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# Rheological controls on the evolution of the eruption dynamics at Mount Etna (Italy)

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Basaltic volcanoes, such as Mount Etna, support diverse styles of volcanism including effusion of lava, fire fountaining or Strombolian explosive activity. Recent investigations of the January-June 2000 fire fountain eruption of Etna demonstrated substantial textural and compositional variations relating to the style of eruption [1]. Specifically, this study showed changes in the degrees of vesiculation and crystallization in eruption products derived from Strombolian versus fire fountaining events. Nonetheless, a thorough evaluation of the physical and rheological properties of Etnean basaltic magmas is still lacking. Here we propose that rheology, and above all effective viscosity, shapes the conditions responsible for the transition from Strombolian to fire fountain activity. In order to quantify the effect of rheology on the eruptive dynamics we have combined a new compositionally-based viscosity model [2] with a model that accounts for the complex rheological effects induced in magmas by the presence of crystals [3]. The results suggest that the textural and compositional changes observed during the eruption produce pronounced and relatively sharp changes in rheology and that this transition in rheology is a catalyst for modifying the style of eruption (e.g., from Strombolian to fire fountaining). Specifically, we suggest that the calculated change in viscosity of magma erupted during each phase is large enough to cause substantial differences in the decompression rate inside the shallow conduit system. This may be responsible for the transition in eruptive style observed during the 2000 activity. A better understanding of the rheology of Etnean magmas and its correlation with the eruptive style

represents a tool to improve the monitoring of the volcano. In addition, it provides further constraints for numerical modelling of transitional eruptive behaviour at basaltic volcanoes.

[1] Polacci et al. 2006, Geology, 34, 201-204; [2] Giordano et al, submitted; [3] Caricchi et al, submitted