Additions to the Ammonite Fauna of the Upper Cretaceous Navesink Formation of New Jersey

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ABSTRACT

New fossil collections provide additional information about the late Campanian and Maastrichtian ammonites from the Navesink Formation of New Jersey. Late Campanian ammonites include Pseudophyllites indra (Forbes, 1846), Nostoceras (N.) approximans (Conrad, 1855) (of which Nostoceras (N.) stantoni Hyatt, 1894, is a synonym), Nostoceras (N.) hyatti Stephenson, 1941, Nostoceras (N.) pauper (Whitfield, 1892), Didymoceras cf. D. draconis (Stephenson, 1941), Exeteloceras rude n. sp., Hoploscaphites pumilus (Stephenson, 1941), and Jeletzkytes cf. J. nodosus (Owen, 1852). Maastrichtian ammonites from the Navesink Formation include Pachydiscus (P.) neubergicus neubergicus (Hauer, 1858), Kitchinites sp., Nostoceras (N.) alternatum (Tuomey, 1854), Baculites sp., Eubaculites cf. E. labyrinthicus (Morton, 1834), Eubaculites sp.?, Jeletzkytes cf. J. plenus (Meek, 1876), Jeletzkytes criptonodosus Riccardi, 1983, and Discoscaphites gulosus (Morton, 1834).

These faunas are correlated with those of Western Europe, the Gulf Coast, and the Western Interior of the United States. The older fauna from the basal phosphatic beds of the Navesink Formation at the classic Atlantic Highlands locality is referred to the Nostoceras (N.) hyatti zone. It is late Campanian in age and equivalent to the Nostoceras (N.) pozaryskii/Belemnella langei zone in Europe and the Baculites jenseni zone in the United States Western Interior. In addition, these beds contain ammonites that range into the early Maastrichtian, as well as Pachydiscus (P.) neubergicus, whose appearance marks the base of the Maastrichtian. Thus, these phosphatic beds represent a condensed sequence that spans the late Campanian to early Maastrichtian. Ammonites also occur at other localities in the Navesink Formation in New Jersey, and correspond to higher levels in the Maastrichtian. The youngest ammonite known from the Navesink Formation, Discoscaphites gulosus, from Sewell, New Jersey, indicates a correlation with the Hoploscaphites nicolletii or Jeletzkytes nebrascensis zone of the Western Interior.

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INTRODUCTION

The Navesink Formation (fig. 1) is a predominantly glauconitic unit that outcrops widely in New Jersey, notably on the coast at Atlantic Highlands (fig. 2), overlooking Sandy Hook Bay. At Atlantic Highlands, the Navesink Formation is about 7.6 m thick and rests with a marked unconformity on the underlying Mount Laurel Sand (fig. 1). The lower part of the Navesink is rich in phosphatic nodules, and these are the source of most of the fossils described herein. Ammonites from the basal part of the Navesink at this locality have been described by Say (1820), Whitfield (1892), and Prather (1905), and, most recently, by Cobban (1974a). The purpose of the present contribution is to update knowledge of the ammonites of this unit at Atlantic Highlands and elsewhere in New Jersey based on the analysis of extensive new collections, most of which were made in the last 20 years by members of the Monmouth Amateur Paleontologists Society, West Long Branch, New Jersey.

AGE OF THE NAVESINK AMMONITE FAUNAS


Fig. 1. Generalized stratigraphic succession for the Upper Cretaceous formations in the northern west-central coastal plain in New Jersey (modified after Owens et al., 1970).
Fig. 2. Locality map for part of New Jersey showing localities where Navesink ammonites were collected.

cf. J. nodosus (Owen, 1852). The bulk of this fauna defines a Nostoceras (N.) hyatti zone (Kennedy and Cobban, 1993), as expressed in expanded sequences in the Gulf Coast and Europe. However, the presence of Pachydiscus (P.) neubergicus neubergicus indicates a minor Maastrichtian component, implying that the lower phosphatic bed is condensed.

A second layer at Atlantic Highlands, 0.2 m above the first and 12 cm thick, yields far fewer ammonites including Nostoceras (N.) mendryki Cobban, 1974a, which is also known from the Maastrichtian Prairie Bluff Chalk of Alabama (Cobban and Kennedy, 1995). A specimen of Jeletzkytes cf. J. plenus (Meek, 1876) is also probably from this layer.

The only other Maastrichtian ammonites from the Navesink Formation are a phosphatic specimen of Nostoceras (N.) alternatum (Tuomey, 1854), collected as float at Big Brook, near Marlboro, New Jersey; a phosphatic specimen of Eubaculites cf. E. labyrinthicus (Morton, 1834) from Crosswicks Creek, south of Allentown, Monmouth County; an unphosphatized specimen of Jeletzkytes criptonodosus Riccardi, 1983, from the middle of the Navesink Formation near Middletown, Monmouth County; some small baculitids and a specimen of Discoscaphites gulosus (Morton, 1834) from the Inversand Pit, Sewell, Gloucester County; and unpublished reports of fragmentary specimens of Sphenodiscus lobatus Tuomey, 1854, from the uppermost Navesink Formation at Crosswicks Creek, south of Allentown, Monmouth County.

Cobban (1974a) and Sugarman et al. (1995) reviewed the evidence for the position of the Campanian—Maastrichtian boundary
The placement of the boundary also depends on the choice of stratigraphic sections studied. Sugarman et al. (1995) and Miller et al. (1999) examined the base of the Navesink Formation at various localities in New Jersey. Using strontium isotope analyses, they concluded that the age of the base varies depending on the locality, becoming younger toward the south. They did not sample the basal part of the formation at Atlantic Highlands. However, our ammonite data suggest that the phosphatic bed near the base of the Navesink Formation at this site represents a condensed sequence, spanning the late Campanian to early Maastrichtian. Through a series of processes involving burial, phosphatization, and reworking, the older, late Campanian ammonites were intermixed with the remains of younger, early Maastrichtian ammonites, forming the phosphatic accumulations near the base of the Navesink Formation. The base of the lower phosphatic bed itself probably represents a hiatus. This conclusion is very similar to interpretations drawn from the distribution of calcareous nannoplankton indicating that the Campanian/Maastrichtian boundary occurs somewhere between the top of the Mount Laurel and the base of the Navesink formations (Sugarman et al., 1995: 34, fig. 16).

**Correlation with Western Europe:** Figure 3 shows the present biostratigraphic divisions based on macrofossils across the Campanian—Maastrichtian boundary in Western Europe. Following the Second International Symposium on Cretaceous Stage

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Fig. 3. Campanian-Maastrichtian macrofossil zonal successions in northwest Europe.
recognized in the Gulf Coast. The Saratoga Chalk of Arkansas yielded 17 species (Kennedy and Cobban, 1993): Gaudryceras sp. (rare), Pachydiscus (P.) arkansanus (Stephenson, 1941) (rare), Pseudokossmaticeras galicianum (Favre, 1869) (rare), Nostoceras (N.) approximans (common), N. (N.) helicinum (common), N. (N.) hyatti (common), N. (N.) pauper (uncommon), N. (N.) colubriformis Stephenson, 1941 (rare), N. (N.) n. sp. (rare), Cirroceras conradi (uncommon), Dimnoceras draconis (Stephenson, 1941) (rare), Leywites oronensis (uncommon), Selenoceras cf. S. texanum (Shumard, 1861) (rare), Baculites undatus Stephenson, 1941 (rare), B. ovatus (abundant). Hoploscaphites pumilus (uncommon), and Jeletzyktes nodosus (rare) (referred to in the present paper as Jeletzyktes cf. J. nodosus).

