Geology and Paleontology of the Lee Creek Mine, North Carolina, II

Foreword

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> Foreword . . . front matter likely to be of interest but not necessarily essential for the understanding of the text of a book and commonly written by someone other than the author[s] of the text.
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> WEBSTER'S THIRD NEW INTERNATIONAL DICTIONARY, 1964.

The first of three proposed volumes on the "Geology and Paleontology of the Lee Creek Mine, North Carolina," has now been published (Ray, 1983). This, the second, volume is devoted exclusively to the Mollusca. Truly comprehensive coverage of this most conspicuous component of the Lee Creek macrofauna justifiably could have occupied at least twice the space. Faunal studies of the mollusks of the Pungo River and Yorktown formations comparable in scope to those of the James City and Chowan River formations (Ward and Blackwelder, this volume) remain as prime desiderata. A mollusk-rich, late Pleistocene bed of regional significance became well exposed by mining too late for inclusion in this volume. Detailed studies as dictated by abundance and state of knowledge of given taxonomic groups, exemplified by the chapters on *Aturia* (Furnish and Glenister, this volume), pycnodonts and ecphoras (Wilson, this volume), and pectens (Gibson, this volume), would be equally well warranted for numerous additional taxa.

The rich shell beds of the middle Atlantic Coastal Plain were of practical interest from the early days of British settlement, as a source of lime for mortar (Ray, 1983:4). Later, in the nineteenth century, these "shell marls" were used extensively to improve the argicultural lands of the coastal plain (see, for example, Olmsted, 1827; Croom, 1835; Emmons, 1858; Mitchell, 1981; Allmendinger, 1985).

Mollusks from the Yorktown Formation of Virginia were the first fossils of any kind from the Western Hemisphere to receive scientific attention and to be illustrated in publication, both nearly 300 years ago. The centerpiece of this story is the classical monument of malacology, Martin Lister's *Historiae Conchyliorum,* parts of which were published for the first time at least from 1685 to 1692, if not to 1697, and probably posthumously, as late as 1770. Some aspects of the paleontological part of the story have been presented by subsequent authors, but as yet not both completely and correctly. The problems stem primarily from Lister's confusing practices in the printing, distributing, and publishing of his great work, a subject of research in itself beyond our scope here, to which a good introduction may be gained from Wilkins (1957), Sawyer (1962), and Keynes (1981). It is unlikely that any two copies of the work as prepared during Lister's lifetime are identical; plates were repeatedly modified as successive "proofs" were printed and variously distributed; some plate numbers were omitted and others duplicated; in no case is it correct to cite 1685 as date of publication in connection with North American fossils.

That Lister's 1000-plus plates include representation of some North American fossil shells was recognized nearly 200 years ago by Lightfoot (1786:162), who listed as number 3516 in his catalogue for auction of the Portland

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Museum "a very curious and rare species of Buccinum in a fossil state, having four high sharp ridges, from *Maryland, very rare—Lister*, 1059.2." However, his observation seems to have had no impact on contemporary or later authors. Other early authors apparently did not recognize as a fossil the specimen represented by Lister (e.g., Schröter, 1783:361; Dillwyn, 1823:48), and Dillwyn referred it to the living species *Buccinum scala,* regarded as a junior synonym of the Indo-Pacific *Thais (Trochia) cingulata* by Dodge (1956:235–237), and earlier by Tryon (1880:170), who also noted that "the normal development of ribs strikingly resembles the fossil *Rapana (Ecphora) quadricostata*, Say, of the United States."

For practical purposes recognition of the significance of Lister's plates for North American paleontology came when Say (1824:134) ascribed a shell illustrated by Lister to his own new species, *Pecten jeffersonius,* based on material then thought to have come from Maryland, but later recognized as coming from Virginia (Gardner, 1943:38, 1948:201; Ward and Blackwelder, 1975:3–4; Wilson, this volume, p. 21). Harris (1937:443) apparently was the first to consider without question that three North American fossils were so represented, as reflected in the following statement: "We have often wondered by what home-returning sailor, specimens of *Ecphora quadricostata, Pecten jeffersonius,* and *Venus tridacnoides* were brought from our colonial shores . and published in . . Lister's *Historiae Conchyliorum."*

