NOTES ON CENOZOIC MURICIDAE FROM THE WESTERN ATLANTIC REGION, WITH DESCRIPTIONS OF NEW TAXA

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I. Abstract

Nine new species-groups assigned to the subfamilies Muricinae and Tritonaliinae are described and one new subgenus *Miocenebra* (Tritonaliinae) is proposed. Two additional species are refigured and reassigned.

II. Introduction

Extensive collecting from the Tertiary formations of the Atlantic and Gulf Coastal Plain by the Tulane Geology Department has yielded a number of new species of Muricidae, as well as providing material which enables the writer to revise the generic (or subgeneric) placement of others. The author has undertaken the project of monographing the Muricidae, and these new species or reassignments are here presented in order to avoid introducing new taxonomic units in the final work. In this paper nine new species-groups and one new subgenus are described. Two additional species are assigned to different supraspecific groups, and are refigured with better specimens. The taxa here presented, with their geologic position, are:

Murex (Bolinus) vaughani Maury ..... Lower Miocene
Murex (Chicoreus) lepidotus, n. sp. ..... Lower Miocene
Murex (Chicoreus) lepidotus dujardinoides, n. subsp. ..... Lower Miocene
Murex (Phyllonotus) dormani, n. sp. ..... Middle Oligocene
Murex (Phyllonotus) infrequens, n. sp. ..... Lower Miocene
Murex (Phyllonotus) riparius, n. sp. ..... Upper Miocene
Murex (Murexiella) macgintyi facetus, n. subsp. ..... ?Lower to Upper Miocene
Murex (Panamurex) gilletteorum, n. sp. ..... Lower Miocene
Murex (Panamurex) clarksvillensis (Mansfield) ..... Upper Miocene
Tritonalia (Tritonalia) festivoidea, n. sp. ..... Lower Miocene
Tritonalia (Miocenebra), n. subgenus ..... Miocene
Tritonalia (Miocenebra) silverdalense, n. sp. ..... Lower Miocene

III. Systematic Descriptions

Family Muricidae

Subfamily Muricinae

Genus Murex Linné, 1758

Subgenus Bolinus Pusch, 1837

Type species: *Murex brandaris* Linné, by original designation.

Murex (Bolinus) vaughani Maury

Plate 1, figs. 1a, 1b.

Murex vaughani Maury, 1910, Bull. Amer. Paleontology, v. 4, no. 21, p. 143, pl. 23, fig. 6.

Murex (Murex) vaughani Maury. Gardner, 1947, U.S.G.S. Prof. Paper 142-H, p. 519.

Murex (Murex?) vaughani Maury. E. H. Vokes, 1963, Tulane Stud. Geol., v. 1, no. 3, p. 102, pl. 1, figs. 2a, 2b.

Figured specimen: USNM 644370; height, 29 mm; diameter, 17 mm. Locality: TU 547, Chipola River (SW ¼ Sec. 29, T1N, R9W), Calhoun County, Florida.

Horizon: Chipola Formation, uppermost lower Miocene.

Discussion: In a recent discussion (1963) of this species the writer referred the species provisionally to *Murex* s.s., feeling that it was misplaced, but unable to make a better assignment. At that time there existed, so far as is known, only the type specimen at the Paleontological Research Institution, and one incomplete specimen in the Tulane

collections. Since that writing another specimen has been collected (TU locality 547) which is the best yet found. This third specimen confirms the previous impression that the species correctly belongs to the subgenus *Bolinus.* It has the thin flaring inductura of that group and completely conforms in all other respects. In addition to the complete specimen, a fragment was also found consisting only of the siphonal canal. This fragment indicates a height of over 60 mm and is ornamented with three rows of long spines similar to *Murex cornutus* Linné or *M. tumulosus* Sowerby, both of which live today off West Africa. Except for lacking the long spines on the body whorl, *M. vaughani* bears a most striking resemblance to these two species and the possibility is immediately presented that this American species is perhaps ancestral to the *Bolinus* stock. *Murex torularius* Lamarck, the European ancestor of *M. brandaris,* the type of *Bolinus,* first appears in the middle Miocene (Helvetian) of France, Spain, Italy, and North Africa (Dollfus, 1926, p. 95) and it is not unlike *M. vaughani.* As the Chipola Formation is considered to be slightly older than Helvetian (Cooke, *et al.,* 1943) it is not impossible that the true origin of the line is in the New World. However, *M. vaughani* has no known American ancestors or descendants so it is more likely that this species made its way across the Atlantic Ocean from an Afro-European site of origin.

The ornamentation of *M. vaughani* is similar to *Murex (Panamurex) gilletteorum,* n. sp., of somewhat older age from the Silverdale beds of North Carolina. The two forms differ so greatly in all other respects, however, that it is not thought they are directly related. It is more probable that the similarity of ornamentation represents convergence.

Subgenus CHICOREUS Montfort, 1810.
Type species: *Murex ramosus* Linné, by original designation.

MUREX (CHICOREUS) LEPIDOTUS
E. H. Vokes, n. sp.
Plate 1, figs. 2a, 2b.

