Solid Earth Discussions

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Reply on RC1

Chao Deng et al.

Author comment on "Impact of basement thrust faults on low-angle normal faults and rift basin evolution: a case study in the Enping sag, Pearl River Basin" by Chao Deng et al., Solid Earth Discuss., https://doi.org/10.5194/se-2021-92-AC1, 2021

Below are some major and minor comments:

1. The only major problem in this manuscript is the lengthy description and discussion. Some parts are repeated and unneeded. For example, the section 6.1 has 150 lines to discuss the possible model for the low angle faults. These models are well-known in interpretating the angle of faults, but several sentences are sufficient for readers to understand the reason why the formation model is adopted. Too many words may have countereffects. I thus recommend shortening this section, leaving section 6.1 without any subsections, and briefing the key evidence for the inherited tectonic model. This kind of problem also applies in the structural description in section 5, and the rest parts of discussion. The current discussion is too long to get the key ideas.

Yes, thanks for helping us making the manuscript easier to follow. We brief the text in sections 5 and 6 now.

2. The abstract could be improved with some more implications. The discussion gives them on the evolution and interaction between the thrust faults and normal faults, they should be introduced at the end of it.

More implications are added. See Lines 20-24.

3. In lines 40-45, as cited in this manuscript, the inherited tectonics has been studied, but, of course, questions remains unsolved in many aspects. Being short of investigation is not a good scientific question for motivation. Instead, I want to see a specific problem in this area, and how this problem can be solved to improve our understanding of the inherited structures, such as how many growth patterns has been studied, how many reactivation modes exist, and etc.

Done. See Line 45.

4. I am curious on the three stages of extension. Their time spans seem continuous. Is there any evidence on separating them? Fig. 2 provides a stratigraphic column of the study area showing that the earliest stage is compressional and lasted until Early Eocene. It contrasts with the background that there should be an extension stage before Cenozoic. Does this basement have some age constraint? What is the timing of the thrusting?

There are lots of literatures about the tectonic evolution of this area, and the three stages of extension are based on regional geology. The widely-accepted division scheme of the rifting stage is based on the regional unconformities recognized in seismic data, which correspond to three tectonic events, and separate the syn-rift stratigraphy into three formations. In our study area, the syn-rift package above the top basement comprises two of them, with the bottom formation missing due to diachronous rifting. Thus, the stratigraphic column in Fig. 2 shows that the first stage of rifting (Late Cretaceous to Early Eocene) has no record in our study area, which is mentioned in Line 105.

5. Data acquisition is missing in the text. Some introduction can be briefly added in the text.

Done. See Line 116.

6. I have some questions on the interpretation of seismic profiles. The fault BF2 is partly normal fault and reverse fault. It is clear to identify its upper part, but why is the lower part explained as a reverse fault? I cannot see any evidence of thrusting. Some of red faults in Fig. 5a may be normal fault, such as the first two faults from the right. The authors need more caution on the geometry of faults.

The reason why we interpret the lower part of BF2 as a reverse fault is that it has similar orientation and dip with the neighbouring basement thrust faults, which are quite common in the study area according to Fig. 5. Yes, the first two faults from the right may be normal faults, but I think it is uncertain because the offset of Tg horizon is too small to be determined with the data resolution. Our point is that they have similar geometry and reflection feature to those neighbouring basement thrust faults, it is more reasonable to make it consistent through the area.

Figures:

7. In fig. 1, the upper sedimentary cover is post-rifting formation, which, however, is cut by some normal faults. There should be a clear definition on the syn- and post rifting stages.

This is a good point, because post-rift minor fault activity has been reported by previous studies in this and other areas. The boundary between the syn- and post-rifting stages is suggested to be T70 horizon, which has been reached a consensus, but people also observe that there are some minor tectonic activities during the post-rift stage, causing reactivation of some syn-rift faults (Ye et al., 2017, Earth Sci.).

8. I find some figures are overlapping, Fig. 5a and 6b, Fig. 5b and 9b, and Fig. 5c and 6a. The purpose of emphasizing one segment from a long profile is not clear. Can the short profiles be integrated with the main profiles?

Yes, the positions of those figures are overlapping, but each of them aims at showing different structural styles with the combination of a few sub-figures. So, integrating them with the main profiles needs to reorganize the order of most of the figures. Can we just modify them to minimize the overlay, as seen in the new figures? See figs 5 and 6.

9. The last figure shows different generations of faults. I think some reactivated faults are better marked in red for clarity.

Done.