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THE KAMCHATKA VALLEY OF TEN THOUSAND SMOKES

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For the first time in history an eruption of the Bezymianny Volcano of the Klyuchevskaya group of volcanoes on Kamchatka took place in 1955-1956. The most important event of the eruption was a giant explosion on March 30, 1956, which occurred at 5.11 p.m. local time (0.6.11 a.m. G.M.T.). In a few minutes a colossal fan-shaped cloud of ashes had risen above the volcano. The lower border of the newly-formed giant "fan" was at 6-8 km, and the upper one at about 36 km. An extremely intense ash-fall stretched NNE from the volcano. Thus in the Klyuchi settlement (45 km distant from the volcano) the ashes fell for 3.5 hours and reached 20 mm in thickness or 24.5 kg/m² in weight (the total from the beginning of the eruption being 45 mm or 40 kg/m²). Impenetrable darkness reigned in the area of the ash-fall; people were walking in the streets in search of their homes. Deafening rumblings of a thunderstorm followed one another. The air was charged with electricity, telephones rang spontaneously, broadcasting loud-speakers fused, lead-ins of antennas sparkled. Ashes blown into the stratosphere by the explosion were caught by currents and passed over the North Pole, they were 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 at a distance. 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 on Chukotka Js. (1,100 km. from the Bezymianny), to 1 millibar.

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

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

The Sukhaya (Dry) Khapitsa Valley situated on the eastern slope of the volcano was found to be buried over a distance of 18 km. by an agglomeratic flow of a chaotic mixture of ash, sand and lava blocks of all possible sizes. Thousands of secondary fumaroles were rising from the surface of this flow.

The eastern surroundings of the volcano were covered with a layer of volcanic sand up to 0.5 m in thickness till a distance of 10-13 km. Further East, at a distance of 27-29 km, the thickness of the sand rapidly decreased to a few cm only. During the explosion ashes were blown out of the crater with a colossal energy, like a stream out of a giant sand ejecting apparatus. The strength of the explosion broke and cut big trees with diameters up to 25-30 cm. at a distance of 25 km.

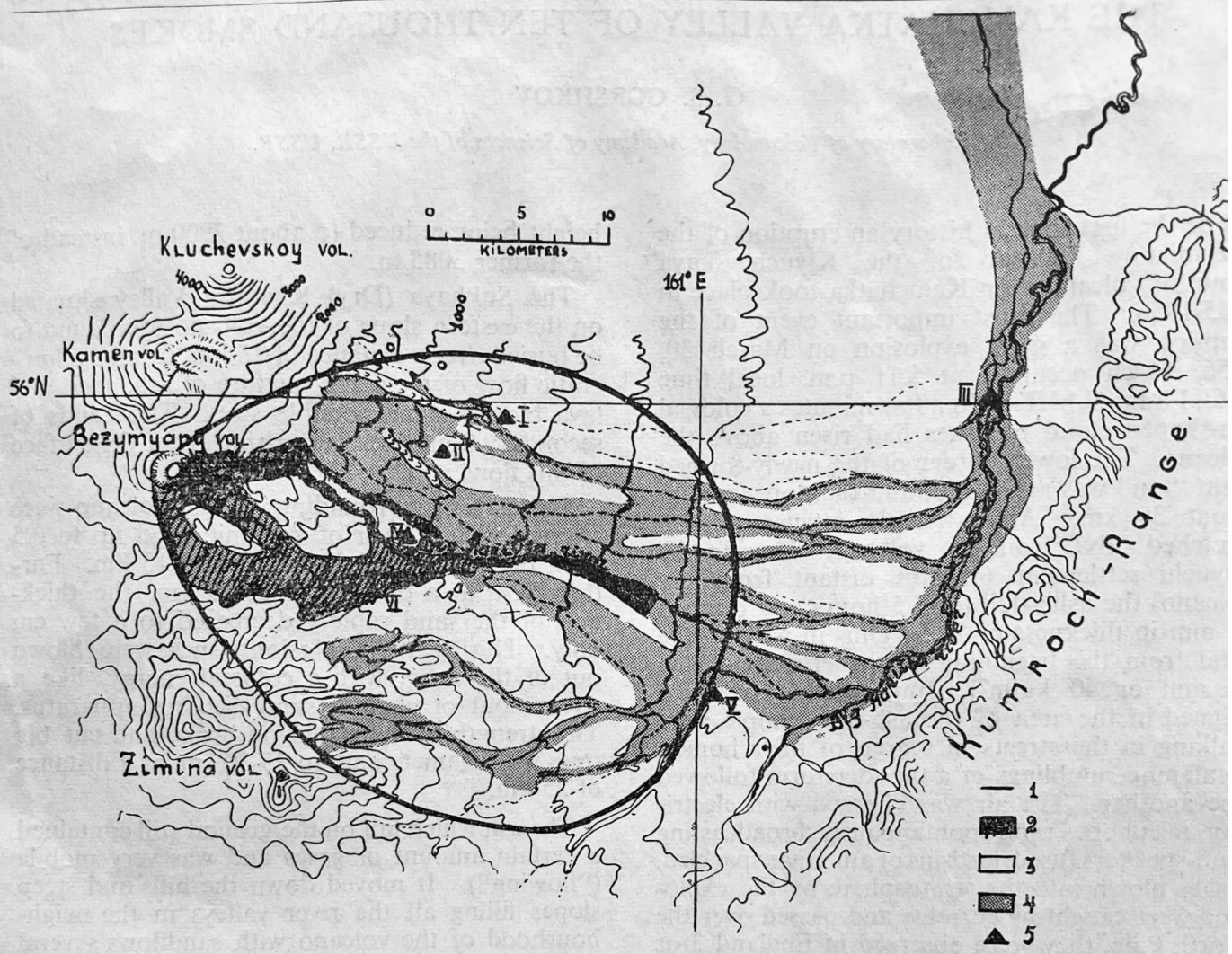
The ash which fall on the ground still contained a certain amount of gases and was very mobile ("flowing"). It moved down the hills and steep slopes filling all the river valleys in the neighbourhood of the volcano with sandflows several meters thick.

