Geophysical Research Abstracts
Vol. 19, EGU2017-92, 2017
EGU General Assembly 2017

Morphology of Bezymianny Volcano and evidence of its activity in 1949 before the 1956 catastrophic eruption

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On March 30, 1956, the Bezymianny Volcano eruption was one of the greatest volcanic events of the 20th century, not only in the Kamchatka Peninsula, but in the whole world. The subsequent intensive lava dome growth and lava flow effusion lead us to consider this volcano as one of the most active in Kamchatka during recent times. Studies of Bezymianny Volcano before the eruption are very poor. It was thought to be dormant for 1000 years. Previously, pre-eruptive morphology of the volcano was reconstructed on the basis of very poor initial data — a 1:100000 scale map from 1950 with low detalization of relief, and some ground-based single photographs.

Photogrammetric processing of archival 1949 stereo aerial photographs allowed us to reconstruct the morphology and state of Bezymianny Volcano prior to the 1956 catastrophic eruption, build DTM, and define quantitative characteristics of its morphological elements. The volcano was about 1500 m in height (3084 m above sea level). It was bisected by two collapse scars directed toward the west and east from the summit. Dimensions of the eastern scar reached 1900×630 m, and its depth was up to 50 m. Dimensions of the western scar were 1050×380 m, and its depth was up to 70 m. The summit had an explosion crater 350 m in diameter with an inner cinder cone 100 m in height. A small horseshoe-shaped crater 35 m in diameter and 5 m in depth was located at the top of the cone. Multiple lava flows of different size and morphology covered the edifice of the volcano. Their lengths varied from 200 m to 3500 m. Furthermore, the 1949 photographs show that the volcano was not dormant as was thought previously. In these, we discovered evidence of recent activity. The summit crater, the cinder cone with talus, and the lava flows are poorly eroded. On the north-eastern flank, we can see thin deposits of pyroclastic flows up to 280 m in length that would have been washed away during the course of 1000 years of dormancy. Also, there are several thermal spots clearly visible on the northern and southern flanks because of the absence of snow cover. The total area of the thermal spots is 45700 m^2. Therefore, we can conclude that Bezymianny Volcano was active not long before the 1956 catastrophic eruption, probably during the preceding 100 years.

This study illustrates how photogrammetric processing of archival images allows reconstruction of the morphology and state of volcanoes before catastrophic eruptions that drastically change their shapes.