ABSTRACT—New collections from the Marshalltown Formation and basal Mount Laurel Sand along the Chesapeake and Delaware Canal in Delaware clarify the ammonite dating of the interval. The Marshalltown Formation yields *Pachydiscus* (Pachydiscus) *sp.*, *Menuties portlocki* (Sharpe, 1855) *complexus* (Hall and Meek, 1856), a subspecies restricted to the *Baculites gregoryensis* and *Baculites scotti* zones in the Western Interior of the United States, and *Didymoceras binodatum* (Kennedy and Cobban, 1993a) known only from the *B. scotti* zone of the Western Interior and correlatives in Arkansas and Texas. The basal part of the Mount Laurel Sand contains a complex assemblage preserved as phosphatic molds: *Nostoceras* (*Nostoceras*) *monotuberculatum* Kennedy and Cobban, 1993a, *Nostoceras* (*N.*) *sp.*, *Didymoceras platycostatum* (Kennedy and Cobban, 1993b), *D. stevensoni* (Whitefield, 1877) (previously thought to be from the Marshalltown) and *Exiteloceras jenneyi* (Whitefield, 1877). The last two are index species of their eponymous zones in the Western Interior. This sequence is compatible with ammonites from the Wenonah Formation, which lies between the Marshalltown and Mount Laurel to the north and contains ammonites indicative of the *Baculites scotti* zone, and the fauna from higher in the Mount Laurel Sand, which includes elements of the *Didymoceras cheyennense* and *Baculites compressus* zones of the Western Interior sequence.

INTRODUCTION

In most of its outcrop area in New Jersey, the Marshalltown Formation is a dark greenish-gray, very fine to fine, clayey, glauconitic sand, whereas the Mount Laurel Sand is largely a light gray to reddish-brown quartz sand that usually contains very little glauconite, the two units being separated by the Wenonah Formation (Owens et al. 1979). However, along the Chesapeake and Delaware Canal at the boundary between New Jersey and Delaware (where the Wenonah is absent; Owens et al. 1970, fig. 4), the unconformable contact between the Marshalltown and Mount Laurel is difficult to determine owing to the presence of a local glauconitic sand, here assigned to the basal Mount Laurel, that resembles the Marshalltown but contains *Exogyra cancellata* Stephenson, 1914, a bivalve known in New Jersey only from the Mount Laurel Sand. This glauconitic sand, about two meters thick on the canal at St. Georges, Delaware (Figures 1, 2), represents a condensed succession that contains fragments of ammonites characteristic of the Western Interior Campanian ammonite zones of *Didymoceras stevensoni* and *Exiteloceras jenneyi*. Examples of *D. stevensoni* and *E. jenneyi* from the Chesapeake and Delaware Canal were described by Cobban (1970). The specimens of *D. stevensoni* were thought to be from the Marshalltown Formation, whereas the examples of *E. jenneyi* were thought to be from the Mount Laurel Sand. Collections made since 1970 by members of the Monmouth Amateur Paleontologists Society (MAPS) of West Long Branch, New Jersey, from the condensed bed at St. George's, includes many fragments of *D. stevensoni* and *E. jenneyi*, as well as a few fragments referable to *Nostoceras monotuberculatum* Kennedy and Cobban, 1993a, and *Didymoceras platycostatum* (Kennedy and Cobban, 1993b). A few specimens of *Menuties portlocki* (Sharpe, 1855) *complexus* (Hall and Meek, 1856) and a fragment of *Didymoceras binodatum* (Kennedy and Cobban, 1993a) have also been collected from spoil heaps along the canal west of St. George's; they probably came from lower in the Marshalltown Formation.
Therefore, the basal Mount Laurel at this locality is an arena-
cceous calcilutite or a very calcareous glauconite quartz sand, a
lithology not observed in the formation elsewhere. Fossils are
abundant along this south-bank exposure, but *Exogyra cancel-
lata* occurs here rather than *E. ponderosa*. Locally, small dark-
brown phosphatized fossils of the same types are present. The
origin of these phosphatic fossils is not known, but they appear
to be derived from a different source than the larger calcitic
shells."