Lister's figure of the snail, *Ecphora,* has been widely regarded as the first published (supposedly in 1685) of a North American fossil, but the year and priority are certainly wrong and the specific identification as *E. quadricostata* is questionable. Lister's figure is reproduced here (Figure 1F) along with photographs of specimens of *E. quadricostata* from the Lee Creek Mine (Figure 1A–E). Say (1824:128) had speculated upon the similarity between his new species, *Fusus 4-costatus,* and that figured by Lister, but rejected their identity because Lister's specimen seemed to lack an umbilicus. Conrad (1864:211) however, regarded Lister's figure as representing a rare variety of the species, as he had himself found one specimen without umbilicus. Recent efforts to locate Conrad's specimen in the collections of the Academy of Natural Sciences of Philadelphia have not as yet been successful (Carol Jones, pers. comm.). The specific identification might be resolved if the original specimen could be found. Shattuck (1904:xxxiv) simply asserted that "in 1685, Martin Lister published a figure of *Ecphora quadricostata.* This was the first American fossil to be figured, and the original came from the Miocene of Maryland." Martin (1904:207, pl. 52: fig. 3) cited Lister in his synonymy of *E. quadricostata* and reproduced Lister's figure. Vokes (1957:30, pl. 25: fig. 1) followed these authors and reproduced the figure again. Ward and Blackwelder (1975:3) were the first to point out that none of Lister's illustrations of the three North American mollusks was published as early as 1685, and that both *Chesapecten jeffersonius* and *Mercenaria tridacnoides* preceded *Ecphora.* However, their assertion that the figure of *Ecphora* was published in 1692 seems not to be demonstrable. Available evidence indicates that it was first published in the Huddesford (1770) edition of Lister (Wilkins, 1957:204; Wilson, this volume; Robert Cross, British Museum (Natural History), pers. comm.).

Conrad (1840:46; in Dall, 1893:68) agreed with Say's (1824) identification of Lister's scallop as *Pecten jeffersonius,* but regarded the peculiarities of the shell margin as resulting from attachment of barnacles, rather than from abnormality in growth as implied by Say. Ward and Blackwelder (1975, pl. 1) and Blackwelder and Ward (1976, frontispiece) reproduced Lister's figure of *Chesapecten jeffersonius,* which they regarded, correctly it seems, as indeed the first illustrated (and described, though not formally) North American fossil. *C. jeffersonius* is unique among the three in that it has descriptive text both on the original plate (Figure 2 here) and in annotations written by Lister and published by Huddesford (1770), all reproduced in full (and that on the plate translated) by Ward and Blackwelder (1975:15).

Conrad (1838:10; in Dall, 1893:28) apparently was the first to recognize among Lister's plates the third example of a North American fossil, the clam *Venus tridacnoides,* an identification accepted also by Gardner (1943:132). Wilson (1983:485) has traced the nomenclatural history of this taxon, which should now be known as *Mercenaria corrugata.* Lister's figures are reproduced here as Figure 3.

These North American fossils probably came into Lister's hands through much more purposive acts than a sailor's curio-collecting. Ewan and Ewan (1970:312) made a strong circumstantial case for their having been received from John Banister, who certainly sent specimens to Lister and others, and who lived and collected on the Virginia coastal plain from 1678 to 1692. Banister's untimely death foreclosed any possibility of completing his planned natural history of Virginia, which undoubtedly would have provided a more nearly adequate record of his extensive contributions, including those in paleontology. The two bivalves illustrated by Lister, now assigned to species of the Yorktown Formation, in all probability were collected by Banister. The *Ecphora* seems less certain in that its specific identity is questionable; it appeared only in one of the last supplemental plates, at least some years after Banister's death, and it is labeled in the figure as "a Marilandia." According to Druid Wilson (pers. comm.) extreme variants of *Ecphora* are to be expected in the pre-Yorktown Miocene and in Maryland, but not in the Yorktown Formation and not in Virginia. The illustrated specimen well might have been obtained by Hugh Jones who served in the ministry in Maryland from 1696 through 1701, during most of that time in Christ Church Parish, Calvert County (Ewan and Ewan, 1970:111; Frick et al., in press; Reveal, 1984). He

