

Interactive comment on “Unravelling the origins and P-T-t evolution of the allochthonous Sobrado unit (Órdenes Complex, NW Iberia) using combined U-Pb titanite, monazite and zircon geochronology and REE geochemistry” by José Manuel Benítez-Pérez et al.

José Manuel Benítez-Pérez et al.

jugb@usal.es

Received and published: 31 May 2020

We want to thank the constructive suggestions and work made by Anonymous Referee #1.

We will reply here the general questions. We consider most of the suggestions are reasonable and will be accepted in a corrected version of the paper.

Printer-friendly version

Discussion paper



The geological background section has been enlarged to provide non local reader with a better perspective of the context. It has now two sub-sections, one devoted to the NW Allochthonous complexes and the other to the structure and rock association of the Sobrado Unit. The number of significant references has been increased to cover all aspects of structural and metamorphic evolution. In a similar way discussion will be reinforced to show the importance of the results.

Specific comments

P3L3: Upper Allochthon detached from Gondwana during Cambro-Ordovician rifting; but both zircon aliquots (mean ages 490 and 530 Ma) are interpreted in a magmatic arc setting (see abstract, discussion and conclusions).

The dual interpretation (rift and arc environments) has been explained in previous contributions and the explanation is included in the new version of the Geological setting: The arc in front of the Iapetus Ocean created a back-arc which evolved to open the Rheic Ocean. The two settings correspond to the two margins of the detached future Upper Allochthon: convergent in the Iapetus side, divergent in the Rheic side.

P3L5: what does mean “oceanic supracrustal sequences”? something that overlies the oceanic crust?

No: metabasites interlayered with metasediments probably representing upper crustal oceanic or transitional oceanic/continental sequences. The term was confusing and has been suppressed and replaced by the description of the previous sentence. P3L24: these ophiolitic rocks belong to the Upper Allochthon? The referred ages are protolith or metamorphic? Give details

The ophiolitic rocks are part of the Middle allochthon. A more detailed description is provided in the corrected version.

P3L25: these ages correspond to the Upper Allochthon? Are they prograde metamorphic ages? Give details

[Printer-friendly version](#)[Discussion paper](#)

No, these are ages from the basal allochthon, related to HP-LT metamorphism. Made clear in the new version.

P3L26: thrust wedge collapse was coeval to continental subduction in the Upper Allochthon? Clarify.

No, this age refers to middle and basal allochthon. Extension and partial collapse in the upper parts of the accretionary wedge occurred during the incorporation of new units at its lower part. Included in the new version.

P3L27: which internal zones?

Variscan orogen internal zones in the Autochthon. Deleted and better explained in the new version.

P3L30: regional oroclinal bending in Iberia is under discussion (see also Pastor Galan...); leave it aside. Done.

P3L33: the study focuses on two units (Sobrado and?).

Only Sobrado unit. It is an error and has been corrected.

P3L34: reference to this HP/HT event has been made in the previous paragraph. The older(Ordovician?) granulite facies event is not mentioned in this section, and it has relevance to the paper. Rewrite these paragraphs to be more comprehensive: give first a detailed description of previous geochronological data of the different units, then the preferred tectonometamorphic evolution.

It has been rewritten and clarified.

P3L37: lithological description of Sobrado horses is too succinct, more rocks appear in legend of Fig 1B.

In principle, only those types relevant for the research had been described. The new text briefly describe other lithologies, mainly those of the overlying Corredoiras unit.

[Printer-friendly version](#)[Discussion paper](#)

P3L38: lower slice: are these rocks ophiolitic? Could them belong to the underlying Middle Allochthon?

They could be ophiolitic, but this has not been established. Probably represent a transitional crust or at least implies some kind of oceanization. hBut in any case, it is the lower horse of the Sobrado unit, belongs to the Upper Allochthon and is not part of the Middle Allochthon.

P4L11: Fornas in Fig 1?

Not included because it occurs some 30 km to the W, which is now explained in the text. The references of Gómez Barreiro and Álvarez Valero describe this structure.

P4L32-36: transfer to next section (mineral description) and rearrange.

P6 L43: are there discordant analyses? (those with >10% have to be rejected, and display them with a different color in Fig 6), also in Fig 6 add an age histogram with probability density including all concordant ages.

Firstly, we reject analysis based on high common Pb content or clear analytical errors. However, we like to report the discordant analyses (even if we don't use them in the age calculation). However, the reviewer is right, they should be displayed with a different color. We will modify this in the corrected version of the manuscript.

P6 L46: Fig 7A does not show the 380-500 Ma aliquot (why?), as Fig 7B do (see fig caption); use the same colors than in the following figures for the two aliquots, idem in Fig 11. We agree, it will be solved in a new version of the figure.

P7 L1: you suggests "inheritance" (likely for <600 and possible for >600 Ma, why?). According to the interpretation, zircons older than 500 Ma (MDA) must be inherited.

This is a mistake.

P7 L14: age results for the third aliquot (>600 Ma) have to be described here. Yes, they will be described

[Printer-friendly version](#)[Discussion paper](#)

P7 L17: REE patterns of zircons older than 600 Ma are not shown anywhere; for comparison, include them in Fig 9 (or at least make reference to a Table). We agree and they will be included in the new version of the manuscript.

P9 L16: slope from 486 to 380 Ma (Fig 11A). That's true, another end is needed for defining the slope

P9 L16-19: you mean such a protracted evolution caused U/Pb to open in the zircons formed during the 490 Ma granulite event. But older zircons were not affected? if yes, the inherited ages (including the 530 Ma median age) are misleading.

It seems like the lead loss only affected to zircons being formed at that time. Older zircon was unaffected or shielded as inclusions in rock-forming minerals

P9 L21: 502 Ma? This age is used in Fig 11A (380-500 Ma aliquot) to obtain a metamorphic 490 Ma median age. Grain n_ 61 belongs to the inherited igneous 500-600 Ma aliquot (Fig 2). Is it grain 61 the 510 Ma zircon in Fig 11B? If yes, MDA is 510 instead of 502 Ma.

This part has been corrected and rewritten in the new version of the manuscript.

P9 L39: inherited zircons older than 600 Ma. Ok

L40: I would not name "population" to a set of only 2-3 data. Ok

P9 L46: WAC is an unlike source for Mesoproterozoic zircons. Gutierrez Alonso et al. (2003) sourced zircons of this period far from Amazonia, not from NE Africa cratons as in more recent interpretations (update reference).

Reference updated

P10 L18: evolving to amphibolite-facies.

Done

Technical corrections

Printer-friendly version

Discussion paper



Do not use plural in the studied samples (a paragneiss, an amphibolite).

P2 L16: facies. Done P2 L21, 32: luminescence Done P2 L22: petrogenetic Done
P2 L47: . . Done P3 L8, 11: Autochthon Done P3 L14: associated Done P4 L11-12:
detachment Done P4 L19: parts of P4 L16: xenocrystic. It is correct here

P5 L32, 33: _m Done P5 L47: 2015b Done P8 L20: negative negative Done Arrow in
Fig 1C: Corredoiras detachment? Yes, included

Fig 6: correct position of 1800 in the corcordia line. Done

Interactive comment on Solid Earth Discuss., <https://doi.org/10.5194/se-2020-38>, 2020.

[Printer-friendly version](#)[Discussion paper](#)