

Solid Earth Discuss., author comment AC1  
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## Reply on RC1

Jean-Baptiste P. Koehl et al.

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Author comment on "Tectonic evolution of the Indio Hills segment of the San Andreas fault in southern California, southwestern USA" by Jean-Baptiste P. Koehl et al., Solid Earth Discuss., <https://doi.org/10.5194/se-2022-9-AC1>, 2022

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## Reply to Anonymous referee

Dear Sir, Madam,

thank you very much for your input on the manuscript, it is highly appreciated. Here is our reply to your comments. We hope the changes we implemented improve the shortcomings of the manuscript highlighted by your comments and suggestions. Please do not hesitate to contact us shall this not be the case for some comments.

### ▪ Comments from Anonymous referee

Comment 1: I suggest that this paper be accepted/reconsidered after major revisions. In general, I enjoyed this paper: it is a good, well-written paper with a structurally interesting dataset from a major transform plate boundary fault zone. The dataset is collected from a transpressional uplift within the San Andreas fault zone, then compared to other similar features along strike. As such, the paper stands to be a good contribution for those trying to understand the internal structure, along-strike complexity, and tectonic evolution of transform plate boundary fault zones, and more specifically the along-strike complexity of the southeastern terminus of the San Andreas transform plate boundary fault.

Comment 2: The overwhelming majority of my comments are minor, albeit numerous. However, there are a few major points concerning the figures that need to be addressed should the manuscript be accepted for publication. These few major points concerning the figures may take some time to complete, and are my only reason for listing the revision as major, not minor. These include: Figure 1 needs to be redone to include a regional map with all the features discussed in the text plotted on that map and, in general, showing the study area in the regional context (southern California, southwestern USA). An updated figure could take the form of a two-panel figure, where Fig. 1a is the regional map showing major features discussed in text, and Fig. 1b is the close-up map that is currently presented as the sole Fig. 1. At present, the reader has no regional context for the features discussed in-text, and some features and faults are not shown on any map,

making their comparison and importance to the study area difficult and unclear.

Comment 3: All maps in the figures (Figs. 2, 3, 5, and 6) should have coordinates of some sort, whether as points or a grid. Additionally, I suggest that un-interpreted images of all of the map areas should be added to the supplemental material (an un-interpreted Fig. 6 is already in the SM).

Comment 4: Folds and faults mapped on Fig. 2 appear continuous across some parts of the Northwestern, Central, and Southeastern domains. However, in Figs. 3 and 6, the folds and faults appear short and discontinuous. These figures should be updated to reflect the full extent of the structure(s) within the figure's frame to be consistent with their geology on the ground and as shown on Fig. 2. Should these changes be addressed, I think the paper will make a good contribution. Good luck, and I hope to see this in print in the near future.

Comment 5: **Specific Comments** - Title: Should a broader geographic description be applied to the title, given this is European journal but the study area is in the USA? Perhaps "Tectonic evolution of the Indio Hills segment of the San Andreas fault in southern California, southwestern USA"

Comment 6: Line 46-47 - What about this continuation in to the ECSZ? The sentence needs more description about the significance of the Indio Hills fault with the ECSZ.

Comment 7: Line 68 - I am curious about the use of the term "culmination" - I am only familiar with this term in fold-thrust systems. As defined at <https://link.springer.com/content/pdf/bbm%3A978-94-011-3066-0%2F1.pdf> : "Culmination: An anticline or dome with four way closure generated by movement of the thrust sheet over underlying ramps." I understand you have transpressional folding/thrusting going on in your study area, so the term could be used, but does the Indio Hills exhibit folding over underlying thrust ramps? Or are you simply referring to a variety of distinct tectonic elements all observed together in one place? If the latter, I think a different term is warranted. If you choose to keep the term culmination, I think you need to explicitly define it, either here or in your Tectonic Culminations section below. Perhaps it is best to simply call it the Indio Hills uplift here on Line 68, as you do in the Fig. 1 caption, and leave the use of culmination (if you keep it) for the section below.

Comment 8: Line 69 - You state the Indio Hills are a transpressional uplift, but consider it analogous to a rift feature (which would suggest transtension)? See next comment.

