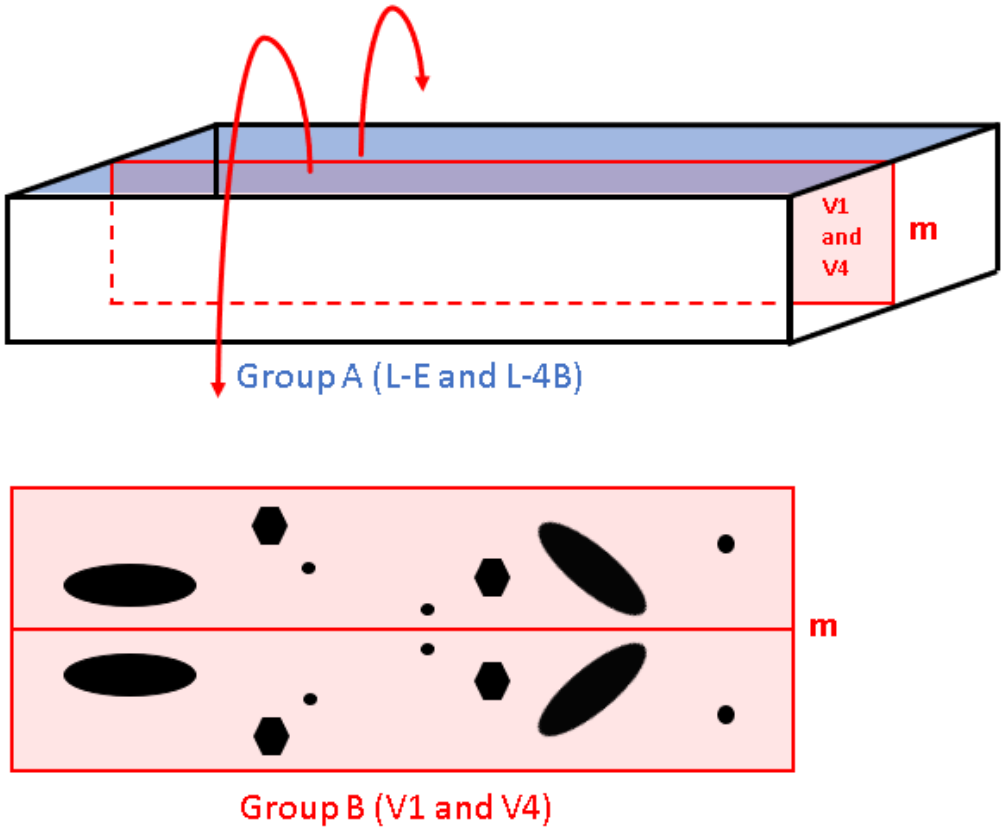
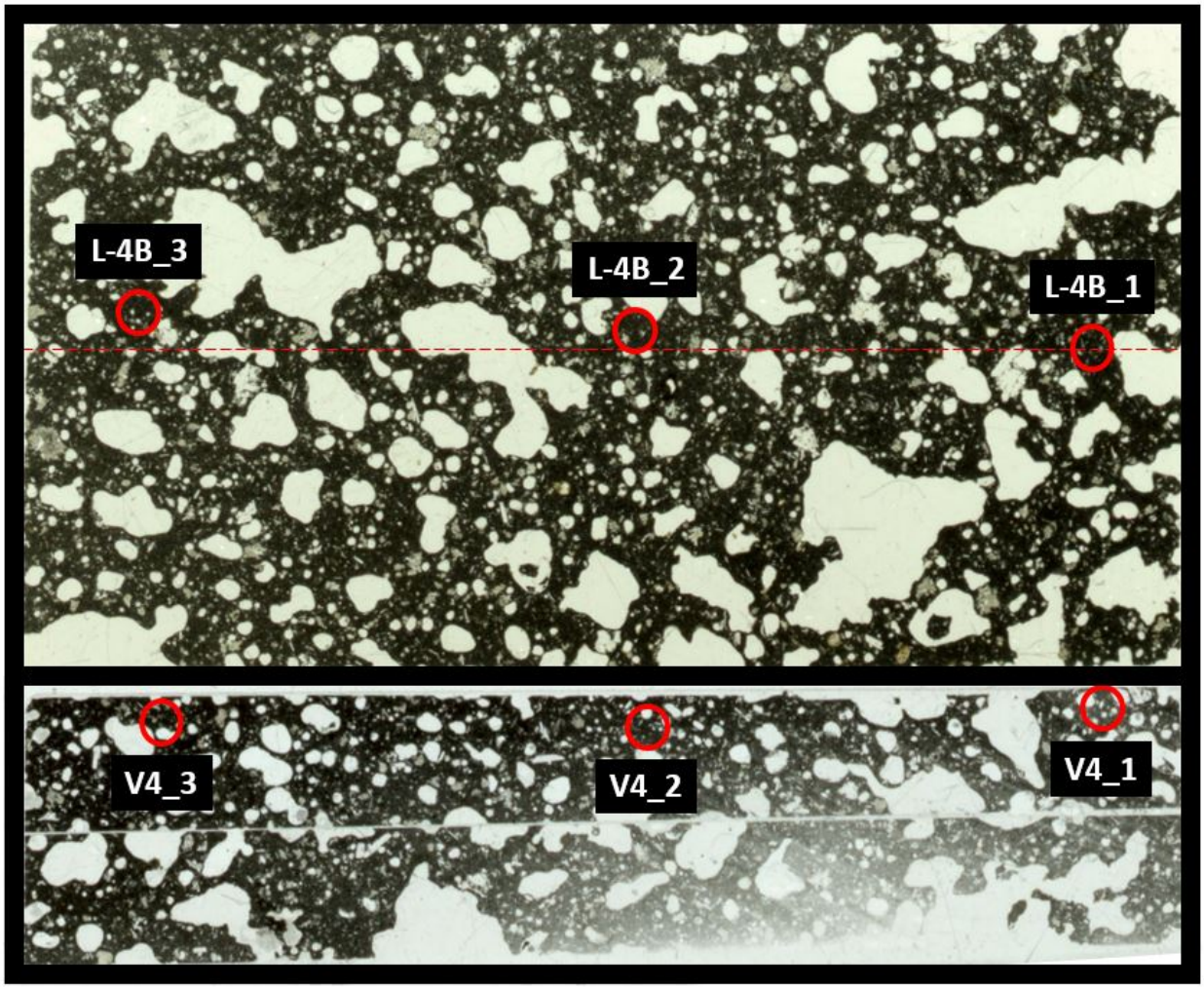
Supplemental Figure 1



