

# Comment on “An experimental study of pyroxene crystallization during rapid cooling in a thermal gradient; applications to komatiites and chondrites”

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## General Comments

The manuscript by Bouquain et al presents the results of several experiments performed on synthetic samples characterized by a starting compositions in the CMAS system. These compositions are less magnesian than those used by Faure et al., 2006. Aim of this study (summarize in row 25 page 229), is to develop an experimental program to help understanding the phase relations and habits of pyroxenes that crystallized under conditions like those in komatiitic lava flows and in chondrites. The manuscript represent a substantial contribution to scientific progress within the scope of this Journal. However, presentation of the experimental procedure, figures, discussion and conclusions could be improved.

## Specific Comments

1- For what concerns the paragraph on the experimental procedures, a more systematic description of the way in which the isothermal and dynamic crystallization experiments were performed will help reader to keep in mind the major differences among them. For example, no information is provided on the conditions at which the isothermal crystallization experiments were performed. Furthermore, few details on electron microprobe data should be provided.

2- Figures should be numbered according to the order of their appearance. There are also some wrong figure quoting in the text, that are outlined in Technical corrections

3- In my opinion, despite what stated in the title and in the first line of the abstract, neither in the Discussion nor in the Conclusions is described in which way results from this study, may have direct application to the interpretation of textures of komatiites and chondrites. Discussions should include a general discussion on the features of komatiites and chondrites, and should evidence goals and limits of the experimental work in reproducing petrographyc and textural features of these natural samples. In this version of the manuscript in the “Application to natural rocks” the authors only consider the komatiites.

4- Finally, some flaws in the verbs accordance, are present. Suggestions are provided in the Technical Corrections.

## Technical Corrections

Page 228, row 3: Change “cooling” with “cooled”

Page 228, row 8: Change “a majority” with “the majority”

Page 228, row 9: Change “A conspicuous” with “An intriguing”

Page 228, row 10: Change “reproduceability” with “reproducibility”

Page 228, row 12: Change “experiments” with “charges”

Page 229, row 2: Insert “they” between “which” and “found”

Page 229, row 4 to 6: the sentence is not clear

Page 229, row 7: Delete “companion” and refer to “Bouquain et al., submitted”

Page 229, row 16: Change “within the thermal” with “by applying a thermal”

Page 229, row 17: Change “in the upper” with “to the upper”

Page 229, row 20: Delete “that”

Page 229, row 2: Change “CMAS” with “CMAS (CaO-MgO...)”

Page 229, row 23: Delete “one”

Page 229, row 25: Change “understand” with “understanding”

Page 230, row 3: Change “Pétrogaphiques” with “Pétrographiques”

Page 230, row 5: Delete “(CaO-MgO...)”

Page 230, row 5: Change “so as” with “in order to”

Page 230, row 5: Insert “on” between “pigeonite” and “the liquidus”

Page 230, row 22: Delete “the” after “preventing”

Page 230, row 24: Delete “entire” before “charge”

Page 230, row 22 to 28: It is not clear if this phase only refer to procedure 1 (If this is the case why you mention Table 1?), or if this is a pre-heating phase performed in isothermal conditions. If the latter is the true why you don't report this information when the isothermal crystallization experiments are discussed?.

Page 231, row 2: Change “are” with “were” Change “match” with “matched”

Page 231, row 13: Delete “period of”

Page 231, row 13: Change “the elimination” with “elimination”

Page 231, row 15: Change “In the other experiments (...)” with “In the experiments labelled...”

Page 231, row 17: Change “or” with “to”

Page 231, row 15 to 17: Why don't you insert this part when procedure 1 is discussed? In Table 2 these experiments have been associated to the procedure 1

Page 231, row 22: Change “first heat” with “heating”

Page 231, row 23: Delete “at the hot hand”

Page 231, row 23: Change "The temperature" with "Its temperature"  
Page 231, row 24: Delete "at the bottom of the charge"

Page 232, row 2: Change "an interval of uncrystallized liquid" with "the amount of liquid remained uncrystallized"  
Page 232, row 10: Change "the position in charge" with "their position in the charge"  
Page 232, row 16: Change "the experience" with "the experiment"  
Page 232, row 21: Change "cooling" with "crystallization"  
Page 232, row 25: Change "in the course" with "during the course of"

Page 233, row 3: Insert "the" between "in" and "part"  
Page 233, row 5: Change "varying" with "variable"  
Page 233, row 6: Change "throughout in the capsule" with "throughout the capsule"  
Page 233, row 14: Change "can be" with "were"  
Page 233, row 18: Change "Some experiments" with "In some experiments the charges"  
Page 233, row 21: Delete "the"  
Page 233, row 23: Change "reproduceability" with "reproducibility"  
Page 233, row 24: Change "was" with "were"

Page 234, row 1: Delete "Yet"  
Page 234, row 5: Change "cooling" with "crystallization"  
Page 234, row 8: Change "employed" with "performed"  
Page 234, row 9: Change "dynamic cooling" with "isothermal experiment" or it is not clear why you refer to Table 1 and why this part is described in this paragraph  
Page 234, row 10: Change "in" with "on" Delete "appropriately"  
Page 234, row 22: Change "appears" with "appeared" Change "has" with "had"  
Page 234, row 23: Change "forms" with "formed" Delete "that are"

