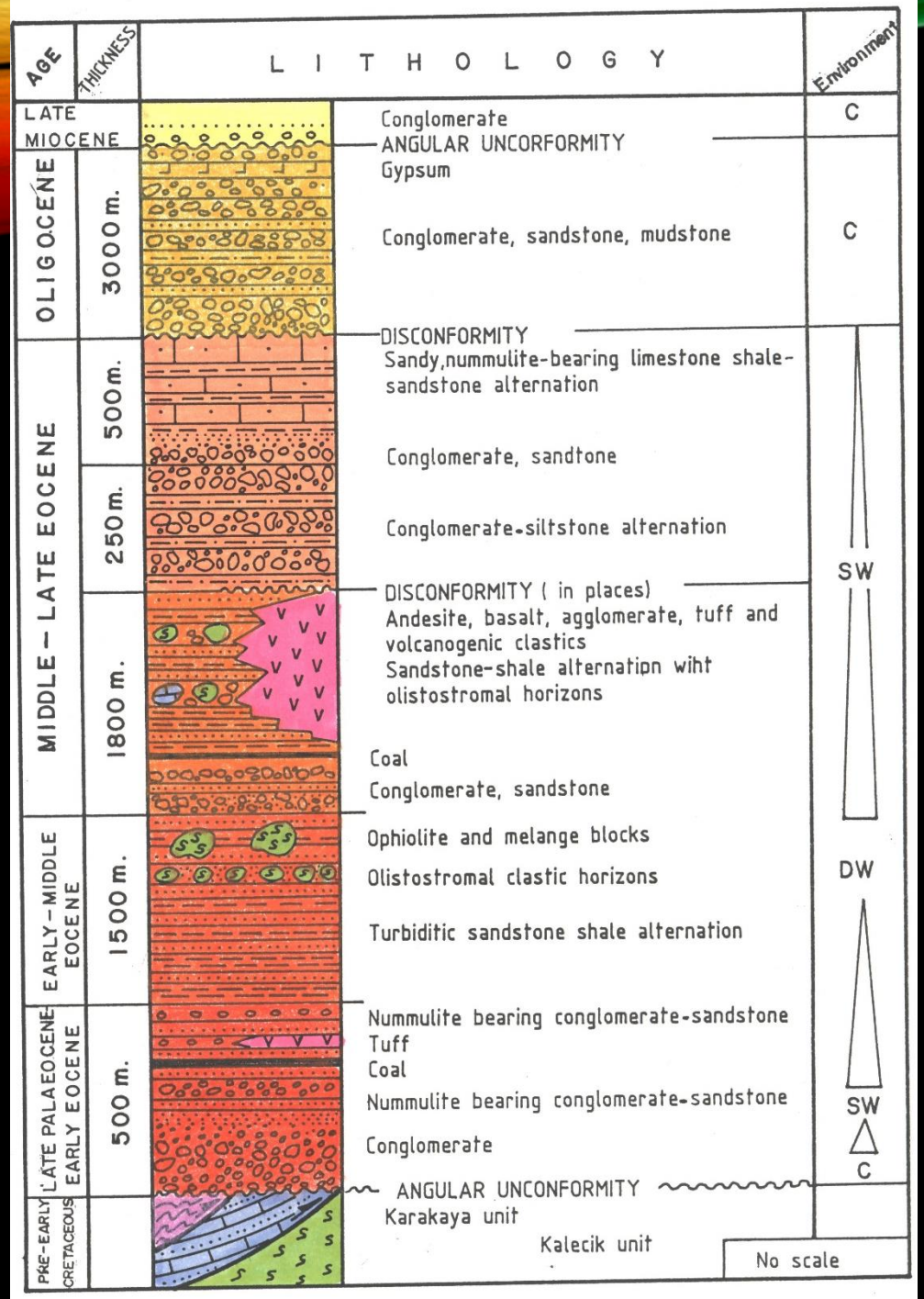


Up the section is a turbidite sequence. In the upper parts of this sequence there are some ophiolite and melange block derived from the Kalecik Unit.

After the emplacement of these blocks, the succesion gains a regressive character and comprises some coal measures.

Some andesitic and basaltic lavas and pyroclastics associated to the sedimentation.