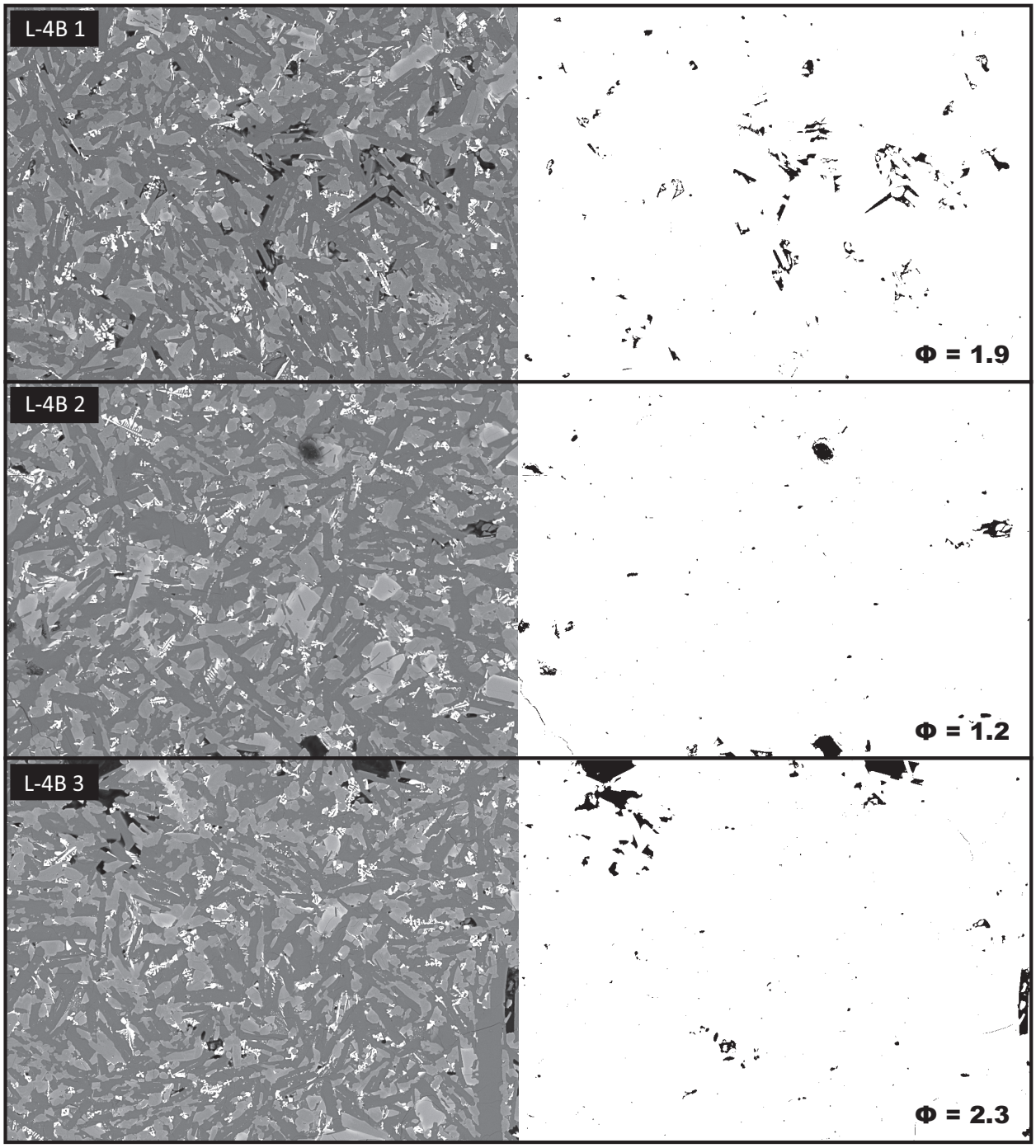
Supplemental Figure 1. The original billets from L-4B and L-E (the orientations of which are indicated by the blue plane in the top figure) were cut lengthwise down the center and opened and rotated 90° in the direction of the arrows, with the newly exposed faces (red surface in the bottom and top figure) serving as the new surfaces of orthogonally oriented V4 and V1, respectively.

