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Textural study of the Puy Chopine trachytic eruption, Chaîne des Puys, France

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The Puy Chopine volcano (Quaternary Chaîne des Puys of the French Massif Central) has a trachytic spine, 160 m high and 500 m wide, in a crater formed by collapse of a scoria cone (Puy de Gouttes), during an explosive eruption with the same petrographic features as the spine. The proximal and distal pyroclastic deposits contain an array of fragments, both juvenile (vesiculated rhyolite pumice, fresh dense rhyolite fragments) and non juvenile (altered dense rhyolite, black scoria, granite, schist). Its complexity has perplexed early workers such as Scrope (1858). One explanation for the Chopine volcano eruption is (Boivin in 1983) that the intrusion of a trachyte magma underneath the Gouttes created a pheatomagmatic eruption, leaving a large crater or maar. A final spine was protruded. However, Boudon et al (2015) suggested that the Chopine could have formed from superficial dome explosions, formed at the onset of lava dome formation, where the impermeable carapace of an extruding magma built up significant overpressure to produce lateral explosions. In addition, van Wyk de Vries et al (2015) suggested that the Chopine first developed as a cryptodome, deforming the Gouttes as a 'crater of elevation', which collapsed to trigger shallow explosions from the exposed intrusion. We describe the textures of the Chopine dome and its explosive facies. Observations of a sequence deposited one km from the eruptive vent have identified at least six units linked to the Chopine eruptive sequence. The lowest gray layer is $\sim$1 m thick, and is composed of accidental lithics and fresh dome materials. This layer is interpreted as a pyroclastic density current deposit with ballistics from the initial explosion. Juveniles vary from very dense to pumice-like, and can be tuff-like breccias. Most clasts are angular, except the non-juvenile and the breccia facies. Notable textural features are color-banding/lenses in some juvenile dense and vesicular samples. Inclusions of fluidal basalt are found in some clasts. The physical (density, porosity, connectivity and permeability), textural parameters (in terms of vesicle and crystal size distribution) and geochemical characteristics of the products of Chopine are analyzed to constrain the eruptive processes. These show that there was dense magma, with brecciated and cooled facies existing near the surface prior to the first explosion, and that the subsequent explosive products were more vesiculated. The Chopine spine represents the final dense magma extrusion, and has similar properties as the initial intrusion. The Chopine has gone through over 200 years of progressive research. With the advancement of technology and knowledge, revisiting such a volcano can provide a fresh perspective on the volcano's eruption dynamics that builds on the initial insights. Findings from this study could serve as an analog for other volcanic systems, but more importantly, contribute to the understanding of the diverse volcanism in Chaîne des Puys, where the trachytic magma sources are probably not extinct.