Tectono-metamorphic processes beneath an obducted ophiolite: evidence from metamorphic soles and accreted units from western Turkey

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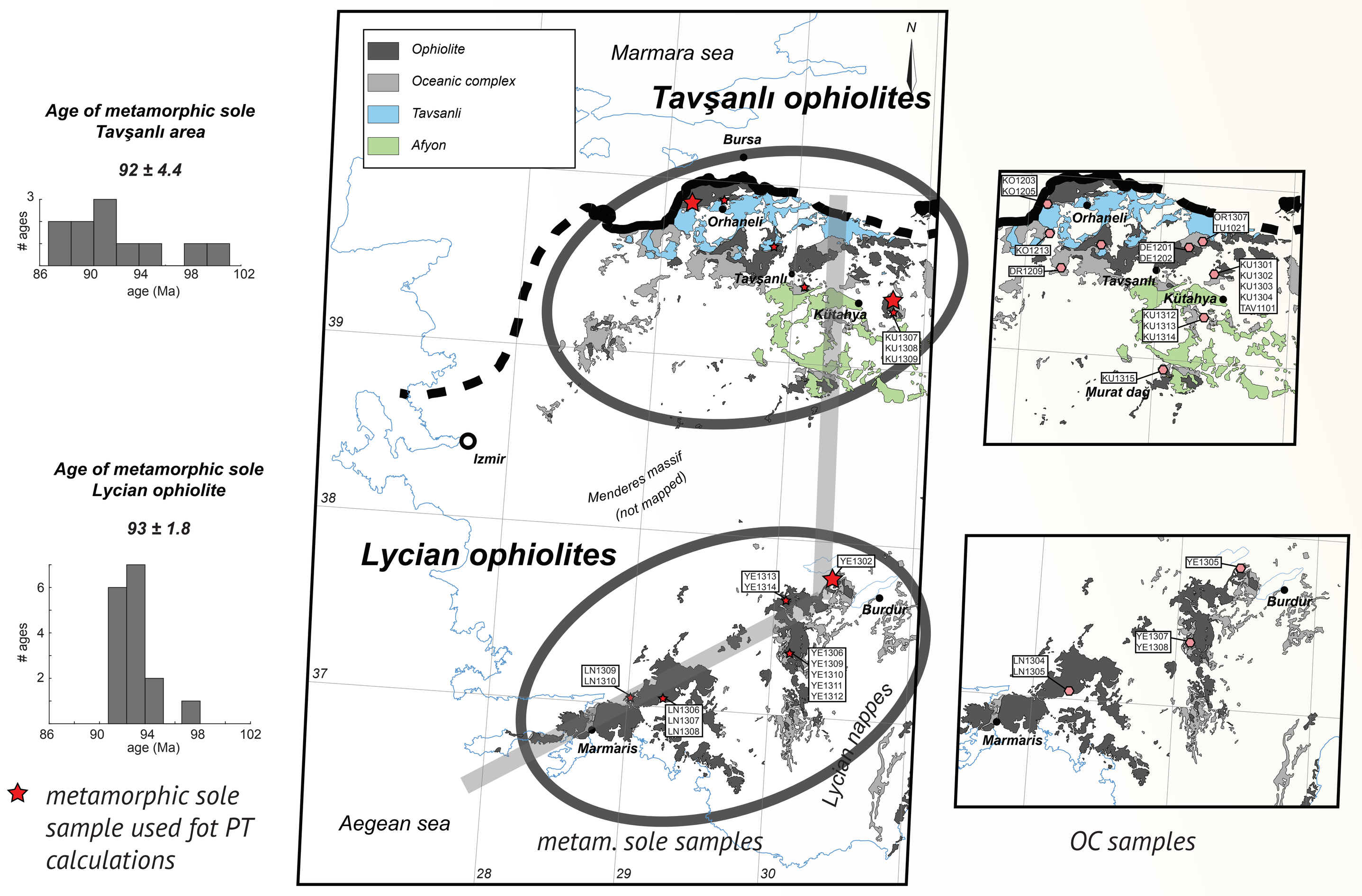
1. Introduction & geological setting

– how can metamorphic soles be preserved along a 200 kilometre-long transect parallel to ophiolite transport in regard to the short-lived event they supposedly represent (cf Oman)?