In Tennessee, the Nostoceras (N.) hyatti zone is represented in the Coon Creek Tongue of the Ripley Formation at its type locality (Wade, 1926). Ammonites include N. (N.) hyatti, N. (N.) approximans, Cirroceras conradi, Parasolenoceras sp., Selenoceras sp., Baculites claviformis, and Jeletzyktes nodosus (referred to in the present paper as Jeletzyktes cf. J. nodosus).

In northeast Texas, Nostoceras (N.) hyatti zone ammonites occur at several localities in the Nacatoch Sand. United States Geological Survey (USGS) Mesozoic locality 17368, 4.1 km southwest of Corsicana, Navarro County, is low in the Nacatoch, with N. (N.) hyatti, N. (N.) colubriformis (Stephenson, 1941), Selenoceras multicostatum Stephenson, 1941, and S. texanum. USGS Mesozoic locality 518, at the north edge of Corsicana, is higher, with N. (N.) hyatti, N. (N.) helicinum, S. multicostatum, and Baculites undatus. USGS Mesozoic locality 762, near Chatfield, Navarro County, is high in the Nacatoch, with Pachydiscus (P.) arkansanus, N. (N.) helicinum, N. (N.) approximans, N. (N.) splendidus, Cirroceras conradi, S. multicostatum, S. texanum, B. undatus, Hoploscaphites pumilus, and Jeletzyktes cf. J. nodosus.

The higher phosphatic bed in the Navesink Formation at Atlantic Highlands yields N. (N.) mendryki, which is also known from the Maastrichtian Prairie Bluff Chalk in Alabama. Nostoceras (N.) alternatum, which occurs as float at Big Brook, near Marlboro,
New Jersey, defines the second zone of the Maastrichtian in the Gulf Coast region (Cobban and Kennedy, 1995). This species is represented in the Coon Creek Tongue of the Ripley Formation in northeastern Mississippi and nine other localities in equivalent parts of the Ripley Formation in Alabama and Georgia, as well as in the Nacatoch Sand in southwestern Arkansas. Rare phosphatized fragments of this species also occur in the Prairie Bluff Chalk in Alabama.

_Eubaculites labyrinthicus_ is present in the Prairie Bluff Chalk in Alabama. _Jeletzkytes criptonodosus_ occurs in the Prairie Bluff Chalk in Alabama and in the Ripley Formation in Union County, Mississippi. _Discoscaphites gulosus_ is known from the Severn Formation in Maryland, the Prairie Bluff Chalk in Alabama, and the Corsicana Formation in Texas.

**Correlation with the Western Interior:** _Nostoceras_ (N.)_ hyatti_ is known only from the Baculites jensi_ zone near Walsenburg, Colorado. The _N. (N.)_ _hyatti_ zone is certainly equivalent to the _B. jensi_ zone, and may or may not encompass lower levels in the Western Interior as well. Of the younger elements at Atlantic Highlands, _Jeletzkytes_ _cf. J. plenus_ is closely similar to forms from the _Baculites eliasi_ zone in Wyoming and Montana. _Jeletzkytes criptonodosus_, which is known from the Navesink Formation near Middletown, New Jersey, occurs in the _Baculites baculus_ zone in the southern part of the Canadian Western Interior and in the _Baculites grandis_ zone in the U.S. Western Interior. _Discoscaphites gulosus_, known from Sewell, New Jersey, occurs in the _Hoploscaphites nicolletii_ and _Jeletzkytes nebrascensis_ zones.

**Localities of collections**

Most of the specimens described here were collected by members of the Monmouth Amateur Paleontologists Society from the celebrated Atlantic Highlands locality in northern Monmouth County, New Jersey, which was described by Minard (1969). This and other relevant localities are shown in figure 2 and described in the text.

**Conventions**

The following abbreviations indicate the repositories of specimens cited in the text:

- American Museum of Natural History, New York (AMNH)
- Academy of Natural Sciences, Philadelphia (ANSP)
- The Natural History Museum, London (BMNH)
- Geological Survey of Canada, Ottawa (GSC)
- Monmouth Amateur Paleontologists Society, West Long Branch, New Jersey (MAPS)
- New Jersey State Museum, Trenton (NJSIM)
- U.S. National Museum of Natural History, Washington DC (USNM)

Suture terminology is that of Wedekind (1916), as reviewed by Kullmann and Wiedmann (1970), with _E_ = external lobe, _L_ = lateral lobe, _U_ = umbilical lobe, and _I_ = internal lobe. The term “rib index” as applied to heteromorphs 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: _D_ = diameter, _Wb_ = whorl breadth, _Wh_ = whorl height, and _U_ = umbilical diameter. Figures in parentheses are dimensions as a percentage of diameter. Specimens are photographed in the conventional position with the aperture on top except for complete or nearly complete specimens of scaphites.

**Systematic Paleontology**

_Order Ammonoidea Zittel, 1884_

_Suborder Lytoceratina Hyatt, 1889_

_Superfamily Tetragonitaceae Hyatt, 1900_

_Family Tetragonitidae Hyatt, 1900_

_Genus Pseudophyllites Kossmat, 1895_

_Type Species: Ammonites indra Forbes, 1846 (p. 105, pl. 11, fig. 7, by original designation)._

_Pseudophyllites indra_ (Forbes, 1846)

_Figure 4C–K, R_

_Ammonites Indra_ Forbes, 1846: 105, pl. 11, fig. 7.
Ammonites Garuda Forbes, 1846: 102, pl. 7, fig. 1.

Pseudophyllites indra (Forbes, 1846), Kennedy and Klinger, 1977: 182, figs. 19a–f, 20–22 (with full synonymy).

Pseudophyllites indra (Forbes, 1846), Henderson and McNamara, 1985: 50, pl. 2, figs. 7, 8, pl. 3, figs. 4, 5, text-figs. 5a, d.

Pseudophyllites indra (Forbes), Lent, 1986: 199, pl. 8, fig. 4.

Pseudophyllites indra (Forbes, 1846), Kennedy, 1986a: 19, pl. 1, figs. 1–5, text-figs. 4e, 5a, 6a–e (with additional synonymy).

Pseudophyllites cf. indra (Forbes, 1846), Kennedy and Summesberger, 1986: 187, pl. 1, figs. 1, 8, pl. 3, fig. 5, text-fig. 4 (with additional synonymy).

Pseudophyllites Kennedy, 1989: fig. 17b.

Pseudophyllites indra (Forbes), Cobban and Kennedy, 1991: E2, pl. 1, figs. 1–5.

