The North American River Otter *Lontra canadensis* as a Late Pleistocene Fossil from the Canadian River, Oklahoma

Nicholas J. Czaplewski
Oklahoma Museum of Natural History, Norman, OK 73072

Abstract: A well-preserved left lower jaw of *Lontra canadensis* found in sands of the Canadian River in east-central Oklahoma provides the first fossil record of the species in Oklahoma. When subjected to pretreatment in advance of radiometric dating, the canine root extracted from the jaw did not preserve enough collagen to be datable. However, its preservation suggests a late Pleistocene or possibly early Holocene age.

Introduction

Otters of the genus *Lontra* are widely distributed in the western hemisphere, where they are represented by four recent species in North, Central, and South America (iucnredlist.org). The North American River Otter, *Lontra canadensis*, is widespread in North America. Prior to the European colonization of the continent, river otters probably occurred in streams across the southern Great Plains (Caire et al. 1989; Dalquest and Horner 1984; Schmidly 1983, 2002). Scant historical records indicate that otters were occasionally found in Oklahoma as far west as the confluence of Otter Creek (named for an otter killed there in 1852) and the North Fork of the Red River in Tillman County, as well as in Medicine Creek in the Wichita Mountains (Halloran and Glass 1964; Halloran 1975). Although the naming histories are otherwise unknown, at least eight other streams are named "Otter Creek," three in western Oklahoma and five in eastern Oklahoma (Table 1; Topographic Mapping Co., no date). Indeed, in the 19th century the Beaver River-North Canadian River in Indian Territory was known as the "Río Nutria" and is shown as such on at least one historic map (Creuzbaur 1848); "nutria" is Spanish for "otter."

During the period following colonization, many mammal species were adversely impacted by habitat destruction, commercial overexploitation, and other factors. These were extirpated from most of Oklahoma and much of the Great Plains by 1900, including river otters (Matthiessen 1959; Caire et al. 1989; Samson and Knopf 1996; Licht 1997; Shackelford and Whitaker 1997; White and Hoagland 1997; Raesly 2001; Barrett and Leslie 2010; Caire et al. 2016). In the late 20th century otters re-entered southeastern and central Oklahoma from rivers and wetlands farther to the southeast by natural re-immigration (Barrett and Leslie 2010). In addition, conservation measures during the same period included the re-introduction into southeastern Oklahoma of river otters from coastal Louisiana (Shackelford and Whitaker 1997; Barrett and Leslie 2010; Caire et al. 2016). By the beginning of the 21st century, these otters have re-entered parts of their ancestral range, including along the Canadian River at least as far as Norman, Cleveland/McClain counties, and the Cimarron River at least as far west as Kingfisher County (Barrett and Leslie 2010; Caire et al. 2016; pers. obs.) as well as along other rivers in eastern Oklahoma. In the 1990s, river otters were re-introduced to the Wichita Mountains Wildlife Refuge and are occasionally sited in tributaries and lakes within the refuge and in tributaries of the Red River near Altus, Oklahoma (K. S. Smith, pers. comm.).

Table 1. Occurrence of streams named "Otter Creek" in the state of Oklahoma, according to Topographic Mapping Co. (no date).

County or Counties and Part	Tributary of:	Course Relative to Landmarks and Nearby Towns
S Kiowa / NW Tillman Cos.	North Fork of the Red River	from Baker Peak through Mountain Park to N of Tipton
N Ellis / S Harper Cos.	Beaver River	near May
E Blaine / W Kingfisher Cos.	Kingfisher Creek	between Watonga and Kingfisher
SE Grandfield / N-C Logan Cos.	Skeleton Creek	E of Marshall
E Haskell Co.	Sans Bois Creek	S of Keota
E McCurtain Co.	Mountain Fork Little River*	SE of McCurtain Co. Wilderness Area
NW Osage Co.	Beaver Creek	W of Grainola
S Rogers Co.	Dog Creek near its confluence with Verdigris River	S of Claremore

* Here inundated by Broken Bow Reservoir.

