ANALYSIS OF SHALLOW LACUSTRINE SEDIMENTS
FILDES PENINSULA, KING GEORGE ISLAND, MARITIME ANTARCTICA

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INTRODUCTION

In this work the processes and agents involved in the alteration of the landscape on the Fildes Peninsula, the largest ice-free area of King George Island, will be studied based on the analysis of shallow lake sediments and the geomorphology of its surrounding area.

AREA OF STUDY

Fildes Peninsula has more than 80 lakes and ponds, that receive sediments from different processes: glacial, glaciofluvial, periglacial and marine. Volcanic activities are reported in many places on the island; the most part of the peninsula is covered by basaltic lavas and by andesitic and dacitic lavas at smaller proportions.

METHODS

– Sedimentological sampling – superficial samples (15cm long) in the shallow parts of the lakes and wetlands, during the BRAZILIAN OPERANTAR XXXI and XXXII (2013 and 2014) – Figures 1 and 2.

– Granulometric and mineralogical analysis – Laser Granulometer and Energy Dispersive X-ray Fluorescence (EDXRF).

– Microscopical analysis – Binocular Lupe and lithological features (texture, color, brightness).

- Calculation of Chemical Index of Alteration (CIA) and Plagioclase Index of Alteration (PIA) of the sediments following formulas:

$$CIA = [Al_2O_3 / Al_2O_3 + CaO + Na_2O + K_2O)] \times 100$$

$$PIA = [(Al_2O_3 – K_2O) / (Al_2O_3 + CaO + Na_2O + K_2O)] \times 100$$

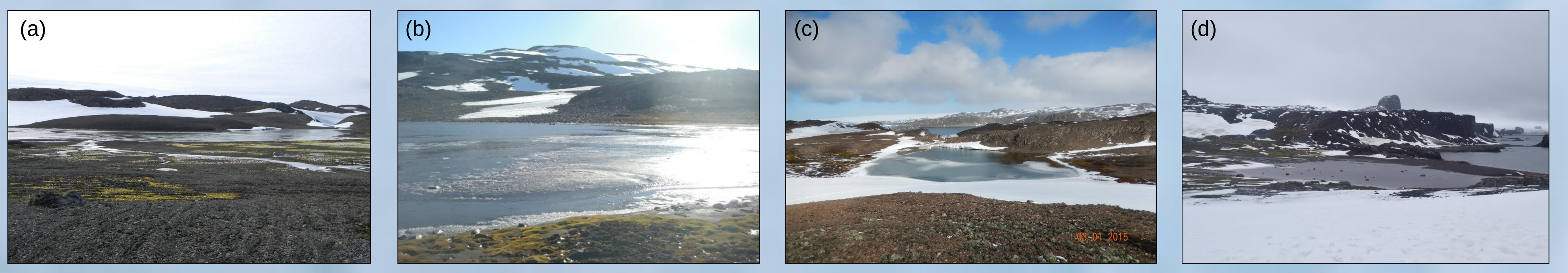

Figure 2: Sediment sampling areas: (a) north; (b) central; (c) south; (d) west coast.

RESULTS AND DISCUSSION

We present one sample from the northern (sample 12), central (sample 10), southern (sample 6) and coastal (sample 11) areas of the Fildes Peninsula (Figs. 1-2). The granulometrical groups of the sediments sampled were classified as sand and sandy muddy (Fig. 3).

Mineralogical analysis (Fig. 4), comprising the north-south transect of the peninsula, indicate prevailing composition of basalts. Olivine phenocrystals in basalts with aphanitic texture, and volcanic glass or obsidian were identified in all samples.

