

A2 CRYSTAL SELECTION

A2.1 Selection of Most Equant Crystal Cross Sections for Detailed Compositional Study

Collecting trace element composition data from crystal rims by selecting individual points to analyze can be a tedious process, so 2-D polygonal grids of 100-200 points across the short dimensions of anorthite laths were programmed for trace element (Mg, Sr, Ba) analysis as described in Section 2.2.4. This approach generated spatial data sets for identifying any compositional zoning present as well as measurements closest to the crystal edges without evidence of melt contamination. Crystals from which anorthite rim data were used to calculate partition coefficients are shown for the seven melt compositions in Figure A2.1.

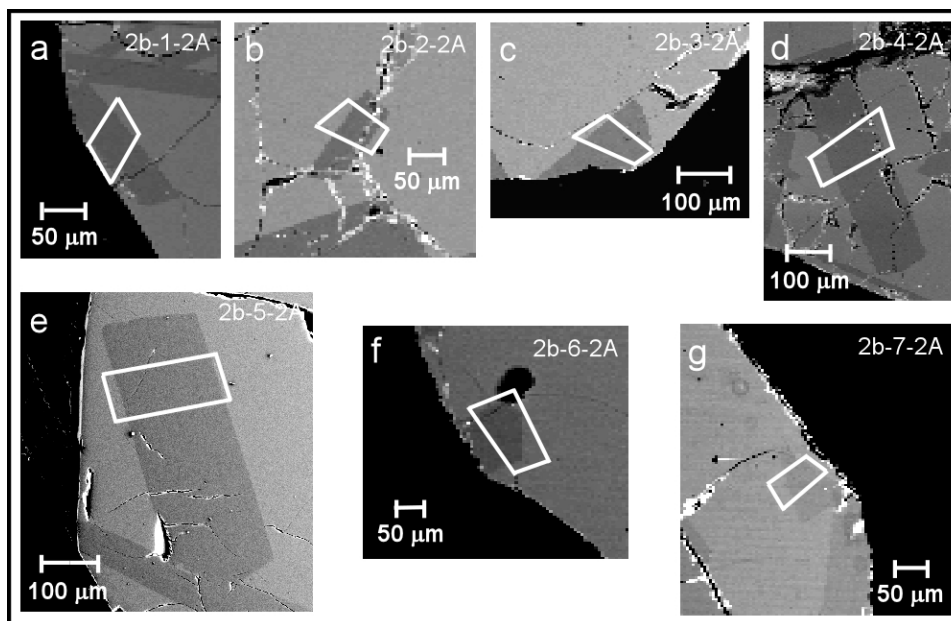


Figure A2.1. BSE imaging of locations of 2-D grid analyses of the most equant crystal (labeled A) from each of the seven CMAS2b compositions, with grid areas marked in white. (a) composition 2b-1, (b) composition 2b-2, (c) composition 2b-3, (d) composition 2b-4, (e) composition 2b-5, (f) composition 2b-6, and (g) composition 2b-7.

A.2.2 Trace Element Compositional Maps

Compositional maps of MgO, SrO, and BaO contents of crystals from the seven melt compositions studied in chapter 2 are plotted on the next seven pages. Analytical uncertainty for each datum is either at or less than the resolution of the legend color scale gradient shown for each element. Solid white lines delineate the boundaries between points completely contained within the crystal and those overlapping with, or fully containing glass, as determined both by composition and careful inspection of SEM imaging of probe spot burn marks in the sample carbon coat. Dashed white lines indicate regions within crystals that display anomalous compositions due to the presence of surficial features such as fractures. One dimensional summary transects were calculated from the 2-D data by averaging data points along lines roughly perpendicular to the A-B lines marked in each figure. Summary transects are plotted in Section A2.3.

