CHECKLIST OF MEGAFOSSILS FROM THE JAMES CITY FORMATION (LOWER PLEISTOCENE) AT JOHNSON POINT, CRAVEN COUNTY, NORTH CAROLINA

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INTRODUCTION

Richly fossiliferous beds exposed along the northern edge of Johnson Point, south shore of the Neuse River (Figure 1), have been the focus of several recent studies (Miller, 1986a, 1986b; Zullo and Miller, 1986; Woods, 1987; Miller and DuBar, 1988). The locality was first described by DuBar *et al.* (1974, p. 111) as the site of an extensive *Crepidula fornicata* biostrome within the James City Formation. Because of the interest being lavished on the locality it is important to have a catalogue available of all the megafossil remains that have been collected to date. Moreover, in a geographic area where fossil localities in river banks are notoriously evanescent, full documentaion of species occurrences at significant sites like Johnson Point is clearly desirable. The purpose of my note is to provide this documentation in the form of a stratigraphic checklist (Table 1) together with illustrations of the more common species (Plate 1). The list includes rare faunal elements not reported in paleoecologic studies (Zullo and Miller, 1986; Miller and DuBar, 1988). Illustrations should be useful in the recognition of James City beds in isolated outcrops in the Neuse River valley. All fossils in this list came from a series of one-litre bulk sediment samples taken from one part of the outcrop in 1982 after undercutting of the river bank had exposed unweathered beds. The aim at that time was to sample each bedding unit present in the fresh exposure. Figure 1 shows the sampled section and Table 1 contains fossil inventories for each of the samples. Additional collecting in this way no doubt would lengthen the roster, but the present compilation at least provides a preliminary checklist.

STRATIGRAPHIC CONTEXT

Regional. – The James City Formation was named by DuBar and Solliday (1963), who designated the river bank exposures near Grantham as the type section (Figure 1). They regarded the unit as possibly Pliocene in age, being situated unconformably below the Pleistocene Flanner Beach Formation. Later work on foraminiferids and mollusks showed the type James City to be early Pleistocene (DuBar *et al.*, 1974). This age revision has been confirmed subsequently by multiple lines of evidence (Blackwelder, 1981a; McCartan *et al.*, 1982). The James City is usually considered time-equivalent with the Waccamaw Formation in southeastern North Carolina and northeastern South Carolina, and with the Caloosahatchee Formation in Florida. However, Cronin *et al.* (1984, p. 45-46) proposed recently that the James City may be slightly younger (1.3-0.7 Ma) than the main part of the Waccamaw. The outdated term "Croatan Formation" has been applied to James City equivalents exposed in the Lee Creek phosphate mine 40 km to the north in Beaufort County (see Ray, 1983).

General depositional environment of the James City in its type area was a shallow, subtropical marine bay having fairly open communication with the ocean (DuBar and Howard, 1969; DuBar *et al.*, 1974; Blackwelder, 1981b). More restricted estuarine facies appear to be preserved at the Fountain quarry locality, Pitt County, described by Snyder and Katrosh (1979); a deeper water, bay-center facies crops out at an isolated downstream locality on the Neuse River near Dam Creek, Craven County (Fallaw and Wheeler, 1969, p. 52 and Plate 4, Fig. 1; Miller, 1985, Zullo and Miller, 1986). These deposits accumulated during an early Pleistocene high stand of sea level to approximately +25 m MSL, which Blackwelder (1981b, Fig. 2) attributed to a warm period occurring between two glacial pulses recognized in South America. The onset of cooler marine climates in the Western Atlantic Ocean and regression of the shelf sea terminating the James City depositional cycle appear to have resulted in extinction of roughly 17% of the mollusks listed here (see Blackwelder, 1981b; Stanley, 1986). Extinct species are designated with an asterisk in Table 1 and discussed below.

