SHORT COMMUNICATIONS

QUATERNARY AVIAN REMAINS FROM DARK CANYON CAVE, NEW MEXICO

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A few years ago Wm. H. Balgemann of Carlsbad, New Mexico, discovered a cave in Eddy County, New Mexico, near Carlsbad, and salvaged from it a quantity of bird and mammal bones. These were submitted to Lyndon Hargrave, then at the Southwest Archeological Center in Globe, Arizona (now at the Center for Anthropological Studies, Prescott College, Arizona). Knowing of my previous interest in avian remains from Quaternary cave deposits, Hargrave graciously gave me the privilege of studying Balgemann's material, and eventually, the greater part of the collection was presented to the Los Angeles County Museum of Natural History by Balgemann. The galliform and small passerine bones, and the single parrot bone were returned to Hargrave and will be reported on separately. In these groups Hargrave's personal collection of modern skeletons from the New Mexico and Arizona areas is extensive.

Data concerning the cave, as supplied by Balgemann and Hargrave, are as follows. The cave is situated in a limestone cliff in Dark Canyon, about 15 mi. SW of Carlsbad, Eddy County, New Mexico. Although the cave is 75 ft above the valley floor, it is easily accessible, and most of the deposits were considerably disturbed, except in one portion of the right wing of the cave. In this area it was evident that a Basketmaker culture overlay the bone-bearing sediments to a depth of 36–38 inches. Most of the bird and mammal bones were found at depths from 50 inches to 8½ ft. Nearly all of the bones are broken and many have been gnawed by animals. No associated skeletons of birds occur, suggesting that much of the material was carried into the cave by carnivores. The possibility that some raptorial birds nested in the cave is indicated by the presence of a few bones of immature individuals of owl (*Tyto*), vulture (*Coragyps*), and caracara (*Caracara*).

Although data on stratification are lacking for most of the specimens, the fact that among both bird and mammal bones there is representation of extinct species suggests at least a late Pleistocene age for the bulk of the material. Among the mammal bones identified by Dr. Theodore Downs, Chief Curator of Earth Sciences, Los Angeles County Museum of Natural History, are several bones of an extinct antelope, presumably *Stockoceros conklingi* (Stock), described from Shelter Cave, New Mexico. Horse teeth are abundant. More than one-third of the non-passerine bird bones represent extinct species, six of which are characteristic of the late Pleistocene of the west coast of North America.

Similar cave deposits, in which bones of extinct animals occurred, have been recorded from four other sites in southern New Mexico: Rocky Arroyo in the Guadalupe Mountains (Wetmore 1931:76 and 1932: 141), Conkling and Shelter caves in Doña Ana County (Howard and Miller 1933), and Howell's Ridge (= "Hachita") in the Little Hatchet Mountains, Grant County (Howard 1962). Fifty-three avian species were listed from Shelter Cave, 25 from Conkling Cavern, 19 from Howell's Ridge, and 13 from Rocky Arroyo. The combined total for the four previously recorded localities is 70 different species. Dark Canyon Cave, with 40 or more species (see table 1), duplicates many of those previously recorded, but adds several new records (5 extinct and at least 10 living species), bringing the total fossil list for New Mexico close to 90 species.

The most significant occurrences are *Falco swarthi* Miller, *Anabernicula* cf. *oregonensis* Howard, *Neophrontops americanus* Miller, *Burhinus* sps. and *Ectopistes migratorius* (Linnaeus).

Falco swarthi was known heretofore only from the type locality, the Pleistocene tar deposits at McKittrick, California. A proximal end of a tarsometatarsus and an incomplete femur in the Dark Canyon material are assigned to this species. The tarsometatarsus is considerably scored with tooth marks. The large size of the bone, and the broad tubercle for the tibialis anticus muscle situated near the external margin of the shaft, agree with the description of the type specimen of *F. swarthi* (Miller 1927:152) as well as with three other tarsometatarsi from McKittrick (in the collections of the Los Angeles County Museum of Natural History). The cave specimen falls between the largest and smallest of these bones in size, with a proximal breadth at the level of the foramina of 12.0 mm (McKittrick bones, 11.6–13.0 mm). The femur of *F. swarthi* has not been described, but a left proximal and a right distal end in the McKittrick collection were identified by DeMay and included in her recorded totals for the species (DeMay 1941:46). These bones are 9 per cent stouter than the femur from New Mexico, but the difference is not beyond the limits to be expected for sexual variation. Measurements of the cave femur are as follows: length, 82.7 mm; breadth of proximal end (estimated), 16.0 mm; breadth of shaft at middle, 7.5 mm; breadth of distal end from uppermost flare of fibular condyle to raised area above the internal condyle, 16.3 mm.

