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CANIDS FROM THE LATE PLEISTOCENE OF UTAH

Michael E. Nelson¹ and James H. Madsen, Jr.²

ABSTRACT.—Two canids, *Vulpes vulpes* and *Canis lupus*, are recorded from shoreline deposits of Lake Bonneville in north central Utah. Both species are new records in the Pleistocene sediments of Utah and add to our scarce knowledge of the large carnivores that inhabited the shoreline environments of Lake Bonneville.

The sand and gravel quarries in the shoreline deposits of Lake Bonneville historically have been the most important sources for late Pleistocene vertebrate fossils in Utah. The Lake Bonneville shoreline mammalian fauna has been partially reviewed by Nelson and Madsen (1978, 1980, 1983), Stokes and Condie (1961), and Stock and Stokes (1969). Miller (1976) described the Silver Creek local fauna from the mountains 20 miles east of Salt Lake City, whereas Heaton (1985) documented the late Pleistocene to Recent Crystal Ball Cave local fauna from westernmost Utah. We report the addition of two canids, the fox, *Vulpes vulpes*, and a wolf, *Canis lupus*, to the Bonneville fauna.

STRATIGRAPHY AND LOCATION

The wolf specimens (UVP 100; UVP 101) and one of the fox dentaries (UVP 082) were collected from what was locally known as the Hardman Gravel Quarries (NW 1/4 and NE 1/4, Sec. 32, T1N, R1E, Salt Lake County) in northern Salt Lake City, an area now largely obscured by large homes and the Ensign Elementary School. Both specimens were collected by Golden York, longtime curator of geology in the University of Utah, Department of Geology Museum. The second fox specimen was collected in 1935 near Bacchus, Utah, southwest of Salt Lake City (locality number, 42SL126V in Sec. 8, T25S, R2W), by Mr. A. V. Jenkins. This latter specimen was found in association with several musk ox (*Symbos cavifrons*) vertebrae.

The Hardman Gravel Pit (locality number, 42SLOOIV), at an elevation of 4,800–5,000 ft,

yielded sand and gravel from the shoreline deposits near the maximum level of Lake Bonneville. Nelson and Madsen (1980), in following Morrison (1965), thought that the Hardman Quarry was in the Alpine Formation and deposited during the time interval of 33,000–68,000 years BP. However, Scott et al. (1983) have shown that the Alpine is not a valid formational designation. Currey et al. (1983) have placed these quarries at the Bonneville level of the Bonneville Lake Cycle, with deposition occurring around 14,500–18,000 years BP.

All specimens have been curated and entered into the Paleontology Collections of the Antiquities Section, Utah Division of State History (UVP). The specimens from the recent mammal collection of the University of Utah are identified by the initials UM.

SYSTEMATIC PALEONTOLOGY

Class	Mammalia
Order	Carnivora
Family	Canidae
<i>Canis lupus</i> Linnaeus, 1758	
Gray Wolf	

MATERIAL.—UVP 101, right M¹-M² with fragments of palatine and maxilla (Fig. 1); UVP 100, left P¹ with alveoli for P³, M¹ and interior roots of M² (Fig. 2). These specimens are most likely from the same individual.

DISCUSSION.—Nowak (1979) recognized four species of wolves from the late Pleistocene of North America: (1) *Canis armbrusteri*, an early? Irvingtonian to early Rancholabrean form; (2) *C. dirus*, the Rancholabrean to early Recent dire wolf; (3) *C.*

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Fig. 1. *Canis lupus*: UVP 101, oclusal view of right M^1-M^2 . Solid bar represents 1 cm.



Fig. 2. *Canis lupus*: UVP 100, lateral view of left P^4 . Solid bar represents 1 cm.

TABLE 1. Tooth dimensions in samples of *Canis lupus*, *C. dirus*, and the Bonneville specimen. The measurement is the maximum anteroposterior length of the crown of P^4 measured on the outer side. Measurements of *C. lupus* and *C. dirus*, with the exception of the Utah specimen, are from Nowak (1979).

Sample	N	O R	X
<i>C. lupus</i> , male, Recent	233	22.2-30.5	25.92
<i>C. lupus</i> , female, Recent	146	22.2-28.2	24.79
<i>C. lupus</i> , Pleistocene, Maricopa	6	23.3-28.5	26.53
<i>C. lupus</i> , Pleistocene, Rancho La Brea	11	23.0-29.2	26.19
<i>C. dirus</i> , Pleistocene, Maricopa	4	31.0-32.5	31.90
<i>C. lupus</i> , Recent, Utah	1	—	12.31
UVP 100, Pleistocene, Utah	1	—	29.60

rufus, the early Irvingtonian to Recent, but poorly known, red wolf; and (4) the late Irvingtonian to Recent gray wolf, *C. lupus*. The largest collections of late Pleistocene wolves have come from the southern California tar pits—McKitterick, Maricopa, and especially Rancho La Brea, where a minimum of 1,646 dire wolves, but less than 15 gray wolves, have been documented. Most other collections in the United States represent single, or small, samples from cave deposits.

