Solid Earth Discuss., 6, C1174–C1186, 2014
www.solid-earth-discuss.net/6/C1174/2014/

Solid Earth
Discussions
Open Access

Interactive comment on "Magma storage and plumbing of adakite-type post-ophiolite intrusions in the Sabzevar ophiolitic zone, NE Iran" *by* K. Jamshidi et al.

K. Jamshidi et al.

khj.jamshidi@yahoo.com

Received and published: 25 October 2014

Dear editor

Thank you very much for the reviews on our manuscript Magma storage and plumbing of adakite-type post-ophiolite intrusions in the Sabzevar ophiolitic zone, NE Iran, by Jamshidi et al. We have now read and reflected on the reviewer's suggestions and have aimed to implement most of them in our revised version. Please find our detailed responses below, where we link our responses to the original comments by the referees. Moreover, we attach one version of the manuscript with all changes marked in green, and one unmarked version.

Remarks by Reviewer #1

Comment 1: At page 2323 (lines 4,5,6), Authors assert that there is no work on Sabzevar postophiolitic rocks: I suggest reading Rossetti et al. (2014) and cited references therein. A proper discussion of the tectono-magmatic scenario presented therein is compulsory.

Response: We agree with the referee. The mentioned reference has now been added to the text, in the introduction section, page 2, marked in green.

Comment 2: Section 3.1 Analytical Techniques and Table 1: Authors do not explain how whole rock iron content has been obtained. A classical ICP-OES + ICP-MS, after lithium metaborate/tetraborate fusion, produce results with iron expressed as Fe2O3 ($\pm$ 0.01 wt.%). Definition of FeO is generally obtained with a Titration, but such method produces major uncertainties ($\pm$ 0.1 wt%). Consequently, if Titration has been used, it has to be specified;

Response: The chemical analyses of Sabzevar samples were performed at ACME Laboratory (Vancouver, Canada), through ICP emission (major elements) and ICP-mass spectrometry for trace elements (Code of analyses 4A04, Group 1T). Fe2O3 is reported as total. We recalculated FeO and Fe2O3 amounts according to the method suggested in Le Maitre (1976).

Comment 3: Table 1: For the fast comprehension of the whole rock data and a better evaluation of the whole rock geochemistry section, I suggest to insert additional information such as: a. A.S.I. (or A/CNK) index; b. #Mg; c. Classical Trace and REE ratios [Eu*, (La/Yb)N, (La/Sm)N, (La/Nb), (La/Yb), (Sr/Y)] used in the paper but not presented. It is not easy follow a geochemical discussion without a friendly table.

Response: We thank the reviewer for his/her suggestion. As suggested, Table (1) has now been expanded and some information such as A/CNK index, #Mg, Eu/Eu*, La/Yb, Sr/Y and Zr/Sm ratios were added. We also added 10 new analyses from the southern region to Table (1). These samples are from 3 dacitic domes, and the data has been received only recently (same laboratory as previous data). Using these new data in the geochemical diagrams, such as Harker diagrams, the compositional gap between southern and northern samples is now almost closed. As a consequence, we now argue that the southern felsic samples may have been derived from the northern intermediate magmas by differentiation processes.

Comment 4: The main core of the work is the thermo-barometric discussion, and it has been developed on 438 microprobe analyses on amphibole, plagioclase and clinopyroxene. Presenting only 14 mineral compositions is not exhaustive unless justified by their representativeness.

Response: Following the suggestion of the referee, Tables 2, 3 and 4 have been expanded to include a larger fraction of our available data.

Comment 5: 3.2, 3.3, 3.4 Sections: Since thermo-barometric formulations are from Ridolfi and Renzulli (2012) and/or Putirka (2008), maybe it could be useful for readers not familiar with such topics to have an Appendix in which selected equations are reported.

Response: We welcome this suggestion. The equations used in this work have now been added as an Appendix.

Comment 6: Section 3.5: it is not clear how Fe and Mg partition coefficient has been selected for the clinopyroxene-melt equilibrium test;

Response: We compare our KD values with the value for KD [Fe-Mg] suggested in Putirka (2008). A clinopyroxene-melt pair that plot within the KD [Fe-Mg] = 0.28 $\pm$ 0.08 envelope is assumed to represent equilibrium conditions. We have now emphasized this point in the manuscript.

