Preliminary Survey of Pleistocene Avifauna in Oregon's Willamette Valley: Unexpected Findings and Expanded Ranges

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Abstract

This paper is an overview of the avifauna recovered from late Pleistocene strata in the central Willamette Valley of Oregon. Field investigations confirm the presence of terrestrial taxa, waterfowl, and raptors. At least eleven avian species, including four whose previously recognized Pleistocene range did not include this geographic area, have been identified. Two of those four species, *Teratornis woodburnensis* and *Meleagris californicus*, are now extinct. All excavations were within the boundaries of the city of Woodburn, located approximately 30 miles south of Portland.

Introduction

Ongoing excavations of late Pleistocene deposits at two central Willamette Valley localities, Woodburn High School and Legion Park, have produced a diverse faunal assemblage. Included are fish, amphibians, reptiles (Ellingson et al 2015), birds and mammals. This paper provides a preliminary overview of the avifauna. While many of the species are still present in the area today, the Pleistocene record does include four extralimital taxa, not associated with this geographic region prior to the Holocene. These species, new to the record, are *Teratornis woodburnensis, Meleagris californicus, Grus canadensis,* and *Tympanuchus phasianellus*.

The geographic area of investigation is part of Mill Creek drainage, a north-south trending negative feature at an elevation of approximately 145'-155' msl. Most of the large areas of ponding reflected in the Pleistocene profiles still occasionally recur. Pleistocene avian material was excavated from elevations overlooking the drainage, as well as from the margins of the ponding areas, and from strata that were part of the previously saturated pond environment.

Faunal material was first documented in the area in the 1950s (Orr and Orr 1999; Orr and Stenger 2000). However, attention did not return to the area until the late 1980s, when a utility corridor was excavated. This led to the recovery of numerous terrestrial faunal species that were identified by investigators William Orr and Gregory Retallack, of the University of Oregon. The site area then again became idle until the mid-1990s, when numerous test excavations were conducted over an area of several kilometers (Stenger 1996a, 1996b). The exposed profiles were uniform over long distances, reflecting very few intrusions and no substantial differences in depositional histories.

Thirty-five radiocarbon/AMS dates from mammalian bone, sediments, and wood provided sequential dates for the strata. The age range for the assemblage discussed below is defined as 12,310+/-80 yBP (Beta-96400) to 11,340 +/-70 yBP (Beta-171431). When calibrated, the age range for this material is 14,752 – 14,020 cal BP to 13,312 – 13,069 cal BP, with 95.4% probability. No avifauna was recovered from the early Holocene strata, which span several millennia in these locations.

Stratigraphic Context

When testing began, the initial documentation included strata that were numbered from the surface downward, as the depth and number of strata to be investigated were unknown. In an effort to retain consistency, that system has remained in place. Thus, the stratigraphy described below defines the modern surface as stratum 1, and the oldest stratum yet investigated as stratum 6 (Table 1). Importantly, discrete stratigraphic changes consistently occur throughout this drainage and are readily identifiable.