Pseudophyllites indra (Forbes, 1846), Shigeta, 1992: 1158, figs. 1–4.


Pseudophyllites indra (Forbes, 1846), Hancock and Kennedy, 1993: 153, pl. 1, figs. 3, 4.

Pseudophyllites indra (Forbes, 1846), Kennedy and Hancock, 1993: 577, pl. 1, figs. 4, 7.

Pseudophyllites indra (Forbes, 1846), Cobban and Kennedy, 1995: 4, figs. 2.1–2.4, 2.10.

Pseudophyllites indra (Forbes, 1846), Kennedy et al., 1995: pl. 6, figs. 4, 5.

Pseudophyllites indra (Forbes, 1846), Kennedy and Christensen, 1997: 85, fig. 5D.

Lectotype: The lectotype is BMNH C51068, the original of Forbes, 1846: pl. 11, figs. 7a, b, from the Valudavur Formation of Pondicherry, south India, designated by Kennedy and Klinger, 1977: 182.

Description: There are four fragments all belonging to the same individual (USNM 445420) (fig. 4C–K, R). This material includes a nucleus 9 mm in diameter (fig. 4H–K) enclosed by a whorl fragment with a whorl height of 13.2 mm (fig. 4E–G), a mold of a septal lobe (fig. 4C, D), and a septate fragment (fig. 4R). The coiling is involute with a small, deep umbilicus. The whorl section is equidimensional and reniform; the umbilical shoulder is inclined outward and the flanks and venter are broadly and evenly rounded. Internal molds are smooth. The structure is imperfectly exposed; it is deeply and intricately subdivided as is typical for the genus. The external saddle is typical for the species and there is a massive septal lobe.

Discussion: Differences between Pseudophyllites indra and other species of the genus are discussed by Kennedy and Klinger (1977) and Kennedy (1986a). The whorl section, septal lobe, and form of the external saddle all indicate that these fragments belong to the type species, P. indra.

Occurrence: The Navesink specimen is from the lower phosphatic layer at Atlantic Highlands, New Jersey. Elsewhere in the United States, P. indra occurs as a rarity in the upper Campanian Nacatoch Sand in northeast Texas, in the lower Maastrichtian Nostoceras (N.) alternatum zone in the Nacatoch Sand in southwest Arkansas, and in the Maastrichtian Prairie Bluff Chalk in Alabama. Outside the United States, the species may appear in the upper Santonian, but is mostly known from the lower Campanian to upper Maastrichtian. There are records from south India, Zululand and Pondoland (South Africa), Madagascar, western Australia, Japan, Sakhalin, Alaska, British Columbia, California, Brazil, Chile, northern Ireland, southern Sweden, Poland, Austria, and southwest France.

Superfamily Desmocerataceae Zittel, 1895

Family Desmoceratidae Zittel, 1895

Subfamily Puozsiinae Spath, 1922

Genus Kitchinites Spath, 1922

Type Species: Holcodiscus pondicherryanus Kossmat, 1897 (p. 40[147], pl. 6 [17], fig. 6, by original designation).

Kitchinites sp.

Figure 4A, B

Description: MAPS A2010a1 is a planulolate fragment 28 mm long with a maximum preserved whorl height of 16 mm and a ratio of whorl breadth to whorl height of 0.58. Coiling is moderately involute, with a very shallow umbilicus. The umbilical wall is flattened and the umbilical shoulder is narrowly rounded. The inner flanks are flattened and subparallel and the outer flanks are convergent. The ventrolateral shoulders are narrowly rounded and the venter is flattened to fee-
bly concave. The surface of the mold is smooth. The suture is poorly preserved, but appears to have been moderately incised and of puzosiine type.

**Discussion:** The coiling and suture suggest Puzosiinae, while the lack of ornament finds a match in certain *Kitchinites*, such as juvenile *Kitchinites spathi* Henderson and McNamara, 1985, p. 57, pl. 4, figs. 5, 6, 9, 10, 14, 15, text-fig. 6b, c, which leads us to refer the fragment to *Kitchinites* sp.

**Occurrence:** Lower phosphatic layer, basal Navesink Formation, Atlantic Highlands, New Jersey.

**Family Pachydiscidae Spatch, 1922**

**Genus and Subgenus Pachydiscus Zittel, 1884**

**Type Species:** Ammonites neubergicus Hauer, 1858 (p. 12, pl. 2, figs. 1–3, pl. 3, figs. 1, 2) by the subsequent designation of de Grossouvre (1894: 177).

*Pachydiscus (Pachydiscus) neubergicus* (Hauer, 1858)

*Figure 4U–W*

Ammonites neubergicus Hauer, 1858: 12, pl. 2, figs. 1–3, non pl. 3, figs. 1, 2.

*Pachydiscus (Pachydiscus) neubergicus* (von Hauer, 1858), Kennedy and Summesberger, 1986: 189, pl. 2, figs. 1, 2, pl. 3, figs. 1–3, pl. 4, figs. 1–5, pl. 5, figs. 1, 4, 5, pl. 6, figs. 1, 2, 5, pl. 15, figs. 7, 8, text-figs. 5a, b (with full synonymy).

*Pachydiscus (Pachydiscus) neubergicus* (Hauer, 1858), Kennedy, 1986b: 34, pl. 4, fig. 3.

*Pachydiscus (Pachydiscus) cf. neubergicus* (Hauer, 1858), Vasicek, 1988: 76, pl. 1, fig. 3.

*Pachydiscus (Pachydiscus) neubergicus* (Hauer, 1858), Kennedy and Henderson, 1992: 420, pl. 10, figs. 6–8, pl. 11, text-fig. 6A (with additional synonymy).

*Pachydiscus (Pachydiscus) neubergicus* (Hauer, 1858), Hancock and Kennedy, 1993: 158, pl. 3, figs. 6, 7, pl. 9, figs. 5–8, pl. 12, figs. 7–9, pl. 13, figs. 5–7.


*Pachydiscus (Pachydiscus) neubergicus* (Hauer, 1855), Kennedy et al., 1995: pl. 6, figs. 16, 17.

**Lectotype:** The lectotype is No. 1858.01.6 in the collections of the Geologische Bundesanstalt, Vienna, the original of Hauer, 1858 (pl. 2, figs. 1–3), designated by de Grossouvre, 1894 (p. 209; see Kennedy and Summesberger, 1986: pl. 3, figs. 1–3). It is from the lower Maastrichtian of Neuberg, Steiermark, Austria.

**Description:** MAPS A2045a2 (not illustrated, plaster cast USNM 445245) has a whorl height of 19.5 mm. The ratio of whorl breadth to whorl height is 0.9. The umbilical shoulder is narrowly rounded. The inner flanks are broadly rounded, the outer flanks are convergent, and the venter is broadly rounded. Three distant umbilical bullae give rise to narrow, prorsiradial ribs that weaken on the middle of the flanks but strengthen on the outer flanks. Several intercalated ribs are present between the primaries; they arise on the middle to outer flanks, so that there are 14 ventral ribs corresponding to the three bullae; these ribs strengthen over the venter, which they cross in a broad convexity.

