OCCURRENCE OF CULTURALLY MODIFIED BISON BONE ELEMENTS IN WEST-CENTRAL AND SOUTHWESTERN COLORADO: AN ARCHAEOLOGICAL ASSESSMENT FOR THE WESTERN COLORADO BISON PROJECT PHASE II

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DARG
Dominquez Archaeological Research Group

Cover
DARG 276, bison skull, sans mandible and a segment of the occiput.

Occurrence of Culturally Modified Bison Bone Elements In West-Central and Southwestern Colorado: An Archaeological Assessment For The Western Colorado Bison Project Phase II

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ABSTRACT

This is a History Colorado State Historical Fund grant (2019-M2-009) related project undertaken by Dominquez Archaeological Research Group for the purpose of conducting data collection and radiometric testing of culturally associated and culturally modified bison faunal elements specific to west-central and southwestern Colorado. The fundamental purpose of this report is to develop a more accurate understanding of the interrelationship of bison and the native occupants of the region and to share this knowledge with the scientific and academic community, the interested public, and with present day Ute peoples and other tribes whose ancestral home and hunting territory included west-central and southwestern Colorado. Resultant data was assimilated into comprehensive and subject specific databases. In addition to the 250 bison faunal elements identified in Phase I of the Western Colorado Bison Project (Shelton, Berry and Conner 2017) an additional 470 bison specimens were located during investigations conducted for this project (Phase II). Of these, 89 specimens are addressed in the body of the report with 402 specimens representing the Ziegler Reservoir Fossil Site (5PT1264) bison bone assemblage. All available specimens were analyzed and evaluated for cultural modification and other indicators and subsequent data was incorporated into both standard spreadsheets, tables and graphs, and electronic interactive databases and query maps. Radiocarbon dates obtained from culturally modified specimens have been added to Dominquez Archaeological Research Group's Colorado Radiocarbon Database Project (dargnet.org/net/RCPublic/RCGraph.html) and to the Western Colorado Bison Study website database (dargnet.org/net/bison/bison.html) both of which include query tools, critical information, images, and interactive maps.

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1.0 INTRODUCTION

Dominquez Archaeological Research Group, Inc. (DARG), in compliance with an award from the History Colorado State Historical Fund (2019-MS-009), conducted an archaeological assessment and research project to locate, identify, and document culturally modified bison faunal elements, specific to the west-central and southwestern Colorado region. The primary focus of the project is to identify those specimens having evidence of cultural modification, collect bone collagen samples from such, and to obtain radiometric and other associated data to be assimilated into a dynamic and interactive electronic database. This project was conducted under the direction of Carl Conner, Principal Investigator and Dr. Michael Berry, database architect. Holly "Sonny" Shelton was the project archaeologist. The DARG Western Colorado Bison Study website database (dargnet.org/net/bison/bison.html), created by Michael Berry during Phase I of the Western Colorado Bison Project (Shelton, Berry and Conner 2017) was updated with data from the present project.

A total of 19 museums within or near the boundaries of the project area were contacted and on-site visits made to examine collections and archives in an effort to identify any bison faunal elements or bison related information curated at these facilities. No traditional field work was involved as examination of the majority of bison faunal elements for cultural modification and associated data occurred at the identified museums. In addition, available historical documents, archaeological reports, archived documents, and images were reviewed in order to identify any reference to findings related to bison or bison faunal elements. Attempts were then made to locate any collected specimens that they might be examined for evidence of cultural modification and other available data. In total, 470 bison faunal elements, held by seven of the 19 participating museums and two citizens, were evaluated and documented. This aspect of the project occurred between 01/14/2019 and 5/10/2020 and was terminated unexpectedly due to museum closures mandated by the State of Colorado secondary to the Covid-19 pandemic of 2020.

Assessment of available bison bone specimens involved initial unaided visual inspection, use of a 50X-500X 0.3MP handheld multi-USB digital microscopic, an American Optical FORTY binocular microscope, and a boom mounted forensic articulating zoom stereo 3.5X by 90X digital microscope, and non-destructive ultra-violet pigment analysis. Photographic documentation was completed on all available specimens regardless of the presence of cultural modification. A series of comprehensive and comparative spreadsheets were developed to catagorize resultant data, which was also incorporated into the electronic databases. Bone collagen samples were collected from selected specimens including culturally modified specimens or specimens of particular interest. These were submitted for radiometric testing with results being entered into the Colorado Radiocarbon Database Project (dargnet.org/net/RCPublic/RCGraph.html). Additional investigations included locating items directly associated with specimens such as photographs, personal documentation and letters, newspaper articles, and professional literature including Southwest Lore. Interviews with local seniors and Native American elders also provided valuable information regarding specific specimens and bison hunting anecdotal information. Bone stabilization and preservation

technique information was provided to those curation facilities desiring such.

In order to provide educational opportunities to the interested public, a bison radiocarbon database – lacking specific location information – has been made available at the Western Colorado Bison Study website (dargnet.org/net/bison/bison.html). Further public education consists of a series of Power Point presentations and accompanying interactive lectures offered to organizations, museums and schools. The newly upgraded DARG website (dargnet.org), and at the Dominquez Archaeological Research Group FaceBook page, each available to the public, offer detailed information, high resolution photographs, 3-D images of faunal elements, and slide shows related to the Project's research.

2.0 Location Of The Project Area

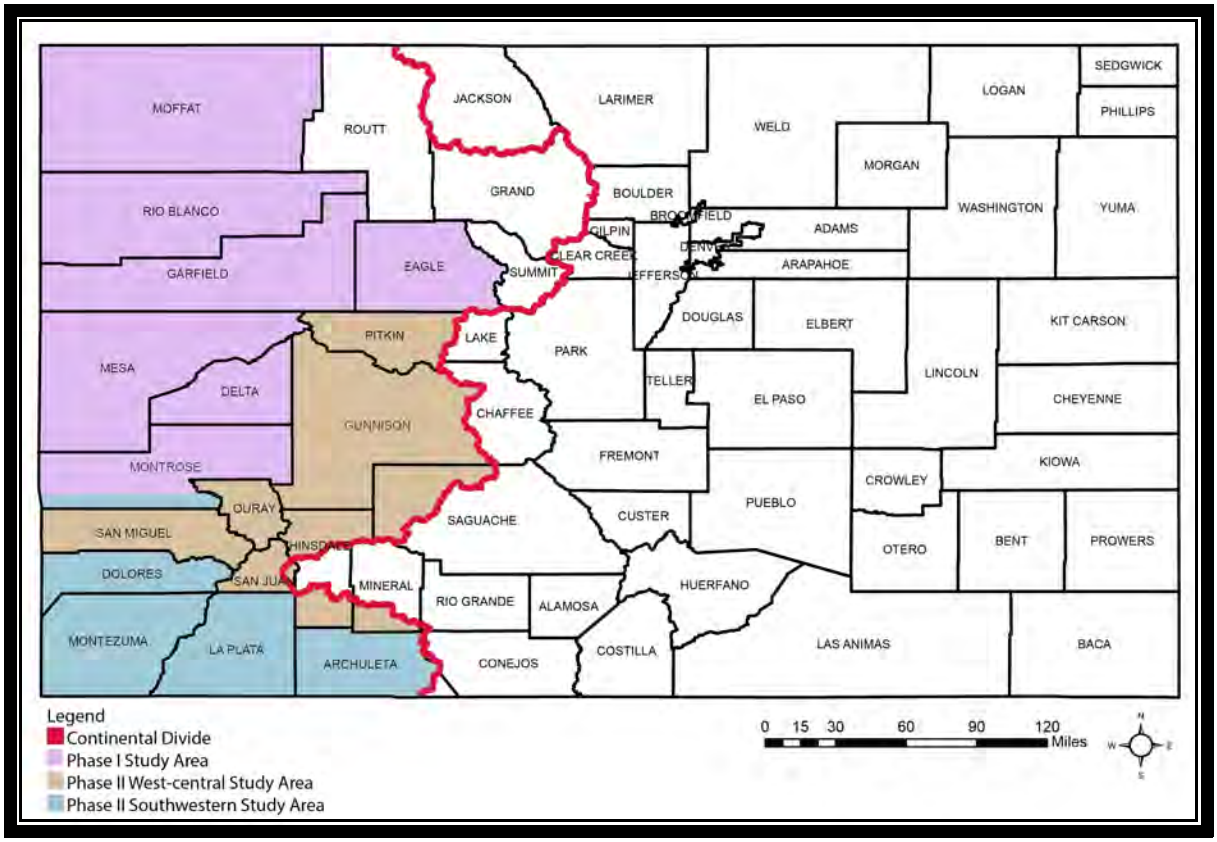

Figure 1. Location of the Project Area

The project, initially including only west-central western Colorado, was expanded in 2020 to encompass four counties in southwestern Colorado and a small portion of southern Montrose County. The total focus area of the project is located within thirteen counties west of the Continental Divide these being Archuleta, Dolores, Gunnison, Hinsdale, La Plata, Mineral, Montezuma, Montrose, Ouray, Pitkin, Saguache, San Juan, and San Miguel (Figure 1). Two physiographic provinces are represented (Fenneman 1931). The western aspect of San Miguel

county and the north-western aspect of Ouray, Gunnison, and Pitkin counties are located in the Colorado Plateau Province. The remainder of the study area, in it's entirety, is situated in the Southern Rocky Mountains Province.

