



A Paleontological and Sedimentological Analysis of Sand Pods at the Base of the Navesink Fm, Big Brook, New Jersey



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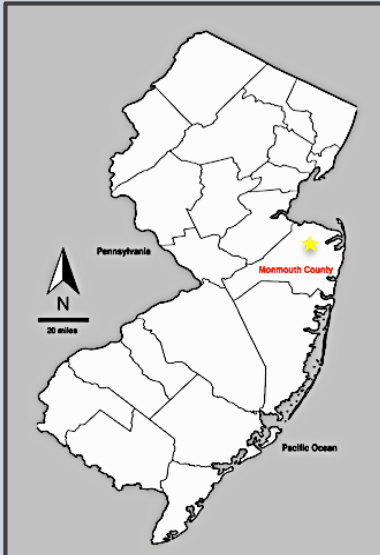
ABSTRACT

The Upper Cretaceous stratigraphic sequence of the Wenonah, Mount Laurel and Navesink Formations exposed in Big Brook, northeastern Monmouth County, NJ has been highly debated. Sandy concretions ("sand pods") occur at the base of the Navesink Fm. The sand pods are commonly fossiliferous, 4 to 50 cm in diameter and composed mostly of fine to medium, glauconitic quartz sand. These concretions are unique to northeastern Monmouth County occurring locally within a 15 cm horizon just above the unconformity bounding the Navesink Fm and the Wenonah Fm. A faunal and sedimentological analysis was conducted. Fifty-five different species were identified, including: *Agorostrea falcata*, *Neithea quinquecostata*, *Ostrea panda* and *Lima acutilineata*, commonly associated with the Mount Laurel Fm. The concretions are interpreted as remnants of the Mount Laurel Fm within a lag deposit at the base of the Navesink Fm resulting from shoreface retreat. Ammonite biostratigraphy suggests this is likely related to a late Campanian to early Maastrichtian transgressive event.

INTRODUCTION



The New Jersey Coastal Plain can be characterized by its Upper Cretaceous stratigraphic sequence of the Wenonah, Mount Laurel and Navesink Formations exposed in Big Brook, northeastern Monmouth County, NJ. This passive margin area has evidence of six to eight cycles between 73.8-71.8 mya (Miller, 2004). The outcrop belt of the Mount Laurel Formation extends from New Jersey through Delaware. It is usually stratigraphically positioned above the Wenonah Fm and below the Navesink Fm. Sedimentologically, the Mount Laurel Fm. Has been described as a glauconitic (20%), slightly clayey, fine sand commonly characterized by a coarsening up sequence. Martino and Curran (1990) described it as a clean, moderately sorted quartz sand with an average grain size of 2-3φ. Interpretations of depositional environment include a subaqueous mouth bar deposit (Owen and Soul, 1969), a delta front with comparison to present day Niger delta (Miller, 2004) and a barrier island with sediment input from an emerging Hudson River (Martino and Curran, 1990).

