

FIGURE OM1. Photomicrographs of typical boninite crystal assemblages. Photomicrographs (a), (b), and (f) are from sample U1439A-21X1 2-3, (c), (d), and (e) are from sample U1439C-28R2W 71-73. Sample U1439A-21X1 2-3 is an example of a highly crystalline boninite lava, while sample U1439C-28R2W 71-73 is an example of a glass rich boninite lava. OL = Olivine, LCPX = Low-Ca Pyroxene. Red circles in (c) and (f) highlight Cr spinel grains in crystals from both samples.

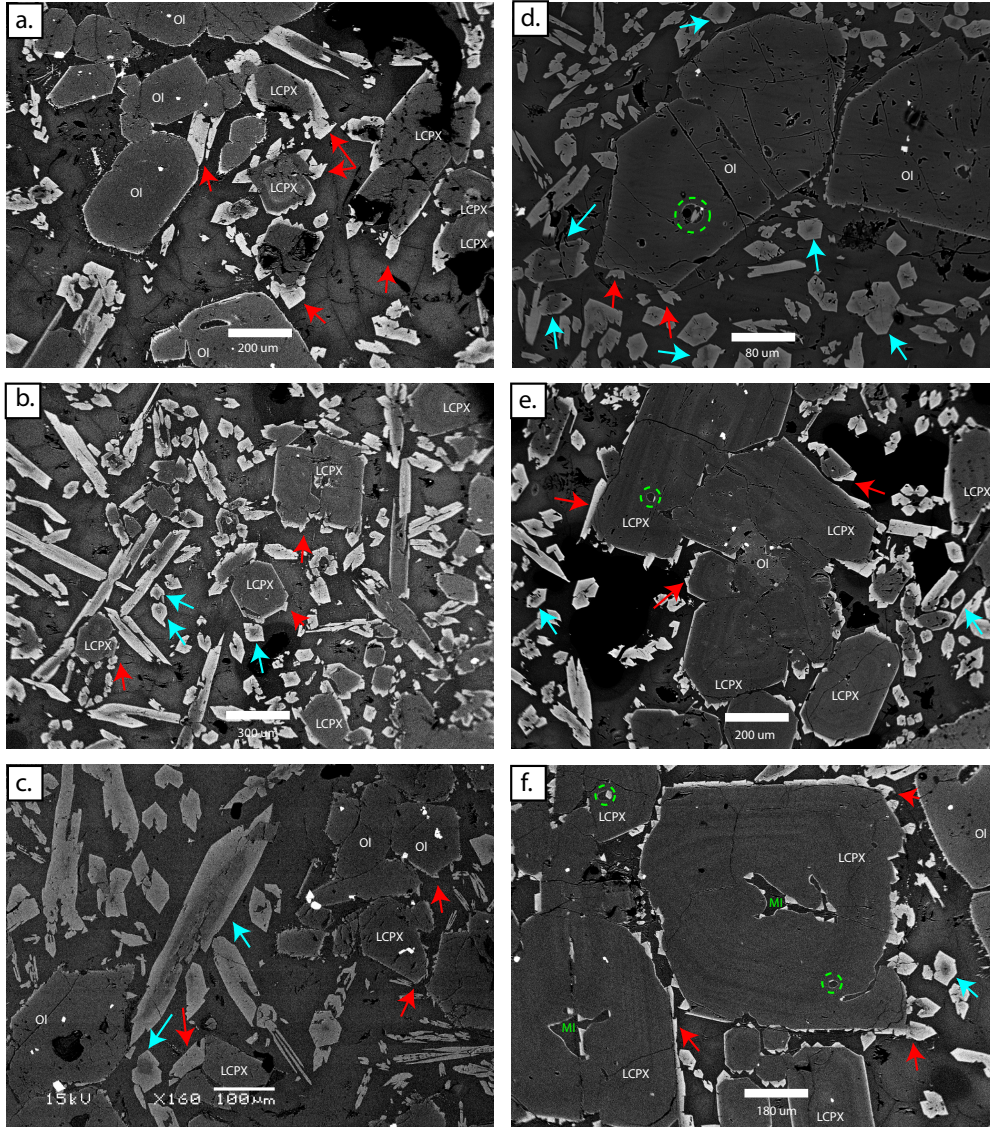
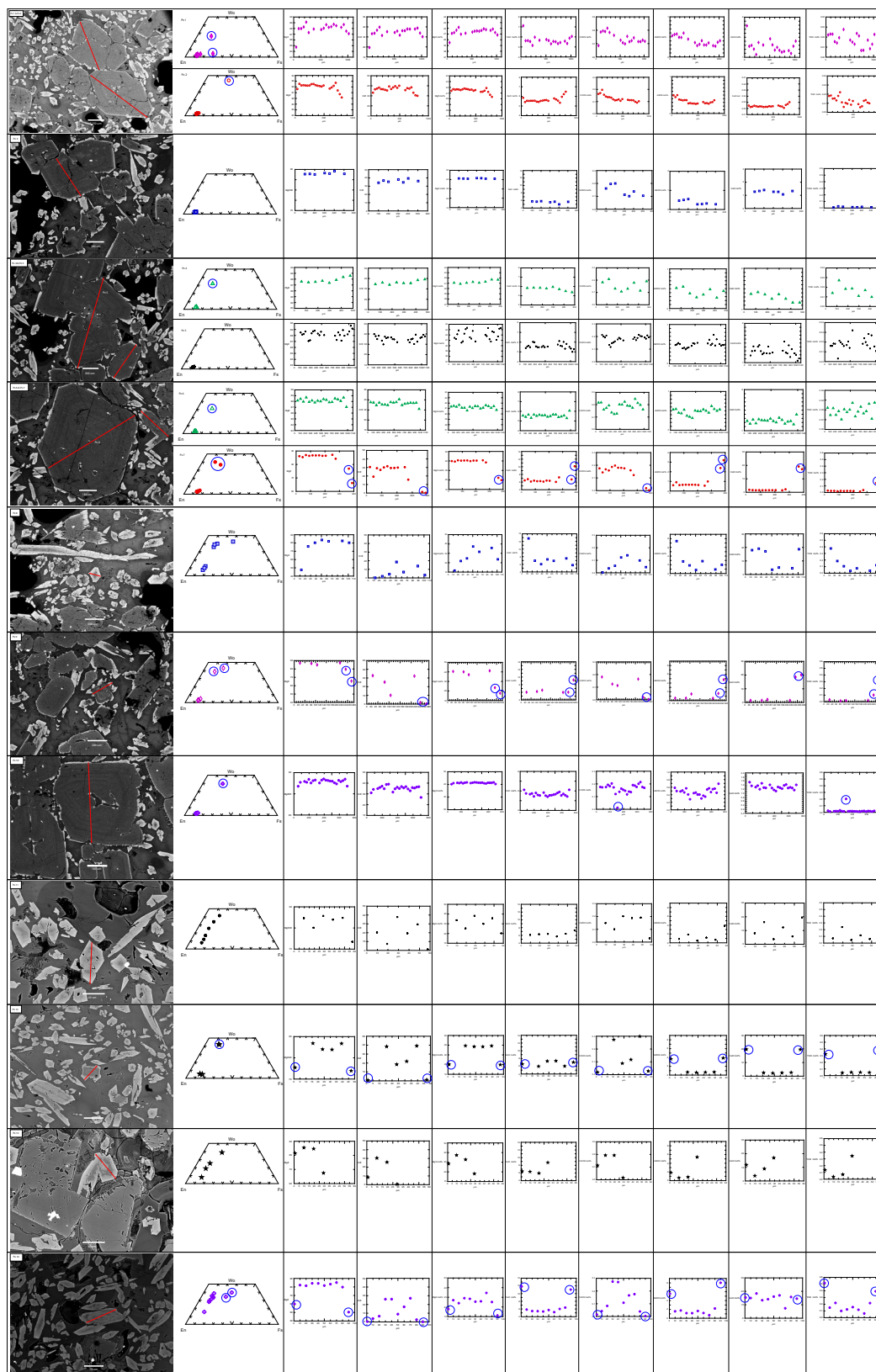


