Fluxes and genesis of CO_2 degassing from typical volcanic-geothermal fields in the Tibetan Plateau

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The India-Asia continent collision zone, formed by subsequent underthrusting of Indian continental lithosphere beneath Asian continent at 55-50 Ma, which has been regarded as a major driver of atmospheric CO_2 concentration (p_{CO2}), and thus the global climate change in the Cenozoic [1]. The rapid uplift and east-west extension of Tibetan lithosphere resulted in the formation of several NS trending rifts in south Tibet. Intensive geothermal activities in Tibetan Plateau suggest huge abilities for releasing greenhouse gases to the atmosphere. However, few studies have been carried out to estimate the greenhouse gas flux so far, and its genesis still remains on highly debate. Gulu-Yadong rift (GYR), the largest and longest extension rift in Lhasa terrane, many volcanic-geothermal fields, which comprise intense hot springs, steaming fissures, geysers and soil micro-seepage, are distributed in the GYR, making it ideal area for studying deep carbon emissions in the India-Asia continent subduction zone. It is indicated that the total flux of greenhouse gases (referring mainly to CO_2) from the north GYR is ca. 15 Mt a^{-1} following the accumulation chamber method, taking up about 3% of the total CO_2 flux from global subaerial volcanism (540 Mt a^{-1}, Burton *et al*. [2]), which suggested that the continental collision-subduction zones represented by the Tibetan plateau are nonnegligible part of deep carbon emissions. Combined with previous petrogeochemical and geophysical data, geochemical characteristics of the volcanic-geothermal gases (including CO_2 and He) show that (1) excess mantle-derived ^3He reflects degassing of volatiles related with partial melts from enriched mantle wedge induced by northward subduction of the Indian lithosphere, and (2) the crust-mantle interaction can provide continuous heat and materials for the overlying volcanic-geothermal system, in which magma-derived volatiles are inferred to experience significant crustal contamination during their migration to the surface.

[1] Kent & Muttoni (2008) PNAS **105**, 16065–16070. [2] Burton *et al*. (2013) Rev. in Mineralogy & Geochemistry **75**, 323–354.