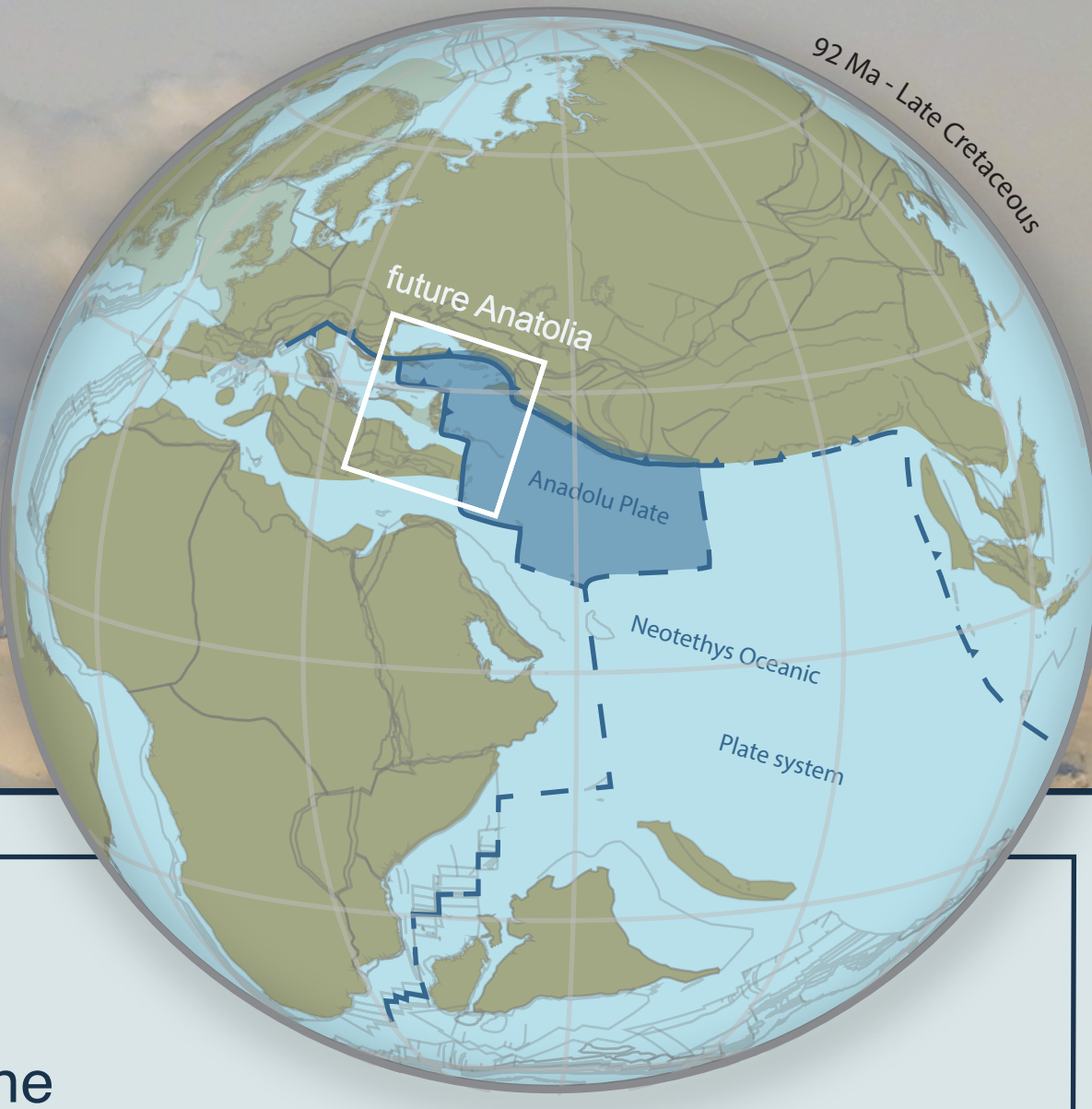


Extensional exhumation of the Afyon high-pressure metamorphic belt along the regional Ivriz detachment, southern central Anatolia

