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Geology, Age and Geochemistry of Tertiary Volcanics, Northern Coast of King George Island (South Shetland Islands, West Antarctica)

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The northern coast of King George Island (South Shetlands, West Antarctica), is formed of two major tectonic units: the downthrown Fildes Block (between Fildes Peninsula and Pottinger Point, and at Venus Bay), and the upthrown Barton Horst (at Corsair Bight, Venus Bay amd North Foreland). These units are separated by the strike-slip collisions fault running parallel with elongation of the island (NE-SE), and by the younger, transverse strike-slip faults (NW-SE).

The Fildes Block is built mainly of andesite effusives (Fildes Peninsula Group) and basaltic and andesitic plugs (Admiralty Bay Group). At Fildes Peninsula, K-Ar dating of these rocks indicated their Late Paleocene through Middle Eocene ages. Further NE, the ages of similar rocks remained until recently (the present paper). The Barton Horst along the northern coast of King George Island (at Venus Bay, between Pottinger Point and North Foreland) is built mainly of altered volcanics (Martel Inlet Group) intruded by moderate-size diorite and granodiorite plutons (Wegger Peak Group; Oligocene).

The present paper is based on samples collected by the first author in 1980/81 along the northern coast of King George Island, between Fildes Peninsula and North Foreland, from onshore and offshore exposures. The majority of these sites were visited during helicopter flights, the only means of geological work along this dangerous glaciated coast. The Fildes Peninsula Group rocks (andesite lavas from four sites) ranged in $^{40}Ar/^{39}Ar$ ages between 57.4 ± 0.7 Ma and 41.9 ± 1.8 Ma indicating that these volcanic rocks were formed during Late Paleocene to Late Eocene. Two basaltic andesitic plugs (Admiralty Bay Group) were dated at 91.5 ± 2.3 (?Late Cretaceous, K-Ar dilute date) and 54.2 ± 1.1 Ma (Early Eocene, laser 40Ar/39Ar isochron age) suggesting a more wide age range.

The major and trace element contents of volcanic rocks were measured with XRF and INAA by Chinese authors in China. As shown in majors and traces discrimination plots, all the volcanic rocks and intrusives are subalkaline rocks following a calc-alkaline trend, although the WPG plutons have higher alkali content. The basalt has the lowest REE abundant and the andesite has the highest, that is, the REE abundant increases with increasing SiO_2 content of rocks. All chondrite-normalized REE patterns are with light rare earth element enrichment and parallel to each other indicating calc-alkaline characteristics and the crystal fractionation control on magma evolution. Comparing with primary mantle composition, the rocks are rich in LIL element (Cs, Rb, Ba, Th) and depleted in Cr, Ni, Co. Also, the trace concentrations of rocks have the same varying patterns as shown by REE that indicate the fractionation in magma generation.

The $^{87}Sr/^{86}Sr$ and $^{143}Nd/^{144}Nd$ ratios of four samples of FPG and two ABG plugs are about 0.7035 and 0.5128 respectively, same as those from Fildes Peninsula and almost no change had been observed when Rb, K, Th of the rocks increased. That implies these rocks did not undergo any crust contamination and might be derived from the same primary magma source of the volcanic rocks in Fildes Peninsula. All plots of rocks distributed along the mantle array in $^{143}Nd/^{144}Nd$ vs. $^{87}Sr/^{86}Sr$ isotope correlation diagram near the Prevalent Mantle area and

cumulate together which strongly supposes the result mentioned above.

For summary, age and geochemical date indicate that the rocks of FPG lavas and ABG plugs, as well as WPG granodiorites are all of calc-alkaline characteristics. They might be generated by fractionation and associated with the same simple magma source resulted from the volcanic activities from Late Cretaceous to Late Eocene in King George Island. The age distribution along the northern coast also suggests the eruptive center migrating from southwest to northeast with time since the rock became younger successively. The volcanic rocks of King George Island volcanism belong to the South Shetland magmatic arc.