

Interactive comment on “Chemical Heterogeneities in the Mantle: Progress Towards a General Quantitative Description” by Massimiliano Tirone

Anonymous Referee #1

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This manuscript reports AlphaMELTS computations of chemical equilibrium between peridotite + eclogite assemblage at 1200oC and 4 GPa. The author varies proportions of peridotite and links it to the change in bulk composition and mineral assemblage. The manuscript is concise and informative; however, there are a few major issues which I consider should be taken into account before publication.

Major comments 1) The manuscript lacks an application chapter and through that it also lacks relevant conclusions. I find that the entire “conclusions” chapter just repeats the introduction and choice of modelling but does not provide any real conclusions. There are a large number of experimental papers on peridotite/eclogite interaction reactions

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(for instance, Yaxley and Green, 1998, Schweitz. Mineral. Petrol). There are also dozens of works on natural rocks, such as ophiolite complexes that contain lenses of eclogites and pyroxenites within peridotites (see works by G. Pearson). However, there is no attempt to compare the modelling results with the natural and experimental assemblage. In fact, the author states: “The results could be compared with existing data on melt products and residual solids observed in various geological settings to investigate indirectly, but from a quantitative perspective, the presence of chemical heterogeneities in the mantle”. This should be done. 2) Currently, I find the abstract too complicated, unclear and somewhat vague. It does not provide 1) the scope of the study, 2) methods, 3) results and 4) conclusions. 3) English needs to be reviewed by a native-English speaker. In its current version there are too many mistakes and unclear sentences. 4) Some text is unclear. The following examples are not the only ones. Page 4. Lines 15-25. For instance, what is the difference between “bulk compositions of the two assemblages separately” and “weighted average of the bulk composition of the two assemblages in proportion 1:1”. Tables: It is also unclear how “the composition of mineral components at equilibrium” in “the lower part of the table” can be negative. 5) Panels C-H in Figure 2 I find confusing and difficult to read. It is also not explained what causes spikes (zigzag distribution) in Cpx, Coe and Gt panels at 4000 time frame. 6) It will be good to explain in text what is shown in figures. How the proportions of minerals change and how these changes vary with the fractions of peridotite added.

Minor comments Page 3 Line 26. What is semi-general? Table 1. Formula of grossular is wrong. Al₂. Enstatite, please, correct the subscript Table 2. Please, specify what are O and C in front of minerals? For instance, reaction (11), what is ODi? Likewise, equation (18), what is CBff and OBff?

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