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БИБЛИОТЕКА
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СО АН СССР

日本火山学会

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Kamchatka Valley of Ten Thousand Smokes.

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For the first time in the history the eruption of the Bezymianny Volcano from the Klyuchevskaya group of volcanoes on the Kamchatka took place in 1955~1956. The most important event in the course of the eruption was a giant explosion on March 30, 1956 which occurred at 5.11 p. m. at local time (0.6.11 a. m. G. M. T.). In a few minutes a colossal fan-shaped cloud of ashes has arisen above the volcano. The lower border of the newly-formed giant "fan" passed at the level of 6~8 km, while the upper - at the height of about 36 km. An extremely intense band of ash-fall stretched NNE from the volcano. Thus in the Klyuchi settlement (45 km distant from the volcano) the layer of ashes fallen for 3.5 hours reached 20 mm in thickness or 24.5 kg/m² in weight (the total figures from the beginning of the eruption—45 mm or 40 kg/m²).

Impenetrable darkness reigned all long the ash-fall; people were wandering in the streets in search of their homes. Deafening rumblings of thunderstorm followed one another. The air was charged with electricity, telephones rang up spontaneously, broadcasting loud-speakers fused, lead-ins of antennas sparkled. Thin ashes flung to the stratosphere by the explosion were caught by jet streams, passed over the North Pole and was observed in England 3 or 4 days later.

It is interesting to note that the explosion on March 30 was not heard either near or distantly. Nevertheless all the meteorological stations in the radius of over 1,000 km. registered the blast wave on barogramms. Thus, in Klyuchi (45 km. distant from the volcano) pressure changed to 23.5 millibar while in Markovo in Chukotka (1,100 km. from the Bezymiannaya) to 1 millibar.

Sensitive microbarographs recorded the explosion wave everywhere which ran round the Globe one and a halftime.

As a result of the explosion the Bezymianny Volcano has changed beyond recognition: from a slightly truncated cone it has transformed into a semi-circular caldera-volcano. The newly immense crater embraced not only the summit but also the whole south-eastern slope to the very foot stretching as 1.5×2 km. The top point of the volcano lowered down by 150~180 m, its absolute height being reduced to about 2900 m instead of the former 3085.

The Sukhaya (Dry) Khapitsa Valley originating in the eastern slope of the volcano was found to be buried at a distance of 18 km. by a violent agglomerate flow of chaotic mixture of ashes, sand and lava blocks of all possible sizes. Many thousands of secondary fumaroles were rising from the surface of the flow.

The environs of the volcano from the East were covered with a layer of volcanic

sand up to 0.5 m in thickness at a distance of 10~13 km. Further to the East at a distance of 27~29 km. the thickness of the sand rapidly decreased down to a few cm. During the explosion ashes burst out of the crater with a colossal force like a stream out of a giant sand ejecting apparatus, barking the trees' rind. The force of the explosion has broken and fallen down big trees with the diameter up to 25~30 cm. at a distance of 25 km.

The ashes brought to the ground by a directional explosion still retained a certain quantity of gases and was very mobile "flowing". It rolled down the hills and steep slopes filling all the river valleys adjacent to the volcano with sandy flows several meters thick.

At the explosion moment the ash was so hot that it burnt the bark of trees and bushes at a distance of 27~29 km., while some trunks were burnt completely. Under the cover of hot ashes over the area of about 500 km² rapid melting of snow took place.

In the Sukhaya Khapitsa and on the slopes of the Zimina and Klyuchevskaya Volcanoes violent mud flows (lahars) originated which rushed down involving big stones destroying everything on its way.

The mud flows ran eastwards to the B. Khapitsa River turned along its valley northwards and discharged themselves into the valley of the Kamchatka River. Two large lakes were found to be entirely buried in mud flow sediments.

The most interesting consequence of the explosion on March 30 was the formation of a big agglomerate flow with thousands of secondary fumaroles in the valley of the Sukhaya Khapitsa River. This picture so much resembled the description of the famous Katmai flow in Alaska that we called the Sukhaya Khapitsa valley "Kamchatka Valley of Ten Thousand Smokes".

The agglomerate flow has been investigated three weeks after the explosion and more thoroughly in summer 1956. The contours of the flow were found to be rather complex (see the chart).

In many parts of the agglomerate flow small explosion craterlets were scattered. The explosions occurred already after the flow stop and judging from all data they were caused by the ejection of fire masses on thick concentrations of ice or snow.

At the eruption moment the agglomerate saturated with gases possessed strong fluidity and could not stay on steep slopes of the volcano.

Due to this factor agglomerate sediments practically lack on the volcano slopes and the agglomerate flow starts as if not from the crater but from the volcano foot where the slope angle does not exceed 4 or 5°.

The overwhelming majority of the flow fumaroles was found to be on the walls and beds of constant and temporary water ways.

Temperature of the fumarole gases sometimes rose to 200° but was in the main about 100°. In their composition the fumaroles represented steam streams with ad-

mixtures of oxygen and acid gases (CO_2 , H_2S , SO_2). The air lacks oxygen: the ratio of oxygen and nitrogen is 1: 48 instead of 1: 4 in the atmosphere. It is evident that in the thickness of the agglomerate flow vigorous oxidizing processes take place.

On clear and hot days when mountain glaciers melted more vigorously and water rapidly arrived at the bed of the Sukhaya Khapitsa the banks composed of hot agglomerates were soon washed off creeping and falling down into the water. Every such crumbling caused a steam explosion, a kind of a "secondary eruption", when ash clouds were thrown up at 200~300 m in height. Especially strong explosions occurred on days with showers in the mountains.

Then hundreds and thousands of secondary explosions sprang up on the surface of the agglomerate flow.

Ash clouds rose to 0.5 km. in height and stretched off by 2 or 3 km. dispersing ashes.

The waters of the Sukhaya Khapitsa were overfilled with loose substance forming a dense but very mobile mud in which big stones easily floated like trees. It was especially interesting to see that after water falls the stones were slowly floating and whirling in the streams of the countercurrents. The solid mass made for 95 per cent of the mud and a pail of such mud gave, only a few centimeters of water by the morning. An enormous quantity of hot masses crumbled into the water caused a noticeable rise of temperature in cold glacial waters (up to 35~45° in the Sukhaya Khapitsa). Throughout the winter of 1956/1957 the agglomerate flow remained warm and was not covered with snow. Fumarolic activity on the flow was observed in 1957 too.

In its force the eruption of the Bezymianny Volcano stands in the same row as those of the Krakatau in 1883, Katmai in 1912 and Pele in 1902. The nature of the eruption resembles that of the Katmai.

First preliminary results of studying the eruption of the Bezymianny volcano as compared with that of the Katmai Volcano in Alaska seem to enable us to reveal some erroneous conceptions on the eruptive conditions of the Katmai and the origin of the Valley of Ten Thousand Smokes.

We think the source of tufa in the Katmai valley to be not assumed fissures under the valley but the central craters of the Katmai and Novarupta, besides it is very doubtful to speak on the assimilation of moraine material by rhyolite magma in the by-surface conditions.