



Estimation of explosive gas ejected in the atmosphere at different stages of the 2013 Tolbachik eruption

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The Tolbachik Fissure eruption named after the 50-th Anniversary of the Institute of Volcanology and Seismology FEB RAS (TFE-50) occurred on 26-th November 2012 in the southern areal zone of NNE cinder cones called "Tolbachik Dol". The 1975 -1976 Great Tolbachik Fissure Eruption (GTFE) occurred in the same area and resulted in three cones of the North Vent and one cone of the South Vent located 18 km and 28 km of Plosky Tolbachik Volcano, respectively. The GTFE was a good example to study air shock waves that accompanied various types of activity. It was suggested for the first time in the worldwide volcanological investigations that acoustic signals in a range of 1-10 Hz associated with the burst of gas bubbles during Strombolian eruptions and the processes related to the fragmentation of magma during Vulcanian eruptions, are revealed to be the air shock waves (ASW).

The amount of gas ejected during the eruption is one of the key features of the volcano's activity. In a case study of three Strombolian eruptions, it was suggested that the volume of liberated gas can be estimated by acoustic emission that occurred during the destruction of bubble gases [Firstov, Kravchenko, 199]. Moreover, the calculation of the discharge of lava made possible to estimate the weight content of gas. This paper provides the estimation of explosive gas at various phases of the TFE-50 activity.

In the area of TFE-50 infrasound vibrations in the atmosphere were recorded by P. Izbekov in February 11-13, 2013 and by the authors in May 13 and from August 12 to August 20, 2013. Besides, from August 14 to August 27 we recorded the voluminous activity of radon (OA Rn) in the soil air at a distance of 7 km of the TFE-50 crater.

During the three periods of observations, we recorded weak air shock waves (ASW) accompanied the destruction of large lava bubbles at the surface of the lava lake and "lava fountains". Infrasound waves generated during the destruction of small bubbles were observed as well. The comparison was made between the intensity of volcanic tremor recorded by "Bezymianny" radiotelemetry station (PTCC BZM, Z component) and the intensity of the infrasound signal. The attenuation of infrasound waves was considered in terms of their intensity. The variations of OA Rn were compared with the volcanic tremor envelope curve at PTCC BZM.