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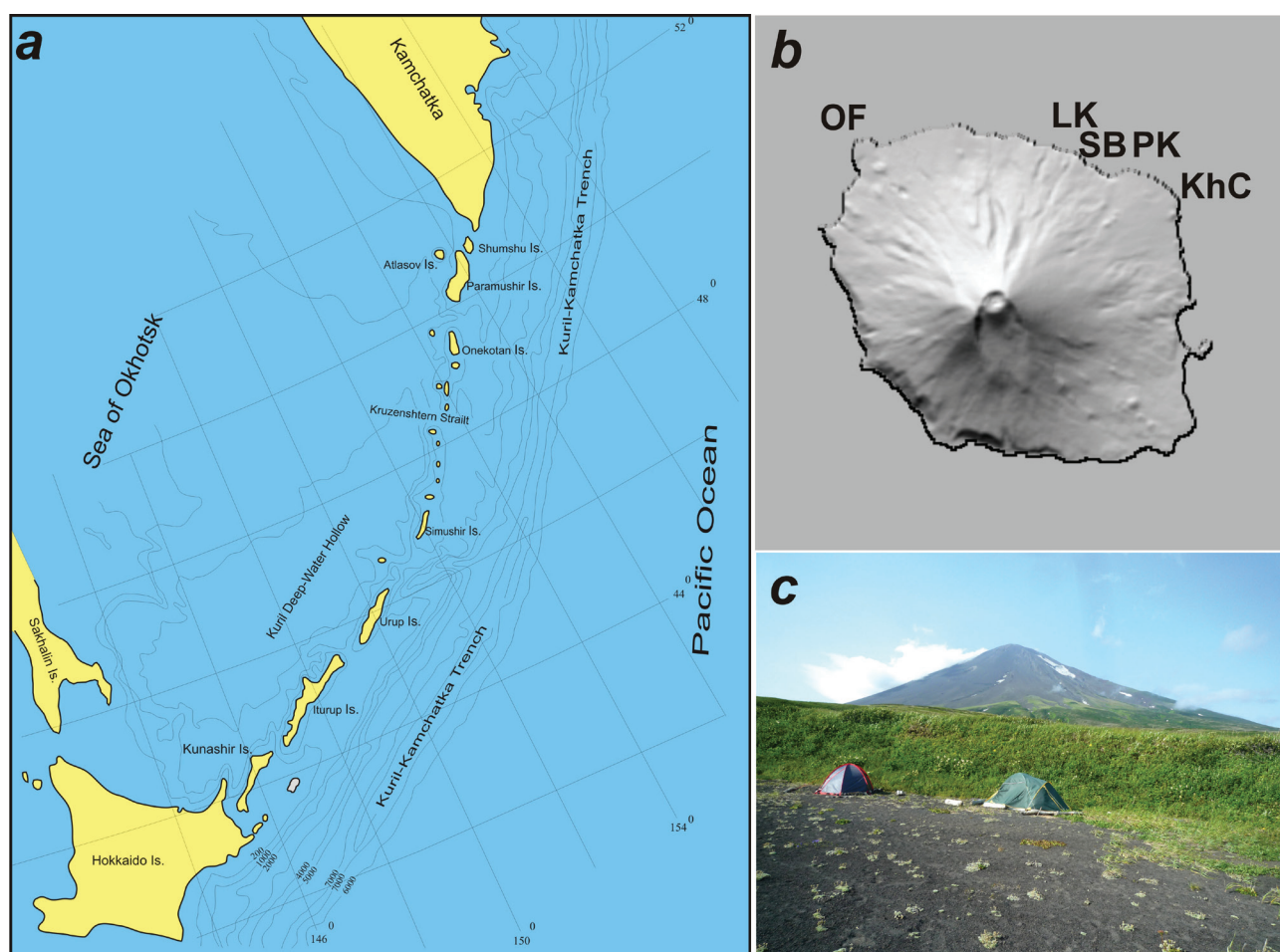
## FIELDWORKS AT ALAID VOLCANO IN 2019, ATLASOV ISLAND, THE KURILES

In August 2019 we carried out comprehensive investigation of the northern part of Alaid Volcano located in the Kuril Island arc on Atlasov Island (Fig. 1a, 1b). These research study is a part of continuous investigation resulted from field works performed on Alaid Volcano in 2007, 2008, 2013–2018 (Anikin et al., 2019; Rashidov, 2013; Rashidov, Anikin, 2014, 2015, 2016, 2017, 2018; Rashidov et al., 2013).

