INTERPRETATION OF THE INTERERUPTION PERIOD OF MOUNT EREBUS, ANTARCTICA

Daisuke SHIMOZURU,

Earthquake Research Institute, the University of Tokyo, 1-1, Yayoi 1-chome, Bunkyo-ku, Tokyo 113

Katsutada KAMINUMA

National Institute of Polar Research, 9-10, Kaga 1-chome, Itabashi-ku, Tokyo 173

and

Raymond R. DIBBLE

Department of Geology, Victoria University of Wellington, Private Bag, Wellington, New Zealand

Abstract: Intereruption period of Mount Erebus based on seismic and infrasound records observed during the period of January to March, 1983, is studied. Predominant pattern in the histogram of the eruption time interval shows Poisson distribution, though at a longer period a minor Gaussian distribution is overlapping. For the comparison with other Strombolian type eruptions, the similar analysis was done in the case of the 1970 eruption of Akitakomaga-take. It shows typical Gaussian distribution. It is also reported that the 1950 eruption of O-Sima and the eruptions of Stromboli in 1971 and 1975 showed Gaussian type time interval of discrete explosions.

The bubble nucleation rate in the case of normal boiling of superheated liquids obeys Poisson process. On the other hand, in the case of bumping, the nucleation rate of bubbles shows Gaussian process. Bumping occurs when the liquid is homogeneous and contains no obstacles. The evidence of widely spread anorthoclase crystals on the flank of Mount Erebus implies that anorthoclase crystals were formed and suspended in the volcanic conduit at some depth, to be hurled out with lava bombs by later frequent eruptions. The blizzard removed the confining mechanically weak lava portion and consequently the anorthoclase crystals were exposed. Thus, the Poisson type intereruption period of Mount Erebus is very likely due to the normal boiling resulting from the high concentration of anorthoclase crystals suspended at some depth of the volcanic conduit.

The depth of explosion earthquakes determined by seismic net extends as deep as 4 km beneath the volcano's summit. At such a depth, supersaturation of water in magma and consequent bubble nucleation, as suggested by soda pop model, are hardly expected. On the other hand, theoretical and experimental studies of liquid boiling establish the fact that the boiling starts with a small amount of additional heat over the saturation temperature at a high pressure. The higher the pressure the less additional heat is required and more intense boiling occurs. This concept satisfies the condition of focal depth of explosion earthquakes beneath the summit crater of Mount Erebus.

To complete our model, the process of supplying an additional heat source should be considered. Inside the expected magma reservoir, besides the ordinary convection system, a subsequent ascent of relatively high temperature blobs to the depth of volcanic conduit may occur. Then, the both factors—additional heat and suspension of crystals—may cause intense boiling of magma. The intereruption period is governed by the period of blobs' ascent, by the concentration of crystals in the magma column and its viscosity.

(Received January 31, 1984)