FIGURE OM2. BSE images of anomalous textures from the four samples, which are the focus of this study (samples U1439C-2R3W 2-3, U1439C-15R1W 8-10, U1439C-19R2W 46-48, and U1439C-25R2W 18-19). Images (b) and (f) from sample (2R3), (a) and (e) from sample (15R1), (c) from sample (19R2), and (d) from sample (25R2). White scale bar can be seen in the bottom center of each image. LCPX = Low Ca Pyroxene, Ol = Olivine. Red arrows in the images point to clinopyroxene overgrowths (in most cases, augite and anomalous Al-rich end-members), which nucleate off of olivine and low-Ca pyroxenes. Blue arrows point to groundmass pyroxenes that exhibit anomalous overgrowth and zoning textures (some exhibit oscillatory, normal, or reverse zoning). Green dashed circles in images (d), (e), and (f) highlight melt inclusion in the phenocrysts. The green MI label in image (f) is also meant to highlight larger melt inclusions, which are in zoned crystals.



(Caption on next page)

FIGURE OM3. Pyroxene chemical traverses from samples 2R3, 15R1, and 25R2. Labels (Px #) in the top left corner of each BSE image refers to the label used in Table OM3 to identify the individual pyroxene grains. A white scale bar can be found in the bottom center of each BSE. The red arrows in each BSE indicate the direction and length of the given chemical traverse (0 μm at the blunt end of the arrow and increasing in value towards the arrow). For BSE images with more than one chemical traverse, the labels (Px #) are also placed directly on the individual crystals analyzed in white. For these BSE images, the labels are also found to the top left of the pyroxene quadrilateral associated with each grain. Pyroxenes overgrowths and pyroxenes within melt inclusions are circled in blue on the pyroxene quadrilateral and on some elemental traverses (they were removed in some elemental traverses because they made it difficult to see chemical variation within low-Ca pyroxene cores). (Px 1) and (Px 2) are also referred to in Figures 4 & 6 within the paper. (Px 14) is referred to in Figure 8.

