

1.6 The Opening NW Passage: Resources, Navigation, Sovereignty & Security

Summary

Project Leader(s)

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This project will map the bottom topography and geological structure of the NW Passage and other regions of the Canadian Archipelago as a first step towards the management of increased intercontinental ship traffic and resource exploration as ice conditions improve, and will contribute invaluable information to assess the economic, sovereignty and security implications of an ice-free NW Passage. The objectives of the project include: 1) to compile corridors of precise high resolution bathymetry, and seabed geomorphology; 2) to improve the mapping of the surficial geological environment of the Canadian Archipelago channels; 3) to obtain sediment cores and grabs of the Holocene record for paleoceanographic analyses at optimal sites in the region.

People

Network Investigators

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Partners

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Publications

Articles Published in Refereed Publications

Beaudoin, J., Hughes Clarke, J.E. and Bartlett, J.E., 2004, Application of Surface Sound Speed Measurements in Post-processing for Multi-Sector Multibeam Echosounders, *International Hydrographic Review*, v.5, no.3, 17-32, Published

Bartlett, J., Beaudoin, J., Hughes-Clarke, J., Brucker, S., Blasco, S., and Bennett, R., 2006, ArcticNet: The Current and Future Vision for its Seabed Mapping Program., *The Hydrographic Journal*, vol. 122, pp. 11 – 16, Published

Beaudoin, J, Hughes Clarke, J.E. and Bartlett, J., 2006, Usage of Oceanographic Databases in Support of Multibeam Mapping Operations Onboard the CCGS AMUNDSEN, *Lighthouse*, No. 68, 1, Published

Fisher, D., Dyke, A., Koerner, R., Bourgeois, J., Kinnard, C., Zdanowicz, C., de Vernal, A., Hillaire-Marcel, C., Savelle, J. and Rochon, A. , 2006, Natural variability of Arctic sea ice over the Holocene, *EOS Transactions*, 87, 28, Published

Schell, T., Moss, T., Scott, D.B. and Rochon, A., 2007, Paleo-sea Ice Conditions of the Amundsen Gulf, Canadian Arctic Archipelago: Implications from the Foraminiferal Record of the Last 200 Years, *Journal of Geophysical Research (Oceans)*, 1, Accepted

Scott, D. B. , Schell, T., Rochon, A., and Blasco, S., 2008, Modern benthic foraminifera in the surface sediments of the Beaufort shelf, slope and Mackenzie trough, Beaufort Sea, Canada: taxonomy and summary of surficial distributions, *Journal of Foraminiferal Research*, v. 38, no. 3, 1, Accepted

Other Refereed Contributions

Bennett, R., Blasco, S., MacLean, B., Rochon, A., Hughes-Clarke, J., Beaudoin, J., Bartlett, J., Jenner, K., Schell, T., 2005, Paleooceanography, Seabed Morphology and Geologic Framework of the NW Passage. , *Paleooceanography, Seabed Morphology and Geologic Framework of the NW Passage.* , 1, Accepted

Richerol T, Rochon A. , 2006, Surface and pre-historical dinoflagellate cyst assemblages from the Beaufort Sea (Canada)., *GAC-MAC annual meeting, Program and Abstracts*, 127, Published

Rochon A., 2006, Evolution of sea surface conditions during the Holocene: Comparison between eastern (Baffin Bay and Hudson Strait) and western (Beaufort Sea) Canadian Arctic, *GAC-MAC annual meeting, Program and Abstracts*, 129, Published

Rochon A, Scott DB, Schell TM, Blasco S, Bennett R, Mudie P. , 2006, Evolution of sea Surface Conditions During the Holocene: Comparison Between Eastern (Baffin Bay and Hudson Strait) and Western (Beaufort Sea) Canadian Arctic, *American Geophysical Union annual meeting*, 1, Published

St-Onge G, Stoner JS, Rochon A, Channell JET, Barletta F. , 2006, Major Holocene paleomagnetic directional swings as possible Arctic chronostratigraphic markers., *GAC-MAC annual meeting, Program and Abstracts*, 143, Published

Non-Refereed Contributions

Beaudoin, J. and Hughes Clarke, J.E., 2004, Retracing (and re-raytracing) Amundsen's Journey through the Northwest Passage, Proceedings of the Canadian Hydrographic Conference, May 2004, Ottawa, 35pp, Published

