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Editorial

Editorial for Special Issue "Present and Past Submarine Volcanic Activity (1)"

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Over 1 million volcanoes on the Earth surface occur in marine and submarine environments in different geodynamic contexts. Most of this volcanic activity remains almost unexplored due to the extreme conditions of deep underwater observations of the eruptive processes. Despite this, the link between volcanism, tectonics, and seabed morphology represents a key aspect for developing new interpretative geological models and verifying or refining older interpretations. Tectonics often drives volcanism, and they both shape the seafloor morphology. Therefore, new observational capacities and multidisciplinary data integration increase our possibility to reach and interpret deep-seated geological structures. As an example, the advances in exploration geophysics allowed to illuminate the submerged portion of volcanic islands and deep volcanic seamounts. A number of 2–3D geological models about seafloor volcanic structures, their feeding systems, hydrothermal system extension and depth are now available using seismic, multibeam swath bathymetry and potential field methods, as well as their detailed digital elevation models. Therefore, the multidisciplinary approach becomes an essential tool to investigate deep marine environments which would otherwise be unreachable, and to unravel what is going on below sea level in remote and almost completely unreachable environments. On the other hand, coastal volcanism and volcanic islands are better known than deep edifices; however, their study is essential to better understand their growth, their dismantling mechanism and their activity, which directly influences the safety and security of manufacts, engineering operas and human lives.

The target of the Special Issue volume was decided by the five published papers which crosscut different and complementary aspects of submarine volcanism, useful for the understanding of past and present activity of the proposed case studies. Different volcanic aspects are here reported through new data and the interpretations of marine volcanoes located in very different and representative geodynamic contexts, spanning worldwide from the Palinuro Seamount in the Southern Tyrrhenian Sea (Italy) to Brothers Volcano of the Kermadec arc (New Zealand), the shallow Tagoro submarine volcano located close to the El Hierro (Canary Islands, Spain), the Avyssos Caldera (Nisyros, Greece), Tsushima Island in the south-western Japan Sea and the island of Surtsey (Vestmannaeyjar, Iceland). These case studies cover several tectonic settings (subduction margins, back-arc basins, rifting) and volcanic types (calderas, arcs, back-arc arcs, fissural volcanism and volcanic complexes). Moreover, the observational scales of the proposed manuscripts span from the monitoring and mapping of the entire volcanic edifice (using geophysics) to the scale of the single fissure vent emission plums and the micro scale of the petrographic characteristics of the submarine and volcano island pyroclastic products. Our introductive synthesis of the manuscripts wants to highlight a first overview of the wide spectrum of possibilities that the current state of the art provides to explore and understand marine and submarine volcanic activity.

Citation: De Ritis, R.; Passaro, S.; Pensa, A. Editorial for Special Issue "Present and Past Submarine Volcanic Activity (1)". *Geosciences* **2022**, *12*, 458. https://doi.org/10.3390/geosciences12120458

Received: 4 November 2022
Accepted: 16 December 2022
Published: 18 December 2022

The study by Cocchi et al. [1] approaches the submarine fissure vents and the underlying hydrothermal systems from a geophysical point of view with an industrial applicative perspective. In fact, hydrothermally altered zones host important enrichment of metals (e.g., Cu, Zn and Pb, but also Au and Ag). Cocchi et al. compared the magnetic signatures and modelling of the apical calderas of the Palinuro Seamount (Tyrrhenian Sea), and the Brother Volcano (Kermadec Arc, New Zeland). The Authors highlight peculiar elements and similarities between the two case studies and show the geometries and depths of the demagnetized material occurring in the thermally altered zones. They also stress the strict relationship among the shape of these zone with the volcano-structural features of the calderas.

Two studies, Olivè Abellò et al. [2] and Dura et al. [3], applied stochastic calculus tools on temporal series of seawater conductivity and temperature measurements carried out in the water column characterized by the presence of vent of fluids from the seafloor. Fluctuations of the conductivity and temperature properties provide meaningful information about the state of activity of the hydrothermal systems. The described statistical technique could be usefully tested in other volcanic contexts in order to determine a large case history of time series of conductivity and temperature fluctuation in different volcanic contexts and phase of activity. In particular, Abello et al. [2] showed the results of sampling points located on the main crater of the Tangoro submarine volcano. This latter, placed close to the El Hierro island in the Canarian Archipelago (Spain), was subjected to recent volcanic activity, and its post-eruptive activity is actually strictly monitored. Data acquisition was carried out by using oceanographic stations specifically targeted to decipher the seawater vertical structure in correspondence of emission plumes. Moreover, the objective of the work is to assess and classify the state of the art of the Tagoro submarine volcanic activity and to define the nature of mechanisms driving the seawater conductivity and temperature fluctuations. Dura et al. [3] adopted similar tools in order to study the Avyssos submarine caldera, placed at the northern side of the Nisyros volcano in the Hellenic Volcanic Arc (South Aegean Sea, Greece). Thanks to the adoption of specific sensor mounted on a Remotely Operated underwater Vehicles (ROV), the Authors reveals the existence of a non-persistent active vents field and of a weak, homogeneous source of hydrothermal fluids outflowing all over the studied area.

Ninomiya et al. [4] and Verolino et al. [5] proposed two petrographic case studies of marine volcanism. More in detail, Ninomiya et al. [4] applied a high-resolution ion microprobe dating technique to the Tsushima Lapilli Tuff underwater deposit (Tsushima Island, Japan) in order to reduce the uncertainty about its age of emplacement. The Tsushima Lapilli Tuff underwater deposit outcrops for ca. 40 km^2, and the unit is considered important since its age constraints the formation time of the Paleo-Tsushima Basin related to the opening of the Japan Sea and the volcanism changes occurred in the whole South-western Japan Sea.

Verolino et al. [5] deals with the pyroclastic textures of the Surtsey Island eruption (Iceland), emplaced during its formation and emersion between 1963–1967. The name "Surtseyan volcanism" was established in the volcanic nomenclature after this eruption, to indicate explosive and effusive phases from multiple vents. Thanks to newly available data and by focusing on the characteristics of the non-sideromelane pyroclasts, the Authors define with an unprecedented level of detail the diversity of pyroclasts and micro-textures from Surtsey Island with respect to those of its satellite vents (available from the literature).

Conflicts of Interest: The authors declare no conflict of interest.

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