Paleontologically, river otters are less well known in North America. A small Pliocene species, *Lontra weiri*, is known from Idaho (Prassack 2016). *Lontra canadensis* is known as a fossil in North America from the late Pliocene (late Blancan land mammal age) of Nebraska, through the early Pleistocene (Irvingtonian land mammal age) of California, Florida, Kansas, New Mexico, and Pennsylvania, to the Holocene (FAUNMAP online database). It has a relatively broad Holocene distribution with numerous records across North America (FAUNMAP). Its late Pleistocene record is substantial, with records from the Rancholabrean land mammal age and Wisconsinan glacial period in Alaska, Arizona, Arkansas, California, Florida, Georgia, Idaho, Illinois, Kansas, Missouri, Tennessee, Texas and (FAUNMAP). An earlier review of the literature (Smith and Cifelli 2000) revealed no record of fossil otters from Oklahoma. The purpose of this paper is to describe a fossil of *L. canadensis* from the Canadian River in eastern Oklahoma.

Methods

An otter fossil was formerly cataloged in the collection of Midwestern State University (Wichita Falls, Texas) as specimen 12945-8. The late Walter W. Dalquest donated this and other fossils from Oklahoma rivers to the Oklahoma Museum of Natural History (OMNH) in the early 2000s. The specimen is now re-cataloged as OMNH 77473. It was temporarily coated with ammonium chloride to circumvent the dark color, enhance surface morphology, and reduce glare for photography (Fig. 1). It was found between 1991 and 1993 along the Canadian River at Hoyt, Oklahoma, along the reach of the Canadian River now downstream of Eufaula Reservoir (OMNH locality V910). Other details of its discovery were not recorded, but it was one of many specimens found by amateur fossil collectors who were asked to search Oklahoma rivers after flooding events and donated their fossils to Midwestern State University. These fossils are often revealed by floods and periodic shifts in the river channels and sands, which removes them from their original depositional context in cross-bedded sands and places them in a new one, possibly repeated over time. This reach of the Canadian River is about 30 km upriver from its confluence with the Arkansas River at Sequoyah National Wildlife Refuge southwest of Vian, Oklahoma. This stretch of the Canadian River follows the boundary between

