Review Report

Crouch and Evans, Shallow Composition and Structure of the Upper Part of the Exhumed San Gabriel Fault, California: Implications for Fault Processes, TEKTONIKA, 2023.

Table of Contents

1st Round of Revisions

Decision Letter

Dear Ms Crouch and Prof Evans,

We have now received 3 reviews of your manuscript, "Composition and structure of the upper part of the San Gabriel Fault, California: Implications for fault processes and seismic properties" submitted to Tektonika.

The three reviews, along with our own assessment, are relatively consistent; all reviewers agree that this manuscript presents interesting and original descriptions of the fault rock sequence around the San Gabriel Fault, and that it's research aims are important and well aligned to that of Tektonika. We are recommending that the paper undergo another round of revisions.

Our view is that this is a very promising contribution to Tektonika. We look forward to receiving a copy of your revised manuscript by 23rd May 2023. Some of the reviewers have used our review form to provide their comments. We ask that when submitting revisions you use this review form to answer their comments, point-by-point. When the review form hasn't been used, please use a traditional response letter. We ask you to submit both a copy of your revised manuscript with changes clearly marked and a clean version during your resubmission. If you require additional time for your resubmission, please don't hesitate to get in touch with the editorial team to discuss a revised timeline.

For your guidance, we append the editor's and reviewers' comments below.

Thank you for giving us the opportunity to consider your work.

Yours sincerely,

Jack Williams, PhD, Associate Editor - Tektonika

Janine Kavanagh, PhD, Executive Editor – Tektonika

Editorial review: Jack Williams

Firstly, my apologies for the length of time it has taken in soliciting reviews for your manuscript. Having carefully read through the article and the reviews myself, revisions are required prior to accepting this submission. I would ask that you pay particular attention to: (1) Reviewer 2's comments about the use of drill core's geotechnical properties to directly quantify the elastic and frictional properties of the fault zone, and (2) Reviewer 3's suggestions for better integration of the results and discussions, careful use of fault rock and fault architecture classifications, and demonstrating the microstructural evidence for aseismic vs seismic slip.

I hasten to reiterate that there is much to admire about this manuscript, and I look forward to receiving a revised version.

Authors' reply to Editors' comment

Dr. Jack Williams
University of Otago
Associate Editor, Tektonika Jul 8, 2023

Dear Dr. Williams,

Thank you for your efforts as an associate editor for Tektonika.
We have recently uploaded revisions for our paper entitled:

"SHALLOW COMPOSITION AND STRUCTURE OF THE UPPER PART OF THE EXHUMED SAN GABRIEL FAULT, CALIFORNIA: IMPLICATIONS FOR FAULT PROCESSES AND SEISMIC PROPERTIES"

By Kaitlyn Crouch and myself. We provide a revised version of the paper and revised figures and our replies to the reviewer comments. Our revised version includes the following major changes:

1. We eliminated much of the discussion of elastic and seismic properties of the rocks in the fault zone. Two reviewers had a range of comments on this topic, which ranged from asking for more information and detail as to how values of E, Vp, Vs, etc., were arrived at, and to making stronger links between these results and our observations of rock properties and the inferred rock properties. To accomplish this we would have had to lengthen the paper, and risk reducing the focus of our paper. Thus, we keep data on the rock properties based on the geotechnical data (the RMR values) as these are directly related to our observations of the core, microstructures, and mineralogy.
2. The changes in (1) allows us to edit, and focus, our observations of the fault-related rocks, and reduces the number of figures. We motivate the work in light of the more focused efforts regarding the alteration and deformation of these rocks, and revised the discussion and conclusions likewise, especially to document the occurrence of hydrothermal alteration, mineralization, and ductile (folding, clay-shearing) processes at shallow crustal levels.
3. Some reviewers were not thrilled with Figure 1. We would like to keep this, and as part of the revisions of the text, we try to more strongly link the information in Figure 1 to our work. One of the points of this figure is to 'set up' our paper (and a related paper in review, Evans et al., and a soon-to-be-submitted paper, Studnicky et al). We present the range of results of other workers on fault zones, not necessarily as endorsements of some of the concepts (such as the legacy work in the Sibson, 1977 model) but to show the range of results used by many, and link these earlier ideas, and our work, with concepts of foci depths and creep vs. seismic slip. Perhaps in a future paper, we, or others working on these issues, will provide an updated model, but that is beyond the scope of this paper.
4. We revised Figure 2 to focus on the local geology of the study sites. Other figures have been modified to improve quality and clarity.
5. We uploaded high-resolution jpegs of the figures; if these are still too low resolution, we can provide very high res. Images [our original .ai files of the photos are > 2Gb, so we save them as high-res .jpg files].
6. We revised the text and aimed to check the grammar, writing style, etc. One reviewer said it read like 'a report' and we think we have revised it.
7. One terminology change is that, except in several places where we are quite certain that we have

evidence for crystal plastic mechanics, we discuss ductile textures and behaviors. We also eliminate the discussion of aseismic vs seismic processes.

