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# Relationship between caldera collapse and magma chamber withdrawal: An experimental approach.

**A. Geyer**, A. Folch and J. Martí

Institute of Earth Sciences Jaume Almera (IJA-CSIC), Barcelona, Spain (ageyer@ija.csic.es / Fax: +34 93 411 00 12 / Phone: +34 93 409 54 10)

**Abstract**. Collapse calderas have received considerable attention due to their link to Earth's ore deposits and geothermal energy resources, but also because their tremendous destructive potential. Although calderas have been investigated through fieldwork, numerical models and experimental studies, some important aspects remain poorly understood yet. One key issue concerns the volumes of magmas involved in caldera-forming eruptions. We perform analogue experiments to correlate the structural evolution of a collapse with the erupted magma chamber volume fraction. The apparatus comprises a transparent box (60 x 60 x 40 cm) filled with dry quartz sand and a water-filled latex balloon as a magma chamber analogue. Evacuation of water through a pipe causes a progressive deflation of the balloon that leads to a collapse of the overlaying structure. The experimental device allows to record the temporal evolution of the collapse and to track the evolution of fractures and faults. We distinguish up to six different steps or stages characterized by the appearance of new structural features or by a distinctive evolution of previous ones, and correlate each different step with the corresponding removed volume fraction. We also determine the critical conditions for caldera onset. Experimental results show that, at any stage, the experimental relationship between volume fraction and chamber roof aspect ratio fits a logarithmic curve. It implies that volume fractions required to trigger a collapse are higher for chambers with low aspect ratios (shallow and wide) than for chambers with high aspect ratios (deep and small). These results are in agreement with natural examples and previous theoretical studies.