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THE STATUS OF SURFACE GEOLOGIC MAPPING IN MISSISSIPPI

David T. Dockery III, Michael B. E. Bograd, and David E. Thompson
Mississippi Office of Geology

INTRODUCTION

At the current rate of production of detailed surface geologic maps, coverage of the entire state of Mississippi will be accomplished in about 100 years.

Now that we have your attention, some explanation is in order as to our plans for improvement. The Mississippi Office of Geology currently has four surface mapping projects underway. Two of these are centered along the Wilcox outcrop belt in Lauderdale, Kemper, Winston, and Noxubee counties with plans for expansion northward to the Tennessee state line. The Wilcox Group contains important clay and lignite resources at and near the surface, is a source of oil in the subsurface of southwestern Mississippi, and is an important source for drinking water in the central and northwestern parts of the state. The third mapping project is along the Catahoula outcrop belt in south-central Mississippi. The Catahoula Formation contains clay resources, and its sandstone units have been utilized as building stones (e.g., the stone wall at Piney Woods School and the Old Capitol in Jackson). Most importantly, sands of the Catahoula Formation are a major source of drinking water for southern Mississippi. The fourth mapping project is in Jackson County where population expansion is placing new demands on local resources; geologic information is needed concerning drinking water resources and locating areas suitable for waste disposal.

The Office of Geology intends also to pull together the work of other geologists and publish their maps to make them available to all potential users.

SCALE AND OUTPUT OF GEOLOGIC MAPS

With all the mapping underway, it might seem that geologic map coverage of the whole state should be forthcoming. So, what's the holdup? There are four aspects of the current mapping program that make for slow going. First, the maps are being published at a scale of 1:24,000 - the same as that of a 7.5-minute topographic quadrangle. This allows much greater detail than is possible at the scale of previously published county geologic maps. At this scale, 837 quadrangle maps are required to cover Mississippi. That's a lot of maps to be done!

Is this much detail really necessary? Yes; many users in construction, environmental remediation, agriculture, and even home buyers would like to see geologic maps of much greater detail, even at the scale of 1:12,000. In some areas around Jackson, such resolution would allow a prospective buyer to determine if a home or business were on or off the Yazoo Clay outcrop belt and allow a better assessment of possible foundation problems. At this point we must define what we mean by "detailed" geologic maps. We define detailed geologic mapping as that done and printed at the scale of 1:24,000, or one inch on the map represents 2000 feet on the ground. Greenly and Williams (1930) stated that only in very simple areas could a scale of 1:20,000 be regarded as detailed. Compton (1962) defined detailed geologic (or topographic) mapping as being at scales larger than 1 inch = 200 feet (1:2400). He referred to the scales 1:24,000 to 1:62,500 as intermediate scales. The U.S. Geological Survey's goals under the National Geological Mapping Act are to see the entire country mapped at the scale of 1:24,000.

At present, 29 geologic quadrangles are available as open-file reports or otherwise, leaving 808 to be done. Some of this number straddle state lines and may be published with adjacent maps. Still, at an optimistic estimate of producing 8 per year with our current programs, coverage of the whole state will require 101 years. Because of reasons below, it is expected that this output will increase.

The second aspect slowing map output is that the current programs have targeted the state's most difficult geologic terrains. These are areas where the present State Geologic Map (Bicker, 1969) is inadequate or incorrect. Once these terrains or outcrop belts are satisfactorily completed, intervening areas can be done with greater ease.

The third aspect is also related to geologically difficult areas of the state. In the past, local formational names were given to sections of the Wilcox Group where traditional units could not be readily distinguished. These local names were used by some and rejected by others. The present mapping programs in the Wilcox outcrop belt utilize only those formations recognized in the group's type area in Wilcox County, Alabama. This provides a uniformity in nomenclature from western Georgia to Mississippi and better reflects the genetically related depositional packages - or, in layman terms, what the real geology is like. Mapping of these formations into northern Mississippi becomes more difficult as the units tend to look more alike there. Careful field work, the drilling of core holes, geophysical log analyses, and analyses of microscopic fossil pollen and dynocysts are necessary to guarantee success. Sometimes maps have to be changed with the arrival of new data.

The care mentioned above, while time consuming, is important to our mapping program. Geologic maps are required to stand the scrutiny of paleontological (fossil) examinations, detailed surface correlation, and test hole data. Only then are they considered reliable geological documents. No geologic map is expected to be 100% perfect in the depiction of its geological outcrops. This is not the issue that concerns us. The disastrous error is that of a geologic map lacking well-defined stratigraphic units - a meaningless or misleading document.

The fourth aspect is one that substantially slows our geologic mapping program. Our maps are now produced digitally using AutoCAD software after the geologist has completed field and office work and map sketching. While digital products are convenient, modifiable, and preferred by many users, they are more efficiently done by full-time data processing technicians. Having no DP technicians available for the surface mapping projects, geologists must create and digitize their own finished maps. The finished digital product requires more of the geologist's time than does the field mapping and test hole drilling. This is complicated by the fact that all must use the same equipment. Funding of a DP technician will free up three geologists to devote their full time to geologic mapping.