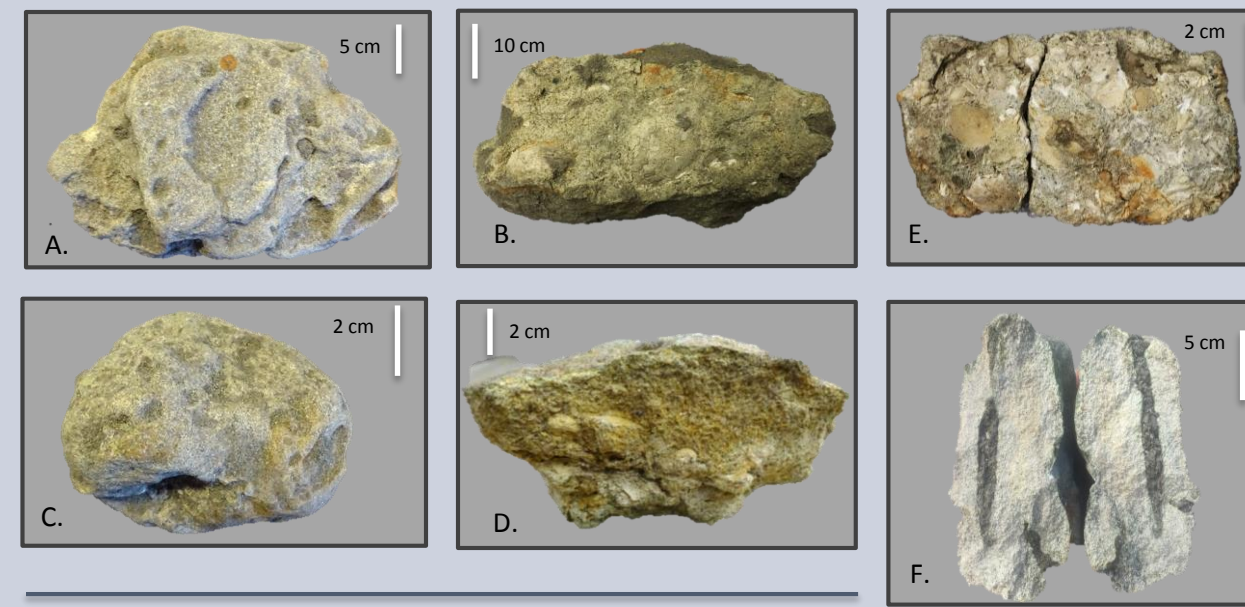


The purpose of this study is to investigate the provenance and processes related to sand pods occurring at the base of the Navesink Fm in Monmouth County, NJ, to clarify the Upper Cretaceous stratigraphic sequence.

METHODS

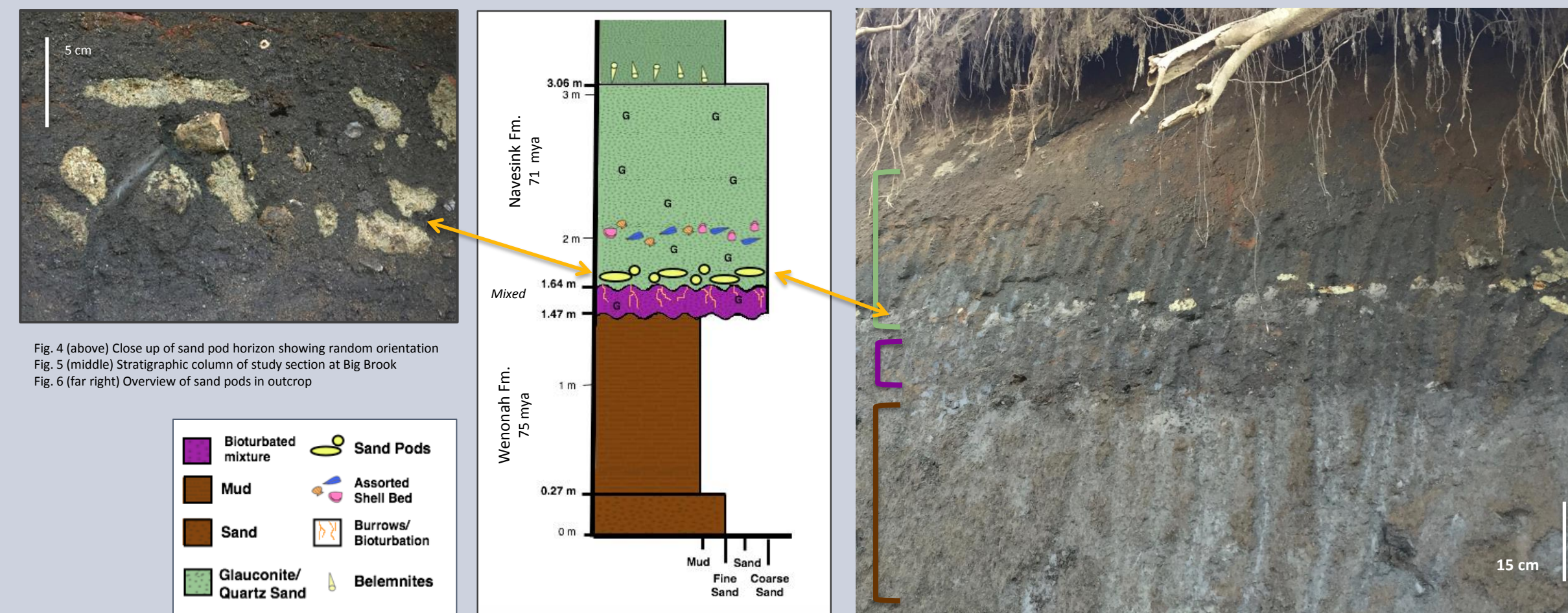
- Three outcrops examined
- Measured using Jacobs staff noting changes in the lithology and fauna
- Bulk samples of pods and sediment were extracted for analysis in lab
- Sediment was disaggregated using hexametaphosphate solution
- Sediment size distribution was determined using a Tyler Ro-tap Testing Sieve shaker model RX-94 with sieves every half phi
- Pods were broken apart by hand for paleontological analysis
- Mineral point counts were done to determine mineral composition

