

# Lower Cretaceous Turbidites of the Pontides and the Opening of the Black Sea\*

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Search and Discovery Article #51045 (2014)\*\*

Posted November 24, 2014

\*Adapted from oral presentation at AAPG International Conference and Exhibition, Istanbul, Turkey, September 14-17, 2014

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## Abstract

A huge Lower Cretaceous submarine turbidite fan, measuring 300 km by 60 km crops out in the Central Pontides in northern Turkey and extends north to the Black Sea. The turbidite fan is known as the Çağlayan Formation in the east and the Ulus Formation in the west. Both of these formations have source and reservoir characteristics and have been drilled onshore for hydrocarbons. Geological field studies and clastic zircon U-Pb dating in the sandstones have shown that the Çağlayan and Ulus formations are deposits of the same basin, which to a large extent was sourced from the Ukrainian shield north of the Black Sea. This implies that during the Early Cretaceous (Barremian-Aptian) there was no “Black Sea” between the Pontides and the East European Platform. A second implication is with regard to the reservoir characteristics of the sandstones in the Çağlayan (Ulus) Formation. Previously, the source for the Lower Cretaceous turbidites was considered to lie in the south, in the large metamorphic area south of the Central Pontides, which is made up predominantly of phyllite and metabasite. New Ar-Ar age data have shown that this metamorphic area is largely of Early Cretaceous age, and therefore cannot be a source for the Çağlayan (Ulus) Formation. Hence, the sandstones in the Çağlayan (Ulus) Formation were largely sourced from the granites and gneisses of the Ukrainian shield and may have suitable reservoir characteristics, a major problem in the Black Sea petroleum exploration. We envisage a large river system draining the Ukrainian shield south to the Tethys ocean via the Central Pontides. A major phase of deformation, metamorphism and uplift occurred during the Albian in the Central Pontides. The distal parts of the Barremian-Aptian turbidite fan, which extended south to the Tethyan ocean, was entrapped in the subduction zone and was

metamorphosed. Oceanic crustal rocks metamorphosed in the eclogite and blueschist facies during the Albian were accreted to the southern margin of Laurasia. Turonian to Coniacian-Santonian pelagic limestones lie unconformably over the [deformed](#) Lower Cretaceous turbidites and mark the opening of the Black Sea basin.

### **Selected References**

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Okay, N., T. Zack, A.I. Okay, and M. Barth, 2011, Sinistral transport along the Trans-European Suture Zone: detrital zircon-rutile geochronology and sandstone petrography from the Carboniferous flysch of the Pontides: *Geological Magazine*, v. 148/1, p. 380-403.

Safonova, I., S. Maruyama, T. Hirata, Y. Kon, and S. Rino, 2010, LA ICP MS U-Pb ages of detrital zircons from Russia largest rivers: Implications for major granitoid events in Eurasia and global episodes of supercontinent formation: *Journal of Geodynamics*, v. 50, p. 134-153.

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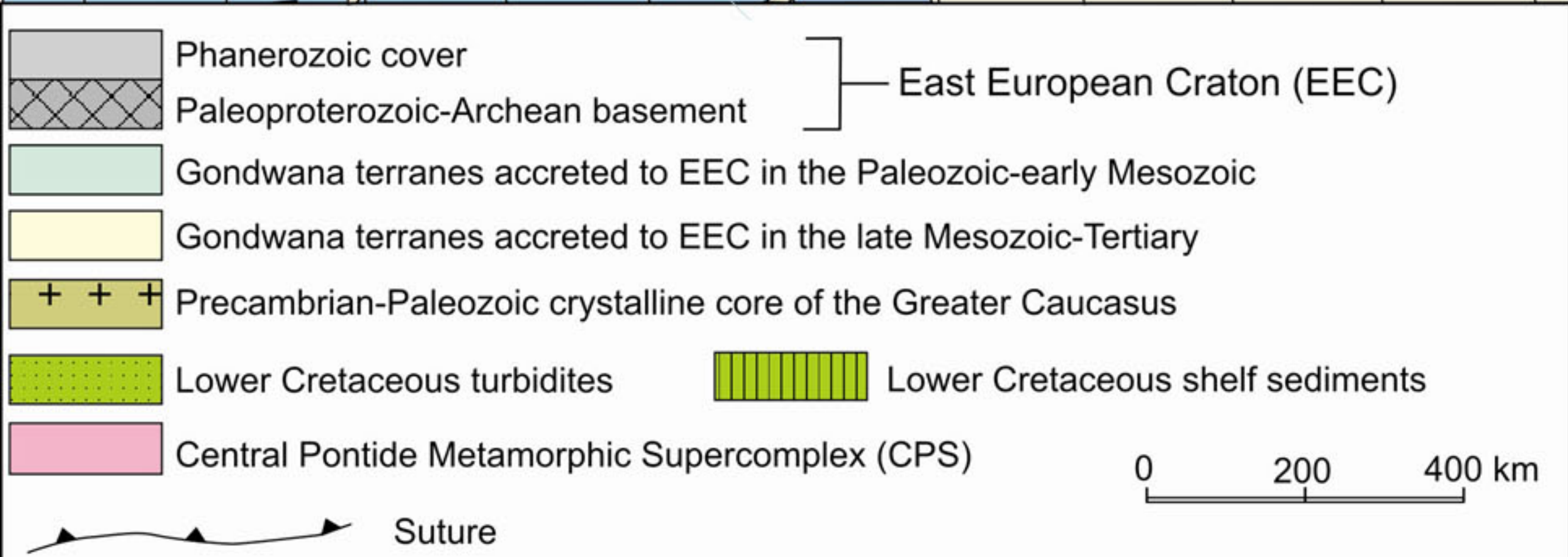
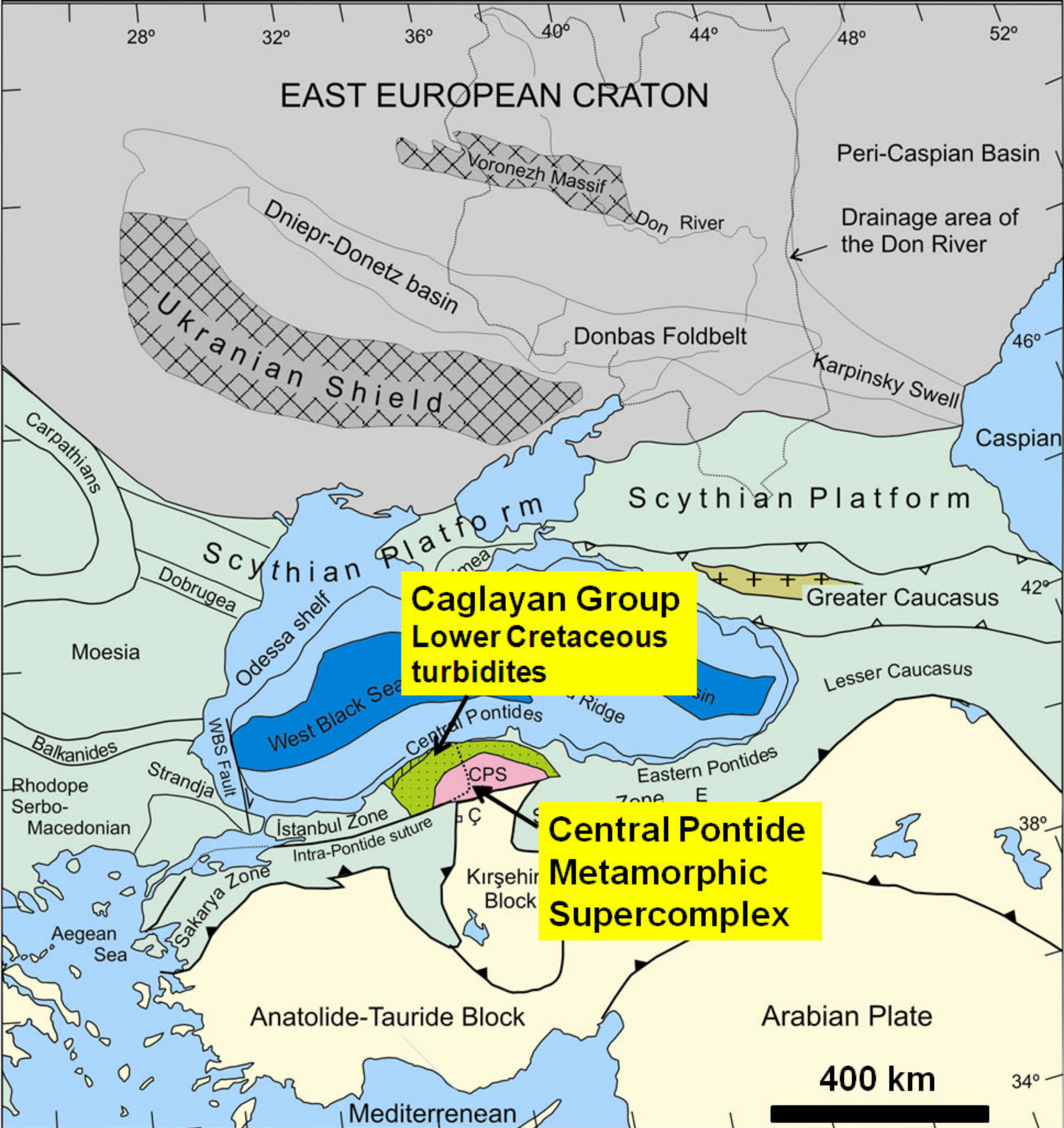
*<sup>c</sup>University of California Santa Barbara, Department of Earth Sciences, Santa Barbara*