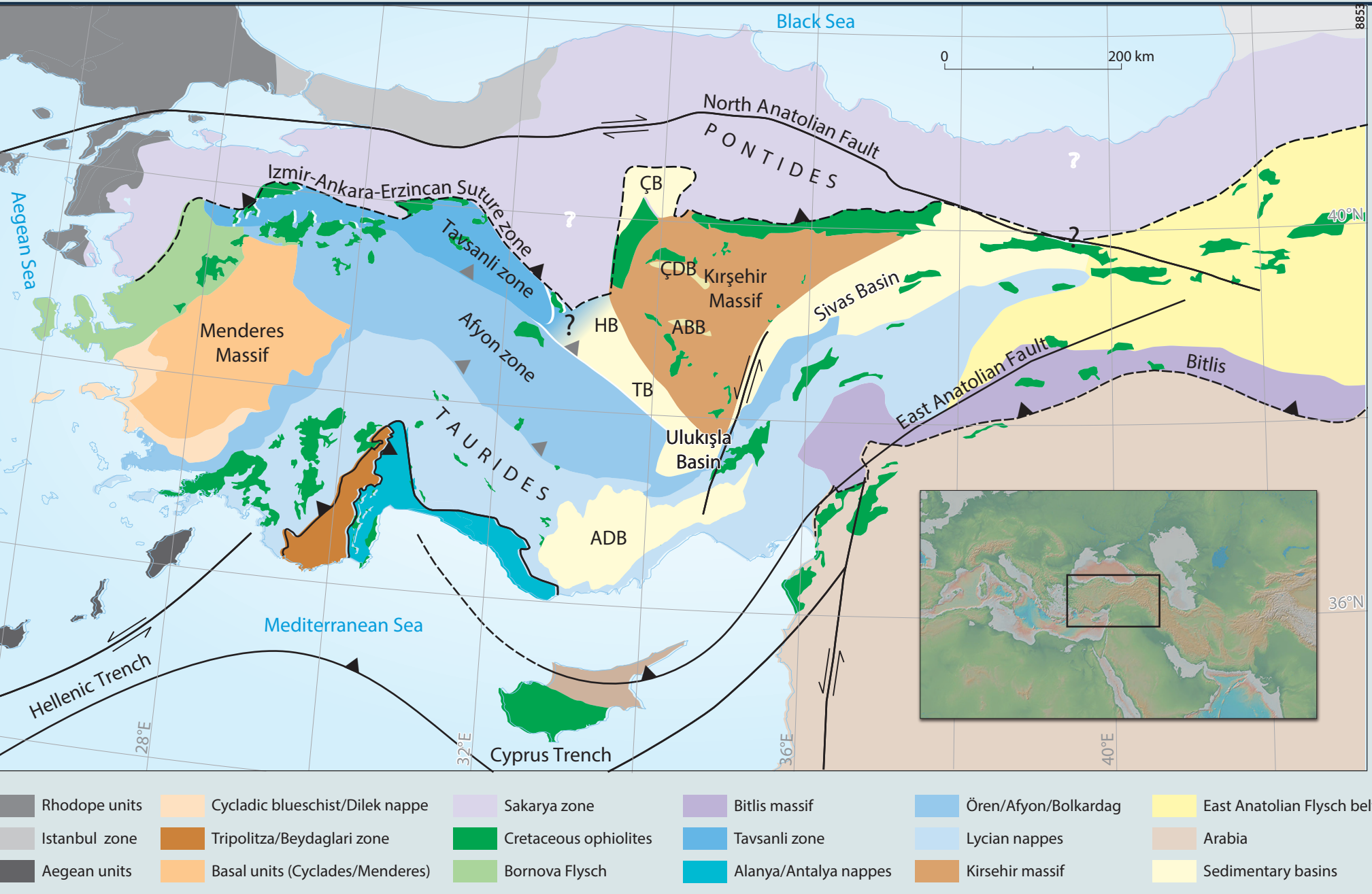
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