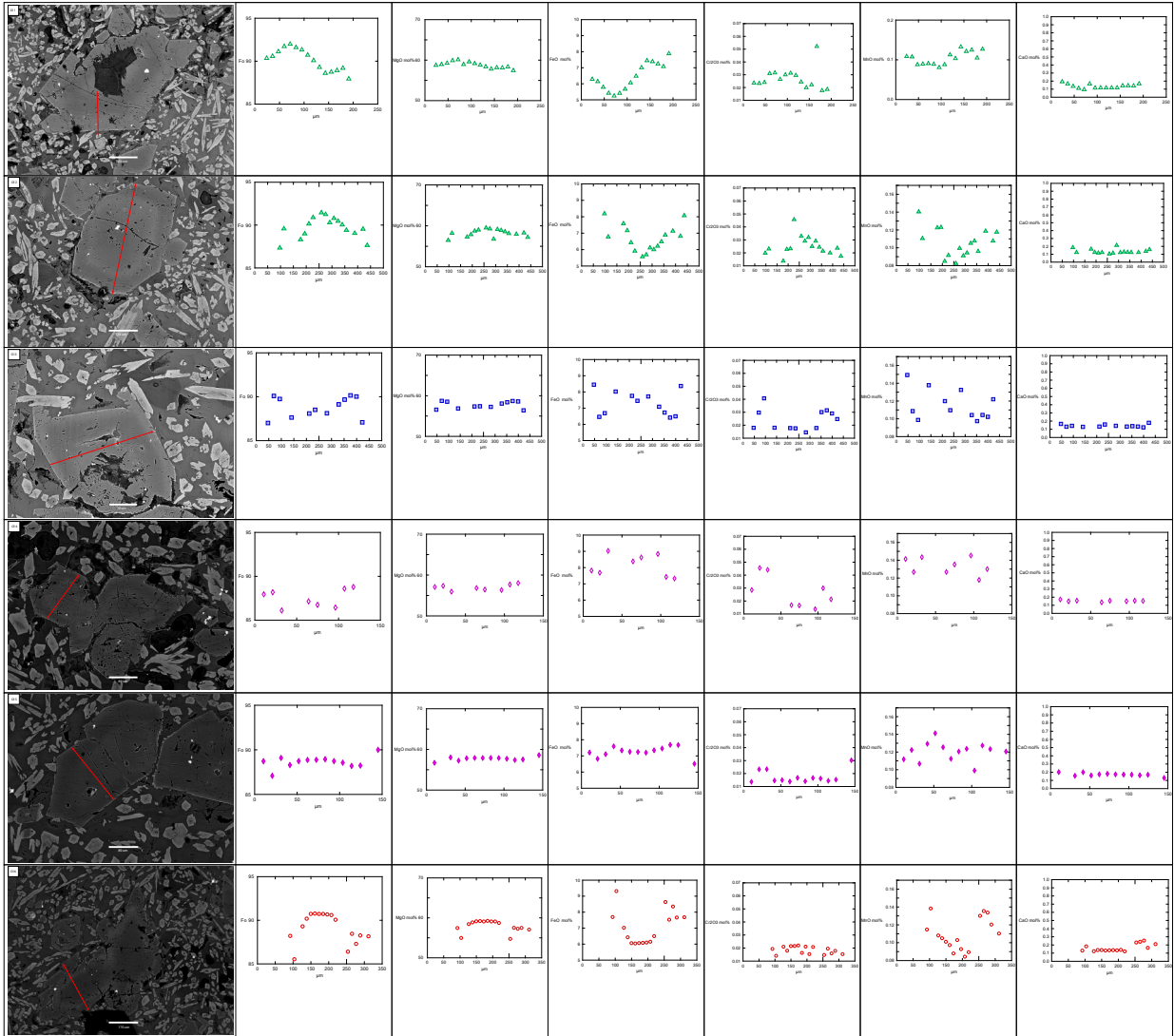


FIGURE OM4. Olivine chemical traverses from sample 25R2. Labels (OI #) in the top left corner of each BSE image refers to the label used in Table OM5 to identify the individual olivine grains. A white scale bar can be found in the bottom center of each BSE. The red arrows in each BSE indicate the direction and length of the given chemical traverse (0 μm at the blunt end of the arrow and increasing in value towards the arrow). (OI 1) is also referred to in Figure 5 within the paper. (OI 4) is referred to in Figure OM5.

