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Along-strike variations of *P–T* conditions in accretionary wedges and syn-orogenic extension, the HP–LT Phyllite–Quartzite Nappe in Crete and the Peloponnese

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ABSTRACT

Syn-orogenic detachments in accretionary wedges make the exhumation of high-pressure and low-temperature metamorphic rocks possible with little erosion. The velocity of exhumation within the subduction channel or the accretionary complex, and thus the shape of *P–T* paths, depend upon the kinematic boundary conditions. A component of slab retreat tends to open the channel and facilitates the exhumation. We document the effect of slab retreat on the shape of *P–T* paths using the example of the Phyllite–Quartzite Nappe that has been exhumed below the Cretan syn-orogenic detachment during the Miocene in Crete and the Peloponnese. Data show a clear tendency toward colder conditions at peak pressure and during exhumation where the intensity of slab retreat is larger. This spatial evolution of *P–T* gradient is accompanied with an evolution from a partly coaxial regime below the Peloponnese section of the detachment toward a clearly non-coaxial regime in Crete.

Exhumation of blueschists and eclogites is a complex process that involves a succession of mechanisms from the depth of the subduction channel to the surface. Tectonic processes within the subduction channel or the accretionary wedge compete with erosion (Platt, 1986; Cloos and Shreve, 1988; Platt, 1993; Avigad et al., 1997; Brandon et al., 1998; Ernst and Liou, 2000; Jolivet et al., 2003; Ring and Layer, 2003). In the case of the Aegean region (Fig. 1), erosion played a minor role in the Tertiary, this is attested by the ubiquitous presence on top of the high-pressure and low-temperature HP–LT units of the Upper Cycladic Nappe that does not show any high pressure metamorphic overprint (Jolivet et al., 2003). In the Aegean the most spectacular structures related to exhumation were formed during post-orogenic extension (Lister et al., 1984; Gautier et al., 1993; Gautier and Brun, 1994) and the formation of extensional metamorphic domes. In this case the HP–LT parageneses are overprinted by high temperature ones. A significant example is the Naxos dome where remains of blueschists and eclogites are found only in the periphery of the dome (Avigad, 1998) whereas the core shows amphibolites and migmatites (Feenstra, 1985; Vanderhaeghe, 2004; Duchêne et al., 2006). In the example of the Tinos core complex, although less severe, the evolution toward high temperatures is clearly seen in the late stages in the *P–T*–time path (Parra et al., 2002b). In such cases extracting from the geological record the part of the tectonic history due solely to syn-orogenic exhumation is not always straightforward, even more when the transition from syn-orogenic to post-orogenic exhumation occurred in a short time span not easily deciphered with radio-chronological studies. A very significant part of the exhumation was however achieved within the subduction zone before the formation of the Aegean Sea (Avigad et al., 1997; Trotet et al., 2001a; Jolivet et al., 2003; Ring and Layer, 2003; Jolivet and Brun, 2008).

Blueschists and eclogite massifs of the Mediterranean region show a wide range of kinematic and *P–T* evolution that are due to different geodynamic contexts (Jolivet et al., 2003). Kinematic boundary conditions, whether the slab is retreating or not for instance, are of paramount importance for the dynamics of the accretionary complex as shown by numerical models and regional syntheses (Beaumont et al., 1999) besides other major factors such as the lithologic nature of the subducted material (Goffé et al., 2003).

