Evidence for distribution and thickness of Athens Sub-episode and older sediments in Ottawa County, Michigan

Patrick M. Colgan
Department of Geology
Grand Valley State University

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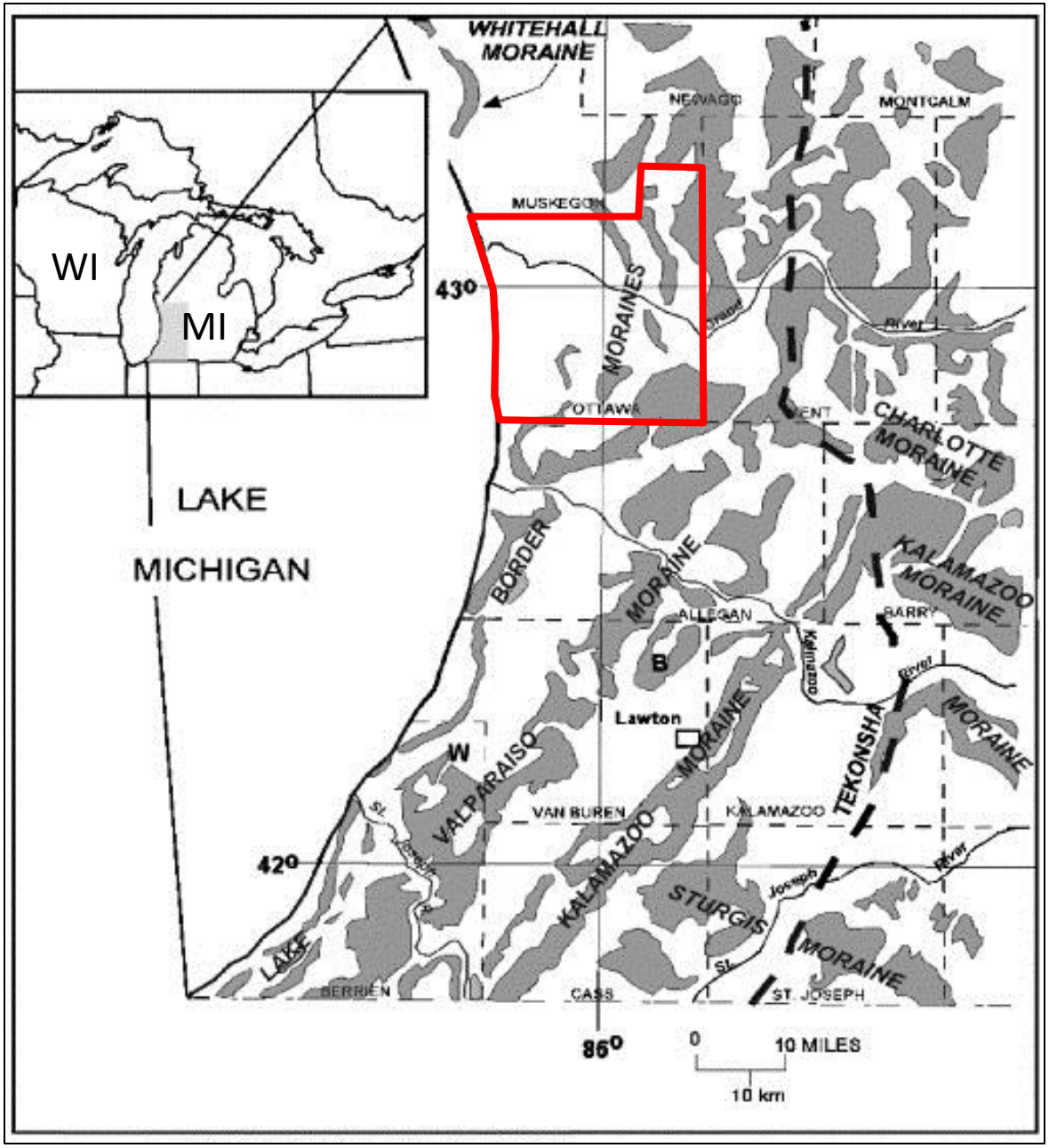
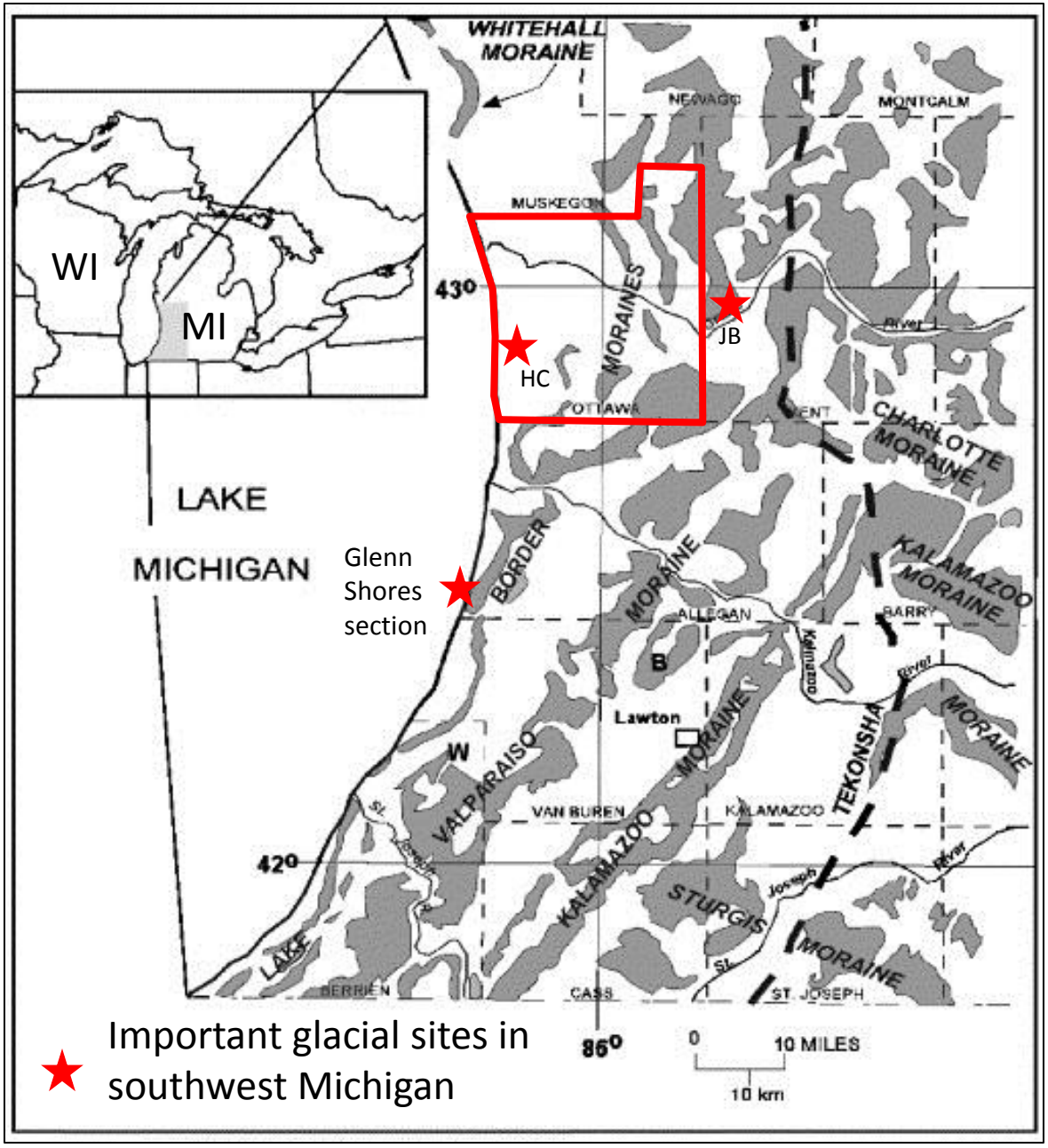
Al Kehew and Derrick Lingle of
Department of Geosciences
Western Michigan University