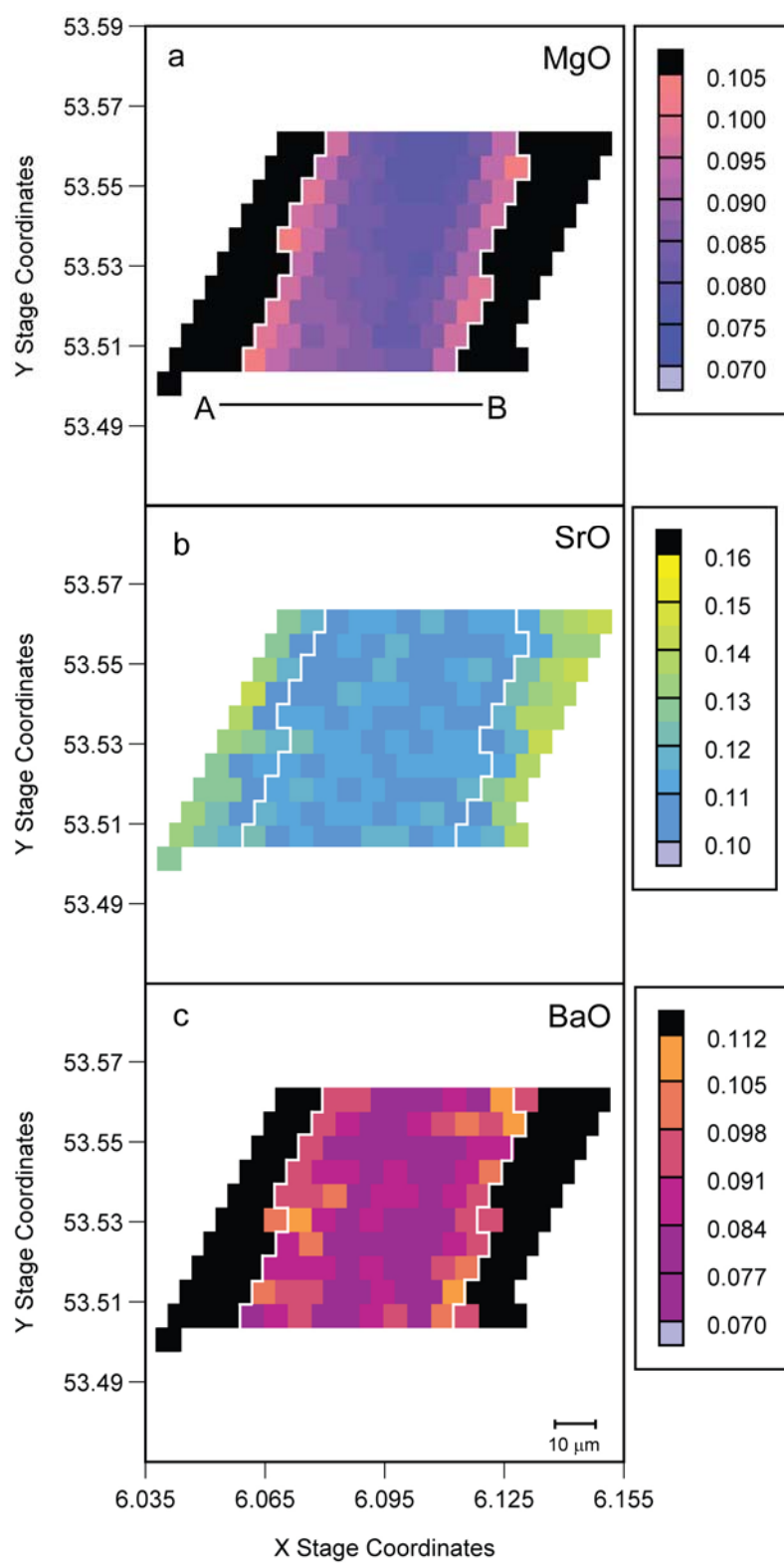


Figure A2.2. Sample 2b-1-2 (a) MgO, (b) SrO, (c) BaO maps (wt. %).

