Underwater Archaeological Surveys in Shakan Bay, SE Alaska

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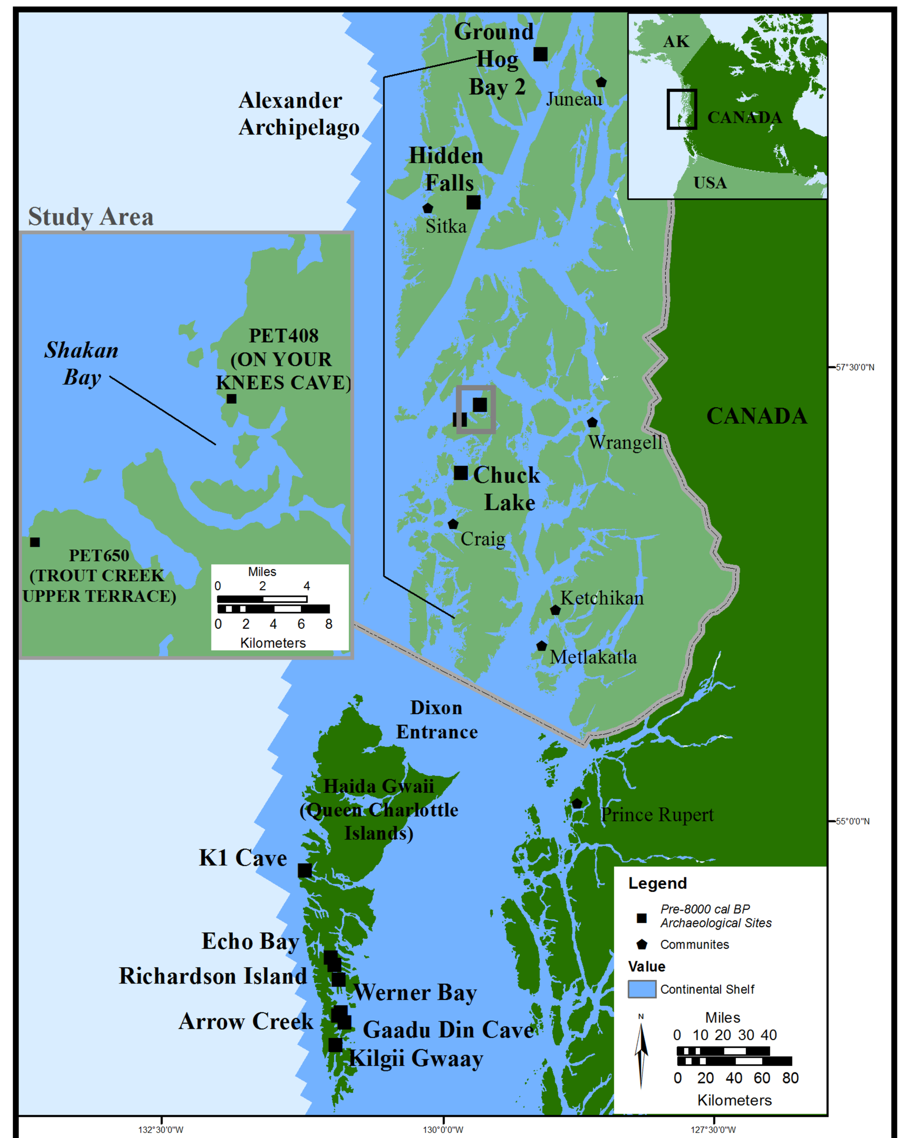
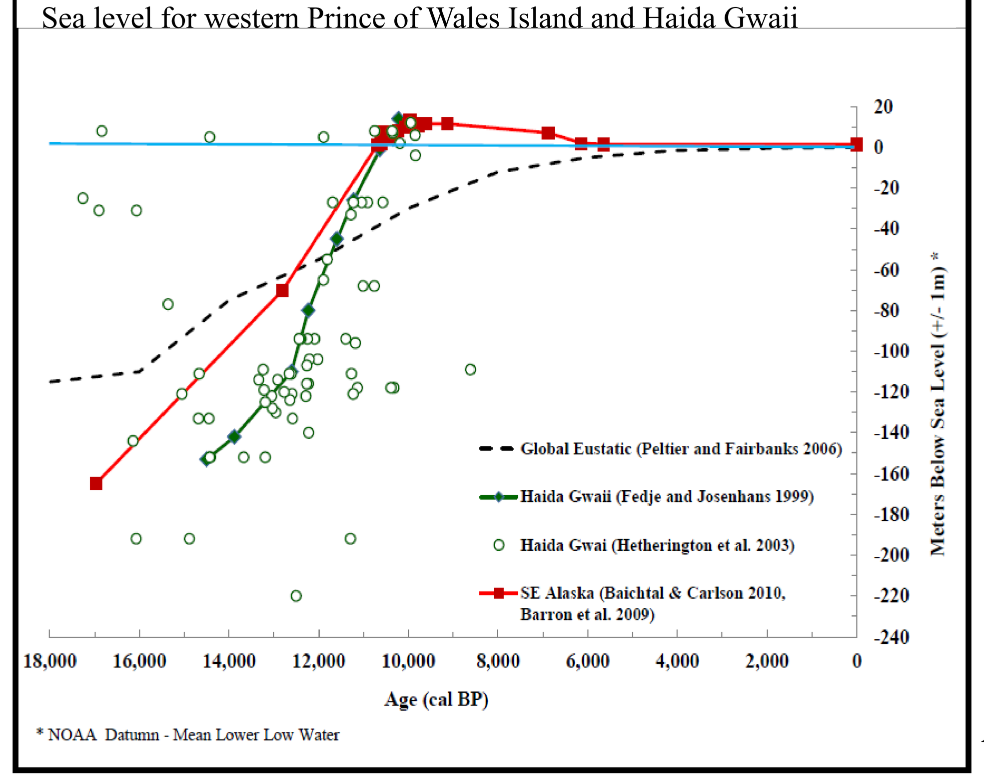
ABSTRACT
The coastline of SE Alaska was submerged by post-Pleistocene sea level rise from at least 16,000 cal yrs BP until it stabilized about 10,600 cal yrs BP. The submerged continental shelf was modeled using bathymetry and other data to identify areas exhibiting high potential for the occurrence of archaeological sites. Two seasons of underwater archaeological survey have been conducted at this location (NSF OPP -#0703980 and 1108367), using multibeam sonar, side scan sonar, sub-bottom profile, real time video from remotely operated vehicle (ROV), and sea floor sampling using a van veen grab sampler and sediment screening. These data have produced a detailed overview of Shakan Bay, located on the northwest corner of Prince of Wales Island.