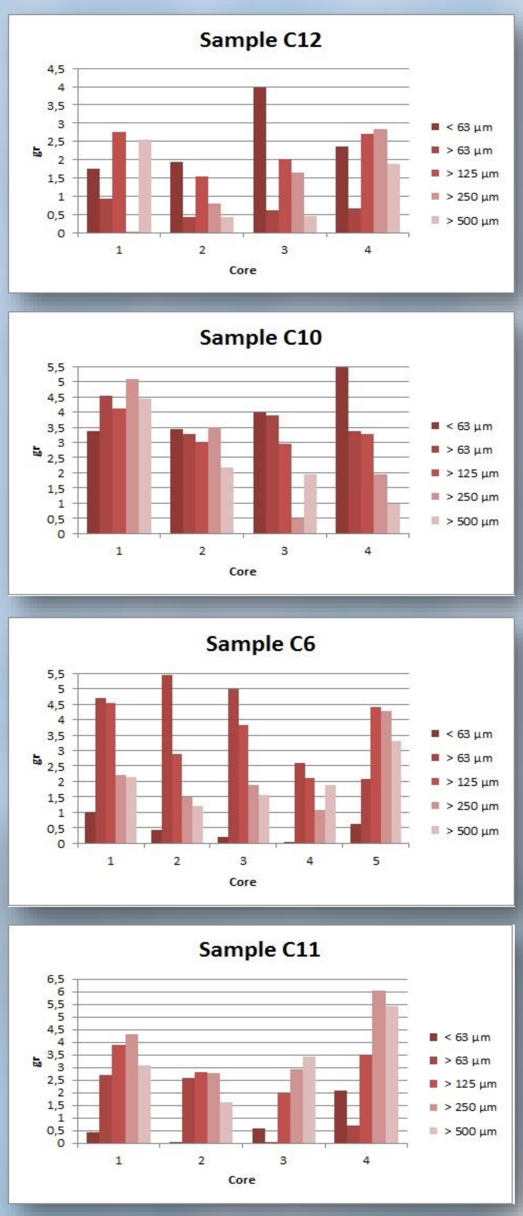

Figure 3: Granulometric distribution of bottom sediment.