The external Hellenic arc was formed during the rifting of the Aegean Sea. The HP–LT parageneses of the Phyllite–Quartzite Nappe are contemporaneous with the HT–LP parageneses of the Cyclades and exhumation is associated with the activity of a large-scale detachment. Little post-orogenic extension is recorded there and we can thus use this example to study the dynamics of syn-orogenic

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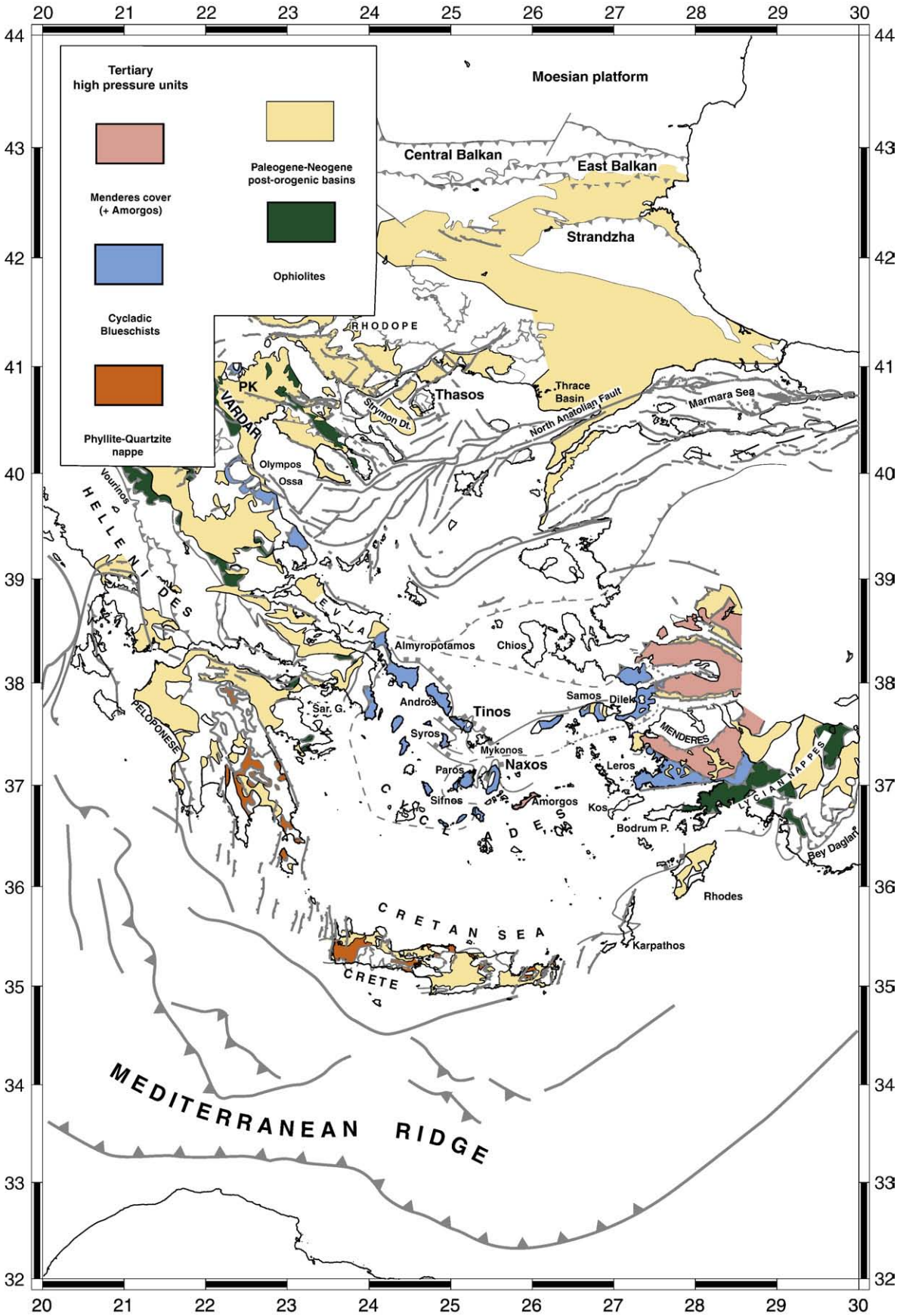

Fig. 1. Tectonic map of the Aegean region showing the main faults, and the main HP–LT metamorphic units of Cenozoic age, the Cycladic Blueschists and the Phyllite–Quartzite Nappe.