Evaluation of Deep Geothermal Reservoir and Magma Process Revealed by Melt Inclusion-Example in Fukano Caldera, NE Japan-

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INTRODUCTION

The deep geothermal reservoir which located beneath the caldera is potential energy resources. Magma process and the formation of the caldera were important geological evidence to reveal deep-seated geothermal reservoir, and caldera fill sediments provide petrological evidence of volcanic activities. Melt inclusion is a reliable material that provides the thermal-chemical information of the magma chamber, as it preserves the composition of the magma before eruptions. This characteristic has been used by the petrologists to determine magma evolution and differentiation. In this study, melt inclusion is used to evaluate the properties of geothermal resources, including the depth, and differentiation process which were conduct in Fukano Caldera Northeast Japan.

Fukano caldera located in the West of Sendai City. This caldera activity started from 7-8 Ma based on stratigraphy and the fossil data (Otsuki et al. 1995). Fukano formation filled in Fukano Caldera is characterized by whitish to grayish white colored massive pyroclastic flow deposits which are composed of small amounts of pumice and volcanic lapilli with 10 to 20 mm in diameter. Tenjin tuff member is grayish white massive pumiceous pyroclastic flow deposit which is contained huge dark colored pumice blocks (size up to 30 cm) and also is intercalated with lake sediments (Takahashi & Nagahashi, 2004).

METHODS

Samples were taken from 20 locations that represent the products of Fukano caldera (Fukano Formation & Tenjin Tuff member). These samples can be categorized into welded tuff and pumice tuff. Quartz crystals were separated from the samples, which are then encased with resin plate. The melt inclusions in quartz crystals are then analyzed using electron probe micro analyzer (EPMA) for 10 elements. The depth of crystallization is determined by the percentage of Quartz (Qtz) –Albite (Ab) –Orthoclase (Or) that calculated from CIPW norm. The eutectic lines will be shifted with the pressure so that if the composition of the melt inclusions in quartz crystals plotted on the diagram, quartz crystallization pressure can be calculated, as well as the emplacement depth. The MI sample then analyzed using LA-ICP-MS for 44 elements. The incompatible elements were normalized with basaltic andesite from the nearby recent volcanic arc (Zao Volcano, Tatsumi et al. 2008) to determine the differentiation of the magma.

ANALYSIS AND RESULT

The samples from Fukano Caldera were classified into low-medium K, low alkali tholeiite dacite-rhyolite with the higher silica content in the sample from the northern part. The norm percentage, crystallization pressure, and depth for the northern part and southern part respectively of 126 melt inclusions are Qtz: 20-46%, Ab: 44-71%, Or: 5-13%, 11-1900 MPa, 0.4-200km and Qtz: 29-41%, Ab: 55-66%, Or: 3.5-8%, 76-660 MPa, 3-24 km. The samples are following plagioclase differentiation path.

