The opening phase of the 2010 summit eruption of Eyjafjallajökull volcano, Iceland: Contributions from morpho-textural and geochemical characterization of tephra

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The 2010 summit eruption of Eyjafjallajökull volcano (Iceland) started on 14 April when the eruption melted its way through the ice-filled summit caldera. We focus on the opening phase of the event (first 15-17 hours), which represents a unique opportunity to investigate triggering mechanisms and pre-eruptive dynamics.

Tephra samples were collected from the pristine fallout deposits ~4.5 km east from the crater. On the whole, the juvenile components along the eruptive sequence show a large morphological and textural variability. The peculiarity of the products of the opening phase is the presence of abundant (40 vol.%) blocky, dense, obsidian-like, microlite-poor clasts. These features suggest important quenching effects of the first body intruded at the base of the ice cover immediately before the eruption onset. Major and trace element analyses on groundmass glass of this phase highlight the occurrence of clasts with a larger compositional variability than those of the products from the following phases. Similarly, $^{87}Sr/^{86}Sr$ ratios determined by microdrilling on single ash clasts revealed the presence of groundmass glass with large isotopic variability, ranging from the typical values recorded in Icelandic magma, up to much higher values ($^{87}Sr/^{86}Sr = 0.70668$), never found in Icelandic volcanics. Conversely, plagioclase crystals from the same phase of activity have low $^{87}Sr/^{86}Sr$ values. These compositional and isotopic data suggest that the very first erupted magma assimilated hydrothermally altered volcanic/epiclastic rocks with high Sr isotopic ratio, possibly in the immediately pre-eruptive phase. The results confirm the importance of studying the products of the opening phases of explosive eruptions in order to get a complete understanding of pre-eruptive conditions.

Zircon U-Pb ages and $\delta^{18}O$ in a 'contaminated' lower crustal metagabbro (Serre Massif, Calabria)

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Previous dating of granulitic metagabbros from the base of a near-complete cross-section of Variscan continental crust exposed in southern Calabria has provided reliable ages of ~300-290 Ma for the late Variscan metamorphism, but less convincing ages of ~593-564 Ma for the original mafic magmatism [1,2,3]. Zircon extracted from a basal metagabbro to determine the age and nature of deep crustal magmatism has two main forms: moderately luminescent, weakly zoned overgrowths or whole grains with no core, and cores surrounded by an overgrowth. 53 SHRIMP U-Pb dates have a wide range from ~3.2 Ga to ~270 Ma. 35 cores are older than ~330 Ma, with weak clusters at 720±40, 620±35 and 560±25 Ma. The largest cluster, at 455±9 Ma (6 cores), is the youngest possibly pre-metamorphic group. Overgrowths and coreless grains (Th/U <0.3) all have dates ≤330 Ma, giving ~313 Ma as the maximum age for the youngest thermal event that produced zircon growth or recrystallization. All this zircon has high $\delta^{18}O$ (9.3–10.6‰), indicating crystallization in the presence of sediment related fluids. Several cores in the 330-500 Ma range have the same features. Older cores have lower $\delta^{18}O$ (6.1-9.2‰), but only three are <7.5‰. There is no preserved evidence for any zircon in the metagabbro being primary zircon crystallized from a mantle-derived magma. Instead, the oxygen isotopes have a strong sediment signature, consistent with the large amount of detrital zircon in the rock. Either the metagabbro is dominantly of metasedimentary origin, or prolonged granulitic evolution of a sediment-'contaminated' mafic magma in the deep crust has largely modified the zircon $\delta^{18}O$ and some U-Pb dates, making it hard to determine the gabbro emplacement age. If the 455±9 Ma zircon is detrital, however, the gabbro magmatism must be younger. These inferences now need to be tested using trace element and isotopic analyses of zircon and other minerals from the metagabbro and associated rocks.

[1] Schenk & Todt (1989) *Terra Abstracts* **1**, 350. [2] Micheletti *et al.* (2008) *Lithos* **104**, 1-11. [3] Fornelli *et al.* (2011) *Mineral. Petrol* **103**, 101-122.

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