A Review of Non-Avian Dinosaurs from the Late Cretaceous of Alabama, Mississippi, Georgia, and Tennessee

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ABSTRACT: The purpose of this paper is to compile and summarize records of southeastern non-avian dinosaur material collected from the Upper Cretaceous Gulf Coastal Plain units in Alabama, Mississippi, Georgia, and Tennessee. In all, information on 155 non-avian dinosaur specimens were compiled (Tables 1-9) from twelve institutions including national museums, state museums, and university collections. Specimens represent hadrosaurs, ankylosaurs, ornithomimids, dromaeosaurs, and tyrannosaurs as well as additional material not identified to lower taxa. This additional material comprises 21% of the total specimen records compiled. Two holotypes (both from Alabama) were represented in the compiled data: the hadrosaur *Lophorhothon atopus* Langston, 1960 and the tyrannosauroid *Appalachiosaurus montgomeriensis* Carr, Williamson, and Schwimmer 2005. With such a significant number of specimens yet to be further identified and two holotypes from the study area, additional research on southeastern dinosaurs is needed.

INTRODUCTION

Although much has been known about Late Cretaceous dinosaurs from the western United States, less is known about dinosaurs of the southeastern states. This paper presents the results of an extensive collections search of non-avian dinosaur material previously collected from Upper Cretaceous Coastal Plain units in Alabama, Mississippi, Georgia, and Tennessee. Because this paper was written for an Alabama Museum of Natural History bulletin, the study area reflects an emphasis on Alabama and its neighboring states. This paper is an effort to record dinosaur material currently in scientific collections, but not to identify, revise, or theorize on taxonomic identifications. It is the hope of the authors that publishing the list of collected material will increase awareness and interest in further research of southeastern dinosaurs.

Study Area

During the Late Cretaceous thermal maximum, eustatic sea level was much higher than today. The northern extent of the Gulf of Mexico stretched up into western Tennessee, northeastern Mississippi, central Alabama, and central Georgia. In the states within the study area, there are Upper Cretaceous units ranging from Cenomanian to Maastrichtian (Figs. 1 and 2) nonmarine clastic, and transgressive and regressive marine clastic and carbonate facies.

Methods

Data was compiled from scientific collections catalogs from twelve museums and universities (see list below) from May through August 2011. Institutions whose dino-

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Fig. 1. Paleogeographic map of the Late Cretaceous southeastern United States. Light blue denotes area covered by water, light green denotes land, and the dashed curved line across the study area represents an estimated coastline during the late Late Cretaceous. States included in the study area are outlined in red (AL, Alabama; MS, Mississippi; GA, Georgia; TN, Tennessee).

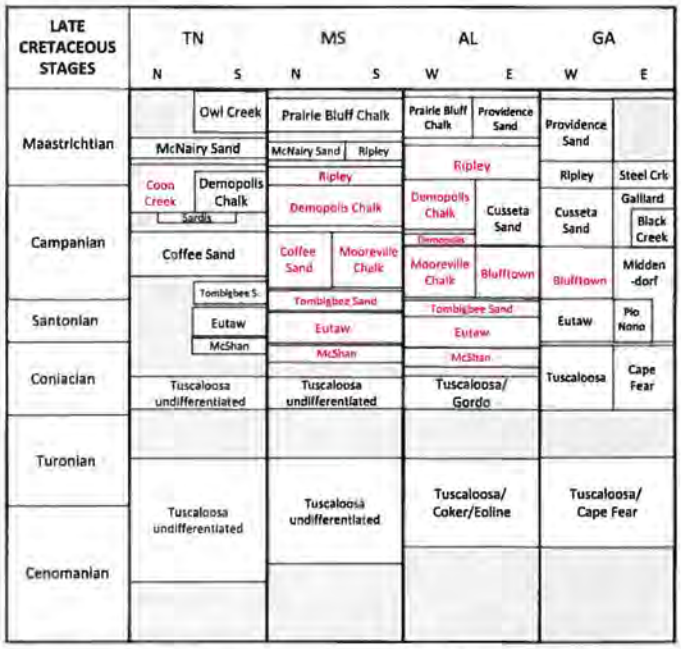


Fig. 2. Upper Cretaceous stratigraphic units with surface exposure in the study area. Red font indicates formations from which dinosaur material is recorded. N, S, E, and W indicate direction along the outcrop belt of the state. Stratigraphic chart modified from multiple sources: Russell and Parks, 1975; Mancini et al., 1996; Falls and Prowell, 2001; and Clarke et al., 1994. Gray areas represent time-rock units missing from the stratigraphic record (unconformities

saur specimens are recorded in this paper are listed below in alphabetic order of institution abbreviation used in the tables of this paper.

Institutional Abbreviations:

AMNH: American Museum of Natural History, New York, NY; **AUMP**: Auburn University Museum of Paleontology, Auburn, AL; **CCK**: Cretaceous research collections at Columbus State University, Columbus, GA; **FHMM**: Frank H. McKlung Museum, Knoxville, TN; **FMNH**: Field Museum of Natural History, Chicago, IL; **MMNS**: Mississippi Museum of Natural Science, Jackson, MS; **MOG**: Mississippi Office of Geology, Jackson, MS; **MCWSC**: McWane Science Center, Birmingham, AL; **PPM**: Memphis Pink Palace Museum, Memphis, TN; **UAM**: University of Alabama Museums, Tuscaloosa, AL; **UM**: University of Memphis, Memphis, TN; **USNM**: U.S. National Museum, Washington, D.C.