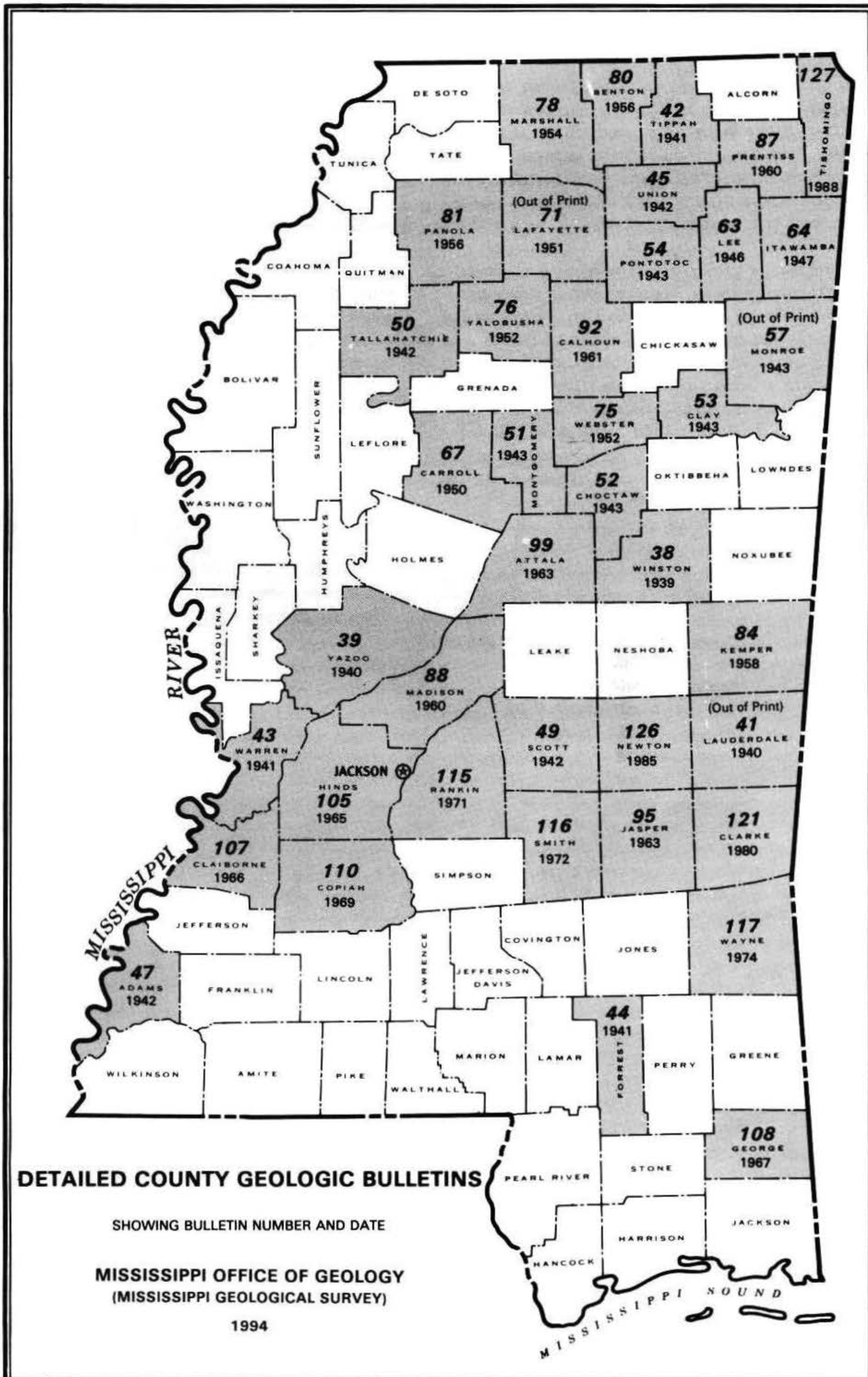
THE VALUE OF GEOLOGIC MAPS

Why bother to map the state's geology in the first place? The best answer to that question is in another question - what if we had no idea of the nature of the strata below our feet. The Biblical parable comes to mind about the wise man who built his house upon the rock and the fool who built upon the sand. The fool in Matthew 7: 24-27 did not know his surface geology. A storm came; the sand gave way; the foundation failed, and great was the fall thereof. Many a structure today suffers a similar fate. Maps showing unconsolidated alluvium are in demand by emergency management agencies. In planning for a major earthquake occurrence along the New Madrid Seismic Zone, emergency management agencies need maps of these and other potentially unstable areas in order to place shelters, staging areas, and field hospitals on solid ground that can withstand the aftershocks.

A second important use of geologic maps is in the exploration for mineral resources. Mississippi's first oil field at Tinsley was found while mapping the surface geology of Yazoo County. The Tinsley Field was a major oil find and is still in operation today. A fault mapped in Wayne County was later the site of a successful oil well. Even though the domestic oil industry is underappreciated, the state has reaped hundreds of millions of dollars in severance taxes on oil production and in lease sales on state-owned land.

Geologic maps are also important in the exploration for materials used by the construction industry every day such as sand and gravel, brick and ceramic clays, lightweight aggregate, and crushed stone. Most of these materials have a low unit value, which requires that their source be close to the job site. For example, land transportation costs on gravel from Tennessee would be considerable for use on a job in southern Mississippi. Geologic maps showing graveliferous units are needed around every metropolitan center where demand is high. Other materials with a low unit value include limestone for cement and agricultural lime and lignite. Lignite is not mined in Mississippi at present but may soon be used to fuel new electric power plants.

Mineral resources in the state with a high unit value (meaning they can be economically shipped over great distances) include bentonite, tripoli, heavy mineral sands, and mineral clays. Of these, only bentonite and mineral clay are



DETAILED COUNTY GEOLOGIC BULLETINS

SHOWING BULLETIN NUMBER AND DATE

MISSISSIPPI OFFICE OF GEOLOGY
(MISSISSIPPI GEOLOGICAL SURVEY)

1994

mined at present. Tripoli was once mined in the state, and heavy mineral exploration is ongoing. Heavy minerals are shipped from Australia for use in plants on the Mississippi Gulf Coast. A local source would be much better. Mineral clays from the Bucatunna Formation in Smith County are heat dried, bagged as is, and (according to a plant worker) sent as soil additives to banana plantations bordering the Southwest Pacific.

A third use for geologic maps is one that has become increasingly important with population growth and development. Geologic maps show the distribution of clay-rich and sand-rich units and are useful to planners concerned with pollution control. A city's most valuable resource is usually a plentiful source of fresh ground water. Therefore, it is of utmost importance that sanitary landfills not be located on the recharge area of the local aquifer. The same is true for hazardous waste sites. For such land-use decisions, a geologic map is not only important but has become a legal document in court decisions. As no map is 100% correct, map editors in many cases have been advised to include legal disclaimers. From a different perspective, a thick clay or chalk unit with low permeability may be viewed as a resource for disposal of hazardous waste should the state be required to dispose of its own.

A fourth use for geologic maps is academic in nature but is perhaps the most interesting. These maps tell the story of the state's geologic past. They show marine formations with fossil shells and the bones of ancient whales (the state fossil), which lived in oceans that once covered the state. Between such units are often the sands and clays deposited in ancient rivers and deltas. Older formations of Upper Cretaceous age contain the remains of long-extinct giant sea reptiles and here and there the bones of dinosaurs. Mississippi has an exceptionally complete sequence of strata ranging from Upper Cretaceous to Paleogene in age, containing well-preserved fossils of international significance. The geologic history revealed in this sequence has been used not only in statewide but in worldwide models of Earth History. Researchers from around the world come to study it. Local geologic names such as the Jackson and Vicksburg groups are used internationally in reference to rock or time intervals that correlate with the Jacksonian and Vicksburgian stages. The Yazoo River has given its name to both a formation, the Yazoo Clay, and a stream morphology (Bograd, 1994).

AVAILABILITY OF GEOLOGIC MAPS AT PRESENT

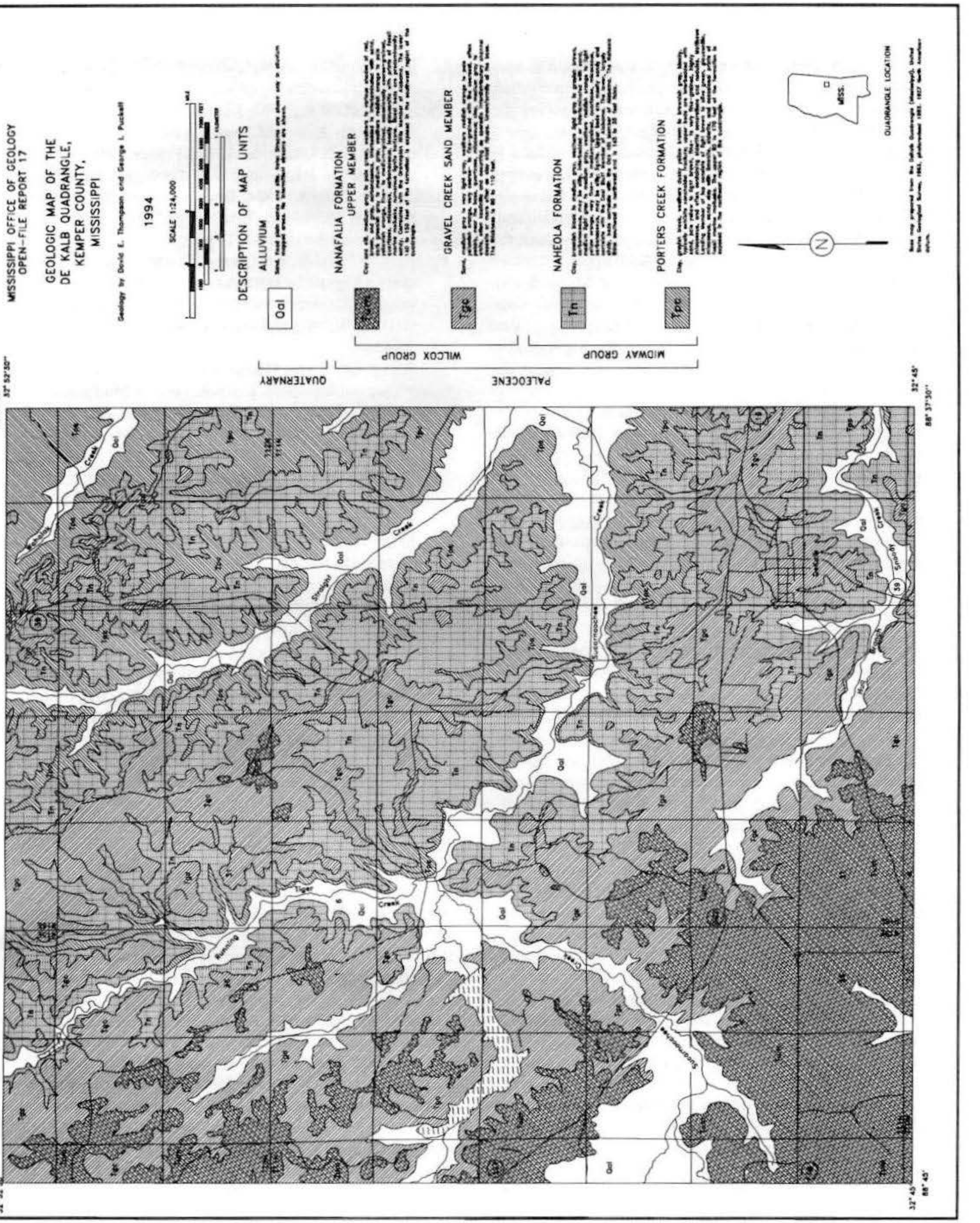
The Mississippi Office of Geology under various names has been making geologic maps for over a century. Early maps include those of the state by Harper (1857), Hilgard (1860), and others (see Gilliland, 1984, for details). The modern state map was done in 1945 and revised with little change in 1969. Current mapping programs will call for revisions leading to a new edition of this map. Forty county geologic maps have been published and accompany the county geologic reports (bulletins); the first was published in 1939 and the most recent in 1988. The quality of these maps varies with the better ones being the most recent, but these maps are generally the best source of information on the geology of any area. The first figure shows counties for which geologic map coverage is available. In addition, water-resources bulletins with geologic maps have been published for the Grenada County area and the six coastal counties. Unfortunately, three of the county bulletins and the coastal report have gone out of print, so researchers may no longer purchase copies.