DEPTH (M) & TERMINUS AGE	HORIZON	STRATUM	DESCRIPTION
0-0.5 DBS (Modern)	Fill or Topsoil (site dependent)	1	Topsoil. Brown silty clay loam
0.5-1.5 DBS (to 6,850 BP)	Mill Creek Clay	2	Dense clay, gray brown to dark gray (10YR5/2m), firm angular structure. Mazama elements chemically defined.
1.3-2.1 DBS (to 10,480 BP)	Woodland Develops over bog	3A	Loose, woody, dark brown (5YR3/2m). Contains wood, peat, seeds, cones and insects. Represented are blue spruce, fir, and cherry.
1.5-2.38 DBS (to 10,920 BP)	Woodburn Bog-Classic Stage	3B	Peat, platy sphagnum moss with leaves and seeds, red-brown to dark brown (5YR4/6); silt rythmites and insects.
1.9-2.8 DBS (to 11,840 BP)	Woodburn Bog-Early Stage	3C	Desiccated bog and loam with minor clay and silt. Firm, organic, with peat residuum (5YR3/3m). Microfauna and avifauna present. Modified mammal bone, hair.
2.8-3.4 DBS (to 12,050 BP)	Post-Flood Horizon	4	Firm, micaceous silt with minor clay, medium dark brown (5YR5/4m-5YR3/3m) with sparse organics. Avifauna, megafauna, artifacts, animal & naturally shed human hair.
3.4-5.5+ DBS (to 12,310 BP)	Willamette Silts-Late Event	5 Upper	Firm, micaceous clayey silt, medium olive-gray (2.5YR6/4m) to gray. Material may be compacted to sand size particles; strong subangular blocky structure. Sparse organics. Subangular pebble erratics. Egg shell, megafauna, and lithic artifacts.
(to 12,760 BP)	Flood deposit	5 Lower	Former "A" soil horizons probable. Some indications of lightly vegetated surfaces. Same silt character as above. Lithics.
+ 6.0 DBS (to 16,800 BP)	Flood deposit	6	Firm, micaceous clayey silt, transitioning from medium olive-gray (2.5YR6/4m) to a more orange, iron rich silt (5YR7/6). Particles cemented to sand size with strong subangular blocky structure. No visible organics. Inclusions of jet, chalcedony, and feldspar. No fauna or cultural.

Table 1. Dated stratigraphic deposits at Woodburn for areas of 145'-155' elevation. The sequence and context of these deposits confirm a Pleistocene avifauna and a Paleoamerican presence. Table adapted from Hibbs (2000). Updates by Taylor (2018).

The Pleistocene fauna discussed in this paper were recovered from stratum 3C through stratum 5. The subjacent stratum 6 has thus far proven unproductive. Field studies and laboratory work demonstrate that the Pleistocene-Holocene boundary occurs at the base of stratum 3B, where it transitions into upper stratum 3C. The conventional radiocarbon age for the stratum 3B-3C interface is 10,920 +/- 60 BP (Beta-208296). Calibrated, this

date becomes 13,160 to 12,870 BP. Both stratum 3B and stratum 6 are sterile, thus firmly bracketing the dates of the faunal bearing strata of 3C through stratum 5.

Specimens Recovered

The avifauna record for this area is fairly robust for the late Pleistocene, with many different species present (Table 2). The assemblage contains 13 different species. Four of these species were previously unrecognized in this area and two of them are now extinct. Of the taxa identified, three are confirmed only to generic level, and two others to ordinal level.

Long term burial in a fully saturated environment was a factor in the conservation of the material. Preservation of the specimens is generally excellent, with little alteration evident. Permineralization is minimal.

Identification	Common name	First elements documented
Meleagris californicus	California Turkey	Left humerus, coracoids, sternum
Grus canadensis	Sandhill Crane	Humerus
Branta canadensis	Canada Goose	Scapula and carpometacarpus
Circus sp.	Northern Harrier or Marsh Hawk	Tarsometatarsus
Strix sp.	Wood Owl	Tarsometatarsus
Passeriformes	Red winged Blackbird sized	Humerus
Passeriformes	Sparrow sized	Humerus
Anas crevasse	Green winged Teal	Tarsometatarsus
Anas platyrhynchos	Mallard	Scapula, ulna
Anas acuta	Northern Pintail	Long bones
Teratornis woodburnensis	Woodburn Teratorn	Humerus, vertebrae, palatine
Tympanuchus phasianellus	Sharp-tailed Grouse	Carpometacarpus
Cygnus sp.	Swan	Cervical vertebrae

Table 2. Eleven species are represented in the Woodburn area assemblage, with further identification pending for two others. The swan vertebrae have not been precisely identified, as they are from a very young or an elderly individual (Thompson 2018).

Multiple stages of maturity, from juveniles to old adults, are documented. Evidence of predation is negligible, and there is no indication of post-mortem transportation. Each specimen came from a well stratified and dated context, and by ~10,900 years ago, all species had disappeared from the stratigraphic record. While the landscape was changing through time, no obvious indications of food shortages were evident. Notably, after several millennia, some species returned to the area.