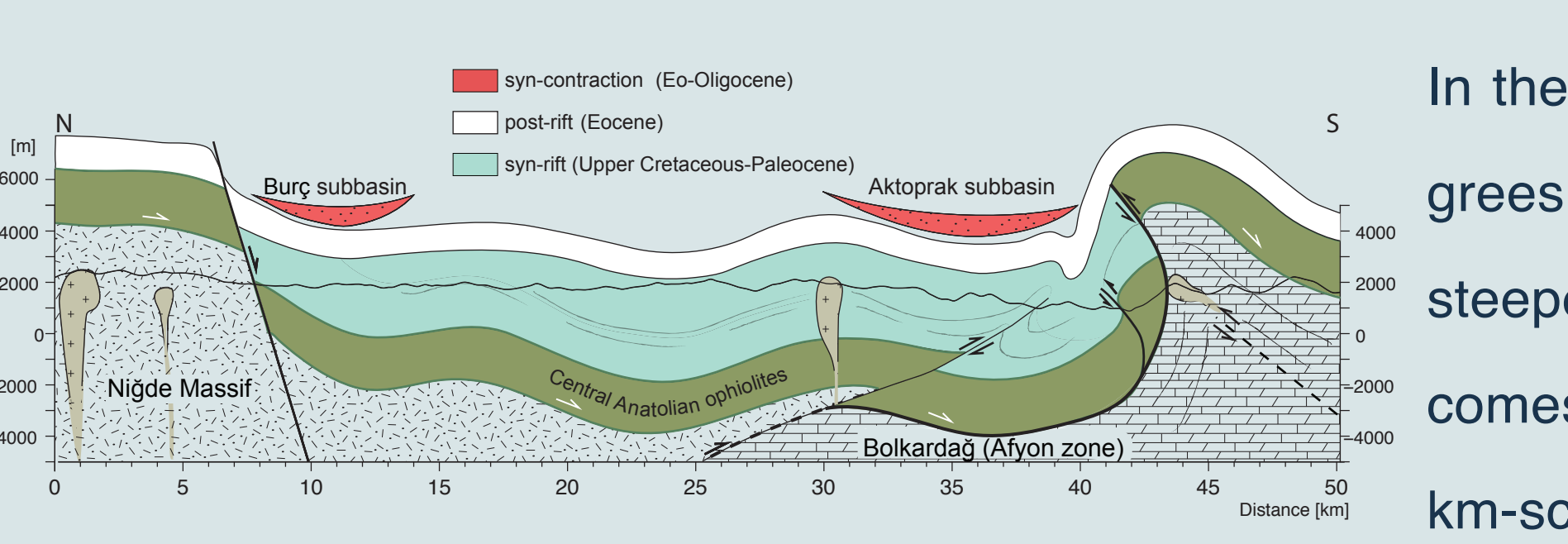
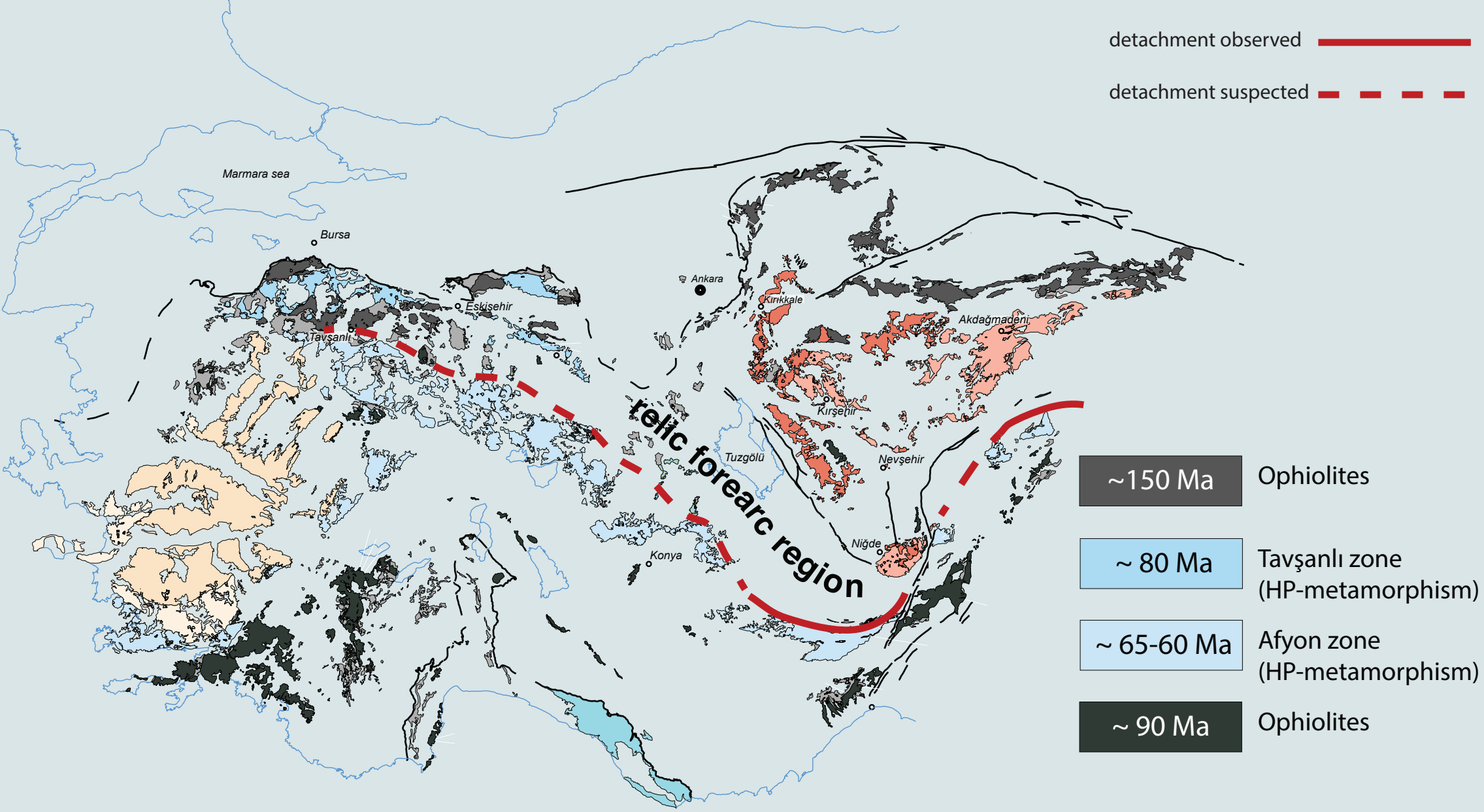
Introduction



