Geophysical Research Abstracts,
Vol. 11, EGU2009-8572-1, 2009
EGU General Assembly 2009

Noble Gas Geochemistry of Submarine Volcanic Glasses from the Viehoff Seamount, Central Bransfield Basin, Antarctica

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The Bransfield Strait is an actively spreading Quaternary back arc basin, and volcanic rocks from seamounts are chemically transitional between island arc and ocean ridge basalts. We measured noble gas isotopic compositions of lavas from this area to investigate mantle components incorporated into the Bransfield Strait volcanism. Pillow basalt samples DV5 and DV6 were dredged from a seamount, but from different depths: 1500m and 1000m deep respectively. Both basalts are derived exactly from the opening axis of the spreading center where is tectonically MORB-like environment. However, the samples show systematically different chemical compositions: DV5 basalts have mildly alkaline nature, while DV6 mildly tholeiite nature.

Nine samples of DV5 and five of DV6 were used for noble gases analysis. Gas concentrations and He/Ne ratios are generally higher in DV5 than in DV6, which may be due to higher hydrostatic pressure at the extrusion site of DV5 (1500 m) than DV6 (1000 m). ^{3}He/^{4}He ratios for DV5 samples are generally lower than those for DV6 samples. The highest ratio of (7.6$\pm$1.4)x10^{-6} obtained by crushing experiment on DV5-2 is lower than the high value of (9.0$\pm$0.8)x10^{-6} in DV6-4. Ne isotopic ratios are almost atmospheric and do not show any indication about the solar Ne component with high ^{20}Ne/^{22}Ne and ^{21}Ne/^{22}Ne. Moreover, ^{40}Ar/^{36}Ar ratios are very low compared with the high values ($>$2000) reported for typical MORB samples. The high ^{3}He/^{4}He ratios in our samples are also lower than the typical MORB values ($>$10x10^{-6}). Addition of radiogenic ^{4}He and atmospheric Ne and Ar (as well as heavier noble gases Kr and Xe) to magma source through the subduction of Drake plate at the South Shetland Trench would be responsible to the observed noble gas composition. These observations seem to indicate that the volcanism occurring at the central axis of the Bransfield Strait started as a marginal basin is still on the evolutional stage to a pure MORB-type volcanism. Ar isotopic ratios show that Ar compositions in DV5 lavas are two component mixture between atmospheric Ar and Ar with higher ^{40}Ar/^{36}Ar ratio which should be originated from magma source. Contrary to this, Ar compositions in DV6 lavas are disturbed and do not show clear mixing trend. Based on the Ar data, we examined K-Ar ages for these samples. If we consider the excess-^{40}Ar, the ages should be upper limits. The disagreement between the ages for DV5-2 and DV5-2(Crushed) might be the case showing the excess-^{40}Ar. The calculated ages show that the DV5 basalts erupted earlier than the DV6. Eruption age of the DV6 basalts would be younger than 0.5 Ma and the DV6-5 is the youngest among the samples studied in this work.