Seismic properties of hydrous phonolite at high pressure and high temperature

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Low viscosity phonolitic magmas of a very narrow compositional range produce both effusive and explosive volcanism in the island of Tenerife (Spain). Fragmentation of low viscosity magma is still elusive and fragmentation models allow for explosive activity if the crystal content is larger than 40 vol.% [1], or if the elastic moduli are lower than commonly assumed. Measurements of elastic moduli of phonolitic magmas may thus help to better constrain these eruptive styles. We investigated the variations of ultrasonic wave velocities of hydrous phonolite from Teide (Lavas Negras, 1150 B.P.) from 550 °C to 100 °C. Measurements of compression and shear wave velocities (V_p and V_s) were carried out in a Paterson-type internally-heated gas pressure apparatus at a pressure of 250 MPa and frequency of 1 MHz. V_p and V_s were recorded every 20 to 50 °C at a cooling rate of 10 °C/min. In order to allow the sample and assembly to equilibrate to the new thermal condition, constant temperature was maintained for a minimum of 20 minutes prior to measurements. V_p and V_s decrease with increasing dissolved water content. Whereas the effect of dissolved water content in phonolitic glass appears to be very small, the effect of dissolved water content in super-cooled liquid become significantly more pronounced and increases as temperature increases. In order to estimate the shear (μ) and the bulk (K) moduli, where $\mu = \varrho V_s^2$ and $K = \varrho(V_p^2 - 4/3 V_s^2)$, we measured the density of each sample after the experiments at room P-T using a gas pycnometer. The measured densities correspond well to densities calculated using existing models [2,3] at temperature corresponding to the transition from solid- to liquid-like behavior [4]. From the calculated densities and the measured seismic velocities, we calculated the bulk and shear moduli. Our results show that variations due to dissolved water content are more pronounced for the shear modulus than for the bulk modulus.

[1] Giordano, Polacci, Papale, Dingwell & Romano (2004), EGU General Assembly Vienna. [2] Lange (1997), *Contrib. Mineral. Petrol.* **130**, 1-11. [3] Ochs & Lange (1999), *Science* **283**, 1314-1317. [4] Giordano, Nichols & Dingwell (2005), *J. Volcanol. Geotherm. Res.* **142**, 105-118.