

The Northernmost Occurrence of the Pleistocene Vampire Bat *Desmodus stocki* Jones (Chiroptera: Phyllostomatidae: Desmodontinae) in Eastern North America

Frederick Grady, Joaquín Arroyo-Cabrales,
and E. Ray Garton

ABSTRACT

Four bones of the extinct vampire bat *Desmodus stocki* Jones were recovered from New Trout Cave, Pendleton County, West Virginia. Three of the four elements were located in a level 30 cm below a level radio-carbon dated to 29,400±1700 years before present (BP); the fourth was located in a younger layer but is suspected to have been redeposited. This is the first record of *Desmodus stocki* from the central Appalachians.

Introduction

The Pleistocene vampire bat *Desmodus stocki* Jones, 1958, occurs in several localities in the southwestern and southeastern United States, northern Mexico (Ray et al., 1988), and as far south as the valley of Mexico (Alvarez, 1972). Most of the known localities are outside the range of the extant vampire bat, *Desmodus rotundus*, and these two vampire bats have been considered allopatric species (Alvarez, 1972).

The occurrence of the extinct *Desmodus stocki* to the north of the common vampire bat's present range has attracted the attention of paleontologists (Ray et al., 1988). The extant vampire bats are intolerant of cold temperatures, and their northernmost occurrence is limited by the 10°C winter isotherm (McNab, 1973). Morgan (1991) offered two explanations for

the occurrences of *Desmodus stocki* north of the present range of *Desmodus rotundus*: (1) the larger *D. stocki* could withstand somewhat cooler temperatures, and (2) climatic conditions were more equable during the late Pleistocene, with warmer winters and cooler summers (Graham and Mead, 1987:371). Identification of Pleistocene vampire bat remains in West Virginia is therefore important for our understanding of these highly specialized mammals, as well as of the historical biogeography of the Appalachian region.

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STUDY SITE

New Trout Cave is located in a low escarpment 20 m above U.S. Highway 220, 5.5 km southwest of Franklin, Pendleton County, West Virginia. The cave is located on the Sugar Grove quadrangle, 38°39'09"N, 79°22'98"W, and the entrance is at an elevation of 570 m. The cave developed in the Coeymans-New Scotland limestones of Devonian age.

In February 1979, a party of explorers from the Monongahela Grotto of the National Speleological Society discovered a deposit of bones in the cave. Samples discovered at that time and during subsequent trips indicated that the deposit was Pleistocene in age. A total of 12 collecting trips were made. The deposit was collected in 30 cm intervals to a depth of 220 cm and wet-screened through 5 mm and 1.5 mm mesh (Grady,

Frederick Grady, Department of Paleobiology, National Museum of Natural History, Smithsonian Institution, Washington, D.C. 20560-0121, United States. Joaquín Arroyo-Cabrales, Museum of Texas Tech University, Lubbock, Texas 79409-3191, United States, and Subdirección de Servicios Académicos, I.N.A.H., Col. Centro, Distrito Federal 06060, Mexico. E. Ray Garton, P.O. Box 200, Barrackville, West Virginia 26559, United States.

TABLE 1.—Measurements (in mm) of humeri of *Desmodus stocki* from different localities (after Arroyo-Cabrales and Ray, 1997 (AR); or Morgan, 1991 (M)), of two specimens of *Desmodus draculae* (paratype and Loltun Cave, (Arroyo-Cabrales and Ray, 1997)) and of the specimens from West Virginia. Mean measurements are presented first, followed by ranges given in parentheses.

Locality	Proximal width	Distal width	Shaft width
<i>Desmodus stocki</i>			
San Josecito Cave (M)	6.3 (5.8–6.8)	6.8 (6.4–7.3)	2.5 (2.0–2.9)
San Josecito Cave (AR)	6.4 (5.9–6.8)	7.0 (6.6–7.6)	2.6 (2.0–2.9)
Reddick I, Florida (M)	6.3 (6.0–6.7)	6.8 (6.4–7.2)	2.6 (2.2–2.7)
New Trout Cave, West Virginia	6.6	7.7	3.8
<i>Desmodus draculae</i>			
Paratype	6.5	7.2	4.0
Loltun Cave, Mexico	7.6	7.7	3.1

1984) at the field laboratory facilities of the Carnegie Museum of Natural History in New Paris, Pennsylvania. Cleaned materials were sorted to separate bones, teeth, mollusk shells, and other biological elements. All samples were deposited in the National Museum of Natural History, Smithsonian Institution, which subsumed the collections of the former United States National Museum (USNM).

