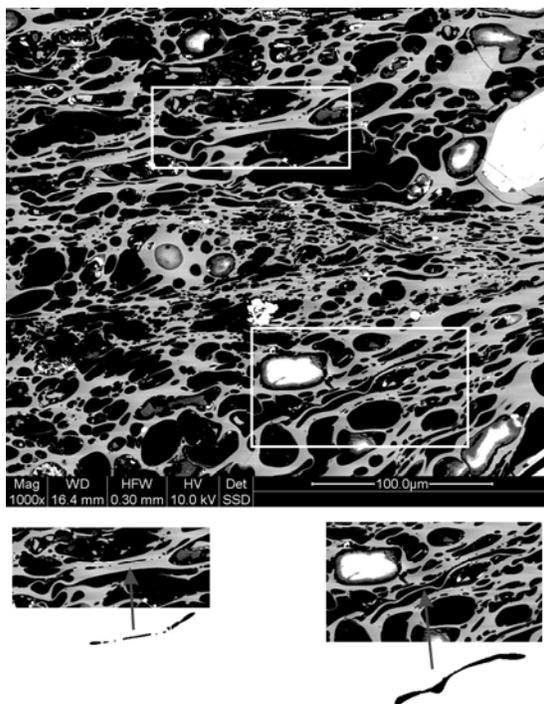


Supplementary Figure DR1

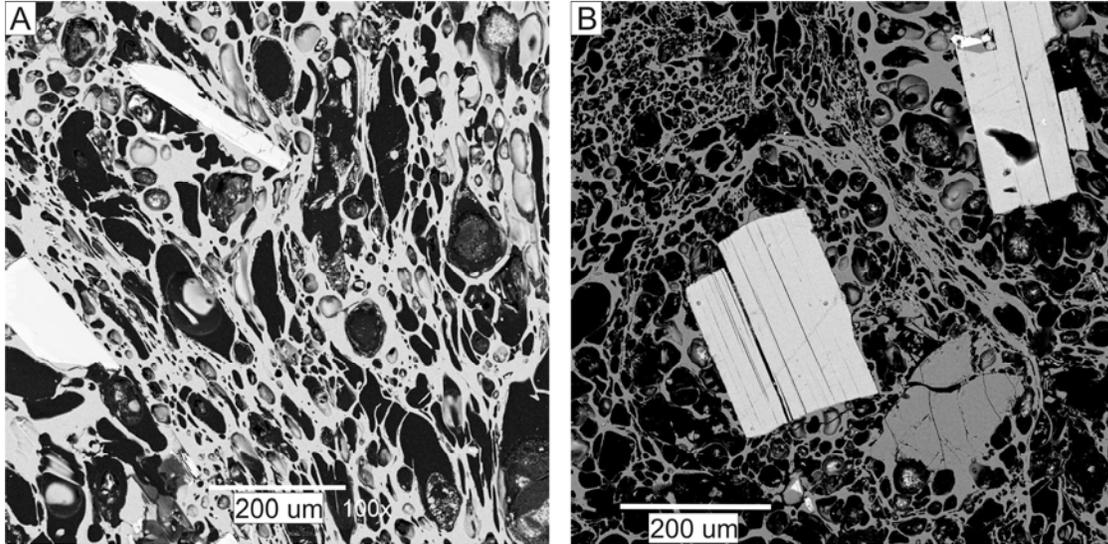
A. Simple shear deformation of an emulsion at high volume fractions produces drop shape asymmetries as shown (from Li et al., 1995).

B-C. SEM BSE images of Cerro Galan pumice. Vesicle asymmetries in Cerro Galan pumice are similar to those in experimental deformation of emulsions, but with pointed tips. Scale bar is applicable for both image B and C.



Supplementary Figure DR2

SEM BSE image of Cerro Galan pumice showing a trail of elongate vesicles and a single elongate vesicle. Trail of vesicles: $L/a = 6.9$. Single elongate vesicle: $L/a = 4.8$.



Supplementary Figure DR3

SEM BSE images of Cerro Galan pumice showing A. asymmetry of bubbles, and B. localization of strain into high shear bands.

Supplementary Video DR1

Scan through 3-dimensional X-Ray tomographic volume of Monte Pilato pumice sample; 1 pixel = 4.45 μm; width of movie frame is 3.18175 mm. Grayscale pixels are glass walls.

Supplementary Video DR2

Reconstructed 3-dimensional X-Ray tomographic volume of Monte Pilato pumice sample; volume dimensions are 445 x 445 x 445 μm. Red blobs are individual vesicles, distinguished and selected through the interactive program blob3D and the vol_tools reconstruction code (Ketcham, 2005; Rivers and Gualda, 2009).

References Cited

- Ketcham, R.A., 2005, Computational methods for quantitative analysis of three-dimensional features in geological specimens: *Geosphere*, v. 1, p. 32-41.
- Rivers, M.L., and Gualda, G.A.R., 2009, 'tomo_display' and 'vol_tools': IDL VM packages for tomography data reconstruction, processing, and visualization, *Eos Transactions of AGU, Joint Assembly Supplement*.