The first avian species to be recognized from the site area was a teratorn. This proved to be a new species, *Teratornis woodburnensis* (Campbell and Stenger 2002). The first skeletal element to be excavated was a humerus (figure 1) with the following

measurements: maximum width through epicondyles, 61.7mm; anteroposterior depth through lateral bounding ridge of sulcus scapulotricipitalis and condylus dorsalis, 31.0mm; shaft width at level of midshaft nutrient foramen, 26.1mm (Campbell and Stenger 2002). After excavation, the specimen was provisionally identified by project paleontologist, William Orr, as that of a raptor, with an approximate wingspan of 4 meters, and potentially a new species (Orr and Stenger 2000).

Figure 1. The teratorn humerus was the first element of this animal to be excavated. Here it is shown (A, C) next to the Rancho La Brea (RLB/Hancock B1370) specimen (B, D). Images provided by Kenneth E. Campbell, Jr. The flat, gray material is from the reconstruction.

The humerus was followed shortly by the excavation of 17 other bones, 15 of which were independent elements. These included a number of diagnostic vertebrae (figure 2). A partial mandibular ramus, a right palatine, and other identifiable bones were then recovered.

Figure 2. Vertebrae from the Woodburn Teratorn, *Teratornis woodburnensis*. Image provided by Kenneth E. Campbell, Jr.

Later excavations recovered the Sharp-tailed Grouse, turkey, pintail, and other specimens listed in Table 2. Inspection by Kenneth E. Campbell and H. Gregory McDonald provided the initial identifications of most species. Direct comparison to avifauna in several repositories, including the Natural History Museum of Los Angeles County (NHMLAC) and the Idaho Museum of Natural History (IMNH) in Pocatello, resulted in the positive identification of at least six species.

The most surprising discovery, after the teratorn, was the California Turkey, *Meleagris californicus* (figure 3). Neither Pleistocene species had been documented for this area prior to our work at Woodburn. A comprehensive examination of the rest of the avian material followed. Many of the Woodburn Pleistocene bird species were found to be previously undocumented for the Willamette Valley, or in some cases, for Oregon. Below are images of some of the Woodburn specimens.

Figure 3a. Humerus of the California Turkey, *Meleagris californicus*, from Woodburn sediments. Two views.

Figure 3b. Field photograph of one California Turkey, *Meleagris californicus*, element.

Hawk material was also excavated. Northern Harrier or Marsh Hawk has been proposed (figure 4). Other species include Sharp-tailed Grouse, Pintail, Green-winged Teal, goose, and swan. These are pictured below (figures 4-9).

Figure 4. A single, small hawk is represented in the avifaunal assemblage. Recent correspondence suggests that this may be a falcon, due to the small size of the bone (Campbell 2018).

