AN OVERVIEW OF THE CHIPOLA FORMATION, NORTHWESTERN FLORIDA

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The Alum Bluff Group of northwestern Florida includes four "formations" – the Chipola, Oak Grove, Shoal River, and Hawthorn units (Fig.1). Of these, the Chipola and Oak Grove are believed, on the basis of molluscan fauna, to be stratigraphic equivalents, and are of late Early Miocene age (Akers, 1972). The Shoal River and Hawthorn are assumed to be Middle Miocene.

The name, Chipola Marl, was first suggested in field notes by collector Frank Burns, of the U. S. Geological Survey, and was originally used as a member of the Alum Bluff Formation; however, Julia Gardner (1926, p. 1) considered the faunas of the different units to be so completely distinct that she elevated the members to the rank of formation. This is not very good stratigraphic technique, as a formation is a lithologic unit, but there is a lithologic difference. The Chipola is a blue-gray to yellowish brown (depending on how deeply weathered it is), highly fossiliferous marl. The Oak Grove and Shoal River units are sands, presumably very near-shore.

The Hawthorn, as Puri and Vernon (1964, p. 145) noted, "is the most misunderstood formational unit in the southeastern United States. It has been a dumping ground for alluvial, terrestrial, marine, deltaic, and pro-deltaic beds of diverse lithologic units." According to these authors, the Hawthorn, which includes phosphatic, dolomitic, algal, and quartzose beds, "indicates the presence of a massive delta along the Georgia, Alabama, and Florida lines" (1964, p. 153). The Hawthorn outcrops only to the east of the Apalachicola River but Gardner included a number of Hawthorn localities in what she called "Chipola Formation."

The typical Chipola Formation, that is, the formation as it is developed in the type area (Fig. 2), occupies a relatively small area, comprising the outcrops on the Chipola River, west of Blountstown, together with its tributaries, and at Alum Bluff, on the Apalachicola River just to the northeast of Blountstown.

In the late nineteen fifties there was no precise information on localities. The USGS localities collected by Burns were said to be "Chipola River, one mile below Bailey's Ferry" and "Tenmile Creek, one mile west of Bailey's Ferry." Cooke's *Geology of Florida* (1945, p. 163) noted that "the type locality [of the Chipola Formation] is on the west bank of the Chipola on the John M. P. McCleland *[sic]* Farm, in the SW 1/4 SW 1/4 sec. 8, T.1N., R.9W., 2 1/4 miles east of Carr." He added that Burns' locality on Tenmile Creek "is probably at or near the crossing of the present State Highway 84 [now State 73] (from Marianna to Clarksville)."

The locality at the bridge (TU 70) is about two miles west of the river and the fauna in no way resembles that said to occur at USGS 2212, one mile west of Bailey's ferry. Thus, from 1958 to 1961 we searched for Bailey's Ferry, thinking this would be the key to the localities. We were not in the least helped by the statement in Dall and Stanley-Brown (1894, p. 159), who said: "The principal localities of interest on the Chipola River are those near a point called Bailey's Ferry, where a bridge has replaced the former ferry ... Just above the bridge, on the right bank, the ferrugineous Chipola marl may be seen rising two or three feet above the water edge ... This is said by residents to be the most northerly point on the Chipola river where the yellow marl is visible in the bank ... A half mile below the bridge is a farm belonging to Mr. John McClellan *[sic]*, on which a fairly good section can be studied."

However, the bridge is about four miles below where Bailey's ferry (Fig. 3) is located (once we finally found it), McClelland's farm (Fig. 4) is a scant half-mile below the ferry but far above the bridge. Once we found Bailey's Ferry, we could locate the section at McClelland's farm, which does rest on the Chattahoochee Limestone (Figs. 5, 6), as Burns had noted, so there is no doubt that this is the correct locality. It is not in section 8, but about 3/4 mile below it. Nor is it one mile below Bailey's Ferry, it is less than one-half mile.

Subsequent work over the years has resulted in some 60 localities (Fig. 7) on the Chipola River and its tributaries – Tenmile

Creek to the west, and Farley Creek to the east. In all, there is a total outcrop of about 4 miles exposed along the river, 1 3/4 miles on Farley, and 1 1/2 miles on Tenmile, or approximately 7 linear miles of exposure.

Here we have discovered one of the most ecologically diverse faunas anywhere in the western Atlantic. The position of the river, which cuts almost directly across the strike of the formation, together with its two tributaries, one east and one west, gives a beautiful three dimensional picture of the area.