The participating museums contacted and/or visited during the project included:

- Animas Museum, 3065 West 2nd Avenue, Durango, CO
- Aspen Historical Society, 620 W. Bleeker St., Aspen, CO
- Canyons of the Ancients Visitor Center and Museum, 27501 CO-184, Dolores, CO
- The Creede Historic Museum, 17 Main St., Creede, CO
- Crested Butte Mountain Heritage Museum, 331 Elk Ave., Crested Butte, CO
- Denver Museum of Nature and Science, 2001Colorado Blvd., Denver, CO
- Gunnison Pioneer Museum, 803 East Tomichi Ave., Gunnison, CO
- Hinsdale County Museum, 130 North Silver St., Lake City, CO
- The Holden/Marlot Mining and Ranching Museum, 40180 Cty. Rd 82, Aspen, CO
- Ouray County Historical Museum, 420 6th Ave., Ouray, CO
- Ouray County Ranch History Museum, 321 Sherman St, Ridgeway, CO
- Museum of the West, 462 Ute Ave., Grand Junction, CO
- The Pagosa Springs History Museum 96 Pagosa St., Pagosa Springs, CO
- The Rimrocker Historical Museum, 411 West 2nd Ave., Naturita, CO
- Saguache County Museum, 405 8th St., Saguache, CO
- San Juan County Historical Museum, 1557 Greene St., Silverton, CO
- Snowmass Village Ice Age Discovery Center, 130 Kearns Rd., Snowmass Village, CO
- Telluride Historical Museum, 201 W. Gregory Ave., Telluride, CO
- Underground Mining Museum, #9 USFS Rd #503, Creede, CO
- Western Colorado University, Hurst Hall 128, 1 Western Way, Gunnison, CO

The majority of specimens were located in museum collections excepting two non-cultural bison skulls and four non-cultural bison horn caps. Two horn caps are stored at the United States Forest Service Office in Gunnison, Colorado. Two additional horn caps, recovered from private ranch land many years ago, were examined with permission of the owner. In addition, two non-cultural bison skulls (DARG 274 and DARG 283) found in Gunnison and Saguache county in the early 1900s were examined with owner permission.

3.0 ENVIRONMENT

3.1 Climate

Climate in the Rocky Mountains and the Colorado Plateau is diverse and complicated with a broad range of temperature and precipitation fluctuations. Throughout time warm dry climate episodes have alternated with cool/wet periods resulting in changes to vegetation and topography that measurably affected the habits of humans and the game they hunted. Although the degree of present climate change is unprecedented, in general, today's climate is

characterized as steppe-type being semi-arid with temperatures ranging from -15° F during the winters to 100° F in the summers. Frosts occur frequently between mid-September and early June, resulting in a growing season of roughly 70-100 days (U.S.D.A. SCS 1982). Average annual rainfall ranges between 12 and 16 inches. Agriculture is limited by multiple variables including low rainfall, a short period of frost-free days, and low winter temperatures (U.S.D.A. SCS 1982). The optimum growing season for native plants is May through June during which time temperatures average around 55° F to 60° F. The surrounding higher elevations are characterized as cooler and moister with temperature variations that can be extreme even within seasonal boundaries. Annually, the high mountain temperatures average 5 degrees cooler with precipitation as much as 10 inches greater than the surrounding lower elevations (U.S.D.A. SCS 1975:244). Temperatures have been recorded as varying between -20° F in winter and 90° F in summer with a frost free seasonal range of 70 to 100 days. Agriculture is limited by the low rainfall, a short period of frost-free days, and low winter temperatures. It is of interest to note three record low temperatures in the Upper Gunnison Basin (UGB) region, previous to the inundation of the Blue Mesa valley, of -45° F in 1906, -43° F in 1916, and -47° F in 1924 (Western Regional Climate Center 2006).

3.2 Paleoclimate

Of all the natural events affecting the planet, climate fluctuation is the single most significant factor in floral and faunal evolution and topographic alteration which, combined, positively or negatively affect human adaptation and, ultimately, human survival. From an archaeological perspective it is critical to consider the response of prey animals and human predators to both long and short term climatic variation. Temperature changes of one or two degrees, occurring gradually or suddenly, will effect significant change in the amount and distribution of moisture upon the diverse topography of western Colorado. In response to these temperature changes vegetation will adjust elevational parameters and forest boundaries, including timberline, in order to accommodate individual specie requirements. For example, as described by Fall (1997) the lower aspect of timberline is more reactive to moisture with upper timberline being more sensitive to temperature changes. Climate research performed at Lily Pond and other locations throughout Colorado (Briles et. al.) provide evidence of greater expanses of tundra and larger lower elevation parklands at approximately 14,700 BP than are present today. During the Younger Dryas (11,000 to 110,000 RCYBP) most mountainous areas of western Colorado were affected by increased glaciation and colder temperatures. Interestingly, some regions, including parts of the Upper Gunnison Basin, were minimally affected with temperatures being tolerable to the degree that native fauna and humans existing during the Younger Dryas would have noticed little change and their lifestyle, even over several generations, would have been minimally affected (Meltzer and Holliday 2010). By the Late Pleistocene the lower boundary of timberline occurred 300 meters to 700 meters below the modern limit with a climate 2 degrees to 5 degrees Celsius cooler and receiving 7 centimeters to 16 centimeters more precipitation annually. Between ~9000 to ~6000 YBP the sub-alpine zone spanned a broader range of elevation with the upper timberline averaging 270 meters above the present maximum and summer temperatures from 1 degree to 25 degrees Celsius warmer. This increase in temperature combined with stronger summer monsoons increased

precipitation by 8 centimeters to 11 centimeters annually. As a result the lower boundaries of the sub-alpine and Montaine zones reached lower elevations. From 6000 YBP to 4000 YBP precipitation waned and temperatures cooled approximately 1 degree Celsius lower than the present and vegetation boundaries gradually retreated upwards. By 2000 YBP a more familiar climate dynamic of increased winter precipitation prevailed in the majority of the study area. These climate changes dictated adaptive measures taken by both wildlife and humans of abandoning unproductive or increasingly hostile environments to seek out more welcoming landscapes. Humans engaged in ongoing modification of ineffective survival strategies by developing new coping skills, new tools, and adaptive survival techniques initiated not only in response vegetal resource changes but also to the presence, absence, and movements of large game animals as they adjusted to the results of climate change.

3.3 Life Zones

Elevational life zones throughout the project area consisted of approximately 5% Desert Canyonlands and Steppe (5000 to 7000 ft.); 20% Foothills Pinyon/Juniper woodlands and Montane shrubs, (6000 to 8000 ft.); 40% Montane (8000 to 10,000 ft.); 25% Subalpine (10,000 to 11,500 ft.); and 10% Krummholz and Alpine tundra (11,000 ft. and above). The life zone boundaries of western Colorado are poorly defined with vegetation intermingling at almost all elevational boundaries (Gregersen 2010). Paleoclimate during the Holocene Epoch would have repeatedly expanded and retracted these life zone boundaries dependent upon associated cool/wet and warm/dry episodes, with all life zones extending to lower elevations in cool/wet periods and retreating to higher, more moist elevations during warm-dry occurrences (Miller 2012,).

3.4 Modern Flora and Fauna

Flora of the various Provinces consists of vegetation specialized to each of the aforementioned life zones and includes a remarkable diversity of species. Alpine plants include many dwarf species and flowers such as Rocky Mountain columbine, dwarf astor, golden draba, and barrenground willow. Subalpine trees and herbage include wild strawberry, larkspur, candytuft, columbine, iris, skunk cabbage, wild raspberry, willow, Bristlecone pine, Engelmann spruce, and fir. Montane forest life boasts aspen and pine forests with a variety of native and introduced grasses, ferns, and red willow while the Woodlands and Foothills consist primarily of pinyon and juniper forests with occasional stunted aspen, Gambel oak, and various drought tolerant flowers, forbs, and grasses including Indian ricegrass, astor, penstemon, and cacti. Finally the lower elevation deserts and canyon lands produce rugged grasses, cacti, sego lily, globe mallow, rabbit brush, yucca, common sagebrush, and sparse pinyon pine and juniper trees (Gregersen 2010) and an assortment of introduced, invasive, and noxious weeds.

Fauna throughout the project area is abundant. Large mammals include carnivores such as mountain lion, black bear, and wolves while herbivores include Rocky Mountain bighorn sheep, desert bighorn sheep, mountain goat, elk, and mule deer. Today, the only bison in the region are those found in zoos, and private or state owned herds. The more common medium

size mammals include coyote, red fox, and bobcat, with many species of smaller mammals including badger, raccoon, skunk, marmot, beaver, pika, chipmunk, and assorted mice and voles. Raptors and other avian life range from the bald and golden eagle, osprey, great horned owl, to Miriam's turkey, Gunnison sage grouse, blue grouse, American dipper, western bluebird, a variety of tanagers, vireos, warblers, finches, and the diminutive and pugnacious broad tailed, black chinned, and rufus hummingbirds. Reptile, amphibian, and insect species, including the buffalo gnat, are varied and diverse.

