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Noble Gas Isotopic Compositions in Basalts from Seamounts of the Bransfield Strait: Evidence for Subduction Type Volcanism

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Noble gas isotopic compositions of basalts dredged from a seamount at the Bransfield Strait were measured to investigate mantle derived noble gas component as well as the eruption ages of these basalt samples. The Bransfield Strait in an actively spreading Quaternary marginal basin, and volcanic rocks from seamounts are chemically transitional between island arc and ocean ridge basalts (Keller and Fisk, 1992). We present noble gas data obtained for 7 samples in Table 1. Noble gas concentrations are variable and their isotopic compositions are generally similar to those of atmospheric ones except for helium isotopic ratios, i.e., (5-9) $\times$ 10^{-6}. For the samples, DV6-2 and DV6-3, $^{3}He/^{4}He$ ratios were not determined due to very low He concentrations in these samples (Table 1). The He isotopic ratios determined are similar to of somewhat lower than those for subduction type He, which may suggest an admixing of radiogenic ^{4}He from an oceanic plate subducting at the South Shetland Trench to MORB type He. Ne isotopic ratios are atmospheric except for the sample DV6-1, for which Ne isotopic ratios are likely mass fractionated favoring heavier isotopes. $^{38}Ar/^{36}Ar$ ratios for all samples close to the atmospheric value, 0.188, whereas small excesses in ^{40}Ar are observed up to $^{40}Ar/^{36}Ar$ = 320 compared to the atmospheric value of 296.0. The $^{40}Ar/^{36}Ar$ ratios are much smaller than those for MORB (>20000) (Staudacher and Allegre, 1988) and in the range for subduction volcanism (Nagao and Takahashi, 1993), indicating a heavy contamination by atmospheric Ar.

For the estımation of eruption age, concentration of *in situ* produced radiogenic ^{40}Ar should be determined for each sample. However, the samples which contain relatively high concentrations of He with $^{3}He/^{4}He$ ratios presumably have mantle derived excess ^{40}Ar due to incomplete degassing at the eruption. Hence, we estimate the eruption ages only for samples DV6-2 and DV6-3 with very low He concentrations, suggesting complete degassing. Concentraions of radiogenic ^{40}Ar were calculated as 0.365 and 0.048 $\times$ $10^{-8}cm^3$ STP/g for DV6-2 and DV6-3, respectively. If we assume the K concentrations of about 0.4wt.% reported for the dredged basalts from other seamounts (Keller and Fisk, 1992) in this area, eruption ages of 0.24 and 0.03 Ma are calculated for DV6-2 and DV6-3, respectively.

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Table 1. Noble gases in submarine basalts from the Bransfield Strait, Antarctica.

Sample	Weight (g)	^{4}He (10^{-10} cc/g)	$^{3}He^{\#}$/^{4}He	^{20}Ne (10^{-10} cc/g)	^{20}Ne/^{22}Ne	^{21}Ne	^{36}Ar (10^{-10} cc/g)	^{40}Ar	^{38}Ar/^{36}Ar	^{40}Ar/^{36}Ar	^{84}Kr (10^{-12} cc/g)	^{132}Xe
DV5-1	0.4626	309	6.20±.74	25.4	9.806 ±.022	0.02862 ±.00037	118	35,100	0.18780 ±.00043	297.49 ±.81	497	150
DV5-2	0.9271	1,070	4.98±.14	21.0	9.882 ±.013	0.02893 ±.00075	58.0	18,600	0.18808 ±.00031	320.26 ±.50	180	9.86
DV6-1	0.4342	38.3	4.4±1.5	13.9	9.399 ±.020	0.02762 ±.00049	17.8	5,360	0.18807 ±.00042	300.32 ±.78	56.9	6.66
DV6-2	1.0310	9.47	n.d.	17.1	9.777 ±.015	0.02846 ±.00082	2.05	643	0.18779 ±.00032	313.82 ±.12	6.26	0.778
DV6-3	0.9300	3.28	n.d.	37.7	9.762 ±.017	0.02885 ±.00063	4.44	1,320	0.18815 ±.00039	297.08 ±.11	12.4	1.30
DV6-4	0.9149	73.4	9.03±.83	31.7	9.888 ±.014	0.02920 ±.00063	8.84	2,650	0.18813 ±.00043	299.97 ±.08	24.86	1.51
DV6-5	0.9567	3,190	7.95±.12	478	9.832 ±.007	0.02919 ±.00047	846	250,000	0.18771 ±.00029	295.60 ±.11	1,680	53.0
Air			1.4		9.800	0.0290			0.188	296.0		

#: Unit of 10^{-6}; n.d.: not determined