Shell large in size, whorls convex. Nucleus of two smooth, slightly bulbous whorls; termination of nuclear whorls marked by abrupt initiation of ornamentation. Seven post-nuclear whorls in the adult, suture appressed. Axial sculpture consists of ten equal nodes on the early whorls; on the third and successive post-nuclear whorls certain of these are strengthened to form four varices, with a single intervarical node between each pair. Spiral sculpture consists of primary threads, three in number on the earliest whorls, increasing to approximately six on the body whorl, with three additional primary threads on the pillar. Intercalated between the primary threads are one secondary, and usually two tertiary threadlets. Entire surface of shell sculptured by minute laminar incrementals which give a shagreened appearance to the intervarical areas. The free edges of the varices are

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PLATE I

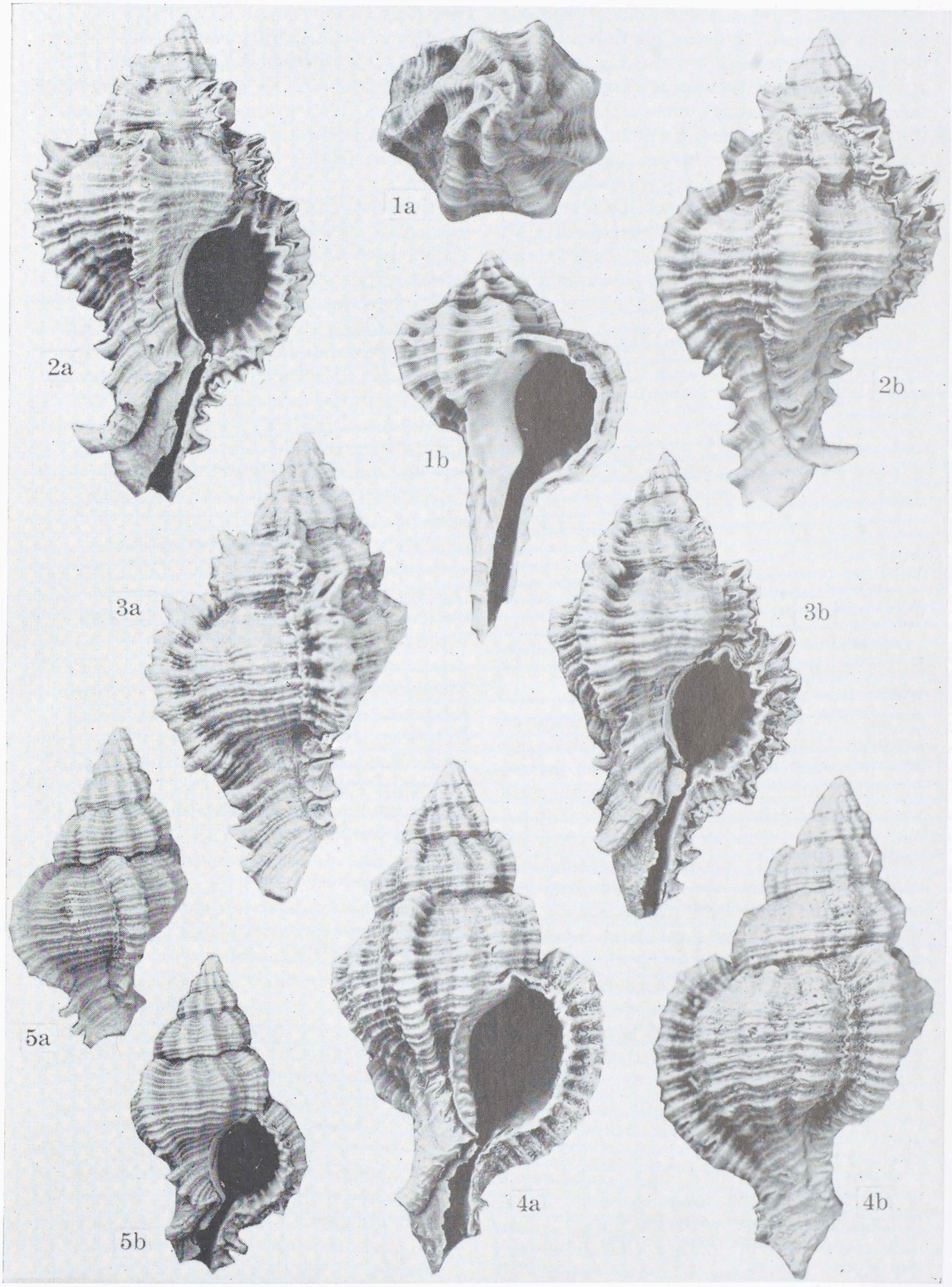

PLATE I

sharply fluted by a succession of laminae with small open spinelets produced where the primary threads cross the varices. Two series of slightly larger spines are developed on the siphonal canal where the primary threads cross. Aperture subcircular; labium smooth, standing free at the anterior end, appressed at the posterior, with slight anal notch. Outer lip crenulated by about 12 paired denticles. Siphonal canal moderately long, broad and sharply recurved at tip; former canals conspicuously divergent.

Holotype: USNM 644371.

Dimensions of holotype: height, 34 mm; diameter, 20 mm. Dimension of larger paratype: height 51.5 mm; diameter, 31 mm; (locality: TU 457).

Type locality: TU 554, Chipola River, at power-line crossing (SW ¼ Sec. 17, T1N, R9W), Calhoun County, Florida.

Figured specimen: Holotype, USNM 644371.

Horizon: Chipola Formation, lower beds only; uppermost lower Miocene.

Discussion: Murex (Chicoreus) lepidotus is not unlike *Murex folidodes* Gardner with which it occurs. Gardner (1947, p. 521) stated: "A few individuals of puzzling affinities occur with *M. folidodes,* and are possibly identical with it. They differ in having only 3 primaries instead of 5 on the early whorls, and in the earlier appearance of primaries. The protoconch of these forms is small, highly polished, and smooth and includes 2 volutions . . . The dividing line between the conch and protoconch is conspicuously defined by the change in texture and by the abrupt initiation of the sculpture, both axial and spiral." There is no doubt that the specimens Gardner was describing are of this new species and better material now available clearly demonstrates that it is distinct from *M. folidodes. M. lepidotus* is a common species, particularly at the classic Chipola locality "one mile below Bailey's ferry" (TU locality 457), where more than a dozen specimens have been collected. It is restricted to the lower portion of the Chipola Formation, with specimens known only from the type locality (TU 554) and the above mentioned TU 457, which are only about ¼ mile apart. *M. folidodes* occurs at these same two localities, but is rare, with only three specimens in the Tulane collections.* *M. folidodes* may be immediately distinguished by its three varices, instead of the four of *M. lepidotus.* There is also a different appearance to the spiral ornamentation, *M. lepidotus* having a much "coarser" aspect, although microscopically the two forms are alike, both having the unusual shagreened surface.

