TEKTONIKA

Review Report

Menant et al., Setting the Sequence of Slicing Events Along Deep Subduction Interfaces: 1. The Tectonic and Thermal Structure of the High-P Duplex in Western Crete (Hellenic Margin)**, TEKTONIKA, 2026.**

Table of Contents

1st Round of Revisions

Decision Letter

Dear Armel,

Thankyou for your near-epic levels of patience as we worked through a long list of potential reviewers trying to find people who were ready to comment on your manuscript. By now we have two reviews, which are both favourable to publication of your work. Both reviews are pasted in at the bottom of this message. There are no marked-up manuscripts or completed formal review forms to attach. From the comments, you will see that, in the view of one of the reviewers at least, there is a little work to be done before this can happen.

We look forward to receiving your revised manuscript, as well as the revised version of the companion manuscript, in due course.

Kind regards,

Graeme

Comments by Reviewer 1

For author and editor

I read with interest the paper "Setting the sequence of slicing events along deep subduction interfaces: 1. The tectonic and thermal structure of the high-P duplex in western Crete (Hellenic Margin)" by Menant et al. Overall, the paper is well written and the state of the art and the new data are well described. The new data are the result of a multidisciplinary approach including high-resolution fieldwork, structural analysis and temperature estimation by Raman technique, which are properly discussed and, overall, largely support the authors' interpretations. The figures are well organised and provide useful information on the geology of the area of interest. The paper sounds good and addresses the aims of the journal Tektonika. However, I suggest some minor revisions before publication. My main concerns are the lack of a "Methods" section and to make the "State of the Art" section less difficult to read.

I reported all my suggestions in the attached file.

Edoardo Sanità

[CONTENTS OF ATTACHED FILE:]

Revision of the paper Setting the sequence of slicing events along deep subduction interfaces: 1. The tectonic and thermal structure of the high-P duplex in western Crete (Hellenic Margin) submitted to the journal Tektonika by Menant and co-authors.

I read with interest the paper "Setting the sequence of slicing events along deep subduction interfaces: 1. The tectonic and thermal structure of the high-P duplex in western Crete (Hellenic Margin)" by Menant et al. Overall, the paper is well written and the state of the art and the new data are well presented and described. The new data are the result of a multidisciplinary approach including high-resolution fieldwork, structural analysis and temperature estimation by Raman technique, which are properly discussed and, overall, largely support the authors' interpretations. The figures are well organised and provide useful information on the geology of the area of interest.

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However, I suggest some minor revisions before publication. My main concerns are the lack of a "Methods" section and to make the "State of the Art" section less difficult to read.

Below, I reported a list of suggestion/comments and clarifications.

Abstract: The abstract is well written. I suggest that the last part of the abstract should clearly state what new constraints the paper provides.

Introduction:

Overall, this section is well written, the problem is broadly stated by the authors and therefore I suggest only a few comments on the form.

1) Sentence 69-74 - The sentence is too long. Please break it into two sentences.

2) Line 70 - Please replace "composing" with "constitute".

Geological setting:

This section is probably a little difficult to read. This is due to the nomenclature, probably inherited from the literature, which could make the geological setting of the area of interest confusing. I suggest that an overview of the tectonic units exposed in the study area be presented as simply as possible to avoid confusion for the reader. I suggest using the format "name unit Unit" unit with capital letters.

Please check this throughout the manuscript.

Line-by-Line comment

1) 157-158 - If available from the literature, please report the pressure values.

2) Line 193 - Please replace "grauwackes" with "graywackes"

3) Line 243 - The Cretan metamorphic is used here for the first time. I suggest introducing it before.

Field constraints on the architecture of the HP-LT duplex:

There are no particular problems to solve. The section is well written and in very good form. However, it suffers somewhat from the lack of a less confusing presentation of the units exposed in the study area. I suggest (see comment above) to make this aspect less heavy.

Line by line comments

1) Line 302 - Replace "propose" with "provide"

2) Line 327 - I didn't see the village of Agriles on the map reported in Figure 1

3) Line 358 - Replace "criteria" with "kinematic indicators"

4) Line 381 - What does "metaclastics" mean? Please, provide more information.

RSCM peak metamorphic temperatures:

As reported above, I suggest moving the RSCM Methodology subsection to a separate Methods section. However, this section is well written and I have only one point to correct.

Line by line comments

1) Line 496 - Please replace "steps" with "gap"

Discussion:

This section is well written and in very good form. All data is properly discussed by Menant and co-authors. I have a few questions that need to be addressed.

Line 710-719 - I agree with the authors on the mechanism to explain the lack of about 30 km of crust across the contact. I suggest adding more references from worldwide examples to further support this result.

Line 735-736 - I suggest to better explain this aspect before the discussion Line 794-800. A third possibility is the interplay between the two processes, with the former (the true spatial extent of each unit) who could affect the latter (late reworking).

Line by line comments

1) Line 644 - Please insert a space between "of" and ">7".

2) Line 820 - Stage 1 in the caption of Figure 11 is reported as a tectonic event. Please standardise this.

