Degassing characteristics of volcanogenetic CO_2 in continental rift system, East Asia

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Continental rift systems, together with the related intraplate volcanism, have been considered as the significant pathways for deep carbon degassing from Earth's interior to the exosphere and leading to global climate changes [1]. The consistent pattern between cumulative rift length and palaeo-atmospheric CO_2 levels since Mesozoic further confirms that the continental rift systems are critical forcing on greenhouse palaeo-climate episodes [2]. Songliao basin and its peripheral region in NE China, have experienced long-duration continental rifting since Late Mesozoic. Wudalianchi potassium-rich active volcanic field, with the latest eruption occurred in 1719-1721 AD, located at the northern margin of Songliao basin within continental rift system in East Asia, exhibits various volcanogenetic degassing characteristics mainly including numerous cold bubbling springs, soil micro-seepage and fault systems. However, magma CO_2 degassing mechanism and its genesis still remain controversial. Diffuse soil CO_2 survey based on accumulation chamber method reveals that average value of the soil CO_2 fluxes is 18.7 g m^{-2} d^{-1} and total flux of soil CO_2 output is ca. 2.45 Mt a^{-1}, suggesting weak degassing of underlying magma chamber in WMVF. Flux mapping shows that the soil CO_2 emissions are mainly controlled by regional faults, peripheral groundwater and surface permeability. Based on the C-He isotope coupling model, combined with previous petrogenesis and geophysical studies, we propose a two-stage model to constrain the evolution of magma-derived volatiles in WMVF. The stage one is concerned with the upper mantle metasomatized by the mixed melts of recycled carbonate and accumulated silicate components from deep-subducted Pacific slab in the mantle transition zone, whereas the stage two is related to variable degree of crustal contamination (organic metasediments and carbonate in the continental crust) during their arising process.

[1] Foley & Fischer (2017) Nature Geoscience **10**, 897–902.
[2] Brune *et al*. (2017) Nature Geoscience **10**, 941–946.