*<sup>d</sup>Department of Earth Sciences, Open University, U.K.*

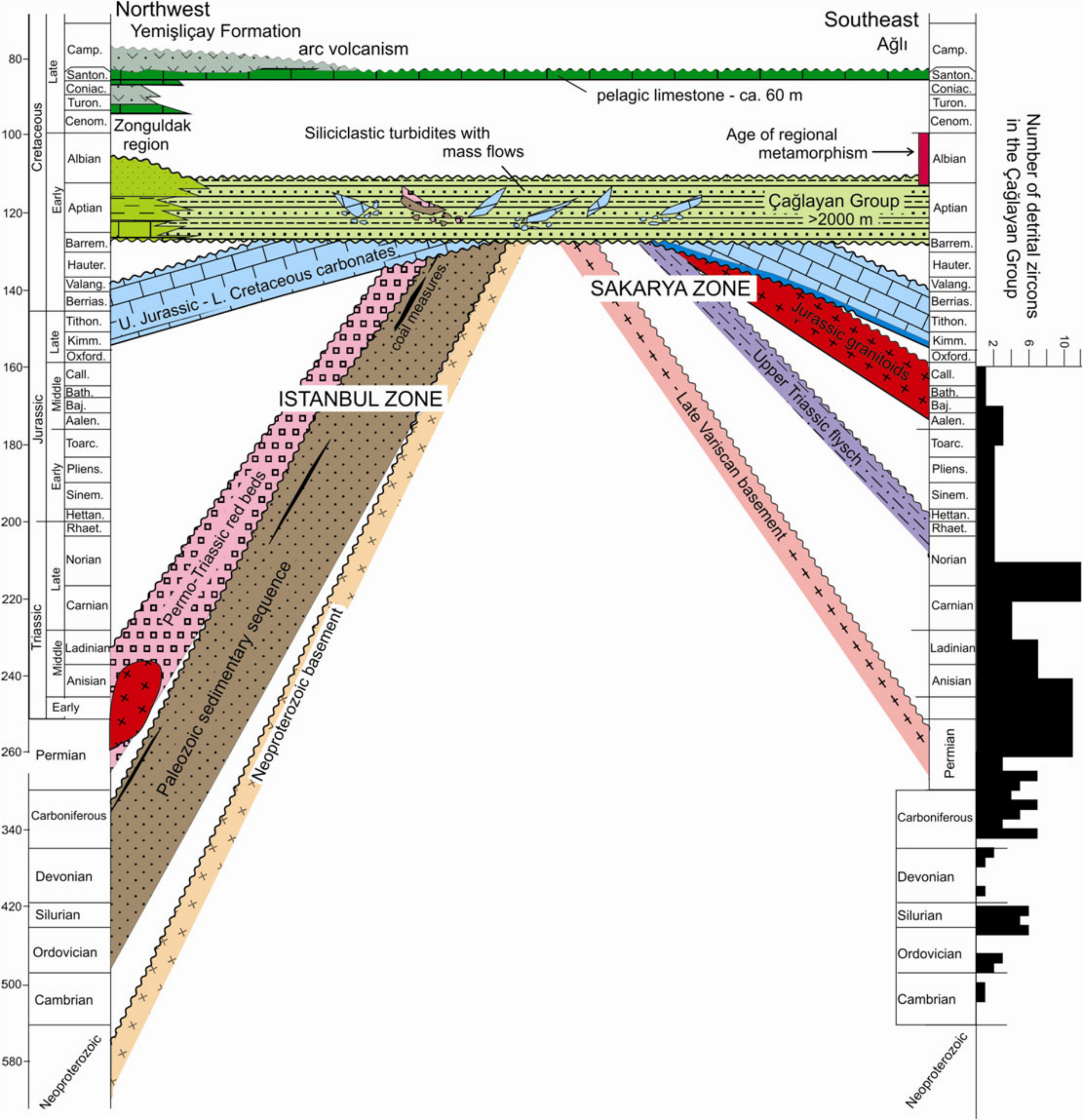
















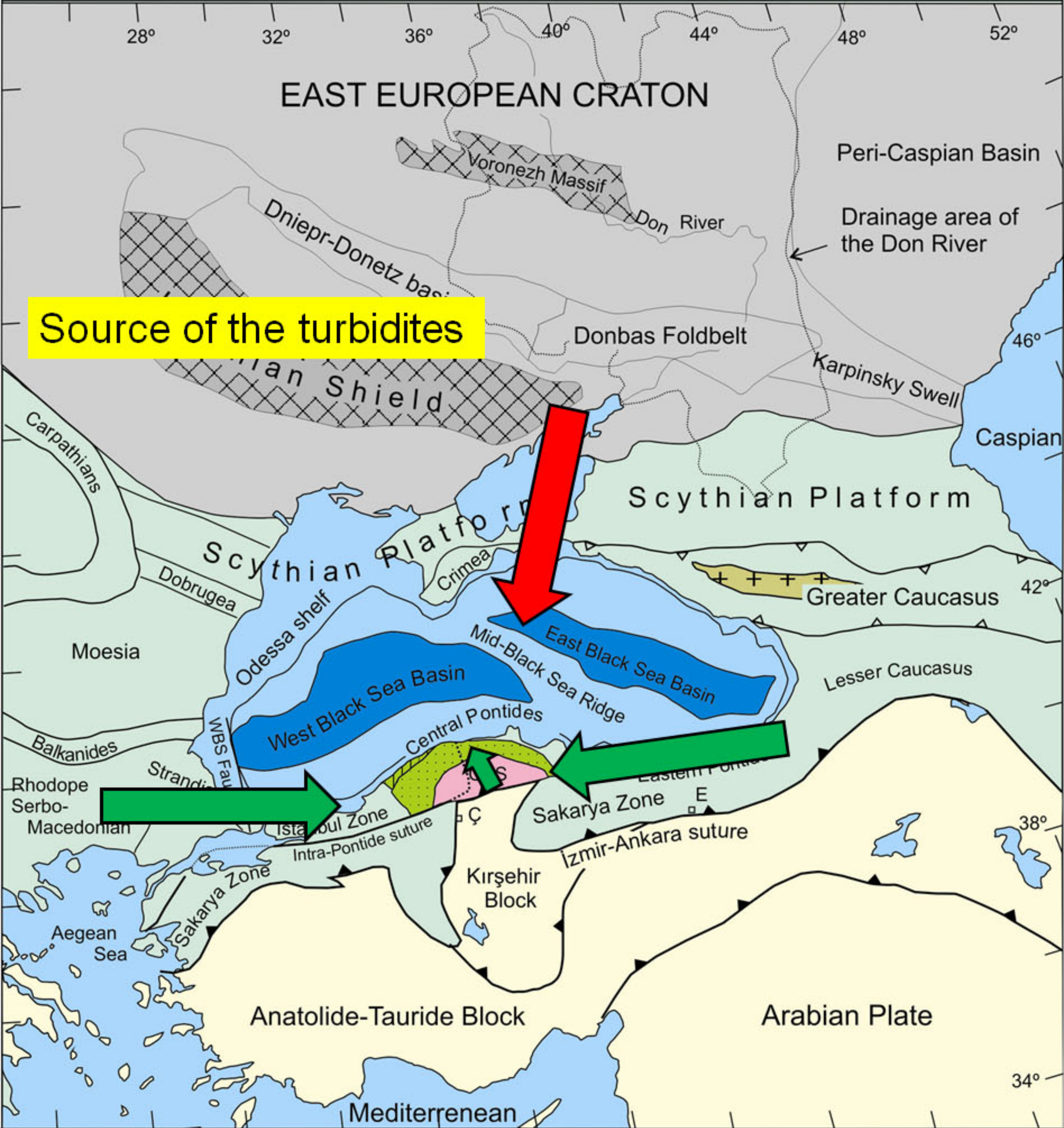




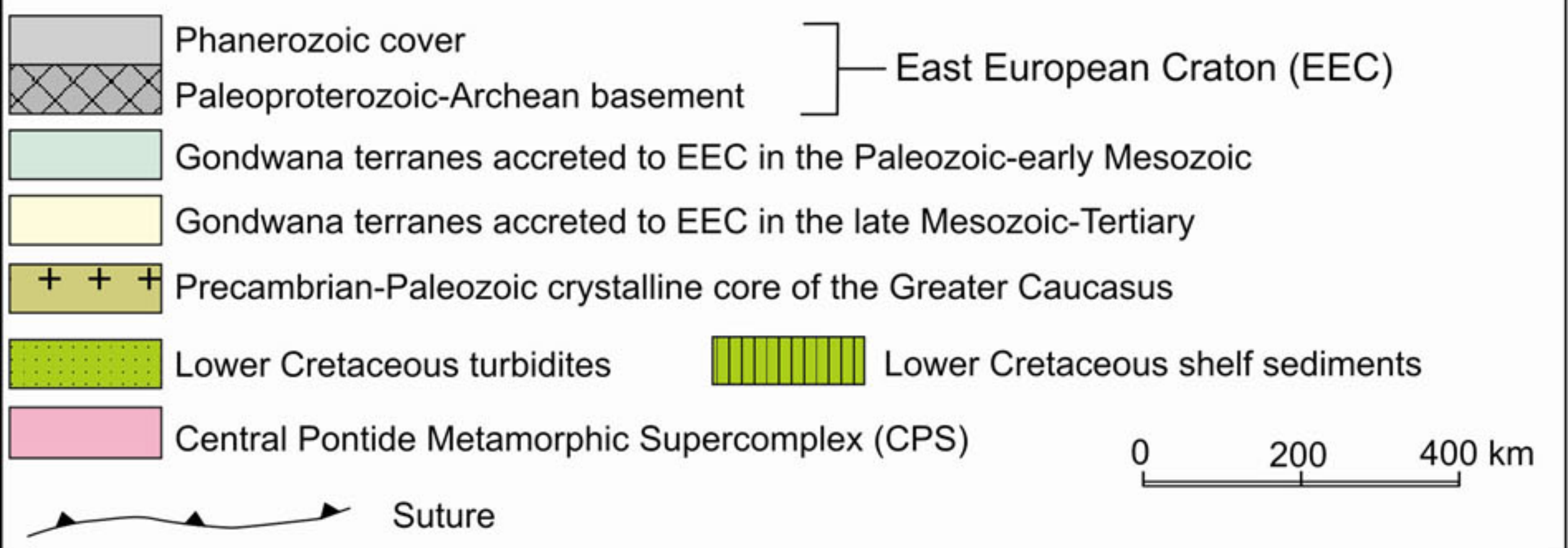








Source of the turbidites



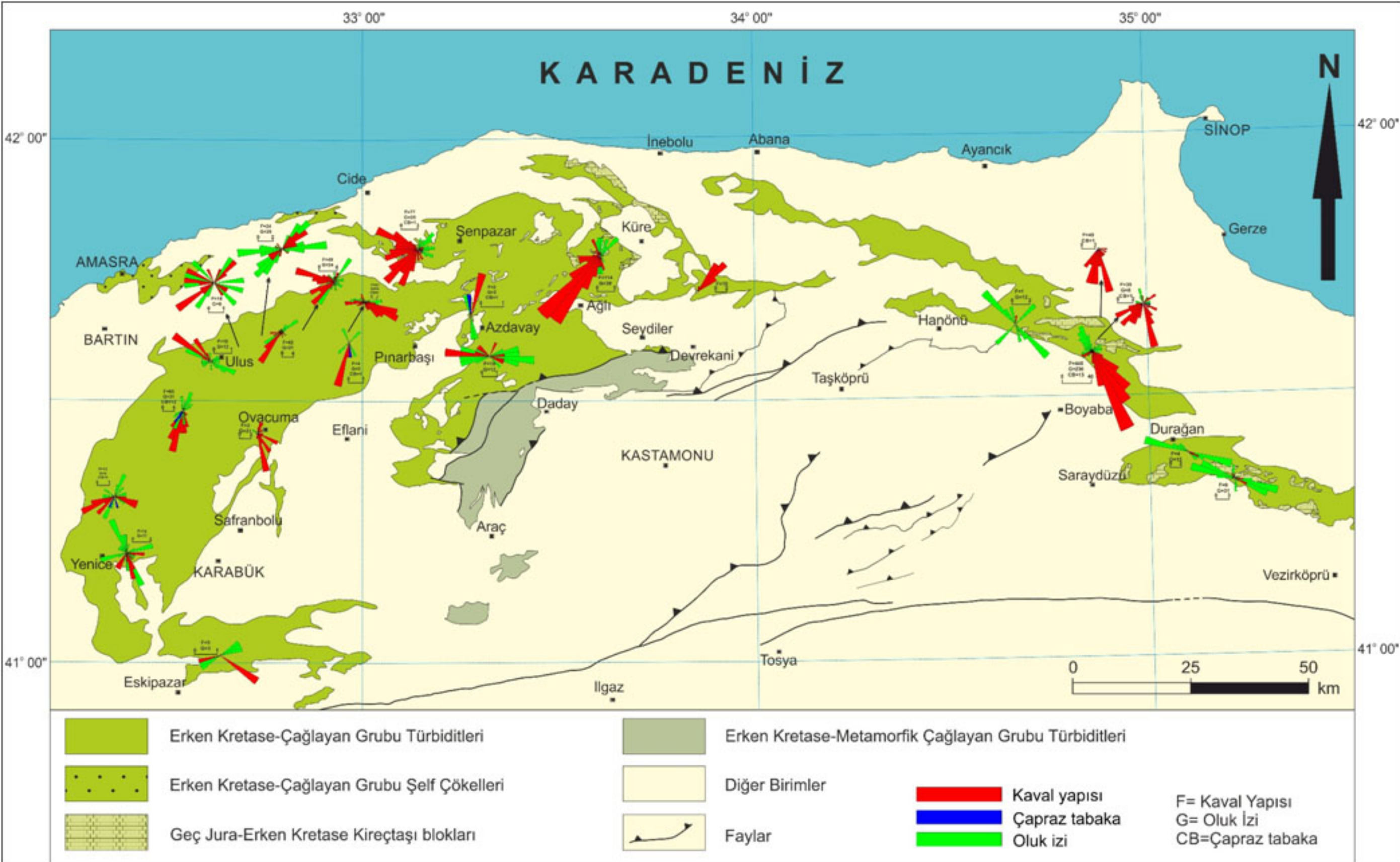


# Paleocurrents



15 07 2013







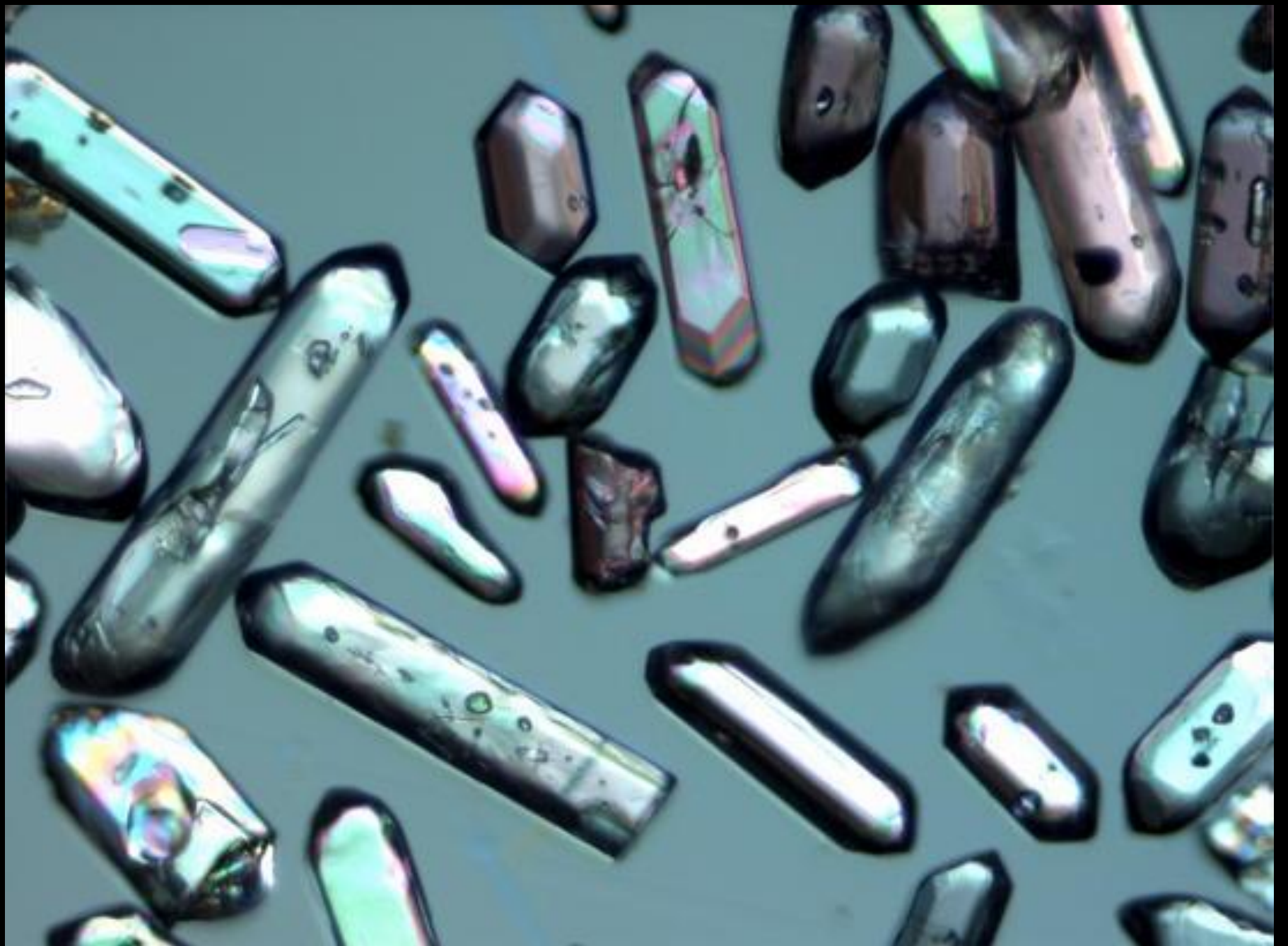
# Detrital zircon geochronology by ICP-MS