Figures:

• Figure 1

top left insert - please add the trace of the crustal section reported below. I suggest changing the grey colours for the "Eocene HP-LT belt".

Geological map from Crete - Please change the colours of the schistosity trajectories. Also, although it is stated in the text, I suggest indicating the chronology of the schistosity reported on the map.

Symbols for mineral and extension lineation - I suggest to better explain the meaning of the adopted symbols.

Please add north both in the insert and in the geological maps. In the insert, please add the scale bar.

• Figure 2

Please add the cardinal points above the vertical scales. Check them for all the geological sections in the manuscript.

What is the grey area in the top right inset? Please add it to the figure caption and check it in all figures.

• Figure 3

I suggest increasing the size of panels C and D.

• Figure 4

Caption - I suggest avoiding the terms detachments and/or extensional shear zone in the presentation of the results. These terms should appear in the discussion and conclusion sections.

Comments by Reviewer 2

The paper by Menant et al., presents a coherent dataset for Western Crete to reconstruct the tectonic evolution of Western Crete from early exhumation/accretion and underplating to late exhumation and low angle normal fault formation. They used a robust structural dataset, field observations and RSCM data. I really enjoyed reading the paper and the authors should be complemented for the robustness and synthesis of a complicated dataset. It is a great contribution. Overall, I think that the manuscript is well written, and I have minor comments. The two major points I have that they would need to be resolved prior to publication are:

- The presentation and connection of the current paper with the mentioned in the text companion paper. I do not have access to the companion paper, but by just reading this contribution I have been left wondering what the main conclusion is take away of the companion paper. There is mention of the companion paper in a couple of places but not clearly outlined what the results are, what methods are explicitly used and how are these two papers complementary to each other.
- The treatment of the RSCM data. I am a little puzzled of how the authors determine the thermal inheritance and exclude data. This needs to be discussed further and be justified. Also given that these rocks are poly-deformed and metamorphosed the authors need to justify why these temperatures do not reflect an exhumation thermal peak associated with deformation of graphite during exhumation rather than peak metamorphic conditions.

Line 35: I am not sure what the word “first” means here. This is publication is not the first contribution investigating underplating/basal accretion.

Line 85: Since Crete is in the Hellenic space, I think it is important to include references about underplating and stacking from the Cyclades especially given that the Cyclades are also mentioned and described in the geologic setting.

Line 94 & 110: I am confused about the companion contributions. Can you please add a sentence that describe what each contribution addresses and what methods are used on each manuscript? I recommend restructuring the sentence and clearly describing the methods used in each manuscript and the main scientific objective addressed.

Line 139: Either rephrased and say the majority on the Cyclades are comprised by the CBU or include in your description the CB and upper unit.

Line 216-219: I would recommend adding the main conclusions of the paper in this sentence. Since the papers are companions, it needs a stronger connection, and the

reader should not have to go to the companion paper to know what the ages and main conclusions of the other paper are.

Line 296: Awkard long sentence please rephrase.

Line 301: Microstructures

Line 314: Define what type of tectonic contacts are the authors referring to here. Not everyone would be familiar.

Line 315: Overprinted is probably a better word than blurred.

Line 319: Please be specific. What is the grain size? Is there a figure illustrating that or an existing published work (If so add citation)?

Line 333: Can the authors be more specific here on the origin of the clasts? What type? What came from the hanging wall and what from the footwall?

Line 358: structures instead of criteria?

Line 426: Which tectonometamorphic units? Please clarify.

Line 616: I would recommend changing the way the different ages are presented. Saying that "*Notably, there are some seemingly conflicting mean Tmax*" implies that these data is straightforward although is not.

Line 613-631: I am not sure I understand how the authors decide which temperatures are recording an inherited component, other than using the average temperatures of the unit from other samples. Why in some samples the inherited thermal signature is hotter and, in some others, colder? The authors also need to discuss about the possibility of resetting during deformation of the graphite during exhumation.

Line 675: I am not sure what mineral equilibria do the author refer to. This is the first time this is mentioned.

Line 742: The paper does not provide pressure estimates. The only pressures mentioned are from *Theye et al., 1992; Jolivet et al., 1996* paper and they are not from the same samples so it cannot be assumed that the rocks used in this study would have experienced the same pressures.

Line 755: I would recommend reminding the reader here exactly what these contacts look like. Why is tectonic slicing concentrated there? What are the lithologic differences? Was it fluid driven weakening?

Line 816: specifically on Crete

Line 811: pre-structuration is an awkward word to use here.

Line 863: Although I agree with this statement as of now it is not well supported or justified with connecting with the data. I think the authors have the data to make this statement, but it needs to be reshaped and incorporate the different stress tensors recorded from their structural data and crack seal veins.

Authors' Reply to Reviewer 1

Revision of the paper **Setting the sequence of slicing events along deep subduction**

interfaces: 1. The tectonic and thermal structure of the high-P duplex in western Crete (Hellenic Margin) submitted to the journal Tektonika by Menant and co-authors.