Bartlett, J.E., Beaudoin, J. and Hughes Clarke, J.E., 2004, CCGS Amundsen: A New Mapping Platform for Canada's North, Lighthouse, Journal of the Canadian Hydrographic Association; Edition No. 65, 30-38, Published

Wert, T., Dare, P., and Hughes Clarke, J., 2004, Tidal Height Retrieval Using Globally Corrected GPS in the Amundsen Gulf Region of the Canadian Arctic, Institute of Navigation GNSS 2004, September 21-24 2004, Long Beach, California. Proceedings, pp., Published

Blasco, S., Bennett, R., Kostylev, V., MacKillop, K., Bartlett, J. and Travaglini, P., 2004, Beaufort Sea Seabed Environmental and Geotechnical Research Related to Offshore Hydrocarbon Development, 32nd Annual Geoscience Forum Proceedings, Yellowknife NWT, n/a, Published

Rochon, A., Mudie, P.J., de Vernal, A. and Levac, E., 2004, Holocene records of climate change in northern Baffin Bay: decadal-scale reconstructions from dinoflagellate cysts, GAC-MAC Annual Meeting, May 12-14, Ste-Catharines., n/a, Published

Schell, T., Scott, D.B., Rochon, A. and Blasco, S., 2004, Recent climate change in the Canadian Arctic, documented through changing microfossil proxies of the Mackenzie shelf, Beaufort Sea, Geological Society of America annual meeting, Denver, USA, n/a, Published

Schell, T., Scott, D.B., Rochon, A. and Blasco, S., 2004, Recent climate change in the Canadian Arctic, documented through changing microfossil proxies of the Mackenzie shelf, Beaufort Sea., CASES first international workshop, Montréal, n/a, Published

St-Onge, G., Long, B. and Rochon, A., 2004, CAT-Scan analysis of sedimentary sequences: a qualitative and quantitative paleoclimatic tool for low sedimentation rate environments such as the Arctic, 32nd International Geological Congress, August 20-28, Florence, Italy, 448, Published

St-Onge, G., Long, B.F., de Vernal, A., Hillaire-Marcel, C. and Rochon, A., 2005, CAT-scan analysis of sedimentary sequences: a tool to identify millennial- to seasonal-scale climatic oscillations., GAC-MAC Annual Meeting, May 15-18, Halifax, n/a, Published

Lajeunesse, P., Allard, M., Beaudoin, J., 2005, The history, processes and products of deglaciation of eastern Hudson Bay inferred from remote sensing and seafloor acoustic data, 35th Annual International Arctic Workshop, Edmonton, Canada, n/a, Accepted

Rochon, A., 2005, Holocene paleoceanography of the Mackenzie Trough area, Canadian Beaufort Sea: Preliminary results., North American Paleontology Conference, Halifax, Canada, 1, Accepted

Rochon, A., Blasco, S., Jarrett, K., Jenner, K., Schell, T.M., Scott, D.B., Shimada, K. and Travaglini, P., 2005, Holocene paleoceanography of the Mackenzie Trough area, Canadian Beaufort Sea: Preliminary results. , 35th Arctic Workshop, Edmonton, Canada, 1, Accepted

St-Onge, G., Blasco, S., Channell, J., Jenner, K., Rochon, A., Schell, T.M., Scott, D.B. and Stoner, J., 2005, Paleomagnetic secular variation records from the Beaufort Sea and Amundsen Gulf, western Canadian Arctic: Implications for Holocene Arctic chronostratigraphy., 35th Arctic Workshop, Edmonton, Canada, 1, Accepted

St-Onge, G., Long, B.F., de Vernal, A., Hillaire-Marcel, C. and Rochon, A., 2005, CAT-scan analysis of sedimentary sequences: a tool to identify millennial- to seasonal-scale climatic oscillations. , GAC-MAC Annual Meeting, May 15-18, Halifax, 1, Accepted

Rochon, A., 2005, Paléocéanographie Holocène de la Fosse du Mackenzie dans la mer de Beaufort, Arctique Canadien. Résultats préliminaires., Centre d'études Nordiques, Université Laval, 1, Published

Rochon, A., 2005, Paléocéanographie Holocène de la Fosse du Mackenzie, mer de Beaufort Canada; Résultats préliminaires., Réunion annuelle de Québec-Océan, Rivière-du-Loup, 1, Published