Jim Evans
Kaitlyn Crouc

Comments by Reviewer 1 and Authors' reply

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 presents new data from a drill core across the San Gabriel fault in southern California with detailed rock description and logs which are correlated to geo-mechanical data. It is well written and presents a discrete example of detailed fault architecture of the upper crust, which provides needed detail on deformation processes, conceptual models of fault rock distribution, the earthquake cycle, and seismic hazard. This work provides an in-situ example of fault rocks at depth in an active fault zone and adds to existing studies of outcrop-based and drill core-based studies. The authors relate results and tie them into the larger scientific context, and help overturn longstanding, simplified conceptual models of fault zone deformation mechanisms and architecture.

I recommend publication after minor revisions.

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:

Minor punctuation and grammar

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:

[Free form box]

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:

We have carefully reviewed and edited the manuscript for grammar, spelling, etc. We also have made substantive edits to address other reviewer comments that should address these technical aspects of the manuscript mentioned above.

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...

Well researched
Well written
Context to scientific questions is adequate
The paper presents important findings to the field of research
Rock descriptions are well done
Figures are clear and captions are well done

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

Some basic attention to typos and grammar are needed during edits.
Some more questions and research on the micro-scale deformation mechanisms would help understand drivers of seismic and aseismic mechanisms. For example, what grain-scale mechanism accommodates inter-seismic healing and creep?

A2.2) Author's responses:

In response to this comment, which is similar to the comments of the other reviewers, we revised the interpretations of the microstructures and cast them as brittle, ductile (and where definitive, plastic) or solution-assisted. With the exception of one sample that may exhibit pseudotachylyte, we do not have strong evidence for seismic processes being recorded in the rocks. We have changed the descriptions of the textures of the phyllosilicates to "ductile" - although we probably in conversation would ascribe kinking, folding, and sheared micas and clay grains to aseismic processes, this is probably too informal an interpretation for a paper absent any other data for slip rates.

We have tried to strengthen, and focus, the motivation for the work - linking the need for microstructure analyses of these rocks to understanding shallow processes.

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] Could elaborate more here.

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

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

Comments:

Line 21: "slip zone"

B1.2) Author's responses

These comments all seem positive.

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:

A few sentences in the introduction lead to some confusion. For example, they state that frictional deformation is dominant but lacks earthquake nucleation, I believe this is meant in relation to the upper-most portions of fault zones not for fault zones as a whole and should be clarified. Also, the fault rock model of Fig 1 is highly simplified, and I suggest the authors bear this out a little more rather than stating simply gouge and breccia give way to cataclasite at a certain depth.

Figure 2: why not make the geologic map bigger so we can see more detail and make the hillshade location image smaller and inset? It's not easy to see where some of the locations are, e.g., Tujunga Canyon.
Figure 3: I can't see any blue arrows.

B2.2) Author's responses

We have tried to strengthen, and focus, the motivation for the work - linking the need for microstructure analyses of these rocks to understanding shallow processes. We try to make it clear that we seek to clearly document the nature of the fault related rocks, and have removed interpretative terms regarding frictional strength, slip stability, etc. These are topics others can address - we want to describe what is in these rocks. [Our original plan was to have Kaitlyn do some initial experiments on friction, at the USGS Menlo Park lab. That discussion started in Feb., 2020, so… we didn't get very far with the experiments.]

Figure 2 has been revised as suggested. Figure 3 - deleted reference to blue arrows.

Figure 1 summarises the work of other researchers to provide context for our work AND a summary of other key summary papers on the topic that we feel were / are influential to many other workers. This provides, in part, a historical review, as well as an attempt to show how workers (including ourselves) now merge microstructural work with newer geophysical data to develop an integrated view of fault zone structure, composition, and their relationships to in-situ properties. Sibson 1977 was developed before inversions of slip patterns on faults, or precisely located small earthquakes, and the aim for this figure is to show this progression. This provides context of our work and what we feel our contributions are. The 'highly simplified' nature of some of the work is inherited from the earlier work - the concepts are not something we necessarily totally endorse, but show concepts that are still used, and cited by, other researchers and people working in the field.

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:

Easy to follow

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:

What is the primary reason you picked the upper slip zone as the main fault, change in lithology?
What is "intense fracture spacing" how close are the fractures?

Figure 7, can you elaborate on what "little" foliations means, are these small in size, closely-spaced, or sparse?

Excellent rock descriptions.

Figure 11 is out of focus or poor resolution, too bad because it looks like some pretty amazing deformation textures in there? Have you thought about the possible presence of retrogressed or altered pseudotachylyte in some of these rocks?? See Price et al 2012 and Kirkpatrick and Rowe 2013(?).

Figure 12: what is the process by which these grains become rounded, cataclasis? Also, did you see evidence of dissolution-precipitation deformation in these samples?

Figure 15d: wow, pretty cool fold here, I've seen similar folds in highly sheared fault rocks before too, what do you think leads to these little microfolds?

Figure 16, I suggest stating what Vp and Vs are in the caption. It might make sense to lay out the geology next to this log, as you do some comparison in the text.

Line 627: logging not oogging, but I wonder what oogging is now.