I read with interest the paper "Setting the sequence of slicing events along deep subduction interfaces: 1. The tectonic and thermal structure of the high-P duplex in western Crete (Hellenic Margin)" by Menant et al. Overall, the paper is well written and the state of the art and the new data are well presented and described. The new data are the result of a multidisciplinary approach including high- resolution fieldwork, structural analysis and temperature estimation by Raman technique, which are properly discussed and, overall, largely support the authors' interpretations.

The figures are well organised and provide useful information on the geology of the area of interest.

The paper sounds good and addresses the aims of the journal Tektonika.

However, I suggest some minor revisions before publication. My main concerns are the lack of a "Methods" section and to make the "State of the Art" section less difficult to read.

Below, I reported a list of suggestion/comments and clarifications.

We thank the reviewer for his kind words regarding this work. We provided a reply to Reviewer's main concerns below.

Abstract: The abstract is well written. I suggest that the last part of the abstract should

clearly state what new constraints the paper provides.

Ok. We improved the abstract accordingly. However, we also had to limit the accurate description of our new finding due to the maximum size allowed for the abstract.

L42-52. Our geological and structural mapping reveals the overall geometry of the nappe stack forming a dome-like structure, exhumed beneath major top-to-the-N and subordinate top-to-the-S detachments that accommodated N-S-directed crustal extension. This trench-perpendicular extension was intermittently rotated into an E-W direction (trench-parallel), as evidenced by a newly recognized top-to-the-W ductile-brittle detachment. Minor compressional events did not significantly alter the 3D architecture of the paleo-duplex. Reported RSCM peak metamorphic temperatures of ~350-450 °C from the nappe stack align with the typical temperature range for the downdip limit of the seismogenic zones, suggesting a first-order thermo-mechanical control on the depth of basal accretion along the subduction interface. These findings provide crucial constraints for interpreting the deep-accretion and exhumation dynamics that shaped the long-term evolution of the Hellenic forearc domain.

Introduction:

Overall, this section is well written, the problem is broadly stated by the authors and

therefore I suggest only a few comments on the form.

Sentence 69-74 -> The sentence is too long. Please break it into two sentences.

Correct. We have split the sentence in two.

L71-76. The recognition of coherent tectonic slices composing most of the now-exhumed accretionary complexes studied worldwide (also called "duplex") (Platt, 1986; Maruyama et al., 1996; Guillot et al., 2009; Agard et al., 2018; Angiboust et al., 2018) support these model predictions. It also highlights the existence of a usually overlooked accretion-driven tectonic and topographic signal along subduction zones where ongoing accretion events are proven or suspected (Scholl, 2019).

Line 70 -> Please replace "composing" with "constitute".

Done.

Geological setting:

This section is probably a little difficult to read. This is due to the nomenclature, probably inherited from the literature, which could make the geological setting of the area of interest confusing. I suggest that an overview of the tectonic units exposed in the study area be presented as simply as possible to avoid confusion for the reader. I suggest using the format "name unit Unit" unit with capital letters. Please check this throughout the manuscript.

We agree that the number of unit names can make the Geological setting appear complex. This mostly reflects the large number of previous studies in this area, each using various toponyms. We believe this level of detail is necessary to ensure our study is understandable for all researchers working in the region. To improve clarity, we (i) added all unit subdivisions and names from the literature to Fig. 1, (ii) adopted the naming format suggested by the reviewer and (iii) made substantial efforts to reduce the length of the Geological Setting while retaining the critical information necessary for discussing our new results. Thus, the section was reduced from 2,187 to 1,872 words. Please, check the revised manuscript with tracked changes to see these modifications.

Line-by-Line comment

157-158-> If available from the literature, please report the pressure values.

Details on the P estimates for the HP-LT metamorphism in Crete is provided later, in dedicated paragraphs of this section (L178-182 and L208-211). Consequently, we prefer to avoid a repetition and we only replaced "low-P metamorphic imprint" by "low-grade metamorphic imprint" for consistency.

Line 193-> Please replace "grauwackes" with "graywackes"

Done.

Line 243-> The Cretan metamorphic is used here for the first time. I suggest introducing it before.

For consistency, we applied a similar terminology throughout the manuscript and,

therefore, replaced "Cretan metamorphic complex" by "metamorphic complex (or duplex) in western Crete" (see L238, L259, L272-273, L856).

Field constraints on the architecture of the HP-LT duplex:

There are no particular problems to solve. The section is well written and in very good form. However, it suffers somewhat from the lack of a less confusing presentation of the units exposed in the study area. I suggest (see comment above) to make this aspect less heavy.

See above our response and the changes made to the presentation of the unit subdivisions and names.

Line by line comments

Line 302 -> Replace "propose" with "provide"

Done.

Line 327 -> I didn't see the village of Agriles on the map reported in Figure 1

Correct. We added this village on Fig. 1.

Line 358 -> Replace "criteria" with "kinematic indicators"

Done.

Line 381 -> What does "metaclastics" mean? Please, provide more information.

We clarify the lithological description by using the word "metaconglomerate". We also modified Fig. 5 accordingly.

L394-396. This W-dipping structure consists of a ~8 m-thick fault zone, with a cataclasite composed of dark grey clasts of metaconglomerate and a hydrothermally altered brownish to yellowish fault gouge.