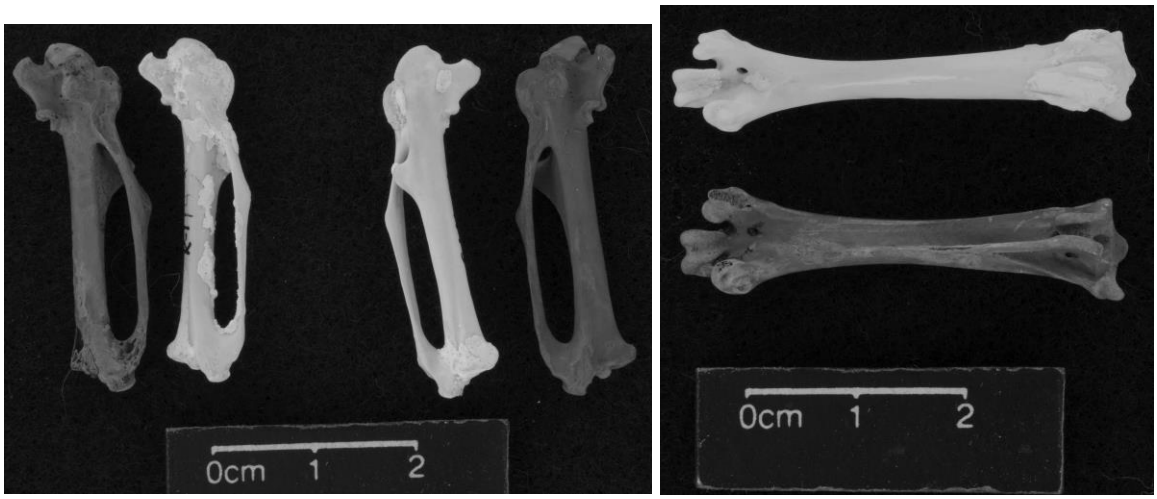

Figure 5. The Sharp-tailed grouse. Woodburn specimens are darker colored. The lighter examples are comparative specimens curated at the Idaho Museum of Natural History, in Pocatello. Photos provided by Rachel Papka.

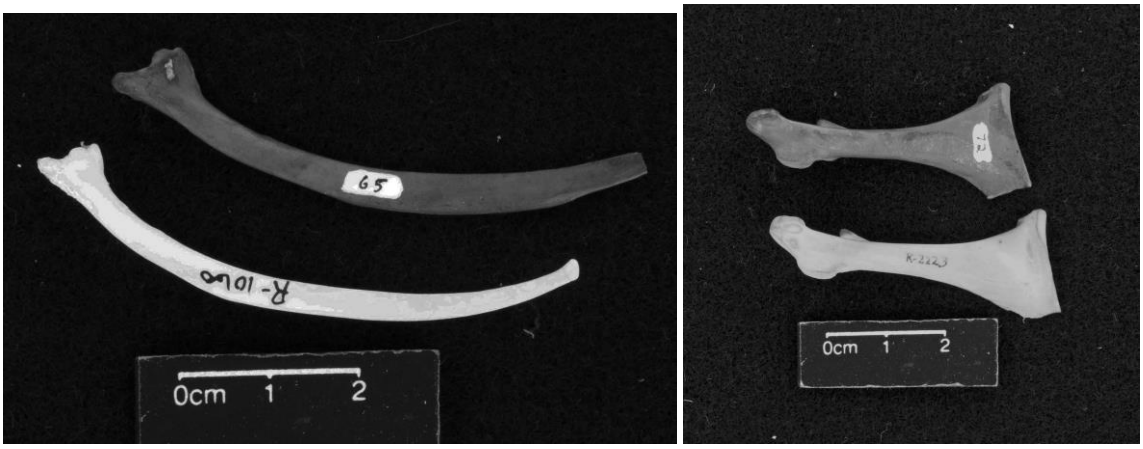

Figure 6. Pintail. The lighter examples are comparative specimens curated at the Idaho Museum of Natural History, in Pocatello. Photos provided by Rachel Papka.

Figure 7. Green-winged Teal. The specimen closest to the scale is a comparative example curated at the Idaho Museum of Natural History, in Pocatello. Photos provided by Rachel Papka.

Figure 8. Goose. The lighter example is a specimen curated at the Idaho Museum of Natural History, in Pocatello. Photos provided by Rachel Papka.