Moraine systems named by Leverett and Taylor (1915), figure by Kehew *et al.* (2005).



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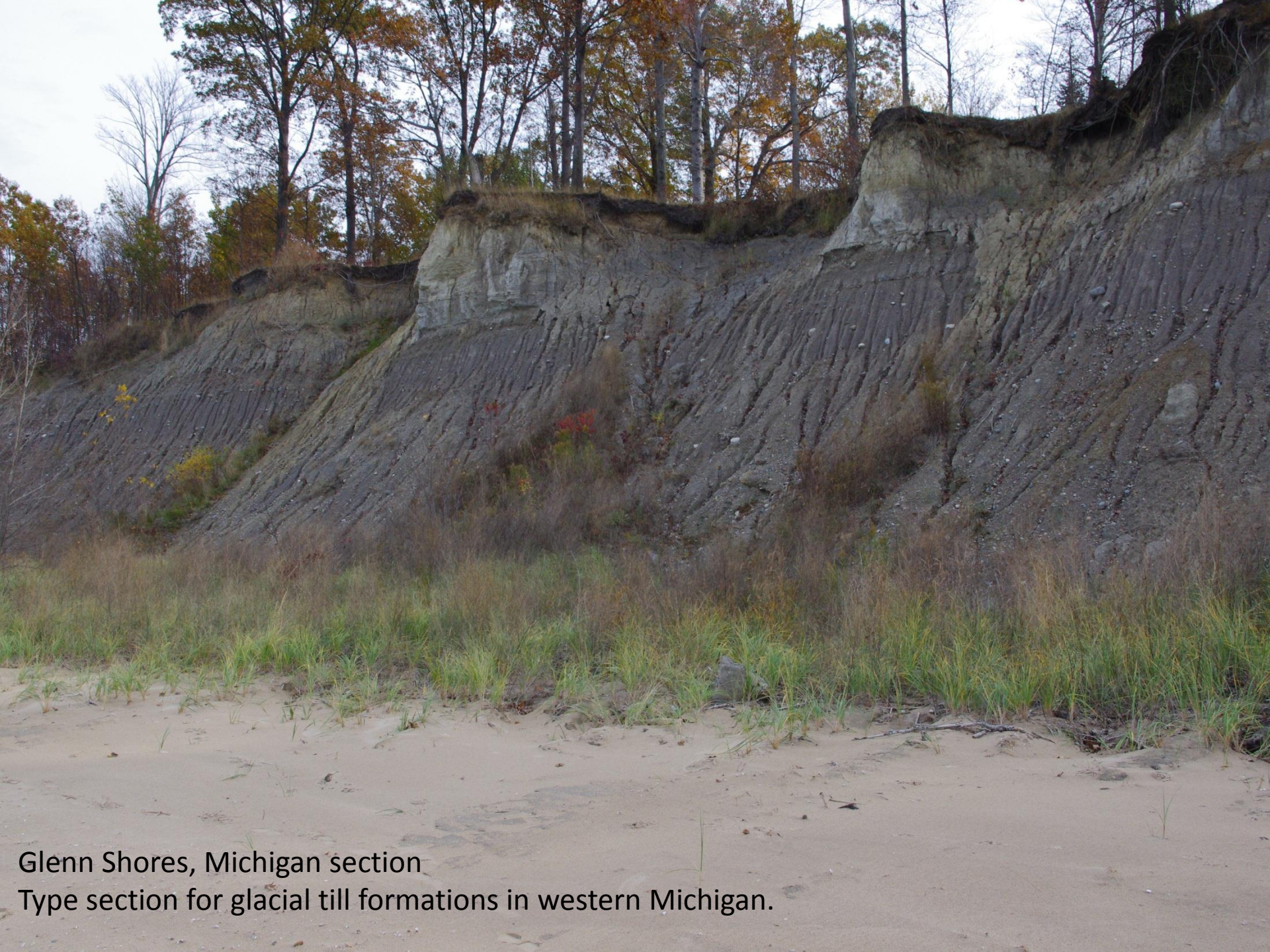
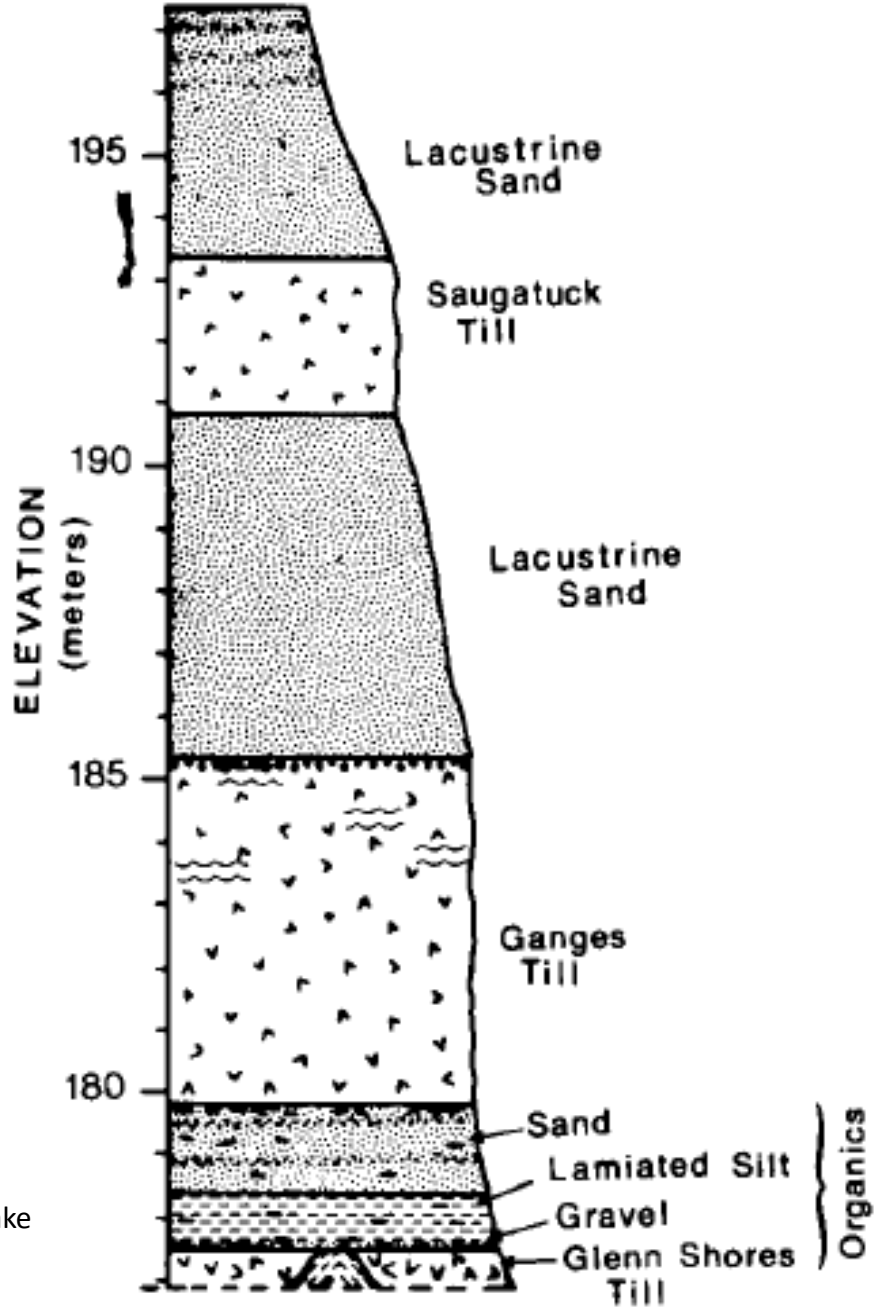


Glenn Shores, Michigan section
Type section for glacial till formations in western Michigan.

Glenn Shores Section

Type section for the Saugatuck, Ganges And Glenn Shores tills.

Organic deposits between Ganges and Glenn Shores till have been radiocarbon dated as between 25,000 and >60,000 years before present.



Monahagn *et al.* (1986). Late Wisconsinan Drift history of the Lake Michigan Lobe in southwestern Michigan. *Geological Society Of America Bulletin*, v. 97, no. 3, p. 329-334.

John Ball Park Section

Saugatuck/Ganges till (~8.5 meters)
Sand (outwash) (0 to ~2 meters)