Nowak (1979) believed that *C. lupus* evolved in Asia, whereas *C. dirus* arose in North America. However, *C. lupus* ultimately "prevailed over the dire wolf, either through competition or because of external factors, and established itself as the major large predator of North America." Terminal extinction dates for the dire wolf are around 9500 BP. (Kurten and Anderson 1980), whereas the gray wolf is still extant in North America. However, modern man has extirpated most of these predators from their origi-

nal range in the contiguous United States, and but a single large population remains in northern Minnesota (Nowak 1979).

Dire wolves were generally larger than gray wolves, having a stockier build and relatively shorter limbs. Most wolves are specifically identified on the basis of their dentition, even though there is some size overlap in these dimensions (Tables 1 and 2). The Bonneville specimen falls into the general size range of a large gray wolf or a small dire wolf.

Both *C. lupus* and *C. dirus* have similar upper fourth premolars that lack a prominent deutocone and lingual cingulum (Fig. 2). However, the length of P^4 on *C. dirus* is generally much longer than on *C. lupus* (Table 1). Both species have rather undiagnostic, small, second upper molars.

In the first upper molar both species have a large paracone and metacone. However, *C. lupus* generally has a large hypocone with a complete anterolingual cingulum that joins the hypocone. In *C. dirus* the hypocone is

TABLE 2. Tooth dimensions in samples of *Canis lupus*, *C. dirus*, and the Bonneville specimen. The measurement is the maximum transverse diameter of M^2 from the outermost point to the innermost point of the crown. Measurements of *C. lupus* and *C. dirus*, with the exception of the Utah specimen, are from Nowak (1979).

Sample	N	O R	X
<i>C. lupus</i> , male, Recent	233	11.4–16.7	13.82
<i>C. lupus</i> , female, Recent	146	11.2–16.3	13.44
<i>C. lupus</i> , Pleistocene, Maricopa	4	12.2–13.7	12.87
<i>C. lupus</i> , Pleistocene, Rancho La Brea	10	12.5–14.3	13.44
<i>C. dirus</i> , Pleistocene, Maricopa	4	14.4–16.0	15.02
<i>C. dirus</i> , Pleistocene, Rancho La Brea	62	13.1–17.0	15.15
<i>C. lupus</i> , Recent, Utah	1	—	12.31
UVP 100, Pleistocene, Utah	1	—	13.53

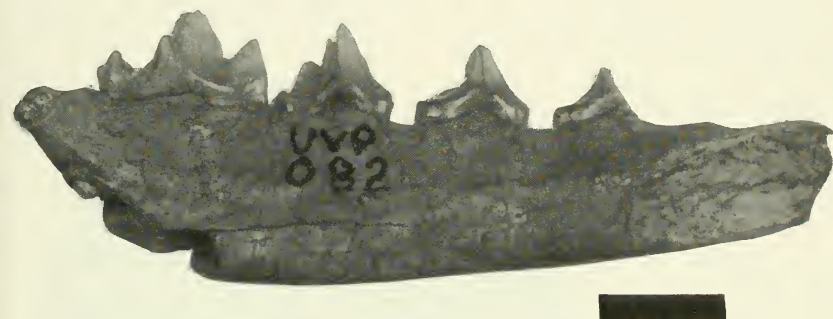


Fig. 3. *Vulpes vulpes*: UVP 82, lateral view of left dentary with P_2 – M_1 . Solid bar represents 1 cm.

generally reduced, and the incomplete anterolingual cingulum does not reach the hypocone but usually ends somewhere near the protocone. The Bonneville specimen morphologically agrees with the traits assigned *C. lupus* (Fig. 1). The large size may simply be an indication of the Pleistocene age of the specimen because many other late Pleistocene carnivores were larger than their recent descendants (Graham 1981).

Canis cf. *dirus* has been reported from the late Pleistocene Silver Creek fauna in the mountains east of Salt Lake City (Miller 1976). The nearest reported occurrences of *C. lupus* are from the latest Wisconsin to Recent Moonshiner Cave in Brigham County, Idaho (White et al. 1984), and Crystal Ball Cave in Millard County, Utah (Heaton 1985).

Vulpes vulpes (Linnaeus)

Red Fox

MATERIAL.—UVP 82, left dentary with P_2 – M_1 and alveoli for P_1 and canine (Figs. 3,

5); UVP 81, left dentary with P_4 – M_2 and alveoli for I – P_3 (Fig. 4).

