

Preliminary experimental results on the influence of sulphur on the phase relationships of the 2021 Cumbre Vieja tephrite-basanite

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Sulphur, and all its species, has been one of the most studied volatiles in the last decades to improve our knowledge of magma degassing processes. Yet, most of the experimental works with sulphur focused their research on evolved magmas. The last S-rich eruption of Cumbre Vieja (La Palma) has provided an opportunity to collect samples throughout the entire eruption sequence. Our attention has been focused on the first products that have erupted, in an effort to provide constraints on S budgets at depth.

We performed experiments with an internally heated pressure vessel (IHPV) at 200 MPa and 1040 °C; the fugacity of oxygen was between ΔNNO 4.10 and ΔNNO -0.48. For each series of experiments, individual capsules were doped with different concentrations of sulphur, using either native sulphur or pyrrhotite as sources, with bulk S contents between 0.5 wt% up to 2 wt%, and under water-saturated conditions, to facilitate comparison with previous similar work [1,2]. Results show that S affects the phase relations in a complex way, as well as the composition of some phases, depending on the $f\text{O}_2$ of the experiments. In particular, amphibole is unstable at intermediate $f\text{O}_2$ and under S-rich conditions, while sulfide precipitates below $\text{NNO}+1.5$ only. Melt S content ranges between about 2000 ppm up to over 8000 ppm, depending on the applied redox conditions, high $f\text{O}_2$ favouring higher S contents, as observed elsewhere. Varying the bulk S content affects the residual liquid compositions, which are however mostly controlled by the prevailing $f\text{O}_2$. Altogether, these two variables affect the SiO_2 and FeO contents of residual melts, by about 10 wt% absolute each in the range explored, illustrating the important role of both $f\text{S}_2$ and $f\text{O}_2$ in controlling the liquid line of descent of basaltic magmas. Our first results will be compared with the data from Hekla eruption[1] and El Chichón[2] to observe the influence of sulphur in different magmatic contexts.

1. Moune & François (2009), *Contrib. Mineral. Petrol.*, 157, 691-707
2. Luhr (1990) *J. Petrol.*, 31, 1071-1114