Ledu, D., Rochon, A. de Vernal, A., 2005, Reconstitutions des oscillations paléocéanographiques de haute résolution à l'Holocène dans le Passage du Nord-Ouest., Réunion annuelle de Québec-Océan, Rivière-du-Loup, 1, Published

Richerol, T., Rochon, A., 2005, Distribution actuelle des kystes de dinoflagellés dans la couche de sédiments de surface, mer de Beaufort (Canada). , Réunion annuelle de Québec-Océan, Rivière-du-Loup, 1, Accepted

Rochon, A., St-Onge, G., Schell, T.M., Scott, D.B., Blasco, S., Bennett, R.J., Beaudoin, J., Hughes Clarke, J. and Ledu, D., 2005, Multi-proxy record of Holocene climatic changes in the Eastern Canadian Arctic: preliminary results., Second ArcticNet Scientific meeting, Banff, Canada, 91, Published

Beaudoin, J., Hughes Clarke, J.E., and Bartlett, J., 2005, Usage of Oceanographic Climatologies and Databases in Support of Multibeam Mapping Operations onboard the CCGS Amundsen, 2005 ArcticNet Annual Conference Proceedings, 1, Accepted

Bennett, R., Blasco, S., Kostylev, V., MacKillop, K., Rochon, A., Bartlett, J., Travaglini, P., 2005, Seabed Features in the Beaufort Sea and their Impacts on Offshore Hydrocarbon Development and the Environment., 33rd Annual Geoscience Forum, Yellowknife, NWT, 1, Accepted

Blasco S.M., Bennett R., Hughes-Clarke J., Bartlett J., Shearer, J.M., 2005, 3-D Multibeam Mapping Reveals Geological Processes Associated With Fluted Seabed, Slump Feature, Pockmarks, Mud Volcanoes and Deep Water Ice Scours in the Beaufort Sea–Amundsen Gulf., Geological Association of Canada – Mineralogical Association of Canada (GAC-MAC) , 1, Published

Blasco, S., Bennett, R., Hughes-Clarke, J., Rochon, A., Beaudoin, J., Bartlett, J., Scott, D., Jenner, K., 2005, The Investigation of Seabed Geohazards in the Canadian Arctic: Assessing the Opening NW Passage. , ArcticNet 2nd Annual meeting, Banff, Canada, 1, Accepted

Blasco, S., MacLean, B., Mudie, P., Sonnichsen, G., Bennett, R., Rainey, W., Scott, D., Praeg, D., Hughes-Clarke, J., Bartlett, J., Mayer, L., Monahan, D., 2005, Northwest Passage Marine Sediments: A Record of Quaternary History and Climate., 32nd Arctic Workshop, Edmonton, Canada, 1, Accepted

Rainey, W.A., Blasco, S.M., Bennett, J.R., Hynes, S.E., and Harmes, R.A., 2005, Application of GIS and Data Management for Arctic Net. , ArcticNet 2nd Annual meeting, Banff, Alberta, Canada, 1, Accepted

Rainey, W.A., Blasco, S.M., Harmes, R.A., and Hynes, S., 2005, Application of GIS to Seabed Geoenvironmental Investigations, Canadian Beaufort Shelf., Geological Association of Canada – Mineralogical Association of Canada (GAC-MAC) Annual Meeting, Halifax, Nova Scotia, 1, Accepted

Bennett, R., Blasco, S., MacLean, B., Rochon, A., Hughes Clarke, J., Beaudoin, J., Bartlett, J., Jenner, K. and Schell, T., 2005, Paleooceanography, Seabed Morphology and Geologic Framework of the NW Passage, 2005 ArcticNet Annual Conference Proceedings, 19, Published

Schell, T., Scott, D., Rochon, A., Blasco, S., Bennett, R., Rainey, W., Jenner, K.A., Hughes Clarke, J., Beaudoin, J. and Bartlett, J., 2005, 'Present is key to the Past' , 2005 ArcticNet Annual Conference Proceedings, 93, Published

Hughes Clarke, J.E., Dare, P., Beaudoin, J., and Bartlett, J., 2006, A stable vertical reference for bathymetric surveying and tidal analysis in the high Arctic., Proceedings of the United States Hydrographic Conference 2005, San Diego, California, n/a, Published

Blasco, S., Bennett, R., 2006, Seafloor Geological Research in the Northwest Passage: Current and Future Directions for NRCan., Oceans Innovation 2005, Rimouski, 1, Accepted