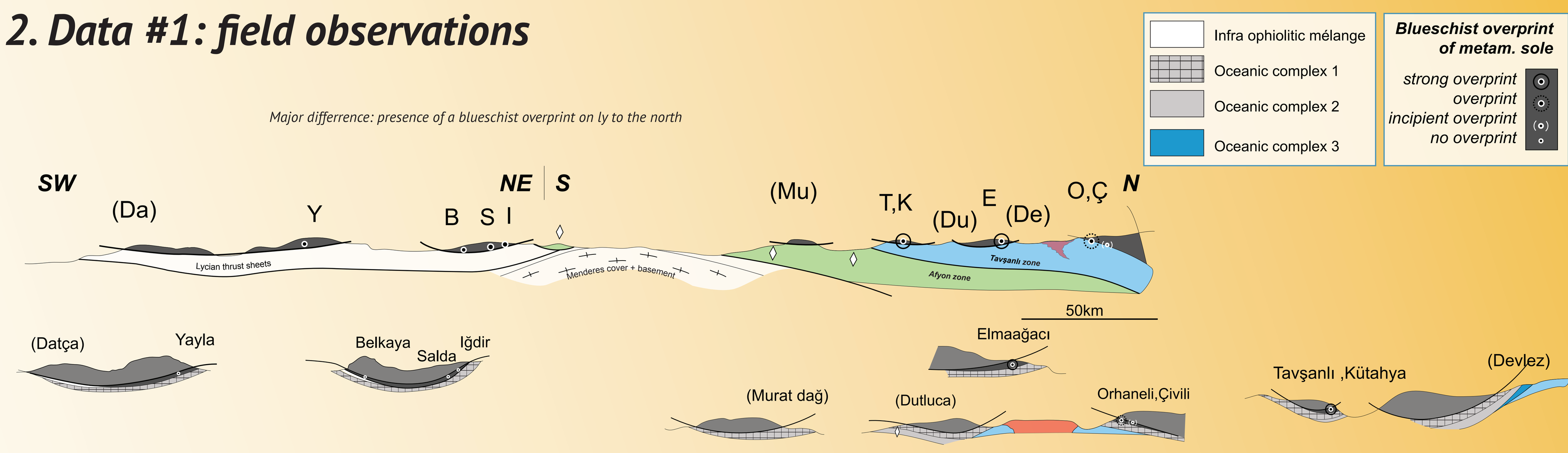
– how can the blueschist overprint observed in several metamorphic sole locations (unlike for Oman) be found in the same structural position and supposedly of the same age?

