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### Evidence of a Boreal Avifauna in Middle Tennessee during the Late Pleistocene

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A faunistically significant, stratified cave deposit was discovered during an archaeological site survey of the proposed Tennessee Valley Authority (TVA) Columbia Dam reservoir that will impound approximately 30 km of the Duck River in middle Tennessee. This small cave, known as Cheek Bend Cave (40MU261), is in a limestone bluff 20 m above the river bed, 13 km east-southeast of Columbia, Maury County. Testing for the presence of aboriginal occupation began in September 1978 and, as a result of encountering huge quantities of animal bone and shell at considerable depths that appeared not to be attributable to man, was continued until May 1979. Three 1 × 2-m excavation units placed along the east wall revealed stratified deposits of animal remains to a depth of about 4.5 m.

On the bases of the species composition within and among strata, differing fill zones, and certain other stratigraphic features, the deposit reflects two distinct and well-defined major episodes of fill. The top 2 m represent the Holocene epoch and contain remains of only extant modern species. In contrast, the faunal assemblage in the bottom 2 m, although it includes some species that still inhabit the cave area (presently a deciduous Western Mesophytic Forest), contains many that are now extirpated and reflect a prairie habitat (Prairie Chicken, *Tympanuchus cupido*; 13-lined ground squirrel, *Spermophilus tridecemlineatus*, pocket gopher, *Geomys* sp.) or a boreal environment (e.g. arctic shrew, *Sorex arcticus*; water shrew, *Sorex palustris*; red-backed vole, *Clethrionomys gapperi*; yellow-cheeked vole, *Microtus xanthognathus*; red squirrel, *Tamiasciurus hudsonicus*; northern flying squirrel, *Glaucomys sabrinus*; and heather vole, *Phenacomys intermedius*). Recovery of a partial carapace of a wood turtle (*Clemmys insculpta*) also suggests, based on the present center of distribution of the wood turtle, a well-established boreal

environment for an extended period of time in this area during the Late Wisconsinan (Parmalee and Klippel 1981).

The avifauna from Cheek Bend Cave is extremely diversified and reflects both open grassland or savanna and forest habitat. Remains of aquatic birds (e.g. Pied-billed Grebe, *Podilymbus podiceps*, and at least three species of ducks) are rare in the deposit, although several species associated with riverine or marsh habitats are represented. Most notable among these are the Yellow Rail (*Coturnicops noveboracensis*) and the Black Rail (*Laterallus jamaicensis*), both probably rare transients in Tennessee, although their modern distribution in the Midsouth is poorly known. We identified a minimum of approximately 60 species, representing 28 families, from the avian sample. Elements of numerous passerine species of the families Parulidae and, particularly, Fringillidae comprised 75-95% of the avian samples from the Holocene levels. Except for the Passenger Pigeon (*Ectopistes migratorius*) and the Ruffed Grouse (*Bonasa umbellus*), all of the identified species represented in the Holocene levels are still a part of the avifauna of middle Tennessee. A comprehensive report dealing with the stratigraphy and chronology of Cheek Bend Cave, its archaeological component, and the total faunal assemblage is being prepared for the Tennessee Valley Authority.

Several species of birds identified from elements recovered in the bottom 2 m of the deposit are especially significant, because they not only represent new state or regional records but also because they suggest a boreal climate and habitat in this region during the Wisconsinan. Five species worthy of special comment are the Hawk Owl (*Surnia ulula*), Boreal Owl (*Aegolius funereus*), Saw-whet owl (*Aegolius acadicus*), Gray Jay (*Perisoreus canadensis*), and Pine Grosbeak (*Pinicola enucleator*). In addition to these

TABLE 1. Avian species identified from the late Pleistocene strata of Cheek Bend Cave, Maury County, Tennessee.

