



# Review Report

Menant et al., Setting the Sequence of Slicing Events Along Deep Subduction Interfaces: 2. *P-T* Conditions and Timing of Accretion and Exhumation in Western Crete (Hellenic margin), TEKTONIKA, 2026.

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## 1<sup>st</sup> Round of Revisions

### Decision Letter

Armel Menant, Johannes Glodny, Samuel Angiboust, Edward R. Sobel, Eloïse Bessière, Laurent Jolivet, Romain Augier, Onno Oncken:

The second cycle of review for your submission "Setting the sequence of slicing events along deep subduction interfaces: 2. P-T conditions and timing of accretion and exhumation in western Crete (Hellenic margin)" is now complete. Thankyou again for your patience.

You will see that the reviewer has just one minor comment for you to address, and otherwise recommends acceptance of the manuscript. Please respond to the comment appropriately, uploading any final version of your materials that it might make necessary, so that I can act on the recommendation.

Best regards,

Graeme Eagles

## Comments by Reviewer 1

Reviewer A:

I thoroughly enjoyed reading this manuscript. I only know a bit about the geology of Crete and the authors have done an excellent job of detailing the geology of the western part of the island. I particularly like the author's model for the evolution of the duplex structures as it fits with my interpretation of the structural setting of much of the Cyclades blueschist unit to the north. The fact that the nappe sequence in western Crete hasn't been dissected by later extensional processes has permitted the authors to assemble a narrative that is both sensible and compelling.

I also wish to emphasize that this is one of the best-prepared manuscripts I have ever had the pleasure to review. The writing is concise and clear, the illustrations are excellent and well-prepared, the analysis is thorough and insightful, and the conclusions are well-supported by the data. Indeed, I failed to find even a single typo!

Recommendation: Accept Submission

## Comments by Reviewer 2

Reviewer D:

The study by Menant et al. presents petrographic, petrologic, and geochronologic data on the metamorphic complex of Crete. The manuscript deserves publication after some revision. My main comment deals with the discussion, which sounds very speculative and not clearly linked to the presented results. This is probably due to the information contained in the companion paper, I did not have access to. I recommend improving the discussion, as well as some other minor points, and to avoid too much unexplained reference to the companion paper (provide key messages from 1 in 2). Some figures could also be improved.

54: Mass transfer: clarify tectonic vs. chemical mass transfer.

Fig 1: a cross section showing the structural architecture with peak metamorphic conditions is recommended. This is probably present in the companion paper, but here the reader is really missing it.

Fig 3a and lines 314-315: how much Ce is present? Is it higher than Ca in cores? If not, I recommend referring to Ce-rich and Ce-poor (not Ca-rich).

I recommend presenting the methods for thermodynamic modeling in Section 3 (Methods).

“Muscovite content”: I recommend clarifying what is meant for muscovite content in the main text (line 263 at its earliest report).

Fig 2 is a bit sad with two empty spaces at the bottom. Some panels (e.g. e) are not easy to understand from the photos and could be line-drawn to fill the gaps.

Table 2: the normalization method for each mineral should be reported.

417: what does successfully calculated mean in this case? Not sure it is needed as, if published, the readers would assume that the results of this study are meaningful.

427: Fe<sup>3+</sup> neglected because of the low degree of retrogression: please clarify better.

Mineral abbreviations should be first letter upper case. If the authors refer to Whitney and Evans (2010), then that must be the case. E.g. fig 5.

Fig 7: here a cross section displaying the new (and older) ages would greatly help preparing the reader for the following figures.

Fig 9b: this figure confuses me a bit. I understand it centers on rates, but I do not clearly follow the functioning of the figure in respect to the juxtaposition of the Medium T and Upper Trypali units. It is assumed that the two units juxtaposed at the very end when the brown and blue fields overlap? From figure 12, it seems the two units coupled at about 15 Ma; however, in fig 9b, at 15 Ma the brown unit is at much shallower depths (5-25 km), whereas the blue one is >25 km.

