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# High Resolution Neutron Computed Tomography of Vesicular Pyroclasts

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In the last decade great efforts have been made in experimental volcanology as well as in the field of analytical and numerical modelling in order to understand explosive volcanic eruptions. 2D textural analysis, e.g. bubble- and/or crystal-size distribution analysis has been an essential component of this progress. Yet reliable information on the spatial distribution of connected vs. isolated vesicle structures, especially with respect to the crystalline phase distribution remains poorly constrained. Image analyses of thin sections have provided insights, but such analysis always implies the transformation from 2D to a 3D structure. That however is especially problematic if the analysed volcanic rocks exhibit a strongly varying size and shape of pore space and phenocrysts resulting in a complex 3D structure; as is often the case in silicic pyroclasts.

Especially for large samples (15 - 50 $cm^3$) neutron computed tomography provides the first non-destructive method to analyse this complex 3D structure. We applied high resolution (50 $\mu$m) neutron tomography to investigate the 3D structure of vesicular (45 – 72 %), silica rich pyroclastic material from different explosive, hazardous volcanoes. The experiments were performed at the ANTARES beamline of the neutron source at the reactor FRM II at Technische Universität München (Germany). Volume reconstructions of the pore space and different crystal phases were calculated with special software from the 2D image slices obtained by tomographic scanning. The reconstructed volumes enabled us to test the applicability of this technique, novel in the field of volcanology, to volcanic rocks with different textural characteristics. Neutron tomography reacts sensitively to hydrogen and thus permits the distinction of different mineral phases as e.g. amphiboles. Within the samples analysed, interconnection between the vesicle distribution and the crystal distribution could be observed. We will argue that this type of analysis yields valuable constraints on the degassing of active volcanoes.