火砕物密度流・降下火砕堆積物の解析にもとづく御嶽山2014年噴火の再構築と物理量推定
Reconstruction and estimation of physical parameters of a phreatic eruption on 27 September 2014 at Ontake volcano, Central Japan, based on pyroclastic density current and fallout deposits

*前野 深[1]、中田 節也[1]、及川 輝樹[2]、吉本 充宏[3]、小森 次郎[4]、石塚 吉浩[2]、竹下 欣宏[5]、嶋野 岳人[6]、金子 隆之[1]、長井 雅史[7]
*Fukashi Maeno[1], Setsuya Nakada[1], Teruki Oikawa[2], Mitsuhiro Yoshimoto[3], Jiro Komori[4], Yoshihiro Ishizuka[2], Yoshihiro Takeshita[5], Taketo Shimano[6], Takayuki Kaneko[1], Masashi NAGAI[7]

1.東京大学地震研究所、2.産業技術総合研究所、3.山梨県富士山科学研究所、4.帝京平成大学現代ライフ学部、5.信州大学教育学部、6.常葉大学大学院環境防災科、7.防災科学技術研究所
1.Earthquake Research Institute, University of Tokyo, 2.Geological Survey of Japan, AIST, 3.Mount Fuji Research Institute, Yamanashi Prefectural Government, 4.Faculty of Modern Life, Teikyo Heisei University, 5.Institute of Education, Shinshu University, 6.Graduate School of Environmental and Disaster Research, Tokoha University, 7.National Research Institute for Earth Science and Disaster Prevention

The phreatic eruption at Ontake volcano on 27 September 2014, which caused the worst volcanic disaster (58 deaths and 5 missing persons) in Japan in the past half-century, was reconstructed based on observation of proximal pyroclastic density current (PDC) and fallout deposits. Witnesses' observations were also used to clarify the eruption process. The deposits are divided into three major depositional units (Units A, B, and C) which are characterized by massive, extremely poor-sorted, and multimodal grain-size distribution with 30–50 wt.% of silt to clay component. The depositional condition was initially dry but eventually changed to wet. Unit A originated from gravity-driven turbulent PDCs in the relatively dry, vent-opening phase. Unit B was then produced mainly by fallout from a vigorous moist plume during vent development. Unit C was derived from wet ash fall in the declining stage. Ballistic ejecta continuously occurred during vent opening and development. As evidenced in the finest population of the grain-size distribution, aggregate particles were formed throughout the eruption, and the effect of water in the plume on the aggregation increased with time and distance. The lithofacies and grain-size characteristics of the poorly-sorted deposits observed in the proximal area are similar to those of mudflows or fallout tephra from past phreatic events. It is important to understand the similarity of the deposits when we interpret this type of poorly-sorted deposit solely based on geological records. Using geological records, witness observations, and a theoretical approach, the physical parameters of the Ontake eruption can be constrained. Based on the deposit thickness, duration, and grain-size data, the particle concentration and flow velocity for three PDC lobes in the initial phase were estimated to be 2 $\times 10^{-4}$ to 2 $\times 10^{-3}$ and 24–56 m/s, respectively, applying a scaling analysis using a depth-averaged model of turbulent gravity currents flowing down slopes. The tephra-thinning trend shows a steeper slope in the proximal area than on the trends of similar-sized magmatic eruptions, indicating a large tephra volume deposited over a short distance owing to the wet dispersal conditions. The Ontake eruption provided an opportunity to examine the deposits from a phreatic eruption with a complex eruption sequence that reflects the effect of external water on the eruption dynamics. Further studies may enable to quantitatively evaluate the major factors that caused the many casualties and severe damage to buildings near the eruption source.

キーワード：水蒸気噴火、御嶽、火砕物密度流、降下火砕物、粒径分布

Keywords: phreatic eruption, Ontake, pyroclastic density current, pyroclastic fallout, grain-size distribution

