Bubble connectivity variation in the pumice clasts from Shimoyamazato pyroclastic rocks, NE Japan

Keiichi Ohtaki[1]; Michihiko Nakamura[1]

[1] Inst. Mineral. Petrol. Econ. Geol., Tohoku Univ.

Essential pumice clasts with wide variety of color and vesicularity (porosity) are included in a pyroclastic flow of the Shimoyamazato pyroclastic rocks erupted 0.21-0.09 Ma from Onikobe volcano, NE Japan. The pumice clasts can be classified into three types according to their color: white, gray, and dark gray pumices. The pumices have the same bulk chemical composition but different modal compositions of microlite (and microphenocryst) (white pumice, ca. 5 %; gray pumice, ca. 10 % and dark gray pumice, ca. 30 %), showing that the decompression and cooling histories in the conduit were different for the pumices. The dark gray pumices have lower vesicularity (62 % in average) and higher density (0.8-1.2 g/cm3) than the white and gray pumices (70 % and 0.4-0.8 g/cm3, respectively). Obsidian-like essential glassy fragments with density of 1.6-2.0 g/cm3 are also included abundantly in the flow. As a measure to characterize the pumice microstructure, we analyzed the 'connectivity' of bubbles, the ratio of the largest bubble area to the total bubble area in the BSE images of the sample sections, and found that each pumice type forms clearly different connectivity trends increasing steeply at a narrow range of porosity ('critical porosity'). The critical porosity decreases in the order of white pumice (81-75 %), gray pumice (73-62 %) and dark gray pumice (63-50 %), and all the connectivity trends reach up to ca.80%. This multiple porosity-connectivity trends cannot be explained by a single continuous vesiculation process. The high bubble connectivity of gray and dark gray pumices at markedly lower porosities than that of white pumice suggests that these connectivity trends record textural evolution of collapsing foams such as bubble coalescence, permeable flow degassing and compaction. Clear correspondence between microlite crystallinity and connectivity trend shows that the gray and dark gray pumices are not derivatives of white pumice but the product of vesiculation and nearly simultaneous foam-collapse of different magma batches having different ascent history in the conduit. We emphasize that connectivity is a sensitive textural parameter to unveil the degassing processes.