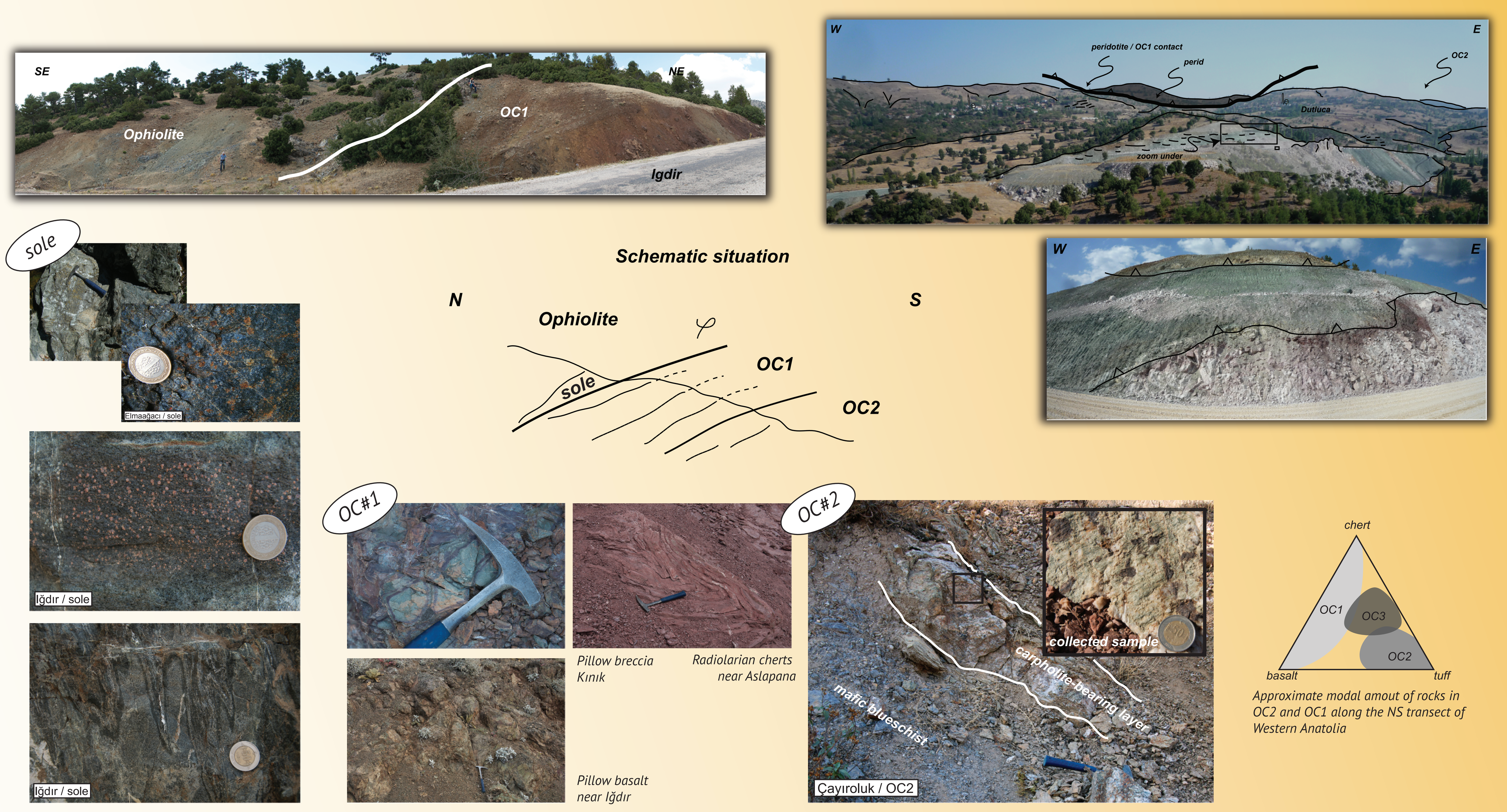
– how can one account for the (so far poorly described) diversity of variably metamorphosed oceanic units (often called oceanic mélanges) also found below the ophiolites, which are representing an accretionary complex formed during the subduction?



During Cretaceous times, the convergence between the Anatolide Tauride block (following the movement of Africa) and Eurasia lead to the closure of a branch of the Neotethyan ocean and to ophiolite obduction.
Since the classical paper of Şengör and Yılmaz, (1981) it is widely assumed that all western Anatolian ophiolites are derived from the same Tethyan realm (northern branch of Neotethys), leading to a variety of similarly looking palaeogeographic reconstructions. Their common origin, however, is not well established: the absence of crustal sequences in both regions hinders correlations, the geographic distribution only allows the association of the northern ophiolites in one group and the southern in another

