The 2016–2017 eruption of Bogoslof volcano, Alaska: preface to the special issue

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The Alaska Volcano Observatory (AVO) and partners have established a tradition of reporting on the results of significant volcanic unrest in Alaska by seeking to compile collected works that describe the overall nature of eruptive activity at individual volcanoes. There are typically multiple novel and noteworthy aspects of each eruptive event that are of broad interest to the volcanological community.

There are more than 50 historically active volcanoes within the Aleutian arc, most of which are ice- and snow-covered stratovolcanoes, and AVO has a long record of monitoring and evaluating subaerial eruptive activity at these volcanoes. Submarine volcanism in the Aleutian arc is much less common, and until the 2016–2017 eruption of Bogoslof volcano, AVO had never monitored, studied, or evaluated a significant submarine eruption. This special issue of *Bulletin of Volcanology* is a first for AVO in that we report on our initial research results from a 9-month long, predominantly submarine eruption of Bogoslof volcano.

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This paper constitutes part of a topical collection:

The 2016–17 shallow submarine eruption of Bogoslof volcano, Alaska

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Bogoslof volcano is an isolated, almost entirely submarine stratovolcano in the southern Bering Sea of Alaska (53.9272° N, 168.0344° W). The volcano is situated about 50 km north of the main volcanic front and has thus been described as a back-arc volcano. The Bogoslof cone has a basal diameter of about 18 km, flanking slopes of 12–14 degrees and about 1700 m of relief. The volcano has a volume of about 130 km³ but only a small portion of the edifice (<0.06%) extends above sea level. The highest point on Bogoslof Island is about 100 m above sea level.

In early May 1796, the Russian Orthodox Missionary Priest Ivan Veniaminov observed an island near the present location of Bogoslof Island around the day known as the feast day of Pope St. John I, or St. John's Day, and thus the island received the name “Joanna Bogoslova” (or John the Theologian's Island). In the present context, Bogoslof volcano is an informal name that refers to the submarine edifice and its surface expression that today includes both Bogoslof Island and Fire Island, a small isolated sea stack about 800 m north of modern-day Bogoslof Island. Bogoslof has been visited by a number of noteworthy mariners and scientists in historic time, including Captain James Cook, the Harriman Expedition to Alaska (including G.K. Gilbert and John Muir), and Thomas A. Jaggar (the founder of the Hawaiian Volcano Observatory).

Bogoslof volcano has had at least nine reported historical eruptive periods since 1796, and at least seven were characterized by extrusion of the submarine to subaerial lava domes of basalt to basaltic andesite composition. Many of the historical eruptions have produced ash clouds, and measurable ash-fall was documented in 1883, 1907, and 2017 on the nearest islands to the south of Bogoslof (Umnak and Unalaska Islands). Prior to 2016, none of the historical eruptions were particularly well studied (Waythomas and Cameron, 2018), and the most recent study of the geology of Bogoslof Island was based on a single day of fieldwork in 1947 (Byers, 1959).

The 2016–2017 eruption posed a formidable monitoring challenge to AVO because no geophysical equipment was located on the island itself. In addition, it was not possible to

make direct observations of the ongoing eruptive activity or visit the island due to its remote location and hazardous conditions. Thus, to monitor the unrest AVO had to rely on seismic and infrasound data recorded by networks on Umnak and Unalaska Islands (about 40 and 60 km south and east of Bogoslof, respectively) and other more distal networks. This information was supplemented with satellite data of various types, occasional airborne observations, and remote detection of volcanic plume lightning—a characteristic feature of several eruptive events. The start of the eruption is not known, but the activity was occurring by December 12–14, 2016, and the last explosive eruption occurred on August 30, 2017; there were at least 70 detected explosive events during this period. Almost all of the Bogoslof eruptions originated at shallow submarine vents (<150-m water depth) complicating AVO's monitoring efforts. Seawater, therefore, played an important role in the eruptive process and hazards.

In this special issue, readers will encounter treatments of the seismology (Haney et al.; Tepp et al.; Searcy et al.), hydroacoustics (Tepp et al.), infrasound (Fee et al.; Lyons et al.; Schwaiger et al.), geology, geomorphology and petrology (Loewen et al.; Waythomas et al.), volcanic lightning (Van Eaton et al.; Haney et al.), SO₂ emissions (Lopez et al.), and remote sensing of volcanic clouds (Schneider et al.) associated with the 2016–2017 Bogoslof eruption. Of the 70 explosive events, samples of ash were only obtained on three occasions and the only visit to the island occurred almost a year after the eruption ended. The collection of works represented here is thus gleaned mainly from geophysical and remote sensing data. A common theme in all of the research contributions is the remote detection of unrest and its interpretation in the context of explosive shallow submarine volcanism. The aim of this collection is to expand the knowledge base pertinent to shallow submarine eruptive activity, and to

complement existing treatments of submarine phreatomagmatic eruptions at Surtsey, Iceland (Thorarinsson et al., 1964; Kokelaar, 1983), Taal, Philippines (Moore et al., 1966), Capelinhos, Azores (Waters and Fisher, 1971), and others (White et al., 2015).

As with many of the historical eruptions monitored and evaluated by AVO, many more individuals that are represented by the contributing authors to this volume had important and valuable roles during the 2016–2017 Bogoslof activity.

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