Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

SVC50-10 Room:106 Time:May 20 14:45-15:03

Perspective on textural study of volcanic products

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The textural and compositional characteristics of erupted products record the history of dynamics which magmas experienced in the conduit invisible. During this decade, the methodologies have been increasingly developed to quantitatively decode the records from the textural and compositional data. For instance, estimations of saturation depth, decompression rate during magma ascent and retention time at depth have been made possible on the basis of microlite compositions, bubble and microlite size distributions. As the results, together with data by the geophysical and geochemical observations, we have been able to draw a realistic view of magma migration from the source region to the surface. This development is a convincing consequence from the simultaneous progresses in three different areas; experimental studies reproducing textures and chemical compositions of erupted products, technology of observations and measurements, and theoretical studies to physico-chemically interpret the textural and compositional data. However, in spite of such progresses, we have not yet succeeded to exactly predict the motion of magma and to quantitatively reconstruct the temporal developments of past eruptions combining the geological information. Much less, we have a long and winding road to discover the rules related to eruption phenomena, such as key observational signals to indicate the mass and style of a future eruption. When we look at the circumstances in material sciences of volcanic products from the view point of this difficulty, we inevitably recognize the defects in current understandings on several fundamental problems, such as the physical origin of the variety in bubble and microlite size distributions and the chemical compositions of minerals crystallizing under disequilibrium conditions. In this talk, I present the current circumstances of CSD (Crystal Size Distribution) studies and propose a new methodology to inversely estimate changes of pressure and temperature as functions of time from CSD with applications to erupted products.

Keywords: textural study, volcanic products, CSD