RESULTS

This section summarizes the data collected for this project. Taxa reported in the results section and the associated tables are as they are recorded in scientific collections catalogs and specimen labels and have not been re-identified or revised.

Dinosaurian taxa recorded

Of the collections information compiled, a total of 155 dinosaur specimens were recorded from states within the study area. In total they include specimens identified as dinosaur, ornithopod, hadrosaur, ankylosaur, theropod, ornithomimid, dromaeosaur, and tyrannosaur. Two holotypes from the study area and are indicated in the below taxa list by bold font. Of all dinosaur specimens recorded, 55% belong to the family Hadrosauridae (Fig. 3). The second largest percentage (21%) of all specimens is uncertain dinosaur taxa (lower taxonomic unit uncertain). The third largest percentage of the specimens is tyrannosauroid, and the remaining smaller percentages include dromaeosaurids, ankylosaurs, and ornithomimids.

Non-avian Dinosaur Taxa from the Study Area

Ornithischia
- Ankylosauria
  - Nodosauridae
    - Gen. undet.
- Ornithopoda
  - Hadrosauridae
    - Lophorhothon Langston, 1960
      - **Lophorhothon atopus Langston, 1960**

Table 1. Dinosaur specimens not identified to lower taxa.

Institution	Collection Number	Material	County	State	Formation	Age
MMNS	VP 4742	Vertebra	Sumter	AL	Lower Eutaw [McShan?]	Coniacian
MCWSC	RMM 3474	Fragmentary claw?	Greene	AL	Tombigbee Sand Mbr., Eutaw Fm.	Late Santonian-early Campanian
UAM	PV1992.46.2	2 bones	Sumter	AL	Demopolis Chalk	Campanian
UAM	PV1993.1.2.2	Bone	Unspecified	AL	Mooreville Chalk	Santonian-Campanian
MMNS	VP 3754	Medial phalanx	Lowndes	MS	Lower Eutaw [McShan?]	Coniacian
MMNS	VP 4253	Partial rib	Lowndes	MS	Lower Eutaw [McShan?]	Coniacian
MMNS	VP 3056	Propodial, proximal portion	Monroe	MS	Mooreville Chalk	Santonian-Campanian
MMNS	VP 3870	Fragment	Monroe	MS	Mooreville Chalk	Santonian-Campanian
MMNS	VP 3048	Vertebra	Unknown	MS	Selma Group	Santonian-Maastrichtian
MMNS	VP 3052	Vertebra	Unknown	MS	Selma Group?	Santonian-Maastrichtian
MMNS	VP 5608	Vertebral centrum	Lowndes	MS	Tombigbee Sand Mbr., Eutaw Fm.	Late Santonian-early Campanian
MMNS	VP 620	Fibula, proximal fragment	Monroe	MS	Tombigbee Sand Mbr., Eutaw Fm.	Late Santonian-early Campanian
MMNS	VP 5875	Tooth	Lowndes	MS	Tombigbee Sand Mbr.?, Eutaw Fm.	Late Santonian-early Campanian
MMNS	VP 3040	Phalanx, proximal	Monroe	MS	Unspecified	Unknown

Saurischia
Theropoda
Ornithomimidae
Gen. undet.
Dromaeosauridae
Saurornitholestes Sues, 1978
Tyrannosauroidea
Appalachiosaurus Carr, Williamson, and Schwimmer, 2005
Appalachiosaurus montgomeriensis Carr, Williamson, and Schwimmer, 2005

Dinosauria

Of the 155 dinosaur specimens recorded from the study area, 14 are not identified in more detail than "dinosaur" (Table 1). All 14 specimens were collected in Alabama and Mississippi. One unique specimen not recorded in Table 2 is an amniote egg (AUMP 1235) found in Dallas County, Alabama in the 1980s and described by Dobie (1978). The egg is elliptical and exhibits a distinct textured exterior. The egg was prepped some years later, to reveal tiny bones of what may be dinosaur. This embryonic skeleton may be a hadrosaur (J. Lamb, pers. comm.), but research is still being conducted and taxon determination is still in question.

Ornithischia

While the vast majority of 98 ornithischian specimens are hadrosaur, six have not been identified to a lower taxon other than ornithischian or ornithopod; 84 are hadrosaur; and the remaining eight ornithischians are ankylosaur and nodosaur (Table 2).

Hadrosauridae

Of the 155 dinosaur specimens from the study area, 84 are identified as hadrosaur (Table 3). Only one hadrosaur

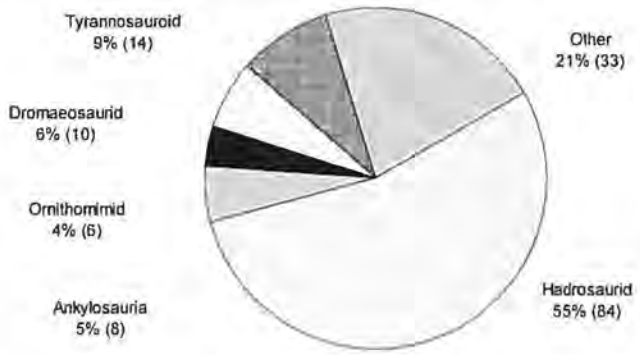


Fig. 3 Taxonomic precentages of the total recorded dinosaur sepcimens from the study area.