Comment.7: Section 4.1, page 2328, line 26: Authors define a plagioclase with An5-An15 as Albite. It is Oligoclase! I suggest to avoid the use of Albite, Oligoclase, Ande-

sine, Labradorite... and just report/comment on the An-Ab-Or content.

Response: We accept this point. The reported plagioclase compositions has been changed to the “An-Ab-Or”-format.

Comment 8: Section 4.2: As indicated in point 3, it is very hard to follow the geochemistry section, without the used key ratios indicated in table

Response: The requested information has now been added to Table (1). Please see also response to comment 3.

Comment 9: Section 4.3.1 Amphibole: Authors do not specify which calculation scheme was used to recalculate the amphibole formula, i.e. 13eCNK or 15eNK or 15eK or 16CAT. The scheme used is 23(O), but with or without Fe-normalization? Then authors discussed and discriminated amphiboles using cations expressed in number of atom per formula unit (apfu) but in the table2 is just presented Mg and four-fold Al. Moreover authors presents only 7 analyses without any indication on rock sample provenience. Please specify calculation schemes, report in table all cations used in the discussion (it is necessary also to better understand/evaluate the thermobarometric results).

Response: We accept the criticism. An appropriate sentence regarding the amphibole stoichiometry was added to section 4.3.1. As the referee requested, Table (2) has now also been expanded and now presents 14 analyses of representative compositions of amphibole. Rock sample provenance is now specified also. Also, all cations per formula for these amphiboles were added to table (2).

Comment 10: Section 4.3.2 Plagioclase: Avoid terms as labradorite or andesine if they are not in accordance with An % values. Please expand the Table, 5 analyses presented on 212 are not sufficient. Add for every analysis the ternary feldspar composition, i.e. An-Ab-Or. New version of Table (3) is attached

Response: Encouraged by the referee, additional information such as An-Ab-Or components were added to Table (3). Six additional analyses of representative plagioclase are now also reported in the table. Comment 11: Section 4.3.2 Plagioclase, Sieved texture plagioclase: Authors state that inverse chemical zonation in plagioclase (rimward Anorthite enrichment) is accompanied by an increase in Fe and Mg (page 2333 lines 22-23). Looking at figure 11e there is no compositional trend in MgO and values presented in table 3 (0-0.4 wt%) are better ex- plained as microprobe imprecision than MgO assimilation from melt. Moreover, Authors suggest to compare their plagioclase data to the work of Troll and Schmincke (2002) where, instead, analyses of alkali-feldspars (An <20%) from a peralkaline trachytoidrhyolitoid system (a completely different petrogenetic setting with respect to the adakitic aluminous calc-alkaline magmatism) are presented. I suggest to eliminate this paragraph or improve it with a better explanation.

Response: We partly agree with the referee on this point. The variation in Mg is not significant, and has therefore been taken out of this paragraph. However, the Fe content most definitely increases with increasing An content, and thus remain a valid point to make. The reference cited (Troll and Schminke, 2002) is not meant as a direct comparison with the rocks studied here. Rather, we want to show that the coupled increase in Fe and An content toward the feldspar rims has been mentioned as an evidence for magma mixing in previous studies. We have now added "c.f." to this reference to quantify our statement.

Comment 12: THERE IS NO 4.3.3 SECTION: Where is clinopyroxene description? How we can consider the P-T results from Cpx with only two analyses (in the same table of plagioclase) and no discussion in text?

Response: We apologise for the mistake on our part. Section 4.3.3, that describe the clinopyroxene composition has now been added to the text. Representative compositions of clinopyroxenes (9 analyses) are now listed in a new table (Table 4), which forms a new supplementary file.

Comment 13: At the moment I cannot evaluate sections 4.4, 4.5, 4.6 because of: a. Few mineral analyses b. Textural relationships? c. No cation scheme or mineral moleculas expressed d. No linkage between single mineral analyses and rock samples.

Response: The mineral compositional tables have now been restructured to 14, 11 and 9 analyses for amphibole, plagioclase and clinopyroxene, respectively, with cations per formula stated. Also, the host rock of each analyzed mineral is now presented in the table. Regarding the textural relationships, please see our response to comment 12.

