







Supplementary Material for:
Improving magmatic CO₂ reconstruction using X-ray Computed Tomography to accurately quantify melt inclusion volumes and geometries

 Helen R. Thornhill *^α,  David J. Ferguson^α,  Alice Macente^{β,γ},  Felix O. Boschetty^{δ, ε},
 Eduardo Morgado^ζ, and  Jason Harvey^α

^α School of Earth and Environment, University of Leeds, Leeds, UK.

^β School of Civil Engineering, University of Leeds, Leeds, UK.

^γ Department of Earth Sciences, University of Florence, Florence, Italy.

^δ Department of Earth Sciences, University of Manchester, Manchester, UK.

^ε Department of Earth Sciences, University of Oxford, Oxford, UK

^ζ Escuela de Geología, Universidad de Mayor, Santiago, Chile.

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Thornhill et al. (2026) should be cited if this material is used independently of the article.

S1 XCT IMAGE PROCESSING WORKFLOW

This is an overview of the general image processing workflow used on all the XCT data from this study to extract melt inclusion data including volumes, geometrical information and orientation data (Figure S1).

A screenshot of a typical Avizo workflow tree is also provided, showing the general workflow required for the processing of each crystal. The watershed segmentation is repeated three times, varying the thresholding values inputted into the algorithm to investigate the uncertainty for each melt inclusion volume.

S2 OPTICAL BUBBLE MEASUREMENTS

A subset of 28 bubbles were measured optically to compare with XCT-generated bubble volumes. This is to highlight the limitations associated with voxel size. As bubbles are significantly smaller than inclusions and generally spherical, it is more efficient to calculate bubble volume from optical measurements. On average it is likely that XCT was underestimating bubble volumes by an average of around 19% (Figure S3).

The bubbles that were measured optically are shown in Figure S4, the red scalebar denotes 100µm.

S3 MELT INCLUSION VOLUMES AND XCT DATA

An excel spreadsheet is provided separately containing the XCT data generated for each melt inclusion in this study.

S4 XCT IMAGE DATA

The original XCT data files are available upon request. Sub-volumes and segmented examples are also available at request, however the Avizo filetype (.am) can only be opened in the Avizo software.

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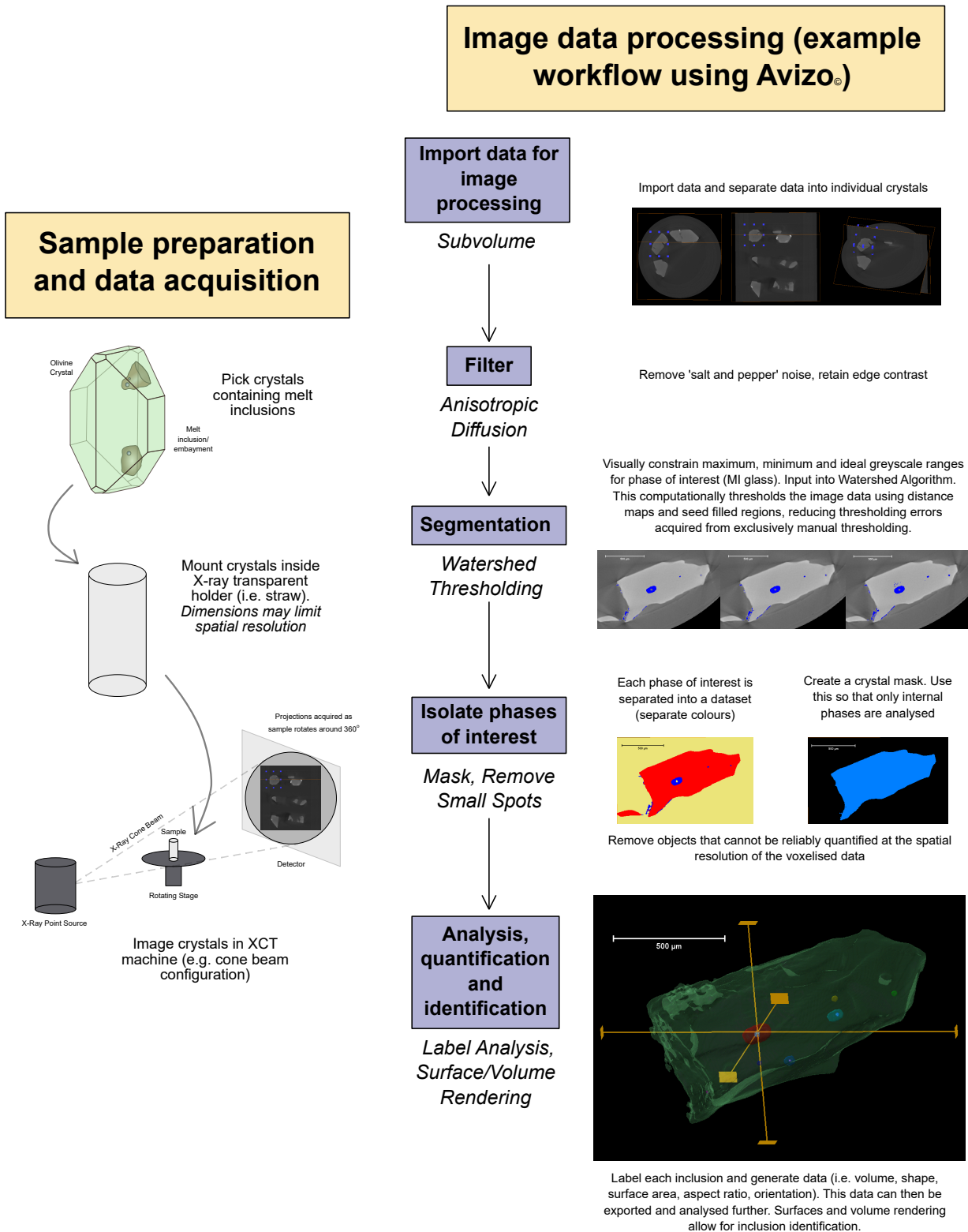


