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ABSTRACTS

Magnetic and field tectonic observations in the Greenwich, Robert, Dee and Barrientos islands: new insights on the South Shetland Block crustal structure

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The Greenwich and Robert islands together with other nearby small islands are located in the central part of South Shetland archipelago. This is a key region for understanding the recent continental fragmentation processes corresponding to the final stages of the opening of the Drake Passage, that have affected the Antarctic Peninsula and Bransfield Basin. During February 2014 field season, new magnetic surveys including total field measurements by a GSM8 proton precession magnetometer, rock magnetic susceptibility and field tectonic researches developed in Pedro Vicente Maldonado Ecuadorian Antarctic Station contribute to constrain the crustal structure and the recent tectonic evolution. Most of the structures are related to volcanic edifices, including domes and pythons feeding volcanic cones, mainly basaltic in composition. Layering is generally determined by alternating lava flows and pyroclastic levels.

The northern part of the Pacific Margin Anomaly belt is identified in this region, which was fragmented during the opening of the Bransfield Basin into two main branches. The previous magnetic data are scarce. A single aeromagnetic line crosses the Greenwich Island. Magnetic susceptibility measurements are comprised between 11* E-03 (SI) and 195* E-03 (SI) with a mean value of 38.6* E-03 (SI). These high magnetic susceptibility values fit clearly with the nature of the basic volcanic rocks on surface (basalts and pyroclastic levels). The interpretation of the total magnetic field intensity measurements suggests that there is an overprinting of very shallow anomalies related to the mafic volcanic edifices and other regional anomalies of deeper crustal bodies. The integration of ground and aeromagnetic total field magnetic anomalies contributes to characterize in more detail the crustal structure and nature of the central part of this archipelago.

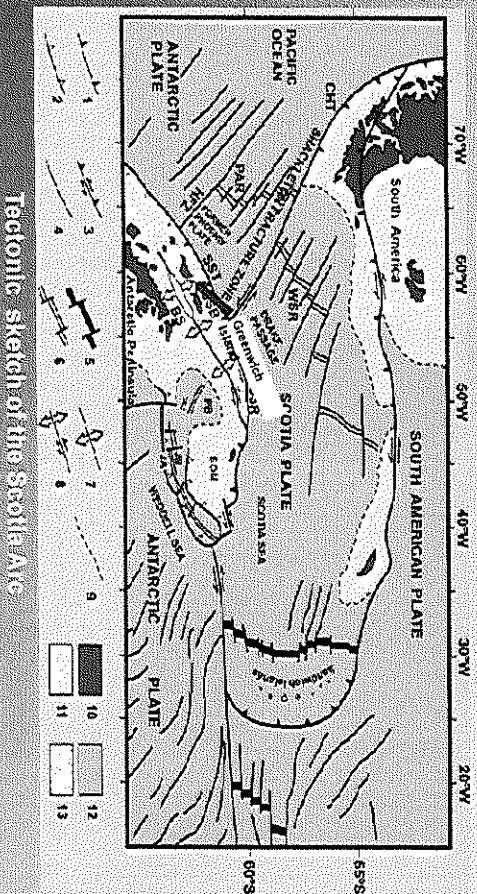
In addition, geological observations show that the fracture system is formed by interacting cooling volcanic and tectonic joints. Preliminary observations have not yet found evidence of major faults previously reported affecting the area. Anyway, calcite filled joints and basic dikes are common and have been formed during late stages of NE-SW extension and NW-SE compression. These structures may be associated with the activity of the oceanic subduction of the former Phoenix Plate that was located towards the NW of the SSB along the South Shetland trench from Mesozoic up to Present.