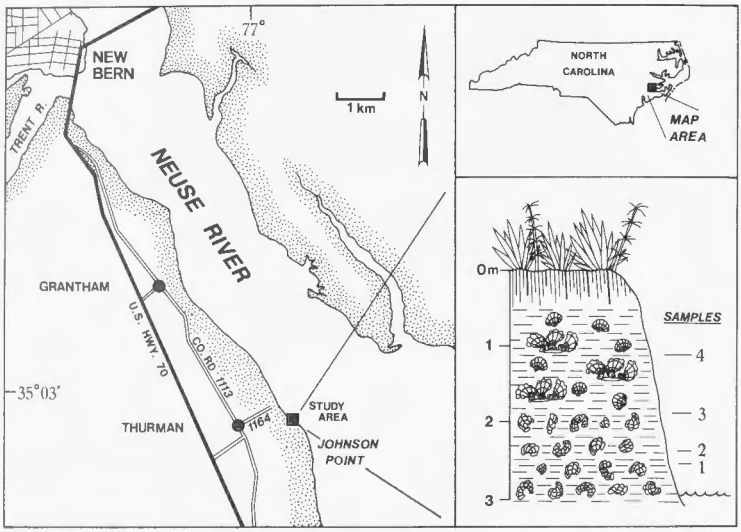

Figure 1. Location of Johnson Point in North Carolina Coastal Plain, showing stratigraphic section sampled in 1982. (Sample numbers same as those used in Table 1. River level is approximately mean sea level.)

Johnson Point Section. – The locality extends from the end of County Road 1164 (from which it can be easily reached) to the tip of Johnson Point, in a low vertical mudstone bank. Sediments are mostly medium bluish gray (5 B 5/1) to olive gray (5 Y 3/2), slighty indurated, shelly sandy mudstone to siltstone containing up to six shelly interbeds each about 10 cm thick. The only visible stratification is in the form of these laterally discontinuous shelly accumulations. Many epibenthic-attached and endobenthic bivalves are in living positions or only slightly disturbed indicating that the fossil deposits are largely autochthonous (Figure 2).

Johnson Point is notable for the occurrence of a well perserved biostrome in the lower 1.0 to 1.5 m of the exposure consisting of stacks of the slipper snail, *Crepidula fornicata* (Figure 2a). DuBar *et al.* (1974, p. 111) were the first to describe this fossil shell bank, which extends for 150 m along the outcrop face. The *Crepidula* biostrome (Table 1, samples 1 and 2) is succeeded by a slighty coarser mudstone bed rich in endobenthic bivalves and varied carnivorous/scavenging gastropods (samples 3 and 4). This bed contains many *Anadara aequicostata* with valves still conjoined (Figure 2b), as well as occasional clumps of *Ostrea sculpturata*. Population-level patterns within the *Crepidula* buildup have been described in detail by Woods (1987). The demise of the biostrome and replacement by a more diverse assembly of benthic organisms resulted from gradual habitat alteration and increase in environmental heterogeneity, possibly owing to local shoaling of the seafloor (Miller and DuBar, 1988).

This is the type locality for the newly described balanid barnacle, *Balanus neusensis* Zullo and Miller, 1986 (Plate 1, fig. 20), which appears to have biostratigraphic potential in correlating early Pleistocene

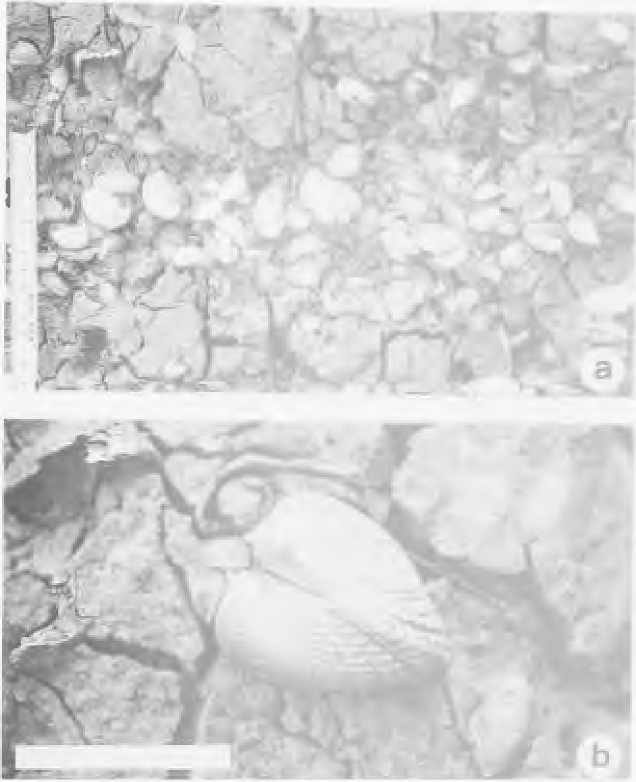

Figure 2. *a*, Shell layer with abundant *Crepidula fornicata* in lower part of exposure (ruler graduated in cm); *b*, *Anadara aequicostata* in upper part of exposure (bar scale represents 3 cm).

marine deposits in the Carolinas.