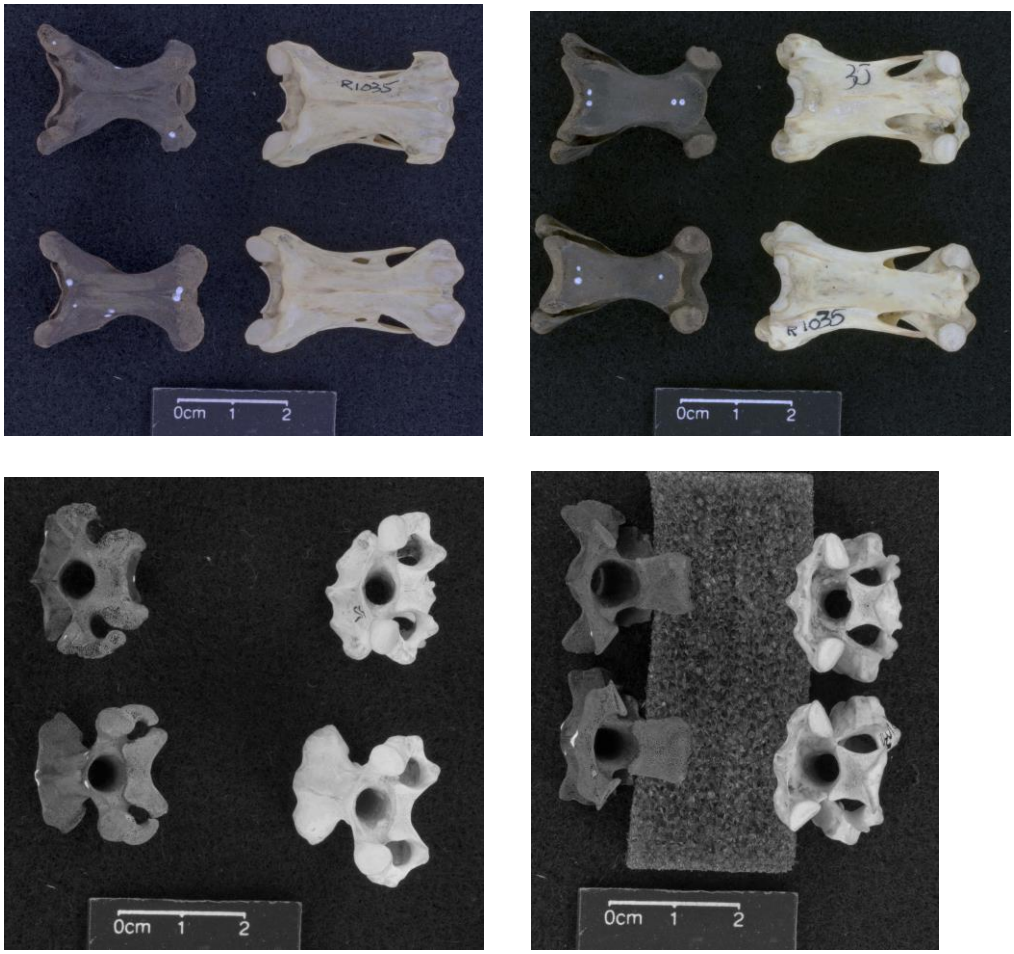

Figure 9. Swan elements. These represent either a very young or an elderly individual, making specific identification difficult. The lighter examples are curated at the Idaho Museum of Natural History, in Pocatello. Photos provided by Rachel Papka.

Methods

The water table in this area averages less than a meter below the surface. Much of the Holocene and all of the Pleistocene strata are far below this depth. Any excavations are rapidly infilled with water. Thus, the safest and most expeditious method for extracting the faunal material is by mechanical excavation, using both a backhoe and trackhoe. Each stratum is removed and placed slightly apart from the other excavated sediments. If slumping and calving of the saturated soils within the trench side walls occurs, the strata are discrete enough to be identifiable at both the gross and microscopic levels.

Hand excavation has been done, but an extremely large area needs to be disturbed to safely allow for the inspection of a small area. Pumps and retaining walls are necessary. Because the sediments to be investigated extend to over 5 meters below surface, and are fully water saturated, mechanical extraction of the deposits is thus safer and more productive.

Cultural indicators

The avifauna discussed in this paper occupied the landscape at the same time as the megafauna and microfauna. A late Pleistocene human presence is also evidenced here. Although sparse, the record of area use by humans is definitive. Among the list of cultural indicators are cut bone, flaked stone, and utilized mountain goat horn. These artifacts are sparsely distributed through the drainage, but represent primary deposition. They are not rounded, polished by movement, or in any other way impacted by transportation. Like the avifauna, these cultural materials occur above the Missoula flood deposits, and are not contained within them.

Naturally shed human hairs have also been recovered. These were verified as human, and ancient, by pathological examination (Grimsbo 1999). The shaft structure (figure 10) and mtDNA of one specimen was analyzed (figure 11). The human hair proved to represent a population of *Homo sapiens* no longer living. Like the megafauna in this location, evidence of a human presence ceases at the start of the Holocene.

