

Solid Earth Discuss., referee comment RC1
<https://doi.org/10.5194/se-2021-95-RC1>, 2021
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Comment on se-2021-95

Anonymous Referee #1

Referee comment on "Variscan structures and their control on latest to post-Variscan basin architecture: insights from the westernmost Bohemian Massif and southeastern Germany" by Hamed Fazlikhani et al., Solid Earth Discuss., <https://doi.org/10.5194/se-2021-95-RC1>, 2021

This paper is interesting, well written, and describes the upper crustal structure of the Saxothuringian in NE Bavaria based on a new reflection seismic survey termed "FRANKEN". The interpretation in terms of seismic facies is generally well done, but not in any way novel or original. Data description and integration with drillhole information is OK for the sedimentary cover. The reflection signature deeper units below the sedimentary cover offer some interesting insights for those who are familiar with the structure and geodynamic evolution of the Saxothuringian (ST in the following) Units exposed at the Earth's surface further to the NE, and show that non-metamorphic, low-grade metamorphic and basement units can be followed about 60-80 km further to the SW.

There are some critical points, however, which I would like to focus my attention on in the following:

Carboniferous-Permian boundary: Seismically the tectonic-stratigraphic contact between the Rotliegend and the subjacent ST sediments and metamorphics cannot be easily constrained in most of the seismic sections. This makes the exact definition of Rotliegend basin architectures very difficult, as they may be given by intra-BSF 1 (BSF is basement seismic facies) reflections. Rotliegend thickness is very variable (0-2800 m) if drillhole data are used. I am not sure if this can be improved by different processing parameters, but this is certainly one of the weak points in the geological story.

Basement Seismic Facies (BSF) concept: The BSF 1-3 scheme looks logical at first, as it depicts a similar superposition everywhere - also in the published DEKORP seismic sections that are extensively discussed and form an important cornerstone of the paper. BSF 2, a packet of high-amplitude and continuous reflections is interpreted as reflecting a system of Variscan shear zones. This has been seen identically in the DEKORP publications (op. cit.), but note that some of these interpretations were in part dramatically disproven

by the drilling data of the KTB further to the SE of the studied area. So, are these reflections necessarily images of shear zones? They may be, or may be not, and without ground-truthing by drillholes this is a difficult conclusion. More neutrally, BSF 2 reflections as zones of high seismic impedance contrast, that may relate to a marked lithological change, grading downward into BSF 3, a seismic facies characteristic for higher grade metamorphics and plutonics of the Cadomian basement of the Mitteldeutsche Kristallinschwelle.

The FRANKEN seismic survey itself: The ST basement here has much weaker BSF facies expression than in the DEKORP lines. I am not clear if this is driven by different choices of the seismic processing parameters, or it but could equally well reflect a NW-ward (e.g. FRANKEN 1801) and SW-ward (FRANKEN 1802, 1803) change in ST basement characteristics (e.g. loss of possible shear zone signature). Possible causes for this are discussed (lines 426 ff. of the ms), but it is the marked absence of other (e.g. drillhole) data and observations that makes any interpretation difficult.

In summary, the paper appears to need some thorough revision before being acceptable for publication. There is also a multitude of typographic errors to be corrected (I have not started to do this and trust that copy editing can do the job), and the citations and reference list need a close look at (see e.g. the citations of SCHWAN, 1974, and SCWAN, 1974 for an obvious example) and improvement.