The Geomorphology of the Pig Point Site (18AN50) Landform Development, Climate Change, and Long-Term Human Occupation

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Lost Towns Project, Inc.
A Non-Profit dedicated to the discovery of the Mid-Atlantic's Cultural Heritage

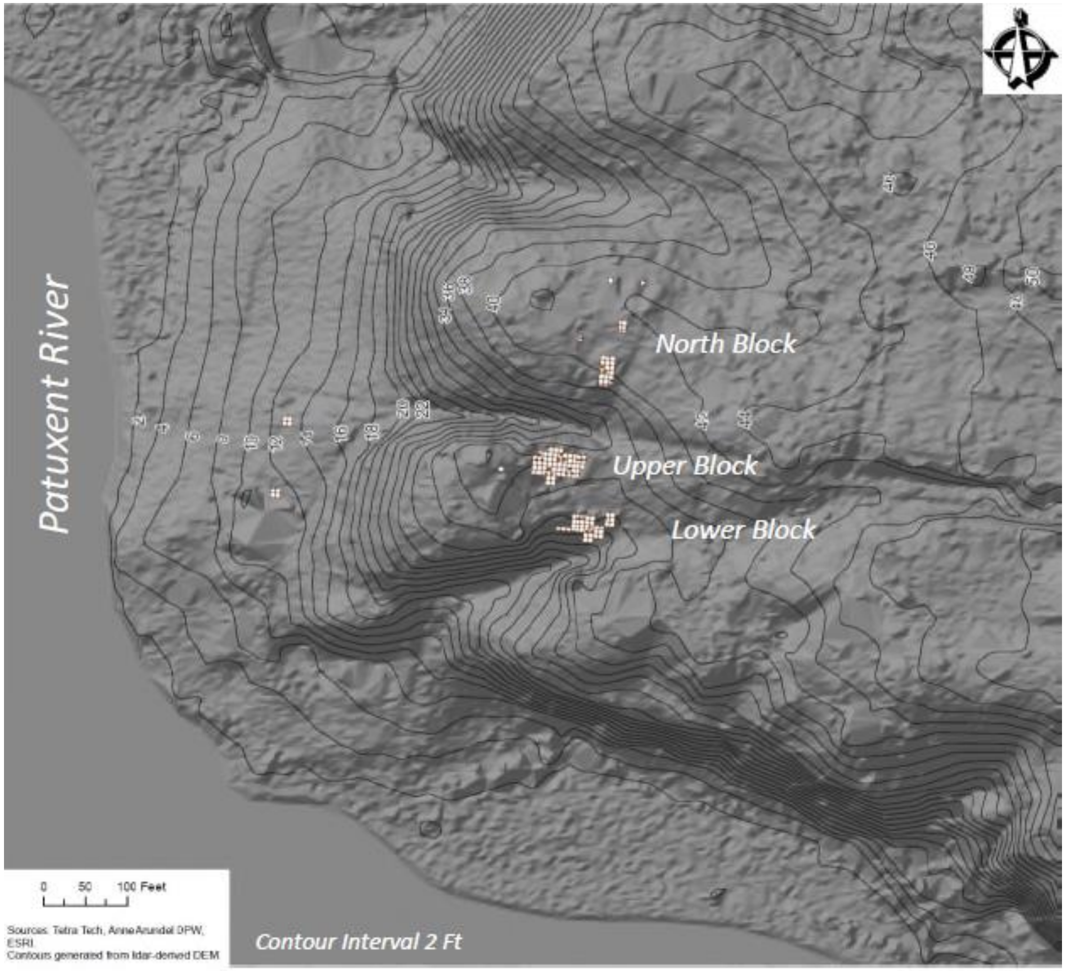
Site Background

Figure 1 – Site Location Map (Pig Point – 18AN50)

Source: Dr. Al Luckenbach – Anne Arundel County Lost Towns Project

Site Background

- Site initially recognized in 2008, with field excavations 2009 to 2015
- 149 5-ft square units documented 365 features, 630,000 artifacts, 30 c-14 dates which spanned nearly 10,000 years
- Three distinct areas excavated:
  - Lower Block
  - Upper Block
  - North Block



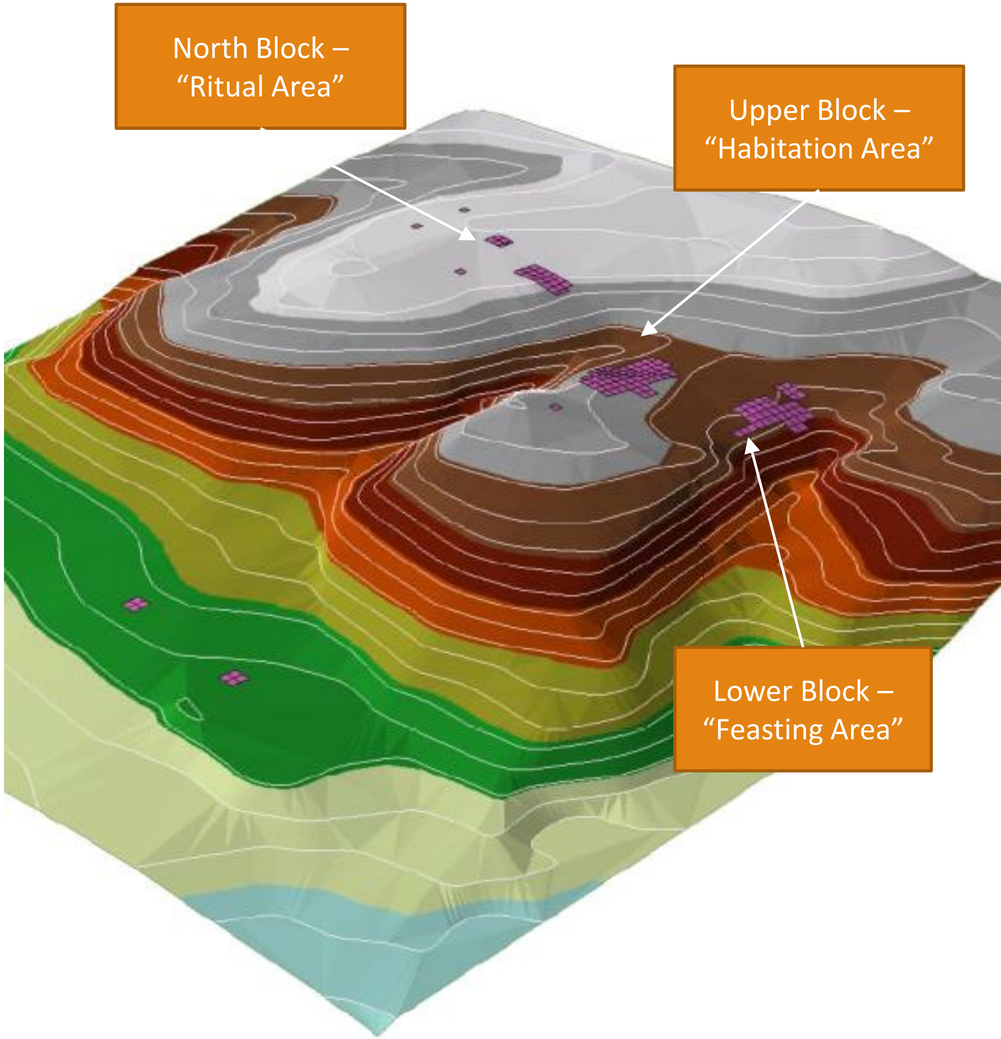
Site Map with Lidar-Derived DEM (ESRI)

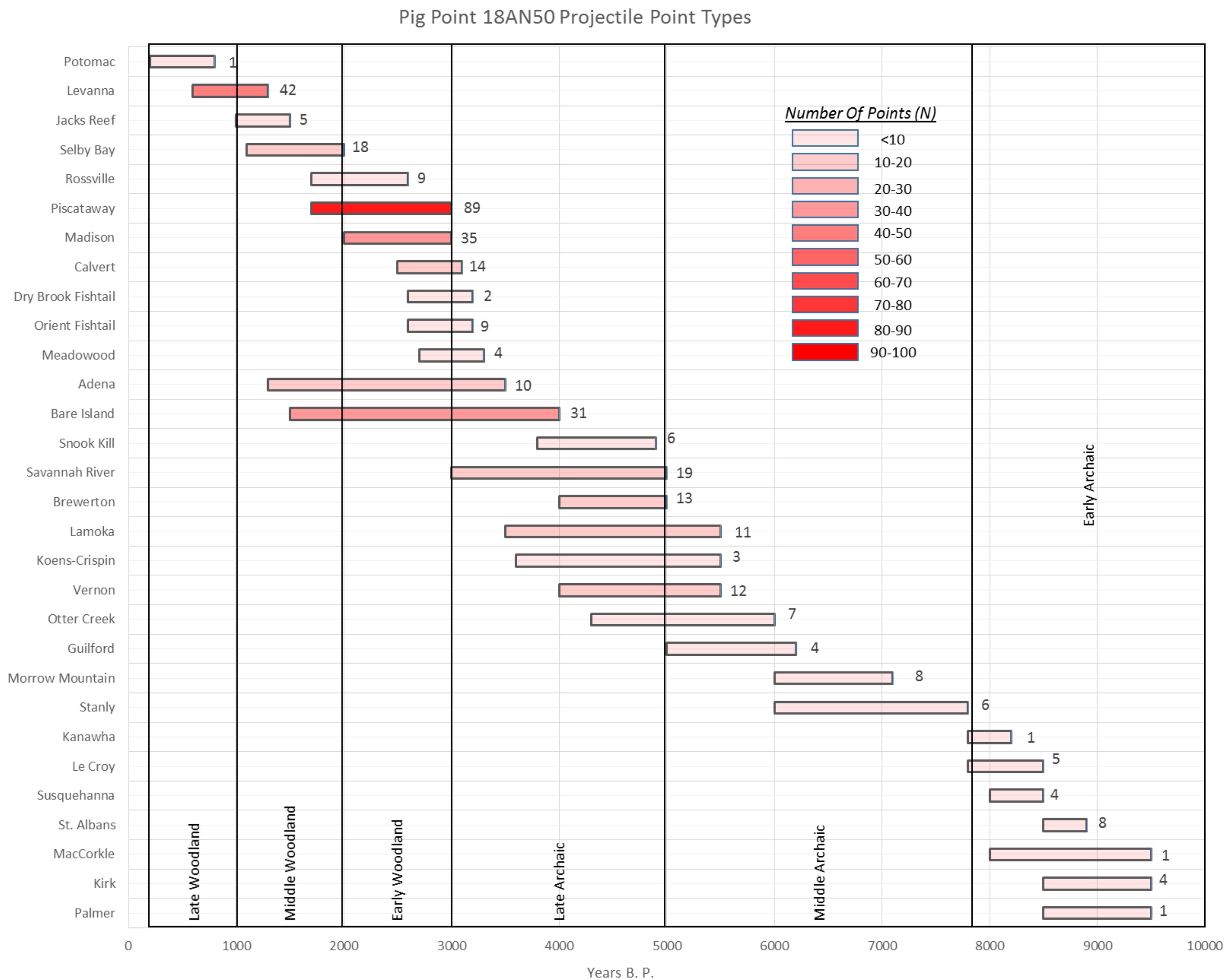
Site Background

- Lower Block – "Feasting Area"
  - Contained Woodland period midden
  - Stratified in situ Early, Middle, and Late Archaic cultural deposits
  - Cultural deposits extended to over 6 ft (2 m) below grade

- Upper Block – "Habitation Area"
  - Intact stratigraphy from Late Woodland to Early Archaic
  - Thousands post-holes marking outlines of "wigwams"

- North Block – "Ritual Area"
  - Rare Adena-influenced mortuary pits





Projectile Points – Over 500 Complete

No Major Data Gaps

Lower Block – Depth (over 6 ft of Cultural Deposits) – Why?

