Geophysical Research Abstracts
Vol. 19, EGU2017-6881, 2017
EGU General Assembly 2017

Dynamics and functional model of the 2012–13 flank fissure eruption of Tolbachik volcano in Kamchatka, Russia

Alexander Belousov (1), Marina Belousova (1), and Benjamin Edwards (2)
(1) Institute of Volcanology and Seismology, Petropavlovsk, Russian Federation , (2) Dickinson College, PA, 17013, USA

The 2012–13 flank fissure eruption of Tolbachik in Kamchatka Peninsula lasted more than nine months and discharged ∼0.55 cub.km DRE of basaltic trachyandesite magma. It is one of the most voluminous historical eruptions of mafic magma at subduction-related volcano globally, and is the second largest in Kamchatka. We present a broad overview of the eruption as well as a model for the magma storage and transport system of Plosky Tolbachik Volcano. The 2012–13 eruption was preceded by five months of elevated seismicity and ground inflation, both of which peaked a day before the eruption commenced on 27 November 2012. The batch of high-Al magma ascended from depths of 5-10 km; its apical part contained 54–55 wt.% SiO_2, and the main body 52–53 wt.% SiO_2. The eruption started by the opening of a 6 km-long radial fissure on the southwestern slope of the volcano that fed multi-vent phreatomagmatic and magmatic explosive activity, as well as intensive effusion of lava with an initial discharge of 440 cub.m/s. After 10 days the eruption continued only at the lower part of the fissure, where explosive and effusive activity of Hawaiian–Strombolian type occurred from a lava pond in the crater of the main growing scoria cone. The discharge rate for the nine month long, effusion-dominated eruption gradually declined from 140 to 18 cub.m/s and formed a compound lava field with a total area of ∼36 sq.km; the effusive activity evolved from high-discharge channel-fed 'a'a lavas to dominantly low-discharge tube-fed pahoehoe lavas. On 23 August, the effusion of lava ceased and the intra-crater lava pond drained. Weak Strombolian-type explosions continued for several more days on the crater bottom until the end of the eruption around 5 September 2013.
The volcanic system, comprising the stratovolcano Plosky Tolbachik and its two radial volcanic rifts, produces alternating eruptions of two genetically related magma types: high-Al basalt (eruptions at the summit and along both rift zones) and high-Mg basalt (eruptions only along the southwest rift). The high-Al magma ascends to the surface from a magma storage zone at a depth of about 5 km below the summit of Plosky Tolbachik. During the 2012–13 eruption the high-Al magma first ascended along the central conduit of the volcano. Then the feeding dyke deviated from the conduit and propagated sub-horizontally along the southwest rift at a depth about 1 km below sea level. The 1975–76 Southern Breakthrough of the volcano was fed in a similar way. In contrast, the 1975–76 Northern Breakthrough of the volcano was fed by vertical dyke of high-Mg magma that ascended to the ground surface from the magma storage zone located directly below the area of the Breakthrough at a depth of approximately 20 km.