SAND POD CHARACTERISTICS



- Pods occur within a 15 cm horizon
- Sizes vary between 4-50 cm
- Range of shapes: discus (Fig. A), ovoid (Fig. B), bulbous (Fig. C) rounded and angular edges (Fig. D)
- Calcite cementation (various degrees of lithification)
- Inside the pods (Fig. E):
 - Fossils are commonly broken
 - Some pods are burrowed pods and lack fossils (Fig. F)

STRATIGRAPHY



SEDIMENT ANALYSIS

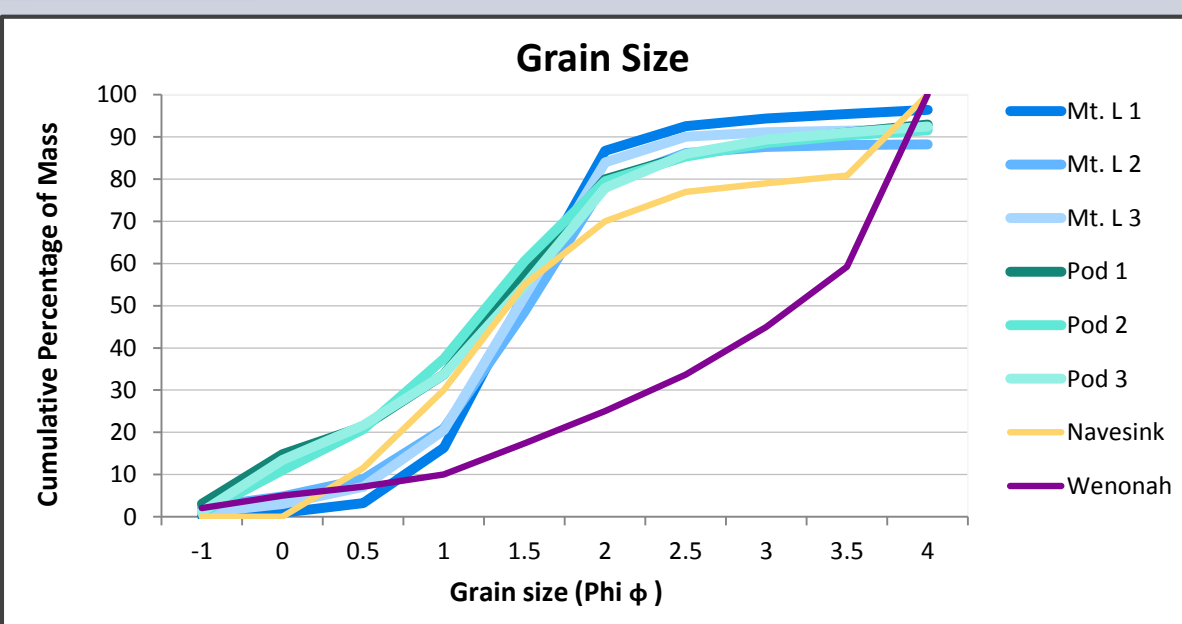


Fig. 2. Grain size analysis of sand pods (Big Brook) show a similarity in distribution to Mount Laurel Fm (Crosswicks Basin)