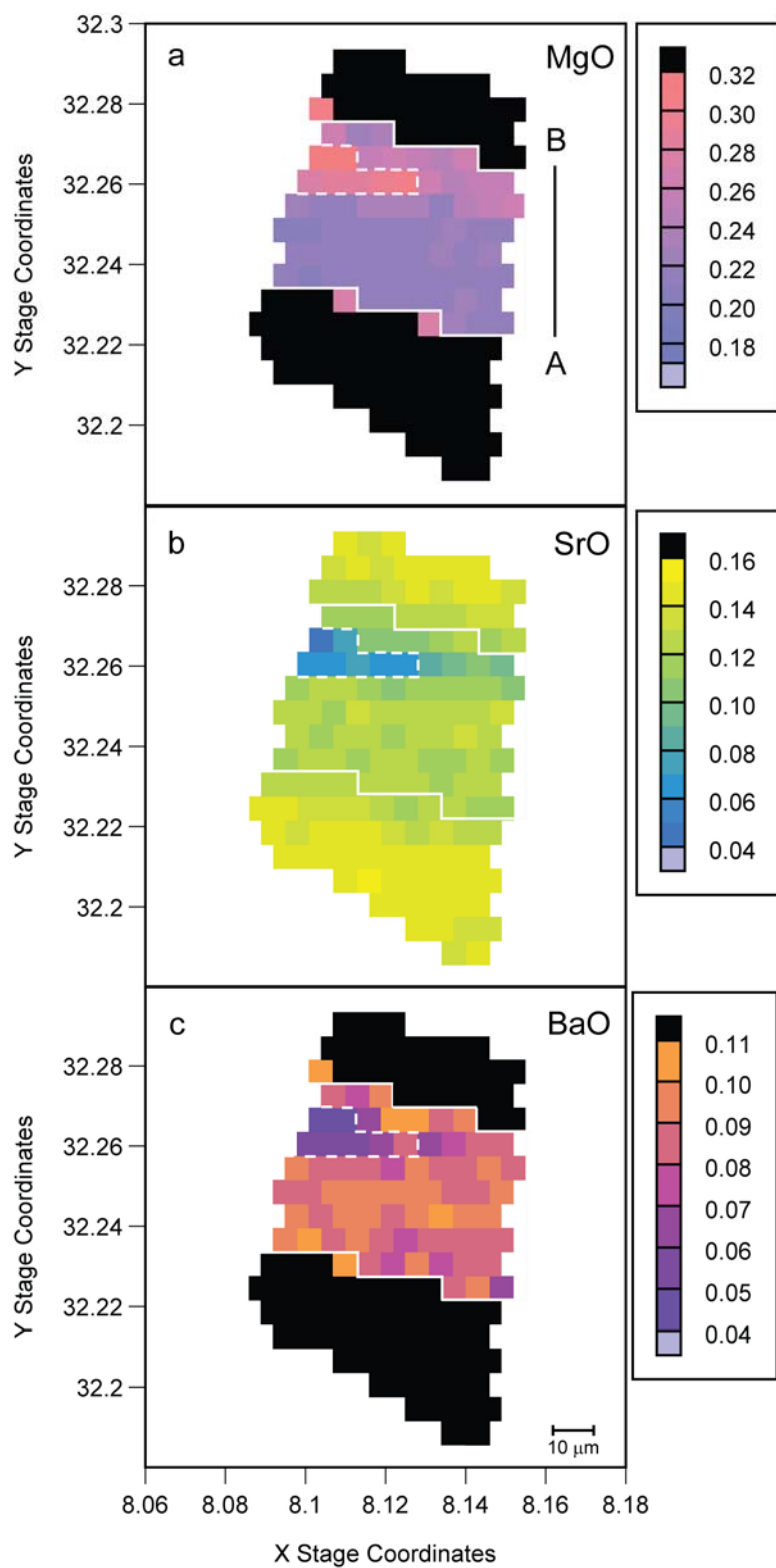


Figure A2.3. Sample 2b-2-2 (a) MgO, (b) SrO, (c) BaO maps (wt. %).