It would appear that Owens and Minard (1970) assigned the
condensed glauconitic unit to the Marshalltown Formation west
of St. Georges and to the Mount Laurel east of St. Georges.
Most of the fossils described in the present report came from
about two meters of dark, glauconitic, clayey sand exposed at
low tide along the south side of the canal just east of the bridge
at St. Georges; we believe it to be the unit assigned to the basal

**MARSHALLTOWN MOLLUSCAN FOSSILS**

Along the Chesapeake and Delaware Canal, Sohl and Mello
(1970, p. 41) reported 72 genera of mollusks (39 bivalves, 30
gastropods, and 3 cephalopods) from the Marshalltown Forma-
tion. They noted that the fossils were generally concentrated
in certain beds, and that *Exogyra ponderosa*, *Agerostrea falcata*,
large *Trigonia*, *Cardium*, *Cucullaea*, and *Cypradera*, were es-
pecially abundant. The cephalopods reported were the ammo-
nites Didymoceras? sp., *Anapachydiscus* sp., and *Parapachydis-
cus* sp. Sohl (1977, p. 89) observed that most fossils were phos-
phatic internal molds, but that calcitic-shelled ostreids were
commonly preserved intact. He also suggested that the Mar-
shalltown was deposited in a shelf to lower shoreface environ-
ment. Some of the Marshalltown bivalves and gastropods were
illustrated by Groot et al. (1954), Pickett (1972), and Lauginiger
(1988). Gallagher (1984) listed some of the typical bivalves and
gastropods found in the Marshalltown along with the ammonite
*Baculites ovatus* Say, 1820.

*Anapachydiscus* sp. can now be assigned to *Menuites portlocki*
(Sharpe, 1855) *complexus* (Hall and Meek, 1856). The few spec-
imens at hand are internal molds of dark gray, fine-grained,
highly glauconitic, clayey sandstone. The *Parapachydiscus* sp.
is placed better in *Pachydiscus* (P.) sp. Its lithologic composition
is similar to that of the *Menuites*. In the Western Interior, *Men-
uites portlocki complexus* occurs in the upper part of the zone
of *Baculites gregoryensis* and in the lower part of the overlying
zone of *B. scotti*.

**BASEL MOUNT LAUREL MOLLUSCAN FOSSILS**

Sohl (1977, p. 90) stated that the Marshalltown Formation
graded upward into the ostreid-dominated assemblages of the
Mount Laurel Sand. Near the base of the Mount Laurel at the
Chesapeake and Delaware Canal, a bed of *Pycnodonte mutabilis*
(Morton, 1828) was noted associated with a few *Exogyra can-
cellata* Stephenson, 1914. Sohl (1977, p. 90) reported that "im-
mediately above this basal bed, in gray, calcareous, very clayey,
glauconitic quartz sand" the diversity of the fauna greatly in-
creased to 62 species and that "Some transport or reworking
is plainly evident in this deposit. Many of the pycnodons are
highly bored by *Lithophaga* and *Cliona*, encrusted by Bryozoa,
and may be reworked from the underlying *Pycnodonte* bed. . .

The fine-grained texture of the sediment and its massiveness
suggests a probable lower shoreface environment into which
much of the faunal assemblage has been reworked." Some of
the basal Mount Laurel bivalves and gastropods were illustrated
by Groot et al. (1954), Pickett (1972), and Lauginiger (1988),
but the cephalopods were not treated.

Ammonites from the glauconitic condensed zone, assigned to
the lower part of the Mount Laurel Sand by Owens et al. (1970)
and Sohl (1977), consist of phosphatic fragments of the index
ammonites of the Western Interior zones of *Didymoceras steve-
nseni* and *Exiteloceras jenneyi*. The *Didymoceras* are light
brown, medium brown, or dark grayish-brown internal molds
that retain bits of fine-grained, clayey, glauconitic sandstone
matrix. Fragments of *Exiteloceras* are dark brown to black with
rusty-brown stains; they appear to be derived from a different
stratigraphic level than that of the *Didymoceras*. According to
Ralph Johnson (oral commun., 1995), the *D. stevensoni* were
collected in place from clayey, glauconitic sand exposed at low
tide on the south bank of the Chesapeake and Delaware Canal
just east of the bridge at St. Georges. The *Exiteloceras* fragments
were found as float on the outcrop at that locality. Other am-
mmonites found as float at that locality are two specimens of
*Nostoceras* (N.) *monotuberculatum* Kennedy and Cobban, 1993a,
a specimen of *Nostoceras* sp., and 10 specimens of *Didymoceras
platycostatum* (Kennedy and Cobban, 1993b).

