Characterization of volatile contents in primitive magmas of an active carbonatitic volcanic complex (Oldoinyo Lengai, Tanzania)

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Carbonatites are rare magmas, usually associated with highly alkaline rocks; they form the main Rare Earth Elements (REE) deposits worldwide. The origin of carbonatites, in particular, their parental melt composition and its CO_2-H_2O contents, are still a subject of debate. Two main hypotheses are still proposed to explain the genesis of those C-rich magmas: they may form by melting of a C-rich mantle source, or through extreme differentiation of upper mantle derived melts resulting in C enrichment causing carbonate-silicate melt immiscibility. In order to address this issue, we have focussed on primitive deep cumulative samples from Embalulu Oltatwa, a flank maar associated with Oldoinyo Lengai (OL), the only active carbonatite volcano on Earth. The studied samples document crystallization of olivine (Ol) followed by clinopyroxene, phlogopite, and then amphibole from a nephelinite melt similar in composition to those from several flank cones in the OL area. The nephelinites are, together with melilitites, among the most primitive magmas from the OL region, and can be considered to be genetically related to OL carbonatites. Nephelinite major, trace, and volatile composition has been characterized from Ol-hosted glass inclusions with EPMA, LA-ICP-MS, and SIMS, respectively. We can thus present the first data for CO_2-H_2O concentrations in carbonatite's parental magma: CO_2 contents up to 4500 ppm, and a H_2O average content of 1.1 ± 0.2 wt%. These data will be used 1/ to discuss the overall evolution of the system in terms of carbon balance, and 2/ to estimate CO_2 and H_2O contents in the mantle source based on Nb and Ce contents in the melts inclusions.