The geologic quadrangle mapping series was initiated with the publication of the Mendenhall West Quadrangle by May and Marble (1976) and the Braxton Quadrangle by Gilliland and Harrelson (1981). Nine geologic maps by Merrill (1988) covering the Tishomingo County portions of 13 quadrangles (including the Belmont, Tishomingo-Bishop, Iuka-Margerum, Yellow Creek-Waterloo, Doskie, Burnsville, Paden, Paden SE, and Fulton NE - Red Bay quadrangles) were published in conjunction with the Tishomingo County Bulletin as open-file reports. Fourteen geologic quadrangle maps by David Thompson along the Wilcox outcrop belt in Lauderdale, Kemper, Winston, and Noxubee counties are scheduled to be published as open-file reports this year. These are the Kewanee, Daleville, Moscow, Lynville, Preston, Tamola, Toomsuba, Lauderdale, Lauderdale NW, Oak Grove, Porterville, DeKalb, Townsend, and Gholson quadrangles. See the second figure for an example, in reduced form, of the geologic quadrangles being published at the scale of 1:24,000. This mapping project was initiated by Phillip Weathersby and Wayne Stover, passed on to George Puckett and David Thompson, and completed by Thompson. Other projects include ongoing work in the Meridian South (first draft completed) and Meridian North quadrangles by Steve Ingram, the Center Ridge and Taylorsville quadrangles in Smith and Covington counties by Don Bates, and the Latimer and Vestry quadrangles in Jackson County by John Marble and James Crellin.

Information about how to order these and other publications of the Mississippi Office of Geology may be found in the current List of Publications, which is available at no charge. Some additional geologic maps of Mississippi have been published by the U. S. Geological Survey and other entities.

GEOLOGIC MAPPING BY OTHER WORKERS

The Office of Geology is doing planning work with outside researchers toward making their already completed maps available through our open-file report series. Dr. Ernest E. Russell, Mississippi State University emeritus, mapped the Cretaceous of Tennessee for the Tennessee Division of Geology and the perimeter of the Yellow Creek Nuclear Power Plant site for the Tennessee Valley Authority. The latter map was helpful in the mapping of Tishomingo County. Dr.


MISSISSIPPI OFFICE OF GEOLOGY
OPEN-FILE REPORT 17
GEOLOGIC MAP OF THE
DE KALB QUADRANGLE,
KEMPER COUNTY,
MISSISSIPPI
1994
SCALE 1:24,000
DESCRIPTION OF MAP UNITS
Qal
ALLUVIUM
NANAFALIA FORMATION
UPPER MEMBER
Tgc
GRAVEL CREEK SAND MEMBER
Tn
NAHEOLA FORMATION
Tpc
PORTERS CREEK FORMATION
QUATERNARY
PALEOCENE
WILCOX GROUP
MIDWAY GROUP
N
MISS.
QUADRANGLE LOCATION
88°45'
32°52'30"
88°37'30"
32°45'
Tiger
Creek
Running
Sucarnoochee
Smooth
Creek
39

Russell has mapped several quadrangles along the Cretaceous outcrop belt in northeastern Mississippi that are unpublished. Tentative arrangements have been made to include these in the open-file report series. Other candidates for open-file reports are maps along the Wilcox and Midway outcrop belts in northern Mississippi by Charles Swann of the Mississippi Mineral Resources Institute. Dr. Maurice Meylan, University of Southern Mississippi, in conjunction with graduate students has produced several geologic quadrangle maps along the Miocene outcrop belt in southern Mississippi. Tentative arrangements have been made to coordinate this work with that of Don Bates in an effort to map the Miocene sediments in the southern part of the state. Dr. Ervin Otvos, Gulf Coast Research Laboratory, has been mapping the geology of the coast for decades, and cooperative projects have been considered there too.

Additional completed mapping products for Mississippi are listed in Fuller et al. (1989). These other maps are mostly reconnaissance maps made by the U. S. Geological Survey in various parts of the state, most recently in 1965.

Considering the amount of work done to date, and the mapping under way by the Office of Geology and other researchers, we are confident that detailed maps of the state can be made available in a reasonable time.

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THE GENUS *CONORBIS* WITH THE DESCRIPTION OF A NEW SPECIES FROM THE EOCENE OF MISSISSIPPI

John K. Tucker
Illinois Natural History Survey
1005 Edwardsville Road
Wood River, Illinois 62095, USA

INTRODUCTION

The genus *Conorbis* Swainson, 1840 (type species: *Conus dormitor* Solander, 1766) was restricted by Koenen (1867) to a number of European Paleogene turrids whose internal shell walls were at least partially resorbed, thereby distinguishing it from the species Koenen (1867) included in *Cryptoconus*. Resorption of the internal shell walls (*sensu* Koenen, 1867; Kohn et al., 1979) is a derived character state (Kohn, 1990).

Cossmann (1896) included *Conorbis* with the Conidae due in part to resorption of the interior shell walls. Powell (1966), on the other hand, included *Conorbis* in its own subfamily, Conorbiinae, within the Turridae. However, he noted "*Conorbis* appears to be very closely allied to *Conus*..." and that "Some early *Conorbis* could well be the radicle from which the Recent Conidae have ascended" (Powell, 1966: 95). Powell (1966) further noted Thiele's (1929) inclusion of *Conus coromandelicus* E. A. Smith, 1894, as a Recent representative of *Conorbis* and the conid-like radular tooth of that species as illustrated by Thiele (1929: fig. 459).

Recently, Taylor et al. (1993) presented a new classification of the Conoidea based primarily on foregut anatomy. Their classification, which is at present untested, is very different from those of all previous authors. Their cladogram (Taylor et al., 1993: fig. 27) suggests that Conorbinae [sic] and Coninae are sister taxa distinguished by possession of an operculum (a plesiomorphic trait), intermediate sphincter to the buccal tube (an apomorphic trait), and presence of accessory salivary glands (a plesiomorphic trait). They do not include internal shell resorption in their limited set of shell character states (ten characters, seven of which are directionless). Had they included this character which is a synapomorphic trait for all of the genera included in Powell's Conorbiinae except for *Cryptoconus* which shows it only slightly (Koenen, 1867; Cossmann, 1896), then the inclusion of *Genota* would not have been questioned in Sysoev's (1993) classification of Recent turrid genera.

The purpose of the present paper is to review the species that have at one time or another been included in *Conorbis* and *Cryptoconus*, to narrow the definition of these taxa by excluding suggested members that do not possess traits of the type species, to reconsider the definition of the Conidae, and to describe a new species of *Conorbis* from the Eocene of Mississippi.

Family Conidae Rafinesque, 1815

Taylor et al.(1993) broadly defined this family and include in it all Conoidea that have a radular caecum, hollow marginal teeth, and no odontophore. In all, seven subfamilies (Clathurellinae, Oenopotinae, Conorbinae, Coninae, Mangeliinae, Daphnellinae, and Taraninae) were included. It is virtually certain that these seven taxa shared a common ancestor (Shimek and Kohn, 1981; Taylor et al., 1993). However, Taylor et al. (1993) omitted significant synapomorphies from their analysis which resulted in such a broad definition. Other family-group taxa are much narrower in their definition (e.g., Pseudomelatomidae, Strictispiridae). Had the nature of the radular membrane (Shimek and Kohn, 1981) and internal shell remodeling (Cossmann, 1896; Kohn, 1990) been incorporated into this analysis, narrower taxa would have been suggested. Therefore, the Conidae is restricted to those taxa that have a vestigial radular membrane, completely enrolled radular teeth, and some indication of internal shell remodeling along with the three synapomorphies pointed out by Taylor et al. (1993). The taxa fitting these criteria occur in Conorbinae and Coninae (*sensu* Taylor et al., 1993). Excluded are taxa that Taylor et al. (1993) placed in Clathurellinae, Oenopotinae, Mangeliinae, Daphnellinae, and Taraninae.