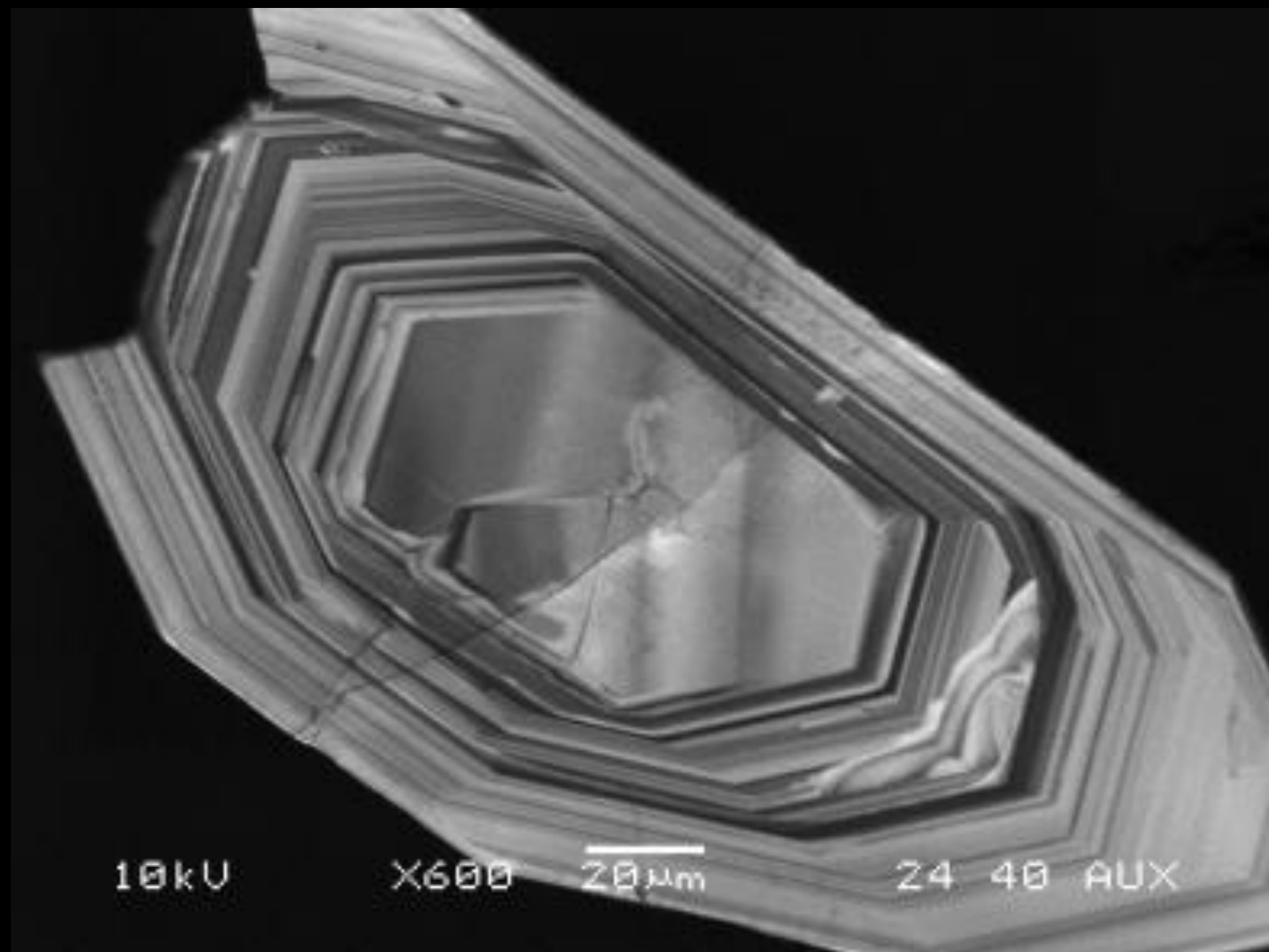




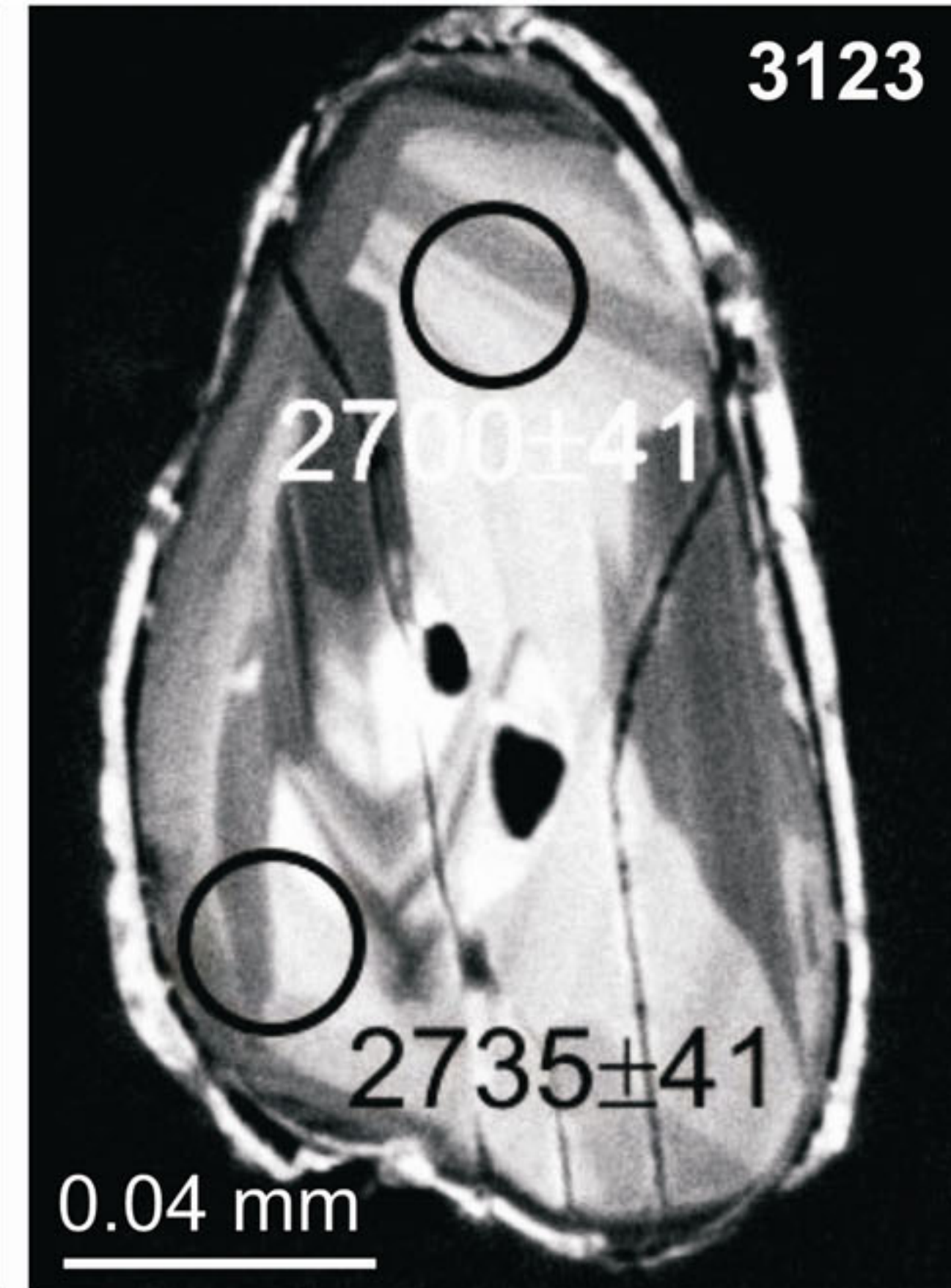
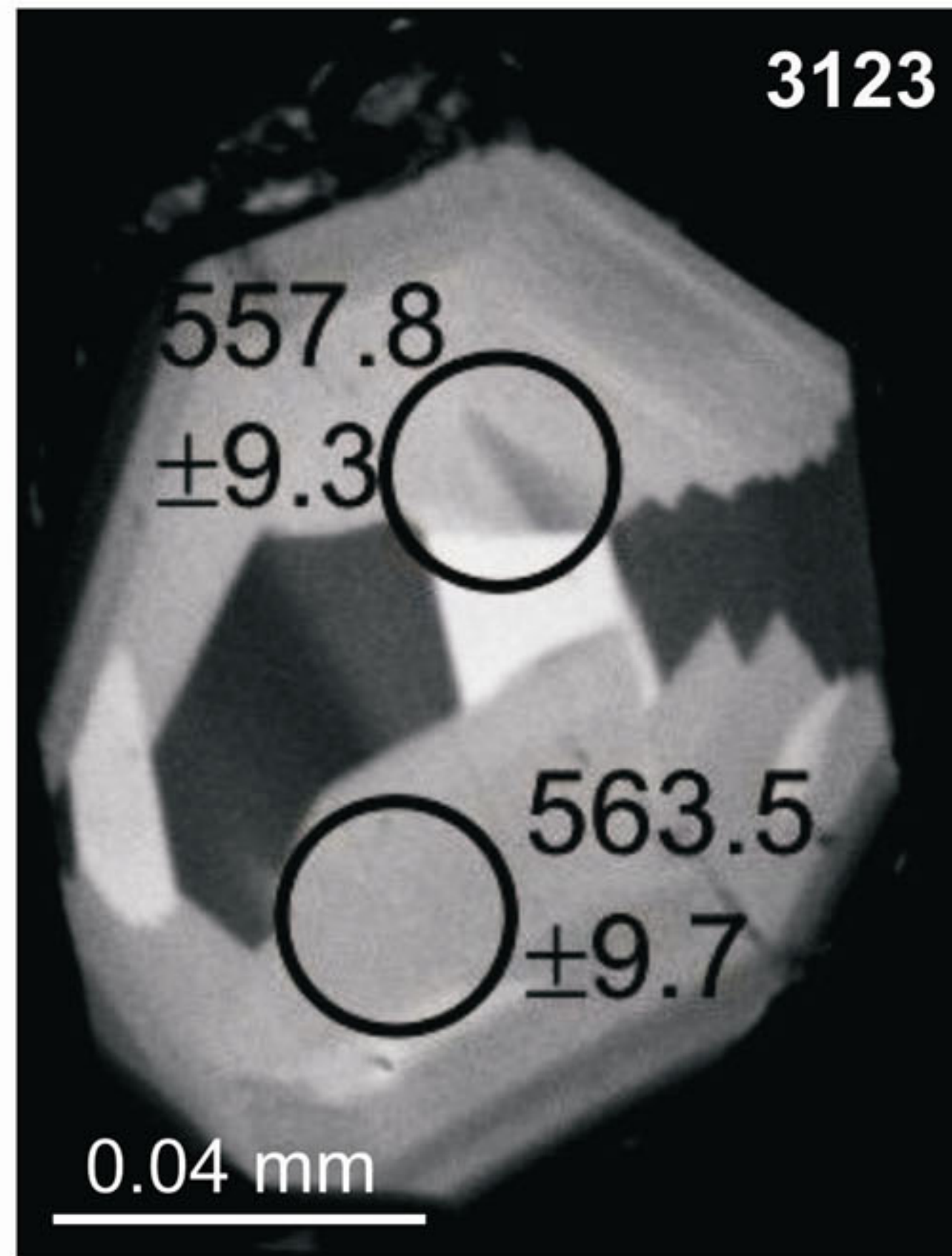
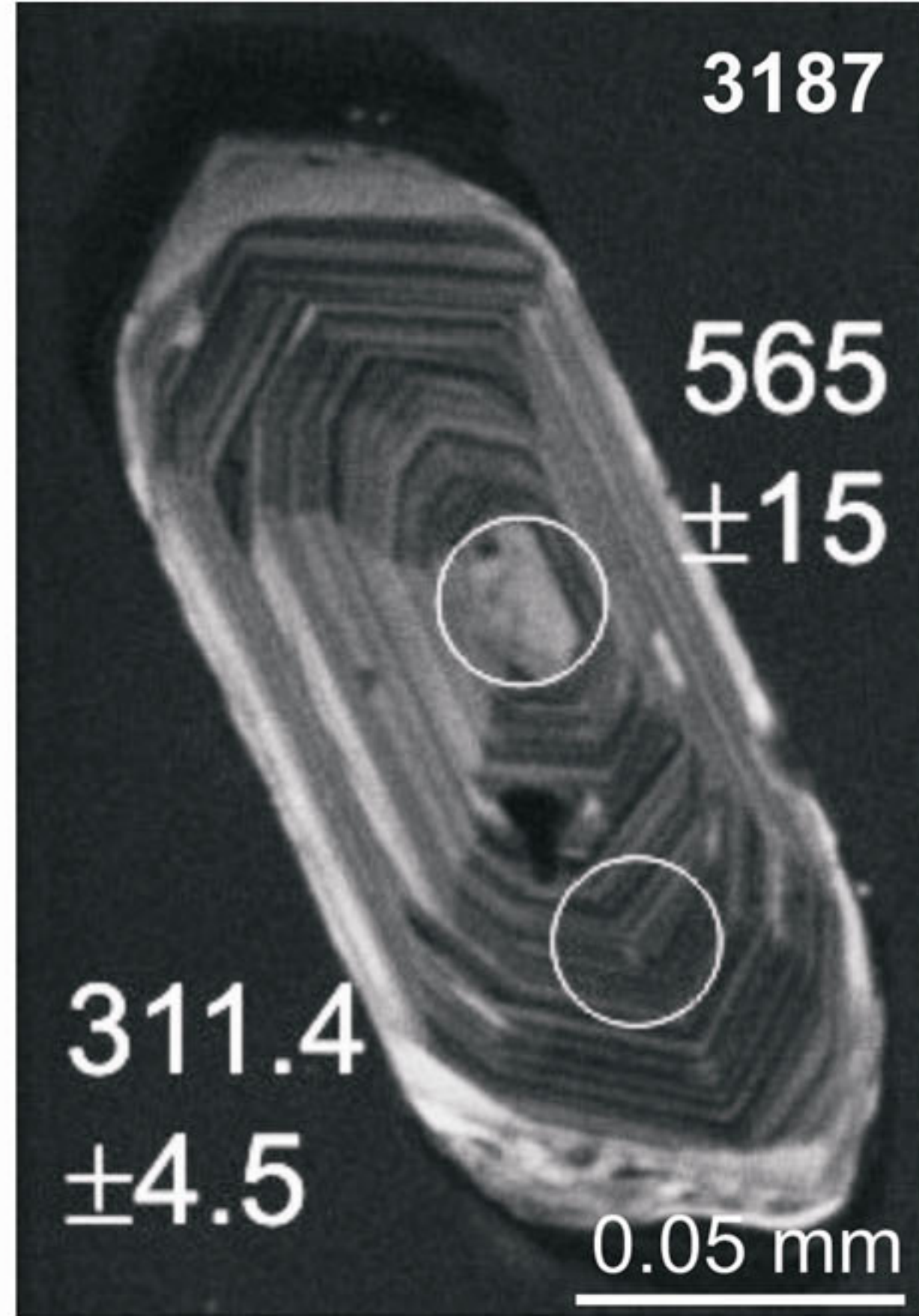
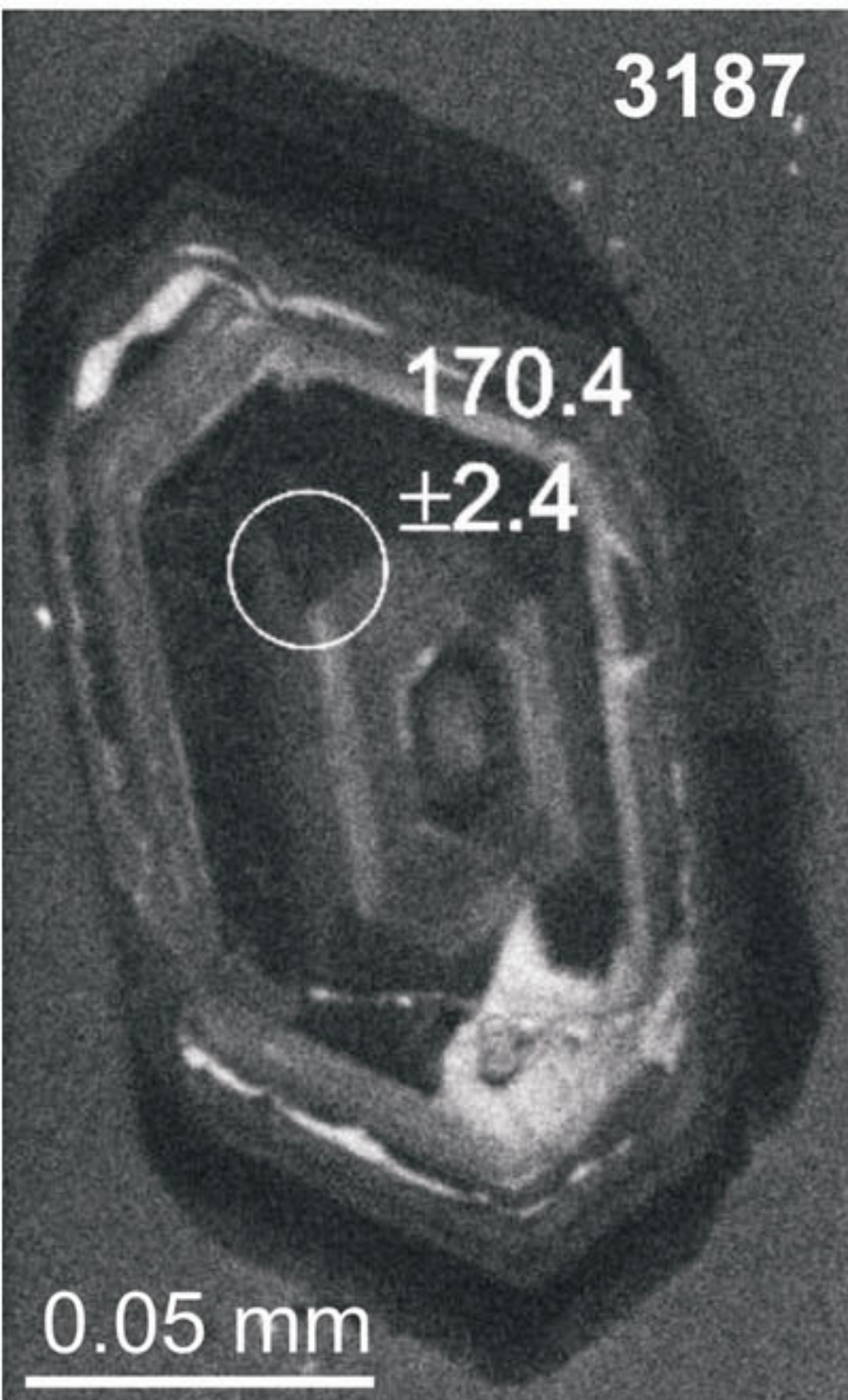