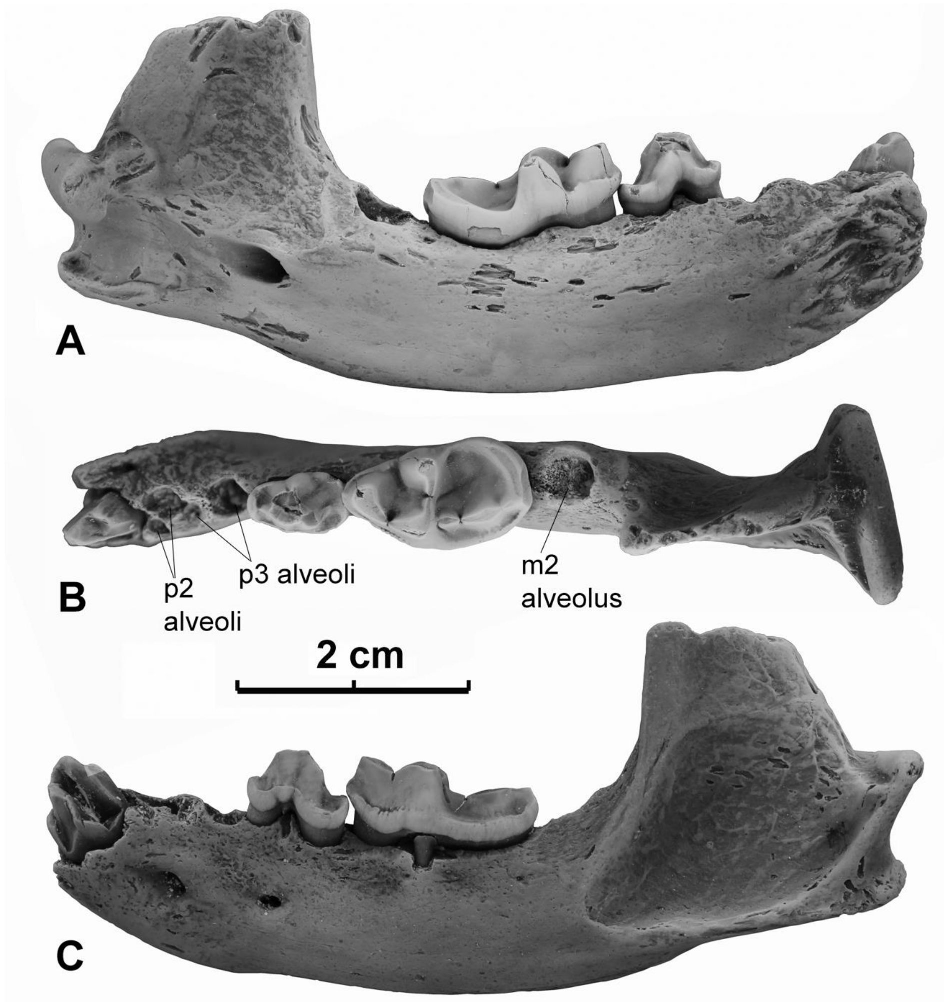

Figure 1. Fossil hemimandible with partial c1, p4, and m1 (OMNH 77473) of *Lontra canadensis* from the Canadian River near Hoyt, Oklahoma. A, medial view; B, occlusal view; C, lateral view.

Muskogee and Haskell counties. The otter jaw was identified by comparisons with six jaws of recent river otters from Oklahoma in collections of the OMNH.

A small portion of the dentary bone was carefully cut away so the lower canine could be extracted. The canine was sent to Beta Analytic, Miami, Florida, where it was subjected to pretreatment prior to radiometric dating. However, the sample did not preserve enough collagen to be datable (Beta Analytic sample Beta-574804, fide their email of 1 December 2020).

Results

OMNH 77473 is a nearly complete left dentary containing the base of the broken canine (extracted for radiometric dating) and the complete p4 and m1 (Fig. 1). The specimen is damaged anteriorly near the mandibular symphysis and missing the incisive alveoli but retains the empty alveoli for the p2, p3, and m2. The top of the coronoid process is broken off but the remaining portion shows a tall and straight vertical anterior edge. The condyloid process is transversely elongated, cylindrical, and situated slightly above the level of the toothrow. The masseteric fossa is large. Two lateral mental foramina are present, one inferior to the p2 alveoli and one inferior to the p4. The dentary bone shows abrasion and rounding of broken edges typical of water and sediment-worn depositional settings, exposing some of the linear spaces between internal trabeculae as small linear holes near the eroded bone surface, especially on the lingual side of the horizontal ramus and both sides of the ascending ramus and angular process.

The p2 and p3 alveoli each indicate two obliquely oriented roots with the anterior of each pair smaller than the posterior, as in many mustelids. The p4 and m1 both show tooth morphology diagnostic of *Lontra canadensis*. The p4 has two main roots aligned with the long axis of the dentary, and with the posterior root larger than the anterior. The p4 has an extra labial rootlet (partly broken off) between its main roots. The p4 has an accessory cuspid directly lingual to the main cusp, whose tip is broken off. This swelling is better developed than on most modern specimens examined. The m1 has an extra rootlet situated laterally and between the main anterior and posterior roots as in typical *Lontra canadensis*. The lower carnassial (m1) has a broad crown with a well-developed trigonid and low and especially wide talonid. In the trigonid, the paraconid is located near the midline of the tooth and is as large as the protoconid. The metaconid is a little smaller and lower in height. The protoconid and paraconid form a high shearing carnassial blade with a deep, narrow, median carnassial notch. Another deep notch occupies the center of the crest between protoconid and metaconid. Cusps of the trigonid form a nearly equilateral triangle, with the protoconid-paraconid crest only slightly longer than the protoconid-metaconid crest. The talonid basin is wide, shallow, open lingually and occupied labially by an accessory cuspule on the posterior base of the protoconid (typical of lutrines; Baskin 1998) and mesiodistally elongated hypoconid, and bordered posteriorly by a curved crest; there is no distinct entoconid or hypoconulid. The accessory cuspule and hypoconid form an additional longitudinal shearing crest with a notch between these cusps. The talonid basin is closed off posteriorly by a curved ridge. The labial cingulum is very wide along the talonid, interrupted at the base of the protoconid, and well-developed and crenulated along the trigonid below the carnassial notch, protecting the gingiva below the shearing crests in life. Lingually, the cingulum is restricted to the anterior and lingual bases of the paraconid and the floor of the trigonid valley. The m1 has a large interdental wear facet on its distal surface resulting from contact with the m2. The preserved teeth show moderately heavy wear.

