

Review Report

**Célini et al., Impact of Salt Tectonics on Temperature Distribution
Revealed by RSCM Thermometry in the SW Alps (France), TEKTONIKA,
2024**

Table of Contents

<i>1st Round of Revisions</i>	2
Decision Letter.....	2
Comments by Reviewer 1	4
Comments by Reviewer 2	15
Authors' Reply to Reviewer 1	24
Authors' Reply to Reviewer 2	28
<i>2nd Round of Revisions</i>	42
Decision Letter.....	42
Comments by Reviewer 1	43
Comments by Reviewer 2	44
Authors' Reply to Reviewer 1	45
Authors' Reply to Reviewer 2	46
<i>Acceptance Letter</i>	47

1st Round of Revisions

Decision Letter

Dear Dr Celini,

We have now received all reviews for your manuscript. They recommend moderate to minor revisions before it is acceptable for publication.

I found your article very interesting, but I ask you to consider the issues raised by the reviewers carefully. Please pay special attention to the Discussion section, which is missing some important information to interpret the thermal data. In addition, there are some grammatical mistakes and, thus, the English should be checked before publication. Title should be '**Impact of salt tectonics on temperature distribution revealed by RSCM thermometry in the SW Alps (France)**' (temperature without S). In addition to the reviewer's comments, I ask the authors to address the following issues:

Introduction. The salt tectonic studies in the French Pyrenees are properly cited, but many recent works are missing from the Spanish Pyrenees. For the Basque-Cantabrian Basin: Pedrera et al. (2021), Roca et al. (2021), Miró et al. (2023). For the Spanish Pyrenees: Pedrera et al. (2023), Gannaway Dalton et al. (2022), Burrell and Teixell (2021) and Hudec et al. (2021).

The BRGM French Geological Map at 1/1000000 (sheet South) is also missing a proper reference, including author names and year (both in Figure 1 and within the text).

Results. The text would read better if the full sample names were given, instead of giving the numbers in the figures (it is confusing because in all figures there are samples 1,2,3,4,5)

Discussion. The impact of salt tectonics in the isotherm patterns should be discussed with more detail, including a more thorough comparison with previous works. This should include at least the works mentioned in the Introduction (Jensen, 1983, 1990; Vizgirda *et al.*, 1985; Mello *et al.*, 1995; Peterson & Lerche, 1995; Davison & Cunha, 2016; Zhuo *et al.*, 2016; Cedeño *et al.*, 2019; Li *et al.*, 2020) and possibly some other recent works (e.g. Grunnaleite and Mosborn, 2019; Canova et al. 2018; Downs, 2012).

Some other comments on the figures:

Figure 2 would benefit from adding the main salt tectonic and thermal events on the right-hand side, so the reader doesn't need to scroll through the text to find this information.

Figures 3 to 6. The location and numbering of pictures and cross-sections is rather confusing. I suggest numbering the cross-section independently, using roman numbers (I-I', II-II', III-III', IV-IV' etc.), clearly indicating the positions of both cross-section ends. Also, indicate the location of each picture more precisely, extending lines

from the 'viewpoint' or using a thicker line. Some other comments on those figures:

- Where is sample 8 in Figure 3?
- What is (C) in Figure 4?
- Indicate sample numbers in all pictures, together with the temperature values.
- Add °C after all temperature values. These values could be depicted in red, to differentiate them from the dip data.
- Change '*samples' names*' for '*sample names*' (or sample locations) in all figures.

Figure 8. Mark with a rectangle the restored portion. Is Figure 8B to scale? Also, indicate that the sample from the Grande Gauthière has been projected and draw the projected sample in the present-day cross-section.

Figures 8, 9 and 10. It would be helpful to indicate the positions of the samples and draw the isotherms through all stages of restoration.

Sincerely,

Berta López-Mir

Section A: Overview of manuscript

A1) Overall evaluation, general comments & summary

A1.1) Reviewer's comments

A1.1.1) General evaluation and publication suggestion – Required:

The manuscript presents new Raman Spectroscopy carbonaceous material (RSCM) data round three salt-related structures located in the south-western Alps. Field/map evidences of salt tectonics in the three structures are first presented and described (section 3). Peak-temperatures are then projected on cross-sections of the structures (section 4) and used to roughly reconstruct the geometry of the isotherms and discuss its meaning in relation to salt tectonics (section 5).

The manuscript is direct and well-organized and presents an interpretation that is in agreement with the presented dataset. The discussion and results section would nevertheless benefit from the inclusion of some additional information/explanations (see suggestions below) and the clarification of some specific points in the interpretation. I think the manuscript is a nice and original contribution, and recommend its publication after the authors evaluate the suggestions proposed in the peer-review form and the annotated pdf attached to this review.

A1.1.2) What does the submission need to be publishable? (select as needed; comment for all cases)

- ☐ No changes required
- ☒ Rewriting: adding some additional information.
- ☐ Reorganising
- ☐ More data/figures
- ☐ Condensing
- ☐ Reinterpretation
- ☒ Other: clarification of some specific points of the interpretation

Comments:

The manuscript is generally clear and well structured, but some additional information would be needed in the RSCM data or interpretations sections:

- (1) one main point of the manuscript is the Jurassic-Early Cretaceous age of the peak temperatures. For justifying this important piece of information (age of the structures is discussed in the light of the geometrical relationship between bedding and isotherms), authors refer to their previous works. I nevertheless missed in the text a brief summary of the main points supporting the pre-orogenic age of peak temperatures, that will avoid readers to dig into previous literature and will prepare them for better understanding the main points of the manuscript discussion.
- (2) Regarding peak thermal estimations, an explanation on why the Lahfid et al (2010) quantitative calibration is used below 200° C is probably required. 5 samples are in the range of 170-190 °C degrees but the published quantitative calibration itself (RA1 regression line) is calculated from 200 °C up to 320°C. Are the 170-190 °C obtained values compatible with other qualitative calibrations (e.g., Saspiturry et al 2020)?
- (3) The interpretation of the peak thermal data lacks one piece of information that is probably significant: why the peak temperature data are higher in two of the salt structures and lower in the third one? Is there a regional scale reason for these differences? And finally, the burial depths that can be estimated from peak thermal data, are they consistent with expected sedimentary thicknesses at the inferred time of peak temperatures?