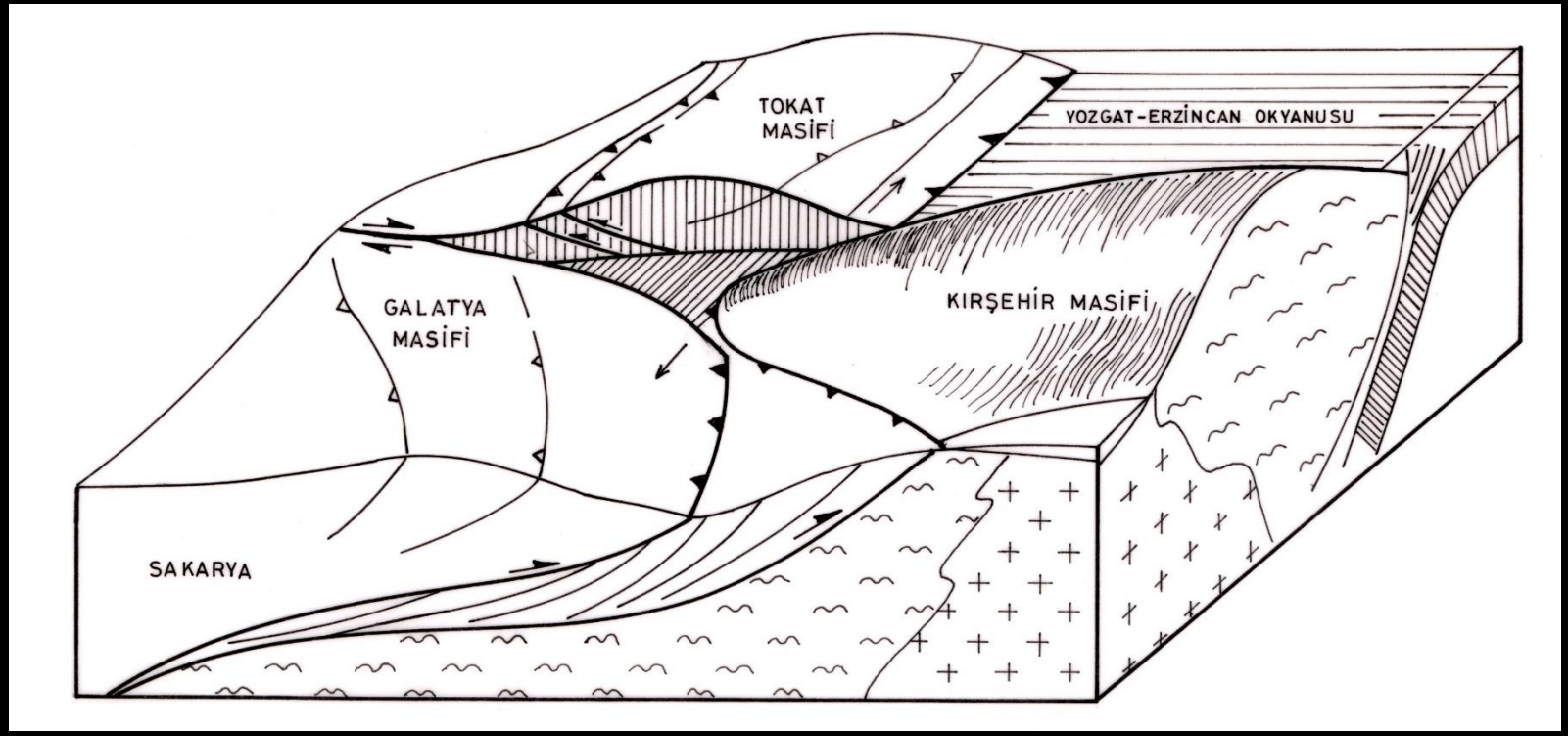
These volcanics were more voluminous around the basin and were continuous up to Oligocene.



The Upper Eocene part of the sequence is mainly represented by coarse clastics and nummulite-bearing shallow marine limestones and marls.