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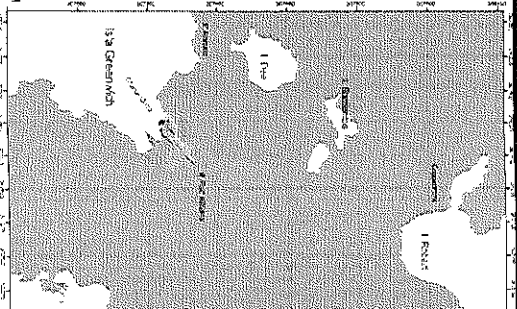
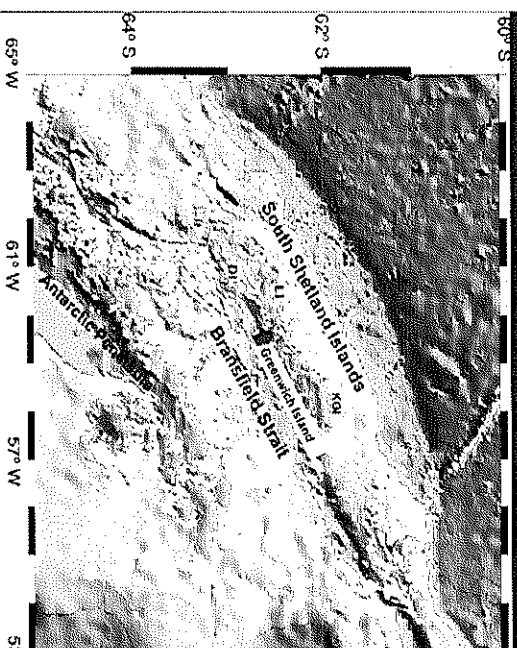


