The Wenas Creek Mammoth Project: 2009 Interim Archaeology Report on Excavations at 45YA1083

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Introduction

The Wenas Creek Mammoth Project is an interdisciplinary investigation of paleontological remains and possibly associated artifacts at Site 45YA1083 on private property near Selah, Washington. Fieldwork at the site was undertaken in a series of five summer university field schools, sponsored by Central Washington University, in 2005, 2006, 2007, 2008, and 2009. In the 2005 season and initial part of the 2006 field season, the site was purely a paleontological excavation of mammoth remains, requiring no excavation permit. In July, 2006, a single artifact was discovered in the excavations, providing the site archaeological isolate status for the first time. Given this find, a permit was requested and granted for the 2007 and subsequent field seasons, providing the requirement for this report.

This interim report is prepared to fulfill obligations of Archaeological Excavation Permit No. 09-13 granted by State of Washington Department of Archaeology and Historic Preservation (DAHP) on June 18, 2009. This report represents a work in progress on the overall project rather than a final report. Its intent is to provide context, research design, field methods, and general findings for the archaeology of the site. Since paleontology is not relevant to the archaeological excavation permit, this document will discuss only general paleontological results to provide context for the archaeology. Given the long-term research nature of the project, its primarily paleontological rather than archaeological focus, and the academic pressures of the major research staff, reporting will be completed on an irregular basis, some as technical reports (Lubinski 2009; Lubinski et al. 2008), and some as peer-review publications (Lubinski et al. 2007; Lubinski et al. 2009).

Investigations through summer 2009 have yielded mammoth and other paleontological bones, but very limited cultural material. The total of cultural materials from the site thus far is three pieces of possible chipped stone debitage. Given the debitage find locations, the archaeology and the mammoth bones are presumed unrelated, although they are in fairly close proximity (as close as 15 cm) and this requires further evaluation. Based on chronometric dating thus far, the mammoth bones are from about 16,000 calendar years ago (CALYBP) or 13,000-14,000 uncalibrated radiocarbon years ago (RCYBP). The artifacts presumably are later, but how much later is unknown. Details of findings to date are given in a later section.
Environmental Context

The Wenas Creek Mammoth Site is located in the Wenas Creek valley about six miles north of the city of Yakima, near the town of Selah in central Washington state (Figure 1). Its exact legal location is suppressed in this document for site protection. The site is at about 1400 feet elevation (427 m) on a bench on the south valley wall of the Wenas Creek valley, about 800 feet (244 m) from the current creek channel and 70 feet (21 m) above the valley floor. At the time of bone deposition at the site (ca. 16,000 CALYBP), Wenas Creek would likely have been higher and closer to the site. The site is drained by two deep ephemeral channels which pass to the west and east of the excavation, and flow into the South Wenas Road ditch north of the site. Prior to construction of the road ditch, the ephemerals would have passed into Wenas Creek, a small tributary of the Yakima River. The site lies on the side of a broad interfluvial ridge between Wenas Creek and the Naches River. The mammoth site occupies the upper edge of a ~300 m long x ~100 m wide bench dissected by several gullies, about 170 m below the crest of the ridge. Although this bench is mapped as “Quaternary landslide deposits” by Walsh (1986), its origin is not certain. It could be a landslide deposit, an alluvial fan remnant, or even a terrace.

The Wenas Creek Valley lies within the northwestern portion of the Yakima Fold and Thrust Belt, with a tectonically folded ridge of basalt (Umtanum Ridge) forming the north valley wall. However, the southern wall upon which the site sits is an erosional remnant cored with volcaniclastic Ellensburg Formation gravels (Waters 1955; Smith 1988). The Ellensburg formation gravels observable uphill of the site and within the excavations include a large number of volcanogenic rocks like tuff and small amounts of cryptocrystalline materials such as a translucent yellow or orange chert. Surface sediment on the slope in the site vicinity appears to be dominated by loess.

The site lies within the Columbia River hydrographic basin, and near the western edge of Columbia Basin physiographic unit, not far from its intersection with the Cascade Range. The area is within the rain shadow of the Cascade Range, which results in a dry, continental climate with marked seasonality. In the historic period, the nearby Yakima Valley had average temperatures of 28 °F in January and 73 °F in July, with about 8 in (20 cm) of annual precipitation (Miller and Highsmith 1949). Most regional precipitation falls as winter rain and snow.
Figure 1. Site location in central Washington. Map created by Ben Sainsbury.

Current native vegetation in the general study area is sagebrush steppe, part of the *Artemisia tridentata/Agropyron* Association defined by Daubenmire (1970). Dominant vegetation in this association is big sagebrush (*Artemisia tridentata*) and bluebunch wheatgrass (*Agropyron spicatum*). Native vegetation observed onsite includes shrubs (mostly big sagebrush, but also some gray rabbitbrush, purple sage, and an unidentified slender bush), forbs (yarrow, lupine, Mariposa lily, unidentified phlox and daisy), and bunchgrasses (needle and thread, wheatgrass, unidentified). There are also introduced plants such as cheat grass, Russian thistle, tumble mustard, and Western salsify.

The Columbia Basin is well-known for Late Pleistocene glacial outburst floods that formed the channeled scablands in eastern Washington (Bretz 1969; Waitt 1980; Clague et al. 2003), now dated 15,700-13,500 RCYBP (Booth et al. 2004). The study site is in an area above the highest-known levels of these outburst flood events, and beyond the limits of Late Wisconsin continental and montane glaciers (Waitt and Thorson 1983; Booth et al. 2004). The Late Wisconsin glaciation, known regionally as the Fraser Glaciation, extended from ca. 25,000-
10,000 RCYBP, with the Last Glacial Maximum (LGM) ~18,000 RCYBP or 21,000 CALYBP. Paleoenvironmental proxy data indicate that the Late Glacial period from 18,000 to 10,000 RCYBP generally had cool, moist conditions (Whitlock et al. 2000; Blinnikov et al. 2002). This is somewhat mismatched with general circulation models, which predict colder, drier Late Glacial conditions (Bartlein et al. 1998). Vegetation near the study site was an *Artemisia* shrub steppe at LGM, with a subsequent shift to grassland and a modeled downward movement of shrub steppe to lower elevations in Late Glacial times, based on pollen and phytolith records from nearby Carp Lake and KP-1 sites (Blinnikov et al. 2002). The Wenas Creek Mammoth site is elevationally near the Late Glacial steppe/grassland ecotone proposed by Blinnikov et al. (2002), and the mammoth bone dates are temporally near the onset of Late Glacial conditions.

**Cultural Context**

The site is located within the lands ceded by the Confederated Tribes and Bands of the Yakama Nation in the Treaty of 1855. In the mid 1800s, Wenas Creek was the approximate territorial boundary of the Upper Yakama bands (e.g., Kittitas) and the Lower Yakama bands (Yakama proper), each composed of a number of smaller independent bands or villages (Schuster 1998:327). These groups all are speakers of dialects of the Sahaptin language (Schuster 1998).

The nineteenth century economy of Yakama bands was typical of hunter-fisher-gatherers, with settled winter villages along the major watercourses and more scattered temporary camps placed to exploit seasonal resources like spawning fish, root crops, and ripening berries (Hunn 1990; Schuster 1998). The principal foods were fish (particularly salmon, steelhead trout, suckers, and "eels" or lampreys), wild roots (particularly bitterroot, camas, cous and desert parsleys) and meat, particularly deer meat (Hunn 1990; Schuster 1998). The typical Yakama annual round would begin with breakup of the winter village for fishing camps during the first salmon run about March, then movement in May to root-digging grounds for gathering and hunting, followed by a return to fishing camps for the June salmon run, and subsequent movement over the summer to higher elevation mountains and/or root-digging grounds for hunting, trout fishing, root collecting, and berry picking (Schuster 1998:331). In the fall, people revisited the valleys for fish runs, hunting, and visiting, returning to the winter villages in about November (Schuster 1998:331).
The mouth of Wenas Creek where it empties into the Yakima River, about three miles downstream of the site, was a noted fishing location (Schuster 1998:Figure 1). Given its lowland valley location not far from the Yakima River, the Wenas Creek valley could have been used for winter villages, fish camps, and a variety of activities such as root digging, hunting of game, berry picking, and placement of burials. One plant, Mariposa lily (*Calochortus macrocarpus*), known to be used by local native peoples (Hunn 1990; Hunn et al. 1998), was observed on the site in June 2006. The valley below may have formerly supported camas (*Camassia quamash*), while the foothills upstream probably supported huckleberry (*Vaccinium* sp.) and chokecherry (*Prunus virginiana*). Burials were sometimes placed in talus slopes such as found several places at the margins of the Wenas Creek valley; several burials were formerly located at the mouth of the creek (Warren 1968).

Given the project focus on Pleistocene bones and nearby artifacts, the relevant prehistoric cultural context is principally Pleistocene and early Holocene archaeology, although the artifacts found to date could be considerably later in time.

At present, the earliest well-established archaeological sites in North America date 11,500 RCYBP and later, most associated with distinctive Clovis artifacts (Anderson and Faught 2000; Holliday 2000; Meltzer 2004). Recent reanalysis of radiocarbon dates indicates that these sites may all date 11,050 RCYBP and later (Waters and Stafford 2007). Many sites with purported human activity dating earlier than 11,500 RCYBP are not well accepted, due to perceived problems with dating, unconvincing evidence of human activity (e.g., artifacts or human remains), and/or association of artifacts and dates (Haynes 1969; Dincauze 1984; Meltzer 2004). The most widely accepted pre-Clovis age site in the Americas is Monte Verde in Chile, which has a 12,500 RCYBP component with abundant organic artifacts plus stone tools and bone (Dillehay 1989, 1997; Meltzer et al. 1997). Other pre-Clovis sites are controversial, either for the reasons noted above or because they are not yet published in sufficient detail for convincing peer review (Meltzer 2004). While many archaeologists no longer doubt that humans arrived in the Americas prior to Clovis, the nature of pre-Clovis archaeology is anything but clear (Haynes 2002; Roosevelt 2002; cf. Kelly 2003).