Some additional suggestions on the interpretation part are indicated below.

A1.1.3) Can the submission be improved by reducing/adding any of the following? (select as needed; comment for all cases)

- ☒ Text
- ☐ Table
- ☐ Figures
- ☐ Supplementary material

Comments:

See comments in section A 1.1.2.

A1.1.4) Please complete the following section if you recommend that the submission is NOT appropriate for publication (select as needed; comment if a box is selected)

- ☐ Quality is poor
- ☐ Research is not reproducible
- ☐ Other

Comments:

[Free form box]

A2) Summary of main merits and main points of improvement

A2.1) Reviewer's comments

The main merits I have found are...

- Review and clear illustration of field evidences supporting the existence of important salt tectonics processes in the studied structures.
- Obtention of new peak thermal estimates for the study area.
- Integration of structural and peak thermal data on new cross-sections. Use of isotherms geometries in order to reconstruct the kinematic evolution of the studied structures.
- Use of non-structural data (consistently with structural observations) to date the studied structures.

The main points of improvement I have found are...

See the three points enumerated in A 1.1.2

Section B: Detailed evaluation of manuscript

B1) Title and abstract

B1.1) Reviewer's comments

*These statements are a **guide** to what good Titles and Abstracts include. Please select YES or NO to the statements below if you wish and detail in the free form box below your reasons for any box checked with NO, or to comment on any other matter.*

The *Title* describes the main topic of the manuscript **accurately** — YES / [NO]

The *Title* describes the main topic of the manuscript **succinctly** — YES / [NO]

The *Title* includes **appropriate key terms** — YES / [NO]

The *Abstract* includes a **clear aim and rationale** — YES / [NO]

The *Abstract* supports the rationale with **sufficient background information** — YES / [NO]

The *Abstract* includes a **well-balanced description of the methods** — YES / [NO]

The *Abstract* describes the **main results sufficiently and adequately** — YES / [NO]

The *Abstract* clearly describes the **importance/impact of the study** — YES / [NO]

The *Abstract* clearly states the **conclusions of the study** — YES / [NO]

The *Abstract* is **clear and well structured** — YES / [NO]

Comments:

[Free form box]

B2) Introduction

B2.1) Reviewer's comments

*These statements are a **guide** to what good Introductions include. Please select YES or NO to the statements below if you wish and detail in the free form box below your reasons for any box checked with NO, or to comment on any other matter.*

The *Introduction* provides **sufficient background and context** for the study — YES / [NO]

The *Introduction* describes the **aim/hypothesis/rationale** clearly, providing **sufficient context** — YES / [NO]

The *objective/hypothesis/rationale* **flows logically from the background** information — **[YES]** / [NO]

The *Introduction* describes the study's **objective and approach** (last paragraph) — **[YES]** / [NO]

The *Introduction* contains **relevant, suitable citations** — **[YES]** / [NO]

The *Introduction* is **organized effectively** — **[YES]** / [NO]

Comments:

For the introduction, see minor comments in the annotated pdf (rewording and acronym definition suggestions).

For the Geological Setting section:

- In section 2.1, there is a number of mentioned structures which are not always appearing in the geological map in figure 1. When possible, please add the mentioned names in the map for location purposes. Besides, a sentence at the end of this paragraph roughly locating, at a regional scale, the three studied structures may be included.
- The second part of section 2.3 is a bit repetitive. Authors can merge this and previous paragraphs.
- In section 2.4, I would suggest to include a summary of the main points supporting a syn-rift age of the peak temperatures. Authors refer to their previous works but it is probably important to clarify which are the main observations supporting the pre-orogenic age of the peak thermal event: interpretation of salt tectonics at the end of the manuscripts largely relies on the age of isotherms and their relationship to folds so this point deserves to be clearly stated (even if already done in previous works).

B3) Data and methods

B3.1) Reviewer's comments

*These statements are a **guide** to what good Method sections include and good practices for Dataset accessibility. Please select YES or NO to the statements below if you wish and detail in the free form box below your reasons for any box checked with NO, or to comment on any*

other matter.

The *Methods* are described **concisely and with enough detail** for reproducibility — **[YES]**
/ [NO]

Necessary information about **data sources/acquisition/processing** is included — [YES]
/ **[NO]**

Data used are accessible via either supplementary files or links in the data availability statement — [YES] / **[NO]**

The *Dataset and/or Methods* are **organized effectively** — **[YES]** / [NO]

Comments:

Authors should specify in the text (section 4.1) the total number of analysed samples and add some additional, early references when describing the methodological approach.

A data availability statement is missing. Besides, a sentence on how spectra peak fit was done (software, peak fit and baseline subtraction method...) is also missing.

B4) Results

B4.1) Reviewer's comments

*These statements are a **guide** to what good Result sections include. Please select YES or NO to the statements below if you wish and detail in the free form box below your reasons for any box checked with NO, or to comment on any other matter.*

The *Results* findings are **supported by data** — **[YES]** / [NO]

The *Results* findings are presented **clearly and succinctly** — **[YES]** / [NO]

The text in the *Result* section **cites tables and figures appropriately** — **[YES]** / [NO]

The *Results* directly **relate to the study objectives** — **[YES]** / [NO]

The *Results* present **data for all the approaches** described in the *Methods* section — **[YES]** / [NO]

The *Results* **text belongs to the Results section**, not to *Introduction*, *Methods*, or

Discussion. — **[YES]** / [NO]

The *Results* section is **organised effectively** — **[YES]** / [NO]

Comments:

In the **cross sections in figure 5** (Sorine and Chateaufort diapirs), there are two features that may deserve some words in the text:

(1) in A, in the syncline separating both diapirs, there is an anticline and a thrust that are not detached on the Triassic evaporites. This seems to imply that there is some compressional deformation affecting pre-orogenic depocentral areas and a detachment level within the Jurassic which is different from the regional Triassic décollement.