I am not an expert, but I see that the MSWD of most of the Rb/Sr is high, or even very high.

Results vs. interpretation. Section 6 and 7 mix results and interpretations. This should be avoided especially, for section 6, if the geochronological results have high or very high MSWD. The latter point has not been discussed in sufficient detail in the manuscript. For example, line 666, a date with MSWD >> 1 is presented as robust. This needs some discussion.

557: aliquots vs crystals: please clarify as aliquot may be confusing here.

565: A more detailed discussion about data omission is needed. For example, what could make aliquot6 much older and discardable?

T\_°C: there should be a space between a T and °C.

The paper by Agard and Vitale Brovarone (2013) could be considered in the discussion as some of the stacking mechanisms are similar to those described here.

The case of Corsica is also cited in the present manuscript. In Corsica, the down-stepping metamorphic ages follow an increasing metamorphic peak (old and shallower on top), whereas it seems to be otherwise here. The paper by Agard and Vitale Brovarone also discussed those aspects relative to an opposite metamorphic trend.

The discussion is often difficult to follow as it mixes very detailed data and large-scale implications (not always justified by the data and their discussion). For example, just as a minor example, I could not understand how material reaching the “base of the forearc crust” is justified/constrained by the presented dataset. Is there direct evidence for that? Or is that an interpretation? What the forearc crust is meant to be should also be clarified in a dynamic system like the one described here. This extends to a large fraction of the discussion which sounds very speculative. The frequent reference to the companion paper is also challenging: it would be easier for the reader to have key pieces of information from the other study repeated in this one.

I do not really know what to suggest besides a partial reshaping of the discussion starting with a (i) robustness/uncertainty of the results, (ii) constraints on the structure and evolution of the considered units, (ii) larger-scale implications. If that was the initial

plan, the final result probably requires a bit more work.

**Recommendation: Revisions Required**

## Authors' Reply to Reviewer 1

### Responses to reviewers' comments

The editor's recommendations refer to comments of two reviewers.

#### Our answer

**Added/modified portions of text.**

Line number for all listed revisions refer to the Manuscript file.

Note that for consistency between the two companion papers, we now capitalize the term "Unit" when referring to tectono-metamorphic units (e.g. "Plattenkalk Unit"), as suggested during the peer review of the companion manuscript.

#### Reviewer A

Recommendation: Accept Submission

I thoroughly enjoyed reading this manuscript. I only know a bit about the geology of Crete and the authors have done an excellent job of detailing the geology of the western part of the island. I particularly like the author's model for the evolution of the duplex structures as it fits with my interpretation of the structural setting of much of the Cyclades blueschist unit to the north. The fact that the nappe sequence in western Crete hasn't been dissected by later extensional processes has permitted the authors to assemble a narrative that is both sensible and compelling. I also wish to emphasize that this is one of the best-prepared manuscripts I have ever had the pleasure to review. The writing is concise and clear, the illustrations are excellent and well-prepared, the analysis is thorough and insightful, and the conclusions are well-supported by the data. Indeed, I failed to find even a single typo!

We thanks Reviewer A for his/her very positive evaluation of our manuscript, which encourages to continue our work in this direction.

## Authors' Reply to Reviewer 2

### [1] Recommendation: Revisions Required

[2] The study by Menant et al. presents petrographic, petrologic, and geochronologic data on the metamorphic complex of Crete. The manuscript deserves publication after some revision. My main comment deals with the discussion, which sounds very speculative and not clearly linked to the presented results. This is probably due to the information contained in the companion paper, I did not have access to. I recommend improving the discussion, as well as some other minor points, and to avoid too much unexplained reference to the companion paper (provide key messages from 1 in 2). Some figures could also be improved.

[3] 54: Mass transfer: clarify tectonic vs. chemical mass transfer.

Ok. We specify this term as “tectonic mass transfers”.

L51-52. Geometry and deformation monitored along active forearc margins are significantly controlled by tectonic mass transfers that occur at >20-km depth along subduction interfaces [...].

