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APPALACHIA 11,000-12,000 YEARS AGO: A BIOLOGICAL REVIEW

John E. Guilday

Vertebrate remains from numerous archaeological sites and cave, fissure, and bog deposits clearly indicate two distinct, successive faunas in the mid-Appalachian area during late glacial and Holocene times.

The mid-Appalachian area is defined as that portion of the Appalachian Plateau and Ridge-and-Valley physiographic provinces lying between latitudes 36° and 34° North: most of Pennsylvania, West Virginia, the eastern halves of Ohio, Kentucky, and Tennessee, and the western parts of Virginia and Maryland, about 475,000 square kilometers of low northeast/southwest-trending ridges, intermontane valleys, and dissected rolling plateau. Maximum altitude is usually less than 1,000 meters above sea level.

During Holocene times, prior to the ecological destruction of the past 300 years, the area was covered with a mixed, oak/chestnut (*Quercus/Castanea*) dominant, closed-canopy, largely deciduous, mast forest. Sufficient topographical relief was present to sustain isolated stations for a few relict species of plants and animals of northern affinities that had lingered since the late Pleistocene. There were limited gallery meadowlands along river courses, and isolated mountain glades, neither of which was extensive enough to support a distinctive endemic vertebrate fauna.

From a mammalian and avian standpoint (leaving aside aquatic habitats) the area was one vast deciduous forest. The predominant birds and mammals were either insectivorous, carnivorous, or consumers of mast, browse, bark, and fruits. Grazing mammals were small in size: two genera of mice (*Microtus* and *Synaptomys*) and cottontail rabbits (*Sylvilagus*), all small enough to be able to exploit the confined, often temporary, areas of meadowlands within the eastern forest. The presence of the bison (*Bison bison*) a large grazer, other than on a transient basis, has not been satisfactorily established within the area. It is basically an open-country grazer and its unequivocal remains are conspicuously absent from mid-Appalachian archaeological sites (Guilday, 1963; 1971a). Mast (acorns, nuts, etc.) specialists were largely arboreal. Three genera of squirrels (*Sciurus*, *Tamiasciurus*, *Glaucomys*) the wild turkey (*Meleagris*), the ruffed grouse (*Bonasa*), and the passenger pigeon (*Ectopistes*) occurred in tremendous numbers, in aggregate bio-mass reminiscent of the bison herds of the Great Plains.

In summary, the Holocene mammal fauna of the area contained about 51 species, only six, or 12%, of which were large in size, i.e. heavier than 20 kilograms: the white-tailed deer (*Odocoileus virginianus*) and the elk (*Cervus elaphus*), both of which are predominantly browsers and mast feeders, their predators, the mountain lion (*Felis concolor*) and the timber wolf (*Canis lupus*), the omnivorous black bear (*Ursus americanus*) and the transient grazer *Bison bison*. Despite the size of the area, major ecological niches were few, or severely limited, in the ecologically homogeneous eastern mast forest with its deficient understory, long winter resting periods, and intermittent snow cover.

In striking contrast, the late Pleistocene mammalian fauna was richer and more diverse, especially in species of browsing and grazing herbivores. This fauna (exclusive of bats) consisted of at least 75 species, an increase of about 32% compared to the depauperate Holocene fauna. The number of large species increased from six to around 26, and from the 12% characteristic of the Holocene to 35% of the total mammalian fauna. Present were 2, possibly 3 genera of muskoxen (*Ovibos*, *Symbos*, and *Bootherium*), bison (*Bison*), horse (*Equus*), tapir (*Tapirus*), 2 genera of peccaries (*Platygonus* and *Mylohyus*), an extinct moose (*Cervalces*), a stilt-legged deer (*Sangamona*), the caribou (*Rangifer*) as well as the elk and white-tailed deer, two genera of ground sloths (*Megalonyx*, *Glossotherium*), mammoth (*Mammuthus*), mastodon (*Mammut*) and giant beaver (*Castoroides*). Large carnivores included the grizzly bear (*Ursus arctos*), the black bear (*Ursus americanus*), the jaguar (*Panthera onca*), the dire wolf (*Canis dirus*), and possibly the saber-tooth cat (*Smilodon*, Trout Cave, W. Va.), American cheetah (*Acinonyx*, Hamilton Cave, W. Va.), the huge short-faced bear (*Arctodus*, Frankstown Cave, Pa.), and an extinct spectacled bear (*Tremarctos*, Grassy Cove Saltpetre Cave, Tenn.) (Kurtén and Anderson, 1980).

The extinct large mammals, though spectacular, tell us little of the precise climatic conditions under which they lived. What their presence clearly implies is a greater degree of ecological diversity. It implies an environment capable of supporting not only a forest fauna, as in the Holocene but, in addition, a greater variety of browsing and grazing herbivores. Such a variety of large mammals could not have coexisted in the closed-canopy, deciduous, mast forest characteristic of the area during the Holocene. This varied megafauna suggests a mosaic of ecological opportunities such as mixed forest and grasslands, allowing a greater variety of housekeeping possibilities to coexist. It would include prairie, with its open-grazing possibilities, as well as forest-edge, rich in understory vegetation, and woodlands with their largely arboreal, seasonal fruitings. All of these, when combined into a landscape of *open* forest with trees thinly dispersed, or in copses, with a ground cover of grasses, seasonal herbs and shrubs would provide the maximum in ecotypes and support the greatest number of vertebrate species, large and small, per area unit.