The Chipola is a moderately small river (Fig. 8), rising in southern Alabama, just south of Dothan. It flows due south for

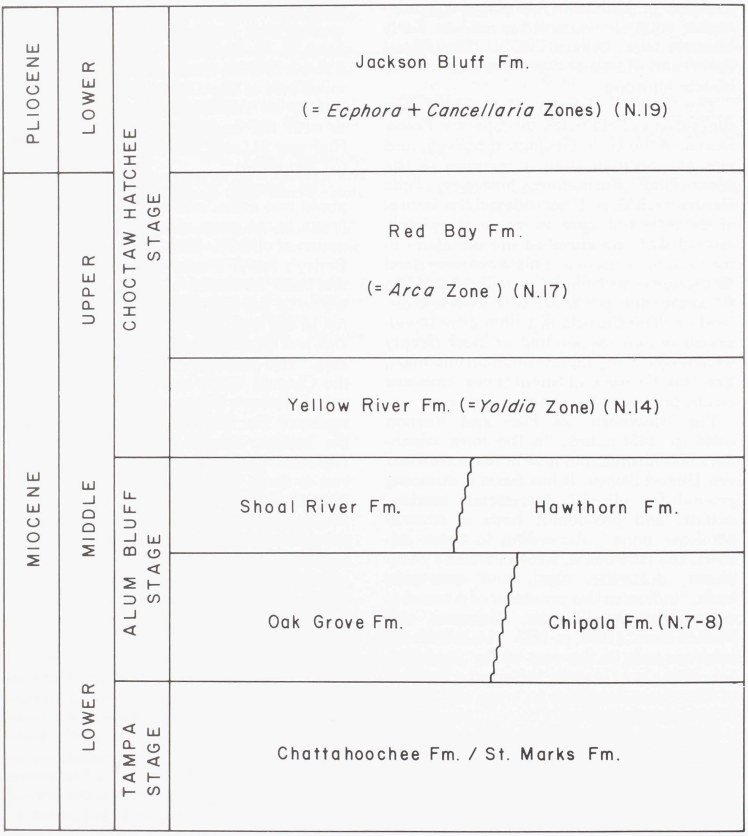

Figure 1. Correlation chart of the Miocene and Pliocene formations of northwestern Florida. Only those units with N. numbers have been accurately dated (Akers, 1972), the others are only approximately correct.

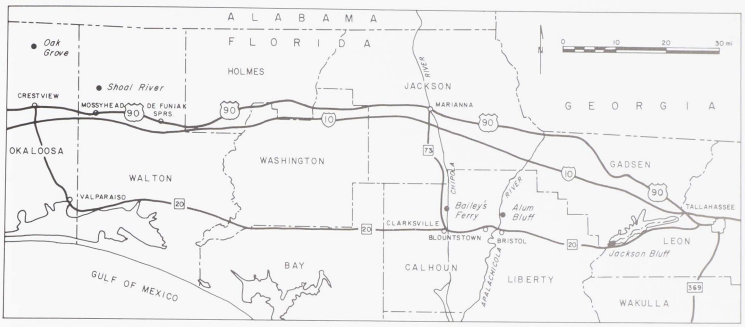

Figure 2. Location of relevant localities in northwestern Florida, showing the disjunct nature of the outcrops of the members of the Alum Bluff Group. The Hawthorn Formation is only to the east of the Apalachicola River, principally north of Gainesville in peninsular Florida.

about one hundred miles to Dead Lake, where it joins the Apalachicola River. For much of the distance between Marianna and Bailey's Ferry, it flows in a canyon cut into the Marianna and Chattahoochee limestones. Bailey's Ferry is located where the Chattahoochee Limestone is just at water-level, making it possible to drive a wagon down to the river without sinking up to the axles in Chipola mud. As one moves downstream, the first outcrop of Chipola Marl is at the aforementioned McClelland's farm, and because of the almost flat-lying beds, here the limestone is also just at water level. These basal beds contain many specimens of *Orthaulax*, *Strombus*, oysters, Amusiums, Nodipectens, and solitary corals, evidently a result of the hard bottom, for we also see this same fauna on Tenmile Creek at the basal contact.

For the next four miles downstream there is a series of low exposures, usually no more than a couple of feet high, that include a shore-line beach (TU 459), complete with specimens of *Donax* and some fresh-water elements, an oyster reef (TU 550), a coral patch-reef (TU 547, 555), with a number of reef-dwelling mollusks not found anywhere else (such as *Pterynotus hoerlei* Vokes, 1972), then into a fine silty-clay (TU 549), reminiscent of the upper beds on Tenmile Creek.

