São Paulo School of Advanced Science on Ocean Interdisciplinary Research and Governance

Environmental characterization of the Larsen A ice shelf, Weddell Sea, West Antarctica, inferred from the associations of benthic foraminifera

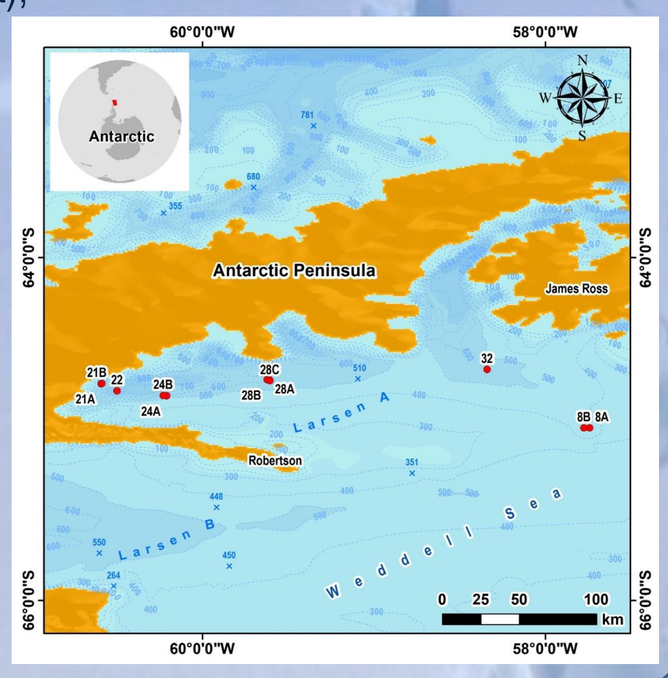
Maria Carolina Hernandez Ribeiro (Graduate student) - Email: maria.carolina.ribeiro@usp.br
Wânia Duleba (Advisor) - Email: wduleba@usp.br

Background

- Ice shelves are extensions of continental glaciers and constitute 11% of Antarctic territory, being very sensitive to environmental changes (e.g. variations in temperature and circulation) (Välisuo et al, 2014);
- Seasonal food flow reaching the bottom, in the form of phytodetritus resulting from the primary productivity of the upper layers (Gutt et al, 2011; Sumida et al, 2014);
- In addition to the availability of food, the distribution of benthic fauna is controlled by other factors in the polar regions, such as depth, sedimentation, currents, icebergs (Lee et al., 2001 A and B), and ecological relations;
- The benthic community existing under the ice shelves lives in an oligotrophic regime, dependent on lateral advection (Gutt et al, 2011) and resembles those of the deep sea (Thistle, 2003; Giere, 2009);
- The meiofauna participates in the benthic fauna, with organisms varying between 32 µm and 1 mm (Giere, 2009, Veit-Köhler et al, 2011). The Foraminifera, protist organisms, participate in the meiofauna but generally aren't considered in the studies (Giere, 2009). Within this group the monothalamids (Monothalamous) are often neglected (Majewski, 2010), although they are abundant in high latitudes (Pawlowski et al, 2008)..

Goals

- The Larsen A ice shelf, in the north of the Antarctic Peninsula, was the first to collapse, in 1995. This event allowed the survey in a new environment (main objective of the **LARISSA** Project);
- Analyze the foraminifera community of the Larsen A region, after the collapse of its ice shelf, from the integration of meiofauna, hydrographic, granulometric and geochemical data.
- Test another methodology to separate the Monothalamous Foraminifera without damaging them.