In 2019, the research area was located within the coastal zone from the Levy Cape to the Khitry Cape, and the base camp was located on the shore of Severnaya Bay at the mouth of the former Ovrazhny Brook (Fig. 1b, 1c, 2).

During field works we sampled collections of rocks composing the research area of Alaid Volcano and xenoliths (Fig. 3). As in other parts of Alaid Volcano (Anikin et al., 2019; Rashidov, Anikin, 2014, 2015, 2016, 2017, 2018; Rashidov et al., 2013) here we also found and sampled occurrence of copper located along cracks or completely covering surfaces (Fig. 4). We discovered the outcrop of hydrothermally altered rocks in the Khitry Cape area (Fig. 1b, 5).

The measurements of rocks magnetic susceptibility in natural occurrences of Atlas Island varies within the  $(4.5–18.3) \times 10^{-3}$  SI range.



**Fig. 1.** Location of Atlasov Island (a); research objects (b); Alaid Volcano and the base camp (c). OF — the Olimpiyskiy Fissure, LC — the Levy Cape, SB — Severnaya Bay, RC — the Pravyy Cape, KhC — the Khitry Cape.



**Fig. 2.** Severnaya Bay.

As it was noted in previous works of Rashidov, Anikin, 2016, despite the large number of streams shown on geographical maps and maps in GPS navigators fresh water is practically absent within the Alaid Volcano research area. There are only overgrown with vegetation stream-ways in the designated Brooks places.

During the field work, we managed to find only the stream of fresh water flowing among the stones at the point with coordinates 50.90908° N and 155.60869° E, which dried up in four days, and a small overgrown swamp at the point with coordinates 50.90193° N and 155.64896° E. Laboratory hydrochemical analysis of the selected water sample from the found brook (table) showed that this water, like water from other streams and waterfalls of Atlas Island, is quite suitable for cooking and drinking. It should be noted that the water from this stream is the least mineralized of all water samples tested on Atlas Island and in Severo-Kurilsk (Rashidov, Anikin, 2015, 2016, 2017, 2018).

Just like in 2016 (Rashidov, Anikin, 2016), “coloured” water of various shades caused by purple phototrophic bacteria was revealed in lava flows in various splash puddles within the examined section of Alaid Volcano (Fig. 6). This once again confirmed

(Rashidov, Anikin, 2016) stable growth of these bacteria in splash puddles on Atlasov Island.

In the area of the base camp, as well as in the area of the Olympic fissure in 2018 (Rashidov, Anikin, 2018), we found a colony of land snails of the Bradybaenidae family (Fig. 7), which are the largest representatives of the land malacofauna in the Asian part of Russia. It should be noted that these snails are a common prey for local birds. The discovery of a new snail colony, along with available literature data (Solovov, 2005), allows us to confidently state that the large snails bradybenides managed to survive the eruptions of Alaid Volcano in the 20th and 21st centuries at least in the southeast, northwest and northern parts of Atlasov Island.

During the fieldwork we made such rare for volcanic island Alaid findings as the cetacean intervertebral disc found on the shore of Severnaya Bay and arctic raspberry in low-grass areas from the Cape Praviy to the Cape Khitry.

While we were staying in the town of Severo-Kurilsk, just as in 2016-2018, (Anikin et al., 2019; Rashidov, Anikin, 2016, 2017, 2018), we conducted visual observations of the activity of Ebeko Volcano, and took rock and ash samples during climbing the volcano. At the time of our climbing the volcano on





Fig. 3. Xenoliths.