MAPS A2045a1 (fig. 4U–W, plaster cast USNM 445424) is a much larger fragment, wholly septate to a whorl height of 50 mm. The whorl section is compressed with a ratio
of whorl breadth to whorl height of 0.8, with the greatest breadth at the umbilical shoulder. The umbilicus is moderately deep, the umbilical wall is flattened and inclined outward, and the umbilical shoulder is rounded. The inner flanks are broadly rounded, the outer flanks are flattened and convergent, and the ventrolateral shoulders are broadly rounded. The venter is quite broad and flattened. Six umbilical bullae are present in the 150° sector preserved; they are strong, feebly concave, and give rise to prorsiradiate ribs that weaken across the middle of the flanks. Pairs of intercalated ribs arise on the outer flanks, and all ribs strengthen markedly across the venter. The suture is imperfectly preserved, but is intricately subdivided and typical for the genus.

**DISCUSSION:** Cobban (1974a: 18, pl. 11, figs. 5–8, text-fig. 15) recorded juvenile *Pachydiscus* sp. from the Navesink Formation at Atlantic Highlands, which Bøaszkiewicz (in Cobban, 1974a: 18) considered to be most similar to *P. (P.) neubergicus*. The larger fragment illustrated here confirms this view and demonstrates beyond doubt the presence of this important Maastrichtian marker species in the eastern United States. Kennedy and Summesberger (1986) provided a full description and synonymy of this species, and illustrated the lectotype and topotype material. Differences between *P. (P.) neubergicus neubergicus* and subspecies *P. (P.) neubergicus dissitus* Henderson and McNamara, 1985 (p. 72, pl. 7, figs. 7, 9, pl. 10, figs. 3–6, text-figs. 11, 12c, 13c) are fully described by these authors.

**OCURRENCE:** The Navesink specimens are from the lower phosphatic layer at Atlantic Highlands, New Jersey. The species is typically lower Maastrichtian in Europe, but ranges up into the lower part of the upper Maastrichtian *Belemnitella junior* belemnite zone. It is known from Denmark, north Germany, Austria, Czechoslovakia, Russia, southwestern France, northeastern Spain, Nigeria, southern India, Zululand (South Africa), and Madagascar, with subspecies *dissitus* in the upper Maastrichtian of western Australia.

**SUBORDER ANCYLOCERATINA WIEDMANN, 1966**

**SUPERFAMILY TURRILITACEAE GILL, 1871**

**FAMILY NOSTOCERATIDAE Hyatt, 1894**

**Genus and Subgenus Nostoceras Hyatt, 1894**

**Type Species:** *Nostoceras stantoni* Hyatt, 1894, p. 569; by original designation = *Ancyloceras? approximans* Conrad, 1855, p. 266.

*Nostoceras (Nostoceras) approximans* (Conrad, 1855)

*Figures 4S, T, 5A–E, K–O*

*Ancyloceras approximans* Conrad, 1855: 266.

*Ancyloceras approximans* Conrad, Conrad, 1860: pl. 47, fig. 4.

*Nostoceras stantoni* Hyatt, 1894: 570.

*Nostoceras stantoni aberrans* Hyatt, 1894: 572.

*Nostoceras stantoni retrorsum* Hyatt, 1894: 579.

*Nostoceras stantoni prematurum* Hyatt, 1894: 572.


*Nostoceras stantoni* Hyatt, Stephenson, 1941: 407, pl. 80, figs. 1–5.

*Nostoceras stantoni aberrans* Hyatt, Stephenson, 1941: 409, pl. 80, figs. 9, 10.

*Nostoceras stantoni retrorsum* Hyatt, 1894, Stephenson, 1941: 408.

*Nostoceras stantoni prematurum* Hyatt, Stephenson, 1941: 409, pl. 80, figs. 6–8; non *Nostoceras* spec. aff. *stantoni aberrans* Hyatt, Bürgl, 1955: 43, pl. 6, fig. 12.

non *Nostoceras* spec. aff. *stantoni aberrans*, Hyatt, Bürgl, 1957: pl. 17, fig. 3.

non *Nostoceras stantoni serratum* Collignon, 1971: 12, pl. 644, fig. 2383.

*Nostoceras* cf. *N. stantoni* Hyatt, Cobban, 1974a: 12, pl. 9, figs. 23–31, text-fig. 9.

?*Nostoceras* sp. cf. *N. stantoni* Hyatt, Matsumoto, 1977: 323, pl. 61, fig. 3.

*Nostoceras (Nostoceras) approximans* (Conrad, 1855), Kennedy et al., 1995: pl. 6, figs. 9–12.

**HOLOTYPE:** The holotype is the original of Conrad (1855: 266), by monotypy. It is ANSP 12861, and was said to be from White River, Arkansas.

**DISCUSSION:** Cobban (1974a) had only helices of this species for his original account of the Navesink fauna. Subsequent collecting has produced adult body chambers that correspond to the holotype of *Nostoceras (N.) approximans* and to *N. (N.) stantoni* Hyatt, 1894 (Stephenson, 1941: 407, pl. 80, figs. 1–
Fig. 5. A–E, K–O. Nostoceras (Nostoceras) approximans (Conrad, 1855). A, B. MAPS A2027a2, macroconch; C–E, holotype, ANSP 12861, microconch, White River, Arkansas; K–M. MAPS 2027a1, microconch; N, O. USNM 445246, pathological microconch. F–H. Exiteloceras rude, n. sp., holotype, USNM 433778, Big Brook, near Marlboro, Monmouth County. I, J. Didymoceras cf. D. draconis (Stephenson, 1941), MAPS A2040b1. All specimens are from the lower phosphatic layer, Navesink Formation, Atlantic Highlands, New Jersey, unless otherwise stated. All figures are ×1.
5), which is treated as a junior synonym. Figured microconchs include the holotype, ANSP 12861 (fig. 5C–E) and MAPS A2027a1 (fig. 5K–M). One specimen, USNM 445246, has suffered an injury in life, and, as a result, one of its rows of tubercles is greatly reduced (fig. 5N, O). An adult macroconch body chamber (MAPS A2027a2) is illustrated as figure 5A, B.

**Occurrence:** Upper Campanian; lower phosphatic layer, basal part of Navesink Formation, Atlantic Highlands, New Jersey; Nacatoch Sand of northeast Texas; Saratoga Chalk of Arkansas; Baculites jenseni zone in the Pierre Shale of Colorado. Records from Colombia and Madagascar belong to other species; that from Japan is doubtful.

**Nostoceras (Nostoceras) hyatti** Stephenson, 1941

Figures 6, 7G–I

A species of *Nostoceras* from the upper Campanian of the United States. The holotype is USNM 77258, the original of Stephenson, 1941: pl. 81, figs. 9–12. The holotype (Bøaszkiewicz, 1980: pl. 10, figs. 1–5) is a specimen of *N. (N.) helicinum*, as are the originals of his pl. 10, figs. 6, 7, 10, 11, 13–15.