Regional tectonic setting

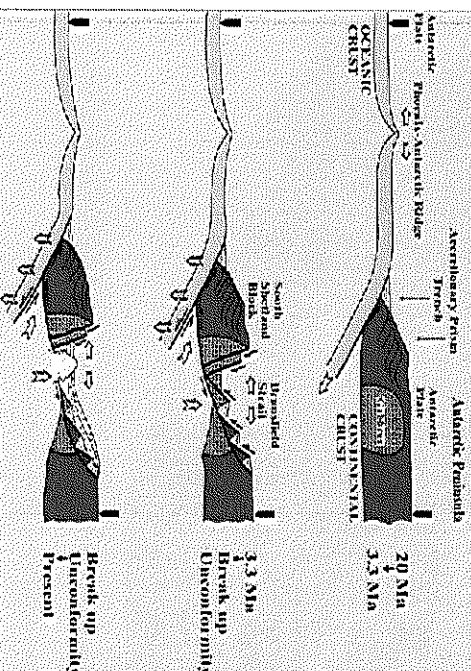


Tectonic sketch of the Scotia Arc

Greenwich, Roberts, Dee and Barrientos islands

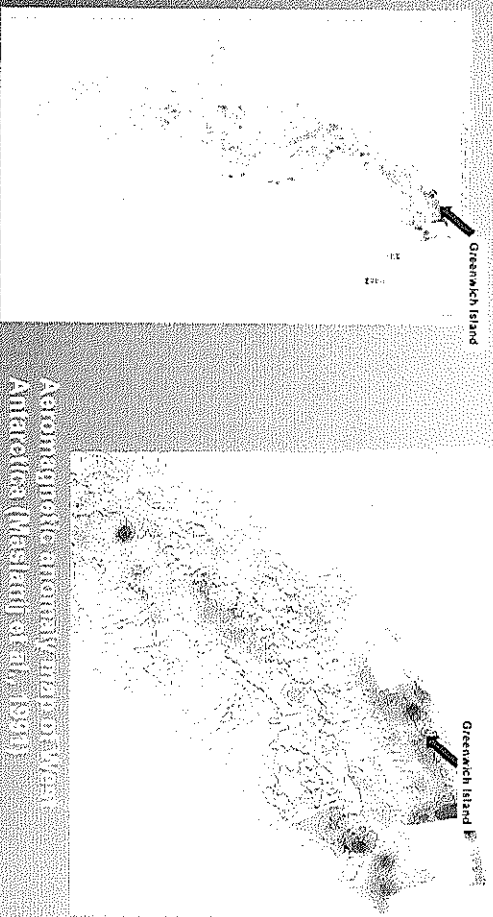


Introduction



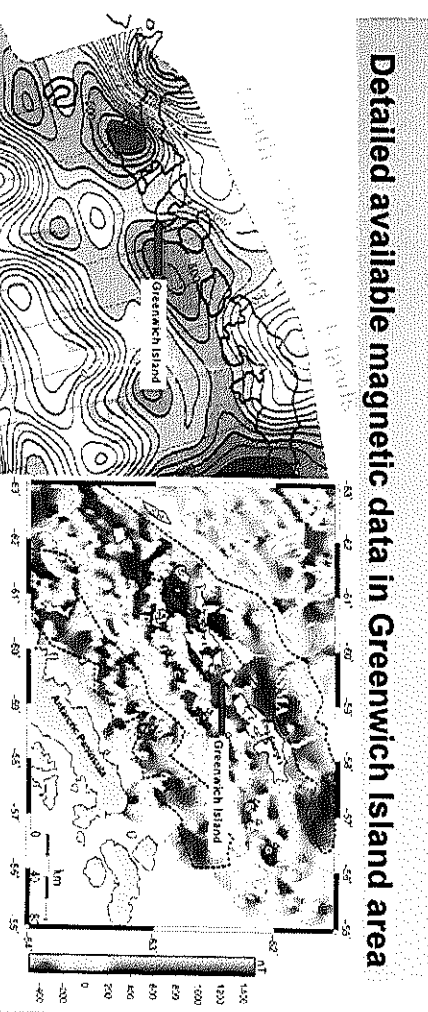
Development of the South Shetland Block in the backarc context to the subduction along the South Shetland Trench and the South Shetland Block

Available aeromagnetic data



Aeromagnetic anomaly map of West Antarctica (Maslanij et al., 1991)

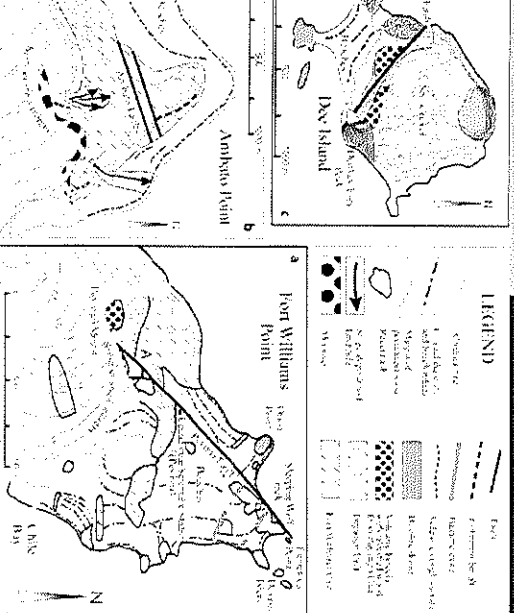
Available magnetic data



Aeromagnetic anomaly map of West Antarctica (Maslanij et al., 1991)

Compilation of magnetic data including marine surveys (Catalan et al., 2015)

Geological maps



Geological map of the Antarctic Peninsula (Greenwich Island and the surrounding area) (Maslanij et al., 1991)

Aims