Figure S1: XCT image processing workflow - made for Avizo but can be adapted to any image processing software.

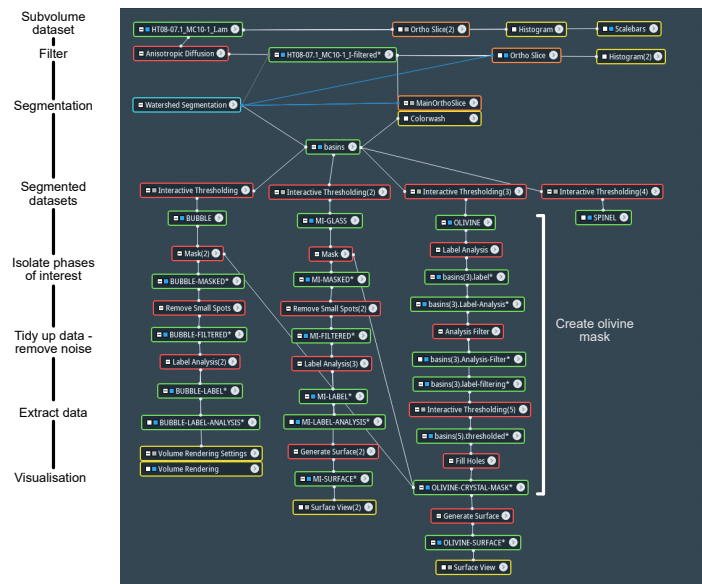


Figure S2: Screenshot of an example Avizo workflow tree showing the typical steps necessary for processing of each subvolume. This is repeated three times for a maximum, minimum and ideal volume for the phases of interest (V2, V3 and V1 respectively).

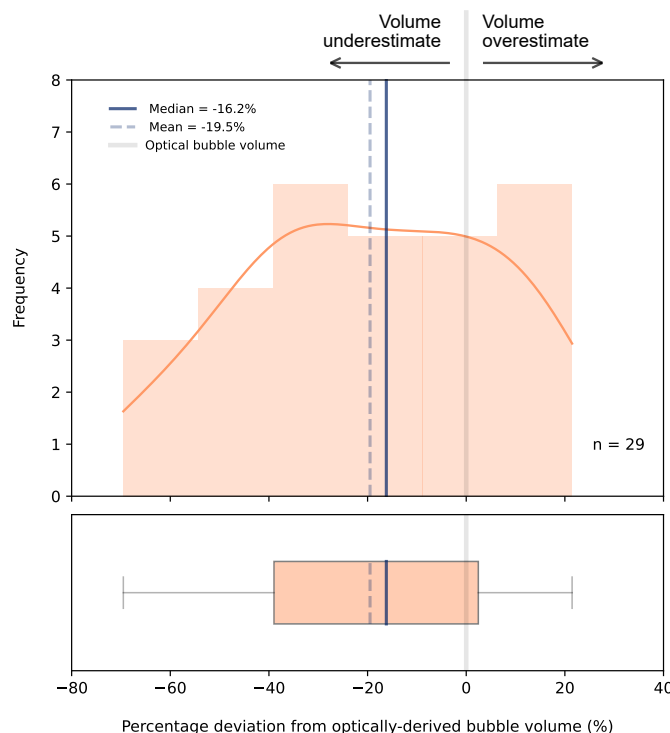


Figure S3: Histogram showing the comparison of the volumes of 28 bubbles measured optically against XCT-generate volumes. XCT underestimates bubble volumes by an average of around 19% due to limitation in spatial resolution due to scan dimensions and voxel sizes.