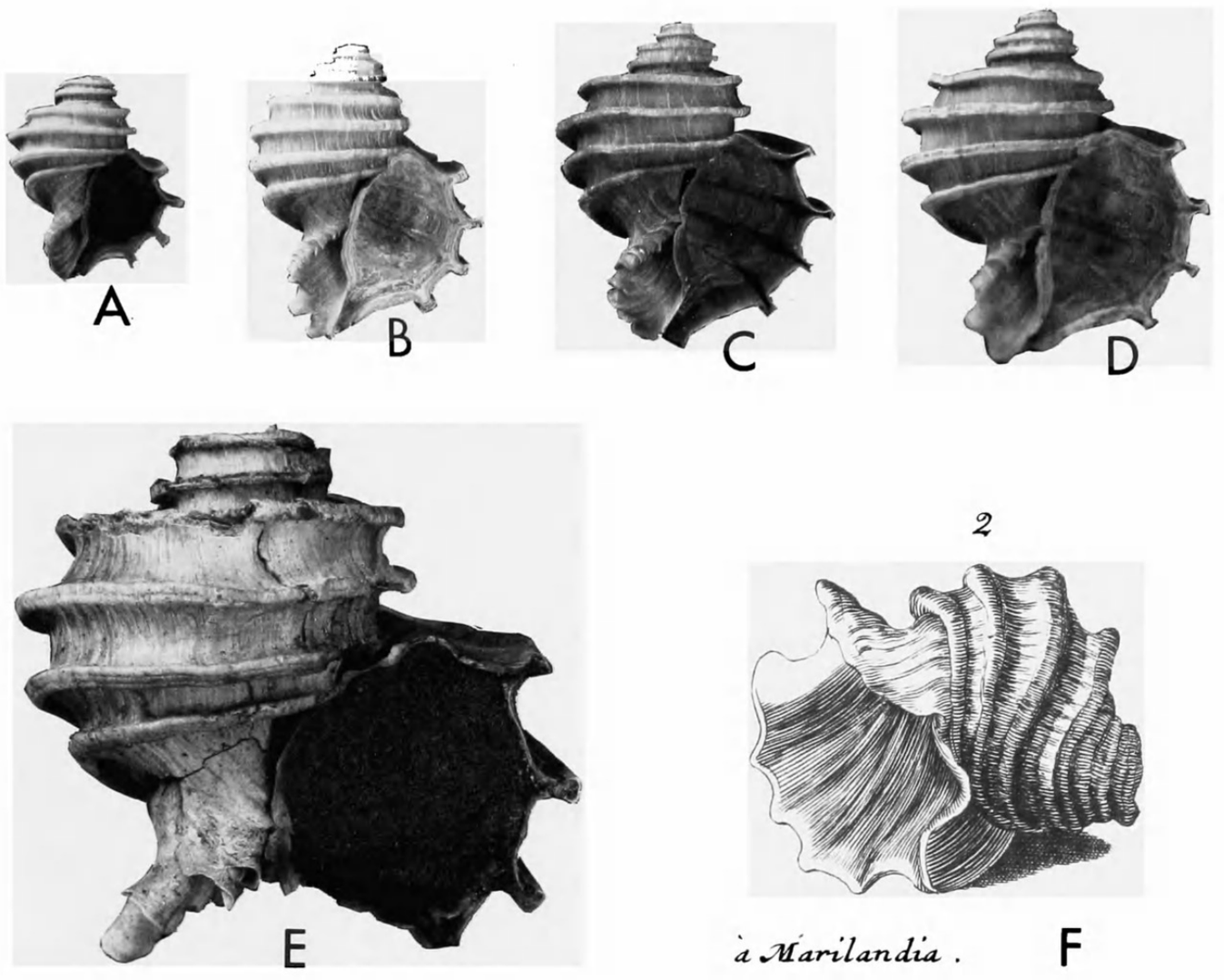
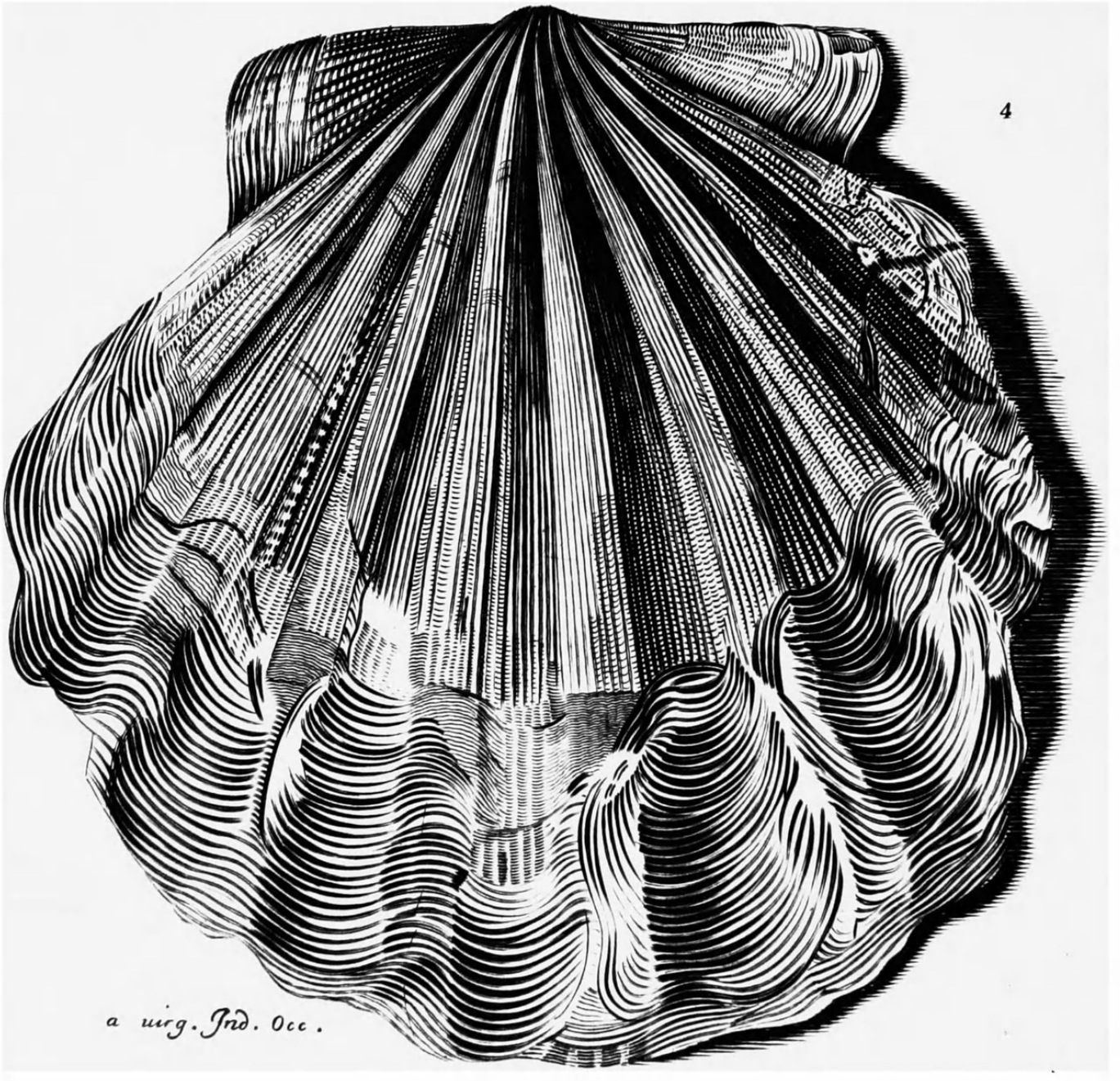