- 1) Observation of magnetic field and rock magnetic intensity and magnetic susceptibility to be compared with available aeromagnetic data
- 2) Geological observations (lithology and major structures) to improve the knowledge on the origin of magnetic anomalies, the crustal structure of the South Shetland Islands and the tectonic evolution

Field researches in February 2014
Ecuadorian base Pedro Vicente Maldonado (Greenwich Island)

This image shows a vertical section of a woven textile, possibly a rug or tapestry. The pattern consists of a series of repeating motifs arranged in a vertical column. The motifs include stylized flowers, leaves, and geometric shapes, all rendered in a high-contrast black and white color scheme. The texture of the fabric is visible, showing the intricate weaving of the threads.

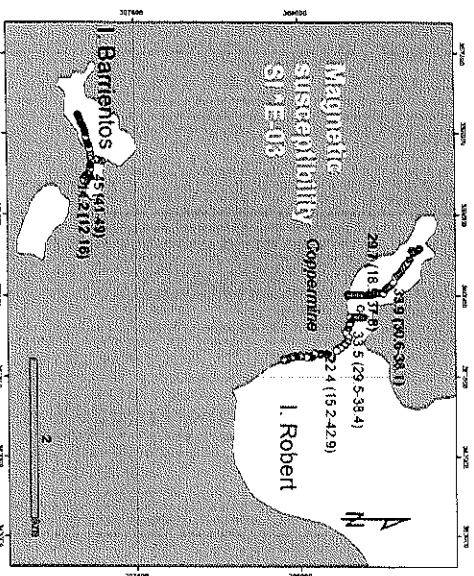
Total field intensity (vector magnetometer)