**DISCUSSION**

The present interpretation of the sequence of fossils from the
Marshalltown Formation and basal Mount Laurel Sand along
the Chesapeake and Delaware Canal can be tested against the
faunal evidence from the Wenonah Formation, discussed by
Kennedy and Cobban (1994). The Wenonah is absent along the
Canal, being cut out in New Jersey, just east of the Delaware
River (Owens et al. 1970, fig. 5); it yields a fauna that can be
correlated with the *Baculites scotti* zone of the U.S. Western
Interior sequence. The Marshalltown Formation, which under-
lies the Wenonah in New Jersey yields *Menuites portlocki com-
plexus*, which occurs in the *scotti* zone and the underlying *Bac-
ulites gregoryensis* zone of the Western Interior, and *Didymo-
ceras binodosum*, which is restricted to the *scotti* zone. The
ammonites assigned to the basal Mount Laurel Sand yield ele-
ments of the *Didymoceras stevensoni* and the succeeding *Ex-
teloceras jenneyi* zone of the interior, with no evidence for the
*Didymoceras cheyennense* zone that separates the *scotti* and *steve-
nsoni* zones.

**CONVENTIONS**

The following abbreviations are used to indicate the reposi-
tories of specimens cited in the text.

USNM: U.S. National Museum of Natural History, Wash-
ington, D.C.

AMNH: American Museum of Natural History, New York,
N.Y.

MAPS: Monmouth Amateur Paleontologists Society, West
Long Branch, New Jersey.

Casts of certain specimens are kept at the U.S. Geological Sur-
vey, Denver, Colorado. The term rib index, as applied to het-
atomorfs, is the number of ribs in a distance equal to the whorl
height at the midpoint of the interval counted. All dimensions
are given in millimeters, with D = diameter, Wb = whorl breadth,
Wh = whorl height, U = umbilicus. Figures in parentheses are
ratios as a percentage of diameter.

**SYSTEMATIC PALEONTOLOGY**

Order Ammonoidae Zittel, 1884
Superfamily Desmocerataeae Zittel, 1895
Family Pachydiscidae Spath, 1922
Genus and subgenus Pachydiscus Zittel, 1884
Type species.—*Ammonites neubergicus* Hauer, 1858, page 12, plate 2, figures 1–3, plate 3, figures 1, 2, by the subsequent designation of de Grossouvre, 1894, page 177.

**PACHYDISCUS (PACHYDISCUS)** sp.

*Figure 3.14, 3.15*

**Description.**—USNM 445404 is wholly septate dark-gray phosphatic fragment filled with light-gray, very glauconitic, clayey sandstone. Maximum preserved whorl height 31 mm. Whorl section compressed with flattened inner flanks, convergent outer flanks, and rounded venter. Ornament of weak prorsiradiate primary and secondary ribs, convex on outer flank and crossing venter in a broad convexity. Suture complex, typical for genus.

**Discussion.**—Although indeterminate, this specimen is of interest as the first record of a compressed *Pachydiscus* of the *P. oldhami* (Sharpe, 1855)–*P. haldemsi* (Schlüter, 1867) group from the Campanian of the area. Similar fragments occur in the middle Campanian Pecan Gap and Annona chalks of Texas and Arkansas.

**Occurrence.**—Chesapeake and Delaware Canal. Probably from Marshalltown Formation.

Genus **MENUITES** Spath, 1922

**Type species.**—*Ammonites menu* Forbes, 1846, p. 111, pl. 10, fig. 1.

**MENUITES PORTLOCKI** (Sharpe, 1855)

**COMPLEXUS** (Hall and Meek, 1856)

*Figure 3.1, 3.2, 3.5–3.13*

*Ammonites complexus* **HALL AND MEEK, 1856, p. 394, pl. 4, fig. 1a–f.**

*MENUITES PORTLOCKI* (Sharpe, 1855) complexus (Hall and Meek, 1856).