The single fragment of humerus of *Anabernicula*

TABLE 1. Avian taxa identified from Dark Canyon Cave, New Mexico.

Species	No. bones
Eared Grebe (*Podiceps caspicus*)	2
Double-crested Cormorant (*Phalacrocorax auritus*)	1
*Extinct Sheldgoose (*Anabernicula* cf. *oregonensis*)	1
Mallard Duck (*Anas platyrhynchos*)	2
Pintail Duck (*Anas acuta*)	2
Green-winged ? Teal (*Anas carolinensis*?)	2
Wood Duck (*Aix sponsa*)	4
Canvasback Duck (*Aythya valisineria*)	1
Merganser? (*Mergus* ? sp.)	1
*Ancestral Condor (*Gymnogyps amplus*)	17
*Western Black Vulture (*Coragyps occidentalis*)	11
Cooper's Hawk (*Accipiter cooperii*)	1
Red-tailed Hawk (*Buteo jamaicensis*)	3
Rough-legged Hawk (*Buteo lagopus*)	1
Gray Hawk (*Buteo nitidus*)	1
Golden Eagle (*Aquila chrysaetos*)	3
*American Neophron (*Neophrontops americanus*)	4
*Swarth Falcon (*Falco swarthi*)	2
Prairie Falcon (*Falco mexicanus*)	5
Sparrow Hawk (*Falco sparverius*)	6
*Early Caracara (*Caracara prelutosa*)	17
Quail, 2 species?	26
Lesser Prairie Chicken (*Tympanuchus pallidicinctus*?)	1
Grouse, 2 species?	2
Turkey (*Meleagris gallopavo*?)	2
Mountain Plover (*Eupoda montana*)	1
*Small, extinct thickknee (*Burhinus* sp.)	1
Thickknee (*Burhinus* sp.)	1
Mourning Dove (*Zenaidura macroura*)	3
*Passenger Pigeon (*Ectopistes migratorius*)	1
Parrot (Psittacidae, sp.)	1
*Conkling Roadrunner (*Geococcyx conklingi*)	2
Barn Owl (*Tyto alba*)	4
Horned Owl (*Bubo virginianus*)	5
Short-eared? Owl (*Asio flammeus*?)	1
Burrowing Owl (*Speotyto cunicularia*)	2
Poorwill (*Phalaenoptilus nuttallii*)	1
Raven (*Corvus corax*)	10
Small passerines, unidentified	49
Total	200

* Extinct species.

from Dark Canyon lacks the proximal end which bears the most diagnostic characters of the element. The great depth and angularity of the shaft in palmar aspect are ducklike characters found as well in *Anabernicula*. The rounded, palmad-facing attachment of the articular ligament, with the attachment of the pronator brevis close to its margin, is gooselike and is characteristic also of the humerus of *Anabernicula oregonensis* as distinguished from that of *A. gracilenta* or *A. robusta* (see Howard 1964:5, and Short 1970:148). *A. gracilenta* has been recorded from Shelter and Howell's Ridge caves (Howard 1964:12). This is the first suggestion of occurrence of *A. oregonensis* outside its type locality, the Pleistocene of Fossil Lake, Oregon. Relationship to *A. minuscula* (Wetmore) from the early Pleistocene of Arizona, cannot be determined without the proximal portion of the bone. It should be noted that the cave specimen slightly exceeds the maximum of seven recorded humeri of *A. oregonensis* from Fossil Lake: breadth of distal end, 15.4 mm; maximum Fossil Lake specimen, 15 mm (Howard 1964:10).