-Magnetic susceptibility of a material is a vector kappameter)

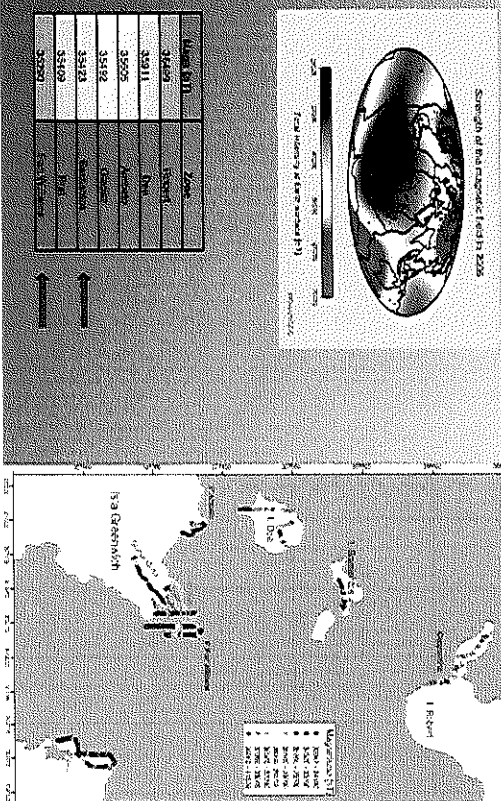
430 sites
Relatively calm period



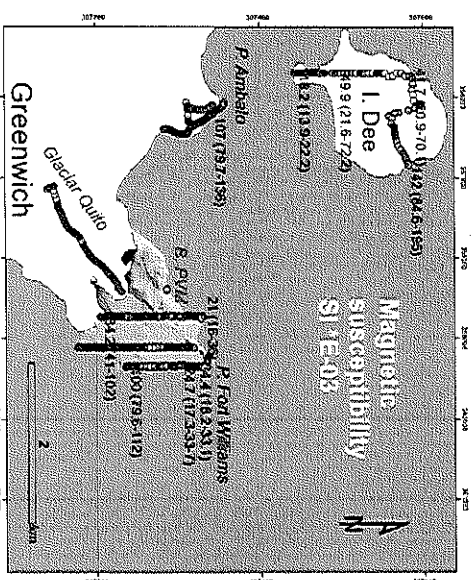
Field data: Total field intensities and susceptibilities

[illegible]

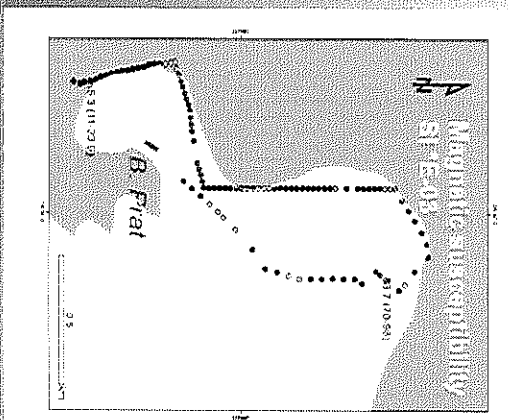
Total field magnetic intensities



Field data: Total field intensities and susceptibilities

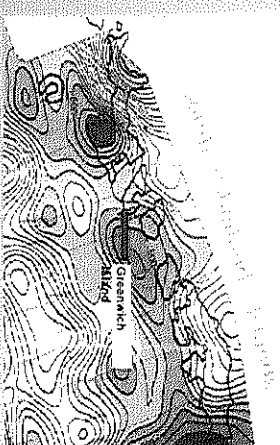
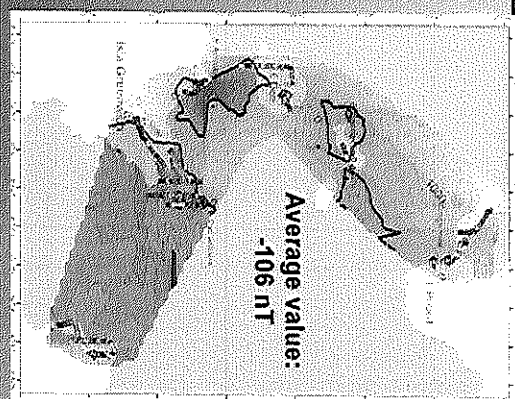
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Total field data, total field intensities and susceptibilities



