Response of the Rb-Sr system in biotite during contact metamorphism in the aureole of the Makhavinekh Lake Pluton, Labrador

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Changes made to revised manuscript v2

Minor wording changes, typographic mistakes, and grammar errors were corrected throughout. The term error has been replaced by uncertainty. The term standard has been replaced by reference material. The term *in situ* has been italicized throughout. Removed or clarified ambiguous statements identified by Reviewer 1. A list of added references is included at the end of the 'track changes' document.

0. Abstract:

Adopted changes recommended by reviewers with greater attention to tense shifts

1. Introduction:

Adopted changes to refer to analytical technique as LA ICP-MS/MS (I don't think there should be a hyphen between LA and ICP). Also included several new references to high-precision single-spot Rb-Sr ages obtainable by LA MC-ICP-MS/MS and to Rb-Sr isotope mapping.

2. Local Geology:

Only minor changes made following advice of reviewers and associate editor.

3. Sample selection and descriptions:

Better referencing to figures of merit included in the text. A new figure (Fig. 4) was added to show BSE images of biotite in the four key textural settings. This figure is reference in this section and again in the Discussion section. UTM coordinates for samples were added to a new sheet for sample descriptions in the Appendix tables.

4. Methods:

Dwell times have been added to the measured isotopes. Major changes to this section include describing NIST610 as primary reference material: all isotope ratios were recalculated using NIST610 instead of MicaMg. However, MicaMg is still mentioned as a check on drift- and mass-bias corrected mass-shifted 87Sr/86Sr. The matrix correction reference material (MCRM), is now referred to as phlogopite from a melanite-syenite 'borolanite' from the Loch Borralan

Complex, Scotland. The age of this phlogopite is now identified as traceable to La Posta biotite (Walawender et al. 1990) and a revised age of 415 Ma is used for matrix correction. This was recently communicated to me by my colleague Adrien Vezinet at ISTERRE Grenoble and my only option is to use a personal communication to reference this age. If the editors have other suggestions I am happy to accommodate. All data for unknowns was recalculated using this revised age. The effect of this change is to shift Rb-Sr ages in the MLP to slightly younger ages. But this does not effect the overall conclusions of the study. In fact the recalculated ages are more in-line with expectations for slow-cooling and open-system behaviour of Sr in biotite above 500C. Reference is now made to Glorie et al (2024) for the mass bias and matrix corrections used. A more detailed statement about uncertainty propagation is included in the revised version. Specifically, dispersion of Rb/Sr and Sr isotope ratios measured on NIST610 is added to the mass-bias corrected ratios. A statement about the difficulties related to propagating age uncertainty from matrix correction RM to unknowns is also made. Adding the full uncertainty from the matrix correction RM to the unknowns is likely to add excess uncertainty to isochron ages for MLP samples (this would also artificially reduced MSWD of regressions). Thus an extra 1% uncertainty (i.e. +13.2 Ma to +18.5 Ma) is added to the calculated isochron ages. A statement is included describing how model ages and model age uncertainties are calculated. Including error correlations in the two-point isochron calculation tends to reduce uncertainty for strongly correlated data points and this effect is accounted for in the revised model age uncertainty. I don't feel that the calculation of model ages needs to be referenced. In my opinion this is common knowledge. The appendix also contains internal 2SE as well as expanded uncertainty (2SE expnd) from dispersion in NIST610.

5. Results

All Figures have been re-drafted with the revised data reduction methods. The associated text has also been revised with the new isochron ages and expanded uncertainty (+ 1%). Each figure is labeled to indicate the distance or textural setting(s) illustrated in the plot.

6. Discussion.

This section is largely untouched except for clarification of text in some areas. I have removed reference to 'pile-up' zoning in central aureole discussion as in retrospect it is impossible to assess this in the rims of such small grains.

A reference to the Isotope mixing model of Davies et al. (2018) has been added to the discussion of the inner aureole neoblast dataset.

7. Conclusions.

A few minor edits were made here to clarify text

8. References

Several new references were added on recommendations of reviewers.

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9. Tables

The appendix tables have been extensively revised. Extra worksheets for ‘Samples’, ‘Initial Sr Plag’, ‘MicaMg-NP’, and ‘Borolanite phlogopite’ were added. Data for Rb/Sr now includes both the 2SE internal and 2SE expanded errors.

10. Figures

Necessary changes have been made to the figures; Figures 5 to 10 have been redrafted using recalculated ratios. The distance from the contact (outer, central, inner, inner-aureole melt film) has been identified for clarity. 1sigma error bars are used for the linearized probably density plots. Anchored isochron ages have been identified on the linearized probably plots.