[4] Fig 1: a cross section showing the structural architecture with peak metamorphic conditions is recommended. This is probably present in the companion paper, but here the reader is really missing it.

This is correct. A lithospheric-scale cross-section has been added to Figure 1 to shed light on the architecture of the Hellenic subduction zone, with emphasis on peak metamorphic conditions and inferred exhumation path.

[5] Fig 3a and lines 314-315: how much Ce is present? Is it higher than Ca in cores? If not, I recommend referring to Ce-rich and Ce-poor (not Ca-rich).

Thanks for this suggestion. We use now the terms “Ce-rich” and “Ce-poor” as Ce content is significantly lower than Ca content in lawsonite cores (based on semi-quantitative analysis with EDS detector).

L372-373. Lawsonite is often zoned with a Ce-rich core and a Ce-poor rim (Fig. 3e).

[6] I recommend presenting the methods for thermodynamic modeling in Section 3 (Methods).

Ok. The methodology for thermodynamic modeling is now presented in a dedicated Section 3.2 (see L195-202).

[7] “Muscovite content”: I recommend clarifying what is meant for muscovite content in the main text (line 263 at its earliest report).

Ok. We now provide an explanation of how the muscovite content was determined.

L281-282. [...] and a muscovite content ranging from 74 to 79 %, as determined from the ternary pyrophyllite-celadonite-muscovite diagram (Fig. 4a, Tables 1, 2).

[8] Fig 2 is a bit sad with two empty spaces at the bottom. Some panels (e.g. e) are not easy to understand from the photos and could be line-drawn to fill the gaps.

We have improved Figure 2 by extending panels d-g and we added some line drawing on panels e and f for sake of clarity. We now also use the standard convention of the right-hand rule for presenting structural measurements on this figure and indicate it in figure caption.

**L299-300. Main foliation measurements (Sn) are reported according to the right-hand rule.**

[9] Table 2: the normalization method for each mineral should be reported.

Ok. We present now the normalization procedure applied for calculation of structural formulas in Section 3.1. Electron probe microanalysis data.

**L185-193. The chemical composition of key minerals constituting the main metamorphic parageneses was analyzed and their structural formulas were calculated following standard normalization procedures. For phengite, normalization was performed to 11 oxygen equivalents. For carpholite, normalization to 9 cations and 10 oxygen equivalents was applied, with Fe<sup>3+</sup> estimated by charge balance and 11 wt. % H<sub>2</sub>O included. Structural formulas for chloritoid and chlorite were calculated using MinPlot software (version 1.1) (Walters, 2022), with chloritoid normalized to 8 cations and 12 oxygen equivalents and Fe<sup>3+</sup> estimated by charge balance and chlorite normalized to 12 oxygen equivalents assuming all Fe as Fe<sup>2+</sup>.**

[10] 417: what does successfully calculated mean in this case? Not sure it is needed as, if published, the readers would assume that the results of this study are meaningful.

Ok, we have removed the term “successfully”.

[11] 427: Fe<sup>3+</sup> neglected because of the low degree of retrogression: please clarify better.

Ok, the sentence has been improved, accordingly.

**L441-443. Fe<sub>2</sub>O<sub>3</sub> was considered negligible due to the low degree of retrogression, which indicates minimal re-equilibration under more oxidizing shallow-crustal conditions.**

[12] Mineral abbreviations should be first letter upper case. If the authors refer to Whitney and Evans (2010), then that must be the case. E.g. fig 5.

Correct. We modified mineral abbreviations in Figures 3, 5 and 6, Table 1 and in Supporting Information.

[13] Fig 7: here a cross section displaying the new (and older) ages would greatly help preparing the reader for the following figures.

Thank you for this suggestion. We have added a new panel (b) showing a cross-section (from the companion paper) on which the newly obtained ages are plotted. To maintain figure clarity, we decided not to include previously published ages on this cross-section. The figure caption has also been updated accordingly.