There is strong evidence for human hunting of mammoths at about a dozen sites in North America, but none in the Pacific Northwest (Grayson and Meltzer 2003; Fiedel and Haynes 2004). This evidence consists of intimate associations of artifacts and mammoth remains,
convincing evidence of cutmarks or human-caused bone breakage, and/or unambiguous human-caused spatial movement of bones (Grayson and Meltzer 2002). In the Pacific Northwest, there are three sites with purported evidence for human hunting of proboscideans (mammoths and/or mastodons): Ledgerwood, Washington (Gustafson et al. 1991); Manis, Washington (Gustafson et al. 1979), and Owl Cave/Wasden, Idaho (Miller 1989), but all lack compelling evidence. In the case of Ledgerwood and Owl Cave, there is insufficient stratigraphic correlation of human artifacts and mammoth remains, and at Manis there is insufficient evidence for artifacts and butchery marks (Carlson 1990; Gustafson et al. 1991; Grayson and Meltzer 2002). Thus, all three sites should be considered paleontological but not archaeological based on the currently published record.

Although the connection of mammoths with Clovis artifacts is well established, there is still considerable uncertainty about the nature of human subsistence strategies in the period. Examinations of the existing faunal record indicate that Clovis hunters took ungulates (e.g., bison, equids, camelids), lagomorphs, and other prey as well as proboscideans (Haynes 2002:Tables 5.1-5.2; Waguespack and Surovell 2003). However, current evidence is insufficient to distinguish between a range of possible human foraging strategies from generalized foragers to specialized big-game hunters, based on possible geographic variation and diverse interpretations in the literature (e.g., Waguespack and Surovell 2003; Cannon and Meltzer 2004; Byers and Ugan 2005).

Overall, there is very little published scientific evidence for humans in the Pacific Northwest prior to 11,000 RCYBP. While a number of Clovis or Clovis-like artifacts have been found (Ames et al. 1998), only one Clovis site has stratigraphic control and chronometric age estimates: the Richey-Roberts (East Wenatchee) site in Washington. This site has yielded a number of unusually large Clovis bifaces in what appears to be a cache (Gramly 1993) atop Glacier Peak G tephra dating ca. 11,200 RCYBP (Mehringer et al. 1984). A handful of other controversial regional sites are being evaluated that may pre-date Clovis (Gilbert et al. 2008; Jenkins et al. 2004) or be contemporary with it but exhibit distinct technology (Davis and Schweger 2004). In the period ~11,000-10,000 RCYBP, there are a number of well-accepted sites such as Lind Coulee (Craven 2004; Daugherty 1956), Marmes (Hicks 2004), and Sentinel Gap (Galm and Gough 2000) in Washington.
Local Archaeological Investigations

Previous archaeological investigations in the immediate site vicinity are limited. No previously recorded sites are noted within two miles of 45YA1083. Few recorded sites or projects have been located in the general area, mostly due to a lack of Section 106-mandated investigation, as the vicinity is almost entirely privately owned and used for farming, ranching, and housing. However, there are two other excavated sites within six miles of the Wenas Creek Mammoth site: the Wenas Creek site (45YA18) and the Rosa Rockshelter (45YA301).

The Wenas Creek site is located about 3.5 miles east-southeast of the study site at the mouth of Wenas Creek. It was recorded in an archaeological survey for a natural gas pipeline, and salvage excavated along its right-of-way in the summer of 1956 under the direction of University of Washington graduate student Claude Warren (Warren 1968). At that time, the site had already been extensively damaged by informal digging, and the focus was made on apparently undisturbed portions of the 50-foot wide right-of-way. Hand excavation of about 750 square feet to bedrock (up to 8.5’ deep) revealed housepits, hearths, postholes, and talus burials, and yielded about 1300 artifacts (Warren 1968:2). Artifacts were dominated by chipped stone, including nearly 200 projectile points, mostly stemmed and corner-notched varieties (Warren 1968:Table 1). Other recovered artifacts included hammerstones, pestles, bone and antler tools, *Olivella* and *Dentalium* shell, and a copper kettle. There are no chronometric dates for this site.

The Rosa Rockshelter site is located along the Yakima River in Yakima Canyon about 5.5 miles east-northeast of the study site. It was explored and mapped in Fall 1969, and partially excavated in the summer of 1970 under the direction of William Smith of Central Washington State College (Smith 1971), now Central Washington University. Twelve 1x1 m squares were excavated to bedrock in the small rockshelter (6.3 x 5.5 x 1.8 m high), recovering perishable materials including one piece of tule matting, three fragments of basketry material, three fragments of leather, and 155 pieces of cordage (Smith 1971). Also recovered but not analyzed were straw and stick fragments, animal bones, and some lithic debitage. The age of the site is unknown.

History of Site Investigation

The Wenas Creek Mammoth Site (45YA1083) is located on lands owned by Haywire Outfit, Inc (formerly Mayo Ranches, Inc.) in Township 14N, Range 18E, in Yakima County,
Washington (exact location suppressed in this document). The site is where construction workers discovered a large bone during construction of a private road on Mayo Ranches property near Selah in February, 2005. The find was made near the south edge of the road while smoothing the grade on that side with a backhoe. Subsequent to the find, the landowner contacted Central Washington University (CWU), provided the bone to the university, and covered the location with backdirt, obscuring the exact location of the find. The bone was later determined to be the left humerus of an unidentified mammoth (*Mammuthus sp.*). A Memorandum of Understanding (MOU) was signed April 27, 2005 between Mayo Ranches and CWU to allow for investigation of the mammoth find location. Since the find was strictly animal bone with no evidence of human artifacts, it was considered a fossil locality not subject to state archaeological law.

A CWU field school investigated the fossil locality in the summer of 2005 (June 27 - August 5), with two principal goals: (1) placing the bone found in construction in geological context, and (2) searching for additional mammoth bone. To begin, a ground-penetrating radar (GPR) survey was conducted under contract by Brian Whiting of Earth Imaging Associates. The purpose of this work was to seek geophysical evidence of additional mammoth bones and thus avoid damaging them in a subsequent backhoe trench. Two GPR grids were investigated at 50 cm intervals: Grid 1, a 26 m N-S x 19 m E-W unit north of the gravel road, and Grid 2, a 10 m N-S x 14.8 m E-W unit south of the road, as near as practical to the estimated find location. Both grids yielded a number of GPR anomalies (e.g., see Figure 2), but none appeared to be mammoth remains. A mechanical trench was then excavated near the presumed find location with a trackhoe to provide geological cross sections for the find. The trench was 37 m long and L-shaped to provide a long downslope section and shorter cross-slope section. No bone or artifacts were discovered in the trench. Hand excavated units were dug in 2x2 m units or smaller at 5 or 10 cm levels with horizontal bases. A map of excavations through 2009 is given in Figure 3. Hand excavation of 25.75 m² of deposits yielded hundreds of bone fragments, but no cultural materials nor human bones were found. All of the mammoth-sized bone was fragmentary and unidentified except for a near-complete right humerus found in place. Sediment samples were obtained for luminescence dating and analyses of sediment particle-size, pollen grains, and opal phytoliths.
In summer 2006, CWU began a second season of field school excavations, with fieldwork extending from June 26 to August 18, 2006. Work focused on hand excavations adjacent to bone-bearing units from 2005, and in areas of GPR anomalies from 2005. These exposed additional mammoth bones and bovid (probably bison) bones. On July 7, a student exposed the first artifact, a chert flake fragment, near mammoth bones in XU 12. Assistant State Archaeologist Stephanie Kramer was consulted, and provided permission to proceed without a permit so long as the flake was documented as an isolate and no additional materials were found. The Yakama Nation Cultural Resource Program was also consulted, and their representatives visited the site July 10. No additional artifacts and no human bones were recovered for the remainder of the season. The context of the flake find in relation to the mammoth bone has not yet been resolved, but it appears to lie stratigraphically above the mammoth bones. An isolate form was submitted August 25, 2006, and assigned number 45YA1083.

In summer 2007, CWU held a third season of excavation from July 2 through August 25, following protocols set forth in the 2007 DAHP Archaeological Permit application (see Lubinski et al. 2008). Work focused on 7.9 m³ of hand excavations adjacent to bone-bearing units from
2005 and 2006. In addition to numerous non-human bones, a single probable artifact was discovered in fieldwork. This chert flake was recovered from the screen in XU 20, apparently above the mammoth bone-bearing level. No other probable human artifacts were recovered.

Figure 3. GIS map of investigations 2005-2009. The "Edge of Disturbance" indicates the southern margin of construction disturbance, while "Backhoe cut" indicates the northern margin of intact stratigraphy. Map produced by Tom Winter.

In summer 2008, CWU held a fourth season of excavation from June 23 through August 15, following protocols set forth in the 2008 DAHP Archaeological Permit application (see Lubinski 2009). Work focused on 17.8 m³ of hand excavations adjacent to bone-bearing units from 2005-2007. In addition to numerous non-human bones, several chert samples were collected for evaluation as possible artifacts. None of these chert samples were found to be definitive human-produced artifacts, although one is considered a possible artifact that should be considered for management purposes.
In summer 2009, CWU held a fifth season of excavation from June 29 through August 20, following protocols set forth in the 2009 DAHP Archaeological Permit application. Work focused on 15.0 m³ of hand excavations adjacent to bone-bearing units from 2005-2008. In addition to numerous non-human bones, chert samples were collected for evaluation as possible artifacts. Analysis of the chert samples is pending.