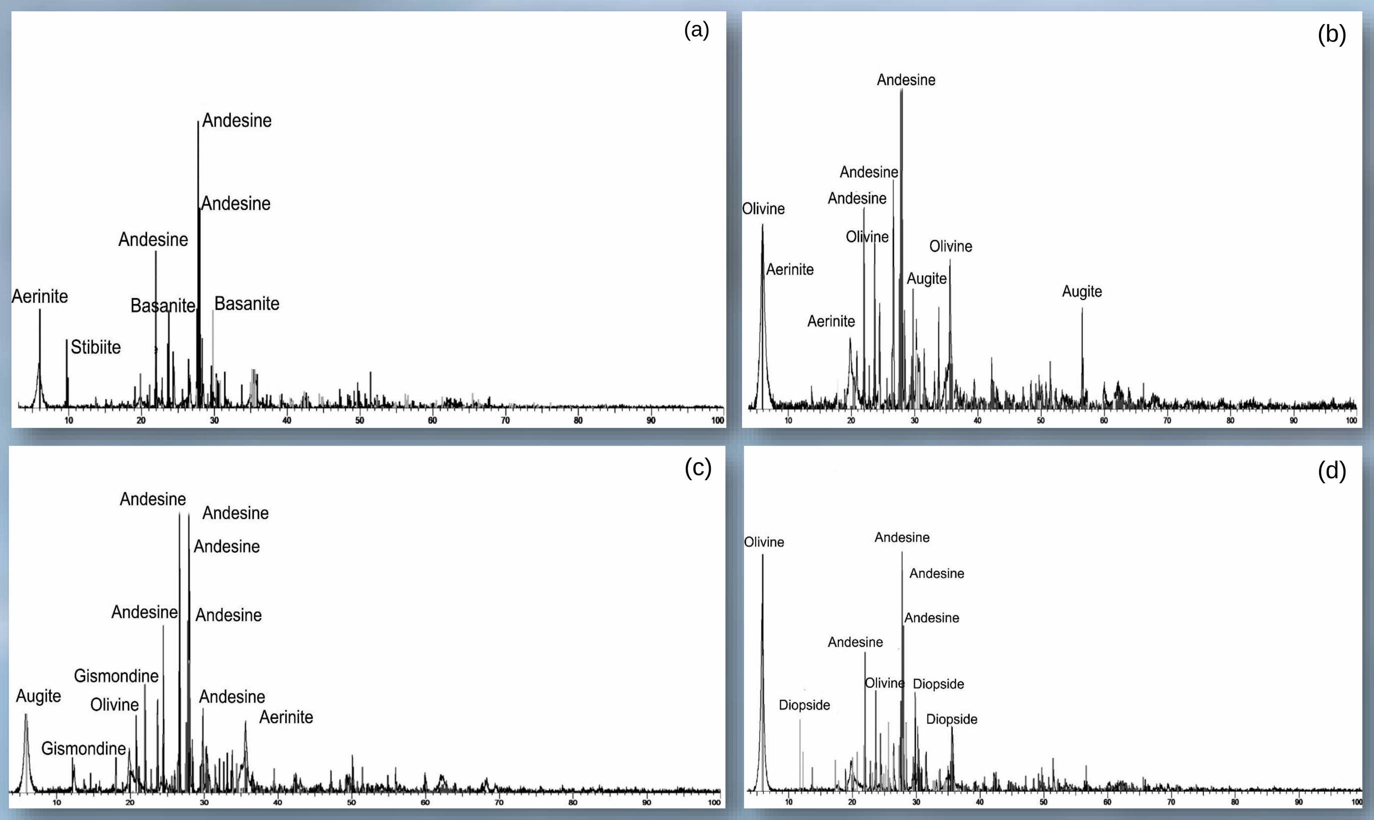

Figure 4: XRD of fine fractions of sample 12 (a), sample 10 (b), sample 6 (c), and sample 11 (d).