Comment 9: Line 68-70 - I think what you mean is that the Indio Hills and Mecca Hills are analogous in that they are both inverted basins? If that is correct, be more explicit here. For example, you could say: "The Indio Hills uplift is an inverted Miocene–Pliocene sedimentary basin lying upon Mesozoic granitic basement rocks. Further to the southeast, the Mecca Hills are also shown to be an inverted Miocene–Pliocene sedimentary basin (Keller et al., 1982; Damte, 1997; McNabb et al., 2017; Bergh et al., 2019)."

Comment 10: Lines 84-86 – You state "We consider" but then list references. Are you interpreting that these units are The Mecca Formation, or did the cited authors interpret these units to be the Mecca Formation in the Indio Hills. The former is slightly problematic, as it is an interpretation before the data section (but understandably a necessary one to make for your study).

Comment 11: Line 103-104 - How would sediment accumulation rates define the age of a formation? More than likely, the dates of those stratigraphic members were used to calculate the sediment accumulation rates. Did the lower and upper members of the Palm Springs Formation show increased rates of sediment accumulation during these intervals?

If so, specify that.

Comment 12: Lines 114-117 - See above comment on use of the term culmination. You only use the term four times in the paper, here three times and once in the former section. I suspect the term should be changed, given the formal definition I pasted in the Line 68 comment above, but if you choose to keep the term then define what you mean by "culmination" either here or at Line 68.

Comment 13: Line 119-124 - Your broad-scope description of tectonic elements here shows the necessity of adding a regional map to your Figure 1. At present, the reader has no context for the Eastern California shear zone (which is a much broader region than you show it in Fig. 1), the San Bernardino and San Jacinto faults, and San Geronimo Pass. These features need added to a map with the location of the study area clearly shown so the reader can see their relationship and importance to the work presented here.

Comment 14: Line 155-156 - Delete the word "off-fault" - damage zones typically encompass principal slip surfaces but are technically part of the fault zone, too, so it seems kind of like a misnomer to say off-fault

Comment 15: Lines 160-163 - Is there a reference for this statement?

Comment 16: Line 219 - Are you saying that the open upright fold geometry is the result of (via) the kink/chevron styles? If so, no change is really necessary, but perhaps it could be described more clearly? If not, and instead you are describing a sequence of changing fold patterns, then I'd replace "via" with "to"

Comment 17: Line 241 - Here again with "via". Do you mean the something is the result of the kink/chevron geometry, or are you saying it is spatially changing from symmetric style, to then changing to a kink/chevron style, to then changing to isoclinal? If so, I'd suggest replacing "via" with "to"

Comment 18: Line 273 - What do you mean by monocline-like? It seems the fold would either be a monocline or an anticline, not a mix of the two. According to your Fig. 3C the fold closest to the Indio Hills fault very much looks to be an asymmetric anticline, with 20NE dip on the northeast limb and 45SW dip on the southwest limb, in which case I would delete "monocline-like" from the sentence.

Comment 19: Line 299-305 - What kind of folds are these? Anticline? Syncline? Both? Note that hinge lines are not mapped on Figure 5 like they are on Figure 2.

Comment 20: Lines 307-319; Lines 310-311 - If you are discussing faults and fractures in the basement, then that is not a fold-related fault (unless the basement is folded). Perhaps the section should be renamed "Major and minor faults, fractures, and fold-related faults"

Comment 21: Line 388 - Cite Figure 2 stereonet at the end of the sentence. Also, these fracture sets look to be  $\sim 90^\circ$  to one another; I'd expect conjugates to be  $\sim 60^\circ$  ( $40-70^\circ$ ) to one another. It might be best to delete the "possibly representing conjugate sets" from the sentence, as I don't think these are conjugates. This shouldn't pose a problem, as you don't discuss these features any further in the manuscript.

Comment 22: Line 416 - "...indicates a younger phase of deformation." Saying younger slip event makes it sound like only one slip event caused the present-day observed deformation pattern.

Comment 23: Line 419 - You could delete "strain" after shortening; since shortening is a

strain term it is a little redundant.

Comment 24: Lines 433-440 – I think it would help the reader here to remind them stratigraphically which unit overlies/underlies which unit, or which unit is older and which unit is younger. E.g., “the Mecca Formation and overlying Palm Springs Formation.” or something to that effect.