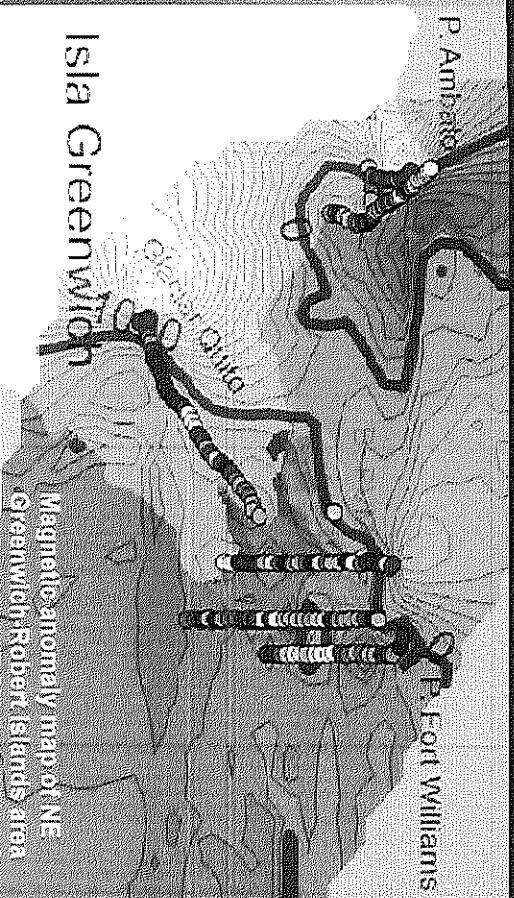
Low total field
magnetic intensities

Total field magnetic anomalies

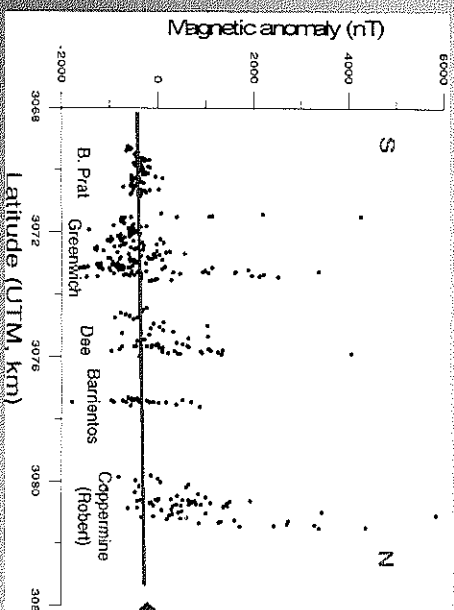


Magnetic anomaly map of the
Greenwich-Robert Islands area

Total field magnetic anomalies

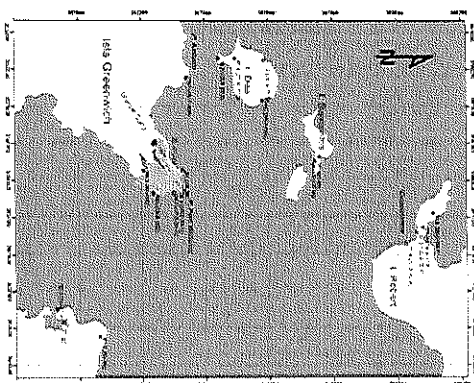


Total field magnetic anomalies



Aeromagnetic

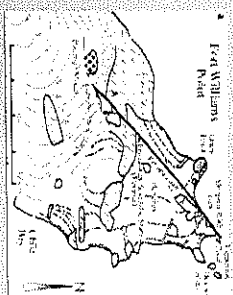
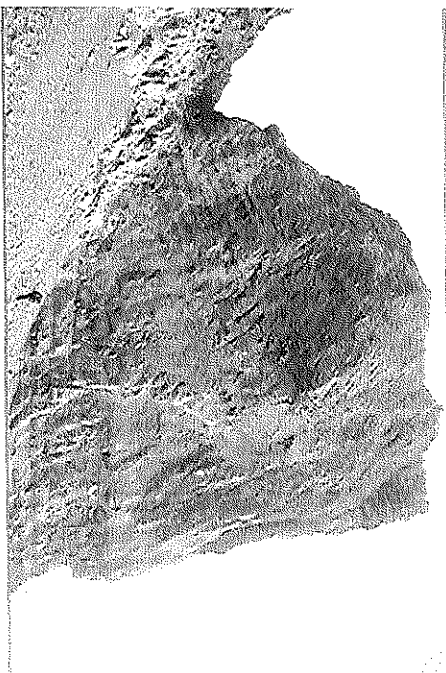
MAGNETIC SUSCEPTIBILITIES



19 sites
 Values compared between
 11 and 195
 Average values in sites between
 14.2 y 142
Total average 38.6

GEOLOGICAL OBSERVATIONS

Greenwich Island 'lean dome' - 'lean dome' is a volcanic edifice with two lava flows in a section of a volcanic edifice.



GEOLOGICAL OBSERVATIONS

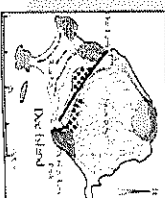
Basaltic and andesitic



Basaltic lava flows

Coppermine, Robert Island

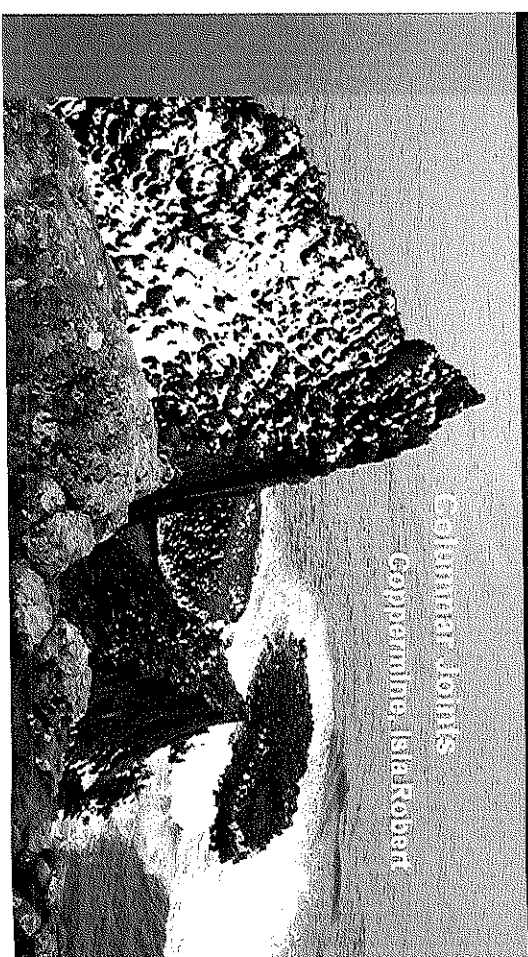
Volcanic phytion, feeding channels
 of volcanic edifice, Due Island