Table 2. Ornithopods and other ornithischians.

Institution	Collection Number	Material	County	State	Formation	Age
USNM	V 6523	Partial axial elements, partial appendicular elements, partial femur, partial tibia, partial astragalus, partial metatarsal, partial fibula (Ornithopod)	Autauga	AL	Rotten Limestone [Ripley?]	Campanian-Maastrichtian
USNM	V 6524	Axial elements, 21 partial vertebrae, appendicular elements, partial femur, partial tibia, partial fibula, partial humerus, partial metatarsal (Ornithopod)	Dallas	AL	Rotten Limestone [Ripley?]	Campanian-Maastrichtian
USNM	PAL 442503	Appendicular element, proximal tibia, distal tibia (Ornithopod)	Perry	AL	Rotten Limestone [Ripley?]	Campanian-Maastrichtian
MMNS	VP 5071	Teeth (Ornithopod)	Lowndes	MS	Lower Eutaw [McShan?]	Coniacian
USNM	PAL 337988	Appendicular element, partial tibia (Ornithopod)	Unknown	MS	Ripley	Campanian-Maastrichtian
MMNS	VP 6016	Left tibia, proximal half (Ornithischia)	Tippah?	MS	Selma Group	Santonian-Maastrichtian

species is identified in the collections records: *Lophorothon atopus*. Of the *L. atopus* specimens, all six are from Alabama. Although Lamb (1998) hypothesized *Lophorothon* to be an iguanodontian, Horner et al. (2004) consider *L. atopus* to be a basal hadrosaur as originally described by Langston (1960). The holotype of *L. atopus* (FMNH specimen P 27383) is from Dallas County (Langston, 1960), and although the holotype is only partial skull material, a recent discovery of another *L. atopus* in Alabama (MCWSC 26037) represents the most complete skull of *L. atopus* found to date (J. Ebersole, pers. comm.).

Ankylosauria

Eight specimens of Akylosauria are recorded from the study area: five from Alabama and three from Mississippi (Table 4). None of the material is identified to species or genus. Although most material is individual teeth and bones, the McWane Science Center specimen RMM 1224 includes 17 vertebrae, one tibia, one neural arch, a proximal portion of ischium, a basisphenoid-basioccipital, the anterior end of the right dentary, teeth, and unidentified skull fragments. This specimen is the most complete nodosaur specimen described from east of the Mississippi River.

Saurischia

Three specimens are recorded as Saurischia without more detailed taxonomic identification (Table 5), although one of these specimens (AMNH specimen FR 21584) may be from South Carolina as questioned in the specimen catalog.

Theropoda

Thirty-seven theropods are recorded, including six ornithomimids, ten dromaeosaurids, and 14 tyrannosauroids (Tables 6, 7, 8, and 9). Seven theropods are not identified to a lower taxonomic level. One specimen (MCWSC 2290) is identified as "Carnosauria" in the collections catalog. The term "Carnosauria" here was used simply to indicate the specimen as a large carnivorous dinosaur, not in reference to the Carnosauria clade.

Ornithomimidae

Six Late Cretaceous ornithomimid specimens are recorded from the study area (Table 7). None have been identified to a lower taxon within the collections databases. All but one of the ornithomimid specimens are from the Late Santonian to early Campanian Tombigbee Sand Member of the Eutaw Formation in Mississippi. Within eastern North America, only one genus of ornithomimid

Table 3. Hadrosaur specimens (asterick following specimen number denotes *L. atopus*)..