Results of the project to date are provided below under "Summary of Current Findings."

Project Personnel

The Wenas Creek Mammoth Project is a multidisciplinary project with a research team of professionals, students, and volunteers. Dr. Patrick Lubinski, an archaeologist and zooarchaeologist, is the overall project director and excavation director. He is an Associate Professor in the Department of Anthropology at CWU. Other research team leaders are: Bax Barton, M.Sc., paleontologist (Curator, Quaternary Research Center, University of Washington); Karl Lillquist, Ph.D., geomorphologist (Professor, Department of Geography, CWU); and Morris Uebelacker, Ph.D., archaeologist and geographer (Professor, Department of Geography, CWU). These four faculty have overseen all phases of work on the project. Jake Shapley, a CWU Graduate Student in Resource Management, also played a significant role in the project, as the principal Teaching Assistant in the field and laboratory from 2005-2008. The 2009 field school was taught by Lubinski.

In summer 2009, 21 students were enrolled in the field school, including 17 for the full eight weeks (Molly Allison, Jim Cook, Eric Crook, Scott Ditsworth, Allie Duda, Rose Frederics, Raul Gaitan, Jocelyn Goldschmidt, Katherine Krieger, Mallory lopex, Kiera Murphy, Mike O'Brien, Barbara Parsons, Janna Parsons, Eric Prendergast, Kaitlynn Simmonds, and Katrina White), and four students for four weeks (Fernando Calderon, Jason Cathcart, John Hartman, and John Hughes). Alfred Keller, a CWU anthropology post-baccalaureate student, was the field school Teaching Assistant. Robert Eikenbary, a CWU anthropology undergraduate student, was the public education coordinator as well as a Teaching Assistant. The 2009 summer field crew is shown in Figure 4. Volunteers who assisted in the field are listed under "Visitation and Public Participation" below.
Student Laboratory Assistants for the 2009-10 academic year included Rachel Arnett, Megan Brown, Misty Defoe, Joy Ferry, Kaitlin Gallagher, Tommy Garnica, Isa Harrison, Shauna Linn, Travis Morelli, Erica Palmaer, Katie Phillips, Kelli Poe, Joshua Pong, Tim Soderstrom, Kevin Sweetman, and Emily Wolden. These students were supervised by Dr. Lubinski, and Graduate Assistants Alfred Keller and Genevieve Brown. Alfred Keller was also the project artist/sculptor who produced replica casts of selected bone finds. Laboratory assistants from the Retired and Senior Volunteer Program (RSVP) for the 2009-10 academic year included Sharon Balding, Linda Brown, Jim Morgan, and Sue von Jentzen.


Research Questions and Design

This investigation is multidisciplinary, with research questions in paleontology and paleoecology, geomorphology, and archaeology. For archaeology, the overriding research concern is whether or not the paleontological remains are associated with human activity. This is an especially important question given the presence of bones from an extinct mammoth and the likely age of about 13,000-14,000 RCYBP. If an association is found between the dated bones and cultural activity, the site will clearly be of international importance and eligible to the
National Register of Historic Places. Our approach and methods are conservative, and no such association is expected. On the other hand, we want to be sure to employ an approach that will find any evidence that may exist.

Since so little is known prior to Clovis in North America, any information about human activity at the site would be highly significant. Even an association of a mammoth and human activity at a later date would be significant, since there are presently no compelling kill sites in the Pacific Northwest. If no cultural materials are found associated with the mammoth bones, the site will still yield significant paleoenvironmental information pertinent to arguments for human arrival and/or use of the region in the Pleistocene. These data will include information on mammoths and contemporary animals, as well as vegetation and climatic conditions if we can obtain sufficient funding for analyses of pollen, phytoliths, and chemical isotopes.

Given these research domains, the principal goals of the 2009 field investigation were threefold: (1) to determine the relationship (if any) of the cultural material to the mammoth bone, (2) to place both cultural material and bone in geological context including age and depositional history, and (3) to search for additional cultural material and faunal remains. To address goals (1) and (2) in the excavations, methods were designed to ensure sufficiently precise locational control to demonstrate any potential relationships between artifacts, bones, and matrix, and to collect excavated materials and sediment samples in a way conducive to future analyses. To address goal (3), prior excavations were expanded and units were systematically sampled for fauna/artifacts and microfauna/microartifacts.

Field Methods

Field investigations in 2009 began on June 29 and continued weekdays through August 14 for the Wenas Creek Mammoth Field School sponsored by Central Washington University, and under the supervision of Dr. Patrick Lubinski of CWU. After the field school was completed, fieldwork continued on a volunteer basis under the direction of Dr. Lubinski through August 20. Additional site covering and backfilling took place on August 27 and September 26.

Formal hand excavation units for the project (2005-2009) were placed either in areas of GPR anomaly or adjacent to units with previously exposed bone (see Figure 3). The overall goal for the GPR units was to test at least one positive and one negative anomaly from each of the two GPR grids. Units 15 and 16 were placed over GPR anomalies in the grid north of the
road (a positive and a negative anomaly, respectively), and XU1 was placed over a GPR positive anomaly in the grid south of the road. A final negative anomaly south of the road may be tested in a future season. The remaining units were grouped into a main excavation block expanding from the original bone find from road construction, and from XU1, which yielded bone in 2005. Baulks (50 cm wide) have been left between key units in the main block to preserve stratigraphy and provide locations for future sampling. Units excavated in 2009 were all located in the main block, and consisted of continuations from prior seasons, new units placed adjacent to bone-bearing units, and baulks removed between previously-excavated units. This work included continuation of work in XU 1, 16, 21, 23, 24, 26, 27, and 28, and initiation of excavation in XU 29, 30, 31, 32, 33, 34, 35, and 36.

Excavation units and adjacent vertical control datums were laid out to correspond with the existing grid system with a Topcon CTS-223W total station theodolite and a prism pole. The prism poles used were the peanut (a CST 1 in. prism and mini-pole combination totaling 10 cm), mini-prism (a SECO 25 mm prism with as few 30 cm pole extensions as practical, to minimize leveling error), or full-size telescoping pole (Crain 8 ft) with one of the two small prisms as needed. The grid system uses a grid north set to 0° North with a magnetic declination of 20°, and a coordinate system with the southeast corner of XU 2 set to North 500 m, East 100 m, Elevation 100 m. The vertical datum nails were used for approximate depth control, but all elevation control was verified with total station shots. Excavation was in units of 2x2 m (less if a 50 cm wide baulk wall is adjacent, or if the unit is a portion of baulk wall itself) in levels of 5 or 10 cm with horizontal floors. An excavation level form was completed for every unit level (see Appendix A). All excavated matrix was dry screened through 1/8 in hardware cloth, except for the fine screen sample. The fine screen sample was taken from a 45 x 45 cm column of sediment reserved in each unit to approximate 5% of the total excavated volume. The fine screen sample was water screened with 1/16 in mesh. The fine screen residuum was dried and taken to the lab for sorting under controlled conditions.

All encountered cultural materials and bone was left in place (as possible) and pedestalled until spatial relationships in the unit were clearly established. Fragile materials (most bones) were consolidated as needed with Butvar B-76 (polyvinyl butyral resin dissolved with acetone), except for those intended for radiocarbon dating or chemical analyses. Bone radiocarbon/chemical sample cores were removed from select larger bones with an electric hand
drill equipped with a 1 in diameter hole saw, which allowed the remainder of these bones to be consolidated with B-76. After fully exposed, all finds were recorded with 3-D coordinates (e.g., high point, low point, horizontal outline) with the total station as possible. As a data backup, hand-drawn plan maps were completed to indicate finds in each unit. For all in situ finds, upside, dip (slope) and strike (compass orientation) were taken with a Brunton compass. For all significant bone finds, 3-D coordinates, dip and strike, taphonomy, taxonomic identification, photographic and other data were recorded on "Bone Find Record" sheets (see Appendix A). Once these data were obtained, the materials were removed, placed in polyurethane zip bags with their assigned field specimen number, and returned to the laboratory. Larger specimens not conducive to safe removal in this way were encased in B-76 or plaster jackets and underlying sediment for transport and final excavation in the laboratory. Excavation progress was photo-documented at the base of each level with a Nikon D-70 digital SLR camera.

Because the potential for cultural association with the paleontological remains was a central goal of the project, particular care was taken in the evaluation of possible culturally modified stone. A sample of angular chert pieces and other stones was collected to provide comparative context for evaluating human vs. naturally-occurring "flakes." Other rocks with fracture morphologies similar to heat crazing were tabulated as "similar to fire-cracked rock" or "pseudo-FCR." All collected lithic samples will be re-examined in the laboratory and evaluated as to the probability of being produced by humans.

All collected materials were tracked through a system starting with assignment of Field Specimen (FS) numbers for each unique collection, be it a single specimen with point provenience or screened material from a unit/level (lot). Provenience information for all assigned Field Specimen numbers was entered into a computerized relational database. Catalog number was assigned in the laboratory to each lot and individual specimen of interest and tied to provenience in the database.

Excavation proceeded in each unit until the entire floor was well within the alluvium (geological Unit/Stratum III) underlying the bones, or the unit was too deep for student safety. At the completion of excavation of each unit, the project geomorphologist examined and mapped the stratigraphy. All walls were mapped with the total station. Representative walls were photographed and mapped on graph paper by the students.
On August 6, 2009, the 12 dosimeters placed by Dr. Jim Feathers of the University of Washington Luminescence Laboratory on August 2, 2008, were removed. These dosimeters were intended to help refine luminescence age estimates from sediment at these 12 locations. The dosimeters were placed in labeled polyurethane zip bags for return to Dr. Feathers' laboratory. A "travel" dosimeter sent by Dr. Feathers to measure dose from time of removal to arrival at his laboratory was prepared by heating it on a white gas camping stove until it glowed. These 13 dosimeters were submitted to the UW lab on August 21, 2009. Final dates are forthcoming.