**Occurrence:** Upper Campanian; lower phosphatic layer, basal part of Navesink Formation, Atlantic Highlands, New Jersey; Nacatoch Sand of northeast Texas; Coon Creek Tongue of Ripley Formation in Tennessee; Saratoga Chalk in Arkansas; Angola?; Israel; Tercis, Landes, France; Maurens, Aquitaine, France; and the Vistula Valley, Poland.

**Turrulites alternatus** (Tuomey, 1854)

Figure 4L–O

Typical *Turrulites* from the Noxubee Formation of Mississippi. The types were from Noxubee County, Mississippi, but are lost.

**Description:** MAPS A2041a1 (fig. 4L, M) is a septate fragment 21 mm long with a maximum preserved whorl height of 11.5 mm. It has a concave upper whorl face and an outer whorl face that is broadly rounded above and flattened below. The juncture of the outer and lower whorl faces is narrowly rounded; the lower whorl face is flattened. Twelve narrow ribs are straight and transverse to slightly concave and prorsiradiate on the outer whorl face. Six strong, transversely elongate tubercles are present at the juncture of the outer and lower whorl faces. Each tubercle is linked to a single rib or a pair of ribs and gives rise to one or two distant, narrow, feebly convex ribs on the lower whorl.
Fig. 6. *Nostoceras* (*Nostoceras*) *hyatti* Stephenson, 1941. A–C. MAPS A2004a1, microconch; D–F. MAPS A2004a2, macroconch. All specimens are from the lower phosphatic layer, Navesink Formation, Atlantic Highlands, New Jersey. All figures are ×1.

face. These ribs either link singly or zig-zag in pairs to transversely elongated tubercles at the margin of the umbilicus. The suture is moderately incised with broad, bifid saddles. NISM 17737 (fig. 4N, O) is a water-worn fragment of a body chamber (no sutures are visible) 23.5 mm long with a maximum preserved height of 11.0 mm. There are seven
Fig. 7. A–F. Baculites sp. A–C. NJSM 13439; D–F, NJSM 12931. Both specimens are from the Navesink Formation, Inversand Pit, Sewell, Gloucester County, New Jersey. G–I. Nostoceras (Nostoceras) hyatti Stephenson, 1941, MAPS A2004a3, pathological macroconch with only one row of ventral tubercles, lower phosphatic layer, Navesink Formation, Atlantic Highlands, New Jersey. All figures are ×1.

Discussion: The distribution of tubercles, with one row at the juncture of the outer and lower whorl faces, and the other close to the umbilicus on the base of the whorl, immediately distinguishes this species from all other representatives of the genus.

Occurrence: Lower Maastrichtian; float, presumably from basal 3 m of Navesink Formation, Big Brook, near Marlboro, New Jersey; Coon Creek Tongue of Ripley Forma-
tion in Mississippi, and correlates in Alabama and Georgia; and Nacatoch Sand in Arkansas.

_Nostoceras (Nostoceras) pauper_ (Whitfield, 1892)

Figure 8A–H

*Turritilites pauper* Whitfield, 1892: 268, pl. 45, figs. 1–5.


*Turritilites pauper* Whitfield, Grabau and Shimer, 1910: 211, figs. 1484, 1485.

*Nostoceras pauper* (Whitfield), Cobban, 1974a: 12, pl. 9, figs. 1–22, text fig. 10.


_Holotype:_ The holotype, by monotypy, is NJSM 7659 from the Navesink Formation, New Jersey, the original of Whitfield, 1892: pl. 45, figs. 1–5.

_Discussion:_ Several additional specimens supplement those already described by Cobban (1947a). New specimens include both the spiral portions of the shell (fig. 8A–F) and the uncoiled body chamber (fig. 8G, H). They are all characterized by coarse ribs and two rows of tubercles, one at mid-flank and the other at the base of the outer whorl face. Differences between _Nostoceras (N.) pauper_ and other species of the genus are discussed by Kennedy and Cobban (1993).

_Occurrence:_ Upper Campanian; lower phosphatic layer of Navesink Formation, Atlantic Highlands; float, presumably from basal Navesink Formation, Ramanessin Brook, Holmdel: and Big Brook, Marlboro, Monmouth County, New Jersey. Outside New Jersey, this species is known from the basal Saratoga Chalk, southwestern Arkansas.

Genus _Didymoceras_ Hyatt, 1894

_Type Species:_ _Ancyloceras? Nebrascensis_ Meek and Hayden, 1856 (p. 71); by original designation by Hyatt (1894: 574).

*Didymoceras cf._ D. _draconis_ (Stephenson, 1941)

Figure 5I, J

compare:

_Nostoceras? draconis_ Stephenson, 1941: 413, pl. 82, figs. 5–9.

_Description:_ MAPS 2040b1 comprises just over one whorl of a helix with a maximum diameter of 57.4 mm; the maximum whorl height is 20.3 mm. The helix appears to have been low so that the whorls were in contact; the upper whorl surface is feebly concave to accommodate the base of the preceding whorl. The adapical half of the fragment is phragmocone, the remainder, body chamber. Narrow delicate ribs are markedly rursiradiate on the upper whorl face, but strengthen and cross the juncture of the upper and outer whorl faces in a feebly concavity, where they may bifurcate. The ribs are even, slightly prorsiradiate, and weakly concave on the outer whorl face; there are occasional intercalated ribs, yielding a total of approximately 85 ribs per whorl. The ribs join in pairs at relatively coarse, transversely elongated, flat-topped tubercles at the juncture of the outer and lower whorl faces, or intercalate between the tubercles. There are 27–30 tubercles per whorl. Single coarse ribs link to much smaller, sharper tubercles on the outer part of the lower whorl face, with single nontuberculate ribs between them. The ribs are strong and feebly convex across the remainder of the lower whorl face.

_Discussion:_ The position of the tubercle rows, one at the juncture of the outer and lower whorl faces and the other on the outer part of the lower whorl face, combined with fine, dense ribbing and large size, distinguish this specimen from all others in the Navesink fauna. This specimen most closely resembles _Didymoceras draconis_ (Stephenson, 1941) (p. 413, pl. 82, figs. 5–9).

_Occurrence:_ Lower phosphatic layer, basal Navesink Formation, Atlantic Highlands, New Jersey.

Genus _Exiteloceras_ Hyatt, 1894

_Type Species:_ _Ancyloceras jenneyi_ Whitfield, 1877 (p. 42, by the subsequent designation of Diener, 1925, p. 88).

*Exiteloceras rude,* new species

Figure 5F–H

_Holotype:_ USNM 433778, Navesink Formation, Big Brook, near Marlboro, Monmouth County, New Jersey.

_Etymology:_ Latin, _rudis_, rough.
**Diagnosis:** An exceptionally coarse-ribbed species of *Exiteloceras*, with a rib index of 4.

**Description:** The holotype is a broadly, evenly curved septate fragment 37.5 mm long with a stout, oval whorl section 15.7 mm high and 13.1 mm wide; the greatest width is below mid-flank. The dorsum is broadly rounded and the flanks are very broadly rounded and converge to a slightly flattened, narrow venter. The ornament consists of strong, rounded, slightly rursiradiate, straight ribs with a rib index of 4. The ribs are weak on the dorsum, and strong on the flanks and venter. Each rib supports a strong, rounded tubercle at the margin of the venter. The suture is too poorly preserved for description.