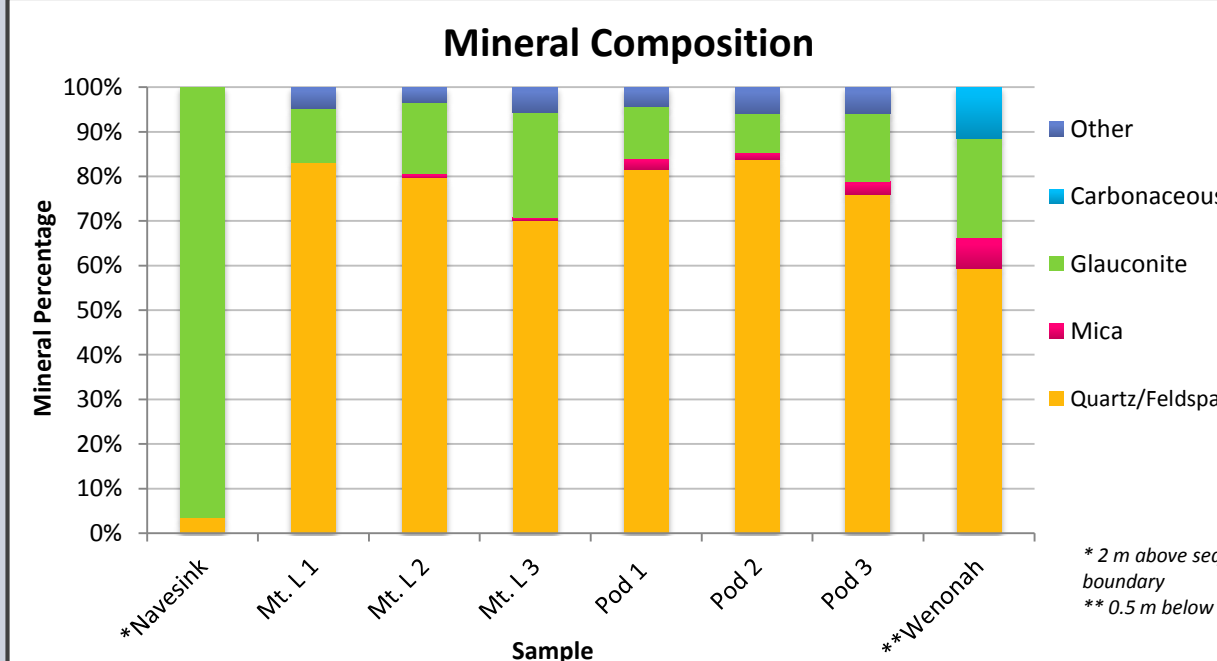


Fig. 3. Mineral composition of sand pods (Big Brook) show a similarity to the composition of the Mount Laurel (Crosswick Basin)