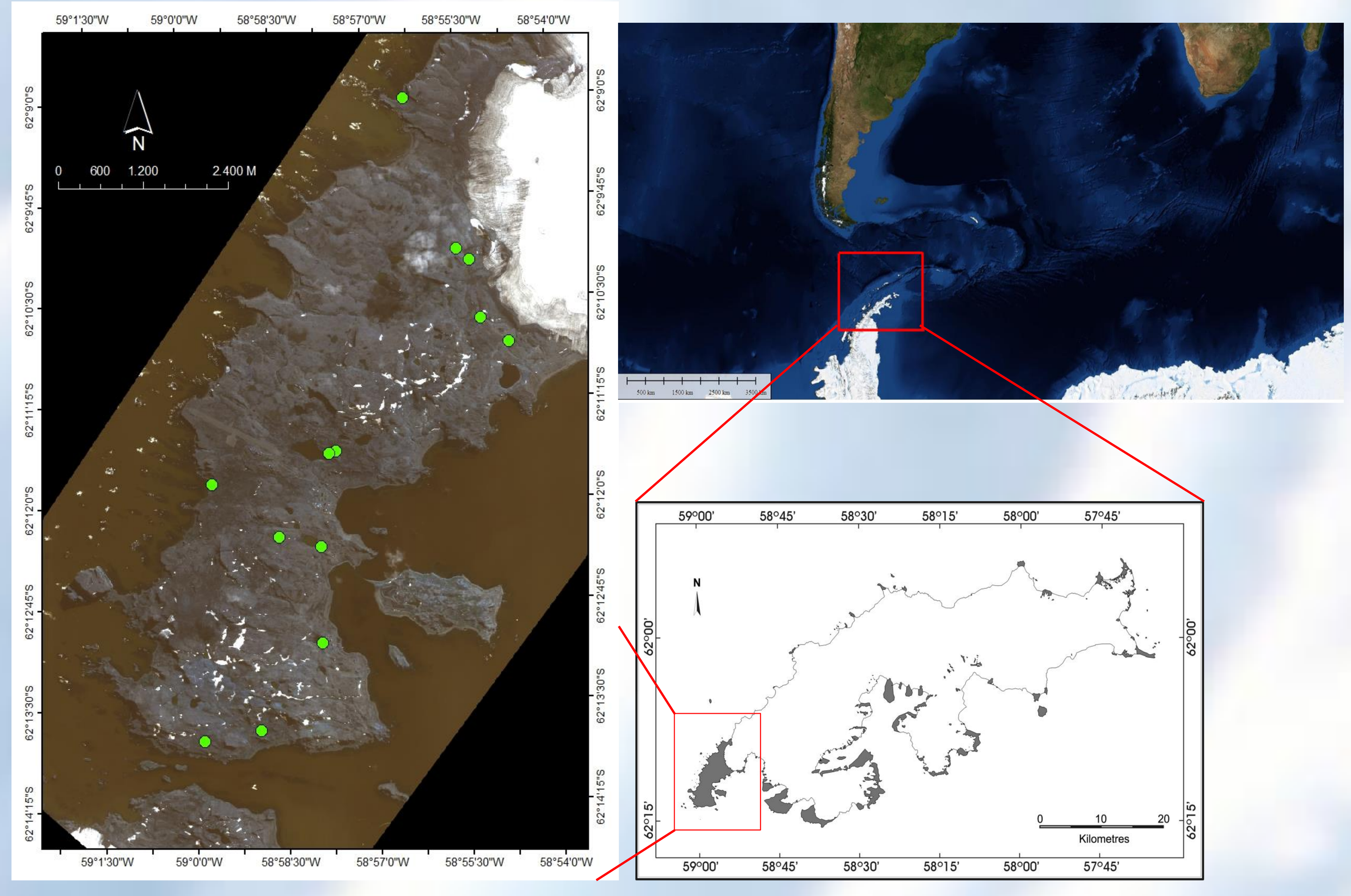

Figure 1: Fildes Peninsula, study area and sampling sites.

Chemical weathering is observed in the sediments from central to the southern part (Fig. 5). At the northern part (Klotz and North Valleys) the sediments directly delivered from Collins glacier still are relatively preserved from the weathering action. Marine influence is also observed in some samples, with the presence of biological components.

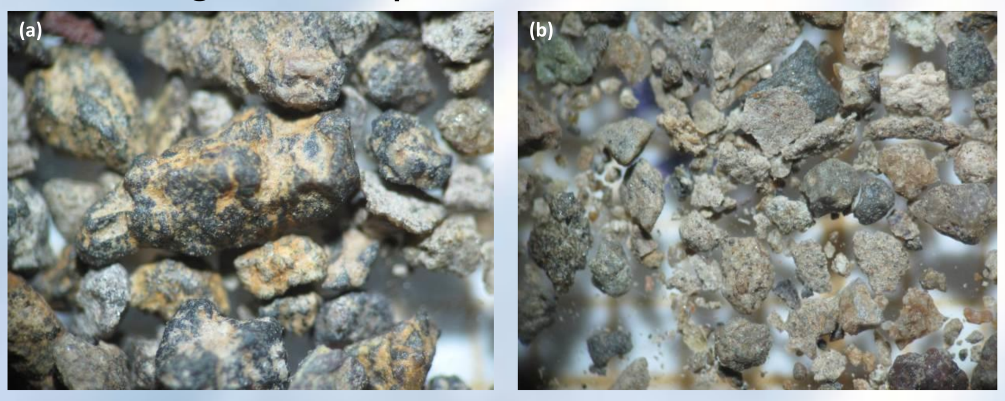

Figure 5: Amplified view (36X) of the sediments (>500 mμ) by petrographic microscope. Sample C6 (a), in the southern peninsula, shows chemical weathering action, while sample C12 (b), closest to Collins glacier, in the northern peninsula, has still unaltered sediments.

In the Figures 6 and 7 (a) it can observed that CIA and PIA increase towards the southern peninsula, the deglaciated area and more exposed to the weathering agents than the northern sector, closest to the Collins glacier. The values also increase toward the coastline (Fig. 7b).

The samples with CIA values <60 display low chemical weathering, 60-80 indicate moderate chemical weathering and >80 exhibit extreme chemical weathering. The CIA values of the samples vary from 50.4 to 62.1 - incipient to moderate.