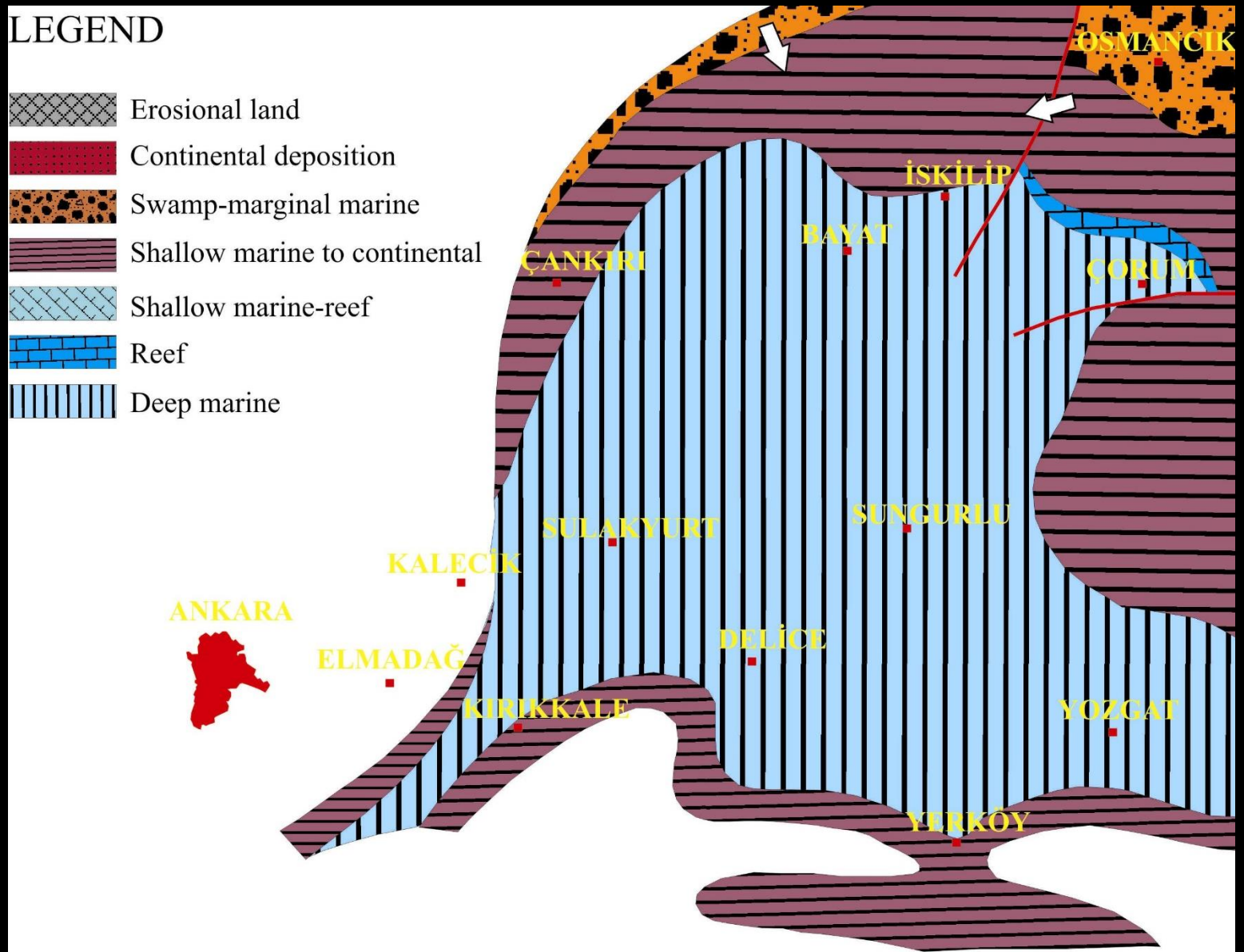
The Oligocene is represented by continental fan deposits, mainly red conglomerates.

The İskilip Unit starts with continental deposits then grades upward into deepening and fining upward sequences which imply normal fault-controlled opening of the Çankırı Basin since Early Eocene.

