

Subaqueous Pumice Eruptions and Their Products

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A review on subaqueous pumice eruptions and their deposits is given. Documented cases of subaqueous pumice eruptions are not so many or incomplete to infer the eruption modes and mechanisms. Observations are limited to phreatomagmatic eruptions at shallow depths or silent upwelling of pumice blocks and lapilli from deep water. The deposits, which are thought to be produced directly by subaqueous pumice eruptions, are depleted in fines relative to the subaerial counterparts, but commonly contain platy or blocky non- to well-vesicular glass shards. Three types of subaqueous pumice deposits are recognized. Type 1 deposit is a flow unit inversely graded and diffusely stratified with pumice swarms at its upper part, and is interpreted to be produced by subaqueous collapse of phreatoplinian eruption-column. Type 2 deposit is a flow unit well-stratified and inversely to normally graded and is associated with pumice fallout deposits. This type is supposed to be produced by subaqueous collapse of minor phreatoplinian eruption-column, direct projection of cock'tail jets, gravitational collapses of subaqueous lava domes, or combination of these. Type 3 deposit is characterized by trains of isolated pumice blocks or their swarm with or without a carpet of fines, and is supposed to be derived from minor phreatomagmatic eruption or popping at the surface of vesicular lava. Subaqueous pumice eruptions in Kikai caldera and off Iriomote Island occurred at water depths of 200-300 m and 500-1000 m, respectively. The former case produced large pumice blocks emplaced on the caldera floor. Subaqueous phreatoplinian eruptions is inferred from type 1 deposits to occur at water depths of 200 m in submarine Wakamiko caldera and 400-1500 m in submarine calderas of the Shichito-Iwojima Ridge, Izu-Ogasawara Arc. Subaqueous pumice eruptions are plausible to occur by combination of magma vesiculation and magma-water interaction even at water depths of 500-1500 m. In deep water, magma vesiculation is suppressed. Phreatomagmatic eruption, however, occur through intrusion of magma into a thick water-saturated pile of its breccia produced at the advancing head, and may trigger explosive magma vesiculation.