So restricted, the Conidae as defined herein is essentially identical to the concept of the family presented by Cossmann (1896). It includes the genera *Genota, Conorbis, Benthofascis,* and *Conus*. Based on Powell's (1966) analysis of the species included in *Pseudotoma* (= *Acamptogenotia* of Powell), I exclude *Pseudotoma* from the family. The genus *Cryptoconus* is considered a synonym of *Conorbis*. The genera *Hemiconus* and *Hermes* are considered synonyms of *Conus* until synapomorphies sufficient to distinguish taxa from within the broadly defined *Conus* are determined, a task beyond the scope of the present work.

Subfamily Conorbiinae De Gregorio, 1890

Genota, Conorbis (with *Cryptoconus* as a synonym), and *Benthofascis* are included in this subfamily. These genera are united by the following characters. All have relatively few whorls (4 to 8) in full size specimens. The sinus is not symmetrical and forms a reverse L with the distinct arcuate projection of the outer lip and is located on the shoulder slope. The shells are biconical with the spire making up nearly half of the length of the shell. In all cases, the spires are scalariform and the shoulders are indistinct in most species. Most species possess a false umbilicus (the "cicatrice pariétale" of Cossmann, 1896). Unfortunately, these shell characters are all plesiomorphic. However, radulae of Recent species of *Genota* and *Benthofascis* share an important apomorphy. Unlike the completely enrolled teeth found in the turrid subfamilies that were excluded from the Conidae, the teeth of *Genota* and *Benthofascis* are not only relatively short but have a waist developed (Powell, 1966). Besides this, *Conorbis* and *Benthofascis* share another important apomorphy, namely the absence of nodules on the shoulder at all growth stages. They also show no axial ornamentation on the body that reaches the shoulder nor is the outer lip thickened. Nodules or other axial ornamentation types are present in *Genota* (and all Paleogene species of *Conus*). Finally, most species of the Conorbiinae show at least some evidence of internal shell remodeling, a trait maximally developed in the Coninae.

Genus *Conorbis* Swainson, 1840

Although kept separate by most previous authors, *Conorbis* and *Cryptoconus* are considered to be synonyms herein. Koenen (1867) distinguished them based on the degree to which internal remodeling was present. However, some of the species he included in *Cryptoconus* have it about as well developed as those he included in *Conorbis*. Powell (1966) distinguished them as follows. Supposedly, *Conorbis* has a "more *Conus*-like shape, with a shorter more broadly conic spire, a broadly conical protoconch of 3 whorls, instead of 2 1/2 whorls, a narrower parallel-sided aperture, and more prominent axial growth lines" (Powell, 1966: 95). These characters are all highly variable within a single species and are not sufficient to objectively distinguish two genera.

In fact, the genus *Benthofascis* can only be distinguished from *Conorbis* by the morphology of the protoconch. In the former, the protoconch is "broad, low, dome-shaped, the tip flattened, smooth and inrolled..." (Powell, 1966: 96), whereas in the latter, the protoconch is multispiral and erect. Other than this difference, shells of the two genera closely resemble each other.

The genus *Conorbis* as defined herein contains species without axial ornamentation on the body or nodules at the shoulder, with a reverse L shaped siphon located on the shoulder slope, with biconic to subbiconic shells that are not

Figure 1. Apertural view of the holotype (PRI 33191) of *Conorbis dolini*, n. sp., from the Moodys Branch Formation, Upper Eocene at Town Creek, Jackson, Hinds County, Mississippi (MGS locality 1). Total shell length is 25.3 mm.

or only barely shouldered, and with an erect protoconch of two to three whorls. This definition excludes some species that have been included by authors such as Powell. For instance, *Conorbis mcnairyensis* Wade, 1917, which was questionably considered a *Conorbis* by both Sohl (1964) and Kohn (1990), is excluded from the genus. This species has no sinus on the shoulder slope and axial ornamentation on the body, both characters not shared with the species included in *Conorbis*. Similarly, *Cryptoconus rembangensis* Pannekoek, 1936, is excluded because it has axial ornamentation on the body and a thickened outer lip. These two are important exclusions because the first species was used to extend the stratigraphic range of the genus into the Cretaceous whereas the latter was used to extend it into the Upper Miocene. The one supposed Recent member, *Conus coromandelicus* E. A. Smith, 1894, is also excluded because that species has nodulose spire whorls, a feature not found in *Conorbis* as defined herein.

These exclusions restrict the time range of the genus to the Paleogene of North America and Europe and to the Eocene - Lower Miocene of the Indo-Pacific region. Although many species-group taxa have been described (Appendix 1) or placed into either *Conorbis* or *Cryptoconus*, relatively few valid species occur in each region if excluded species and synonyms are discounted. Only three Indo-Pacific species are recognized as valid members of the genus. All of these species are remarkably uniform in morphology even though they range from Eocene to L. Miocene in age. All Indo-Pacific species are ovate and biconical in shape. They have indistinct shoulders and scalariform rounded spire whorls. Each of the three species have spiral grooves that reach the shoulder and two or more spiral ridges on the whorl tops.

A total of seven European species are recognized. Unlike their Indo-Pacific congeners, the European species are much more diverse morphologically. Three of these species (*Conorbis dormitor, C. filosus,* and *C. grotriani*) are similar in that the spiral ridges and grooves on the body always reach the shoulder. *C. grotriani* is unique among all previously described species of *Conorbis* in being distinctly shouldered whereas the other species have shoulders that are barely recognizable. *C. dormitor* and *C. filosus* are very similar to each other. However, the former species has a spire that is only slightly scalariform whereas the latter has the spire distinctly scalariform with the spire whorls distinctly rounded. In *C. dormitor*, the spire whorls are nearly flat and form an evenly conical shaped spire.

C. filosus and *C. priscus* are also very similar to each other but the latter has a pronounced false umbilicus and an enlarged subsutural collar whereas the former has an indistinct or internal false umbilicus and no enlarged subsutural collar. Instead, *C. filosus* has three to four spiral ridges on the whorl tops that are subequal in size. The spiral ridges on the body whorl of most (but not all) specimens of *C. priscus* also fade out before reaching the shoulder. The shoulder slope in most specimens of *C. priscus* is also slightly to markedly concave whereas it is convex in *C. filosus*. However, small specimens of the two species are difficult to separate.

Like *C. priscus*, the other European species of *Conorbis* (*C. elongatus, C. interpositus,* and *C. labiatus*) have spiral ridges restricted to the anterior portion of the body whorl. These four taxa can be divided into two species pairs. One pair (*C. priscus* and *C. labiatus*) contains rather squat rounded shells while the other pair (*C. elongatus* and *C. interpositus*) contains species that are distinctly elongated in appearance. The species in each pair are further distinguished similarly. In the first pair, *C. priscus* has two or more spiral ridges on the whorl tops whereas *C. labiatus* has either no such ridges or only has a swollen subsutural ridge present. In the second pair, *C. interpositus* has ridges well developed on the whorl tops whereas they are absent or restricted to a single subsutural ridge in *C. elongatus*.

Like their European congeners, the North American species of *Conorbis* are morphologically diverse. As among the European species, there are those that have spiral ridges on the body whorl that reach the shoulder (*C. alatoideus* and *C. washingtonensis*) and those that have the spiral ridges obsolete before reaching the shoulder (*C. conoides* and *C. porcellanus*). A fifth species described as new herein is the North American counterpart of the European *C. grotriani* in that it is distinctly shouldered and has ridges that reach the shoulder. At present no North American counterpart of the elongated European species (*C. elongatus* and *C. interpositus*) is known.