Institution	Collection Number	Material	County	State	Formation	Age
AUMP	AUMP 3083	Left metatarsal IV	Russell	AL	Blufftown	Campanian
AUMP	AUMP 3026	Ablated tooth crowns	Russell	AL	Blufftown	Campanian
CCK	CCK-90-6-1	Ablated tooth crowns	Barbour	AL	Blufftown	Campanian
CCK	CCK-87-20-4	Tibia and ablated astragalus	Russell	AL	Blufftown	Campanian
CCK	CCK-87-20-1	Fibula	Russell	AL	Blufftown	Campanian
CCK	CCK-87-20-5	Digit IV phalanges	Russell	AL	Blufftown	Campanian
CCK	CCK-87-20-6	Digit IV phalanges	Russell	AL	Blufftown	Campanian
CCK	CCK-87-20-7	Digit IV phalanges	Russell	AL	Blufftown	Campanian
CCK	CCK-87-20-8	Digit IV phalanges	Russell	AL	Blufftown	Campanian
CCK	CCK-87-20-3	Metatarsal II	Russell	AL	Blufftown	Campanian
CCK	CCK-87-20-2	Metatarsal III	Russell	AL	Blufftown	Campanian
CCK	CCK-87-20-9	Distal tarsal	Russell	AL	Blufftown	Campanian
MCWSC	MCWSC 6087	Distal femur		AL	Tombigbee Sand Mbr., Eutaw Fm.	Late Santonian-early Campanian
UAM	PV2005.6.112	8 caudal vertebrae, and one bone fragment	Dallas	AL	Mooreville Chalk	Santonian-Campanian
UAM	PV1993.1.2.1	Metatarsal	Greene	AL	Mooreville Chalk	Santonian-Campanian
UAM	PV1995.3.1	Bone	Greene	AL	Mooreville Chalk	Santonian-Campanian
UAM	PV2005.6.342	Caudal vertebra	Greene	AL	Mooreville Chalk	Santonian-Campanian
UAM	PV2005.6.414	17 bone frags	Greene	AL	Mooreville Chalk	Santonian-Campanian
UAM	PV2005.6.315	Partial bone	Pickens	AL	Mooreville Chalk	Santonian-Campanian
UAM	PV1985.72.6	Caudal vertebra	Unknown	AL	Mooreville?	Santonian-Campanian
UAM	PV2005.6.287	6 bone fragments	Bullock	AL	Ripley	Campanian-Maastrichtian
UAM	PV2005.6.352	Large bone fragment	Lowndes	AL	Ripley	Campanian-Maastrichtian
UAM	PV1990.9	Proximal femur	Montgomery	AL	Tombigbee Sand Mbr., Eutaw Fm.	Late Santonian-early Campanian
UAM	PV1985.72.2	Long bone fragment	Unknown	AL	Tombigbee Sand Mbr., Eutaw Fm.	Late Santonian-early Campanian
UAM	PV1985.72.8	Bone fragment	Unknown	AL	Tombigbee Sand Mbr., Eutaw Fm.	Late Santonian-early Campanian
UAM	PV1985.72.9	Bone fragment	Unknown	AL	Tombigbee Sand Mbr., Eutaw Fm.	Late Santonian-early Campanian

Table 3. Hadrosaur specimens, *continued.*

Institution	Collection Number	Material	County	State	Formation	Age
USNM	PAL 508515	Skull element, tooth	Bullock	AL	Unspecified	Unknown
FMNH	P 27383*	HOLOTYPE; Skull, jaws, vertebrae, ribs, limb bones	Dallas	AL	Mooreville Chalk	Santonian-Campanian
MCWSC	RMM 2985*	4 anterior phalanges (1 terminal)	Greene	AL	Mooreville Chalk	Santonian-Campanian
MCWSC	MCWSC 1319*	6 bones from the tarsus	Hale	AL	Mooreville Chalk	Santonian-Campanian
MCWSC	MCWSC 26037*	Skull material	Unknown	AL	Tombigbee Sand Mbr.?, Eutaw Fm.	Late Santonian-early Campanian
AUMP	AUMP 982*	Left jaw	Montgomery	AL	Selma Group	Santonian-Maastrichtian
UAM	V993.1.2.2	Metatarsal	Dallas	AL	Mooreville Chalk	Santonian-Campanian
MCWSC	MCWSC 12620*	Vertebrae and bone fragments	Hale	AL	Unspecified	Unknown
CCK	CCK-79-3-1	Partial posterior left dentary	Stewart	GA	Blufftown	Santonian-Campanian
CCK	CCK-85-2-1	Distal third of a left metacarpal III	Stewart	GA	Blufftown	Santonian-Campanian
CCK	CCK-88-16-1	Posterior caudal vertebra	Stewart	GA	Blufftown	Santonian-Campanian
CCK	CCK-90-17-1	Posterior caudal vertebra	Stewart	GA	Blufftown	Santonian-Campanian
CCK	CCK-90-4-1	Dentary tooth crown and partial root	Stewart	GA	Blufftown	Santonian-Campanian
CCK	CCK-79-03	Jaw fragment	Stewart	GA	Blufftown	Santonian-Campanian
MMNS	VP 4633	Tooth	Lowndes	MS	Basal Mooreville	Santonian
MMNS	VP 118	Tooth, maxillary	Lee	MS	Coffee Sand?	Campanian
MMNS	VP 5118	Left femur (missing distal epiphysis)	Union	MS	Coon Creek	Campanian-Maastrichtian
MMNS	VP 5917	Tooth, crown	Union	MS	Coon Creek	Campanian-Maastrichtian
MMNS	VP 5275	Phalanx, ungual, 2nd pedal digit, left	Monroe	MS	Demopolis Chalk	Campanian
MMNS	VP 3242	Tooth, partial	Noxubee	MS	Demopolis/Mooreville contact zone	Campanian
MMNS	VP 292	Tooth	Clay	MS	Eutaw	Santonian
MMNS	VP 675	Femur, left, distal end	Lowndes	MS	Eutaw	Santonian
MMNS	VP 108	Phalanx, pedal, digit II, first, right	Monroe	MS	Eutaw?	Santonian
MMNS	VP 111	Limb bone fragment	Monroe	MS	Eutaw?	Santonian
MMNS	VP 112	Centrum, caudal	Monroe	MS	Eutaw?	Santonian
MMNS	VP 3057	Tooth	Lowndes	MS	Lower Eutaw [McShan?]	Coniacian
MMNS	VP 3759	Tooth	Lowndes	MS	Lower Eutaw [McShan?]	Coniacian

