

The recent activity of Sheveluch volcano

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Sheveluch is one the most active volcanoes of Kamchatka. This volcanic massif began to develop approximately 60,000-70,000 years ago. The present structure of the volcano includes three main units: Old Sheveluch (3283 m), the old caldera about 9 km in diameter and Young Sheveluch (2800 m). The historical catastrophic eruptions from Sheveluch occurred in 1854 and 1964. Last the large extrusive-explosive eruptions took place on 1980-1982, 1993-1995 and 2001.

The crater about 1.5x3 km in size at Young Sheveluch appeared after catastrophic 1964 eruption. In 1980, a new lava dome on the floor of this crater began growing nonexplosively and no precursory seismicity was noted (Gorelchik et al., 1996). During the first two months the dome grew most intensively with an average velocity of 2.5 m/day. According to photogrammetric measurements in March 1982 (Dvigalo, 1988), when lava extrusion was over, the dome attained the height of 180 m, the base of 540-800 m and the volume of 0.021 km³.

The lava dome continued to grow slowly until 1984 but between 1984-1993 its growth ceased. In 1984, the height of the dome was about 160 m and the volume of 0.037 km³ (Zharinov et al., 1995). A new phase of the dome evolution began in 1984. Occasional gas-ash explosions up to 3-4 km above the dome started to occur during incessant fumarolic activity of the volcano. The explosions took place on the top and near the base of the dome. Compared to 1984, explosive activity of the volcano increased in 1987 (from 4-5 explosions in 1984 to 35-40 in 1987) and remained at the same level in 1988-1992. The increase explosive activity of 1988-1992 was accompanied by intensified seismic activity. For example, the number of earthquakes sometimes amounted to 20 events per month in 1989 and 100 in 1991.

The large explosive eruption of Sheveluch occurred on April 22, 1993, but a new extrusive activity of the dome began from April 4. The highest velocity of the dome growth – above 7.0 m/day and a gradual increase of seismic activity up to 400 earthquakes per day were recorded between 4 and 22 April. On April 22, the ash explosions rose 16-18 km ASL. The run-out distance of the pyroclastic flows was 5-8 km and of the mudflows – about 28 km (Khubunaya et al., 1995). In October 1993, the height of the dome was about 452 m and the volume of 0.172 km³ (Zharinov et al., 1995). The extrusive phase of the dome evolution extended till 1995. In January 1995, the volume of the dome was 0.199 km³ (Fedotov et al., 2001).

Between 1995 and 2001, the separate short-lived ash explosions up to 10 km ASL that accompanied by the different intensity of the seismic events occurred.

The sharp increase in seismic activity occurred on April 22, 2001. The largest earthquake $M_l=4$ occurred on April 27. According to AVHRR satellite data from AVO USA, the thermal anomaly was noted on April 30 at the dome of the volcano. Probable a new extrusive phase of the dome activity began from April 28-30. On May 12 and 16, three new extrusive domes were discovered in the area of the old dome. The large explosive eruption of the volcano began on May 19. On May 19 and 21, the explosions sent the ash plumes to 10-12 km ASL that drifted to the southwest. The run-out distance of the pyroclastic flows was 18 km and of the mudflows – about 30 km (Fedotov et al., 2001). The maximum change of the dome

height happened between May 22 and 29. The velocity of the dome growth was ~3.0 m/day in this time. In July 2001, the height of the dome was about 670 m and the volume of ~0.239 km³.

Now the growth of the dome continues and accompanies by viscous lava flows and glowing avalanches. Sometimes the separate short-lived ash explosions up to 5-7 km ASL, that produce pyroclastic flows and mudflows occur at the dome.

The three stages of the dome growth after catastrophic 1964 eruption were observed in 1980-1984, in 1993-1995 and from 2001 to present time. The sharp increase in seismic activity preceded the last two stages as well as the large explosive eruptions occurred in the beginning of them. In 1980, no noticeable precursory seismic events and no explosions were registered.

On the base of the features of the recent activity of Shiveluch from 1980 to present time and data of the eruptive history of the volcano before 1964, together with monitoring of the current volcanic activity (seismological and visual observation, and satellite data) possible scenario of a future evolution of the volcano can be developed.

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