



The subliquidus rheology of recent basaltic lavas from Stromboli

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Stromboli is a basaltic arc volcano well-known for its exceptionally persistent activity of continuous degassing, mild intermittent explosions, rare lava emissions and sporadically more violent explosions. In particular, paroxysmal events might have a severe impact on the local population. To understand its eruption dynamics, a well constrained characterization of magma properties and, in particular, rheological properties is required. Volcanism at Stromboli generates a variety of products that need to be fully characterized in terms of their rheological behaviour mainly according to phase distribution, volatile content and stress-strain conditions. These eruptive products, similar in overall chemical composition, strongly differ in terms of crystallinity and vesicularity (from dark holocrystalline scoria to aphiric “golden” pumice), posing an added challenge for the investigation of their rheology.

In order to quantify the effect of crystals on the rheology of basaltic magma from Stromboli, we have investigated the liquid and the liquid+crystal rheology of remelted products of aphiric golden pumices of the 15th March 2007 eruption. Viscosities of pure liquids and liquid+crystals mixtures within the range 10^0 - 10^5 Pa s at T between 1170 and 1600°C were measured by concentric cylinder viscometry in air. Rotational rates varied between 0.1 and 20 rpm.

Viscosity of the liquids ranges from $10^{0.2}$ to $10^{2.4}$ in agreement with [1]. Below 1200 °C, viscosity changes significantly as a function of crystal content, . In addition to the

crystal volume fraction, the crystal shape also appears to be important in influencing the viscosity of the strombolian magmas and in affecting non-Newtonian behaviour. This serves as a potential explanation of the shear thinning behaviour observed in these experiments.

Rheology of crystal-bearing samples is also affected by the strain rate, showing clear non-Newtonian behaviour at low deformation-rates.

In addition to evaluating the onset of non-Newtonian rheology, isothermal viscosity measurements prove to be sensitive indicator of the time-temperature-viscosity window over which crystallization occurs at Stromboli.

[1] Giordano et al., 2006, Chem Geol. 229,42-56