A wide variety of domestic livestock is also found throughout the project area. Domestic beef and dairy cattle, horses and mules, musk oxen, sheep, goats, hogs, and domestic fowl have been common in the area since the late 1800s when farming and ranching operations were first introduced into the region. Recently domesticated exotics, raised to supply the exotic meat industry, include beefalo, musk oxen, llama, and several meat goat species.
These historic and modern introduced bos species negatively affect the project as the bones of these and non-bos species, are frequently found and at times confused with bison bone by amateur, avocational, and professional archaeologists. Of greater concern to the Project is the ongoing issue of bison bone specimens have been disregarded by professionals and the public as domestic cattle bones and therefore, not being collected or documented.

4.0 GEOLOGY

The geology within the study area includes two physiographic provinces; the Southern Rocky Mountains, and the Colorado Plateau. The Southern Rocky Mountain Region consists of metamorphic and granite rock that was uplifted to form the cores of the region's mountain ranges. The predominantly hard, crystalline rock structure is resistive to erosion and produces a multitude of high, jagged peaks, many towering above 14,000 feet in elevation, that define the topography and character of the region. Anticlinal arches and intermountain basins are interspersed throughout the region and form high elevation, isolated parks amenable to large game. The fundamental structure of the modern Rocky Mountains was formed 70 to 80 million years ago in the Late Cretaceous (Mesozoic) during the Laramide Orogeny. Geologic uplifting that occurred during this time resulted in both thrust and reverse faulting forcing older strata over the younger strata. As uplifting continued, marginal basins subsided and were eventually filled with massive amounts of clastic sediment.

By the time tectonic activity and uplift began to slow and finally cease through the Neogene (Pliocene) and Quaternary periods (Cenozoic), the Southern Rocky Mountains and the Colorado Plateau had attained impressive vertical movement of greater than one mile. During the Pleistocene Epoch cyclical glacial movement created alpine cirques and glacial moraines. Glacial deposits and glacial till is evident in high elevation basins. Today, small, high elevation residual glaciers and ice patches are all that remain of the great ice masses from this epoch. Over time intermittent episodes of extreme erosion have washed away and redeposited soft sediments creating the modern topography of deep canyons, entrenched rivers, and rugged landscapes seen today.

The majority of the study area lies within the Colorado Plateau. This region consists primarily of relatively horizontal sedimentary rock layers altered by eons of uplift and erosion into broad basins separated by up-warps, ridges, and plateaus. This province, drained by the Colorado River, has been eroded and shaped into multitudinous canyons, mesas, and cuestas resulting in a complicated and harsh landscape; much of which is remote, isolated, and extremely difficult to access. Outside of the Colorado Plateau the High Plains and Upper Sonoran deserts are bisected by major drainages such as the Colorado, Gunnison, and San Juan rivers. In the lower elevations Quaternary terraces and pediments, some composed of Mancos (Cretaceous) shale, enclose broad river valleys that intermittently narrow into deep canyons cutting through various formations ranging from Precambrian rock to Mesa Verde Group (Cretaceous) formations.

4.1 Alluvial Deposition Processes (adapted from Berry et al. 2012)

Alluvial deposition processes in the non-mountainous regions of west-central Colorado significantly impact the burial, preservation and ultimate exposure of bison faunal remains. An understanding of these processes aides in predicting where bison remains may be interred and in anticipating areas in drainages and cut banks where they are most likely to be exposed. The majority of bison faunal remains are recovered from Holocene soils. In the middle Holocene, from 6500 to 4500 radiocarbon years before present (RCYBP), cool/moist climates caused incision, though erosion in this interval was not sufficient to remove the heavy Pleistocene gravels. Once these gravels were exposed drainages started a cycle of valley widening, usually undercutting the braided alluvium and forming vertical walls. In the late middle Holocene, from 4500 to 2500 RCYBP, drier conditions prevailed and resulted in deposition of the second major alluvial unit. Variable climatic conditions in the late Holocene, after 2500 RCYBP, caused alternate periods of incision and deposition.

Unlike the period of earliest Holocene alluviation, the volume of sediment available during the second period was much less, so the bulk of the middle Holocene deposits remained in the upper reaches of main drainages and in their tributaries. These deposits display a fan-like geometry overlying the early Holocene alluvium and can deeply bury faunal remains.

Another period of incision occurred in the late Holocene and in many perennial streams, the incision took place sometime after 2800 but before 1100 RCYBP. In many ephemeral streams where the second deposit is preserved, the second and third periods of alluviation are almost continuous. The evidence of incision in this period is fleeting since the incision primarily followed the path of least resistance and re-excavated the arroyos formed in the middle Holocene.

Deposition of the third alluvial deposit started as early as 2000 RCYBP, was interrupted and partly incised during the Little Ice Age (ca. 600 to 150 years ago), and resumed deposition afterwards. Today drainages are still adjusting to the sediment release, and down-cutting since the turn of the 19th and 20th centuries is more properly considered avulsion; the normal reworking of sediment in a drainage on the scale of hundreds of years, as opposed to incision in

the middle and early part of the late Holocene, and dissection in the Late Pleistocene. Incision occurs on the scale of thousands of years, and dissection, on the scale of tens of thousands of years. It should be stated clearly that the volume of sediment released from chemical weathering in the highlands is directly proportional to the duration of the preceding cool/moist climates.

The occurrence of cultural horizons, including culturally modified bison bone, in alluvial sequences is predictable over a large region of west-central Colorado. Sites are commonly present at the base and near the top of Kaycee-equivalent deposits, and in most deposits overlying Kaycee-equivalent deposits.

4.2 High Elevation Depositional and Chemical Processes Affecting Bone Weathering

Recent evidence from both Phase I and Phase II of the Western Colorado Bison Project has revealed a significant number of high elevation bison remains recovered from elevations that range from 8000 feet above sea level to approximately 10,067 feet above sea level. Depositional and chemical processes at high elevation can differ to some degree from processes at lower elevations and result in distinguishable weathering effects on bone. Due to the increasing number of bison bone specimens recovered from high elevations in western Colorado, it is important to explore and consider the effects of these processes on bone.

During Phase I of the study high elevation bison bone was noted atop the Grand Mesa in Mesa County and in the northern and central aspects of the Flat Tops Wilderness Area of Rio Blanco County. During a Phase II visit to the Denver Museum of Nature and Science the unexpected discovery of a large, well preserved bison skull, with little associated information initiated a search for it's origin. After extensive investigation by DARG archaeologist Barbara Davenport, it was eventually determined to have been found by spelunker R. Graham in September of 2002 at Bison Site Cave (5GF2734) on the Flat Tops Wilderness Area of Garfield County. The specimen was situated inside the cave which is located within a mile of the Ute Trail Corridor at an elevation above 8000 feet.

Within the Phase II study area bison remains have been found at high elevations at and above 8000 feet in the vicinity of Cochetopa Pass, the Crested Butte area, in Taylor Park, and in a Folsom pithouse at the Mountaineer site, 5GN2477, located atop Tenderfoot Mountain, a high mesa near Gunnison, Colorado. At slightly lower elevations within both the Phase I and Phase II study areas, bison bone has been found exposed in deflating forest duff, eroding out of small drainages and cut-banks, and from the sides of irrigation ditches located on high country farms and ranches. Among the several hundred bone specimens collected from the Tenderfoot site (5GN1835) a bison phalange was found situated at a slightly lower elevation of 7680 feet.

High elevation depositional processes can significantly affect the quality of preservation of buried bone specimens. These processes differ to some degree between Montane, Transitional, Sub-alpine and Alpine life zones with measurable differences in areas

of past volcanic activity. The majority of Alpine soils are weakly developed and poorly sorted with some parent material originating from bedrock weathering. Shide and Munroe (2015) found that Alpine soils primarily form due to the accumulation of organic matter and leaching of minerals from mobile lithic elements such as scree. Thin mantles of residual glacial sediment may contribute significantly to the continuity of alpine pedogenises as these glacial sediments tend to cover bedrock. Alterations in soil depth and chemical composition of surficial sediments can be dependant upon the origin of the glacial contents, the amount of till deposited, and the extent of reworking secondary to erosional slope processes. Most alpine soils have low bulk density and high phosphorus fixing capacity. Though dependant upon moisture availability, decomposition is usually slow and organic matter accumulates as duff. On steeper slopes duff and soil is more likely to erode away resulting in exposure and subsequent mechanical weathering of any buried bone material. On gentle slopes and in high elevation parks erosion is less dramatic and buried bone is less likely to be fully exposed as soils have accumulated to deeper levels. Specimens recovered from these sheltered areas tend to be found in a more stable state of preservation due to a lesser degree of mechanical weathering. Often the interior orifices of the bone elements are filled with sediment and duff while the bone surfaces host mosses and lichens. Impacted sediments are frequently useful in determining the soil types a recently exposed bone was buried in while layering of small clasts within the sediment may provide information on the direction of water flow affecting a specimen. The resultant information can be useful in determining movement of the element over time. Lichenometery, most commonly used to date the recession rates of glaciers, can occasionally be employed for establishing a broad date range providing the bone surface has not been altered for an extended period of time and that the lichen species are suitable for testing.