Tenmile Creek (Fig. 9) is the major tributary of the Chipola River. It comes in from the northwest and enters the river at Bailey's Ferry. Where it is crossed by the Clarksville Highway it is deeply entrenched in a narrow canyon cut into the Chipola Formation, in beds that have a higher percentage of silt and less lime than in the more easterly outcrops. The beds are considered to be shallower in origin than those on the river, but in very quiet water, perhaps lagoonal.

As one moves downstream on Tenmile, the creek gets wider and the fossil fauna changes to become similar to that on the upper reaches of the river. The beds are more calcareous, and the paleo-depth is thought to be on the order of 10-15 fathoms (20 to 30 meters). This is the area that includes the "one mile west of Bailey's Ferry" locality of Burns. This facies extends for about one-half mile and then one comes to the base of the formation, where the Chipola can be seen to be resting on the Chattahoochee Limestone. For the last mile of its length, Tenmile flows in another canyon cut into the limestone, and at one time there is said to have been a natural bridge but it is now gone.

Farley Creek (Fig. 10) is a much smaller and shallower creek, only about four miles in length, flowing first to the south, then curving to the west, to enter the river

Figure 3. Bailey's Ferry, on the west side of the Chipola River, approximately 4 miles above the crossing of Florida Highway 20.

Figure 4. Graves of Mr. and Mrs. J. P. M. McClelland at Bailey's Cemetery, just west of Bailey's Ferry.

Figure 5. Outcrop of Chipola Formation resting on the harder Chattahoochee Limestone, at McClelland's Farm, west side of the Chipola River, about one-half mile below Bailey's ferry.

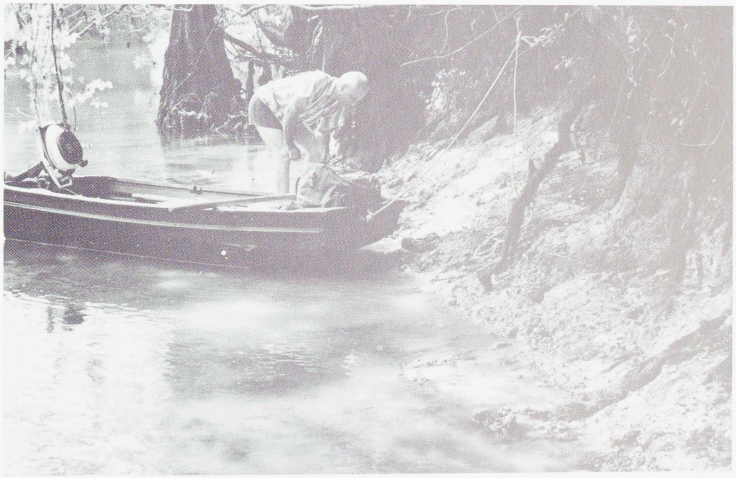

Figure 6. Collecting from the basal Chipola Formation at McClelland's Farm.

about a mile and one-half below McClelland's Farm. For much of its length it flows parallel to the strike of the formation, and the facies of the outcrop exposed for almost two miles along Farley tends to be much the same everywhere along its length. It is a bivalve-rich, miliolid limesand. There are many calcareous algae present, as well as numerous coral-heads, but no true reef is developed and we assume it is a shallow back-reef facies. In the upper reaches, one approaches the paleoshoreline, and then crosses into gravelly non-fossiliferous fluvial beds.

Thus, in this small area we have a section from shoreline to a patch-reef that was about two miles off-shore. To the west there were quiet muddy lagoons, to the