**COBBAN AND KENNEDY, 1993, p. 2, pls. 1–3, pl. 4, figs. 4–10, pl. 5, figs. 1, 5–7, pl. 6, figs. 9–15, pl. 7, fig. 5, pl. 8, figs. 3, 4, text-fig. 2 (with synonymy).**

*MENUITES PORTLOCKI* (Sharpe, 1855). **KENNEDY AND COBBAN, 1994, p. 98, figs. 3.1–3.16.**

**Type.**—Lectotype, designated by Cobban and Kennedy (1993, page 2), is AMNH 9531/1, from the Gregory Member of the Pierre Shale in south-central South Dakota.

**Diagnosis.**—Dimorphic subspecies characterized by moderately depressed whorl section; inner whorls ornamented by strong, widely spaced ribs.

**Material.**—One septate microconch and four septate macroconchs.

**Description.**—All specimens are fragments ranging from 30 to 106 mm in diameter. Coiling very involute, with U = 24 percent of diameter, deep, with rounded wall. Whorl section depressed reniform with whorl breadth to height ratio of up to 1:22. Smallest specimen (Figure 3.1, 3.2), at diameter of 30 mm, has estimated 5–6 umbilical bullae per half whorl that are flattopped and appear to have been the bases of septate spines. Bullae give rise to narrow, distant, straight prorsiradiate ribs, either singly or in pairs, and there may be single shorter ribs intercalated above midflank. All ribs strengthen somewhat over ventrolateral shoulder and are nearly transverse on venter. This style of ornament extends to largest specimen (USNM 445418, diameter 95 mm). Ribs weak (Figure 3.5–3.11) or strong (Figure 3.12, 3.13) and number up to 12 per half whorl. Sutures poorly preserved, complexly subdivided, and typical for genus.

**Discussion.**—Dimorphism is extreme in this subspecies (Cobban and Kennedy, 1993). Large collections of well-preserved specimens from the Western Interior reveal that microconchs attain diameters of 70–110 mm, whereas macroconchs attain diameters of as much as 360 mm. Inner whorls of microconchs and macroconchs have strong, widely spaced ribs, but ornament on the adult body chambers is very different. Microconchs have conspicuous umbilical and ventrolateral tubercles and a loss of most ribbing which is rejuvenated at the aperture. Macroconchs have smooth body chambers.

USNM 445405 (Figure 3.12, 3.13) is an incomplete microconch that ends at the first appearance of a ventrolateral tubercle. USNM 445406, 445408 and 445410 (Figures 3.1, 3.2, 3.6–3.11) are parts of macroconch phragmocones that show the reduction in ribbing as the shells enlarge. USNM 445418 (unfigured) is a poorly preserved septate macroconch 96 mm in diameter.

**Occurrence.**—Marshalltown Formation, Chesapeake and Delaware Canal, Delaware. A MAPS specimen (A2015e) was found in the Marshalltown at Auburn, New Jersey, and Bernstein (1988, page 208) recorded *MENUITES?* from the Marshalltown of that area. *MENUITES PORTLOCKI COMPLEXUS* also occurs in the Wenonah Formation in New Jersey (Kennedy and Cobban, 1993). Large collections of well-preserved specimens from the Western Interior reveal that microconchs attain diameters of 70–110 mm, whereas macroconchs attain diameters of as much as 360 mm. Inner whorls of microconchs and macroconchs have strong, widely spaced ribs, but ornament on the adult body chambers is very different. Microconchs have conspicuous umbilical and ventrolateral tubercles and a loss of most ribbing which is rejuvenated at the aperture. Macroconchs have smooth body chambers.
Figure 2—Generalized geological map of the Chesapeake and Delaware Canal and adjacent parts of Delaware and New Jersey (modified from Owens et al., 1970).

1994) as well as at many localities in the Pierre Shale and equivalent rocks in Montana, South Dakota, Wyoming, Colorado, and Utah.

Suborder ANCYLOCERATINA Wiedmann, 1966
Superfamily TURRILITACEAE Gill, 1871
Family NOSTOCERATIDAE Hyatt, 1894

Genus and subgenus NOSTOCERAS Hyatt, 1894

Type species.—Nostoceras stantoni Hyatt, 1894, page 569; =Ancyloceras? approximans Conrad, 1855, page 266, by original designation.

