

32nd IGC - Florence, 2004

Abstract title

PERIODICITIES IN THE DYNAMICS OF THE VOLCANIC ERUPTIONS IN KAMCHATKA

Authors

OZEROV ALEXEY ¹

presenter's e-mail: ozerov@ozеров.ru

1 - Institute of Volcanology, Russian Academy of Science

Keywords

volcanology

eruption mechanism

eruption periodicities

gas bubbles

magma column

Abstract

Detailed studies of eruption dynamics of two most active volcanoes essentially differing in product compositions (Klyuchevskoy (basalts) and Karymsky (andesites)) have been carried out. These volcanoes also differ in the character of eruptive activity. The studies were conducted in two ways: detailed visual observations of the eruption dynamics; analysis of historical data on periodicities in their activity; examining seismological and acoustic data obtained during the eruptions.

In the course of long-term observations, five major periods have been distinguished in the dynamics of the Klyuchevskoy volcano: T1=1 min 34 s; T2=6 min 10 s; T3 =40 min; T4=5 h 30 min; T5=36 h, which manifested themselves in the succession of isolated explosions and in the character of bombing. When considering possible reasons of the occurrence of periodicities, preference is given to the processes of gas bubbles' levitation within the ascending liquid magmatic column, which results in structuring of the arriving melt into layers of foam and those of liquid. Their regular alternation, at certain discharge rates, creates clear periodicity in the character of the eruptions.

Studies of the Karymsky volcano have revealed that important feature of its activity is the existence of two levels of periodicity in the eruption dynamics: minute's level manifested in rhythmical recurrence of isolated explosions, and second's level showing itself in oscillations occurring immediately in the course of the explosion. Experiments and mathematic modeling fulfilled reveal that the process characterized by two periods is the result of progressive motion of viscous-elastic magmatic melt along the walls of the discharge conduit. Longer (minute's) period occurs in the process of energy accumulation within the lower part of the magmatic column and the following relaxation. Second's periods are generated in the result of alternation of phases of adhesion and creeping of the upper part of the column immediately during its movement.

It has been shown that periodical patterns are part and parcel of the eruptive process. Periodicities revealed are stable, they have been traced in the eruption dynamics for dozens of years. Clear periodicities manifest themselves in the eruptive processes of volcanoes with various compositions - basaltic magmatism is characterized by longer (minute's and hour's) periods, while minute's and second's ones are more typical for andesite type of magmatism.

ACCEPTED as Oral Presentation

in session: "G24.03 - Experimental volcanology"