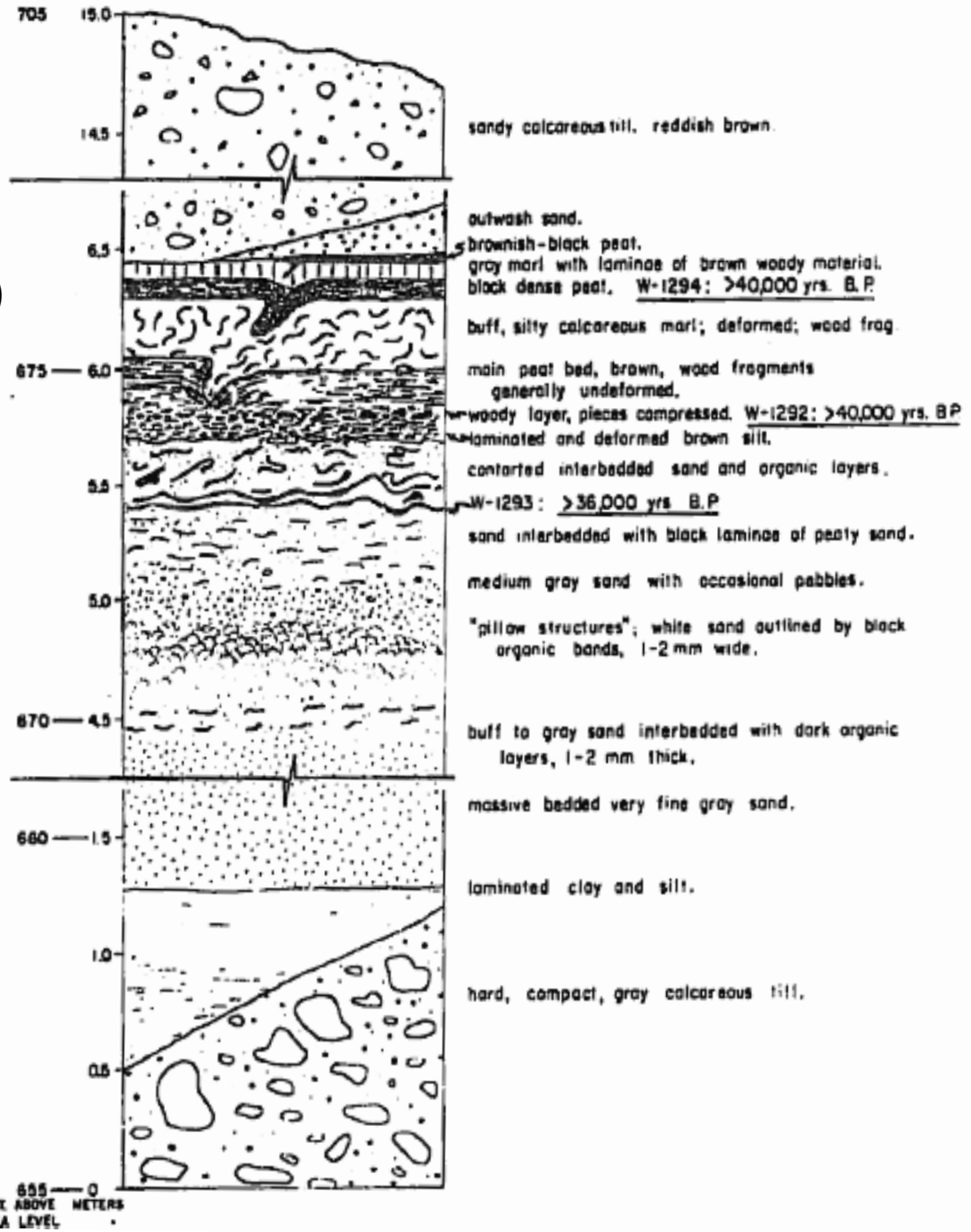
peat & organic beds (>40,000 years old) (~1.0 meter)

sand, silt, clay w/organics ? (~1.0 meter)

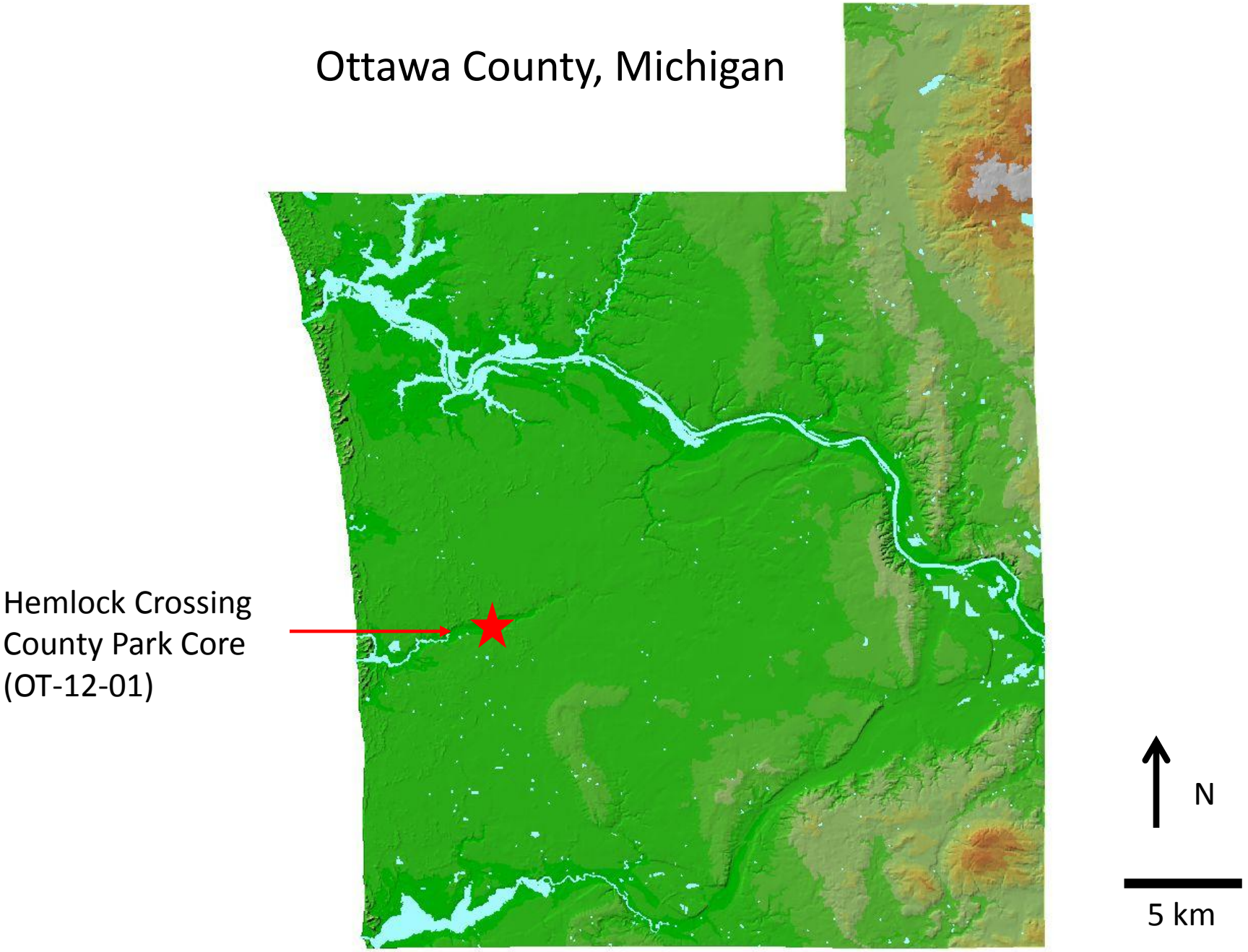
massive sand (~2.75 meters)