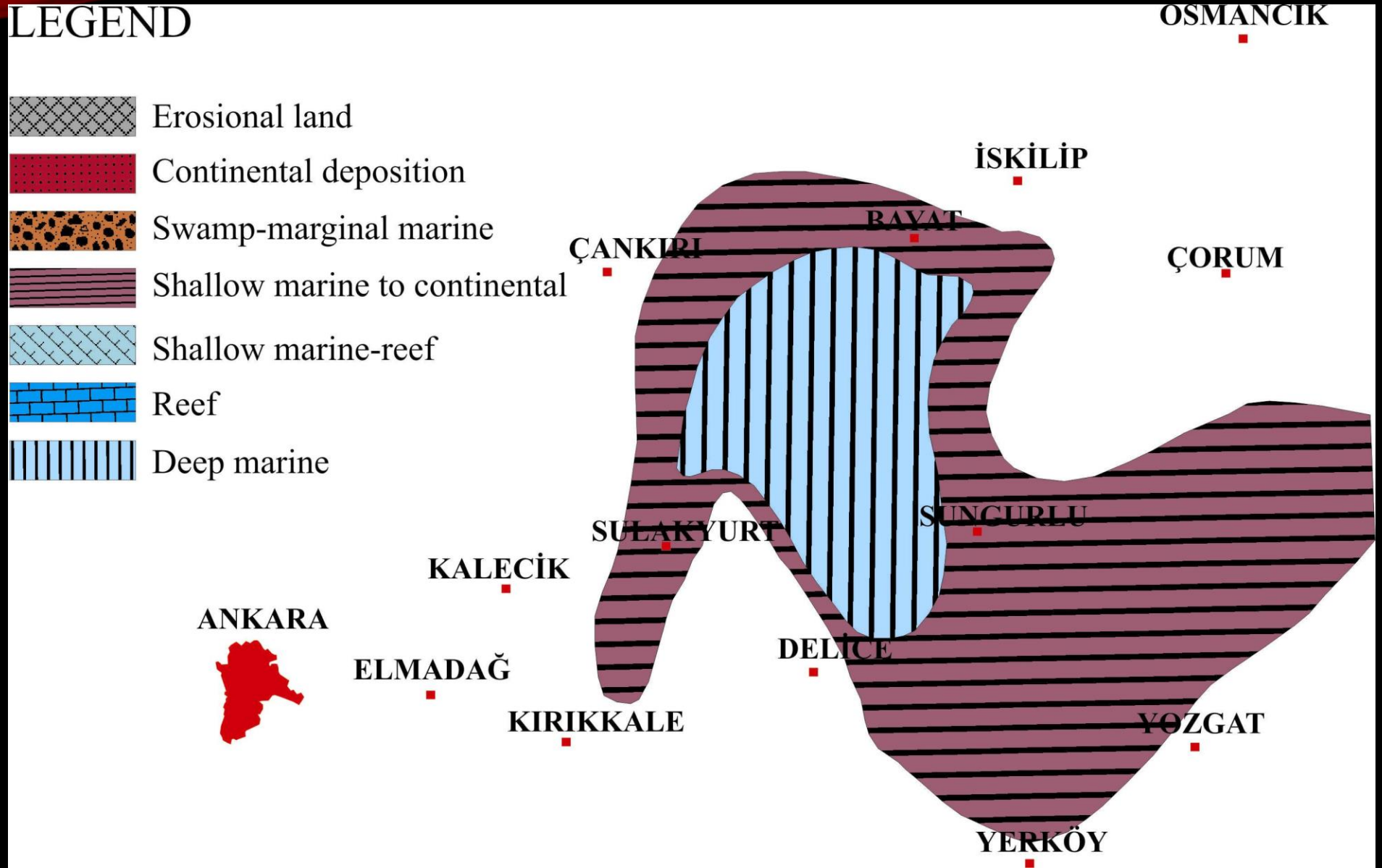


The Çankırı Basin opened as a post collisional basin on the Kırşehir and Sakarya Continents and on the Ankara-Erzincan Suture

