

# ***Interactive comment on “Resolved stress analysis, failure mode, and fault-controlled fluid conduits in low-permeability strata” by David A. Ferrill et al.***

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The paper “Resolved stress analysis, failure mode, and fault-controlled fluid conduits in low-permeability strata” by Ferrill et al., is well organized and deals with the very interesting topic of mechanical models (generally speaking) where the authors are very expert. I really enjoyed reading it.

The paper follows some previous works extending theoretical models to real faults deeply studied previously by the same authors. In light of this, the boundary conditions of the applied mechanical model should be very well explained and constrained, in my opinion, in order to give to the reader all the instruments to completely understand the

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meaning of the results. This is the part of the paper that I think should be improved.

In particular it is not clear to me for example what are the constraints for the hypothesized pore pressure, being this quite high ( $\lambda > 0.7$ ). The same for the mechanical properties of the involved lithologies proposed in Figure 6. No indication is reported along the paper about the source for the adopted mechanical data such as for example cohesion and coefficient of friction.

Keeping the focus on Fig.6 the proposed model is not clear to me. Since no build-up processes for fluid pressure are invoked along the text, if I well understand, rocks will fail in the initial stage, for a decrease of the  $\sigma_3$  being the system in an extensional regime. This brings mudrock to break first as showed in the model. Thus, at this time, a decrease in pore pressure is expected since, generally speaking, a rupture is related to an increase in permeability/porosity that lead to a decrease in pore pressure. However, following the model, a continuous process of build up for fluid pressure should be present in the system in order to overcome the  $\sigma_3$  and bring to hydraulic fractures on chalk. So I am wondering how can we reach the condition for high overpressure on chalk if a rupture already occurred on mudrock?.

That said, should we assume different boundary conditions for mudrock and chalks and reconsider figure 3?

In conclusion I think that this very interesting paper deserves some more rigorous constraints for the applied mechanical model. Moreover, a more comprehensive discussion on the model implication and on its evolution over time and space will strongly improve the paper together with a comparison with results from other authors (see line to line comments).

Some line to line notes are on the pdf attached file

Hope this helps

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Please also note the supplement to this comment:

<https://www.solid-earth-discuss.net/se-2020-17/se-2020-17-RC2-supplement.pdf>

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Interactive comment on Solid Earth Discuss., <https://doi.org/10.5194/se-2020-17>, 2020.

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