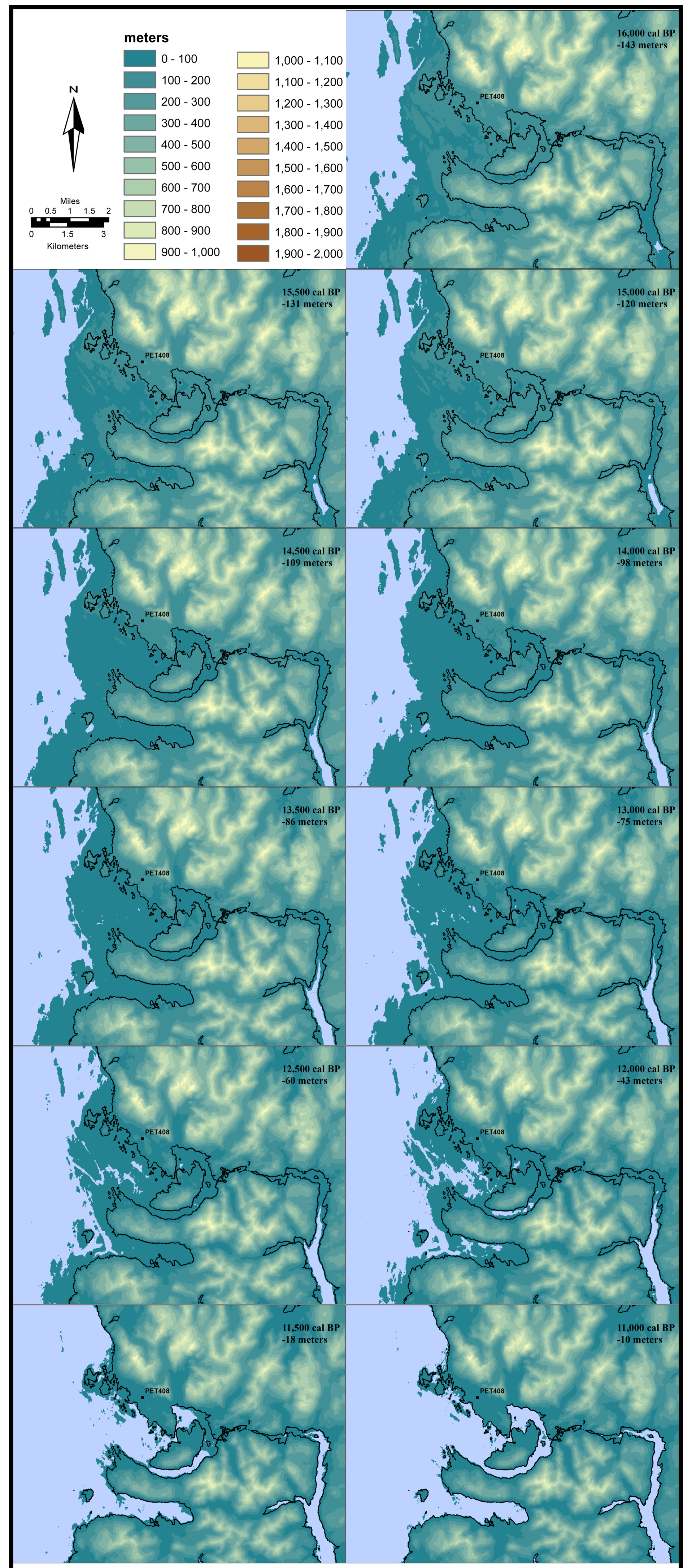


Map of study area in relation to northern Northwest Coast including the continental shelf and selecct pre-8000 cal BP archaeological sites.

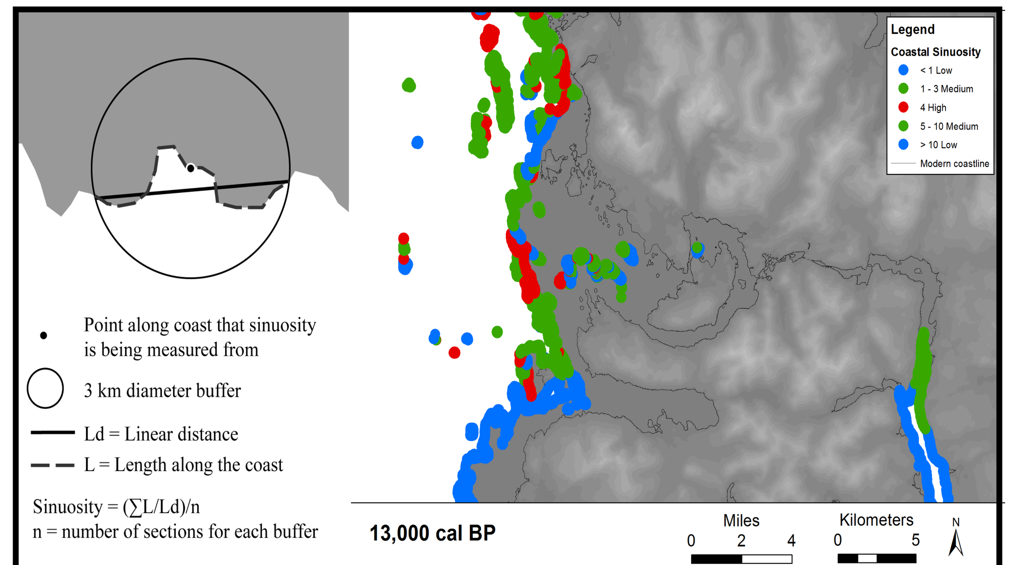
Sea level for western Prince of Wales Island and Haida Gwaii



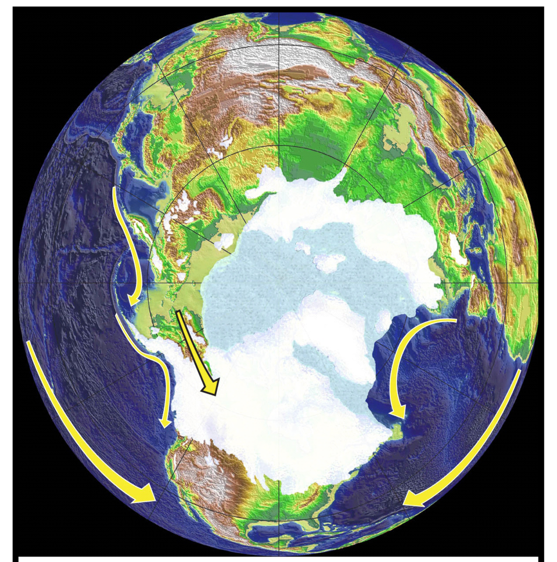
* NOAA Datum - Mean Lower Low Water



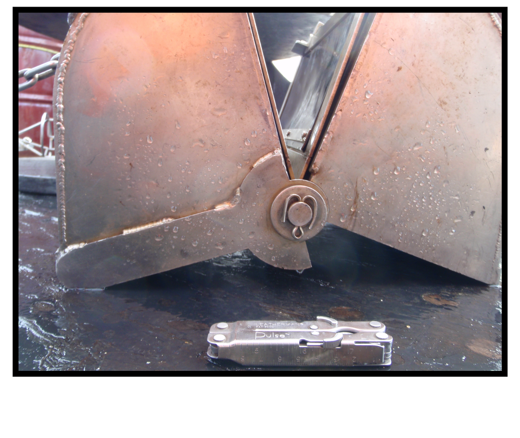
Land-sea reconstruction based on sea level (left) in 500 calendar years before present (cal BP) including the depth below modern sea level. The resolution is 1 meter for the DEM and 2 meters for the subsequent model.