B4.2) Author's responses

We chose the upper fault as the main fault based on the lithology juxtaposition observed in the borehole and at the surface, and the consistency with fault dip that results as well.

Fracture spacing descriptions are summarised in the supplemental file 8.

'Little' foliation is replaced by sparsely

We think we have fixed the figure resolutions. The original .ai files are > 1 Gb, and we downsampled to make them small enough for submitting. We have saved them as high resolution jppgs in this version

Retrogressed pseudotachylyte - - hard to determine - without high resolution microscopy. While we didn't do SEM, we do show, in a companion paper, with micro XRF mapping, that some of the thin slip surfaces may be retrograded p-tachs, but this requires the other paper to really show that.

How did folds form - we'd assume by simple shearing? How else ? We added a phrase to indicate that

we didn't do any oogging …

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:

Line 667: a meter thick
Line 783: punctuation is off here.
Line 814: Im curious what did you use as the classification of plastic here? Are we talking about dislocation creep or some other mechanism? I don't remember seeing it earlier in the paper.

B5.2) Author's responses

We have made these edits. We rephrase,, throughout that the textures are 'ductile' except where we can definitely see evidence for twinning, subgrain formation (rare) or other types of crystal plasticity.

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.…) — [YES]
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]

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] NA

Citations throughout are relevant, suitable, and comprehensive — [YES]

Comments:

Figures in general a very well done and informative. One or two had poor resolution that should be addressed. I also suggest making the geology map larger in figure 2 at the expense of the hillshade. Captions are succinct and thorough.

B6.2) Author's responses

[Free form box]

Section C: Additional comments

C1) Minor/line-numbered comments

C1.1) Reviewer's comments

See line comments listed above. The original manuscript did not have line numbers so I turned them on myself in Microsoft word, so I hope the line items match the authors copy. Only minimal edits and changes suggested in line items. Paper should be edited again with keen attention to basic grammar and punctuation, nothing major, probably mostly typos.

C1.2) Author's responses

[Free form box]

C2) Other remarks

C2.1) Reviewer's comments

[Free form box]

C2.2) Author's responses

[Free form box]

Comments by Reviewer 2 and Authors' reply

Section A: Overview of manuscript "Composition and structure of the upper part of the San Gabriel Fault, California: implications for fault processes and seismic properties"

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.

The paper "Composition and structure of the upper part of the San Gabriel Fault, California: implications for fault processes and seismic properties" by Kaitlyn Crouch and James P. Evans is an interesting study examining the macro- to microscale structure of the S. Gabriel Fault Zone through the analysis of the drill cores retrieved along the ALT-B2 geotechnical borehole which crosses a section of the fault down to a depth of 493.1 m. The Authors carefully characterized the drill core rocks based on their deformation intensity, mesoscale texture, microstructures, mineralogy and geomechanical parameters. Importantly, the observations of the drill core rocks were compared with surface exposure of the same fault zone in few different nearby localities of the San Gabriel Mountains. The study contains descriptions of the fault zone rocks from the hand sample to the microscale. Geomechanical data are obtained from the technical report of the company that performed the drilling and are used to calculate the rock mass rating RMR_{1989} of the rocks (i.e. a parameter quantifying rock strength for its engineering stability). Variations of RMR_{1989} along the drill core are used to determine the occurrence and limits of fault damage zones, and eventually to calculate elastic fault zone properties in an indirect way. As main results, the Authors show that the fault zone consists of two principal slip zones (i.e. fault cores) composed of cohesive cataclasite, ultracataclasite and clay gouges within an upper and a lower damage zones ~60 m and 50 m thick. Microstructures along the drill core and in fault zone exposures record the cyclic occurrence of distributed "ductile" deformation (folded horizons, well foliated fault cores), hydrothermal veining, cohesive cataclasites and localized shear deformation. Both intensely fractured and altered rocks show low RMR_{1989} which then correspond to low calculated Young's moduli and P- and S-wave velocities. The microstructural variability of the fault rocks (i.e. diffuse versus localized deformation) has been discussed in terms of cyclic aseismic and seismic processes, while the reduction of elastic moduli has been briefly discussed in relation to its potential role in affecting coseismic energy and slip distribution at shallow depth.
I personally think that the paper is interesting and supported by many data and observations. I find it suitable for publications in *Tektonika* given its nature and the research topic. That said, I also think that the paper requires on average moderate revisions before being considered for publication. In particular, in some sections the paper lacks a bit of focus. In addition, both the mesoscale description of the drill core rocks and the thin section analyses are extensive and organized in a kind of report style which would benefit from some text condensing and significant improvement of the figure quality (i.e. resolution and size of some of the thin section scans). Lastly, I think that if the Authors would like to keep the section relative to the elastic property calculation, it needs to be clearly explained in the text how the calculations have been done and a thorough discussion of the significant limitations affecting these indirect estimates should be added. At the moment, this section of the study is not well developed.

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:

Rewriting: little parts of the abstract and introduction should be revised. Both the sections "Mesoscopic observations" and "Microstructures and alteration textures in core" would benefit from some rewriting and mainly condensing. The Authors can highlight the key observations. As they are written now, these two sections are difficult to follow.