Comment 25: Line 435 – would the fault be below the contact between the PS and MH formations, or would the fault be at/near the contact of the PS and MH formations?

Comment 26: Line 456-457 – dip-slip fault-parallel fold: wouldn't this just be a fault-propagation fold? I suppose it could also be a fault-bend fold by that description, but I get the impression it is fault-propagated.

Comment 27: Line 509 – stress, or strain?

Comment 28: Line 516 – I'd be more satisfied if these features were rigorously measured and restored back to a discrete bedding orientation through stereonet analysis. As presented in Supplement S6, you are “restoring” apparent dips at the outcrop face to an approximate horizontal based on the apparent dip of bedding in the picture/outcrop face. I absolutely agree with what you are saying and interpreting, but wonder if you should not refer to this as a restoration, per se, but rather that these features “appear to define a low-angle fold and thrust system (Supplement S6).”

Comment 29: Lines 558-559 – Concerning use of axial surfaces (i.e., axial planes), wouldn't a surface/plane be E-W-striking (not trending)? Perhaps it is better to just say E-W-trending folds.

Comment 30: Line 667 – Transpressional plate regime. Are you suggesting that the plate is entirely under transpression in this area (in which case, which plate – or both?), or are you saying San Andreas fault zone transpression? Depending which you mean could be important, as just to the east ~100 km some of us are arguing for late Miocene–Pliocene (and possibly ongoing) transtension in the lower Colorado River corridor. This is all the more complicated in that the ECSZ does seem to be overwhelmingly transpressive. Looking through your cited reference (Bergh et al., 2019), I think you mean San Andreas fault zone transpression – if so, please modify the “transpressional plate regime” part of the sentence to instead reflect SAFZ transpression. If you indeed mean transpression across the plate(s), I think you need to be more specific of the extent of this transpressional plate regime, and possibly even reconcile your claims by looking into recent literature for Pacific-North America plate boundary transtension inboard of the SAFZ just next door to the east (e.g., Singleton et al., 2019; Thacker et al., 2020; Dorsey et al., 2021), albeit ca. 3 to 1 Ma earlier than you propose the Indio Hills to have formed.

Comment 31: Lines 713-722; Point 4 in Conclusions (Lines 738-740) – I am a bit confused about how the Indio Hills and Durmid Hills are shown as initially different in Fig. 8a, but in this paragraph you suggest that the two areas might be similar in that the Indio Hills might be an early phase of a ladder structure like the Durmid Hills. In Fig. 8a you clearly show an inherent difference between the two areas: Indio Hills has E-W folds, Durmid Hills has NE-SW left-lateral faults - am I to assume the E-W folds had already formed, or did E-W folds not form, which would again suggest an inherent difference between the two areas? I am also confused how these two areas are potentially similar when the proposed timing of fault activation for the oblique dextral-reverse fault in both locations is opposite: The Indio Hills fault (what became the oblique dextral-reverse fault) formed before the Banning fault, while the Eastern Shoreline fault (what became the oblique dextral-reverse fault) formed after the main San Andreas fault, according to your figure.

Comment 32: **Technical Corrections** – Line 33 – A geographic description is required. For example: "...San Andreas fault zone (SAFZ: Fig. 1; California, southwestern USA), ..."

Comment 33: Line 34 – add "the" ("...deformation compared to the Mecca Hills...")

Comment 34: Lines 41-42 – Note that "Eastern California shear zone" is commonly written with "shear zone" not capitalized. Change here, and throughout the manuscript to be "Eastern California shear zone"

Comment 35: Line 60 – delete "transform" and remove "s" from movements so it reads "...North American plates and movement along the SAFZ..." Also, should it be North America plate or North American plate?

Comment 36: Line 65 (end of paragraph) – I think a final sentence is needed here that brings it all back into perspective. Perhaps something akin to: "This recent work provides the opportunity to explore the understudied Indio Hills segment in order to compare its structural development with other along-strike uplifted features on a major transform plate boundary fault zone."

Comment 37: Line 128 – Gorgonio is misspelled

Comment 38: Line 127-130 – Suggest breaking this one sentence into two different sentences.