The pH of alpine soils is a significant factor in the degree of preservation of bone artifacts found at elevation. Those bison faunal elements recovered from natural non-archaeological alpine geosols exhibit varying degrees of weathering and mineral coloration. Alpine soil pH evolves from a combination of non-organic matter derived from geological sources and decomposing organics including plants, humus, and other composting detritus. The pH of these combined sources can range from low (acidic) to high (alkaline) soil pH and tend to have a midrange of a pH of 5 to 8 (Hunt 2007). Soils in high elevation conifer forests are usually acidic podzols while the thinner soils above timberline are more neutral or slightly alkaline. Organic collagen in bison bone begins the weathering process as the collagen hosts a microbial population which initiates the decomposition process resulting in the formation of organic and carbonic acids. As collagen is lost the ridged structure of the bone weakens as hydroxyapetite crystals of both thin and dense bone are compromised. Soil pH contributes to weathering by altering the chemical balance between the bone and surrounding soils. For example, hydrogen ions from acid soils can replace calcium from hydroxyapetite thereby leaching it away from the bone tissue. Bone found in low acid soils with higher calcium content is more likely to be stabilized and will weather at a slower rate. Therefore, bison bone found below timberline in the acidic soils consisting of conifer and other organic duff will weather at a more rapid rate than bone buried at higher elevations in alkaline soils having a higher calcium ratio. The melting forefronts of high elevation ice patches, often covering

undisturbed prehistoric alpine tundra surfaces, have produced well preserved bone and other prehistoric cultural artifacts and paleontologic specimens. As ice patches, unlike glaciers, do not move, the preserved and protected artifacts are subjected to minimal mechanical, weathering, and external force damage. The extreme cold and low oxygen content of the ice patch environment minimize bacterial colonization and inhibit fungal, lichen, and vegetal growth that contribute to decay. Safely secluded beneath the ice these sites and artifacts do not yet tempt unauthorized collectors. As the ice patches melt these artifacts briefly retain a state of preservation that is unprecedented in most North American archaeological sites yet, once exposed, they quickly succumb to deterioration therefore, the window of opportunity for recovery is brief. A non-cultural bison skull dated to 967 ± 15 BP, discovered in Glacier National Park by Dr. Craig Lee (Lee et. a 2014) in 2012, may merely provide evidence that bison were present at that elevation or it may indicate intentional placement by humans. Archaeological artifacts recovered from ice patches investigated by Dr. Lee from sites in 16 national parks and forests include several ice patch locations in eastern Colorado. Dr. Lee's remarkable work has produced evidence of large game hunting as represented by a well preserved 10,300 year old atlatl fore-shaft recovered from an ice patch north of Yellowstone National Park. Additional ice patch artifacts, such as textiles and stone tools, provide further evidence of human exploitation of high elevation resources.

Until the approximately the late 1990s large, persistent ice patches were known to exist in the remote saddles and alpine slopes of many mountains near Crested Butte, Colorado. Some of these ice patch locations included Whetstone Mountain, Mt. Emmons (Red Lady Mountain), Gothic Mountain, and Schofield Pass. In the early 1960s an ice patch locally referred to at the time as Blue Glacier, was located southwest of Scofield Pass in a north-facing basin of Mount Baldy. This ice patch contained small crevasses and caverns of blue ice (Shelton 2019, personal knowledge) large enough for a child to crawl into. Although this ice patch is no longer perpetual, there are several remaining in the area that would be worthy of investigation to determine if artifacts are in process of being exposed. It is not inconceivable that archaeological evidence that includes bison remains or large game hunting tools may still be present in the remote high elevations of western Colorado which still contain these residual ice patches.

5.0 CULTURAL HISTORY

Cultural resource investigations in the region have yielded surface diagnostic artifacts and excavated cultural materials consistent with the regional cultural history. In general, local and regional archaeological studies suggest there was nearly continuous human occupation of western Colorado for the past 13,000 years. Evidence provided by chronometric diagnostic artifacts and radiocarbon analyses indicate regional occupation during the following Eras: Paleoindian (big-game hunting peoples, ca. 13,000 - 6500 BC), Archaic (hunter/ gatherer groups, ca. 6500 BC - AD 300), Formative (horticulturalists/ foragers, ca. AD 300 - AD 1250), Pre-horse hunter/gatherers (Early Numic, ca. AD 1250 - AD 1550), and Historic (the early historic horse-riding nomads and historic tribes, Late Numic, ca. AD 1550 - AD 1920). Overviews of the prehistory are provided in documents published by the Colorado Council of Professional Archaeologists' entitled *Colorado Prehistory: A Context for the Northern*

Colorado River Basin (Reed and Metcalf 1999), and in the Colorado Historical Society's publication entitled *Colorado Mountains Prehistoric Context* (Guthrie et al. 1984)

In southwest Colorado the Formative Era documentation provided by chronometric diagnostic artifacts, radiocarbon analyses, and tree-ring data indicate regional occupations during Basketmaker II (1000 BC to AD 500), Basketmaker III (AD 500-750); Pueblo I (AD 750-900), Pueblo II (AD 900-1150), Pueblo III (AD 1150-1300), and Post Pueblo (AD 1300-1840) cultural periods. An overview of the prehistory of the that region is provided in the Colorado Council of Professional Archaeologists' publication entitled *Colorado Prehistory: A Context for the Southern Colorado River Basin* (Lipe et al. 1999).

The Gunnison Valley has provided one the most detailed records of the past 13,000 years in western Colorado. Radiocarbon data from the excavation of 25 sites (Euler and Stiger 1981; Jones 1982, 1984; Stiger 1981) in the Curecanti National Recreation Area indicates a nearly continuous occupation of the Gunnison Basin for the past 10,000 years (Jones 1984:19-21). Jones reports that changes in the frequency of the radiocarbon data suggest several periods of intensive utilization of the area dating between 6700 and 5200 years B.P. (ca. 4700-3200 BC), 4900 and 2600 years B.P. (ca. 2900-600 BC), and between 2500 and 1800 years B.P. (ca. 500 BC - AD 200).

In the Gunnison Basin, surface finds of Clovis, Folsom, Hell Gap/Agate Basin, Cody Complex, and James Allen projectile points on sites and as isolated finds indicate that the entire PaleoIndian period is represented there (Baker et al. 1980; Coe et al. 1980; Reed and Scott 1980). In general, data from excavated PaleoIndian sites are scant for the western Colorado region; however, some of the oldest radiocarbon dates for the state (11,790±1700 B.P. and 14,487±610 B.P.) have been acquired from Gunnison County site 5GN189 (Mueller and Stiger 1983). Also, a hearth dated 9791±830 B.P. at 5GN205 is considered to be Folsom (Early PaleoIndian) in origin (Euler and Stiger, 1981:42,59). In adjacent Chaffee County, site 5CF358 yielded a Milnesand Point from Component I (dated ca. 10,000-9500 B.P.), a PaleoIndian occupation preserved at 40 centimeters below present ground surface (Black 1986:91).

At altitudes of 8000 feet or more in Colorado, pole and mud structures have been found in the Curecanti National Recreation Area near Gunnison and the Windy Gap site near Granby. Radiocarbon dates of ca. 5270-4980 BC and ca. 3590-1810 BC from the Curecanti sites compare with Windy Gap's dates of ca. 6500 BC, ca. 2740 BC, and ca. 2280 BC (Cassells 1983:73-80). South of the town of Gunnison at the Mountaineer Archaeological Site located atop Tenderfoot Mountain is evidence of some of the oldest habitation structures in Colorado. This site has over 60 concentrations of prehistoric artifacts suggesting as many separate occupations over many years (Stiger 2003).

One of excavated portions of the Mountaineer Site contained projectile points and structures associated with the Middle Paleoindian Folsom Tradition and has been dated ca. 10,400 BC. A habitation structure identified there is characterized as consisting of a shallow

basin about 3.5m in diameter encircled by rocks (cleared from the interior). Remains indicated it had a tipi-like superstructure of aspen poles and other plant material plastered over with mud. The floor included a fire-pit (hearth), a storage pit, and an anvil-stone likely used for cracking large animal bones to obtain the marrow. The characteristics of the structure and its interior features, spacial distribution of camp activities, and a trash disposal area suggest occupation for an extended period (ibid.).

Little is known regarding a Formative tradition occupation of the Gunnison Valley. However, excavations at site 5GN810 produced three hearths that dated ca. AD 535, an indication of a Late Archaic/Formative period occupation. This is a significant find because it had previously been assumed that the Fremont and Anasazi had little influence in this area, and that the Late Archaic settlement/subsistence lifeways continued until they were merged with the Numic (early Ute) ca. AD 1300. Other evidence of Formative cultures' influence in the area is found in surface finds of black-on-white and corrugated pottery. Also, rock art found at site 5GN928 in the Gunnison area, consisting of a white-painted geometric design and a triangular bodied anthropomorph, is considered stylistically to be attributed to the eastern Fremont (Scott 1981:1).

Early Ute occupation of the region has been found at the Pioneer Point Site, located in the Curecanti National Recreation Area. There, over seven hundred sherds of Uncompahgre Brownware ceramics (micaceous and non-micaceous tempered) were recovered. These are associated with features dated ca. AD 1466, and AD 1476 (Dial 1989: 19). Desert Side-notched and Cottonwood projectile points were also found at the site.

Historic records and military documents describe occupation or use of landscapes and resources within the study area by EuroAmerican trappers, traders, settlers, miners, and ranchers and farmers . An overview of the history of the region is provided in the Colorado Historical Society's publication entitled *Colorado Mountains Historic Context* (Mehls 1984). Additional data can be found in the historical context published by the Colorado Council of Professional Archaeologists entitled *Colorado History: A Context for Historical Archaeology* (Church et al. 2007).