Friedberg (1912, pl. 10, fig. 10) has figured a specimen of *Murex austriacus* Tournouër (*"M. sedgwicki* Michelotti" Hoernes, not of Michelotti) which is exceedingly close to our new species. The principal difference between the two lies in the greater number of secondary spiral threads in the European form. *M. austriacus* was described from the Tortonian of the Vienna Basin, and Friedberg also reports the species from the Helvetian of Grund, therefore *M. austriacus* seems to be younger than the Florida species and may be a descendant of the form.

Murex lepidotus, and its subspecies, *dujardinoides,* are placed in the subgenus *Chicoreus* although they are not entirely typical of the group. In their laminate varices they are more closely related to the French Miocene species, *M. dujardini* Tournouër, which is the type of an obscure subgenus *Pirtus,* proposed in 1885 by de Gregorio, but universally ignored since that time. The subgenus *Pirtus* is by any standard to be considered a *nomen oblitum* and the writer has no desire to resurrect it, for to do so would certainly jeopardize the standing of the widely-accepted *Torvomurex. Murex denudatus* (Perry), the type species of *Torvomurex,* is strikingly similar to *M. dujardini* and to our American *M. lepidotus dujardinoides.* The similarity is so striking in fact, that it is almost impossible to accept convergence as being responsible, and we must consider the Australian group as being directly descended from these Miocene species. The most obvious course is to petition the International Commission on Zoological Nomenclature to place the name *Pirtus* on the Official Index as a *nomen obitum,* however, the problem of the *nomena oblita* is yet to be satisfactorily resolved by the Commission. Therefore it was deemed

*In the USNM collection from "one mile below Bailey's ferry" there are 125 specimens of *M. lepidotus* and only 30 specimens of *M. folidodes,* so this proportion seems to be relatively constant.

better, at this time, to simply refer these forms to the broader group *Chicoreus*. Ultimately they probably should be placed in the subgenus *Torvomurex.*

MUREX (CHICOREUS) LEPIDOTUS DUJARDINOIDES E. H. Vokes, n. subsp.

Plate 1, figs. 3a, 3b.

Shell large in size, whorls moderately convex. Nucleus of two smooth, slightly bulbous whorls; termination of nuclear whorls marked by appearance of ornamentation, both axial and spiral. Seven post nuclear whorls in the adult, suture appressed. Axial sculpture consists of ten equal nodes on the early whorls; on the fourth and successive post-nuclear whorls certain of these nodes are strengthened to form three varcies, with two intervarical nodes between each pair. Spiral sculpture consists of primary threads, three in number on the earliest whorls, increasing to approximately seven on the body whorl, with three additional primaries on the pillar. Intercalated between the primary threads are one secondary, and usually two tertiary threadlets. Entire surface of shell sculptured by minute laminar incrementals which give a shagreened appearance to the intervarical areas. The free edges of the varices are sharply fluted by a succession of laminae with open spinelets produced where the primary threads cross the varices. One larger open spine developed at the shoulder, and two series of large spinelets on the siphonal canal. Aperture subcircular; labium smooth, standing free at the anterior end, appressed at the posterior, with a slight anal notch. Outer lip crenulated with about 12 paired denticles. Siphonal canal moderately long, broad, and sharply recurved at tip; former canals conspicuously divergent.

Holotype: USNM 644372.

Dimensions of holotype: height, 32.5 mm; diameter, 18.5 mm.

Type locality: TU 547, Chipola River (SW ¼ Sec. 29, T1N, R9W), Calhoun County, Florida.

Figured specimen: Holotype, USNM 644372.

Horizon: Chipola Formation, upper beds only; uppermost lower Miocene.

Discussion: The subspecies *dujardinoides* differs from *M. lepidotus* s.s. in having only three varices rather than the four of the typical form. The varices of *dujardinoides* are more foliaceous and there are two intervarical nodes rather than the one of *M. lepidotus.* This new subspecies is fairly common occurring only in the upper portion of the Chipola Formation, with paratype material from TU localities 458 and 453. The two forms are mutually exclusive with *M. lepidotus* confined to the lower part of the formation. *M. folidodes* Gardner, which is also confined to the lower Chipola, differs from this new subspecies in the nature of the spiral ornamentation. As with *M. lepidotus,* the subspecies *dujardinoides* also has a much "coarser" aspect to the ornamentation, *M. folidodes* may be further distinguished by the presence of only one intervarical node, in contrast to the two nodes of *dujardinoides.*

Both *M. lepidotus,* and especially *dujardinoides* are exceedingly close to the French species *M. dujardini* Tournouër from the middle Miocene of the Loire Basin. A common species, *M. dujardini* is said by Glibert (1952a, p. 292) to possess three or four varices, with usually two intervarical nodes. Our Chipola species is scarcely to be distinguished from the French one. The principal difference between the two forms is the more cancellate appearance of the early whorls of *M. dujardini.* In the French species the spiral ornamentation is equal in strength to that of the axial nodes, while in the American form the axial nodes are relatively much stronger, giving a "nodose" rather than "cancellate" aspect to the first three post-nuclear whorls. In addition there is a reduction of the number of intervarical nodes from two to one in the larger specimens of *M. dujardini,* but this reduction is not found in the American form.

In the collections of the Academy of Natural Sciences of Philadelphia there is a worn specimen (ANSP 4003) collected by William Gabb, said to be from the Miocene of Santo Domingo. As best as can be determined this specimen is the same as our *dujardinoides* and extends the geographic range of the species considerably. The exact horizon is not known so that the effect upon the stratigraphic range cannot be ascertained. It is a large specimen 46.5 mm in height (incomplete), however this is not unusual for one battered specimen in the Tulane collections measures over 50 mm (TU locality 453).