Subduction and accretion of crustal fragments during the closure of the Neotethys since the Mesozoic formed the Anatolian fold-and-thrust belt. In latest Cretaceous–Paleocene time, a passive continental margin of the so-called **Tauride block subducted into an E-W trending segment of the Neotethys subduction zone and underwent blueschist-facies metamorphism.**

At present, blueschist rocks, locally known as the Afyon zone, are found exhumed in the overriding plate of this subduction zone, behind a younger thin-skinned fold-thrust belt of non-metamorphic rocks of the Taurides. Afyon zone metamorphics were previously dated by Ar/Ar yielding 65-60 Ma cooling ages (Pourteau et al., 2013). The structures responsible for exhumation of the Afyon zone, as well as their age remain undocumented. ~65 Ma cooling ages of the Afyon zone metamorphics coincide with/shortly post-date peak pressure metamorphism and provide a maximum age for the onset of exhumation.

Basement units



In the west, the fault zone is dipping ~40-50 degrees N. Towards the east, the foliation becomes steeper to subvertical. The Ivriz structure becomes incorporated in the steep limb of a major, km-scale north-verging fold of Eo-Oligocene age.

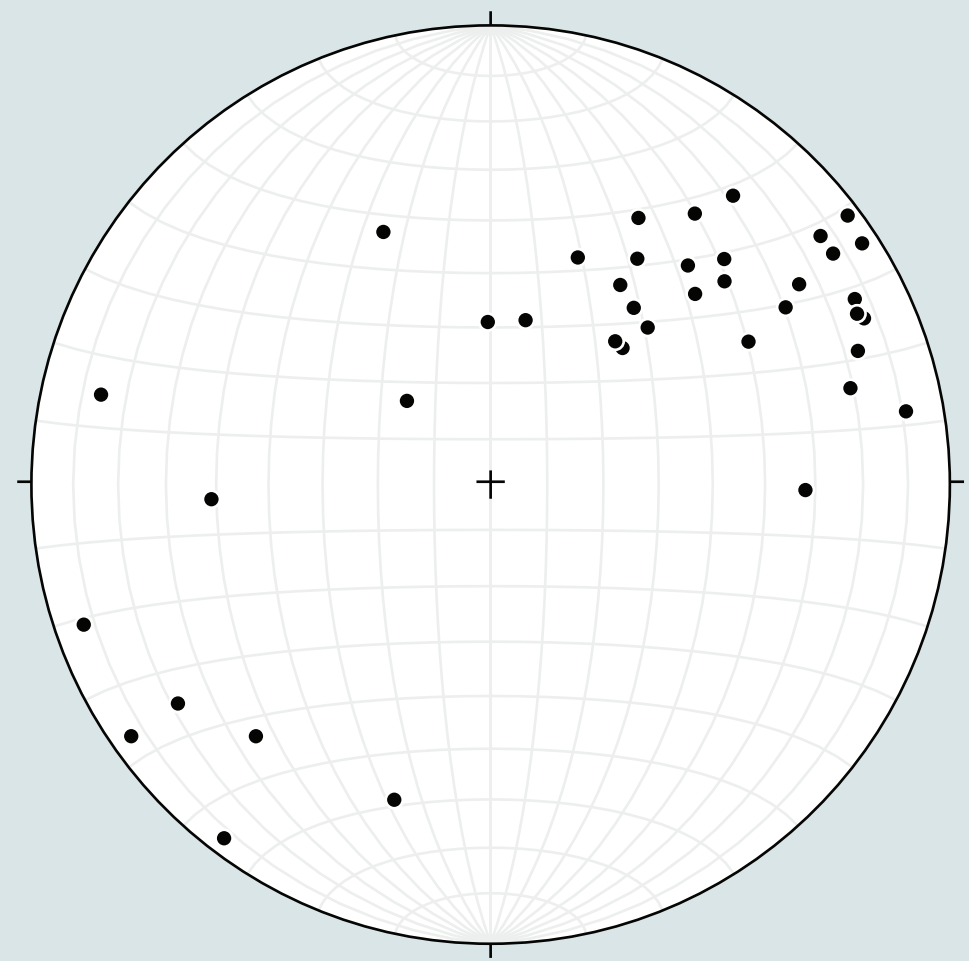
To the north of the Bolkar mountain range lies the Ulukışla basin. Its Uppermost Cretaceous **sediments record synsedimentary N-S extension**, in a similar direction as indicated by stretching lineations observed on the Ivriz structure.



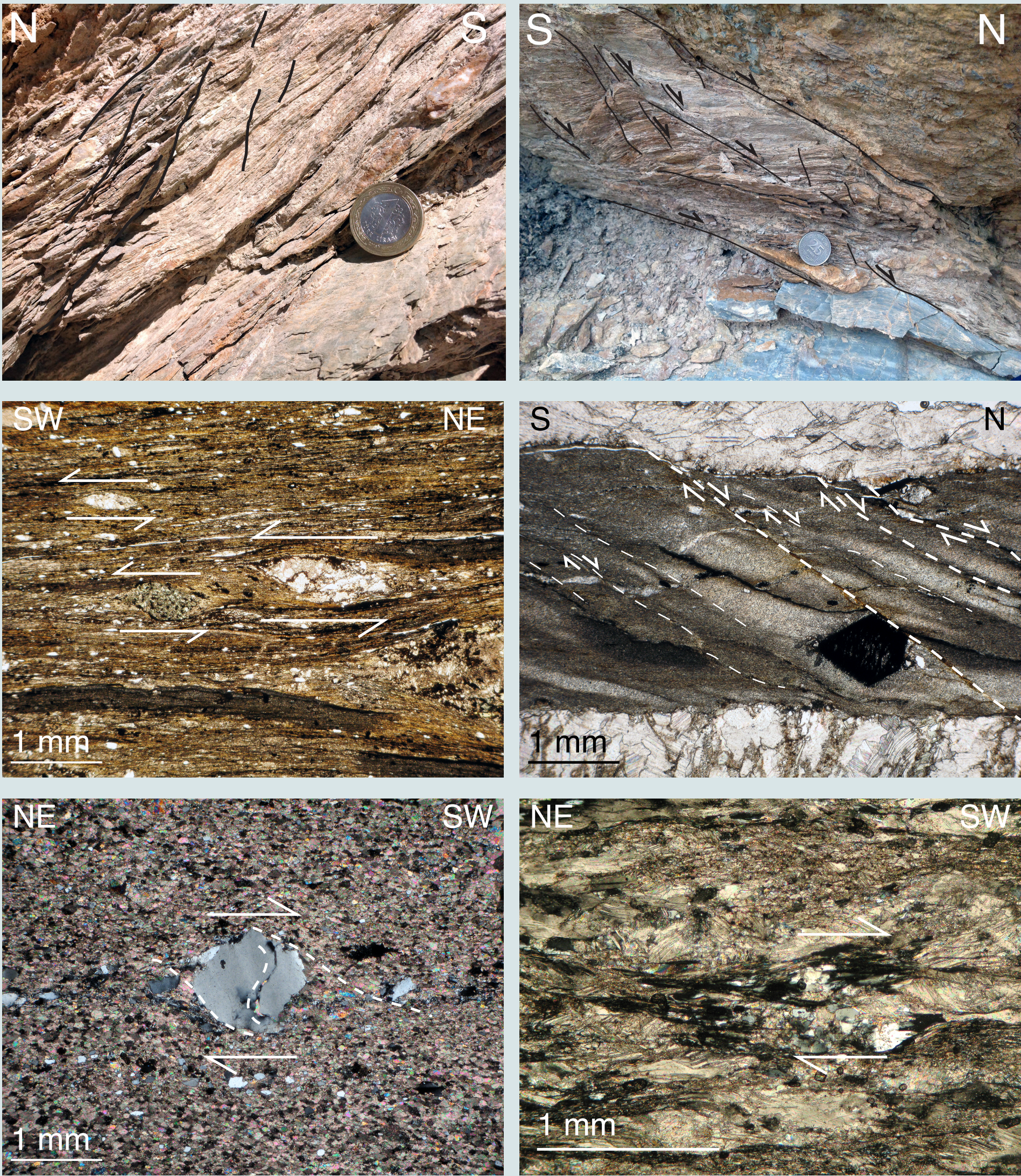
The **temperature of the last deformation decreases towards the brittle cataclastic part** of the fault.

