"Diagenetic alterations of suspended particulate organic matter in Antarctic glacier runoff and coastal waters evidenced by amino acids"

Report on the research visit, in October 2018, to the State Key Laboratory of Estuarine and Coastal Research, East China Normal University, Shanghai, China supported by *Antarctic Science International Bursary*

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Project background Amino acids, the building blocks of proteins, are the major forms of nitrogen in both terrestrial and aquatic organisms, and also, represent important constituents of living and dead organic matter (OM). The yields and composition of total hydrolysable amino acids (THAA) pool have been used successfully as diagenetic indicators in several types of samples (e.g. suspended and sedimentary particulate OM). THAAs are selectively decomposed or preferentially preserved during diagenesis, and seem uncompromised to source variations (Vandewiele et al., 2009, Zhang et al., 2012). Glycine, serine and threonine tend to be accumulated during degradation of OM, whereas glutamic acid, tyrosine and phenylalanine are depleted (Dauwe et al., 1999; Fernandes, 2011). Highly degraded, refractory OM of marine and terrestrial origin shows significantly different amino acid composition, as consequence of the different diagenetic processes involved in the formation and preservation of marine and terrestrial OM (Dittmar et al., 2001; Fernandes, 2011). Also, D-amino acids can be used to estimate microbial contribution to detrital OM (Vandewiele et al., 2009; Fernandes, 2011).

The aim of the extended research was to visit the State Key Laboratory of Estuarine and Coastal Research of the East China Normal University (ECNU) in Shanghai, China to perform THAAs analysis in collaboration with Professor Jing Zhang. The information provided by THAAs will be useful to assess if changes in food quality and availability are related to mixing processes of POM from different sources and/or to biogeochemical transformations of POM such as degradation state. This will aid for understanding the fate of suspended POM across glacier runoff and in near shore Antarctic waters, and its implications for determining food quality and availability for marine heterotrophic consumers in Antarctic coastal waters.

Study area King George Island (KGI) between 61° 54 – 62° 16´S and 57° 35 – 59° 02´ W, is the largest island of the South Shetland Archipelago, AP. It is bounded by the Drake Passage on the north, and by the Bransfield Strait on the south (Figure 1). The study area covers the south side of the Collins Glacier, commonly called Bellingshausen Dome or Small Dome, which is located in the southwest of KGI near the Uruguayan Artigas Antarctic Base (Figure 1). The Bellingshausen Dome has several limbs that melt before reaching the sea, and generates nine streams that flow into both sides of the coast (Chinarro, 2014). Five streams compose the drainage system into the Bransfield Strait. After following diverse proglacier routes, the whole flow converges at a pond, where a ionospheric observation station is located (Figure 1). The pond output is a unique melt water stream that flows under the bridge leading to the Uruguayan Artigas Base, and finally reaches the sea at Maxwell Bay (Chinarro, 2014) (Figure 1). The Collins Glacier is relatively sensitive to regional climatic variations, as it is small and near the pressure melting point (Simões et al., 2015). These features make the Collins Glacier an ideal place to evaluate the influence of melt water runoff on the adjacent coastal waters in a local scale. Considerable glacier retreatment and diminishing ice thickness has been reported for the Collins Glacier (Meredith & King, 2005; Rückamp et al., 2011; Simões et al., 2015). Modelling scenarios predicted its disappearance in about 285 years, should the last decade regional climate conditions continue to be the same (Rückamp et al., 2011). Thus, the intensification of seasonal glacial melting, summer runoff and consequently changes in the quantity and composition of suspended POM, among other environmental changes, could be expected for this area in the following decades, with significant impacts on the adjacent marine ecosystem and its food webs.

Sampling Water samples were taken in January 2018. In the proglacier channels and the melt water stream the sampling was carried on foot, collecting surface water with a pre-cleaned bucket. In the ionospheric pond it was carried out on board of a rubber boat provided by the Uruguayan Antarctic Institute and available in Artigas Base, and in Maxwell Bay sampling was carried on board the BAP Carrasco of the Peruvian Navy.

In the laboratory of Artigas Base, suspended particles were concentrated filtering water samples through pre-combusted GF/F glass fibre membranes (nominal pore size 0.7 µm) under mild vacuum, and immediately frozen (-20 °C) until laboratory analysis.