Subgenus PHYLLONOTUS Swainson, 1833

Type species: *Murex imperialis* Swainson (not *M. imperialis* Fischer, = *M. pomum* Gmelin), by subsequent designation, Swainson, 1833.

MUREX (PHYLLONOTUS) DORMANI
E. H. Vokes, n. sp.
Plate 2, figs. 3a, 3b.

Shell of moderate size. Nucleus smooth, 3½ whorls ending at a small varix or riblet. Post-nuclear whorls convex, about five in the adult; suture deeply impressed. Axial sculpture consists of three high, rounded varices, which bear a single open spine at the shoulder, commonly lost in the adult. Varices excavated behind, irregularly placed with respect to the corresponding varix on the previous whorl. Between each pair of varices is one strong intervarical node (sometimes two in the younger stages). Spiral ornamentation exceedingly variable, with a tendency toward one primary thread on the shoulder, and three to six secondaries and tertiary threadlets between the suture and this first primary. Usually two or three secondary threadlets between the first and the second primary thread which is at the periphery; few secondaries and no tertiaries on the remainder of the whorl, in general only primaries, about 15 on the body whorl, becoming obscure on the pillar. Aperture oval, labium smooth, distinct, separate from body wall at anterior end. Outer lip with about eight denticles internally. Anterior canal moderately long, recurved; antecedent canals forming an anterior fasciole.

Holotype: USNM 644373.

Dimensions of holotype: height (incomplete), 22 mm; greatest diameter, 14.8 mm.

Type locality: Byram, Mississippi.

Figured specimen: Holotype, USNM 644373.

Horizon: Byram Marl, middle Oligocene.

Discussion: This Oligocene form is much like *M. mississippiensis* Conrad from the Vicksburg Group. It differs from that species in the more irregular spiral ornamentation and an overall smoother appearance. Also it usually has one strong intervarical node, in contrast to the two weaker ones of *M. mississippiensis. M. dormani* is placed in the subgenus *Phyllonotus* more because of its resemblance to *M. mississippiensis* and later species which are obviously descended from this line and which do belong in *Phyllonotus* than because of any strong morphological alliance with the group.

M. dormani is named in honor of Mr. James H. Dorman, who collected the type material.

MUREX (PHYLLONOTUS) INFREQUENS
E. H. Vokes, n. sp.
Plate 1, figs. 4a, 4b.

Shell of moderate size, spire elevated. Nucleus consists of four polished, conical whorls, terminating in a crescentric varix. Seven post-nuclear whorls in the adult, more or less convex. Early post-nuclear whorls ornamented by 14 equal axial nodes, which are crossed by three spiral threads. On the third to fourth whorls three of these axial nodes become stronger, forming varices, with the others remaining as intervarical nodes; two to three between each pair of varices. Spiral sculpture consists of four to five primary threads on the medial portion of the shell with one secondary and two tertiary threadlets between each pair of primary threads; approximately 12 primary threads on the body whorl and pillar. On the anterior portion of the varices and on the extended siphonal canal small open spinelets are produced where the primary threads cross. Aperture oval in shape, labium thin, slightly flaring, marked by numerous rugae which are a reflection of the underlying ornamentation; weak posterior anal notch. Outer lip crenulated by 12 to 14 paired denticles. Siphonal canal short, broad, recurved.

Holotype: USNM 644374.

Dimensions of holotype: height, 36 mm; diameter, 19 mm.

Type locality: TU 458, Chipola River above Farley Creek (Center Sec. 20, T1N, R9W), Calhoun County, Florida.

Figured specimen: Holotype, USNM 644374.

Horizon: Chipola Formation, uppermost lower Miocene.

Discussion: This new species may represent the form cited by Gardner (1947, p. 522, pl. 53, fig. 7) as "incertae sedis," based on an immature specimen. *M. infrequens,* as the name implies, is a rare shell, and may be confused with the more common *M. lepidotus dujardinoides,* with which it oc-

curs. It differs from that form in its almost complete lack of varical fronds. It may also be distinguished by the irregularity of the varices, in contrast to the regular procession of the varices along the spire-whorls of *dujardinoides*. *M. infrequens* is found throughout the Chipola Formation, paratype material occurring at TU localities 547, 196, and 70.*

Murex infrequens is the earliest species to exhibit the flaring inductura on the parietal wall which is so conspicuous in the Recent forms of *Phyllonotus*. The older species such as *M. mississippiensis* Conrad and *M. trophoniformis* Heilprin which seem to be ancestral to the line do not have this characteristic feature. The one trait that all of the members of *Phyllonotus* share is the irregular placement of the varices on the successive whorls. In all other groups of the Muricinae the varices follow in a regular series forming either a straight or spiral line up the whorls of the spire.

MUREX (PHYLLONOTUS) RIPARIUS
E. H. Vokes, n. sp.
Plate 1, figs. 5a, 5b.

Shell moderate in size, spire elevated. Three nuclear whorls, of which the first two are smooth and noticeably flattened, the last faintly ornamented and convexly rounded; nucleus ending at strong rib-like varix. Six post-nuclear whorls in the adult, convex, with impressed suture. Ornamentation of the early whorls consists of 11 equal axial nodes crossed by four to five spiral threads. On the fourth to fifth post-nuclear whorls three of the axial nodes increase gradually in size, becoming varices on the fifth whorl, with the others forming weak intervarical nodes, one or two between each pair of varices. Spiral ornamentation consists of five primary threads with one intercalated secondary on the medial portion of the shell, and with two additional tertiary threadlets on the adult whorls only; 13 primary threads on the body whorl and pillar. Where the primary spiral threads cross the varices, small open spinelets are produced on the apertural side of the varix; these spinelets are better developed on the anterior portion of the varix, and especially on the extended siphonal canal where two fairly long spines occur. Aperture subcircular, labium smooth, somewhat appressed, with posterior anal notch. Outer lip crenulated with eight to ten denticles. Siphonal canal short, broad, recurved at anterior end.