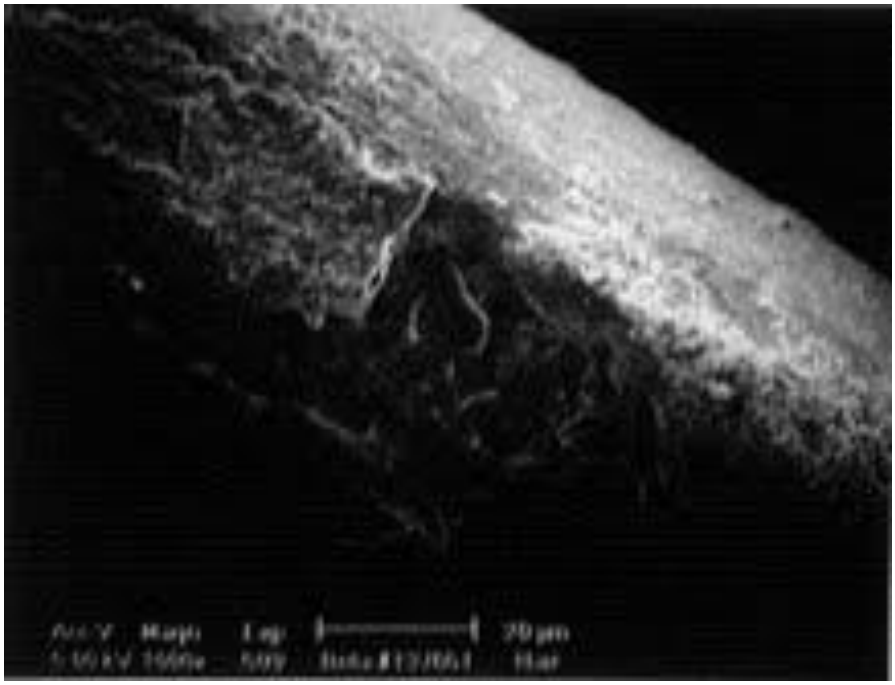

Figure 10. Human hair recovered from late Pleistocene sediments at Woodburn. Original microscopic inspection by Ray Grimsbo, Intermountain Forensic Laboratories (2000). Photomicrograph provided by Ron Hatfield, Beta Analytic Laboratory.

