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The complexities of gas loss in volcanic conduits

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The dynamics of magma flow within a volcanic conduit depends highly on the distribution of the gas volume fraction. The gas exsolving during the ascent toward the surface can be kept trapped within the magma or escape from it through connected bubbles. This escaping gas can then reach either the surface, or the margins of the conduit to exit definitively from the global magma flow dynamics. We explore these processes with a 2D numerical model that fully addresses the anisotropic nature of gas loss from the magma (Collombet, 2009). This model is using the permeability law of Klug and Cashman (1996), which is based on laboratory measurements of natural pumices. When an artificial sampling from the outputs of the numerical simulations is compared to a sampling of pumices collected in the field, we find that the distribution of the gas volume fraction within the conduit is correctly reproduced by the model for the upper 500 m of the conduit but that the model predicts the existence of large gas pockets below a superficial plug. There is also a porosity discrepancy from 0.5 to 2 km depth, which suggests that the modeled gas escape is not efficient enough in the deepest parts of the conduit. We explore in this presentation the consequences of the model prediction on gas loss in volcanic conduits.