**L511-512. (b) Synthetic cross-section of western Crete with Rb/Sr multimineral ages from this study.**

[14] Fig 9b: this figure confuses me a bit. I understand it centers on rates, but I do not clearly follow the functioning of the figure in respect to the juxtaposition of the Medium T and Upper Trypali units. It is assumed that the two units juxtaposed at the very end when the brown and blue fields overlap? From figure 12, it seems the two units coupled at about 15 Ma; however, in fig 9b, at 15 Ma the brown unit is at much shallower depths (5-25 km), whereas the blue one is >25 km.

This is an insightful remark. We initially proposed a linear depth-time evolution for the Upper Trypali unit due to the lack of robust time constraints on its exhumation path. However, this assumption is not supported by lithospheric cross-sections shown in Fig. 12. We apologize for this mistake. Given the absence of reliable constraints, we decided only to present our interpretation of exhumation rates for the Medium-T Phyllite-Quartzite Unit. The text has been revised accordingly.

[15] I am not an expert, but I see that the MSWD of most of the Rb/Sr is high, or even very high.

MSWD values for Rb/Sr multimineral dating can be high due to the low uncertainties of the isotopic analyses (see Table S3 in Supporting Information), which do not allow a robust fit of the regression line if minor isotopic disequilibrium is present in the analyzed phases. However, this does not preclude robust Rb/Sr age estimates and MSWD as high as 5 is generally seen considered geologically meaningful (see for instance Smye et al., 2021; Glodny and Ring, 2023).

[16] Results vs. interpretation. Section 6 and 7 mix results and interpretations. This should be avoided especially, for section 6, if the geochronological results have high or very high MSWD.

This is correct. We have moved the interpretations from Sections 6 and 7 to Section 8 (see comments #17 and #19 for further details).

[17] The latter point has not been discussed in sufficient detail in the manuscript. For example, line 666, a date with MSWD  $\gg 1$  is presented as robust. This needs some discussion.

In line with the two previous comments, we have revised the discussion of the ages to better address the reliability of the Rb/Sr ages in light of MSWD values. As noted above, however, MSWD values  $\leq 5$  are generally considered significant for Rb/Sr multimineral dating and can be regarded as robust (see for instance Smye et al., 2021; Glodny and Ring, 2023).

L672-678. The High-T Phyllite-Quartzite Unit yields a moderately reliable Rb/Sr age of  $16.4 \pm 1.6$  Ma (Fig. 6a), interpreted as a crystallization age under greenschist-facies conditions as attested by the epidote + chlorite + phengite + paragonite assemblage of the dated sample (Figs. 3a; Table 1). The elevated MSWD (=11) reflecting slight Sr-isotopic disequilibrium among the low-Rb/Sr phases, requires that this age be interpreted with caution. Nevertheless, its consistency with a K/Ar age on white mica from Seidel et al. (1982), supports an early Miocene exhumation for this unit (Figs. 7a, 11).

L688-712. In the Medium-T Phyllite-Quartzite Unit, the  $20.8 \pm 1.4$  Ma Rb/Sr age obtained from a chloritoid-bearing phyllite (sample CR1965b) is interpreted to record near peak-metamorphism conditions of 15-17 kbar and 390-440 °C, as attested by the good alignment of the chloritoid point along the regression line. This age displays an acceptable MSWD (= 4.1) reflecting minor scatter among white-micas Rb/Sr isotopic data due to diffusion, deformation or fluid-rock interaction processes (Smye et al., 2021; Glodny and Ring, 2022), supporting its geological significance. A slightly older Rb/Sr age of  $24.3 \pm 1.2$  Ma from the same units should be considered with caution because of its moderately high MSWD (= 8.1). Nevertheless, when combined with existing geochronological constraints (Seidel et al., 1982; Jolivet et al., 1996), these ages support a protracted blueschist-facies event between 25 and 20 Ma, likely corresponding to peak-pressure conditions during detachment of the Medium-T Phyllite-Quartzite Unit from the subducting crust (Figs. 7a, 11). Consistently, recent K/Ar ages of 21-26 Ma on illite/white-mica mixtures from fault gouges (Ring et al., 2022) suggests that these structures were active at HP-LT conditions, although they should not be considered as major tectonic contacts (see discussion in Menant et al., this volume). Subsequent retrogression occurred during the middle Miocene, as recorded by the  $15.75 \pm 0.55$  Ma Rb/Sr age obtained from a top-to-the-NNE greenschist-facies shear zone located in the vicinity of the underlying Upper Trypali Unit (Figs. 2c, 6d). Despite a high MSWD (= 40) attributed to Sr-isotopic disequilibrium among the low-Rb/Sr phases, this age provides evidence that this major tectonic contact, formed during the HP-LT nappe stacking, was reworked as an extensional shear zone during duplex exhumation. The underlying Upper Trypali Unit yields consistent Rb/Sr ages between 14 and 20 Ma obtained from lawsonite-bearing phyllite and lawsonite- and carpholite-bearing veins (Figs. 6e, h-j). Low MSWD values obtained for part of the dataset support the geological significance of these ages that are interpreted to record crystallization under blueschist-facies conditions.

