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Solid Earth
Discussions

Interactive comment on "Comparative geochemical study on Furongian (Toledanian) and Ordovician (Sardic) felsic magmatic events in south-western Europe" *by* J. Javier Álvaro et al.

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General comments: This study compares the geochemistry of two distinct igneous felsic magmatic events in southwestern Europe during the Ordovician, which marked the northern Gondwana at that time. These magmatic events took place when compressive tectonics were absent and are generally associated with rifting of the continental margin related to the opening of the Rheic Ocean. What makes this study so interesting is that it is the first one to compare a large number of published geochemical data of igneous rocks with known emplacement ages in order to find out if common geodynamic settings can be attributed to these magmatic pulses. Although some new

geochemical data is presented, it is mainly a review paper. The main problem is that a lot of data is being presented and discussed without providing a sufficient overview, leaving the reader a bit lost. A more concise presentation of the published data, and a discussion how their new analytical data adds to the understanding of the geodynamic setting would improve the paper. In the discussion of the geodynamic setting of the Ordovician magmatic events it is not always clear what is a recapitulation of other authors and their own contribution. Better structuring should make this more clear.

Specific comments: The title is too general and unimaginative, suggesting that the paper only presents data. The key finding of this study should be reflected in the title. If I am correct, the Toledanian phase lasted into the early Ordovician. If so then the title is misleading as it reads "...Furongian (Toledanian) and Ordovician (Sardic) felsic magmatic events..." The introduction could be improved by stating the problem and the objective of the study, the latter of which is listed in the final paragraph. Also, it would be helpful to give an approximate time frame of the Toledanian and Sardic phases. Some statements in the first paragraph ("but they are related to neither metamorphism nor penetrative deformation", line 57) should be accompanied with key references. The author's own new analytical data should also be mentioned in the introduction with a justification on why it was deemed necessary. As it is, there is no mention of it and the reader has the impression that this is purely a review paper. Geologic Setting: A lot of geochronological data is presented with detailed listing of the age uncertainties, e.g. 478.1 +/- 1.2 Ma. Since it is not their own data, this can be represented as ca. 478 Ma. And instead of listing every single age of an orthogneiss complex, the ages of a zone can be summarized, e.g. 471-450 Ma for the migmatitic orthogneisses of the Montagne Noire (lines 289-291). When the authors discuss the Pyrenees, they refer to the Eastern Pyrenees. While most of the data is from the Eastern Pyrenees, the Aston and Hospitalet domes, discussed by Denèle et al. and Mezger & Gerdes, are located in the Central Pyrenees. So, I would refer to chapter 2.2 as "Central and Eastern Pyrenees". In line 279 they refer to "augen gneisses" (the actual spelling is "augengneiss) as metamorphic high-grade gneisses. I don't think that is correct. The term augengneiss refers

to the microstructure, large augen (commonly, but not restricted to K-feldspar) in a finer grained matrix, mainly in metagranites. There is no direct metamorphic association, although most metagranitic augengneisses are probably amphibolite facies. At last, a map showing the trend of Ordovician ages throughout western Europe would nicely summarize this chapter and provide some needed overview.

Geochemical data: Since the authors also present new data, a paragraph on the analytical methodology should be included, as well as where the analyses were made. This is completely missing. Similar to the Geologic Setting chapter, a lot of detailed geochemical data is presented, making for a repetitive reading. Most of the major elements data can be represented in an extra figure, and individual magmatic suites referred to as “potassium-rich dacite to rhyolite” (line 417) without listing the range of major elements. The discussion of epsilon Nd data is a bit spotty. First, it is unclear in the text what epsilon Nd values are discussed (line 422). Obviously, they are not the present day values but those at the time of emplacement. Second, line 429 refers to erroneous TDM values, without elaborating what they are. Third, in the same sentence, a 147Sm/144Nd ratio of greater than 0.13 is considered high. That is an average value even for felsic rocks, mafic and ultramafic rocks can have ratios of 0.3. There needs to be some clarification.

Interpretation of epsilon Nd values: The second last paragraph (lines 730-733) states that very little variation in epsilon Nd values is a sign of magmas derived from young crustal rocks. An epsilon Nd value per se does not indicate the age of a rock, but rather how much the protolith melt was evolved. Negative epsilon Nd values of -3.5 to -4.0 indicate moderately evolved protoliths, not an Archean continental margin, but also not a juvenile volcanic arc. Likewise, referring to depleted mantle model ages of 1.8 to 1.4 Ga do not reflect a short crustal residence time. To summarize, the discussion and interpretation of Nd data requires some revision.

Discussion: The geographic trend of younger ages of Ordovician magmatism is not discussed. Is there a link between the Toledanian and Sardic phases or are these

strictly bounded to regions, CIZ and Pyrenees and north thereof, respectively?

Technical corrections: Here I mainly refer to the figures and tables. Typos and minor grammatical errors are flagged in the annotated PDF that is attached to this review. Fig. 1: The sample numbers are very hard to read. Even when considering that figures can be viewed enlarged online. The majority of the sample localities in 1B are not discussed in the paper. So why listing them all in the figure captions? For easier location of the individual regions, add the region name to 1B through E. Figs. 2, 8 and 13: the labels are much too small. Fig. 5: Place symbols as inset in the figure instead of referring to the legend of a previous figure. Fig. 9: What do the double-sided arrows signify? Table 1: Add a vertical line separating the different regions to enhance orientation. Information on the lab that did the analyses should be included in a footnote or the table caption. The sample location (lat/long) should be moved to the column header. Latitudinal and longitudinal data are listed up to the fourth decimal of a second! Just as a reminder, one second latitude represents approximately 30 m. It is more than sufficient to report full seconds. Table 2: It consists only of already published data. This is not evident from the table caption. The table shows several rows without any data. Is there a purpose? Sr isotope data are listed in the table, but they are not discussed in the text. Why? If not necessary, that data should he deleted.

Please also note the supplement to this comment:
https://www.solid-earth-discuss.net/se-2020-45/se-2020-45-RC2-supplement.pdf

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