Eruptive history and structural development of Quaternary Sanzugawa caldera, Yuzawa, Akita

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Intra-caldera ignimbrites record more complete information about the onset, climax, and aftermath of the caldera-forming eruption than extra-caldera ignimbrites. However, it is often more inaccessible because it is occupied by a thick caldera-fill. Therefore, there are fewer studies on the stratigraphy, structure and lithofacies of intra-caldera ignimbrite than that of extra-caldera ignimbrite. This study report Torageyama Formation within Sanzugawa caldera as an ideal instance continuously capable of observing intra-caldera ignimbrite sequence, structure and lithoface, and discuss the eruptive history and structural development of the caldera.
Sanzugawa caldera, located in southern Akita prefecture, formed by caldera-forming eruption associated with large volume pyroclastic flows. The caldera is filled with pumice flow deposits (Torageyama Formation), which deposited during the caldera-forming eruption. The Pleistocene Torageyama Formation (1.21 Ma) consists of mainly crystal-rich, dacitic lapilli-tuff, breccia and tuff, has a thickness of >1500 m and overlies basement of Onagawa to Nisikurosawa formation, having an unconformable relationship. The Torageyama Formation is distinguished five lithofacies: (1) Eutaxitic, massive lapilli-tuff, mLT; (2) Massive lithic breccia, mlBr; (3) Cross-stratified lapilli-tuff, xsLT; (4) Parallel-stratified tuff, //sT; (5) Diffuse-stratified lapilli-tuff, dsLT. The emLT is common lithoface of the Torageyama Formation, which repeatedly distributed over this area. The mlBr and xsLT develop at the base of the emLT, //sT and dsLT respectively develop at the top of and in the middle of the emLT with sharp or gradational contacts. The author can estimate that the Torageyama Formation is a sequence of intra-caldera ignimbrite because these lithofacies and relationships indicate a characteristics of intra-caldera ignimbrite lithofacies. This study suggest that a caldera collapse triggered the caldera-forming eruption in 1.21 Ma and initiated ignimbrite-forming phase lacking initial Plinian phase, is supported from; (a) the lack of precursory fallout deposits in many of ignimbrites; (b) the space required to enclose the large volume of the intra-caldera ignimbrite; and (c) the distribution of the Torageyama Formation limited to the intra-caldera setting. The Torageyama Formation is divided into seven pyroclastic flow units (PDC-1 to PDC-7) by repeated patterns of ignimbrite lithofacies. Pyroclastic flow supplied more than seven pyroclastic flow pulses repeating waxing and waning, suggested by the number of pyroclastic flow layers. The flow direction is estimated from northeast to southwest, supported from dune structure and imbrication of ignimbrite lithofacies, and Otoriyasawa is relatively crystal-poor and interbedded more mlBr. In addition, ring-like distribution of strike surrounds Takamatsudake and their dips incline outward of the caldera. This structure implies a resurgent dome in post-caldera stage, resulted in uplift of Takamatsudake area where the center of the caldera after the formation of the Torageyama Formation.

Keywords: Sanzugawa caldera, Torageyama Formation, Intra-caldera ignimbrite

