Chaotic flow and fragmentation patterns in the acidic feeder system from the Paraná-Etendeka Large Igneous Province

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The external and internal geometries of volcanic conduits and feeding dykes have great effect on both magma ascent and flow rates, as they may influence degassing pathways and rupture mechanisms toward the surface. However, most studies are focused on only characterizing the geometry of central conduits. In the Early Cretaceous Paraná-Etendeka magmatic province (PEMP), one of the largest flood volcanic provinces on our planet, sheet-like rhyolitic to dacitic products cover an area over 30,000 km^2. In South Brazil, where these silicic rocks are found on top of basaltic flows, the opening of new quarries for dimension stones exploitation revealed part of their conduit system (Lima et al., 2012; doi:10.5327/Z1519-874X2012000200004): a 0.5 up to 2 km wide discontinuous fissure system. The present work describes a peculiar mechanism recognized in the feeder system of this igneous province: side-by-side flow and blow.

We present and discuss the use of fractal dimension (FD) for the description and classification of an ancient fissure feeder system and related deposits. The combination of detailed field work and determination of FD along outcrops, point towards different morphological domains for flow and blow structures. Fragmentation fronts form a zone of layered lens-shaped eutaxitic-like and breccia domains. Next to the fragmentation front, flows may be tightly folded with sub-horizontal superposed axial planes depicting a collapsing vertical movement. Huge solitary bubbles (diameter>40cm) may represent coalescent slugs of foamed magma. Bubbles complexly refold previous flow lines in a chaotic way. Described patterns suggest at least two different fragmentation episodes preceding or coeval with melt extrusion: a) a high temperature event (above glass-transition) and, b) a lower temperature event (below glass-transition). Additionally, repetitive intrusive and rheomorphic to remelting events may be locally recognized through deformational signs such as: pseudotachylite-like veins, progressive development of a strong stretching foliation and stair-stepping objects along the flow.

Our data point towards parallel oscillations in response to the periodic decompression process in the conduits. A very efficient magma ascent system together with high heat flux