PALEOECOLOGY OF MOLLUSCAN COMMUNITIES IN THE PLIO-PLEISTOCENE NASHUA FORMATION: PRELIMINARY RESULTS OF SAMPLE UPPER 3C FROM BUCK HAMMOCK MATERIALS IN DEER PARK, FLORIDA

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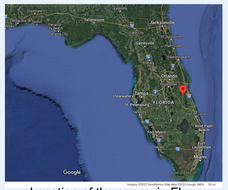
Introduction

- The Plio-Pleistocene (3.6-0.01 Ma) marine molluscan extinctions in the Western Atlantic are not widely understood. Previous work has focused primarily on well-documented assemblages from southern Florida representing the Gulf Province or in the Caribbean, as well as in the Carolinas (O'Dea et al. 2007, Herbert & Paul 2014, Leonard-Pingel & Jackson 2016, Kelley et al. 2011).
- This study incorporates data on samples that were collected from Buck Hammock Materials in north-central Florida during September 2022. No published data are yet available for community-level analyses from this formation that is situated near the boundary between the Carolinian and Gulf Province.
- This poster focuses on preliminary results gathered thus far from sample Upper 3C and compares that to existing data from other samples collected at this same location

Locality

- The Nashua Formation was formed over several cycles of sedimentation late in the Pliocene and early in the Pleistocene. This section north of the Caribbean most likely formed in the Pleistocene in an open marine setting containing shallow waters.
- The typical lithology of the formation consists of medium to fine shell rich quartz sand to a sandy coquina with varying amounts of clay, heavy minerals and phosphate.
- In fall 2022, nine samples each were collected from lower and upper sections of a quarry wall from Buck Hammock Materials, located southeast of Deer Park in north-central FL.
- Samples were taken from bottom up (labeled as 1, 2, 3) and from left to right (A, B, C)



Location of the quarry in FL


View of Buck Hammock quarry


Upper 3C material came from top-right

Methods

Samples were processed and analyzed using the steps listed below.

Sieve Material
- Shells and fragments ≥5mm were separated from the matrix via sieving.

Pick Specimens
- Bivalves with umbos and gastropods with apices are retained for study.
- Everything else was stored separately and not further analyzed as part of this work.

Identify Taxa
- Specimens are sorted into taxonomic groups with the goal of identifying them all to genus using the online Neogene Atlas of Marine Life and Kittle et al. (2013).
- Once identified, ecological life modes are assigned to each genus

Separate by Shape and Size
- Whole (>85% intact) and fragmented specimens are separately counted
- More abundant taxa are also grouped by size in increments of 10mm

Inspect for Signs of Predation
- Complete and incomplete drillholes, and other evidence of predation (or bioerosion), including repair scars, are recorded.
- Drilling frequencies and prey effectiveness are calculated where enough specimens are available to do so as per methods in Kowalewski (2002)



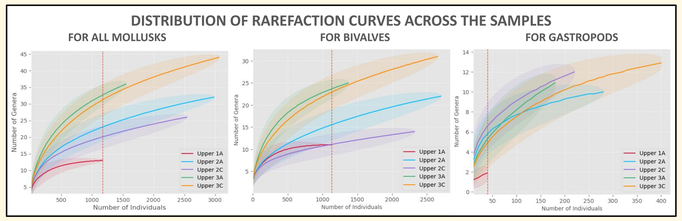

GSU students collecting the samples in the field, sieving the material, and sorting through the specimens in the lab

Diversity & Abundance

Rarefaction curves for Upper 3C do not plateau as they do for other samples such as Upper 1A.

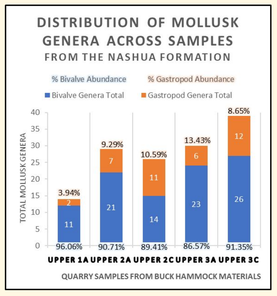
Bivalves appear to be adequately sampled in Upper 1A but not yet for Upper 3C.

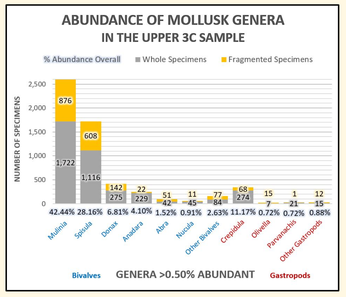
More sampling is needed for gastropods across all samples.