Early Archaic Kirk Point

Source: Dr. Al Luckenbach - AA County Lost Towns Project

Geomorphological Investigation

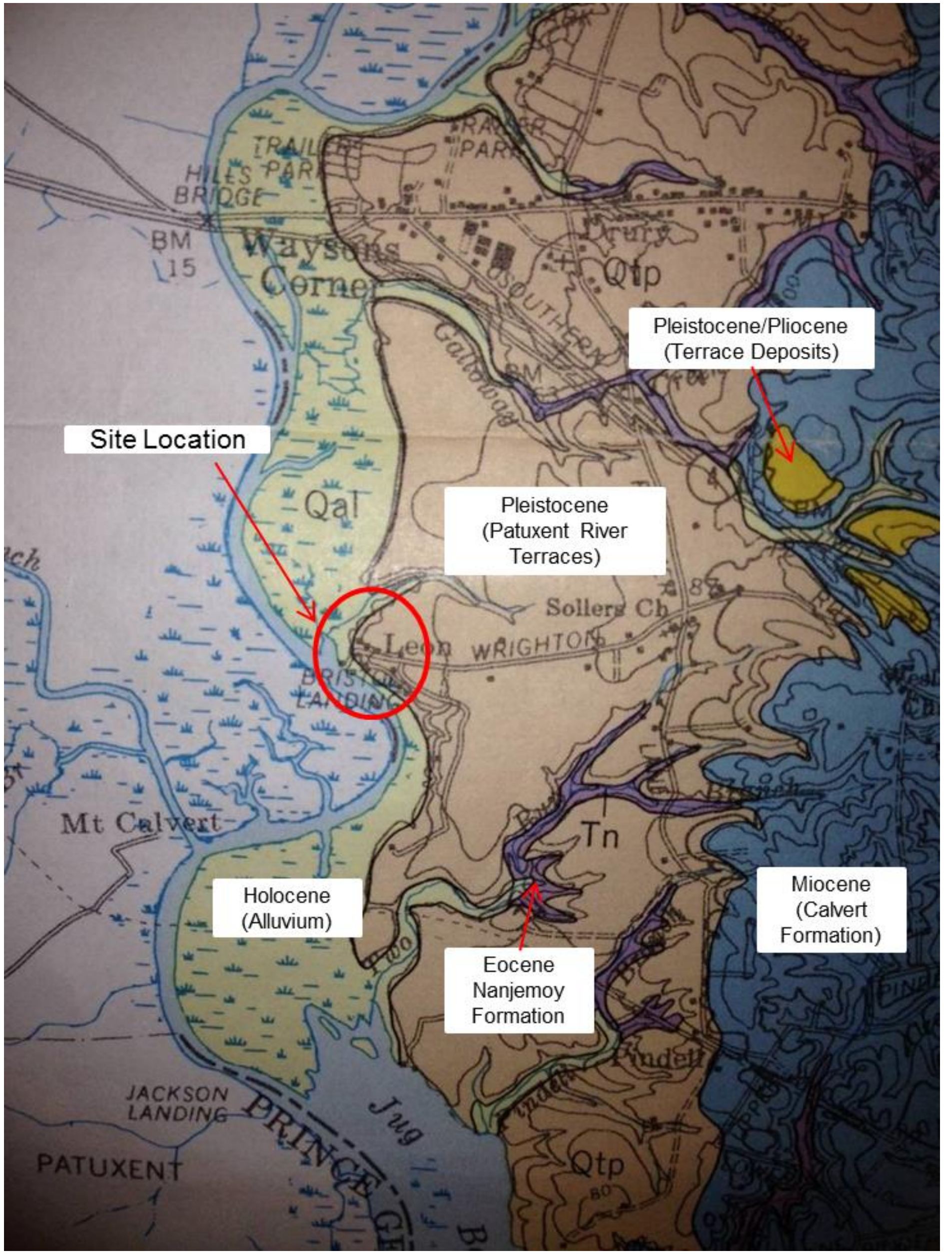
Development of a Site Conceptual Model

- Desktop Study (Previous Research)
- Developed Draft Geologic X-Sections
- Visual Observations via Site Visits of Open Excavations
- Hand Auger Soil Sampling (Multiple)
- Digital Photography of Sediments
- 3D Stratigraphic Modeling
- Soil Survey and Soil Profile Analysis
- ESRI GIS Mapping (LIDAR)
- Coulter-Counter Grain Size Analysis

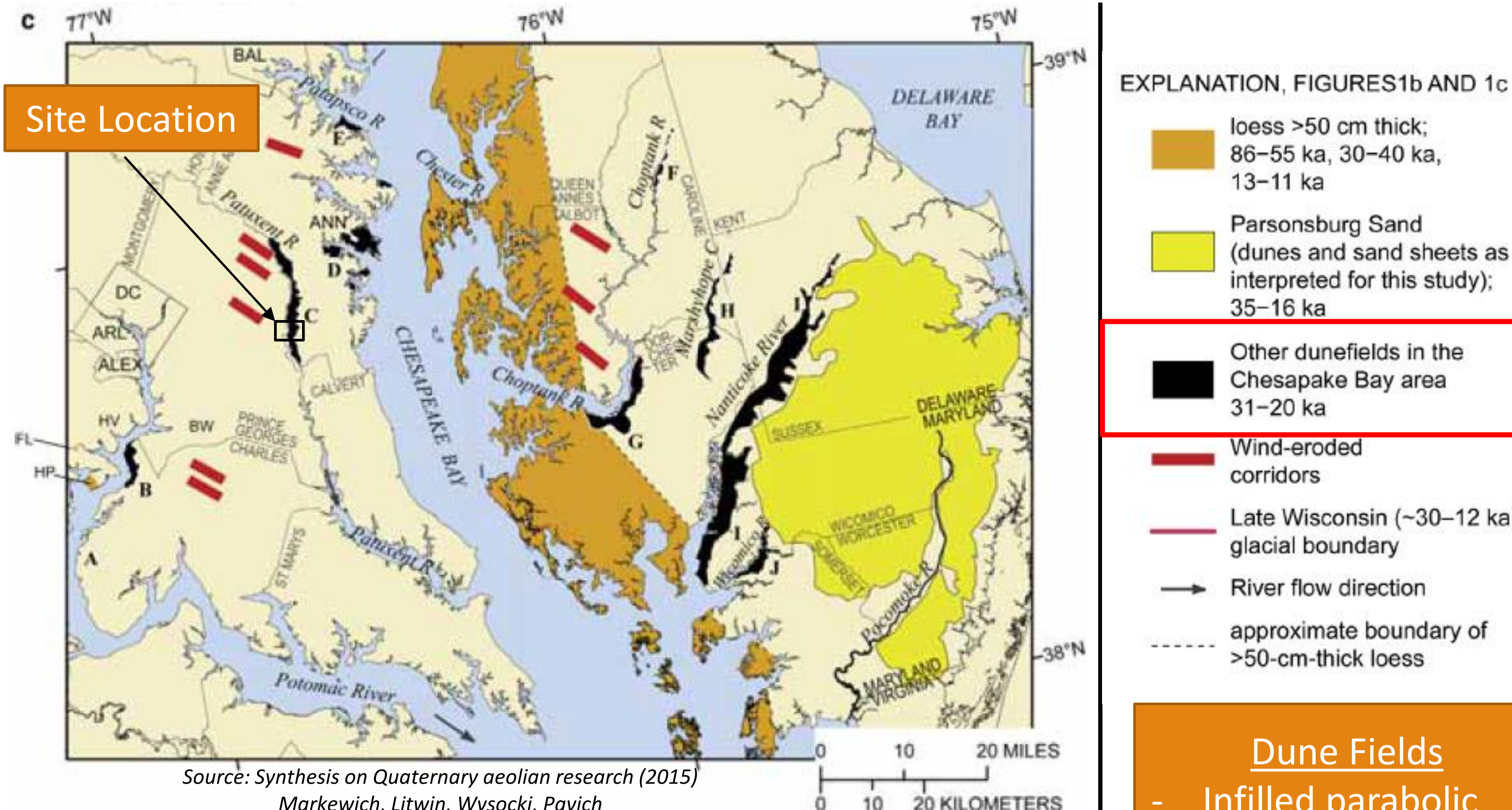
Multiple Lines of Evidence

Geology

- Patuxent River Valley Terrace Deposits
  - Mapped as Pleistocene
  - Interbedded sand and gravel
  - Lesser amounts of Silt/Clay
  - Quartzose gravel typically concentrated in lower portion
  - Cobbles and boulders of mafic rock
  - Limonite conglomerate
  - Glauconitic Sands



Source: MGS – Anne Arundel County Geologic Map



Source: Synthesis on Quaternary aeolian research (2015)
Markewich, Litwin, Wysocki, Pavich

Dune Fields

- Infilled parabolic
- Medium Sands (0.25-0.50 mm)
- NW to SE Trending Ridge lines

Synthesis on Quaternary aeolian research in the unglaciated eastern United States

