Magma-derived CO_2 emissions in the Tengchong volcanic field, SE Tibet: Implications for deep carbon cycle at the India-Asia continental subduction zone

MAOLIANG ZHANG [1*], ZHENGFU GUO [1], LIHONG ZHANG [1], YUTAO SUN [1], ZHIHUI CHENG [1], TSANYAO FRANK YANG [2]

[1] Key Laboratory of Cenozoic Geology and Environment, Institute of Geology and Geophysics, Chinese Academy of Sciences, Beijing 100029, China, mlzhang@mail.iggcas.ac.cn (* presenting author)

[2] Department of Geosciences, National Taiwan University, Taipei 10699

Large-scale active volcanoes, together with strongly modern hydrothermal activities, are located in the Tengchong volcanic field (TVF) of the southeastern margin in the India-Asia continental subduction zone. They provide an important opportunity for estimating deep carbon flux released by active volcanoes at the India-Asia continental subduction zone and probing nature of continental lithospheric subduction-related volatile recycling. We performed a soil microseepage survey using accumulation chamber method and calculated an average soil CO_2 flux of ca. 280 g m^{-2} d^{-1} and a total soil CO_2 output of 6.30×10^5 t a^{-1} for the Rehai geothermal park and adjacent region in the TVF. Combined with previous estimation of magma-derived CO_2 flux from hot springs (5.30×10^4 t a^{-1}) and soil microseepage in other two volcanic and geothermal anomaly regions (3.80×10^6 t a^{-1}), total magma-derived CO_2 flux of the whole TVF is about 4.48×10^6 t a^{-1}, which should be incorporated for estimation of the global volcanic subaerial CO_2 flux in future. Both bubble gas and soil gas samples from the TVF display enrichment in CO_2 (>85%) and remarkable contribution from mantle components as suggested by $^3He/^4He$ (1.55–5.27 R_A) and $\delta^{13}C$-CO_2 (–9.00‰ to –2.07‰). Combined with previous studies on Holocene volcanic rocks and seismic tomography, we suggest that components from both recycled crust and continental crust were involved in origin and evolution of mantle-derived magmatic volatiles in the TVF based on a He-C isotope coupling model. We suggest that mantle-derived volcanism at continental subduction zone can be important mechanism for liberation of carbon stored in ancient crustal carbonates, which has the potential to act as a complement to volatile recycling mechanism at subduction zones.