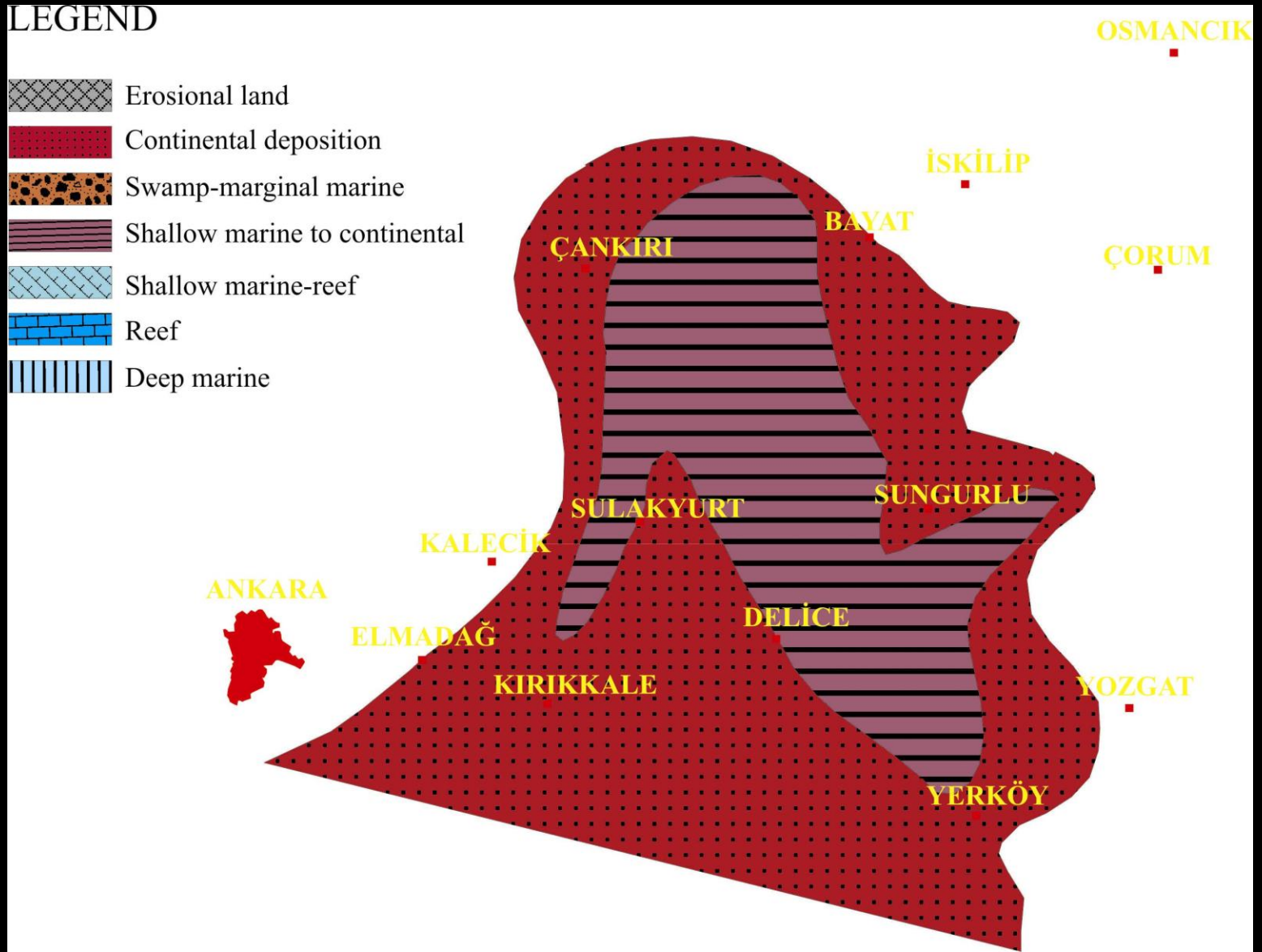
During the Early-Middle Eocene the basin reached its deepest and largest position.



At the end of Middle Eocene, the basin shoulders uplifted by thrust faults and the basin started to shallow.



At the end of the Eocene, the Çankırı basin was an intramontane basin surrounded by thrusts. The basin filled during the Oligocene. It also remained as an intramontane basin during the Miocene



