Sequencial facies change observed in a submarine lava fountain deposit from the Ogi Basalt

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Geological and Volcanological study on ancient submarine volcanic strata is important to know the size range and eruption features of submarine volcanoes in each tectonic setting. Middle Miocene volcanic strata, widely distributed in the Japan Sea side of Northeast Japan, provides good fields to study submarine volcanoes formed in a back-arc basin in two or three dimensions.

Sawasaki pyroclastic rocks of the Ogi Basalt Formation from the Sado Island, Japan, are composed of middle Miocene submarine lava fountain deposits (Fujibayashi and Sakai, 2003). From the field and microscopic observations, facies change in coarse strata can be described as follows.

1. Coarse Sawasaki pyroclastic rocks are divided into scoria agglomerate, scoria lapilli tuff and scoria lapilli stone. Their essential materials are vesiculated olivine basalt with the same petrography.
2. Structure of scoria agglomerate beds varies horizontally and vertically from inverse grading to massive. Inversely graded scoria agglomerate beds contain a lot of spatter bombs with chilled margins well reserved. Massive ones only contain small amount of spatter bombs that are sparsely distributed in a strata.
3. There is a positive correlation between maximum spatter size and thickness of beds that shows inverse grading. However, thickness of beds composing inversely graded scoria agglomerate is thinner than those composing massive one.
4. Upper beds of the massive scoria agglomerate are intercalated with beds of scoria lapilli tuff, and are overlain by alteration of scoria lapilli tuff and lapilli stone.
5. Scoria lapilli tuff and scoria lapilli stone are composed of scoria lapilli and accessory fragments. The thickness of scoria lapilli tuff beds decreases in the upper part, and instead, thickness of scoria lapilli stone beds increases. Internal normal grading is observed in scoria lapilli stone beds.

It is concluded that inversely graded scoria agglomerate is the most proximal fall deposit in the Sawasaki pyroclastic rocks. Ejected smaller spatter and their quenched fragments (scoria) settled first, and larger spatter bombs must be suspended longer in seawater. Because they have much more heat and gas than smaller bombs. One bed should be formed at one eruption. Massive scoria agglomerate and alteration of scoria lapilli tuff and scoria lapilli stone were formed from mass flows, originated from gravitational collapse of inversely graded fall deposits. The latter was formed from distilled flows by water injection during the dense flow that formed massive scoria agglomerate.