The extinct vulture, *Neophrontops americanus*, is represented by portions of two tarsometatarsi and an incomplete humerus and ulna. The bones were not associated. They agree in all particulars with comparable elements from the type locality (Rancho La Brea Pleistocene). The species is known from three other California Pleistocene sites, and from deposits of the same age in San Josecito Cave, Nuevo León, México, but this is the first record for New Mexico.

A femur, broken through the distal internal condyle, exhibits a combination of characters that agree most closely with those of *Burhinus bistriatus*. Distally, the rotular groove is broad, the popliteal area deep and smoothly rounded, its internal border high and strongly flared. Proximally, the posterior face is rugose, the obturator ridge sharp; the short trochanter bends medially towards the tip, the anterior intermuscular line borders it medially, then deviates towards the external side of the shaft before swinging back to medial position. (The external deviation, however, is less abrupt than in *B. bistriatus*.) The shaft is straight and stocky, the head projecting abruptly. Length from proximal articular surface to distal edge of intercondylar fossa is 45.1 mm, least diameter of shaft, 4.1 mm. In two specimens of *B. bistriatus* at hand these measurements are 49.3–51.4 mm and 4.6–4.8 mm, respectively. The fossil is thus 9–14 per cent shorter and 12–17 per cent narrower than in the existing form, and seemingly represents a distinct species. However, I prefer not to describe it as new because of the suggested relative similarity in size of *B. nanus* Brodkorb from the Pleistocene of New Providence Island, Bahamas. Brodkorb (1959:355) records a tibiotarsus of his species which is 10–18 per cent shorter and 25–35 per cent narrower proximally than *B. bistriatus*, and a tarsometatarsus 6–9 per cent narrower of shaft and 15–17 per cent narrower proximally. Hopefully, further excavation at the Dark Canyon site will produce additional specimens that may throw further light on the relationships of this small thickknee.

A proximal fragment of a humerus, lacking the head and both external and internal tuberosities, has the high, sharp capital shaft ridge with deeply furrowed shaft commonly found in charadriiforms. On the opposite aspect, however, the bicipital furrow is broad (occupying approximately half the distance from the deltoid to the bicipital crest) and shallow. This character I find only in *Burhinus*. The shaft is slightly heavier than the larger of the two humeri of *B. bistriatus* at hand. It is, therefore, improbable that the humerus belongs to the same species as the femur noted above. It might represent the existing species, but because of its very fragmentary condition, no species assignment is attempted.

The historically abundant Passenger Pigeon, *Ectopistes migratorius*, became extinct at the turn of this century. Pleistocene occurrences have been recorded in scant numbers from California, Tennessee, Georgia, and Florida, and abundantly from one site in Virginia. The single distal end of a humerus from Dark Canyon Cave is the first record for New Mexico.

The other four extinct species represented in the cave occurred also in one or more of the other New Mexico caves: *Gymnogyps amplus* in Howell's Ridge,

Rocky Arroyo, and probably Conkling Cavern; *Coragyps occidentalis* in Conkling, Howell's Ridge, and possibly Rocky Arroyo (see Howard 1968:126); *Caracara prelutosa* in Conkling and probably Shelter Cave; *Geococcyx conklingi* in Conkling and Shelter caves. The falconiform species are characteristic of the Pleistocene of a wide area of North America (Brodkorb 1964). The *Gymnogyps* and *Coragyps* bones are assigned to the Pleistocene species on the basis of their size.

The bones representing *Podiceps caspicus* and *Phalacrocorax auritus* vary slightly in size from representatives of these species living in New Mexico today. The two grebe bones are smaller. In this regard it is significant that half of the bones of Eared Grebe recorded from the Pleistocene of Fossil Lake, Oregon (Howard 1946:152), were found to be smaller than modern skeletons of this species (Howard, notes). The single cormorant ulna from the cave is larger than specimens of *Phalacrocorax auritus albociliatus* and more closely approximates an ulna of *P. a. cincinnatus* from Alaska. This occurrence recalls a former record (Howard 1958) of a large cormorant from Crypt Cave, Nevada, radiocarbon dated as older than 20,000 years Before Present. The Crypt Cave specimen was likened to *P. a. cincinnatus* in size and proportions. These variations in grebe and cormorant are noted for reference in checking future records from prehistoric deposits.

