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High-resolution aeromagnetic views of the Antarctic Peninsula: new snapshots of the magmatic arc from Adelaide Island

T. Jordan (1), R. F. Neale (2), and F. Ferraccioli (1)

(1) British Antarctic Survey, Madingley Road, Cambridge, U.K., (tomj@bas.ac.uk), (2) Institute of Geophysics and Tectonics, University of Leeds

The Antarctic Peninsula is a natural laboratory for studying the process of magmatic arc evolution and terrane accretion along the Paleo Pacific margin of Gondwana. Reconnaissance aeromagnetic surveys has played a key role in mapping the Jurassic-Cretaceous arc-magmatic province, and accreted terranes along the Antarctic Peninsula (Ferraccioli et al., 2006, GRL). However, the relatively coarse ($\sim$3 km) line spacing and 1-2 km elevation of the regional surveys limits their utility for imaging the detailed magmatic features and tectonic structures along the former active margin. Here we present results from two new high-resolution aeromagnetic surveys flown during the 2010-11 field season over Adelaide Island, which includes exposures of Cretaceous forearc basin sediments and Early Tertiary plutons, which may relate to westward migration of the arc towards the trench. The surveys cover the northwest and southeast parts of Adelaide Island with a line spacing of 1 km and 500 m line respectively, and a terrain clearance of $\sim$250m. With the aid of a variety of digital enhancement techniques we delineate a series of 20-30 km-long linear magnetic anomalies with amplitudes of 200-600nT and wavelengths of $\sim$5-10 km over the northwest of Adelaide Island. The NNE-SSW trends of these anomalies reveal clear structural controls within the forearc or possibly intra-arc portion of the active margin. However, similar trends are not observed to the southeast, over exposures of Eocene (44 – 58 Ma) mafic and intermediate arc plutons. We put forward two alternative interpretations to explain the contrasting magnetic signatures: i) The anomaly patterns reflect different degrees of structural control on magma emplacement, with the north-western intrusive bodies emplaced along a major strike-slip fault system; ii) Alternatively, the north-western anomalies reflect uplifted slivers of oceanic basement of the forearc, as interpreted for example over the Great Valley in California or over an Early Cambrian forearc in northern Victoria Land in East Antarctica (Ferraccioli et al., 2002, GRL). We favour an arc origin for all the observed anomalies on Adelaide Island, due to proximity of the north-western anomalies to exposed arc-related rocks (tonalities, gabbros, and granodiorites), the lack of mapped thrust faults on Adelaide Island, and limited evidence of obduction of oceanic crust along the western margin of the Antarctic Peninsula.