6.0 PREVIOUS WORK

The initial phase of the Western Colorado Bison Project (WCBP Phase I) research project was made possible by a Colorado State Historical Fund grant (2016-AS-008) with the project being developed and undertaken by Dominquez Archaeological Research Group (DARG) of Grand Junction, Colorado. The project was initiated in 2017 and concluded in 2019 with submission of a report entitled The Occurrence of Culturally Modified Bison Bone Elements in Northwest and West-Central Colorado: An Archaeological Assessment for the Western Colorado Bison Project. The study area included the western Colorado counties of Delta, Eagle, Garfield, Mesa, Moffat, Montrose, and Rio Blanco and consisted of successfully conducting an assessment of curated culturally modified bison faunal elements specific to

northwest and west-central Colorado.

Until the advent of the WCBP Phase I project no other comprehensive data collection efforts dedicated specifically to bison procurement west of the Continental Divide in Colorado had been completed. Over the past decade multiple archaeological projects undertaken by Grand River Institute of Grand Junction, Colorado had produced evidence of bison and bison procurement activity on Colorado's western slope. Although Meaney and Van Vuren's (1993) record searches of bison distribution in the west provided information to conclude that bison were present in parts of northwestern Colorado it quickly became clear that very little research specific to the occurrence and procurement of bison in Colorado west of the Continental Divide had been done and the development of the WCBP was inspired by this realization.

Phase I of the project coordinated with local and regional museums within the study area in order to locate and examine and collect data from any bison faunal elements or bison related information within their collections. Data collection concentrated on identifying evidence and types of cultural modification, the elements original location, weathering stages, bone collagen sampling, and scientific, historic, and anecdotal comments related to each element evaluated. All available specimens were analyzed and evaluated for cultural modification and other indicators via visual and microscopic examination and reviews of formal archaeological reports. The resultant data was assimilated into comprehensive and professionally accessible databases with those radiocarbon dates obtained from culturally modified specimens being incorporated into the Dominquez Archaeological Research Group's Western Colorado Bison Project interactive database and the Colorado Radiocarbon Database Project. Each of these electronic resources provide interactive maps and query tools.

The WCBP Phase I study produced a total of 250 faunal elements with 171 specimens available for direct visual inspection. These were evaluated for cultural modification defined as: possible butchering, butchering chop marks, spiral fracture, stone tool cutting, use wear polish, impact indentation, craniectomy, abrasion striations, and metal tool cutting. In addition, evidence of human manipulation absent of surface modification, such as the intentional rearrangement of faunal elements due to butchering activity or for ceremonial purposes, was noted. Burning was noted as cultural modification when it was deemed secondary to human activity such as cooking. Non-cultural modification including carnivore and rodent gnaw marks, mammal claw scratches, root etching, burning, oxidation, and mineral staining were noted when evident. Data collected from the 79 remaining specimens not available for direct visual inspection was accessed from photographs, report content and occasionally supplemented with input from the archaeologists who had recovered the bones. Of the 250 bison bones evaluated in Phase I, a total of 96, an astounding 38.4%, exhibited evidence of some form of cultural modification or human manipulation. Human manipulation of bone with no additional cultural modification totaled 11% of all culturally modified bone.

Bone collagen samples with previously obtained radiometric dates and those directly submitted for testing during Phase I totaled 35 with dates ranging from 11,700±90 BP to AD 1830±40. The resultant bison bone collagen dates revealed four distinctive episodes of activity

beginning in the Formative Era and moving forward into the Historic period. Formative Era peoples, limited to hunting on foot, would likely have taken bison on an intermittent or occasional basis thereby contributing to the low incidence of culturally modified bone identified during this period. Intermittent drought episodes throughout the region would have resulted in fluctuations in bison populations within the study area. Some bison may have succumbed to starvation but significant numbers likely migrated northward and northeast both to higher elevations and into the more productive ecosystems of the Yellowstone, Missouri, Platte and Kansas river drainages. Excluding a date of 11,790 BC to 11,410 BC produced by DARG 66, the Wyman Museum *Bison priscus* skull in Craig, Colorado, and concentrating on the higher calibration percentages, the most frequent occurrence of bison within the Phase I study area spanned a time period between the middle to late 1400s and into the early 1800s. These dates fall within the later Medithermal climatic period and include the Little Ice Age which occurred between AD 1300 and 1870. This time of predominant cool/wet climate with interspersed warmer episodes resulted in an environment capable of sustaining a substantial western slope bison population. A striking concentration of dates beginning AD 1600 and into the early 1800s was likely indicative of the presence of the horse mounted Ute and speaks to hunting by intrusive tribes that would likely have included the Shoshone whose rock art within the study area frequently depict bison.

The work completed in Phase I of the WCBP contributed to a more accurate understanding of the interrelationship of bison and the prehistoric and historic occupants of the western slope of Colorado and inspired continuation of the Western Colorado Bison Project as Phase II.

7.0 OBJECTIVES

The primary objective of Phase II of the Western Colorado Bison Project is to enhance scientific understanding of human interactions with bison west of the Continental Divide in west-central and southwestern Colorado. The intention of the project was to locate curated bison bone specimens, inspect them for evidence of cultural modification, analyze and document such evidence and, when possible, obtain bone collagen samples to submit for radiometric testing. The resultant data, including retrievable radiocarbon dates and select associated information, was entered into the Colorado Radiocarbon Database Project and the Western Colorado Bison Project Database and made available to interested professionals, academics, students, and the public. Museums in eleven of the thirteen counties in west-central Colorado were contacted and/or visited and, with permission, any available bison faunal specimens, associated materials, and information were evaluated. Archaeological reports, publications, historic documents, and various grey papers found to contain bison related information were also reviewed and gleaned for data. The results of the effort were used to supplement and enhance previously collected data found in Phase I of the Western Colorado Bison Project (Shelton, Berry and Conner 2017). Those bison faunal elements not exhibiting cultural modification were also incorporated into the database (and samples taken) to provide baseline data useful for analyzing population concentrations, migration patterns, species

differentiation, and in anticipation of use by future interested researchers and students.

8.0 METHODS

Project work included: coordination with regional museums, curators, volunteers, and individuals; examination of available curated bison faunal elements in collections; record and document searches. Examination and documentation of said elements and any associated information was performed. Bone collagen was collected from those elements with cultural modification and was submitted for radiometric testing. Spreadsheet forms with data categories were developed and all data was assimilated into electronic databases. Ultimately, this data was integrated into the Western Colorado Bison Study website (dargnet.org/net/bison/bison.html), a supplement to the Dominquez Archaeological Research Group's Colorado Radiocarbon Database Project. The database has a query/search system that provides specimen attributes, radiometric dates, and site data, photographs of the documented specimens, an interactive map, and other relevant information. The Western Colorado Bison Study website is a dynamic tool that continues to evolve as up to date information is added.

The methodology included:

The establishment of a project boundary that included Archuleta, Dolores, Gunnison, Hinsdale, La Plata, Mineral, Montezuma, Montrose, Ouray, Pitkin Saguache, San Juan, San Miguel counties:

- A review of selected archaeological reports, historical and military documents, museum collections, archives and records, and anecdotal information referencing bison faunal elements, the presence of bison, and bison hunting within the study area;

Assessment of data collected from bison faunal elements found in the previously listed museums and in regional curation facilities including the Western Colorado University C. T. Hurst Museum in Gunnison, Colorado, the Museum of the West in Grand Junction, Colorado, the Denver Museum of Nature and Science in Denver, Colorado, and Canyons of the Ancients Visitors Center and Museum in Dolores, Colorado.

Excepting those bison bones that were inaccessible due to curation restrictions, unknown curation location, the unanticipated natural disaster of the 2019 Hinsdale County flood, and the 2020 Covid-19 pandemic health crisis, faunal elements were examined to determine the presence or absence of cultural modification with the majority of such being subjected to microscopic analysis. In addition, with permission of the curation facility, a small number of bones were examined using the previously described digital forensic microscope made available by the Colorado Mesa University Forensic Investigation Research Station located in Whitewater, Colorado. Weathering stages were determined using the parameters established by Behrensmeyer (1978). All available specimens were scanned using non-destructive ultra-violet fluorescence analysis (Cardin 1991) in order to identify the presence of remnant organic and/or mineral based pigments. Data collected from direct observation of

bison bone and data from previous archaeological work involving bison bone was assimilated into three primary descriptive categories. These included culturally modified bison bone, bison bone ecofacts, and non-culturally modified bison bone. Determination of cultural modification required identification of the presence of one or more of a variety of butchering marks, use wear, impact marks, pigment, culturally associated burning or processing, or that the bone had been modified into a tool. An ecofact is defined as organic material or a natural object found at an archaeological site and possessing archaeological significance. Bison bone was considered an ecofact when found in association with other artifacts or features and/or having archaeological significance such as being a particular skeletal element known to have frequently been selected for prehistoric or historic use as a tool. Non-culturally modified bone either exhibited no evidence of human use or was too severely damaged, weathered, or deteriorated for evidence of use to be confidently determined.