Reorganising: the text refers a lot to relevant information that are in the Supplementary files. For instance, part of the material about the elastic property calculations should go in the main text. At the same time, some of the many thin section scans could go in the Supplementary files.

Condensing: it mainly refers to the "Mesoscopic observations" and "Microstructures and alteration textures in core" sections. In particular many figures, especially the thin section scans, are small, difficult to see and at quite low resolution.

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 the point above.

A1.2) Author(s) Responses:

We revised the abstract and introduction to be more focused on observations and interpretations of the rocks. We deleted the discussion of elastic properties [leaving in the RMR data, as they relate to / are derived from / incorporate mesoscopic rock description, to which we related the microstructures.]

Thin section figures have been made bigger.

A2) Summary of main merits and main points of improvement

A2.1) Reviewer's comments

I found the study of Crouch and Evans very interesting and supported by many observations. In addition, I think that the manuscript tackles a relevant topic, which is the one of characterising in detail the internal structure, composition and mechanical properties of the shallow portion of a seismogenic fault zone. In this sense, the Authors carefully studied the microstructural record of the fault zone rocks and found evidence of cyclic possibly seismic-aseismic deformations occurring at depth in the past. In addition, the recognition of two distinct principal slip zones is an important information to constrain the architecture of the fault zone along strike when the borehole information is compared to the fault zone surface expression at nearby localities.

On the other side, I think that the study needs to be improved in the two main following points:
1) The section related to the elastic property calculations starting from the RMR_{1989} values needs to be better developed. At the moment, relevant information is missing in the main text to understand what has been done. In addition, a thorough discussion of the strong limitations affecting these calculations is missing. Indeed, since there are no sonic logs, these calculations are indirect and based on empirical relations. In the current manuscript it is not clear at which length scale are the fracture density, the RMR_{1989} and then the elastic properties determined. Then, nothing is said about the effect of confinement, pore fluid pressure and saturation on the elastic properties (for example the presence of fluids could affect differently P- and S-waves). Are the elastic properties only affected by the open fractures (inherited or newly formed during exhumation) or by other of the many mechanical parameters that contribute to the RMR_{1989} values? And at which length scale?
I have the impression that the section about the elastic property estimates is not fundamental for the paper, which is already long and gathers many direct and robust observations/measurements about the structure, variable deformation intensity, composition and deformation mechanisms within the shallow portion of the fault zone. If the Authors decide to keep this section, I suggest to improve the section as written above.

2) The sections "Mesoscopic observations" and especially "Microstructures and alteration textures in core" should be condensed and slightly reorganized. There are too many information and figures and it is difficult for the reader to maintain the focus. In addition, the microstructures figures are small and several have very low resolution.

A2.2) Author's responses:

- *We eliminated the detailed discussions of the relationships between RMR, VP, Vs, and elastic properties etc data. We keep the RMR curves, as these are derived from observations, as explained in the supplemental file 8.*
- *We revised the observations - microstructure describes rocks from different parts of the fault zone, and not a march through the core, and then the field samples.*

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** — [NO]

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:

The abstract could contain few lines of methods explaining how the macro- to microstructures, mineralogy, and mechanical properties of the drill core rocks have been determined.

The conclusive sentence of the abstract should be more conservative, since the study does not investigate and explain what are the controlling parameters of the derived elastic properties.

B1.2) Author's responses

Within the length constraints of 250 words, we tried to add a few words regarding methods in the abstract

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:

I disagree with the first sentence of the Introduction in the sense that there is not paucity of data from the shallow portion of fault zones. Indeed, most of our data on fault zones come from the shallow part of exhumed fault zones, as it is also the case for the San Gabriel Fault section studied here. The Authors should be careful to distinguish in their prose what is the evidence of deformation processes occurring at depth and recorded in the exhumed fault rocks and which are the fault rocks and deformation features formed near the surface or during progressive exhumation.

I am not also sure that such a broad reference to Fig.1 is needed in the introduction. Indeed, this paper does not deal with frictional stability of fault materials, seismic behaviour, seismicity distribution etc. In addition, I think that the left panel of Fig.1 showing a general scheme of a fault zone with depth is somehow outdated. For example, I do not agree with the thickness variations with depth. I would expect to have a flower-like structure (thickness increase) nearby the surface, then shrinking with depth due to confinement, and a subsequent widening where crystal-plastic deformation starts to become relevant and viscous shear zones develop.

B2.2) Author's responses

- *We have revised the introduction to motivate the work by the need to examine the nature of these rocks, not a paucity of such data. The 'lack of data" was a bit of a red herring construct. We establish the depth setting in the geologic setting, and the exhumation history - which has been revised since we (Chester et al., Evans and Chester) and others (Anderson, d'Alessio) worked on these faults*
- *We would like to keep Figure 1, and as stated in our reply to another reviewer, we use this figure to motivate our work, to provide a broader context for our [and other, similar work], and to give readers who might be less familiar with some of they types of analyses - microstructures vs. reviewer expects with depth, vs. us, is not the point in figure 1 - we show what other, earlier workers suggested, and this influential, 50 yr old model has, perhaps in some cases incorrectly,*

been applied by many workers and ingrained by many seismologists. Our hope is that with this paper, a related paper we have submitted [Evans et al., Tektonika] papers by authors such as Fondriest, Boulton, Rowe, Kiirkpatrick, Williams, might offer other interpretations that are based on newer methods and data, and integrate newer data on earthquake foci, co-seismic vs aseismic slip. This paper - Crouch and Evans, is meant to provide data interpretations for a part of the fault depth zone.

