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Thermal properties of andesite from Popocatepetl and Volcán de Colima, México.

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The thermal conductivity (K), specific heat (Cp) and the coefficient of heat transfer surface (H) are the basic parameters to describe the process of cooling a volcanic rock fragment released in an explosive event. The analysis of the cooling process by conduction, convection and radiation of heat in volcanic rock fragments, has been limited to basalts, and various minerals such as olivine, pyroxene, quartz, etc. (Miao & Chen, 2014; Branlund & Hofmeister, 2012; Romine et al, 2012;. Schön, 2011; Stroberg et al, 2010;. Schatz & Simmons, 1972). There are no detailed studies on the thermal properties of the andesites, abundant in continental stratovolcanoes, and particularly susceptible from lava domes with frequent destruction processes, such as Popocatepetl and Volcan de Colima.

Previously, we developed an algorithm for calculation of the grain-size distribution, degree of fragmentation, the thermal energy released and its possible correlation with Volcanic Explosive Index (VEI) from the cooling curves of fragments from vulcanian and strombolian explosions. These curves were obtained from sequences of time over incandescent deposits recorded at selected pixel thermal images of vulcanian activity in the Popocatepetl and Volcan de Colima, Mexico. However, the model was limited by the lack of thermal parameters of the andesites, forcing a first approximation using basalts data.

We present a simple model for the cooling process using andesites samples from Popocatépetl and Volcan de Colima. First, the samples were subjected to a rounding process to minimize surface effects. Then, heated to 800 ° C were extracted from the muffle and cooling rate is measured. The thermal conductivity and coefficient of surface heat are determined using a thermal camera and three thermocouples embedded at various depths within the sample. An inversion method was implemented to determine the thermal properties parameters , by comparing the observed data regarding cooling model for a solid sphere in the the Heat Equation (Carslaw and Jaeger, 1959). These results are expected to accurately determine the thermal conductivity, specific heat and surface heat transfer coefficient, to improve the calculation of the degree of fragmentation, in thermal imaging sequences explosions.