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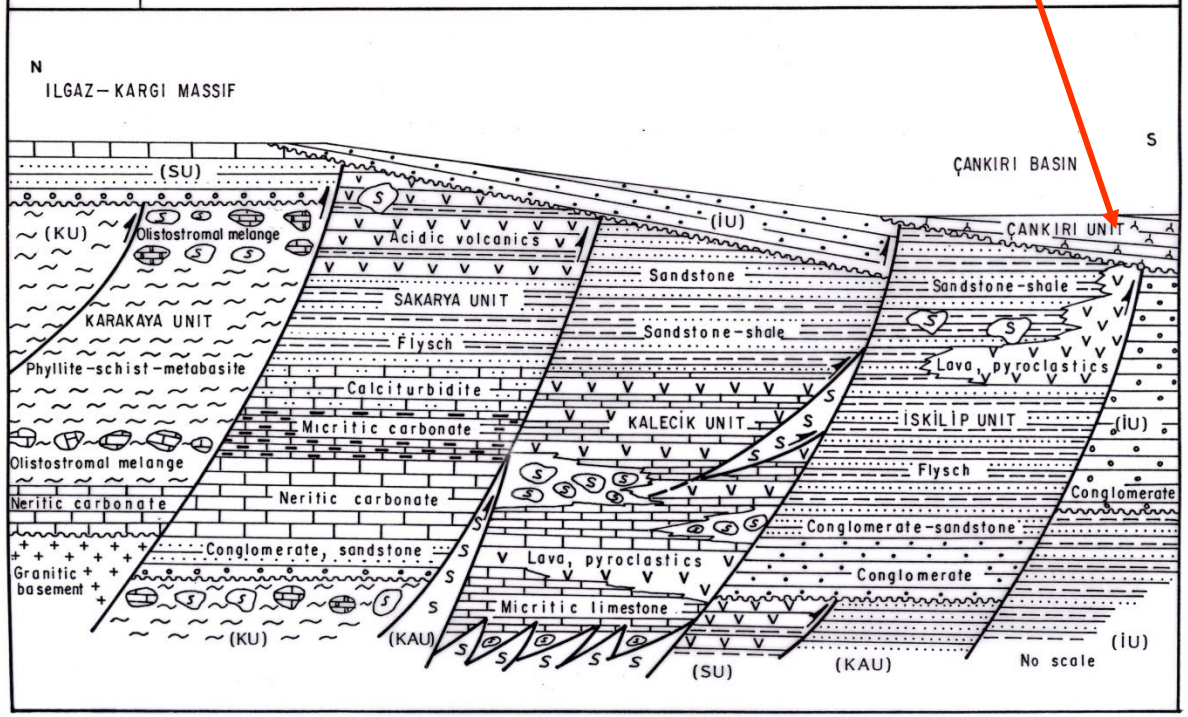
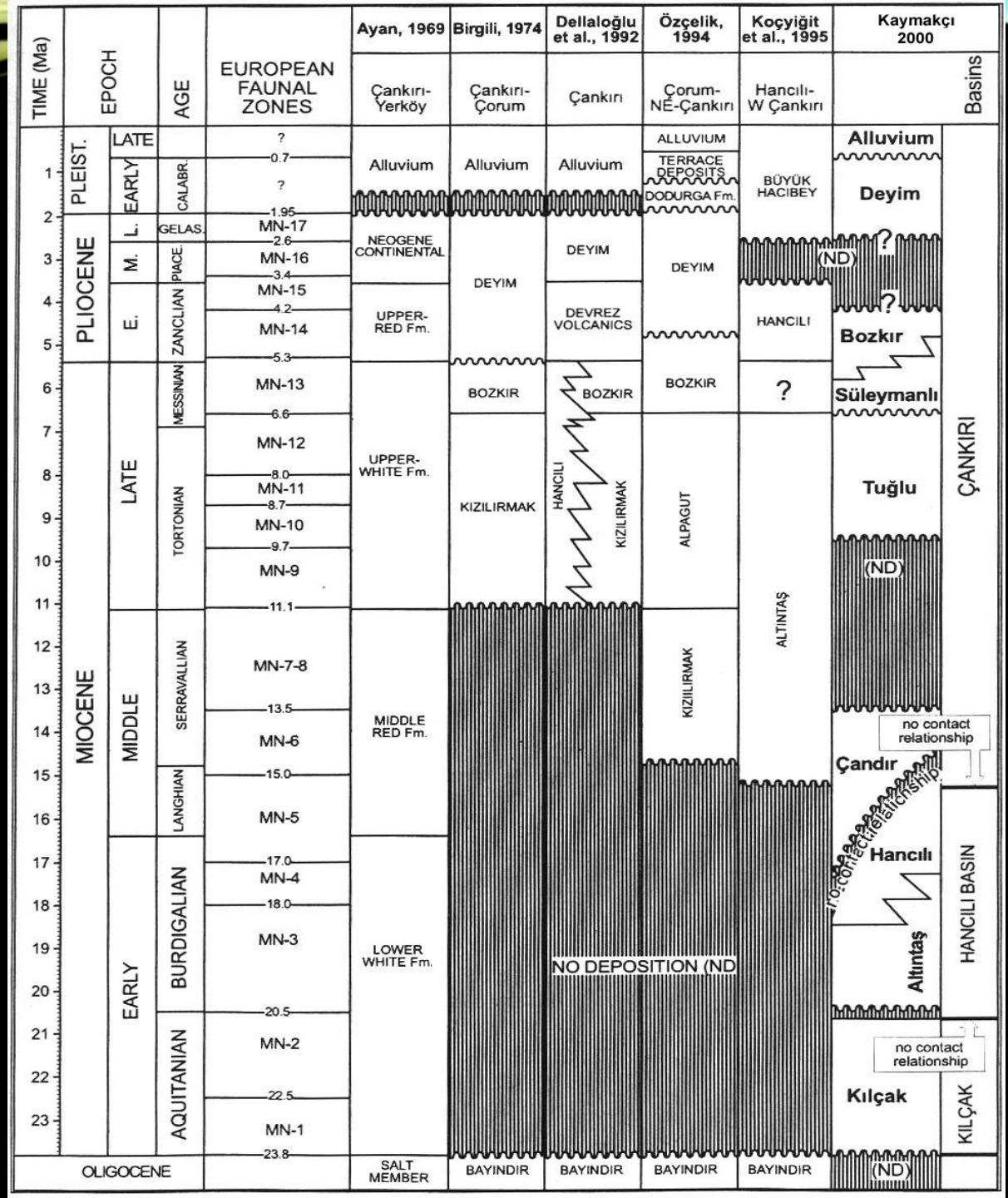