(2) in B, there is a clear thickness change in the late Bajocian-Bathonian from the northern to the southern limb of the structure. Do authors think that may be related to a basement feature underneath the salt structure? Is that fitting the explanation at the end of section 3.2?

Besides, the unconformities and stratigraphic relationships authors describe for the northern structure are hard to see in the geological map in figure 4. Authors may consider including an enlargement of the features described.

Regarding the **Daluis diapir**, the geological map and cross-section do not seem to show the salt piercing the overlying units. Is the structure then a diapir or could it be simply defined as a salt-related pillow, fold or salt-structure?

Regarding **RSCM data**, in sample LRG04-409 (the one with the lowest temperature), the thermal estimation is done using the qualitative estimation in Saspiturry et al (2020) but authors provide a quantitative average temperature and standard deviation value ($143 \pm 9^\circ\text{C}$) in Table 1. May authors explain how they obtained this specific value? Is any other calibration formula different from Lahfid et al (2010) used (that could be used for the 170-190° C range?).

B5) Discussion and conclusions

B5.1) Reviewer's comments

*These statements are a **guide** to what good Discussions and Conclusions include. Please*

select YES or NO to the statements below if you wish and detail in the free form box below your reasons for any box checked with NO, or to comment on any other matter.

The *Discussion* is **focused on the objectives** of the study — **[YES]** / [NO]

The *Discussion* **addresses all major results** of this study, which are shown in *Results* — [YES] / **[NO]**

The *Discussion* section makes **comparisons with other studies** that are relevant and informative — **[YES]** / [NO]

The *Discussion* section properly identifies all **speculative statements** — [YES] / **[NO]**

The *Discussion* section presents the **implications of the study** persuasively — **[YES]** / [NO]

The *Discussion* section **highlights novel contributions** appropriately — **[YES]** / [NO]

The *Discussion* section **addresses the limitations** of the study appropriately — [YES] / **[NO]**

The *Discussion* section is **organised effectively** — **[YES]** / [NO]

The *Conclusions* are **consistent** with and **summarise** the rest of the manuscript — **[YES]** / [NO]

The *Conclusions* are **supported by the data** in *Results* and **follow logically** from the *Discussion* — **[YES]** / [NO]

The *Conclusions* are **clear and concise** — **[YES]** / [NO]

Comments:

- As mentioned at the beginning of the review, there is a major difference between the temperatures recorded in 2 of the structures (higher temperatures in Daluis and Astoin) and the temperatures recorded in the remaining one (lower temperatures in the Rocher de Hongrie). The discussion will benefit from an explanation on the meaning of this difference on the thermal record.
- Regarding the interpretation of the carapace in the Astoin structure, the thermal argument is a nice one. I wonder if there is any other field evidence that helps on supporting this interpretation (absence of thrust related deformation at the contact, specific lithologies in the carapace?).

- Why a geothermal gradient of 30°C/km is used when the pure compressional scenario is discarded and an 80°C/km gradient when the salt tectonics scenario is justified?
- Isotherms geometries are reconstructed in Daluis and Rocher de Hongrie but not in Astoin where they are presumably tilted to the south. If these isotherms are tilted, this implies a post-thermal peak deformation (alpine compression?). It may be worth to discuss this point and try to use isotherm geometries to carry out the restoration in figure 8B.
- In the Rocher de Hongrie structure, the extension of the 190°C isotherm in the northern limb is not justified by data. This part of the isotherm should be described in the text and presented in the figure as tentative. Besides, one question regarding the interpretation arouse while reading: Alternatively (or additionally) to a local negative thermal anomaly, may some extensional collapse of the salt structure be considered for explaining the low thermal value recorded in the northern limb, close to the salt?

B6) Figures, tables and citations

B6.1) Reviewer's comments

*These statements are a **guide** to what good Figures and Tables include and how they are presented. Please select YES or NO to the statements below if you wish and detail in the free form box below your reasons for any box checked with NO, or to comment on any other matter.*

*Tables and Figures are **ordered logically** and **numbered sequentially** — [YES] / [NO]*

*Tables and Figures have **captions that explain** all their major features — [YES] / [NO]*

*Tables and Figures have **captions that complement** the information in the main text — [YES] / [NO]*

*Tables and Figures present data that **relate** to the study objective — [YES] / [NO]*

*Tables and Figures present data that are **consistent** with and support the description of results — [YES] / [NO]*

*Tables and Figures have **succinct and informative titles** — [YES] / [NO]*

*Figures are **accessible** (elements are clearly labelled, accessible colour palettes, colour contrasts, font size legible, etc....) — [YES] / [NO]*

Please, check our [\[Figure guidelines\]](#)

*Figures with **maps or cross-sections** contain all **elements to be understood** (north arrow orientation, scale, visible coordinates, sufficient coordinate grid intercepts) — **[YES]** / [NO]*

*Figures with **maps** have **sufficient location information** (in the map or caption) — [YES] / **[NO]** read above*

*Cross-sections have clear labels for **scale and coordinates** at ends and within-section kinks — **[YES]** / [NO]*

*All georeferenced elements are provided in common format (.shp, .geotiff, .kml) [in an open-access repository] — [YES] / **[NO]***

*Citations throughout are relevant, suitable, and comprehensive — **[YES]** / [NO]*

Comments:

- Figure 1. Rifting phases and compressional phases are indicated in the stratigraphic column in figure 2, but it may help to also include them in the legend of the geological map in figure 1.
- Figure 2. Age of peak temperatures may be indicated in the stratigraphic column.
- Figure 3. The picture in B is at low resolution and should be replaced. The labelling used in C is not appearing in A. Colours are sometimes very similar so having this labelling in the legend would help the reader identifying the units.
- Figure 4. The figure reference for the cross-sections is missing. Indeed, as in figure 3, it would be nice to have the uninterpreted panoramic picture.
- Figure 5. From the figure caption, it seems that the cross-section is taken from the map but I guess the section is yours, built from the geological map of the BRGM.
- Figure 9. The isotherm geometry in the northern part of the cross-section relies on just one data point. Because of that I would suggest to draw the isotherm geometry as tentative or interpretative (dashed line) and describe this feature in the text as interpreted (for the northern limb, clear and data supported in the south).

