Solid Earth Discuss.,
https://doi.org/10.5194/se-2017-97-RC1, 2017
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Solid Earth Discussions

Interactive comment on "Oblique reactivation of lithosphere-scale lineaments controls rift physiography – The upper crustal expression of the Sorgenfrei-Tornquist Zone, offshore southern Norway" *by* Thomas B. Phillips et al.

Anonymous Referee #1

Received and published: 2 October 2017

Review of the paper Title: Oblique reactivation of lithosphere-scale lineaments controls rift physiography - The upper crustal expression of the Sorgenfrei-Tornquist Zone offshore southern Norway Author(s): Thomas B. Phillips et al. MS No.: se-2017-97 MS Type: Research article

In this paper, the Authors present a detailed analysis of the development and evolution of the Farsund Basin, offshore southern Norway, an E-trending basin believed to represent the upper crustal expression of a major lithosphere-scale lineament, the Sorgenfrei-Tornquist Zone. The analysis is based on borehole-constrained 2D and

3D seismic reflection data; it documents complex activations of faults, which reflect a multistage tectonic evolution in turn controlled by interactions between the variable regional/local stress field and the long-lived pre-existing lithospheric fabric. The results of this analysis offer insights into the role of inherited lithosphere-scale structures on the architecture of deformation at upper crustal levels.

Overall the paper is very interesting; the analysis of the dataset is very detailed and the results support the interpretations, with the complex evolution of the basin controlled by the presence of the inherited lithosphere-scale structure and the variable stress field. The only doubt I have is with the idea of this basin representing a pull-apart (at least a 'classic' pull-apart). Indeed, many of the structures typically associated with these strike-slip basins do not seem to be present in the Farsund Basin (at least in the investigated area). For instance, basin sidewall faults or cross-basins faults seem to be lacking; similarly, offset segments of the major strike-slip faults (principal deformation zones, see Dooley and Schreurs 2012) are not very clear (for instance from Fig. 15). Deformation as illustrated in Fig 15 (or even in the more regional sketch of Fig 16) seems to be more similar to a 'distributed transtension' (Dooley and Schreurs 2012) than to a typical pull-apart. Anyway, I think the Authors should address this in more detail throughout the manuscript.

The stress field indicated in Fig. 15B (Early Jurassic) as also portrayed in Fig. 16 should involve some extensional displacement along the roughly E-W faults. Also, in Fig 15C there is no widening of the basin associated to the dextral transtension (i.e. it could be better to increase the distance between the two systems of faults bounding the basin to the North and South passing from panel B to panel C)

Other technical corrections 115. The 'Tornquist fan' does not seem to be indicated in Figure 1a 220. Cheng et al 2017 - reference not needed here 385. last lines not clear to me 740. n/a-n/a - please check this Fig. 1 Panel A. The rectangle indicating the location of Fig1c seems to be too large.