First-order macroscopic brittle kinematic indicators (kink-bands, shear bands, s-c fabrics) in calcschists and schists from the highest levels of the footwall show a **top-to-the-N sense of shear.**

Stretching lineations



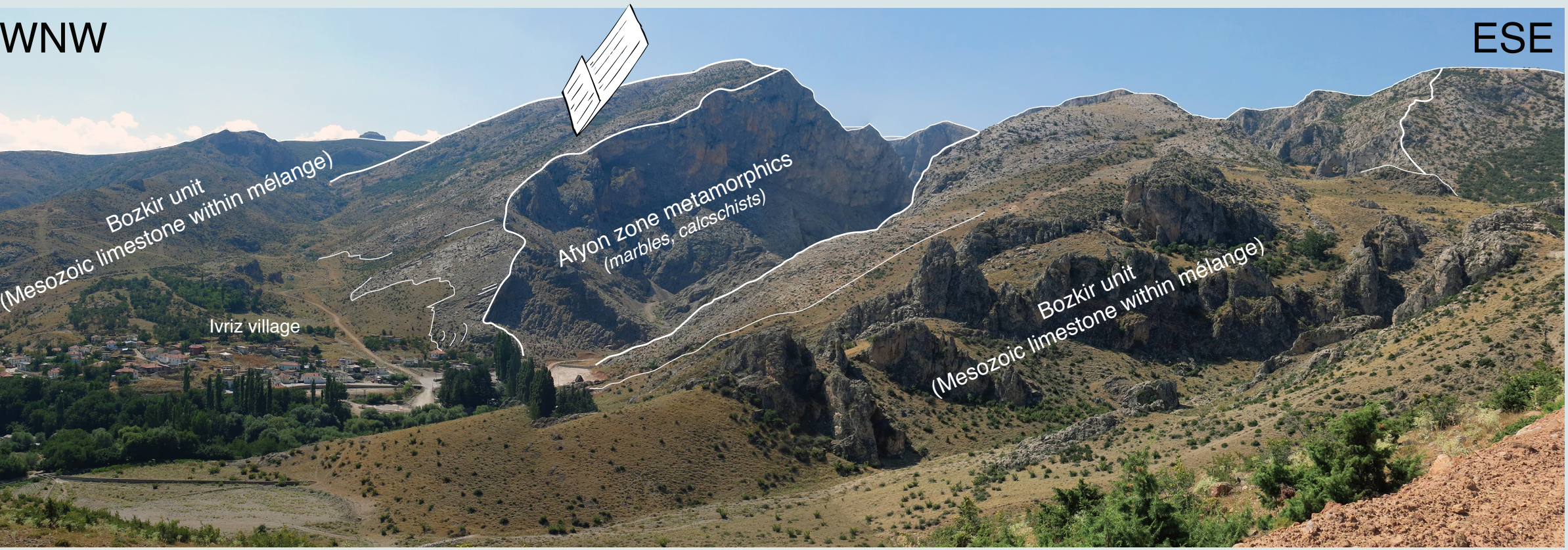
Additional kinematic indicators will come from oriented ultra-thin (10 μ m) thin sections of mylonitic marbles.