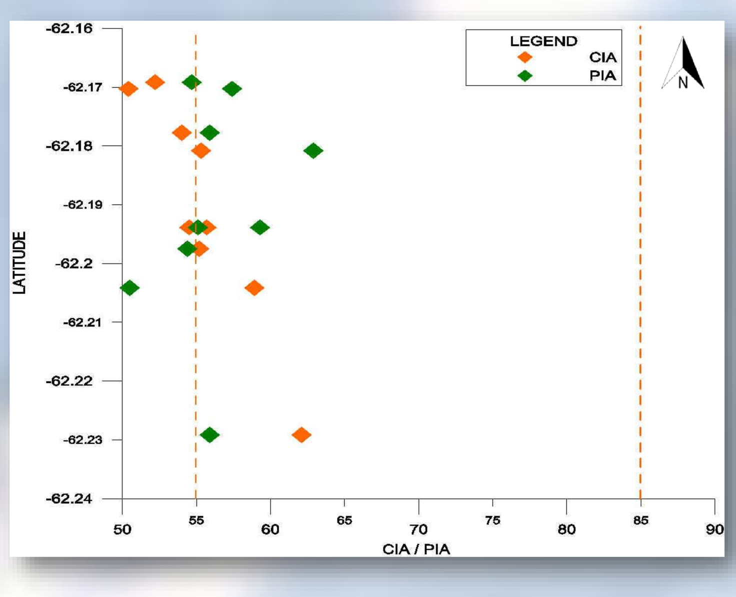

Figure 6: CIA and PIA for the lacustrine samples and their relation with the latitude.

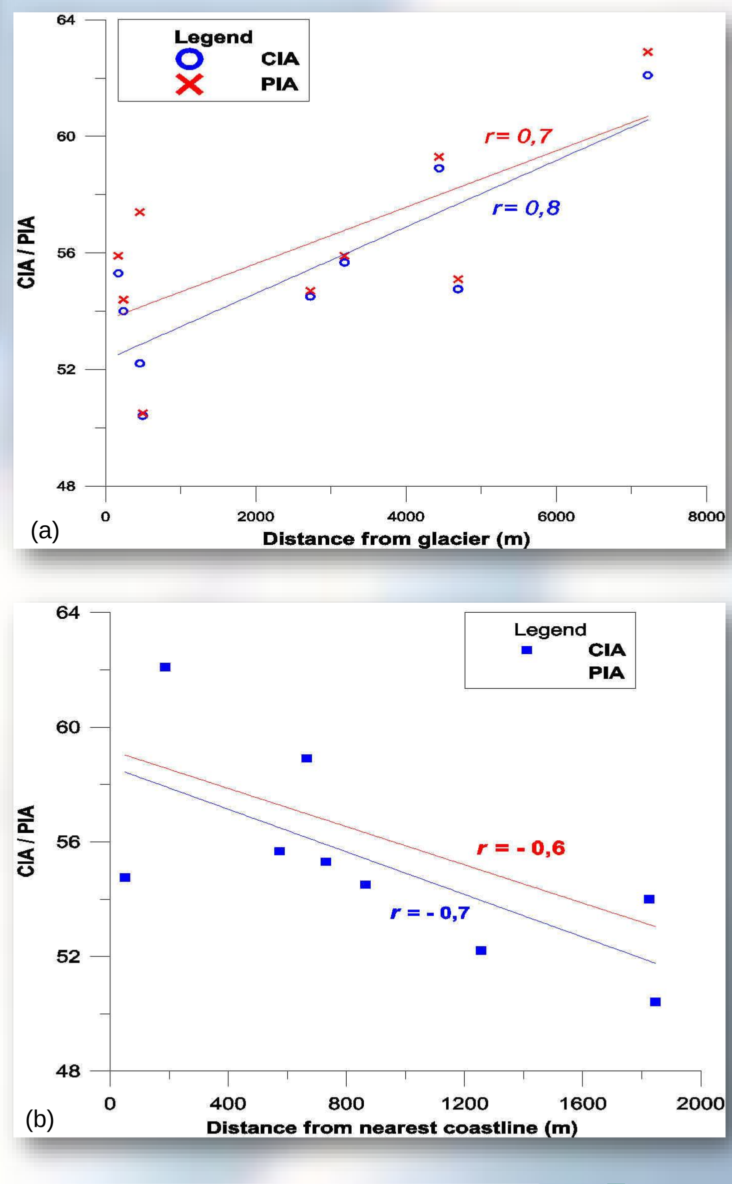

Figure 7: Scatter plots and regression lines between CIA and PIA and distance from the glacier (a), and coastline (b).

CONCLUSION

The mineralogy and granulometry of sediments samples reveal the local basaltic rocks as main source. The northern lakes show the current control of the Collins glacier on the sedimentation processes. The local deglaciation from the southern toward the northern part of the peninsula has permitted sediment input from other sources, such as liquid precipitation, melting snow, wind, and waves and tides actions, which reveals the dominant periglacial conditions. It is also considered the role of permafrost active layer melting, which alters the geomorphological dynamic and sediment transport to lakes and wetlands. The chemical weathering is an evidence for local response to the regional rising temperature.

Support