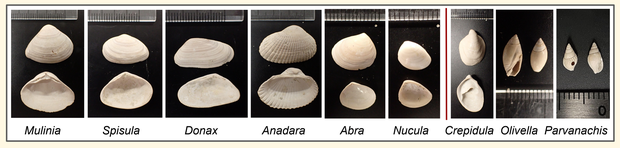


SUMMARY DATA TABLE FOR NASHUA SHELL SAMPLES

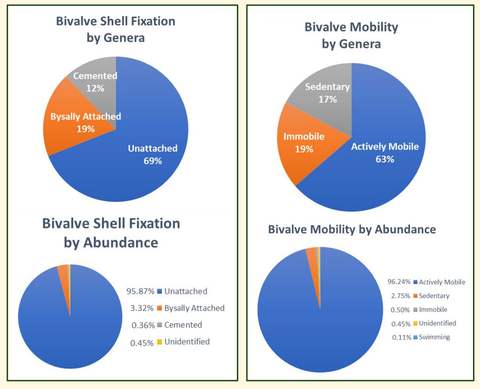
Mollusks	Buck Hammock Samples	Upper 1A	Upper 2A	Upper 2C	Upper 3A	Upper 3C
BIVALVES	Number of Genera	11	21	14	23	26
	Number of Specimens	2244	5468	4644	2,739	5,299
	% Whole	72.73%	81.78%	80.15%	65.95%	66.28%
	% Fragmented	27.27%	18.22%	19.85%	34.05%	33.72%
	Number of Individuals	1122	2734	2322	1553.5	2649.0
	Complete Drillholes	12	122	36	73	85
	Incomplete Drillholes	3	29	5	2	5
	% Abundance of Bivalves	96.06%	90.71%	91.35%	89.41%	86.57%
GASTROPODS	Number of Genera	2	7	11	6	12
	Number of Specimens	46	280	220	184	411
	% Whole	67.39%	70.00%	73.18%	70.65%	77.13%
	% Fragmented	32.61%	30.00%	26.82%	29.35%	22.87%
	Number of Individuals	46	280	220	184	411
	Complete Drillholes	2	3	11	8	18
	Incomplete Drillholes	3	0	2	1	2
	% Abundance of Gastropods	3.94%	9.29%	8.65%	10.59%	13.43%
TOTAL	Number of Genera	13	28	25	29	38
	Fragmented Specimens	627	1080	981	1,004	1,881
	Whole Specimens	1663	4668	3883	1,919	3,829
	Number of Specimens	2290	5748	4864	2,923	5,710
	% Whole	72.62%	81.21%	79.83%	65.65%	67.06%
	% Fragmented	27.38%	18.79%	20.17%	34.35%	32.94%
	Number of Individuals	1168	3014	2542	1,737.5	3060
	Complete Drillholes	14	125	47	81	103
	Incomplete Drillholes	6	29	7	3	7
	% Abundance Overall	100.00%	100.00%	100.00%	100.00%	100.00%