Page 235, row 2: Change "The results are" with "The results of all experiments"  
Page 235, row 8: Change the label of Fig. 7 according to the order of appearance  
Page 235, row 13-14: Change "in any of isothermal" with "in any of the isothermal"  
Page 235, row 15: Delete "in the starting material"  
Page 235, row 16: Check the number of the experimental run in which forsterite is the only crystalline phase. From Table 2 it seems that they are 3  
Page 235, row 18: Insert "either" between "have" and "euhedral"  
Page 235, row 19: Change Fig. 5 with Fig. 6. Please check the figures and label them according to the order of their appearance  
Page 235, row 21 to 28: Change Fig. 5 with Fig. 6. Please check the figures and label them according to the order of their appearance  
Page 235, row 25: Change "In the two other experiments (...)" with " In experiments CPX02..."

Page 236, row 3: Change "disintegrated but" with "disintegrated. In this..."  
Page 236, row 5: Change "olivine coexists with pyroxene, the forsterite habit" with "olivine coexists with pyroxene, its habit"  
Page 236, row 6: Change "case the border of the crystals" with "cases crystal borders"  
Page 236, row 7: Please check the figures and label them according to the order of their appearance; Change "Experiment....the variety....by this mineral" with "In the experiment CPX09 (Fig..) olivine shows a variety of textures"  
Page 236, row 10 to 13: These two sentences can become a unique sentence, as they state the same thing. Please change the figures label  
Page 236, row 16: Change "Fig. 5e" with Fig. 6e"  
Page 236, row 19: Change "to starting" with "to the starting"  
Page 236, row 23: Change "coexist" with "coexisted"  
Page 236, row 24: Change "except for" with "except in"  
Page 236, row 26: Change "appears" with "appeared" and "over" with "higher than"  
Page 236, row 26: Change "were observe in only one run" with "were only observed in run CPx.."  
Page 236, row 27 and 28: Change "in all others" with "in all the others" and "occurs" with "occurred"

Page 237, row 2: Change "Figure 6e" with "Fig. 8e"  
Page 237, row 3 and 4: Change "Fig. 6" with "Fig. 8"  
Page 237, row 4: Change "In other experiments such..." with " In the experiments CPX19 and cpx 22"  
Page 237, row 5: Change "forms" with "formed"  
Page 237, row 6: Check Figure label and change "In the two experiments" with "These experiments" and "but with..." with "showed contrasting results"  
Page 237, row 11: Check Figure label and change "fill" with "filled"  
Page 237, row 16: Delete "(Fig. 2)", it has been quoted shortly before.

Page 237, row 17: Change "crystallize" with "crystallized"  
Page 237, row 18: Change "These are" with "These were"  
Page 237, row 28: Change "Silica phase" with "A silica phase"

Page 238, row 11: Delete "very"  
Page 238, row 16: Change "from another run" with "from the one" and delete "at far lower temperature"  
Page 238, row 17: Delete "and no crystalline phases are present"

Page 239, row 11: Add "(1985)" after "Kinzler and Grove"  
Page 239, row 20: Change figure label according to the order of appearance  
Page 239, row 20: Change "dynamic-cooling thermal-gradient" with "dynamic crystallization" as you already explained that these experiments were performed under a thermal gradient  
Page 239, row 3: Change "Fig. 5f" with "Fig.6f"  
Page 239, row 25: it is not clear why you asses that the crystals you found at the base of the capsule were possibly crystallized in the upper, cooler portion of the capsule. Maybe you can re organize the text from line 25 to 29

Page 240, row 3: Change "Fig. 5" with "Fig. 6"  
Page 240, row 5: Change "Fig. 5a" with "Fig. 6a"  
Page 240, row 10: Change "curved" with "rounded"  
Page 240, row 18: Change "cooled" with "cooling"  
Page 240, row 19: Change "liquidus in the entire" with "liquidus the entire"  
Page 240, row 27: Change "CPX10, which was" with "CPX 10. In this latter the charge was"

Page 241, row 3: Change "as" with "an"

Page 242, row 1: Change "REFS" with some relevant references  
Page 242, row 5: Change "the depths" with "depth"  
Page 242, row 7: Change "grew" with "had"  
Page 242, row 8: Change "mantles" with "rims"

Page 247, Table 3: Put a space between "experiments" and "#CPX15" Provide some analytical details.

Page 248, caption to figure 1: Change "procedures of cooling" with "cooling procedures"

Page 250, caption to figure 3: Change "ternary" with "ternary diagram" Change "are also shown from Fig. 4" with "are shown in more detail in Fig. 4"

Page 251, caption to figure 4: Change "drawn" with "projected". For completeness, the analyses of olivines should be projected too.

Page 252, caption to figure 5: Change "shawn" with "shown"

Page 253, caption to figure 6: Change "quenched" with "quenching"

#### Figures

Please label the figures according the order of their appearance.

Fig 5 I think this figure has never been cited and discussed in the manuscript.