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EDITED AND REVIEWED BY
Millard F. Coffin,
University of Tasmania, Australia

*CORRESPONDENCE
Karen Bemis,
bemis@marine.rutgers.edu

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Editorial: Early career scientists' contributions to submarine volcanism and associated hydrothermal systems

Karen Bemis[1]*, Thibaut Barreyre[2] and Arran Peter Murch[3]

[1]Rutgers, The State University of New Jersey, New Brunswick, NJ, United States, [2]University of Bergen, Bergen, Norway, [3]National Museum of Science and Nature, Tokyo, Japan

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Editorial on the Research Topic
Early career scientists' contributions to submarine volcanism and associated hydrothermal systems

Recent submarine eruptions, including those at Axial Volcano (Nooner and Chadwick, 2016), West Mata Submarine Volcano (Chadwick et al., 2019), "Volcano F″ in the Tofua Arc (Brandl et al., 2020), and a new volcano off the eastern coast of Mayotte (Feuillet et al., 2021), have spurred interest in submarine volcanism. Submarine volcanoes have all the eruptive products of subaerial volcanoes (e.g., lava flows, explosions, ash/lapilli/pumice, cone growth) combined with extensive hydrothermal systems through which they influence ocean chemistry and sustain complex ecosystems (e.g., Cas and Giordano, 2014). Interactions between the volcanic systems and the various tectonic/magmatic settings (including mid-oceanic spreading ridges, intraplate settings, and subduction zones) that host them produce a complex variety of responses.

Advances in oceanographic data Research Topic through the use of remotely operated and autonomous underwater vehicles (ROVs/AUVs), along with seafloor geophysical instrumentation at cabled submarine observatories, have allowed monitoring of submarine volcanoes before, during, and after eruptions in unprecedented detail (e.g., Kelley et al., 2014). This detail is leading to greater understanding of past (ancient) deposits from submarine volcanoes, present hazards of such volcanism, and the processes driving submarine eruptions (e.g., Cantner et al., 2014; Murch et al., 2022; Yeo et al., 2022).

This Research Topic explores the diversity of submarine volcanoes, their associated hydrothermal systems, and their tectonic context.

The products of both shallow and deep submarine volcanoes provide a record of past eruption processes. Knafelc et al. used radiogenic isotopes and petrographic textures to elucidate the eruption history of Havre volcano. Pumice from the 2012 Havre submarine eruption, during which rhyolites were emplaced as minor lava flows, a field of sunken pumice, and a volumetrically-dominant pumice raft, contained diverse rock fragments sourced from varying depths and representing earlier eruptions. Crystal fractionation melt models indicated the likely stages between a basaltic forerunner and the current rhyolites.

McIntosh et al. reconstructed the original water contents of marine tephras from sedimentary core C9010E using recent advances in Fourier transform infrared spectroscopy (FTIR). These tephras were erupted by the shallow silicic submarine

Oomurodashi volcano in the northern Izu-Bonin arc. Numerical modeling of hydration and volatile processes suggest OH contents reflect quench fragmentation within the shallow submarine edifice and imply the marine tephra layers in the core were produced in the same eruption as subaerial tephra deposits on nearby Izu-Oshima and Toshima islands.

Shifting gears to examine the interaction of volcanoes and ocean as active processes, Preston et al. demonstrated how *in situ* methane sensors on an AUV can aid discovery of hydrothermal venting sites. Methane signals tracked hydrothermal output similarly to standard turbidity sensors, picking up plumes at 2.2–3.3 km from a reference source, and more sensitively than temperature, salinity, and oxygen instruments, the signals of which dilute with background physical mixing. The introduction of change-point detection algorithms (streaming cross-correlation and regime identification) is projected to facilitate real-time hydrothermalism discovery.

Diving deeper into hydrothermal plume behavior, Bemis et al. extracted the bending direction for the main plume rising above the Grotto Vent in Main Endeavour Field, Juan de Fuca Ridge, as a measure of the convolution of hydrothermal flux rates and the strength of ambient ocean bottom currents. They observed that the prominence of southward bottom currents decreased systematically from 2010 to 2014. After considering spectral properties of the plume observations and regional observations of winds and currents during 2010–2014, they concluded that the bottom current generating mechanisms are either related to tidal processes or not periodic, with the systematic change most likely related to changes in venting output along the Endeavour Segment which changed the impact of the cumulative plume entrainment fields.

This Research Topic of articles explores how technological advances can increase our understanding of submarine volcanism, past and present. We anticipate this Research Topic will provide a variety of starting places for future research on submarine volcanism. We hope it will stimulate discussion.

Author contributions

KB took the lead in writing the Editorial, TB and APM contributed to writing. All the authors discussed the content of the Editorial.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

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