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Magma flow direction of basaltic rocks in the King George Island, Antarctica

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The magmatic arc along South Shetland Islands, East Antarctica is considered to have been formed by back arc spreading related to the subduction along the South Shetland Trench, north of the Antarctic Peninsula during the late Cretaceous and middle Miocene. This magmatism consists of lava flows with subordinate pyroclastic deposites, intrusive dykes and sills and plutons, displaying a typical subduction-related calc-alkaline volcanic association. Moreover, radiometric dating indicated an apparent westward migration of the magmatic centers with time along the length of arcs (Birkenmajer 1994). The King George Island is represented by mainly Eocene basaltic to basaltic-andestic lavas, dacitic lavas, tuff and diorite?dolerite plutons. These magmatisms may have corresponded to major plate tectonic events of the area, such as the break-up of Gondwana land and the opening of Drake Passage. It is known that the flow direction of magma is directly connected to the mode and rates of a back arc spreading. There has been no data for the flow direction in this area, although magmatic flow direction of these volcanisms determines whether the intrusive volcanic rocks are fed by vertical injection of magma from deep seated magma chambers or by lateral injection from crustal magma chambers. In this presentation, we report the flow structure of basaltic rocks and diorite around the Marian cove in King George Island, Antarctica. We sampled 12 basaltic lavas, 8 plutons, 6 basaltic-andestic dykes, all located within 4 kilometer radius from the Korean Antarctic research station (King Sejong station) in the western side of King George Island. The plutonic rocks of diorite and dolerite are only found along the Marian cove, where is corresponding to the strong surface positive magnetic anomaly regions taken by ship-borne and foot-borne surveys. We measured a preferred alignment of magnetic minerals along framework-forming plagioclases in these rocks using anisotropy of magnetic susceptibility (AMS) with the verification of petrofabrics and source minerals by a field-emission gun electron microscope. The result reveals that plutonic rocks have high value of magnetic susceptibility and their anisotropy represents the vertical intrusion from the deep seated magma, being the possible origin of surface magnetic anomaly. The basalt dykes at Weaver and Barton Peninsula or along the Potter Cove are associated with steep plunge direction of the Kmax AMS axes, which gives support to notice that vertical magma flow may be related to a higher buoyancy of the magma during dyke intrution. The magnetic lineation of some basaltic rocks are mainly within 30? from the horizontal plane, suggesting the presence of lava flows along the topography. Moreover, the basaltic lavas in the center of Barton Peninsula show a high value of magmatic susceptibility, being corresponding to the surface negative magnetic anomaly.

Keywords: Antarctica, anisotropy of magnetic susceptibility, magnetic anomalies, volcanic activity, back arc spreading