Comment 39: Line 134 – Eastern California shear zone (decapitalize shear zone) – change here and throughout the manuscript and figure captions.

Comment 40: Line 137 – Delete "attitude and" so the sentence reads "Farther southeast, however, the geometry of the..."

Comment 41: Line 138 – Add an "s" to remains

Comment 42: Line 140-142 - Suggest separating these into two sentences: "The transpressional character of the Indio Hills uplift was suggested by Parrish (1983) and Sylvester and Smith (1987). Recent work, however, has not been conducted, and detailed structural analyses have not been published from this segment of the SAFZ."

Comment 43: Line 143 – perhaps change focusing to "that focused"

Comment 44: Line 149 – Be explicit here with who you are referring to. I think you mean Keller et al. (1982). If so, I suggest replacing "Their" with the reference.

Comment 45: Line 173 - I think you mean main San Andreas fault strand, based on the abbreviation, but that is not totally clear as written. Suggest saying "main San Andreas fault (mSAF) strand..."

Comment 46: Line 178 and throughout the manuscript and figures – Make sure to decapitalize "fault" after all formal names. E.g., East Shoreline fault, Banning fault, etc., even for San Andreas fault.

Comment 47: Lines 204-205 – I think this sentence needs reworked: "The study area comprises three major fold systems that are oblique to the SAFZ. These fold systems are E-W trending, moderately west-plunging, and contain multiple smaller-scale parasitic folds (Fig. 2)."

Comment 48: Lines 243-244 – This is more of an editorial preference by EGU, but I don't

think forelimb and backlimb need dashed? If not, change throughout the manuscript. If so, ignore.

Comment 49: Line 267 – I think you mean southeastern here, not southwestern

Comment 50: Line 314 – Change offset to displacement.

Comment 51: Lines 327-329 – Add “for a damage zone of a”: “The granite there is highly fractured and cut by vein and joint networks (see description below), as is expected for a damage zone of a major brittle fault.”

Comment 52: Line 377 – minor-scale (needs a dash I think)

Comment 53: Line 386 – in other places I think you refer to it as a leucogranite. Be consistent, whether you choose simply granite or leucogranite.

Comment 54: Lines 396-397 – Suggested rewording: “The folds are arranged in a right-stepping pattern, and are increasingly asymmetric and sigmoidal (Z-shaped) to the northeast as they approach the Indio Hills fault.” Change as you see fit, but at present the sentence is difficult to understand.

Comment 55: Line 429 – as inferred for other parts of the SAFZ

Comment 56: Line 430 – remove en dash (–) in front of to

Comment 57: Line 506 – perhaps just say slip here, not “the last slip event”

Comment 58: Lines 560-562 – Your sentence is in present tense (“this is observed”) but you refer to the Banning fault as you interpret it to have been at a former time. Perhaps say “what was then a precursory Banning fault.”

Comment 59: Lines 601-602 – Should be Eastern California shear zone (says East, not Eastern, and shear zone needs decapitalized)

Comment 60: Lines 607-608 – These two faults do not appear to be on Figure 1

Comment 61: Line 610 – delete comma after “enhanced”

Comment 62: Lines 633-634 – Earlier in the paper (and in Fig. 8) you define main San Andreas fault as mSAF, whereas here you say main SAFZ. Is there a reason for the difference (e.g., one refers to a discrete/singular fault plane, whereas the other refers to the main fault zone)? Should mSAF just be changed to main SAFZ, or vice versa? Also do this at Lines 40, 117, 608, 637, 654, 690, 695, 698, and in various figures.

Comment 63: Line 639 – the Indio Hills fault (missing “the”)

Comment 64: Lines 634 and 649 – On line 634 you reference Fig. 8c before referencing 8a and 8b, and on line 649 you reference Fig. 8c before referencing Fig. 8b. You do reference Fig. 8 in its entirety at line 627 – this is more of an editorial decision by EGU if subfigures can be referenced out of sequence.