silt and clay (0 to ~0.75 meters)

Glenn Shores till

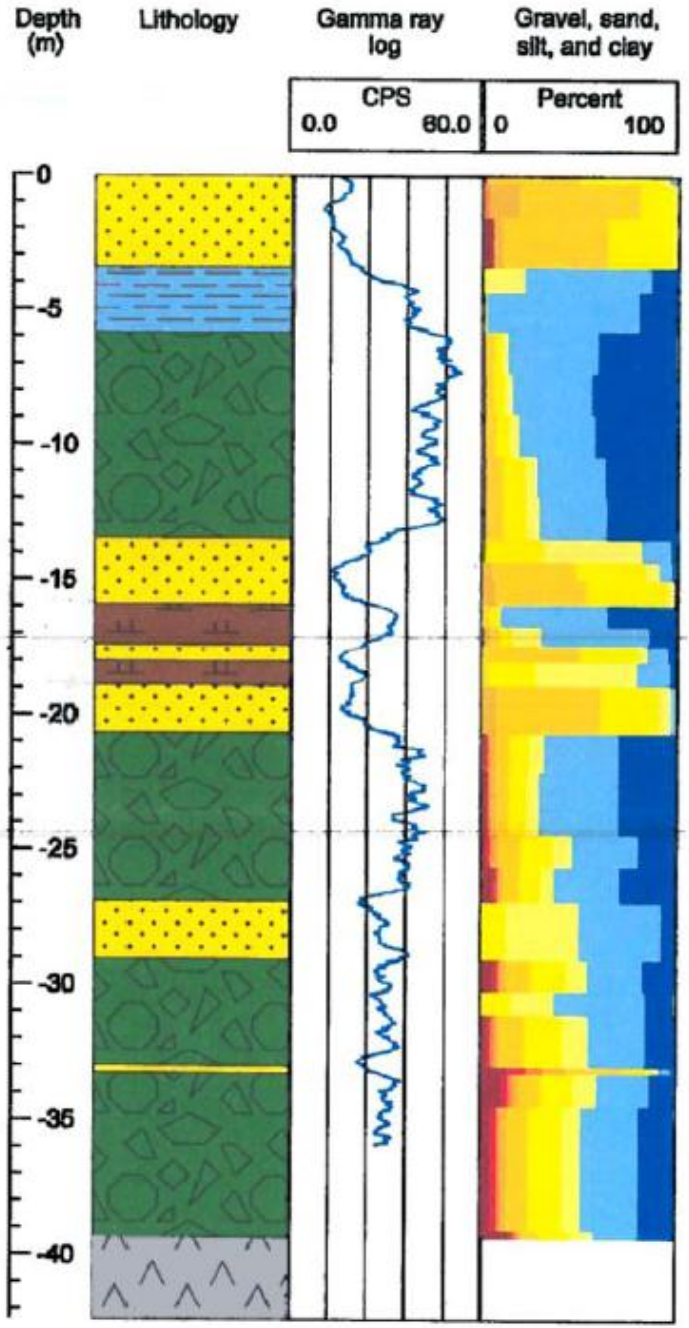


Zumberge, J.H. and Benninghoff, W.S. (1969). A Mid-Wisconsin Peat in Michigan U.S.A. Pollen et Spores 11, 585-601.


Ottawa County, Michigan
Hemlock Crossing
County Park Core
(OT-12-01)
N
5 km


drilling site

Rotosonic drilling at Hemlock Crossing County Park in late July 2012



Sediment Description	Environmental Interpretation
sand, fine to medium	lacustrine
silt, w/clay light gray rare gravel	glaciolacustrine *Glacial Lake Chicago*
diamict, dark gray Stone poor clay/silt dominated	subglacial till *Saugatuck/Ganges till*
sand, with some fines peat, sand with thin sand inter-beds sand, fine to medium	lacustrine palustrine
diamict, light gray, sand/silt rich, stone rich	subglacial till *Glenn Shores till?*
sand w/silt and clay red brown	subglacial sand
diamict, red brown sand-rich, stone rich weathered?	subglacial till *un-named till*
shale, dark gray to black weathered, fissile	marine *Coldwater Formation*

Derrick Lingle photo

Wood and plant fragments separated and ready to be radiocarbon dated
At Beta Analytic Radiocarbon Laboratory

CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-23:lab. mult=1)