<b>Falconidae</b>	
American Kestrel, <i>Falco sparverius</i>	
<b>Tetraonidae</b>	
Ruffed Grouse, <i>Bonasa umbellus</i>	
Sharp-tailed Grouse, <i>Pedioecetes phasianellus</i> <sup>a</sup>	
Greater Prairie Chicken, <i>Tympanuchus cupido</i>	
<b>Rallidae</b>	
Yellow Rail, <i>Coturnicops noveboracensis</i>	
<b>Scolopacidae</b>	
Common Snipe, <i>Capella gallinago</i> <sup>a</sup>	
American Woodcock, <i>Philohela minor</i>	
<b>Columbidae</b>	
Passenger Pigeon, <i>Ectopistes migratorius</i>	
<b>Strigidae</b>	
Barred Owl, <i>Strix varia</i>	
Boreal Owl, <i>Aegolius funereus</i> <sup>a</sup>	
Saw-whet Owl, <i>Aegolius acadicus</i> <sup>a</sup>	
Hawk Owl, <i>Surnia ulula</i> <sup>a</sup>	
<b>Apodidae</b>	
Chimney Swift, <i>Chaetura pelagica</i> <sup>a</sup>	
<b>Picidae</b>	
Common Flicker, <i>Colaptes auratus</i> <sup>a</sup>	
Red-bellied Woodpecker, <i>Melanerpes carolinus</i>	
Hairy Woodpecker, <i>Picoides villosus</i>	
<b>Tyrannidae</b>	
Eastern Phoebe, <i>Sayornis phoebe</i>	
<b>Alaudidae</b>	
Horned Lark, <i>Eremophila alpestris</i> <sup>a</sup>	
<b>Corvidae</b>	
Blue Jay, <i>Cyanocitta cristata</i>	
Gray Jay, <i>Perisoreus canadensis</i> <sup>a</sup>	
<b>Sittidae</b>	
Red-breasted Nuthatch, <i>Sitta canadensis</i> <sup>a</sup>	
<b>Turdidae</b>	
Robin, <i>Turdus migratorius</i>	
<b>Icteridae</b>	
Meadowlark, <i>Sturnella</i> sp.	
<b>Fringillidae</b>	
Purple Finch, <i>Carpodacus purpureus</i>	
Pine Grosbeak, <i>Pinicola enucleator</i> <sup>a</sup>	
Pine Siskin, <i>Carduelis pinus</i> <sup>a</sup>	
cf. Towhee, <i>Pipilo erythrophthalmus</i>	
cf. White-throated Sparrow, <i>Zonotrichia albicollis</i>	

<sup>a</sup> Remains present only in late Pleistocene strata.

five, remains of 23 other species were identified from the late Pleistocene strata (Table 1). In addition to the three owls, Gray Jay, and Pine Grosbeak, the Red-breasted Nuthatch (*Sitta canadensis*) and Pine

Siskin (*Carduelis pinus*) also suggest extensive coniferous forests in the vicinity of Cheek Bend Cave. Although most species comprising the avian assemblage reflect a forest habitat, the presence of meadowlark (*Sturnella* sp.), Horned Lark (*Eremophila alpestris*), Prairie Chicken, Sharp-tailed Grouse (*Pedioecetes phasianellus*), and some rodents such as the pocket gopher (*Geomys* sp.) is indicative of these forested areas having been interspersed with short-grass prairie or savanna.

The Hawk Owl lives in Canada and Alaska in coniferous forests mixed with birch scrub, tamarack bogs, and muskegs (Bent 1938). This owl is a rare and sporadic winter vagrant in northern Plains and Midwest states; there are no historic records of it from Tennessee and no Pleistocene records from anywhere. Identification of *Surnia ulula* from Cheek Bend Cave is based on a complete phalanx (phalanx I, digit I) and premaxilla (Fig. 1). Distribution of the Boreal Owl is similar to that of the Hawk Owl, as is its choice of habitat. The only fossil (Holocene?) record of *A. funereus* is from Shelter Cave, New Mexico (Brodkorb 1971). Evidence of its occurrence in historic times in Tennessee is lacking. Diagnostic elements of at least two individuals of the Boreal Owl from Cheek Bend Cave consist of the proximal two-thirds of a right and shaft section of a left tarsometatarsus, distal one-third of a right and distal end of a left tibiotarsus, distal end of a right femur, head of a left humerus, distal end of a left ulna, proximal end of a left radius, sections of a lower jaw, articular end of a left scapula, coricoidal articular facet and manubrium section of a sternum, and 18 phalanges.

Although the Saw-whet Owl is not restricted to the northern coniferous forests, its center of distribution and greatest abundance lies in the woodland areas across southern Canada, the Great Lakes states, and in the northeastern United States. It is a rare winter resident in the Midsouth; there are only four reported sight records of this owl in the Nashville area (ca. 60–80 km north of Cheek Bend Cave) (Riggins 1977). All remains of *A. acadicus* were recovered from the same late Wisconsinan levels (300–400 cm below the surface) in which the bones of the Hawk Owl and Boreal Owl occurred. Remains of the Screech Owl (*Otus asio*), a common inhabitant of primarily deciduous forests of eastern North America, were found in the Holocene levels of Cheek Bend Cave but not in the Pleistocene levels. Elements of the Saw-whet Owl consist of the distal section of a right and left coracoid, articular end of a right scapula, proximal one-half of a right and distal one-third of a left radius, distal end of a left ulna, a complete right tibiotarsus, distal one-third of a right tarsometatarsus, and seven phalanges.

