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Interactive comment on "Boninite and boninite-series volcanics in northern Zambales ophiolite: Doubly-vergent subduction initiation along Philippine Sea Plate margins" *by* Americus Perez et al.

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Review of "Boninite and boninite-series volcanics in the northern Zambales ophiolite: Doubly-vergent subduction initiation along Philippine Sea Plate margins" by Perez et al. for Solid Earth Discussion

This paper provides new structural, stratigraphic, petrographic, and geochemical data from the northern Zambales ophiolite, Philippines, that is an important contribution to our understanding of this important terrane in the western Pacific. The resulting

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geochemical/petrological stratigraphy is compared with the Izu-Bonin-Mariana forearc crust and a tectonic model is proposed to explain the origin of the Zambales ophiolite.

The paper has two main parts. The first part is a very well-documented detailed study of the volcanic facies preserved in the ophiolite crust combined with detailed geochemical analyses of the crustal rocks. This section is well-written and does not need much revision; I have just minor corrections, questions, and suggestions listed below. The second part is the tectonic model, which, in my opinion has issues that need to be addressed, especially the relationship of the Zambales with the rest of Luzon as discussed below (page 13, lines 21-35). Although I personally do not agree with the proposed model, I think it will invite debate and stimulate further study that will advance our understanding of this important area in the western Pacific.

I recommend publication with moderate revision focusing on the tectonic model.

Page 1 Line 13: Delete “uniquely” and just say “predominant.”

Page 2 Lines 2-4: The statement that Cenozoic subduction initiation (SI) requires preexisting weak zones or lithospheric collapse is erroneous. All models of SI require a weak zone, even lithospheric collapse. Lines 9-10: I wouldn’t say that the IBM is “the most appropriate locality” to test models of subduction initiation. It might be the most appropriate place to test the Stern and Bloomer-type model, but there are other models as well. Maybe say “one of the most appropriate. . .” Lines 24-25: Cite references for “spontaneous” (e.g., Leng and Gurnis) and “induced” (e.g., Hall et al.) SI that have been replicated by numerical modeling. Line 28: delete semi-colon Line 30: Maybe change “unequivocally be attributed” to “uniquely explain.”

Page 3 Line 1: In discussing the basement complexes of the Philippines, Encarnacion (2004) might be an appropriate paper to cite. (Encarnacion, 2004, Multiple ophiolite generation preserved in the northern Philippines. Tectonophysics.) Line 17: Change “structurally bound” to “fault-bound” (if that is what is meant by “structurally bound”). Lines 21-22: In reference to “terrane docking,” I presume the Zambales ophiolite is the

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terrane. But what is it docking with? (Indeed, what do you mean by "docking"?) Line 23: Change "in the westernmost margin" to "just west" of the ophiolite. The Mesozoic cherts are not found in the ophiolite itself, but in mélange-type shear zone material west of the ophiolite. Line 23-25: Besides Queano et al. 2017, you should also cite Hawkins and Evans (1983) who first described these cherts and Encarnacion (2004) who provides additional description of the shear zone. Line 24: The shear zone is not "buried;" it is well-exposed in several places.

Page 4 Lines 2-4: You might want to note that the idea that the San Antonio massif is a displaced block from the north is disputed by Encarnacion et al. (1999) for lack of convincing evidence. Line 18: You may want to add that the arc affinity of the Acoje block is also consistent with radiogenic isotope data (Pb, Sr, and Nd), which indicate hydrous fluid enrichment (Encarnacion et al., 1999). Line 24: What rock types were the "bedding planes" measured on? Line 26: Change to ". . .NW-plunging anticline just south." Line 28: What does "conjugate intrusive directions" mean? (Intruded into conjugate fractures sets?). Please clarify. Line 32: Change to "subaqeous fall-out deposits" (?)

Page 5 Lines 3-4: Do the terms "Strombolian to Hawaiian fire fountaining" apply to subaqeous/submarine volcanics? I would think not(?) Are these deposits in fact subaerial? If so, that would be a very important finding! It would imply that portions of the Zamabales ophiolite in fact contain what might be actual subaerial island arc crust, which would substantially change the paleogeography of Luzon. Please clarify. Line 12: What are the "upright structures"? Sedimentary/volcaniclastic bedding? Please clarify.

Page 6 Line 1: Change "12" to "Twelve." (Avoid numerals at the beginning of a sentence.) Line 2: Add "Standard JB-2 and JB-3 . . ."

Page 7 Line 15: Change to "The Cs, Rb, . . . and Mn contents in . . ."

Page 8 Line 16: Change to ". . .MORB for most trace elements. . ."

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Page 10 Line 32: Please add a few words summarizing the general consensus on boninite genesis. (“. . .there is general consensus on boninite petrogenesis, namely that. . .”

Page 12 Line 3: Change semi-colon to a period. Line 7: Change “Ma” to “Myr.” (You are referring to differences in ages, not a point in time.)

Page 13 Lines 2-5: Regarding the paleomagnetic data, do the declinations support a Philippine Sea Plate connection as well? The Philippine Sea Plate has been inferred to have rotated clockwise. There are additional previous paleomagnetic studies (for example, Fuller et al., 1991, J. Asian Earth Sciences) that appear to demonstrate counterclockwise rotation for Luzon. Line 20: By “rapid emplacement” do you mean “rapid formation”? If not, what do you mean by “rapid emplacement”? Line 20: Change to “The timing of the proposed subduction inititation. . .” Lines 21-35 to lines 1-3 of page 14: This section discusses the relationship between the Zambales ophiolite and Eocene (Angat) and Cretaceous ophiolites in the east Luzon area. The authors state that the similarity in ages of the Zambales and Angat ophiolites presented in Encarnacion et al. (1993) “does not necessarily prove and affinity” between the two. But Encarnacion et al. (1993) (and Encarnacion et al., 1999, and Encarnacion, 2004) did not use the ages alone in arguing that the Zambales and Angat ophiolites (and Cretaceous ophiolites) are contiguous (not exotic/allochthonous to each other). The geology and stratigraphy as well are consistent with the Zambales-Angat ophiolite forming adjacent to the Cretaceous ophiolite in the east, which was the main point of Encarnacion et al., 1993 (and reiterated/amplified in Encarnacion, 2004). Regarding the issues mentioned above, I think suggesting that the Zambales is exotic to east Luzon causes greater problems with the proposed model, because the east Luzon ophiolites and arc crust are in-between the Zambales and the Philippines Sea Plate. In other words, if one wants to separate the Zambales ophiolite from east Luzon, shouldn’t it also be separate from the Philippine Sea Plate?

Page 14 Lines 5-7: Why is doubly-vergent subduction “feasible”? Please elaborate.

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Line 29: Change to “By studying the Zambales ophiolite. . .” Line 29: Delete “(SI)” Line 29: It is stated that subduction initiation is a “plate-scale process.” I’m not sure what the purpose of this statement is. When is it not a plate-scale process? Please clarify.

Figure 2: The caption should include the references for the ages shown in the figure.

Figure 2: Page 5 says the 44.1 Ma age is from a sill. This isn’t clear or indicated in the stratigraphic column.

Figure 10: In panel “b”, what are the diamonds, inverted triangles, and squares?

— end —

Please also note the supplement to this comment:
https://www.solid-earth-discuss.net/se-2017-138/se-2017-138-RC2-supplement.pdf

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