Laboratory number: **Beta-329000**

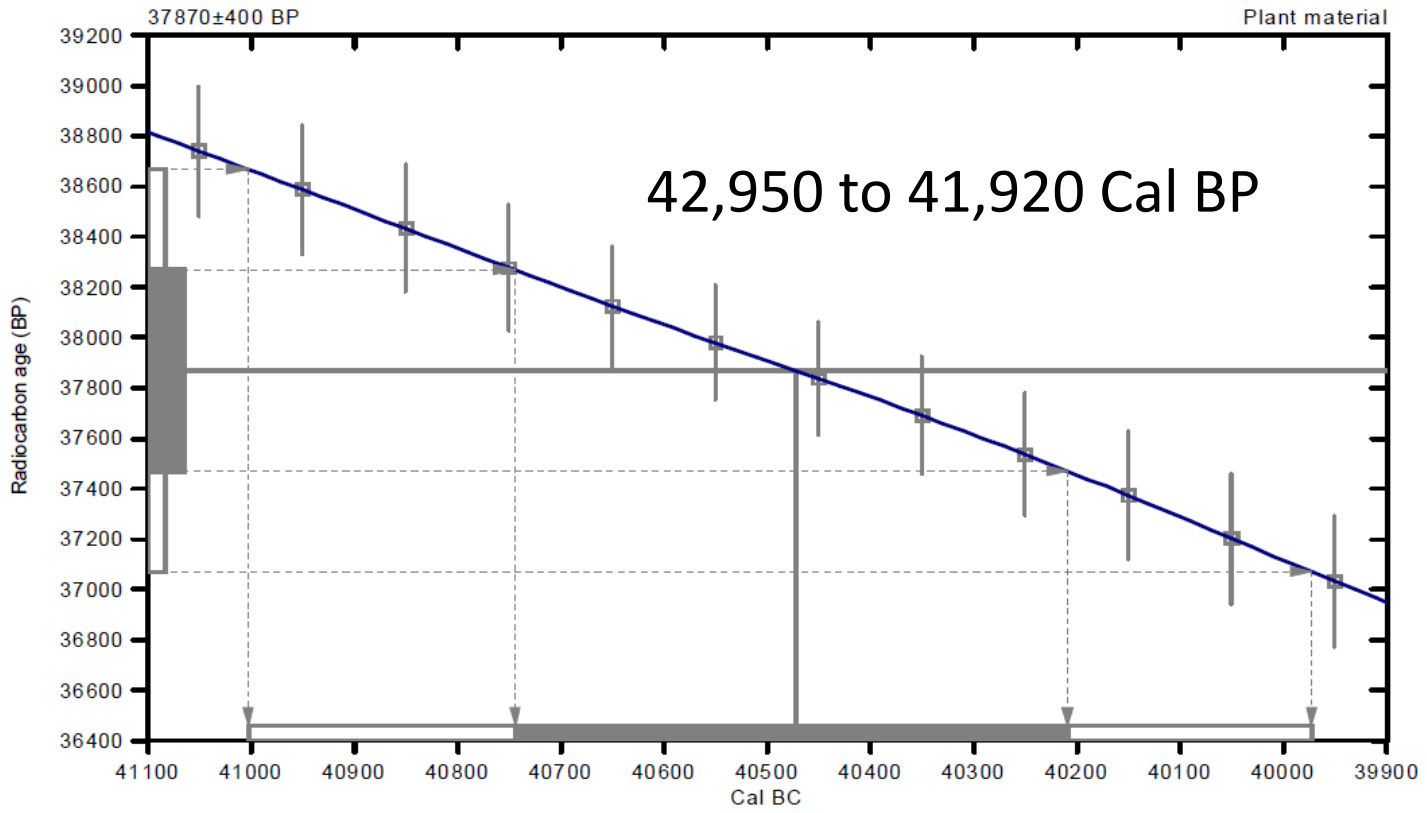
Conventional radiocarbon age: **37870±400 BP**

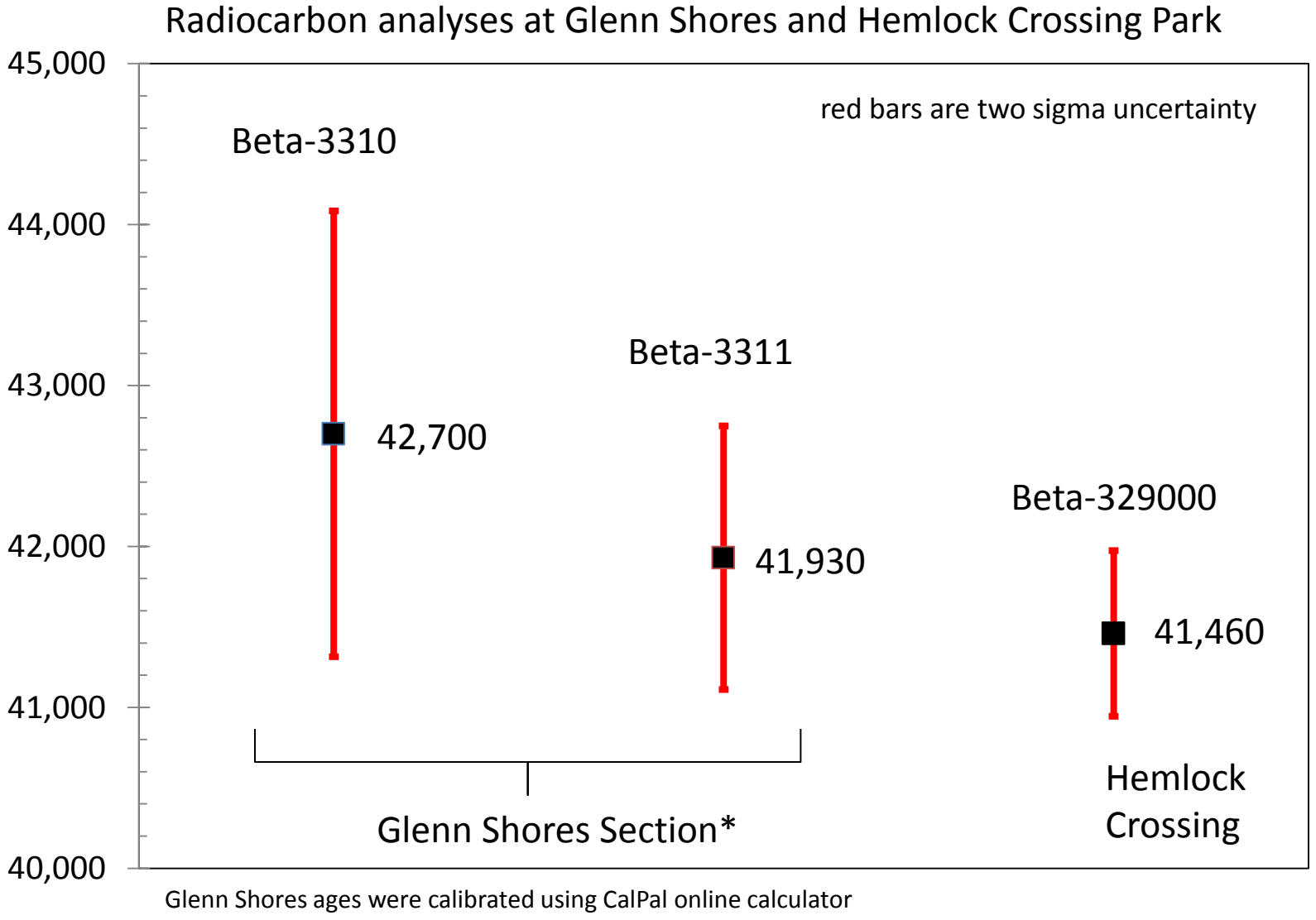
2 Sigma calibrated result: (95% probability) **Cal BC 41000 to 39970 (Cal BP 42950 to 41920)**

