SCG09-P01 Room:Poster Time:April 28 18:15-19:30

Gas geochemistry and soil CO2 flux in active volcanic areas, China

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Changbaishan intra-plate volcano and Tengchong hydrothermal area are two of the active volcanic areas in China. In order to better understand current status of magma/hydrothermal activities of the Changbaishan intra-plate volcano and Tengchong hydrothermal area, we have conducted the soil gas survey and bubbling gas sampling from hot springs around the Tianchi crater lake and Rehai geothermal area.

In Changbaishan volcano, the results show that CO_2 is the major component gas for most samples. The maximum value of helium isotopic ratio of 5.8 R_A (where R_A = ^{3}He/^{4}He in air) implies more than 60% of helium is contributed by mantle component, while carbon isotope values fall in the range of -5.8 to -2.0 ‰ (vs. PDB), indicating magmatic source signatures as well. Nitrogen dominated samples, 18Dawgo, have helium isotopic ratio of 0.7 R_A and carbon isotope value of -11.4 ‰, implying the gas source might be associated with regional crustal components beneath 18Dawgo. The first-time systematic soil CO_2 flux measurements indicate the flux is ca. 22.8 g m^{-2} day^{-1} and 6.8 g m^{-2} day^{-1} at the western and southern flank of Changbaishan, which is at the same level as the background value in the Tatun Volcano Group (24.6 g m^{-2} $day^{-1)}$, implying that Changbaishan may not be as active as TVG.

In Tengchong hydrothermal area, the preliminary results show that CO_2 is the major component gas for most samples. The helium and carbon isotopic ratio fall in the range of 0.5 R_A to 3.5 R_A and -4.7 to -1.6 ‰ (vs. PDB), respectively. We also analyzed the hot springs water. The δD and δ^{18}O values fall in the range from -59.8 to 84.6 ‰ and -6.20 to -12.38 ‰ (vs. SMOW), respectively. Rehai has the highest helium isotopic ratio of 3.5 R_A, which implies ca. 40% of helium is mantle-derived. The δD and δ^{18}O results implied the water in this area was affect by primary magmatic water. Nevertheless, samples from Banglazhang and Shihchiang hydrothermal areas show much lower helium isotopic ratio of 0.8 R_A and 0.5 R_A, respectively. It suggests that the local tectonic setting plays an important role for the gas degassing in this area.

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The reaction between $MgCO_3$ and SiO_2 at high pressure and temperature and genesis of ultra-deep diamonds

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Carbon, one of the important light elements for the Earth science, is reserved in the deep part of the Earth. The evidence of the deep carbon is found in ultra-deep diamonds or estimations of carbon fluxes between the surface and interior of the Earth. Subducting slabs are considered as an important C-source of the Earth. Following reactions of $MgCO_3$ and SiO2 are potentially important in the slabs descending into the deep mantle:

$MgCO_3$ (magnesite) + SiO_2 $\rightarrow$ $MgSiO_3$ (perovskite) + CO_2

CO_2 $\rightarrow$ C (diamond) + O_2

These reactions can play a fundamental role in the deep carbon cycle.

In this work, we investigated the reaction between $MgCO_3$ and SiO_2 up to about 80 GPa and 3000 K using a laser-heated diamond anvil cell combined with in-situ synchrotron X-ray diffraction (XRD) technique and Raman spectroscopy. The starting material is the powered 1:1 (in mole fraction) mixture of natural magnesite (Brazil, Bahia) and reagent α-quartz. 5 wt.% platinum powder was added to the sample mixture in order to absorb laser and estimate the pressure in the sample chamber. NaCl, KCl or SiO_2 glass powder was stuffed into the sample chamber as pressure media. XRD patterns of high P-T samples and recovered samples were acquired at beamline BL10XU of SPring-8. Raman spectroscopy was carried out to high-pressure conditions. Raman spectroscopy was also conducted for the recovered samples.

In the present results made at about 70 GPa, diamond and $MgSiO_3$ perovskite are detected at temperatures greater than 1750 K. The high P-T XRD patterns in the experiments at 50-60 GPa and 2000-3000 K show the appearance of a small amount of $MgSiO_3$ perovskite. Our study demonstrated that formation of diamonds was confirmed in the range of 1300-1500 km depth of the lower mantle in subducting slabs due to the reaction of $MgCO_3$ with SiO_2 and the breakdown of CO_2. This phase relations have a possibility to explain one of the origins of diamonds from the lower mantle.