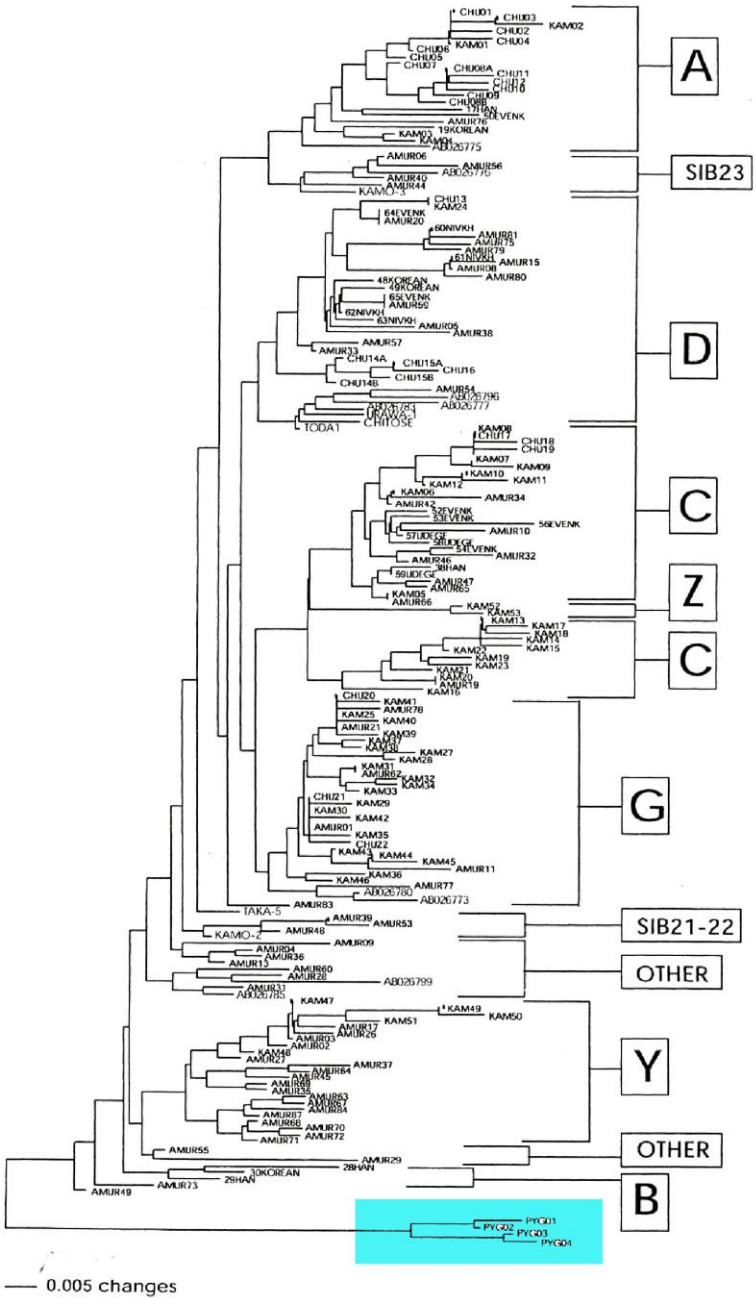

Figure 11. Results of the analysis of the mtDNA of one Woodburn hair. The lowest entry, highlighted in blue, is the Woodburn specimen, verifying that this hair is human and a separate haplogroup from any of the recognized populations. DNA information provided by Lori Baker, while at the University of Tennessee.

Environmental indicators

At the onset of the Holocene, the area of investigation became seasonally saturated. The stratigraphy reflects this and the entomology also indicates an often inundated bog-like environment (Schwert 2000). Yet, by 10,400 yBP, precipitation patterns had altered dramatically (Stenger 2003; Bryson et al. 2009). At that time, drier habitat plant

communities replaced the seasonally refreshed bogs. After several millennia, the seasonal inundation patterns returned.

The surrounding, higher elevations, are now lightly forested. It has been suggested that this upper landscape previously supported prairie grasses and other related biota. The presence of Pleistocene bison (*B. antiquus* and *B. alaskensis)* and horse (*E. occidentalis*) support this idea, as do animals such as the Sharp-tailed Grouse.

Concluding Comments

This paper provides an introduction and status report for the Pleistocene avifauna of Woodburn. It does not represent the entire assemblage of birds. Numerous additional species are still to be indentified.

It is interesting that their presence at Woodburn represents a range extension for many of the avian species—a considerable range for some of them (Campbell 2001; McDonald 2015). Comparable range extensions are displayed by some of the mammalian fauna including the terrestrial species *Oreamnos americanus*, *Ovis canadensis* (Stenger 2003; Orr and Stenger 2000), and now *Bison alaskensis* (Thompson 2018). The Woodburn biota confirms the premise that the late Pleistocene avian extinctions "…correlate well with the mammalian megafaunal extinction with respect to severity and timing" (Tyrberg 2008).

Here, the vanishing from the record also includes humans. This follows the suggestion that, "The fact that avian extinctions did occur in the Late Pleistocene …been used as an argument against the hypothesis that predation by humans caused the megafaunal extinctions" (Grayson 1977).

A final issue to consider is the possible disruption of migratory patterns and the effect upon breeding areas over long periods, due to wildfires (Erlandson 2008). The uncorrected dates discussed by that author are ~11,000–10,900 14C years (calibrated to 13.1-12.9 ka). Avifauna stop being represented at Woodburn at ~10,920 14C year (calibrated to 13.1 to 12.8 BP). While this disruption would potentially only effect our migratory species, indirect effects upon other bird populations are possible.

When the avifaunal species not mentioned here have been identified, an updated paper will be issued. In the interim, it is hoped that this paper will stimulate discussion, and the recalibration of range for various avian and mammalian species.

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