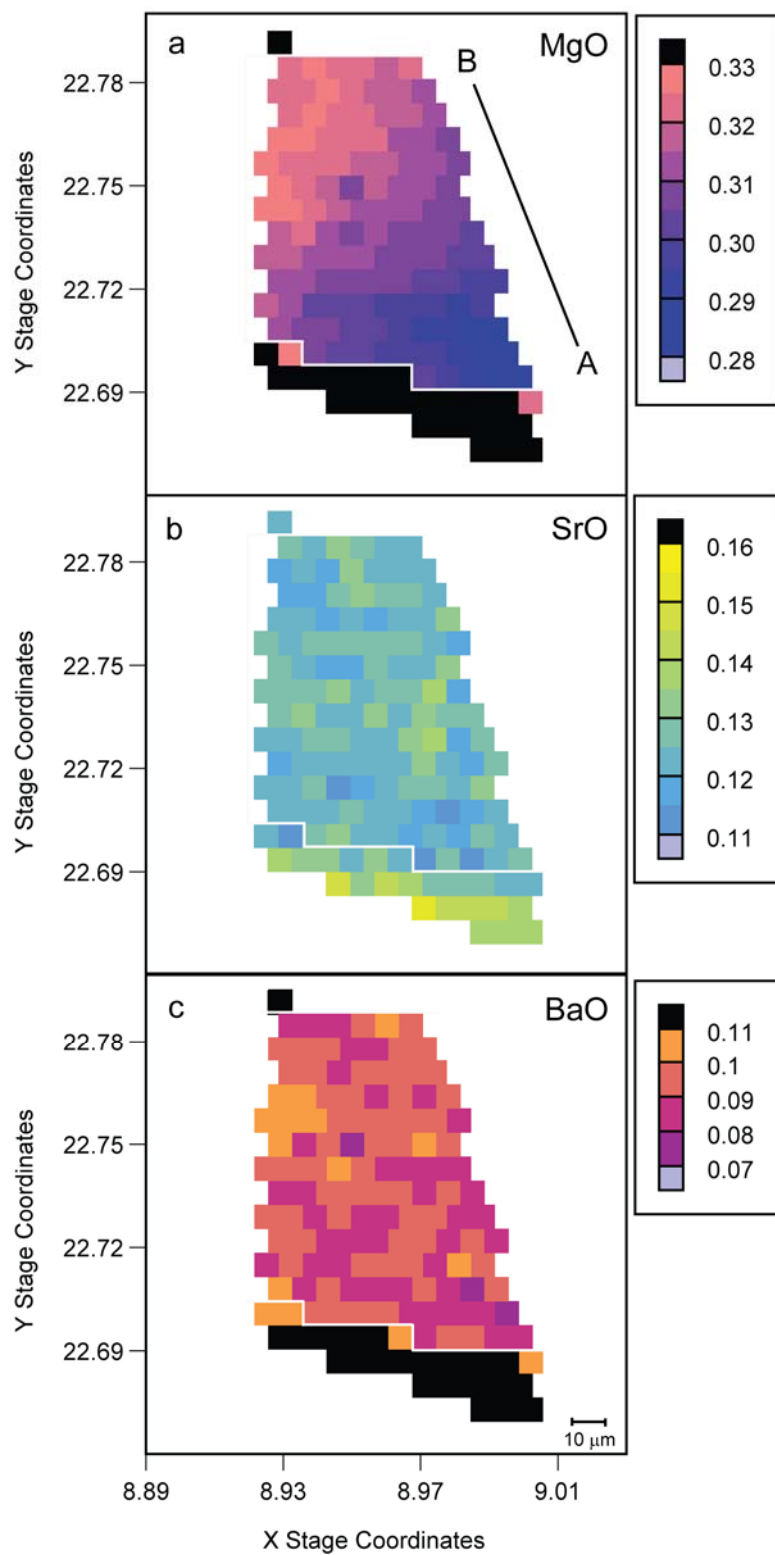


Figure A2.4. Sample 2b-3-2 (a) MgO, (b) SrO, (c) BaO maps (wt. %).