L720-723. These Rb/Sr ages display relatively low MSWD and are confidently interpreted to date the late stages of mylonitic deformation along these two structures that were synchronously active under HP-LT conditions when the Upper Trypali Unit was inserted into the nappe stack.

L726-728. The high MSWD (= 21) requires that this age be interpreted with caution, but it may nevertheless indicate an early tectono-metamorphic event preserved in this siliciclastic formation.

[18] 557: aliquots vs crystals: please clarify as aliquot may be confusing here.

Ok. We now clarify the meaning of "aliquot" (i.e., single-crystal zircon aliquot) the first time it is mentioned in Sections 3.4 and 7.

L242. Single-crystal zircon aliquots were heated with the laser system at 12 A [...].

L570-571. Six single-crystal zircon aliquots were separated and analyzed.

[19] 565: A more detailed discussion about data omission is needed. For example, what could make aliquot6 much older and discardable?

This is a fair point. We now provide a more detailed discussion of the reasons for discarding aliquots from sample CR2069 in the Discussion Section 8.2.

L742-754. The late cooling event is well constrained by ZHe ages, except for sample CR2069 that displays an over-dispersed age population and a poorly constrained mean age of  $13.4 \pm 4.2$  Ma (Figs. 7c, 8, Table 3). For this sample, aliquot #6 yields an anomalously old age ( $23.2 \pm 0.8$  Ma), comparable to the nearby Rb/Sr age of sample CR1925a ( $24.3 \pm 1.2$  Ma; Fig. 7), which cannot be explained by differences in closure temperature caused by radiation damage or grain size (Fig. 8a); it is therefore excluded from further interpretation. Then, omitting either aliquot #3 (oldest) or #5 (youngest) removes the over-dispersion and yields mean ages of  $12.5 \pm 1.3$  Ma and  $14.0 \pm 1.2$  Ma, respectively. Again, because the age pattern does not reflect varying closure temperature (Fig. 8a), other factors, such as crystal zoning, are likely responsible for the anomalous ages, justifying the exclusion of one of these aliquots. Given the structural position of sample CR2069 within the nappe stack, we favor the younger age interpretation as the most plausible, which does not modify the overall ~12-15 Ma cooling age range for the High-T and Medium-T Phyllite-Quartzite Units.

[20] T\_°C: there should be a space between a T and °C.

Done in the main text, figures and Supporting Information.

[21] The paper by Agard and Vitale Brovarone (2013) could be considered in the discussion as some of the stacking mechanisms are similar to those described here.

This is, indeed, a relevant paper for our discussion. We now address some of its outcomes in Sections 8.3 and 8.4.

