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Solid Earth Discussions

# *Interactive comment on* "Alkali basalt from the Seifu seamount of the Japan Sea: post-spreading magmatism in the back-arc region" *by* Tomoaki Morishita et al.

**Anonymous Referee #2**

Received and published: 22 August 2019

This study presents an interesting dataset and has potential for publication but needs significant editing and addition of modelling before acceptance. There are four main problems to address:

(1) The English and structure need to be improved, as commented by reviewer 1.

(2) The dataset is of good quality but limited for a paper. WR geochemical data and an Ar age are provided for only 1 basalt sample. Given inaccessibility of seamounts it is possible that this is a dataset worth considering for publication, but it is currently difficult to understand why this is so. It is very uncommon to publish a paper based on 1 basalt sample, so the introduction needs to explain why the new data is significant



for our understanding of the magmatic/tectonic evolution of the Japan Sea, and what is the key critical question, or set of questions, that the new data allow to address.

(3) The basalt composition is very unusual and interesting. I agree with the authors that there seems (apparently) to be a minor slab-component contribution to the origin of this basalt. However, because of the unusual medium to heavy REE contents (spoon-shaped, not flat, in normalised multielement diagram), I am not convinced that garnet and/or amphibole was not residual in the source. This could be easily addressed by modelling of mantle partial melting.

(4) Finally, it is very surprising that the discussion does not comment on the petrological value of the two types of xenoliths that are abundant in the basalt. The xenoliths were previously studied by Ninomiya et al. 2007, mostly published in Japanese, and only briefly referred to in the beginning of the manuscript. Ninomiya et al. reported the occurrence of (i) mantle xenoliths possibly metasomatically enriched by slab-derived fluids and (ii) xenotliths of subcontinental peridotite. How is it possible then that the studied basalt is coming from a shallow upper mantle that is mostly uncontaminated by continental and slab components? It is critical that this apparent inconsistency is resolved/explained during the revision. Also, could these xenoliths help shed light on the likely processes required to explain the unusual HREE pattern of the studied basalt?

Detailed comments for the authors (mostly to help improve the introduction):

Previous work by Ninomiya et al. 2007 needs to be summarised in the geological background, in particular mentioning the nature of the two types of xenoliths/crysts, because this study (mostly published in Japanese) provides significant constraints and/or context to discuss the source/petrogenesis of the studied carrier basalt. The first mention of the subcontinental nature of some of the xenoliths is currently in the Methods section.

You should not invite the reader to access 6 other papers to understand the Methods -

all methods need to be discussed/summarised in the Methods section.

P.2 L6: What are the 2 distinct magma types referred to here? L7: Define "western Pacific back-arc basin swarm". In addition, this is a very strange term, which I think is unlikey to be understood by many readers. It should be replaced by a more generic term commonly used in international geological literature. L14: "basinS" - Do you actually mean that there are several basins in the back-arc basin, or is this a typo or does it mean there are several oceanic grabens between horsts including continental crust/thinned continental lithosphere? L15-17: What sort of dating? If K-Ar ages, are you confident they represent crystalisation ages? L20: Better to avoid "seamount chain" if there is no hotspot. Perhaps rephrase as "elongated cluster of seamounts". L30: Reference needed for the occurrence of continental crust (seismic imaging evidence?).

P.3 L8: repeat the age of the Yamato seamounts for clarity. L11-19: This looks more like a result section - probably too detailed anyway for an introduction. L15: You should probably tone down "indicating that all orthopyroxene phenocrysts are of xenocryst origin" to "suggest that all...". Alternatively replace "all" by "most".

Figure 1: Is it possible to include a map showing known/generally accepted ages of the oceanic basins (or somehow add this in the current Figure)?

Table S1: What is the error range of TIMS results? Can you provide standard and blank analyses?

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