Comment 14: Regarding the Discussion (Section 5) and The Magma Plumbing System (Section 5.1), Authors start a long discussion to claim for an extensive fractionation of amphibole in the evolution of the northern intermediate magmas. Then, they conclude that the southern acidic melts could derive from a different magmatic differentiation processes since the Sr content is not as expected (many sentences, few references). I suggest the authors to use the Dy/Yb ratio as presented in many works (i.e. Xiao-Long Huang et al. 2010) focused on amphibole fractionation in TTG and Adakite suites. See also Rossetti et al (2014) on this regard and the cited references therein. Moreover in the work of Rossetti et al. (2014), it has been already demonstrated through the Dy/Yb and Rayleigh fractionation equation that it is possible to generate a rhyolitic adakitic melt in the Sabzevar belt via differentiation, only considering calcic-amphibole extraction.

Response: We agree with the referee. On the basis of our new geochemical data and diagrams and the recently published work on similar adakite rocks from Soltanabad (NE Sabzear) by Rossetti et al., (2014). We have now reconsidered our model on the origin of southern adakite-like samples in the revised Discussion (section 5).

Comment 15: In Section 6 Conclusions. It has been affirmed that is not possible to compare northern adakites with southern ones since they are calc-alkaline and peraluminous respectively. Calc-alkaline is a term used for magmatic series, peraluminous is a term used to define Alumina saturation in a specific melt. They are not comparable terms. Could we correct sentence in this way “northern suite is metaluminous and southern is peraluminous”?

Response: The mentioned sentence (Conclusion point 1) was corrected according to the referees comment. See amended manuscript.

Comment 16: In Conclusions – Point 2, authors suggests a primitive calc-alkaline magma with a water content up to 10.3 wt%. References are requested.

Response: We now state the source of this number in the conclusion section explicitly (i.e. section 4.4 of the main manuscript). No reference is required as this is our result.

Comment 17: Conclusions Point 6 must be eliminated. The sentences is presented as a conjecture and not demonstrated.

Response: The conclusion point 6 was not omitted in its entirety, but the sentence has now been rewritten following the referees discussion points.

Comment 18: Figure 5: Trachyte Field in TAS seems little strange and Irvine and Baragar boundary seems upward shifted. The K2O vs SiO2 diagram is not from Rollinson 1993, but from Peccerillo and Taylor 1976. Control typing of #Mg. Improvement on symbols is requested in all diagrams.

Response: Accepted. Figure (5, a, b, c, d) has now been redrawn and the reference has been corrected.

Comment 19: Figure 6: Authors present Harker diagrams. What about the Fe content? (see above)

Response: The FeOtot contents is already plotted in the Harker diagrams, as requested. Please refer to fig 6(b).

Comment 20: Figure 7: Please present Trace and REE elements with classical diagrams without mixing them. In Sample/Chondrite spider diagrams present only the REE patterns.

Response: The sample/Chondrite spider diagram was changed in the figure (7). We now present a pure REE pattern also. Please see the new figure.

Comment 21: Figure 9,11,12,13: Symbols change every time. Select a symbol (shape and colour) for every rock-type and then use it consistently in every diagrams. Minerals from a rock types must have the same shape and colour of the rock-type itself.

Response: We agree with the referee, and have now changed the figures accordingly throughout the entire manuscript.

Comment 22: Figure 16: the same suggestion about symbols in diagrams.

Response: In Figure 16 (now figure 17), we use schematic symbols to illustrate different mineral textures. These schematic symbols have now been updated and, the legend for Figure 17 has been improved for the new version. Please refer to the new figure 17.

Please also note the supplement to this comment:
http://www.solid-earth-discuss.net/6/C1174/2014/sed-6-C1174-2014-supplement.pdf

---

Interactive comment on Solid Earth Discuss., 6, 2321, 2014.

