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A study of crystals and glasses from the 2011 submarine eruption at El Hierro, Canary Islands

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A submarine eruption began off the south coast of El Hierro, Canary Islands, on 10 October 2011. This is the first confirmed eruption at El Hierro in over 500 years of historical records. Here we present preliminary results on the composition of crystals, matrix glass and glass (melt) inclusions from samples erupted on ca. 15 October and on 1 November 2011. While the October samples are glassy, aphyric lava crusts enveloping xenoliths of sedimentary origin (see Troll et al., 2011), the November sample is a fragment of a block composed entirely of juvenile lava bearing crystals of olivine (Fo79-81), Fe-Ti oxides and clinopyroxene (Mg#=71-79). Microprobe analyses of microlite-poor matrix glass chips from the October and November samples are similiar and yield an average basanite composition of 45.2 wt.% SiO_2, 4.3 wt.% TiO_2, 4.8 wt.% MgO and 6.4 wt.% alkalis (Na2O + K2O). A few highly vesicular, microlite-rich glass shards from the 1 November sample have slightly lower MgO and CaO, and higher FeO(t) and Na2O, attesting to the effect of rapid microlite crystallisation on glass composition. Chlorine and sulphur concentrations in matrix glass range from 710-1270 ppm and 300-640 ppm, respectively. The uncorrected compositions of melt inclusions largely overlap with the matrix glass major element and chlorine data. By contrast, melt inclusions show much higher sulphur concentrations, with a range of 660-3950 ppm. Indeed, 60% of analysed melt inclusions (n=38) yield S concentrations above 1500 ppm. Such high S concentrations are uncommon for MORB and OIB, with a few examples from Loihi Seamount (up to 3330 ppm; Hauri, 2002), and Gran Canaria (up to 5810 ppm; Gurenko and Schmincke, 2000), and have important implications for the mantle source and degassing of Canary Island volcanoes. In addition, preliminary results on clinopyroxene-melt barometry yield crystallisation pressures corresponding to uppermost mantle depths beneath El Hierro, in remarkable agreement with syn-eruptive seismicity.

References:

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