Holotype: USNM 644375.

Dimensions of holotype: height, 22.5 mm; diameter, 12 mm.

Type locality: TU 60, Jackson Bluff, Ochlockonee River, Leon County, Florida.

Figured specimen: Holotype, USNM 644375.

Horizon: Choctawhatchee Formation, upper Miocene.

Discussion: Murex (Phyllonotus) riparius is rare, presently known only from the type locality. It occurs with a superficially similar species, which is close to the Recent *M. florifer,* but is easily distinguished by the almost complete lack of varical fronds in *M. riparius*. Even the young specimens of the *M. florifer* type show distinct foliaceous varices which are never developed in this new species. *M. riparius* appears not unlike the Recent *M. consulae* Verrill (*M. pulcher* Adams *non* Sowerby). However it lacks the greatly extended siphonal canal of that form, and the varices of *M. riparius* are not continuous up the spire as they are in *M. consuelae,* so that the resemblance is probably coincidental rather than suggestive of close relationship. The only known form with which this new species is readily comparable is the above described *Murex (Phyllonotus) infrequens* from the lower Miocene Chipola Formation. It may be distinguished from that species by the different nucleus, *M. infrequens* having four polished, conical whorls to the protoconch. In all other respects the two species are much alike, but with this noticeable difference in the nature of the nuclei there is some question whether they are as closely related as they would appear.

Subgenus MUREXIELLA Clench and Pérez Farfante, 1945

Type species: *Murex hidalgoi* Crosse, by original designation.

MUREX (MUREXIELLA) MACGINTYI FACETUS E. H. Vokes, n. subsp.
Plate 2, figs. 4a, 4b.

Murex (Chicoreus?) Burnsii Whitfield. DALL, 1890, Wagner Free Inst. Sci., Trans., v. 3, pt. 1, p. 141. (*Nomen nudum*)

* There are 8 specimens in the USNM collection from "one mile below Bailey's ferry" (TU locality 457), although the writer has not yet found any there.

Not *Murex* (*Pteronotus*) *Burnsii* ALDRICH, 1894, Nautilus, v. 7, no. 9, p. 98, pl. 4, figs. 4, 4a. (January)
Murex shilohensis var. *burnsi* WHITFIELD, 1894, U.S.G.S. Mon. 24, pt. 3, p. 98, pl. 17, fig. 2. (Post-March, 1894, *fide* advertisement, p. vi)
Murex burnsi Whitfield. ALDRICH, 1895, Bull. Amer. Paleontology, v. 1, no. 2, p. 14. (Not *Murex burnsii* Aldrich, 1894)
Chicoreus burnsii (Whitfield). DALL, 1915, U. S. Natl. Mus. Bull. 90, p. 75.
Murex (*Chicoreus*) aff. *burnsii* Whitfield. GARDNER and ALDRICH, 1919, Acad. Nat. Sci. Phila., Proc., v. 71, p. 18.
Muricidea burnsi (Whitfield). RICHARDS and HARBISON, 1942, Acad. Nat. Sci. Phila., Proc., v. 94, p. 212, pl. 19, fig. 10.

Shell moderate in size, body whorl greatly inflated. Nucleus of 1½ smooth, rounded whorls; six post-nuclear whorls in the adult. Spiral sculpture consists of sharply raised ribs, two in number on the early whorls, five on the body whorl. Axial sculpture consists of six to seven varices; where the spiral ribs cross the varices long, recurved, foliaceous, open spines are produced. In addition, one spine is formed where no rib is present between the suture and the shoulder, and two spines are produced on the extended siphonal canal. The intervarical space is patterned with microscopic spiral lirae and growth lines which give a reticulate surface. The varices are formed of finely laminate layers, creating a complex webbing between the spines. Aperture subcircular; labium completely free, erect, and smooth; the outer lip bearing six grooves corresponding to the varical spines. Siphonal canal moderately long and recurved, the succession of previous canals forming an anterior fasciole.

Holotype: USNM 644376.

Dimensions of holotype: height, 24 mm; greatest diameter, including terminal varix, 18 mm.

Type locality: TU 520, canal ⅓ mile east of Brighton, Highlands County, Florida.

Figured specimen: Holotype, USNM 644376.

Horizon: ? Tampa Limestone, lower Miocene. Kirkwood Formation, middle Miocene. Choctawhatchee Formation, and Brighton beds, upper Miocene.

Discussion: Murex macgintyi facetus may be distinguished from *M. macgintyi* s.s. by the much shorter spire and more inflated body whorl of the subspecies. The varices are more foliaceous and the spines are much longer, so that the subspecies resembles *Murex hidalgoi,* the type of *Murexiella,* to a strong degree, although in *M. hidalgoi* the spines are not recurved as in *facetus.* This new form is no doubt ancestral both to *M. hidalgoi* and to *M. macgintyi,* as well as to