FAUNAL ANALYSIS

Fauna	Kuehne (1999) Bivalve Distribution Comparison				Fauna	Kuehne (1999) Bivalve Distribution Comparison			
	Sand Pods	Wenonah	Mt. Laurel	Navesink		Sand Pods	Wenonah	Mt. Laurel	Navesink
Bivalvia					<i>Ostrea plumosa</i>		x	x	x
<i>Agerostrea falcata</i>	74	x	x	x	<i>Ostrea sp.</i>	1			
<i>Agerostrea mesenterica</i>					<i>Paranomia scabra</i>			x	x
<i>Anomia argentea</i>		x	x	x	<i>Pecten bellisculptus</i>	3			
<i>Anomia perlinaea</i>			x		<i>Pecten bubonis</i>	2			
<i>Anomia tellinoidea</i>	1		x	x	<i>Pecten kaufman</i>	2			
<i>Anatimya anteradiata</i>	1				<i>Pecten Neithea quinquecostata</i>	8	x	x	x
<i>Aphrodina tippiana</i>	2				<i>Pecten simplicius</i>	4			
<i>Belliscula sp.</i>	1				<i>Pecten sp. a</i>	1			
<i>Cardium pilsbryi</i>	1				<i>Pecten sp. b</i>	1			
<i>Cardium deltanum</i>	1				<i>Pecten sp. c</i>	2			
<i>Cardium sp.</i>	3				<i>Pecten sp. d</i>	2			
<i>Chlamys craticulus</i>			x		<i>Pecten sp. e</i>	1			
<i>Chlamys mississippiensis</i>			x	x	<i>Pecten trivisanus</i>	2			
<i>Chlamys venustus</i>	1		x		<i>Plicatulae urtica</i>			x	x
<i>Chlamys weeksi</i>			x		<i>Protocardia spilmani</i>			x	
<i>Chlamys whitfieldi</i>		x	x	x	<i>Pterotrigonia eufaulensis</i>		x	x	x
<i>Corbula crassiplica</i>	1				<i>Pycnodonte convexa</i>		x	x	x
<i>Crassatella vasdosa</i>		x	x	x	<i>Solyma gardenae</i>	3			
<i>Crenella sp.</i>	1				<i>Solyma lineolatus</i>		x	x	x
<i>Cubitostrea tectica</i>	1	x	x	x	<i>Sponylus enchinata</i>			x	x
<i>Cucullalidae antrosa</i>			x	x	<i>Sponylus gregalis</i>			x	x
<i>Cucullalidae neglecta</i>		x	x	x	<i>Striacinae congesta</i>			x	
<i>Cucullalidae trippana</i>		x		x	<i>Syncyclonema simplicium</i>			x	
<i>Cymbophora cancellosa</i>	24				<i>Teneia parillis</i>		x	x	x
<i>Cypremaria depressa</i>	7				<i>Trigonia eufaulensis</i>	3			
<i>Cypremaria excavata</i>	1				<i>Turritella austini</i>	5			
<i>Exogyra cancellata</i>			x	x	<i>Turritella sp.</i>	2			
<i>Exogyra costata</i>			x	x	<i>Unicardium sp.</i>	3			
<i>Gervillia ensiformis</i>		x	x	x	<i>Venilla conradi</i>		x	x	x
<i>Glycymeriidae microdentus</i>		x			<i>Vetericardiella crenilirata</i>			x	
<i>Glycymeriidae mortoni</i>			x	x	<i>Vetericardiella subcircuta</i>		x	x	
<i>Granocardium tenuistriatum</i>		x	x	x	<i>Yoldia papyria</i>	1			
<i>Gryphaostrea vomer</i>	14	x	x	x	Gastropoda				
<i>Icanotia pulchra</i>			x		<i>Cronella whitei</i>	15			
<i>Inoperna carolinensis</i>		x	x	x	<i>Cronella triplicata</i>	1			
<i>Isocardia bulbosa</i>	1				<i>Bellifusus medians</i>	1			
<i>Isocardia treidani</i>	1				<i>Palmitics rectilabrum</i>	1			
<i>Lima acutilineata</i>	23		x		<i>Cnidaria</i>				
<i>Lima Kimbroensis</i>	1				<i>Micrabacia cibaria</i>	6			
<i>Lima pelagica woolseyi</i>	2				<i>Mollusca</i>				
<i>Lima reticulata</i>		x	x	x	<i>Belemnite americana</i>	4			
<i>Lima Sellarsii</i>	8				Other				
<i>Lima sp.</i>	3				<i>worm sp.</i>	1			
<i>Lima whitfieldi</i>		x	x	x	<i>worm sp. b</i>	1			
<i>Linearia metastrata</i>		x	x	x	<i>worm sp. c</i>	1			
<i>Linearia navarona</i>	1				<i>worm sp. d</i>	1			
<i>Nucula whitfieldi</i>	1				<i>worm sp. e</i>	1			
<i>Ostrea panda</i>	6		x						

Fig. 7. Species table with Kuehne (1999) Bivalve Distribution for comparison. Table shows fauna found within the sand pods (yellow), species specific to the Mount Laurel (blue), and those found in both (red).