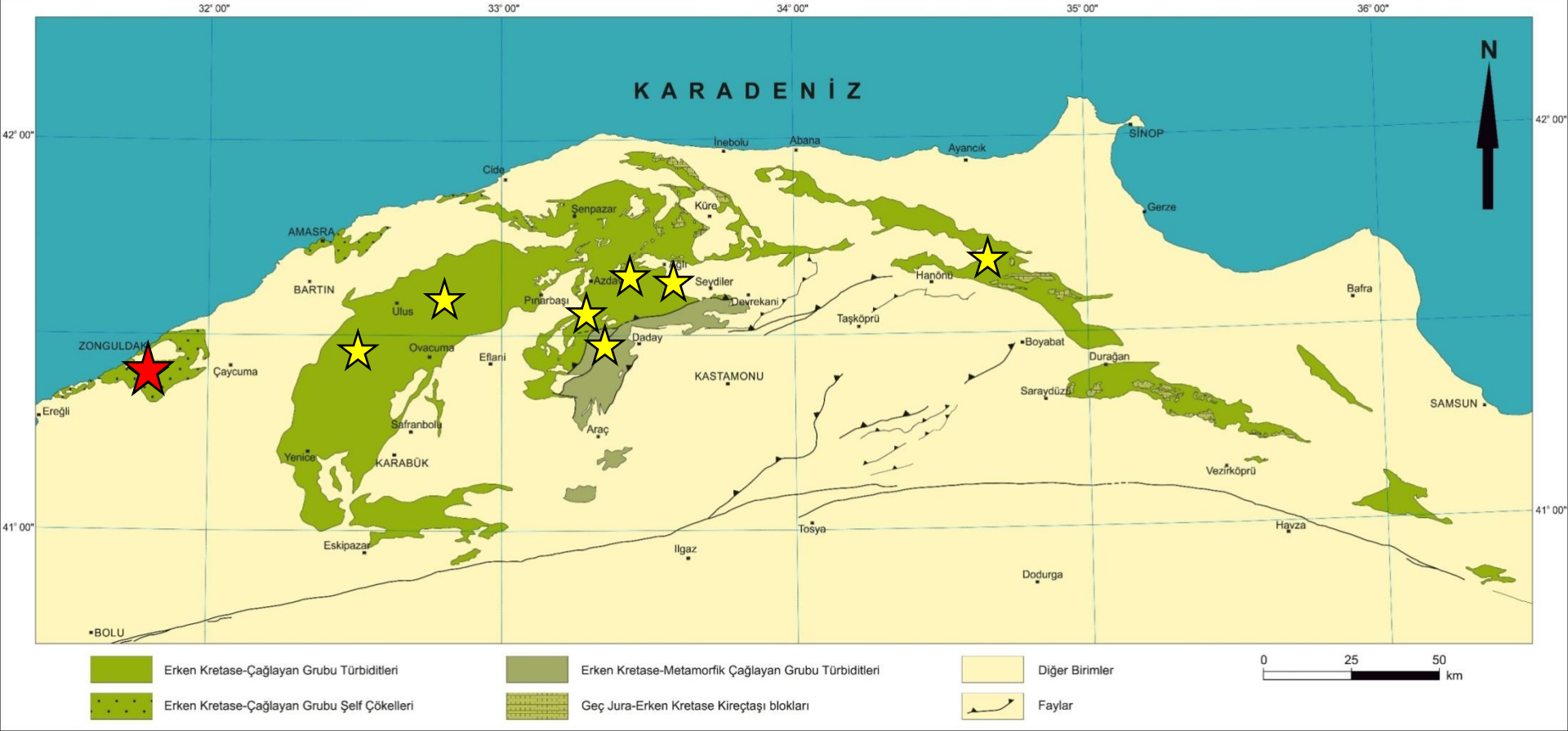








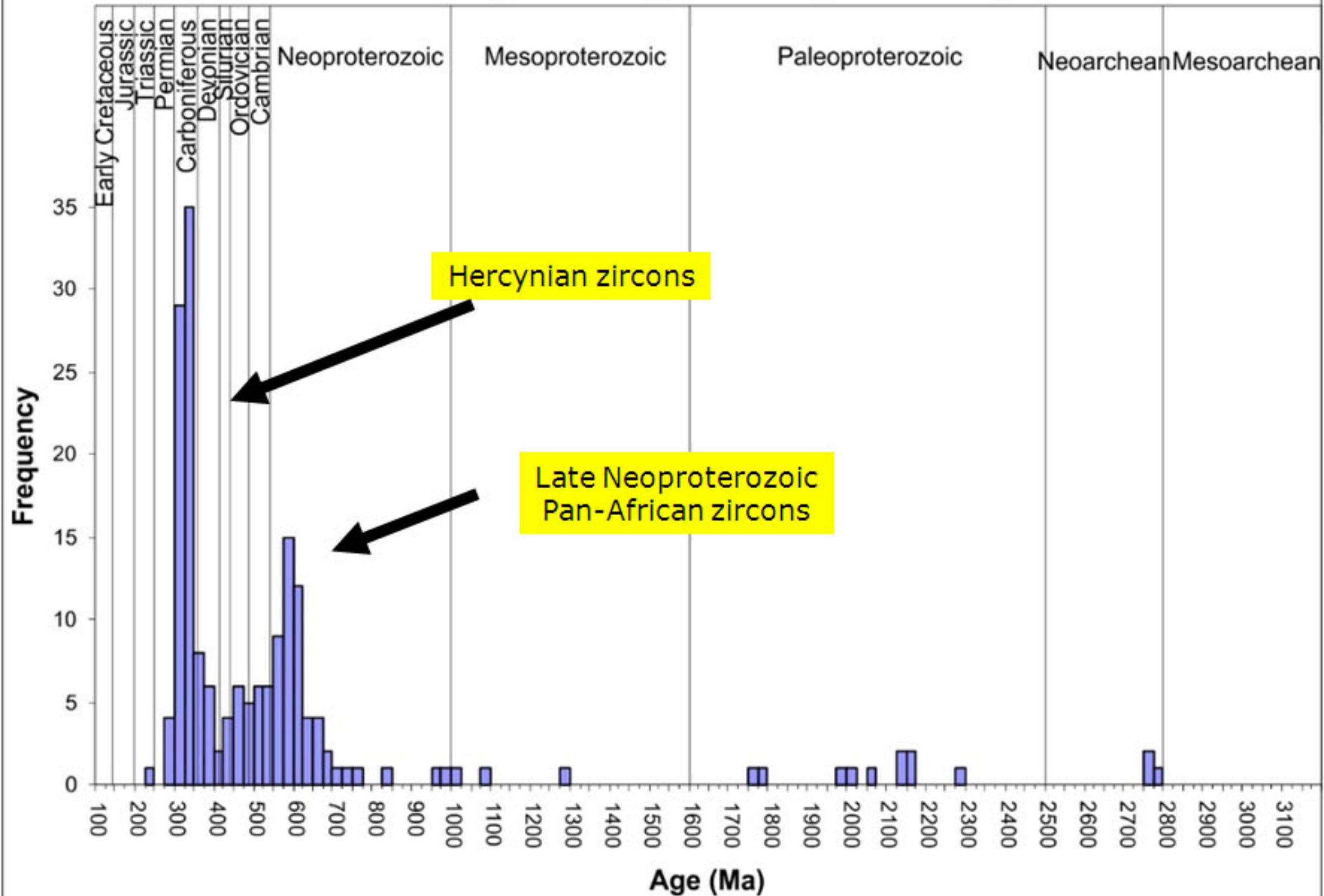






**Samples 1A, 13, 22A n=180**

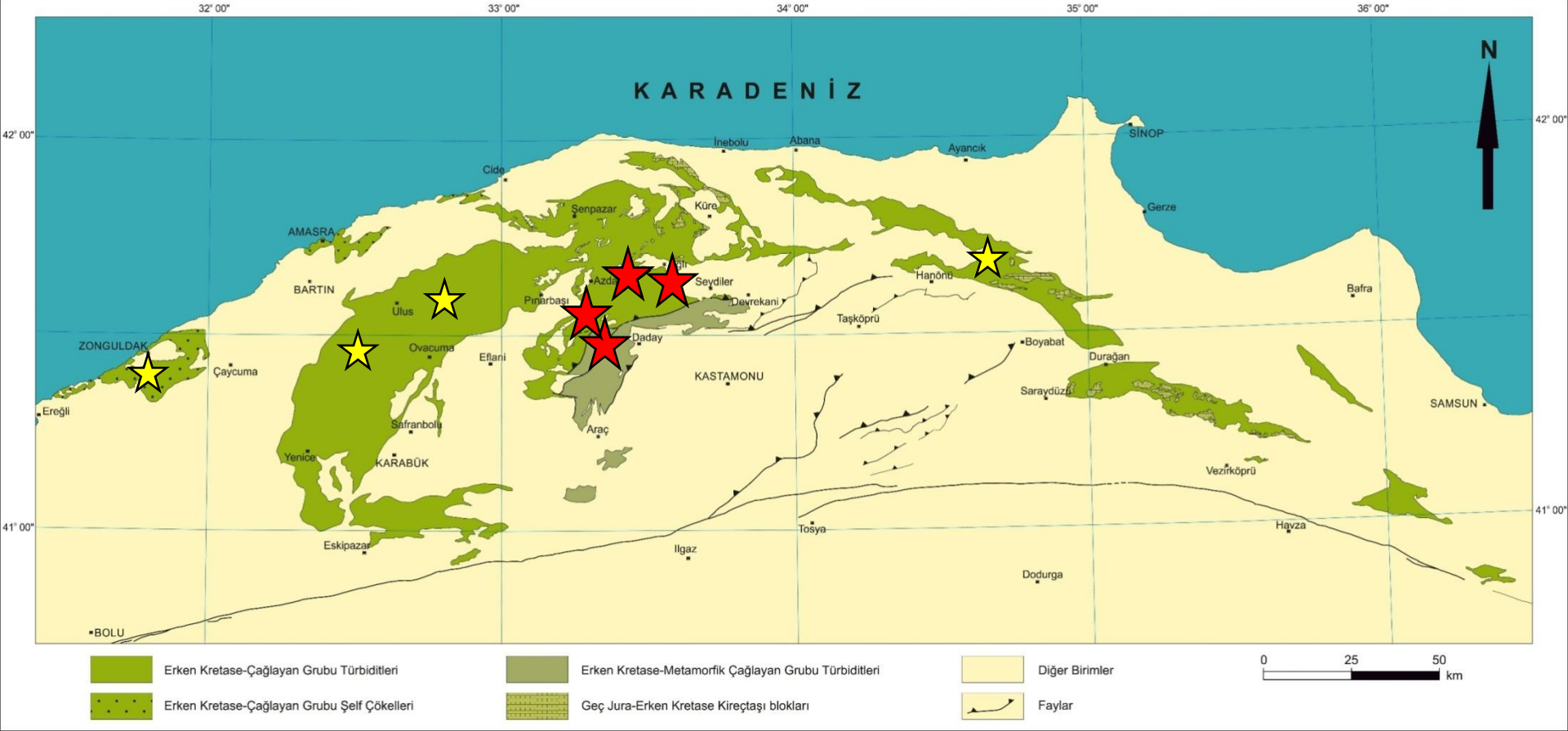
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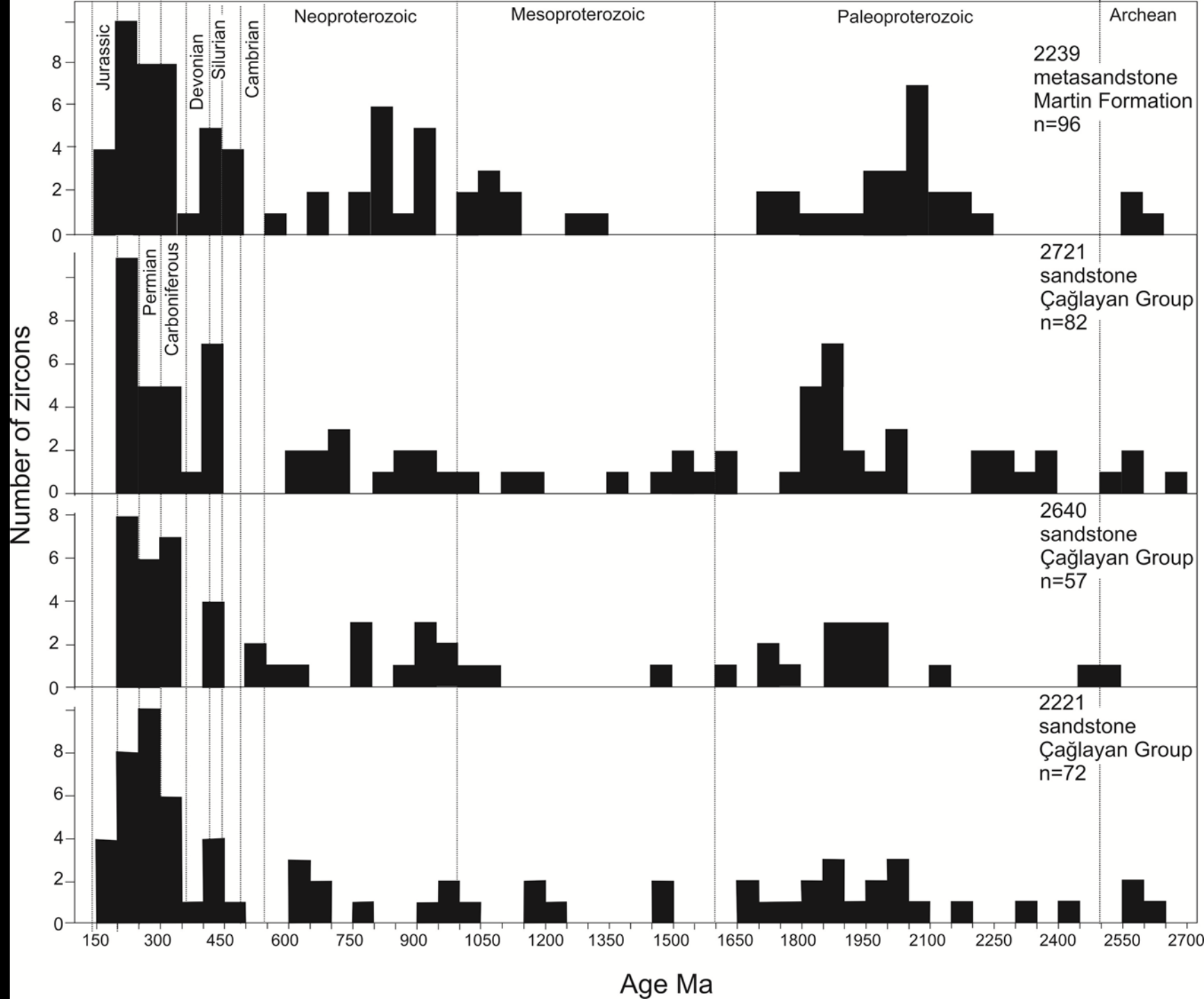