Supplemental Figure 2



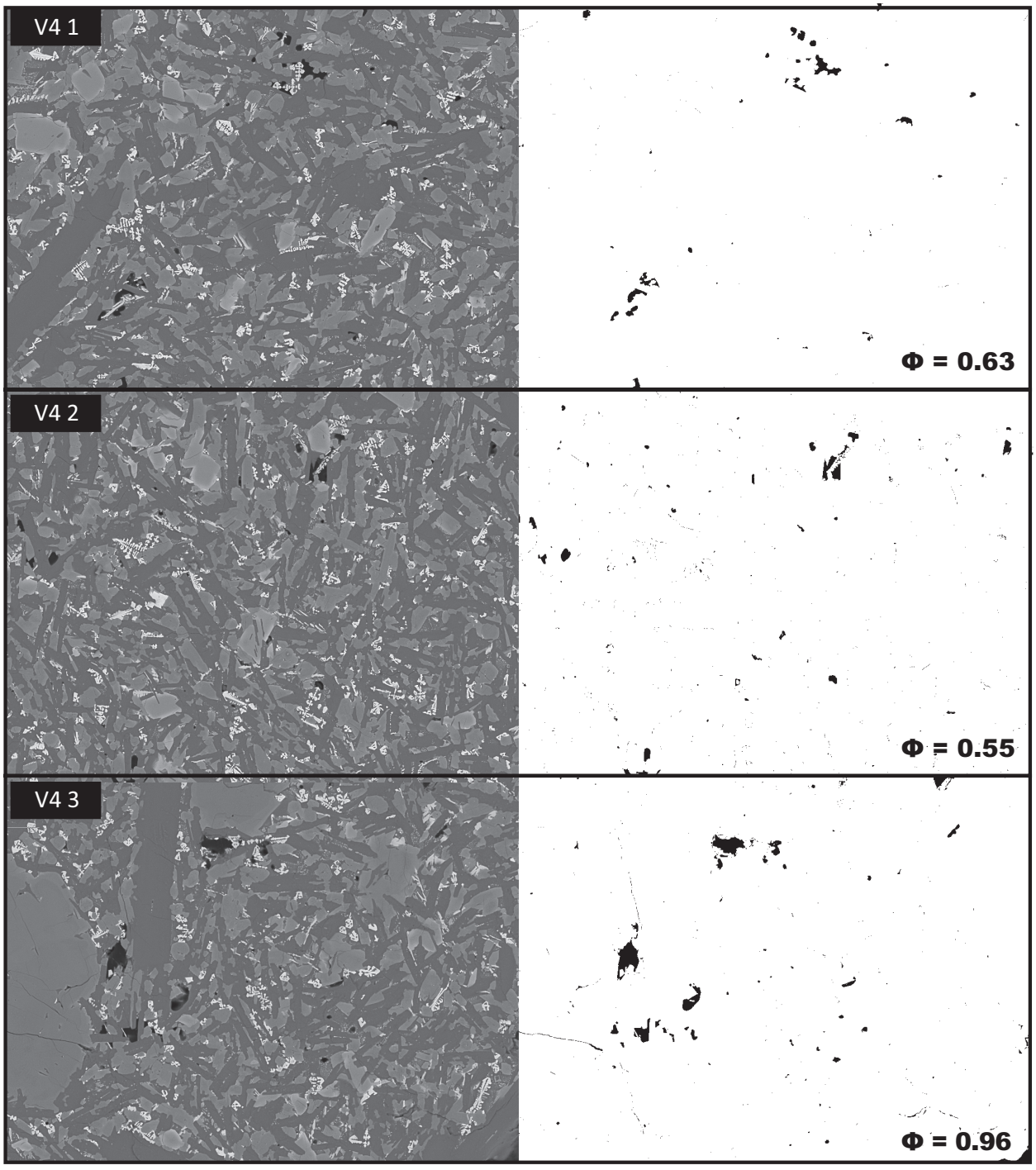
Supplemental Figure 2. The red circles represent the six regions from which BSE images were produced. L-4B (upper image, carbon coated) and orthogonally oriented V4 (lower image, pre-carbon coated) were sampled for groundmass crystal lengths only (crystal lengths under 150 μm). Since V4 is produced from a mid-sectional cut along the elongated direction of the billet from L-4B, more proximal areas to regions chosen in L-4B are closer to the upper and lower regions of the elongated