All of the large mammals mentioned survived into late-glacial times, and their terminal radiocarbon dates place most of them within Clovis times and, potentially, in contact with the Paleo-Indian in eastern North America (Kurtén and Anderson, 1980). However, the only species of large mammal no longer present in the mid-Appalachians that has been archaeologically associated with man has been the caribou (Dutchess Quarry Cave, southeastern New York, 12,530 yrs. BP, Funk *et al.*, 1970). It is possible that not all of these species coexisted at any one time during a rapidly changing climatic episode. But most of them did, and whether they were all, in fact, associated with early man in the East is beside the point at the moment, the point being that such an association of ecologically diverse large mammals could not exist in the mid-Appalachians under present forest conditions, and their variety requires a much different ecological set-up.

The study of large extinct mammals gives us little beyond ecological generalities, but the analysis of small vertebrate remains is more illuminating. Although small mammal remains are relatively rare in archaeological sites (except those in the cave or rockshelter situation where their presence is usually due to non-human agencies) they are extremely common in cave and fissure deposits of all ages, due to natural entrapment or to the sloppy housekeeping of owls and other raptorial birds. In all Holocene archaeological and paleontological sites within the area, one invariably finds remains of only those species of vertebrates that exist in the area today (with a few minor range changes) back as far as 9,240 years BP (Hosterman's Pit, central Pennsylvania, Guilday, 1967). Other sites with Recent faunas that approximate this age are: New Paris No. 3, Bedford Co., Pa., 8,570 yrs. BP (Guilday and Bender, 1958) and Sheep Rock Shelter, Huntingdon Co., Pa., 8,920 yrs. BP (Guilday and Parmalee, 1965; Michels and Smith, 1967). The best faunal sequence, extending through the Holocene, is that of the Meadowcroft Rockshelter, Washington Co., Pa., in southwestern Pennsylvania (Adovasio *et al.*, 1979). Evidence from that site, supplied by a large stratified faunal sample of 149 species and over 5,000 individual animals, demonstrates that the local fauna changed only in minor aspects throughout the depositional episodes, and that the fauna held its integrity throughout the Holocene. Several species of reptiles are now found a little west or south of the site, but little change was indicated in either the mammalian or the avian component of the extensive Meadowcroft faunal sample until the advent of the ax and the plow.

Cave and fissure deposits older than those of New Paris No. 3 and Hosterman's Pit, Pa., show a dramatic change in both the large and the small mammal components of their preserved faunas. None of these sites are archaeological in nature but radiocarbon dating places them in potential temporal

concordance with Paleo-Indians—New Paris Sinkhole No. 4, Pa., 11,300 yrs. BP, wind-wafted charcoal specks, (Guilday *et al.*, 1964), Bootlegger Sink, York Co., Pa., 11,500 yrs. BP, caribou bone, (Guilday *et al.*, 1966; unpublished date), Welsh Cave, Woodford Co., Ky., 12,950 yrs. BP, peccary bone, (Guilday *et al.*, 1971), Baker Bluff Cave, Sullivan Co., Tenn., 10,560; 11,640; 19,100 yrs. BP, animal bone, (Guilday *et al.*, 1978). Many other undated cave and fissure assemblages in the area agree in species composition (Guilday, 1971b). Detailed ecological analysis is possible because all species of the rich small mammal faunas of these sites are still living somewhere today and can be directly studied.

The late Pleistocene fauna can be broken down into four categories: (1) extinct species, (2) present day boreal forms, (3) present day midwestern prairie forms, (4) species still present in the area. The ranges of the latter three groups are now largely allopatric but all apparently coexisted within the area during early post-glacial times, suggesting a more diverse ecological situation than the regional one today.

This late glacial period microfauna is clearly dominated by boreal forms, in particular those voles and lemmings characteristic of the modern northern Canadian spruce forest and taiga. The yellow-cheeked vole (*Microtus xanthognathus*), for example, is found today no farther south or east than the west coast of Hudson's Bay. Its remains occurred by the hundreds of individuals at New Paris Sinkhole No. 4, Pa., and Clark's Cave, Va. (Guilday *et al.*, 1977), and it was a constant and common element in this fauna throughout the Appalachian area from Pennsylvania south into Kentucky at Welsh Cave, West Virginia at Eagle Rock Cave (Guilday and Hamilton, 1973), in Virginia, and in eastern Tennessee at Baker Bluff Cave. The Collared lemming (*Dicrostonyx hudsonius*), an eastern Arctic tundra form that now occurs no farther south than central Labrador (Hall and Kelson, 1959), has been recovered both from New Paris Sinkhole No. 4, Pa., and New Trout Cave, Pendleton Co., W. Va. dated 17,060; 29,400 yrs. BP, (Grady and Garton, 1971). Other small mammals characteristic of the Canadian forest such as the northern bog lemming (*Synaptomys borealis*), the heather vole (*Phenacomys intermedius*), and the Arctic shrew (*Sorex arcticus*) are present in such faunas as far south as Tennessee. Some species of northern affinities that occur in the mid-Appalachians today in relict situations, flourished in these faunas as well, such as the snowshoe hare (*Lepus americanus*) and the rock vole (*Microtus chrotorrhinus*).

