

## ***Interactive comment on “Seismic LAB or LID? The Baltic Shield case” by M. Grad et al.***

### **Anonymous Referee #2**

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The title of this manuscript is intriguing, as it is unclear why there should be a contradiction between the LAB and LID. The authors do not define the two terms, but I thought that the LAB is the base of the LID, in which case there is no need to pose the question.

The real content of this manuscript is presentation and traveltimes interpretation of seismic record sections acquired on the Swedish seismometer array for local earthquakes around the Baltic Shield. The seismic interpretations do not add new knowledge about the mantle in the Baltic Shield, and the uncertainties are large, although not discussed in the manuscript. As such, the interpreted velocity models probably include several non-constrained features, but it is unclear which features are robust.

In principle the manuscript addresses significant relevant scientific questions within the scope of SE, but it does not present novel concepts, ideas or tools, although the record

C267

sections represent new data. I recommend rejection based on lack of novelty and unsupported conclusions.

#### Detailed review

The seismic sections are sampled with a density of ca. 40-100 km which probably is too coarse for modeling velocity-depth profiles at the detail presented. Further all record sections are constructed for data from a wide angular fan originating from the epicenter of the source instead of along a linear profile, such that substantial lateral smearing may occur. Because of the coarse sampling the interpreted models are highly non-unique and the models may therefore be considered subjective. This is particularly important for the discussion of low velocity zones (LVZ) in the Baltic mantle, because the interpreted data do not possess the resolution required for identification of thin (<50 km thick) LVZs. The profiles are non-reversed and the models therefore can only represent apparent velocity and depth, as the trade-off between velocity and dip cannot be resolved. The authors use a standard crustal model for the interpretations despite it is well known that there is significant lateral variation in seismic structure of the Baltic Shield. The authors present single models for each record section, even though it is obvious that a wide range of velocity models may fit the data to the same degree as the models presented by the authors. These uncertainties are not discussed in the manuscript, which questions the conclusions.

All seismograms include strong reverberation which could indicate substantial heterogeneity in the seismic structure, but these aspects remain largely unnoticed. The S-wave picks similarly indicate substantial heterogeneity from the scatter in arrival times.

I am surprised to learn that the asthenosphere is a thin low velocity zone below the Baltic Shield. This interpretation contradicts many other views on this subject of an asthenosphere continuing down to the transition zone. Some reference should be included for this statement. I miss a discussion of the mid-lithospheric discontinuity (e.g. Rychert, Rondenay, Fisher, Shearer) and its relation to a possible intra-lithospheric LVZ

C268

(e.g. Thybo, Gorman, Karato) in relation to the presented models.

In general, the manuscript include much self-referencing. The references on the evolution of the Baltic Shield are limited to a (self-)reference on the East European Craton, instead of providing an overview of the evolution of the shield itself based on the substantial existing literature. The references to interpretations of the FENNOLORA data (the key high resolution seismic data set on the Baltic Shield) are only to the thesis by Guggisberg (1986) instead of his published papers, and other mantle interpretations of the same dataset are not even mentioned, e.g. Stangl (thesis and EGT volume paper), Perchuc, Abramovitz. Likewise, new regional interpretations of the Baltic Shield based on teleseismic recording are not referenced (e.g. TOR Working Group, Olsson, Eken, Brunetton). The discussion of the Moho map does not refer to interpretations of data from the BABEL, Eurobridge, EugenoS experiments. One earthquake had its epicenter close to the northernmost FENNOLORA shotpoints; it would be relevant to compare the data. Some data sections are merely presented but not interpreted.

The authors do not identify any lvz from refractions, but this is also impossible and therefore not surprising.

The use of English language may be improved, and the wording lacks precision. Some locations referred to in the text are not shown on the maps.

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Interactive comment on Solid Earth Discuss., 5, 699, 2013.