Section C: Additional comments

C1) Minor/line-numbered comments

C1.1) Reviewer's comments

Most of the comments in the annotated pdf are here mentioned, but some typos, rewording suggestions, etc can be found in the annotated file.

C2) Other remarks

C2.1) Reviewer's comments

[Free form box]

Section D: Feedback to improve Tektonika's review process

We kindly ask reviewers and authors to provide any feedback that can help improve this review form, or other aspects of the review process.

Feedback can also be emailed at any time to jtektionika@gmail.com

Section A: Overview of manuscript

A1) Overall evaluation, general comments & summary

A1.1) Reviewer's comments

A1.1.1) General evaluation and publication suggestion – Required:

Please use this space to describe, in your own words, the core subject of the submission and your overall assessment of its suitability for publication.

This paper highlights the importance of factoring in salt tectonics to fully understand the thermal evolution of a basin. It does so by exploring three examples from the southern sub-Alpine fold-and-thrust belt in which the salt-related structures developed before the basin acquired its thermal maximum. This resulted in a temperature distribution different to the one that could be expected if the structures had developed purely by compression after the thermal maximum event. This article follows on and complements several papers detailing the interpretation of the salt-related structures in the SW Alps and the thermal evolution of the basin. The methodology followed is clear and the results are consistent. The manuscript is well written and easy to follow, and figures are clear. I recommend its publication with some minor modifications outlined below.

A1.1.2) What does the submission need to be publishable? (select as needed; comment for all cases)

- ☐ No changes required
- ☐ Rewriting
- ☐ Reorganising
- ☐ More data/figures
- ☐ Condensing
- ☐ Reinterpretation
- ☒ Other

Comments:

Very minor modifications regarding the readability of some figures and the need to expand the explanation in some sections (See section C1.1).

**A1.1.3) Can the submission be improved by reducing/adding any of the following?
(select as needed; comment for all cases)**

- ☒ Text
- ☐ Table
- ☐ Figures
- ☐ Supplementary material

Comments:

A few suggestions on a few paragraphs to add to improve readability can be found in section C1.1

A1.1.4) Please complete the following section if you recommend that the submission is NOT appropriate for publication (select as needed; comment if a box is selected)

- ☐ Quality is poor
- ☐ Research is not reproducible
- ☐ Other

Comments:

[Free form box]

A2) Summary of main merits and main points of improvement

A2.1) Reviewer's comments

Please describe below in a few sentences (100 to 300 words) the main merits of the submission and suggestions for improvements.

The main merits I have found are...

It is a paper with a clear hypotheses that follows on from previous work in a well-documented area of study. Geological field examples chosen are brilliant to illustrate importance of understanding salt tectonics evolution to make sense of the thermal distribution of a basin and

highlights potential misinterpretations if salt tectonics are not accounted for. The paper is very clearly written and is concise, with plenty of bibliographical references to back up the structural interpretation of the three field examples. The structure of the paper is easy to follow and figures supply all the data required to understand the conclusions.

The main points of improvement I have found are...

Further explanation of the effect of salt in the thermal signature of surrounding sediments both in the introduction and the discussion could improve the readability (see specific lines above). Changing the colour scheme of the labels in some of the figures could improve its readability.

Section B: Detailed evaluation of manuscript

B1) Title and abstract

B1.1) Reviewer's comments

*These statements are a **guide** to what good Titles and Abstracts include. Please select YES or NO to the statements below if you wish and detail in the free form box below your reasons for any box checked with NO, or to comment on any other matter.*

The *Title* describes the main topic of the manuscript **accurately** — YES

The *Title* describes the main topic of the manuscript **succinctly** — YES

The *Title* includes **appropriate key terms** — YES

The *Abstract* includes a **clear aim and rationale** — YES

The *Abstract* supports the rationale with **sufficient background information** — YES

The *Abstract* includes a **well-balanced description of the methods** — YES

The *Abstract* describes the **main results sufficiently and adequately** — YES

The *Abstract* clearly describes the **importance/impact of the study** — YES

The *Abstract* clearly states the **conclusions of the study** — YES

The *Abstract* is **clear and well structured** — YES

Comments:

[Free form box]

B2) Introduction

B2.1) Reviewer's comments

*These statements are a **guide** to what good Introductions include. Please select YES or NO to the statements below if you wish and detail in the free form box below your reasons for any box checked with NO, or to comment on any other matter.*

The *Introduction* provides **sufficient background and context** for the study — YES

The *Introduction* describes the **aim/hypothesis/rationale** clearly, providing **sufficient context** — YES

The *objective/hypothesis/rationale* **flows logically from the background** information — YES

The *Introduction* describes the study's **objective and approach** (last paragraph) — YES

The *Introduction* contains **relevant, suitable citations** — YES

The *Introduction* is **organized effectively** — YES

Comments:

[Free form box]

B3) Data and methods

B3.1) Reviewer's comments

*These statements are a **guide** to what good Method sections include and good practices for*

Dataset accessibility. Please select YES or NO to the statements below if you wish and detail in the free form box below your reasons for any box checked with NO, or to comment on any other matter.

The *Methods* are described **concisely and with enough detail** for reproducibility — YES

Necessary information about **data sources/acquisition/processing** is included — YES

Data used are accessible via either supplementary files or links in the data availability statement — YES

The *Dataset and/or Methods* are **organized effectively** — YES

Comments:

[Free form box]

B4) Results

B4.1) Reviewer's comments

These statements are a **guide** to what good Result sections include. Please select YES or NO to the statements below if you wish and detail in the free form box below your reasons for any box checked with NO, or to comment on any other matter.