At the conclusion of the field season, all active units were covered for the winter. Covering involved lining unit floors and walls with geotextile, shoveling a thin layer of fine sediment onto the floor, and placing a constructed plywood and 2 x 4 stud cap over the open hole. The cap was anchored upslope with steel reinforcing bar and/or attachment to an uphill cap, and the resulting structure was bermed to prevent water from running into the units. This created a sort of plywood "shingled roof" over the excavation block.

Seven inactive units were backfilled by hand and/or front end loader at the end of the field season: XU 13, 16, 22, 24, 27, 29, and 30. Additionally, XU20 was filled about halfway. Backfilling included partial use of four truckloads (yards each) of fill dirt delivered by Chad Galland. This new dirt was necessary because there appeared to be insufficient screened dirt to fill our excavations (certainly some of the fine loess blew away). Chad Galland also assisted backfilling on September 26 with a backhoe. (Note that units 2, 4, 5, 6, 7, 8, 9, 10, 11, 14, 15, 19, and 26 were backfilled in prior seasons, although XU 14 was reopened in 2009 and remains unfilled.)

Also at the conclusion of the field season, our first permanent datum was set. This datum consisted of a vertically-oriented steel reinforcing bar anchored in concrete near the west fence gate. This datum (called “X” in our naming system) was placed with its top at location N 500.100, E 80.000, Elevation 101.800 in our grid coordinate system.

Laboratory Work

The Wenas Creek Mammoth Project maintains a laboratory currently in Room 227 Dean Hall at Central Washington University. The laboratory houses the recovered specimens from the project, the project computer data, selected field equipment, bone consolidation facilities, and
work space. Laboratory work is in progress for all seasons of the project, with some portions near complete (e.g., 2005-2009 collection and photograph catalogue record) and others barely initiated (e.g., bone identifications). It is expected to take years to complete laboratory work for the project.

A number of laboratory assistants worked in the lab under supervision of Lubinski, Alfred Keller and/or Genevieve Brown. Alfred Keller and Genevieve Brown were funded Graduate Assistants in 2009-10, with some of their time assigned to the project for laboratory supervision. Assistants since the 2009 field season have included CWU students enrolled for Independent Study credit and volunteers from the Retired and Senior Volunteer Program (RSVP). Assistants worked on cataloguing finds, cleaning and consolidating bone, computer data entry, initial identifications, and sorting through fine screen matrix for bones and artifacts.

All collected materials were tracked through a system starting with assignment of Field Specimen (FS) numbers for each unique collection, be it a single specimen with point provenience or screened material from a unit/level (lot). Provenience information for all assigned Field Specimen numbers were entered into a computerized relational database. Catalog numbers were assigned in the laboratory to each lot and individual specimen of interest and tied to provenience in the database. Catalog number, along with material type, count, and provenience was written in pencil on a pre-printed acid-free label inserted into a polyurethane zip bag for each specimen or lot. Large specimens (e.g., complete mammoth bones) were labeled directly on the treated bone surface to facilitate refit attempts. All materials are stored by catalog number for researcher access. While provenience information is with each specimen or lot, it is anticipated that researchers will use the database to find specimens of interest during our analysis and in the future.

Fragile bone was treated with Butvar B-76 (polyvinyl butyral resin) dissolved in acetone for consolidation, except when untreated portions were desired for future radiocarbon or chemical analyses. Bone treated in the field was cleaned in the laboratory with acetone for removal of adhering dirt, and fresh consolidant was applied. Other bone was dry brushed or cleaned with water prior to analysis. Future bone analysis will consist of recording, as possible, element, side, portion, taxon, and taphonomic attributes (e.g., size, weathering stage, carnivore modification, digestive corrosion, butchery cutmarks, etc.). We will attempt refits of all potentially identifiable mammoth-sized bone fragments.
Project records include excavation level forms, bone find records, profile maps, supervisor's log book, Field Specimen record, catalog records, analysis notes, total station coordinates, and photographic files. During analysis, these will be located in the Department of Anthropology at Central Washington University. Subsequent to analysis, these will be curated at the same location.

Laboratory analyses are underway for a number of specific topics related to the overall project. General archaeological analyses are being supervised by Lubinski. Analysis and evaluation of lithic materials is underway currently by Lubinski and Patrick McCutcheon. Identification and discussion of faunal/paleontological remains, and bone taphonomy is being undertaken currently by Lubinski. Sediment analysis and interpretation is being undertaken currently by Lillquist. Fine screen sample processing and analysis is being undertaken and supervised currently by Lubinski, while Barton is supervising analysis of materials recovered from 2005-2008. Pertinent findings of these analyses will be reported as they are completed.

Making of replica casts of key bones for public education purposes continued from the 2008-09 academic year. This work was performed by artist and student assistant Alfred Keller. The first step is to clean and consolidate the bone to be copied, and then begin the casting process. The casting process involves making a two-part mold with a GI-1000 silicone inner mold surrounded by a polyisocyanate foam resin mother mold to support the silicone. The mother mold is made in two halves by encasing the bone in clay, building walls for the mold exterior, and pouring in foam, which expands and hardens. The inner mold is made in two halves by removing clay from the bone and filling the void between the bone and the mother mold with silicone. To make the casts, more of the same foam material is poured into the four-part mold to make multiple copies of each cast. To date, casts have been made of the original find left mammoth humerus (FS 1), mammoth atlas (FS 59), mammoth femur (FS 546) and comparative cow humerus and human atlas. Earlier experiments were made in 2007-08 with different materials and the left bovid metatarsal cannonbone (FS 275) and a comparative cow left metatarsal cannonbone.

Visitation and Public Participation

The project is located on a private road on private land, but due to the interest of the landowners, it was open to the public. Public participation in 2009 included an on-site
interpretive tent, guided site tours, limited volunteer opportunities, and visits by the press. The interpretive tent was a 20 x 10' portable garage with a series of trifold panel displays describing the site history and general information about mammoths and archaeology, as well as the available bone replica casts. Visitors were encouraged to start in this tent, sign in on the guest register, and also to use it as a shady resting station. We provided guided tours Tuesday through Saturday from July 14 through August 8, 2009, every half hour from 9:00 AM through 2:00 PM. Tour guides were principally Teaching Assistant/Public Education Coordinators Robert Eikenbary and Alfred Keller, and volunteer docents (Sharon Balding, Jim Briggs, Merrill Greenlee, Ray Foisy, Aimee Higdon, Nancy Kenmotsu, and Sarah Nauman). A few tours were also provided by Dr. Lubinski and selected field school students (Molly Allison, Janna Parsons). Over the course of the summer tour period, there were at least 2,180 guests. An unknown number of additional guests did not sign the guest book. Guests included daycare groups (e.g., Apple Land, Busy Bear, Kids R Me), schoolchildren (e.g., Cub Scout Pack 161, Salvation Army Day Camp), university students (e.g., South Puget Sound Community College's archaeology field school), senior centers (e.g., Redmond) and members of the press.

Visits were made by professional archaeologists Dale Croes, Steve Hackenberger, Pat McCutcheon, Larry Ross, William Schroeder, Jared Valenta, Scott Williams, and Pei-Lin Yu. Press visits were made by the Daily Sun News (Sunnyside), KAPP-TV, and KIMA-TV. The site was also featured in a national History Channel program "Journey to 10,000 BC," which first aired March 9, 2008.

Volunteers helped greet visitors, lead tours, sort fine screen sediment, and screen for excavations under supervision. There were 24 general public volunteers throughout the summer: Becky Arnold, Jim Briggs, Genevieve Brown, Jessica Eicher, Darrell Emmott, Sharon Balding, Mike Bogart, Ray Foisy, Merrill Greenlee, Aimee Higdon, Clint Hughes, Lisa Hurn, Nick Hurn, Ted Hurn, Nancy Kenmotsu, Sarah Nauman, Cadi Poile, Laurie Porter, Mike Rafferty, Diane Smith, Andrew Templeton, Austin Templeton, Jared Valenta, Pei-Lin Yu. The "volunteer" list could also include 20 visiting students from other field schools, namely 20 visiting members of the South Puget Sound Community College archaeology field school. Two of the Mammoth field school participants also volunteered after the field school was over to complete fieldwork: Pat Lubinski and Janna Parsons.
2009 Results

Approximately 15.0 m³ of sediment was excavated in 16 formal units in the 2009 season, yielding a variety of notable bones, bone fragments, and rock samples/chert fragments (see Table 1). A large number of rock samples (588) were recovered from excavations in 2009. Unlike prior years, this year we collected all possible toolstone (chert/cryptocrystalline rock) from entire units, regardless of how angular the fragments. This was done systematically in an attempt to characterize the naturally-occurring toolstone-quality rocks in the site deposits. These rocks range in shape from well-rounded pebbles to fairly sharp, angular to very angular lithic debris. None was an unambiguous artifact of human manufacture, but a detailed examination of these samples has not been completed at this time. Those results are still forthcoming.

Fifty-six in situ bones were removed this season (see Table 2). Bones exposed in 2009 or prior years but not yet recovered are in Table 3. No plaster jacketing was used in bone recovery this season. We found that a thorough covering of all bone surfaces with Butvar B-76 conservation material allowed safe, unbroken removal. While a number of the bones recovered in 2009 were unknown elements or minimally-identifiable rib fragments, 15 were identified elements with some potential for taxonomic identification. These fall into two main groups: Size Class 7 (mammoth-size) and Size Class 6 (bison-size).