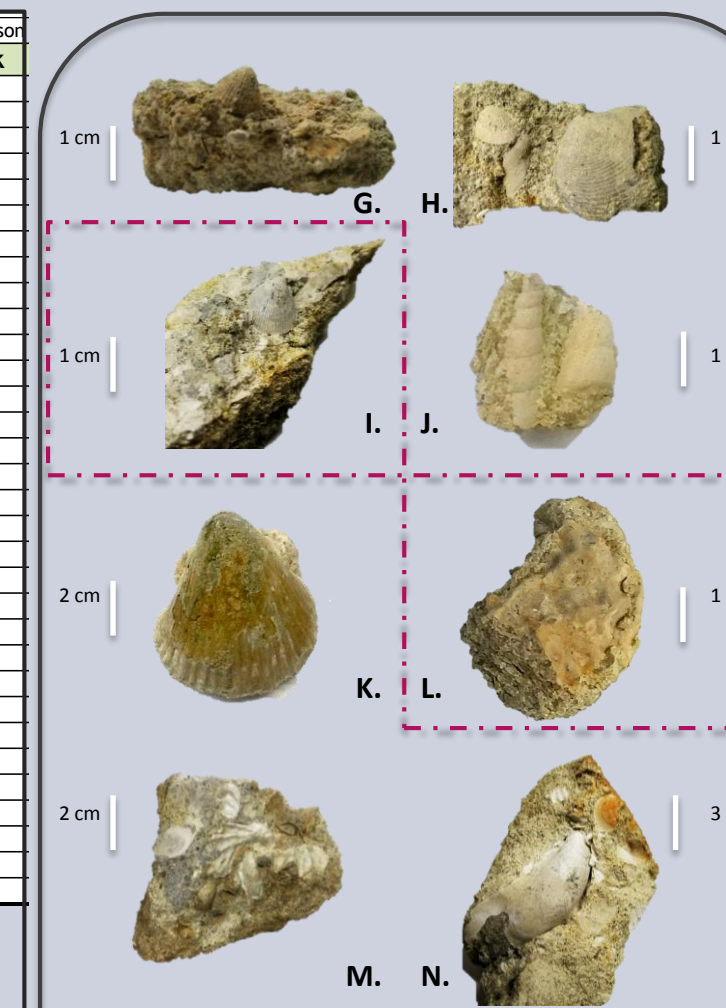


Fig. G. *Micrabacia cibaria*
 Fig. H. *Cymbophora cancellosa*
 Fig. I. *Cronella whitei*
 Fig. K. *Neithea quinquecostata*
 Fig. L. *Ostrea panda*
 Fig. M. *Agorostrea falcata*
 Fig. N. *Gryphaostrea vomer*

Restricted to Mt. Laurel Fm.

CONCLUSIONS

- Paleontological analysis revealed fifty-five species, including *Ostrea panda* and *Lima acutilineata*, which are restricted to the Mount Laurel Fm (Fig. 7). *Agorostrea falcata* and *Neithea quinquecostata* were abundant in the sand pods and are also commonly abundant in the Mount Laurel Fm.
- Sedimentological analysis of the sand pods (Fig. 2 & Fig. 3) show a similarity of grain size distribution and mineral composition to the Mount Laurel Fm.
- Random orientation and morphology of the sand pods suggest reworking.
- We interpret these sand pods to be remnants of the Mount Laurel Fm as a result of erosion and shoreline retreat during the onset of a transgressive system tract.
- This suggests the unconformable boundary lies at the base of the Navesink Fm and on top of the Wenonah Fm. The Mount Laurel Fm is not preserved in the Big Brook area except for the sand pods.

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