**Discussion:** This specimen is most unusual in its coarse ribbing and in its stratigraphic position. The rib index of 4 contrasts with 5 or more for comparable-sized specimens of *Exiteloceras jenneyi* (Whitfield, 1877), an older species. *Lewyites oronensis* (Lewy, 1969) (p. 127, pl. 3, figs. 10, 11), a loosely coiled planispiral heteromorph that has been found in the basal Navesink at Atlantic Highlands, New Jersey, is much more densely ribbed and has tubercles on every other rib.

**Occurrence:** This specimen was found as float in the bed of Big Brook near Marlboro, Monmouth County, New Jersey, but is presumed to be derived from the Navesink Formation.

**Family Baculitidae Gill, 1871**

**Genus Baculites Lamarck, 1799**

[= Homaloceratites Hupsch, 1768, p. 110 (non binominal); Euhomaloceras Spath, 1926, p. 80]

**Type Species:** *Baculites vertebrales* Lamarck, 1801 (p. 103) by subsequent designation by Meek, 1876: 391.

**Baculites sp.**

*Figure 7A–F*

**Description:** NJSM 12931 (fig. 7D–F) is 44 mm long with an oval whorl section 16.0 mm high and 12.5 mm wide at its larger end. The taper angle of the shell is 3°. The only ornament is very weak, closely spaced ventral ribbing. The simple suture is poorly preserved. NJSM 13439 (fig. 7A–C) is a body chamber fragment 37 mm long with an oval whorl section 17.6 mm high and 13.1 mm wide in the middle of the specimen. Lirae are concave on the dorsal third of the flanks and project strongly forward on the ventral two-thirds of the flanks. The lirae strengthen into ribs and cross the venter with a narrow convexity.

**Occurrence:** NJSM GP 14257 (not illustrated) is a fragment 29 mm long, with an oval whorl section, 13.5 mm high and 9.3 mm wide at its larger end. The venter is very narrow and slightly pinched. The taper angle of the shell is 3°. Ornament is lacking, except for weak ventral ribs that have a rib index of 3. The incompletely preserved suture is simple, as for the genus.

**Discussion:** In their small size, oval whorl section, narrow venter, and smooth flanks, these specimens resemble material from the Maastrichtian Prairie Bluff Chalk of Mississippi described as species A and C by Cobban and Kennedy (1995).

**Occurrence:** Navesink Formation, Inversand Pit and along the bank of Chestnut Branch Creek, Sewell, Gloucester County, New Jersey (for details of this locality, see Richards, 1956: 79; Gallagher, 1984: 26; 1992; 1993: 142).

**Genus Eubaculites Spath, 1926**

**Type Species:** *Baculites vagina var. Ootacoensis* Stoliczka, 1866 (p. 199, pl. 90, figs. 14, ?15), by original designation, from...
the Maastrichtian of Ootacod, south India, = *Baculites labyrinthicus* Morton, 1834, p. 44, pl. 13, fig. 10.

*Eubaculites* cf. *E. labyrinthicus* (Morton, 1834)  
Figure 4P, Q

compare:  
*Baculites labyrinthicus* Morton, 1834: 44, pl. 13, fig. 10.  
*Baculites labyrinthicus* Morton, Gabb, 1861a: 394, pl. 3, fig. 1.  
*Baculites labyrinthicus* Morton, Gabb, 1861b: 77.

**DESCRIPTION:** USNM 445379 (fig. 4P, Q) is a plaster cast of a septate fragment 38.5 mm long, with a whorl height of 32.0 mm and a whorl breadth of 18.9 mm (ratio of whorl breadth to whorl height is 0.59). The dorsum is broad and flat with a narrowly rounded dorsolateral margin. The dorsal flanks are flattened and divergent; the mid-flank region, which is the point of greatest whorl breadth, is broadly rounded; the outer flanks are flattened and converge to a narrowly rounded venter. Traces of a transverse rib are preserved on the dorsal half of the flanks at the larger end of the specimen. The sutures are intricately subdivided.

**DISCUSSION:** The fastigiate rather than tabulate venter suggests that this is a specimen of *Eubaculites* nearest to *E. labyrinthicus* (Morton, 1834) (p. 44, pl. 13, fig. 10), originally described from the Prairie Bluff Chalk of Alabama. *Eubaculites carinatus* (Morton, 1834) (p. 44, pl. 13, fig. 1), the prior name of the widely recorded *E. lyelli* (d’Orbigny, 1847) (see Kennedy, 1987: 195, pl. 27, figs. 5–8, pl. 32, figs. 13, 14, with synonymy) is easily distinguished by its crescentic flank ribs and tabulate venter. *Eubaculites simplex* (Kossmat, 1895) (p. 156, pl. 19[5], figs. 13a, b, non pl. 19[5], figs. 14a, b) has a tabulate venter and is smooth. *Eubaculites vagina* (Forbes, 1846) (see figures in Klinger, 1976) has a tabulate venter and bituberculate flanks.

**OCCURRENCE:** Basal part of the Navesink Formation in a tributary on the west side of Crosswicks Creek, south of Allentown, Monmouth County, New Jersey. The specimens are associated with a large collection of *Baculites ovatus* Say, 1820.

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**Eubaculites sp.**  
Figure 8I–T

**DESCRIPTION:** MAPS A2057a1, 2 (fig. 8I–P) are two septate internal molds 41.0 and 43.5 mm long with taper angles of 4 and 6° and maximum whorl heights of 16.0 and 17.0 mm, respectively. The whorl section is oval with a narrow venter. The flanks are broadly rounded and the dorsum is well rounded. The flanks are ornamented by low, broad crescentic ribs, with a rib index of 3. No ribs are present on the venter. MAPS A2057a3 (fig. 8Q–T) is a very large septate fragment 79 mm long. It has a maximum whorl height and breadth of 35.7 mm and 25.7 mm, respectively. Like the smaller specimens, it has an oval whorl section with a broad dorsum and narrow venter. There are five broad crescentic ribs on the flanks, with a rib index of 3. The suture in all three specimens is fairly simple.

**DISCUSSION:** These specimens resemble *Eubaculites carinatus* (Morton, 1834) in their oval whorl section with narrow venter, flank ornament, and suture. They differ, however, in lacking a clearly defined tabulate venter. In addition, the large specimen is unusually large for this species.

**OCCURRENCE:** Basal part of the Navesink Formation in a tributary on the west side of Crosswicks Creek, south of Allentown, Monmouth County, New Jersey. The specimens are associated with a large collection of *Baculites ovatus* Say, 1820.
Fig. 9. A–F. Hoploscaphites pumilus (Stephenson, 1941). A, B. MAPS 2032a1; C, D. MAPS 2032a2; E, F. MAPS 2032a3; G–I. Discoscaphites galosus (Morton, 1834), NJSM 16121, Inversand Pit, Sewell, Gloucester County, New Jersey. J–P. Jeletzkytes cf. J. nodosus (Owen, 1852). J–L. MAPS A2020a3; M, N. MAPS A2020a5; O, P. MAPS A2020a4. All specimens are from the lower phosphatic layer, Navesink Formation, Atlantic Highlands, unless otherwise stated. All figures are ×1.
Hoploscaphites pumilus (Stephenson, 1941), Kennedy et al., 1995: pl. 6, figs. 1, 2.

