Another round of SLAN personnel exchange took place in April when Robin Edwards (Trinity College Dublin) visited Trevor Bell and his research group at Memorial University of Newfoundland (MUN) in St John’s. Robin’s trip was funded by an Academic Bursary from the Ireland-Newfoundland Partnership with the aims of furthering SLAN-related projects focussing on postglacial sea-level change, and exploring fourth level curriculum developments in the general areas of earth and environmental science. During his eight-day visit, Robin met with a range of academics, research staff, and postgraduate students, in addition to giving a research seminar on sea level change. However, the main focus of activities centred on several sediment cores collected from Moreton’s Harbour in March 2009.

In formerly glaciated regions such as Newfoundland, complex patterns of relative sea level (RSL) change can arise as a consequence of processes such as differential glacioisostatic adjustment. In some areas, the removal of the overlying mass of ice results in rebound of the land surface leading to RSL fall. One of the consequences of this process is that small marine basins may be elevated above the limits of tidal influence, and become transformed into freshwater lakes.
The sediments contained within these “isolation basins” record the isolation of the system from the sea, and can be used to reconstruct past RSL changes. Similarly, in regions where RSL rise has been occurring, freshwater systems may be inundated by rising tidal levels, and sea level index points can be established where the sediments preserve indicators of the onset of marine conditions. Whilst these environmental changes are commonly evident in the lithostratigraphy, microfossils such as foraminifera or diatoms, are routinely employed to support and refine any lithostratigraphic interpretation.

Research interest in Moreton’s Harbour stems from the fact that it is a marginal marine basin containing sediments that could provide information on RSL change by recording its isolation from, or inundation by the sea at points in the past. As reported in the last SLAN newsletter, five sediment cores ranging in length from 40 – 225 cm were recovered from water depths of 14-16 m within Moreton’s Harbour. In the March visit, the inner harbour was frozen permitting percussion drilling to take place from the sea ice itself. When the team revisited the site at the end of April, most of this ice had melted, although there was still an opportunity for Robin to venture a short way out onto the “rough ice”, whilst trying (not entirely successfully) to avoid getting wet feet!

On return to the laboratory, the whole cores were first analysed used MUN’s multi-sensor core logger (MSCL). Sediment cores were then split and a visual description made of the lithology. Half-sectioned cores were subsequently cleaned before being re-scanned by the MSCL to produce a precise photographic record prior to sediment sub-sampling for foraminifera, loss on ignition and radiocarbon dating.
The objectives of Robin’s analysis were: 1) to determine whether foraminifera were present within the sedimentary sequences, indicating marine conditions (submergence); 2) to determine the suitability of foraminifera as an environmental indicator in the Moreton’s Harbour cores with reference to their general abundance, state of preservation, and potential taphonomic alteration; 3) to characterise the lithological units and identify any transitions capturing the onset or removal of marine conditions that may be suitable for the establishment of sea level index points; 4) to provide some basic training on the use of foraminifera in sea level reconstruction including the methods of sample preparation and analysis.

In total, qualitative analysis of foraminifera was performed on 11 samples, noting the presence or absence of foraminifera, the principal genera / species present, the quality of the foraminiferal tests and their general abundance.

The lithostratigraphic and foraminiferal analysis confirmed the suggestion that Moreton’s Harbour holds thick sequences of organic rich sediments containing microfossils suitable for palaeoenvironmental reconstruction. Significantly, all the sampled sediments contain foraminiferal species that are typical of coastal and estuarine environments. This indicates that the entire sedimentary sequence accumulated in a marine environment, and that RSL must have been above the height of the rock sill. Occasional larger clasts within the fine-grained sediments may reflect ice rafting of material, whilst distinct lenses of broken shell and sand are occasionally present, suggesting changes in energy regime and/or sediment transport. However, none of the material examined to date indicates the onset or removal or marine conditions within the sediment cores as was speculated in the previous report in Newsletter 5. This may indicate that the base of the sequence was not sampled, or that the basin has always operated as a marine system.
Whilst not diagnostic of RSL changes, the preliminary, qualitative analysis conducted during the visit indicates that there are subtle variations in the number and proportion of foraminiferal species present in the various sediment units. The preservation of foraminifera is also variable, with some assemblages exhibiting clear signs of dissolution that may indicate the loss of foraminifera through time. Abraded and broken tests are comparatively rare in most units suggesting that sediment reworking within the basin is not significant. Well-preserved foraminifera are associated with the shell-rich, sandy horizons, suggesting that these are more likely to reflect the incursion of higher energy conditions into the Inner Harbour, rather than the erosion and transport of marginal beach sediments into the basin fill. Large diatom valves were visible in the foraminiferal samples, suggesting that rich diatom assemblages may be present within the Harbour sediments, and that further analysis may be useful in examining changes in salinity regime and RSL change.