In addition to rib fragments, the Size Class 7 bones recovered in 2009 include a sacrum, five probable vertebral fragments, a metapodial foot bone, and a phalanx toe bone. Although some of these elements (e.g., complete thoracic vertebrae) have distinctive traits that may allow identification of mammoth as opposed to mastodon (Olsen 1979), others lack such distinction (e.g., complete sacra [Olsen 1979:16]). Given the state of preservation of the Wenas Creek bones, it is unlikely that these elements will provide species identification on osteological grounds. The sacrum (FS 617/781) was a partially fused set of sacral and possibly caudal vertebrae excavated from the border of XU 21 (started in 2008) and XU 35. The lateral “wings” of the vertebrae were missing, but the centra on the cranial end were well-preserved, and the linked vertebrae measured about 40 cm long. Other probable vertebral fragments included FS 890/920 (a centrum and dorsal spine fragment, probably thoracic), FS 900 (a poorly preserved specimen, possibly thoracic vertebra), FS 951 (a centrum and partial neural arch, probably cervical), FS 963 (a possible spine fragment), and FS 968 (a largely intact centrum plus a little neural arch, probably cervical). The metapodial (FS 1119) was a near-complete specimen about
<table>
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<tr>
<th>Unit</th>
<th>Size (m)</th>
<th>Excavated Levels</th>
<th>Volume (m³)</th>
<th>Results</th>
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<tr>
<td>XU 01</td>
<td>NA</td>
<td>None. Removal of bone pedestal only.</td>
<td>NA</td>
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<td>XU 16</td>
<td>0.45 x 0.45</td>
<td>L3A-17B of fine screen sample block only (98.00-96.50 m)</td>
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<td>1.5 x 1.5</td>
<td>Removal of bone pedestals &amp; L18 (100.75-100.65 m)</td>
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<td>Unit completed*. Yield: chert fragments, recovery of bones exposed in 2008 (FS 575, 594, 700, 714, 778, 782, 810)</td>
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<td>XU 23</td>
<td>1.5 x 1.5</td>
<td>L15-17 (101.00-100.80 m)</td>
<td>0.45</td>
<td>Unit completed*. Yield: chert and bone fragments, 12 notable bones (FS 653, 674, 688, 701, 801, 803, 804, 821, 853, 855, 856, 928)</td>
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<td>XU 24</td>
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<td>XU 28</td>
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<tr>
<td>XU 29</td>
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<td>L1-13 (101.38-100.00 m)</td>
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<tr>
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<td>L1-14 (100.87-99.70 m)</td>
<td>2.80b</td>
<td>Unit completed. Yield: chert and bone fragments, nine notable bones (FS 900, 951, 958, 966, 968, 992, 1009, 1016, 1119)</td>
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<tr>
<td>XU 31</td>
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<td>L1-12 (100.73-99.70 m)</td>
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<td>L1-15 (102.31-100.90 m)</td>
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<td>Unit completed except for fine screen sample block. Yield: chert and bone fragments, four notable bones (FS 592 femur, 599 tibia, 1122, 1123)</td>
</tr>
</tbody>
</table>

* Except for bones extending into unit walls, which may or may not be recovered later.

b Includes estimate for partial upper levels (estimate used 1/4 of total potential unit volume for these levels, due to both south and east downslopes).
<table>
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<th>FS #</th>
<th>Cat#</th>
<th>Prov.</th>
<th>Taxon*</th>
<th>Element</th>
<th>Length (cm)</th>
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<td>unknown</td>
<td>4</td>
<td>fragment</td>
</tr>
<tr>
<td>963</td>
<td>831</td>
<td>XU 34</td>
<td>6/7</td>
<td>vertebra?</td>
<td>20</td>
<td>fragment</td>
</tr>
<tr>
<td>964</td>
<td>782</td>
<td>XU 34</td>
<td>7</td>
<td>phalanx</td>
<td>6</td>
<td>near complete</td>
</tr>
<tr>
<td>966</td>
<td>830</td>
<td>XU 30</td>
<td>Bovid</td>
<td>phalanx, 2nd</td>
<td>6</td>
<td>complete</td>
</tr>
<tr>
<td>968</td>
<td>664</td>
<td>XU 30</td>
<td>7</td>
<td>vertebra</td>
<td>21</td>
<td>fragment</td>
</tr>
<tr>
<td>970</td>
<td></td>
<td>XU 31</td>
<td>6/7</td>
<td>rib</td>
<td>18</td>
<td>shaft fragment</td>
</tr>
<tr>
<td>971</td>
<td></td>
<td>XU 31</td>
<td>5/6/7</td>
<td>unknown</td>
<td>7</td>
<td>fragment</td>
</tr>
<tr>
<td>992</td>
<td>832</td>
<td>XU 30</td>
<td>7</td>
<td>unknown</td>
<td>11</td>
<td>fragment</td>
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</table>
### Table 2. Bone Specimens Recovered In Situ in 2009 (continued)

<table>
<thead>
<tr>
<th>FS #</th>
<th>Cat#</th>
<th>Prov.</th>
<th>Taxona</th>
<th>Element</th>
<th>Length (cm)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1009</td>
<td>759</td>
<td>XU 30</td>
<td>5/6/7</td>
<td>unknown</td>
<td>6</td>
<td>fragment</td>
</tr>
<tr>
<td>1016</td>
<td>XU 30</td>
<td>5/6/7</td>
<td>unknown</td>
<td>4</td>
<td>fragment</td>
<td></td>
</tr>
<tr>
<td>1023</td>
<td>XU 34</td>
<td>6/7</td>
<td>rib?</td>
<td>11</td>
<td>shaft fragment</td>
<td></td>
</tr>
<tr>
<td>1024</td>
<td>XU 34</td>
<td>5/6/7</td>
<td>unknown</td>
<td>8</td>
<td>fragment</td>
<td></td>
</tr>
<tr>
<td>1025</td>
<td>XU 34</td>
<td>5/6/7</td>
<td>unknown</td>
<td>8</td>
<td>fragment</td>
<td></td>
</tr>
<tr>
<td>1028</td>
<td>XU 34</td>
<td>5/6</td>
<td>tooth enamel</td>
<td>2</td>
<td>fragment</td>
<td></td>
</tr>
<tr>
<td>1075</td>
<td>XU 28</td>
<td>5/6/7</td>
<td>unknown</td>
<td>12</td>
<td>fragment</td>
<td></td>
</tr>
<tr>
<td>1119</td>
<td>728</td>
<td>XU 30</td>
<td>7</td>
<td>metapodial</td>
<td>15</td>
<td>near complete</td>
</tr>
<tr>
<td>1122 + 1123c</td>
<td>XU 36</td>
<td>6/7</td>
<td>rib?</td>
<td>12</td>
<td>shaft fragment</td>
<td></td>
</tr>
<tr>
<td>1124</td>
<td>657</td>
<td>XU 35</td>
<td>6/7</td>
<td>rib?</td>
<td>19</td>
<td>shaft fragment</td>
</tr>
</tbody>
</table>

**Note:** Excludes specimens found in the screen.

* Size Class 5 is about deer size, Size Class 6 is about bison size, and Size Class 7 is about mammoth size.
* More of this specimen remains in situ.
* These two specimens were found adjacent to each other, and are conjoining fragments.

### Table 3. Bone Specimens Left In Situ in 2009

<table>
<thead>
<tr>
<th>FS #</th>
<th>Exposed</th>
<th>Prov.</th>
<th>Taxon</th>
<th>Element</th>
<th>Length (cm)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>153</td>
<td>2005</td>
<td>XU 1</td>
<td>unknown</td>
<td>unknown</td>
<td>2+</td>
<td>into W wall</td>
</tr>
<tr>
<td>282</td>
<td>2006</td>
<td>XU 14/34</td>
<td>unknown</td>
<td>unknown</td>
<td>8+</td>
<td>into W wall</td>
</tr>
<tr>
<td>333</td>
<td>2006</td>
<td>XU 12</td>
<td>6 or 7</td>
<td>unknown</td>
<td>5+</td>
<td>into E wall</td>
</tr>
<tr>
<td>475</td>
<td>2007</td>
<td>XU 18</td>
<td>7</td>
<td>unknown</td>
<td>18+</td>
<td>into E wall</td>
</tr>
<tr>
<td>495</td>
<td>2007</td>
<td>XU 18</td>
<td>6 or 7</td>
<td>rib?</td>
<td>50+</td>
<td>into W wall</td>
</tr>
<tr>
<td>508/510</td>
<td>2007</td>
<td>XU 18/34</td>
<td>7</td>
<td>vertebra, thoracic</td>
<td>52+</td>
<td>into W wall</td>
</tr>
<tr>
<td>513</td>
<td>2007</td>
<td>XU 18</td>
<td>unknown</td>
<td>unknown</td>
<td>10+</td>
<td>into W wall</td>
</tr>
<tr>
<td>526</td>
<td>2007</td>
<td>XU 18</td>
<td>unknown</td>
<td>unknown</td>
<td>5+</td>
<td>into E wall</td>
</tr>
<tr>
<td>529</td>
<td>2007</td>
<td>XU 18</td>
<td>unknown</td>
<td>unknown</td>
<td>2+</td>
<td>into W wall</td>
</tr>
<tr>
<td>614</td>
<td>2008</td>
<td>XU 21</td>
<td>6?</td>
<td>rib?</td>
<td>13+</td>
<td>into W wall</td>
</tr>
<tr>
<td>650a</td>
<td>2008</td>
<td>XU 23</td>
<td>6 or 7</td>
<td>unknown</td>
<td>11+</td>
<td>into W wall</td>
</tr>
<tr>
<td>690</td>
<td>2008</td>
<td>XU 24</td>
<td>unknown</td>
<td>unknown</td>
<td>?</td>
<td>recorded and then lost</td>
</tr>
<tr>
<td>691</td>
<td>2008</td>
<td>XU 24</td>
<td>unknown</td>
<td>unknown</td>
<td>4+</td>
<td>into S wall</td>
</tr>
<tr>
<td>720</td>
<td>2008</td>
<td>XU 24</td>
<td>unknown</td>
<td>unknown</td>
<td>4+</td>
<td>into S wall</td>
</tr>
<tr>
<td>800</td>
<td>2008</td>
<td>XU 23</td>
<td>unknown</td>
<td>unknown</td>
<td>4+</td>
<td>into W wall</td>
</tr>
<tr>
<td>802/804b</td>
<td>2008</td>
<td>XU 23</td>
<td>7</td>
<td>rib</td>
<td>40+</td>
<td>into E wall</td>
</tr>
<tr>
<td>813</td>
<td>2008</td>
<td>XU 28</td>
<td>unknown</td>
<td>unknown</td>
<td>5+</td>
<td>into S wall</td>
</tr>
<tr>
<td>872</td>
<td>2009</td>
<td>XU 32</td>
<td>7</td>
<td>longbone?</td>
<td>21+</td>
<td>into W wall</td>
</tr>
<tr>
<td>925</td>
<td>2009</td>
<td>XU 34</td>
<td>7</td>
<td>vertebra?</td>
<td>18+</td>
<td>into W wall</td>
</tr>
<tr>
<td>950</td>
<td>2009</td>
<td>XU 32</td>
<td>7</td>
<td>longbone?</td>
<td>25+</td>
<td>into W wall</td>
</tr>
<tr>
<td>998</td>
<td>2009</td>
<td>XU 31</td>
<td>unknown</td>
<td>unknown</td>
<td>5+</td>
<td>into N wall</td>
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<td>1107</td>
<td>2009</td>
<td>XU 35</td>
<td>unknown</td>
<td>unknown</td>
<td>?</td>
<td>into W wall</td>
</tr>
<tr>
<td>1108</td>
<td>2009</td>
<td>XU 35</td>
<td>6 or 7</td>
<td>rib?</td>
<td>35+</td>
<td>into W wall</td>
</tr>
</tbody>
</table>

