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Solid Earth
Discussions

Interactive comment on "Estimating the depth and evolution of intrusions at resurgent calderas: Los Humeros (Mexico)" *by* Stefano Urbani et al.

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This manuscript focuses on the resurgence of Los Humeros Volcanic Complex (LHVC), using field work results together with analogue modeling to infer the depth and extent of intrusions responsible for resurgence. Resurgence has been identified recently at LHVC, so there is a real need for documenting and modeling it. The manuscript brings interesting results for resurgence in general (discontinuous process in time and space). However, a certain number of problems or questions (divided into two parts) should be resolved before publication.

(1). Introduction should be reworked to better present caldera resurgence

References are missing in the introduction. Important articles related to caldera resur-

gence should be cited at the beginning. Smith and Bailey (1968) and Lipman (1984) are two key literature review papers that should be referred to when defining resurgence and its main characteristics.

Smith, R. L., & Bailey, R. A. (1968). Resurgent cauldrons. Geological Society of America Memoirs, 116, 613–662. https://doi.org/10.1130/MEM116

Lipman, P. W. (1984). The Roots of Ash Flow Calderas in Western North AmericaâĂŕ: Windows Into the Tops of Granitic Batholiths. Journal of Geophysical Research, 89(B10), 8801–8841.

Some statements are two quickly made :

- When it comes to the magmatic origin of resurgence, it is not a resolved question yet, as hydrothermal systems are also important sources of deformation in calderas and as different processes and timescales overlap in post-collapse caldera deformation. This complexity should be mentioned and a few arguments in favor of the magmatic origin should be given (such as large amplitudes and long timescales of the uplift, magmatic intrusions found in old eroded resurgent calderas).

- "It is attributed to the emplacement of silicic magma". I have reasons to believe that resurgence also happens in basaltic environments even if it is not documented yet (article in preparation on a caldera in Galapagos). Additionally, resurgence is often associated with the injection of more primitive (then more mafic) magma (see references in a paper you cited: Brothelande et al., 2016, P.2, end of the first paragraph).

When mentioning uplift styles and rates of natural resurgence, give specific natural examples (and associated references).

A short description of the morphology of resurgent structures should be given, so the reader could be able to compare Los Potreros resurgent dome to other examples, and know if it has a typical or atypical morphology. Most resurgent domes are elongated and host one (or several) longitudinal graben at the top (See for instance Fig. 1 of

Brothelande et al., 2016). Can circular domes can be considered as less common in nature?

L. 53-55 - Confusing sentence: “with resurgence within the innermost... due to the uplift of a resurgence due to...”. Please reformulate. Additionally “commonly” seems incorrect in this context.

(2). Analogue modelling should be revised

L. 143 : incorrect use of term “respectively”.

Figure 2 should be better designed: it does not show how the silicone intrudes the sand pack. Caption can be completed as well.

I would not use the term graben to designate the crestal depression that develops at the apex of a circular tectonic dome : a graben is generally a depressed block of the crust bordered by parallel faults.

A very small number of experiments were conducted: 3. This is far to be enough to be representative and reliable. How are experiments 4 and 5 different in terms of initial conditions? It seems there is only two sets of different initial conditions. Two additional concerns arise from there:

- The sand pack thickness T is considered as the only unknown variable. Unless it is properly justified, the source diameter D is also unknown, and should be varied. D is commonly considered as a variable in experiments, that show a high relevance of the T/D ratio.

- The authors claim they evidence a linear relationship between Lg and T (L.257 – Fig. 7): how can a relationship be inferred from only two points?

I am very confused by the author’s choice of model geometries. This manuscript present experiments of circular shaped domes with circular depressions in order to interpret an elongated dome with a longitudinal graben (Loma Blanca bulge). Why?

Then, they rely on Brothelande and Merle (2015) to complete their results interpretation and Tt calculation. However, the geometry of models are different : Brothelande and Merle study elongated sources with linear grabens. Is this exactly comparable?

On the other hand, previous analogue models of circular intrusion-related domes have been performed, some of which showing crestal depressions and radial extension patterns as in the authors experiments. However, they are very poorly referenced : Acocella et al., 2001 ; Walter and Troll, 2001; Marti et al., 1994; Galland et al., 2009, etc. Please recall more clearly what were the main conclusions of resurgence analogue experiments, and how the new experiments in this manuscript were designed to complete these studies.

Acocella, V., Cifelli, F., & Funiciello, R. (2001). The control of overburden thickness on resurgent domes: insights from analogue models. Journal of Volcanology and Geothermal Research, 111(1–4), 137–153. https://doi.org/10.1016/S0377-0273(01)00224-4

Galland, O., Planke, S., Neumann, E.-R., & Malthe-Sørenssen, A. (2009). Experimental modelling of shallow magma emplacement: Application to saucer-shaped intrusions. Earth and Planetary Science Letters, 277(3–4), 373–383. https://doi.org/10.1016/j.epsl.2008.11.003

Marti, J., Ablay, G. J., Redshaw, L. T., & Sparks, R. S. J. (1994). Experimental studies of collapse calderas. Journal of the Geological Society, London, 151(6), 919–929. Retrieved from http://jgs.lyellcollection.org/content/151/6/919.short

Walter, T. R., & Troll, V. R. (2001). Formation of caldera periphery faults: an experimental study. Bulletin of Volcanology, 63(2–3), 191–203. Retrieved from http://link.springer.com/article/10.1007/s004450100135

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