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PLATE II

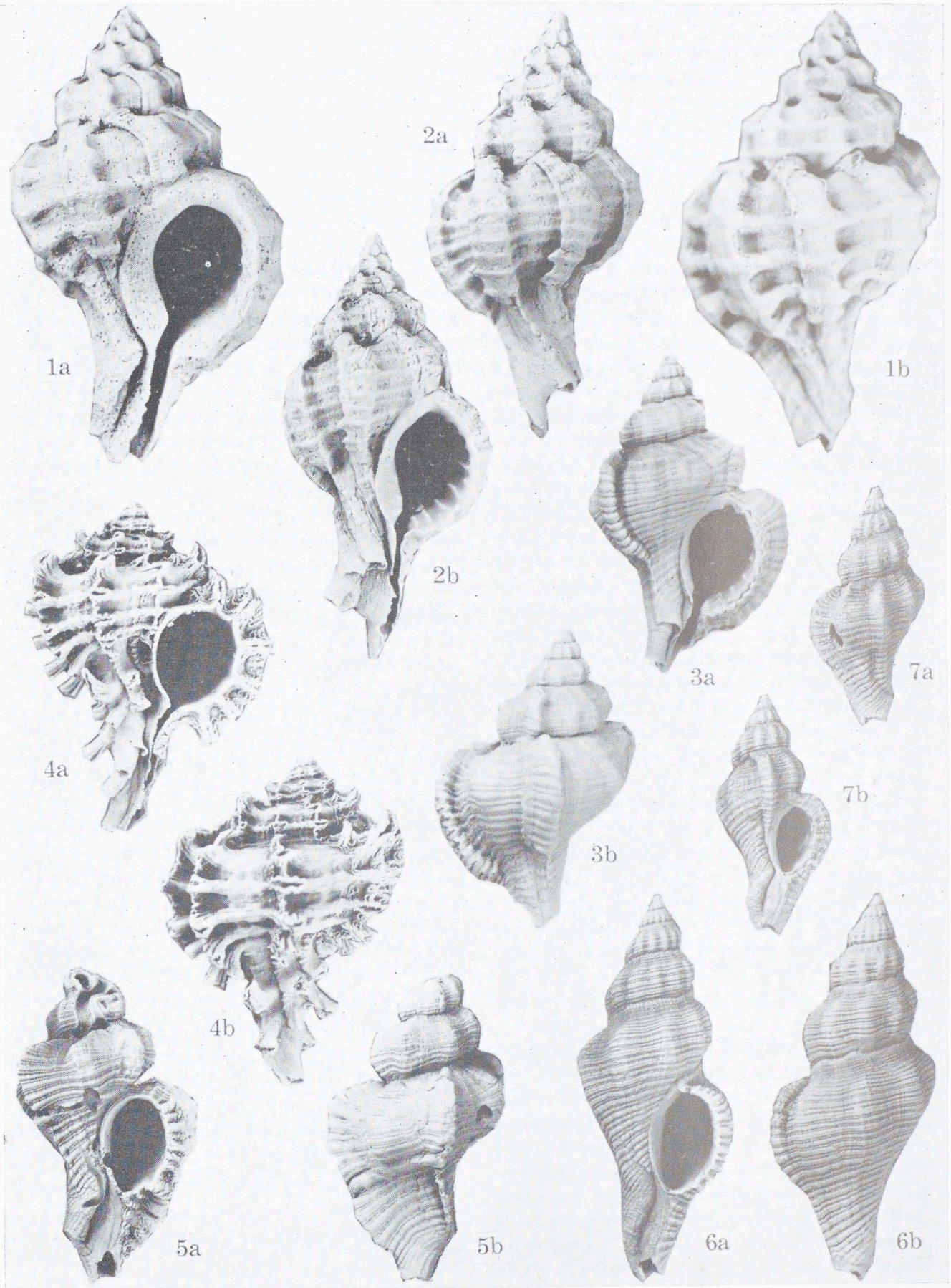

PLATE II

M. humilis Broderip from the west coast of Panama.

The history of this taxon is exceedingly complicated. It was first mentioned by Dall (1890, p. 141) who said: "The truncated specimen, upon which Prof. Whitfield has founded his variety *Burnsii,* belongs, in my opinion, to a different species and subgenus [than *Murex shilohensis*]." Dall was referring to a name which was still in manuscript, for although Whitfield's report had been transmitted to the Director of the U. S. Geological Survey in 1889, it was not published until after March, 1894. Unfortunately, before Whitfield's monograph reached the public, another *Murex burnsi* (named for the same man, Frank Burns of the U.S. National Museum) had been described by Aldrich from the lower Oligocene at Red Bluff, Mississippi. Matters would be greatly simplified if it were possible to consider Whitfield's *burnsi* as being validated by Dall in 1890, but there is no true description given by Dall, and the name is a *nomen nudum* at this point. Dall did compare the species with *Murex interserratus* Sowerby, stating that "the young shell . . . is the complete image of *Murex interserratus* Sby. of the same age. The last species is still living in the southeastern Antilles in deep water. It is, of course, impossible to say how much *M. Burnsii* would, in the adult state, differ from the living shell." The *"Murex interserratus"* of Dall has been identified by Clench and Pérez Farfante (1945, p. 48) as *Murex carnicolor,* not *M. interserratus,* and this species is not even to be referred to the same subgenus as *M. burnsi,* so that Dall's comparison is scarcely valid. Aldrich, however, considered that his name was preoccupied by Dall's usage, and so in 1895, unnecessarily changed his *burnsi* to *M. grandispinosa.*

Because Whitfield's type specimen is incomplete, absolute identification with our new form is not possible. Therefore it was deemed advisable, as a new name was necessary for the preoccupied *burnsi,* to select a new type specimen for the form here described. Although the two forms are in all probability synonymous, the writer does not wish to consider this taxon as a new name for *M. burnsi* Whitfield, but rather as a new subspecies of which *burnsi* is considered a synonym.

M. macgintyi facetus is not uncommon in the upper Miocene of Florida. It occurs at Jackson Bluff, Leon County (TU locality 60), in northern Florida, and at the type locality in southern Florida. Whitfield described *burnsi* from the beds at Jericho, New Jersey, which have now been assigned to the Kirkwood Formation, of middle Miocene age (Richards and Harbison, 1942). If Dall's report of the occurrence of this species from the Tampa "Silex Beds" at Ballast Point is correct then the species ranges from the lower through the upper Miocene. The Pliocene form is *M. macgintyi* s.s.

McGinty described a species, *"Tritonalia" graceae* from Belle Glade, Florida which is similar to *Murex macgintyi.* From the description it might be confused with our new form, however, his illustration shows a very different shell, much attenuated, with a long, slim canal and a coronet of long shoulder spines.

Subgenus PANAMUREX Woodring, 1959.

Type species: *Murex gatunensis* Brown and Pilsbry, by original designation.

MUREX (PANAMUREX) GILLETTEORUM E. H. Vokes, n. sp.

