

Solid Earth Discuss., referee comment RC1
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Comment on se-2021-99

Jonas Kley (Referee)

Referee comment on "Late Cretaceous–early Palaeogene inversion-related tectonic structures at the northeastern margin of the Bohemian Massif (southwestern Poland and northern Czechia)" by Andrzej Głuszyński and Paweł Aleksandrowski, Solid Earth Discuss., <https://doi.org/10.5194/se-2021-99-RC1>, 2021

General comments

Dear authors,

this is a highly welcome contribution on an area for which no easily accessible information was available before. It adds an interesting facet to the panorama of tectonic inversion phenomena presented in the Special Issue. I like your approach of combining the reprocessed seismic data with field observations and glimpses at earlier interpretations, deriving a new, unified model in the end. The manuscript is in a very mature stage already, well written, easy to follow and beautifully illustrated. Most of my annotations refer to very minor issues such as typos (of which there were very few). In some instances I made suggestions for alternative phrasing which you may follow or not.

A formal thing I would like to mention upfront is the absence of a discussion section. The discussion of own and other authors' interpretations is instead distributed in bits and pieces throughout the paper. Counter to first intuition, this makes a lot of sense. As the paper deals with different areas and geologic situations one by one, a bulk separation of description and interpretation would require dealing with each structure twice: First, going through all structures for description, and then again for discussion. This would make for very awkward reading. Within each paragraph, there is a clear separation of descriptive and interpretative elements.

Specific comments

As regards contents, I only have two remarks, a minor and a more substantial one:

(1) In l. 33 ff. you describe folds 1000 km long, 150-250 km wide and up to 3 km high (equal to 1.5 km amplitude). This would put them in the realm of mantle (not crustal) folding as modelled by, e.g., Cloetingh et al. 2005, implying that they should be seen to affect the Moho. I don't think that is the case. (Age in our Central European case is considered to be around 300 Ma).

I think that all of these structures are single folds only to a very first approximation; in fact, they are overgrown by many smaller-scale structures. The interesting question then becomes how much different mechanisms contribute to uplift. I have discussed this a little bit in the 2018 Geol.Soc. paper you cite and in more detail we have done so in the von Eynatten et al. and Hindle and Kley contributions to this Special Issue. (I don't mean this as a nudge to cite those). We find ourselves compelled to invoke a role for mantle processes and breaking/flexing the plate, whereas other authors (e.g., Jef Deckers in the Special Issue and earlier publications) are inclined towards lithospheric or crustal folding. Maybe you can elaborate in a few sentences on this unsettled debate. Whether you want to take sides or just state there is no consensus is of course your choice.

(2) The paragraph on joints relies entirely on matching orientations but is mechanically problematic. Joints are opening-mode fractures that form with the smallest principal stress being tensile (Mohr circle touches the Griffith fracture criterion to the left of zero normal stress). This can occur either at shallow levels in the crust or with elevated fluid pressures, but always at low differential stress (s_1-s_3). The inversion structures, however, certainly formed at a peak of differential stress. In addition, joints or veins open in the s_1/s_2 Multiple (e.g., orthogonal) sets of vertical joints are therefore indicative of a (mildly) extensional regime with s_1 vertical. Joints forming in a thrust regime should be horizontal. My advice would be to drop this entire short section with the accompanying figure. This would not weaken the paper in the slightest.

Technical corrections:

See annotated pdf

I am looking forward to seeing this contribution published!

Jonas Kley

Please also note the supplement to this comment:

<https://se.copernicus.org/preprints/se-2021-99/se-2021-99-RC1-supplement.pdf>