

Original Russian Text © Melnikov D.V., Girina O.A., Manevich A.G., 2018, published in Vestnik KRAUNTs. Nauki o Zemle, Vol. 39, No 3 (2018), pp. 5–8.
Original text is available at <http://www.kscnet.ru/journal/kraesc/article/view/218>.

CRATER LAKE IN THE ACTIVE CRATER OF MUTNOVSKY VOLCANO, KAMCHATKA

Mutnovsky Volcano is one of the largest and most active volcanoes of the Southern Kamchatka. The volcano consists of four successively formed stratovolcanoes with summit calderas. The rocks are represented by high-alumina basalts, basaltic andesites, andesites, dacites (<http://geoportals.kscnet.ru/volcanoes/volc.php?name=Mutnovsky>). Currently, the volcano is in the stage of fumarole-hydrothermal activity. The last volcanic eruptions were phreatic and occurred in 2000, 2007, and 2013 (Gavrilenko, 2000; Gavrilenko et al., 2007; Girina et al., 2014; Zelensky et al., 2002). The Active Crater (AC) and the Southwestern

Crater (SW) (fig. 1) are active craters of the volcano. According to the published data (Gavrilenko, 2003; Marenina, 1956) there was a thermal lake 250×280 m in size in the Southwestern Crater of Mutnovsky Volcano until 1954, and then the crater was filled with glacier. The lake appeared again after the 2000 eruption. By 2002, it had cooled quite quickly, but in spring 2003 the lake temperature began to rise again (Gavrilenko et al., 2007). Since the end of 2003 till September 2018 the glacier has been filling the Southwestern Crater and in summer a small glacial lake appeared on its surface (fig. 2).

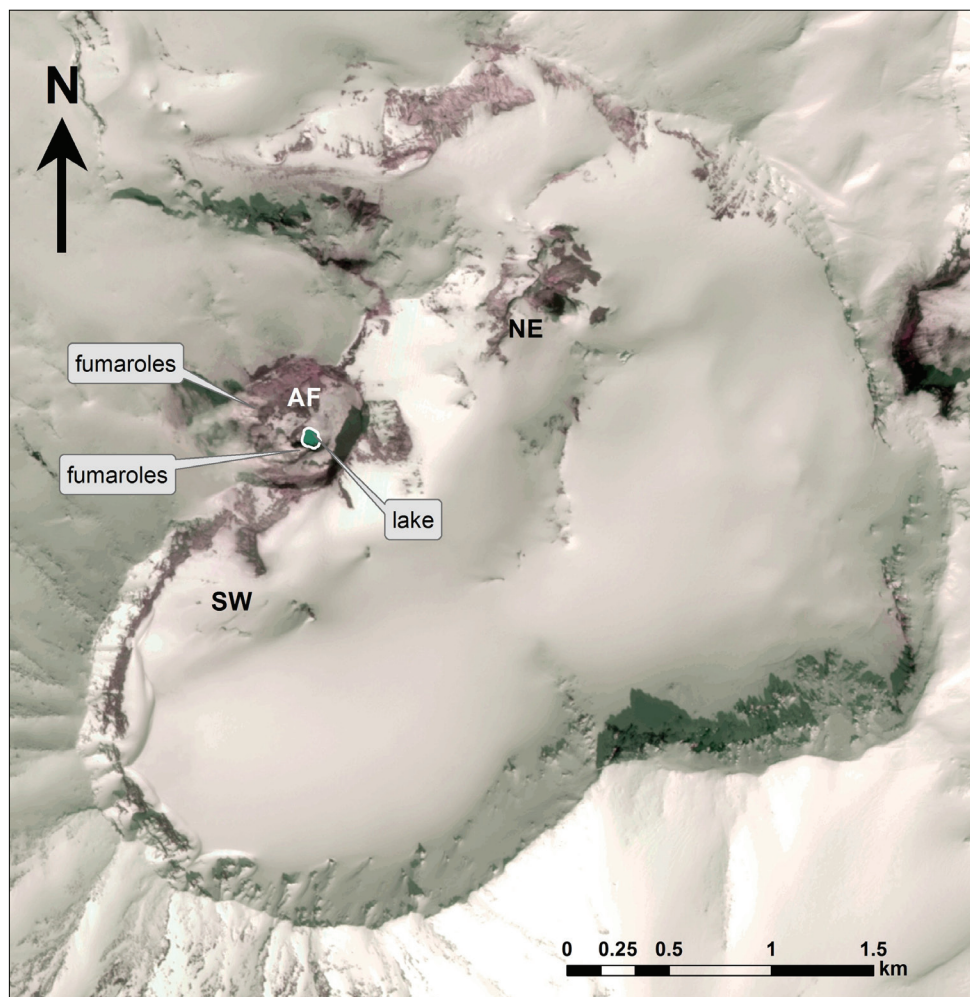


Fig. 1. Mutnovsky Volcano, May 15, 2018. Satellite image from Resurs-P, Sangur. AF — Active Funnel with a crater lake, SW — South-West crater, NE — North-East crater.

Another 200×250 m lake (Lower Lake) was located in the Northeast Crater (NE) in the area of the Bottom fumarole field (Gavrilenko, Gavrilenko, 2003). Last time it was observed in 1955; by its nature it was a dam lake.

On March 24, 2018, for the first time in the history of Mutnovsky Volcano observations (http://www.kscnet.ru/ivs/volcanoes/inform_messages/2018/Mutnovsky/), the crater lake in the Active Crater of the volcano was discovered by Laurent Tavignot. The lake was located at the bottom of the explosive crater formed

during the 2013 eruption. The powerful fumarole was observed on the southern shore of the lake, similar situation was documented in June 2018 (http://www.kscnet.ru/ivs/volcanoes/inform_messages/2018/Mutnovsky/).