FIGURE 1.—Ecphoras from the Atlantic Coastal Plain: A–E, *Ecphora quadricostata*, Yorktown Formation, Lee Creek Mine, North Carolina, approximately ×1 (A, USNM 371353, and B, USNM 371352, collected by Druid Wilson from spoil heaps; C, USNM 371354, and D, USNM 371355, collected by Jack H. McLellan from spoil heaps. E, USNM 371351, collected by Peter J. Harmatuk in place in basal bed of Yorktown Formation). F, *Ecphora* sp., collector and formation unknown; from Maryland according to original figure caption (first published in, and reproduced at approximately original size from, Lister, Huddesford edition, 1770, pl. 1059: fig. 2).

was described in 1699 by the British naturalist James Petiver as "a very curious Person in all parts of Natural History; particularly in Fossils; some of which he hath sent me from Maryland . " (Dandy, 1958:142). These may in part have been among the fossils sent in 1697 to England by Jones, apparently intended for Edward Lhwyd, but diverted to other hands, probably including those of Petiver and John Woodward (Frick et al., in press). Woodward "evidently" lent fossils to Lister for illustration (Keynes, 1981:31). Petiver's friend, Dr. David Krieg, would seem to have been yet another possible source of the *Ecphora,* as he collected in Maryland in 1698, at least informally under the aegis of the Temple Coffee House Botany Club, which included Sloane and Lister, and later apparently prepared some of Lister's plates for engraving (Frick et al., in press).

It seems not at all improbable that some or all of these historic fossils may yet be rediscovered, although thus far none of Lister's specimens has been identified positively in the Ashmolean Museum at Oxford (MacGregor, 1983; confirmed by H.P. Powell, Oxford University, pers. comm.). Lister of course used other collections extensively, including those of the Dutchess of Portland and Sir Hans Sloane, including ultimately that of Petiver. Wilkins (1953) did not record the American fossils among Listerian shells recognized in the Sloane Collection, but it is not clear that he searched the paleontological holdings. However, a recent

4. pecten omnium longè maximus, minùs cauus, octo uel decem, ad Summum, strijs donatus; item huic canaliculi profundi.



