Chemical and textural characterization of cannonballs from Cerro Chopo volcano (Costa Rica): a preliminary approach to their origin

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The term "cannonball" is generally referred to spherical or sub-spherical juvenile tephra, which are found at basaltic cinder cones worldwide (e.g. Alvarado et al., 2011). Cannonballs are interpreted as hot pasty lava rounded by mechanical processes while travelling at high speed down slopes (Francis, 1973) or as repeatedly recycled juvenile tephra through the vent (Alvarado et al., 2011). However, those mechanisms of formation are not well demonstrated and source of controversy.

In this study, we present a physical and chemical characterization of cannonballs from Cerro Chopo (Costa Rica). Visual and SEM observations reveal the occurrence of two distinct domains inside the sample: i) a core zone, characterized by porosity in the range 25-28%, large vesicles (up to 0.78 mm length), polymodal vesicle distribution with coalescence phenomena to form larger size vesicles and collapse of the smaller ones; and ii) a rim zone, with porosity of ~19%, micro-vesicles (up to 0.12 mm length), abundant microlites (particularly clinopyroxene + magnetite) displaying steeper crystal size distributions than the core zone. No significant variations in crystal compositions (Fo82-87 olivine, diopsidic-augitic clinopyroxene, and An77-An85 plagioclase:) are observed from core-to-rim of the cannonball indicating an origin from a common magmatic source.