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Solid Earth Discussions

Interactive comment on "First magmatism in the New England Orogen, Australia: Forearc and arc-backarc components in the Bakers Creek Suite gabbros" *by* Seann J. McKibbin et al.

Anonymous Referee #2

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This study presents a new set of geochemical data and U-Pb ages on zircons from the Bakers Creek suite Gabbros. Theses new data are are used to constrain the tectonic settings of the first magmatism of the New England Orogen. As a non-specialist of geochronology, I have no comments on the zircon chronology work and I leave its evaluation to specialists. I provide here a review on the work related to the geochemistry of major and trace elements.

Major comments:

First, I regret to say that the analytical section suffers from the lack of results on geological reference materials and information on the limits of detection, quantification and LA-ICP-MS settings. Second, I was not convinced by the use of the major and trace

element data sets proposed by the authors. Bellow, I report some examples illustrating (1) that the data presentation suffers from the lack of clarity (definition of sample grouping, sample selection, etc.), and (2) that the interpretations are not supported by the use of trace and major elements.

1. Analytical session.

Page 3 line 27: "some trace elements": which ones did you analyzed by XRF and how does these data compared to LA-ICP-MS data? How did the authors measure the L.O.I.? Page 3 line 32: please provide the ICP-MS and laser settings (laser energy, laser shots frequency, spot or raster ablation mode, etc.). Which NIST glasses is used for the calibration and what are the reference values used for this NIST? Please provide also the detection limits. What is the purity of the lithium borate flux used for the fusion? Could this be a concern for the sample characterized by very low trace element contents (e.g. Th< 0.05 ppm)? Finally, did the authors analyze any of the BIR-1g, BHVO-2g, etc. reference materials to certified their analytical protocol?

2. Data presentation

- In figures 4 and 5, the data are sub-divided into basaltic melts (which corresponds in reality to finely and coarse crystalline gabbros), cumulate rocks and hybrid melts. Because the term "Hybrid melts" is not mentioned at all in the discussion or in the data table, the reader has no clues about the nature and origin of this group of sample. To which sample these hybrids melts corresponds to? What does the term "hybrid" stand for? - The authors mentioned also "anomalous samples" in figure 4 and 5. How do they define the anomalous character of these samples? My guess is that theses samples correspond to those analyses with extremely low Th contents (i.e. < 0.05 ppm), which could potentially be close or even below the limit of quantification. This observation echo's my comment on the analytical session.

These two examples show that it is not very easy (or very time consuming) to understand and follow the links between between the figures, the text, and data tables.

2- data interpretation

Because of the lack of clarity (linearity) in the data presentation, I was not really able to evaluate properly the geochemical interpretation of major and trace elements data. Nonetheless, I address bellow few major comments for the authors.

- The authors use the geochemistry of Large Ion Lithophile Elements (LILE) to demonstrate the arc-sub-arc settings of Baker Creek suite gabbros (page 9 line 4-9 and figures 5a and 9a). Given the age of these samples ($\sim$ 300Ma), the authors should first demonstrate that the LILE abundances of these samples have not been modified by alteration. - As far as I understand, the Th/Yb ratio is the only non-LILE trace element ratio that suggests a sub-arc setting for Bakers Creek gabbros. This result should also be confirmed by the use of other trace element ratios such as Nb/La, Nb/Ta and Th/La. Note that I do not see any evidence for a sub-arc setting from the trace element ratios involving Ti, Zr, Y and V. - The MORB reference should not be restricted to one point. Please report the MORB field instead of a single point. Baker Creek gabbros might certainly overlap with MORB data in figures 7. - The sub-arc setting is discussed only on the basis of 10 analyses of backers Creek gabbros. Five of theses analyses display an "anomalous signature" or correspond to coarsely crystalline gabbros that may not be representative of melt compositions. How representative are the geochemical results of Bakers Creek gabbros in this context? What is the story of the "Hybrid melts" and "cumulate" rocks? Is it compatible with the one from Bakers Creek gabbros? - The role of crustal contamination is also not discussed in this paper. Is it possible for example that the high Th/Yb ratios measured in Baker creek sample (Fig 8a) could result from crustal assimilation?

Minor comments

Page 6 line 8: the figure shows only FeO vs. MgO. Page 6 line 9: repot the MORB and BABB fields in Fig 4.b. Page 6 line 24: It is not possible to see clearly theses samples in Fig. 5. There are 5 different symbols and 3 different colors. Page 7 line

1: replace "peaks" by "anomalies" Page 8 line 10: "Magmatic differentiation occurred before or during emplacement of magmas at depth in the mantle wedge" Why would differentiation occur within the mantle wedge? Page 8 line 15: I found the uses of the term "melt" abusive for the chemical composition of plutonic rocks. I think that this statement needs to be discussed and argued in the text. Page 9 line 18: please specify the nature of the components. Data table: The data table could benefit from the addition of petrography information (grain size, cumulate, chilled margin, etc.).

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