NOSTOCERAS (NOSTOCERAS) MONOTUBERCULATUM
Kennedy and Cobban, 1993a

Figures 3.3, 3.4, 4, 5.1, 5.2, 5.12, 5.16, 5.17


Types.—Holotype is USNM 441493, paratypes are USNM 441494 to 441501, from the basal phosphate bed of the Annona Chalk at USGS Mesozoic locality D8826 near Yancy, Hempstead County, Arkansas.

Diagnosis.—Whorls in tight contact with narrow apical angle; densely ribbed; single row of small tubercles at midflank; two or three constrictions per whorl.

Material.—Three phosphatic internal molds of one or two whorls.

Description.—All specimens include parts of body chambers and two also include some of the phragmocone. Largest specimen (Figure 3.3, 3.4) has diameter of 42.5 mm and greatest whorl height of 21.5 mm. Translation rate is high producing high spire with low apical angle (Figure 5.1). Whorls in tight contact, and most of upper whorl face occupied by concave impressed zone to accommodate base of previous whorl. Outer and lower faces flattened and slightly convex. Junction of upper and outer and lower and outer whorl faces narrowly rounded. Eleven prominent, spirally elongate tubercles present at midflank linked by pairs of concave prorsiradiate ribs to upper whorl suture and by similar number to lower suture with in a few cases a nontuberculate rib between. Ribs flex forward and are strong and markedly convex on lower whorl face. Periodic distant constrictions present. Sutures (Figure 4) have moderately incised, bifid elements.

Discussion.—Nostoceras (N.) monotuberculatum differs from N. (N.) pauper (Whitfield, 1892, page 268, plate 45, figures 1–5; see revision in Cobban, 1974, page 12, plate 9, figures 1–22, text-figure 10) from the Navesink Formation in having one rather than two rows of tubercles. Nostoceras (N.) mendryki Cobban (1974, page 13, plate 10, figures 1–17, text-figure 11), also from the Navesink Formation, is a further species from the area that has two rows of tubercles.

Occurrence.—Float assumed to be from the lower part of the Mount Laurel Sand at the Chesapeake and Delaware Canal, St. Georges, Delaware. Also found at the base of the Annona Chalk in southwestern Arkansas. A single specimen was collected at the top of the upper sandstone member of the Mancos Shale near Aspen in west-central Colorado (Freeman, 1972, listed as Nostoceras cf. N. pauper). The Colorado specimen is probably from the zone of Didymoceras stevensoni.

NOSTOCERAS (N.) sp
Figure 5.9–5.11

Material.—Figured specimen MAPS A2038a from St. Georges on the Chesapeake and Delaware Canal, Delaware.

Description.—A complete whorl of 34 mm diameter has whorl height of 19 mm and apical angle approximately 30 degrees. Whorls in tight contact with deeply impressed upper whorl face. Outer whorl face broadly rounded; lower whorl face nearly flat.
Junction of upper and outer whorl faces abrupt; that of outer and lower faces more rounded. Ornament of 44 narrow ribs that are prorsiradiate on outer flank and rectiradiate on upper and lower whorl faces. Small, pointed tubercles present on every other rib or every third rib just above midflank. A second row of smaller tubercles present on every rib or every other rib at junction of outer and lower whorl faces. One constriction present parallel to ribs.

**Discussion.**—The specimen resembles similar-sized *Nostoceras* (*N.* sp.) pauper (Whitfield, 1892) in its apical angle, in the shape of its whorls, in the number of ribs per whorl, and in the presence of two rows of tubercles on every other or third rib. It differs only in having the rows of tubercles farther apart. The holotype of *N. (*N.*) pauper* is from a younger stratigraphic level (Navesink Formation, New Jersey). *Nostoceras (N.) danai* Kennedy and Cobban, 1993a (page 90, figures 7.2, 7.3, 7.6–7.20, 7.23, 12.6) also has two rows of tubercles and an apical angle like that of *Nostoceras (N.*) sp.*, but the outer flank is more flattened and the ribbing is denser.

**Occurrence.**—Float from the condensed bed in the lower part of the Mount Laurel Sand on the south bank of the Chesapeake and Delaware Canal just east of the bridge at St. Georges, Delaware.