Plate 2, figs. 1a, 1b.

Shell large for the group, and heavy. Nucleus unknown, seven post-nuclear whorls in the adult. Axial ornamentation consists of six to seven stout rib-like varices; the spiral ornamentation of four strong, raised ridges, which ride up over the varices. Between these conspicuous spiral ridges the shell is patterned with irregular microscopic spiral lirae and axial growth lines giving a semi-reticulate appearance. Aperture ovate, labium heavy, standing free in the anterior portion, somewhat appressed posteriorly. Outer lip denticulate, with about ten more or less well defined teeth. Canal moderate in length, slightly recurved, and open.

Holotype: USNM 644377.

Dimensions of holotype: height, 43.5 mm; greatest diameter, 26 mm.

Type locality: TU 562, Onslow County marl-pit, near Silverdale, Onslow County, North Carolina

Figured specimen: Holotype, USNM 644377.

Horizon: Silverdale beds, lower Miocene.

Discussion: This species is most closely related to *Murex (Panamurex) laccapoius*

(Gardner) from the Chipola Formation (uppermost lower Miocene) and *Murex* (*Panamurex*) *clarksvillensis* (Mansfield) from the Choctawhatchee Formation (upper Miocene) of northwestern Florida. It differs from these two species primarily in its larger size, but it also has proportionally much heavier spiral ornamentation. The type material is worn and does not exhibit the characteristic *Panamurex* rugae on the anterior portion of the labium, but these may appear on better specimens.

The exposures of marl at Silverdale, North Carolina, were assigned to the "Trent Marl" by Kellum (1926, p. 13), and that author concluded that the age of the formation was lower Miocene. However the Trent was originally described as being overlain by the upper Eocene Castle Hayne Formation and therefore some question exists concerning the assignment of the Silverdale beds to the Trent. There seems to be little doubt that the Silverdale fauna is of lower Miocene age, and the writer prefers not to use the term "Trent Marl" in conjunction with the Silverdale material until the question is settled.

Murex (*Panamurex*) *gilletteorum* is presently known only from the type locality where it is relatively rare, with just four specimens being found after intensive collecting. This species is named for Mr. and Mrs. John Gillette, of Silverdale, North Carolina, for their years of kindness to marauding paleontologists.

MUREX (PANAMUREX) CLARKSVILLENSIS (Mansfield)

Plate 2, figs. 2a, 2b.

Muricidea clarksvillensis MANSFIELD, 1937, Jour. Paleontology, v. 11, no. 7, p. 610, pl. 85, fig. 6.

"Shell of moderate size; solid; spire about one-third length of shell; axial sculpture stronger than spiral; consisting of 5 whorls, nucleus decollated. Whorls rounded, weakly tabulated in front of the rather deep suture and rapidly and uniformly expanding. Spiral sculpture consisting of rather strong primary threads (13 on body whorl and canal) over-running axials and interspaces and usually of a secondary intermediate threadlet. Ribs 6, extending from suture to suture on the spire whorls and to the end of the canal on the body whorl. Aperture axially ovate. Outer lip within provided with 8 widely spaced spiral lirations. Inner lip with a thin callus and bearing on its anterior third 3 lirations. Canal rather short and recurved; the raised margin of the canal and the siphonal fasciole separated by a small chink.

"Dimensions of holotype (U. S. Nat. Mus. 496424): Length, 30 mm; diameter, 17 mm." (Mansfield, 1937)

Figured specimen: USNM 644378; height, 31.4 mm; diameter, 15.0 mm. Locality: TU 60, Jackson Bluff, Ochlockonee River, Leon County, Florida.

Horizon: Choctawhatchee Formation, upper Miocene.

Discussion: The worn holotype of *"Muricidea" clarksvillensis,* the only specimen heretofore figured, does not exhibit the distinctive characteristics possessed by better specimens. Therefore a more perfect example is here shown in order to demonstrate the subgeneric affinities of Mansfield's species. From this specimen it can be seen that *M. clarksvillensis* resembles *Murex gatunensis,* the type of *Panamurex,* and should be assigned to that subgenus. It should be noted that the recognition of this subgenus in the upper Miocene Choctawhatchee Formation extends the geological range for the *Panamurex* group, previously cited by Woodring (1959, p. 217) as "late middle Miocene." Moreover, in addition to *M. clarksvillensis,* another Choctawhatchee species, *"Muricidea?" alaquaensis* Mansfield, described from Walton County, Florida, also is to be referred to *Panamurex.*

Subfamily TRITONALIINAE

Genus TRITONALIA Fleming, 1828

Subgenus TRITONALIA s.s.

Type species: *Murex erinaceus* Linné, by subsequent designation, Gray, 1847.

TRITONALIA (TRITONALIA) FESTIVOIDEA, E. H. Vokes, n. sp.

Plate 2, figs. 5a, 5b.

Shell moderate in size, spire elevated, suture deeply constricted giving a much inflated aspect to the individual whorls. Nucleus unknown, about five post-nuclear whorls in the adult. Axial ornamentation consists of three wing-like varices, which are sculptured with minute imbrications on the apertural side. Between each pair of varices is one very strong node. Spiral ornamentation consists of coarse threads alternating with usually three finer threadlets between each pair; about 18 primary threads on the body whorl and pillar. At the juncture of the body whorl and the pillar there is a

raised rib which corresponds to an ill-defined anterior apertural tooth and is a conspicuous spiral ridge. Aperture oval, labium distinct, not appressed. Outer margin of the aperture denticulate, with about four weak teeth. Canal moderate, slightly recurved, completely roofed over to form a tubular structure typical of *Tritonalia.*

Holotype: USNM 644379.

Dimensions of holotype: height (incomplete), 24 mm; greatest diameter, 14 mm.

Type locality: TU 562, Onslow County marl-pit, near Silverdale, Onslow County, N. C.

Figured specimen: Holotype, USNM 644379.