**Type:** The holotype, by original designation, is USNM 21041, the original of Stephenson, 1941: pl. 90, figs. 10–12, from the Nacatoch Sand in the vicinity of Chatfield, Navarro County, Texas.

**Description:** MAPS A2032a1 (fig. 9A, B) is the most complete specimen. It is a microconch 44.0 mm long. The phragmocone is fairly involute with a small, deep umbilicus. The whorl section at the ultimate septum is compressed (ratio of whorl breadth to whorl height is 0.74), with the greatest breadth at the umbilical shoulder. Primary ribs arise at the umbilical seam and strengthen across the umbilical wall. The ribs are straight and prorsiradiate on the inner flanks and increase by branching and intercalation on the outer flanks. All ribs are equally strong on the venter. Umbilicolateral and ventrolateral tubercles develop on the adoral part of the phragmocone. The body chamber is compressed (ratio of whorl breadth to whorl height at mid-shaft is 0.84) with a steep umbilical wall and nearly flattened flanks that converge to a broadly rounded venter. The flanks are covered with broad, poorly defined ribs. There are five umbilicolateral tubercles. The ventrolateral tubercles become stronger and more clavate on the adoral part of the shaft but weaken on the final hook.

**Discussion:** These specimens supplement material described by Cobban (1974a). Tubercles are absent on the inner whorls of the phragmocone but develop on the outer whorls. This is a feature of the holotype, but is not visible on Stephenson's figures. Small specimens differ in no significant respects from Discoscaphites erucoides Stephenson, 1941 (p. 429, pl. 91, figs. 2–4), which is here regarded as a synonym.

**Occurrence:** Upper Campanian; lower phosphatic layer, basal part of Navesink Formation, Atlantic Highlands, New Jersey; Saratoga Chalk, Arkansas; Nacatoch Sand, Navarro County, Texas; Marnes de Plagne, Pail- lon, Haute Garonne, France; and Tercis, Landes, France.

Genus Jeletzkytes Riccardi, 1983

**Type Species:** Scaphites nodosus Owen, 1852 (p. 581, pl. 8, fig. 4, by original designation).

Jeletzkytes cf. J. nodosus (Owen, 1852)

**Figures 9J–P, 10, 11, 12C–F**

**Compare:**

Scaphites (Ammonites) nodosus (N.S.) Owen, 1852: 581, pl. 8, fig. 4.
Jeletzkytes cf. J. nodosus (Owen, 1852), Kennedy et al., 1995: pl. 6, fig. 3.

**Description:** MAPS A2020a1 (fig. 10) is a large, nearly complete macroconch body chamber 116 mm long. It has a pronounced umbilical bulge. There are 11 umbilicolateral bullae and 7 much larger ventrolateral clavi. The ribs are strong and widely spaced and cross the venter with an adoral projection. MAPS A2020a2 (fig. 11) is a large, well-preserved microconch, 89.2 mm in maximum length; the adoral portion of the hook is missing. The phragmocone is robust with a ratio of whorl breadth to whorl height of 1.33 at the ultimate septum. There is a deep umbilicus with a steep umbilical wall and a sharply rounded umbilical shoulder. The whorl section of the phragmocone is subquadrate with broadly rounded flanks, sharply rounded ventrolateral shoulders, and a broadly rounded venter. Strong primary ribs arise on the umbilical wall and are rectiradiate on the flanks. They bear strong umbilicolateral bullae. Single ribs link these bullae to equally prominent ventrolateral tubercles. Two or three ribs loop between ventrolateral tubercles on either side of the venter. One or two equally strong nontuberculate ribs intercalate between these groups. All ribs cross the venter with a broad convexity.

The body chamber is robust with a ratio of whorl breadth to whorl height of 1.25 at mid-shaft. The umbilical seam is concave in lateral view. The whorl section is subquadrate with broadly rounded flanks, sharply rounded ventrolateral shoulders, and a broadly rounded venter. Strong primary ribs are prorsiradiate on the inner flanks and bear
Fig. 10. *Jeletzkytes cf. J. nodosus* (Owen, 1852), MAPS A2020a1, macroconch, lower phosphatic level, Navesink Formation, Atlantic Highlands, New Jersey. Both figures are ×1.
Fig. 11. *Jeletzkytes* cf. *J. nodosus* (Owen, 1852), MAPS A2020a2, microconch, lower phosphatic level, Navesink Formation, Atlantic Highlands, New Jersey. All figures are ×1.
sharp umbilicolateral tubercles. These tubercles give rise to pairs of ribs that increase by intercalation on the outer flanks. There are six ventrolateral tubercles on the preserved part of the body chamber. They become increasingly stronger and more clavate in an adoral direction. Groups of three ribs loop between ventrolateral tubercles on either side of the venter with one equally strong non-tuberculate rib between these groups. All ribs cross the venter with a broad convexity.

MAPS A2020a4 (fig. 9 O, P) is the final hook of the body chamber of a microconch. It has a concave umbilical wall and depressed, reniform whorl section (ratio of whorl breadth to whorl height is 1.38, accentuated by crushing). Four small, sharp bullae perch just outside the umbilical shoulder, and give rise to narrow sharp primary ribs in groups of three. At the adapical end of the fragment two of these ribs loop to a ventrolateral tubercle, but for most of the fragment,
the ribs loop across the venter to umbilicola-
lar bulle on the other side, with some in-
terated ribs arising at the ventrolateral
shoulder, such that there is dense even ven-
tral ornament.

MAPS A2020a7 (fig. 12F) is a fragment
of a large body chamber with well-preserved
flank ornament consisting of looped and in-
terated ribs, and subspinose umbilicola-
lar and ventrolateral nodes.

DISCUSSION: The holotype of Jeletzkytes
nodosus (Owen, 1852) (p. 581, pl. 8, fig. 4)
is a macroconch that is finer ribbed than the
present material, which can be matched,
however, in other material from the Pierre
Shale of the U.S. Western Interior. USNM
182522 (Cobban, 1974a: pl. 11, figs. 13, 14)
differs from the present specimens in having
many more ventrolateral tubercles on the
phragmocone. Until the status of J. nodosus
is resolved on the basis of the abundant ma-
terial from the U.S. Western Interior, we refer
the New Jersey specimens to Jeletzkytes cf.
J. nodosus. The relationship with Acantho-
scaphites praequadrispinosus Bøaszkiewicz,
1980 (p. 38, pl. 19, figs. 2, 3, 6–8, pl. 20,
figs. 1–3, 6–8, pl. 21, figs. 1–6) also bears
further scrutiny.