Measurements (in millimeters) of the specimen are: dentary length 68.5; dentary depth on medial side at anterior root of m1, 12.3; dentary depth on lateral side at anterior root of m1, 11.8; condyle width, 15.9; p4 anteroposterior length, 8.1; p4 transverse width, 5.1; m1 (carnassial) anteroposterior length, 14.9; m1 transverse width 8.8; length from anterior edge of c1 alveolus to posterior edge of m2 alveolus, 42.7; length from anterior edge of c1 alveolus to posterior margin of articular condyle, 67.6. Overall, the jaw length is relatively short, possibly indicating a female otter (recent otters show modest sexual dimorphism in which males are only 5% larger than females; Jackson 1961), but the p4 and m1 are more robust than in modern specimens of *L. canadensis*.

Discussion

The age of the otter specimen is uncertain because it did not retain sufficient collagen to enable radiometric dating, but other evidence suggests it is probably of late Pleistocene age. Vertebrate remains found in sand and gravel bars in Oklahoma rivers, including below Eufaula Dam, range in appearance from fresh bones often with adhering connective tissue to darkened and permineralized bones of extinct species such as *Mammuthus columbi* (Columbian mammoth), *Mammut americanum* (American mastodon), and *Bootherium bombifrons* (helmeted muskox) (W. W. Dalquest, in litt., and personal observation). Flooding events and releases from Eufaula Dam cause shifting river channels below the dam, exposing and transporting bones, removing them from their original depositional context and their associated contemporaneous fauna. Thus, bones found on sand and gravel bars can be of varying ages ranging from late Pleistocene to late Holocene and do not represent an associated local fauna. Without these critical contextual data and without being able to date the otter fossils, there is no reliable means to determine the jaw's exact age. However, the modern and late Holocene bones found in the river are of low density, slightly elastic, pale in color, and little stained, and tend to fracture longitudinally. By contrast, the bones identifiable as those of extinct species are dense due to permineralization, dark brown or glossy blackish in color, inelastic, and tend to fracture transversely (W. W. Dalquest, in litt.; personal observation). Relative to these attributes, the otter jaw is dark brown with blackish tooth roots and light brown enamel, relatively dense for its size, and inelastic. Normally, the amount of collagen remaining within the bone (and especially within the denser roots of the teeth) decreases with age. A mastodont rib fragment from the Canadian River near Hoyt dated to the late Pleistocene at 11,560 ± 130 years before present (Beta-75145) by Dalquest (W. W. Dalquest, in litt.; this is an uncalibrated standard radiocarbon age). The lack of collagen in the otter canine root and the other features of its preservation suggest a relatively great age, probably late Pleistocene or possibly early Holocene.

Several characteristics of the jaw confirm its identity as a member of the mustelid subfamily Lutrinae (m1 with accessory cuspule behind protoconid and with distinct metaconid) and of the genus *Lontra* (p4 accessory cusp, m1 broad with high trigonid, broad shallow talonid basin, no entoconid) (Baskin 1998; Van Zyll de Jong 1972). Its size compares with and confirms the species as the Nearctic river otter, *Lontra canadensis*. Pleistocene fossils of river otters are rare in North America not only for the Nearctic river otter but also for the Neotropical river otter in Mexico (Arroyo-Cabrales et al. 2013). The Canadian River specimen documents the occurrence of the river otter in the late Pleistocene or early Holocene along the Canadian River about 30 km downstream from its historic confluence with the North Canadian River and 45 km upstream from its confluence with the Arkansas River. It constitutes the first fossil record of *L. canadensis* in Oklahoma. Together with the fossil records from other states, it helps to establish the Pleistocene distribution of the species in North America.

River otters occupy smaller rivers and streams, lakes, swamps, beaver ponds, and other wetlands with some shaded areas and log jams (Yeager 1938). They select clear streams and rivers with pools, log jams, and rapids with abundant fishes (Seton 1909; Melquist and Hornocker 1983). Otters are well known to feed mainly on medium-sized fish but also eat a variety of other small vertebrates such as frogs and salamanders (e.g., *Notophthalmus viridescens*, red-spotted newt) and invertebrates such as crayfish and gastropods (Hatcher 1984). Among the many late Pleistocene and Holocene fossils from the Canadian River bone assemblage are very few fish fossils, including only skeletal elements of large catfishes (Ictaluridae). The available fish fossils are fin spines of individual ictalurids much larger than the fishes typically eaten by river otters. However, the fish fauna of the late Pleistocene river certainly would have supported a high diversity of species and a fish fauna somewhat different from that of today.

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