The *Results* findings are **supported by data** — YES

The *Results* findings are presented **clearly and succinctly** — YES

The text in the *Result* section **cites tables and figures appropriately** — YES

The *Results* directly **relate to the study objectives** — YES

The *Results* present **data for all the approaches** described in the *Methods* section — YES

The *Results* **text belongs to the Results section**, not to *Introduction*, *Methods*, or *Discussion*. — YES

The *Results* section is **organised effectively** — YES

Comments:

[Free form box]

B5) Discussion and conclusions

B5.1) Reviewer's comments

*These statements are a **guide** to what good Discussions and Conclusions include. Please select YES or NO to the statements below if you wish and detail in the free form box below your reasons for any box checked with NO, or to comment on any other matter.*

The *Discussion* is **focused on the objectives** of the study — YES

The *Discussion* **addresses all major results** of this study, which are shown in *Results* — YES

The *Discussion* section makes **comparisons with other studies** that are relevant and informative — YES

The *Discussion* section properly identifies all **speculative statements** — YES

The *Discussion* section presents the **implications of the study** persuasively — YES

The *Discussion* section **highlights novel contributions** appropriately — YES

The *Discussion* section **addresses the limitations** of the study appropriately — YES

The *Discussion* section is **organised effectively** — YES

The *Conclusions* are **consistent** with and **summarise** the rest of the manuscript — YES

The *Conclusions* are **supported by the data** in *Results* and **follow logically** from the *Discussion* — YES

The *Conclusions* are **clear and concise** — YES

Comments:

Add conclusions regarding the Daluis diapiir

B6) Figures, tables and citations

B6.1) Reviewer's comments

*These statements are a **guide** to what good Figures and Tables include and how they are presented. Please select YES or NO to the statements below if you wish and detail in the free form box below your reasons for any box checked with NO, or to comment on any other matter.*

*Tables and Figures are **ordered logically** and **numbered sequentially** — YES*

*Tables and Figures have **captions that explain** all their major features — YES*

*Tables and Figures have **captions that complement** the information in the main text — YES*

*Tables and Figures present data that **relate** to the study objective — YES*

*Tables and Figures present data that are **consistent** with and support the description of results — YES*

*Tables and Figures have **succinct and informative titles** — YES*

*Figures are **accessible** (elements are clearly labelled, accessible colour palettes, colour contrasts, font size legible, etc....) — NO (not always)*

Please, check our [\[Figure guidelines\]](#)

*Figures with **maps or cross-sections** contain all **elements to be understood** (north arrow orientation, scale, visible coordinates, sufficient coordinate grid intercepts) — NO, not always*

*Figures with **maps** have **sufficient location information** (in the map or caption) — YES*

*Cross-sections have clear labels for **scale and coordinates** at ends and within-section kinks — YES*

All georeferenced elements are provided in common format (.shp, .geotiff, .kml) [in an open-access repository] — Not sure

Citations throughout are relevant, suitable, and comprehensive — YES

Comments:

Some labels in figures are hard to read, especially white numbers over light colours. I suggest using different colours for temperatures and dip data.

The figures with interpreted field photographs are missing a scale bar.

There are missing north arrows in figures but it is understood that in all of them north is up.

Section C: Additional comments

C1) Minor/line-numbered comments

C1.1) Reviewer's comments

Minor suggestions for text and figures

Text

- In line 42 of the introduction, the text could be improved by expanding on what is the impact of rock salt in the thermal signature of the surrounding sediments. Although references are cited, it would be worth giving examples on how the mismatches between estimated and real paleotemperatures would present.
- Line 343. Refer to figure 1.
- Line 518. The authors could expand a bit more on the causes of said thermal anomalies.
- Line 527. Is there an estimation of the minimum original width of the diapir to support the deflation of isotherms? Could you expand on why the deflection is only found at the northern flank?
- Line 537. What's the explanation for the sample at 277°C?
- Conclusions: would be worth adding some conclusions regarding the Daluis diapir.

Figures:

- Figure 4a. White labels of dip data are hard to read over light-coloured colours.
- Figure 4b. The caption mentions temperature data that is missing from the figure.
- Figure 4b. If purple lines refer to
- For most figures: suggestion to symbolise dip data and temperatures in different colours to make figures easier to read.

C2) Other remarks

C2.1) Reviewer's comments

[Free form box]

Section D: Feedback to improve Tektonika's review process

We kindly ask reviewers and authors to provide any feedback that can help improve this review form, or other aspects of the review process.

Feedback can also be emailed at any time to jtektionika@gmail.com

Authors' Reply to Reviewer 1

Introduction. The salt tectonic studies in the French Pyrenees are properly cited, but many recent works are missing from the Spanish Pyrenees. For the Basque-Cantabrian Basin: Pedrera et al. (2021), Roca et al. (2021), Miró et al. (2023). For the Spanish Pyrenees: Pedrera et al. (2023), Gannaway Dalton et al. (2022), Burrell and Teixell (2021) and Hudec et al. (2021).

We added the references as suggested.

The BRGM French Geological Map at 1/1000000 (sheet South) is also missing a proper reference, including author names and year (both in Figure 1 and within the text).

We added as suggested. We also added the proper references for every pieces of geological map at 1/50000 that we used in figs. 3, 4 and 6.

Results. The text would read better if the full sample names were given, instead of giving the numbers in the figures (it is confusing because in all figures there are samples 1,2,3,4,5)

We modified as suggested.

Discussion. The impact of salt tectonics in the isotherm patterns should be discussed with more detail, including a more thorough comparison with previous works. This should include at least the works mentioned in the Introduction (Jensen, 1983, 1990; Vizgirda *et al.*, 1985; Mello *et al.*, 1995; Peterson & Lerche, 1995; Davison & Cunha, 2016; Zhuo *et al.*, 2016; Cedeño *et al.*, 2019; Li *et al.*, 2020) and possibly some other recent works (e.g. Grunnaleite and Mosborn, 2019; Canova *et al.* 2018; Downs, 2012).