167

FIGURE 2.—*Chesapecten jeffersonius* (Say, 1824), right valve (thought to have been collected by John Banister from the Yorktown Formation of Virginia; first published in Lister, 1687, pl. 167; reproduced at approximately original size from Huddesford edition, 1770).

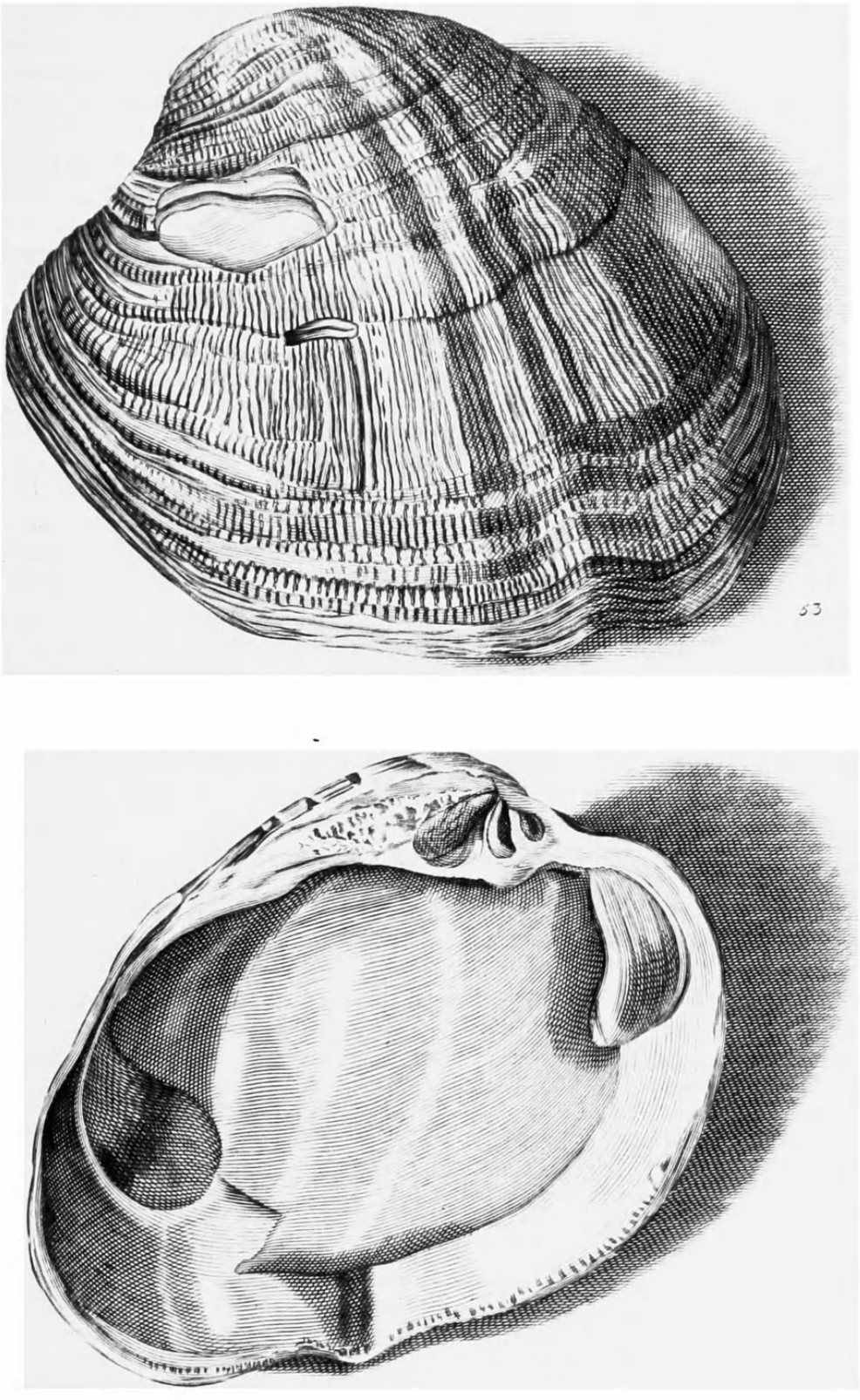


FIGURE 3.—*Mercenaria corrugata* (Lamarck, 1818), left valve in external (above) and internal (below) aspects (thought to have been collected by John Banister from the Yorktown Formation of Virginia; first published in Lister, 1688, pl. 499; reproduced at approximately 0.8 original size from Huddesford edition, 1770).

search of both the modern and fossil collections of the British Museum (Natural History) did not yield Lister's *Ecphora* (John Cooper, British Museum (Natural History), pers. comm.) Interestingly Wilkins (1953:14) did note that "the last five plates [1055–1059] seem to have been drawn by different artists [the identity of Lister's artists and engravers is a special problem, discussed at length by Keynes, 1981:25–35], most of the specimens being from collections other than those connected with the present account." The appearance of *Ecphora* in one of those plates suggests a history for it later than and separate from that for *Chesapecten* and *Mercenaria*. Could it be the very specimen listed by Lightfoot? The specimens scarcely can be recovered through further speculation from this side of the Atlantic, but might be pursued fruitfully in England and possibly on the Continent.