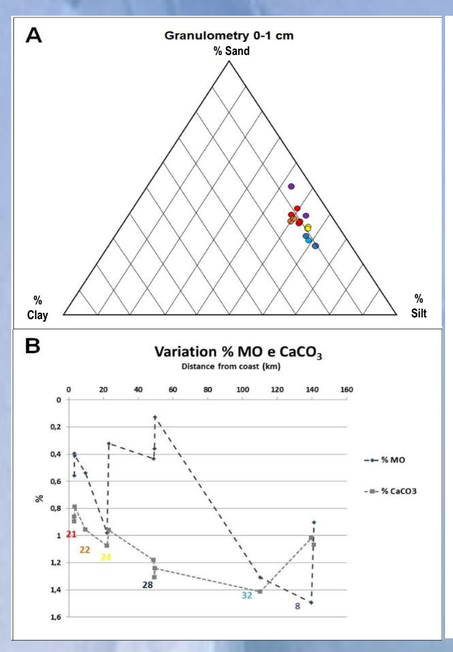


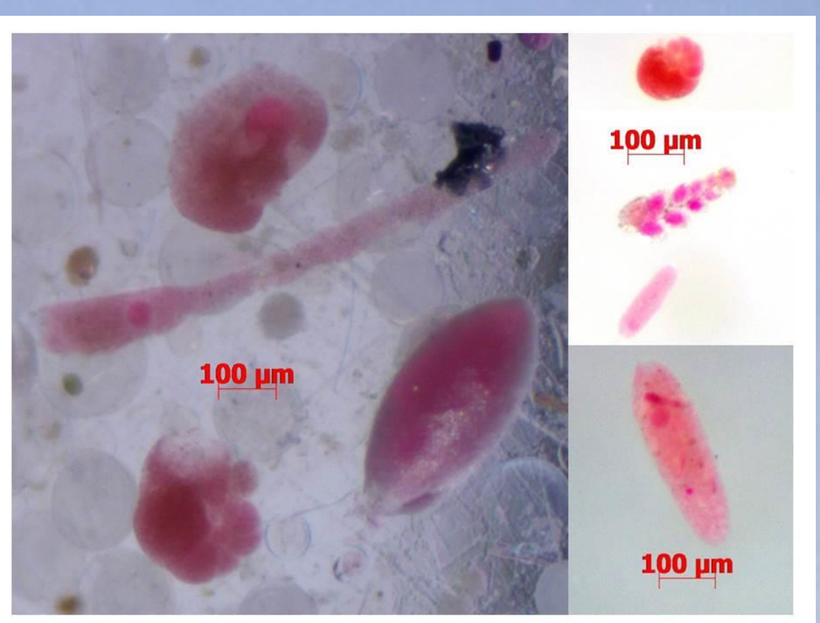
Methods

- Samples were collected at Larsen A and the Weddell Sea in March-April 2012 on RVIB Nathaniel B. Palmer on a transect offshore. The corers were collected with megacorer and sliced in the intervals: 0-1, 1-2 and 2-3 cm. The sediment was fixed with 4% formalin buffered with borax and stained with Bengal Rose.
- A portion of each sample was withdrawn and pretreated (removal of MO and $CaCO_3$) (Konert & Vanderberghe, 1997, adapted). The granulometry was obtained by granulometry by laser diffraction (Forde et al, 2012).
- At least about 10 cm^3 of each sample was wet washed in sieves (63 µm) and screened under stereomicroscope in alcohol 70%.

Initial Results

- Just like the metazoan organisms of meiofauna, previously studied (Ribeiro, 2015), the abundance of the foraminifera adhered to the same pattern, in the upper layer of sediment (0-1 cm);
- Monothalamous as well as calcareous and agglutinants foraminifera were found in the stations, especially in the open sea (stations 8 and 32);
- Most of the samples were classified as sandy silt, and the percentages of organic matter and calcium carbonate decreased towards the coast.





References:
Forde, J.; Collins, P. C.; Patterson, A.; Kennedy, R. Comparison of granulometric methods and sampling strategies used in marine habitat classification and ecological status assessment. Marine Pollution Bulletin, v. 64, p, 1018-1028. 2012.
Konert, M.; Vanderberghe, J. Comparison of laser grains size analysis with pipette and sieve analysis: a solution for the underestimation of the clay fraction. Sedimentology, v. 44, p. 523-535. 1997.
Lee, H. J.; Gerdes, D..; Vanhove, S.; Vincx, M. Meiofauna response to iceberg disturbance on the Antarctic continental shelf at a Kapp Norvegia (Weddell Sea). Polar Biology, v. 24, p. 926-933. 2001 A.
Lee, H. J.; Vanhove, S.; Peck, L. S.; Vincs, M. recolonisation of meiofauna after catastrophic iceberg scouring in shallow Antarctic sediments. Polar Biology, v. 24, p. 918-925. 2001 B.
Sumida, P. Y. G.; Smith, C. R.; Bernardino, A. F.; Polito, P. S.; Vieira, D R. Seasonal dynamics of megafauna on the deep Wesr Antarctic Peninsula shelf in response to variable phytodetrital influx. Royal Open Science, v. 1, 140294. 2014.
Giere, O. Meiobenthology: The microscopic motile fauna of aquatic sediments. 2nd ed. Springer, 528 p. 2009.
Gutt, J.; Barrat, I.; Domack, E.; D'Acoz, C. D.; Dimmler, W.; Grémare, A.; Heilmayer, O.; Isla,. E.; Janussen, D.; Jorgensen, E.; Kock, K. H.; Lenhert, L. S.; López-González, P.; Langner, S.; Linse, K.; Manjón-Cabeza,. M. E.; Meibner, M.; Montiel, A.; Raes, M.; Schenke, H. W.; Seiler, J. & Smithe, C. R. Biodiversity change after climate-induced ice-shelf collapse in the Antarctic. Deep-Sea Research II, v. 58, p. 74-83. 2011.
Majewski, W. Benthic foraminifera from West Antarctic fiord environsments: an overview. Polish Polar Research, v. 31, n. 1, p. 61-82. 2010.
Pawlowski, J.; Majewski, W.; Longet, D.; Guiard, J.; Cedhagen, T.; Gooday, A. J.; Korsun, S.; Habura, A. A.; Bowser, S. S. Genetic differentiation between Artctic and Antarctic monothalamous foraminiferans. Polar Biology, v. 31, p. 1205-1216. 2008.
Ribeiro, M. C. H. Comunidade bêntica da área da plataforma de gelo Larsen A (Antártica) 17 anos após sua desintegração, com ênfase na meiofauna. Dissertação de Mestrado, Programa de Oceanografia, Instituto Oceanográfico da Universidade de São Paulo. 2015.
Thistle, D. On the utility of metazoan meiofauna for studying the soft-bottom deep sea. Vie et Milieu, v. 53, n. 2/3, p. 97-101. 2003.
Välisuo, I.; Vihma, T.; King, J. C. Surface energy budget on Larsen and Wilkins ice shelves in the Antarctic Peninsula: results based in reanalyses in 1989-2010. The Cryosphere, v. 8, p. 1519-1538. 2014.
Veit-Köhler, G.; Guilini, K.; Peeken, I.; Sachs, O.; Sauter, E. J.; Würzberg, L. Antarctic deep-sea meiofauna and bacteria react to the deposition of particulate organic matter after a phytoplankton bloom. Deep-Sea Research II, v. 30, p. 1983-1995. 2011.