**Note:** Four specimens erroneously listed in the 2008 report (Lubinski 2009:Table 3) as left in situ, were actually removed in the 2008 field season (FS 683, 692, 716, and 717)

* Fragment 11 cm long was removed in 2009; remainder is in situ.
* Fragment 24 cm long was removed in 2009; remainder is in situ.
15 cm long that cannot at present be identified to side, front foot, hind foot, or ray. The phalanx (FS 964) was a near-complete specimen about 6 cm long, probably a second phalanx.

The Size Class 6 (bison size) bones included a complete left femur (FS 592), left tibia (FS 599), two first phalanges (FS 263, 948), and a second phalanx (FS 966). These bones were found in three sets, with the femur and tibia found in direct contact with each other in XU 36, the two first phalanges found only 7 cm apart in XU 33, and the second phalanx found alone in XU 30. The tibia was sampled for future radiocarbon dating and/or chemical analysis with two cores (FS 1111, 1112) made with a hole saw. The femur and tibia are good size matches to be derived from the same animal, but cannot be articulated smoothly at this time, in part due to missing distal portions of the femur. The two first phalanges are left and right sides and are excellent matches, probably indicating that they are left and right of a pair from one leg. The second phalanx is a right side that articulates strongly and smoothly with the right first phalanx, probably indicating it is derived from the same leg. It is very probable that all of these bones (femur, tibia, first phalanges, and second phalanx) make up a single left hindleg of a hoofed mammal (artiodactyl), likely a bison. In fact, Size Class 6 bones recovered in earlier seasons (metatarsal cannonbone, cuneiform 2+3 tarsal, fibula, astragalus, and calcaneus) also are consistent with the left hindleg of the same animal. Species identification is in progress.

The other two identifiable specimens are a vertebra and a tooth fragment. The vertebra (FS 801) is a centrum with partial transverse processes from a Size 6 (bison size) or Size 7 (mammoth-size) animal. It is likely a Size 7 caudal vertebra, but it needs further cleaning and checking against Size 6 lumbar and caudal vertebrae. A 2 cm-long tooth fragment (FS 1028) is from a Size 5 or 6 mammal (deer-size to bison-size). This specimen consists of a fragment of tooth enamel with some attached dentine and a worn enamel edge that is probably a trace of occlusal (biting) surface. Unlike all of the other bones discussed here, FS 1028 was found in gravelly Stratum 3 alluvium (XU 34 Level 12) which underlies the finer-textured, bone-bearing, Stratum 2 colluvium. Thus it presumably predates the mammoth and bison noted above.

Bone recovered in 2009 has not yet been subject to taphonomic analysis that could potentially reveal human action, such as cut marks or hammerstone impact marks. These analyses will be undertaken and reported as they are completed, along with more general taphonomic information like bone weathering, root etching, breakage patterns, conjoins, carnivore or rodent gnawing, etc.
Findings in 2008 continue to support the ongoing interpretation of site stratigraphy by site geomorphologist/stratigrapher Karl Lillquist. The site has three principal strata: a basal unit (Unit III) of stratified gravels and sand, a middle Unit II of non-stratified fines with gravels, and an upper massive silt-dominated Unit I. Based on field characteristics these units have been tentatively interpreted as alluvium, colluvium, and loess, respectively. The bones and artifacts appear to derive primarily from Unit II, although it is as yet unclear if they are geologically contemporaneous or if Unit II can be subdivided into stratified microstrata.

Summary of Current Findings

Thus far from five seasons of excavation (2005-2009) and analyses completed to date, the archaeological findings are limited to recovery of three possible chipped stone flakes. These three specimens were evaluated by Patrick Lubinski and Patrick McCutcheon and the two best candidates described in detail in a Current Research in the Pleistocene article (Lubinski et al. 2009). All three are described below. Regardless of possible ambiguities for these three specimens, all should be counted as cultural at least for the purposes of cultural resource management. A catalog of these three possible flakes is provided in Appendix B. Additional, more ambiguous chert fragments are being evaluated.

Specimen FS 584 (catalog # 470) was recovered in 2008. The specimen (Figure 5) is composed of a waxy orange, largely opaque, petrified wood, and measures about 19 x 12 x 3 mm. It exhibits two near-flat surfaces resembling dorsal and ventral faces, and would be characterized as a flake fragment in Sullivan and Rosen's (1985) debitage typology. About half of the margins are thin and nearly feathered, while the other half are snapped/fractured. The dorsal face is slightly concave, and exhibits well expressed compression rings on the entire face except where there is some petrified wood texture. However, the ventral face, which is slightly convex, has only three rings, each with a near-planar intervening surface. Between the third ring and flake margin is a slight hinge before a final small feather termination. Margins exhibit discontinuous, unifacial chipping damage with scars <0.5 mm.

Specimen FS 584 is ambiguous, not being easily dismissed as a geofact and not being easily accepted as an artifact. It lacks attributes best expressed in human-produced flakes but occurring rarely in geofacts, namely a bulb of percussion, fissures, and errailures (Peacock 1991). The attributes possessed by the specimen (partial expression of dorsal cortex, presence of
compression rings or ripples) are found in both artifacts and geofacts (Peacock 1991). The marginal damage seen on this specimen is similar to that illustrated by Hosfield and Chambers (2003) on flakes exposed to riverbed abrasion. The status of this specimen is uncertain. In terms purely of cultural property management, it should probably be considered an artifact, but this is not a scientific certainty.

![Figure 5. Lithic Sample FS 584 (catalog #470), interpreted as possible flake. The dorsal aspect is shown at left and ventral aspect at right. The bars at base are 1 cm each. Photos by Alfred Keller.](image)

Specimen FS 584 was found by a student within some loose dirt at the base of Level 11 in XU 21. It was initially observed about 40 cm northeast and vertically level with a mammoth-size femur (FS 546) in the same unit. If taken at face value, this location would be about 15 cm above the base of the bone and 2 cm below the top of the bone at its nearest point. Given the slope of the geological strata, that would place it stratigraphically equivalent with the bone. However, its exact original location when uncovered is unknown. It is reliably estimated to be derived from the east half of the unit level, within North 494.0-455.5 m, East 92.75-93.50 m, Elevation 101.05-101.10 m in our grid system. This provenience is 45-90 cm below the present sloping ground surface. By comparison to the stratigraphy mapped in the east wall of the unit, this specimen is likely derived from the geological stratum (II) from which mammoth bone was recovered elsewhere, although it could be from the base of the overlying Stratum I, interpreted as wind-blown sediment.

Specimen FS 479 (catalog #327; Figure 6), recovered in 2007, is classified as a broken flake in Sullivan and Rosen’s (1985) system, due to breakage of a portion of the distal margin. (It was erroneously identified as a complete flake in the prior reports.) This specimen can be described as follows (Lubinski et al. 2009:86):
It is a broken flake exhibiting a flat platform with an angle of 55°, an éraillure scar on a diffuse bulb of percussion, 5 dorsal flake scars (including two 1-mm-long scars adjacent to the platform), feather termination, and no cortex. All intact edges exhibit discontinuous chipping damage, with scars <0.5 mm. The specimen is made of translucent tan chert visually similar to natural material in the excavation matrix. The érrailure, platform angle, and lack of cortex imply this is an artifact, while the diffuse bulb of percussion and apparently local raw material imply a geofact (Patterson 1983; Peacock 1991).

The edge damage is ambiguous, derived from either human action or geological action such as streambed abrasion (see Hosfield and Chambers 2003). It was found in the 1/8 in. screen for XU 20 Level 10, which is North 498-499 m, East 90-91.5 m, Elevation 100.4-100.5 m in our grid system, and 65-100 cm below the present sloping ground surface. Given the slope of the hill and location of the Stratum II-Stratum III contact, the flake could be derived from the geological stratum (II) from which mammoth bone was recovered elsewhere, or from the underlying, higher-energy, apparently alluvial Stratum III.