Bennett, R., Blasco, S., Hughes-Clarke, J., Beaudoin, J., Bartlett, J., Rochon, A., Schell, T., 2006, Seabed Morphology, Geologic Framework, and Paleoceanography of the NW Passage. , Atlantic Geoscience Society Colloquium, Wolfville, Nova Scotia, 1, Accepted

Scott, D., Schell, T. and Rochon, A., 2006, Foraminifera and associated organisms on the present McKenzie shelf and Amundsen Gulf: The ground truthing for ArcticNet, 2005 ArcticNet Annual Conference Proceedings, 93-94, Published

Rochon, A , Scott, D B, Schell, T M, Blasco, S, Bennett, R J, Mudie, P J. , 2006, Evolution of sea Surface Conditions During the Holocene: Comparison Between Eastern (Baffin Bay and Hudson Strait) and Western (Beaufort Sea) Canadian Arctic, AGU Fall Meeting, U43B-0867, Accepted

Scott, D.B., Schell, T.M. and Rochon, A., 2006, Holocene Paleo-Sea Ice Cover in The Canadian Arctic- Implications For Future Predictions, Geological Society of America Abstracts with Programs, Vol. 38, No. 7, 525, Accepted

Ledu D, Rochon A, de Vernal A. , 2006, Reconstitutions des oscillations paléocéanographiques hautes résolutions à l'Holocène dans le Passage du Nord-Ouest, GAC-MAC annual meeting, Program and Abstracts, 86, Published

Scott, D., Schell, T., St-Onge, G., Rochon, A. and Blasco, S, 2006, Foraminiferal assemblage changes over the last 15,000 years on the Mackenzie/Beaufort sea slope and Amundsen Gulf, Canada: implications for past sea-ice conditions, ArcticNet, 1, Accepted

Schell, T., Scott, D., André, R. and Steve, B., 2006, Holocene paleoceanography of the mid Western Canadian Arctic Ocean, and paleo-sea ice conditions in the Mackenzie Trough and Canyon, Beaufort Sea., ArcticNet, 1, Published

Schell, T., Moss T., Scott, D. and Rochon, A., 2006, Recent paleo-sea ice conditions of the Amundsen Gulf, Canadian Arctic Archipelago as indicated by the foraminiferal record of the last 200 years., ArcticNet, 1, Published

Walsh, F. and Scott, D., 2006, Foraminifera associated with the Kopanur mud volcano and other "pingo-like" features on the Beaufort Shelf, Arctic Ocean: possible paleo-indicators of methane seeps, ArcticNet, 1, Published

Scott, D., Schell, T., Rochon, A. and Blasco, S., 2006, Benthic foraminifera in the surface sediments of the Mackenzie shelf and slope, Beaufort Sea, Canada: applications and implications for past sea-ice conditions, ArcticNet, 1, Published

Richerol, T., Rochon, A., Blasco, S., Scott, D, Schell, T. and Bennett, R., 2006, Distribution of dinoflagellate cysts in surface sediments of the Mackenzie Shelf and Amundsen Gulf, Beaufort Sea (Canada)., ArcticNet, 1, Published

Scott, D., Schell, T., Rochon, A. and Blasco, S., 2006, Modern benthic foraminifera in the surface sediments of the Beaufort Shelf, Slope and Mckenzie Trough, Beaufort Sea, Canada: Distributions and Taxonomy., ArcticNet, 1, Published

Lajeunesse, P., St-Onge, G., Hughes Clarke, J. and Beaudoin, J. , 2006, Late-Quaternary glacial and postglacial geology of Hudson Bay and western Hudson Strait: new evidence provided by the CCGS Amundsen, 2006 ArcticNet ASM, 1, Published

Bell, T., St. Hilaire, D., Hughes Clarke, J., Tarasov, L. and Sharp, M., 2006, Seabed Mapping at the terminus of Belcher Glacier, 2006 ArcticNet ASM, 1, Published

Church, I. , Haigh, S. , Brucker, S. , Hughes Clarke, J.E. , 2006, Comparing GcGPS ellipsoid height records, predicted tides and a Hydrodynamic Circulation Model for the Pond Inlet, Eclipse Sound and Navy Board Inlet System, 2006 ArcticNet ASM, 1, Published

Bell, T., St. Hilaire, D., Hughes Clarke, J., Tarasov, L. and Sharp, M., 2006, Seabed Mapping at the terminus of Belcher Glacier, 2006 ArcticNet ASM, 1, Published