From April 2, 2018, satellite images obtained and processed in KVERT (Kamchatkan Volcanic Eruption Response Team) (<http://www.kscnet.ru/ivs/kvert/>), bear evidence for thermal anomaly within the Active Crater of the volcano, which we believe is associated with the crater lake (fig.3). On May 15, 2018, the high



Fig. 2. Glacial lake in the South-Western crater of Mutnovsky Volcano, August 25, 2018. Photo by I.M. Romanova.

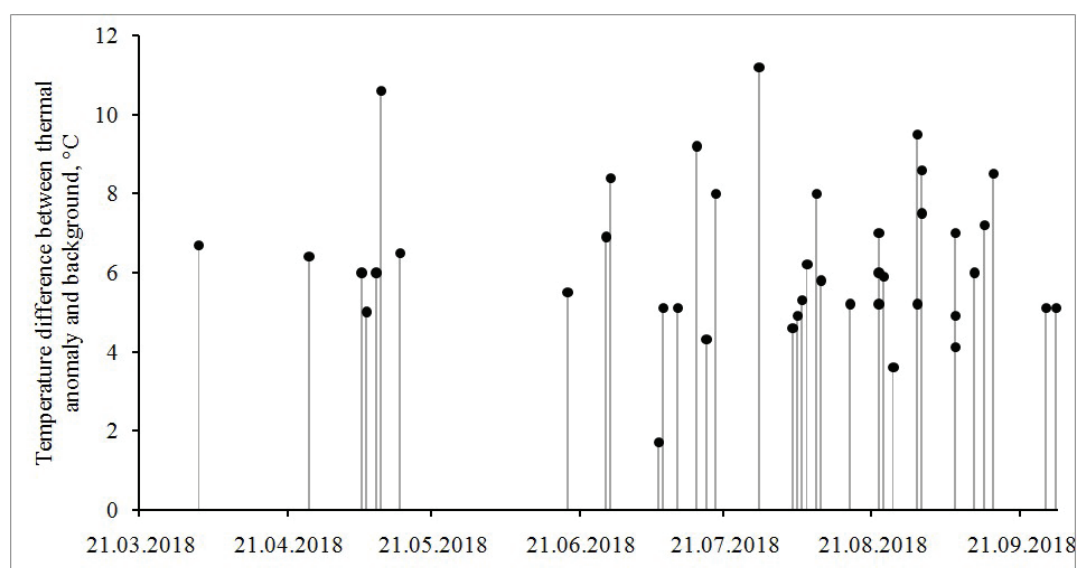


Fig. 3. The difference between the brightness temperature of the thermal anomaly and the background temperature within Mutnovsky Volcano in 2018 based on satellite data.

CRATER LAKE IN THE ACTIVE CRATER



Fig. 4. Explosive crater at the bottom of the Active Funnel, August 2, 2013. Photo by D.V. Melnikov.



Fig. 5. Crater lake inside the Active Funnel of Mutnovsky Volcano, August 25, 2018. Photo by D.V. Melnikov.

spatial resolution satellite images Resurs-P and Sangur allowed us to determine the boundaries and the size of the lake surface, which was 1,800 m² at that time (fig. 1). According to the authors' visual observations (fig. 5), by September 2018 the lake area gradually decreased, but up to now it is not possible to define its dimensions because there are no satellite images of high spatial resolution. Probably, the crater lake was formed during intensive snow melting in the spring and summer of 2018 as a result of the fumaroles' activity at the bottom of the Active Crater.

Crater lakes of Mutnovsky Volcano periodically appear and disappear, which is probably linked directly to the fluctuations of the volcano's activity.

This work was supported by the Russian Science Foundation (project No. 16-17-00042).

References

- Gavrilenko G.M.* Mutnovsky volcano awoke // *Priroda*. 2000. № 12. P. 41-43 (in Russian).
- Gavrilenko G.M., Gavrilenko P.G.* Crater lakes of Mutnovsky volcano, Kamchatka // *Vestnik KRAUNTs. Nauki o Zemle*. 2003. № 2. P. 118-121 (in Russian).
- Gavrilenko G.M., Melnikov D.V., Zelensky M.E., Tavignot L.* Hydrochemical monitoring of Mutnovsky volcano (Kamchatka) and phreatic eruption in april 2007 // *Vestnik KRAUNTs. Nauki o Zemle*. 2007. № 1(9). P. 127-132 (in Russian).
- Girina O.A., Manevich A.G., Melnikov D.V.* et al. Kamchatka volcano activity in 2013 // *Vulkanizm i svyazannye s nim protsessy*. Book of Abstracts, Petropavlovsk-Kamchatsky: IViS DVO RAN. 2014. P. 48-45 (in Russian).
- Zelenskii M.E., Ovsyannikov A.A., Gavrilenko G.M., Senyukov S.L.* Eruption of Mutnovskii Volcano, Kamchatka // *Volcanology and Seismology*. 2002. № 6. P. 25-28 (in Russian).
- Marenina T.Yu.* Geological and petrographic study of Mutnovsky volcano // *Trudy Lab. Vulkanologii AN SSSR*. 1956. № 12. P. 3-52 (in Russian).
- Melnikov D.V., IVS FEB RAS,*
Girina O.A., IVS FEB RAS;
Manevich A.G., IVS FEB RAS