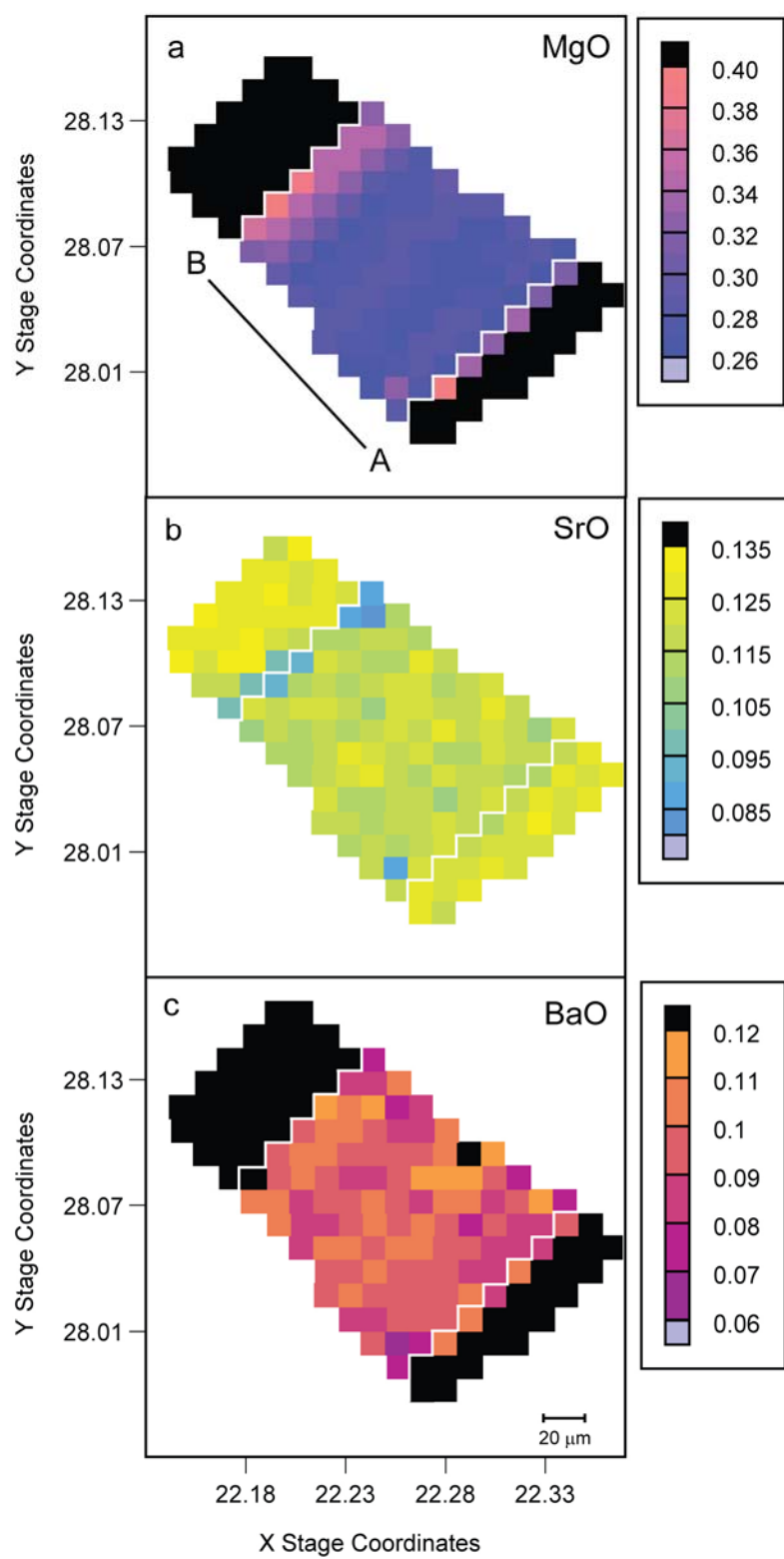


Figure A2.5. Sample 2b-4-2 (a) MgO, (b) SrO, (c) BaO maps (wt. %).

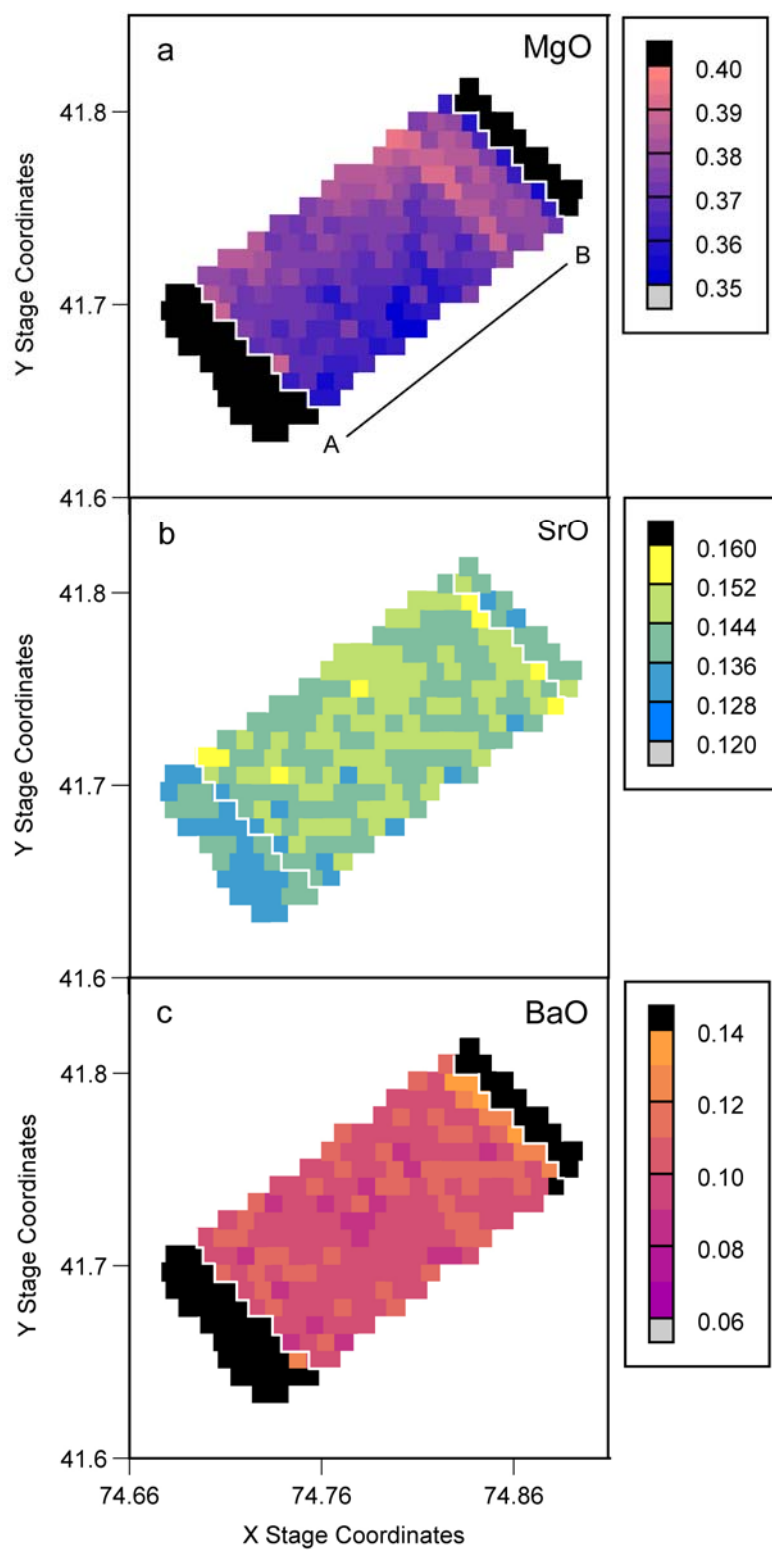


Figure A2.6. Sample 2b-5-2 (a) MgO, (b) SrO, (c) BaO maps (wt. %).