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 — [NO]

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:

As stated before, some of the material presented as Supplementary files should go in the main text and vice versa. The most critical point concerns the need to have a thorough description in the main text of how RMR_{1989} and then the elastic properties of the drill core rocks have been performed. Another relevant point concerns at which length scale fracture density and RMR_{1989} and eventually elastic properties have been determined.

B3.2) Author's responses

We cut most of the elastic properties work, and keep the RMR data - these are values based on observations by project geologists. We still keep the descriptions of the RMR data in the supplement; otherwise the paper would be long, and there would be text that in our view, be a diversion from the main points of this paper. We feel the paper presents a summary of data and interpretations, and the supplement files provide all of the basic data from which we make these interpretations. Core-based studies generate large data sets

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** — [NO]

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** — [NO]

Comments:

The sections "Mesoscopic observations" and especially "Microstructures and alteration textures in core" need to be condensed and more effectively organized. They are very difficult to follow for the reader. The elastic property section shows the final P- and S-wave velocity distribution along the drill core but there is a kind of gap of knowledge in between (i.e. methods not well explained; see point B3.1).

B4.2) Author's responses

Please see our responses elsewhere. We have reorganised and clarified our observation sections, and E, Vp, etc analyses are deleted. We revised, focused, and edited the microstructure discussions.

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* — [NO]

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

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

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

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

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

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:

Section 4.1 of the Discussions is nice.

Section 4.2 of the Discussion is also properly discussing the meso- and microstructural observations presented before. I just think that compelling evidence of seismic faulting have not been presented in this study. So, when talking about cyclic seismic-aseismic record in these fault rocks, the Authors should be more conservative. Indeed, these are just interpretations.

Section 4.3 of the Discussions is not developed enough. Again, nothing has been written to discuss the strong limitations affecting the elastic property calculations. This is a critical point of this study, in my opinion.

B5.2) Author's responses

We eliminated the deformation rate comments, and deleted elastic moduli, etc., discussions to focus on deformation mechanisms, alteration textures, and implications for structure and composition of the fault zone.

Comments by Reviewer 3 and Authors' reply

These are the comment provided by Review 3 - they did not use the Tektonika form

Reviewer 3

In this manuscript, Crouch and Evans present microstructural, mineralogical, and rock mechanics analyses of fault rocks that comprise the San Gabriel Fault zone, an active fault in Southern California. The analyses were mainly performed on fantastic drill core recovered from the ALT-B2 geotechnical borehole, but additional observations from outcrops are also included. These observations of fault rocks recovered from a large-displacement fault zone merit publication and will be of wide interest to the fault research community. However, revisions are required for the manuscript to meet its potential. I have three main suggestions for revision, listed below.

Main Comment 1: With the combination of borehole velocity data and nearly continuous core recovery, the authors have a great opportunity to document the fault core and damage zone processes that result in marked reductions in the elastic moduli. This is the main research question that can be addressed by the data gathered. Previously published papers (e.g., Townend et al. 2013, doi:10.1002/ggge.20236; Allen et al. 2017, doi:10.1002/2017JB014355, and references therein) have explored similar questions, with Allen et al. (2017) integrating microstructural observations with seismic velocity measurements. I suggest carefully editing and restructuring the manuscript so that the (meso-) and microstructural observations are better integrated with the rock mechanics data.

Given the comments of reviewer MF, and the length restrictions of the paper, we have cut most of the rock mechanics data and analyses. This enables us to address the other main comment of this reviewer and MF, which is to develop a better focus on the microstructural data and interpretations. To address MF comments, we would need to add considerably more text to present how the various mechanical properties were calculated - these calculations are based on various empirically derived correlations that take some space to adequately describe. We do feel that a strong link to rock mechanics properties is made via the fracture data in Figure 2 and the RMR curve in Figure 14. RMR is determined from 6 observations, which we describe in a supplemental file. The revision of Figure 14 deletes the Vp and Vs results, and opens up this figure to prove more space to link the microstructural observations and mineralogy to a first order, observation-based, rock mechanics parameters.

Main Comment 2: The authors have an outstanding opportunity to present microstructural observations in their figures. Unfortunately, some figures referenced in the text were missing (Figures 8H, 9G, 9H). Figure quality/resolution could also be improved by making images within the figures larger, focusing on figures and figure captions that are clearly linked to explaining the elastic moduli results, and adding more clear labels to microstructures in the figures.