Jonathan, B. and Hughes Clarke, J.E. , 2006, Impact of InterAnnual Oceanographic Variability on ArcticNet Multibeam Echosounding Post-Processing, 2006 ArcticNet ASM, 1, Published

Hughes Clarke, J, E. , Brucker, S. , Church, I. , Bell, T. and Forbes, D. , 2006, Glacial and PostGlacial seabed modification in Oliver and Eclipse Sounds, 2006 ArcticNet ASM, 1, Published

Schell, T.M., Scott, D.B., Rochon, A., Blasco, S., Bennett, R., and Jenner, K. , 2006, Recent Paleooceanography of the MacKenzie Trough (Beaufort Sea) with comparisons to Lancaster Sound (Baffin Bay), using foraminifera as proxies, AGS colloquium, 1, Accepted

Bennett, R., Blasco, S., Kostylev, V. MacLean, B., Rochon, A., Hughes-Clarke, J., Beaudoin, J., Bartlett, J., 2006, Seabed processes and geological structure of the Northwest Passage, 2006 ArcticNet ASM, 1, Accepted

Blasco, S. , Bennett, R. , Kostylev, V., Campbell, P., Shearer, J. and Conlan, K., 2006, Seabed topography, geological structure and evolution of the sea-ice regime on the Beaufort Shelf at the western entrance to the Northwest Passage, 2006 ArcticNet ASM, 1, Published

Bennett, R., Blasco, S. and MacLean, B., 2007, Seabed Features Related to Glacial Ice Dynamics in Amundsen Gulf, 2007 Canadian Quaternary Association Conference Proceedings, Ottawa, 1, Published

Church, I., Hughes Clarke, J.E. and Susan, H., 2007, Use of a Nested Finite-element Hydrodynamic Model to Predict Phase and Amplitude Modification of Tide Within Narrow Fjords, Proceedings of the 2007 United States Hydrographic Conference, Norfolk VA, 1, Published

Bennett, R., Blasco, S., Beaudoin, J., Hughes-Clarke, J., MacLean, B., 2007, Geohazards and Navigational Hazards in the Northwest Passage, 2007 ArcticNet Annual Conference Proceedings, 36, Published

Church, I., Haigh, S., Hughes-Clarke, J., 2007, Applying Predicted Tides from a Local Hydrodynamic Model to Multibeam Bathymetry: A Solution for Seabed Monitoring in Remote Locations, 2007 ArcticNet Annual Conference Proceedings, 41, Published

Ledu, D., de Vernal, A., St-Onge, G., 2007, Palynological Evidence of the Holocene Thermal Maximum in the Northwest Passage: A Possible Shift in the Arctic Oscillation at Millennial Time Scale, 2007 ArcticNet Annual Conference Proceedings, 70, Published

Beaudoin, J., Hughes Clarke, J.E., Bartlett, J., Blasco, S. and Bennett, R., 2008, Mapping Canada's Arctic Seabed: Collaborative Survey Processing and Distribution Strategies, Proceedings of the Canadian Hydrographic Conference and National Surveyors Conference, 1, Accepted

Specialized Publications

Rochon, A., 2004, CASES et l'Arctique canadien en photos: la traversée du Passage du Nord-Ouest, ISMER, UQAR, Rimouski, Canada, n/a, Published

Rochon, A, 2004, CASES et l'Arctique canadien en photos: la traversée du Passage du Nord-Ouest. Les midis des sciences naturelles, Département de biologie, UQAR, Rimouski, n/a, Published

Blasco, Steve, J. Hughes Clarke, R. Bennett, J. Bartlett, J. Beaudoin and W. Rainey, 2004, Seafloor Features and Geological Processes as Revealed by New Multibeam Mapping Technology, Northwest Passage, Proceedings ArcticNet 2004 Annual Scientific Meeting, 9, Accepted

Beaudoin, Jonathan, John Hughes Clarke and J. Bartlett, 2004, When it rains, it pours: Dealing with not enough and too much sound speed information in EM300 multibeam post-processing, Proceedings ArcticNet 2004 Annual Scientific Meeting, 22, Accepted

Wert, T., 2005, Tidal Height Retrieval using Globally Corrected GPS in the Amundsen Gulf Region of the Canadian Arctic, M.Sc. thesis, n/a, Published