One of the important features of the excavations at New Trout Cave is the stratigraphic control provided by C-14 dating of the units. Arbitrary 30 cm levels were designated A–H from top to bottom of the excavation. Dates of three units were obtained from 100 gm samples of bone collagen: level A, 17,060 ± 220 years before present (yrs BP); level B, 28,250 ± 850 yrs BP; and level C, 29,400 ± 1700 yrs BP. All dating was performed by the Carbon Dating Section, Smithsonian Radiation Biology Laboratory (no longer in operation). Additional dating by T. Stafford, University of Colorado (pers. comm., 1995) indicated that level B ranges from about 13,000 yrs BP to more than 40,000 yrs BP and that level D is older than 50,000 yrs BP.

The fauna includes fish, amphibians, reptiles, birds, and at least 60 species of mammals. Several studies have already been published about some of the taxa, including amphibians and reptiles (Holman and Grady, 1987), mollusks (Bogan and Grady, 1991), gophers (Grady, 1984), and collared lemming (Grady and Garton, 1981), and Grady and Gorton (1982) produced a general synthesis of the faunal elements. Vampire bat remains from New Trout Cave were briefly noted by Ray et al. (1988), who assigned them to *Desmodus* sp., although they are morphologically close to *D. draculae* Morgan, Linares, and Ray. Our study indicates that the specimens pertain to *Desmodus stocki*.

Taxonomic Account

Order CHIROPTERA

Family PHYLLOSTOMIDAE

Subfamily DESMODONTINAE

Desmodus stocki Jones, 1958

MATERIAL EXAMINED.—One right cochlea (USNM 374284), level D; one left humerus, distal end (USNM

374285), level D; one right humerus, proximal epiphysis (USNM 374286), level D; one right metacarpal III, proximal end (USNM 3742870), level B.

The specimens clearly pertain to the genus *Desmodus*. They compare satisfactorily with the extant species, *D. rotundus*, but are much larger. They were compared with the bones available for specimens of *D. stocki* collected from the type locality of the species, San Josecito Cave, Nuevo Leon, Mexico, and with the paratype of *D. draculae* from Cueva del Gaucharo, Venezuela. The specimens from West Virginia were found to be within the range of variation of *D. stocki* or close to it, as shown by the series of specimens from San Josecito Cave. The proximal humeral epiphysis from New Trout Cave measured 3.30 mm in length and 3.27 mm in width, whereas three specimens of *D. stocki* measured 3.27–3.40 in length and 3.23–3.40 in width. The distal epiphysis from New Trout Cave, including the lower part of the shaft, is slightly larger than available specimens of *D. stocki* (Table 1). Arroyo-Cabrales and Ray (1997) pointed out that the San Josecito Cave vampire bat series was presumably formed by specimens from both sexes, males being of larger size; therefore, it is possible that the West Virginian specimen was a male of extreme size for the species. Although it might be argued that the distal humeral end of our specimen, especially when the remainder of the shaft is included, overlaps with measurements for *D. draculae* (Arroyo-Cabrales and Ray, 1997), the two species can be separated by a diagnostic character of the humerus: in *D. stocki*, including the New Trout specimen, the crest on the lateral epicondyle of the capitulum is low and rounded; in *D. draculae* and *D. rotundus*, the crest is well developed and sharp-pointed. The *D. draculae* paratype is also abraded, and its measurements likely underestimate its actual size.

One of the New Trout specimens was collected from level B, but it may have been intrusive, even though the available date for that level is still within the previously reported time range for *Desmodus stocki*: late Pleistocene (ca. 120,000 yrs BP) to Holocene (2500–5000 yrs BP) (Arroyo-Cabrales and Ray, 1997). Most of the bone from the lower levels (D–H) of New Trout Cave is reddish in color, whereas most of the bone from levels A–C is ivory to tan. All four New Trout vampire bones are reddish in color. Three specimens were collected from level D, 30 cm below level C, which dated at 29,400 yrs BP. New

dates (R.W. Graham pers. comm., 1995) suggest considerably older dates, especially for the D and lower levels of New Trout Cave.

The herpetofauna found below level C in New Trout Cave was interpreted by Holman and Grady (1987) to be consistent with mild winters and warm summers. This interpretation is supported by the presence of the water rat, *Neofiber alleni*, which is found in level D (Grady and Garton, 1982). The presence of the extinct vampire bat *Desmodus stocki* in association with these taxa suggests that consistently mild winters, which

have been hypothesized as necessary to accommodate the physiological constraints of this bat, prevailed at that time. These associations also suggest that *Desmodus stocki* was not more cold tolerant than the extant vampire bat, *Desmodus rotundus*. Rather, the extinct vampire bat and its associated fauna suggest that the late Pleistocene climatic conditions in West Virginia were substantially more equable than the tundra and boreal environments reported as typical for the late Pleistocene (e.g., Graham and Mead, 1987).

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