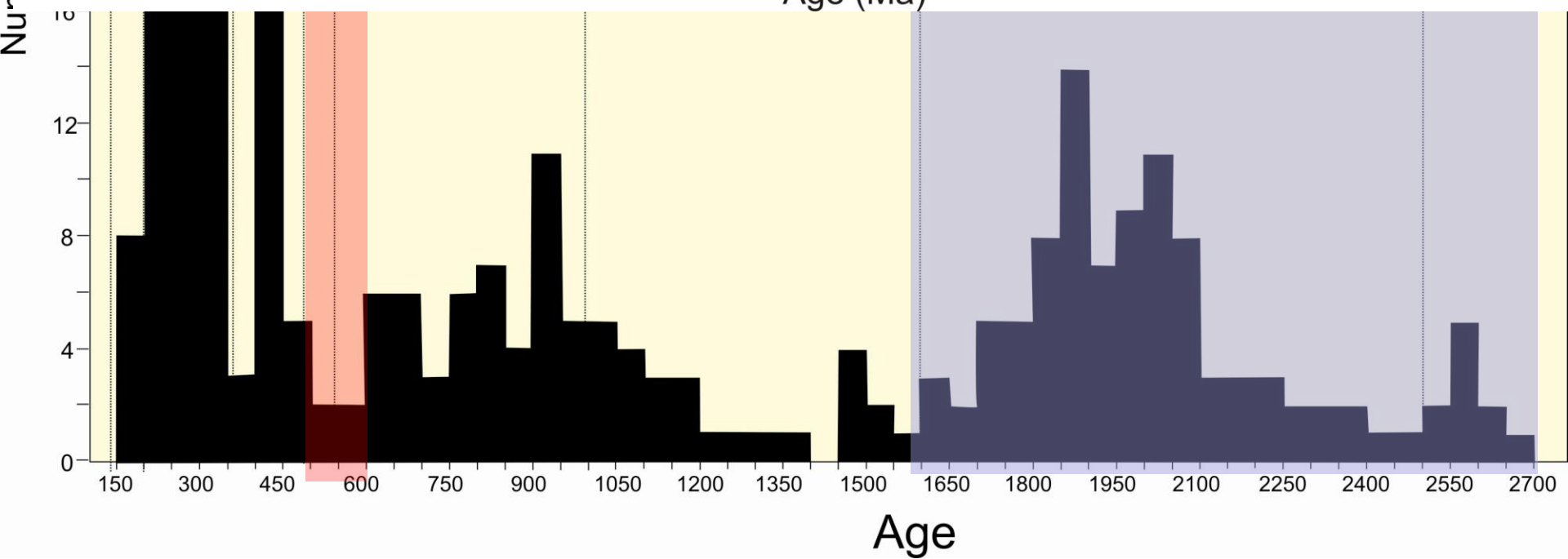
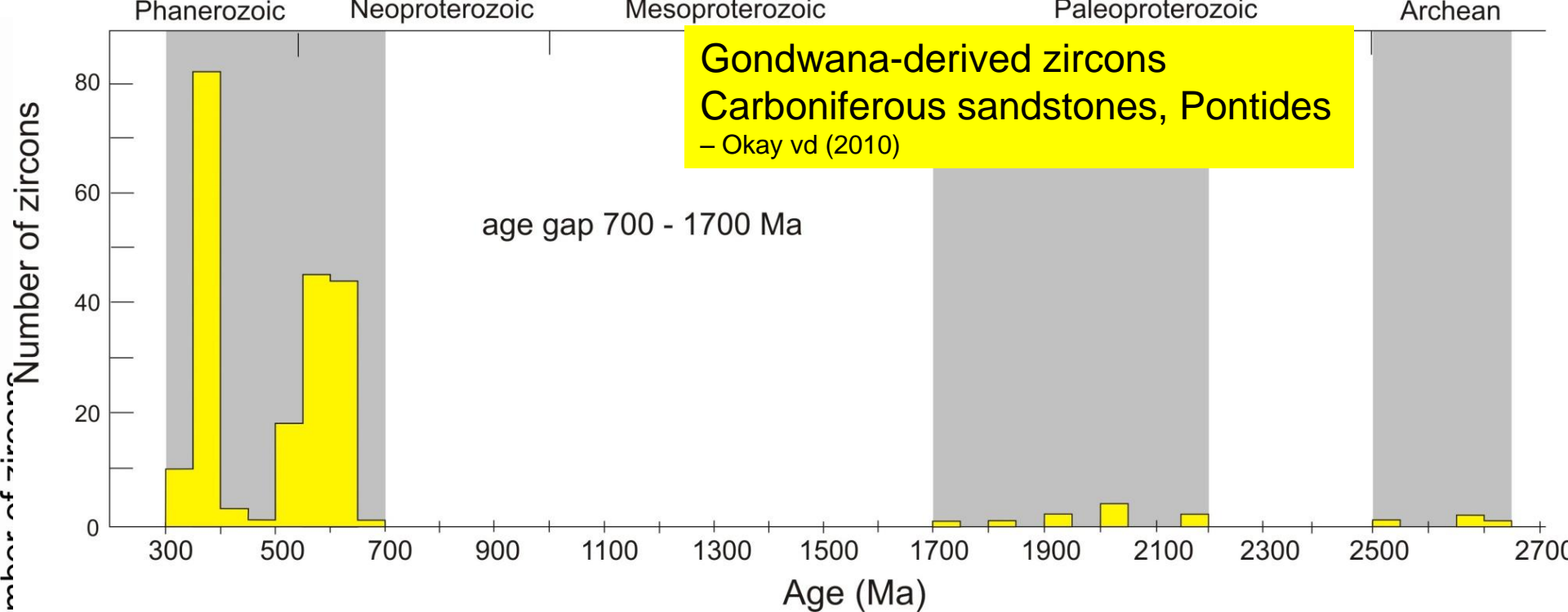