It may help to group the figures by the microstructures or fault zone architectural element being described rather than outcrop vs. borehole samples. An explanation about how minerals were identified in thin sections and mineral labels would also be helpful (see Allen et al. 2017 Fig 8 and Boulton et al. 2017 Figs. 4 & 5, doi:10.1002/2016GC006588, for mineral labels; see also Bradbury et al. 2011 Figs. 5, 6, 8, doi:10.1016/j.epsl.2011.07.020, for microstructural labels as well as Bradbury et al. 2007 Figs 4 &5,

doi:10.1130/GES00076.1, for clear, labelled thin section images). A figure dedicated to showing the fascinating cross-cutting relationships may also be created and cited to support the discussion and conclusions.

We have made these changes - grouped the microstructure descriptions by which element of the fault we described, and integrated the descriptions of faulted rocks from the borehole and field sites, rather than separately. We also made sure that all of the figures are included.

Main Comment 3: Revising the discussion to highlight the results figures would improve the manuscript. I especially like Figure 17 and wish that the discussion focused on explaining it, with ample references to previous figures in the manuscript. With a little restructuring, it may be easier to walk the reader through all the excellent observations.

At the start of the discussion and throughout, it's unclear how the results show that the rocks observed are frictionally weak. It's also not clear what the source of the secondary cohesion is – calcite cement? Cohesion can add significantly to overall rock strength at shallow depths. Yet do the cohesive rocks still have reduced seismic velocities/elastic moduli?

In section 4.1, are the along strike changes in SGF structure related to changes in strike or dip? What was the reference used to name/classify the fault rocks (Woodcock & Mort, 2008, doi:10.1017/S0016756808004883)? How were/are the architectural elements of the fault zone defined?

In section 4.2, how was nontronite distinguished from montmorillonite? How did glauconite get into the fault zone? Why is the mineral assemblage associated with temperatures at depths >2.5 km?

Finally, what distinguishes (shallow) fault rocks formed coseismically from those that formed aseismically? Rowe & Griffith (2015, doi:10.1016/j.jsg.2015.06.006) wrote an excellent review of whether fault rocks other than pseudotachylyte preserve evidence of coseismic slip. Although this reference appears in the reference list, I could not find it cited in the main text.

Point 1: [now figure 14] We have eliminated the Vp and Vs results, which open the figure up a bit, and we edited the caption and the main text to try to lead people through this clearly.

Point 2: we have eliminated the statements regarding frictionaly weak. From previous work, we might assume coefficients of friction of 0.3 to 0.5, but that is speculation. We present data on the composition of the fault-related rocks, in large part clays, ± carbonates. We leave it to others to consider these minerals in various friction experiments.

Point 3. Please note that the previous section 4.1 was highly edited to the present version. The variations in the SGF could be due to changes in strike, dip, or the nature of protoliths. We are not sure what this might be due to, and seems beyond the scope of our paper. We revised the text to reflect this. Fault-related rock terminology is based on various works by Chester, Chester, Caine, Evans, Forand, Bradbury, etc. We define the locations of the different fault elements from the summary in Figure 14, and our data presented, and revised text to describe this.

Point 4. Nontronite identified in XRD (see Supplemental file 7, Table 1). The glauconite could either be incorporated into the fault zone from the various sedimentary rocks that appear as *small 'slices' in the fault zone, or as an XRD analysis software artifact where the XRD patterns can overlap with hiite-smectites, and vary as a function of K, Mg, and Fe content.*

"Why is the mineral assemblage associated with temperatures at depths >2.5 km?" - This question is a little unclear, but we think we address this by pointing out that the entire rock mass has been exhumed - from depths of > 2.5 km. Additionally, we point out that some of these rocks indicate a contribution of hydrothermal alteration in the faults (First proposed by Anderson et al., 1983) and we further that point in a companion paper (Evans et al., submitted to Tektonika). We revise the text to make this clearer.

Point 5. We deleted the assertions of seismic, aseismic, etc.

2nd Round of Revisions

Decision letter

Dear Kaitlyn and Jim

Thank you for providing a revised version of your manuscript describing the fault rock sequence around the San Gabriel Fault (SGF). On reading the revised manuscript, we are satisfied that the reviewers' comments have largely been addressed and that your paper will provide a useful and novel contribution to Tektonika.

We do have a few (minor) comments we would like to see addressed prior to acceptance. However, we do not think another round of peer review is required. As these comments are minor, we look forward to seeing an updated version of this paper within two weeks.

We ask that when submitting revisions you respond to each point raised and that you submit both a copy of your revised manuscript, with the new changes clearly marked, and a clean version, during your resubmission.

If you require additional time for your resubmission, please don't hesitate to get in touch with the editorial team to discuss a revised timeline.

Thank you for giving us the opportunity to consider your work.

Yours sincerely,

Jack Williams, PhD, Associate Editor – Tektonika
Janine Kavanagh, PhD, Executive Editor - Tektonika

Comments by Editors and Authors' reply

Comments from the Associate Editor

• I agree with the new approach of distinguishing between 'brittle' and 'ductile' deformation mechanisms around the SGF. That said, (I think) there is unfortunately widespread confusion and misconceptions around the term 'ductile' in structural geology (see also Wang 2021). To avoid any ambiguity in this study, all I would ask is that is that some definitions for ductile, brittle, and plastic deformation in this study are included (possibly using Wang 2021 as a template?).
Wang, K. (2021). If not brittle: Ductile, plastic, or viscous?. Seismological Society of America, 92(2A), 1181-1184.