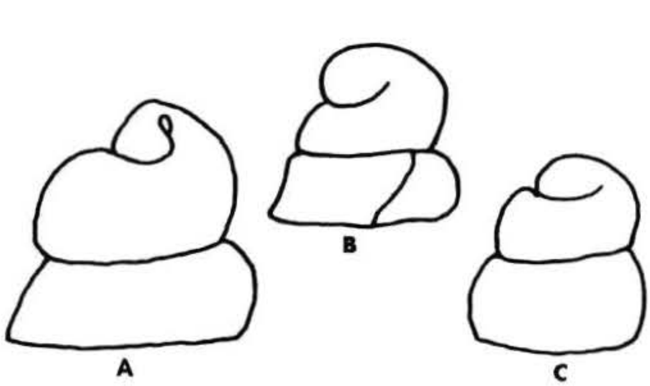

Figure 2A. Drawing of protoconch of the holotype (PRI 33191) of *Conorbis dolini*, n. sp. 2B. Drawing of protoconch of a 24.3 mm long specimen (PRI 33192) of *Conorbis porcellanus* from the Byram Formation, L. Oligocene at NE/4, Sec. 29, T6N, R4W, Hinds County, Mississippi (MGS locality 106). 2C. Drawing of protoconch of a 20.5 mm long specimen (PRI 33193) of *Conorbis alatoideus* from the Moodys Branch Formation, Upper Eocene, Jackson, Hinds County, Mississippi.

Conorbis dolini new species

Figures 1, 2A, 3B

Description: Protoconch of two and one-half rounded, swollen whorls whose first whorl is smooth, inclined, and partially hidden by the smooth swollen second whorl; teleoconch of six whorls. The first whorl has a subsutural collar and three spiral grooves with growth lines raised into axial ridges that stop at the shoulder. Enlarged growth lines then persist into the sixth whorl. The subsutural collar also persists and becomes punctate by whorl three. The spiral grooves number three on whorls one through four with a relatively large centrally located ridge being produced. This central ridge becomes even more pronounced in whorls five and six and is crossed by the enlarged growth lines producing a cancellate appearance in the outer two whorls; the other spiral ridges persist as well. The spire whorls are only slightly scalariform due to pronounced impressed suture between adjacent whorls. The whorl tops are flat, being neither convex nor concave throughout the length of the spire. The spire is only slightly elevated consisting of about one-third of the total length of the shell.

The body whorl is ornamented with spiral grooves and flat-topped ridges. These reach the shoulder but are separated from the spire ornamentation by a narrow smooth area at the shoulder angle. Although not sharply angular, the shoulder angle is pronounced. The shell is about one-half as wide (12 mm) as it is in total length (25.3 mm), giving it a somewhat squat, conical appearance. Growth lines are pronounced

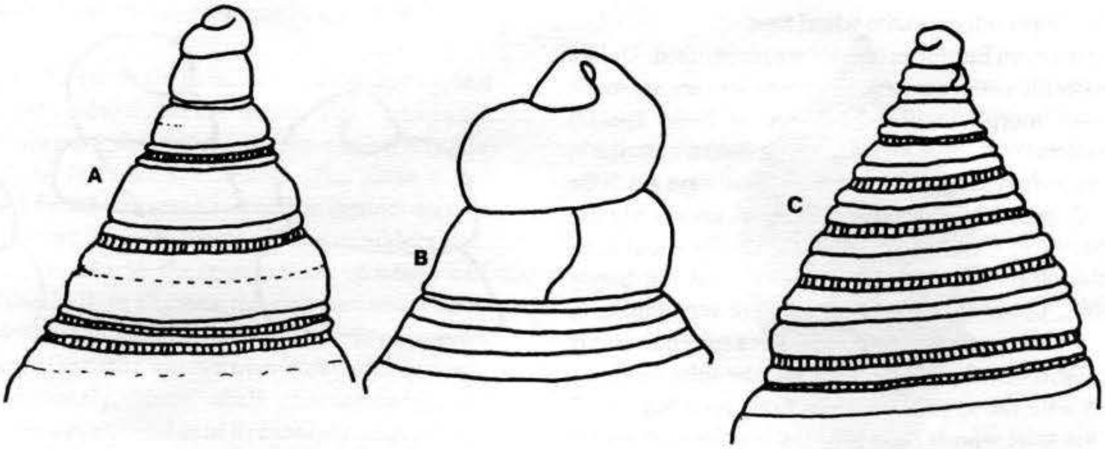

Figure 3. Spire with protoconch of *Conorbis alatoideus* (A), *Conorbis dolini* (B), and *Conorbis porcellanus* (C).

where they cross the grooves between adjacent ridges on the body whorl. The sides of the body whorl are slightly but distinctly convex. The aperture is moderately narrow and widest at the anterior end of the shell just posterior to the false umbilicus which is pronounced.

Type specimen: A single specimen (PRI 33191) collected by Luc Dolin, for whom the species is named, was available for study.

Type Locality: Moodys Branch Formation, Jackson Group, Upper Eocene at Town Creek (MGS locality 1) in Hinds County, Mississippi.

Comparison: This species is immediately distinguished from other North American congeners by the shouldered rather *Conus*-like shell whose spire is only very slightly scalariform. All other North American species have indistinct rounded shoulders. The protoconch of this species with its swollen rounded second whorl but inclined first whorl (Fig. 2A) is also unique. Other North American species do not have the first whorl inclined (Figs. 2B, C).

This species is also similar in shape and ornamentation to *C. grotriani*, a species from the L. Oligocene of Germany. However, the European species does not have a pronounced central ridge on the whorl tops which is a characteristic feature of *C. dolini*.

In some ways the new species is similar to Paleogene species of *Conus*. However, it possesses the conorbid traits of reverse L shaped sinus and a false umbilicus, both features not found in Paleogene species of *Conus*. The new species, like all other species assigned to the Conorbiinae, does not have nodules on the spire whorls whereas these are characteristically present in Paleogene species of *Conus*.

ACKNOWLEDGMENTS

Luc Dolin collected and donated the holotype of the new species. David T. Dockery, III allowed me to study it and provided much assistance including preparation of Figure 1. Alan J. Kohn and Donn L. Tippett provided copies of many obscure references. The Malacology Section Library at the Smithsonian Institution, United States National Museum, provided photocopies of other references.

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Appendix 1: A catalog of the species-group taxa that have been included in either *Conorbis* or *Cryptoconus* by previous authors. Each species-group taxon is alphabetically arranged with the first line containing the species-group name as originally spelled excepting capitalization of the first letter of each name, the author and date of the original description, and the original genus-group taxon. The second line contains the type locality and time-stratigraphy for the type locality cited in the original description. Subsequent lines contain a citation of the first authority to assign particular taxa to either *Conorbis* or *Cryptoconus* if it was originally described in a genus other than those two and/or the assignment of the taxon along with a reference to previously published determinations if any. Comments in square brackets are those added by myself, herein. The † symbol indicates that the type specimen is a fossil. Valid species of *Conorbis* are in bold-faced italic type.

†*aequipartitus* Cossmann, 1889. *Conorbis*.
Grignon. Lutétien, M. Eocene.
Is *Cryptoconus* [= *Conorbis*] *interpositus* (Deshayes, 1865) f. Tucker and Le Renard, 1993.

†*alatus* Edwards, 1857. *Conus* (*Conorbis*).
Bracklesham beds, M. Eocene.
Is *Cryptoconus* [= *Conorbis*] *priscus* (Solander, 1766), f. Tucker and Le Renard, 1993.

†***alatoideus*** Aldrich, 1885. *Conus* (*Conorbis*).
Moodys Branch, Jackson, Hinds County, Mississippi. Moodys Branch Formation, L. Jackson Group, U. Eocene
Conorbis f. Palmer and Brann, 1966

†*alphonsi* Briart and Cornet, 1871. *Pleurotoma*.
Mons, Belgium. Montien, L. Paleocene.
Is *Cryptoconus* [= *Conorbis*] *priscus* (Solander, 1766), f. Tucker and Le Renard, 1993.

†*amphiconus* J. de C. Sowerby, 1850. *Pleurotoma*.
Bracklesham Bay. M. Eocene.
Conorbis f. Koenen, 1867.
Is *Cryptoconus* [= *Conorbis*] *priscus* (Solander, 1766), f. Tucker and Le Renard, 1993.