RSCM peak metamorphic temperatures:

As reported above, I suggest moving the RSCM Methodology subsection to a separate Methods section. However, this section is well written and I have only one point to correct.

We added a new Method section (Section 3) before presenting our results, according to reviewer's comment.

L281-310. 3. RSCM methodology […].

Line by line comments

Line 496 -> Please replace "steps" with "gap"

Done.

Discussion:

This section is well written and in very good form. All data is properly discussed by Menant and co- authors. I have a few questions that need to be addressed.

Line 710-719 -> I agree with the authors on the mechanism to explain the lack of about 30 km of crust across the contact. I suggest adding more references from worldwide examples to further support this result.

Good remark. Thanks. We revised this sentence and added two references to other natural examples of detachment in order to strengthen our statement.

L707-708. […] that are, instead, typical of detachment faults reported in mountain belts worldwide (e.g., Lister & Davis, 1989; Jolivet et al., 1998).

Line 735-736 -> I suggest to better explain this aspect before the discussion

This remark overlaps comments [3] and [21] of Reviewer #1. As explained above, we clarified the last part of this paragraph.

L730-733. Given that the peak metamorphic temperature was likely coeval (or near coeval) to the peak pressure for all the tectono-metamorphic units (see Section 5.1), there are two explanations for the decreasing RSCM temperatures towards the base of the nappe stack [...].

L738-740. To tackle this issue, finer P-T estimates, combined with precise dating of the accretion and exhumation stages for the different tectonic units, are presented in the companion paper (Menant et al., this volume).

Line 794-801 A third possibility is the interplay between the two processes, with the former (the true spatial extent of each unit) who could affect the latter (late reworking).

Good point. We added a new sentence, according to reviewer's suggestion.

L797-800. It is also plausible that the interplay between the two processes contributed to the duplex asymmetry, as exhumation-related deformation may have been partly controlled by the original extent of the accreted tectonic slices.

Line by line comments

Line 644 -> Please insert a space between "of" and ">7".

There was already a space here.

Line 820 -> Stage 1 in the caption of Figure 11 is reported as a tectonic event. Please standardise this.

Ok. We replaced "Stage" by "tectonic event" to be consistent throughout the manuscript.

L820-821. […] (see structures from tectonic event #1 in Fig. 11).

See also L835 a L843.

Figures:

Figure 1 top left insert -> please add the trace of the crustal section reported below. I suggest changing the grey colours for the "Eocene HP-LT belt".

Done.

Geological map from Crete -> Please change the colours of the schistosity trajectories. Also, although it is stated in the text, I suggest indicating the chronology of the schistosity reported on the map.

For the sake of clarity, we changed the color of the schistosity trajectories where they were hardly visible (i.e., in the light-blue-colored Lower Trypali unit).

Because it was sometimes difficult to distinguish S1 and S2 schistosities in the field, we decided to represent them together, showing only the most prominent foliation to highlight the large-scale geometry of the duplex. This mapping of S1-2 schistosity trajectories is now indicated in the legend of the figure.

Symbols for mineral and extension lineation -> I suggest to better explain the meaning of the adopted symbols.

A sentence has been added in the figure caption accordingly.

L129-130. Arrowheads on mineral and stretching lineation markers indicate sense of shear.

Please add north both in the insert and in the geological maps. In the insert, please add the scale bar.

Done.

Figure 2

Please add the cardinal points above the vertical scales. Check them for all the geological sections in the manuscript.

Done.

What is the grey area in the top right inset? Please add it to the figure caption and check it in all figures.

The grey area corresponds to the surface exposure of the metamorphic complex in western Crete. We added a legend in the inset of Figs. 2, 4, 5 and 7 to define it.

Figure 3

I suggest increasing the size of panels C and D.

Done. Thank you for the suggestion.

[49] Figure 4

Caption -> I suggest avoiding the terms detachments and/or extensional shear zone in the presentation of the results. These terms should appear in the discussion and conclusion sections.

In the caption, the term “detachment” is clearly presented as an interpretation with a reference to Section 6.2 (i.e., Discussion) for further explanation. We believe that sufficient caution is exercised in the wording and would therefore prefer to keep the caption as it stands.

Figure 5

See comment on Figure 4 for interpretation of results.

See our reply above.

Figure 7

Panel b -> please plot only the poles.

Because the lower panel of Fig. 7b illustrates the orientation and the dip of planes (i.e., HP-LT tensile veins), we believe that representing the poles and the planes in the stereographic projection is necessary and prefer to keep the figure as it stands.

Panel d -> please explain the meaning of the different symbols used for transport direction (double arrow and single arrow) to avoid confusion for the readers.

Ok. The legend of single/double arrows (below panel d) has been improved to avoid confusion between the two symbols.

Figure 8

Please add a legend, scale bar and north direction to the figure.

Done.