direction as shown in V4. Bright region at the bottom-right is due to increased thinness of sample in that area. Field of view is ~30mm across.

Supplemental Figure 3



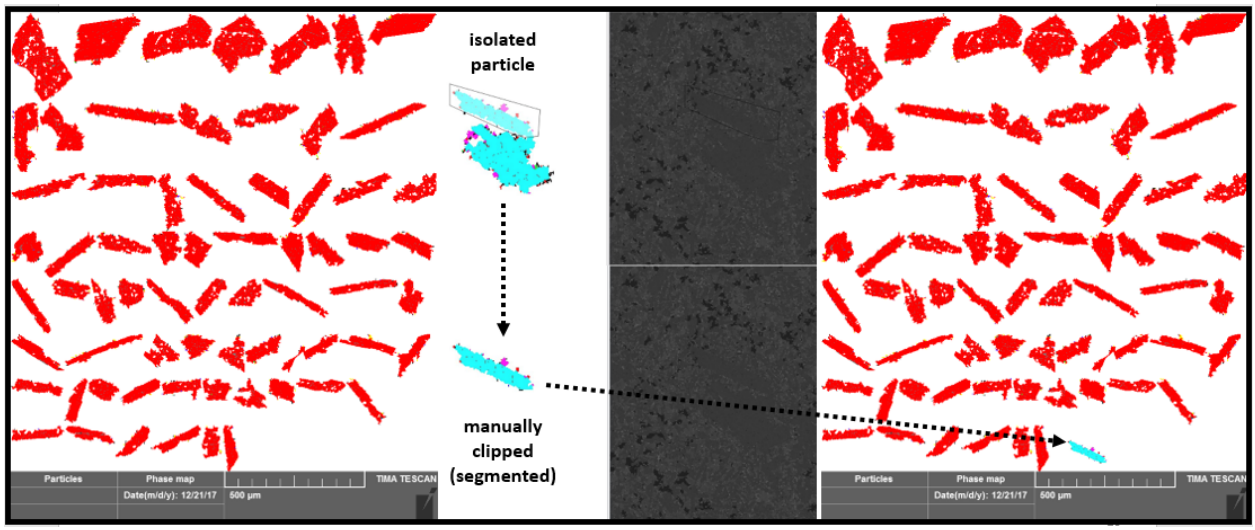
Supplemental Figure 3. ~300 µm x ~250 µm BSE images from L-4B (Group A). Supplemental Figure 2 shows the location of the sampled groundmass areas. Feldspars appear dark gray. Microlite texture appears random with minimal porosity (Φ) regions chosen. Areas near vesicles were avoided. Lighter phases are olivine, clinopyroxene and opaques.

