Clastogenic origin of lava cap inferred from groundmass differentiation by nanolite crystallization

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Recent observations of rhyolite eruptions and textural and isotopic studies of rhyolitic lava revealed that some effusive lava was formed simultaneously with blasts and pyroclastic fountains [1]. In this study, we present another possible indicator of "fragmentation and rewelding" processes—groundmass differentiation by nanolite crystallization.

We analysed chemical compositions of groundmass interstices (excluding crystals larger than 0.5 μm in width) for various pyroclasts from the Shinmoedake 2011 eruption: pumices of sub-Plinian eruptions (1), pumices (2) and dense juvenile fragments (3) of Vulcanian explosions, and a fragment of volcanic breccia (~30 cm in diameter) possibly derived from a late stage crater-filling lava cake. Bulk groundmass compositions of these samples were the same [2]. By simply considering the order of explosivity, the interstitial groundmass was expected to be differentiated in the order of (1)-(2)-(3) and (4). In fact, however, (3) was similar to (1), being more primitive than (2). The silicic pumice clasts of (2) overlapped with (4) (Figure 1). This seemingly paradoxical result may be explained if we consider the following process: magma that formed vulcanian pumice (2) differentiated in a shallow conduit, whereas (3) was formed by welding of pyroclasts that were once fragmented in a deeper conduit during sub-Plinian activity; the growth of groundmass minerals of (3) was suppressed after fragmentation by low diffusivity due to dehydration.

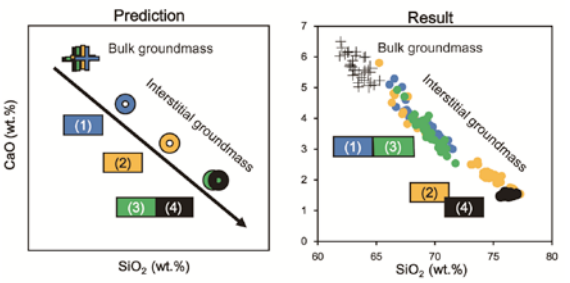

Figure 1: Predicted vs. actual compositions (CaO) of interstitial groundmass. (2) is more differentiated than (3).

[1] Castro et al. (2014) *EPSL*, **405**, 52–61. [2] Mujin and Nakamura (2014) *Geology*, **42.7**, 611–614.