We added comparisons with other previous works, especially for the Rocher de Hongrie to discuss the potential reason for an asymmetric thermal record around it. We did not for the Astoin allochthonous salt sheet because only Mello *et al.* (1995) have studied isotherms patterns around allochthonous salt sheets and we already compared our results to their works. Conversely, we did not add comparisons for the Daluis diapir because it would be irrelevant considering the impact of the diapir on the isotherm pattern. It only shows that salt-related deformation occurred prior to the maximum thermal event such as in the Pyrenees and the Basco-Cantabrian basin (e.g., Ducoux *et al.*, 2019; Izquierdo-Lavall *et al.*, 2020), and we already mention these works. Not so much can be said about the isotherms around the Daluis structure.

Some other comments on the figures:

Figure 2 would benefit from adding the main salt tectonic and thermal events on the right-hand side, so the reader doesn't need to scroll through the text to find this information.

Added as suggested.

Figures 3 to 6. The location and numbering of pictures and cross-sections is rather confusing. I suggest numbering the cross-section independently, using roman numbers (I-I', II-II', III-III', IV-IV' etc.), clearly indicating the positions of both cross-section ends. Also, indicate the location of each picture more precisely, extending lines from the 'viewpoint' or using a thicker line. Some other comments on those figures:

- Where is sample 8 in Figure 3? *Mistake corrected.*
- What is (C) in Figure 4? *Actually, it is Fig. 5A, we corrected.*
- Indicate sample numbers in all pictures, together with the temperature values.
- Add °C after all temperature values. *Added.* These values could be depicted in red, to differentiate them from the dip data. *We modified and highlighted the temperatures as in Fig. 4.*
- Change '*samples' names*' for '*sample names*' (or sample locations) in all figures. *Done.*

Figure 8. Mark with a rectangle the restored portion. Is Figure 8B to scale? Also, indicate that the sample from the Grande Gauthière has been projected and draw the projected sample in the present-day cross-section.

Figure modified as suggested.

Figures 8, 9 and 10. It would be helpful to indicate the positions of the samples and draw the isotherms through all stages of restoration.

We modified as suggested for Fig. 9 but we did not draw the isotherms in every step of the reconstruction because it is irrelevant due to the fact the isotherms were acquired only at the Early Cretaceous step. So we decided to not draw isotherms on former steps because such temperatures were not achieved. For Fig. 10, nothing has changed because there is no reconstruction needed to understand here that the isotherms cross-cut an existing structure.

Sincerely,

Berta López-Mir

Reviewer A:

The manuscript presents new Raman Spectroscopy carbonaceous material (RSCM) data around three salt-related structures located in the south-western Alps. Field/map evidences of salt tectonics in the three structures are first presented and described (section 3). Peak-temperatures are then projected on cross-sections of the structures (section 4) and used

to roughly reconstruct the geometry of the isotherms and discuss its meaning in relation to salt tectonics (section 5).

The manuscript is direct and well-organized and presents an interpretation that is in agreement with the presented dataset. The discussion and results section would nevertheless benefit from the inclusion of some additional information and the clarification of some specific points in the interpretation, including the following:

- One main point of the manuscript is the Jurassic-Early Cretaceous age of the peak temperatures. For justifying this important piece of information (age of the structures is discussed in the light of the geometrical relationship between bedding and isotherms), authors refer to their previous works. I nevertheless missed in the text a brief summary of the main points supporting the pre-orogenic age of peak temperatures, that will avoid readers to dig into previous literature.

We added a few information in the section 2.4 dedicated to the thermal evolution of the SW Alps. We chose to not give too many details about this and only the main points because it is the subject of another publication. If we agree that it can avoid readers to dig into previous literature, we also think that demonstrating a second time the timing of the thermal peak is not the subject of the present manuscript.

- Regarding peak thermal estimations, an explanation on why the Lahfid et al (2010) quantitative calibration is used below 200° C is probably required. 5 samples are in the range of 170-190 °C degrees but the published quantitative calibration itself (RA1 regression line) is calculated from 200 °C up to 320°C. Are the 170-190 °C obtained values compatible with other qualitative calibrations (e.g., Saspiturry et al 2020)?

We agree that this point requires additional information. The limits of a calibration are never strict but more transitional. The ranges of temperatures in which a calibration is considered efficient is actually the range of temperatures for which the calibration is best fitted for. But the upper and lower limits are not well defined. The range 170-190°C constitutes the lower limit of the Lahfid et al. (2010) calibration into which the calibration can be applied but very carefully, by performing a qualitative analysis alongside the quantitative analysis. This is why we performed the quantitative analysis of Lahfid et al. (2010) AND the qualitative analysis from Saspiturry et al. (2020) on these 5 samples. The temperatures obtained with both methods were very similar, so we decided to keep the values obtained through the quantitative analysis as they imply Raman parameters comparable to those of the samples in the range 200-350°C. We added sentences to explain our reasoning in the method section.

- The interpretation of the peak thermal data would benefit from the inclusion of an explanation on the peak thermal differences among structures: why the peak temperature data are higher in two of the salt structures and lower in the third one? Is there a regional scale reason for these differences? And finally, the burial depths that can be estimated from peak thermal data, are they consistent with expected sedimentary thicknesses at the inferred time of peak temperatures?

Yes, there is a regional scale reason for these differences. The fact is that the thermal peak recorded at Daluis and Astoin is higher than the one at the Rocher de Hongrie because they are located in the Digne Nappe and the Authon-Valavoire thrust sheet while the later is in the autochthonous Vocontian Domain. During the Early Cretaceous, the Digne and Authon-Valavoire thrust sheets were located in their restored position farther to the NE, i.e. where the lithosphere was thinner than in the Vocontian Domain to the SW. So they suffered a more important thermal peak than the Rocher de Hongrie. We added a small section in the discussion regarding this regional scale differences.

Regarding the sedimentary thicknesses, at the time of peak temperatures, indeed they are consistent. The thermal numerical modelling performed in Célini et al. (2023) has proven it. We do not believe that this deserves an explanation in this manuscript because it was the subject of another publication more dedicated to this topic.

I think the manuscript is a nice and original contribution, and recommend its publication after the authors evaluate the suggestions proposed in the peer-review form and the annotated pdf attached to this review.

We did not find any peer-review form nor annotated pdf attached to the review of reviewer A.