Horizon: Silverdale beds, lower Miocene.

Discussion: Tritonalia festivoidea, as the name would suggest, resembles *Tritonalia festiva* (Hinds) from the Recent of the California Coast. The Silverdale species differs from the Recent one in its smaller size, and in the nature of the spiral sculpture, the threads of *festiva* being of a uniform width. The varices of the fossil are much less expanded and recurved than the Recent form, but they share the imbricate structure. The preservation of the type material is not good, and the description is a composite of the three specimens which were collected.

Glibert (1952a, pl. 7, figs. 6a, 6b) has figured a specimen from the middle Miocene of France which is very similar to our Carolina form. This specimen is assigned by Glibert to *Tritonalia dufrenoyi* (Grateloup) but the typical *dufrenoyi* does not bear this strong resemblance, and it is possible that Glibert's shell may represent a different species. Nevertheless the relationship of *festivoidea* and the European species should be noted. Friedberg (1912, pl. 10, fig. 3) figured a shell which he called "*Ocenebra erinacea* Linné" from the Miocene of Poland that is also close to this new species. The original reference is in an obscure publication but the specimen has been refigured by both Korobkov (1955, pl. 71, figs. 7a, 7b) and Orlov, *et al.* (1960, figs, 527a, 527b). Orlov cites the species as being from the Tortonian or upper Miocene of the Ukraine.

MIOCENEBRA E. H. Vokes, n. subgen.

Type species: *Tritonalia (Miocenebra) silverdalense* E. H. Vokes, n. sp.

Diagnosis: Shell greatly elongated, spire much elevated, constricted above the shoulder with an appressed suture. Formation of the varices irregular, with one always present at the aperture, although the others may be reduced to strong nodes. Aperture oval, margin complete, outer lip slightly crenulated. Canal elongated and completely closed over to form a tubular structure.

This new subgenus differs from the typical *Tritonalia* (type: *Murex erinaceus* Linné) in having the shell greatly elongated. In the elongate form this subgenus perhaps resembles *Pteropurpura* (type *Murex macropterus* Deshayes) most nearly, but differs in lacking the greatly expanded wing-like varices of that group. *Miocenebra* is similar to *Tritonalia* in the tubular canal, a trait which is found in many groups of the Tritonaliinae, in the irregular formation of the varices, details of the early whorls, and the structure of the aperture.

TRITONALIA (MIOCENEBRA) SILVERDALENSE E. H. Vokes, n. sp.

Plate 2, figs. 6a, 6b, 7a, 7b.

Shell moderate in size, spire greatly elevated, whorls constricted above the shoulder, with an appressed suture that is sinuated by the axial nodes. Six adult whorls, nucleus unknown. Axial sculpture on the early whorls consists of about 12 equal nodes, which gradually diminish to about seven unequal nodes on the body whorl. Of these seven nodes, three are stronger, giving the appearance of varices, but there is no evidence of a break in the shell deposition, so that these are not true varices except at the aperture. Spiral sculpture consists of irregularly alternating weak and strong cords. Each strong cord has a medial groove which separates it into what appears to be two, however if the specimen is worn this groove disappears and the cord seems to be a single wide one. There are perhaps as many as 30 primary spirals on the body whorl and pillar of an adult specimen. Aperture oval, slightly crenulated within the labrum by grooves which correspond to the major external cords. Siphonal canal long, completely closed over by an extension from the columella, to form a tubular structure.

Holotype. USNM 644380; paratype: USNM 644381.

Dimensions of holotype: height, 28.5 mm; greatest diameter, 12.4 mm.

Dimensions of immature paratype: height, 18 mm; diameter, 9 mm.

Type locality: TU 562, Onslow County marl-pit, near Silverdale, Onslow County, N. C.

Figured specimens: Fig. 6, Holotype, USNM 644380; Fig. 7, Paratype, USNM 644381.

Horizon: Silverdale beds, lower Miocene.

Discussion: There is no species known from the Tertiary of the Atlantic and Gulf Coastal Plains with which this new form can be compared. Glibert (1952b, pl. 7, figs. 14a, 14b) has figured a specimen from the middle Miocene of Bolderberg, Belgium, said to be *Murex poelmanni* Geraerts, which seems to be referable to *Miocenebra,* but no other form has been found which appears closely related to this new subgenus.

IV. Locality Data

The following are Tulane University locality numbers:

60. Choctawhatchee Fm., Borrow pit at Jackson Bluff, Ochlockonee River (NW¼ Sec. 21, T1S, R4W), Leon Co., Florida.

70. Chipola Fm., Ten Mile Creek, at bridge of Florida Highway 73 (NW¼ Sec. 12, T1N, R10W), Calhoun Co., Florida.

196. Chipola Fm., Ten Mile Creek, about ½ mile upstream from bridge of Florida Highway 73 (NE¼ Sec. 11, T1N, R10W), Calhoun Co., Florida.

453. Chipola Fm., lowest beds at Alum Bluff, Apalachicola River (SE¼ Sec. 24, T1N, R8W), Liberty Co., Florida.

457. Chipola Fm., west bank of Chipola River, (SW¼ Sec. 17, T1N, R9W), Calhoun Co., Florida.

458. Chipola Fm., east bank of Chipola River, above Farley Creek (Center Sec. 20, T1N, R9W), Calhoun Co., Florida.

520. Unnamed formation, spoil banks, canal ⅓ mile east of Brighton, Highlands Co., Florida.

547. Chipola Fm., west bank of Chipola River (SW¼ Sec. 29, T1N, R9W), Calhoun Co., Florida.

554. Chipola Fm., east bank of Chipola River, just below power line crossing (SW¼ Sec. 17, T1N, R9W), Calhoun Co., Florida.

562. Silverdale beds, marl-pit on south side of Webb Creek about ¾ mile southwest of Silverdale, Onslow Co., North Carolina. [This pit is approximately across Webb Creek from the old "Gillette" marl-pit.]

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