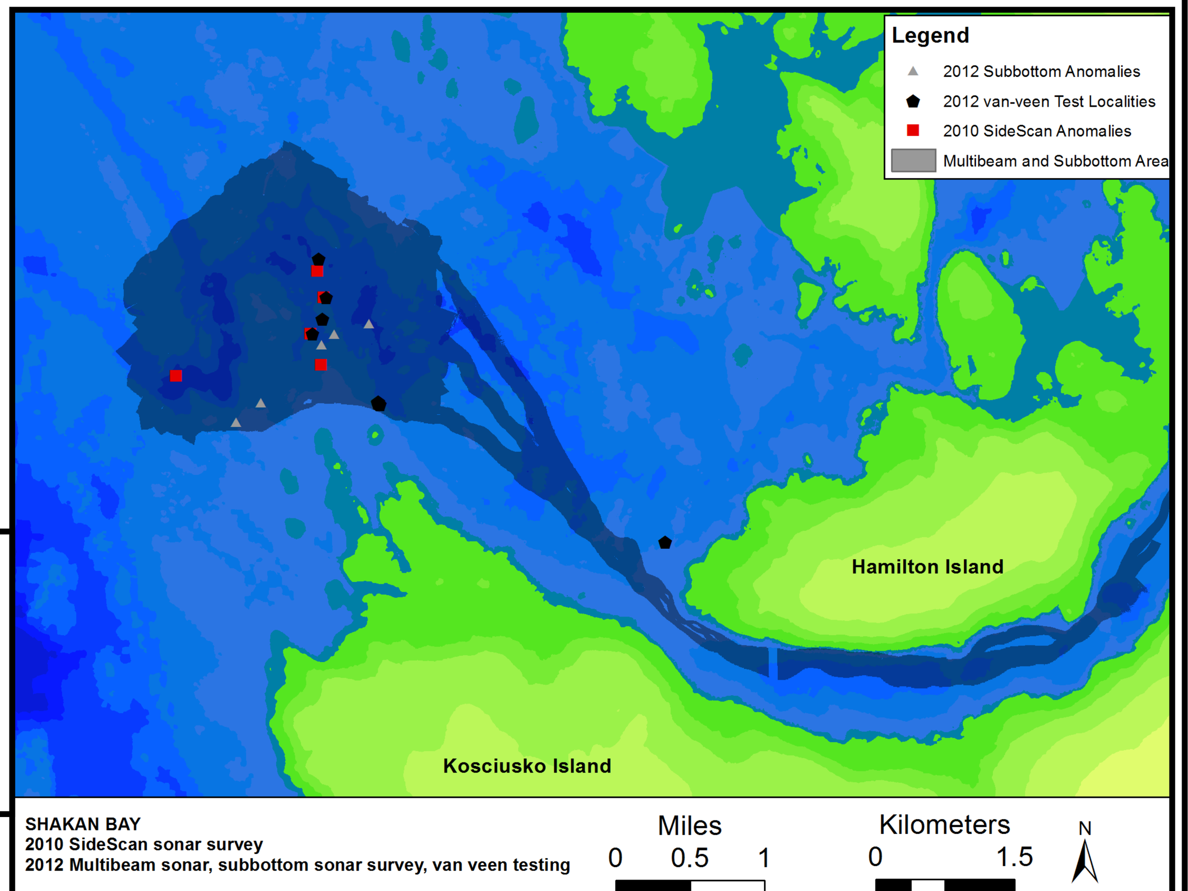
Sinuosity (or complexity) of a coast line is a measure of the bends or curves within a set distance. Here 50 meter buffers were used to calculate the sinuosity for Shakan Bay. Archaeological sites are statistically located on or near moderately (4) complex coasts. This variable was incorporated into the weighted overlay.