Table 3. Hadrosaur specimens, *continued.*

Institution	Collection Number	Material	County	State	Formation	Age
MMNS	VP 3777	Tooth	Lowndes	MS	Lower Eutaw [McShan?]	Coniacian
MMNS	VP 3058	Vertebrae, caudal, proximal	Clay	MS	Mooreville Chalk	Santonian-Campanian
MMNS	VP 3073	Postzygaphosis	Monroe	MS	Mooreville Chalk	Santonian-Campanian
MMNS	VP 3039	Phalanx, pedal, partial	Monroe	MS	Mooreville Chalk	Santonian-Campanian
MMNS	VP 3053	Phalanx, ungual	Monroe	MS	Mooreville Chalk	Santonian-Campanian
MMNS	VP 3042	Vertebra, caudal	Unknown	MS	Mooreville Chalk?	Santonian-Campanian
MMNS	VP 2991	Tibia, left, distal	Lowndes (or Clay)	MS	Mooreville, lower	Santonian-Campanian
MMNS	VP 3046	Vertebra, caudal	Monroe	MS	Selma Group	Santonian-Maastrichtian
MMNS	VP 3047	Vertebra, caudal	Monroe/Lee	MS	Selma Group	Santonian-Maastrichtian
MMNS	VP 3043	Tibia?, left, proximal	Unknown	MS	Selma Group	Santonian-Maastrichtian
MMNS	VP 3059	Sacral centra?, caudal centra?, right ulna (2 pieces), distal right MT4, prox phalanx #4, neural arch caudal vertebra & neural arch ant thoracic vertebra	Lowndes	MS	Tombigbee Sand Mbr., Eutaw Fm.	Late Santonian-early Campanian
MMNS	VP 4757	Humerus, left, partial	Lowndes	MS	Tombigbee Sand Mbr., Eutaw Fm.	Late Santonian-early Campanian
MMNS	VP 5510	Teeth, crowns	Lowndes	MS	Tombigbee Sand Mbr., Eutaw Fm.	Late Santonian-early Campanian
MMNS	VP 5947	Caudal vertebra	Lowndes	MS	Tombigbee Sand Mbr., Eutaw Fm.	Late Santonian-early Campanian
MMNS	VP 5952	Tooth	Lowndes	MS	Tombigbee Sand Mbr., Eutaw Fm.	Late Santonian-early Campanian
MMNS	VP 3037	Tooth	Lowndes	MS	Unspecified	Unknown
MOG	no number	Limb, pelvic, and vertebrae	Lee	MS	Demopolis Chalk	Campanian
MOG	no number	Leg bone	Lee	MS	Demopolis Chalk	Campanian
MOG	no number	Toe bone	Lee	MS	Demopolis Chalk	Campanian
PPM	1990.47.1	Tooth	Prentiss	MS	Coffee Sand	Campanian
PPM	1991.29.1	Tooth	Prentiss	MS	Coffee Sand	Campanian
PPM	1997.16.2	Vertebra	Prentiss	MS	Tombigbee Sand Member, Eutaw Fm.	Late Santonian-early Campanian
PPM	1998.1.18	Tooth	Prentiss	MS	Tombigbee Sand Member, Eutaw Fm.	Late Santonian-early Campanian
UAM	PV2005.11.7	2 bone fragments	Lowndes	MS	Unspecified	Unknown
UAM	PV2005.5.196	1 tooth	Lowndes	MS	Unspecified	Unknown

Table 3. Hadrosaur specimens, *continued.*

Institution	Collection Number	Material	County	State	Formation	Age
USNM	PAL 175583	Skull element, right dentary, axial elements, left femur, left tibia, right proximal ulna, distal right radius, metatarsal-3+4, phalange	Lee	MS	Eutaw	Santonian
USNM	PAL 487107	Appendicular element, distal femur	Lowdnes	MS	Unspecified	Unknown
MMNS	VP 3055	Dental battery, edentulous, fragment	Clay	MS	Mooreville Chalk	Santonian-Campanian
FHMM	1989.29.1	Posterior caudal vertebra; middle caudal vertebra; large vertebral centrum	Unknown	TN	Demopolis?	Campanian
PPM	2005.6.1	Tooth	Decatur	TN	Coon Creek	Campanian-Maastrichtian
UM	no current number	Skull	Unknown	TN	Coon Creek	Campanian-Maastrichtian

Table 4. Specimens of Ankylosauria.