Authors' Reply to Reviewer 2

The paper by Menant et al., presents a coherent dataset for Western Crete to reconstruct the tectonic evolution of Western Crete from early exhumation/accretion and underplating to late exhumation and low angle normal fault formation. They used a robust structural dataset, field observations and RSCM data. I really enjoyed reading the paper and the authors should be complemented for the robustness and synthesis of a complicated dataset. Overall, I think that the manuscript is well written, and I have minor comments.

We thank the reviewer for his/her kind words regarding this work.

The two major points I have that they would need to be resolved prior to publication are:

1) The presentation and connection of the current paper with the mentioned in the text companion paper. I do not have access to the companion paper, but by just reading this contribution I have been left wondering what the main conclusion is take away of the companion paper. There is mention of the companion paper in a couple of places but not clearly outlined what the results are, what methods are explicitly used and how are these two papers complementary to each other.

According to reviewer's comment, we modified the end of the Section 1 (Introduction) where we now distinguish the methods used in the 2 companion papers and mention the main outcomes and the overall goal of the 2nd contribution. This highlights the connection between the 2 papers.

L96-99. In the present two companion papers, we report a multi-disciplinary study to unravel with an unprecedented resolution the tectono-metamorphic evolution of the paleo-accretionary complex exposed in western Crete, Greece (Fig. 1) (Creutzburg and Seidel, 1975; Papanikolaou and Vassilakis, 2010).

L109-111. This first contribution provides new field observations, structural measurements and Raman spectrometry on carbonaceous material (RSCM) analyses to constrain the 3D geometry and thermal architecture of the paleo-duplex of western Crete.

L118-122. These outcomes will be used in the second contribution (Menant et al., this volume), together with new petrological observations, P-T pseudosection modeling, Rb/Sr multi-mineral geochronology and U-Th/He thermochronology on zircon, to reconstruct the P-T-t evolution of the previously identified tectono-metamorphic units and to provide new insights into the long-term basal-accretion dynamics of the Hellenic subduction zone.

2) The treatment of the RSCM data. I am a little puzzled of how the authors determine the thermal inheritance and exclude data. This needs to be discussed further and be justified.

We acknowledge that the definition of thermal inheritance provided in Section 5.2 might be confusing, just like Fig. 9. To make this critical point clearer, we revised the text in

Section 5.2 (identification of the inherited thermal signature from internal distribution of Tmax) and in Section 6.1 (discussion regarding the Tmax distribution at the scale of the different tectono-metamorphic units). We also modified Fig. 9 and its caption to avoid confusion.

L574-576 (section 5.2). In case #1 (13 samples), most spectra reflect the coldest, and youngest thermal signature, while a small fraction indicates a higher Tmax interpreted as an inherited component (Fig. 9a).

L613-616 (section 6.1). Additionally, the main Tmax component of these samples is similar to the dominant inherited thermal signature of nearby samples CR1926b and CR2070 (i.e., compare Figs. 9b, 9c). This suggests that CR1945a and CR2045 only record the thermal inheritance and, thus, we interpret their Tmax as maximum temperature bounds.

L586-588 (caption of Fig. 9). (c) Specific Tmax distribution showing an inherited thermal signature only, inferred from RSCM temperatures and Tmax dispersion in nearby samples (see Section 6.1).

Also given that these rocks are poly-deformed and metamorphosed the authors need to justify why these temperatures do not reflect an exhumation thermal peak associated with deformation of graphite during exhumation rather than peak metamorphic conditions.

The reviewer raises an important point. In the first version of this manuscript, we did not explicitly correlate the RSCM peak temperatures with the peak metamorphic pressure. However, there is a good agreement of the mean Tmax with the peak metamorphic conditions from literature (see L636-642), supporting this hypothesis. We added 2 sentences in Sections 6.1 and 6.2 to justify this correlation and to support the discussion.

L642-647 (Section 6.1). This overall consistency also suggests that the RSCM peak temperature was coeval (or near coeval) with the peak pressure and that no significant heating occurred during subsequent exhumation. This interpretation is notably supported by retrograde P-T paths for the Phyllite-Quartzite s.l. Unit in western Crete that show either cooling or only minor heating during decompression (Jolivet et al. 1996; see also the companion paper for new P-T paths; Menant et al., this volume).

L730-733 (Section 6.2). Given that the peak metamorphic temperature was likely coeval (or near coeval) to the peak pressure for all the tectono-metamorphic units (see Section 6.1), there are two explanations for the decreasing RSCM temperatures towards the base of the nappe stack [...].

[5] Line 35: I am not sure what the word “first” means here. This is publication is not the first contribution investigating underplating/basal accretion.

We acknowledge this part of the sentence might be confusing. We clarified it by mentioning the 2 companion papers.

L35-38. This first contribution of two companion papers (see also Menant et al., this

volume) presents a detailed reconstruction of the tectonic and thermal structure of a high-pressure/low-temperature paleo-accretionary duplex in western Crete (Greece) that formed along the active Hellenic margin during the Oligocene-Miocene.

Line 85: Since Crete is in the Hellenic space, I think it is important to include references about underplating and stacking from the Cyclades especially given that the Cyclades are also mentioned and described in the geologic setting.

