

**NOAA Office of Ocean Exploration  
Semi-Annual Progress Report**

**I Overview**

*Grant:* NA10OAR0110187

*Funding:* \$104,248

*Title:* Unlocking 10,000 Years of Great Lakes History: The Search for Prehistoric Archaeological Sites along Lake Huron's Alpena-Amberley Ridge.

*Area:* Great Lakes

*Principle Investigators:*

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*Participating Institutions:*

University of Michigan  
Thunder Bay National Marine Sanctuary  
Wayne State University

*Award Period:* 06/01/2010 – 05/31/2011

*Report Period:* 06/01/2010 – 11/30/2010

## **II. Evaluation**

### **1. Work Accomplishments:**

The one year award from OE identified three overarching goals of the research which were to be realized via four specific objectives. The general goals of the project are: (1) to undertake acoustic imaging of a large area of the Alpena-Amberley Ridge beneath modern Lake Huron; (2) to ground truth selected features identified as of potential cultural origin; and (3) to generate a dynamic 3D model of caribou and human movements on the reconstructed ancient landscape.

#### **a. Scheduled tasks for this period.**

- 1) Design and conduct a multibeam survey over a large contiguous portion of the Alpena-Amberley Ridge;
- 2) Initiate the creation of GIS layers representing new information collected during acoustic and follow up survey;
- 3) Begin the identification and documentation of potential cultural targets;
- 4) Incorporate new environmental and cultural information into a dynamic simulation of the ancient landscape.

#### **b. Tasks accomplished for this period.**

##### *1) Multibeam Survey:*

Multibeam survey was undertaken on the central Alpena-Amberley Ridge during the period 5/29-6/6/2010. Operations were conducted out of Alpena, Michigan and utilized the *R/V Storm*, which had been fitted with a multibeam unit. The multibeam equipment and technician were contracted from SeaFloor Systems Inc. Throughout the survey, backscatter data generated by the multibeam unit was monitored in real time by a project archaeologist. During the survey period, an area representing 115 km<sup>2</sup> (45 miles<sup>2</sup>) was imaged along a survey track totaling 1,468 kms (912 miles).

##### *2) Creation of New GIS Layers:*

The collected multibeam data were post-processed by Seafloor Systems, Inc. The processed data were returned in two forms, as large XYZ point files, and as four constituent georeferenced image files. In addition, we also contracted to receive a mosaic of the raw backscatter data for the survey block, as during survey it was observed to provide important information on the character of the lake bottom. Both sets of data have been transformed into ArcGIS 9.3 layers and added to the main project GIS.

##### *3) Identify and Document Potential Cultural Targets:*

With the addition of the new data layers to the project GIS work has begun to identify settings and features of potential cultural significance. The bulk of this activity to date has involved the detailed scanning of the new layers, and superimposing previously identified features on the new and detailed view of the lake bottom. While the bulk of 'ground truthing', including all SCUBA operations, is scheduled for the second half of the project period, three follow up sorties to the Alpena-Amberley Ridge were conducted to check features observed during the multibeam survey. The sorties were

conducted from the University of Michigan's *S/V Blue Traveler* and employed an Outland 1000 ROV to obtain close up video imagery of the potential targets. Deployments on 6/15 and 6/17 were directed at target areas identified by project archaeologists from the real time backscatter data observed during survey, while the 10/10 deployment targeted new features suggested by the processed multibeam imagery.

#### 4) *Incorporate New Environmental Data into Simulation Model*

The one meter resolution XYZ files generated from the processed multibeam data were transferred to Dr. Robert Reynolds at Wayne State University where they were used to create wire frame surfaces and incorporated into the developing landscape simulation. The simulation group also incorporated the raw backscatter data into their environmental model, which proved particularly useful in identifying ancient shorelines, waterways and erosional features.