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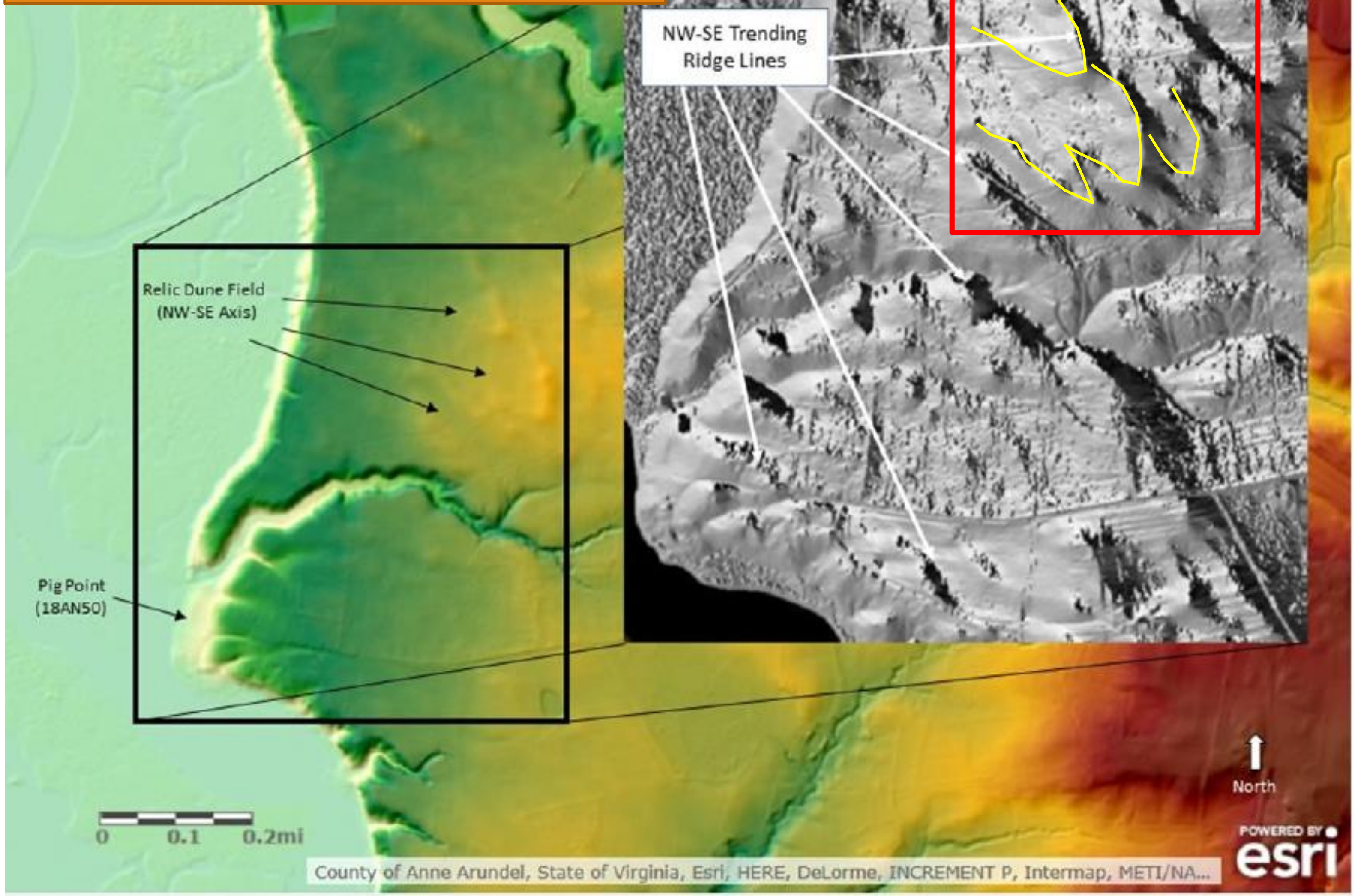
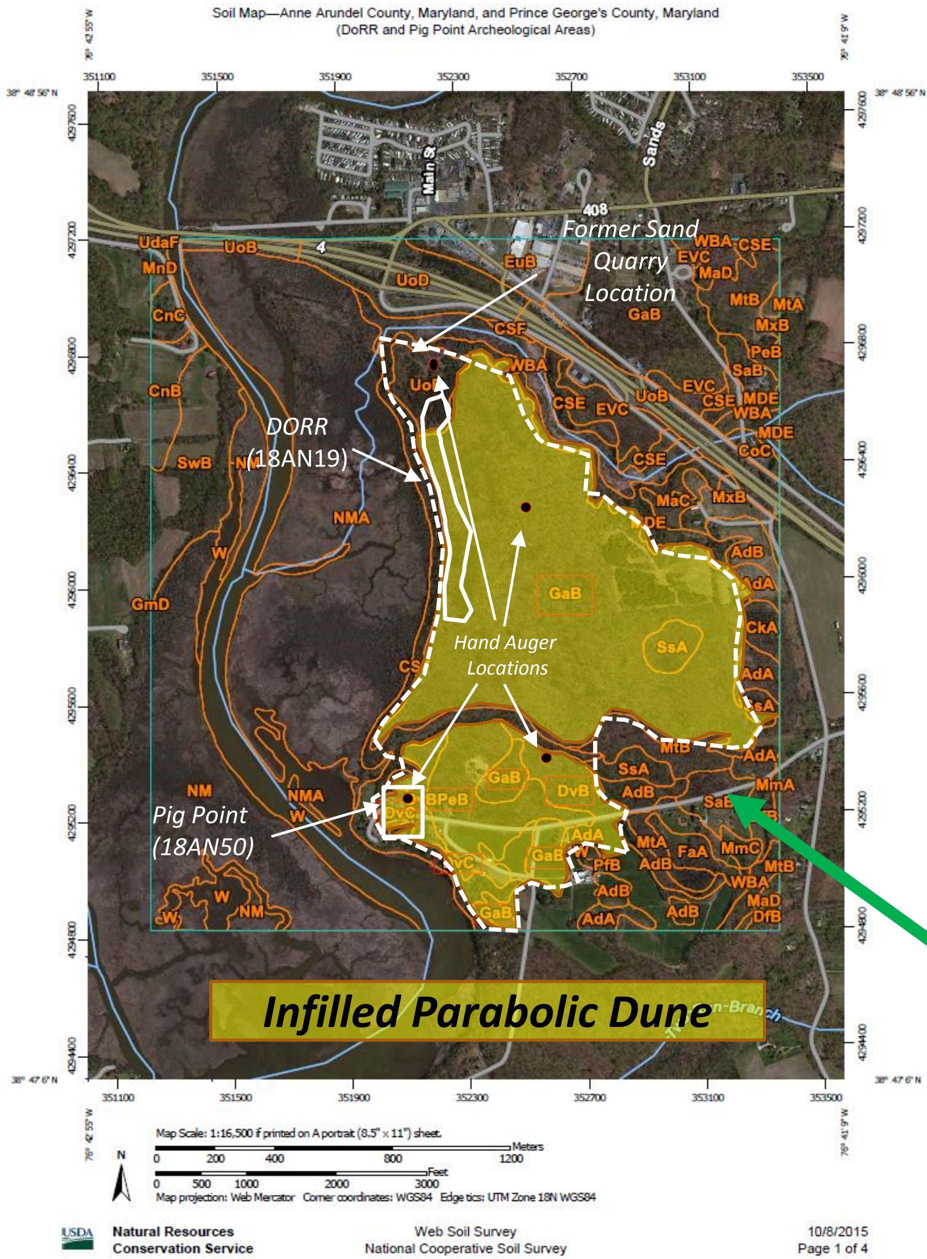
LIDAR maps confirmed presence of parabolic topographic relief and NW to SE ridge lines

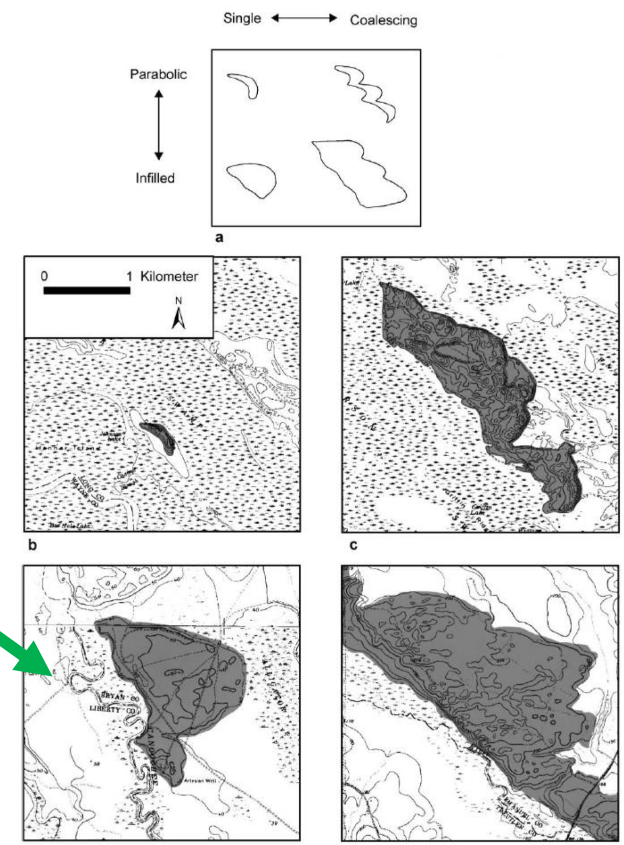


Regional Map – Source Bordering Dune Aeolian Topography

Aeolian Sand Soils in Pig Point and DORR Archeological Areas (NRCS)



Soil Series	Taxanomic classification	Texture	Drainage	Parent material
Middle Atlantic Coastal Plain				
Aeolian sand soils				
Downer	Coarse-loamy, siliceous, semi-active, mesic Typic Hapludults	Loamy sand	Well drained	Loamy fluviomarine deposits
Evesboro	Mesic, coated, Lamellic Quartzipsamments	Sand	Excessively drained	Sandy marine and eolian deposits
Galestown	Siliceous, mesic Psammentic Hapludults	Loamy sand	Somewhat excessively drained	Sandy eolian deposits and/or fluviomarine sediments
Hammonton	Coarse-loamy, siliceous, semiactive, mesic Aquic Hapludults	Loamy sand	Moderately well drained	Loamy fluviomarine sediments



Source: Ivester and Leigh (2003)

Riverine dunes on the Coastal Plain of Georgia, USA

Andrew H. Ivester[a,*], David S. Leigh[b]
[a] Department of Geosciences, State University of West Georgia, Carrollton, GA 30118-3100, USA
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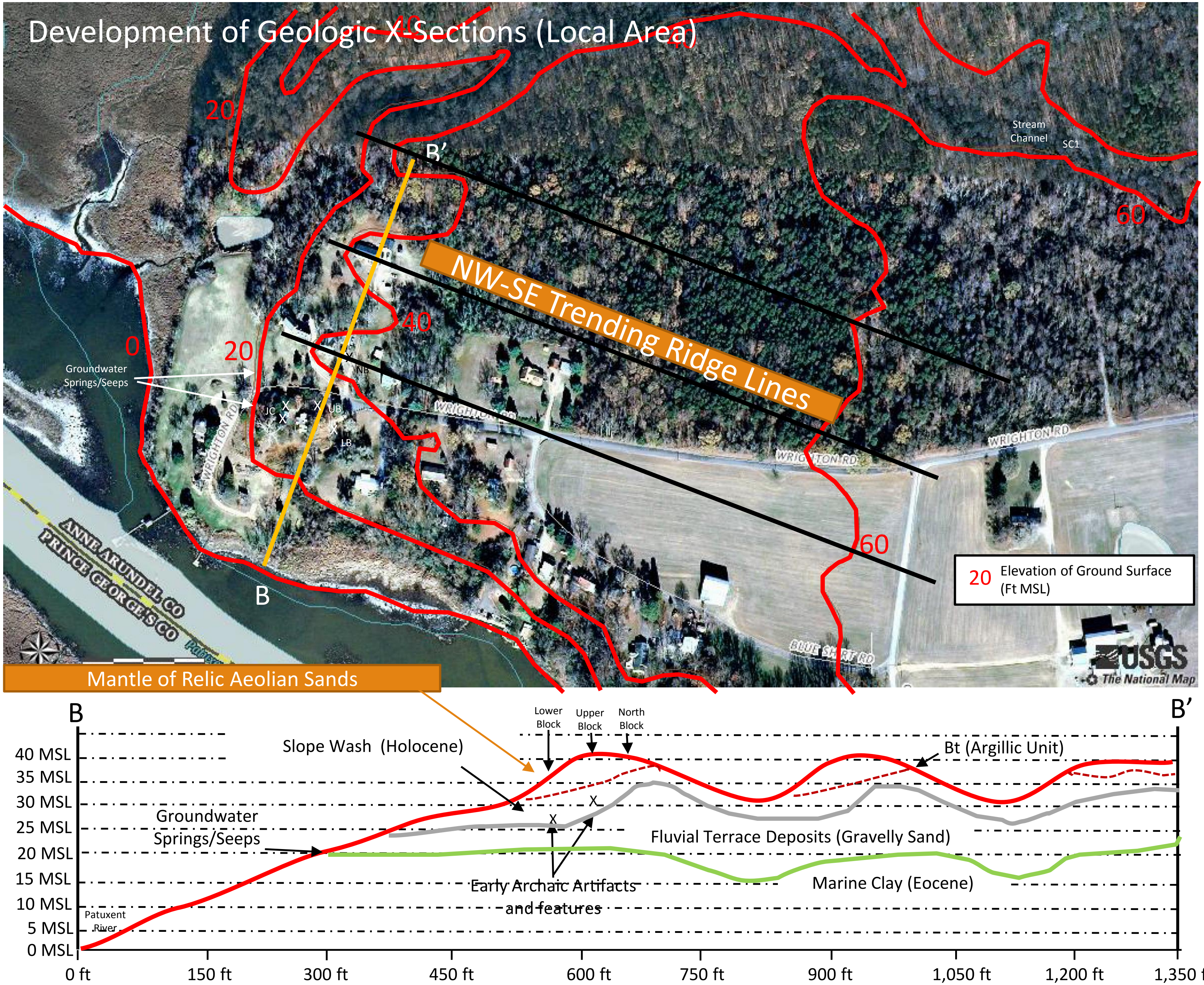
Received 8 June 2001; received in revised form 31 July 2002; accepted 2 August 2002

