Genesis of Armored Lava Bombs with Detached Rinds (ALB-DR) during Rootless Cone Formation (Mývatn, Iceland)

Arthur Chardon*[1], Gabriel Buguet[1], Hervé Leyrit*[2], Elsa Ottavi Pupier , Rejanne Le Bivic[2], Julien Duquennoy[1], Maxime Denis[1], and Sébastien Potel[2]

[1]Institut Polytechnique UniLaSalle – 19 rue Pierre Waguet 60000 Beauvais, France – France
[2]Institut Polytechnique UniLaSalle, UPJV, B2R (GeNumEr), U2R 7511 – 19 Rue Pierre Waguet, BP 30313, 60026 Beauvais, France – France

Résumé

The Mývatn–Aaldalur area lies within Iceland's Northern Volcanic Zone, where fissure-fed basalts of the _˜2.15 ka Younger Laxá Lava (YLL) interacted with water-saturated lacustrine and alluvial sediments to produce extensive fields of rootless cones. Among the associated ejecta, a new type of Armored Lava Bomb with Detached Rinds (ALB-DR) is described.
Three localities were investigated: Geirastair (West Mývatn) and Fagranes (Aaldalur plain) with lapilli/spatter cones and Rauhólar (Laxárdalur valley) with lapilli cones. These edifices range from 15–20 m in diameter and 6–7 m in height. The bombs all feature a core surrounded by a rind of YLL material. At Geirastadir and Raudholar, the rind consists of an inner layer (1–1.5 cm thick), poorly vesicular with 10–15% plagioclase phenocrysts, and an outer layer that is highly vesicular (40–50%) with 5–7% plagioclase. The nature of the core varies by site: it consists of vesicular YLL at Geirastadir (spherical vesicles) and Fagranes (pipe-shaped vesicles), while at Raudholar, it is made of unconsolidated diatomaceous silts. A circumferentially discontinuous pericore gap 1–3 mm thick commonly separates core and rind.

Previous models suggest that bombs are first ejected from a vent, then fall back into the crater, become re-coated by ponded or spattering lava, and are re-ejected. A direct-sheathing mechanism is therefore proposed, driven by phreatomagmatic bursts at the lava–wet-sediment interface: (i) sedimentary fragments and basal lava clasts are entrained and ascend through the molten surface layer; (ii) during coating, a transient steam film (Leidenfrost-like) at the core–lava interface limits bonding while shear wraps the core in molten YLL; (iii) rapid quench of the rind, together with core dewatering and late degassing, promotes partial debonding that preserves the discontinuous gap.
ALB-DR constitute diagnostic products of rootless explosive processes in basaltic successions where vents are cryptic. Their morphology and textural features provide constraints on cooling kinetics, core–rind rheology, and fragment ascent dynamics within active flows. This framework highlights the role of steam-film physics in shaping armored bombs and may be applicable to other fissure-fed basaltic provinces.

*Intervenant

Mots-Clés: Icelandic Northern Volcanic Zone (NVZ), rootless cones, armored lava bombs, lava–sediment interaction, Younger Laxá Lava (YLL)