Comment 65: Line 652 – missing a reference

Comment 66: Line 680 – Eastern Shoreline fault (combine Shore and line)

Comment 67: Line 689 – Here I think you mean Eastern Shoreline fault

Comment 68: Line 692 – see comment above about main SAFZ and mSAF. Here you say main SAF, which you defined earlier in the paper as mSAF - should this one be mSAF or main SAFZ?

Comment 69: Line 695 and 697 – Eastern Shoreline fault

Comment 70: Line 736 – delete “in”

Comment 71: **Detailed comments on figures** – Figure 1 – Figure 1 needs a regional scope. At the very least, a regional map showing California and the study area should be squeezed onto to Figure 1. However, I’d suggest a more detailed regional map showing structural relationships in the area and the numerous features mentioned in the text that are not on any of the maps (e.g., San Geronio Pass). For example, from Figure 1, the reader at present would have no context to the extent of the Eastern California shear zone. This can be done as a two-panel figure, where Fig. 1a is a regional map showing major features discussed in the text and the field area, and Fig. 1b can be the present Fig. 1 map.

Comment 72: Line 982 – Brawley Seismic Zone needs defined as BSZ in the caption.

Comment 73: Lines 985-986 – As in the manuscript, decapitalize shear zone in “Eastern California shear zone” in this caption and in all figure captions. It is okay, of course, for the abbreviation to be ECSZ.

Comment 74: All fault names here, in all figure captions, and throughout the manuscript should not have “fault” capitalized as part of the name. E.g., Banning Fault should be Banning fault, etc.

Comment 75: Figure 2 – I hate to be a stickler here because these are GoogleEarth images, but all maps (Figs. 2, 3, 5, 6) should technically have at least a few coordinates, whether as a grid of lat/long or UTM, or a few lat/long coordinate points.

Comment 76: Note that your typed words have the spell check wiggle line underneath them. Make sure your final image does not have these.

Comment 77: On your stereonet labels, I suggest adding that the first two are bedding: “SAFZ-oblique bedding planes” and “SAFZ-parallel bedding planes”

Comment 78: In the text I think you say faults and fractures, but here you only say fractures. If both were measured, both should be specified here: “Sediments faults and fractures”; “Basement faults and fractures”

Comment 79: What program did you use to make the stereonets? Allmendinger’s? You should probably cite the program, unless it is a script you wrote.

Comment 80: Figures 2, 3, 5, and 6 – In the supplemental file you have an un-interpreted figure 6; it would be good to also put un-interpreted images of figures 2, 3, and 5 in the supplemental file as well.

Comment 81: Figures 3, 5, and 6 – Your mapped features (fold hinges and faults) commonly end before the end of the figure’s frame, whereas on Figure 2 many of these same features are shown to be continuous across the frame of the figure. I would suggest mapping the features along their full extent and ending them at the end of the figure frame, instead of cutting them short within the figure frame. As currently drawn, it gives the impression to the reader that these folds and faults are short and discontinuous only within the frame of the figure, but Figure 2 shows clearly that many of these features are

continuous from one domain into the other. For example, the southeastern corner of Fig. 3b is also the northwestern corner of Fig. 3c – from southwest to northeast there is an anticline then syncline then overturned anticline then overturned syncline/syncline – I think that these are the same folds in both figures, but as currently drawn Figs. 3b and 3c give the impression these are different folds.

Comment 82: Figure 3 – What are the yellow dots? I think these are photograph locations; if so state this in the Figure 3 caption.

Comment 83: In each panel (a, b, and c), you could place the domain name right above the scale bar. For example: in Fig. 3a, label “Northwestern” above the scale bar, “Central” in 3b, and “Southeastern” in 3c. This would make it easier for the reader.

Comment 84: Figure 4 – Line 1019 – The stereonet represents the cm-scale folds, correct? If so, add “cm-scale” to the caption so it is clear to the reader that these are the small cm-scale folds that cannot be seen in the photos.

Comment 85: Figure 5 – Label “Banning fault” on the main figure.

Comment 86: The fold hinge should be mapped on this figure like it is in Fig. 2.

Comment 87: Figure 7 – Line 1040 – You say Tentative model here; tentative on what? Perhaps just say “Model illustrating...”

Comment 88: Figure 8 – I make this point at Lines 633-634, but in your figure, how does SAFZ differ from mSAF? Is one a discrete fault that is considered the main strand (mSAF) and the other is a zone of deformation (SAFZ)? Is using mSAF necessary?