Photographic documentation of each specimen was completed using an Olympus Tough Tg-6 digital camera. Measurements of each available faunal element were recorded and faunal element identification was accomplished following techniques set forth by Brown and Gustafson (1979) and by referring to the exceptional bison bone artwork created by Dr. Lawrence S. Todd of Colorado State University. With permission of the legal owner, bone collagen samples were taken from those faunal specimens exhibiting evidence of cultural modification. Selected samples of particular interest, such as a bison bone located at a high elevation, were submitted for radiocarbon analysis and dating. When possible, the original location of all bison faunal elements was noted and the locations translated to the closest UTM and plotted using standardized GIS procedures on the study area map. All collected data was recorded electronically on a standardized assessment tool created by DARG associates and translated to an Excel spreadsheet for ease of reference and development of a variety of comparative tables and graphs. As the majority of faunal elements found in the region were impregnated with compact calcite soils (known to be extremely destructive when bone is exposed to atmospheric humidity) participating museums were provided printed instructive information relating to bone element conservation and stabilization techniques based upon correct cleaning and safe storage procedures (Appendix J).

9.0 FINDINGS

This section of the report, organized by west-central and southwestern regions and by county, describes all identified faunal elements and provides an overview of their attributes. Additional detailed data regarding each specimen encountered and examined during the project, including the specific faunal element, the presence or absence of cultural or natural modification, the weathering stage, comments, known UTMs, and radiometric data, are located in Appendices A through G. The Ziegler Reservoir Fossil Site (5PT1264) collection of 402 bison bones is detailed in Appendix H, the data spreadsheet, and discussed in Appendix I.

Each specimen is identified using an assigned DARG number; a site number if available; and any available accession or temporary number(s) related to the element or

element group. As specimens were discovered during different stages of the project and associated information was often not immediately available; and frequently requiring no small amount of “detective work”, the DARG specimen numbers do not necessarily present in sequence. Included in this section are detailed descriptions which include skeletal element identification and the curation facility or present specimen location. Although no archaeological sites were revisited as an aspect of this project, previously recorded sites in west-central and southwestern Colorado known to have either produced bison bone or noting the nearby presence of bison bone include, but are not be limited to: Cement Creek Cave paleontological site, 5MN654, Cottonwood Pueblo; 5MT4797, Cougar Springs Cave site; 5OR69, the Dallas Townsite; 5MT2149, Escalante Ruin site; 5GN1664, the Gateview Site/Marion Railroad Camp/Prehistoric Site; 5GN191, the Kezar Basin site; 5GN2477, the Mountaineer site; 5GN41, the Pioneer Point site; 5GN1835, the Tenderfoot site 5GN1835; and 5MN1068 the Zephyr site, the Jeff Lick site; 5MN3462, and Cottonwood Pueblo site; 5MN654. Specimens with known UTM’s, as listed in Appendix G, are available only in the OAHP copy in order to minimize public knowledge of and to protect specific site locations.

In January 2020 The World Health Organization declared a Public Health Emergency of International Concern related to the spread of the highly contagious corona virus disease SARS-CoV-2, commonly referred to as Covid-19. In March of 2020 the Public Health Emergency was upgraded to a worldwide pandemic. In response to this designation Governor Jared Polis wisely initiated immediate statewide quarantine and other orders severely limiting a broad spectrum of social interactions and closing of public venues, schools, universities, and businesses. The public were encouraged to remain at home and travel was strongly discouraged in an effort to stay the spread of the deadly disease. As the project archaeologist was also a Registered Nurse it was necessary to reschedule work on the project as the demand for nursing service took precedence. The resultant impact on Phase II of the Western Colorado Bison Project was profound as all museums, libraries, universities, and government entities were closed and their collections were not accessible. Due to these developments it was not possible to view, identify, examine, analyze, or photograph any specimens curated at the Canyon of the Ancients Visitor Center and Museum in Dolores, Colorado, the Pagosa Springs History Museum in Pagosa Springs, Colorado, or to continue work at Western Colorado University, Hurst Hall in Gunnison, Colorado or at the Museum of the West in Grand Junction, Colorado. In addition it was not possible to continue microscopic analysis of selected specimens at Colorado Mesa Universities’s Forensic Investigation Research Station. Creative solutions, including working between nursing shifts, accessing records remotely, and seeking out alternative contacts and resources, were implemented and the project continued to move forward. The primary negative impact to the project was the inability to tour museums to locate and identify bison bone and, especially, to directly view, confirm identification, and analyze curated bone specimens. With the help of museum curators and volunteers bison bone and possible bison bone specimen lists and adequate details were obtained and the resultant information was incorporated into the research. As the SARS-CoV-2 pandemic is ongoing it is not possible at this time to determine when the above noted facilities will be fully accessible to the degree required for the project to effectively investigate their collections. When safe to do so the project archaeologist will visit the above noted museums, obtain any additional data and,

if indicated, an addendum will be submitted to the History Colorado State Historical Fund to be attached to this document.

Region: West Central Colorado

9.1 Gunnison County

DARG 251, is a partial bison cranium preserving a partial right horn core with missing terminus, the entire left horn core and cap, the skull roof and frontal excepting the portion removed via craniectomy, the partial parietal, both partial orbits with articulated lacrimals, and a partial palatine (Plate 1). The specimen is sans the premaxilla, lower nasals, and the lower turbinates, all appearing to have been fractured or deteriorated post mortem. Six maxillary teeth are intact on the right side with fragments of three teeth remaining on the left. Approximately 8 centimeters of the nasals remain. The right horn core base circumference measures 24.1 centimeters with the left horn core base at 26 centimeters. The weathered left horn cap is present and strongly adhered to the horn core. Only the extreme tip is missing likely due to rodent gnaw which is present on various prominences of the skull. Cultural modification consists of a somewhat circular 11.6 centimeter by 10.7 centimeter frontal craniectomy offset left of center. Although rodent gnaw is evident on the perimeter of the orifice, the cultural modification is apparent. Scalloped, concave impact indentations that shallowly protrude into the skull cavity encompass the periphery. Fine crescent-shaped impact fractures are visible on the upper right, the top, and the left edges of the orifice (Plate 2).

The craniectomy extends into the brain cavity. Details of the find, documented in Southwest Lore (Hagie 1942) indicate the specimen was recovered in 1942 from a steep hillside southeast of the Willow Creek Ranger Station in Taylor Park, Gunnison County, CO. The craniectomy is the only cultural modification evident on the specimen. Approximately 85 percent of the skull is covered to some degree, with various lichens as is much of the remaining horn cap. Older central mats of 1 to 2.4 centimeter in diameter foliose lichens occur primarily on the right side of the specimen on the right orbit and extending to the base of the right horn core and the right aspect of the upper frontal and the occiput. Smaller, younger thalli are dispersed across much of the rest of the specimen including the left horn cap. As foliose lichens grow between 2 and 5 mm per year and crustose lichens grow 0.5 mm annually the pattern of crustose and foliose lichens on the skull may indicate a lengthy period of surface exposure. Extensive and specific research and analysis, well beyond the scope of this project, would be required to calculate a reasonable time span of exposure. The initial and longest period of exposure to the surface occurred on the right side of the skull (Thackeray 2016) as indicated by the central lichen mats. A bone collagen sample was taken from the interior turbinates and the dense bone of a portion of the remaining zygomatic process. The specimen has been curated at the C. T. Hurst Museum at Western Colorado University in Gunnison, CO, catalog number 4410 since 1942.

Plate 1. DARG 251, a partial bison skull with craniectomy.

Plate 2. DARG 251, detail of crescent-shaped, concave impact indentations and fine impact fractures on periphery of craniectomy.

DARG 252, is a bison atlas (Plate 3) missing approximately 70% of the right transverse process and approximately 10% of the left transverse process. Weathering is severe at stage 3 to 4 (Behrensmeyer 1978). Both the vertebral and transverse foramen are impregnated with small poorly sorted sandstone fragments and soils high in calcite with visible sulfites. Organic detritus is also present but does not include conifer needles suggesting the specimen originated below the Montaine life zone. The specimen was recovered on 21 May 1998 by Mr. Tom McGinnes from a location identified as the Olmstead site. The specimen was initially located in the wall of an arroyo in immediate association with multiple bison horn core fragments. There is no cultural modification. To date no further information concerning this site, it's location, or associated artifacts or dates has been found. The specimen was identified at and is curated in the C. T. Hurst Museum at Western Colorado University in Gunnison, CO.

Plate 3. DARG 252, a bison atlas

DARG 253, consists of 80 fragments of a bison horn core recovered from the wall of an arroyo at the Olmstead site by Tom McGinnes on 21 May 1998. These specimens were found in immediate association with a bison atlas. The fragments range in size from 8 centimeters in length by 2.5 centimeters wide to multiple minuscule fragments measuring less than 0.1 centimeters. There is approximately one gram of powdered horn core debris in the storage bag and this is likely due to mechanical abrasion secondary to repeated movement during transport and storage of the sample. There is no cultural modification. To date no further information concerning this site, it's location, or associated artifacts or dates has been found. The specimens were examined at and are curated in the C. T. Hurst Museum at Western Colorado University in Gunnison, CO.