### c. **Special Problems**

Work has generally been to schedule and without major difficulties. The issues that did arise overwhelmingly had to do with the need to gain experience with the use and capabilities of the multibeam unit. It was expected that the fitting of the multibeam unit and accompanying sensors would be complex, and that there would inevitably be some teething problems, although the results ultimately obtained were quite good. The only other problem related to the delay between the completion of the multibeam survey and the receipt of the processed imagery from Seafloors, Inc. There was an initial delay in the processing of the collected data, and then once processed, one of the four XYZ files was corrupt. It took another six weeks to obtain a validated version of this final sector, which represented a significant delay for the simulation group. Future work will clearly benefit from developing an in house capability to process the acoustic data.

## 2. **Expenditures:**

### a. **Scheduled Expenditures:**

Expenditures scheduled for this period included:

- 1) The costs of the contract with Seafloor Systems for the rental of multibeam equipment and technician and post-processing of collected data;
- 2) Other costs associated with the multibeam survey including vessel time, and costs associated with fitting the multibeam equipment onto the survey vessel;
- 3) Subcontract with Wayne State University to support simulation work;
- 4) Expendable supplies and travel;
- 5) Indirect costs.

### b. **Actual Expenditures:**

Actual expenses paid or encumbered co-inside with the above categories:

- 1) Seafloor Systems contract (\$25,000)
- 2) Vessel preparation and operation (\$18,500)
- 3) WSU subcontract (\$20,005)
- 4) Expendable Supplies: (\$ 479)

4) Travel: (\$1,483)

Total expenditures paid or encumbered:

Direct:	\$65,467
Indirect:	\$17,021
Total	\$82,488

**c. Special Problems:**

No special problems

**3. Results**

**a. Inventory of field activities:**

1. Multibeam Survey: Four sorties for a total of 142 hours of survey time.
2. ROV : Three sorties, examination of seven locations.

**b. Samples collected:** None

**c. Significant findings:**

Multibeam survey provided a clear view of a major landform on the lake bottom that would have been exposed throughout the Lake Stanley low water stand. Two of the most promising cultural features observed to date are located on this landform. Survey also provided clear evidence for the elevation of the final stable low water stand in the Lake Huron basin.

ROV investigations documented a complex of features that are consistent in form and construction with a funnel shaped caribou drive. This is the second such feature that has been confidently identified, and is much more complex in layout than the previously published structure. ROV work also identified a previously unreported arrangement of more recent aged tower(s) and support anchors located midlake on the Alpena-Amberley Ridge. It is speculated that these towers were designed to function either as weather observation post or as targets.

**d. Papers and presentations:**

The archaeological results of the current project will be presented in a full length paper planned for *American Antiquity*, the flagship journal for American Archaeology. A shorter report on the midlake tower will be submitted to the journal *Historical Archaeology*. A paper comparing acoustic imaging techniques for archaeological survey is scheduled to be presented at the annual meeting of the Society for American Archaeology in Sacramento, CA in March, 2010.

Environmentally relevant results will be presented in a pair of papers, currently in preparation, with Dr. Guy Meadows of the University of Michigan Marine Hydrodynamics Laboratories. One will present findings on the present day environmental conditions of the Alpena-Amberley Ridge with a particular emphasis on the conditions promoting the absence of sediments on the ridge, and the second will focus on the evidence for basin-wide lake elevations during the final Lake Stanley low water stage.

Progress on the dynamic simulation of the ancient landform and its inhabitants will be presented by Dr. Robert Reynolds and his colleagues at Wayne State University. The simulation group has submitted a paper titled "Learning Group Behavior in Games Using Cultural Algorithms: The Land Bridge Game Engine Example" to the IEEE Spring Symposium which will be held in Paris from April 14-19 2011.

**e. Media coverage:**

The research effort was reported in the local media via a feature story in the Alpena News (6/4/2010), and a video segment on WBKB TV (6/7/2010). The work was also featured as a component of an hour length program being produced for National Geographic that is tentatively titled Emptying The Great Lakes, and produced by Northern Sky Entertainment, LTD. During a port call during the survey, Senator Bernard Levin received a tour of the *R/V Storm* and was briefed on the research efforts to date.

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Date 11 January, 2011