Reply to referees' comments

We than very much for two reviewers' comments that significantly improved the revised manuscript.

Referee#1

1) Primary issue: English

Reply: English of the revised version has been improved by a commercial English editing service (but not for this response letter).

2) The discussion 4.2 Origin of the SSM basalt and its tectonic setting. Split it into two sections: (1) source lithology and heterogeneity of the SSM basalt, and (2) Tectonic origin and implications.

Reply: We split subchapter 4.2 into two: (4.2. Origin of the SSM basaltic melt) and 4.3. Tectonic setting of the SSM basalt.

Modeling for melt chemistry:

Reply: We modeled calculated melt components between spinel peridotite conditions and garnet peridotite conditions. These results support the SSM melts might be formed at spinel peridotite conditions with low degree of partial melting (New Figure 8) (4-8 lines of page 6).

Reply 2: We examined contributions of slab-derived components by correlations between elements of incompatible and less incompatible elements (New Figure 9). Fig. 9 suggest not much slab-derived components were contributed for the formation of the SSM melt (9-13 lines of page 6).

Effects of weathering on Sr-isotopes:

Reply: We showed leached and unleached data and these data supported that isotopic compositions have not been significantly affected by the alteration. (8-10 lines of page 5)

Minor

(1) Rearrangement of introduction

Reply: As we also reply to a question from reviewer 2, we also includes why only one basaltic sample (because this sample only contains mantle-derived xenolith)(9-14 lines of page 2) was examined in this paper in introduction. The motivation and results might not be a "Wow" type paper (I am sure that it is very "Wow" for the authors), but we strongly believe that our results contribute to know back-arc magmatism, and our introduction leads the readers to be interested in back-arc magmatic history.

(2) Use "seamounts" instead of the term "seamount chain" in the geological background. The latter makes readers link these seamounts with mantle plumes. However, the authors did not consider any possibility of plume at all in the whole paper.

Reply: We changes seamount chain to seamounts. But Yamato Seamount Chain and Kinan Seamount Chain have been used in previous papers. We use Seamount Chain (S and C are uppercase) for these seamounts.

(3) provide thin section image showing olivine, plagioclase, opx, cpx and spinel phenocrysts.

Reply: We prepared two images (both polarized light and cross polarized images) for a tiny xenolith-bearing one and matrix (New Figure 2). These doe not contain cpx, opx, and spinel phenocryst, but the readers can see the typical texture of the SSM basalt and can understand why we assume that some opx and spinel phenocrysts were of xenocryst origin.

(4) direct fusion method

Reply: We described a brief summary of the method of direct fusion (24-28lines of page 3)

(5, 6) supplementary table S1 to the main text, and original EPMA-LAICPMS data in the text

Reply: We did.

(7) Revise the "a few mm grains" to be accurate in 3.1. Replace "were done" with "were conducted".

Reply: We did (< 2mm and conducted, respectively).

(8) delete the “and high-K to shoshonitic composition subdivided by Le Maitre (1989)” in 3.2. The SSM basalt is obviously sodic.

Reply: We deleted this sentence.

(9) Rewrite 3.2. Results.

Reply: We added several lines of information, such as low-Ti basalt, MgO, and FeO/MgO ratio. FeO/MnO ratio was used for discussions.

(10) Conclusion is too long:

Reply: The conclusion was shortened to focus on the most important results of this study (24-27 lines of page 7).

Reviewer #2

English Reply: English of the revised version has been improved by a commercial English editing service (but not for this response letter).

(1) Why only one sample?

Reply: This is only sample contains mantle-derived sample. We described importance of description of this sample in “Introduction” (9-14 lines of page 2).

(2) Modeling for REE pattern.

Reply: We modeled calculated melt components between spinel peridotite conditions and garnet peridotite conditions. These results support the SSM melts might be formed at spinel peridotite conditions with low degree of partial melting (New Figure 8) (4-8 lines of page 6).

(4) Xenolith information

Reply: We briefly summarized xenolith reported by Ninomiya et al. (2017) (5-9 lines of page 3). Our data suggest that peridotite xenoliths in the sample are not directly related to peterogenesis of the SSM basalt (21 line page 6).

Detailed comments.

Others: Analytical methods should be described.

Reply: We added the minimum necessary description on analytical methods (See analytical methods).

Other comments are related to the introduction

Reply: We rearrange and changed introduction as suggested above including several comments from the reviewer 2.

Age data in Figure 1:

Reply: We added age data in the revised Figure 1.

Table S1 (Now Table 1) Error range of TIMS results

Reply: We showed error of 2sigma range.

We hope the revised manuscript would be considered for the publication in Solid Earth.

Best regards,

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