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Solid Earth Discussions

SED

Interactive comment

Interactive comment on "Insights from elastic thermobarometry into exhumation of high-pressure metamorphic rocks from Syros, Greece" *by* Miguel Cisneros et al.

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We thank I. Baziotis for comments that help clarify analytical methods in this manuscript. The comments are addressed below, and these changes will be incorporated into the revised version of the manuscript. Replies are italicized, and changes made that will be made to the text are highlighted in red (also italicized).

1. Lines 230-235: Within the "electron probe measurements" be more specific. In particular, clarify which elements measured on which spectrometer. Additionally, give the element measured (in parenthesis) every after standard.

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We have clarified the crystals used for each element and the "primary calibration" standards that were assigned to each element.

"The EPMA is equipped with five wavelength-dispersive spectrometers. Epidote and omphacite were analyzed for Si Al, Na, Mg, Ca, Cr K, Ti, Fe, and Mn on TAP (Si, Al), TAPH (Na, Mg), PETJ (Ca, Cr), PETL (K, Ti), and LIFH (Fe, Mn) crystals."

"Primary calibration standards used included: albite (Si, Na), anorthite (Al, Ca), synthetic forsterite (Mg), chromite (Cr), microcline (K), synthetic rutile (Ti), synthetic fayalite (Fe), and synthetic pyrolusite (Mn)."

2. Line 234: What you mean by "primary standards".

We refer to primary standards as the "primary calibration standards" that are used to calibrate x-ray intensities of specific elements during microprobe measurements. We would refer to secondary standards as those standards whose composition is known, but that are not assigned as a primary standard for a specific element (i.e., the standard x-ray intensity for a specific element is not used to calibrate the x-ray intensities of unknowns); the secondary standard can be used to evaluate the accuracy of measurements.

We will change the text to read "primary calibration standards" for clarity:

"Primary calibration standards used included: albite (Si, Na), anorthite (Al, Ca), synthetic forsterite (Mg), chromite (Cr), microcline (K), synthetic rutile (Ti), synthetic

fayalite (Fe), and synthetic pyrolusite (Mn).”

3. line 344: Are you sure that the approach TWEEQC estimated equilibrium conditions?

Given that the TWEEQ results are not our results, we prefer to not speculate on whether the results represent equilibrium conditions. The authors (Trotet et al., 2001) provide several lines of evidence (mineral habit, textural observations, and the intersection of independent reactions) that support equilibrium conditions; however, we do note that retrograde rocks from the CBU on Syros commonly preserve multiple stages of protracted mineral growth within a single thin section (e.g., see descriptions for sample KCS34 from Delfini), perhaps making equilibrium assumptions more difficult to prove valid.

4. Please define within the text the Xep and Xcz.

This is a good point for clarity, we use the mol fraction expressions from Franz and Liebscher (2004) for epidote (X_{ep}), clinozosite (X_{cz}), and tawmawite (X_{taw}), wherein X_{ep}, X_{cz}, and X_{taw} are:

$$X_{ep} = \frac{Fe^{3+}}{Fe^{3+} + Al + Cr^{3+} - 2}$$

$$X_{cz} = \frac{Al - 2}{Fe^{3+} + Al + Cr^{3+} - 2}$$

$$X_{taw} = \frac{Cr^{3+}}{Fe^{3+} + Al + Cr^{3+} - 2}$$

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More mineral chemistry calculation details are provided in Supplementary Table S6. We note that X_{taw} does not exceed 0.01 for any of our measured epidotes.

This additional information will be added to the end of section 4.5 (electron probe measurements):

"Mol fraction expressions from Franz and Liebscher (2004) were used to calculate epidote (X_{ep}), clinozosite (X_{cz}), and tawmawite (X_{taw}) compositions. Further information on mineral chemistry calculations are available in Supplementary Table S6."

5. The authors measured epidote and omphacite using EPMA, but i cannot find any text about omphacite chemistry. Right?

The chemistry of omphacite inclusions in garnet is mentioned on lines 275 – 277. Further information on the chemistry of omphacite inclusions in garnet can be found in Supplemental Table S6. The chemistry of omphacite inclusions is not a significant portion of the story we present in the manuscript, and is therefore not extensively discussed in the main text. We will add a brief clarification on the omphacite inclusion (in garnet) mineral chemistry that supports similar entrapment pressures determined from quartz inclusions within different garnet zones:

"Omphacite inclusions within different garnet zones (core: $X_{jd} \approx 0.84$, rim: $X_{jd} \approx 0.81$) also show no difference in composition, which is consistent with qtz-in-grt barometry results (Delfini: KCS1621, Supplementary Table S6)."

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References:

Franz, G. and Liebscher, A.: Physical and Chemical Properties of the Epidote Minerals–An Introduction–, Reviews in Mineralogy and Geochemistry, 56(1), 1–81, doi:10.2138/gsrmg.56.1.1, 2004.

Trotet, F., Vidal, O. and Jolivet, L.: Exhumation of Syros and Sifnos metamorphic rocks (Cyclades, Greece). New constraints on the P-T paths, European Journal of Mineralogy, 13(5), 901–902, doi:10.1127/0935-1221/2001/0013-0901, 2001.