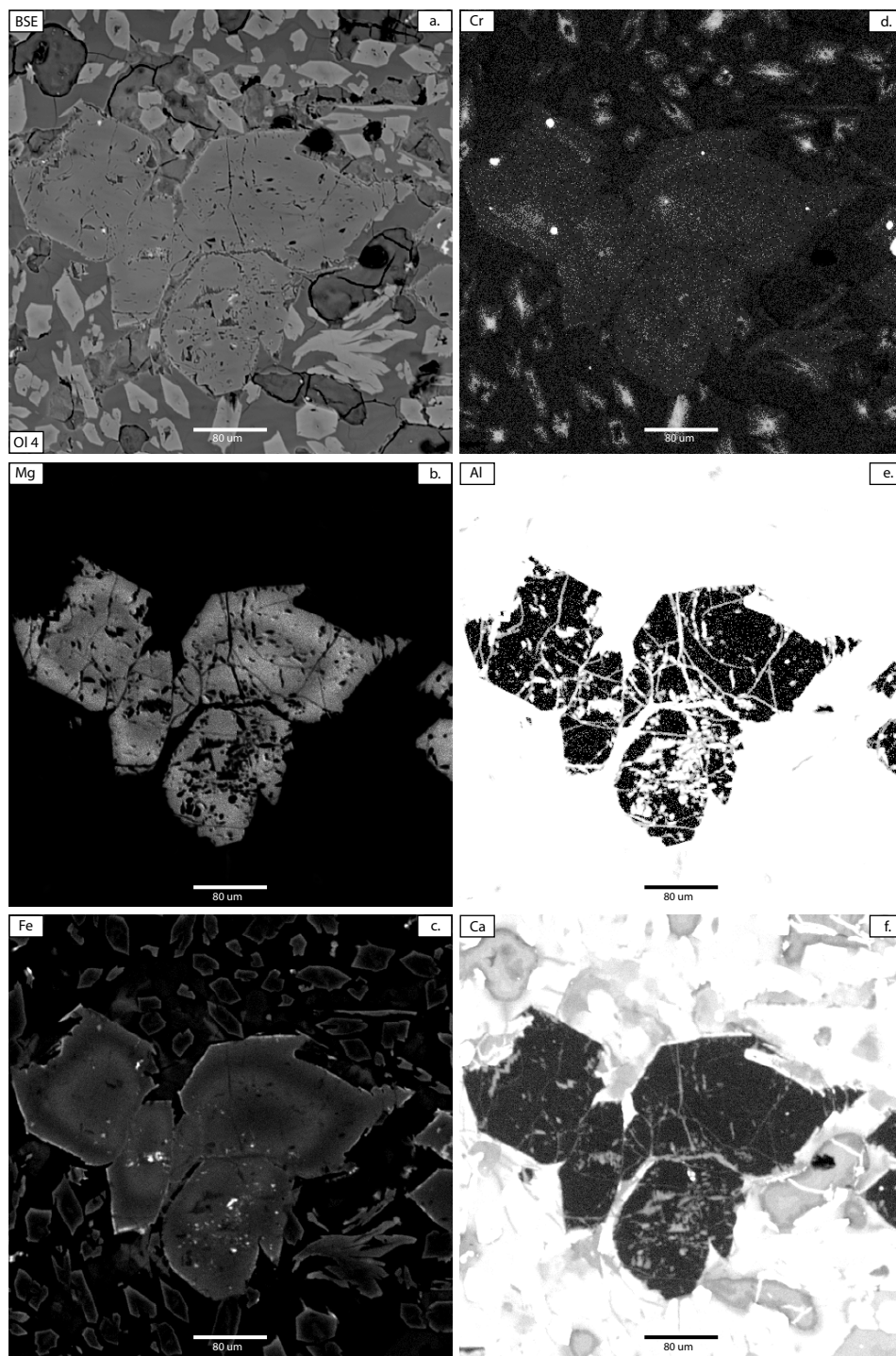


FIGURE OM5. Elemental maps of zoned olivine phenocrysts from sample 25R1. Label (Ol 4) in the bottom left-hand corner of BSE image (a) refers to the label used in Table OM5 and Figure OM4 to identify the individual olivine grains. BSE image (a) and elemental maps (b), (c), (d), (e), and (f) were produced using EPMA. Bright coloration in the elemental maps indicates enrichment in a given element, while darker coloration indicates depletion.