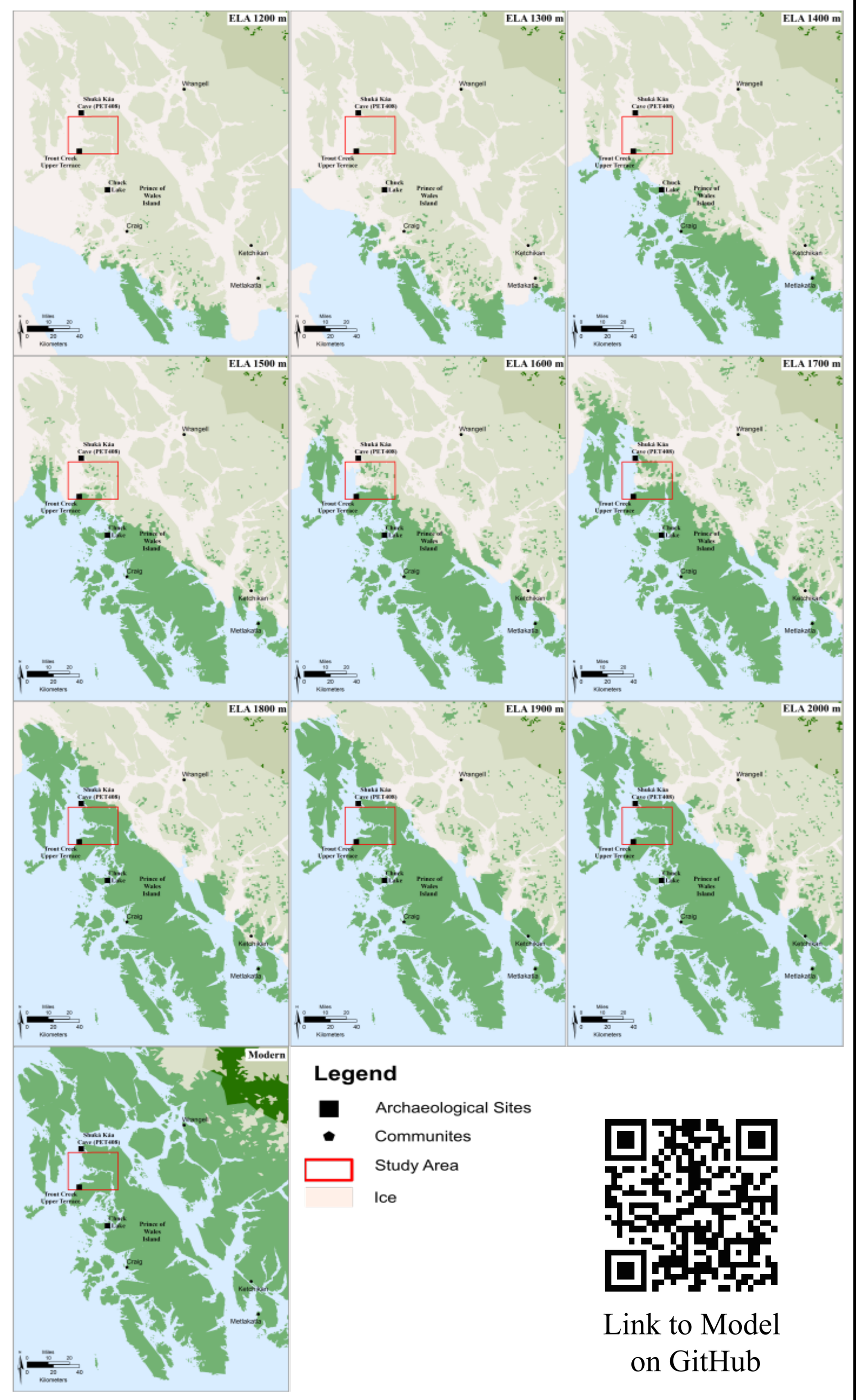
Five possible routes for the peopling of the Americas. This research investigates the coastal migration hypothesis where people mayhave travelled along the south coast of Beringia and down the Northwest Coast of North America.