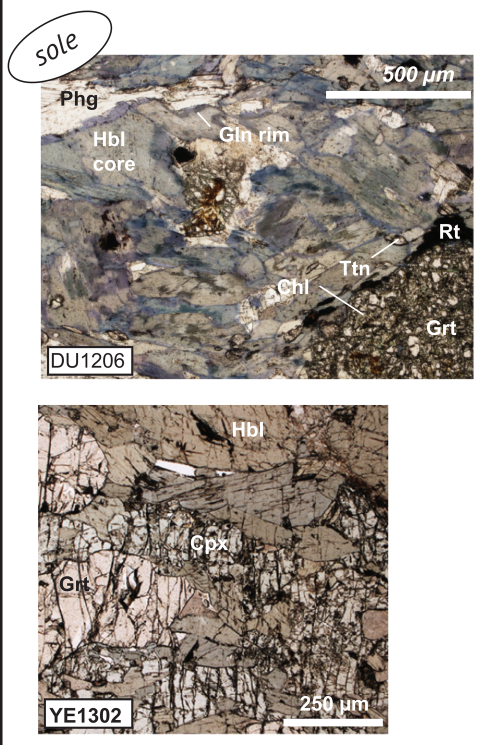
2. Data #1: field observations

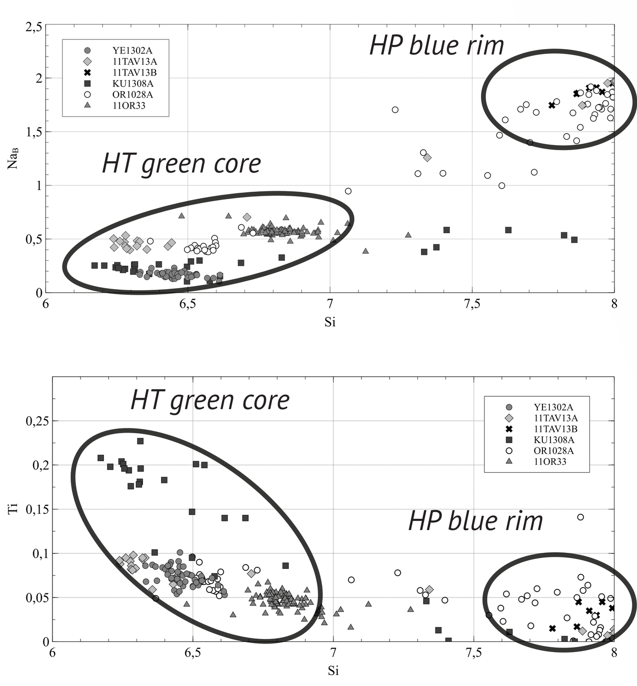


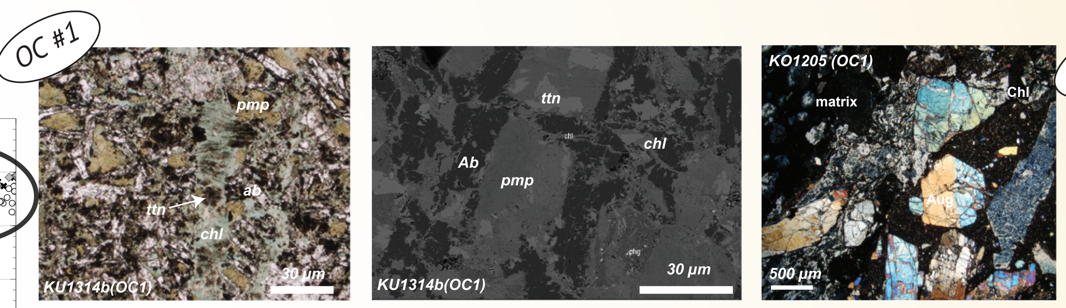


Approximate modal amount of rocks in OC2 and OC1 along the NS transect of Western Anatolia