Relic Aeolian Conditions Determined by Soil Survey Data

Development of Geologic X-Sections (Local Area)

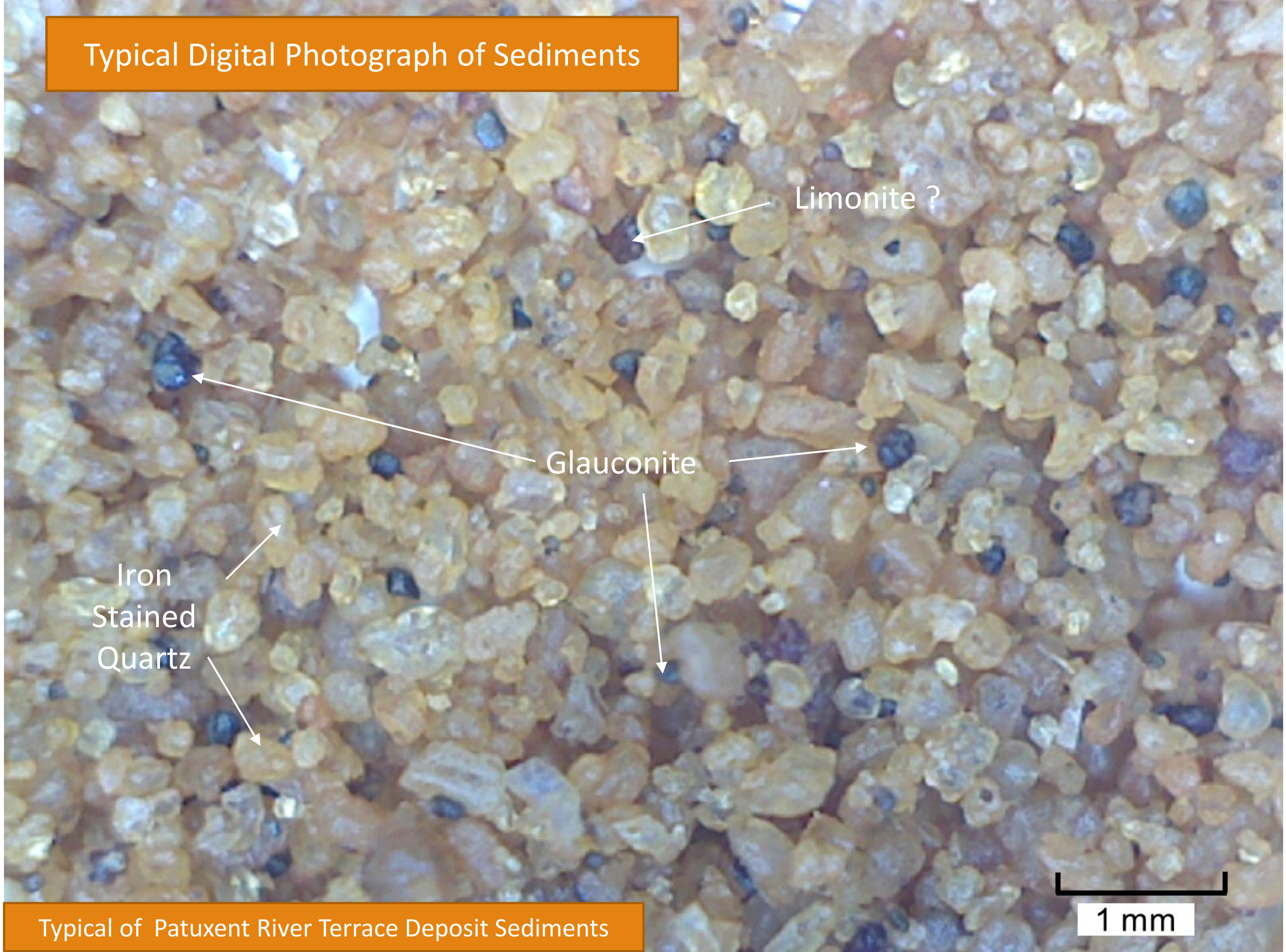


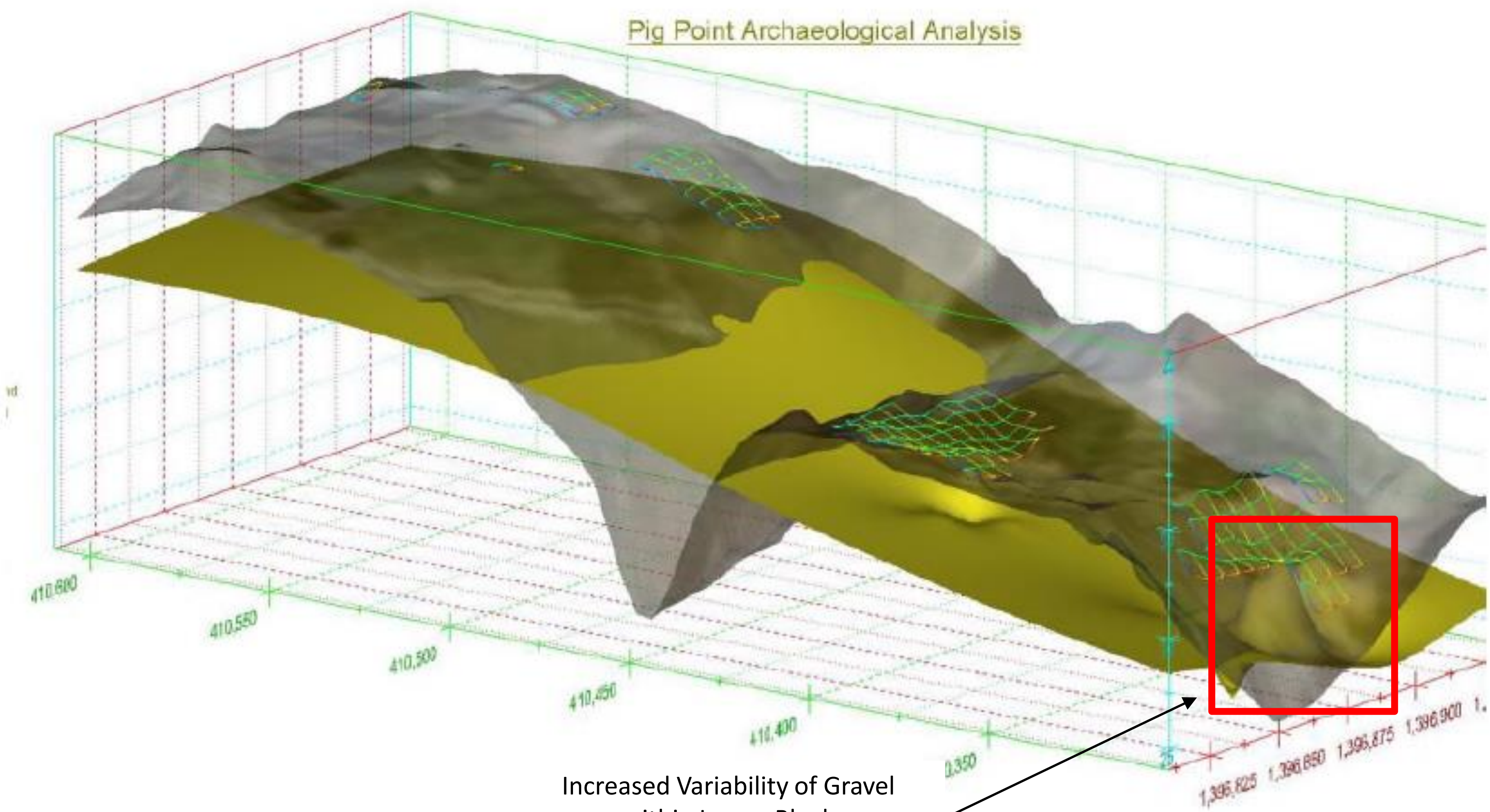
In Field - Data Collection

Data collection:

- Soil sampling from open excavations
- Hand auger sampling at bottom of archeological units and in near-by strategic areas