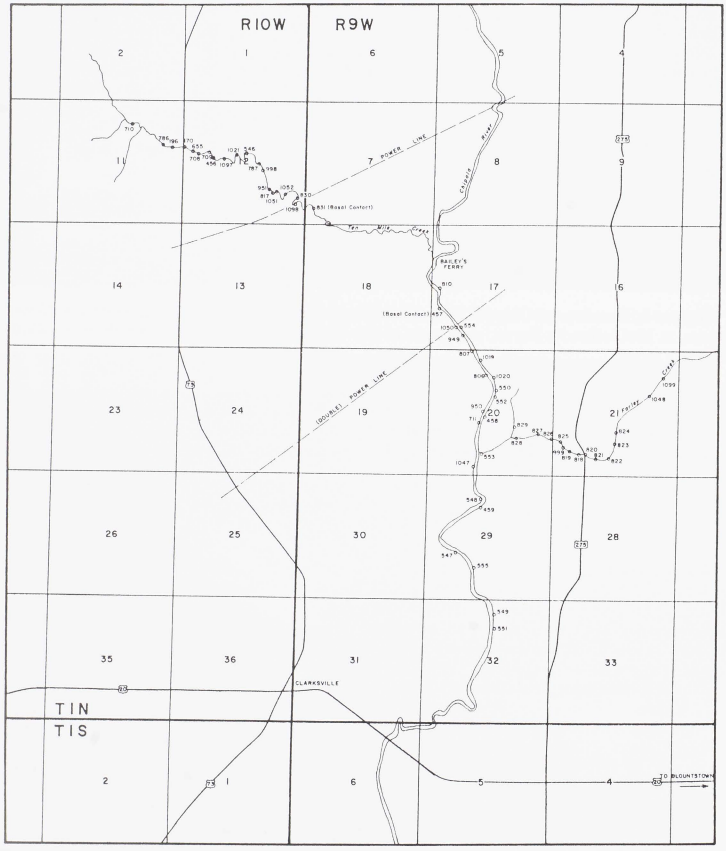

Figure 7. Tulane University fossil localities in the type area of the Chipola Formation, Calhoun County, Florida. Map based on U.S.G.S. topographic maps – Clarksville and Altha West quadrangles.

TABLE 1

FAMILY	Gardner had	total now
Ostreidae	5	6 (H.E. Vokes, 1977a)
Limidae	0	4 (H.E. Vokes, 1973)
Mytilidae	3	10 (H.E. Vokes, 1986)
Milthidae	3	4 (H.E. Vokes, 1969a; 1969b)
Cardiidae	13	16 (H.E. Vokes, 1977a; 1982)
Conidae	6	17 (Hoerle, 1976)
Olividae	3	6 (Drez, 1981)
Volutidae	2	4 (Hoerle & Vokes, 1978)
Turbinellidae	1	3 (E.H. Vokes, 1964)
Vasidae	1	4 (E.H. Vokes, 1966; 1970b)
Muricidae	11	37 (E.H. Vokes, 1963 *et. seq.*; Gertman, 1969; Vokes & D'Attillio, 1980; Vokes & Houart, 1986)
Calyptraeidae	4	9 (E.H. Vokes, 1975b)
Epitoniidae	1	3 (Olsson, 1967)
Cerithiidae	1	19 (Hoerle, 1972)
Potamididae	0	2 (Hoerle, 1972)
misc. unrep. families	0	15*
TOTAL	54	159

east more calcareous back-reef flats. Nowhere was the water probably more than 15 fathoms (30 meters) in depth – warm, clear, and absolutely teeming with life.

How many species of mollusk are there in the Chipola Formation? This a good question. Gardner, in the Introduction to her *opus magnum* on the Alum Bluff fauna (1926, p. 2), makes the statement that there are 439 species of Mollusca in the Chipola Formation.

However, if you count only her localities that are in the type area, that is the Chipola River, Tenmile Creek, and Alum Bluff, you get 421 species. Add to this 19 species described by Maury in 1910 and not included by Gardner, as she had no specimens, you arrive at 440 species.

So, I will base my calculations on this latter number. In those families that have been monographed more recently by either Harold Vokes, myself, or our associates (Fig. 11), we find that Gardner had a total number of 54 species in these selected families. To these have been added 105 more, for a total of 159 species in these families now.

Part of the reason for this great increase is because all of the material Gardner worked with was from two localities: "one mile west of Bailey's Ferry" (= TU 546), and "one mile below Bailey's Ferry," (= TU 457) both of which are in the basal beds and are extremely similar in facies. Her only other locality was the lower bed at Alum Bluff (= TU 453). This is also the reason why Maury (1910) was able to describe so many species from "Bailey's Ferry" that were not found in any of the USGS collections. Harris and Veatch, in making their collection for the Cornell Museum, obviously put a boat on the river and collected many of the sites that we subsequently located.

Table 1 gives an indication of the increases in some representative families. In all, from Gardner's count of 54 species in these selected families, we now have 159 species. This is very close to a 200% increase (162 = 200%). However, this is a bit misleading, as Gardner forgot (literally, according to Druid Wilson, pers. comm.) to do the Families Cerithiidae and Potamididae. If we include those species that Gardner should have had (that is, already de-

*See various *Notes on the fauna of the Chipola Formation*, Tulane Stud. Geol. Paleont., volume 10 *et seq.*

Figure 8. The Chipola River just below the crossing of Florida Highway 20, east of Clarksville, Calhoun County.