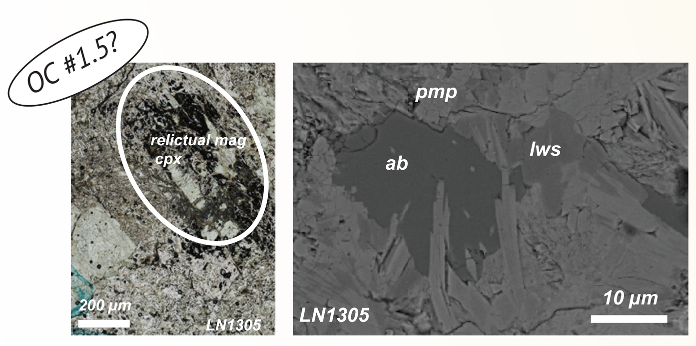
3. Data #2: petrology



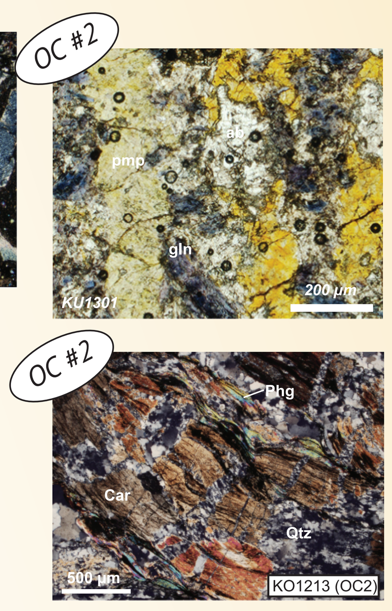




Samples from OC #1 consist manly of incipient metamorphosed rocks. The magmatic texture might still be observed. Sometimes magmatic mineral are preserved. OC #1 rocks are strongly hydrothermalized. They show typical albite-epidote-chlorite paragenesis. In some samples volcanic glass can be observed. Some other samples show the developpement of pumpellyite.

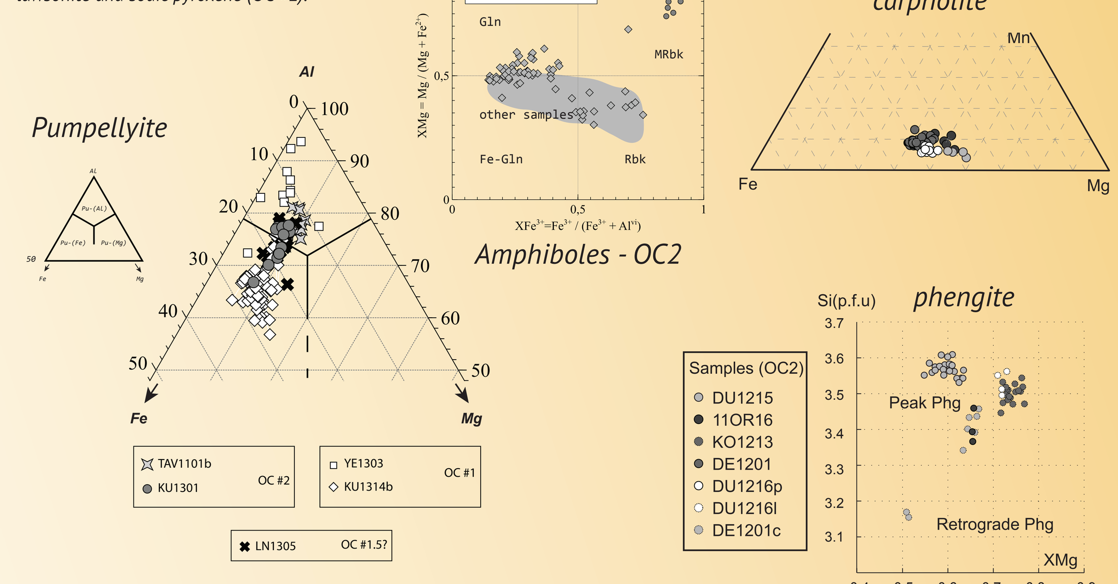


Some samples apparently related to OC #1 show the developpement of lawsonite related to pumpellyite. They can be assigned to OC #1.5



Fe-Mg carpholite was also observed in OC #2 coexisting with quartz, phengite and chlorite

Samples from OC #2 show the developpemnet of pumpellyite associated with sodic amphibole, lawsonite and sodic pyroxene (OC #2).