Supplemental Figure 4



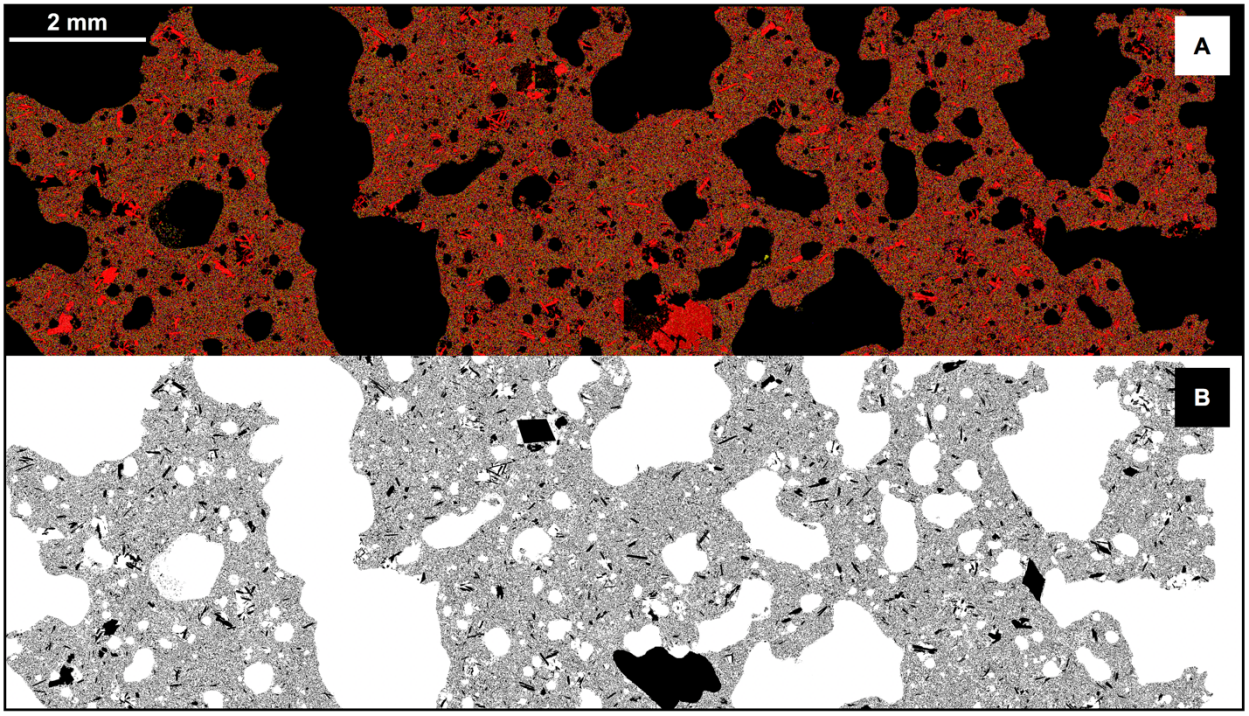
Supplemental Figure 4. ~300 µm x ~250 µm BSE images from V4 (Group B), orthogonal to L4B. The three regions are spatially close to group A groundmass areas sampled in Supplemental Figure 1 but represent a perpendicular cut section. Elongated dark gray shapes are plagioclase, similar to that in Supplemental Figure 3. Only plagioclase ≤150 µm based on the long axis measurement were considered here.