Figure 6. Artifact FS 479 (catalog #327). This is a complete flake from the screen in XU 20, Level 10. The ventral aspect is shown. The bars at base are 1 cm each. Photo by Jake Shapley.
The most unambiguous artifact is FS 261 (catalog #176; Figure 7), recovered in 2006. This specimen can be described as follows (Lubinski et al. 2009:85):

This flake fragment (Sullivan and Rosen 1985) lacking cortex has one intact lateral margin parallel with two prominent dorsal arrises, like a blade fragment. The length of one of these arrises has been traversed by a scar ~1 mm wide. A proximal notch-like feature exhibits 2-3 regular unifacial flake scars ~1 mm in length. This feature and the intact lateral margin also exhibit discontinuous, unifacial chipping damage with scars <0.5 mm. The specimen is made of red translucent chert, unique among the rocks found in the excavated matrix. The combination of patterned features, flake scars parallel to the medial axis, apparently non-local raw material, and lack of cortex imply this is an artifact (Patterson 1983; Peacock 1991), while the notch and edge chipping are more ambiguous (see Hosfield and Chambers 2003).

The fragment measures 13 x 16 x 3 mm, and has all edges broken transversely, except for a feathered lateral margin and a notched area on the proximal edge. Specimen FS 261 was found in situ in XU 12, Level 5, at North 500.874 m, East 92.093 m, Elevation 100.147 m. This find is about 23 cm below present ground surface and 15 cm above FS 279 (catalog #198), a mammoth-size metapodial bone (see Figure 8). Although it was found above the bone (Figure 9), it lies within the same geological stratum (Unit II).

Figure 7. Artifact FS 261 (catalog #176). This is a flake fragment from in situ in XU 12, Level 5, about 15 cm above mammoth-size metapodial FS 279. The dorsal aspect is shown. The bars at base are 1 cm each. Photo by Jake Shapley.
Figure 8. Location of flake FS 261 in relation to mammoth bone from XU 12 in 2006. Exposed on the floor are four mammoth-size vertebrae, a mammoth-size metapodial, a mammoth-size phalanx, a bovid cannonbone, and an unidentified fragment. The flagging tape in the wall indicates the find location of the flake (mislabeled FS 259 on the photo board). Photo 20060721_006 by Melissa Hogrefe.

Figure 9. Elevation backplot (modeled cross-section) of XU 12. Dot labeled "Artifact" is FS 261 flake. Graph shows all total station data for a 20cm wide strip (500.80 - 501.00 m North) of the unit shown in Figure 5. Unit extends from 92.0-93.5 m East. Figure by Pat Lubinski.
The three possible cultural flakes constitute a "site" about 7 m North-South by 4 m East-West, with a maximum depth of 100 cm below surface. The chronological relationship of the three specimens is not clear. When compared to the geological strata, FS 261 was found high in Stratum II, about 15-20 cm below the Stratum I-Stratum II contact (see Figure 9), and 15 cm above the nearest bone. On the other hand, FS 479 was found near the Stratum II-Stratum III contact, and may derive from either low in Stratum II or high in Stratum III. Assuming it derives from Stratum II, it could be either earlier or roughly contemporary with FS 261, depending on whether Stratum II is a single deposit or multiple deposits not distinguishable in the field. The stratigraphic position of FS 584 is uncertain. Given the ambiguity of the relationship between the three possible artifacts, and between these flakes and bone, the findings of substance for the project thus far are more paleontological than archaeological. No association between the three possible flakes and the bone can be demonstrated.

Bones found in place are depicted in Figure 10. Bone analysis is underway, and many specimens currently lack element and taxonomic identifications. This analysis is complicated by the lack of adequate Pleistocene megafauna comparative material at CWU. Nonetheless, some elements are definitely mammoth (*Mammuthus* sp.), and a number of others are definitely mammoth-size and probably mammoth. Other elements are definitely cattle family (bovid), probably *Bison antiquus*, or bison-size. Additional rodent-sized bone has not yet been examined. Given its "in progress" state, bone identifications and descriptions will not be provided here, but in a later report.

Four bone samples from 2005-2006 investigations have been submitted to three laboratories for radiocarbon dating; three from the mammoth left humerus, and one from the bovid metatarsal. These have returned three plausible age estimates. When taken in conjunction with two infrared-stimulated luminescence (IRSL) dates on sediment adjacent to the right humerus, ages of ~13,000-14,000 RCYBP or 15,500-17,000 CALYBP are inferred for both the mammoth and bovid (Table 4), although corroborating age estimates are needed. The radiocarbon assays have also provided δ13C dietary values of -25.5 and -26.2‰ for mammoth, and -24.5‰ for bison, when corrected by -5‰ using Sullivan and Kreuger's (1981) model for the relationship of collagen and dietary value. These values fall within the range of expected values from northern grazers, such as those measured from early Holocene bison at the Hudson-Meng site in Nebraska (Jahren et al. 1998).
Figure 10. GIS map of bones and artifact discovered in situ 2005-2009. Note especially the flake in XU 12, humerus in XU 11, scapula in XU 14, femur in XU 21, and atlas in XU 25. Map produced by Tom Winter.
Table 4. Age Estimates for the Wenas Creek Mammoth Site

<table>
<thead>
<tr>
<th>Method</th>
<th>Lab #</th>
<th>Material</th>
<th>Raw Age, 1 ( \delta )</th>
<th>Calibrated Age, 2 ( \delta )</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMS</td>
<td>Wk-18064</td>
<td>bone (mammoth humerus)\textsuperscript{a}</td>
<td>13,398 ± 58 RCYBP</td>
<td>15,547-16,324 BP\textsuperscript{p}</td>
</tr>
<tr>
<td>AMS</td>
<td>OxA-16755</td>
<td>bone (mammoth humerus)\textsuperscript{b}</td>
<td>14,010 ± 90 RCYBP</td>
<td>16,266-17,097 BP\textsuperscript{b}</td>
</tr>
<tr>
<td>AMS</td>
<td>Wk-20117</td>
<td>bone (bovid metatarsal)</td>
<td>13,788± 70 RCYBP</td>
<td>16,051-16,827 BP\textsuperscript{b}</td>
</tr>
<tr>
<td>IRSL</td>
<td>UIC 1688</td>
<td>sediment (Unit II base)</td>
<td>13,970 ± 1190 BP\textsuperscript{c}</td>
<td>11,540-16,300 BP\textsuperscript{d}</td>
</tr>
<tr>
<td>IRSL</td>
<td>UIC 1203</td>
<td>sediment (Unit III top)</td>
<td>18,280 ± 1580 BP\textsuperscript{c}</td>
<td>15,070-21,390 BP\textsuperscript{d}</td>
</tr>
</tbody>
</table>

\textsuperscript{a} Another AMS bone collagen C14 assay from the same mammoth humerus was rejected as anomalously young and internally inconsistent. The sample \([\text{Beta-207938}]\) yielded two assays over 1,000 years apart at 9,730 ± 40 and 11,000 ± 40 RCYBP.

\textsuperscript{b} \( \delta \) age ranges (or maximum extent of multiple 2 \( \delta \)-sigma age ranges) calibrated with CALIB 5.0 using intcal04 data set, present= 1950.

\textsuperscript{c} For IRSL ages, present set to AD 2000.

\textsuperscript{d} 2 \( \delta \)-sigma age range, present adjusted to 1950 for comparison to radiocarbon dates.

Future Research

A number of major research questions direct overall work at the site, and all of these are under investigation. Some of these questions are archaeological, while others are paleontological or geomorphological. Most touch on several research domains. The speed with which and degree to which we can address these questions and goals depends on future time and funding. Given the employment of most of the research team in academic settings, we can and will continue to work on these regardless of our success with obtaining additional research funding. However, the scope of the research will be considerably diminished without significant additional resources.

Question 1: What is the human involvement with the site? This is the principal archaeological question, and we hope to continue to address it through several means. First, we are planning a taphonomic analysis of the bones themselves to see if any provide evidence of human butchery, disarticulation, or movement. Second, we plan a detailed analysis of spatial relationships going beyond the simple backplot in Figure 9 to better model the three-dimensional relationship of sediments, bones, and artifacts. This will likely involve computerized GIS or CAD. Third, we plan a detailed examination of all collected lithics (chert fragments and ambiguous "possible" flakes) to evaluate their potential to be humanly produced. Finally, we plan on additional excavations, which may yield less ambiguous results than those found to date.

Question 2: What is the site's depositional history? This question connects archaeology and sedimentology or geomorphology, and will inform the first question by providing more details about the likelihood for contemporaneity of the flakes and bones. For the archaeology, it
relates to an evaluation of bone and sediment movement and alteration. We plan an analysis of bone orientation, refits, and weathering which may intimate the mode of bone accumulation or reveal a stratigraphic subdivision based on a weathering front on the bones. Analysis of sediments is underway, including particle size analysis that may allow for more secure or finer stratigraphic divisions. If significant additional funding can be secured, we hope to obtain a suite of single-grain optically-stimulated luminescence dates on coarse sediment grains, as well as soil micromorphological analyses to evaluate the age and movement of sediment bearing the bones and artifacts, and thus the strength of their association.

Question 3: What is the origin of the landform on which the site lies? As noted earlier, the landform may be a landslide, alluvial fan, or terrace. These three landforms would have different implications for depositional history of the archaeological site, as well as its relationship to the surrounding landscape. This largely geomorphological question may be addressed by analysis of collected sediment samples and a GIS-based map investigation of the hillside and surrounding landforms. If additional funding is obtained, we would also plan additional backhoe trenching.