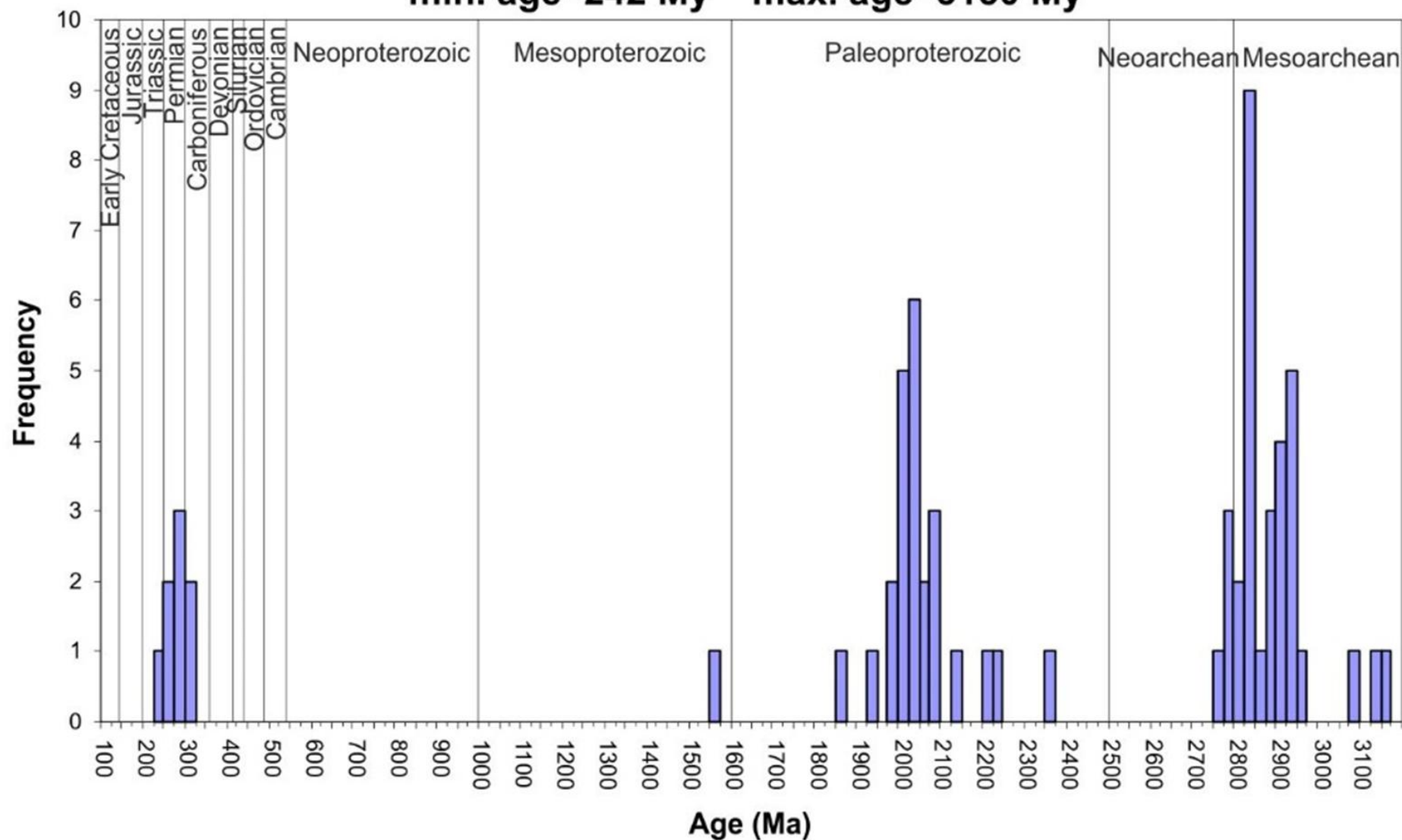




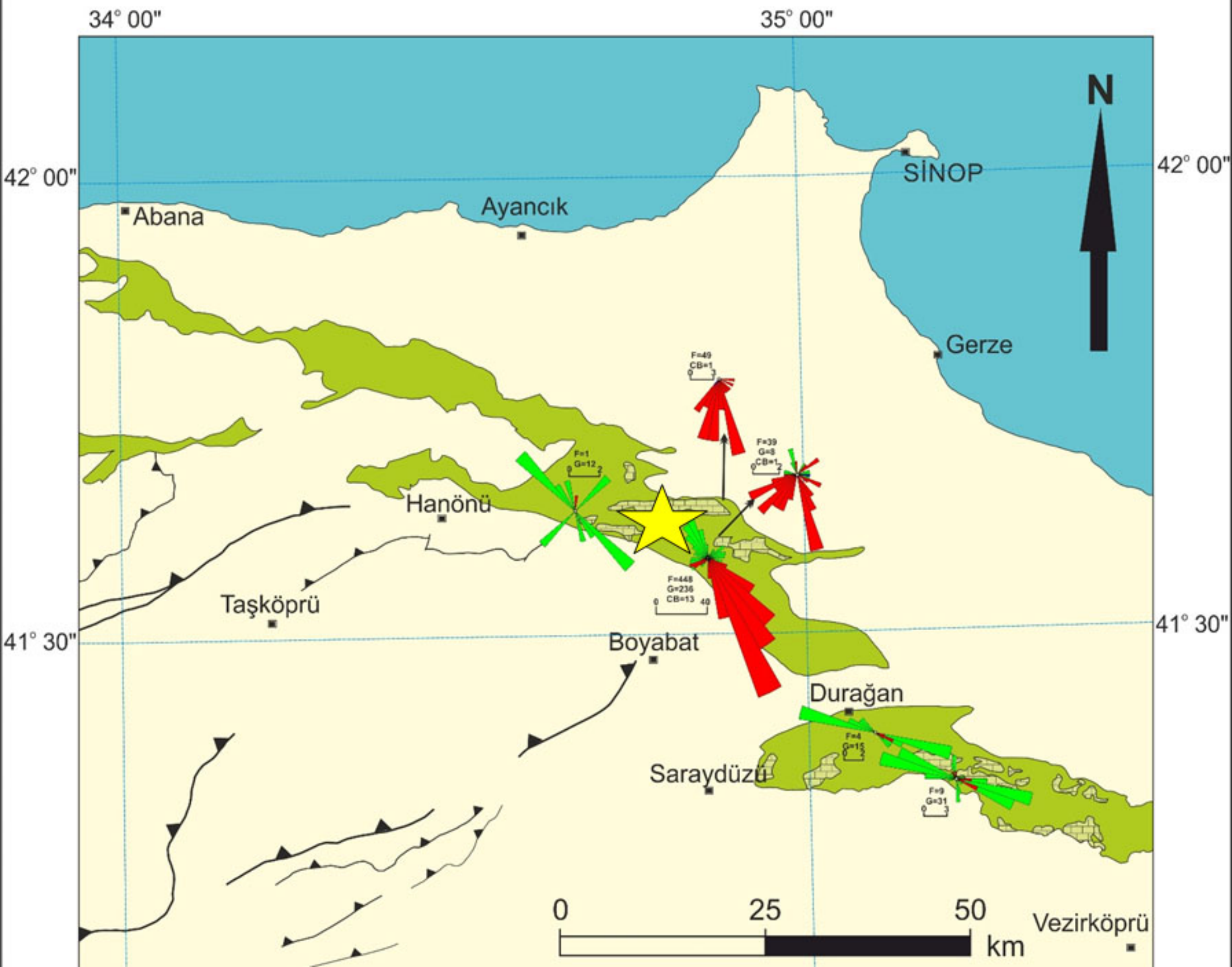


38 n=65

min. age=242 My max. age=3150 My



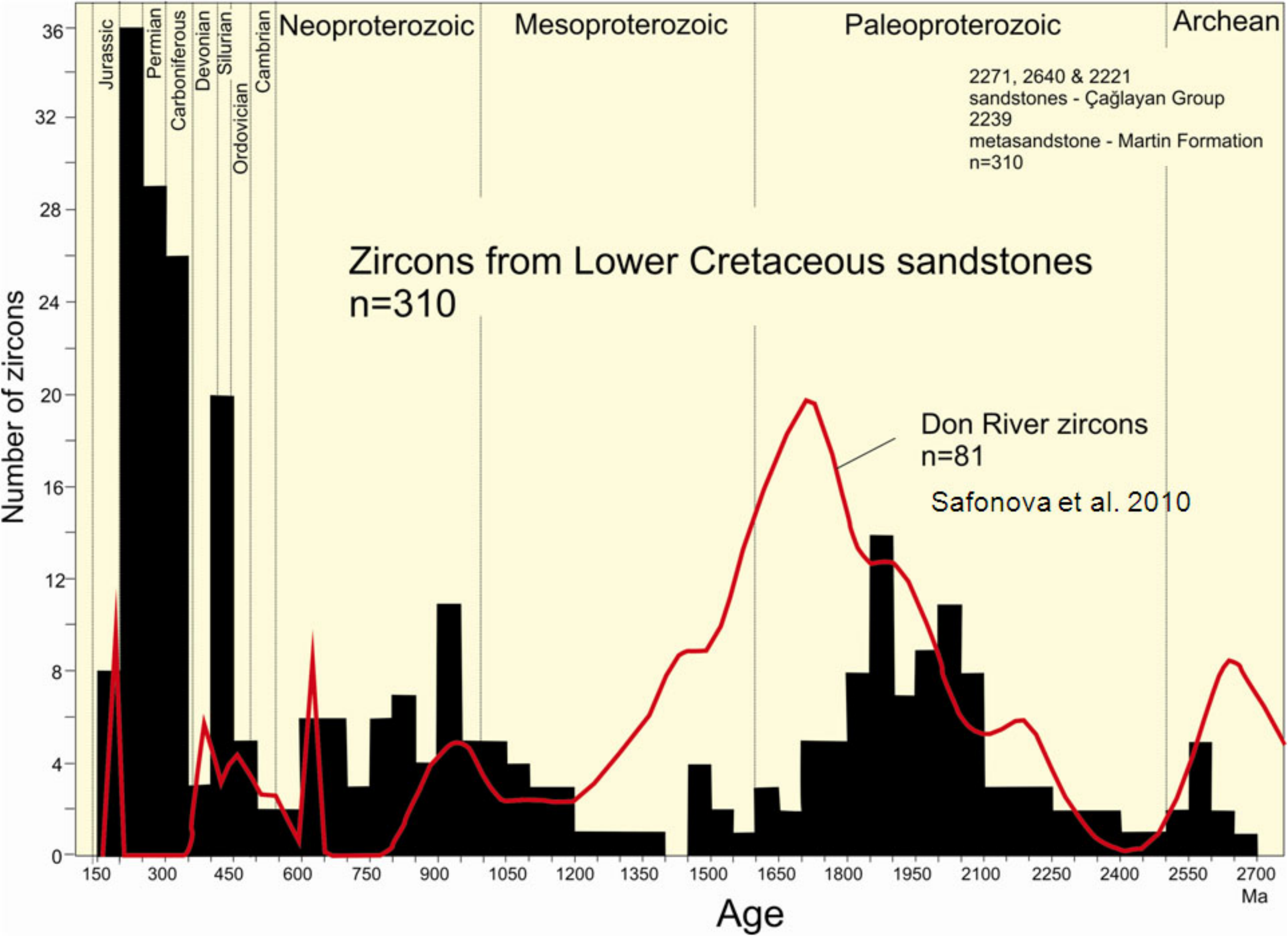


















Early Cretaceous  
(Barremian - Aptian)  
130-110 Ma

EAST EUROPEAN CRATON

Donbas Foldbelt

Karpinsky Swell

Depositional area  
Of the Çağlayan Group

Scythian Platform  
Crimea

Dobrugea

Moesia

Strandja Massif

Istanbul Zone

Mid-Black Sea Ridge  
Sakarya Zone

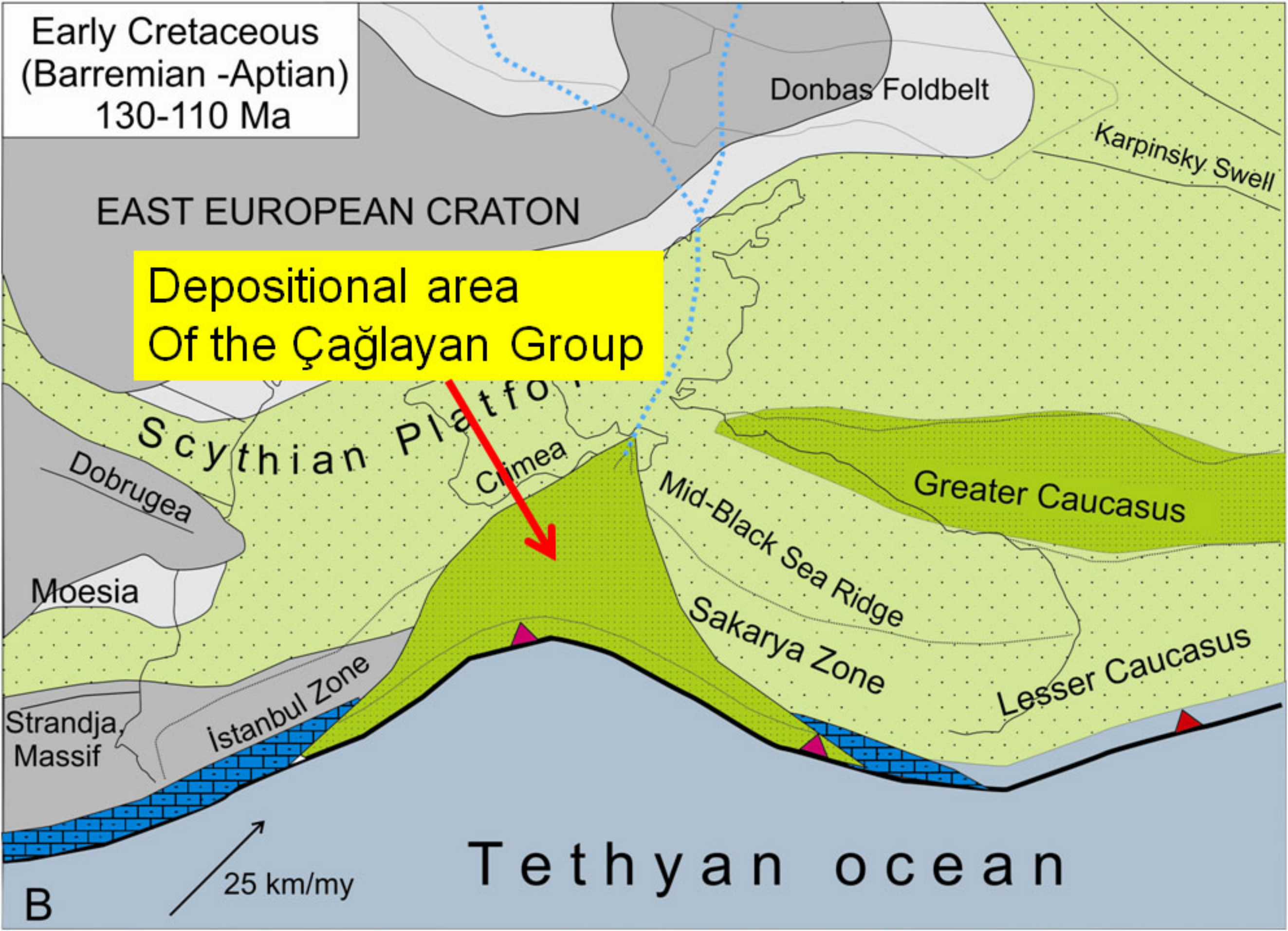
Greater Caucasus

Lesser Caucasus

Tethyan ocean

B

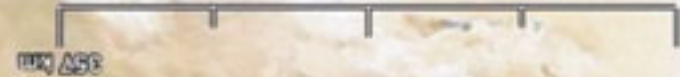
25 km/my



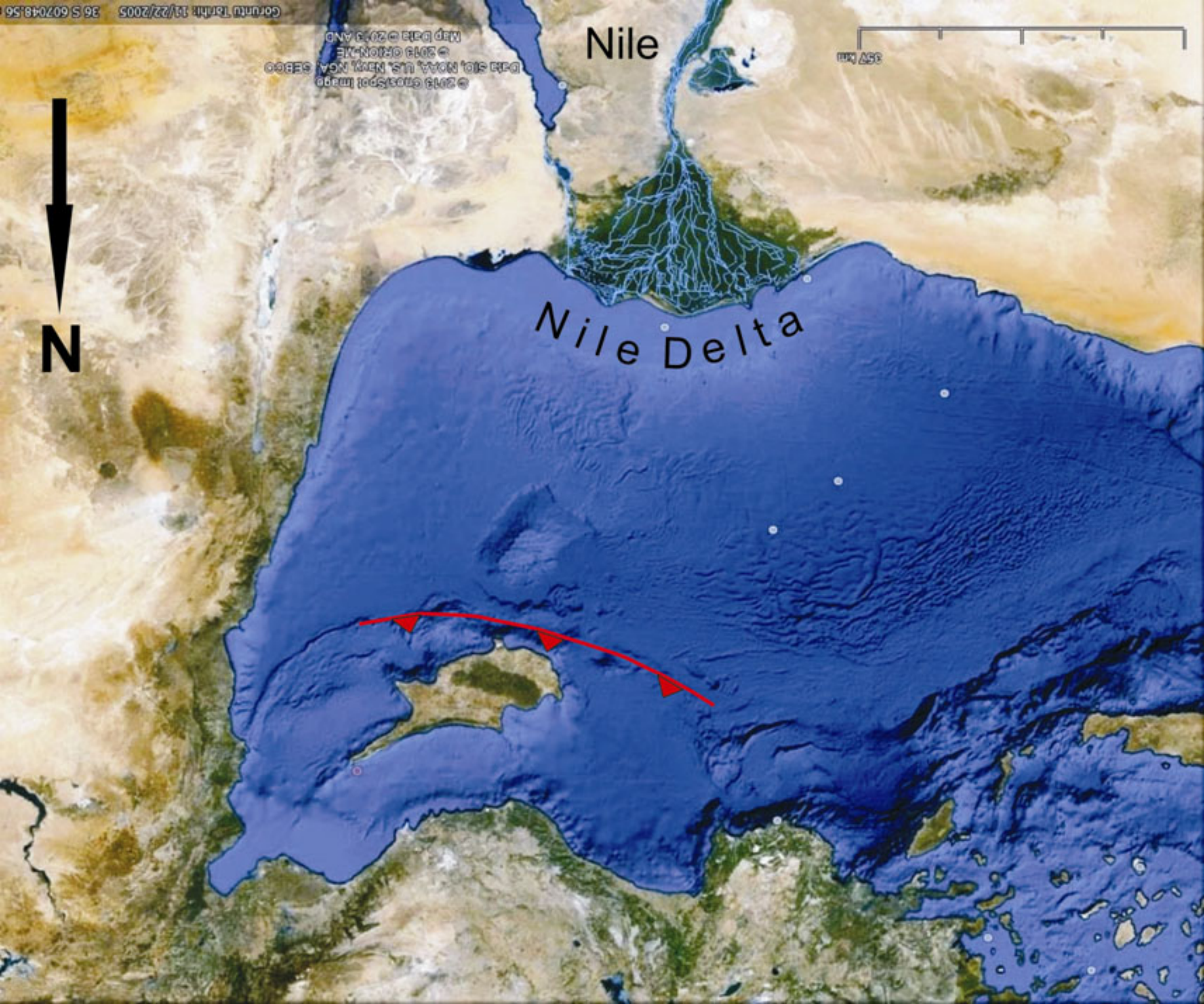


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Nile