Data Collection – Soil Sampling and Completion of Hand Augers

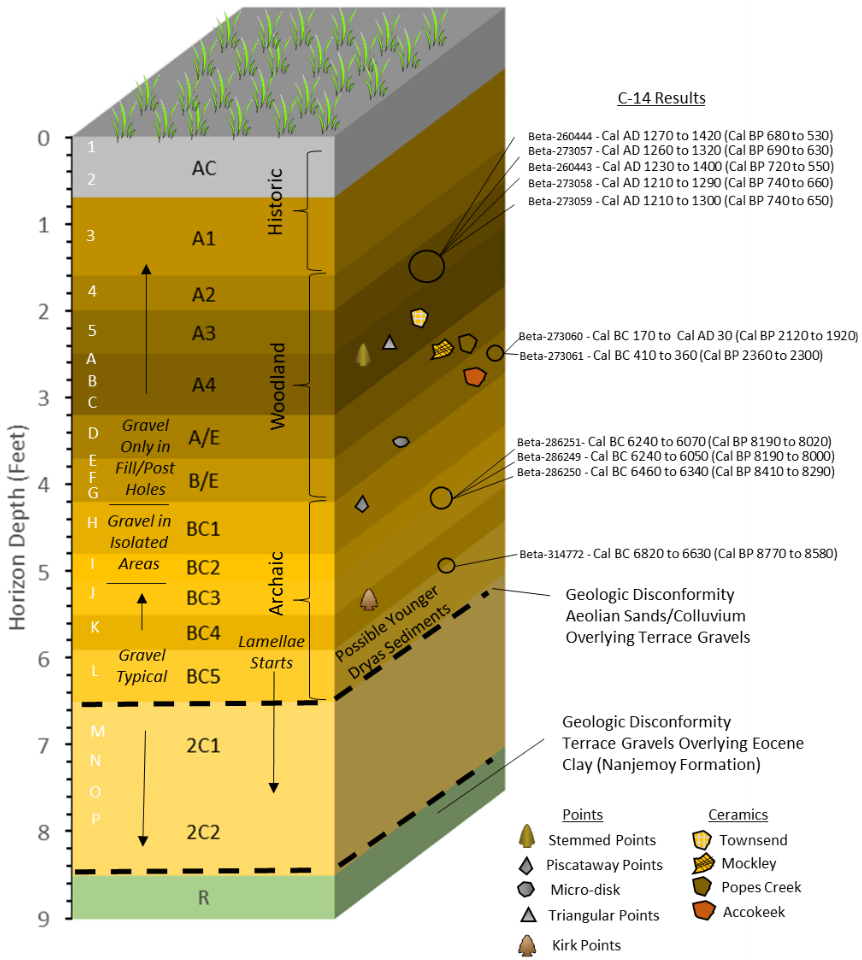

Typical Digital Photograph of Sediments
Limonite ?
Glauconite
Iron Stained Quartz
1 mm
Typical of Patuxent River Terrace Deposit Sediments



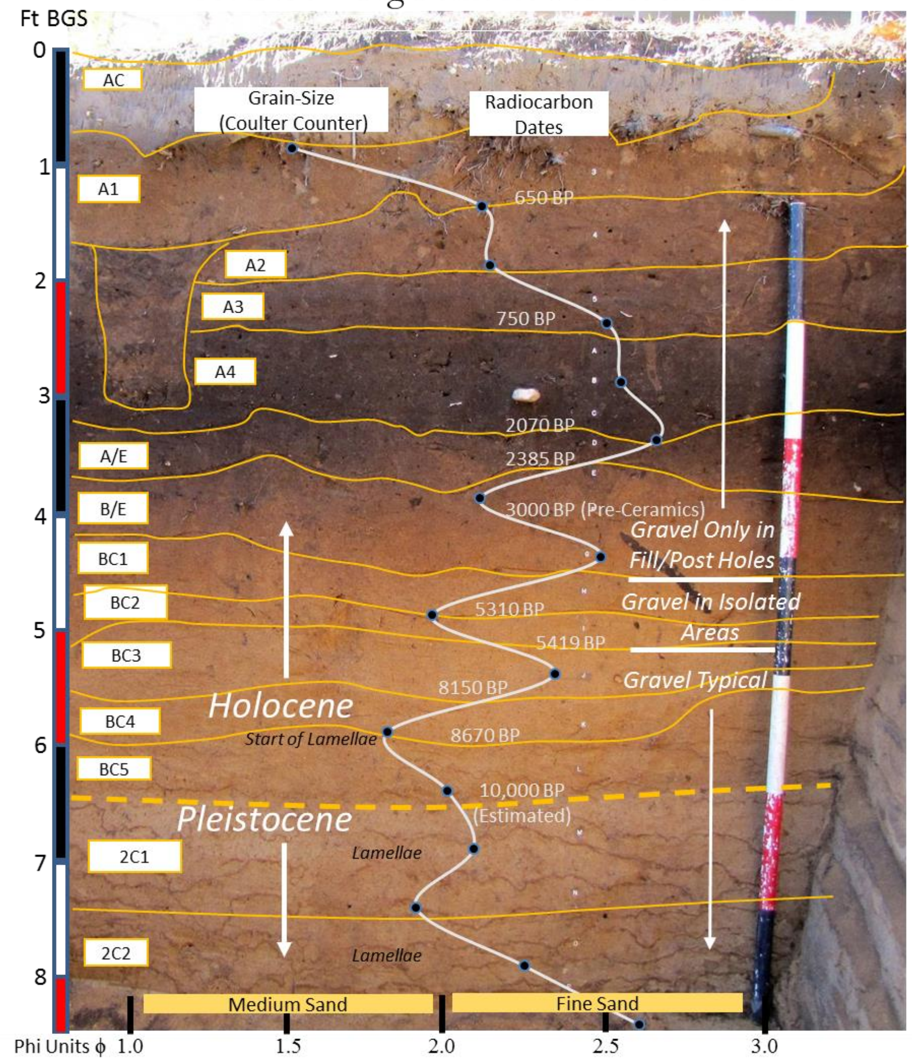
Increased Variability of Gravel
within Lower Block
(Adjacent to Swale/Stream Bank)

3D Model of Gravel/Non Gravel Interface
Potential Climate Change Events?

Pig Point - Lower Block



18AN50 – Pig Point Lower Block Profile

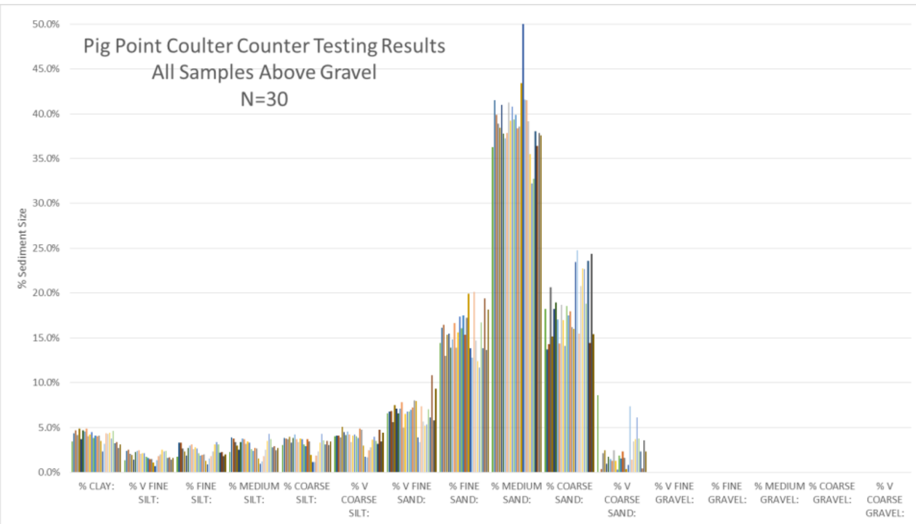


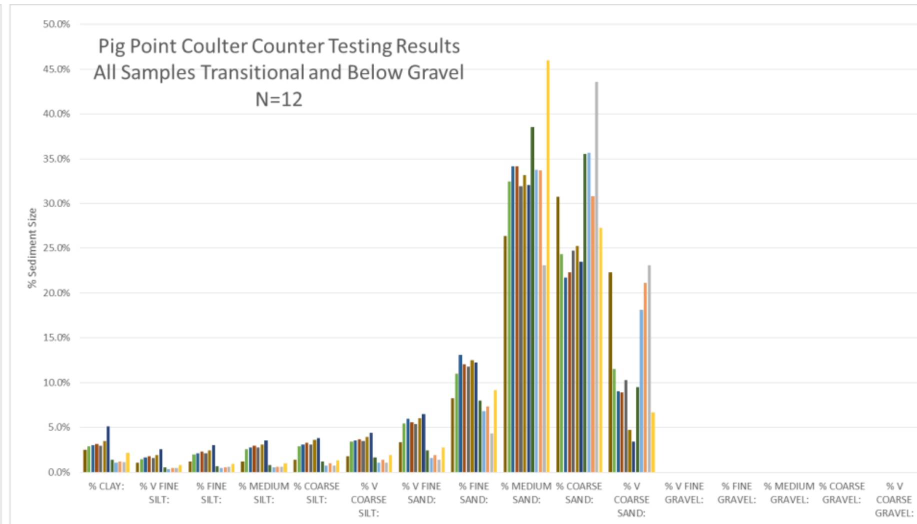
Document multiple climate-driven erosional and depositional cycles

Highest % in Medium Sand Fractions

Table 2 - Particle Size Analysis Summary (Coulter Counter < 2mm)

			Total (<2 mm) (%)			Sand fractions (2-0.05 mm) (%)					Folk and Ward Method (Phi)			
											(M_Z):	(σ_I):	(Sk_I):	(K_G):
Sample Location	Sample Depth (ft)	N	Clay	Silt	Sand	vfs	fs	ms	cos	vcos	Mean	Sorting	Skewness	Kurtosis
Lower Block - Above Gravel	1 to 5.5 ft BGS	10	3.7%	13.3%	83.0%	6.6%	15.3%	37.3%	20.3%	3.4%	2.2	2.1	0.6	1.8
Lower Block - Transitional	6.0 to 6.5 ft BGS	2	2.9%	12.7%	84.4%	5.7%	12.0%	33.3%	23.0%	10.3%	1.9	2.1	0.5	1.9
Lower Block - With Gravel	7.0 to 8.5 BGS	4	3.7%	14.7%	81.6%	5.9%	12.2%	32.8%	24.0%	6.8%	2.2	2.3	0.5	1.7
North Block - Above Gravel	0.2 to 5 ft BGS	18	4.1%	14.5%	81.4%	6.7%	15.7%	40.0%	17.2%	1.8%	2.4	2.1	0.6	1.7
North Block - With Gravel	7 to 13 ft BGS	6	1.6%	4.6%	93.8%	2.2%	7.3%	33.6%	33.9%	16.8%	1.0	1.3	0.2	1.7
Upper Block - Above Gravel	1 to 1.5 ft BGS	2	4.6%	16.2%	79.2%	5.8%	12.1%	37.4%	20.8%	3.1%	2.5	2.4	0.6	1.8