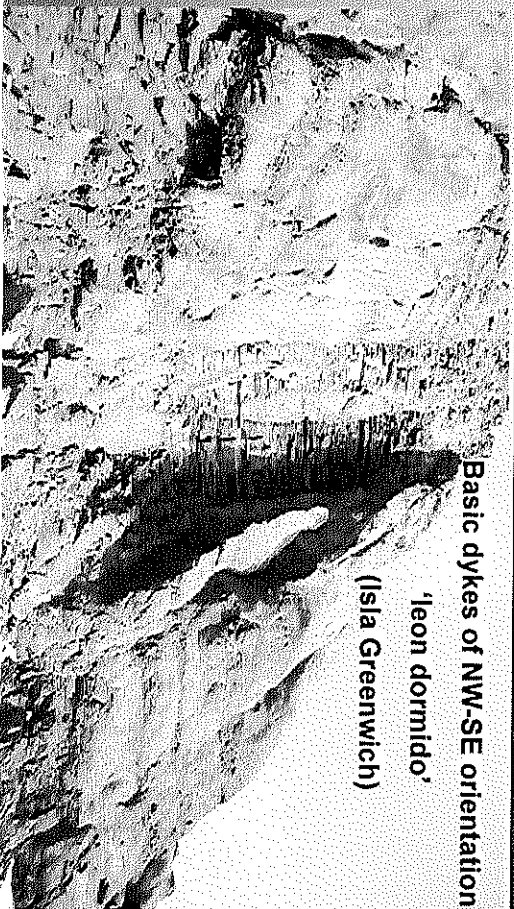
GEOLOGICAL OBSERVATIONS

Coppermine, Robert Island

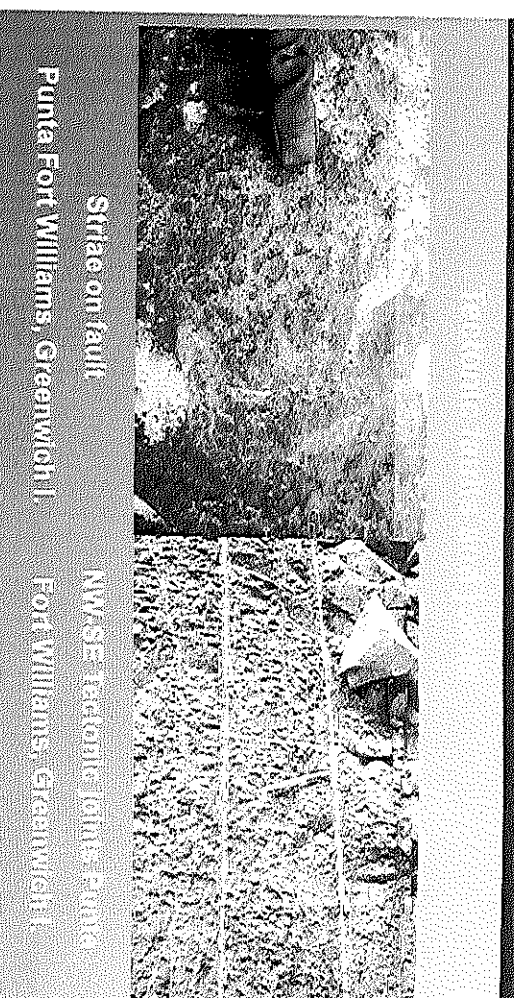
Coppermine, Robert Island



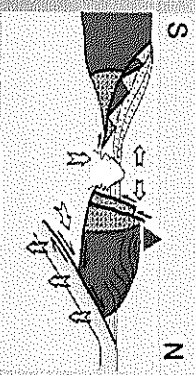
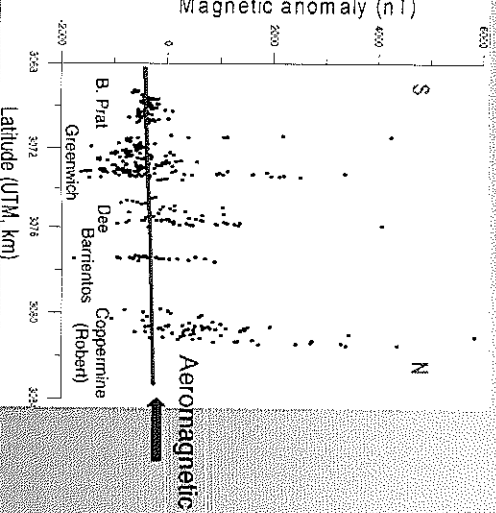
GEOLOGICAL OBSERVATIONS



GEOLOGICAL OBSERVATIONS



Discussion



CONCLUSIONS

Magnetic researches

- Basic dykes of NW-SE orientation (average 38°C, 400m from the surface)
- Magnetic anomalies are negative (av. -400 nT) and positive (av. 400 nT) magnetic anomalies have higher gradients and higher frequencies than other anomalies.
- Maxima are more intense and irregular in shape.
- Discontinuous dipoles of hundreds of meters wavelength are responsible for a magnetic anomaly increasing northwards.

Geological researches

- Most of the structures and the present-day relief are related to recent tectonics.
- NW-SE dykes and joints together with minor faults formed in a NW-SE compressional stress field are related to South Shetland Trench subduction.
- In South Shetland Block, probably deep magmatic sources (Crataceous gabbros) are overprinted on shallow faults (young volcanoes)? →



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