Section A: Overview of manuscript

A1) Overall evaluation, general comments & summary

A1.1) Reviewer's comments

A1.1.1) General evaluation and publication suggestion – Required:

Please use this space to describe, in your own words, the core subject of the submission and your overall assessment of its suitability for publication.

This paper highlights the importance of factoring in salt tectonics to fully understand the thermal evolution of a basin. It does so by exploring three examples from the southern sub-Alpine fold-and-thrust belt in which the salt-related structures developed before the basin acquired its thermal maximum. This resulted in a temperature distribution different to the one that could be expected if the structures had developed purely by compression after the thermal maximum event. This article follows on and complements several papers detailing the interpretation of the salt-related structures in the SW Alps and the thermal evolution of the basin. The methodology followed is clear and the results are consistent. The manuscript is well written and easy to follow, and figures are clear. I recommend its publication with some minor modifications outlined below.

A1.1.2) What does the submission need to be publishable? (select as needed; comment for all cases)

- ☐ No changes required
- ☐ Rewriting
- ☐ Reorganising
- ☐ More data/figures
- ☐ Condensing
- ☐ Reinterpretation
- ☒ Other

Comments:

Very minor modifications regarding the readability of some figures and the need to expand the explanation in some sections (See section C1.1).

**A1.1.3) Can the submission be improved by reducing/adding any of the following?
(select as needed; comment for all cases)**

- ☒ Text
- ☐ Table
- ☐ Figures
- ☐ Supplementary material

Comments:

A few suggestions on a few paragraphs to add to improve readability can be found in section C1.1

A1.1.4) Please complete the following section if you recommend that the submission is NOT appropriate for publication (select as needed; comment if a box is selected)

- ☐ Quality is poor
- ☐ Research is not reproducible
- ☐ Other

Comments:

[Free form box]

A1.2) Author(s) Responses:

Thank you for the comments, we modified and added clarifications where needed as suggested.

A2) Summary of main merits and main points of improvement

A2.1) Reviewer's comments

Please describe below in a few sentences (100 to 300 words) the main merits of the submission and suggestions for improvements.

The main merits I have found are...

It is a paper with a clear hypotheses that follows on from previous work in a well-documented area of study. Geological field examples chosen are brilliant to illustrate importance of understanding salt tectonics evolution to make sense of the thermal distribution of a basin and highlights potential misinterpretations if salt tectonics are not accounted for. The paper is very clearly written and is concise, with plenty of bibliographical references to back up the structural interpretation of the three field examples. The structure of the paper is easy to follow and figures supply all the data required to understand the conclusions.

The main points of improvement I have found are...

Further explanation of the effect of salt in the thermal signature of surrounding sediments both in the introduction and the discussion could improve the readability (see specific lines above). Changing the colour scheme of the labels in some of the figures could improve its readability.

A2.2) Author's responses:

We modified the figures labels as suggested in the relevant figures. We added a few sentences in the introduction in order to better highlight the role of salt structures in sedimentary basins.

Section B: Detailed evaluation of manuscript

B1) Title and abstract

B1.1) Reviewer's comments

*These statements are a **guide** to what good Titles and Abstracts include. Please select YES or NO to the statements below if you wish and detail in the free form box below your reasons for any box checked with NO, or to comment on any other matter.*

The *Title* describes the main topic of the manuscript **accurately** — YES

The *Title* describes the main topic of the manuscript **succinctly** — YES

The *Title* includes **appropriate key terms** — YES

The *Abstract* includes a **clear aim and rationale** — YES

The *Abstract* supports the rationale with **sufficient background information** — YES

The *Abstract* includes a **well-balanced description of the methods** — YES

The *Abstract* describes the **main results sufficiently and adequately** — YES

The *Abstract* clearly describes the **importance/impact of the study** — YES

The *Abstract* clearly states the **conclusions of the study** — YES

The *Abstract* is **clear** and **well structured** — YES

Comments:

[Free form box]

B1.2) Author's responses

[Free form box]

B2) Introduction

B2.1) Reviewer's comments

*These statements are a **guide** to what good Introductions include. Please select YES or NO to the statements below if you wish and detail in the free form box below your reasons for any box checked with NO, or to comment on any other matter.*

The *Introduction* provides **sufficient background and context** for the study — YES

The *Introduction* describes the **aim/hypothesis/rationale** clearly, providing **sufficient context** — YES

The *objective/hypothesis/rationale* **flows logically from the background** information — YES

The *Introduction* describes the study's **objective and approach** (last paragraph) — YES

The *Introduction* contains **relevant, suitable citations** — YES

The *Introduction* is **organized effectively** — YES

Comments:

[Free form box]

B2.2) Author's responses

[Free form box]

B3) Data and methods

B3.1) Reviewer's comments

*These statements are a **guide** to what good Method sections include and good practices for Dataset accessibility. Please select YES or NO to the statements below if you wish and detail in the free form box below your reasons for any box checked with NO, or to comment on any other matter.*

The *Methods* are described **concisely and with enough detail** for reproducibility — YES

Necessary information about **data sources/acquisition/processing** is included — YES

Data used are accessible via either supplementary files or links in the data availability statement — YES

The *Dataset and/or Methods* are **organized effectively** — YES

Comments:

[Free form box]

B3.2) Author's responses

[Free form box]

B4) Results

B4.1) Reviewer's comments

*These statements are a **guide** to what good Result sections include. Please select YES or NO to the statements below if you wish and detail in the free form box below your reasons for any box checked with NO, or to comment on any other matter.*

The *Results* findings are **supported by data** — YES

The *Results* findings are presented **clearly and succinctly** — YES

The text in the *Result* section **cites tables and figures appropriately** — YES

The *Results* directly **relate to the study objectives** — YES

The *Results* present **data for all the approaches** described in the *Methods* section — YES

The *Results* **text belongs to the Results section**, not to *Introduction*, *Methods*, or *Discussion*. — YES

The *Results* section is **organised effectively** — YES

Comments:

[Free form box]

B4.2) Author's responses

[Free form box]