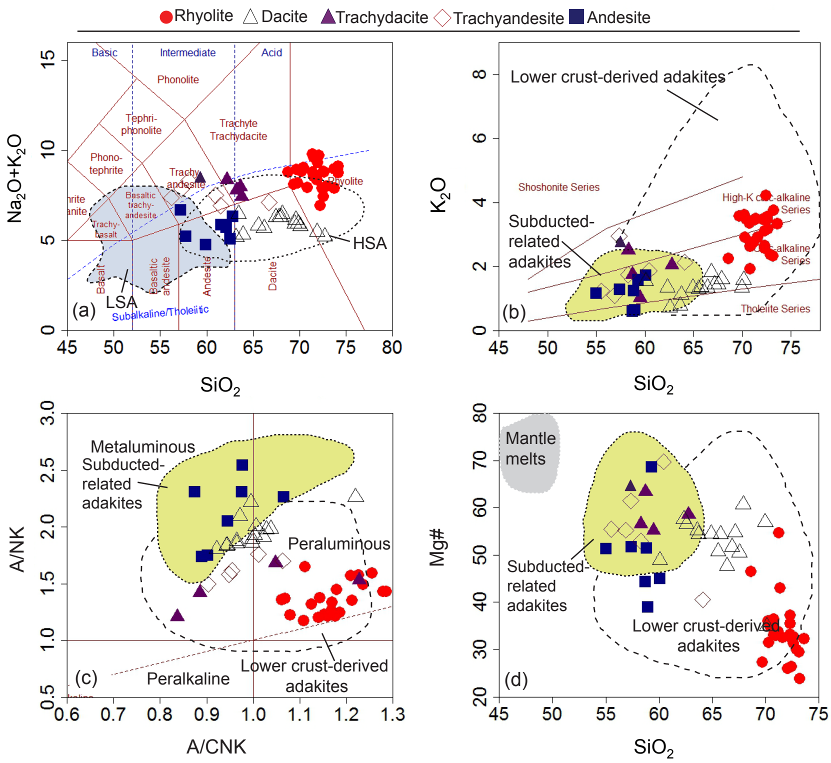

Fig. 1. Fig. 5 Selected major element plots for the subvolcanic post-ophiolite rocks. (a) Total alkalis vs. silica diagram after Le Bas et al. (1986). The boundary between alkaline and subalkaline series is a

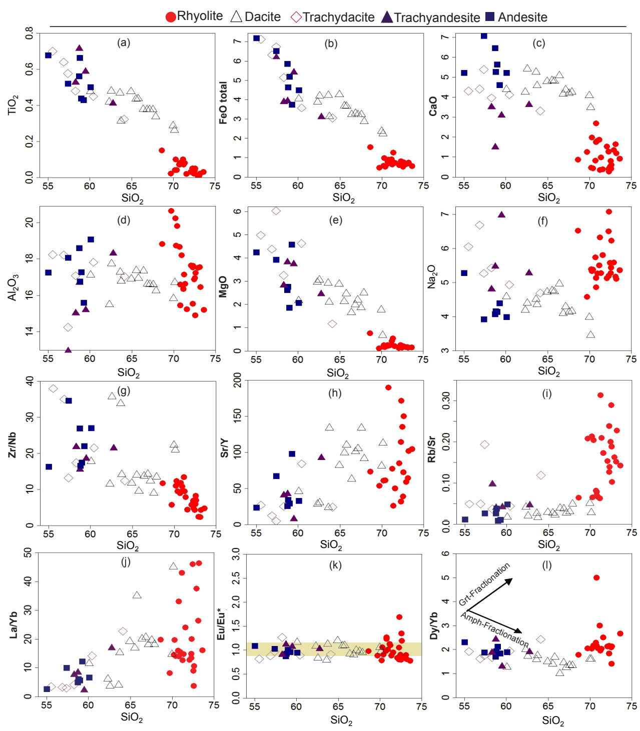

Fig. 2. Fig. 6 Harker diagrams of the major oxides (wt. %) and incompatible element ratios vs. SiO2 for the studied rocks.