DARG 254, is a bison left humerus fragment (Plate 4) excavated during construction of an irrigation ditch near an unspecified location near Gold Creek. The recovery location is described on an attached tag as "above Parlin", therefore, if found on Gold Creek it would have been north of Ohio City, Colorado which is 8.7 miles northeast of the hamlet of Parlin, Colorado. The higher elevations of the Gold Creek drainage, averaging 8,600 feet above sea level, are on United States Forest Service (USFS) lands and therefore, an unlikely location as there are few irrigation ditches there. It is deduced that the specimen was likely found in a 1.5 mile span in the farmed valley area of the Gold Creek drainage north-northeast of Ohio City, Colorado. The specimen has a spiral fracture of the diaphysis suggestive of cultural modification for removal of bone marrow (Binford 1981). The distal aspect of the epiphesium shows two probable chop marks and one probable impact indentation (Plate 5). Unfortunately, the bone in this area is so severely weathered it prohibits absolute confirmation of cultural modification. Compact silt with calcite and sparse sulfites present in the interior and orifices of the specimen are congruent with sediments found in the Gold Creek drainage. The specimen was found in association with a bison left radius fragment (DARG 255), a right maxilla fragment (DARG 256), and a single bison premolar(DARG 257). It was identified at and is curated in the C. T. Hurst Museum at Western Colorado University in Gunnison, CO.

Plate 4. DARG 254, is a bison left humerus fragment with a spiral fracture and chop marks.

DARG 255, is a bison left radius fragment excavated during construction of an irrigation ditch near an unspecified location near Gold Creek. The recovery location is described on an attached tag as “above Parlin”, therefore, if found on Gold Creek it would have been north of Ohio City, Colorado which is 8.7 miles northeast of the hamlet of Parlin, Colorado. The higher elevations of the Gold Creek drainage, averaging 8,600 feet above sea level, are on USFS lands and therefore, an unlikely location as there are few irrigation ditches there. It is suspected the specimen was found in a 1.5 mile span in the farmed valley area of the Gold Creek drainage north-northeast of Ohio City, Colorado. The specimen was found in association with a bison left humerus fragment (DARG 254) with possible cultural modification, a bison maxilla fragment (DARG 256), and a single bison premolar (DARG 257). Situated on the fractured diaphysis is a sharp 3 centimeter wide and 5 centimeter long V-shaped, internally faceted fracture (Plate 5) that tapers to an apex oriented toward the epiphesium. It is similar to fractures occurring from intentional impact and may be indicative of cultural modification. No additional cultural modification is visible. The specimen was identified at and is curated in the C. T. Hurst Museum at Western Colorado University in Gunnison, CO.

Plate 5. DARG 255, a bison left radius with V-shaped possible impact fracture.

DARG 256, is a right maxilla fragment consisting of one erupted molar and one un-erupted molar. It was found in association with a bison left humerus fragment (DARG 254) with possible cultural modification, a bison left radius (DARG 255) and a single bison premolar (DARG 257). The specimen was excavated during construction of an irrigation ditch near Parlin, Colorado and north of Ohio City, Colorado. The recovery location is described on an attached tag as “above Parlin”, therefore, if found on Gold Creek it would have been north of Ohio City, Colorado which is 8.7 miles northeast of the hamlet of Parlin, Colorado. The higher elevations of the Gold Creek drainage, averaging 8,600 feet above sea level, are on USFS lands and therefore, an unlikely location as there are few irrigation ditches there. It is

suspected the specimen was found in a 1.5 mile span in the farmed valley area of the Gold Creek drainage north-northeast of Ohio City, Colorado. The specimen was identified at and is curated in the C. T. Hurst Museum as part of a comparative collection at Western Colorado University in Gunnison, CO.

DARG 257, is a single unremarkable bison premolar missing the root. It was found in association with a bison left humerus fragment (DARG 254), a bison left radius fragment (DARG 255), a right maxilla fragment (DARG 256). The specimen was excavated during construction of an irrigation ditch near Parlin, Colorado. The recovery location is described on an attached tag as "above Parlin", therefore, if found on Gold Creek it would have been north of Ohio City, Colorado which is 8.7 miles northeast of the hamlet of Parlin, Colorado. The higher elevations of the Gold Creek drainage, averaging 8,600 feet above sea level, are on USFS lands and therefore, an unlikely location as there are few irrigation ditches there. It is suspected the specimen was found in a 1.5 mile span in the farmed valley area of the Gold Creek drainage north-northeast of Ohio City, Colorado. There is no cultural modification and the specimen was identified at and is curated in the C. T. Hurst Museum at Western Colorado University in Gunnison, CO.

DARG 258, is a right side bison mandible (Plate 6) missing all structure forwards of the M3 molars. The specimen, along with a collection of unidentified bison bone (DARG 259), a bison right humerus (DARG 260), and an unknown bison vertebra, were found on the McLain Ranch property located west of Gunnison County road 76 two miles southwest of Ohio City, Colorado, by Mr. David McLain. Mr. McLain unearthed the bones while plowing a section of ranch property slightly north of Indian Head Rock and 40 feet east of Quartz Creek (Personal Communication Mrs. Ladonna McLain 2020) at an elevation of 8040 feet above sea level. He donated all the specimens, excepting the vertebra, to Western State College. A formal excavation conducted on 20 May 1998 by Western State College staff. The McLain family states college personnel failed to find any additional specimens. A 1.3 centimeter long by 1.0 millimeter wide oblique, curvilinear scrape mark is located below the M3 molars on the lower lingual aspect of the mandible (Plate 7). It is probable the scrape mark is indicative of cultural modification secondary to cutting to remove the tongue. As it is very difficult ro remove the tongue via the mouth of a bison or any game, an expedient manner of removing the tongue from a kill is done by creating one or more incisions under the mandible and then performing multiple cuts to the adjacent tissue to remove tongue. As the cutting tool used strikes the lingual aspect of the mandible cut and scrape marks result (Costamagno et al. 2019). Although a claw or other unknown scratch mark cannot be fully ruled out, the mark strongly resembles a culturally induced scrape likely from a stone tool as incised, unevenly spaced parallel ridges attributable to the knapping marks on a stone tool edge, and unlike the even tooth marks of a rodent, are apparent. Of interest is a 3.0 centimeter somewhat square broken chert fragment which was found near the specimen and is curated with it. Other than an accompanying tag with the initials SDE, no other notes were included regarding the chert fragment. The McLain Ranch is designated a Colorado Centennial Ranch and access to the site report on History Colorado data base COMPASS is restricted per request of the family. It is unknown of the

bones are referenced in the report. The specimen is curated in the C. T. Hurst Museum at Western Colorado University in Gunnison, CO.

Plate 6. DARG 258, a bison right mandible with a lower buccal aspect scrape mark.

Plate 7. DARG 258, detail of scrape mark on buccal aspect of bison right mandible.

DARG 259, the McLain site, consists of a collection of unidentified bone fragments, likely bison as they were found in close association with a bison right mandible (DARG 258), a bison right humerus (DARG 260), and an unknown bison vertebra. The tag that accompanies these specimens states they were recovered from an exposure in a ditch in peat soil on 20 May 1998 from the McLain site. All bones were found on the McLain Ranch property located west of Gunnison County road 76 two miles southwest of Ohio City, Colorado, by Mr. David McLain who unearthed the bones while plowing a section of ranch property slightly north of Indian Head Rock 40 feet east of Quartz Creek (Personal Communication Mrs. Ladonna McLain 2020). He donated all the specimens, excepting the vertebra, to Western State College. Although Western State College personnel conducted an investigation at the site no additional bones were found. An accompanying tag has the initials SDE. There is no evidence of cultural modification on any of the bone fragments. The McLain Ranch is designated a Colorado Centennial Ranch and access to the site report on the History Colorado data base COMPASS is restricted per request of the family. It is unknown of the bones are referenced in the report. The assemblage is curated in the C. T. Hurst Museum at Western Colorado University in Gunnison.

DARG 260, the McLain site, is a robust bison right humerus (Plate 8). The specimen was found on the McLain Ranch property located west of Gunnison County road 76 two miles southwest of Ohio City, Colorado, by Mr. David McLain who unearthed the specimen and several other bones while plowing a section of ranch property slightly north of Indian Head Rock and 40 feet east of Quartz Creek (Personal Communication Mrs. Ladonna McLain 2020). He donated all the specimens, excepting the vertebra, to Western State College. Western State College personnel conducted an investigation at the site on 20 May 1998 and according to an accompanying tag DARG 260 was found 10 to 13 centimeters below the surface atop a black peat layer in Grid A. The initials SDE are present on the tag. It is assumed the specimen was initially found fractured into three segments as these have been carefully reassembled and secured with an unidentified adhesive. The proximal end is missing most of the lateral tuberosity. There are three groups of distinct gouge, gash, or scratch marks and a single gouge, gash or scratch mark on the head of the humerus (Plate 9). These marks are segregated into groups A, B, C, and D. Group A consists of four slightly curvilinear, parallel marks ranging in length from 1.4 to 1.5 centimeters. Group B consists of four slightly curvilinear, parallel marks between 2.0 and 0.5 centimeters long. Group C includes three parallel slightly curvilinear, parallel marks between 2.0 and 0.6 centimeters long. D is a single 3.1 centimeter long slightly curvilinear mark. All the gouge, gash, or scratch marks are approximately 1.0 millimeter in width. Due to the multiple mark groupings, the curvilinear parallel arrangement, and the bulb of initiation on several of the marks, it is determined that

Plate 8. DARG 260, bison right humerus.