At the moment of the explosion the ash was so hot that it burned the bark of trees and bushes at distances of 27-29 km from the erupsion centre, while some trunks were burned completely. Rapid melting of snow took place, under the cover of hot ashes, over an area of about 500 km².

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

The mud flows ran eastward to the B.Khapitsa River turned north following the valley and discharged themselves into the valley of the Kamchatka River. Two large lakes were found burried under mud flow deposits.

The most interesting consequence of the explosion on March 30 was the formation of a large agglomerate flow with thousands of secondary fumaroles in the Valley of the Sukhaya Khaüitsa River. This picture so much resembled the



Sketchmap of the area influenced by the explosion of Bezymianny on March 30, 1956, 1. boundary of the area ruin by the explosion, 2. agglomerate flow, 3. mud deposits, 4. routes of mud flows (lahars), 5. expedition camps. (Compil by the author).

description of the famous Katmai flow in Alaska that the Sukhaya Khapitsa valley was given the name: "Kamchatka Valley of Ten Thousand Smokes".

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

In many parts of the agglomerate flow explosive craterlets were scattered. The explosions occurred after the flow stopped and judging from all data were caused by the ejection of incandescent masses on thick concentrations of ice or snow.

At the moment of the eruption the agglomerate saturated with gases had a strong fluidity and could not stay on steep slopes of the volcano. Due to this, agglomerates practically lack on the volcanic slopes and the agglomerate flow starts, if not from the crater, from the foot of the volcar where the angle of the slope does not exceed or 5°.

The length of the agglomerate flow is 18 km its max. width is 4 km. The area covered by th flow is 55-60 km^2. The thickness of the flo in the marginal part amounts to 20-30 m, in th central part it is, doubtless, higher and probably reaches 70-80 m. If we accept an average thick ness of 50m, the volume of the agglomerate flo is about 3 km^3.

The overwhelming majority of the fumaroles ar found on the walls and beds of constant an temporary water ways. The temperature of th fumarole gases sometimes rises to 200° but is i the main about 100°. According to compositio the fumaroles represent steam flows with ac mixtures of air and acid gases (CO_2, H_2S, SO_2 The air lacks oxygen: the ratio of oxygen t

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 melt more vigorously and water rapidly arrives at the bed of the Sukhaya Khapitsa the banks composed of hot agglomerates soon wash away and fall into the water. Every crumbling of caused a steam eruption, a kind of a "secondary eruption", with ash clouds rising to 200-300 m. Especially strong explosions took place on days when rain fell in the mountains.

Then, hundreds, even thousands of secondary eruptions occurred at the surface of this agglomerate flow.

Ash clouds rose to 0.5 km. and drifted off 2 or 3 km., dispersing ashes.

The waters of the Sukhaya Khapitsa were overfilled with loose materials forming a dense but rather mobile mud in which large rocks were easily transported. Enormous quantities of hot material crumbled down into the water and caused a noticeable rise of temperature in these 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 still observed in 1957.

The strength of the 1956 eruption of the Bezymianny Volcano can be compared with that of the eruptions of Krakatao in 1883, Katmai in 1912 and Pelée in 1902. The nature of the eruption resembles that of Mt. Katmai.

The first preliminary results of a comparative study of the eruption of the Bezymianny volcano with that of the Katmai Volcano in Alaska, enables, 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 tuffs in the Katmai valley not to be fissures under the valley, but central craters of the Katmai and Novarupta, besides it is very doubtful to speak of an assimilation of moraine material by rhyolite magma in the by-surface conditions.