Institution	Collection Number	Material	County	State	Formation	Age
MCWSC	RMM 3277	1 dermal scute and associated fragments, first ankylosaur from Tombigbee member	Hale	AL	Tombigbee Sand Mbr., Eutaw Fm.	Late Santonian-early Campanian
FMNH	P 27469	Ilium	Dallas	AL	Mooreville Chalk	Santonian-Campanian
MCWSC	RMM 1224	17 vertebrae, 1 tibia, 1 neural arch, proximal portion of ischium, basisphenoid-basioccipital, anterior end of right dentary, teeth, other unidentified skull fragments. Donated by BSC,2 labels in box with two tylosaurs and a dinosaur. Partial scapula and unidentified bone.	Lowndes	AL	Ripley?	Campanian-Maastrichtian
MCWSC	MCWSC 13942	Scute, coracoid, phalange, unidentified elements	Montgomery	AL	Unspecified	Unknown
UAM	PV2005.5.192	1 (toe?) bone	Greene	AL	Mooreville Chalk	Santonian-Campanian
MMNS	VP 104	Partial presacral rod	Monroe	MS	Eutaw?	Santonian
MMNS	VP 3088	Tooth	Lowndes	MS	Lower Eutaw [McShan?]	Coniacian
MMNS	VP 5254	Tooth, with nearly complete root	Clay	MS	Tombigbee Sand Mbr., Eutaw Fm.	Late Santonian-early Campanian

Table 5. Saurischia specimens not identified to lower taxa.

Institution	Collection Number	Material	County	State	Formation	Age
AMNH	FR 21584	Phalanx	Unknown	AL or SC	Unspecified	Unknown
UAM	PV2005.5.197	Phalanx	Lowndes	MS	Unspecified	Unknown
USNM	V 4869	Appendicular elements, right femur-A-B, partial fibula	Lee	MS	Eutaw	Santonian

Table 6. Theropod specimens not identified to lower taxa.

Institution	Collection Number	Material	County	State	Formation	Age
FMNH	P 27398	Foot bone	Dallas	AL	Mooreville Chalk	Santonian-Campanian
MCWSC	RMM 2577	Bone fragments	Dallas	AL	Mooreville Chalk	Santonian-Campanian
MCWSC	MCWSC 2290	Carnosauria caudal centrum	Hale	AL	Tombigbee Sand Mbr., Eutaw Fm.	Late Santonian-early Campanian
MMNS	VP 4949	Phalanx, proximal, pedal, 3rd digit	Lowndes	MS	Eutaw	Santonian
MMNS	VP 103	Phalanx, pedal, proximal, right	Monroe	MS	Eutaw?	Santonian
MMNS	VP 113	Centrum, caudal, anterior half	Monroe	MS	Eutaw?	Santonian
MMNS	VP 3763	Vertebra, caudal	Lowndes	MS	Tombigbee Sand Mbr., Eutaw Fm.	Late Santonian-early Campanian
MMNS	VP 5597	Phalanx, proximal, proximal fragment	Lowndes	MS	Tombigbee Sand Mbr., Eutaw Fm.	Late Santonian-early Campanian
MOG	no number	Toe bone	Lowndes	MS	Tombigbee Sand Mbr., Eutaw Fm.	Late Santonian-early Campanian
PPM	1999.1.5	Carnivorous dinosaur tooth	Prentiss	MS	Tombigbee Sand Member, Eutaw Fm.	Late Santonian-early Campanian

Table 7. Ornithomimid specimens.

Institution	Collection Number	Material	County	State	Formation	Age
CCK	CCK-85-1-1	Partial proximal right tibial shaft	Stewart	GA	Blufftown	Santonian-Campanian
MMNS	VP 3087	Phalanx, ungual, pedal	Lowndes	MS	Lower Eutaw [McShan?]	Coniacian
MMNS	VP 3931	Vertebral centrum, caudal	Lowndes	MS	Tombigbee Sand Mbr., Eutaw Fm.	Late Santonian-early Campanian
MMNS	VP 5595	Ungual phalanx	Lowndes	MS	Tombigbee Sand Mbr., Eutaw Fm.	Late Santonian-early Campanian
MOG	no number	Claw	Lowndes	MS	Tombigbee Sand Mbr., Eutaw Fm.	Late Santonian-early Campanian
MCWSC	MCWSC 13939	Third metatarsal	Lowndes	MS	Tombigbee Sand Mbr./ Eutaw Fm. contact	Late Santonian-early Campanian

Table 8. Dromaeosaur specimens.

Institution	Collection Number	Material	County	State	Formation	Age
UAM	2001.1?	1 tooth	Greene	AL	Mooreville Chalk	Santonian-Campanian
CCK	CCK-93-12-1	Distal tibiotarsal	Stewart	GA	Blufftown	Santonian-Campanian
CCK	CCK-93-12-2	Distal tibiotarsal	Stewart	GA	Blufftown	Santonian-Campanian
CCK	CCK-93-12-3	Distal tibiotarsal	Stewart	GA	Blufftown	Santonian-Campanian
MMNS	VP 4882	Teeth	Lowndes	MS	Eutaw	Santonian
MMNS	VP 3051	Tooth, partial	Lowndes	MS	Lower Eutaw [McShan?]	Coniacian
MMNS	VP 4300	Tooth	Clay	MS	Tombigbee Sand Mbr., Eutaw Fm.	Late Santonian-early Campanian
MMNS	VP 5820	Tooth, partial, eroded	Lowndes	MS	Tombigbee Sand Mbr.?, Eutaw Fm.	Late Santonian-early Campanian
MCWSC	MCWSC 13940	3 teeth	Lowndes	MS	Tombigbee Sand Mbr./ Eutaw Fm. contact	Late Santonian-early Campanian
UAM	PV2000.2.2	1 small tooth	Lowndes	MS	Unspecified	Unknown

has been named – *Coelosaurus antiquus* Leidy 1865 – from the northeastern states and North Carolina (Makovicky et al. 2004; Weishampel et al., 2004). Whether the ornithomimid material from this study area is a different genus or species from that of *C. antiquus* is yet to be determined.