#### ▪ **Author’s reply**

Comment 1: agreed.

Comment 2: agreed.

Comment 3: agreed.

Comment 4: agreed. See response to comment 81.

Comment 5: agreed.

Comment 6: agreed.

Comment 7: agreed. Yes, the Indio Hills exhibit folding over underlying thrust ramps, as proposed for the SAFZ-parallel anticline near the Indio Hills fault (see also Supplement S3a for an example in the field). We agree though that it is certainly more appropriate to use the term “uplift” instead of “culmination” to avoid confusion.

Comment 8: agreed. See response to comment 9.

Comment 9: agreed.

Comment 10: agreed.

Comment 11: agreed.



Comment 12: agreed. See response to comment 7.

Comment 13: agreed. See response to comment 2.

Comment 14: agreed.

Comment 15: agreed.

Comment 16: agreed.

Comment 17: agreed.

Comment 18: agreed.

Comment 19: agreed.

Comment 20: agreed.

Comment 21: agreed.

Comment 22: agreed.

Comment 23: agreed.

Comment 24: agreed.

Comment 25: the fault would be below the contact, not at/near the contact.

Comment 26: agreed.

Comment 27: agreed.

Comment 28: agreed.

Comment 29: agreed.

Comment 30: agreed.

Comment 31: the Durmid Hills and Indio Hills uplifts are located on either sides of the main San Andreas fault and the E–W-trending macro-folds in the Durmid Hills seem to have formed slightly (but perhaps not significantly) after those in the Indio Hills (see new Table 1 for the timing of the main geological events in the Coachella Valley as suggested by the other reviewer). These uncertainties around the timing of geological events in the various uplifted areas along the main San Andreas fault are, no doubt, related to the sparsity of geochronological ages of structures along the fault. As depicted by the similar timing of uplift in all three uplifted areas, it is probable that all areas evolved (almost) synchronously, but even if it were the case, it is not yet possible to argue for such a scenario. More geochronological data and absolute ages are needed in this part of California.

Comment 32: agreed.

Comment 33: deformation is meant in a general sense.

Comment 34: agreed.

Comment 35: agreed. However, "North American plate" is the correct term.

Comment 36: agreed.

Comment 37: agreed.

Comment 38: agreed.

Comment 39: agreed. See response to comment 34.

Comment 40: agreed.

Comment 41: agreed.

Comment 42: agreed.

Comment 43: the sentence was deleted and the paragraph reworked according to the other reviewer's comments.

Comment 44: agreed. However, inserted reference earlier than suggested by the anonymous reviewer's comment.

Comment 45: agreed.

Comment 46: agreed.

Comment 47: agreed.

Comment 48: agreed. However, the authors of the present manuscript will wait for proof-reading comments by the editorial team to make the suggested correction in case it is not required by the journal.

Comment 49: agreed.

Comment 50: agreed.

Comment 51: agreed.

Comment 52: agreed.

Comment 53: agreed.

Comment 54: agreed.

Comment 55: agreed.

Comment 56: agreed.

Comment 57: agreed.

Comment 58: agreed.

Comment 59: agreed. Also see response to comment 34.

Comment 60: agreed.

Comment 61: agreed.

Comment 62: disagreed. "main SAFZ" should be changed to "main San Andreas fault".

Comment 63: agreed.

Comment 64: agreed.

Comment 65: agreed.

Comment 66: agreed.

Comment 67: agreed. Also did this throughout the manuscript.

Comment 68: agreed.

Comment 69: agreed. See response to comment 67.

Comment 70: agreed.

Comment 71: agreed. See response to comment 2.

Comment 72: agreed.

Comment 73: agreed. See response to comment 34.

Comment 74: agreed.

Comment 75: agreed. See response to comment 3.

Comment 76: agreed.

Comment 77: agreed.

Comment 78: disagreed. The term "fracture" is general and applies both to "faults" and "fractures".

Comment 79: agreed.

Comment 80: agreed. See response to comment 3.

Comment 81: agreed.

Comment 82: agreed.