Meanwhile, because Lister's figures are the starting point in the study of mollusks of the Chesapeake series, and because the figures are available together in no single, recent, widely distributed publication, it seems that the present volume is a suitable place for their reproduction. Accordingly, they are presented here in Figures 1–3, with data as presently understood in the respective captions. All of the figures and their plate numbers are taken from the Huddesford edition (1770), specifically from the copy in the library of the Division of Mollusks, National Museum of Natural History, Smithsonian Institution.

Of course Lister's work was pre-Linnaean, and however interesting antiquarially, had only limited relevance to North American paleontology, except as a harbinger of things to come. The superabundance of well-preserved mollusks in the deposits of the Atlantic Coastal Plain inevitably resulted in intensive and extensive research as the sciences of malacology and paleontology developed. Following close upon the pioneering work by Say (1819–1824; see Summers, 1982), Conrad began his sustained and voluminous flow of publications extending at least from 1830 to 1877 (see Dall, 1893, especially pages v-xiv, for proof that Conrad was a worthy successor to Lister in the arena of idiosyncratic publication). The modern era of basic descriptive and increasingly synthetic taxonomic work spans approximately a century, and this long and strong tradition continues vigorously, as evidenced in the chapters by contributors to this volume, where citations to many of the writings of their predecessors may be found. The existence and progressive improvement and expansion of a broad and deep database of this kind are the indispensable prerequisites to addressing questions of a more theoretical or abstract nature, as exemplified by Blackwelder (1981), Stanley and Campbell (1981), Miyazaki and Mickevich (1982), and Kelley (1983).

General acknowledgments relating to the Lee Creek project may be found in Ray (1983:9–11). With regard to this foreword, I wish to thank Joseph Ewan for reading and improving the manuscript; James L. Reveal for information on Hugh Jones; Carol Jones for trying to find specimens at the Academy of Natural Sciences of Philadelphia alluded to by Timothy Conrad; Stephen Keynes for responding to my letter to his father, the late Sir Geoffrey Keynes; John Cooper and H.P. Powell for information about collections at the British Museum (Natural History) and Oxford, respectively; Robert Cross and associates at the British Museum (Natural History) for looking into publication dates of Lister; the late Joseph Rosewater for access to *Historiae Conchyliorum* and other rare molluscan literature; Victor E. Krantz for photographs; Lawrence B. Isham, for preparing the figures as a "rush" job on the last afternoon of his last day before retirement, after more than 30 years at the Smithsonian Institution; and Mary Parrish for modification of Figures 1 and 3.

Finally, it should go without saying, but must not, that I have no credentials in malacology; even these historical notes are derivative. Any slight augmentation of my minimal layman's knowledge of the subject is to be attributed primarily to the authors of the chapters in this volume, to whom I am deeply indebted, both for specific assistance to me and for fortitude and patience in seeing this volume to completion. The preceding unquestionably fulfills every criterion of a foreword, with one debatable exception. If indeed it is "likely to be of interest," that results in significant part from Druid Wilson's influence.

Literature Cited

Allmendinger, David F., Jr.
1985. The Early Career of Edmund Ruffin, 1810–1840. *The Virginia Magazine,* 93(2):127–154.

Blackwelder, Blake W.
1981. Late Cenozoic Marine Deposition in the United States Atlantic Coastal Plain Related to Tectonism and Global Climate., *Palaeogeography, Palaeoclimatology, Palaeoecology,* 34:87–114.

Blackwelder, Blake W., and Lauck W. Ward
1976. *Stratigraphy of the Chesapeake Group of Maryland and Virginia.* (Guidebook 7b: Northeast-Southeast Sections Joint Meeting 1976). 55 pages, frontispiece, 3 plates, 15 figures. Arlington, Virginia: Geological Society of America.

Conrad, Timothy A.
1838. *Fossils of the Medial Tertiary of the United States, No. 1,* pages xvi + 32, plates 1–17. Philadelphia: Judah Dobson. [Reprinted in Dall, 1893:1–52, plates 1–17.]
1840. *Fossils of the Medial Tertiary of the United States. No. 2,* pages 33–56, plates 18–29. Philadelphia: Judah Dobson. [Reprinted in

Dall, 1893:53–80, plates 18–29.]