Dromaeosauridae

Ten dromaeosaurid specimens are recorded from the study area (Table 8). Seven specimens are teeth, and three are bone material – all specimens are from Santonian-Campanian units. Of the dromaeosaur material, only one genus has been suggested based on tooth morphology – the velociraptorine *Saurornitholestes* (Kiernan and Schwimmer, 2004).

Tyrannosauroidea

Fourteen tyrannosaur specimens are recorded from the study area (Table 9). One species is identified in the records and the holotype for that species is from Alabama – *Appalachiosaurus montgomeriensis* (McWane specimen RMM 6670). The holotype was collected in Montgomery County, Alabama, from the Campanian Demopolis Chalk. The specimen includes skull bones, two hind limbs, humerus, pelvis, vertebra, and rib and is described by Carr et al. (2005). The holotype of *A. montgomeriensis* (RMM 6670) is only one of two known tyrannosaurs identified to species from the eastern half of the country (Carr et al., 2005). This specimen is also the most complete tyrannosaur from the eastern US. Previously other tyrannosauroid material from the study area was compared with *Albertosaurus* (Schwimmer et al., 1993; Carr et al., 2005), however, currently all tyrannosauroid material from this area is now regarded as *A. montgomeriensis* (D. Schwimmer, pers. comm.).

Summary of dinosaur material by state

Geographic and Stratigraphic Distribution

Of the four states within the study area, all have yielded Late Cretaceous dinosaur specimens (Fig. 4). Records indicate 55 specimens from 11 counties in Alabama, 83 specimens from eight counties in Mississippi, 12 specimens from one county in Georgia, and three specimens from one county in Tennessee. From the recorded data, geologic units from which specimens were collected ranged from Santonian through Maastrichtian and the majority of the dinosaur material was collected from the Mooreville Chalk, Blufftown, and Eutaw Formations.

Table 9. Tyrannosauroid specimens.

Institution	Collection Number	Material	County	State	Formation	Age
CCK	CCK-83-81-7	Bone shafts (*A. montgomeriensis*)	Barbour	AL	Blufftown	Santonian-Campanian
MCWSC	RMM 6670	HOLOTYPE; Skull, 2 hind limbs, humerus, pelvis, verts, rib (*A. montgomeriensis*)	Montgomery	AL	Demopolis Chalk	Campanian
UAM	PV 85.72.76	Limb bone	Hale	AL	Mooreville Chalk	Santonian-Campanian
CCK	CCK-94-5-1	Tooth (*A. montgomeriensis*)	Bullock	AL	Blufftown	Santonian-Campanian
CCK	CCK-90-1-2	Phalangeal fragment (*A. montgomeriensis*)	Stewart	GA	Blufftown	Santonian-Campanian
CCK	CCK-85-1-2	Bone shafts (*A. montgomeriensis*)	Stewart	GA	Blufftown	Santonian-Campanian
MOG	no number	Toe bone	Monroe	MS	McShan	Coniacian
MOG	no number	Toe bone	Monroe	MS	McShan	Coniacian
MOG	no number	Vertebra	Monroe	MS	McShan	Coniacian
MOG	no number	Toe bone	Lowndes	MS	Tombigbee Sand Mbr., Eutaw Fm.	Late Santonian-early Campanian
UAM	PV2005.5.195	1 bone	Lowndes	MS	Unspecified	Unknown
UAM	PV2000.2.3	1 tooth	Lowndes	MS	Unspecified	Unknown
MCWSC	MCWSC 10942	Proximal femur	Unknown		Unspecified	Unknown
MCWSC	RMM 6150	Proximal femur	Unknown		Unspecified	Unknown

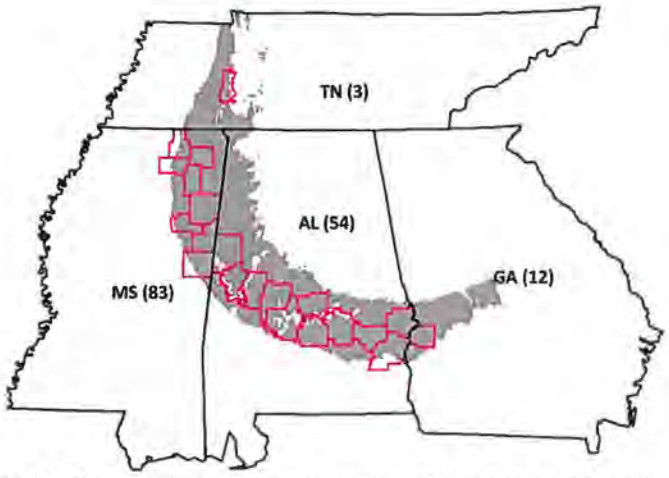


Fig.4. Dinosaur material from the study are as noted in this paper. Upper Cretaceous outcrop belts shown as gray. Counties from which dinosaur material has been collected are outlined in red. Number of dinosaur specimens are shown in each state.