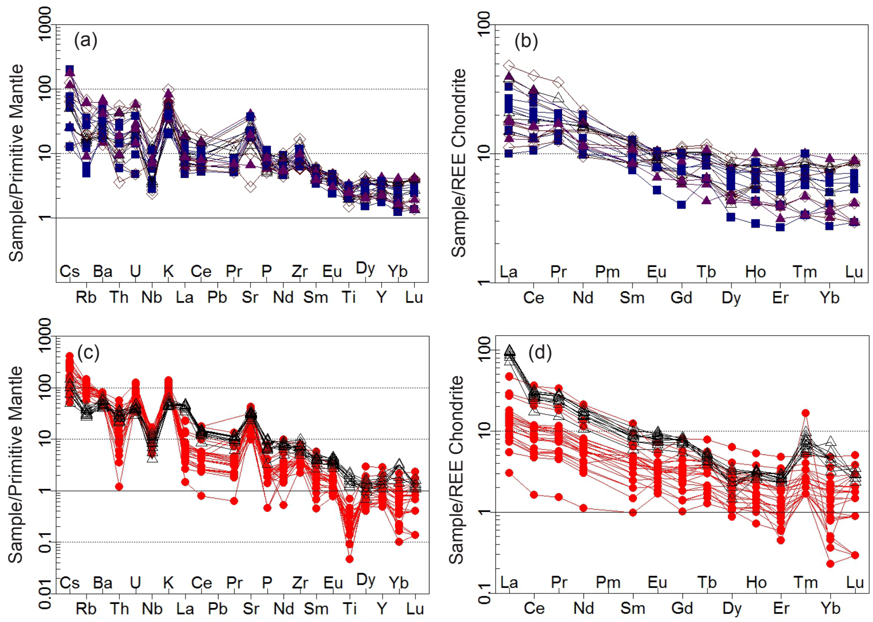

Fig. 3. Fig. 8 (a) Plot of Sr/Y vs. Y for the studied rocks. Fields of adakite and arc normal rocks are from Petford and Atherton (1996) and Defant and Drummond (1990). (b) Plot of Sr vs. CaO+Na2O (wt.%) show

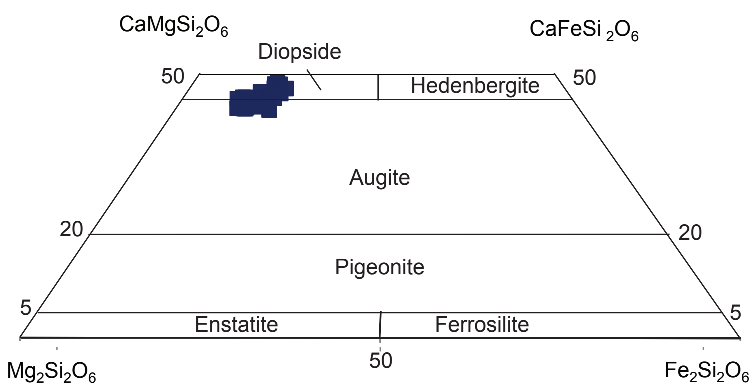

Fig. 4. Fig. 12 Composition of clinopyroxene (n. 29). All clinopyroxene data plots in the Diopside field.

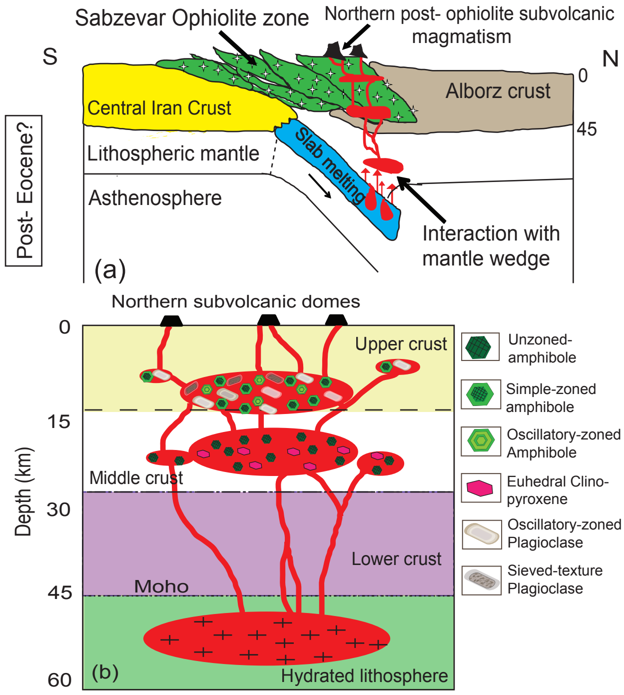

Fig. 5. Fig.17 (a) Tectonic framework illustrating northward subduction of Sabzevar oceanic crust (eastern branch of Neo-Tethys) beneath eastern Alborz zone. (b) Schematic illustration of the magma plumbin