†*angustus* Brébion, 1992. *Conorbis marginatus* (Lamarck, 1804).
L'Orme. Lutétien, M. Eocene.
Is *Conorbis priscus* (Solander, 1766), f. Tucker, herein.

†*apennicus* Bronn, 1838. *Cryptoconus*.
Paris Basin. Eocene.
Conus f. d'Orbigny, 1852.

†*approximata* Deshayes, 1865. *Pleurotoma*.
Grignon; Parnes; Fonteney; Mouchy; and Chaussy. Lutétien, M. Eocene.
Is *Cryptoconus* [= *Conorbis*] *priscus* (Solander, 1766), f. Tucker and Le Renard, 1993.

†*asyli* De Gregorio, 1880. *Conorbis*.
S. Giovanni Ilarione. Parisiano.
Is *Conorbis labiatus* (Deshayes, 1834), f. Tucker, herein.

†***atractoides*** Tate, 1890. *Conus* (*Conorbis*).
Adelaide Bore, Adelaide, S. Australia. Clayey greensands, Janjukian?, L. Miocene.
Conorbis f. Powell, 1944.

†*barbadensis* Trechmann, 1925. *Cryptoconus*.
Spa, Barbados. Scotland beds, Eocene.
Not identifiable to genus f. Tucker, herein.

†*baudoni* Cossmann, 1889. *Cryptoconus*.
Mouchy. Lutétien, M. Eocene.
Is *Cryptoconus* [= *Conorbis*] *interpositus* (Deshayes, 1865) f. Tucker and Le Renard, 1993.

†*bhagothorensis* Vredenburg, 1925. *Conorbis dormitor* (Solander, 1766), variety. Nari of Bhagothoro Hill, Sind. Oligocene.
Is *Conorbis sindiensis* Vredenburg, 1925, f. Tucker, herein.

†*biapproximatus* De Gregorio, 1880. *Conorbis*.
S. Giovanni Ilarione. Parisiano.
Is *Cryptoconus* [= *Conorbis*] *priscus* (Solander, 1766), f. Ferrero, 1971.

†*biarritzensis* Boussac, 1911. *Conorbis dormitor* (Solander, 1766), variety. Biarritz. Priabonien, Priabonien, U. Eocene.
Is *Conorbis dormitor* (Solander, 1766), f. Tucker, herein.

†*bistriata* Deshayes, 1834. *Pleurotoma*.
Parnes and Mouchy-le-Châtel. Lutétien, M. Eocene.
Is *Cryptoconus* [= *Conorbis*] *filosus* (Lamarck, 1804), f. Tucker and Le Renard, 1993.

†*brevispira* Newton, 1891. *Conorbis alatus* (Edwards, 1857), variety.

Bramshaw. Bracklesham beds, M. Eocene.
Is a *nomen nudum*.

†*calophora* Deshayes, 1865. *Pleurotoma*.
Beynes. Lutétien, M. Eocene.
Is *Cryptoconus* [= *Conorbis*] *filosus* (Lamarck, 1804), f. Tucker and Le Renard, 1993.

†*carinatus* K. Martin, 1933. *Cryptoconus*.
Waisiu, East Indies. Tertiary.
Thatcheria f. Charig, 1963.

†*cingillus* T. Brown, 1838. *Conus*.
Barton. Horizon not stated.
Is *Conorbis dormitor* (Solander, 1766), f. Tomlin, 1937.

†*cincta* Deshayes, 1834. *Pleurotoma*.
Beyne. Lutétien, M. Eocene.
Is *Cryptoconus* [= *Conorbis*] *filosus* (Lamarck, 1804), f. Tucker and Le Renard, 1993.

†*clavicularis* Lamarck, 1804. *Pleurotoma*.
Grignon. Lutétien, M. Eocene.
Is *Cryptoconus* [= *Conorbis*] *filosus* (Lamarck, 1804), f. Tucker and Le Renard, 1993.

†***conoides*** Conrad, 1835. *Pleurotoma*.
Claiborne, Alabama. Gosport Sand, U. Claiborne Sand, M. Eocene
Conorbis f. Conrad, 1865.

†*conradi* De Gregorio, 1890. *Conorbis* (*Cryptoconus*?).
Claiborne, Alabama. Gosport Sand, U. Claiborne Group, M. Eocene
Nomen novum pro Pleurotoma conoides Conrad, 1835.
Is *Conorbis conoides* Conrad, 1835, f. Tucker, herein.

coromandelicus E. A. Smith, 1894. *Conus*.
80-110 fm, 14°18'15"N, 80°18'30"E and 128 fm, 15°04'07"N, 80°25'07"E, Coromandel Coast, India.
Conorbis f. Thiele, 1929.
Is not a *Conorbis* f. Tucker, herein.

†*cooperi* Dickerson, 1916. *Drillia*.
Marysville Buttes, Sutter County, California. Tejon, Eocene.
Cryptoconus [= *Conorbis*] f. B. Clark and H. E. Vokes, 1936.
Is not a *Conorbis* f. Tucker, herein.

†*cossmanni* Tucker and Le Renard, 1993. *Cryptoconus*.
Chaumont. L. Lutétien, M. Eocene.
Nomen novum pro Pleurotoma denudata Deshayes, 1865.
Is *Cryptoconus* [= *Conorbis*] *priscus* (Solander, 1766), f. Tucker and Le Renard, 1993.

†*defecta* Pezant, 1910. *Cryptoconus infragradatus* Cossmann, 1889, variety.
Parnes. Lutétien, M. Eocene.
Is *Cryptoconus* [= *Conorbis*] *elongatus* (Deshayes, 1834), f. Tucker and Le Renard, 1993.

†*degensis* Bellardi, 1877. *Cryptoconus*.
Dego. Miocene inferiore.
Is *Conorbis labiatus* (Deshayes, 1834), f. Tucker, herein.

†*denudata* Deshayes, 1865. *Pleurotoma*.
Chaumont. L. Lutétien, M. Eocene.
Renamed *Cryptoconus* [= *Conorbis*] *cossmanni* by Tucker and Le Renard, 1993.
Is *Cryptoconus* [= *Conorbis*] *priscus* (Solander, 1766), f. Tucker and Le Renard, 1993.

†*depulsa* Pezant, 1909. *Pleurotoma* (*Conorbis*) *marginata* Lamarck, 1804, variety.
Parnes. Lutétien, M. Eocene.
Is *Cryptoconus* [= *Conorbis*] *priscus* (Solander, 1766), f. Tucker and Le Renard, 1993.

†*deshayesii* Desmoulins, 1842. *Pleurotoma*.
Beyne. Lutétien, M. Eocene.
Nomen novum pro cincta Deshayes, 1834.
Is *Cryptoconus* [= *Conorbis*] *filosus* (Lamarck, 1804), f. Tucker and Le Renard, 1993.

†*deshayesii* Koenen, 1867. *Conorbis*.
Lattorf. L. Oligocene.
Is *Conorbis labiatus* (Deshayes, 1834), f. Tucker, herein.

†***dolini*** Tucker, herein. *Conorbis*.
Town Creek, Hinds County, Mississippi. Moodys Branch Formation, Jackson Group, U. Eocene.

†*dollfusi* Vincent, 1878. *Pleurotoma*.
Wanzin, Belgium. L. Landénien, Paleocene.
Cryptoconus [= *Conorbis*] f. Cossmann, 1896.
Is *Conorbis priscus* (Solander, 1766), f. Tucker, herein.

†***dormitor*** Solander, 1766. *Conus*.
Hampshire. Horizon not stated.
Conorbis f. Koenen, 1867.

†*dudariensis* Strausz, 1966. *Cryptoconus priscus* (Solander, 1766), subspecies.
Dudar, Ungarn. Mergelm Lutétien, M. Eocene.
Is *Conorbis priscus* (Solander, 1766), f. Tucker, herein.

†*dunkeri* Koenen, 1867. *Cryptoconus*.
Lattorf and Lethen. L. Oligocene.
Is *Conorbis elongatus* (Deshayes, 1834), f. Tucker, herein.

†***elongata*** Deshayes, 1834. *Pleurotoma*.
Grignon; Parnes; and Mouchy. Lutétien, M. Eocene.
Cryptoconus [= *Conorbis*] f. Koenen, 1867.