Intercept data

Intercept of radiocarbon age with calibration curve: Cal BC 40470 (Cal BP 42420)

1 Sigma calibrated result: (68% probability) Cal BC 40740 to 40210 (Cal BP 42690 to 42160)





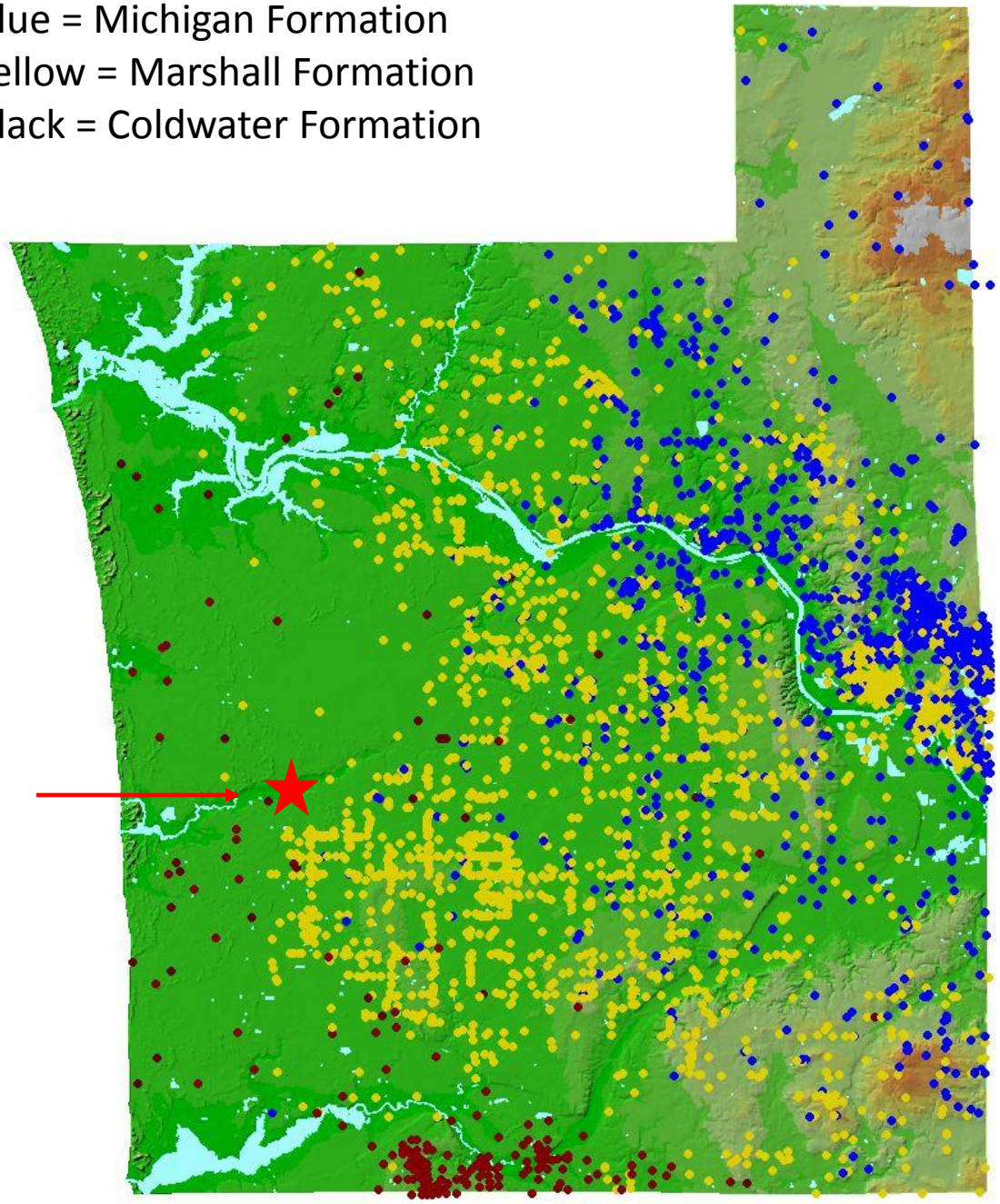
*Glenn Shores radiocarbon analyses are from Larson & Monaghan (1988). Lake phases and glacio-fluvial sequences of the Lake Michigan Basin: Southwestern Michigan, in Larson, G. and Monaghan W. (eds.). Wisconsin and Holocene Stratigraphy in Southwestern Michigan. Midwest Friends of the Pleistocene 35th Field Conference Field Guide.