OCCURRENCE: Jeletzkytes cf. J. nodosus
is known from the lower phosphatic layer, basal
Navesink Formation, Atlantic Highlands,
New Jersey. Similar specimens are reported
from the Coon Creek Tongue of the Ripley
Formation in Tennessee; Saratoga Chalk, Ar-
kanas; Nacatoch Sand, Chatfield County,
neast Texas; Baculites reesidei and B. jenseni
zones, U.S. Western Interior; and the
Vistula Valley, Poland.

Jeletzkytes cf. J. plenus (Meek, 1876)
Figure 13

cmpare:
Scaphites nodosus, var. plenus Meek, 1876: 429,
pl. 26, figs. la–c.

DESCRIPTION: USNM 455380 (fig. 13) is a
plaster cast of a large macroconch with a
phragmocone 65 mm in diameter (the origi-
nal specimen is lost). The whorl section of
the phragmocone is slightly compressed with
broadly rounded flanks and a broadly arched
venter. Primary ribs arise on the umbilical
wall and strengthen across the inner flanks of
the phragmocone, where they bear small bul-
late umbilicolar tubercles. Each of these
tubercles gives rise to one or two straight,
prorsiradiate ribs; other ribs intercalate both
high and low on the flanks. Single ribs or
pairs of ribs link the umbilicolar tubercles
to 11 or 12 much stronger clavate ventrolat-
eral tubercles on the last half-whorl of the
phragmocone. Groups of two or three narrow
ribs loop between the ventrolateral tubercles
and cross the venter in a broad convexity,
while one or two nontuberculate ribs of equal
strength intercalate between the tuberculate
groups.

The body chamber is incomplete, but its
estimated complete length is 110 mm; it is
slightly higher than wide (ratio of whorl
breadth to whorl height at mid-shaft is 0.92).
The umbilical wall is convex and the umbil-
ical shoulder is straight in profile, so that
most of the umbilicus of the spire is occlud-
ed. The inner flanks are broadly rounded, the
outer flanks are flattened and convergent, and
the venter is broadly rounded. Strong, dis-
tant, narrow prorsiradiate ribs arise on the
umbilical wall; they are feebly concave
across the umbilical shoulder and markedly
prorsiradiate and concave on the flanks. Five
strong umbilicolar bulle are present on
the shaft, and two weaker ones are present
on the first part of the final hook (the rest of
the body chamber is missing). Groups of two
or three ribs link these bulle to much strong-
er clavate ventrolateral tubercles, with one to
three nontuberculate ribs, some of them long
intercalaries, between the tuberculate groups.
An estimated 10 ventrolateral tubercles were
present on the complete body chamber.
Groups of two or three weakly convex ribs
loop across the venter between ventrolateral
tubercles, and are separated by one or two
nontuberculate ribs.

DISCUSSION: This specimen differs from
the holotype of Jeletzkytes plenus in being
more compressed and more coarsely ribbed.
J. plenus occurs in the Baculites eliasi and
B. baculus zones in the Western Interior of
the United States. Until the taxonomy of J.
plenus is resolved on the basis of the abun-
dant material from the U.S. Western Interior,
we refer this specimen to J. cf. J. plenus.

OCCURRENCE: ?Upper phosphatic layer,
Fig. 13. Jeletzkytes cf. J. pleuris (Meek, 1876), USNM 455380, cast (original specimen is lost), macroconch, upper phosphatic level, Navesink Formation, Atlantic Highlands, New Jersey. All figures are ×1.
basal Navesink Formation, Atlantic Highlands, New Jersey.

*Jeletzkytes criptonodosus* Riccardi, 1983

*Jeletzkytes criptonodosus* Riccardi, 1983: 28, pl. 6, fig. 10, pl. 7, figs. 1, 2, pl. 8, figs. 7–9, text-figs. 25–27.

*Jeletzkytes cf. criptonodosus* Riccardi, 1983: 30, pl. 11, figs. 1–21, text-figs. 28–31.


**Type**: The holotype is GSC 67104, from the Belanger Member of the Bearpaw Formation of Saskatchewan, Canada (Riccardi, 1983: pl. 6, fig. 10, pl. 7, figs. 1, 2).

**Description**: MAPS A2050a1 (fig. 12A, B) is a fragment with a maximum preserved whorl height of 35.5 mm; it is from the adapical end of the body chamber, and shows part of the final septum. A feeble umbilical bulge suggests that it is a small macroconch. The whorl section is compressed, with broadly rounded inner flanks, flattened, convergent outer flanks, and a broadly arched venter. There are six small umbilicolateral bullae, each of which gives rise to two or three narrow, delicate, prorsiradiate, weakly convex primary ribs that loop and zig-zag between small ventrolateral clavi. The poorly preserved venter is smooth to very feebly ribbed.

**Discussion**: This fragment compares well with specimens of *Jeletzkytes criptonodosus* in the USGS collections from the *Baculites grandis* zone of the U.S. Western Interior as well as with the Canadian paratype figured by Riccardi (1983) as his pl. 8, figs. 7, 8 from the *B. baculus* zone of the southern part of the Canadian Western Interior.

**Occurrence**: Lower Maastrichtian; middle part of Navesink Formation, from the oyster conglomerate, at Nut Swamp Brook, Middletown, Monmouth County, New Jersey; *Baculites baculus* zone in the Canadian Western Interior; *Baculites grandis* zone in the U.S. Western Interior; Prairie Bluff Chalk in Alabama; and Ripley Formation in Mississippi.

**Genus Discoscaphites Meek, 1870**

**Type Species**: *Ammonites Conradi* Morton, 1834 (p. 39, pl. 16, fig. 3, by original designation).

*Discoscaphites gulosus* (Morton, 1834)

**Figure 9G–I**

*Ammonites Conradi* var. (A) *gulosus* Morton, 1834: 39, pl. 16, fig. 2.

*Scaphites gulosus* (Morton), Owen, 1852: 578.

*Scaphites* (*Discoscaphites*) *conradi* var. *gulosus* (Morton), Meek, 1876: 432, pl. 36, fig. 1.

*Discoscaphites conradi* var. *gulosus* (Morton), Reeside, 1927: 29.


**Type**: The holotype is ANSP 51552, from the Prairie Bluff Chalk at Prairie Bluff, Alabama.

**Description**: NJSM 16121 (fig. 9G–I) is most of a stout adult body chamber 42.0 mm long with a whorl height of 20.4 mm. Only one side is preserved. The flank is flattened and the venter is broadly rounded. The ornament comprises five equally spaced rows of small, round tubercles located on low, poorly defined, very weak ribs.

**Discussion**: This specimen is part of a small macroconch that resembles those illustrated by Landman and Waage (1993) from the Fox Hills Formation of South Dakota.

**Occurrence**: This specimen was collected from a spoil pile of the Navesink Formation at the Inversand Pit at Sewell, Gloucester County, New Jersey. It could be from a lag deposit above the Navesink Formation, but its state of preservation is characteristic of Navesink fossils. The species is known elsewhere from the Upper Maastrichtian Severn Formation in Maryland, the Prairie Bluff Chalk in Alabama, the Corsicana Formation in Texas, and the *Hoploscaphites nicolletii* and *Jeletzkytes nebrascensis* zones of the Fox Hills Formation in South Dakota.

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