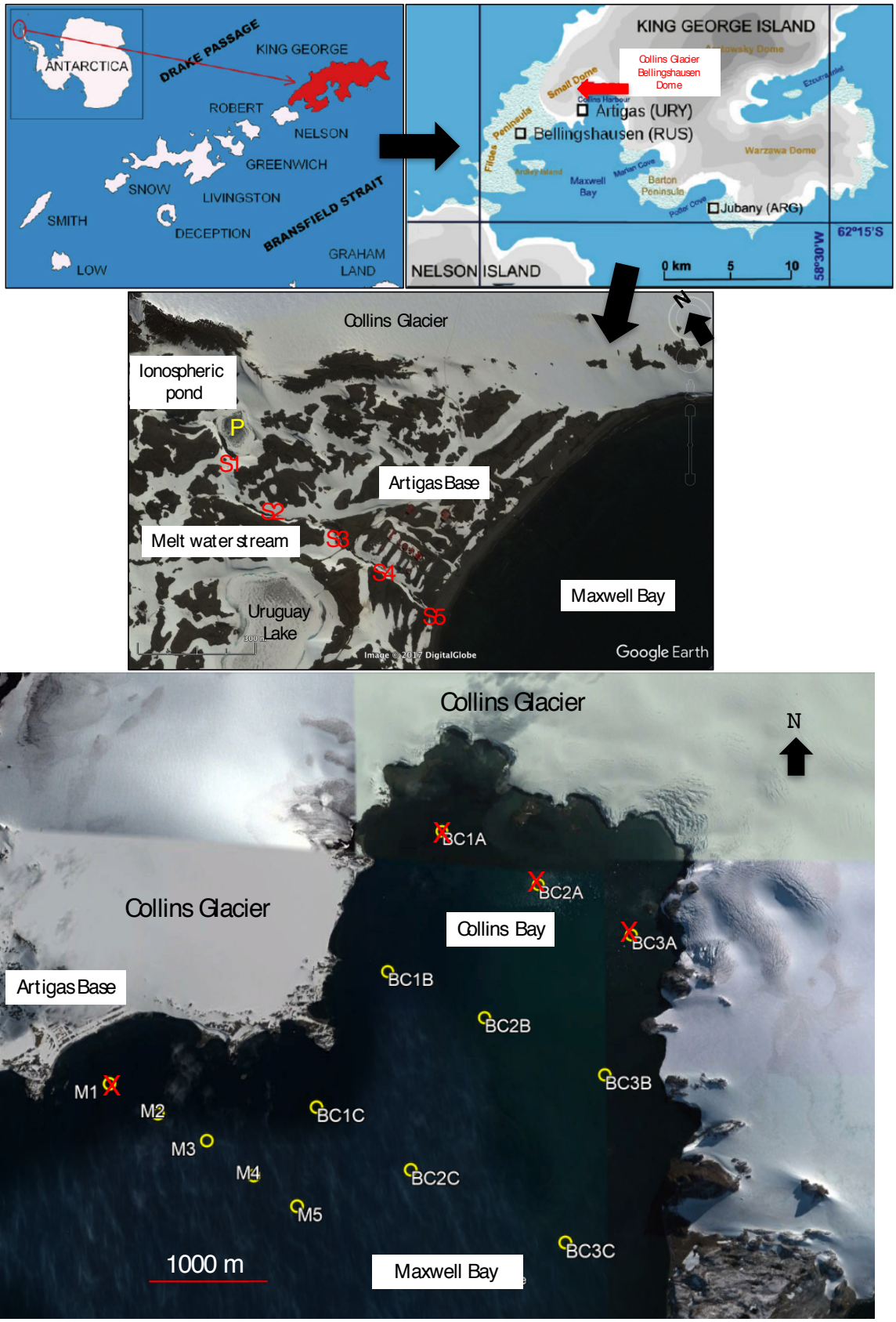


Figure 1. Study area showing the Collins Glacier front, the ionospheric pond, the melt water stream (above) and the adjacent coast in Maxwell Bay (below). Proglacier channels are not shown due to the scale. (Figure adapted from Chinarro, 2014). X = These stations were not sampled.

THAAs analysis in ECNU Amino acids were analysed following the protocol described in Fitznar et al. (1999). Freeze-dried GF/F filters were hydrolysed with HCl at 110 °C for 24h. Following pre-column derivatization with *o*-phthaldialdehyde and *N*-isobutyryl-L/D cysteine (IBLC/IBDC), amino acid enantiomers were measured using a HPLC system (1200 series, Agilent, USA). Data will be analysed in the following month and a paper will be submitted next year. I also intend to present these results in a regional or international congress about Antarctica.

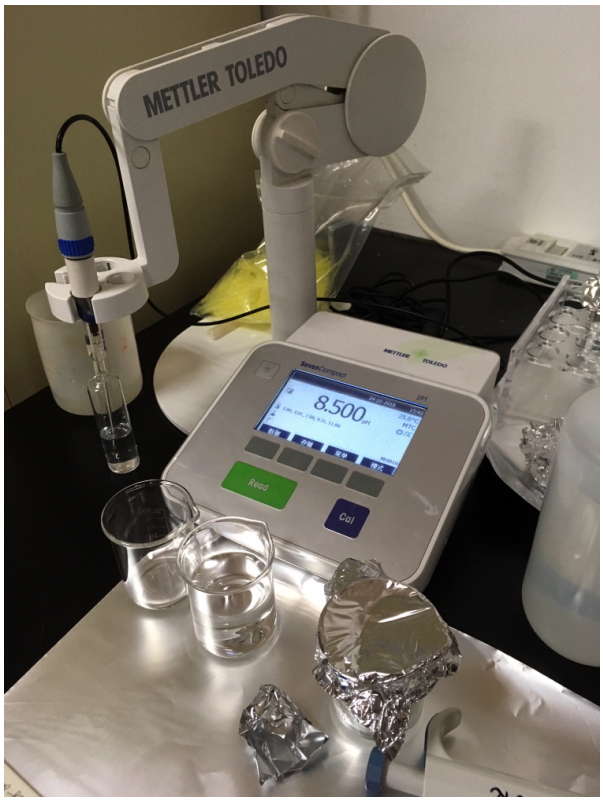
Personal impression My visit to the ECNU in Shanghai, China was a very good experience not only for professional growth but also for personal progress because I had the opportunity to meet very nice people, eat delicious Chinese food and learn about the millenary history of China.

Acknowledgements Professor Zhuoyi Zhu is very acknowledged for his help and support during my stay and also for opening the lab for AAs analysis. All the staff of the State Key Laboratory of Estuarine and Coastal Research is acknowledged for their kind reception. Many thanks to Wenchao for helping me with AAs analysis!! Finally, I am very grateful to Wei (Professor Jing Zhang´s secretary) for her kindness and fellowship during my stay, you are great Wei!!

Image gallery

Artigas Base and the Collins Glacier behind.

Natalia Venturini working near the Collins Glacier.



Adjusting pH of AAs samples before derivatization and injection in the HPLC.

Natalia Venturini in the campus of the East China Normal University, Shanghai, China.

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