NOTES ON MOLLUSKS

Of the more than 70 species identified in samples, 59 are mollusks. Nearly half of these are small and rare. Eighteen of the 37 gastropods (48.6%) and 9 of the 21 bivalve species (42.9%) are represented by 10 or fewer individuals. Only 9 of the 59 mollusk species (15.3%) are numerically abundant in all samples. These include *Crepidula fornicata*, a high-spired variety of *Anachis lafresnayi*, *Anachis obesa*, *Nassarius albus*, *Boonea seminuda*, *Nuculana acuta*, *Anadara aequicostata*, *Ostrea sculpturata*, and *Abra aequalis*, all of which are represented by complete growth series with many juvenile specimens. Uncommon but conspicuous specimens of *Busycon* sp., *Noetia limula*, *Ar-*

Table 1. List of fossils from the James City Formation at Johnson Point. Sample numbers refer to Figure 1. Counts are specimen tallies corrected to estimate numbers of individual organisms (e. g., for bivalves 1 beak fragment = 1/2 individual). Because of mode of preservation (e.g., dismembered zoaria of fragile bryozoans), abundance of certain organisms given as: A, abundant; C, common; R, rare. Extinct taxa indicated with *.

TAXA	SAMPLES			
	1	2	3	4
GASTROPODA				
Cyclostremiscus obliquistriatus (H. C. Lea, 1843)*	–	–	–	*1*
Vermicularia cf. *knorrii* (Deshayes, 1843)	–	–	–	12
Cerithiopsis emersoni (C. B. Adams, 1838)	–	–	2	–
C. vinca Olsson & Harbison, 1953*	–	1	3	3
Seila adamsi (H. C. Lea, 1845)	4	1	7	6
Triphora dupliniana (Olsson, 1916)*	–	–	1	1
Triphora sp.	–	–	1	–
Epitonium apiculatum (Dall, 1889)	1	2	2	10
Melanella conoidea Kurtz and Stimpson, 1851	2	–	3	18
M. intermedia (Cantraine, 1835)	–	–	7	1
?Melanella sp.	–	1	–	–
Crepidula fornicata (Linné, 1758)	1292	545	586	447
C. convexa Say, 1822	1	2	2	2
C. plana Say, 1822	12	6	7	5
Crepidula sp.	–	–	–	1
Polinices sp.	–	3	2	14
Urosalpinx cinerea (Say, 1822)	5	2	13	17
Anachis lafresnayi (Fischer and Bernardi, 1856) var.	48	18	18	37
A. obesa (C. B. Adams, 1845)	30	25	19	21
Anachis sp.	6	–	–	–
Mitrella lunata (Say, 1826)	4	2	2	8
Busycon sp.	8	1	12	1
Nassarius albus (Say, 1826)	27	8	11	15
Olivella sp.	–	–	–	1
Prunum sp.	3	3	1	13
Hyalina sp.	–	–	1	3
? Turridae indet.	–	1	–	–
Booonea seminuda (C. B. Adams, 1837)	758	434	543	434
B. impressa (Say, 1821)	2	2	21	36
Odostomia conoidea (Brocchi, 1814)	–	–	1	–
Odostomia sp.	2	–	1	–
?Odostomia sp.	–	–	–	1
Turbonilla (Chemnitzia) sp.	–	3	22	19
T. (Pyrgiscus) sp. A	6	4	8	23
T. (Pyrgiscus) sp. B	2	1	7	8
Ringicula sp.	–	–	2	–
Acteocina candei (Orbigny, 1842)	1	–	–	–
BIVALVIA				
Nucula proxima Say, 1822	6	7	8	16
Nuculana acuta (Conrad, 1832)	138	62	144	287
Yoldia limatula (Say, 1831)	4	1	4	10
Anadara aequiscostata (Conrad, 1845)*	70	28	52	201
Noetia limula (Conrad, 1832)*	–	1	–	12
Modiolus sp.	–	–	1	5
Argopecten eboreus (Conrad, 1833)*	1	1	1	2
Ostrea sculpturata Conrad, 1840*	122	55	130	300
Parvilucina multilineata (Tuomey and Holmes, 1857)	–	1	–	1
Diplodonta sp.	–	–	–	1
Bornia longipes (Stimpson, 1855) var.	–	–	–	3
Ensitellops protexta (Conrad, 1841)	3	1	3	9