Comment 83: since the three macro-folds are shown in order from northwestern to southeastern, it is unnecessary to specify the name of the "domain" on each part of Figure 3. In addition, this could give the impression to the reader that, e.g., only the southeastern macro-fold may be observed on Figure 3c, which is not the case since the central macro-fold is also shown there.

Comment 84: agreed.

Comment 85: agreed.

Comment 86: agreed.

Comment 87: agreed.

Comment 88: agreed.

▪ **Changes implemented**

Comment 1: none commanded by the reviewer's comment.

Comment 2: designed new figure 1a and b.

Comment 3: added coordinates to Figure 2, on which all Google Earth images are located. Also added uninterpreted version of all Google Earth images to the supplements and reorganized the supplement numbers in the manuscript.

Comment 4: see response to comment 81.

Comment 5: added ", southwestern USA" in the title.

Comment 6: added "and its role as possible transfer fault" lines 51–52.

Comment 7: replaced "culmination" by "uplift" lines 74, 76, 198, 229, 680, 720 and 980, and by "tectonic uplifts" line 840.

Comment 8: see response to comment 9.

Comment 9: changed "culmination" into "uplift" line 122. Changed "analogous" into "an analog" and "rift" into "inverted" line 124.

Comment 10: replaced "We consider" by "Previous mapping in the area (Dibblee, 1954; Lancaster et al., 2012) considered" lines 139–140, and deleted reference to Dibblee (1954) line 142.

Comment 11: deleted ") are consistent with sediment-accumulation rate estimates (" lines 165–166.

Comment 12: see response to comment 7.

Comment 13: see response to comment 2.

Comment 14: deleted "off-fault" line 249.

Comment 15: added reference to Sylvester and Smith (1976, 1979, 1987) and Bergh et al. (2019) lines 256–257.

Comment 16: replaced "via" by "to" line 319.

Comment 17: replaced "via" by "to" line 345.

Comment 18: deleted "to monocline-like" lines 379–380.

Comment 19: replaced "folds" by "synclines" line 407, and added "**(synclines)**" line 1321 and the hinge line of the folds in Fig. 5.

Comment 20: deleted "fold-related" line 416.

Comment 21: added "(see stereoplot in Fig. 2)" line 506. Deleted ", possibly representing, conjugate sets" lines 505–506.

Comment 22: replaced "a younger slip event" by "younger deformation along this fault" lines 548–549.

Comment 23: deleted "strain " line 552.

Comment 24: replaced "Palm Spring and Mecca foramtions" by "Mecca Formation and overlying Palm Spring Formation" lines 570–571.

Comment 25: none.

Comment 26: deleted "dip-slip" and replaced "parallel" by "propagation" lines 591–592.

Comment 27: replaced "stress" by "strain" line 673.

Comment 28: replaced "restored" by "rotated" line 497, and "restoring" by "rotating" lines 500 and 686.

Comment 29: replaced "trending" by "oriented" line 744.

Comment 30: deleted "in a changing transpressional plate regime" line 884.

Comment 31: added "The *en echelon* folds formed at a comparable time, i.e., < 0.76 Ma in the Indio Hills and at ca. 0.5 Ma in the Durmid Hills (Table 1)." lines 919–920.

Comment 32: added "in California, southwestern USA" lines 34–35.

Comment 33: none.

Comment 34: changed "Eastern California Shear Zone" into "Eastern California shear zone" throughout the manuscript.

Comment 35: replaced "transform movements" by "movement" line 67.

Comment 36: added "These recent works call for further characterization of the understudied Indio Hills segment in order to compare its structural development with other uplifted features along a major transform plate boundary fault zone." lines 72–75.

Comment 37: corrected into "San Gorgonio Pass" line 216.

Comment 38: split the sentence into two line 217.

Comment 39: see response to comment 34.

Comment 40: deleted "attitude and" line 226.

Comment 41: changed "remain" into "remains" line 227.

Comment 42: split the sentence into two and replaced ", but" by "However" line 231.

Comment 43: the sentence was deleted and the paragraph reworked according to the other reviewer's comments.

Comment 44: replaced "their study" by "Keller et al. (1982) lines 240–241.

Comment 45: added "San Andreas " and deleted "strand " line 273.