†*erecta* Deshayes, 1865. *Pleurotoma*.
Saint-Félix. Lutétien, M. Eocene.
Is *Cryptoconus* [= *Conorbis*] *interpositus* (Deshayes, 1865) f. Tucker and Le Renard, 1993.

†*eucalypti* De Gregorio, 1880. *Conorbis bistriatus* (Deshayes, 1834), forma.
S. Giovanni Ilarione. Parisiano.
Is *Conorbis priscus* (Solander, 1766), f. Tucker, herein.

†*evulsa* Deshayes, 1865. *Pleurotoma*.
Cuise-la-Motte; Retheuil; Laversine; and Laon. Yprésien, L. Eocene.
Is *Cryptoconus* [= *Conorbis*] *priscus* (Solander, 1766), f. Tucker and Le Renard, 1993.

†*exacutus* Bellardi, 1877. *Cryptoconus*.
Dego and Carcare. Miocene inferiore.
Is *Conorbis priscus* (Solander, 1766), f. Tucker, herein.

†*exortus* De Gregorio, 1880. *Conorbis lineolatus* (Lamarck, 1804), forma.
S. Giovanni Ilarione. Parisiano.
Is *Conorbis filosus* (Lamarck, 1804), f. Tucker, herein.

†*expolitus* Kljushnikov, 1958. *Cryptoconus*.
Dnepropetrovska, Ukraine. U. Eocene.
Is *Conorbis filosus* (Lamarck, 1804), f. Tucker, herein.

†*faasi* Kljushnikov, 1958. *Conorbis procerus* (Beyrich, 1853), variety.
Dnepropetrovska, Ukraine. U. Eocene.
Conorbis f. Amitrov, 1973.
Is *Conorbis filosus* (Lamarck, 1804), f. Tucker, herein.

†*favoritus* De Gregorio, 1880. *Conorbis bistriatus* (Deshayes, 1834) forma.
S. Giovanni Ilarione. Parisiano.
Is *Conorbis priscus* (Solander, 1766), f. Tucker, herein.

†***filosa*** Lamarck, 1804. *Pleurotoma*.
Grignon. Lutétien, M. Eocene.
Cryptoconus [= *Conorbis*] f. Koenen, 1867.

†*glabrata* Lamarck, 1804. *Pleurotoma*.
Grignon. Lutétien, M. Eocene.
Is *Cryptoconus* [= *Conorbis*] *priscus* (Solander, 1766), f. Tucker and Le Renard, 1993.

†***grotriani*** Koenen, 1865. *Conus*.
Helmstädt. L. Oligocene.
Conorbis f. Koenen, 1867.

†*hemilissus* Edwards, 1857. *Conus* (*Conorbis*) *alatus* Edwards, 1857, variety.
Brockenhurst. Headon Beds, Oligocene.
Conorbis f. Glibert, 1960.
Is *Cryptoconus* [= *Conorbis*] priscus (Solander, 1766), f. Tucker and Le Renard, 1993.

†*herculei* Pezant, 1909. *Pleurotoma* (*Conorbis*) *filosa* Lamarck, 1804, variety.
Parnes. Lutétien, M. Eocene.
Is *Conorbis filosus* (Lamarck, 1804), f. Tucker, herein.

†*inaequistriata* Deshayes, 1865. *Pleurotoma*.
Grignon. Lutétien, M. Eocene.
Is *Cryptoconus* [= *Conorbis*] *filosus* (Lamarck, 1804), f. Tucker and Le Renard, 1993.

†*infragradatus* Cossmann, 1889. *Cryptoconus*.
Grignon. Lutétien, M. Eocene.
Is *Conorbis elongatus* (Deshayes, 1834), f. Tucker, herein.

†*injucundus* G. D. Hanna, 1924. *Cryptoconus*.
Marysville Buttes, Sutter County, California. Tejon, Eocene.
Nomen novum pro Drillia cooperi Dickerson, 1916.
Is not a *Conorbis* f. Tucker, herein.

†***interposita*** Deshayes, 1865. *Pleurotoma*.
Aizy. Yprésien, L. Eocene.
Cryptoconus [= *Conorbis*] f. Cossmann, 1889.

†*irravadicus* Noetling, 1895. *Pleurotoma* (*Cryptoconus*).
Burma. Miocene.
Eosurcula f. Shuto, 1984.

†*kressenbergensis* Schlosser, 1925. *Cryptoconus*.
Emanuelnebengestein; Purarian Alps. Lutetian, M. Eocene.
Is *Conorbis interpositus* (Deshayes, 1865) f. Tucker, herein.

†***labiata*** Deshayes, 1834. *Pleurotoma*.
Parnes and Mouchy-le-Châtel. Lutétien, M. Eocene.
Cryptoconus [= *Conorbis*] f. Koenen, 1867.

†*laevigata* Melleville, 1843. *Pleurotoma*.
Laon. Yprésien, L. Eocene.
Renamed *Cryptoconus* [= *Conorbis*] *mellevillei* by Tucker and Le Renard, 1993.
Is *Conorbis priscus* (Solander, 1766), f. Glibert, 1960.

†*lavacillensis* De Gregorio, 1895. *Conorbis semistriatus* (Deshayes, 1834), variety.

Lavacille near Bassano. Tertiary.
Is *Conorbis filosus* (Lamarck, 1804), f. Tucker, herein.

†*ligans* De Gregorio, 1880. *Conorbis lineolatus* (Lamarck, 1804), forma.
S. Giovanni Ilarione. Parisiano.
Is *Conorbis filosus* (Lamarck, 1804), f. Tucker, herein.

†*lineolata* Lamarck, 1804. *Pleurotoma.*
Grignon. Lutétien, M. Eocene.
Cryptoconus f. Koenen, 1867.
Is *Conorbis filosus* (Lamarck, 1804), f. Tucker, herein.

†*longobiconicus* Sacco, 1893. *Conorbis protensus* (Michelotti, 1861), variety.
Cassinelle. Tongriano.
Is *Conorbis labiatus* (Deshayes, 1834), f. Tucker, herein.

†*marginata* Lamarck, 1804. *Pleurotoma.*
Grignon. Lutétien, M. Eocene.
Conorbis f. Koenen, 1867.
Is *Conorbis priscus* (Solander, 1766), f. Tucker, herein.

†*mcnairyensis* Wade, 1917. *Conorbis.*
Coon Creek, McNairy County, Tennessee. Ripley Formation, U. Cretaceous.
Is not a *Conorbis* f. Tucker, herein and with query f. Sohl, 1964; Kohn, 1990.

†*mellevillei* Tucker and Le Renard, 1993. *Cryptoconus.*
Laon. Yprésien, L. Eocene.
Nomen novum pro Pleurotoma laevigata Melleville, 1843.
Is *Conorbis priscus* (Solander, 1766), f. Tucker, herein.

†*multipartitus* Kljushnikov, 1958. *Conorbis deshayesi* (Desmoulins, 1842), variety.
Dnepropetrovska, Ukraine. U. Eocene.
Is *Conorbis filosus* (Lamarck, 1804), f. Tucker, herein.

†*normalis* De Gregorio, 1880. *Conorbis bistriatus* (Deshayes, 1834), forma.
S. Giovanni Ilarione. Parisiano.
Is *Conorbis labiatus* (Deshayes, 1834), f. Tucker, herein.

†*otwayensis* Long, 1981. *Conorbis atractoides* (Tate, 1890), subspecies.
Point Flinders, Cape Otway, Victoria, Australia. Glen Aire Clay, U. Aldingan, L. Oligocene.

†***perliratus*** Cossmann and Pissarro, 1909. *Cryptoconus.*
Jhirak, India. U. Ranikot beds, Eocene.

†*pleurotomoides* Cossmann and Pissarro, 1901. *Cryptoconus.*
Fresville. U. Lutétien, M. Eocene.
Is *Conorbis elongatus* (Deshayes, 1834), f. Tucker, herein.

†***porcellana*** Conrad, 1848. *Pleurotoma.*
Vicksburg, Mississippi. Byram Formation, Vicksburg Group, Oligocene.
Conorbis f. Conrad, 1866.

†***priscus*** Solander, 1766. *Murex.*
Hordwell. Barton beds, Eocene.
Cryptoconus [= *Conorbis*] f. Cossmann, 1889.