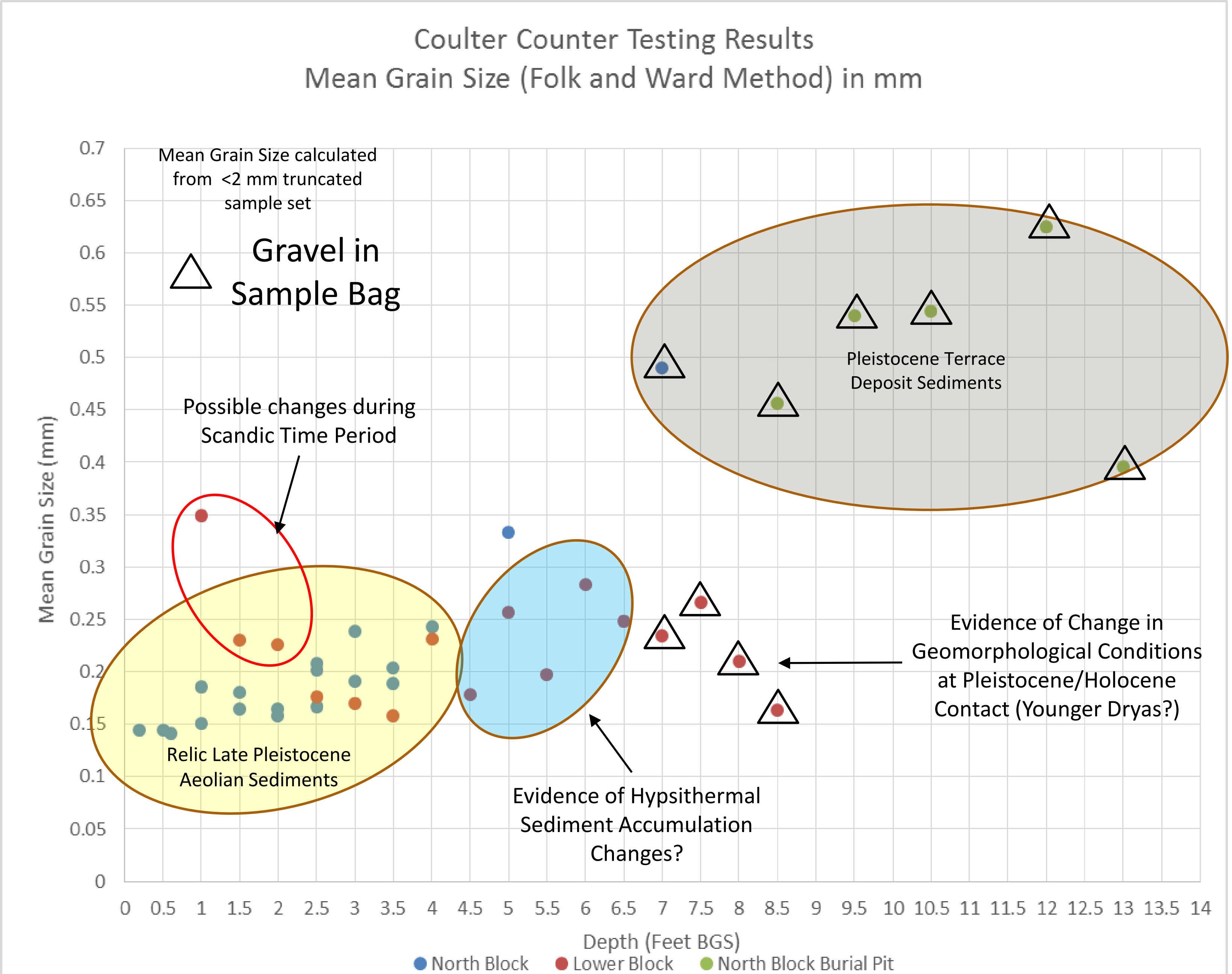




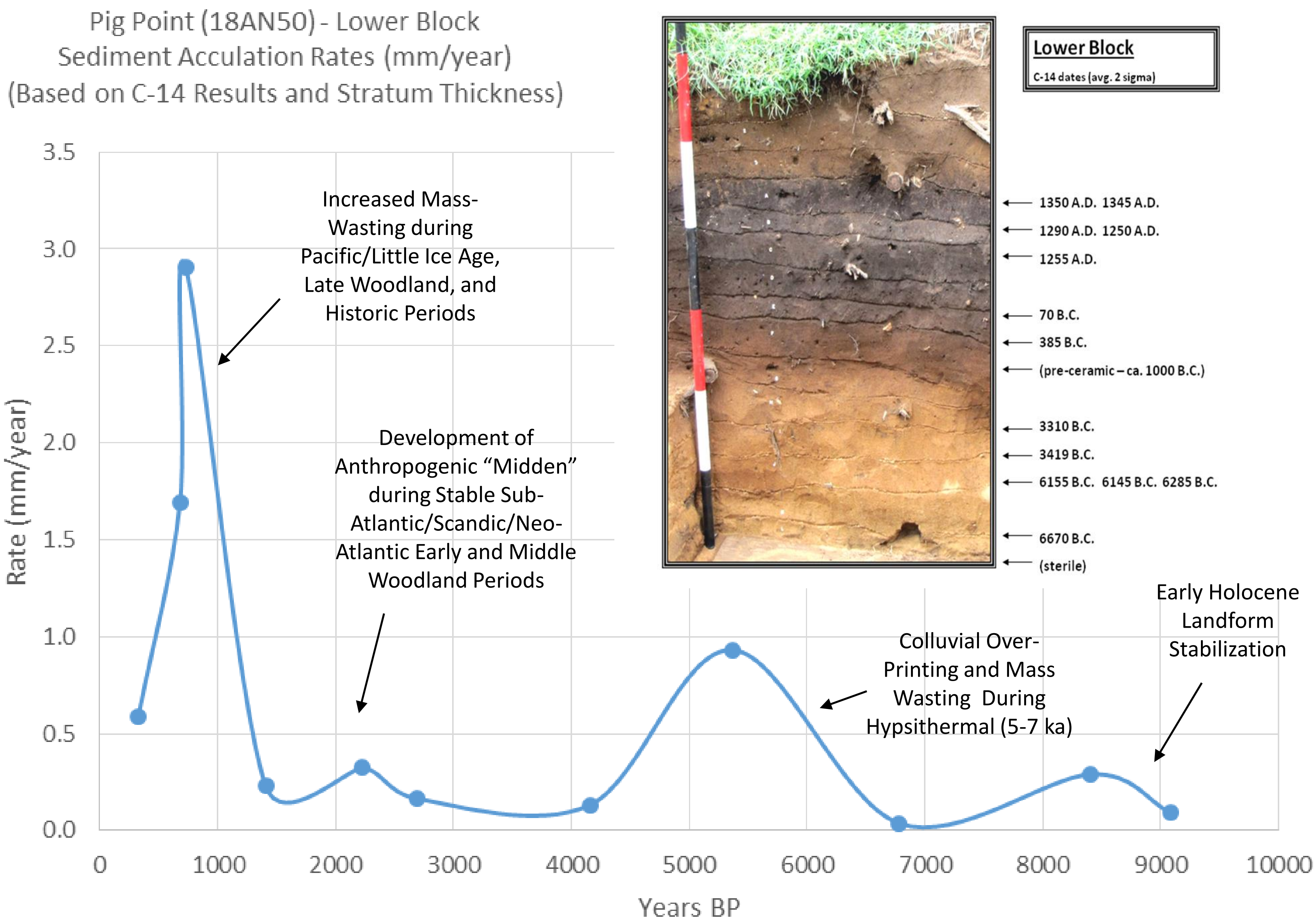
Higher % of VF and F Sand

Higher % of C and VC Sands

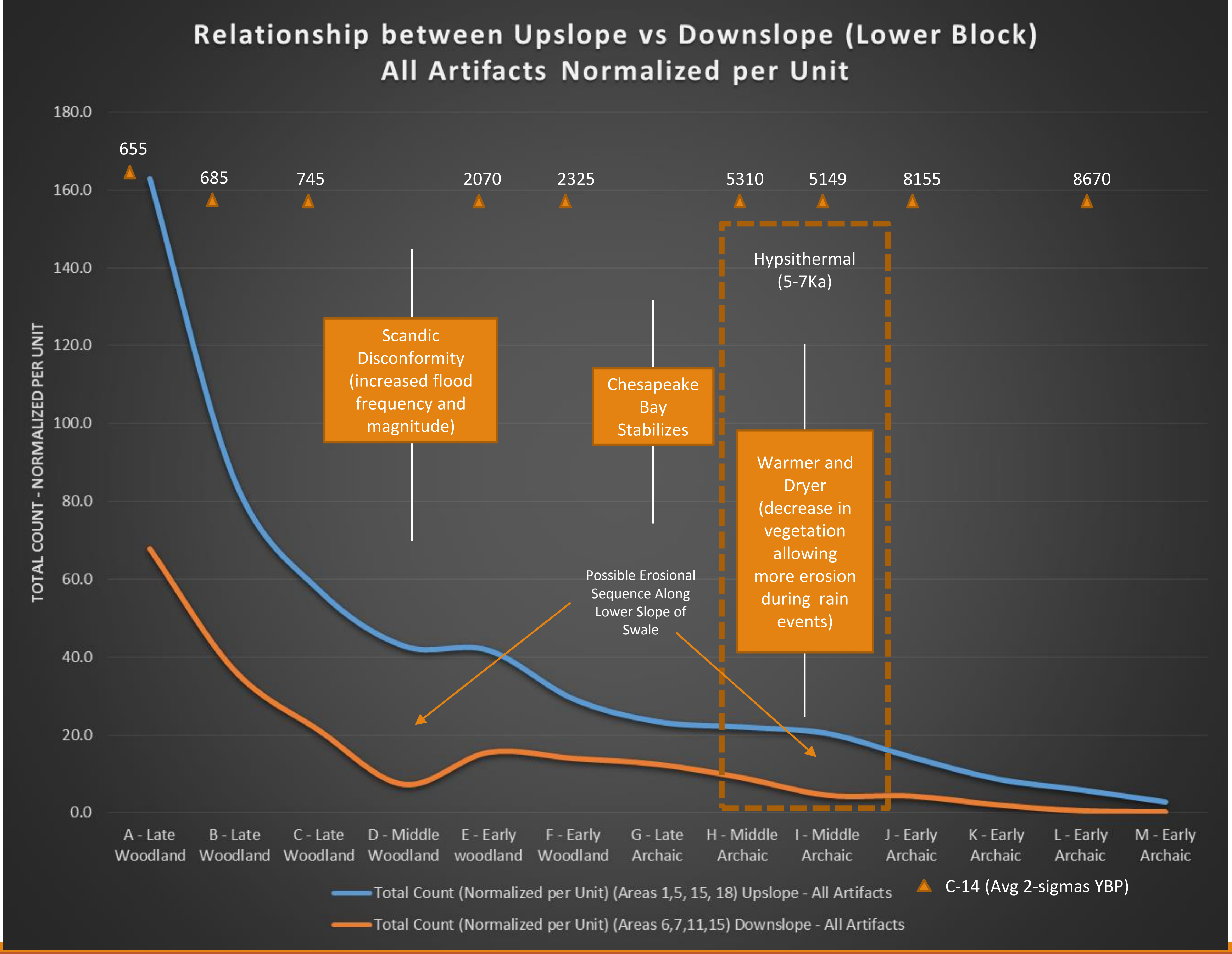
Coulter-Counter Grain Size Analysis – 42 Samples