Spisula sp.	–	–	1	–
Mulinia lateralis (Say, 1822)	3	2	24	23
Ensis sp.	–	–	1	–
Tellina aff. *texana* Dall, 1900	–	–	–	1
Cumingia tellinoides (Conrad, 1831)	4	3	8	29
Abra aequalis (Say, 1822)	10	6	13	112
Mercenaria permagna (Conrad, 1838)*	7	4	14	28
Calloardia sayana (Conrad, 1833)	–	–	1	2
Sphenia sp.*	7	6	21	54
Corbula conradi Gardner, 1943*	–	1	2	10
Hiatella arctica (Linné, 1767)	–	1	2	4
POLYPLACOPHORA				
Chaetopleura sp.	1	1	1	2
CRUSTACEA				
Balanus spp.	224	124	210	218
Brachyura indet.	5	6	9	38
BRYOZOA				
Terebripora sp.	–	R	–	–
Spathipora sp.	C	C	A	C
Electra sp.	R	C	C	C
Cyclocolposa perforata Canu and Bassler, 1923	A	A	C	A
Cribrilina punctata (Hassall, 1841)	C	C	C	C
Celleporaria cf. *albirostris* (Smitt, 1873)	R	–	–	C
Hippoporina cf. *pertusa* (Esper, 1796)	C	C	C	C
Hipporprella cf. *gorgonensis* Hastings, 1930	–	–	R	–
DEMOSPONGIAE				
?Cliona spp.	C	C	C	C
POLYCHAETA				
Polydora spp.	C	C	C	C
?Hydroides sp.	R	–	–	–
SCLERACTINIA				
Septastrea sp.	R	R	–	R
ECHINOIDEA				
Clypeasteroida indet.	–	–	R	R
PISCES				
shark teeth	–	1	–	–
small teleost vertebrae	–	1	2	–

gopecten eboreus, and *Mercenaria permagna* are the mollusks normally recovered when surface-picking is the sole means of collection. Works consulted in the determination of mollusk species included: Tuomey and Holmes, 1857; Gardner, 1943, 1948; Olsson and Harbison, 1953; Waller, 1969; Abbott, 1974; Blackwelder, 1981c.

Beds exposed at Johnson Point are within Blackwelder's (1981c) molluscan zone M3, or *Glycymeris subovata-Anadara ovalis* Interval Zone (defined as the interval between last appearance of *G. subovata* and first appearance of *A. ovalis*). Zone M3 delineates the Windyan Substage of the Colerainian Stage, regional chronostratigraphic divisions of the Late Cenozoic in the Atlantic Coastal Plain (Blackwelder, 1981c, Text-fig. 1). Several extinct bivalves restricted to the Colerainian in the Carolinas occur at Johnson Point: *Anadara*

aequicostata, Noetia limula, Ostrea sculpturata, and *Mercenaria permagna* (see Plate 1). The extinct scallop *Argopecten eboreus,* which is rare in samples, ranges through the Burwellian (includes the upper part of the Yorktown Formation) and Colerainian stages. Other extinct bivalves in the checklist with unknown stratigraphic durations are *Corbula conradi* and a possible new species of *Sphenia* (Plate 1). In addition, three species of small snails apparently are extinct: *Cyclostremiscus obliquistriatus, Cerithiopsis vinca,* and *Triphora dupliniana.*