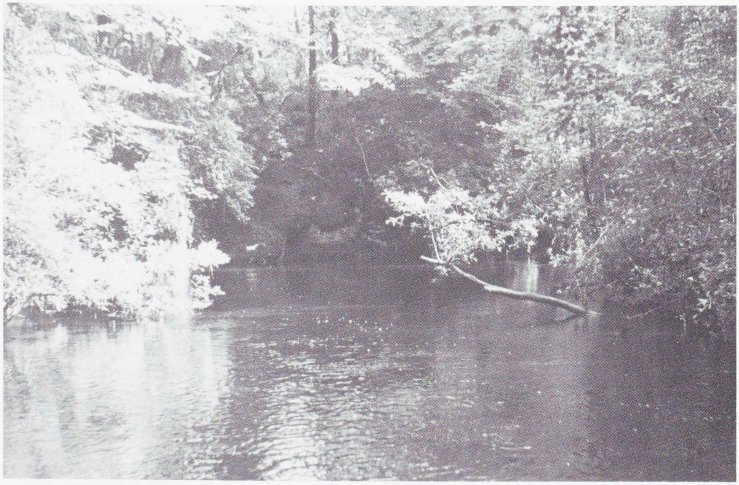

Figure 9. Tenmile Creek, near USGS locality 2213, "one mile west of Bailey's Ferry."

Figure 10. Farley Creek, on the east side of the Chipola River, approximately 3 miles north of Florida Highway 20.

Figure 11. The late Shirley E. Hoerle collecting on Tenmile Creek.

scribed by Dall or others), we see an addition of just one species of *Potamides*, and the Cerithiidae go from nine to 19, instead of from one to 19, as it appears in Gardner. If we go back and insert the missing species that she should have had in these two families, a more realistic value would be: Gardner's 63 species to 159 now, or a 150% increase.

Using this measure of increase, which is somewhat arbitrary I admit, and extrapolating it to the entire fauna we come up with an estimated total molluscan fauna in the type area of 1114 species. This is not an unreasonable figure for a tropical fauna. Woodring (1928, p. 22) estimated that a modern West Indian fauna, including every ecologic niche from shoreline to about 100 fathoms should include perhaps 1000 species. Nowhere does the Chipola approach such depths, but otherwise most of the ecologic niches are present.

When one compares this fauna to other described faunas in the region, one is more impressed by the great number. In the fossil record, the nearest approach to it is the Bowden, Jamaica, fauna monographed by Woodring (1925, 1928) with a total of 610 species. But the Bowden is unique in that this entire fauna comes from one locality – a roadcut, consisting of a shallow-water deposit, complete with boulders, wood, leaves, etc., moved by gravity downslope into very deep water, resulting in an almost complete cross-section of all the ecologic niches mentioned by Woodring.

Woodring's other great faunal study of the Gatun fauna in Panama (1957-1982) has yielded only 369 species. Dockery's studies of the Vicksburg Group (1982; MacNeil and Dockery, 1984), which includes more than one formation as well as varied ecologies, has a total of 555 species.

In the Recent western Atlantic, Warmke and Abbott (1961) cited 858 species from Puerto Rico, of which 437 are shelled gastropods. This latter number has been increased to 703 by Ortiz-Corps (1985); a comparable increase in the entire fauna indicates a total of 1380 species. Vokes and Vokes (1973) list 796 species from the Yucatan Peninsula, again covering every ecologic niche except the deep-water. David Robinson (pers. comm.) has in preparation a checklist of the Recent mollusks of the Dominican Republic with about 640 species.

When it is finally done, the study in progress on the fossil fauna of the Dominican Republic (Saunders, Jung, Biju-Duval, 1986) will be the most nearly complete of any fauna yet studied (at least, in the Western Hemisphere, the Paris Basin Eocene may surpass it). Just as a measure of comparison, in the Cercado/Gurabo faunal units, representing the shallow and deep water, respectively, I have documented 48 species of muricid (Vokes, 1989); the Chipola and Oak Grove together have 40 muricids.

Thus, our estimate of the Chipola fauna approaches the number of species one might expect in a tropical fauna. In the Chipola Formation we see the reflection of the last truly tropical climatic conditions during the Miocene. The Shoal River Formation, which follows the Chipola, represents a more temperate climate, leading into the distinctly chilly Late Miocene. The Chipola also represents the last major transgression in the western Atlantic, before the lowering of sea-level, due to Late Miocene glaciation. Thus, there are beds of the same age as the Chipola exposed in northeastern Mexico (Guajalote Formation), Panama (La Boca Formation), Venezuela (Cantaure Formation) and the Dominican Republic (Baitoa Formation).

Because of a great similarity of facies, there is a marked resemblance of the Chipola fauna to that of the somewhat younger beds in the Aquitaine Basin of France and the Vienna Basin, as has been noted in previous papers, and one can only wonder at the mechanism of transportation.

This paper has dealt only with the mollusk fauna but other groups of invertebrates are equally worthy of study and would show a corresponding richness in terms of both numbers of species and numbers of individuals.

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