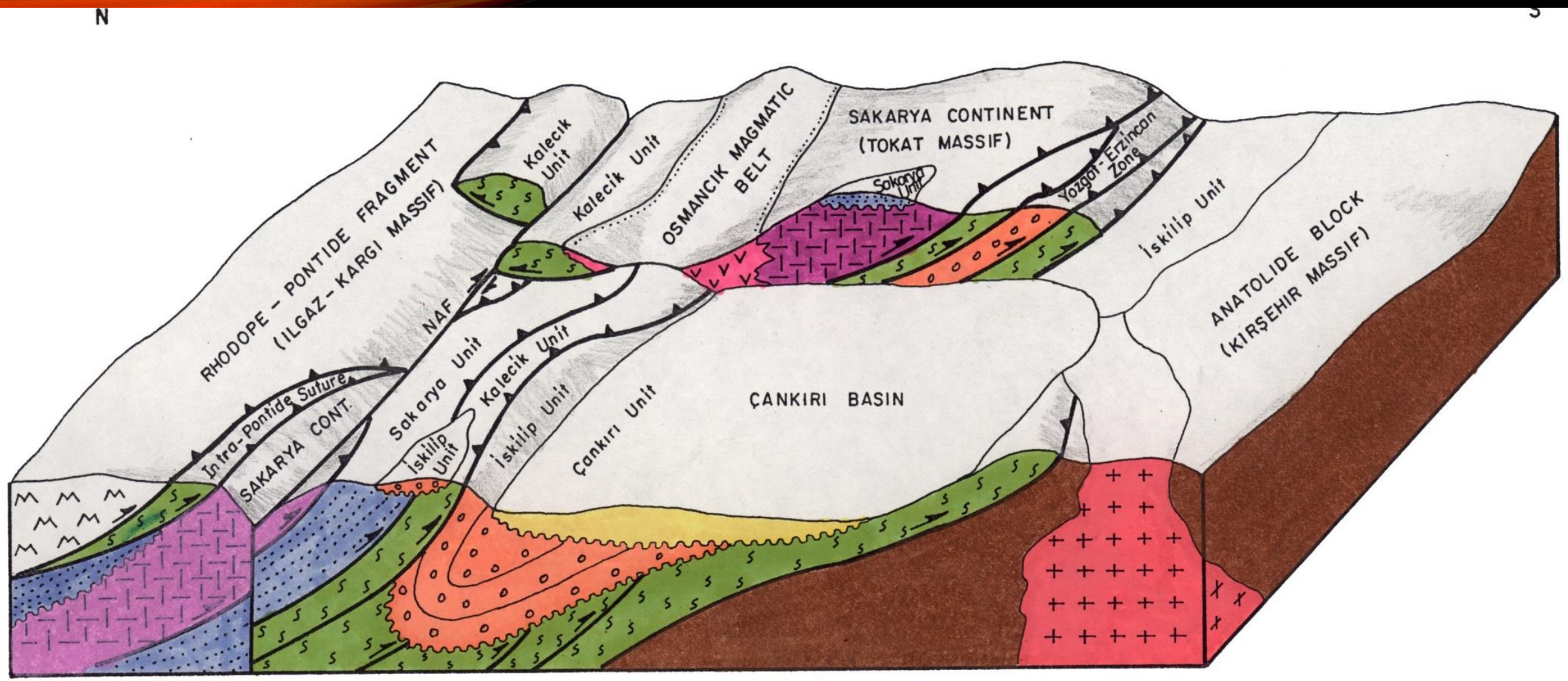
ÇANKIRI UNIT

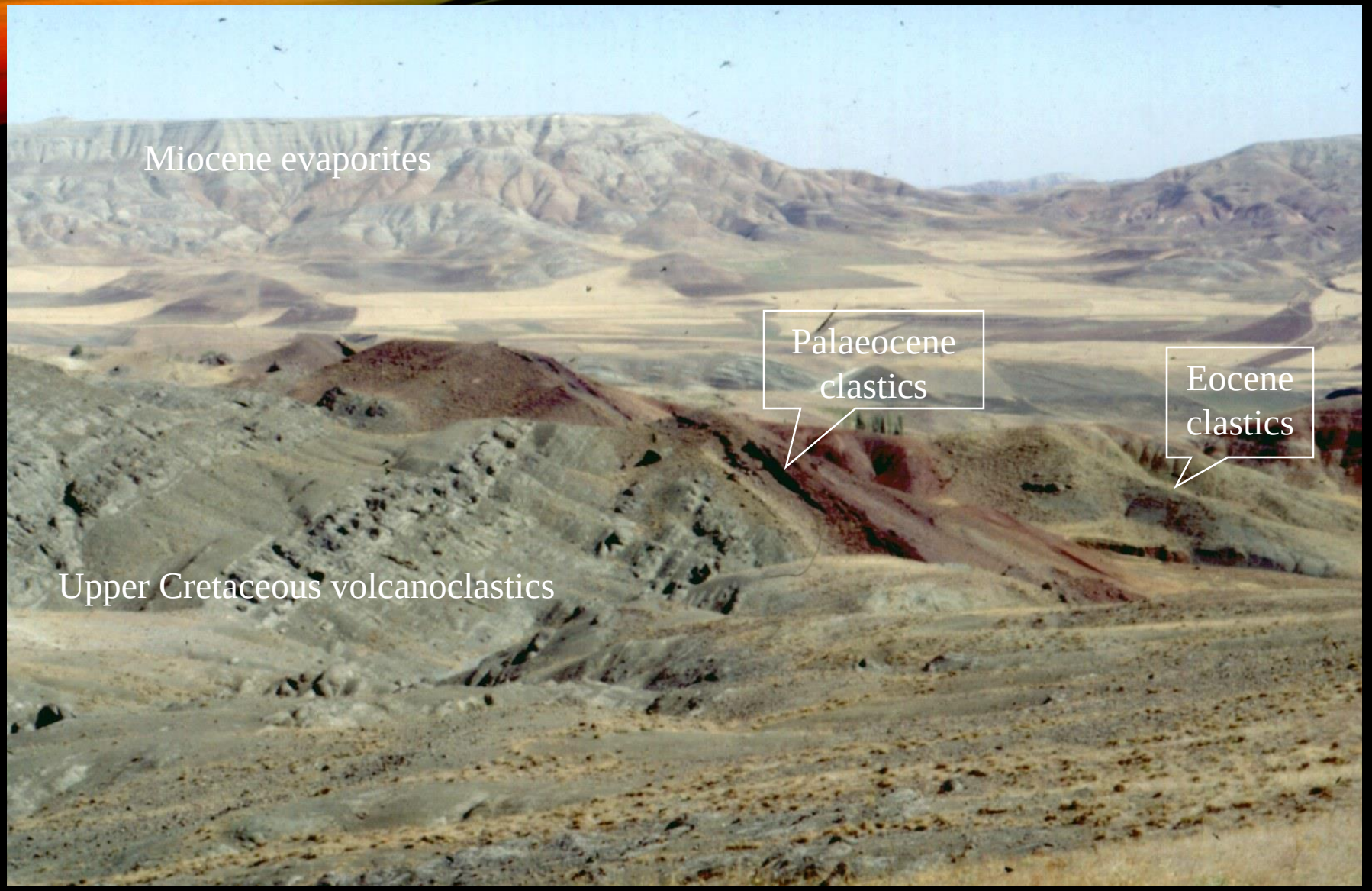
This unit is represented by fluvial red-beds and evaporites of Late Miocene and unconformably overlies all the older units. It is seen as horizontal beds within the basin but it is affected by strike-slip and thrusts along the basin margins.

CORRELATION CHART OF THE MIOCENE AND YOUNGER SEDIMENTS WITHIN THE ÇANKIRI BASIN

(AFTER KAYMAKÇI, 2000).




N
S
RHODOPE - PONTIDE FRAGMENT
(ILGAZ - KARGI MASSIF)
Kalecik Unit
Kalecik Unit
OSMANCIK MAGMATIC BELT
SAKARYA CONTINENT
(TOKAT MASSIF)
Sakarya Unit
Yozgat - Erzincan Zone
İskilip Unit
ANATOLIDE BLOCK
(KIRŞEHIR MASSIF)
NAF
Intra-Pontide Suture
SAKARYA CONT.
Sakarya Unit
Kalecik Unit
İskilip Unit
İskilip Unit
Çankırı Unit
ÇANKIRI BASIN



General view of the ÇANKIRI BASIN