We are from the Rutter-Blenkinsop etc school of terminology – and as we examine microstructures, the term brittle refers to fractures, faults, veins – where at the grain scale we can identify 'loss of cohesion' as a planar zone where we can see discontinuity of the primary igneous or metamorphic fabric. We hope the new following sentence in the methods helps:

"We use our microscopic observations to search for evidence for grain-scale brittle, crystal-plastic, diffusive mass transfer, and alteration-related deformation (cf., Rutter, 1986. Blenkinsop et al., 2020; Wang, 2021). "

There is, as you point out, much confusion and complexity, especially when we discuss the scales of observation and try to relate the observations to some sort of mechanical behavior. We deleted all uses of 'ductile' in favor of more precise (we hope) phrasing in the discussion – 'sheared rocks', or 'folded, and sheared'. Etc. We try to further bring out the point of hydrothermally altered and sheared rocks, and add a reference to Blenkinsop et al., 2020, who discuss these sorts of structures extensively.

• Section 2/Figure 3: Can it be clarified in Figure 3 caption if the fracture density plot was derived from drill-core analysis or the acoustic imaging of the borehole wall? It's not quite clear in the current version. If drill-core analysis was used to derive fracture density, were any attempts made during the core-logging to distinguish between natural damage zone fractures and drilling-induced fractures? (see for example: Chatterjee, S., & Mukherjee, S. (2022). Review on drilling-induced fractures in drill cores. Marine and Petroleum Geology, 106089.)

- *These are data from the rock core logging. To make this clearer, we revised the figure caption, shown below; we added some details to Supplemental File, and added a reference to the Caltrans manual for these types of data. This manual provides the detail that any state—or federally funded Geotech project in California manages rock core data.*

Figure 3. Cross-section of the ALT-B2 borehole showing simplified lithology, fracture density measured in core, locations of core samples, geochemical data, and the SGF. The lithologies consist of Mendenhall Gneiss to 313 m depth and Josephine Granodiorite to the bottom of the borehole. There are two principal slip zones, two damage zones, two highly fractured zones, and two zones of lower fracture intensity and sheared rocks (arrows) recorded in the cored rocks and related rock mass characterization. Fracture density is derived from the core logging, which followed the methods of Caltrans, 2010; see Supplemental File 2). Rock mass ratings (RMR) from geotechnical reports are a measure of the core-scale rock strength, based on fracture density, alteration, hardness, and moisture content. Dashed lines indicate the locations of poor to very poor (<40) RMR values, which broadly equate to low values of Young's modulus. Fracture spacing is: slight=30-90 cm spacing; moderate=10-30 cm spacing; intense=

2.5-10 cm spacing; very intense = fracture spacing of <2.5 cm. The Kelly bushing elevation is 864 m MSL. Results do not report ~6 m of surface gravel and soil.

• Section 2: Can some more information be provided on the XRD analysis? For example, how were XRD patters obtained? What software was used to identify phases from these patterns? Was this qualitative or semi-quantitative XRD? How are 'major' and 'minor' minerals in Table 2 distinguished? I recognise some of this is included in the supp info, and I would just like to see it moved to the main manuscript.

The following is added to methods,

X-Ray Diffraction data were collected and analyzed using the PANalytical X'Pert PRO XRD machine at USU Geosciences X-ray Diffraction Lab. Approximately 10-20 g of crushed rock sample were crushed to a homogenous powder in a tungsten carbide bowl using a ROCKLABS Ring Mill Pulverizer in USU's Rockprep Lab. One g of whole-rock powder sample material was analyzed in an aluminum sample plate from 2-75° at X-Ray conditions of 45 kV and 40 mA at one second per 0.02° step increments. Mineral phase identification was interpreted using the PANalytic X'Pert HighScore program version 4.5 and the ICDD PDF- 4+ Inorganic database of reference patterns. The range of potential mineral phases were further refined based on the XRF data results and petrographic analysis. Mineral candidates with high scale and score factors were prioritized, then phases were user-matched to the position and intensity of the reference patterns match to sample peaks. We did not perform clay-specific XRD analyses, and in samples where clay is abundant, the clay mineral phases were identified based on a match to reference patterns in the database. The sample locations, their descriptions, and X-ray diffraction data summaries are provided in Supplemental File 1.

• Section 4.2: It is suggested in the third paragraph of this section that the lower principal slip zone (PSZ) is the more 'mature' SGF stand. However, it is the upper PSZ that is termed the 'the main fault zone', in Section 3.1 since it represents the main geologic boundary. This is based on the upper PSZ juxtaposing the Mendenhall Gneiss to the north against the Josephine Granodiorite to the south (though I note it's Mesozoic quartz diorite that is mapped the south of the ALT borehole in Figure 2, not Josephine Granodiorite?).