Supplemental Figure 5



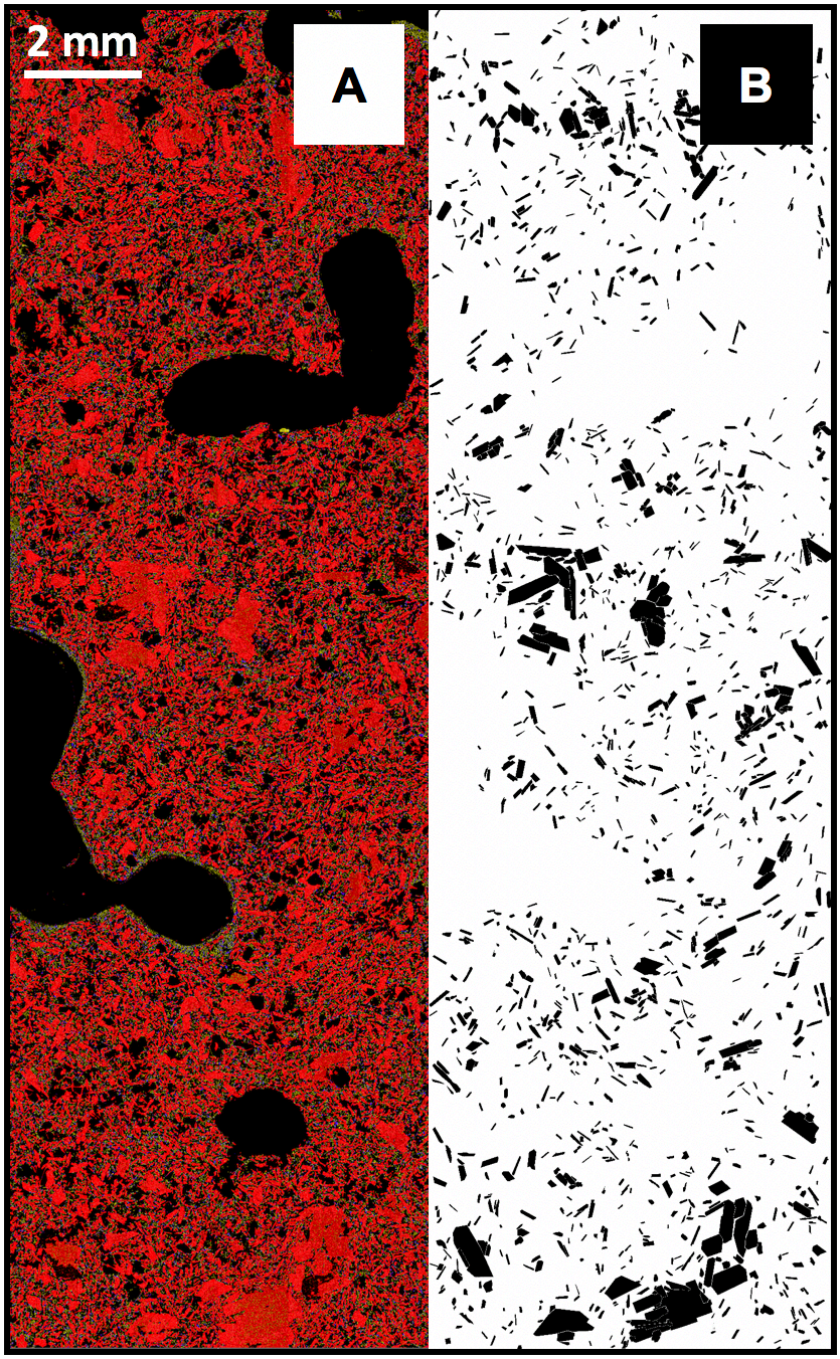
Supplemental Figure 5. An example of segmenting, or digitally clipping, a larger plagioclase cluster into smaller components. A particle from an isolated-particle image (left) is selected (center-left, in blue) and manually separated into smaller particles. The goal is to create discrete crystals for length measurements in ImageJ. The particle is then automatically placed back into the isolated-particle image (right) by size rank according to the diameter of a best-fit circle.

Supplemental Figure 6



Supplemental Figure 6. L-4B TIMA panoramic SEM-EDS image (A). Plagioclase crystals that displayed scanning issues, missing pixels or excessive fracturing were manually traced and filled in (B) by comparing the image to the thin section photomicrograph/polarizing microscope image.

Supplemental Figure 7



Supplemental Figure 7. L-E TIMA panoramic SEM-EDS image (A). Plagioclase crystals that displayed scanning issues, missing pixels or excessive fracturing were manually traced and filled in (B) by comparing the image to the thin section photomicrograph/polarizing microscope image.