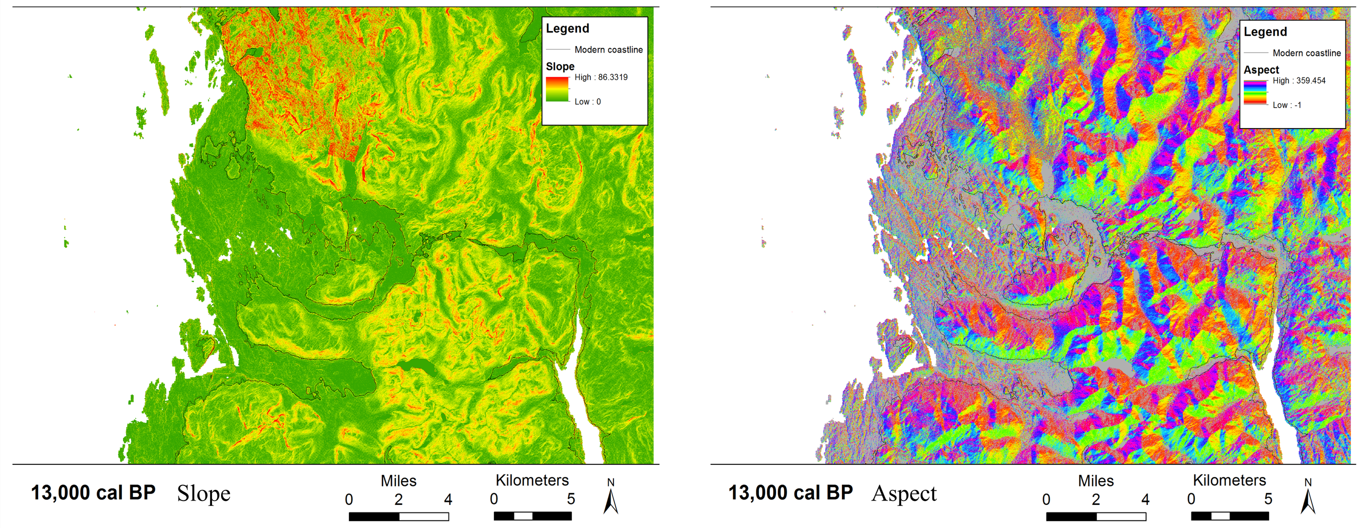
During 2013 and 2014 different iterations of a suction dredge sampling (below right) were tested and evaluated for use in subsurface testing resulting in a significant improvement in sediment recovered compared to van veen sampling (above).



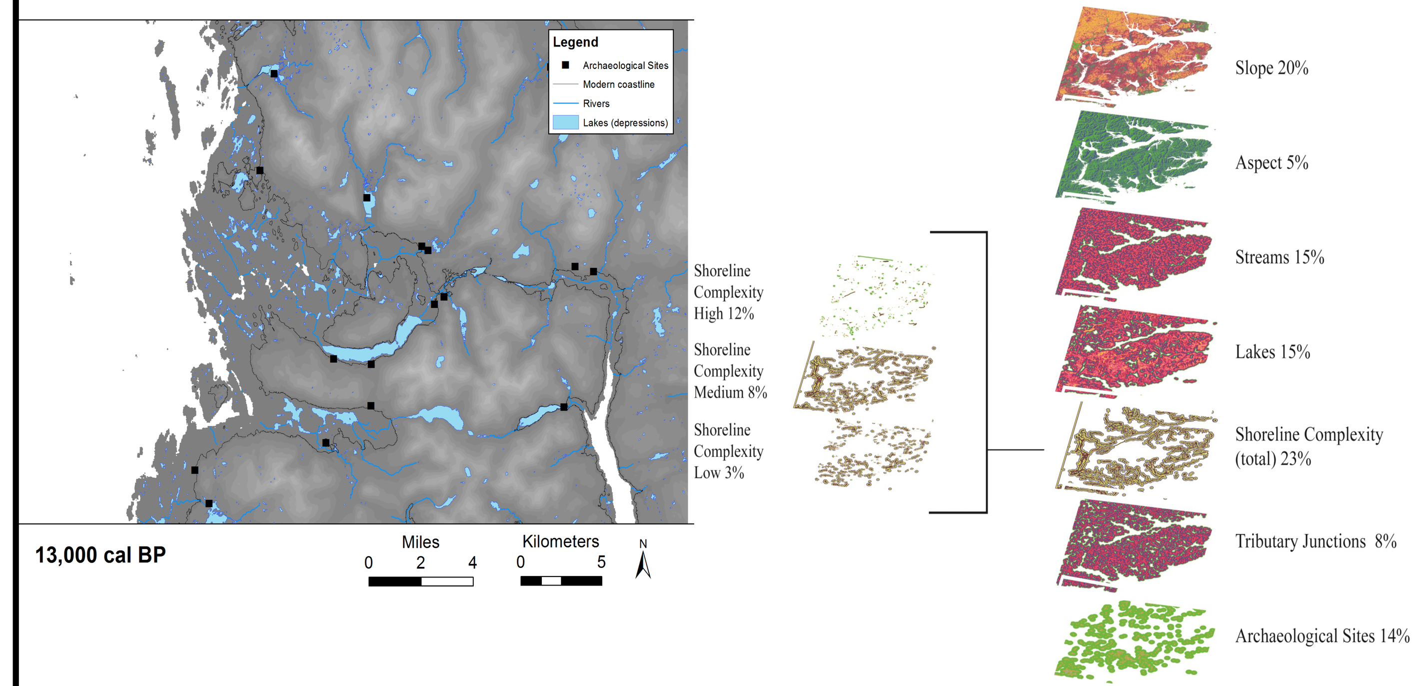
Field testing was conducted as part of the Gateway to the Americas I and II NSF projects in 2010 and 2012. The above map depicts the side scan sonar anomalies identified from 2010, the areas tested using a van veen grab sampler (above left) in 2012 and some of the identified anomalies from the subbottom profile survey data. The multicolour background elevation model or DEM incorporates the multibeam sonar data collected in 2012.