We already cite here two papers (Glodny and Ring, 2022; Uunk et al., 2022) dedicated to the timing of the HP-LT nappe stacking in the Cyclades. We decided to keep these two references (+ the 5 references dedicated to other subduction zones) to avoid to extend a reference list which is already long.

Line 94 & 110: I am confused about the companion contributions. Can you please add a sentence that describe what each contribution addresses and what methods are used on each manuscript? I recommend restructuring the sentence and clearly describing the methods used in each manuscript and the main scientific objective addressed.

As mentioned in our response to Reviewer's first major point, we modified this part of the discussion to better distinguish the methods and the outcomes of the two companion papers (see above).

Line 139: Either rephrased and say the majority on the Cyclades are comprised by the CBU or include in your description the CB and upper unit.

We rephrased this sentence accordingly.

L143-147. In the Cyclades, these rocks form the Cycladic Blueschist unit that is directly exposed below the low-grade metamorphic units and preserves a subduction-related HP-LT imprint from the early Eocene (Bonneau and Kienast, 1982; Wijbrans and McDougall, 1986; Jolivet et al., 2003; Laurent et al., 2021).

Line 216-219: I would recommend adding the main conclusions of the paper in this sentence. Since the papers are companions, it needs a stronger connection, and the reader should not have to go to the companion paper to know what the ages and main conclusions of the other paper are.

This sentence was referring to a more detailed description of metamorphic and geochronological constrains from literature in the Geological Setting of the companion paper (and not to its conclusions). We agree it was unclear, and not necessary here. We have therefore removed it.

Line 296: Awkard long sentence please rephrase.

Done.

L277-279. To address this debate, a detailed reassessment of the structural record and tectonic contacts, particularly the major ductile-brittle shear zones at the top of the HP-LT nappe stack, is required.

Line 301: Microstructures

Done.

Line 314: Define what type of tectonic contacts are the authors referring to here. Not everyone would be familiar.

We now specify the type of contact when these structures were formed.

L327-328. In the field, pristine kinematics along major contacts, initially functioning as thrusts between the tectono-metamorphic units, are often overprinted by later tectonic reworking.

Line 315: Overprinted is probably a better word than blurred.

Correct. We changed "blurred" by "overprinted".

Line 319: Please be specific. What is the grain size? Is there a figure illustrating that or an existing published work (If so add citation)?

Ok. We provided now in the text a quantification of the grain size in mylonitic bands and added a microscopic picture for illustration (Fig. 3d).

L332-334. Its footwall consists of a few-meter-thick mylonitic to ultramylonitic zone with intense grain-size reduction (i.e., <50 μm; Fig. 3c) affecting impure marbles in the uppermost part of the Kalamos beds (belonging to the Upper Trypali unit).

Line 333: Can the authors be more specific here on the origin of the clasts? What type? What came from the hanging wall and what from the footwall?

Ok. We are now more precise in the lithological description of the clasts, their abundance and their origin.

L344-347. […] and the contact between these two units is typically expressed as a meter-thick, moderately dipping tectonic breccia with angular clasts, predominantly of quartzite from the hanging wall and minor marble from the footwall (Figs. 2b, 3e).

Line 358: structures instead of criteria?

We use now the word "kinematic indicators", according to comment [37] of Reviewer #2.

L372-373. […] although minor top-to-the-S kinematic indicators are also observed (Fig. 2a).

Line 426: Which tectonometamorphic units? Please clarify.

Intense folding is observed in all the units forming the HP-LT duplex. We modified this sentence, accordingly.

L440-441. Intense folding is recognized in all the tectono-metamorphic units forming the HP-LT duplex in western Crete.

Line 616: I would recommend changing the way the different ages are presented. Saying that "Notably, there are some seemingly conflicting mean Tmax" implies that these data is straightforward although is not.

Ok. We have revised the sentence (now 2 sentences) and adjusted the presentation

of the locally reported higher mean Tmax values in a more neutral tone.

L603-607. However, rare instances of mean Tmax exceeding the RSCM temperature range for a given unit are locally reported. Thus, sample CR1910a from the ~390-415°C Medium-T Phyllite-Quartzite unit yields 423 ± 20°C, while samples CR1926b and CR2070 from the ~360-390°C Upper Trypali unit yield 407 ± 22°C and 416 ± 19°C, respectively (Table 1).

Line 613-631: I am not sure I understand how the authors decide which temperatures are recording an inherited component, other than using the average temperatures of the unit from other samples. Why in some samples the inherited thermal signature is hotter and, in some others, colder? The authors also need to discuss about the possibility of resetting during deformation of the graphite during exhumation.

The inherited component is always associated with a higher thermal imprint (see the definition given L574-576). We never mentioned a "colder inherited thermal signature". However, we acknowledge that it might be confusing, especially regarding Fig. 9c. We therefore revised the text (Sections 5.2 and 6.1) and we modified Fig. 9 and its caption (see our reply to comment [3]).

Line 675: I am not sure what mineral equilibria do the author refer to. This is the first time this is mentioned.

The T estimates from several mineral equilibria come from previous petro-metamorphic studies (Seidel et al., 1982; Theye et al., 1992; Joliet et al., 1996). We clarified this sentence, accordingly.