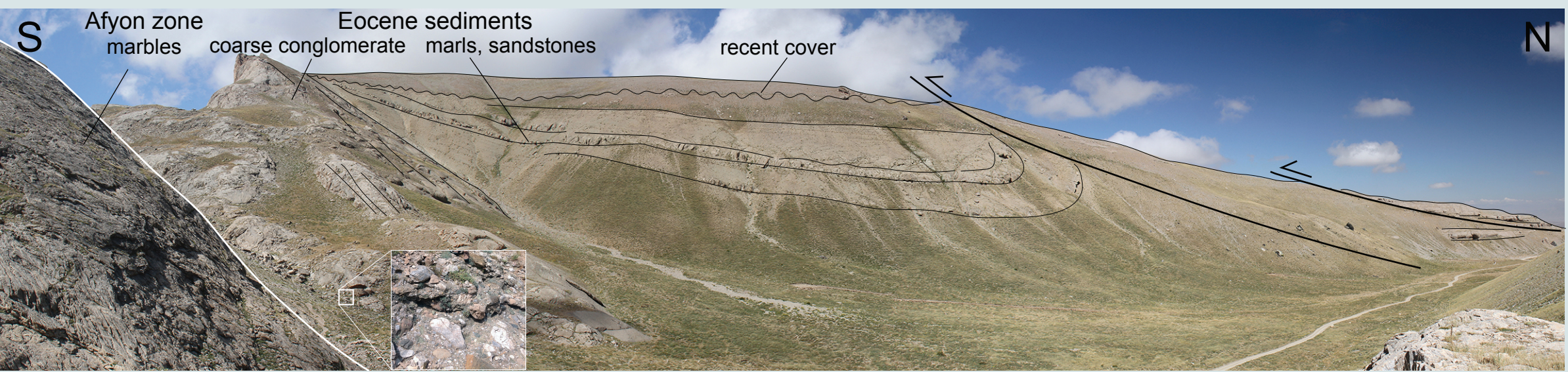
First-order microscopic kinematic indicators in calcschists and schists from the footwall show a **top-to-the-SW sense of shear** in the ductile part and top-to-the-N in the brittle part.

Field relations

- Linear E-W trending structure >120 km
- Sheared metamorphic rocks of the Afyon zone in the footwall are tectonically juxtaposed against an ophiolitic mélangé unit or unconformably overlain by Eocene sediments
- Marble mylonites of the Ivriz structure are intruded by a granitoid, previously dated at 56 Ma. The mylonites are recrystallized and the granite is not sheared.



Field relations close to Ivriz village, the type locality of the Ivriz detachment. Marbles and calcschists of the footwall are in faulted contact with the Bozkır unit that contains non-metamorphic limestones. The fault surface is marked by a clear north-dipping slope along the Bolkar mountains.



Field relations close to Karagöl, where the Bolkardağ marbles (Afyon zone) are unconformably overlain by a coarse conglomerate (reworking ophiolitic and Bolkardağ debris, inset), overlain by Lutetian (Eocene) marls and sandstones that record (synkinematic) outcrop-scale thrusting.

Conclusions

- Juxtaposition of metamorphic against non-metamorphic rock
- Decrease in temperature of the latest deformation towards the contact
- Structure is an extensional detachment that accommodated exhumation from at least lower greenschist facies conditions to the surface.
- ~65 Ma cooling ages of the metamorphics coincide with/shortly post-date peak pressure metamorphism and provide a maximum age for the onset of exhumation. Simultaneous syn-sedimentary N-S extension in the Ulukışla basin shows that the forearc was already in extension at that time.
- Sediments sealing the detachment demonstrate that the detachment was no longer active in Lutetian time (49-40 Ma). The 56 Ma intrusion of the Horoz granite into the marble mylonites and absence of post-intrusion mylonites show that by 56 Ma, the Afyon zone metamorphics were already at upper crustal, brittle levels.
- The Ivriz detachment is a regionally important structure and potentially one of the largest extensional back-arcs in the Mediterranean region.**

