Review of the paper: "**Evolution of the Iberian Massif as deduced from its crustal thickness and geometry of a mid-crustal (Conrad) discontinuity**"
by **Puy Ayarza, José Ramón Martínez Catalán, Ana Martínez García, Juan Alcalde, Juvenal Andrés, José Fernando Simancas, Immaculada Palomeras, David Martí, Irene DeFelipe, Chris Juhlin, Ramón Carbonell** submitted to Solid Earth open-access journal.

Major comments

The submitted manuscript concentrates on the reinterpretation of normal incidence seismic data along profiles in the Iberian Massif, Spain with the aim to present a cross-section through the Iberian Massif as the westernmost exposure of the European Variscides. The authors reprocess normal incidence data along 6 profiles and interpret them together with data along one other profile. They try to unify heterogeneity of the data during processing, which may have been lavish task to complete. Finally, they supplement these results with other result from the other profile CIMDEF.

In general, the paper is very extensive, discussing at length many geological evidences, however, the main goal of the paper is not clearly stated. The authors reprocessed 6 profiles though finally interpret 7 of them. About 6 reflection profiles, many of these data were already well documented and published (e.g. Simancas et al., 2013, Ehsan et al., 2014, etc.) documenting lots of details in the sections and interpretation and providing much more constraints than in the submitted manuscript. In the submitted manuscript, the authors show final reprocessed data, however, they do not provide any comparison with the previous results, they do not document the improvements or differences. So that, there is not clear evidence what is new in their submitted interpretation. Also, in the interpretation, they discuss details that are not constrained by the data in such a way. They also mention wide-angle data, but they do not provide velocity profiles though they convert TWT into depths which makes the interpretation less credible.

Except general comments, I have also difficulties with some interpretations provided in this manuscript. From Figs. 3-8, showing seismic sections and their interpretation, it is not clear how the interpretation is constrained, the interpretation is not correlated with geology, motion along lines (red arrows) is not documented, red dashed lines are not explained and do not correlate with the data, black lines termed Main lithological boundaries are not attributed to these lithologies, sometimes they are not constrained by the data (see e.g. line (d) in Fig. 3, bottom black line in Fig. 4b, line (c) in Fig. 4b, lines (b) in Fig. 5, numerous (a) lines in Fig. 8. Labelling of reflectors (a,b,c etc…) is not explained in figure captions and also sometimes does not correlated with the data. Interpretation is not the same for all profiles, see e.g. interpretation of data in Fig. 8 vs Fig. 7. (For more see also my comments below.)

According to two final figures and discussion, the authors seem to focus on two major discontinuities in the Iberian Massif – the Moho and the mid-crustal discontinuity. However, in my opinion, they are not well documented/constrained by the data at some parts (see, e.g., the bottom line in Fig. 4 in the N marked with "?" which does not seem to be justified by the data; or strong reflectors (d) at depths ~30-35 km in Fig. 6 considered by the authors as reflectors in the mantle with anomalously shallow Moho at depth 22km which may have natural also different explanation) and thus the interpretation might not be correct. The mid-crustal discontinuity is also discussed in relation to outdated term Conrad discontinuity, however, there is no comparison with velocity profiles which would help to discuss its genealogy. To conclude, I would suggest substantial reworking before potential resubmission.

Further points:

Figures in general – quality of figures in general is very poor. Tectonic setting is missing, seismic sections are poorly labelled, explanation of figures and labels is not provided in figure captions but only in text, geology is not provided in sections for comparison and references.

Fig. 1: needs reworking since there are difficulties to see profiles on top of tectonic structure. The geology is very detailed but the tectonic structure that is essential for the goal of this paper is not visible clearly from this figure.

Fig. 1: Tectonic zones referred in the text many times are not seen from Fig. 1

Interpretation of seismic sections along individual profiles:
Figs. 3-8 – Moho labelling should be provided in all Figs. 3-8; labels for individual horizons/reflectors should be provided in figure captions.

Figs. 3-8 in Legend – *Geometry of attribute analysis boundaries* – not clear what it means, it needs to be explained.

Fig. 3: I do not see subhorizontal reflector (e) extending through the whole section justified by the data.

Fig. 3: *Moho at 14.5s TWT ->* from Fig. 3 I can see the depth of ~40km, so what is correct?

