

Authors' response to the referee comment

We appreciate the interactive comment of the anonymous reviewer (#1), as well as the general positive perception on the approach followed in our paper to quantify Variscan left-lateral displacements in SW Iberia. We consider his/her comments useful in order to improve the content and structure of the manuscript. To do so, we will take into account in the revised version most of the constructive criticism raised by the reviewer (in red), though in the following paragraphs we reply to the comments in a point-by-point response:

1. *Structure of the paper*

The paper is full of redundancies and jumps between the geological setting, detailed structural descriptions and used methods for the quantification. In all these descriptions the reader is lost in details and the roughly estimated left lateral displacements are hidden in the text...

The main criticism of this reviewer concerns the structure of the paper, which is considered full of redundancies and jumps. Before commenting on the changes introduced to eliminate some obvious redundancies, let us first explain why we do not entirely agree with the reviewer. Given the quantitative approach of the paper and the well-known regional geology of the area at issue here, we prefer to summarize domain by domain the essential geological features constraining the kinematic analysis performed, together with the particular numerical method applied. Accordingly, we will not concentrate all of the geological information (geological context, strain, kinematic and geochronological data) in a unique section separated from sections devoted to applied models and kinematic analysis. Instead, we will retain an introductory geological overview, followed by a presentation of deformation partitioning in the region, and sections dealing with the kinematic analysis of each domain. Each one of these latter sections will thus include a summary of data relevant for the particular kinematic assessment performed.

Despite retaining the general structure of the paper, a number of significant modifications will be introduced following the recommendation of the reviewer:

- a) Most of the sections will be simplified to avoid non-relevant information or repetitions.
- b) Sections dealing with kinematic analysis will be rearranged in a more systematic way, from north to south, with the only exception of displacements due to the latest brittle faulting that will be considered jointly at the end.
- c) Figures 6, 7, 9 and 10 in the first version will be eliminated. The information provided in Fig. 6 will be introduced in a reorganized Fig. 2. As for Figs. 7, 9 and 10, we will refer to a recently published paper (Pérez-Cáceres et al., 2015). With this reduction of the number of figures, we will avoid distraction from the main target of the paper (quantification of left lateral displacements), though providing the essential and relevant geological data.
- d) The last figure (Fig. 14) will be redrawn for clarity, according to the reviewer's suggestion.

2. *Geological setting and existing models*

Reading your paper it seems as if exclusively your group proposed sinistral strike slip for this part of the Variscides in contrast to the generally agreed large scale dextral strike slip (sensu Shelley and Bossière, 2000). This is definitely not the case...

We do know that sinistral strike-slip tectonics in SW Iberia was proposed many years ago by all previous authors, i.e. it is not an exclusive proposal of our paper. Actually, our work (besides introducing some new data) mainly focuses on quantifying that left-lateral kinematics. However, to avoid the wrong perception raised by the reviewer, we will introduce in the text more quotes on that topic: Burg et al. (1981), Matte (1991), Quesada et al. (1994), Expósito et al. (2002), Silva and Pereira (2004). Additional references

suggested by the reviewer and regarding the formation of the Ibero-Armorican Arc are beyond the scope of our manuscript.

3. The exotic character of the Pulo do Lobo complex and subduction of the Ossa Morena Zone beneath the South Portuguese Zone

In the qualitative reconstruction of Fig. 2, the Pulo do Lobo complex is interpreted as the outer shelf of the South Portuguese Zone, i.e. the upper plate. This view contrasts with the classical view of an accretionary wedge and is in conflict with detrital mica data precluding an initial proximity with the South Portuguese Zone (Braid et al., 2011). Because the Pulo do Lobo Complex is essential for your model you have to discuss this topic thoroughly.

The interpretation of the Pulo do Lobo (Pulo do Lobo and Ribeira de Limas formations) as an accretionary prism has been challenged recently on the following grounds: i) its structure is dominated by three folding phases (Pérez-Cáceres et al., 2015), instead of the imbricated thrust stack claimed by some authors (e.g. Eden and Andrews, 1990); ii) the age of the basalts intercalated with metasediments is Early Carboniferous (Dahn et al., 2014; Pérez-Cáceres et al., 2015), i.e. hardly compatible with the previous view of these basalts as tectonic slices of the Rheic Ocean floor; and iii) recent data on inherited zircons do not support the "exotic" interpretation of this unit (Pérez-Cáceres et al., in prep.). Furthermore, a discussion on this issue would be very distractive and (against the opinion of the reviewer) not relevant for our main goal. Thus, regarding this issue we will refer to Pérez-Cáceres et al. (2015) to read more on our current view.

4. Left-lateral displacements and Fig. 2

Moreover, in the Late Devonian your reconstruction reveals a large distance between the Ossa Morena Zone and the South Portuguese Zone. How fits this result with your previous model (Fig. 2)?

The limitations inherent to cross-sections of regions dominated by lateral displacements are obvious and apply to our Fig. 2, which is intended to give the sequence of tectonic events and the frontal component of deformations. In order to solve these limitations, we will enlarge the (already existing) symbols indicative of left-lateral component normal to the cross-sections. The assessment of these lateral displacements will be provided in the redrawn last figure of the manuscript.

5. Ductile shearing

Age of ductile shearing: how correlates a cooling age of 370-360 Ma (Ar/Ar Hornblende) with 340 Ma (U/Pb on zircon)? A critical reappraisal of the published geochronological evidence is necessary.

"Nevertheless, the previous high pressure metamorphism would have occurred prior to Late Devonian time" What is the evidence for this statement (references, data)? And what is the relation to the orogenic wedge geometry.

The interpretation of the available geochronological data on ductile shearing at the CIZ/OMZ boundary entails some difficulties. However, the important points to our main purpose are: i) latest Devonian and Early Carboniferous cooling ages are accredited; ii) whatever the exact age of the HP event, according to textural evidences, it is previous to the main shearing displayed by these rocks. Regarding the possible orogenic significance of the HP event (subduction of the OMZ under the CIZ), the reader will be referred to Simancas et al. (2001).

6. "There is no transpressional model that fits the complex and heterogeneous evolution of the OMZ": What's about the tectonic model of the OMZ by Silva and Pereira (2004)?

Among the many authors supporting the left-lateral component of deformation that characterizes SW Iberia, Silva and Pereira (2004) suggested the extreme hypothesis that continuous orogen-parallel

transcurrent continental tectonics affected the OMZ from Neoproterozoic to Carboniferous times. Whatever the case and concerning the collisional evolution of the Ossa-Morena Zone, the general model of these authors does not display the complex kinematics envisaged in our manuscript.

7. *Regarding the South Iberian Shear Zone are there some geochronological data?*

As said in the text, the age of the so-called Southern Iberian Shear Zone has been constrained by hornblende Ar/Ar geochronological data (Dallmeyer et al., 1993).

8. *Avalonian spur? Why is the SPZ considered as a spur? Would you call Pakistan an Asiatic spur in terms of the India-Asia collision?*

Maybe the word "spur" is not the most appropriate; it will be changed to "salient".

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