L664-666. In conclusion, the close alignment between our RSCM temperatures and T estimates from previous petro-metamorphic studies (Seidel et al., 1982; Theye et al., 1992; Jolivet et al., 1996), combined with […].

[21] Line 742: The paper does not provide pressure estimates. The only pressures mentioned are from Theye et al., 1992; Jolivet et al., 1996 paper and they are not from the same samples so it cannot be assumed that the rocks used in this study would have experienced the same pressures.

While these are not the same samples, they are all from the Phyllite-Quartzite s.l. Unit, which partly justifies the comparison. However, the uncertainty in P estimates from previous studies, which did not differentiate the various tectono-metamorphic units within the Phyllite-Quartzite s.l. Unit, makes it challenging to discuss the origin of the RSCM-temperature decrease from the top to the base of the nappe stack. The new petrological data and thermodynamical modeling provided in the companion paper offer valuable insights into this discussion. However, given the absence of a straightforward interpretation, we prefer to avoid a detailed discussion here and instead briefly mention the new results and referring readers to the companion paper where they are addressed in detail.

L738-740. To tackle this issue, finer P-T estimates, combined with precise dating of the accretion and exhumation stages for the different tectonic units, are presented in the companion paper (Menant et al., this volume).

[22] Line 755: I would recommend reminding the reader here exactly what these contacts look like. Why is tectonic slicing concentrated there? What are the lithologic differences? Was it fluid driven weakening?

We revised this sentence to provide a concise summary of the main shear-zone characteristics as described in the Result section.

L750-754. New field observations and RSCM measurements presented in this study, combined with lithostratigraphic, structural and radiometric data compiled from literature, allowed to identify a minimum of five tectono-metamorphic units bounded by major ductile-brittle shear zones exhibiting a top-to-the-S reverse kinematics that is commonly overprinted by tectonic reworking

[…].

However, while the mechanisms responsible for the slicing are indeed an interesting topic, a detailed discussion (such as the potential roles of lithological contrasts or fluid-driven weakening) goes beyond the scope of this study. Furthermore, our current observations do not provide sufficient constraints to support such interpretations. For these reasons, we have chosen not to further develop these aspects in the manuscript.

Line 811: pre-structuration is an awkward word to use here.

Ok. We modified this sentence by avoiding the word "pre-structuration".

L830-832. Field evidence for tectonic structures formed prior to subduction remains, therefore, elusive and are likely difficult to identify due to the tectonic and metamorphic overprint during the basal-accretion and exhumation stages.

Line 816: specifically on Crete

Ok. We have clarified our wording in this sentence.

L816-818. This study provides constraints on the succession of deformation events recorded by the metamorphic duplex in western Crete during its journey from the subduction interface to the forearc upper crust.

Line 863: Although I agree with this statement as of now it is not well supported or justified with connecting with the data. I think the authors have the data to make this statement, but it needs to be reshaped and incorporate the different stress tensors recorded from their structural data and crack seal veins.

In this section (L816-852), we already highlighted the apparent discrepancy between different deformation records and stress regimes (when it was inferred) during the deep-accretion and exhumation stages, which lead us to discuss the hypothesis of short-term fluctuations in the stress regime. Given the significant uncertainty associated with interpreting the stress regime "fossilized" by deformation markers formed under ductile conditions, we initially chose to avoid making a definitive statement. However, we acknowledge that our wording may have been too elusive and we have now added several sentences to (i) better emphasize the structural evidence we do have and (ii) propose future research directions aimed at testing our hypothesis.

L867-877. For instance, S-vergent mylonitic thrusts and ~E-W-striking HP-LT tensile veins with crack-seal fabrics both formed near the basal-accretion site (Figs. 3b, 6b-c, 7b). These structures may reflect contrasting stress regimes along the deep subduction interface; i.e., a compressional regime with a N-S-oriented σ1 for the thrusts and an extensional regime with a N-S oriented σ3 for the veins. This apparent contradiction could be explained by short-term fluctuations in stress regime, as discussed above. However, under HP-LT conditions where ductile deformation prevails, reconstructing the stress field and determining whether such stress regimes are regional or localized remains a significant challenge. Addressing this issue requires detailed structural analysis in paleo-duplexes worldwide, combined with investigations of both long- and short-term stress evolution predicted by physically-based modeling.

2nd Round of Revisions

Decision Letter

Dear Author,

We have reached a decision regarding your submission to ТЕКТОNIKA, "Setting the sequence of slicing events along deep subduction interfaces: 1. The tectonic and thermal structure of the high-P duplex in western Crete (Hellenic margin)".

Our decision is to: Accept Submission

There are only some very minor comments by one of the Reviewers to be addressed, please see below.

Line 192: Awkward sentence. Please rephrase.

Line 279: here instead of required I would suggest saying was conducted in this study. Or continue the sentence and say that was conducted to this study.

Lines 433-435: Fibrous veins are not crack seal veins. Fibrous textures can form without brittle fracturing. Fibrous veins often also suggest slow opening and filling. I would switch the emphasis to the perpendicular to the opening direction cracks/inclusion bands (Eg., Bons 2001 and Bons 2000).