Anyway, I recognise the differing significances of the upper and lower PSZ are explained in the proceeding discussion with respect to the upper PSZ actually representing a trace of the DeMille Fault Zone. So does this mean the Little Tujanga outcrop 2, where the Mendenhall Gneiss is also juxtaposed against the Josephine Granodiorite (Figure 5a), represents the DeMille Fault Zone too? Also the upper PSZ is described in this discussion as the 'southwestern' fault, whilst the cross section in Figure 2 implies it is to the north of the lower PSZ? In short, please clarify how the PSZs correspond to the SGF and the DeMille Fault Zone, and why the Josephine Granodiorite is not mapped to the south of the SGF in Figure 2.

We aimed to depict the geology of the area as clearly as possible in Fig 2, and to faithfully represent the geology as generalized from previous geologic maps (Dibblee, etc). Where Mzgd is shown rather than Kj, for example, that is based on the existing maps. These uses are due to difficulty in differentiation of Kj vs a more general Mzgd in the field. The nomenclature, descriptions, and ages of these rocks, where available, are still not as clearly defined as we might like in this area. We have made small edits to Figure 2 to reflect this, and changed text and figure captions to reflect this. Please see below.

We have edited Figure 2 to clearly represent the two strands of the fault, and added a callout to the DeMille Fault. Bold text indicates the changes. Many thanks for catching this.

Figure 2. Location of the study site. San Gabriel Mountains, southern California. A) Geologic map adapted from Yerkes et al. (2005), Dibblee and Ehrenspeck (1991), and Dibblee and Carter (2002) shows the location of ALT-B2 borehole and Little and Big Tujunga (LT, BT) field sites along the San Gabriel Fault. SGF—San Gabriel fault; SBSGF – south branch San Gabriel Fault, NBSGF- north branch San Gabriel Fault; **DmF – DeMille Fault**; LT—Little Tujunga; BT—Big Tujunga. SMT – dashed line is the frontal Sierra Madre thrust. Inset map shows the active fault traces from the SCEC Community Fault Model 5.3. **The ALT B2 drill hole was located where the San Gabriel fault is mapped as consisting of two closely spaced fault strands. The LT1 and LT2 sites are along the southern strand of the fault, mapped as the DeMille Fault by Dibble and Ehrenspeck (1991). The BT 1-4 sites lie in the intersection region of the North and South Branches oof the San Gabriel Fault.** B) Simplified cross-section adapted from CHSRA drill logs (Guptill, electronic comm., 2017) of the borehole ALT-B2 site. The ALT-B2 borehole plunges 68° south through the steeply north-dipping San Gabriel Fault (SGF) to a total depth of 493.1 m. The geologic descriptions of the rock types are shown in the logs (Figure 3) as is the location of narrow fault zones.

We have also clarified – well, corrected, our description of the fault strands, and to reduce confusion, oriented the cross section in Figure 2 to be a typical geologic cross section with north to the right (The engineering sections were reversed). The text now reads:

The **upper, northeastern fault** encountered in the ALT-B2 borehole may be the subsurface expression of the northern strand of the fault, whereas the **lower, southwestern fault zone encountered in the borehole may correlate with the of the DeMille Fault**, as mapped by Dibbele and Eherenspeck (1991), where it merged with the San Gabriel Fault in the region of the borehole.

• Section 4.3: the sentence 'the presence of these alteration assemblages indicates that the minerals formed at temperatures above the ambient temperature values expected at depths of 2-2.5 km' may have confusing implications given that these fault rocks haven't actually been to depths >2-2.5 km. Are you suggesting they formed from post-seismic elevated temperatures around the fault due to frictional heating? Or is it being suggested that phases such as calcite and chlorite can form at higher temperatures, but in this case have formed at relatively low temperatures in the upper 2-2.5 km (or do these phases have minimum temperatures for forming?)

The sentence is deleted.

• Conclusions: suggest remove implications that the SGF damage zone correspond to low Vp and Vs values, and instead link it to fracture density and RQD. I guess this was a left over from the initial submission and hadn't been updated yet?

Sorry. Left over. Deleted.

Comments from the Executive Editor

• It is Tektonika's policy that "pers. Comm." references should be removed please.

All deleted.

• There are occasions where you have cited a work that is in submission and not yet published. If possible, we would encourage you to refer to a preprint doi for these works (for example using EarthArXiv) so that the work can be discovered by Tektonika's readers. If this isn't possible then Tektonika's policy is that these unpublished references should be removed please.

The related paper, Evans et al., is back and being revised. We have put the first draft on an EarthArXiv and changed the reference:

Evans, J. P., Crouch, K. A., Studnicky, C., Bone, S., Edwards, N., and Webb, S., Fluid-rock interactions, hydrothermal processes, and accommodation of slip in shallow parts of the San Andreas and San Gabriel Faults, southern California, submitted to Tektonika; EarthArXiv preprint https://doi.org/10.31223/X5X096.

I am sorry – I don't see any new points or suggestions on the July 12 version

Janine sent a file with her comments – we have addressed them all, and you can see them in the compared documents. I didn't make them on the version Janine sent because we were already well into making the final edits on another version.