

Subaqueous Fire Fountains of Basaltic Magma

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Vesicle shapes, sizes and population densities in glassy constituents of pyroclastic rocks provide abundant information on the eruption processes.

Scoriaceous agglomerate, scoriaceous lapilli tuff and scoriaceous vitric tuff (Sawasaki pyroclastic rocks) from the Miocene Ogi Basaltic Formation, closely associated by pillow lavas, are considered to be dominated by the products of fire fountain under seawater because the scoriaceous agglomerate contains water-chilled spatters sometimes forming spatter cones. These appear to be the proximal facies, and the scoriaceous lapilli tuff might be the distal facies formed from watery volcanoclastic gravity flows. The scoriaceous vitric tuff could be the fall deposit of ash- and silt-size particles suspended in a hot water plume over the fire fountain.

The vesicles in the fine glassy particles of the scoriaceous agglomerate are almost spherical, while those of the scoriaceous lapilli tuff are sometimes elongated into the tube-like shapes. In the scoriaceous vitric tuff, the vesicles are generally flattened. Thus, the finer lithofacies are characterized by elongated and flattened vesicles. It is suggested that the magma forming Bannular flow (B Vergnolle and Mangan, 2000) was sheared between the center gas column and the vent-wall, and was easily crushed into ash- and silt-size particles in the jet flow at the eruption.

VSD (vesicle size distribution) patterns of glassy particles of the scoriaceous agglomerate and lapilli tuff commonly show low population density within a range of large vesicle sizes (>0.2 mm in diameter) and high population density within a range of small vesicle sizes (<0.2 mm in diameter). The vesicularities are larger (up to 50%) than those of the glassy crusts of the pillow lavas (less than 20%) whose VSD patterns do not show the enrichment in small-size vesicles. It is suggested that an addition of volatile components to the magma chamber caused violent nucleation of bubbles and consequently reduced the magmatic explosion. There are some granitic, gabbroic, and sedimentary xenoliths included in pyroclastic rocks. They are usually partially melted, and biotite crystals are largely resolved. Accordingly, such partially melted basement rocks are likely to have supplied magma with volatile components.