In eastern North America both the Gray Jay and Pine Grosbeak occur throughout the coniferous forests of southern Canada, and in the United States they seldom appear farther south than the upper Great Lakes and northern New England states. Like

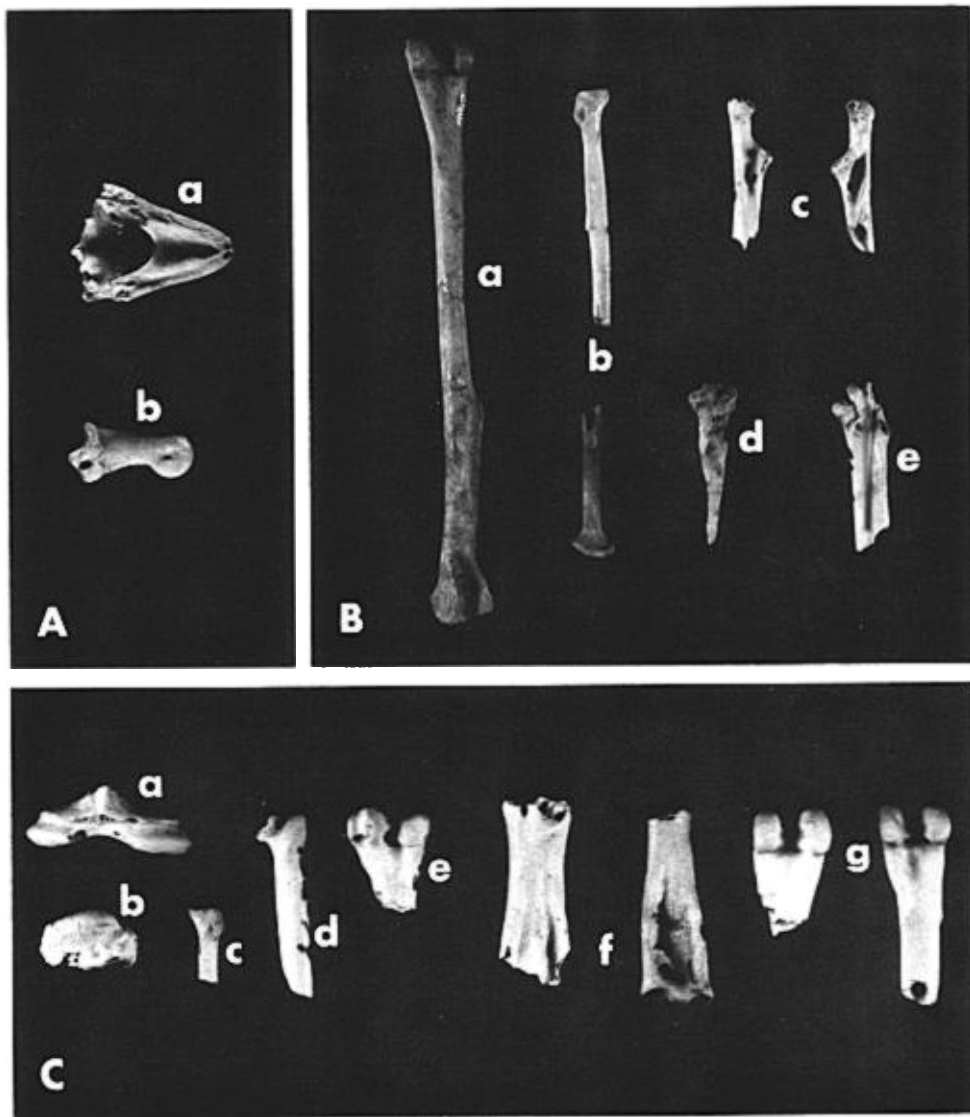


Fig. 1. Avian fossils from Cheek Bend Cave, Maury County, Tennessee. A. *Surnia ulula*: a, premaxilla; b, phalange. B. *Aegolius acadicus*: a, tibiotarsus; b, radii; c, coracoids; d, ulna; e, tarsometatarsus. C. *Aegolius funereus*: a, sternum; b, humerus; c, radius; d, ulna; e, femur; f, tarsometatarsi; g, tibiotarsi.

the Hawk Owl and Boreal Owl, these two passerines are associated with a boreal habitat and seldom wander or migrate great distances. Identification of *Pinicola enucleator* was based on sections of the lower jaw and left carpometacarpus (distinct from *Pheuticus* and *Hesperiphona*) and that of *Perisoreus canadensis* on limb elements including the distal ends of two left humeri and two complete left carpometacarpus. Fossil records of these passerines are lacking (Brod-korb 1978).