Wells to Bedrock

Blue = Michigan Formation

Yellow = Marshall Formation

Black = Coldwater Formation



Hemlock Crossing County Park Core (OT-12-01)

N

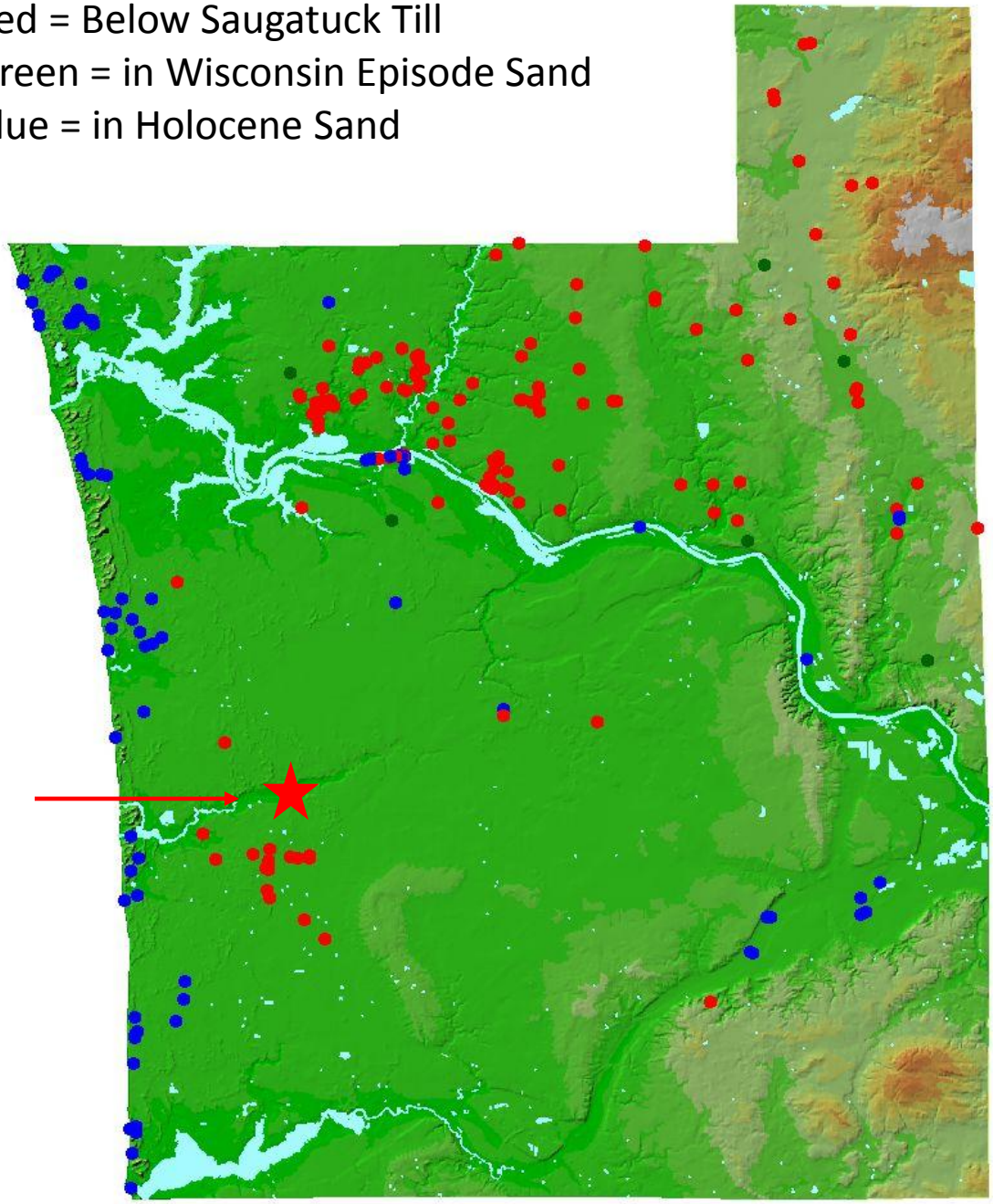
5 km

Water Wells with organic sand units

Red = Below Saugatuck Till

Green = in Wisconsin Episode Sand

Blue = in Holocene Sand



Hemlock Crossing County Park Core (OT-12-01)

N

5 km

Table 1 – Thickness of sand and organic layer in Ottawa County, Michigan

	N	**Mean (meters)**	**Min (meters)**	**Max (meters)**
organic sand/silt thickness	143	3.4	0.3	14.6
elevation of top of organic sand	143	168	129	210
depth of top of organic sand	143	27	5.4	66
bedrock depth	1276	49	9	152

Note: Lake Michigan mean elevation (1860 to 2010) is ~176 meters a.m.s.l. (577 feet).

Conclusions & Implications

- Age of organics in sand is ~42,000 years BP (MIS-3).
- Average depth to bedrock is about 49 m below the land surface in Ottawa County and varies from 9 to 150 m depth below the surface.
- Average depth to bottom of organic bearing sand is about 24 m and varies from 5 to 51 m depth below the surface.
- Thickness of pre-MIS-3 glacial sediments varies from about 4 to 102 meters, with a mean thickness of about 25 m.
- This implies that there is a significant thickness of glacial sediments older than MIS-3 in Ottawa and surrounding counties.