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Solid Earth Discussions

Interactive comment on "Resolving uncertainties in the application of zircon Th / U and CL gauges to interpret U-Pb ages: a case study of eclogites in polymetamorphic terranes of NW Iberia" *by* Pedro Castiñeiras et al.

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The manuscript deals with U-Pb dating of eclogites in polymetamorphic terranes of the Cabo Ortegal Complex (NW Iberia). The manuscript is focused on zircon geochemical and isotopic characterisation of eclogitic samples. It is demonstrated that in order to interpret the geochronological data internal zoning (CL features) as well as minor and trace element must be taken into account. The authors suggest that zoning features and geochemistry are decoupled with respect to the U-Pb isotopic data and regional geology. In particular the authors show that zircon are characterized by inter-

nal features typical of magmatic growth and Th/U ratios>0.1 that are uncommon for HP metamorphic rocks.

The manuscript is well written and well organized. Figures are of good quality and useful for the understanding of the text. Data are of good quality too and support the results. The manuscript is of large interests and deserves to be published in the special issue entitled: The Iberian Massif in the frame of the European Variscan Belt.

I would suggest a few comments/suggestions before being published.

In my opinion, and in agreement with the suggestion of the other reviewer, methods should be separated from the data sections. More details about the petrography and microstructures are also fundamental in order the reinforce the interpretation.

For the introduction section and for the interpretation of the data I would also suggest to take into account the new (review)papers on zircon geochronology and petrochronology (Rubatto, 2017, Petrochronology: methods and application; Kohn and Kelly 2018 Microstructural Geochronology). Moreover, the internal microstructures and their effect on both trace element and isotopes (e.g. Piazolo et al 2016, Nature Comm.) should be mentioned in the introduction and discussed. The authors suggest that in order to interpret the zircon ages within polymetamorphic terranes internal features and geochemistry must be taken into account. Nowadays, this is the typical and minimum approach followed for studying and interpreting zircon data. Moreover, the recent developments on some microanalitycal techniques allow to collect simultaneously minor and trace elements together with isotopes (see the Review volume Petrochronology: methods and applications edited by Kohn, Engi and Lanari). Therefore their suggestion of a combined study of both zoning+chemistry with isotopes in not really original.

-The decoupling between zircon CL/BSE features and geochemistry has been described in other papers (e.g. Flowers et al., 2010 Chemical Geology). These authors concluded that:" The lack of correlation between the intracrystalline age domains and the deceptively simple CL and BSE core–rim relationships of most zircon crystals in

our study highlights the hazards of too heavily relying on CL and BSE zonation during U–Pb data interpretation. The results reported here may not be uncommon for low-U metamorphic zircon that underwent one or more high-temperature metamorphic events."

- According to the authors, the Th/U ratios generally higher that 0.1 are a further evidence for the decoupling between non-metamorphic fingerprint and metamorphic ages. However, the Th/U ratio is strongly controlled by bulk rock and stability of Th-bearing phases (e.g. Rubatto, 2017). When Th-bearing phases (e.g. monazite/allanite) are absent the Th/U ratios of metamorphic rocks may vary in the range of 0.1-1 (e.g. Rubatto, 2017). These Th-bearing phases are not common accessory minerals in mafic/ultramafic metamorphic rocks.

-For the special issue dealing with the Iberian massif in the frame of the European Variscan belt I would suggest to add a comparison with other eclogitic/HP rocks from the Variscan sectors (e.g Germany, Sardinia).

As a general comment I would suggest to improve the Introduction section and to modify the discussions. Within the conclusions I would also suggest to add that also microstructures should be taken into account for the interpretation of zircon data experiencing a polymetamorphic history under HP and/or HT conditions. I would also suggest to change the title and probably the title suggested by the other reviewer is more appropriate than the original one. In the pdf you can find more comments/suggestions. Please accept my comments/suggestions with the aim of improving the manuscript. Sincerely, Antonio Langone

Please also note the supplement to this comment:
https://www.solid-earth-discuss.net/se-2020-53/se-2020-53-RC2-supplement.pdf

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