**Genus Didymoceras** Hyatt, 1894

**Type species.**—*Ancyloceras nebrascensis* Meek and Hayden, 1856, page 71, by original designation.

**Didymoceras platycostatum** (Kennedy and Cobban, 1993b)

- **Figures 3.18, 3.19, 5.3–5.5, 6.1–6.9, 7, 8.1–8.3
- **Nostoceras (Nostoceras) platycostatum Kennedy and Cobban, 1993b**, page 131, pl. 2, figs. 16, 17, pl. 4, figs. 1–13, 33, 34, text-fig. 7A.

**Types.**—Holotype is USNM 441521, from the *Baculites scotti* zone in the Pierre Shale at USGS Mesozoic locality D1412 about 1.6 km north–northeast of Oral in the NW¼ NW¼ sec. 26, T7S, R. 7 E., Fall River County, South Dakota. Hypotype USNM 475020 is also from USGS Mesozoic locality D1412. Other hypotypes are USNM 475021–475037 from the Bergstrom Formation of Travis County, Texas, and USNM 475038 from USGS Mesozoic locality D904 in the Pierre Shale of Fall River County, South Dakota.

**Material.**—MAPS A2022b.

**Diagnosis.**—Earliest juvenile whorls in contact in helix, later whorls free in low open helical spire. Ornament of low, broad ribs generally flat-topped on internal molds but sharp and narrow on shell. Constrictions infrequent.

**Description.**—Whorl heights 20–34 mm, whorl section circular. Coiled in low, loose, open helical spire. Ornament of low, broad, flat-topped to rounded ribs strongest on outer whorl face, where rib index is 7 or 8. Owing to helical coiling, prorsiradiate ribs start across outer whorl face and then curve slightly forward on upper and lower faces and cross inner face with shallow convexity. Most ribs simple, but some bifurcations present. A few of the flat-topped ribs have a median groove. One specimen has an occasional very low, broad ventrolateral tubercle at an estimated whorl height of 26 mm. Highly incised suture has narrow-stemmed bitemb lobes and saddles.

**Discussion.**—The species *platycostatum*, originally assigned to *Nostoceras*, is placed herein in *Didymoceras* because of its open helical adult coiling in contrast to the tight helical adult coiling of *Nostoceras*. Juveniles are absent in the Delaware collections, which include a septate fragment (Figure 3.18, 3.19) much larger than the type specimens from Arkansas. Tubercles may disappear on parts of the whorls of *Didymoceras nebrascense* (Meek and Hayden, 1856), and such whorls may have low, flat-topped ribs like those of *D. platycostatum*, but the same-sized whorls of those species can be distinguished by the denser ribbing of *D. nebrascense* (rib index of 9–14).

**Occurrence.**—Float from the condensed bed in the lower part of the Mount Laurel Sand at St. Georges, Delaware. The species is known elsewhere only from the base of the Annona Chalk in southwestern Arkansas.
**Discussion.**—The presence of constrictions distinguishes *D. binodosum* from all other North American species of the genus. See Cobban and Kennedy (in press) for extensive illustration of the species, and its ontogeny.

**Occurrence.**—Collected as float along the Chesapeake and Delaware Canal, derived from the Marshalltown Formation. The species occurs in the Kimbro concretion zone in the Bergstrom Formation in Travis County, Texas, in the *Baculites scotti* zone of the Pierre Shale in South Dakota and Colorado, and in the upper Campanian of Poland. The *Didymoceras* sp. of Ken-
FIGURE 6—1–9, Didymoceras platycostatum (Kennedy and Cobb, 1993b). 1–3, USNM 450343; 4–6, USNM 450344; 7–9, USNM 445413, all from the base of the Chesapeake and Delaware Canal, Delaware. All figures ×1.

FIGURE 7—Didymoceras platycostatum (Kennedy and Cobb, 1993a). USNM 445383, from the base of the Mount Laurel Sand on the Chesapeake and Delaware Canal, Delaware.

Helicoceras Stevensoni Whitfield, 1877, p. 39; Whitfield, 1880, p. 447, pl. 14, figs. 5–8, 1901, p. 219, pl. 29, 30; Boyle, 1893, p. 146; Hyatt, 1894, p. 568.

