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A history of vesicles and crystals in volcanic rocks in 3 and 4 dimensions

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Textures of volcanic rocks preserve important information on the processes that have generated them. Textural data can be combined with observations from the natural system as well as with information from analytical, experimental and numerical modelling of volcanic processes and eruption dynamics to improve our understanding and forecasting of volcanic eruptions. A major contribution to both qualitative and quantitative analysis and interpretation of textural data has been provided by the application of X-ray computed microtomography to volcanic rocks. In this contribution, I will illustrate examples of how 3D and 4D X-ray microtomographic images have been used to investigate crystallisation, vesiculation, degassing and development of magma permeability in scoria and pumice products, and to highlight the mechanism of non-explosive degassing of magmatic volatiles in basaltic systems.