Fig. 4: I do not see (b,c) structures interpreted in the section constrained by the data.

Fig. 4: It is not clear how the arrows are derived.

Fig. 4: I do not see the bottom line in the N marked with "?"justified by the data. How is it constrained? And is this Moho? If not, where is it?

Fig. 6: How can the authors derive the red arrows from the reflection data?

Fig. 6: *the Moho is located at around 9 s TWT (~27 km), the shallowest identified so far in the Iberian Massif ->* from Fig. 6 I can see strong reflector (c) at ~9s TWT, however, its depth is stated at 21-24 km. This seems to be very shallow if this is the Moho. This needs to be explained.

Fig. 6: strong reflectors (d) at depths ~30-35 km considered by the authors as reflectors in the mantle with anomalously shallow Moho at depth 22 km above. How can the authors distinguish what is the crust and what is the mantle? Cannot the (d) reflector at depths of ~30-35km represent the crust/mantle boundary? This needs to be explained.

Fig. 7: Red dashed lines – not clear what they represent and how they are related to the initial normal incidence data.

Fig. 7: *fairly transparent upper crust ->* I do not see fairly transparent upper crust throughout the whole section, it might be transparent in certain parts (e.g. around 6000-7000 CDP), however it exhibits variations aside. Also previous interpretations (Ehsan et al., 2014) show reflections in the upper crust along this section.

Fig. 8: I am surprised by the level of interpretation presented in Fig. 8 compared to e.g. Fig. 7. Are the data that much different? I cannot see so many reflectors from section in fig. 8, on the other hand, I can see more structure in the upper crust in section of fig. 7 (see also my comment above).

Fig. 8: red circles are not explained.

The authors include non-reprocessed profile CIMDEF in their final interpretations (see Fig. 9 and 10), however, they do not provide references nor even discuss this profile in respect to differences in the interpretation methods. Since the results along this profile were achieved from different data and methods, comparison of results in this respect is crutial.

Geology section is very long and comprehensive, however, it does not give the generalised overview of tectonic setting that is necessary for the goal of the paper (if it is the Moho and mid-crustal discontinuity).

192-198 – This para does not fit the overall text on tectonics.

299,338 – Is the migration velocity same for all profiles? And why there is chosen this value of 5600m/s?

Pfs ESCIN 3.3., 3.2., ALCUDIA and IBERSEIS do not state any migration velocity. It should be included.

264-283 processing of datasets – This chapter does not state, which data are to be processed and interpreted. This should be included.

326 – *Moho at 14.5s TWT* -> from Fig. 3 I can see the depth of ~40km, so what is correct?

424 – *the Moho is located at around 9 s TWT (~27 km), the shallowest identified so far in the Iberian Massif* -> from Fig. 6 I can see strong reflector (c) at ~9s TWT, however, its depth is at 21-24 km. This seems to be very shallow if this is the Moho. I can also see strong reflectors (d) beneath termed subcrustal reflectors. They are at depths of ~30-35km. How can the authors distinguish what is crust and what is the mantle? Cannot the (d) reflector at depths of ~30-35km represent the crust/mantle boundary?

448 – fairly transparent upper crust -> I do not see fairly transparent upper crust throughout the whole section, it might be transparent in certain parts (e.g. around 6000-7000 CDP), however it exhibits variations aside. Also previous interpretations (Ehsan et al., 2014) show reflections in the upper crust along this section.

There too many references (over 100, some of them are local in Spain and not accessible for broad readership) – needs elimination and restriction to only the most relevant ones.

Minor edits

I would suggest many minor edits, however, at this stage of reworking they are not relevant. Just few ones to state here:

43 – reference in missing

104, 139 cropping out -> outcropping

328, 696, 799, … and many other times – related with –> related to

709 – underplating

1425 – sample interval -> sample rate

1425 – sample rate is missing

1417-1425 – migration velocity is missing - stated only in text

1429-1452 – migration velocity is missing

Fig. 9 – profile CIMDEF is not interpreted – reference is missing

Fig. 10 – what is the lilac dashed line?

Fig. 10 – profile CIMDEF is not re-interpreted, it is already published, however, reference is missing

Reference to figures needs to be unified throughout the manuscript. Sometimes they are referred as Fig., sometimes as Figure, sometimes as figure. It needs to be unified.