

This manuscript presents seismic profiles and analog modeling to discuss the formation of the Barents Shear Margin. Reviewing such a long manuscript really tasks me, especially that the poor preparation of figures. I cannot find geological units, such as Senja shear margin, Hornsund fault zone, and many other names referred in the text. Even the structures in figure and captions are not matched. Another issue is that too much and redundant description of results prevents me understanding the key evidence and motivation of this work. The text can be shortened by half if they want to have a clearly written paper. I therefore suggest returning this manuscript to authors for a major revision by deleting and combining unnecessary parts, and highlighting the finding or importance of this work.

Below are details of comments:

In the abstract, I do not find any highlighted scientific significance. The last sentence, “this is in general agreement with observations in previous and new reflection seismic data from the Barents Shear Margin”, seems to inform us this is only repeating the formation of the rifting margin, while its implications are still in investigation. The uniqueness or characteristics of the Barents margin are necessary for readers to know why this problem matters, and thus deserves modeling. This lacks in the abstract.

The Introduction is not informative. Actually, I find one section in lines 327-374 that belongs to “Introduction”, because it summarizes previous work and provide motivation to carry out this study. This section is better moved to and incorporated with the current introduction.

As I mentioned above, the major problem bothering me is the mismatched geological unit names and figures. In fact, this is the key to understanding the regional tectonic context. In figure 1, I cannot find KFC, SFZ in the map, while SB and VH are not explained in the captions. Furthermore, there are other units not found on the map, including the Tromso basin, Bjornoya basin, and Stappen High, etc. Please check the background and make sure all the units are easily located on the figures. This is crucial.

The regional background is already of some unnecessary information. Except locating the units, regional tectonic evolution remains untouched. Regional geological history may serve as the connection for these tectonic units by introducing, for example, how many tectonic stages and how magma evolved. With the figure 1, I find I am lost in these complex structures of the Barents shear margin.

In lines 291-302, this whole paragraph presents the fold patterns in the VVP, but neither figures nor references are provided. I do not know if these are based on new data or published data. The purpose of this section is unclear. It belongs to background if identification of fold families comes from Giennenas (2018).

The setup of experiment has 100 lines of words. Some can be moved to supplementary files. Figure 3 shows an uneven margin corresponding to the mapped continent-ocean boundary. I am curious whether this is current or initial shape of continental margin. How can we figure out the initial shape of margin?

I also find figure 3a is different from figure 4. Figure 4 has confining bars on the oceanic crust side, while these bars are to the east of the continental crust of figure 3. I need similar labels of figure 4 in figure 3.

This experiment was conducted with similar rates for all three stages of deformation. I wonder if there are some geological constraints for these rates? Besides, the authors always succeed in writing things in a complex and ambiguous way. Some simple sentences may have better effect than the sentences in lines 423-438. Until the end, I do not know how the engine moves for Phase 3.

Modeling results has 250 lines! In addition to it, there are at least one hundred lines in the discussion which still describe the results of the modeling! These two sections requires reorganization to cut off redundant and repeated description of the observed structures in the sandbox. It seems the authors choose to keep all the details of the experiment, whereas the key results were flooded by them.

My last suggestion is to separate the discussion into several subsections. Tectonic implication deserves its own section.

Line 170: Which two segments?

Line 188: Which basin?

Line 212: Coincides with its border? Temporally or spatially?

Line 225: This sentence is hard to understand.

Line 232: Reference?

Line 246: There is a square.

Line 250: Hard-linked?

Line 271: Fig. 4.1 does not exist.

Line 273: This sentence is not clear. What kind of imprint did Cenozoic tectonics leave?

Line 321: 3 is missed for fold family.

Line 333: Put directions for all profiles. Also, mark the fold types on each figure.

Line 442: 100-200 of what?

Line 449-458: This part is not necessary.