Hence, whilst the analysis did not reveal any sediments suitable for the construction of sea level index points, the results demonstrate that Moreton’s Harbour and similar basins in the region, have the potential to provide useful RSL data. Foraminifera are present and can be applied in the future, perhaps in combination with diatom analysis. Failure to recover the inferred freshwater/terrestrial sediments at the base of the sequence is most likely due to technical and logistical limitations associated with coring. Firstly the depth of water placed a limit on core penetration and only permitted the recovery of the upper couple of meters of sediment. Secondly, breakup of sea ice during the coring expedition in March meant that it was not possible to sample the outer part of the Harbour. Sediment samples from the base of two of the cores will be sent for radiocarbon dating to establish a general chronology for the sequences investigated in this study. These data will provide an important reference for further work in the region, and expanding this dataset will be one area of SLAN research over the coming months.
[2] New SLAN researchers

**Dominic Lacroix**
Memorial University, Newfoundland

Dominic Lacroix (MSc Calgary) has recently joined the SLAN team at Memorial University as a Joseph-Armand Bombardier doctoral scholar. He is being supervised by Priscilla Renouf (Archaeology) and Trevor Bell (Geography).

Dominic began his career as an aerospace engineer, and remains interested in using modern technology as a tool to explore the past. He now specializes in the use of geophysical prospecting methods in archaeology. Borrowing interpretive techniques developed for oil and gas exploration, his Master’s research focused on the development of computer simulations to aid in the interpretation of ground-penetrating radar data obtained at archaeological sites. Although the majority of his fieldwork experience was gained on the Alberta Plains, his expertise has brought him to work on a number of projects spanning from the Canadian Arctic to Mexico and the Caribbean.

Dominic will be developing his PhD project over the coming months and is planning to visit with other SLAN members at the University of Ulster (Coleraine) and Dublin to broaden his expertise and contribute to group projects. Welcome Dominic.

**Benjamin Thebeaudoue**
Trinity College Dublin

Benjamin joined Robin Edwards at TCD in September 2009 to begin his PhD titled 'Testing simulations of relative sea-level change: a marine geophysical perspective'. Relative sea-level (RSL) histories provide unique insights into the topical issues of ice sheet response to climate change and future sea-level rise. Data from Ireland are particularly instructive due to their location at the former limit of a major ice sheet. Despite their significance, Irish RSL histories are contested and the debate largely characterised by polarised views that reflect methodological and discipline-related divisions. This project will cross this boundary by integrating approaches from both sides of the methodological divide to test the validity of two competing and mutually exclusive views of RSL change since the last glacial maximum (LGM).

In addition to participating in structured / taught elements as part of postgraduate training in the School of Natural Sciences (TCD), Benjamin will receive specialist training at the University of Ulster and at Ottowa in addition to receiving technical advice from the other collaborating scientists.

Rory Quinn¹, Wes Forsythe¹, Ruth Plets¹, Kieran Westley¹, Trevor Bell², Fergal McGrath³, Sara Benetti¹ and Rhonda Robinson⁴

¹Centre for Maritime Archaeology / School of Environmental Sciences, University of Ulster, ²Geography, Memorial University, ³Marine Institute, Ireland and ⁴Northern Ireland Environment Agency

SLAN researchers have been awarded a further €80,000 under the Irish National Strategic Archaeology Research Programme (2008-09) to continue work on archaeological applications of the Joint Irish Bathymetric Data. Currently, these data are being processed to produce 1m-resolution bathymetric and compensated backscatter data sets for the entire study area.

Results from Phase 1 and Phase 2 of the project were presented at the European Association of Archaeologists 15th Annual Meeting (September 2009, Riva del Garda, Italy) and at the European Association of Geoscientists and Engineers 15th European Meeting of Environmental and Engineering Geophysics (Near Surface) (September 2009, Dublin, Ireland).
[4] Student training cruise

The University of Ulster will run an undergraduate training exercise aboard RV Celtic Voyager, supported by the Marine Institute (Ireland) Integrated Marine Exploration Programme (IMEP) via funding secured under the Government’s Strategy for Science, Technology and Innovation 2006-2013 (SSTI).

The training cruise will be run in the JIBS study area, with undergraduate and research students getting the opportunity to collect marine geophysical and geo-archaeological data to inform their own research projects and dissertation topics. Targets for the sampling surveys will be picked from the JIBS geo-acoustic data.

The overall purpose of the IMEP is to further develop national capacity in marine exploration by developing a pool of trained personnel who can utilise national assets and increase the quantum and nature of information gathered on surveys. In addition, in order to expand existing marine research capabilities and build research potential, the programme aims to provide grant-aid for ship-time, a requirement identified under the Infrastructure Supporting Programme of Sea Change.