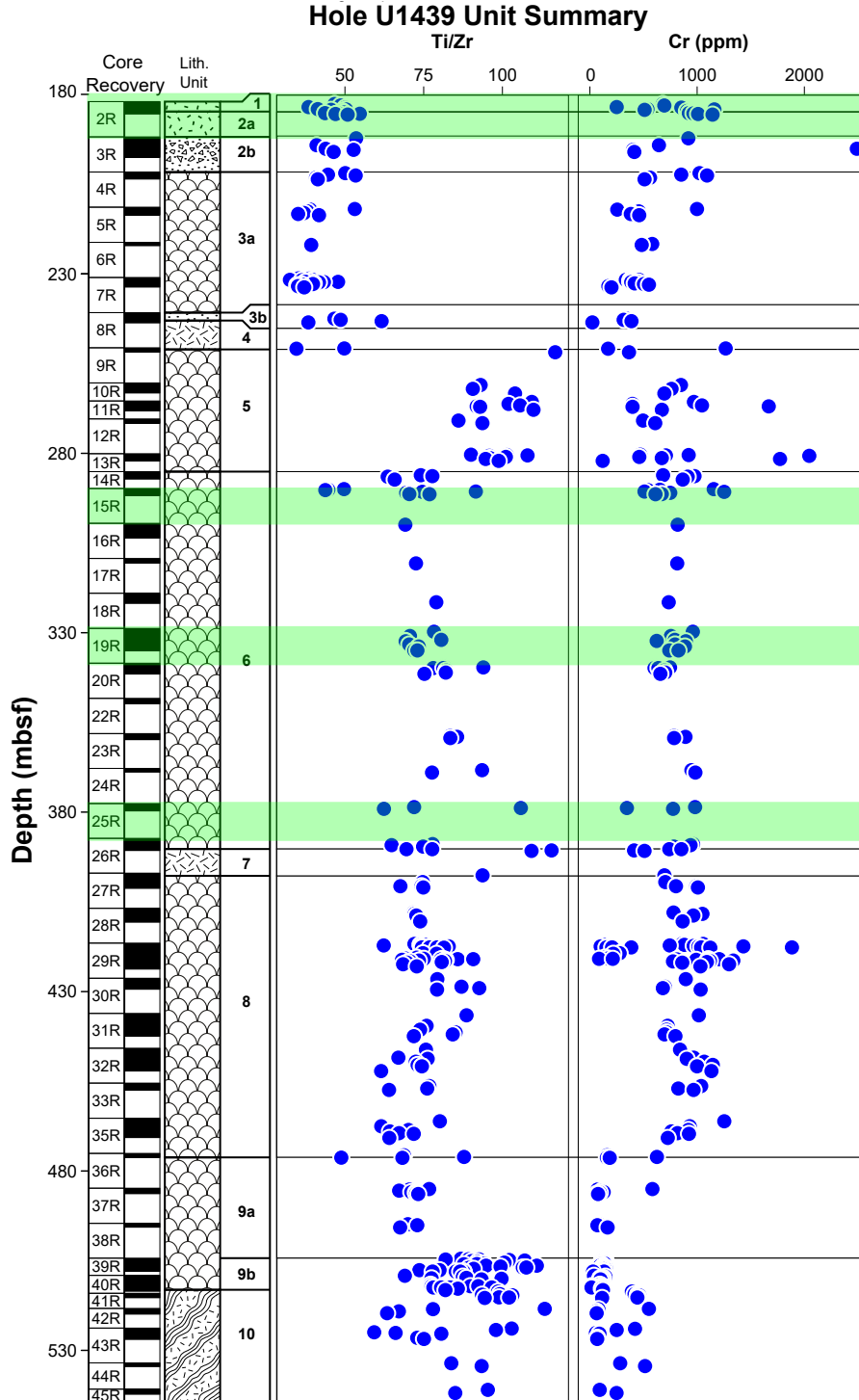


FIGURE OM6. Correlating samples with zones of high chemical variability within the core. The green lines cutting across the graphs indicate the location of the samples from this study within the core. Ti/Zr and Cr parts per million (ppm) are plotted in correlation to the given samples stratigraphic position. The correlation between samples from this study and zones of high chemical variability in the core is likely due to the open system magmatic processes that effected the lavas upon ascent. Modified after Ryan et al. (2017).