August 11, 2019 it was sending emissions from the active crater with intervals of 50–60 minutes (Fig. 8, 9).

During our visit to Alaid Volcano on September 29, 2019, fumarole activity was observed in its snow-covered crater (Fig. 10, 11), less intense than in 2018. Dense and loose fresh basalts were sampled in the near-crater part of the volcano, as well as fresh volcanic bombs, and hydrothermally altered rocks. The measured temperature on the surface of the altered rocks at a point with coordinates 50.85663° N and 155.55547° E was estimated to be 35°C.

Laboratory studies showed that the magnetic susceptibility of the selected samples varies in the range  $(4.5\text{--}18.3)\times 10^{-3}$  SI.

Once again, the results obtained during the field work in 2019 suggest that it is important to continue integrated interdisciplinary research of island-volcano Alaid that is what we are trying to do now. Currently, the selected xenoliths were sent for joint research to the Far Eastern Geological Institute FEB RAS geochemistry laboratory, the snails were sent to the Federal Scientific Center of the East Asia Terrestrial Biodiversity, and the “coloured” water samples were sent to the Faculty of Physics of Lomonosov Moscow State University.

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Chemical composition of waters from the brook on Atlasov Island and the Severo-Kurilsk port area.

Objects	Atlasov Island	Severo-Kurilsk
Sampling point	Severnaya Bay	Severo-Kurilsk port
Cations, mg/l		
Na <sup>+</sup>	2.52	5.48
K <sup>+</sup>	0.06	1.73
Ca <sup>2+</sup>	1.38	12.21
Mg <sup>2+</sup>	0.52	1.71
Fe <sup>2+</sup>	< 0.1	< 0.1
Fe <sup>3+</sup>	< 0.1	< 0.1
NH <sub>4</sub> <sup>+</sup>	< 0.05	< 0.05
Сумма	4.47	21.13
Anions, mg/l		
HCO <sub>3</sub> <sup>-</sup>	7.32	1.22
Cl <sup>-</sup>	2.66	2.56
SO <sub>4</sub> <sup>2-</sup>	3.00	41.00
F	0.13	0.12
NO <sub>2</sub> <sup>-</sup>	< 0.02	< 0.02
NO <sub>3</sub> <sup>-</sup>	0.33	1.21
PO <sub>4</sub> <sup>3-</sup>	< 0.1	< 0.1
Сумма	13.44	46.11
Microcomponents, mg/l		
Li	0.407	0.252
Cu	<0.001	0.0034
Zn	0.0703	0.4288
Pb	<0.005	<0.005
Ni	<0.005	<0.005
Co	<0.005	<0.005
Mn	0.0029	0.0266
V	<0.005	<0.005
Cd	<0.005	<0.005
Ba	<0.005	<0.005
Sr	0.0051	0.0089
As	0.0074	0.0128
Ag	<0.005	<0.005
Cr	<0.005	<0.005
Other components definitions		
pH	6.31	4.4
H <sub>3</sub> BO <sub>3</sub> , mg/l	< 0.5	< 0.5
SiO <sub>2p</sub> , mg/l	4.54	23.30
Mineralization, mg/l	22.45	90.54





**Fig. 4.** Cu occurrences.



**Fig. 5.** The Khitryy Cape.





Fig. 6. Splash pools with «coloured water» on lava flows.



Fig 7. Land snails of the Bradybaenidae family.



Fig. 8. The August 11, 2019 ash emission at Ebeko Volcano.





**Fig. 9.** The August 11, 2019 active crater at Ebeko Volcano.



**Fig. 10.** The 29 September, 2019 Alaid Volcano Crater.





Fig. 11. Fumarole activity in the crater of Alaid Volcano.

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- Rashidov V.A.,* Institute of Volcanology and Seismology FEB RAS, Far Eastern Geological Institute FEB RAS  
*Anikin L.P.,* Institute of Volcanology and Seismology FEB RAS