Question 4: What animals are represented at the site? As noted above, the identification of bones from the site is currently in its early stages. We plan on more work in this area, which will have to involve visits to locations with comparative Pleistocene mammal materials, and will thus require some additional funding and time. We are also exploring the possibility of using ancient DNA from bone samples at the site.

Question 5: What were environmental conditions at the time of the mammoth? To address this question, there are several potential sources of paleoenvironmental proxy data. We have recovered some microfauna (e.g., rodent remains) which may address this question, and we plan to identify these bones for this purpose. A small sample of pollen and opal phytoliths was examined by a graduate student, and these indicate the potential for these data sources. We would like to obtain funding for professional analysis of pollen and phytolith samples. Another data source that would depend on funding is stable isotopic chemical analysis of the mammoth and bovid bones.
Acknowledgments

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Mehringer, Peter J., Jr, J. C. Sheppard, and F. F. Foit, Jr.

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Miller, S.J.

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Olsen, Stanley J.

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Roosevelt, Anna C.


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Walsh, T. J.

Warren, Claude N.
Waters, A. C.

Waters, Michael R., and Thomas W. Stafford, Jr.

Whitlock, Cathy, Andre M. Sarna-Wojcicki, Patrick J. Bartlein, and Rudy J. Nickmann

### Appendices:

**Appendix A: Excavation Forms**

1) Excavation Record Form
2) Bone Find Record Form

(following four pages)
Excavation Record  
Project: CWU Wenas Creek Mammoth Investigation 2009

<table>
<thead>
<tr>
<th>Site #</th>
<th>45YA1083</th>
<th>Date Page Started</th>
<th>Excavator(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excavation Unit #</td>
<td>North</td>
<td>East</td>
<td>Unit Size</td>
</tr>
<tr>
<td>Level #</td>
<td>Elevation: Top</td>
<td>Elevation: Bottom</td>
<td>Level Thickness</td>
</tr>
<tr>
<td>Elevations From:</td>
<td></td>
<td></td>
<td>Datum/control corner</td>
</tr>
</tbody>
</table>

Elevations From:  ☐ datum  ☐ ground surface  ☐ control corner  Datum/control corner name or location

form revised 24 June 2009

Description of Deposits:

<table>
<thead>
<tr>
<th>Color</th>
<th>Texture (e.g., silty clay, sandy loam)</th>
<th>Consistence (e.g., loose)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inclusions (e.g., many pebbles &lt;1cm)</td>
<td>Carbonate: (e.g., slight whitening; scattered ribbons)</td>
<td></td>
</tr>
<tr>
<td>Disturbance: % of level disturbed</td>
<td>By what? (e.g. rodent burrows, roots)</td>
<td></td>
</tr>
<tr>
<td>Other notes on deposits (e.g., geological stratum, soil formation, cultural horizons, tephra)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Artifacts and Samples Collected:  (Be sure to note material, count, in situ/in screen, # of bags for multi-bag samples)

<table>
<thead>
<tr>
<th>FS#</th>
<th>Description</th>
<th>N</th>
<th>E</th>
<th>Elev.</th>
</tr>
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<tbody>
<tr>
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</tbody>
</table>

Relevant Uncollected Materials:  (e.g., unmodified cobbles, burned stone, non-artifact CCS, etc.)

<table>
<thead>
<tr>
<th>Material</th>
<th>Count:</th>
<th>Weight (g):</th>
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<tbody>
<tr>
<td></td>
<td>&lt;3 cm</td>
<td>3-6 cm</td>
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<td></td>
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</tbody>
</table>

Features defined in this level:  (# & description)
### Excavation Record

#### Site: 45YA1083

<table>
<thead>
<tr>
<th>Corner Elevations:</th>
<th>SW</th>
<th>NW</th>
<th>NE</th>
<th>SE</th>
<th>Center</th>
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<tbody>
<tr>
<td>TOP actual</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BOTTOM actual</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BOTTOM target</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Elevation (m):**

**Depth below datum (cm):**

#### Plan Map: This map depicts excavation unit □ at top of level □ at bottom of level

(On map, label grid coordinates, note limits of excavation, in situ artifacts, features, areas of staining, areas of disturbance, etc.)

**Scale?** 1 block = □ 5 cm □ 10 cm □ other (explain):

Arrow Direction?
□ Grid North □ True North □ Other (explain):

#### Photographs:

<table>
<thead>
<tr>
<th>Date</th>
<th>Exp. #:</th>
<th>Description</th>
</tr>
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<tbody>
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<th>Exp. #:</th>
<th>Description</th>
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<tbody>
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</table>

#### Notes: (describe artifact distributions, extent of staining, and relationships between artifacts, stained areas, features & disturbances, etc.)

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### Bone Find Record

**Project:** CWU Wenas Creek Mammoth Investigation 2009

<table>
<thead>
<tr>
<th>Site #</th>
<th>Catalog #</th>
<th>FS #</th>
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<tr>
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<thead>
<tr>
<th>Excavation Unit #(#s)</th>
<th>Level(#s)</th>
<th>Date FS assigned</th>
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<tbody>
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</table>

<table>
<thead>
<tr>
<th>Recorder(#s)</th>
<th>Date removed to lab</th>
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<tbody>
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</tbody>
</table>

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**Bone Sketch:**

- **Dimensions & Orientations**
  - **Length (cm)**
    - Maximum Length
    - Length (long axis)
    - Width (perpendicular)
    - Thickness
  - **Bearing (compass degrees)**
    - (Declination set at ____________)
  - **Dip (degrees down)**
    - Long axis
    - Perp. axis
  - **Strike (bearing to down direction)**
    - Long axis
    - Perp. axis
  - Long axis dip/strike taken where? (top, bottom…)
  - Perp. axis dip/strike taken where?

- **Indicate**
  - high point, low point, any excavation damage, and important features (arrow points grid North)

---

**Total Station Shots:**

- **High Point:**
  - Date taken
  - North
  - East
  - Elevation

- **Low Point:**
  - Date taken
  - North
  - East
  - Elevation

---

**Outline:**

- Date taken
- Shot numbers
- Topography:
  - Date taken
  - Shot numbers

---

**Photographs:**

(Be sure to get at least one closeup of fully exposed bone to clearly show orientation, weathering, etc.)

<table>
<thead>
<tr>
<th>Date</th>
<th>Exposures</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
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</tbody>
</table>
**Bone Find Record**  
**Site:** 45YA1083  
**FS#:** ___________

**Bone Treatment:**  
- Butvar applied? (Circle one)  
  - Yes  
  - No  
- Samples removed from bone? (Circle one)  
  - Yes  
  - No  

(If Butvar applied, describe where & how many coats. If sampled, list FS# and describe here, and indicate location on sketch)

**Taphonomic Data:**

<table>
<thead>
<tr>
<th>Visible root etching? (Circle all that apply)</th>
<th>none</th>
<th>adhering roots</th>
<th>slight</th>
<th>significant</th>
</tr>
</thead>
</table>

**Root etching location?**

**Weathering on upper (skyward) surface:**  
- Surface Description (e.g., anterior)  
- Weathering Stage(s)

**Weathering on lower (groundward) surface**  
- Surface Description (e.g., anterior)  
- Weathering Stage(s)

**Uppermost skyward point marked on bone? (Circle one)**  
- Yes  
- No  

**Excavation damage? (Circle one)**  
- Yes  
- No  

Describe:

Notes on excavation damage & general state of preservation:

**Weathering Stages: (cortical)**

- 0 unweathered
- 1 some longitudinal cracking
- 2 light surface flaking, deeper cracking with angular edges
- 3 surface rough with fibrous texture, crack edges rounded and 1.0-1.5 mm deep
- 4 surface coarse, fibrous; extensive surface flaking; cracks penetrate to inner cavities
- 5 bone falling apart in situ  
  (Lyman & Fox 1989)

**Weathering Stages (compact)**

- 0 articular surfaces intact with no surface cracking
- 1 articular surfaces intact with some surface cracking
- 2 more than 50% of articular surfaces intact
- 3 less than 50% of articular surfaces intact
- 4 no articular surface area remains intact
- 5 large areas of fibrous bone exposed  
  (Todd et al. 1987)

**Identification:**

<table>
<thead>
<tr>
<th>Element</th>
<th>Justification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portion</td>
<td>Justification</td>
</tr>
<tr>
<td>Side</td>
<td>Justification</td>
</tr>
<tr>
<td>Taxon</td>
<td>Justification</td>
</tr>
</tbody>
</table>

**Notes (e.g., pertinent morphometrics, justification sources)**

**General Notes:**  
(e.g., bone orientation, preservation, identification, relationship to other bones. Use anatomical terms as possible.)
### Appendix B: Artifact Catalog

<table>
<thead>
<tr>
<th>Catalog#</th>
<th>FS #</th>
<th>Description</th>
<th>Unit</th>
<th>Level</th>
<th>Coordinates</th>
</tr>
</thead>
<tbody>
<tr>
<td>176</td>
<td>261</td>
<td>tertiary flake fragment (collected 2006)</td>
<td>XU 12</td>
<td>L 5</td>
<td>in situ</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>N500.874, E92.093, Z100.147</td>
</tr>
<tr>
<td>327</td>
<td>479</td>
<td>complete tertiary flake (collected 2007)</td>
<td>XU 20</td>
<td>L 10</td>
<td>in screen from N498-499, E90-91.5, Z100.4-100.5</td>
</tr>
<tr>
<td>470</td>
<td>584</td>
<td>secondary flake fragment (collected 2008)</td>
<td>XU 21</td>
<td>L 11</td>
<td>out of context but in level E ½: from N494.0-495.5, E92.75-93.50, Z101.05-101.10</td>
</tr>
</tbody>
</table>

### Appendix C: DAHP Site Form

(provided separately)