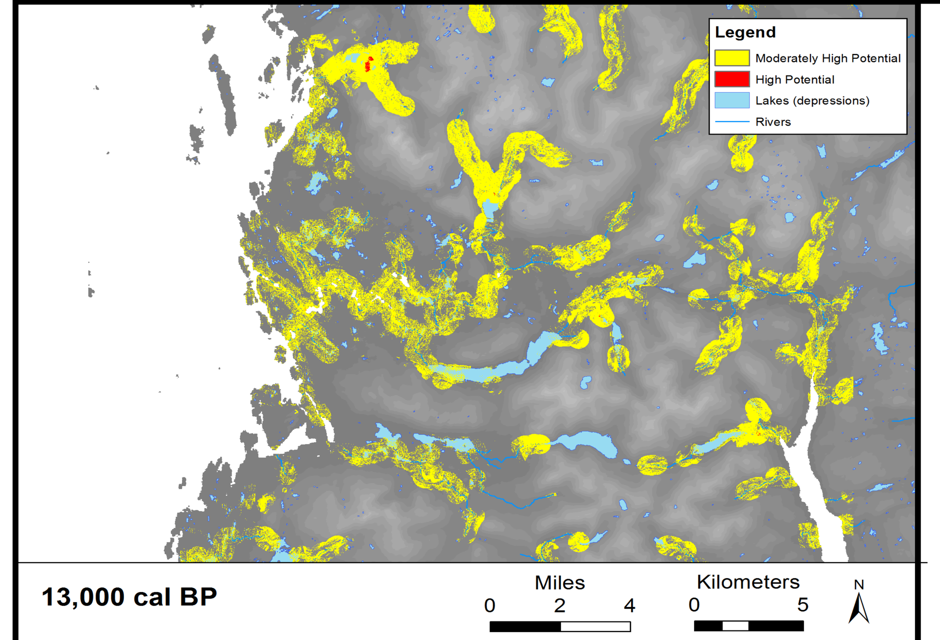


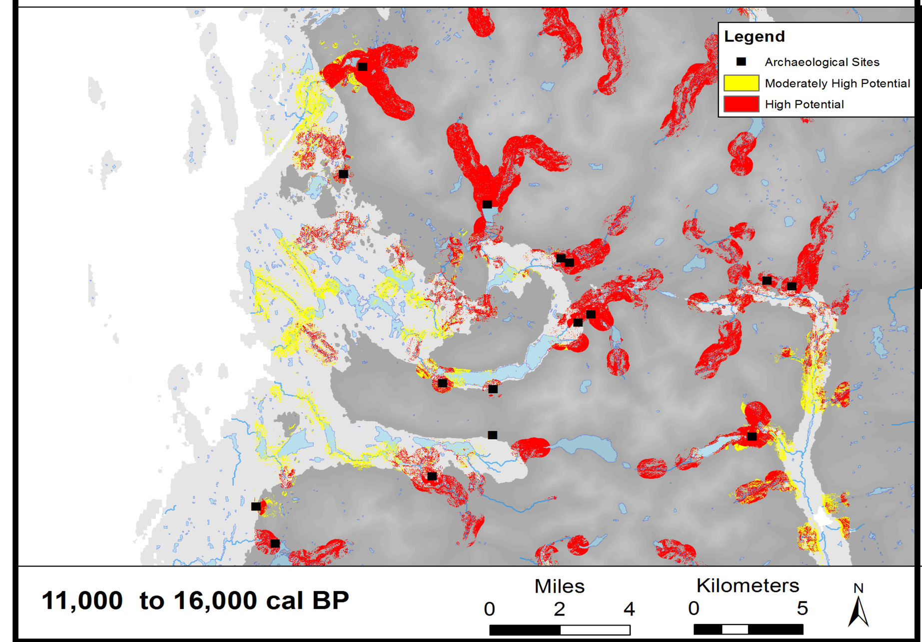
Uncalibrated model outputs of glaciers using the IceFlow model. Equilibrium line altitude (ELA) is the elevation at which mass balance is equal, where accumulation of snow is exactly balanced by ablation over a period of a year. The above model uses 5000 year simulations in 50 year increments at a resolution of 1000 meters. The maximum positive mass balance was capped at 0.3 meters per year. The mass balance gradient was 1 m (mass balance) per km (vertical elevation). This has been posited, but not fit to data, for these exploratory model runs. All models were run with respect to present-day elevations and sea-level but included differential glacial-isostatic adjustment and shallow ice approximation.