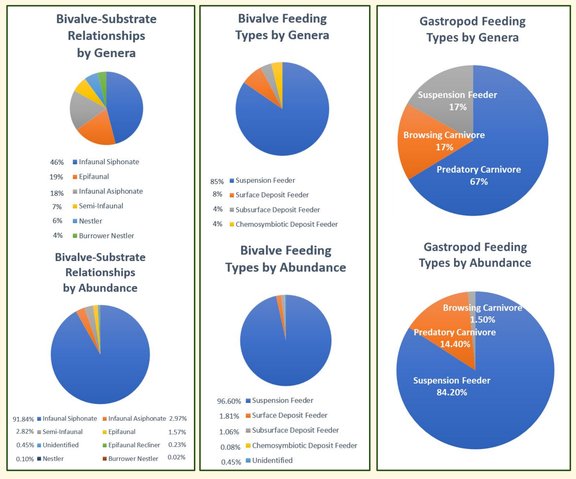




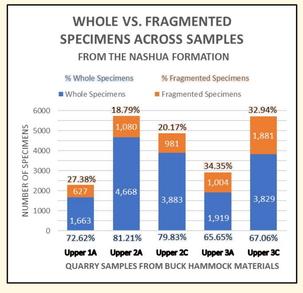


Ecology



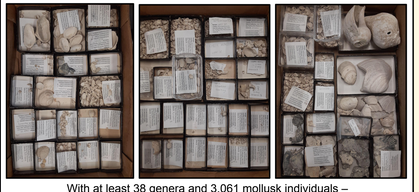


Shell Size, Shape, Taphonomy



Efforts were made to sort the shells by genus and size, and to record the numbers of whole, fragmented, and drilled shells. Bioeroded shells were also noted.

Out of the 5,710 shell specimens, most were between 5-20mm and only 4 specimens (*Mercenaria* and *Busycon*) were larger than 50mm. Many more bivalve and gastropod specimens were noted in the samples at sizes smaller than 5mm and thus not included in the data.


With at least 38 genera and 3,061 mollusk individuals – Upper 3C is the most diverse and one of the largest samples to date.

Preliminary Findings

Diversity & Abundance
- To date 26 bivalve genera and 12 gastropod genera are documented in Upper 3C.
- *Mulinia*, *Spisula*, and *Donax* are the most abundant genera – 89% of all the bivalves.
- *Crepidula* is the most abundant gastropod making up 83% of all gastropod specimens.
- Comparing with the other samples, Upper 3C had many more *Abra* and several genera that were not recorded previously, such as the bivalves *Chione* and *Cumingia*
- Yet, more challenging specimens remain to be identified and new genera are expected

Ecology
- Bivalves: The majority of specimens in this sample are infaunal-siphonate suspension feeders that are actively mobile and unattached to the substrate.
- Only a few genera, including *Abra* and *Nucula*, are infaunal deposit feeders.
- Gastropods: *Crepidula* is an epifaunal suspension feeder. All others are carnivores.

Predation & Bioerosion
- *Mulinia* had the greatest number of drillholes (46) which are presumed to be from naticids, and evidence of bioerosion (53 shells) is mainly by polychaetes and sponges.
- Details on predation and bioerosion across all samples are the focus of another poster.

Shell Size, Shape, and Taphonomy
- Size: The vast majority of the shells were <30mm and only a few were >50mm.
- *Mulinia* and *Spisula* shells were roughly sorted by size into groups of <10mm, 10-20mm, and >20mm shells, with the larger shells being the least numerous.
- 1000+ Mactridae specimens <5mm were also found although not included in the data (yet add evidence to support deposition of the assemblage in/near the original habitat).
- Shape: ⅓ of the shells were fragmented and the broken edges are sharp, indicating durophagy as a source of shell breakage rather than weathering by transport.
- Over 50% of the *Abra* shells were fragmented, likely due to their thin, fragile shells.
- 22.8% of gastropods were fragmented (about 5-10% lower than other samples), but many individuals were not counted due to missing apices, seemingly the weakest part.
- Taphonomy: These unaltered hard parts (mostly aragonitic composition) look overall well-preserved, and only 0.4% of the shells were too poorly preserved to be identified.
- *Nucula* was the only genus that had some articulated shells preserved with a shiny periostracum, which is not surprising given their life mode, size, and shell structure.
- The periostracum was also noticed in other small mollusks that were around 5mm.

Non-molluscan taxa: encrusting bryozoans, corals, sea urchin spines, and a crab dactyl

Conclusions & Future Work

- No published data are yet available for the Nashua Formation in studying the paleoecology of these communities in north-central Florida. This work adds to assemblage level analysis using *in situ* samples. Multiple samples were collected from lower and upper sections at the quarry and will be used to compare changes in space and time.
- These preliminary results will help in better understanding the range of similarities and differences across samples and localities and how variations in the formation might reflect both the inherent patchiness of benthic communities and deposits that may vary in time.
- More research is needed in regards to further processing of this sample, and additional material collected *in situ* from the quarry should also be analyzed. New comparisons to other deposits of this unit that may exist elsewhere is needed as well. Further work on the Nashua Formation could help researchers better understand community changes in an understudied part of the Plio-Pleistocene coastline in north-central Florida.

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