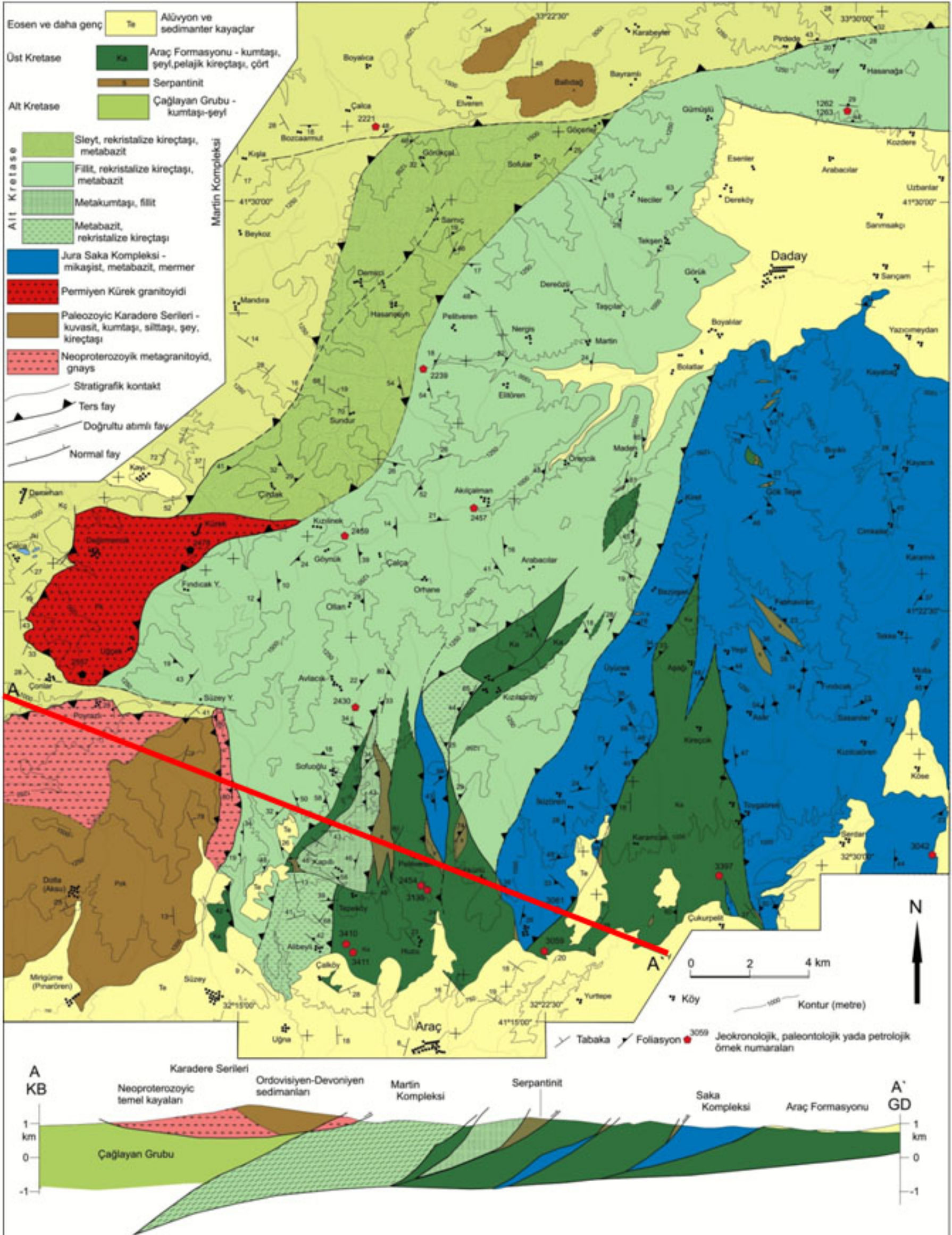
Nile Delta



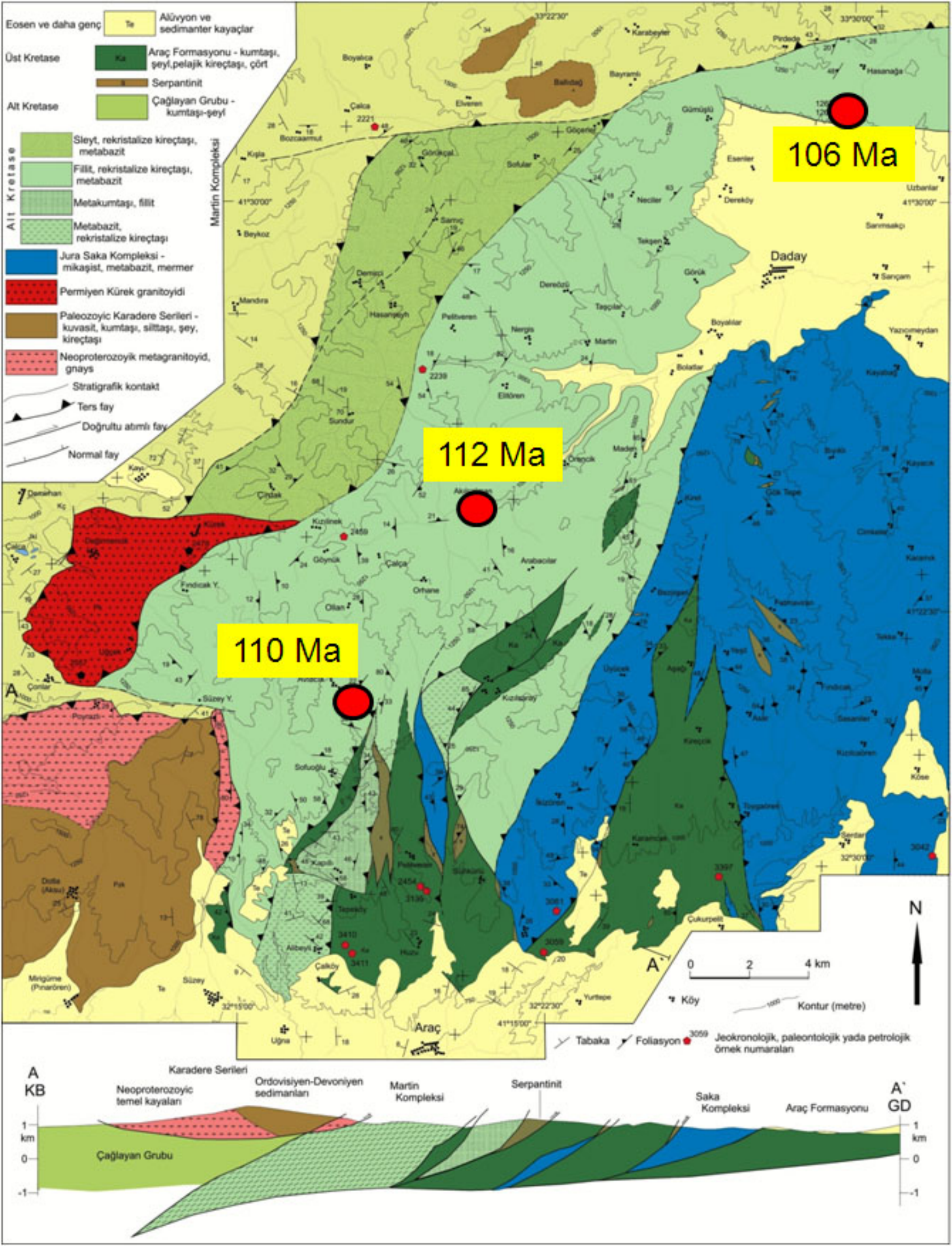




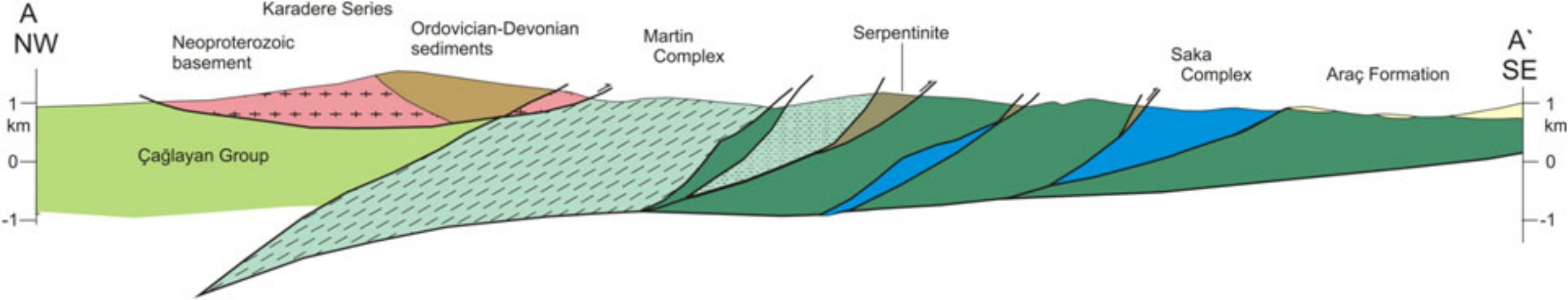






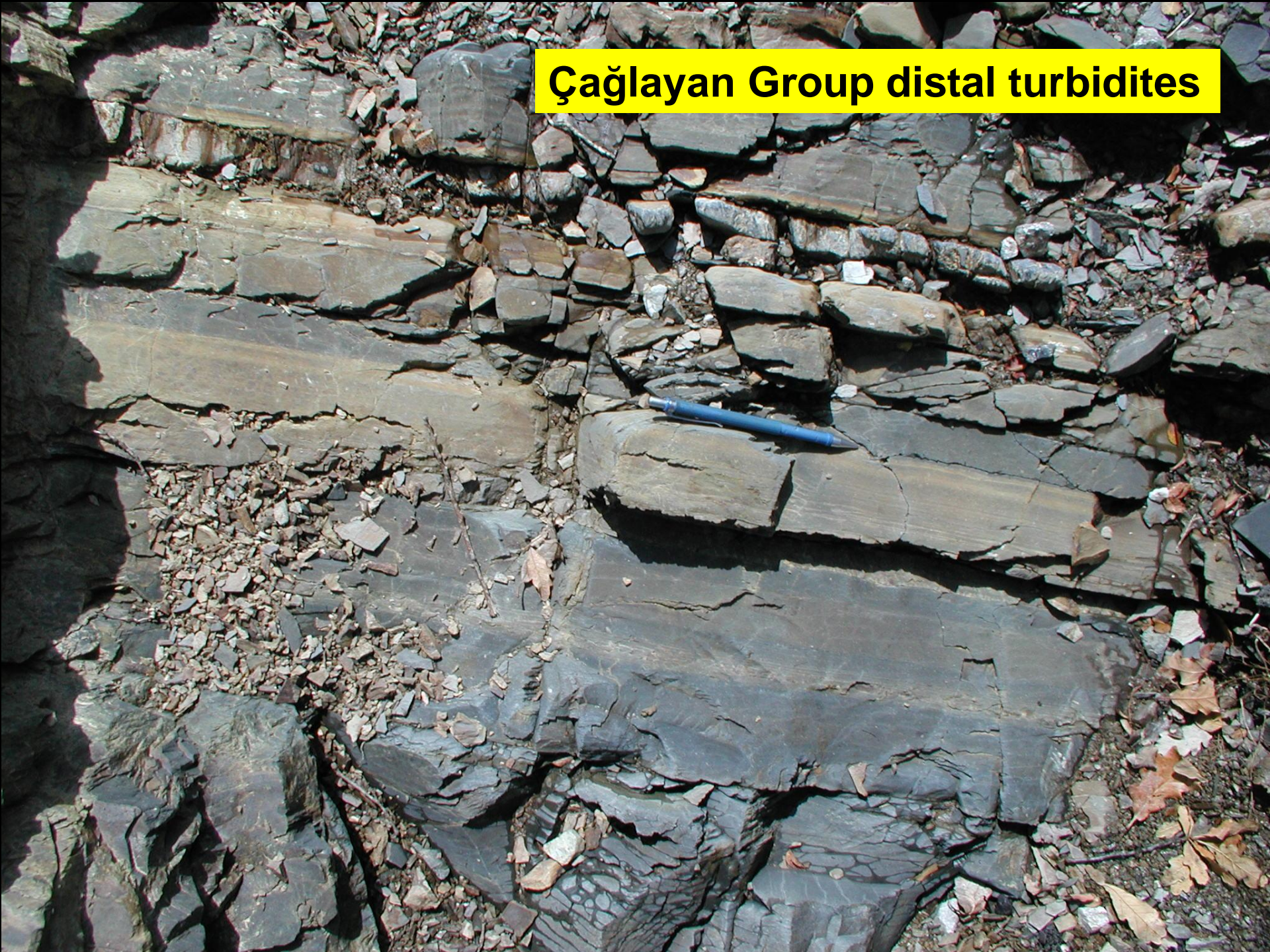








# Çağlayan Group distal turbidites

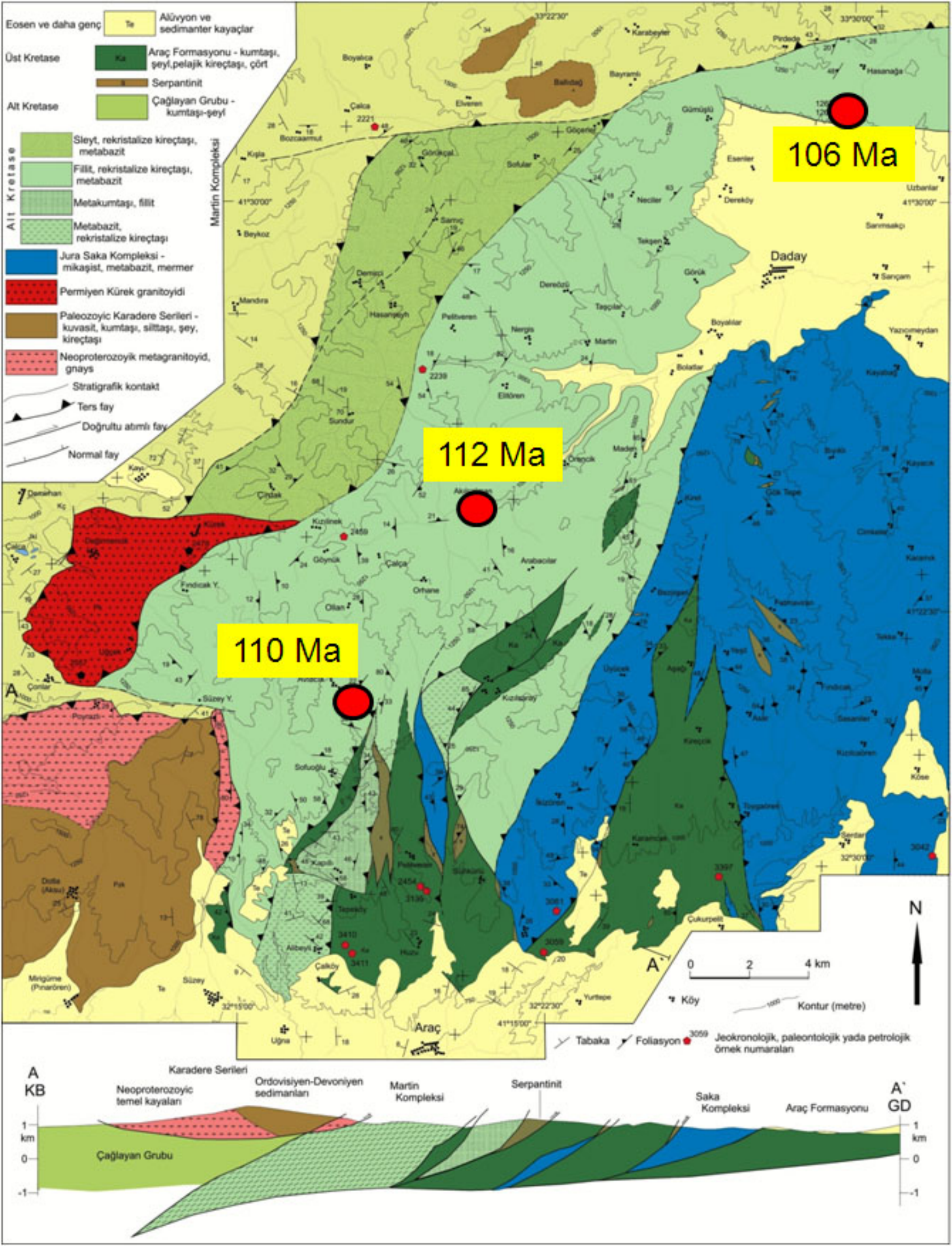




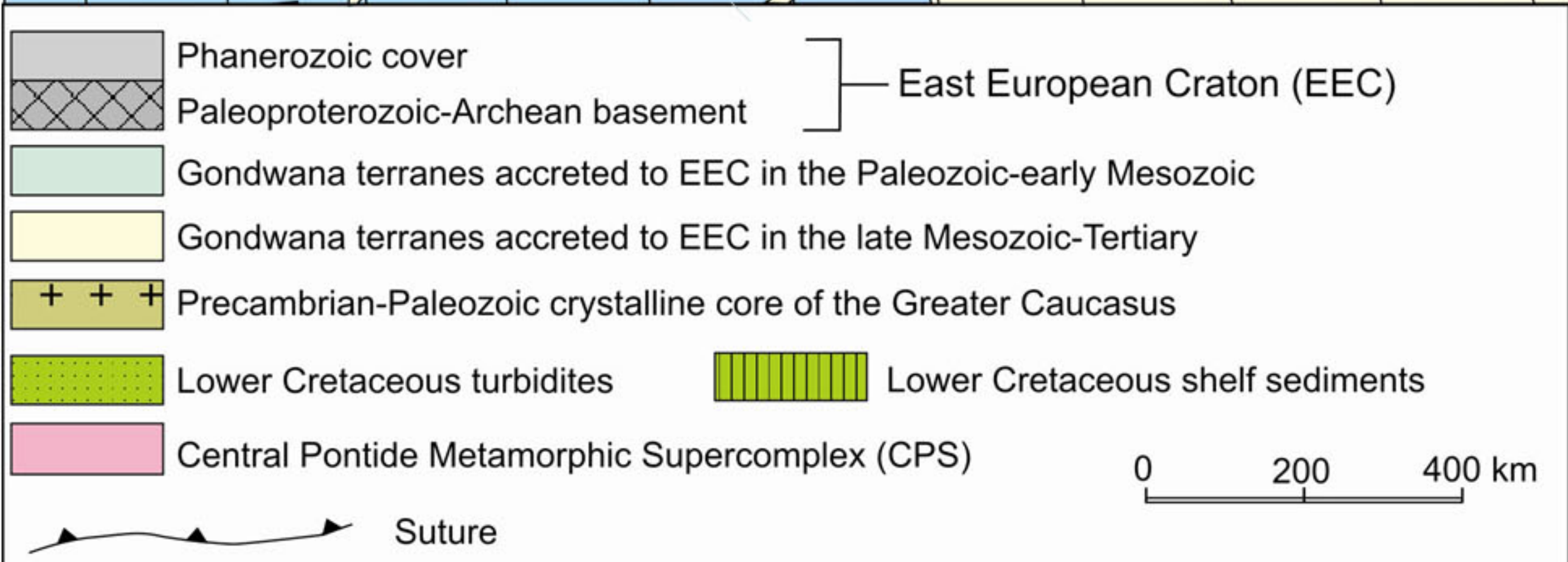
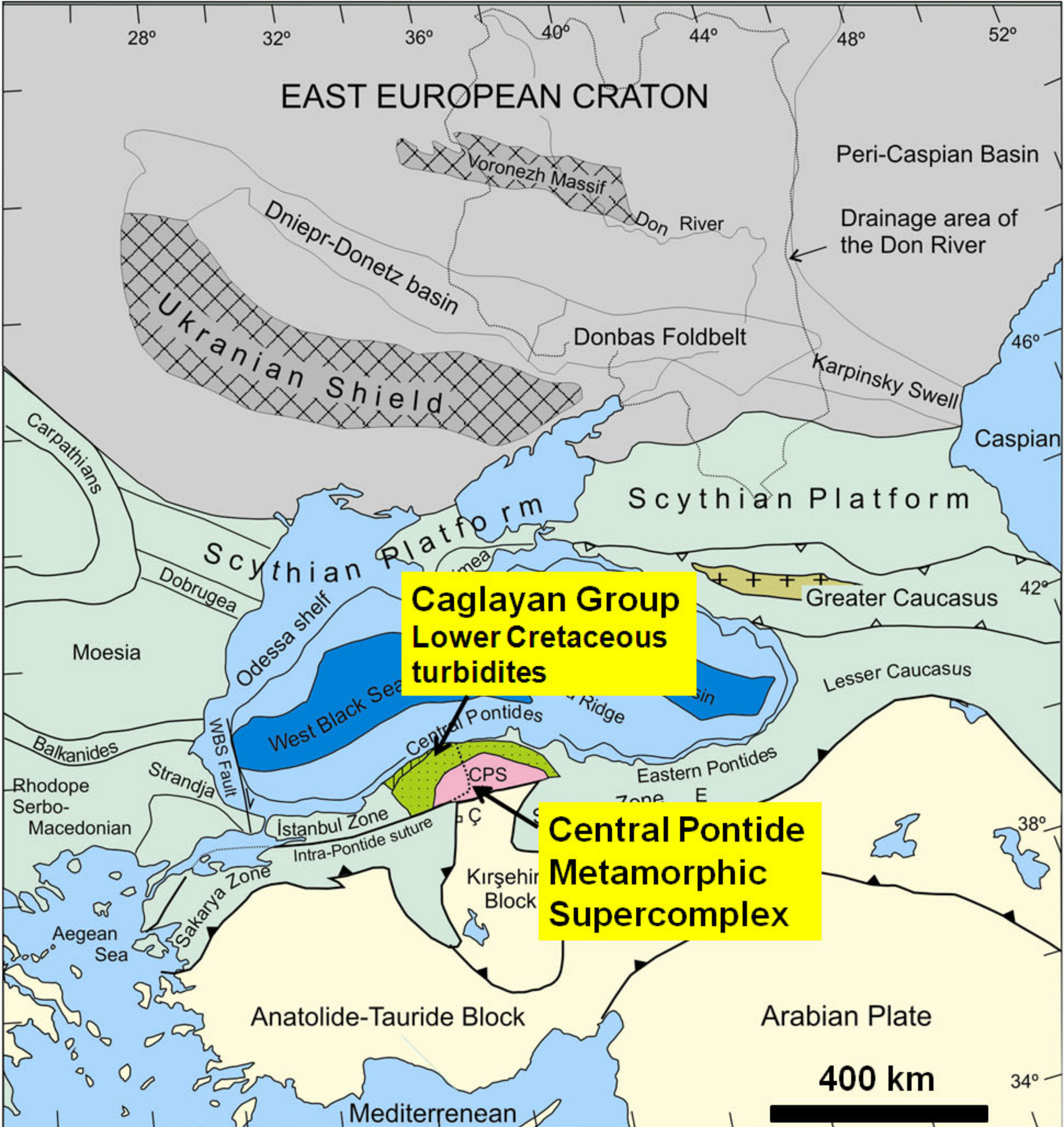
## Slate and phyllites







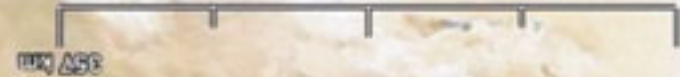






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Nile

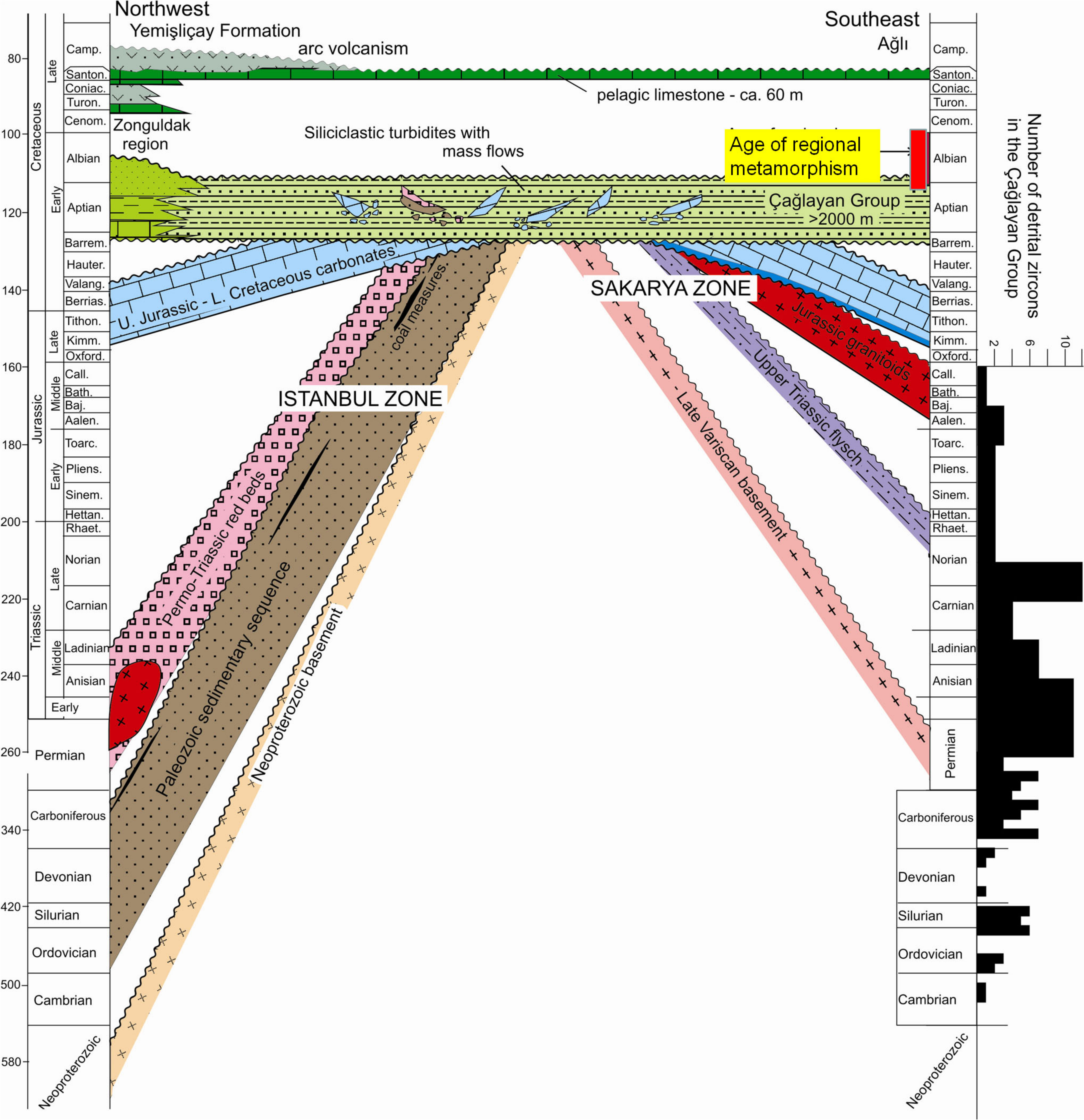


N

Nile Delta





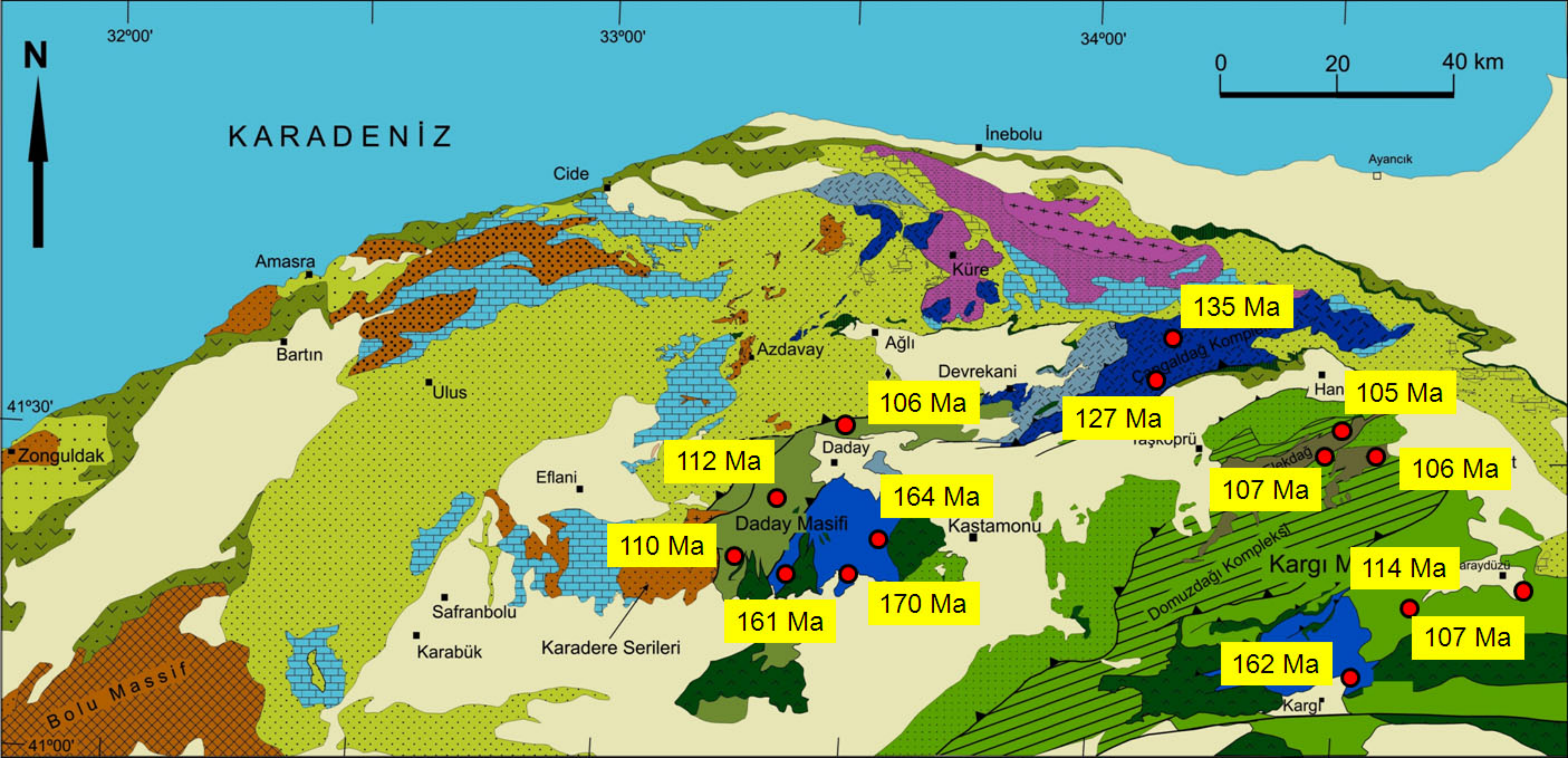




# Conclusions

1. A Early Cretaceous submarine fan on the southern margin of Eurasia fed by major river/s.
2. Distal turbidites of the fan were entrained in a subduction zone and were metamorphosed in the Early Cretaceous.
3. Metamorphic area in the southern Central Pontides previously considered Triassic and older, is of Cretaceous and Jurassic in age.
4. There was no Black Sea basin in the Early Cretaceous.
5. Early Cretaceous rifting and Late Cretaceous opening of the West Black Sea Basin are probably separate events.







Lower Cretaceous

Jurassic

Upper Triassic

S

KARGI  
COMPLEX

DOMUZDAĞ-  
SARAYCIKDAĞ  
UNIT

ÇANGALDAĞ  
COMPLEX

KÜRE  
BASIN

Jurassic

N

EURASIA

PALAEOTETHYS

Devrekani  
Metamorphite

Late Permian-Early Triassic

