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Melt flow in a conduit and seismic signals time evolution: a laboratory study

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A variety of seismic signals have been related to fracturing and magma transport in the volcanic edifice. Previous studies have provided a first experimental support to this association by reproducing fluid generation and migration while recording seismic signals in a layered sample comprising an olivine-MORB-olivine sandwich.

Here, we developed a new experimental set up, consisting in a melt reservoir beneath a volcanic conduit, which allowed a much better control on the physical mechanisms taking place and the related seismic signals.

Experiments were carried out using an internally-heated Paterson gas apparatus especially designed for the measurements of physical properties of rocks up to 1373K and 300MPa confining pressure. Acoustic emissions were measured during heating of cold pressed synthetic aggregate of MORB powder till complete melting.

High frequency events were recorded at 750-960K, corresponding to glass transitions in the MORB glass (Giordano and Dingwell, 2003). A long lasting low frequency event took place at 1200K, corresponding to melt migration in the conduit, followed by high frequency events, related to brittle intrusive mechanisms due to the magma intrusion in the brittle medium at the top of the conduit. A direct relationship between seismic waveforms + spectrograms and physical phenomena can be assessed, by scaling length and frequency. These evidences provide solid and well constrained new experimental insight into magma migration in the lithosphere and the mechanism of

dyke emplacement in volcanic edifices.