1864. Notes on Shells, with Descriptions of New Fossil Genera and Species. *Proceedings of the Academy of Natural Sciences of Philadelphia,* 16:211–214.

Croom, H.B.

1835. Some Account of the Organic Remains Found in the Marl Pits of Lucas Benners, Esq. in Craven County, N.C. *American Journal of Science and Arts,* 27:168–171.

Dall, William Healey, editor

1893. *Republication of Conrad's Fossils of the Medial Tertiary of the United States, with an Introduction by William Healey Dall.* xviii + 136 pages, 49 plates. Philadelphia: Wagner Free Institute of Science Special Publication. [Also footnotes, references to plates, and index by Dall.]

Dandy, J.E.

1958. *The Sloane Herbarium: An Annotated List of the* Horti Sicci *Composing It; with Biographical Accounts of the Principal Contributors, Based on Records Compiled by the Late James Britten, with an Introduction by Spencer Savage.* 246 pages, frontispiece, 2 plates. London: British Museum (Natural History). [Page 246 followed by 96 facsimiles of handwriting of contributors to herbarium, on 32 unnumbered pages.]

Dillwyn, L.W.

1823. *An Index to the* Historia Conchyliorum *of Lister, with the Name of the Species to Which Each Figure Belongs, and Occasional Remarks.* 48 pages. Oxford: Clarendon Press.

Dodge, Henry

1956. A Historical Review of the Mollusks of Linnaeus, Part 4: The Genera *Buccinum* and *Strombus* of the Class Gastropoda. *Bulletin of the American Museum of Natural History,* 111(3):153–312.

Emmons, Ebenezer

1858. Agriculture of the Eastern Counties; Together with Descriptions of the Fossils of the Marl Beds. In *Report of the North-Carolina Geological Survey,* xvi + 314 pages, more than 256 figures. Raleigh: H.D. Turner. [Reprinted in part, 1969, *Bulletins of American Paleontology,* 56(249):57–230, with new index.]

Ewan, Joseph, and Nesta Ewan

1970. *John Banister and His Natural History of Virginia, 1678–1692.* xxx + 486 + [2] pages, 9 "charts and exhibits," 70 figures. Urbana, Chicago, London: University of Illinois Press.

Frick, George F., James L. Reveal, C. Rose Broome, and Melvin L. Brown

In press. Botanical Explorations and Discoveries in Colonial Maryland, 1688 to 1753. *Huntia,* 7.

Gardner, Julia

1943. Mollusca from the Miocene and Lower Pliocene of Virginia and North Carolina, Part 1: Pelecypoda. *United States Department of the Interior, Geological Survey, Professional Paper,* 199-A:iv + 178 pages, plates 1–23, 4 figures, 2 tables. [Published January 1944.]

1948. Mollusca from the Miocene and Lower Pliocene of Virginia and North Carolina, Part 2; Scaphopoda and Gastropoda. *United States Department of the Interior, Geological Survey, Professional Paper,* 199-B:iv + 179–310 pages, plates 24–38.

Harris, Gilbert D.

1937. First Century of Progress in Cenozoic Marine Invertebrate Paleontology. *Bulletin of the Geological Society of America,* 48:443–462.

Huddesford, William

1770. *Martini Lister, M. D. Historiae sive Synopsis Methodicae Conchyliorum* . . . . 1059 + 22 numbered plates. Oxford. [see Keynes, 1981:43, for bibliographic details.]

Kelley, Patricia H.

1983. Evolutionary Patterns of Eight Chesapeake Group Molluscs: Evidence for the Model of Punctuated Equilibria. *Journal of Paleontology,* 57:581–598, 5 figures.

Keynes, Geoffrey

1981. Dr. Martin Lister: A Bibliography. *Godalming, St. Paul's Bibliographies,* 3: xii + 52 pages, 18 plates.

[Lightfoot, John]

1786. A Catalogue of the Portland Museum, Lately the Property of the Duchess Dowager of Portland, Deceased: Which Will Be Sold at Auction, by Mr. Skinner and Co. . . . . viii + 194 pages. London. [See S.P. Dance, 1962, The Authorship of the *Portland Catalogue* (1786). *Journal of the Society for the Bibliography of Natural History,* 4:30–34, regarding attribution to Lightfoot.]

Lister, Martin

1685–1692. *Historiae sive Synopsis Methodicae Conchyliorum* . . . . 1057 + 22 numbered plates. London. [see Keynes, 1981:41, for bibliographic details.]