In a recent study of the late Pleistocene vegetation of the eastern Highland Rim and Cumberland Pla-

teau, based on the analyses of pollen recovered from sediment cores from Anderson Pond (White County) and Mingo Pond (Franklin County), Delcourt (1979) was able to show that several major vegetational changes have taken place during the past 25,000 years. During the Wisconsin glacial maximum, about 19,000–16,300 yr BP, boreal taxa of jack pine, spruce, and fir were dominant, and "Between 16500 and 12500 yr BP, mixed coniferous deciduous forests covered the landscape between 34°N and 37°N latitude" (Delcourt 1979: 276). In his discussion of the vegetation of eastern North America 18,000 yr ago,

Wright (1981: 122) states that "Boreal forest formed a belt perhaps 1000 km broad, starting at or near the [Laurentide] ice front in the north and ending south near a line extending from central Georgia around the southern end of the Appalachian Highlands to Tennessee . . ." Recovery of remains of predominantly boreal small mammals from the lower levels of Cheek Bend Cave and those of four avian species whose present primary northern ranges coincide, coupled with pollen analyses data, suggest that the Nashville Basin was characterized by climatic conditions that included somewhat lower annual mean temperatures than exist today and a climax vegetation dominated by coniferous forest. Although the possibility exists that the former presence of the Hawk Owl, Boreal Owl, Saw-whet Owl, Gray Jay, and Pine Grosbeak at this cave site was the result of southward-wandering vagrants, the small mammal assemblage and the remains of at least two individuals of *A. funereus* and *P. canadensis* suggest a locally established population of these boreal birds during the Wisconsinan.

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Cheek Bend Cave (40MU261) and the analysis of the faunal materials were made possible.

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### Flightlessness in Flying Steamer-Ducks

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Steamer-ducks comprise a single, widely distributed, flying species, *Tachyeres patachonicus* (Falklands and Fuego-Patagonia), and three flightless species, *T. brachypterus* (Falklands), *T. pteneres* (Tierra del Fuego and the southern coast of Chile), and the recently discovered (Humphrey and Thompson 1981) *T. leucocephalus* (coast of Chubut, Argentina). This paper presents data on wing loading and use of flight for escape by Flying Steamer-Ducks and evidence that some individuals are permanently incapable of flight.

Flying Steamer-Ducks occur in freshwater and marine coastal environments in Patagonia, Tierra del Fuego, and the Falkland Islands (Weller 1976, Humphrey and Thompson 1981). They feed on sessile or slow-moving molluscs, crustaceans, and insect larvae, which they often obtain by diving, using hind feet and partly spread wings for propulsion (Murphy 1936: 960; Humphrey and Livezey unpubl. data).

Weller (1976: 47) noted the "hesitancy of . . . Flying Steamer Ducks to fly . . ." Murphy (1936: 970), writing of Beck's collecting activities, stated

that Flying Steamer-Ducks "are capable of getting well into the air within a space of 2 meters, even in a dead calm," and "they rarely dived at the approach of . . . [Beck's] craft, but preferred to take wing. . . some of them flew heavily, not rising far above the water, while others mounted high into the air and passed quite out of sight." Reynolds (in Lowe 1934: 474) wrote that "*Tachyeres patachonicus* is capable of sustained and rapid if somewhat heavy flight. . . . At times *T. patachonicus* may well be taken for a flightless bird, and some of the confusion distinguishing between the two species [*patachonicus* and *pteneres*] is probably due to the unaccountable reluctance to rise so often demonstrated by this species."

During field seasons in 1979 (Humphrey and Max C. Thompson) and 1980-1981 (Humphrey and Livezey), 57 specimens of Flying Steamer-Ducks were collected near Ushuaia, Tierra del Fuego (5-17 November 1979, 24-27 December 1980, 4-6 January 1981), Puerto Deseado, Province of Santa Cruz (10-16 October 1979, 20-26 January 1981), and Puerto Melo,