Figure 8: This figure is great and convey the main interpretation. However, since there is no supplementary material, this figure needs to have the sample names on the map. It is very hard to go back and forth between figure 8 and table 1 to see the details of the analyses.

Once this last version of the manuscript is uploaded we will proceed to copyediting. Best wishes,

the Editorial team of Tektonika

Comments by Reviewer 1

I read the revised version of the manuscript Setting the Sequence of Slicing Events Along Deep Subduction Interfaces: 1. The Tectonic and Thermal Structure of the High-P Duplex in Western Crete (Hellenic Margin) by Menant and Co-Authors. The authors provided a satisfactory response to each of my concerns.

Therefore, the manuscript is ready to be published in the Tektonika journal.

Edoardo Sanità

Comments by Reviewer 2

I have now finished reviewing the revised manuscript by Menant et al.,

The authors addressed all of my concerns and comments from the first revision and I only have a couple very minor comments below.

Line 192: Awkward sentence. Please rephrase.

Line 279: here instead of required I would suggest saying was conducted in this study. Or continue the sentence and say that was conducted to this study.

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Authors' Reply to Reviewer 1

No responses were necessary.

Authors' Reply to Reviewer 2

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, (i) we now use the standard convention of the right-hand rule for presenting structural measurements in Figs. 3-6 and indicate this in the corresponding captions and (ii) we have added a space before "°C", as suggested during the peer review of the companion manuscript. We also added three recent references relevant to our study (Wicker and Bufféral, 2024; Bouhot et al., 2025; Zaccharias and van Hinsbergen, 2025).

Reviewer 2:

I have now finished reviewing the revised manuscript by Menant et al., The authors addressed all of my concerns and comments from the first revision and I only have a couple of very minor comments below.

Line 192: Awkward sentence. Please rephrase.

Ok. For sake of clarity, we have rephrased this sentence into two.

L191-195. Above lie gypsum layers with metamorphic graywackes and slightly bituminous dolomites (the Stomion beds), followed by alternating marbles and phyllites (the Kalamos beds, ~300 m thick). These are in turn overlain by intercalated marbles, phyllites, quartzites, metaconglomerates and metavolcanics (the Rambi Seli beds, ~400 m thick).

Line 279: here instead of required I would suggest saying was conducted in this study. Or continue the sentence and say that was conducted to this study.

Thank you for this suggestion. We have modified this sentence, accordingly.

L277-279. To address this debate, a detailed reassessment of the structural record and tectonic contacts, particularly the major ductile-brittle shear zones at the top of the HP-LT nappe stack, was conducted in this study.

Lines 433-435: Fibrous veins are not crack seal veins. Fibrous textures can form without brittle fracturing. Fibrous veins often also suggest slow opening and filling. I would switch the emphasis to the perpendicular to the opening direction cracks/inclusion bands (Eg., Bons 2001 and Bons 2000).

We agree with the reviewer's comment. However, in carpholite-bearing veins, brittle fracturing affecting carpholite is reported (see "cracks" in Fig. 6b), together with inclusions trails that are characteristic of crack-seal fabric (Ramsay, 1980). To further support our interpretation of vein-opening dynamics, we now provide new microscopic evidence of inclusion trails (see Fig. S1 inSupporting Information) and have slightly modified the main text.

L439-441. Together with intrusion trails also reported in tensile veins (see Fig. S1 in Supporting Information), these observations suggest incremental crack-seal growth under HP-LT conditions and N-S oriented stretching.

Figure 8: This figure is great and convey the main interpretation. However, since there is no supplementary material, this figure needs to have the sample names on the map. It is very hard to go back and forth between figure 8 and table 1 to see the details of the analyses.

Ok. We have added the sample name for each Tmax in Fig. 8 and updated the figure caption, accordingly.

L540-541. Sample names are shown in italics.

References used in the rebuttal letter

Bouhot, M., Menant, A., Ganino, C., Angiboust, S., Oncken, O., Jolivet, L., Deldicque, D., Skarpelis, N. and Orange, F. (2025) 3D Petro-Structural Evolution of the High Pressure-Low Temperature Phyllite-Quartzite Nappe Pile in southern Peloponnese, Greece, Tectonics, 44, e2025TC009089. https://doi.org/10.1029/2025TC009089.

Ramsay, J.G. (1980) The crack–seal mechanism of rock deformation, Nature, 284(5752), 135–139. https://doi.org/10.1038/284135a0.

Wicker, V. and Buffétal, S. (2024) Deformation Mechanisms During the Syn‐Orogenic Extrusion of the High‐Pressure Phyllites‐Quartzites Unit in the Central and Northern Peloponnese, Greece, Tectonics, 43.

Zachariasse, W.J. and van Hinsbergen, D.J.J. (2025) Is there a Cretan Supradetachment Basin? Insights From Detailed Mapping on Northwestern Crete (Greece), Tektonika, 3(2), 81-107. https://doi.org/10.55575/tektonika2025.3.2.97.

Acceptance Letter

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