†*procerus* Beyrich, 1853. *Conus.*
Westeregeln, Magdeburg. Tertiary.
Conorbis f. Koenen, 1867.
Is *Conorbis labiatus* (Deshayes, 1834), f. Tucker, herein.

†*propefilosus* De Gregorio, 1880. *Conorbis.*
S. Giovanni Ilarione. Parisiano.
Is *Conorbis filosus* (Lamarck, 1804), f. Tucker, herein.

†*protensa* Michelotti, 1861. *Pleurotoma.*
Dego. Miocene inférieur.
Conorbis f. Glibert, 1960.
Is *Conorbis labiatus* (Deshayes, 1834), f. Tucker, herein.

†*punctata* Brébion, 1992. *Cryptoconus lineolatus* (Lamarck, 1804), variety.
Villiers. Lutetian, M. Eocene.
Is an unavailable varietal name.
Is *Conorbis filosus* (Lamarck, 1804), f. Tucker, herein.

†*punctatus* Tucker and Le Renard, 1993. *Cryptoconus lineolatus* (Lamarck, 1804), subspecies.
Villiers, la Ferme de l'Orme. Lutétien, M. Eocene.
Is *Conorbis filosus* (Lamarck, 1804), f. Tucker, herein.

†*raulini* Peyrot, 1930. *Conorbis.*
Peyrehorade. Aquitanien [= U. Oligocene].
Is *Cryptoconus* [= *Conorbis*] *interpositus* (Deshayes, 1865) f. Tucker and Le Renard, 1993.

†*regulolineatus* De Gregorio, 1880. *Conorbis bistriatus* (Deshayes, 1834), forma.
S. Giovanni Ilarione. Parisiano.
Is *Conorbis filosus* (Lamarck, 1804), f. Tucker, herein.

†*rembangensis* Pannekoek, 1936. *Cryptoconus.*
Sedan, Rembang, Java. U. Miocene.
Is not a *Conorbis* f. Tucker, herein.

†*restitutus* White, 1887. *Conus* (*Conorbis*).
Rio Piabas, Province of Pará. Cretaceous.
Conus f. Kohn, 1990; age is Miocene f. Maury, 1925.

†*rouaulti* Cossmann, 1923. *Cryptoconus*.
Gan. Yprésien, L. Eocene.
Is *Cryptoconus* [= *Conorbis*] *interpositus* (Deshayes, 1865) f. Tucker and Le Renard, 1993.

†*sandiegoensis* M. A. Hanna, 1927. *Cryptoconus*.
La Jolla, California. Eocene.
Is not a *Conorbis* f. Tucker, herein.

†*scandens* Schaufhaeutl, 1863. *Fusus*.
Germany. Eocene.
Cryptoconus f. Schlosser, 1925.
Is *Conorbis interpositus* (Deshayes, 1865) f. Tucker, herein.

†*semi-baudoni* Pezant, 1909. *Pleurotoma* (*Conorbis*).
Parnes. Lutétien, M. Eocene.
Is *Cryptoconus* [= *Conorbis*] *filosus* (Lamarck, 1804), f. Tucker and Le Renard, 1993.

†*seminuda* Edwards, 1857. *Conus dormitor* (Solander, 1766), variety.
Barton; Alum Bay; Lyndhurst; and Brockenhurst. Headon beds, Oligocene.
Conorbis f. Koenen, 1867.
Is *Cryptoconus* [= *Conorbis*] *priscus* (Solander, 1766), f. Tucker and Le Renard, 1993.

†*semi-striata* Deshayes, 1834. *Pleurotoma*.
Parnes and Mouchy. Lutétien, M. Eocene.
Is *Conorbis filosus* (Lamarck, 1804), f. Tucker, herein.

†*semisubdecussata* Pezant, 1909. *Pleurotoma* (*Conorbis*).
Fay. Lutétien, M. Eocene.
Is *Cryptoconus* [= *Conorbis*] *filosus* (Lamarck, 1804), f. Tucker and Le Renard, 1993.

†*senessei* Delpey, 1938. *Conorbis*.
La Jouane and Lit de l'Eau Salée à Sougraigne. U. Santonien.
Is not certainly a *Conorbis* f. Kohn, 1990.

†***sindiensis*** Vredenburg, 1925. *Conorbis dormitor* (Solander, 1766), variety.
Navi of Bhagothoro Hill, Sind. Oligocene.
Conorbis f. Powell, 1966.

†*somniator* Oppenheim, 1901. *Conorbis*.
Castelcies. Tertiary.
Is *Conorbis grotriani* (Koenen, 1865), f. Tucker, herein.

stearnsiana Raymond, 1904. *Pleurotoma* (*Genota*).
25-30 fm, off San Diego, California.
Cryptoconus [= *Conorbis*] f. Dall, 1921; Is a *Megasurcula* f. Grant and Gale, 1931.

†*stromboides* Schlotheim, 1820. *Conus* (*Conilites*).
Germany. Oligocene.
Is *Conorbis dormitor* (Solander, 1766), f. Tucker and Le Renard, 1993.

†*subagranulatus* Sacco, 1893. *Conorbis antidiluvianus* (Bruguiere, 1792), variety.
Castelnuove d'Asti. Miocene.
Is *Conus antidiluvianus* Bruguiere, 1792, f. Hall, 1964.

†*subangulata* Deshayes, 1834. *Pleurotoma*.
Parnes and Mouchy-le-Châtel. Lutétien, M. Eocene.
Conorbis f. Koenen, 1867.
Is Cryptoconus [= *Conorbis*] *priscus* (Solander, 1766), f. Tucker and Le Renard, 1993.

†*subclavicularis* Bellardi, 1877. *Cryptoconus*.
Dego. Miocene inferiore.
Is *Conorbis labiatus* (Deshayes, 1834), f. Tucker, herein.

†*subdecussata* Deshayes, 1834. *Pleurotoma*.
Courtagnon and Damerie. Lutétien, M. Eocene.
Is *Cryptoconus* [= *Conorbis*] *priscus* (Solander, 1766), f. Tucker and Le Renard, 1993.

†*subfilosa* d'Orbigny, 1852. *Pleurotoma*.
Gaas and Lesbarritz; Dax. Stampien, L. Oligocene and Burdigalien, Miocene, respectively.
Nomen novum pro Pleurotoma filosa of Grateloup, 1847.
Is *Conorbis priscus* (Solander, 1766), f. Tucker, herein.

†*sublaevigata* d'Orbigny, 1852. *Pleurotoma*.
Laon. Yprésien, L. Eocene.
Nomen novum pro Pleurotoma laevigata Melleville, 1843.
Cryptoconus [= *Conorbis*] f. Cossmann, 1889.
Is *Conorbis priscus* (Solander, 1766), f. Glibert, 1960.

†*submarginatus* Koenen, 1890. *Conorbis*.
Lattorf and Unseburg. L. Oligocene.
Is *Conorbis filosus* (Lamarck, 1804), f. Tucker, herein.

†*subsimilis* Schlotheim, 1820. *Conus* (*Conilites*).
Germany. Oligocene.
Is *Conorbis dormitor* (Solander, 1766), f. Tucker and Le Renard, 1993.

†*surculaeformis* Cossmann and Pissarro, 1909. *Cryptoconus*.
2 miles E of Kandaira, Vera plain east and underscarp of Jakhmari. U. Ranikot beds, Eocene.
Is not a *Conorbis* f. Tucker, herein.

†*umbgrovei* K. Martin, 1931. *Conorbis*.
Nanggulan. U. Eocene.
Is *Conorbis sindiensis* Vredenburg, 1925, f. Tucker, herein.

†*unifascialis* Deshayes, 1834. *Pleurotoma.*
Grignon. Lutétien, M. Eocene.
Is *Cryptoconus* [= *Conorbis*] *labiatus* (Deshayes, 1834), f. Tucker and Le Renard, 1993.

†*unisulcata* De Gregorio, 1896. *Pleurotoma* (*Cryptoconus*) *lineolata* Land. [sic] variety.
Roncà. Eocene.
Is *Conorbis filosus* (Lamarck, 1804), f. Tucker, herein.

†***washingtonensis*** Van Winkle, 1918. *Conus.*
0.25 mile W of Lincoln Creek Station, Chehalis Valley, Washington. *Molopophorus lincolnensis* zone, L. Oligocene.
Conorbis f. Powell, 1966.

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Editors: Michael B. E. Bograd and David Dockery