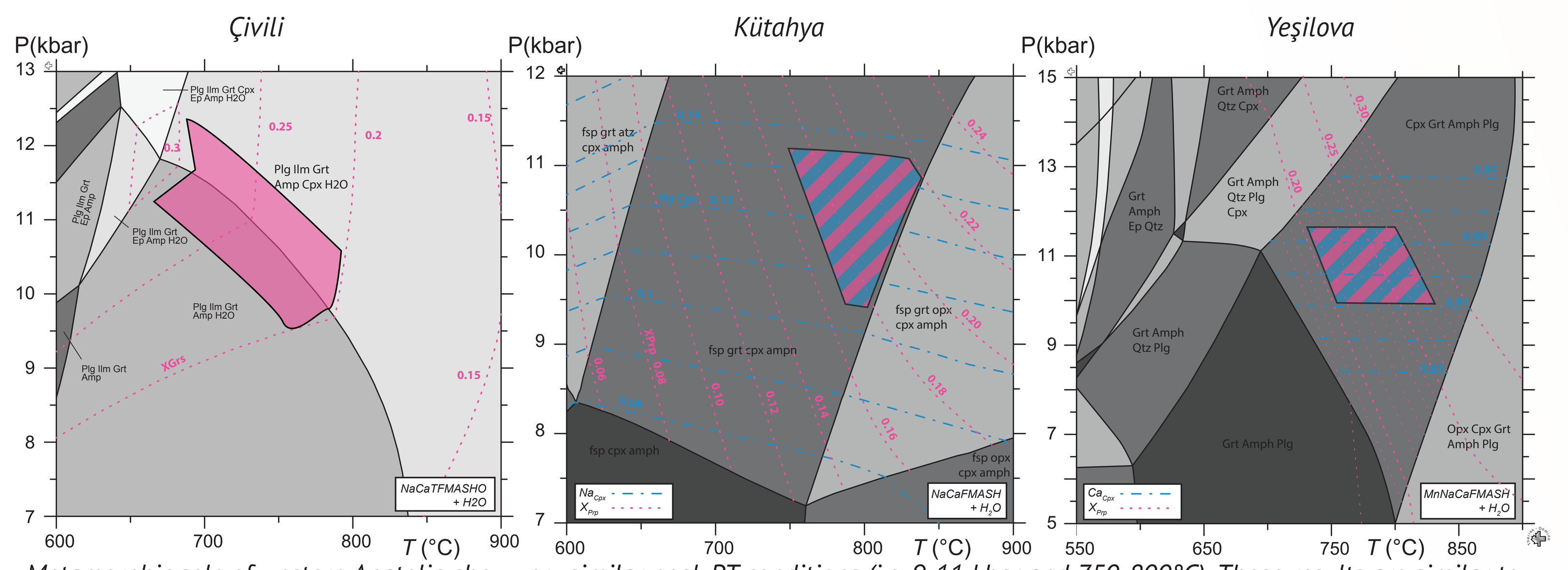


Metabasite...

...and Fe-Mg carpholite bearing samples [for OC #3 see Plunder et al., 2015]

4. PT estimates

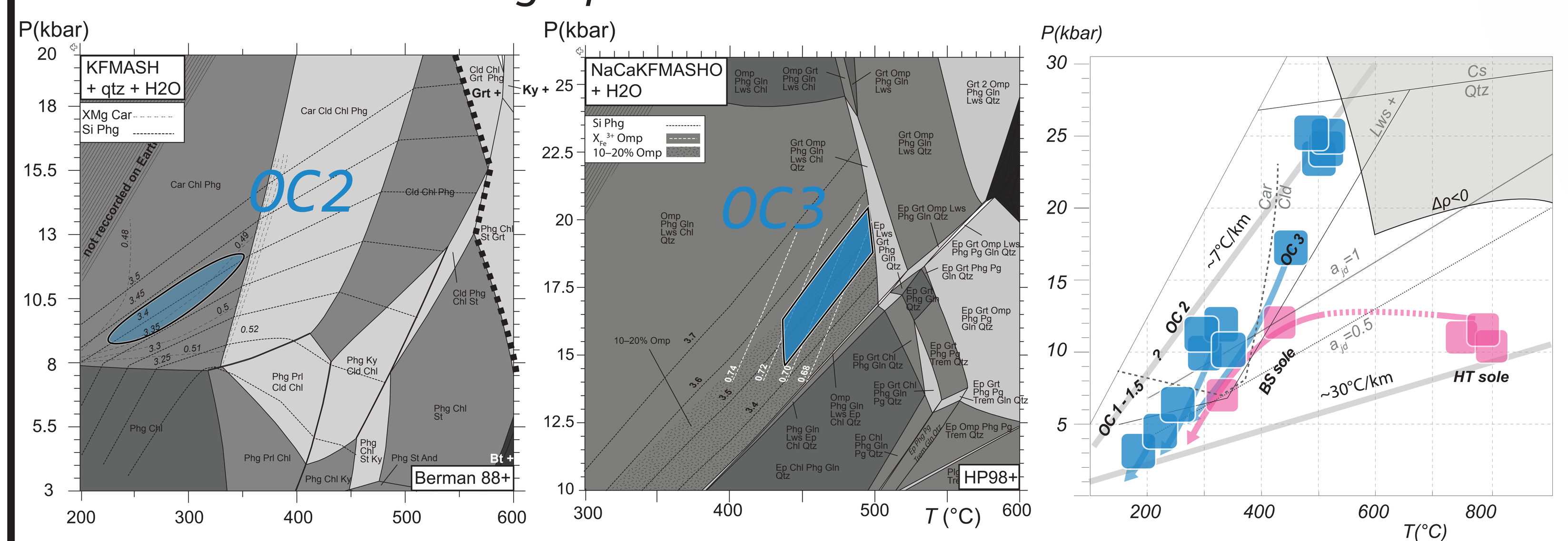
Incipient subduction: the metamorphic sole