Other specimens assigned to modern species are indistinguishable from comparable modern skeletal elements, and the species represented are known in New Mexico today. Ten of the existing species were not found in the other New Mexico caves: grebe, cormorant, Mallard, Wood Duck, Canvasback, Rough-legged and Gray Hawks, Mountain Plover, Burrowing Owl, and Poorwill.

COMPARISON WITH OTHER CAVES

The occurrence of *Burhinus* in Dark Canyon Cave marks the first record of the genus in the United States. Pertinent to this assignment is the recognition now of a thickknee tarsometatarsus from San Josecito Cave in northeastern México. This specimen was recorded by Miller (1943:160) as "indeterminate wader." On the label with the specimen, however, Miller had noted that the bone resembled the thick-knee but was smaller. My examination of the bone shows that it does, indeed, agree with *Burhinus* in the long, slender shaft and evenly flared external and internal trochleae which are nearly equal in distal extent. Unfortunately the hypotarsus and proximal cotylae are missing. The length of the portion preserved is 72.5 mm, with possibly 10 mm, or at most 15 mm of the proximal end lacking. Breadth across the distal trochleae is 8.9 mm, least breadth of shaft, 3.3 mm. The smaller of the two *B. bistriatus* specimens at hand measures 106.3 mm in overall length, 9.8 mm in distal breadth, and 3.7 mm in breadth of shaft. Relative to the existing species, the fossil conforms very well in size to the femur from Dark Canyon Cave. It is also within 0.1 mm in shaft breadth of Brodkorb's referred tarsometatarsus of *B. nanus*, which unfortunately lacks the distal extremity. As at least twelve other species from Dark Canyon Cave occur in San Josecito Cave, it is not unlikely that the thickknee also is the same. There is less likelihood of relationship to *B. nanus*, as the avifauna of the Bahama Cave is typically West Indian.

Comparing the avifaunas of the five New Mexico caves, Dark Canyon Cave resembles Shelter Cave and exceeds the other three in high representation of passerine bones. Waterbirds and galliforms (especially quail) are better represented in Dark Canyon than in any of the four other sites. Both in number of species and abundance of bones of falconiforms, Dark Canyon is close to Shelter Cave, but falls below Conkling Cavern. Howell's Ridge had fewer falconiform species, but a much greater abundance of condor bones than any of the other caves.

To compare the age of the five caves on the basis of the proportion of extinct species, it is necessary to consider only the non-passerine forms as the passerine content of Dark Canyon Cave has not been assessed. Furthermore, the condor, *Gymnogyps*, and the vulture, *Coragyps*, are, for the purposes of this comparison, rated as extinct, even though the single *Gymnogyps* bone from Conkling Cavern and the single *Coragyps* bone from Rocky Arroyo are of a size that could belong to either the Pleistocene or Recent form, and early records had placed them in *G. californianus* and *C. atratus* (see Brodkorb 1964 and Howard 1968). As for the record of *G. californianus* from Shelter Cave (Howard and Miller 1933), the wing elements on which this record was based have since been compared with specimens from Rancho La Brea now assigned to the extinct *Breagyps clarki* Miller, and are found to resemble that species. *G. californianus* must, therefore, be deleted from the Shelter Cave avifauna and replaced by *Breagyps clarki*.

With the above points in mind, the proportion of extinct species in the Dark Canyon avifauna is found to be closest to Conkling and Howell's Ridge caves (Dark Canyon, 23 per cent extinct; Conkling Cavern, 23.5 per cent; Howell's Ridge, 22 per cent; Rocky Arroyo, 16.5 per cent; and Shelter Cave, 14 per cent). While, admittedly, these figures cannot be depended upon for an exact assignment of the relative age of the cave deposits, they do suggest that the avifaunas of Dark Canyon, Conkling Cavern, and Howell's Ridge were nearly contemporaneous, and that the difference in content of passerine, waterbirds, and galliforms was a matter of the ecology of the regions.

