

Interactive comment on “Mechanisms of clay smear formation in unconsolidated sediments – insights from 3D observations of excavated normal faults” by Michael Kettermann et al.

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This manuscript provides an excellent documentation of the 3D structure of a meso-scale clay smear in an unconsolidated sand-clay sequence. There has long been a need for this type of study, which unfortunately is difficult to perform in practice. The authors have carefully chosen a good field opportunity, with industrial back-up for its execution. I have no hesitation in strongly recommending the manuscript for publication.

My personal interest in this work comes from its applicability in subsurface data, for example fault seal analysis in hydrocarbon exploration/production and CCS. In this regard, I think a very useful addition to the figures would be explicit SGR results for each

C1

section where FW and HW parts of the clay are visible. SGR values are mentioned in places in the text but in a rather approximate way.

On page 5, line 16, the comment should be more carefully worded to avoid misinterpretation - I suggest "If we are looking for faults with $SGR < 0.2$, single source clays have to be $< 20\text{cm}$ thick if the fault throw = 1.0m ."

The discussion of Figure 11 (clay smear thickness histogram) should include a consideration of sampling artifacts at the small-thickness end of the distribution. This is analogous to the concerns about fault-population sampling (e.g. Pickering et al 1995) where truncation at small sizes distorts the statistical fit. I would also suggest plotting the fitted log-normal distribution onto the histogram.

In general I feel that it is good to have the discussion/modelling section here in this same paper as the outcrop observations, in contrast to Anonymous Referee #1. However, the Matlab model presented on p.13 (lines 6-18) and Figures 19-21 does not seem particularly insightful, so maybe it could be omitted to shorten the paper a little, or moved to a second Appendix.

Some minor technical corrections are as follows:

p.1, line 12: sheared not shared

p.2, line 29, insert 'and' after 'faults,'

p.3, line 19, 'in relays' not 'of relays'

p.6, lines 14-16 would be better moved to around line 3, as they are general observations

p.7, line 21: R- and R'- shears are absent... there seem to be lots of them on the lower part of Figure 7c. And also, it does NOT seem that the shear zone is wider; refer to interpretation in Fig.13b.

p.7, lines 27-28: this sentence refers to Fig.22 and is out of sequence.

C2

p.8, line 8: omit 'with'

p.8, line 10: 'sections 3, 9, 10'....section 9 does NOT show thin smear at the footwall cutoff: perhaps 3, 10 & 11?

p.8, line 19: cast not casted

p.8, line 25-26: I cannot understand this sentence: what is 'footwall cutoff on the hanging-wall side'?

p.10, line 2: principal not principle

p.10, line 18: given that the Kleine Vennekate reference is relatively inaccessible, I suggest that this b/a vs SGR plot be explained more, perhaps in the caption to Fig.17.

p.13, line 4: insert 'implies' after 'smear'

p.15, line 2: than not as

p.15, lines 7-8: meaning unclear, please re-write

Figure 6a, very pretty, but please state in the caption that the colours have been added to improve clarity!

Figure 9: make part (e) exactly the same size as the red box in part (d), to improve the reader's ability to match up features in the two images

Figure 13: in agreement with Referee #1, improve annotation of D-shear

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