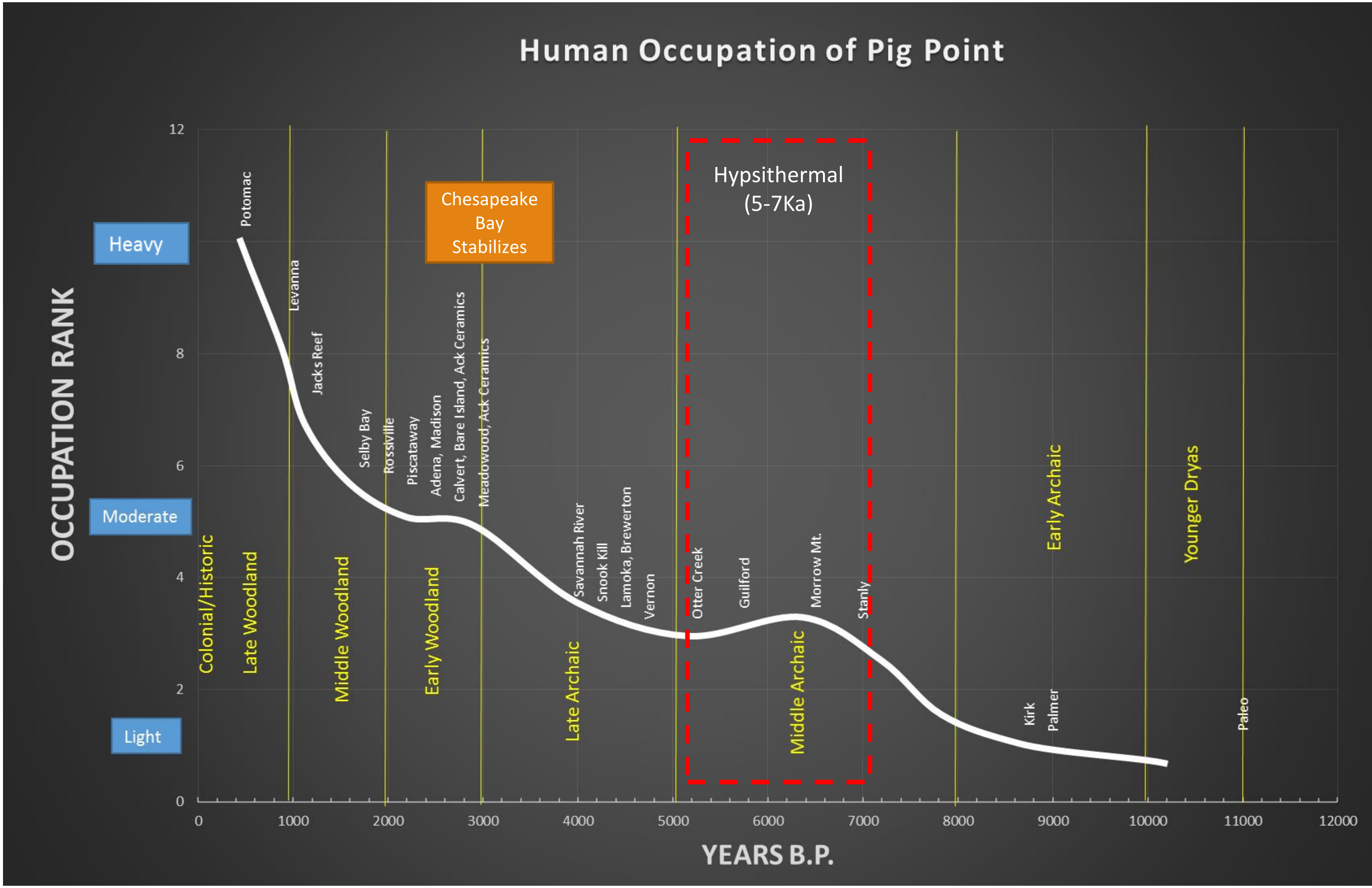
Coulter-Counter Grain Size Analysis – Relic Aeolian vs Fluvial Coarse Gravel



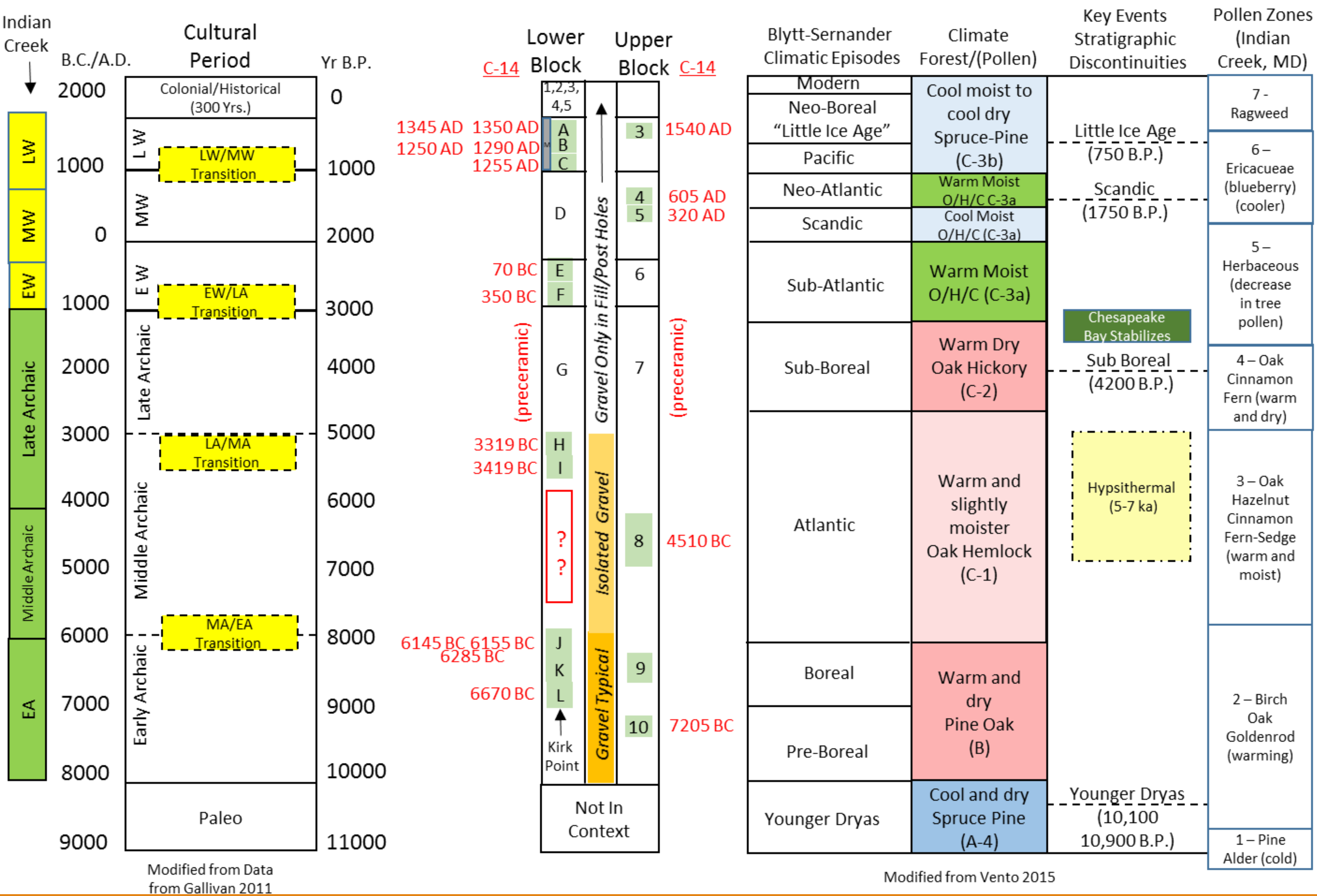
Pig Point (18AN50) - Lower Block
Sediment Acculation Rates (mm/year)
(Based on C-14 Results and Stratum Thickness)
Rate (mm/year)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
Years BP
Increased Mass-Wasting during Pacific/Little Ice Age, Late Woodland, and Historic Periods
Development of Anthropogenic "Midden" during Stable Sub-Atlantic/Scandic/Neo-Atlantic Early and Middle Woodland Periods
Colluvial Over-Printing and Mass Wasting During Hypsithermal (5-7 ka)
Early Holocene Landform Stabilization
Lower Block
C-14 dates (avg. 2 sigma)
1350 A.D. 1345 A.D.
1290 A.D. 1250 A.D.
1255 A.D.
70 B.C.
385 B.C.
(pre-ceramic – ca. 1000 B.C.)
3310 B.C.
3419 B.C.
6155 B.C. 6145 B.C. 6285 B.C.
6670 B.C.
(sterile)



Sediment Accumulation Rates and Climate Change

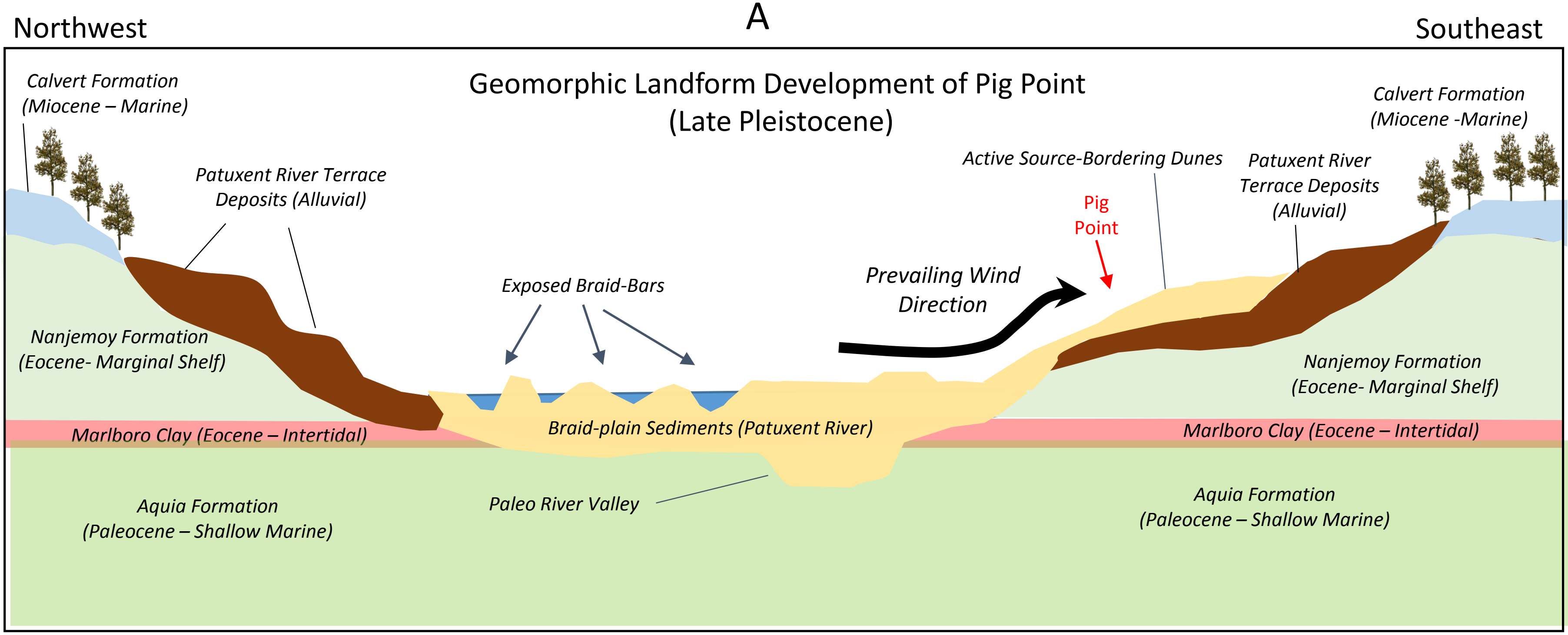

Human Occupation of Pig Point
OCCUPATION RANK
Heavy
Moderate
Light
12
8
6
4
2
0
YEARS B.P.
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
11000
12000
Chesapeake Bay Stabilizes
Hypsithermal (5-7Ka)
Potomac
Levanna
Jacks Reef
Selby Bay
Rossiville
Piscataway
Adena, Madison
Calvert, Bare Island, Ack Ceramics
Meadowood, Ack Ceramics
Savannah River
Snook Kill
Lamoka, Brewerton
Vernon
Otter Creek
Guilford
Morrow Mt.
Stanly
Kirk
Palmer
Paleo
Colonial/Historic
Late Woodland
Middle Woodland
Early Woodland
Late Archaic
Middle Archaic
Early Archaic
Younger Dryas