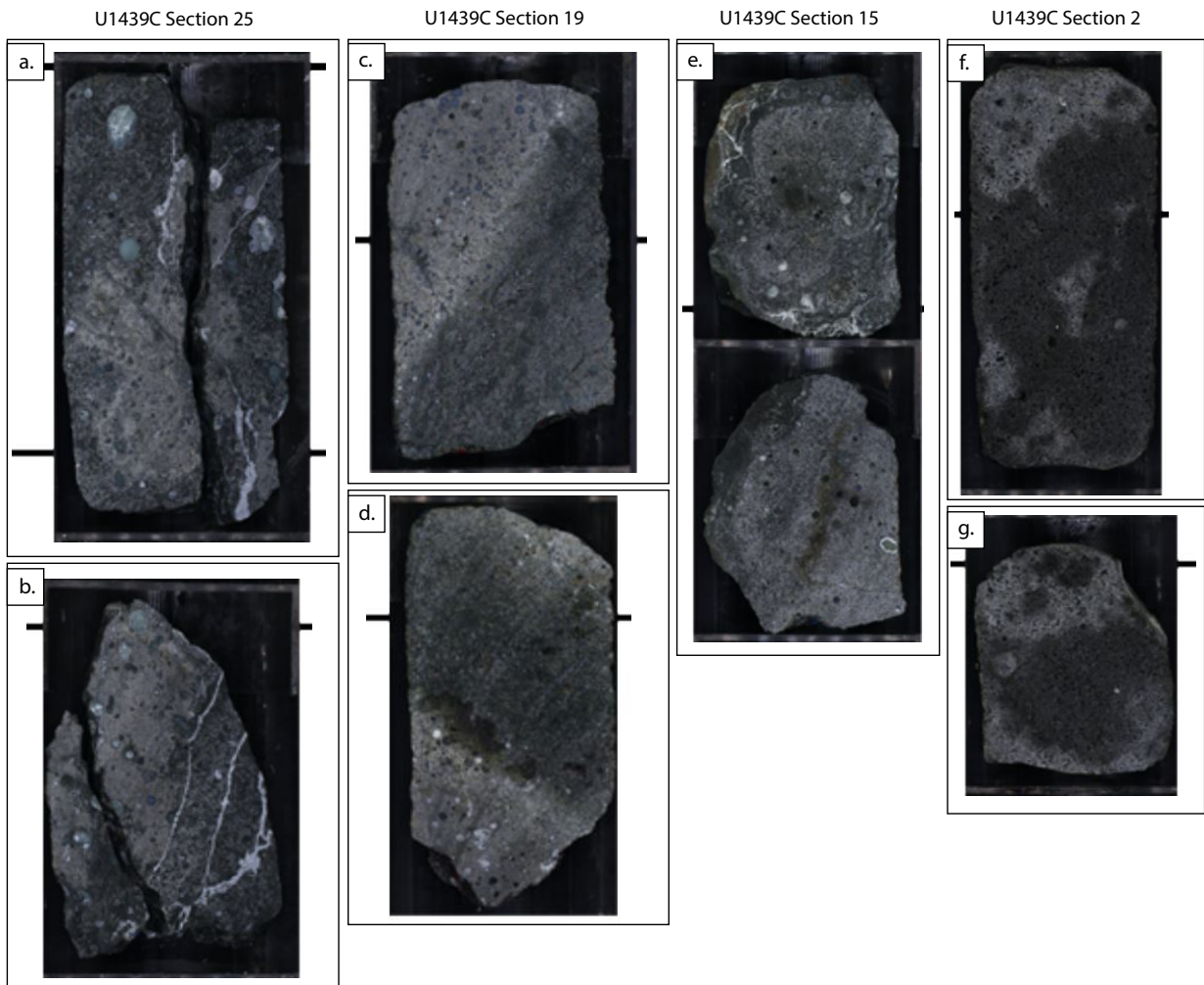


FIGURE OM7. Magma mingling textures observed in core U1439C from IODP expedition 352. Textures in this figure were all observed in sections of the core, which also correlate to the samples which exhibit anomalous zoning in this study (as indicated by the labels above each set of image).