Alabama

A wide outcrop belt of Upper Cretaceous units curves through Alabama from the northwestern corner down to the southeastern part of the state outlining the northern extent of the Gulf Coastal Plain. Collection of dinosaur material in Alabama dates back to the late 1800s as noted in the records of the US National Museum. Of the 55 dinosaur specimens recorded from Alabama, 36 are hadrosaur (Table 3), five are nodosaur (Table 4), four are tyrannosaur (Table 9), and one is dromaeosaur (Table 8). The remaining dinosaur material has not been identified in more detail (Tables 1, 2, 5, 6). The major-

ity of the material is held at collections within the state including the University of Alabama Museums, McWane Science Center, and Auburn University. Most specimens were collected from Santonian and Campanian units of western Alabama including the Blufftown, Mooreville Chalk, and Eutaw Formations. Two dinosaur holotypes are also from Alabama: Appalachiosaurus montgomeriensis (McWane specimen RMM 6670; Carr et al., 2005) and Lophorhothon atopus (FMNH specimen P 27383; Langston, 1960).

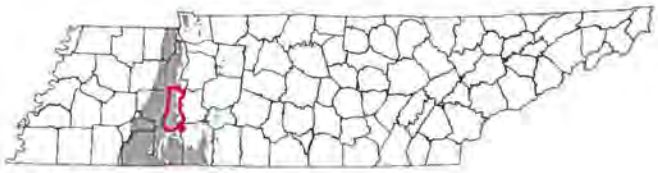
Also of note are the recent findings in the Ingersoll Shale Member of the Eutaw Formation in easternmost Alabama. According to Knight et al. (2011), the excavated site in Russell County contains the most feathers found in Mesozoic rocks of North America, a finding that could help expand our understanding of Late Cretaceous feathered dinosaurs.

Mississippi

In Mississippi, the Upper Cretaceous outcrop belt is found in the northeastern quadrant of the state, curving along the inflection point between the Gulf Coastal Plain and the Mississippi Embayment. A total of 83 dinosaur specimens are recorded for Mississippi. Records of collected dinosaur material go back to the late 1800s and include 41 hadrosaur (Table 3), three nodosaur (Table 4) five ornithomimid (Table 7), six dromaeosaur (Table 8), six tyrannosaur (Table 9), and 22 additional specimens not identified to family (Table 1, 2, 5, 6). While material has been collected from eight counties, the most productive sites have been those within the Santonian Eutaw Formation, particularly the upper and lower facies of the formation. The uppermost facies of the Eutaw is the Tombigbee Sand Member, considered to be a marine lag deposit (Russell and Parks, 1975).

Georgia

In Georgia, the Upper Cretaceous outcrop belt extends from west central Georgia into the central part of the state. Georgia dinosaur material includes 12 specimens – hadrosaur (Table 3), ornithomimid (Table 7), dromaeosaur (Table 8), and tyrannosauroid (Table 9). All specimens are from the Campanian Blufftown Formation in Stewart County, Georgia. Although Schwimmer et al. (1993) referred to the tyrannosauroid material as *Albertosaurus*, this may actually be *Appalachiosaurus*, which was described later by Schwimmer and others in Carr et al. (2005). Of special note are the three distal tibiotarsal specimens (CCK-93-12-1, CCK-93-12-2, and CCK-93-12-3) which represent the only dromaeosaur bone material from the study area.



Tennessee

In Tennessee, Upper Cretaceous deposits run along the eastern edge of the Mississippi Embayment cropping out in a northerly stretching belt through western Tennessee. Dinosaur material from Tennessee includes three hadrosaur specimens (Table 3). The first described dinosaur specimen from Tennessee includes hadrosaur bones (FHMM 1989.29.1) from an unknown location in western Tennessee. According to Bryan et al. (1991), the material was brought from the Tennessee Division of Geology to the University of Tennessee, Knoxville with minimal information regarding place of collection other than "west Tennessee." Gray chalky matrix on the bones yielded a Campanian nannofossil assemblage which suggests the bones may have been collected from the Demopolis Chalk (Bryan et al., 1991). Additional hadrosaur material, a partial tooth (PPM 2005.6.1) and a hadrosaur jaw found in 2009 (Markin and Gibson, 2010; UM unnumbered specimen), were collected in Decatur County from the Coon Creek Formation. The Decatur County site is the only site with known locality to produce material in Tennessee.

CONCLUSIONS

Wang and Dodson (2006) calculated that as much as 71% of dinosaur genera have yet to be identified, and the greatest dinosaur diversity is within the Campanian and Maastrichtian (Dodson, 1990). The study area has much to offer with respect to Wang and Dodson's findings given the following: 1) Of the specimens recorded, 21% have not yet been identified to lower taxa and 2) The majority of the Cretaceous outcrop belt in the study area is Campanian and Maastrichtian. Considering these points, there may be more taxa within this region waiting to be discovered and described, adding to our understanding of Late Cretaceous dinosaurian diversity, biogeography, and evolution.

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35. New Genera and Species of Cavernicolous Diplopods from Alabama. Richard L. Hoffman. 13 pp., illus., 1956. $3.00
36. Archaeological Investigations in Mobile County and Clarke County, Southern Alabama. Steve B. Wimberly. 262 pp., 7 plates, 1960. $5.00

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