Heteroceras? nebrascense (Meek and Hayden). Whitfield, 1880, p. 451, pl. 14, fig. 9, pl. 15, fig. 6; Gilbert, 1896, pl. 64.


Type.—Holotype is USNM 12307, the original of Whitfield, 1877, page 39, 1880, page 447, plate 14, figures 5–8, from the Pierre Shale, Weston County, Wyoming.

Diagnosis.—A fairly high-spired species that has a highly variable early growth stage of loosely coiled whorls or even straight limbs, a later growth stage of helical whorls in contact, and a final growth stage represented by a U-shaped body chamber. Ornament of ribs that bear tubercles on both sides of venter.

Material.—Fifty fragments of internal molds of which one is a complete whorl, and the rest are less than one-half whorl.

Description.—All fragments from helical growth stage. Whorl sections circular to slightly depressed; whorl heights range from 12 to 36 mm. Outer and inner whorl faces may be more broadly rounded than lower and upper faces. Upper face may have flattened area to accommodate previous whorl. Ribs single, coarse, blunt, rursiradiate on outer whorl face; rib index 4 to 7. Ribs weaken greatly on lower and upper whorl faces, bend slightly and cross inner face with shallow convexity. Every rib or two bears low, broad, blunt tubercle at middle of outer whorl face and another tubercle at the base of that face. Suture deeply digitate and typical of genus.

Discussion.—Didymoceras stevensoni is easily distinguished from D. platycostatum by its loosely coiled juvenile growth stage, its more tightly coiled later stage, and its coarser ribbing and prominent tubercles.

Occurrence.—Found in place in glauconitic, clayey sandstone of Marshalltown lithology, but assigned to the basal Mount
Laurel Sand by Owens and Minard (1970); south bank of the Chesapeake and Delaware Canal just east of the bridge at St. Georges, Delaware. The species is widely distributed in the Western Interior, where it defines the D. stevensoni zone of late Campanian age. A typical example of the helical growth stage of a specimen from Colorado is shown in Figure 8.10. The species has been recorded recently from France (Bilotte, 1994).

Genus Exteloceras Hyatt, 1894

*Type species.*—Anicyloceras jenneyi Whitfield, 1877, page 42, by subsequent designation of Diener, 1925, page 88.

**Exteloceras jenneyi** (Whitfield, 1877)  
*Figure 9.1–9.15*

Anicyloceras Jenneyi WHITFIELD, 1877, p. 42, 1880, p. 452, pl. 15, fig. 5, pl. 16, figs. 7–9; STANTON, 1888, p. 185; BOYLE, 1893, p. 40.

Exteloceras (Anicyloceras) Jennyi (sic) WHITFIELD, HYATT, 1894, p. 577.


**Type.**—Holotype is USNM 12295, from the Pierre Shale, Westcon County, Wyoming.

**Diagnosis.**—A planispiral species that has loose, elliptical coiled juveniles and loose, circular coiled adults. Ornament of mostly single ribs each bearing a small spinose ventrolateral tubercle. Suture highly digitate.

**Material.**—Seven short fragments of septate internal molds.

**Description.**—All specimens are parts of adult phragmocones. Whorl sections subovate and higher than wide with height from 22 to 32.5 mm. Dorsum broadly rounded, flanks flattened and convergent to venter, which is narrowly rounded intercostally and flattened costally. Ribs rectiradiate to slightly rursiradiate convergent to venter, which is narrowly rounded intercostally than interspaces. Rib index 3 to 5. All ribs strengthen into coarse, bases of septate spines. Opposite tubercles connected by broad, weak rib. One specimen (Figure 9.9, 9.10) has ribs of irregular species.

**Discussion.**—The fragments from Delaware differ in no significant respects from the holotype (Whitfield, 1880, pl. 16, figs. 7–9) and other abundant Western Interior material. Early whorls, not seen in the Delaware material, have hamitid (Figure 9.13–9.15) to loose elliptical or circular coiling (Figure 9.11–9.12).

**Occurrence.**—Float from beds assigned to the basal part of the Mount Laurel Sand along the Chesapeake and Delaware Canal just east of the bridge at St. Georges, Delaware. Abundant in the Pierre Shale and equivalent rocks in Montana, Wyoming, South Dakota, Colorado, and New Mexico. Also recorded from California and Colombia (Kennedy, 1992).

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