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NOTES ON THE USE OF DESERT SPRINGS BY BIRDS IN CALIFORNIA

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We now know a good deal about the temperature regulation and water economy of desert birds in the laboratory, but to properly interpret this knowledge we need to know more about the behavior and physiology of the birds in the wild. Bartholomew and Cade (1963) have summarized much of the scattered information about desert birds' drinking habits, and detailed observations have also been published by Heim de Balzac (1936), Miller and Stebbins (1964), and Willoughby and Cade (1967). Our own observations, reported below, confirm and extend those of Miller and Stebbins on the birds of the southern California deserts.

Most of our observations were made at and around Upper Carrizo Spring, on the eastern edge of the San Jacinto Mountains, Riverside County, California. The habitat is Lower Sonoran, with creosote bush (*Larrea tridentata*), *Yucca mohavensis*, *Agave deserti*, *Opuntia* spp., and Ocotillo (*Fouquieria splendens*) on the slopes and flats, and mesquite (*Prosopis chilensis*), screwbean (*P. pubescens*), catclaw (*Acacia greggii*), and desert willow (*Chilopsis linearis*) in the creeks. Upper Carrizo Spring is one of three springs within about six miles along Carrizo Creek; there is also permanent water in Deep Canyon, about three miles away. Because of its altitude (about 750 m), the area is considerably cooler than is the Coachella Valley below, and the temperature did not exceed 40°C while we were there, though undoubtedly on occasions it does.

Between 1 August 1964 and 30 July 1965 we spent more than 150 hr watching at Upper Carrizo Spring, including six all-day watches in the summer and fall; we also spent many hours looking for and watching birds in the surrounding hills. We were watching especially for Black-throated Sparrows (*Amphispiza bilineata*), and our results for this species have already been published (Smyth and Bartholomew 1966a). Our incidental observations on other relatively common species resident during the summer are given in table 1. Also in table 1 are a few observations made during a single all-day watch at Cottonwood Spring, Joshua Tree National Monument (see Miller and Stebbins 1964 for a description of this area).

The first group in table 1 contains insectivorous, carnivorous, or fructivorous birds, none of which was seen to drink at air temperatures up to 40°C. The second group contains birds of similar diets which, in contrast, were seen to drink. It is likely that all species in both groups can live without drinking at all, except perhaps at extremely high temperatures; the most likely exceptions to this are the Poor-will and Lesser Nighthawk, which feed on the wing. Further field observations on the drinking habits of these two species are needed.

On the other hand, it is probable that all birds in both groups drink occasionally if water is available, and that the individual species differ only in the temperatures below which they do not bother to drink at all. This temperature must be at least above 40°C for some birds, for at this temperature we have watched Bewick, Rock, and Cañon Wrens all foraging near the water's edge without once trying to drink.

The third group in table 1 consists of birds which, at least for part of the year, are mostly granivorous. All of them drank regularly in the summer, though all but the doves can probably live without drinking when succulent green vegetation or insects are available (Bartholomew and Cade 1963; Smyth and Bartholomew 1966a).

In general, these observations and those of other workers imply that whether desert birds drink or not depends very much on their diet and much less on air temperatures. This might mean that, in colonizing the desert, insectivorous, carnivorous, or fructivorous species are limited more by the desert's food resources, or their inability to exploit them, than by a lack of drinking water.

The study area was also used by migrants, either in passage or as winter residents. The fringillids among them drank frequently, even when edible green vegetation was available; these were the Black-headed Grosbeak (*Pheucticus melanocephalus*), Lazuli Bunting (*Passerina amoena*), Pine Siskin (*Spinus pinus*), Sage Sparrow (*Amphispiza belli*), Oregon Junco (*Junco oreganus*), Chipping Sparrow (*Spizella passerina*), and White-crowned Sparrow (*Zonotrichia leucophrys*). Also, several insectivorous migrants or winter residents were frequently seen to drink; these were the Nashville Warbler (*Vermivora ruficapilla*), Yellow Warbler (*Dendroica petechia*), Wilson Warbler (*Wilsonia pusilla*), and Western Bluebird (*Sialia mexicana*).

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