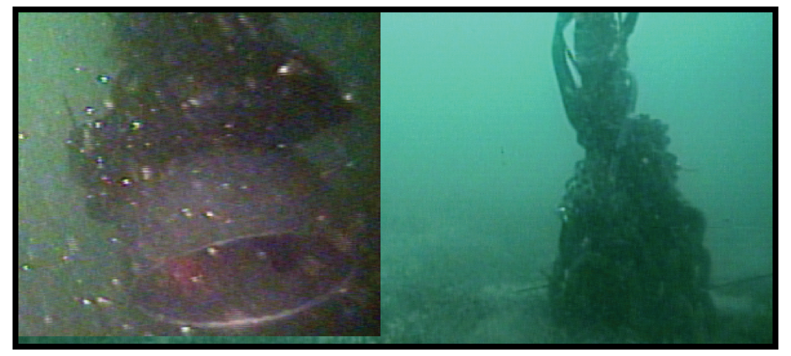
Slope and Aspect (above), water features and archaeological sites (below left) including lakes (basin or depression fills) and streams, all feed into a weighted overlay (below right weight, right for models).

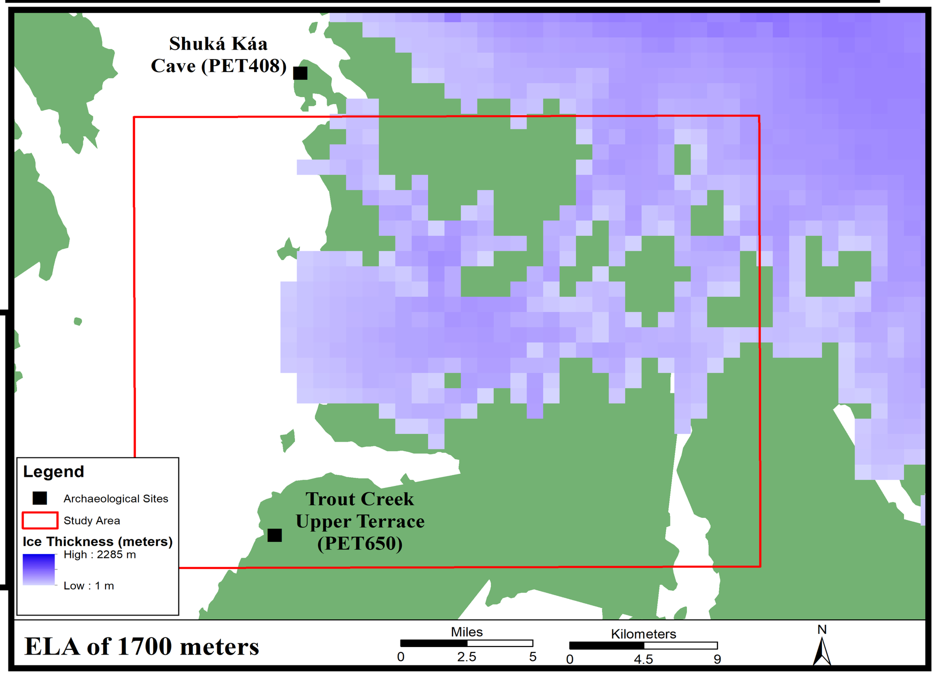






Final predictive model. Shakan Bay (top left) depict the 13,000 cal BP model and a combined model for all time periods (bottom left). The light grey is the maximum extent while the modern land mass is darker grey. The combined model includes the archaeological sites within the region.





Shakan and Shipley Bays with an ELA of 1700 meters. PET650 is a terrace including microblades from 9900 to 9550 cal BP (Carlson and Baichtal 2015). PET408 includes paleontological remains throughout the last glacial maximum (Heaton and Grady 2003). The slope around PET408 would shed ice, likely leving it locally ice-free. A more refined glacial model would need ice rheology and climate inputs to be more accurate.

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