L825-834. This different accretion depth is associated with an increase in the apparent thermal gradient, a pattern also noted for the Phyllite-Quartzite s.l. Unit in southern Peloponnese (Bouhot et al., 2025), which may reflect progressively warmer conditions near the subduction interface through time. This trend contrasts with the largely invariant thermal regime proposed for continental subduction by Agard and Vitale-Brovarone (2013), based on a P-T-t compilation of HP-LT terranes exhumed during continental subduction. In the Hellenic subduction zone, the increasing geothermal gradient may reflect enhanced asthenospheric flux into the mantle wedge driven by accelerated slab roll-back following major slab tearing beneath western Anatolia at ~15 Ma (Dilek and Altunkaynak, 2009; Jolivet et al., 2013; Menant et al., 2016b).

L866-874. In western Crete, the five tectono-metamorphic units yield contrasted P-T(-t) evolutions witnessing a succession of slicing episodes along the plate interface at depths ranging from 25-30 km to 55-60 km (Figs. 9, 12). Subsequent decollement and imbrication of cover units into an antiformal stack have also been reported from other HP-LT paleo-accretionary wedges formed during continental subduction (Agard and Vitale-Brovarone, 2013). According to these authors, decreasing peak metamorphic conditions toward the base of the nappe stack, as observed in western Crete (Fig. 10) or in Cuba (García-Casco et al., 2008), may reflect stronger mechanical coupling at the base of the upper continental plate, promoting successive slicing events within the

**sedimentary cover of the subducting plate.**

[22] The case of Corsica is also cited in the present manuscript. In Corsica, the down-stepping metamorphic ages follow an increasing metamorphic peak (old and shallower on top), whereas it seems to be otherwise here. The paper by Agard and Vitale Brovarone also discussed those aspects relative to an opposite metamorphic trend.

Ok. See our reply to the previous comment.

[23] The discussion is often difficult to follow as it mixes very detailed data and large-scale implications (not always justified by the data and their discussion). For example, just as a minor example, I could not understand how material reaching the “base of the forearc crust” is justified/constrained by the presented dataset. Is there direct evidence for that? Or is that an interpretation? What the forearc crust is meant to be should also be clarified in a dynamic system like the one described here. This extends to a large fraction of the discussion which sounds very speculative.

If we understand this comment correctly, Reviewer B raises a point regarding the nature (and therefore the definition) of the base of the forearc crust. This deep crust remains poorly constrained as it is not exposed due to the activity of the Cretan detachment (Jolivet et al., 1996). To avoid confusion, and because it is not the main goal of this study, we have rephrased this sentence as follows.

**L819-821. In the early middle Miocene, the High-T and Medium-T Phyllite-Quartzite Units reached mid-forearc crustal levels (~14-18 km), where they were affected by N-S-directed, bivergent ductile shear zones under greenschist-facies conditions (Figs. 2c, 9).**

We have also modified the following sentence, accordingly.

**L835-837. These five basal-accretion events contributed to the growth of a thick HP-LT duplex beneath the Hellenic forearc domain, stretching from eastern Crete to northern Peloponnese (Seidel et al., 1982; Jolivet et al., 2010).**

Regarding the rest of the comment on the speculative nature of parts of the discussion, we partly disagree, as our interpretations are based on new results and published literature, and we have taken care to present hypotheses cautiously (see for instance L889-906 where we discuss possible drivers of the Myr-scale uplift documented in Crete and Karpathos). Nonetheless, we acknowledge that the last paragraph of Section 8.4 could be moderated and we have accordingly modified this section.

**L907-931. Given the forearc topographic response, basal-accretion events along the plate interface are likely to influence the stress state and, consequently, the deformation history of the forearc crust. [...] The widespread occurrence of N-S trending lineation, stretched boudins and extensional shear zones in blueschist- and greenschist-facies rocks, along with major ductile-brittle detachments and high-angle normal faults, is consistent with a dominant extensional regime during the exhumation of metamorphic nappe stack (Fassoulas et al., 1994; Jolivet et al., 1994, 1996; van Hinsbergen and Meulenkamp, 2006; Marsellos et al., 2010; Nicol et al., 2020). In contrast, the recognition of ductile and brittle structures indicative of compressional to**