MacGregor, Arthur, editor

1983. *Tradescant's Rarities: Essays on the Foundation of the Ashmolean Museum, 1683, with a Catalogue of the Early Collections.* xiv + 382 pages. Oxford: Clarendon Press.

Martin, George C.

1904. Systematic Paleontology, Miocene, Mollusca, Gastropoda. *Maryland Geological Survey, Systematic Geology and Paleontology Report,* 2:131–270, plates 39–63. [Plates with legends (pages 31–55) bound separately.]

Mitchell, Betty L.

1981. *Edmund Ruffin, a Biography.* xii + 306 pages. Bloomington: Indiana University Press.

Miyazaki, Joan M., and M. F. Mickevich

1982. Evolution of *Chesapecten* (Mollusca: Bivalvia, Miocene-Pliocene) and the Biogenetic Law. *In* Max K. Hecht, Bruce Wallace, and Ghillean T. Prance, editors, *Evolutionary Biology,* 15:369–409, 6 plates, 18 figures, 6 tables. [New York and London: Plenum Press.]

Olmsted, Denison

1827. *Report on the Geology of North-Carolina, Conducted under the Direction of the Board of Agriculture, Part II.* pages 85–155. Raleigh: North Carolina Board of Agriculture.

Ray, Clayton E., editor

1983. Geology and Paleontology of the Lee Creek Mine, North Carolina, I. *Smithsonian Contributions to Paleobiology,* 53: 529 pages, frontispiece, 95 figures, 101 plates.

Reveal, James L.

1984. Hugh Jones (1671–1702)—Calvert County Naturalist. *The Calvert Historian,* 1(2):1–11.

Sawyer, F. C.

1962. A Copy of *De Cochleis* and Two Copies of the *Historia Conchyliorum* of Martin Lister (1638–1712). *Journal of the Society for the Bibliography of Natural History,* 4:28–29.

Say, Thomas

1824. An Account of Some of the Fossil Shells of Maryland. *Journal of the Academy of Natural Sciences of Philadelphia,* 4:124–155, plates 7–13. [Reprinted, 1896, *Bulletins of American Paleontology,* 1(5):300–346, plates 26–32.]

Schröter, Johann Samuel

1783. *Einleitung in die Conchylienkenntniss nach Linné, Erster Band, von den Schnecken.* xxxii + 860 pages, 3 plates. Halle: Johann Jacob Gebauer.

Shattuck, George Burbank

1904. Geological and Paleontological Relations, with a Review of Earlier Investigations. *In* William Bullock Clark, George Burbank Shattuck, and William Healey Dall, The Miocene Deposits of Maryland. *Maryland Geological Survey, Systematic Geology and Paleontology Report,* 2:xxxiii-cxxxvii.

Stanley, Steven M., and Lyle D. Campbell

1981. Neogene Mass Extinction of Western Atlantic Molluscs. *Nature,* 293:457–459, 2 figures.

Summers, Gerald
1982. A Bibliography of the Scientific Writings of Thomas Say (1787–1834). *Archives of Natural History,* 11:69–81.

Tryon, George W., Jr.
1880. Manual of Conchology; Structural and Systematic, with Illustrations of the Species, Vol. II: Muricinae, Purpurinae. 289 pages, 70 plates. Philadelphia: published by the author.

Vokes, Harold E.
1957. Miocene Fossils of Maryland. *Maryland Board of Natural Resources, Department of Geology, Mines and Water Resources Bulletin,* 20:viii + 85 pages, 31 plates.

Ward, Lauck W., and Blake W. Blackwelder
1975. *Chesapecten*, a New Genus of Pectinidae (Mollusca: Bivalvia) from the Miocene and Pliocene of Eastern North America. *United States Department of the Interior, Geological Survey, Professional Paper,* 861: 24 pages, 7 plates, 2 figures, 3 tables.

Wilkins, Guy L.
1953. A Catalogue and Historical Account of the Sloane Shell Collection. *Bulletin of the British Museum (Natural History), Historical Series,* 1(1):1–48, plates 1–12.
1957. Notes on the *Historia Conchyliorum* of Martin Lister (1638–1712). *Journal of the Society for the Bibliography of Natural History,* 3:196–205, 1 figure.

Wilson, Druid
1983. The Lee Creek Enigma, *Mclellania aenigma,* a New Taxon in Fossil Cirrhipedia. *In* Clayton E. Ray, editor, Geology and Paleontology of the Lee Creek Mine, North Carolina, I. *Smithsonian Contributions to Paleobiology,* 53:483–498, 3 plates.