B5) Discussion and conclusions

B5.1) Reviewer's comments

*These statements are a **guide** to what good Discussions and Conclusions include. Please select YES or NO to the statements below if you wish and detail in the free form box below your reasons for any box checked with NO, or to comment on any other matter.*

The *Discussion* is **focused on the objectives** of the study — YES

The *Discussion* **addresses all major results** of this study, which are shown in *Results* — YES

The *Discussion* section makes **comparisons with other studies** that are relevant and informative — YES

The *Discussion* section properly identifies all **speculative statements** — YES

The *Discussion* section presents the **implications of the study** persuasively — YES

The *Discussion* section **highlights novel contributions** appropriately — YES

The *Discussion* section **addresses the limitations** of the study appropriately — YES

The *Discussion* section is **organised effectively** — YES

The *Conclusions* are **consistent** with and **summarise** the rest of the manuscript — YES

The *Conclusions* are **supported by the data** in *Results* and **follow logically** from the *Discussion* — YES

The *Conclusions* are **clear and concise** — YES

Comments:

Add conclusions regarding the Daluis diapiir

B5.2) Author's responses

Added as suggested.

B6) Figures, tables and citations

B6.1) Reviewer's comments

*These statements are a **guide** to what good Figures and Tables include and how they are presented. Please select YES or NO to the statements below if you wish and detail in the free form box below your reasons for any box checked with NO, or to comment on any other matter.*

*Tables and Figures are **ordered logically** and **numbered sequentially** — YES*

*Tables and Figures have **captions that explain** all their major features — YES*

*Tables and Figures have **captions that complement** the information in the main text — YES*

*Tables and Figures present data that **relate** to the study objective — YES*

*Tables and Figures present data that are **consistent** with and support the description of results — YES*

*Tables and Figures have **succinct and informative titles** — YES*

*Figures are **accessible** (elements are clearly labelled, accessible colour palettes, colour contrasts, font size legible, etc....) — NO (not always)*

Please, check our [\[Figure guidelines\]](#)

*Figures with **maps or cross-sections** contain all **elements to be understood** (north arrow orientation, scale, visible coordinates, sufficient coordinate grid intercepts) — NO, not always*

*Figures with **maps** have **sufficient location information** (in the map or caption) — YES*

*Cross-sections have clear labels for **scale and coordinates** at ends and within-section kinks — YES*

All georeferenced elements are provided in common format (.shp, .geotiff, .kml) [in an open-access repository] — Not sure

Citations throughout are relevant, suitable, and comprehensive — YES

Comments:

Some labels in figures are hard to read, especially white numbers over light colours. I suggest using different colours for temperatures and dip data.

The figures with interpreted field photographs are missing a scale bar.

There are missing north arrows in figures but it is understood that in all of them north is up.

B6.2) Author's responses

[We modified the labels as suggested when it was difficult to read.

Regarding the interpreted field pictures, we chose initially to not put a scale bar as they are drone pictures, sometimes taken from very far away with important perspective effects. We find irrelevant to put scale bars in such pictures. But as they are all represented in cross-sections, the readers can have an idea of the dimension of the structures.

Section C: Additional comments

C1) Minor/line-numbered comments

C1.1) Reviewer's comments

Minor suggestions for text and figures

Text

- In line 42 of the introduction, the text could be improved by expanding on what is the impact of rock salt in the thermal signature of the surrounding sediments. Although references are cited, it would be worth giving examples on how the mismatches between estimated and real paleotemperatures would present.
- Line 343. Refer to figure 1.
- Line 518. The authors could expand a bit more on the causes of said thermal anomalies.
- Line 527. Is there an estimation of the minimum original width of the diapir to support the deflation of isotherms? Could you expand on why the deflection is only found at the northern flank?
- Line 537. What's the explanation for the sample at 277°C?
- Conclusions: would be worth adding some conclusions regarding the Daluis diapir.

Figures:

- Figure 4a. White labels of dip data are hard to read over light-coloured colours.
- Figure 4b. The caption mentions temperature data that is missing from the figure.

- Figure 4b. If purple lines refer to
- For most figures: suggestion to symbolise dip data and temperatures in different colours to make figures easier to read.

C1.2) Author's responses

We modified as suggested by the reviewer. Line 527, we do not have any estimation of the original width and line 537, in the same vein we do not have a reason for that apart from the fact that the temperature is around 30°C higher than the others that are all coherent. This might be due to the treatment of the RSCM data during the fitting process.

C2) Other remarks

C2.1) Reviewer's comments

[Free form box]

C2.2) Author's responses

[Free form box]

Section D: Feedback to improve Tektonika's review process

We kindly ask reviewers and authors to provide any feedback that can help improve this review form, or other aspects of the review process.

Feedback can also be emailed at any time to jtektionika@gmail.com

2nd Round of Revisions

Decision Letter

Dear Naim,

first of all: all our apologies for the silence. We didn't receive any warning or message from the Tektonika OJS system and thus were not aware of your emails and submission of the revised manuscript... It is very unfortunate, frustrating, and embarrassing for us as Editors. I should have checked more carefully the files related to your submission. My mistake - so please accept my apologies. (as an explanation – but not a justification: I changed job on November 1st and lost many emails in the battle...)

I now email you directly without going through the OJS system to make sure we answer immediately your messages.

The Associate Editor Berta López Mir and myself read through your files and thank you for your careful revisions. Although you were not transmitted the annotated file from ReviewerA, it appears that most of the suggestions have been addressed in the revised manuscript. However, we spotted some typos highlighted by the reviewer which are still present in the new version of the contribution. I attach here the documents provided by the reviewer. If you could go through and check the suggestions, we are pretty convinced these final revisions are minor and should take very little time.

Please email me directly the new version and I'll upload all the files myself in the system – and promise to speed up each of the next steps for the publication of your manuscript.

Best regards,

Gwenn Peron-Pinvidic

Comments by Reviewer 1

Comments by Reviewer 2

Authors' Reply to Reviewer 1

Authors' Reply to Reviewer 2

Acceptance Letter

Manuscript accepted Wednesday 24th of January