transpressional deformation, without a clear temporal relationship to the extensional fabrics, suggests changes in the stress regime over a timescale that remains poorly constrained (Tortorici et al., 2010; Chatzaras et al., 2013; see also discussion in Menant et al., this volume). By analogy with observations from megathrust and forearc earthquakes, which demonstrate that major seismic ruptures can transiently modify the forearc stress state (Wang et al., 2019) and trigger reverse seismic or aseismic slip on fault segments (Shirzaei et al., 2012; Mouslopoulou et al., 2020), episodic basal-accretion events might have contributed to Myr-scale stress perturbations in the forearc crust. These perturbations could plausibly result in composite deformation patterns reflecting the cumulative effects of such events. This hypothesis is broadly consistent with natural observations and analog modeling that highlight the influence of mass fluxes on the mechanical stability of convergent margins (Lallemand et al., 1994). However, further research is required to test this hypothesis particularly throughout precise geochronological dating of the varied structural fabrics and numerical investigation on the forearc's tectonic response to deep accretionary events.

The abstract and the conclusion have been also slightly modified, accordingly.

L46. This study further suggests a sequence of ~2-3-Myr-long deep slicing events [...].

L950-958. This work further suggests a recurrence time of ~2-3-Myr for basal-accretion events along this segment of the Hellenic subduction, occurring between 20 and 60 km depth during the late Oligocene to middle Miocene. This Myr-scale cadence of deep slicing events, observed in other HP-LT paleo-duplexes worldwide, indicates that such processes could provide a characteristic timescale for accretion-related surface uplift and forearc deformation. This topographic and tectonic signature may be detectable at active forearc margins and therefore merit closer attention in future studies to track deep, and often overlooked, mass-flux events. In light of this, the evidence supports the ongoing occurrence of basal-accretion events beneath Crete from the late Oligocene to the present, likely contributing to the island's emergence.

[24] The frequent reference to the companion paper is also challenging: it would be easier for the reader to have key pieces of information from the other study repeated in this one.

A summary of the main outcomes from the companion paper is already provided in Section 1. Introduction (L64-72). Nonetheless, some key results are now more explicitly described in several sections where the companion paper is cited.

L212-214. Because the maximum recorded temperatures in the paleo-accretionary complex of western Crete are much lower; i.e., ~450-460 °C (Menant et al., this volume), [...].

L293-296. Only the different maximum recorded temperatures estimated by the RSCM geothermometry provide clear evidence for the existence of these two units; i.e., ~420-460 °C and ~390-415 °C for the High-T and Medium-T Phyllite-Quartzite Units, respectively (Menant et al., this volume).

L600-604. A minimum of five tectono-metamorphic units are identified in western Crete,

based on distinct maximum recorded temperatures estimated using RSCM geothermometry (Menant et al., this volume); i.e., from top to bottom, the High-T and Medium-T Phyllite-Quartzite Units (~420-460 °C and ~390-415 °C, respectively), the Upper and Lower Trypali Units (~360-390 °C and ~320-330 °C) and the Plattenkalk s.l. Unit (~340-350 °C).

[25] I do not really know what to suggest besides a partial reshaping of the discussion starting with a (i) robustness/uncertainty of the results, (ii) constraints on the structure and evolution of the considered units, (iii) larger-scale implications. If that was the initial plan, the final result probably requires a bit more work.

In our opinion, the current organization of the paper is appropriate for discussing the P-T environment and timescale of deep accretion dynamics, as well as its regional and broader implications. In addition, this paper was positively received by Reviewer A. We therefore chose to keep the overall organization of the discussion while making substantial improvements regarding (i) the robustness of our results (see our replies to comments #15, #16 and #17), (ii) comparison with other HP-LT terranes in continental subduction settings (see our reply to comment #21) and (iii) the formulation of the proposed hypotheses, which has been moderated to better reflect the associated uncertainties (see our reply to comment #23).

#### References used in the rebuttal letter

Agard, P. and Vitale-Brovarone, A. (2013) Thermal regime of continental subduction: The record from exhumed HP-LT terranes (New Caledonia, Oman, Corsica), *Tectonophysics*, 601, 206-215. <https://doi.org/10.1016/j.tecto.2013.05.011>.