Comment 46: decapitalized "fault" throughout the manuscript.

Comment 47: added a comma before and after "SAFZ-oblique" line 307 and changed "with" into "having" line 308.

Comment 48: none for the moment. Awaiting comments by the editorial team.

Comment 49: changed "southwestern" into "southeastern" line 379.

Comment 50: replaced "offset" by "displacement" line 429.

Comment 51: replaced "near" by "in the damage zone of" line 446.

Comment 52: added an hyphen between "minor" and "scale" line 501.

Comment 53: deleted "leuco-" line 444.

Comment 54: changed sentence into "In map view (Fig. 2), the folds are right-stepping, and each fold set is increasingly asymmetric (Z-shaped) and sigmoidal towards the Indio Hills fault in the northeast." lines 523–525.

Comment 55: added "other " line 570.

Comment 56: deleted en dash line 571.

Comment 57: replaced "slip event" by "episode of movement" line 675.

Comment 58: deleted "precursory" line 753.

Comment 59: replaced "East" by "Eastern" line 810. Also see response to comment 34.

Comment 60: added the Camp Rock and Calico faults to Figure 1.

Comment 61: deleted comma after "enhanced" line 825.

Comment 62: replaced "SAFZ" by "San Andreas fault" lines 853–854.

Comment 63: replaced "in" by "along the" line 860.

Comment 64: added "a-c" line 844.

Comment 65: replaced missing figure reference by "Figs 2 & 3c and Supplement S3a" line 875.

Comment 66: combined "Shore" and "line" line 904.

Comment 67: replaced "Shore" by "Shoreline" lines 920, 928, and 929.

Comment 68: replaced "main SAF" by "main San Andreas fault" line 930.

Comment 69: see response to comment 67.

Comment 70: deleted "in" line 976.

Comment 71: see response to comment 2.

Comment 72: added "; **BSZ: Brawley seismic zone**" line 1285.

Comment 73: see response to comment 34.

Comment 74: uncapitalized "Fault" throughout the manuscript.

Comment 75: see response to comment 3.

Comment 76: adjusted text in figures 2, 7, and 8.

Comment 77: added "(bedding)" twice in figure 2.

Comment 78: none.

Comment 79: added "**via the Orient software (Vollmer, 2015)**" line 1304 and Vollmer (2015) to the reference list.

Comment 80: see response to comment 3.

Comment 81: adjusted the hinge line of structures in Figures 3a–c, 5, and 6.

Comment 82: added "**The yellow dots show the location of field photographs.**" line 1319.

Comment 83: none.

Comment 84: added ", **centimeter-scale**" line 1329.

Comment 85: added "main San Andreas fault" to Figure 5.

Comment 86: re-drew the fold hinge in Figure 6 as it appears in Figure 2.

Comment 87: deleted "Tentative" line 1351.

Comment 88: changed "SAFZ" into "mSAF" in Figure 8.

### **Additional revisions by the author of the present manuscript**

-Added "(we refrain from using the name "Indio strand" given to this fault by Gold et al., 2015 to avoid confusion with the Indio Hills fault)" lines 39–41.

-Moved "Atwater and Stock, 1998;" before "Spotila et al., 2007;" line 64.

-Changed "uppermost members" into "upper member" line 118.

-Replaced "marks the" by "is a" line 201.

-Deleted "-" line 480.

-Deleted en-dash line 506.

-Added "(probably southwest-dipping)" line 753.

- Replaced "show" by "suggest" line 786.
- Added a comma line 831.
- Corrected "Janecke et al., 2019" into "Janecke et al., 2018" line 842.
- Deleted "and main SAFZ" line 863.
- Moved "basement-seated" from line 899 to line 891.
- Deleted "The Indio Hills fault acted as a SW-dipping, normal fault in Miocene time, i.e., prior to inversion as an oblique-slip, right-lateral-reverse fault during mid (-late?) Pleistocene times" lines 899-901.
- Moved ", whereas the main San Andreas fault initiated probably as a dominantly right-slip fault during the later stages of uplift in the late Pleistocene." from lines 903-904 to lines 894-896.
- Deleted "portion of the SAFZ" line 912.
- Deleted "in Durmid Hills" line 1235.