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Interactive comment on “Floating sandstones off El Hierro (Canary Islands, Spain): the peculiar case of the October 2011 eruption” by V. R. Troll et al.

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Floating sandstones off El Hierro (Canary Islands, Spain): The peculiar case of the October 2011 eruption.

By Valentin Troll et al. —————

Comments by Raphaël Paris (Laboratoire Magmas & Volcans, Clermont-Ferrand).

General comments:

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Interactive Discussion

Discussion Paper



Troll et al. propose a sedimentary origin for the white pumiceous rock found in El Hierro 2011 lavas at the beginning of the eruption (eruption that is not finished yet).

1. Origin of the gas: I can't understand the origin of the gas in your model. The structure of the rock (so-called "Restingolite") suggest that the two phases, dark glassy crust and white pumiceous heart, are almost immiscible (see also Araña and Ibarrola, 1973), the mingling being limited to thin veins of juvenile basanitic magma in the white pumice. The experimental approach carried out by Berg (2011) tentatively reproduces the formation of vesicules in sedimentary xenoliths exposed to high temperature and pressure (850-870°C, 1 kbar), but the results show few vesiculation, whereas the Restingolite displays ~80% vesiculation (pumice-like).

2. Lines 63-68 and abstract: The other hypothesis proposed to explain the origin of the white pumice-like rock emitted during the 2011 eruption in El Hierro are only briefly presented and (too) rapidly ruled out. Considering that quartz crystals could be incorporated in the latest stage of magma ascent (close to the vent, in contact with present-day sea-bottom sediments), how can you eliminate a magmatic origin just on the basis that "igneous rocks reported from El Hierro barely reaches silica concentrations of 65 wt. %"?

3. The texture and structure of the "Restingolite" and its associated xenoliths are described and compared to other xenolith-bearing rocks in the Canary Islands. Nevertheless, the comparison is not detailed enough to allow the reader having its own opinion.

The "rhyolitic pumices" found in the Teneguia lavas (1971 eruption in La Palma) were described by Araña and Ibarrola (1973) as "white and homogeneously porous pumices, closely resembling foam [...] They have never been found included in the lavas." It is quite evident that the same processes occurred in El Hierro 40 years after, but the Teneguia eruption was not submarine. Thus, the hypothesis proposed by Coello (2011) is flawed. Klügel et al. (1999) also describe "pumiceous quartz-bearing rocks with rhyolitic composition", but at the end of the 1949 eruption in La Palma.

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Interactive Discussion

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As far as I know, the other samples mentioned do not display the same structure, but rather appear as inclusions in the host magma (to be discussed): e.g. in the 1730-36 lavas in Lanzarote, the xenoliths are not vesiculated (sample ANG-58 in Table 3, see Aparicio et al., 2006).

Gran Canaria: surprisingly sample HAT917C (Hoernle, 1998) mentioned in table 3 display only 20% of vesicularity in Hansteen & Troll (2003), whereas Gran Canaria sample presented in fig. 3 G-H-I shows 78% of vesicularity. Please clarify this point (see also remark lines 176-178).

On final figure 4, I think that it would be very useful to carefully plot data from xenoliths in 1949 lavas in La Palma (Klügel et al., 1999), 1730-36 lavas in Lanzarote (Aparicio et al., 2006) and 1979 Teneguia lavas in La Palma (Araña & Ibarolla, 1973). Other analysis of the 2011 eruption (15 October samples) are available at: http://www.ign.es/ign/recursos/volcanologia/pdf/Informe_petrologico_erupci%C3%B3n_Hierro.pdf

Specific comments:

Title: the use of the term “sandstone” should be avoided -> sedimentary xenoliths? (following your hypothesis). The term “floating” is maybe not necessary, since blocks of basanitic lava without pumice were also found floating for a while during their degassing at the sea surface (later phases of the eruption).

Line 69: “high-silica volcanism is uncommon on El Hierro” -> please remind that there are some mafic trachytic lavaflows (with no more than 55.6 % of Si: Carracedo et al. 2001).

Lines 77-78: the sentence “We collected ... and elemental analysis” should be moved to line 60 (after “first days of eruption”).

Lines 78-81: delete this sentence.

Line 159: similar in composition AND STRUCTURE (white pumice heart surrounded by a dark basaltic crust).

SED

3, C562–C566, 2011

Interactive
Comment

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Interactive Discussion

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Line 159: “their analysis n° 2”: there are 3 analysis of the white pumice in Anaña and Ibarolla (1973): n°2, 3 and 4.

Lines 176-178: The authors provide data on Gran Canaria “xeno-pumice” (% of vesicularity and synchrotron view) but without giving any reference.

Line 210: Please remind the definition of the “layer 1” of the oceanic crust (for colleagues who are not familiar with this).

Sampling of the following phases (November 2011) did not revealed any white pumice, only basanitic magma. This is an important observation to mention.

Line 240 - Seismicity: Do you remember what was the depth of the 13 earthquakes recorded between March and October 2004?

Line 240 - Seismicity: when looking at IGN data, we can observe this depth range of 7-17 km in August and July, but after 21 September the depth distribution is less homogenous.

Line 240 – Depth of fractionation: A thermobarometric and petrologic study by Stroncik et al. (2009) suggest that the final crystal fractionation of magma beneath El Hierro is within the uppermost mantle, at depth between 19 and 26 km, the magma supply being limited and periodic in intermittent magma chambers.

Fig. 3E & 3F: It's surprising to find clay fragments preserved in such a vesiculated “body”. Do you have an explanation? Don't you think that sediments from the present-day sea bottom (shallow eruptive vent at ~300 m deep) could have been incorporated in the magma?

Fig. 4: Zr is used for 75% of the charts presented. Please justify this choice.

Technical corrections:

There is no location map provided.

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Interactive Discussion

Discussion Paper



Line 51: keywords: “submarine eruption”.

Line 27: delete the word “intriguing”.

Line 60: Could you indicate the date of sampling?

Line 173: Figure 2D & E are for El Hierro, not for Gran Canaria.

Line 227: “The large quantities” -> start a new paragraph.

Table 1 is not necessary (it’s my opinion).

XRD analysis should appear as a figure (coupling A2 and A3), not only appendix.

References: McLeod & Sparks (1998) and Sparks (1998) have the same title. Do you mean Sparks (1978) JVGR 3, 1-37?

References

Abratis, M., Schmincke, H.U., Hansteen, T.H., 2002. Composition and evolution of submarine volcanic rocks from the central and western Canary Islands. *Int J Earth Sci (Geol Rundsch)* (2002) 91:562–582.

Stroncik, N.A., Klügel, A., Hansteen, T.H., 2009. The magmatic plumbing system beneath El Hierro (Canary Islands): constraints from phenocrysts and naturally quenched basaltic glasses in submarine rocks. *Contrib. Mineral. Petrol.* 157, 593-607.

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