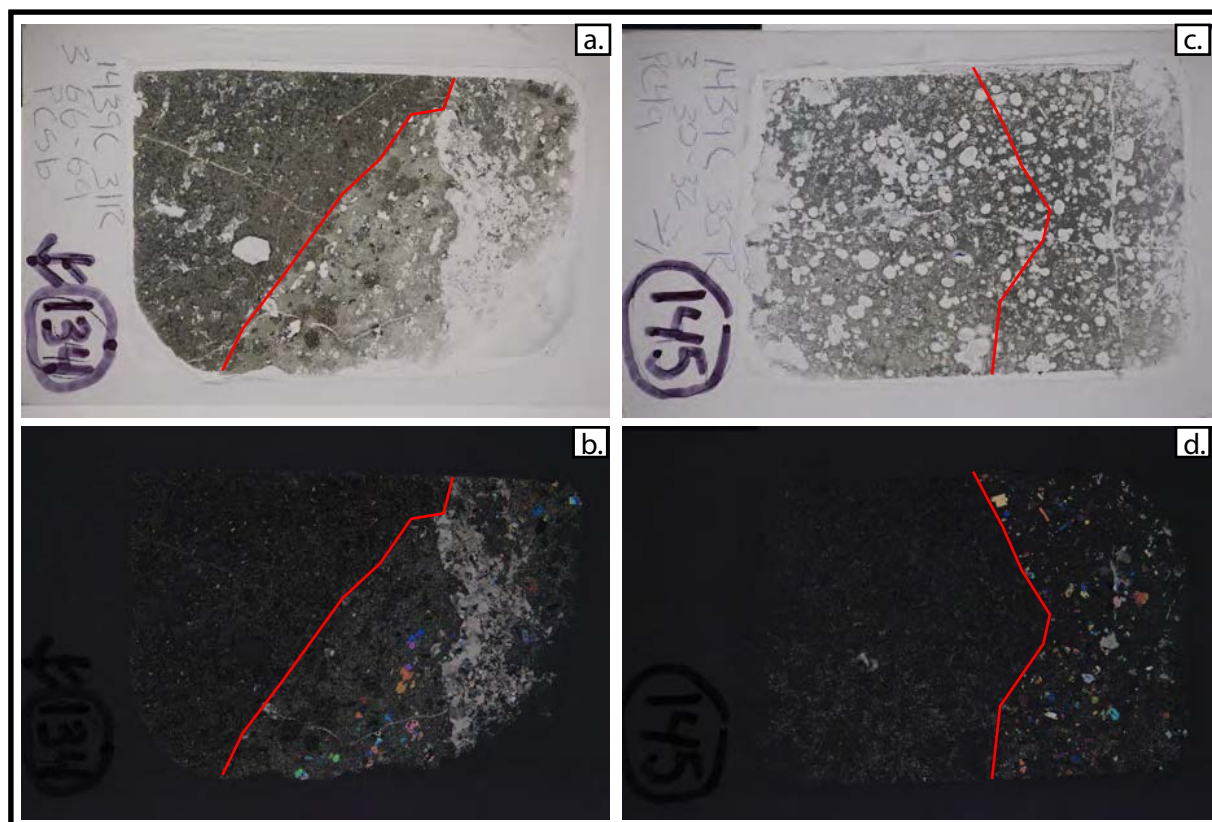


FIGURE OM8. Mixing textures in boninite lavas at thin-section scale. Full thin section photomicrographs of samples U1439C-31R-3 66-69 (**a** & **b**) and U1439C-35R-3 (**c** & **d**). Photomicrographs (**a** & **c**) were captured using plane-polarized light (PPL), while (**b** & **d**) were captured with cross-polarized light (XPL). Red lines across the samples represent the interface between the interacting lavas. On the left side of both samples, aphyric lavas which contain groundmass Cpx can be seen while the right side of the samples contain lavas with olivine and Opx phenocryst and Cpx-rich groundmass. Images can be found in the IODP Expedition 352 proceedings with the preliminary expedition report (i.e., Reagan et al. 2014, 2015).