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Interactive comment on "Chronostratigraphic framework and provenance of the Ossa-Morena Zone Carboniferous basins (SW Iberia)" *by* M. Francisco Pereira et al.

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Reply to the interactive comment of referee#1 (António Castro) on "Chronostratigraphic framework and provenance of the Ossa-Morena Zone Carboniferous basins (SW Iberia)" by M. Francisco Pereira et al. (Manuscript number se-2020-26).

First, the authors would like to thank the constructive comments made by referee#1 (António Castro), which contribute to improving our scientific work submitted for publication in Solid Earth Special issue. "The Iberian Massif in the frame of the European Variscan Belt".

Referee's comment 1: "The manuscript is well written and clearly exposed in the most important principles and methodology. It can be improved by making some minor changes in several parts of the text. For instance, the Introduction can be improved by reorganizing the text and set the focus rather on the regional problem than the methodology. Thus, Introduction must start on line 64, and the first paragraph (47-63) can move to item 3 (Methods). Lines 88-89 must go at the very beginning of the Introduction, as this a tribute volume. Because the paper is a regional contribution, the item "Geological setting" can be moved in part to the Introduction. A description of the sampled sedimentary units can be given in this second item after the introduction (like a material description)." Author's reply 1: "Comments on how to improve the organization of content by different sections (1- Introduction, 2- Geological Setting and 3- Rational and Analytical methods) are relevant and will be considered in the revised version that will be prepared for Solid Earth Special issue: "The Iberian Massif in the frame of the European Variscan Belt".

Referee's comment 2: "About the Discussion and interpretations. If there are implications of these new data on one of the most debated topics of SW Iberia, namely the polarity of subduction during the closure of the Rheic Ocean, this must be discussed in this paper. Only a few lines refer to this problem (446-461). For instance, if subduction was beneath the Laurussian margin, why the coeval arc magmatism is in the passive margin (Gondwana)? Subduction to the north (beneath Ossa-Morena, the active Gondwana margin) is a more realistic interpretation according to structural and petrologic data." Author's reply 2: "This geochronology study aims to establish the chronostratigraphic framework of the Carboniferous strata in the Santa Susana-São Cristovão region (OMZ, SW Iberia) and to discuss their provenance. In section 6.2., the provenance of the Carboniferous strata is discussed based on a timeline related to the evolutionary model of the convergence between Laurussia and Gondwana. As referee #1 noted, our approach to the polarity of subduction during the Rheic Ocean closure is very brief. We chose to do so because this topic is discussed in another paper of ours (Pereira et al., in press) but, we will consider extending this discussion

in the revised version that will be prepared for Solid Earth Special issue "The Iberian Massif in the frame of the European Variscan Belt". We agree that referee #1 has highlighted a topic that has been much debated by geologists working in the Variscan orogen of SW Iberia. Over the past four decades, different models have emerged to explain the geodynamic evolution of SW Iberia, with the subduction polarity being widely discussed (Quesada et al., 1994; Castro et al., 1996; Ribeiro et al., 2007; Pin et al., 2008; Simancas et al., 2009; Braid et al., 2011; Pérez-Cáceres et al. 2015; Pereira et al., 2017a). This topic is quite complex and requires a careful analysis of the advances of scientific knowledge over the past four decades, which was based on different criteria that have been reassessed. As more data from geological mapping, structural geology, geochemistry, petrology, and geochronology were gathered, new hypotheses about the polarity of the subduction were suggested. The structural and petrological data (mentioned by referee #1) have been used extensively to justify the polarity of the subduction of oceanic lithosphere (Rheic Ocean) under Laurussia or under Gondwana (Pereira et al., 2017a and references therein). A major obstacle that exists, regarding the interpretation of the polarity of the subduction in SW Iberia, is that most models do not consider that Laurussia (i.e. PLZ and SPZ) will only have been juxtaposed to Gondwana (i.e. OMZ), regarding a geographic relationship comparable to the current one, in Late Carboniferous. That is, until then, from Late Devonian to Early Carboniferous, they probably have had a different and independent geodynamic evolution. Using a different perspective than the one followed by the previous models, we consider that the geodynamic evolution in SW Iberia may have been related to the closure of two oceanic basins that will have coexisted in the Devonian as suggested by paleogeographic reconstructions (Cocks and Torsvik, 2006; Stampfli and Kozur, 2006; Stampfli et al., 2013); Our recently proposed geodynamic model (Pereira et al., in press) admits: i) the closure of the Rheic Ocean in the Late Devonian under Laurussia, with the development of a magmatic arc (well-documented in the Meguma terrane, Nova Scotia) and synorogenic basins; this active margin of Laurussian was progressively accreted to the Gondwana passive margin facing the Rheic Ocean; at the same time, the Gondwana

passive margin facing the Paleotethys Ocean was developing (i.e. OMZ), immediately after the two ocean basins have coexisted ; ii) the onset of the closure of the Paleotethys Ocean in the Early Carboniferous under Gondwana (i.e. OMZ), and possibly in Laurussia regions facing this ocean (i.e. PLZ and SPZ) , where a magmatic arc (Gil Márquez, Beja and Évora plutons; Jesus et al., 2007; Gladney et al., 2014; Pereira et al., 2015a) and synorogenic basins (Mértola turbidites, Pyrite belt, Toca da Moura and Cabrela volcanic-sedimentary complexes) developed; high heat flow due to asthenospheric upwelling and extensive emplacement of Early Carboniferous igneous rocks in the OMZ (Pereira et al., 2009, 2015a) could have resulted from the subduction of an oceanic ridge (Castro et al., 1996; Díaz Azpiroz et al., 2006); and iii) in Late Carboniferous, large-scale transcurrent movements may have juxtaposed OMZ to PLZ and SPZ, simultaneously with the rapid uplift of Variscan orogeny; at the same time the Paleotethys subduction under Gondwana was responsible for the growth of a magmatic arc in Iberia until the Permian (Santa Eulália-Monforte, Nisa-Albuquerque, Los Pedroches plutons, NW and central Iberian plutons, and Pyrennes plutons and volcanism; Pereira et al., 2014; 2015b, 2017b).

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