Metamorphic sole of western Anatolia show very similar peak PT conditions (i.e. 9-11 kbar and 750-800°C). Those results are similar to what is proposed for the other sole of worldwide ophiolite (Agard et al., subm.) and for Oman (Soret, comm. pers.)

Mature subduction: high pressure slices

SUMMARY



Methodology

Pressure-Temperature pseudosection (i.e. phase diagram for fixed bulk composition) were calculated using the software package Theriak/Domino (de Capitani & Petrakakis, 2010). Two database were used: the database of Holland & Powell (1998) for mafic rocks with update for amphibole and clinopyroxene (Diener et al., 2007; Green et al., 2007). The database by Berman (1988) was used for carpholite-bearing rocks (see discussion in Pourteau et al., 2014). Part of the calculation were presented in plunder et al. (2015).
High pressure overprint in the metamorphic sole is estimated on the basis of the paragenesis and on reaction observed in the samples (ab = jd + qtz). The activity of jadeite in clinopyroxene is extrapolated from Liu & Bohlen (1994) and need to be taken with care. Lawsonite stability curve after Evans (1990). Carpholite stability after Vidal et al. (1992).

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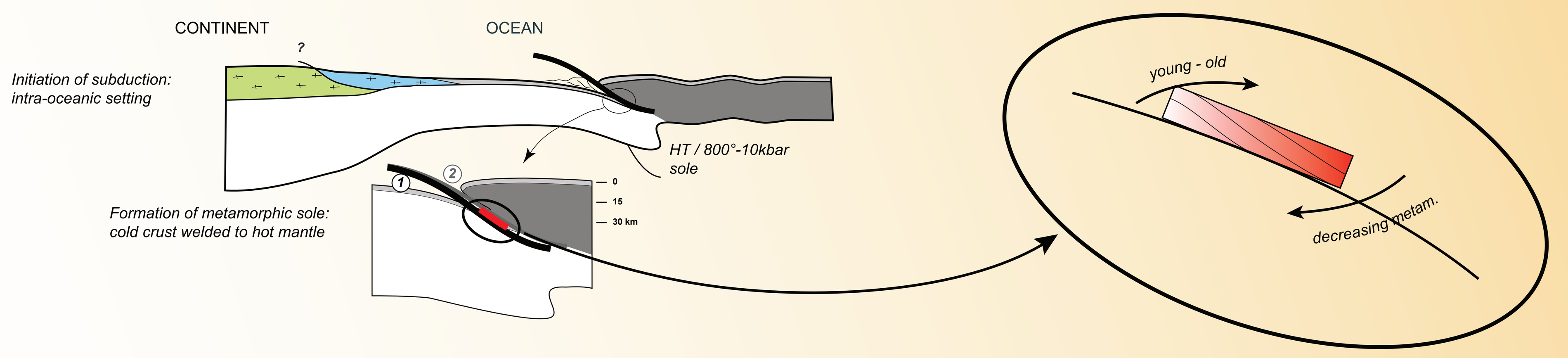
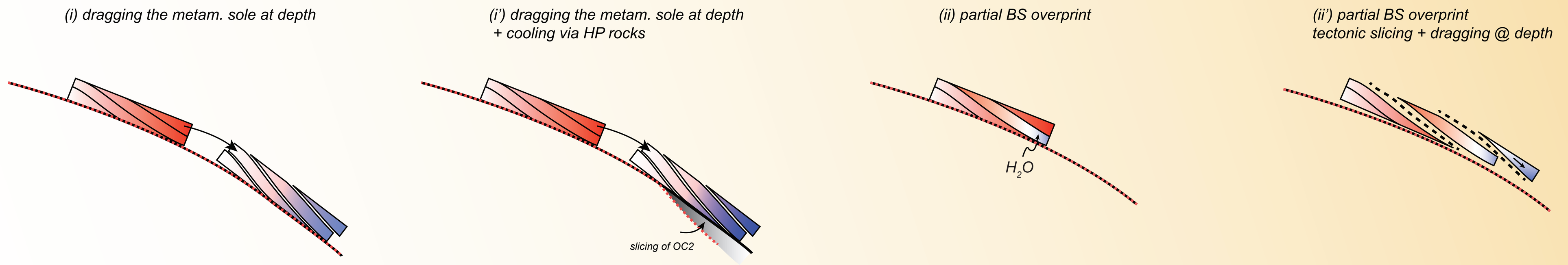
5. Mechanism in the subduction zone