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PLATE 1

Figures

1. *Crepidula fornicata* (Linné, 1758). Interior view, female or sexually transitional shell, 38 mm in length.
2. *Nassarius albus* (Say, 1826). Height 16 mm.
3. *Anachis lafresnayi* (Fischer and Bernardi, 1856) var. Height 19 mm.
4. *Urosalpinx cinerea* (Say, 1822). Height 16 mm.
5. *Boonea seminuda* (C. B. Adams, 1837). Height 11 mm.
6. *Melanella conoidea* (Kurtz and Stimpson, 1851). Height 9 mm.
7. *Anachis obesa* (C. B. Adams, 1845). Height 11 mm.
8. *Crepidula plana* Say, 1822. Interior view, 24 mm in length.
9. *Anadara aequicostata* (Conrad, 1845). Interior of right valve, length 54 mm.
10. *Nuculana acuta* (Conrad, 1831). Interior of left valve, length 11 mm.
11. *Noetia limula* (Conrad, 1832). Exterior of left valve, length 60 mm.
12. *Sphenia* sp. Exterior of broken right valve, length 10 mm.
13. *Mercenaria permagna* (Conrad, 1838). Exterior of right valve, length 100 mm.
14. *Mulina lateralis* (Say, 1822). Interior of left valve, length 15 mm.
15. *Abra aequalis* (Say, 1822). Exterior of left valve, length 18 mm.
16. *Ostrea sculpturata* Conrad, 1840. Exterior or right valve, length 79 mm.
17. *Corbula conradi* Gardner, 1943. Interior of right valve, length 13 mm.
18. *Cyclocolposa perforata* (Canu and Bassler, 1923). Field of view is about 4 mm wide.
19. *Spathipora* (small) and *Polydora* (large) borings. Field about 3 mm wide.
20. *Balanus neusensis* (Zullo and Miller, 1986). Cluster length 57 mm, height 32 mm.
21. *?Cliona* borings in *Noetia* shell. Individual openings are approximately 1 mm in diameter.

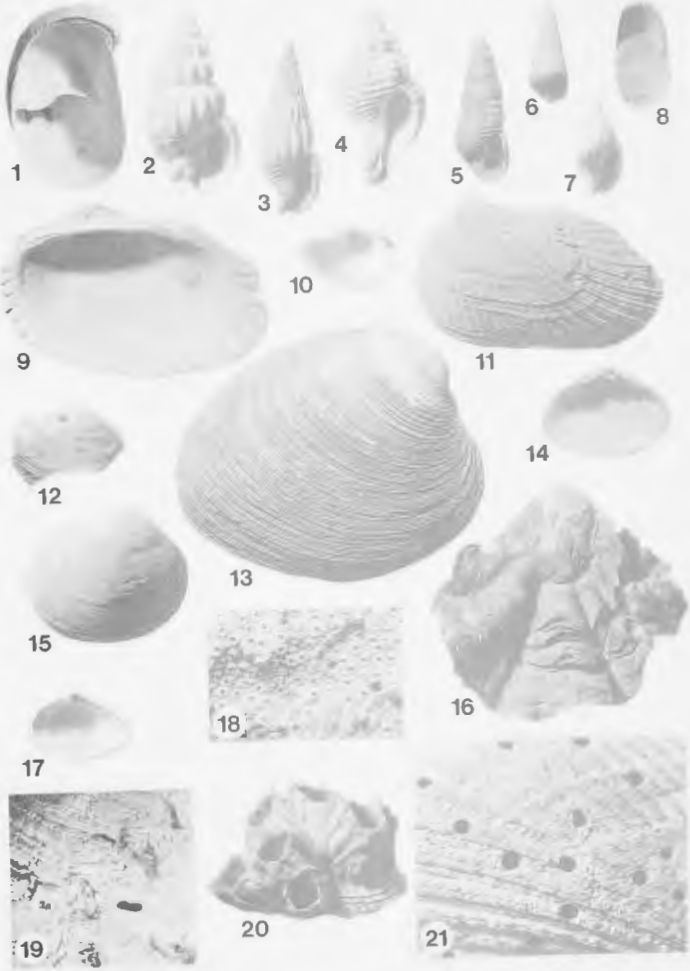

PLATE 1

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