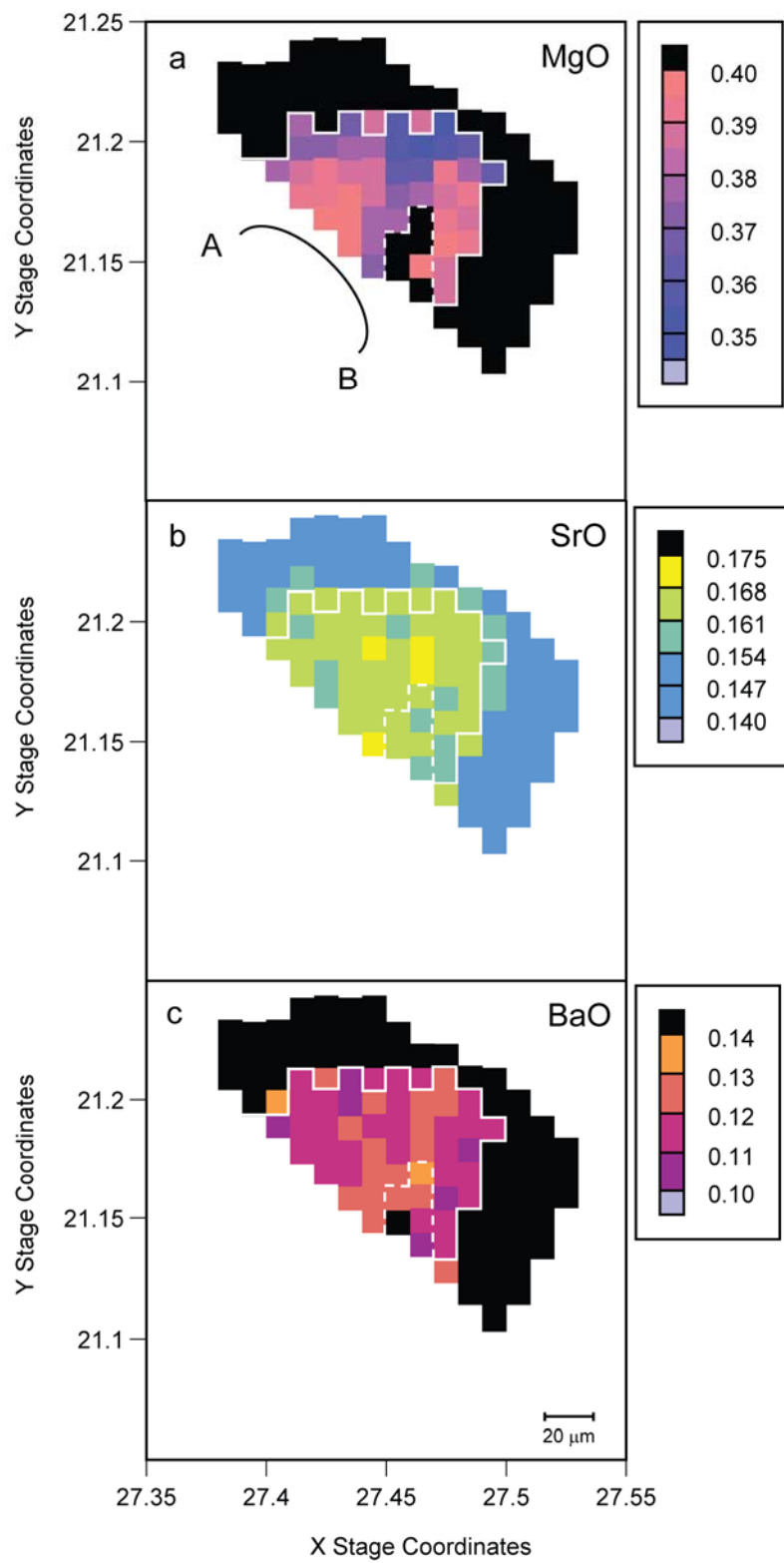


Figure A2.7. Sample 2b-6-2 (a) MgO, (b) SrO, (c) BaO maps (wt. %).