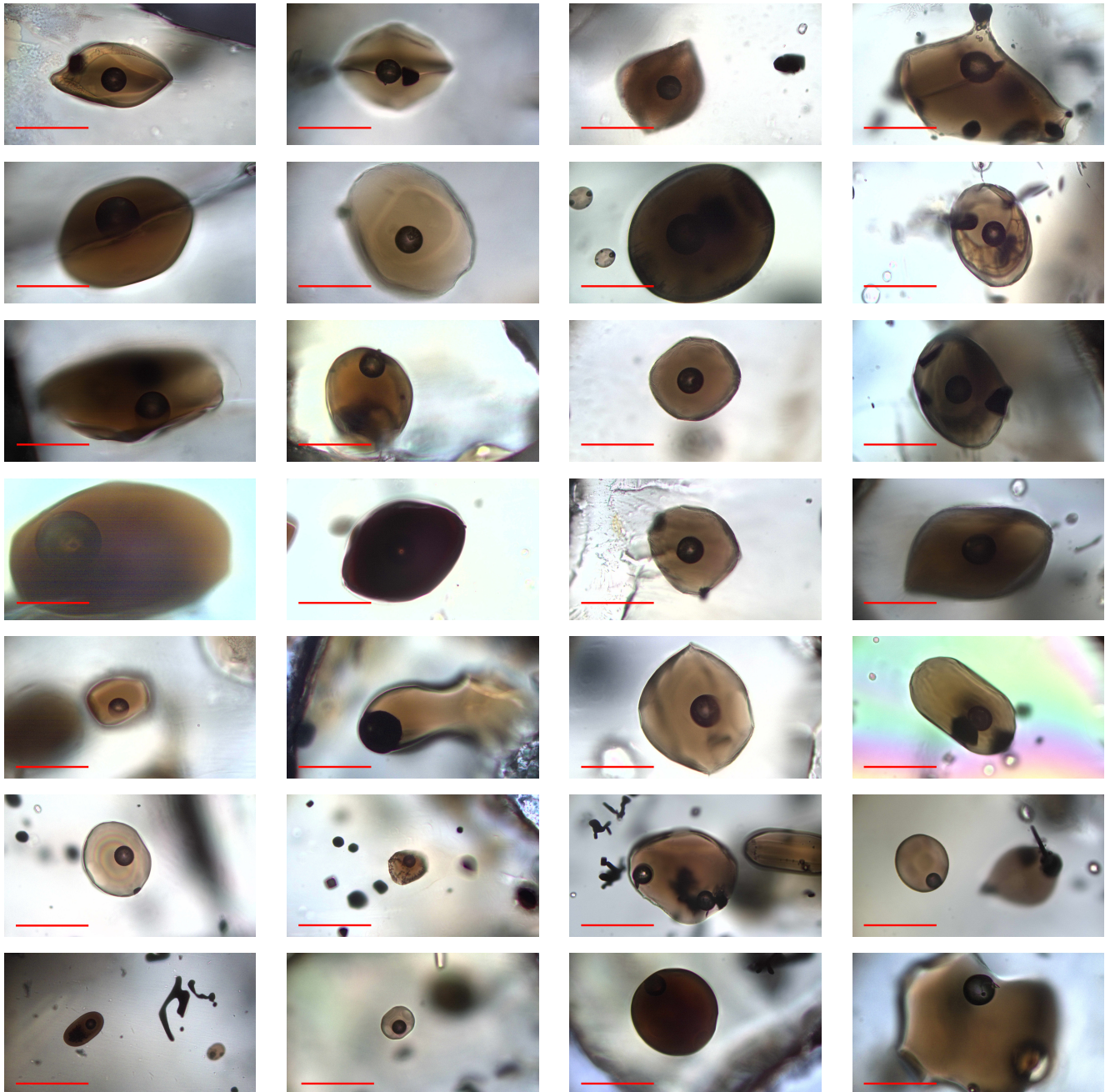


Figure S4: Optical images of 28 bubble-bearing melt inclusions, used to generate bubble volumes. These volumes were determined by measuring the bubble diameter from optical images and assuming a spherical geometry. Red scalebar = 100 μ m.