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# Altered ash particles mineralogy from Mt. Tangkuban Parahu volcanic products, Indonesia: constraint on the sub-volcanic hydrothermal system

Syahreza Angkasa (1,2), Tsukasa Ohba (1), Mirzam Abdurachman (3), Iwan Setiawan (4), and Mega Rosana (5)

(1) Graduate School of International Resource Science, Akita University, Japan, (2) Departement of Geological Engineering, Universitas Pertamina, Indonesia, (3) Departement of Geological Engineering, Institut Teknologi Bandung, Indonesia, (4) Research Center for Geotechnology, Indonesian Institute of Sciences (LIPI), Indonesia., (5) Faculty of Geological Engineering, Universitas Padjadjaran, Indonesia.

The Mt. Tangkuban Parahu is a shield-like stratovolcano located in Sunda Volcanic Complex (SVC) the province of West Java, Indonesia. Most of the historical eruption at Mt. Tangkuban Parahu resulted from the magmatic activity, however, at Holocene epoch the sub-volcanic hydrothermal system plays an essential role in producing a massive number of phreatic explosions (e.g.,the 2013 eruption with increase activity of fumarolic degassing on the surface). To constraint the sub-volcanic hydrothermal system of Mt. Tangkuban Parahu, we investigated the mineralogy of altered ash fraction (1 millimetres – 250 $\mu$m) mainly from fine ash to lapilli tuff facies of the Holocene volcanic products by using petrography, SEM-EDS, and X-ray diffraction. The main mineral phases are quartz, amourphous silica (opal-cristobalite and opal-tridymite), alunite and kaolinite with the accessory anatase, K-feldspar, pyrite, rare chalcopyrite and enargite. The silica alteration on volcanic products ranging from pervasive strong – selective moderate degree of alteration and incorporated with multiple phases of alunite (e.g., K, Na) and kaolinite grains. Both alunite and kaolinite predominantly occurred a filling pore or voids, although some fracture-filling (veinlets) of alunite grains along with quartz, hematite, and rare pyrite. From the alteration type and mineral assemblages (pervasive silica, selective-moderate silica+alunite+anatase, selective-moderate silica+alunite+anatase$\pm$kaolinite) display the origin of acidic alteration on the near surface environment (T$<$120?C), whereas the ore minerals associated with pervasive-strong silica possibly originated from the roots of surface alteration (T$<$280?C) at greater depth. The presence of ore minerals along with alunite and quartz veinlets always coexisted with the juvenile component of vesiculated and blocky scoria on the volcanic products. These indicate the sub-volcanic magmatic intrusion has an implication to the condition of hydrothermal system underneath Mt. Tangkuban Parahu.