Glodny, J. and Ring, U. (2022) The Cycladic Blueschist Unit of the Hellenic subduction orogen: Protracted high-pressure metamorphism, decompression and reimbrication of a diachronous nappe stack, *Earth Sci. Rev.*, 224, 103883. <https://doi.org/10.1016/j.earscirev.2021.103883>.

Jolivet, L., Goffé, B., Monié, P., Truffert-Luxey, C., Patriat, M. and Bonneau, M. (1996) Miocene detachment in Crete and exhumation P-T-t paths of high-pressure metamorphic rocks, *Tectonics*, 15(6), 1129–1153. <https://doi.org/10.1029/96TC01417>.

Smye, A.J., Seman, S.M., Scambelluri, M., Starr, P.G., Federico, L. (2021) Exhumation dynamics of high-pressure metamorphic rocks from the Voltri Unit, Western Alps: constraints from phengite Rb-Sr geochronology, *Contrib. Mineral. Petrol.*, 176, 1-24. <https://doi.org/10.1007/s00410-020-01767-0>.

## 2<sup>nd</sup> Round of Revisions

### Decision Letter

Armel Menant, Johannes Glodny, Samuel Angiboust, Edward R. Sobel, Eloïse Bessière, Laurent Jolivet, Romain Augier, Onno Oncken:

The second cycle of review for your submission "Setting the sequence of slicing events along deep subduction interfaces: 2. P-T conditions and timing of accretion and exhumation in western Crete (Hellenic margin)" is now complete. Thankyou again for your patience.

You will see that the reviewer has just one minor comment for you to address, and otherwise recommends acceptance of the manuscript. Please respond to the comment appropriately, uploading any final version of your materials that it might make necessary, so that I can act on the recommendation.

Best regards,

Graeme Eagles

## Comments by Reviewer 2

Dear Authors and Editor

I see that my comments were taken into account and, in most cases, considered relevant to improve the manuscript. The responses to my earlier comments are overall fine and convincing. The only thing I would recommend to reconsider is the response to comment 11 about ferric iron. I do not understand why Fe<sub>2</sub>O<sub>3</sub> can be excluded because of limited retrogression. Is this because of the specific Fe partitioning in peak minerals? or a general consideration? in the second case, I would not see retrograde metamorphism and the only process justifying Fe<sub>2</sub>O<sub>3</sub> incorporation in minerals.

Besides this minor comment, I recommend publication of this study as it is.

## Authors' Reply to Reviewer 2

Dear Authors and Editor

I see that my comments were taken into account and, in most cases, considered relevant to improve the manuscript. The responses to my earlier comments are overall fine and convincing. The only thing I would recommend to reconsider is the response to comment 11 about ferric iron. I do not understand why Fe<sub>2</sub>O<sub>3</sub> can be excluded because of limited retrogression. Is this because of the specific Fe partitioning in peak minerals? or a general consideration? in the second case, I would not see retrograde metamorphism and the only process justifying Fe<sub>2</sub>O<sub>3</sub> incorporation in minerals.

Ok. We have further justified the exclusion of Fe<sub>2</sub>O<sub>3</sub> in the pseudosection calculation by highlighting the observed peak metamorphic paragenesis, which includes pyrite but not hematite, thereby supporting the negligible presence of Fe<sub>2</sub>O<sub>3</sub> in the chemical system.

L441-444. Fe<sub>2</sub>O<sub>3</sub> was considered negligible due to (i) the low degree of retrogression, which indicates minimal re-equilibration under more oxidizing shallow-crustal conditions and (ii) the presence of pyrite and absence of hematite in the peak metamorphic paragenesis.

## Acceptance Letter

Armel Menant, Johannes Glodny, Samuel Angiboust, Edward R. Sobel, Eloïse Bessière, Laurent Jolivet, Romain Augier, Onno Oncken:

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Best regards,

Graeme Eagles