The prairie element characteristic of this older fauna, the thirteen-lined ground squirrel (*Spermophilus tridecemlineatus*) and the badger (*Taxidea taxus*), occurred as far east as the Piedmont of eastern Pennsylvania (Bootlegger Sink) and as far south as Tennessee (Baker Bluff Cave). The ranges of the grizzly bear (Welsh Cave, Ky.), the pocket gopher (*Geomys*) (Parmalee and Klippel, 1981), and the least chipmunk (*Eutamias*) also extended farther to the east than they do today. As a group they are suggestive of grassland conditions of some sort.

Most of the temperate species present in the area today occurred in one or another of these local faunas, but in limited numbers, becoming relatively scarcer in northerly sites.

Birds also furnish environmental clues. Evidence from the extensive avian sample of the Meadowcroft Rockshelter again indicates that there was no major change in avian distribution, at least in the Ohio valley, during Holocene times, and all regional archaeological sites contain only those avian species present in the area until the 19th century. In late glacial period faunas, however, such northern forms as the sharp-tailed grouse (*Pedioecetes*), ptarmigan (*Lagopus*), spruce grouse (*Dendragapus*), and gray jay (*Perisoreus*) from Clark's Cave, Va., and the western magpie (*Pica*) from Natural Chimneys, Va. (Guilday, 1962), and Baker Bluff Cave, Tenn., occurring in association with birds still regionally present, suggest a similar mixture of boreal, prairie, and forest forms.

Palynological studies, most recently summarized by H. E. Wright (1981), and W. A. Watts (1979), indicate that in our area in late glacial times, from approximately 18,000 yrs. BP to 12,000 yrs. BP, south of a narrow tundra fringe along the glacial margin and sporadically down the Appalachian summits, the land supported a mixed, but essentially coniferous, forest cover, spruce/fir-dominated (*Picea/Abies*) west of the Appalachians, and pine-dominated, particularly jack pine (*Pinus banksiana*), east of the Appalachians, as far south as Tennessee and Georgia. The area must have contained essentially contiguous areas of grassland intermingled with forest in order to support the greatly augmented numbers of large grazers. The presence of now midwestern species suggests that this was a drier, as well as a cooler climatic episode.

In the mid-Appalachians boreal animals clearly predominated but shared the area with both temperate and midwestern species of small mammals. The presence of now temperate species, in minor numbers, is interesting and suggests less seasonal extremes than at present, enabling species of both northern and southern affinities to coexist. Regional temperatures were lower, on a yearly average, but

the situation suggests that winters may not have been much more severe than they are today, enabling temperate species to persist, while summers were relatively cooler, permitting boreal forms to extend their ranges to the south.

Archaeologically, the presence of Paleo-Indians in the area is well documented from lithic artifacts but, unfortunately, conditions of preservation in the humid East are rarely conducive to long term preservation of vertebrate remains except in isolated bog, fissure, and cave deposits, situations where the presence of man would not necessarily be expected. Caves are abundant throughout the area but, in addition to most of the major ones having been disturbed by saltpetre miners who engaged in wholesale removal of cave fill from the late 1700s until after the Civil War (Faust, 1964), caves do not appear to have been resorted to by Paleo-Indian people in the area; consequently, deposits such as those found in European caves, for instance, where early men were responsible for extensive bone deposits, have never been discovered, and rapid erosion in a chemically hostile environment has removed any evidence of possible Paleo-Indian /Pleistocene megafauna interaction. Thus, although the contemporaneity of the Paleo-Indian with the rich late Pleistocene fauna of the area is probably a fact, it will be extremely hard to document.

The point to be emphasized is that, at about 12,000 years ago, this rich and varied late Pleistocene fauna crashed in numbers, most of the megafauna became extinct, and many other vertebrates adjusted their ranges, either becoming of relict status or leaving the area completely, some to the north, some to the west, as the regional environment changed rapidly and the deciduous forests closed in to present, by at least 9,000 years ago, an essentially modern aspect. This suggests that Paleo-Indian lifeways changed accordingly in some fashion, whether by displacement or evolution, in response to severe environmental challenge, and that all subsequent regional Indian cultures were faced with essentially the same Holocene environmental conditions in respect to the harvesting of forest products, both botanical and zoological. This may not have been true in other areas, particularly in those sites farther west or north, closer to modern ecotonal margins such as the prairie/forest interface as at Graham Cave and Rodgers Shelter, Missouri (McMillan and Klippel, 1981), but was true at least in the mid-Appalachian region, situated squarely, as it was, in the eastern deciduous forest.

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