Cultural Periods/C-14/Stratum/Climate Correlation Chart

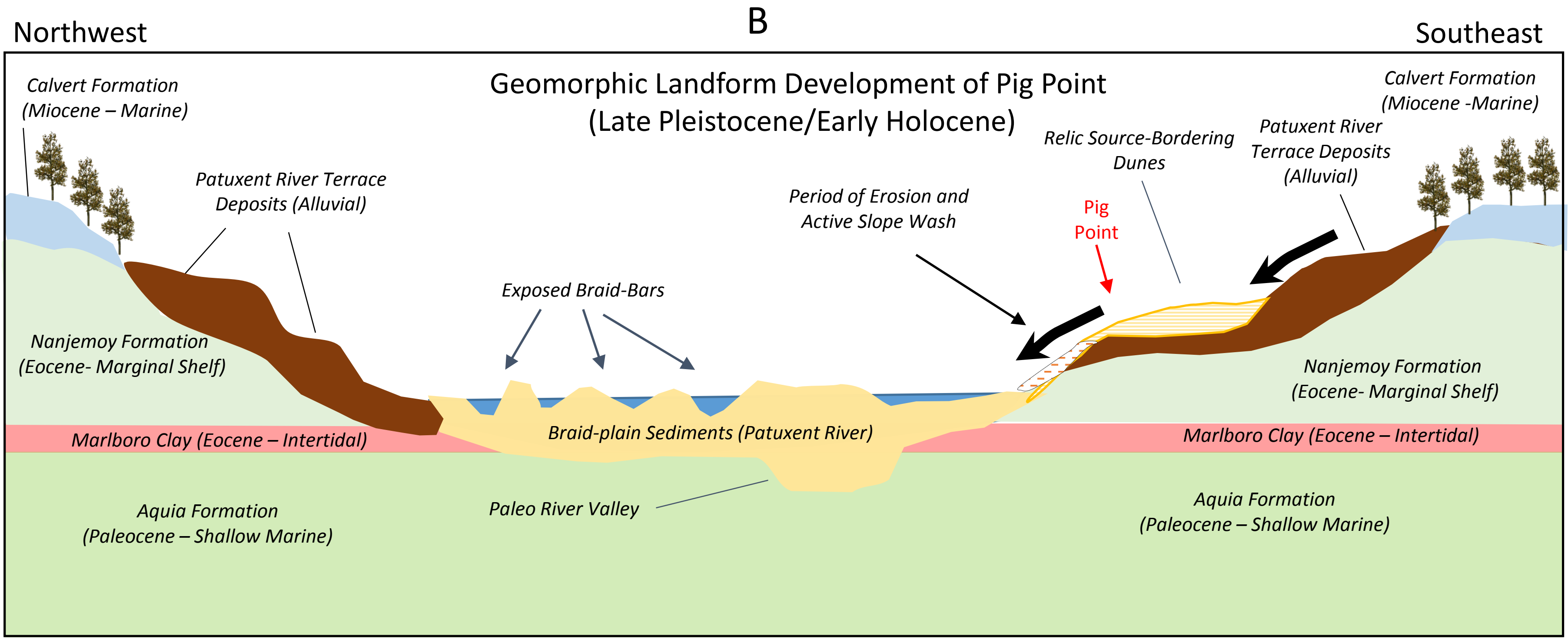


Summary – Correlation Chart

A

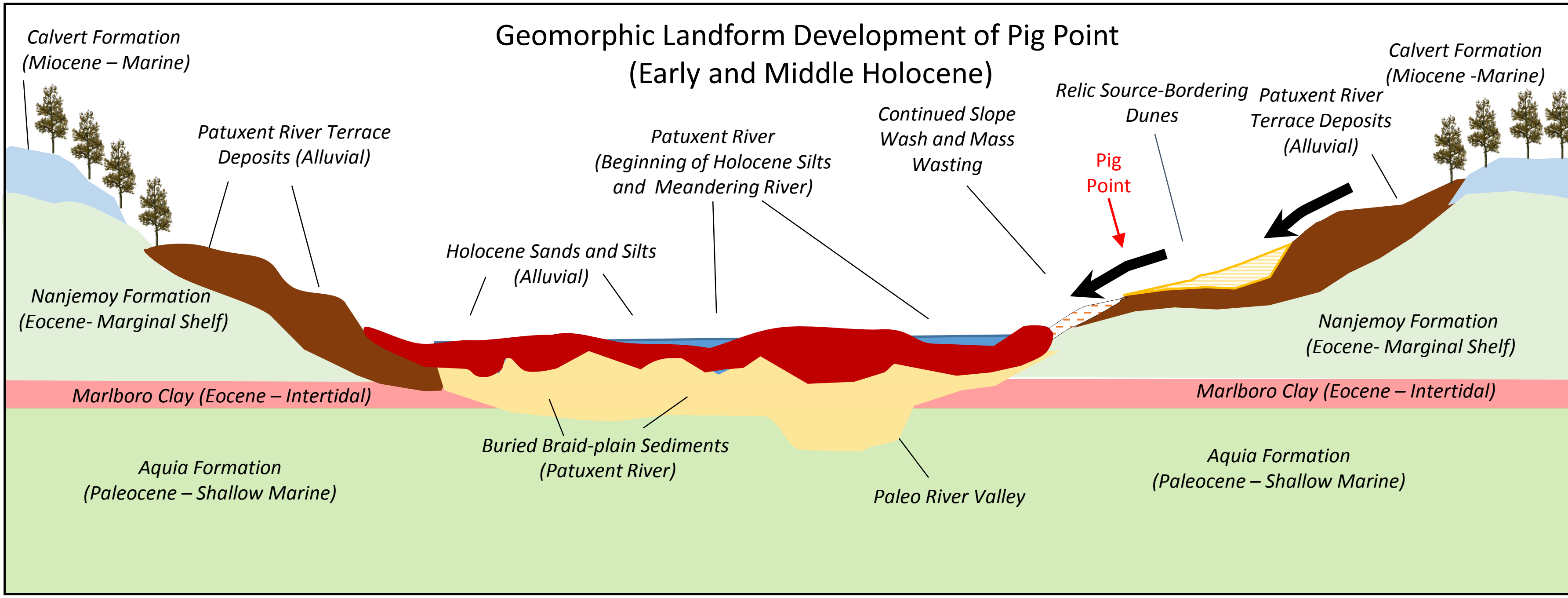


(a) Alluvial deposition of basal Pleistocene terrace sand and gravel deposits and Late Pleistocene deposition of active source-bordering aeolian dunes from braid-plain river sediments



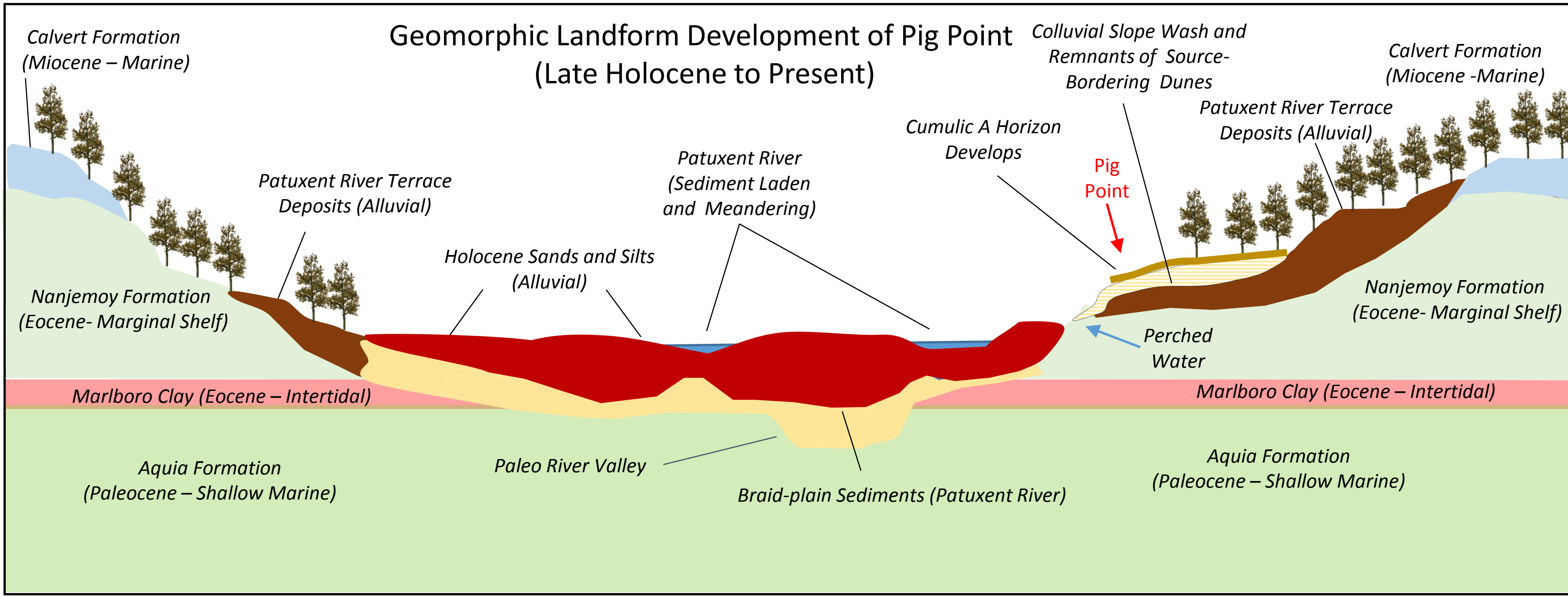
(b) Terrace scarp erosion during the warm, wet interstadial culminating in the cool and dry Younger Dryas

Northwest C Southeast



(c) Increased erosion and colluvial over-printing (increased mass wasting) of up-gradient aeolian sands with enhanced activity in the Middle Archaic “hypsithermal”

Northwest D Southeast



(d) Landform stability and development of a cumulic A horizon with anthropogenic enrichment during the stable Sub Atlantic through Neo Atlantic (Early and Middle Woodland periods) and additional colluvial over-printing by accelerated mass wasting from the Little Ice Age through historic deforestation (Late Woodland and Historic periods)

Special Thanks

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- *Dr. Al Luckenbach – Anne Arundel County Lost Towns Project*
- *James marine, Ed Dolan – Tetra tech*