Solid Earth

Open Access

Discussions

EGU

Interactive comment on "Imaging East European Craton margin in Northern Poland using extended-correlation processing applied to regional reflection seismic profiles" *by* Miłosz Mężyk et al.

Anonymous Referee #2

Received and published: 9 March 2019

This paper presents a concise interpretation of a suite of four deep seismic reflection profiles obtained by extended correlation of regional industry lines. The seismic lines constrain the character of the reflective crust below NE Poland on the margin of the East European craton where the crust was assembled during the Svecofennian orogeny and subsequently reworked. In the igneous crust, the signal-to-noise ratio of the seismic data is relatively low, and it is difficult to map large structures over distances greater than a few km, precluding a detailed structural interpretation; however, the pattern of intermittent reflectivity is similar to that observed in southern Finland, and is

likely representative of the crust in this region. The base of the crust is not directly evident, but can be inferred from the laterally averaged decay in reflection amplitudes and is in reasonable agreement with wide-angle seismic studies. This paper thus makes a valuable contribution to seismic studies of the crust in Eastern Europe, and merits publication after some revision.

The rational for some parts of the interpretation requires clarification, for example the interpretation of the anorthosite intrusions in transparent regions of the crust. Non-reflective zones occur in many areas, but can only be reasonably, and speculatively, inferred to be intrusions where underlying reflections are present, demonstrating good signal penetration into the deeper crust. Why isn't the transparent crust at 6-24 km between CDP 5000 and 6000 on line 1200 interpreted to be a pluton? Consistency in the interpretation is necessary. What are the black lines on the interpreted seismic sections intended to show? Are they intended to indicate representative reflection fabrics or shear zones or something else; the first is a characterization of the data to assist the reader, the second is an interpretation, which requires more explanation, even if only in general terms. How do you define the lower crust mentioned on page 6, lines 10-12, i.e. it's top as Moho is already inferred? When discussing features on the seismic sections, it would greatly help the reader if they were identified on the figure by a label that was then referenced in the text.

The inference of S-C' fabrics is an interesting result, but needs to be clearly demonstrated, because I couldn't really see this in the data. I suggest adding a cartoon-like figure to explain what structure you are inferring from the data, and a couple of labels on the seismic to explain where these features are seen. What do you mean by non-coaxial flow? Be clear on direction relative to strike of orogeny.

Equations (1) to (3) are not really necessary as most specialists are familiar with them, but they could be retained, but in this case the assumptions should be stated, e.g. linear sweep. All sweep parameters should be included in the text: start and end frequencies, type of sweep, e.g. linear upsweep, start and end tapers etc.

The number of figures could be reduced. Figure 3 is not really necessary unless the authors are going to interpret plutons from the magnetic fabric shown or to clearly use the figure for some specific aspect of the interpretation. It is useful to see the comparison of displays in Figure 4, but I think Figure 5 could be omitted, especially if the number of black lines, many of which are not clearly justified, is reduced in the interpreted sections. The frequency decay in the lower panel in Figure 6 does not contribute much and can also be removed, but the refraction Moho, or its range over these parts of the lines, should be indicated in the upper panel.

Minor comments, questions and suggested edits:

Title suggestion: Imaging the East European Craton margin in Northern Poland using extended correlation processing of regional seismic reflection profiles

P1,L8: remove both "the" P1,L11: 3-layer cratonic crust P1,L15: which we primarily associate with Paleoproterozoic crust formed during P1,L16: and are similar to those observed... P1,L18: What is direction of crustal flow: orogeny normal? Be specific. P1,L19: Didn't you indicate shortening in the text, so why extension here? Not clear. P1,L22: of thickened crust

P2,L9: by refraction P2,L10: define LT. They portray relatively P2,L13: 1980s. Give years acquired P2,L17: aimed to provide P2,L19: data has already P2,L20: These seismic profiles have been used as P2,L20: a new interpretation P2,L22: deformation extends much P2,L23: showed that these ... study deep P2,L27: apply extended P2,L28: Precambrian crust P2,L29: cover, previous inferences were based mostly on P2,L30: (K..,2017), but with these new seismic reflection data it is now possible P2,L31: these new data P2,L32: to that observed P2,L33: remove ? ... of Mesoproterozoic magmatism,

P3,L1: Can you indicate the known extent of the Svecofennian orogeny in Figure 1? Is it defined by the coloured terranes in Figure 1. If so, please state explicitly. P3,L2: with a 1.83-1.84 Ga P3,L6: has been recognized P3,L7: during Rodinia breakup P3,L8: has

been recognized P3,L98: by Caledonian P3,L14: by PolandSPAN P3,L23: are clearly visible P3,L24: Refer to labels on Fig.3 to indicate intrusions P3,L27: employed acquisition P3,L31: recorded with P3,L35: structure with a processing sequence optimized to preserve the P3,L39: that by using P3,L40: the PolandSPAN data could be

P4,L2: upsweep. This is important! P4,L5: means that the reference signal we correlate with the recorded data was truncated during the correlation process, preserving the full bandwidth for the original record length, but losing bandwidth at later times. P4,L30: Define Vrms P4,L32: Why is DMO "vital"? DMO applies very little correction at late times, so is the effect due to the suppression of steeply dipping noise, i.e. similar to an F-K filter. How was DMO applied? F-K in common offset or Kirchhoff implementation? Are these crooked lines, which will affect results of algorithm: F-K not tur 3-D DMO, but Kirchhoff may be.

P5,L9: yields curves P5,L10-13: Not clear to me exactly how the frequency decay curves were computed, e.g. what "amplitude values". Needs to be reworded. However, since I suggested that these displays be removed, this section could be omitted with corresponding edits elsewhere. P5,L20: Cite figures here P5,L21: From exactly what feature are you tracking the lower crust-mantle transition? Downward termination of reflectivity, but note there are coherent events in the mantle, which could be noise, so you need to exclude these, and explain how/why. P5,L24: would flatten out at 20 km P5,L25: In contrast to the poorly P5,L27: and extends for P5,L28: Moho can also be inferred from both amplitude... which we present in P5,L29: time where the curves do not decay further P5,L31: some reflections might continue into the upper mantle, such as events visible on line 5600 P5,L33: the one on line 5600 P5,L35: Poland show a much more.... crust compared with P5,L36: which is a result of the different methodologies employed. DELETE TO. However, as discussed

P6,L2: defined as the base of bands of intermittent reflections dividing P6,L10-12: How are you defining the lower crust using the reflection data? Explain. P6,L17: Label these features on figures. How are they inferred from the seismic reflections or gaps in

seismic reflectivity. P6,L25: Use label to indicate position in Figure 7. P6,L27-39: This can be explained

P7,L2: 2005) due to the structural record P7,L10: of AMCG magmatism P7,L13: How related to lower crustal delamination? Please clarify. P7,L15: of a lower/middle P7,L38-39: with Caledonian deformation. . . represent a Proterozoic

P8,L4: with Paleoproterozoic crustal formation. . .. Orogeny, and which a resimilar to those observed P8,L13: basement may be linked

Figure 1: Darken coastline to make location of terranes clearer with respect to NE Europe. Figure 4,5,7: Distance scale is too small to be legible. Depth annotation does need to be so frequent, perhaps every 5 km?

––––––––––––––––––––––––––––––

Interactive comment on Solid Earth Discuss., https://doi.org/10.5194/se-2019-26, 2019.