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A new way to estimate viscosity of natural silicate melts, on the base of a non-Arrhenian model

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It is common knowledge the importance of estimating viscosity in explosive volcanism. Magmas are multiphase systems where their rheological properties are affected by a number of factors whose contributions are not easy to evaluate.

An indirect method of estimating viscosities is the application of the so called modified Einstein-Roscoe equations (MER) (Einstein and Roscoe, 1911; Marsh, 1981; Pinkerton and Stevenson, 1992) which take into account the rock crystallinity and the viscosity of the interstitial melt. We based our study on the pomiceous product of the major explosion which occurred on April 5^{th} at Stromboli volcano. An accurate estimate of the crystal content of the erupted products have been obtained applying image analysis to optic microscope and SEM pictures and constraining CSD, while one of the major limit of the MER equations is to guesstimate the viscosity of the interstitial melt. Since the model of Bottinga and Weill (1972) and Shaw (1972) led to viscosity estimates which were systematically lower than field measurements and experimental data and the model of Giordano and Dingwell (2003) does not fit the experimental data on Hawaiian tholeiite basalt performed by Shaw (1968) at near-liquidus and superliquidus temperatures, we constructed a "modified" Tamman-Vogel-Fulcher equation by integrating the model of Giordano and Dingwell with that of Shaw. This can be done by calculating viscosities using Giordano and Dingwell's at-and-below the glass transition and Shaw's at $T \geq 1200^{\circ}C$, then interpolating the results with a TVF equation. We expanded the model by considering the effect of crystallinity in the MER equation proposed by Pinkerton and Stevenson (1992). This method has been experimented on the basaltic melt of Stromboli, on the Arenal lavas (Costa Rica) in the light of the ex-

perimental data of Cigolini et al. (1984) and on the SSB (Albarède et al., 1997) Kapor lavas erupted in 1998 at Piton de la Fournaise volcano, Reunion Island (Villeneuve, 2002).