Nipissing Barrier Stratigraphy Exposed along the Nottawasaga River in Wasaga Beach, Ontario

HUANG, Zhaoyu[1], MORRISON, Sean M.[1], MULLIGAN, Riley P.M.[2] and JOHNSTON, John W.[1]

(1)Department of Earth and Environmental Sciences and Water Institute, University of Waterloo (2)Ontario Geological Survey

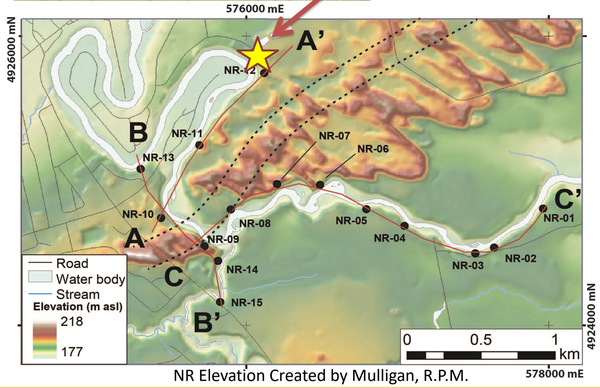
ABSTRACT

Recent three-dimensional sediment mapping efforts in Simcoe County by the Ontario Geological Survey have reinvigorated interest in local postglacial sediment successions. A cut bank exposure along the Nottawasaga River in Wasaga Beach, Ontario, was studied to improve paleohydrographic reconstructions of the upper Great Lakes. This location provides a unique glimpse into the subsurface through an extensive prograding and aggrading lacustrine barrier system and helps refine the regional stratigraphic framework and lake-level rise to the highstand during the Nipissing Phase of the upper Great Lakes. The exposure was studied by hand-digging thirteen overlapping sediment pits. Sediments were described using standard sedimentological logging techniques, recording lithology, sedimentary structures, bed contacts and unit geometry. Elevations were collected from the top of each sediment pit using a total station and were calibrated to the International Great Lakes Datum (1985). The location of each pit was determined using GPS and aerial photographs. Numerous photographs were taken and sediment samples were collected for grain size analyses. Additional samples were collected beneath prominent unit contacts in the exposure to determine the age of sediments using optically stimulated luminescence. All data are being used to create a facies model for the entire riverbank section. Together, the sediments record a uniquely exposed aggradational sequence deposited during the rise to the last pre-modern highstand of the upper Great Lakes.

LOCATION FIGURE

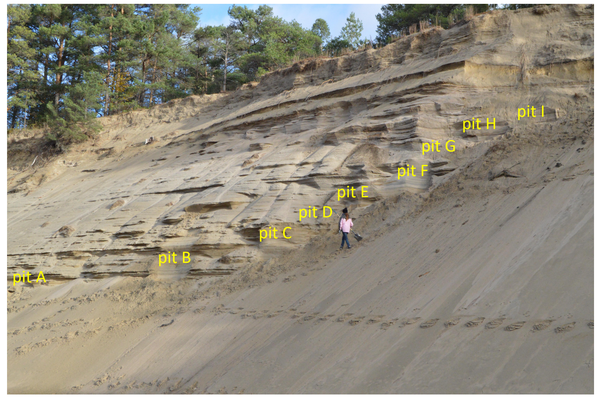
Great Lakes -
Lake Huron -
Georgian Bay -
Wasaga Beach

Nottawasaga River
Study site



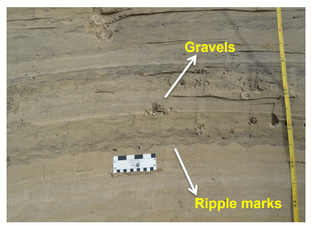
NR Elevation Created by Mulligan, R.P.M.

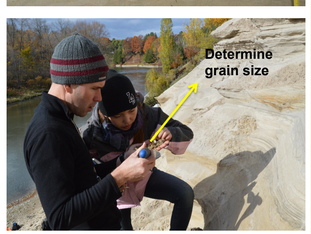
MATERIALS & METHODS



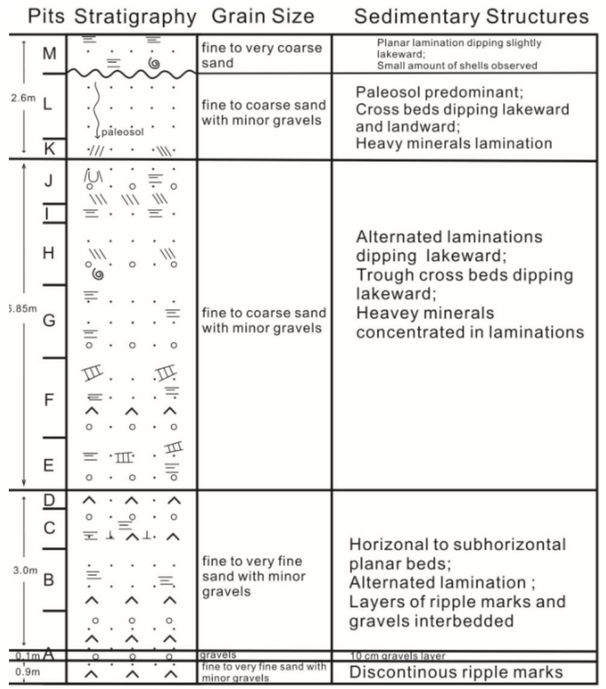
Analytical Methods:

1. **Pits hand-dug**: 13 overlapping sediment pits were hand-dug to show exposure;
2. **Geological description:** sediments were described according to lithology, sedimentary structures, bed contacts and unit geometry;
3. **Grain size:** Sediment samples were collected for grain size analyses;
4. **Elevations:** Elevations were collected for each pit and were calibrated to the International Great Lakes Datum (1985);
5. **Location:** The location of each pit was determined using GPS and aerial photographs;
6. **Age-dating:** Samples were collected to determine the age of sediments using optically stimulated luminescence (OSL);
7. **Facies model:** All data are being used to create a facies model for the entire riverbank section.





RESULTS



Legend

- sand
- ripples
- cross stratification
- sharp boundary
- calcareous
- unconformity
- sand and gravel
- parallel lamination
- dewatering structure
- snail shell
- cross bedding

Riverbank section observations

- All sand with minor gravel, sand size coarsens upward;
- Interbedded ripples and laminations;
- Ripple marks decrease upward;
- Laminations throughout;
- trough cross beds increase upward;
- Heavy minerals and shells;
- Paleosol near top (soil developed 1.35m deep)

Number of facies

- Six distinct facies based on grain size and sedimentary structures

DISCUSSION AND NEXT STEPS

Interpretation:

- Aggradational barrier formed in the Nipissing phase (high sediment supply);
- Basal gravels - base of foreshore (near shoreline);
- Ripples - nearshore (under water level);
- Laminations - foreshore (ocassionally under water level);
- Paleosol - exposed surface, ancient soil developed (above water level)

Next steps:

- Grain size: laser diffraction particle size analyzer;
- OSL Age-dating: facies chronolgy from 2 samples, one at bottom and top;
- help refine regional 3D hydrostratigraphic framework (Ontario Geological Survey);
- Paleohydrographic reconstuctions in upper Great Lakes (Nipissing Phase)

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