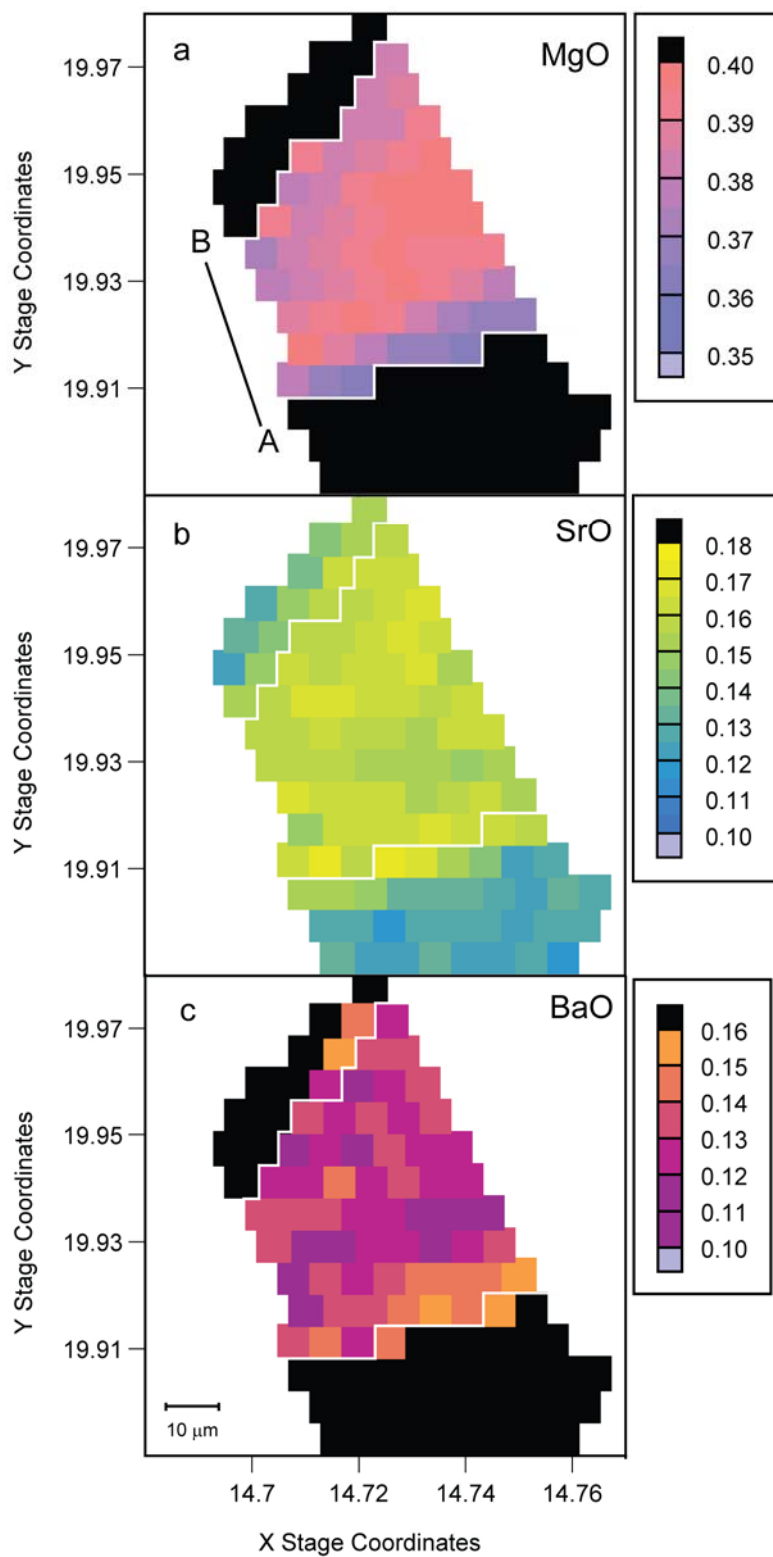


Figure A2.8. Sample 2b-7-2 (a) MgO, (b) SrO, (c) BaO maps (wt. %).

A2.3 Trace Element Summary Transects from 2-D Data of A2.2

While no evidence of major element zoning exists for anorthite crystals grown in the experiments described in chapter 2, the trace elements Mg, Sr, and Ba all display some degree of heterogeneity from core to rim in at least several of the sample transect summaries (Figure A2.9). SrO and BaO contents tend to display similar zoning behavior except for the crystal of 2b-1-2 in (a), where MgO and BaO closely track one another. Systematic trace element heterogeneity is not ubiquitous throughout this sample set and is barely present in several crystals, in particular (e) and (f). MgO zoning is most pronounced in (b) and (d), and in cases where one edge of a crystal clearly displayed higher MgO than the other, partition coefficients were calculated using data from the rim with the lower MgO content. Since the specific growth histories of each crystal are unknown, this approach assumed that growth may have been more rapid early during crystal formation and thus more likely to produce disequilibrium partitioning with higher levels of trace elements incorporated into the crystal structure.