DISCUSSION.—Anderson (1984) recognized five species of late Pleistocene foxes from North America, all of which are extant. The gray fox, *Urocyon cinereoargenteus*, is common in Rancholabrean faunas over much of North America (Kurten and Anderson 1980). The arctic fox, *Alopex lagopus*, is restricted to the arctic regions of North America, Europe, and Asia. It is rarely found in Pleistocene deposits, and in North America has only been reported from the Old Crow River, Yukon Territory (Anderson 1984). *Vulpes velox*, the swift fox, *V. macrotis*, the kit fox, and *V. vulpes*, the red fox are all common in Rancholabrean and Recent faunas of North America. *Vulpes velox* is the dominant small fox in Pleistocene faunas east of the Rocky Mountains, whereas *V. macrotis* is common in the western United States. *Vulpes vulpes* is more cosmopolitan in nature and has been identified in numerous Pleistocene sites from Virginia to California.



Fig. 4. *Vulpes vulpes*: UVP 81, lateral view of left dentary with P₄-M₂. Solid bar represents 1 cm.



Fig. 5. *Vulpes vulpes*: Lateral view of lower carnassial of UVP 82. Note well-developed cusp at inner junction of talonid and trigonid. Solid bar represents 1 cm.

Members of the genus *Vulpes* differ from *Urocyon* in their relatively smaller molars and the shape of their mandible (Kurten and Anderson 1980). In *Vulpes* the "... lower border of the mandible forms an even curve without the lobe seen in *Urocyon*, ..." whereas in the Arctic Fox "... the premolars are higher crowned, M₁ has a distinctly shorter talonid, and the tubercular teeth are more reduced than in *Vulpes*."

The smaller species of *Vulpes*, *V. macrotis* and *V. velox*, may have differences that are only sub-specific; recognition in the fossil record is based mainly on the geographic location of the fauna (Anderson 1984, Kurten and Anderson 1980). Both these forms are much smaller (body weight of 1.4-2.9 kg) than *V. vulpes* (4.5-6.7 kg) and are easily recognized in the fossil record.

The Bonneville specimens were compared to the large representation of *V. vulpes* from

TABLE 3. Tooth dimensions in samples of *Vulpes vulpes* from Moonshiner Cave, Idaho, and the shoreline deposits of Lake Bonneville, Utah.

Measurement	N	OR	X	UVP081	UVP082
Length P ₂	12	.80-0.90	.85	—	.88
Length P ₃	15	.87-1.00	.94	—	.93
Length P ₄	14	.82-1.07	.99	1.01	.97
Length M ₁	16	1.44-1.63	1.53	10.62	1.40
Length M ₂	15	.64-0.73	.70	.70	—
Length P ₁ -M ₂	16	5.27-6.18	5.75	5.68	—

the late Pleistocene to Recent Moonshiner (120 individuals) and Middle Butte (46 individuals) caves in southern Idaho and to Recent specimens (24 individuals) in the University of Utah mammal collections (Table 3). In size and morphology there appears to be little difference in specimens from all localities. UVP 081 lacks the lower third molar and the significance of this feature is unknown (Fig. 4). In Recent specimens from Utah two individuals had a single dentary lacking the M₃; the tooth was present in the other dentaries. In Pleistocene specimens from Little Box Elder Cave, Wyoming, 5 of 19 specimens lack an M₃, whereas all 11 specimens from Jaguar Cave in Idaho have an M₃ (Kurten, written communication, 1985). Approximately 6% of the Moonshiner specimens lack the M₃.

Another variation in the tooth structure can be seen in the lower carnassial (Fig. 3). A small accessory cusp is developed in one of the Bonneville specimens at the internal junction of the trigonid and talonid (Fig. 5). Two Recent specimens from Utah lack this cusp, but it is present in 22 individuals (University of Utah mammal collection); however, the size of this cusp shows considerable variation. Kurten (1967) believed that there might be a connection between the cusplless morphotypes and a cold or continental climate.

Hager (1972) observed 30 Recent specimens of *V. vulpes* from Colorado and Wyoming and reported that all were cusped morphotypes. The significance of the cusplless or cusped morphotypes as an indicator of paleoclimate, therefore, is probably very dubious for *V. vulpes* (Graham 1981).

In examining the Recent specimens of *V. vulpes*, an additional variation in tooth structure was also noted. An adult individual from Kuskokwim Delta, Alaska (UM 18291), lacked a right, lower, first premolar. Therefore, it

appears that variation in dental makeup of *V. vulpes* is quite common.

Documented Pleistocene specimens of *V. vulpes* have not been reported from Utah. The species is known from Crystal Ball Cave in western Utah (Heaton 1985), but the exact age of all elements of this fauna is difficult to ascertain, and faunal mixing may have occurred.

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