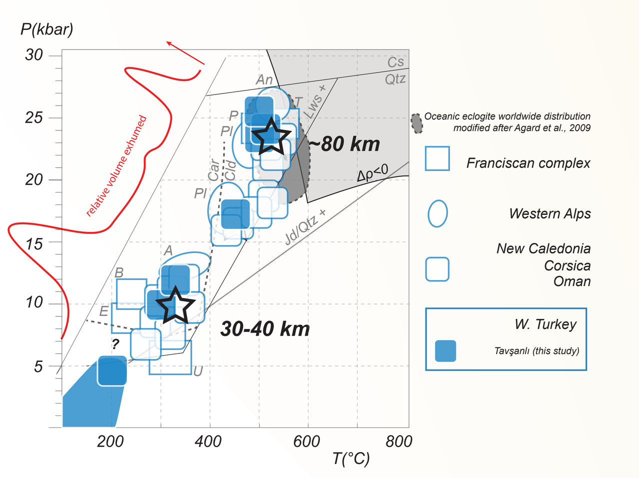
Early stages: formation of the metamorphic sole

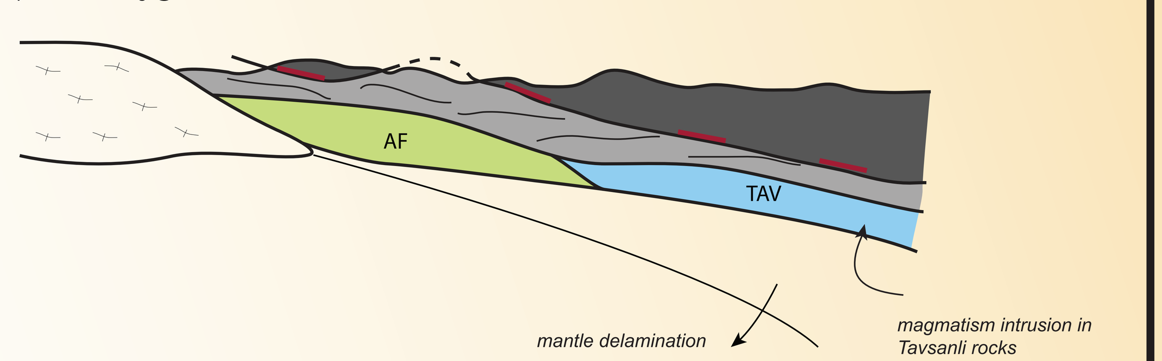


How to explain the blueschist-facies overprint?



Into the subduction zone





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