Three crystals, labeled 'B' crystals, in 2b-1-2, 2b-4-2, and 2b-7-2, were also compositionally mapped to test if other crystals in these experiments would produce the same partition coefficients as the 'A' crystals. Results from the 'B' crystals confirmed the D values calculated from the 'A' data.

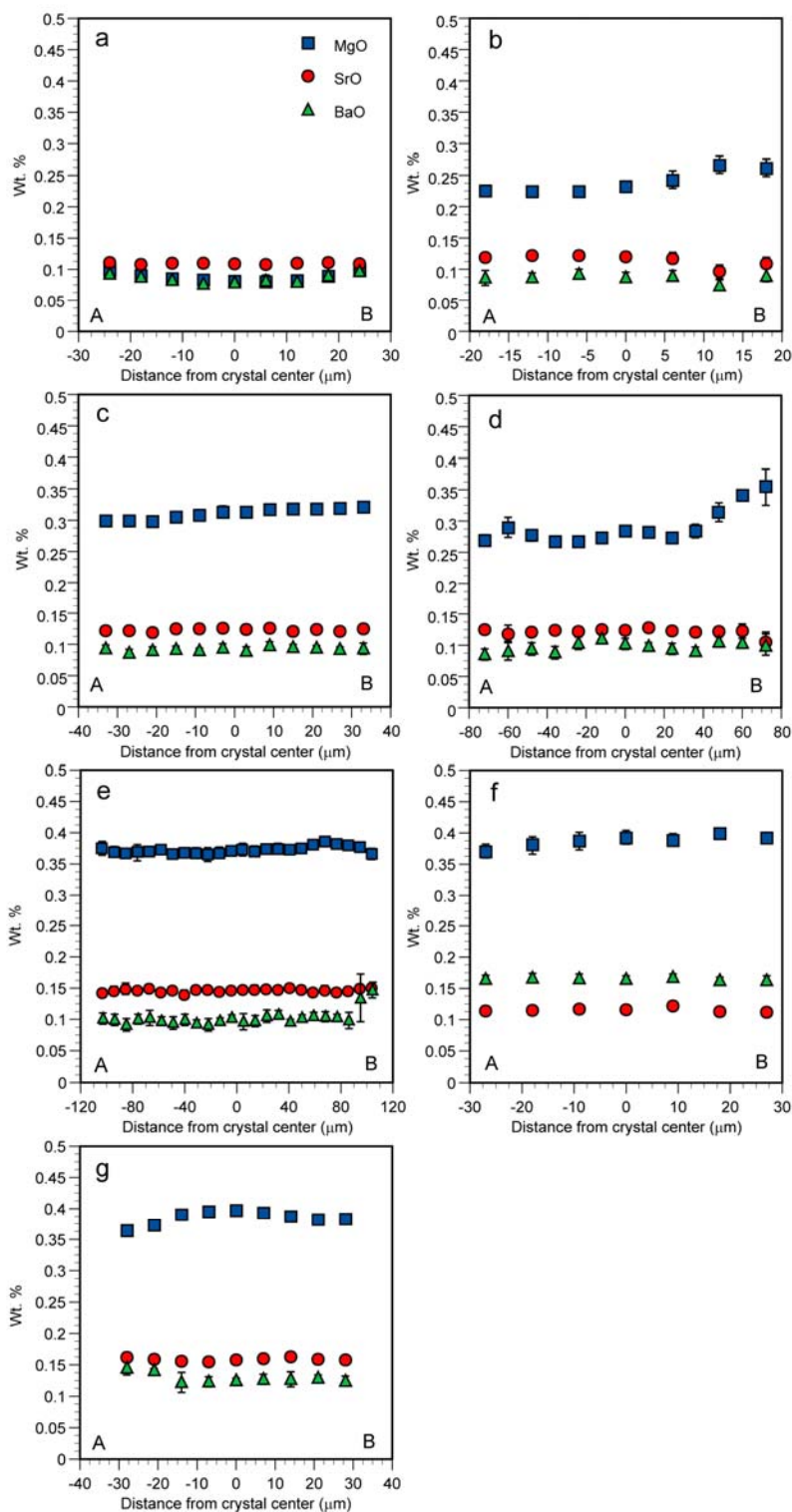


Figure A2.9. MgO (squares), SrO (circles), and BaO (triangles) transects summarizing zoning trends in the ‘A’ crystals of the seven melt composition grids in Section A2.2. 1 σ error is contained within the size of the symbols except where shown. (a) 2b-1-2, (b) 2b-2-2, (c) 2b-3-2, (d) 2b-4-2, (e) 2b-5-2, (f) 2b-6-2, (g) 2b-7-2.