Plate 9. DARG 260, detail of predator claw marks.

they are likely large predator claw marks. The lateral tuberosity is fractured and though the remnant edges are scalloped the degree of weathering prohibits confirmation of cultural modification. Centrally located approximately 8.0 centimeters below the head of the humerus on the diaphysis is a primary impact point with a somewhat diamond shaped area of missing bone (Plate 10). There are impact indentations around the impact point as exhibited by fine fractures that arc inward toward the orifice. Resultant breakage fractures emanate from that point creating a spiral fracture. The evidence indicates the bone was likely impacted by the apex of a stone tool. This specimen is considered to exhibit cultural modification in the form of impact and spiral fracturing. The exact location of the excavation site is unknown at this time as the report cannot be located. The McLain ranch is presently designated a Colorado Centennial Ranch and access to the site report is restricted per request of the family. It is unknown if the find is referenced in that report. The specimen is curated in the C. T. Hurst Museum at Western Colorado University in Gunnison, CO.

Plate 10. DARG 260, detail of stone tool impact point and spiral fracturing.

DARG 261, is a small bone fragment from the McLain site packaged with DARG 260, the bison humerus. There is no evidence of cultural modification. The McLain ranch property is located between Parlin, Colorado and Ohio City, Colorado on Gunnison County road 76 approximately ½ a mile north of the Indian Head rock and 2 miles south of Ohio City. The exact location of the excavation site is unknown at this time. Mr. David McLain who unearthed the specimen and several other bones while plowing a section of ranch property slightly north of Indian Head Rock and 40 feet east of Quartz Creek (Personal Communication Mrs. Ladonna McLain 2020). The McLain ranch is presently designated a Colorado Centennial Ranch and access to the site report is restricted per request of the family. It is unknown of the find is referenced in that report. An accompanying tag has the initials SDE, but there are no further notes. The specimen is curated in the C. T. Hurst Museum at Western Colorado University in Gunnison, CO.

DARG 262, 5GN1664, the Marion Site, consists of an identifiable bison metatarsal (5GN1664.21) located in Feature 21, hearth B in one of three prehistoric components of the site. Investigations at the site focused on the Marion railroad camp, a Denver & Rio Grande railroad workers camp on the Lake Branch line and situated on the Lake Fork of the Gunnison River north of Gateview and south of Sapinero at an elevation of 7,355 feet. Three prehistoric components, that do not spatially overlap, were identified at the site. Radiocarbon dates of 1060+/- 46 BP and 2047+/- 48 BP were obtained from two of the five hearths tested. Late Prehistoric projectile points were also found. Radiometric testing of charcoal from hearth B resulted in a date range of 1172 BP to 918 BP however; the confidence level regarding this date is noted as low without explanation. Additional radiocarbon dates obtained from charcoal located in the remaining hearth features produced date ranges of 2130BP to 1020BP. Medium size mammal bones representing mule deer and pronghorn were found as were a number of small bone fragments that may indicate processing for bone grease (Binford 1981). As the location of the specimens is unknown it was not possible to examine them for cultural modification.

DARG 263, 5GN41, the Pioneer Point site excavation produced 15 burned and unburned bison bone fragments. These were found in association with rim and body ceramic fragments that are likely Uncompahgre Brown ware (Buckles 1971). Quartzite flakes, charcoal, a single side-notched projectile point, and bifacial and unifacial stone tools were also recovered in and around a hearth. The artifacts, features, and the location of the site together are interpreted as a Summer or Fall temporary faunal processing camp and a game observation site dedicated to hunting and processing of large game (Dial 1989). Charcoal collected from hearth features produced dates of 460+/-70 BP and 470+/-80 BP. The site is located at an elevation of 8035 feet and immediately southwest of Colorado State Highway 92 on a relatively level point that overlooks the broad, deep drainage of Curecanti Creek at its terminal descent into the Black Canyon of the Gunnison. Today a modern pull out and picnic area is located approximately 50 feet west of the site. The site continues to function as a hunting location as it is not uncommon today to see hunters parked at the pull out glassing the area for big game during the Fall hunting seasons. Midwest Archaeological Center mitigated the site by complete excavation in 1981 and it is understood that the specimens are presently curated at the Midwest Archaeological Center, in Lincoln, Nebraska.

DARG 264, site 5GN1709, consists of a bison horn cap (5GN1709-1) recovered during the 1949 elk hunting season between October 15th and 30th by Pitkin County Ranger District Forest Ranger James Oluf Folkestad and the Gunnison National Forest Administrative Assistant Ralph Mike Sweet (Plate 11). There is no evidence of cultural modification. It was described by Mr. Sweet as being found "1-1/2 miles up Texas Creek from the highway on the south side in a fringe of lodgepole pine about 200 yards south of the creek...". As the reservoir was created in 1937 the highway referenced would have been today's Gunnison County Road 742. From the available description the original location of the specimen is determined to lie between where Texas Creek crosses County Road 742 on a one and one half mile northeast track upstream and within a 200 foot corridor on the southern aspect of the Texas Creek drainage in Taylor Park, Colorado. Of note is the elevation, 9,187 feet, at which the specimen

was located. The Taylor Park basin, previous to inundation by Taylor Park Reservoir, is an area long known for consistent populations of large game animals, especially deer and elk, and continues to be hunted in modern times for both species. The secluded location and gentle topography with its abundant graze combines to produce a habitat that would easily have accommodated moderate numbers of bison in the past. Although the area is no longer frequented by modern Ute people it continues to be relevant in modern memory and was referred to possessively as "very good Ute hunting land" by Ute tribal spiritual leader Mr. Clifford Duncan, although he himself never hunted there (personal communication 2013).

Mr. Sweet noted in his brief that he delivered the horn cap to the Secretary of the Chamber of Commerce, Gunnison, Colorado. A photo and notation in the Denver Post dated January 8, 1950 indicates the specimen was to be given to the Colorado State Museum. At this time the specimen resides in the Grand Mesa Uncompahgre and Gunnison National Forests, Gunnison District Offices at 216 N Colorado St., Gunnison, Colorado.


There Were Bison in the . . .

Denver Post
1-8-50

Monarch Air Lines Photo by Charlie Wunder.

The buffalo is famed as a resident of the great plains of the early-day west—but he also ranged through the mountains of central Colorado, evidence now shows. Above, Bonita McCorkhill Whalen of Gunnison, Colo., holds a buffalo horn which was found one and one-half miles from the mouth of Texas creek in Taylor park near Gunnison—deep in the mountains. The finders were District Forest Ranger James O. Folkestad and ~~Assistant Ranger~~ Ralph M. Sweet. They said the horn, to be given to the Colorado State museum, is at least 100 years old. Administrative assistant

Plate 11. DARG 264, Denver Post article and image of bison horn cap.

DARG 265, is a bison second phalange (Plate 12) recovered from site 5GN2477, the Mountaineer site, Block A, near Gunnison, Colorado at an elevation of 8,600 feet above sea level. It was found in association with a large bison tibia fragment. The bison phalange was recovered near the interior back wall of a Folsom structure located atop the western aspect of Tenderfoot Mountain on the Mountaineer Site. The structure is determined to be a lithic workshop and the specimen a technological tool, a mallet, used for flintknapping activity. Of great interest is the presence of a fractured stone anvil and a large cobble tool situated near large mammal rib fragments all located within the structure. A concentration quartzite cobble fragments inside the structure showed evidence of percussion scarring suggestive of use as hammer stones. Sample CAMS105764, taken from a bison tibia (DARG 267) recovered near the structure's back wall produced a 14C date of 10,440 BP. It is noted that nearby Rood Block, located in the southeastern aspect of the site, produced over 600 large mammal bone fragments,

some located within a structure. Unfortunately, it was not possible to confirm the bones as bison as the bone collagen from the samples proved inadequate for radiometric dating. The Mountaineer site was first recorded in 1994 in response to disruption from cell tower construction atop Tenderfoot Mountain. Survey and other archaeological work has occurred from 2001 through 2018 with Dr. David J. Meltzer and his graduate students of Southern Methodist University participating beginning in 2002 through 2011. Dr. Mark Stiger (2001, 2006, and 2019 in press) continues work at the site. The specimen may be curated in the C. T. Hurst Museum in Hurst Hall at Western Colorado University, Gunnison, CO.

Plate 12. DARG 265, bison second phalange from the Mountaineer Site, 5GN2477.

DARG 266, is from 5GN2477, the Mountaineer site, Block A, and consists of an unknown number of large mammal rib fragments (possibly bison) recovered from within a lithic workshop structure excavated during a student field school conducted by Dr. Mark Stiger of Western Colorado University, in Gunnison, CO. Bone collagen samples were taken from several rib fragments and a seven centimeter long rib fragment (Plate 13) and submitted as samples CAM105765 and UCIAMS-11240. They produced dates of 14C 10,295 BP and 10,380 BP respectively. These fragments were found near a stone anvil and a chopper and bring to mind Binford's (1978:152) comments concerning the breaking of fresh uncooked mammal ribs into short sections for the purpose of consuming the nutritious interior when the flavor is optimal as it becomes bitter when not fresh. As the structure is deemed a workshop the possibility of all or some of the ribs being used as lissior leather working tools should be considered as their use in such a setting as tools would be appropriate and a reasonable possibility. Lissiors, used by Neanderthals and by today's modern leather craftsmen, are exclusively made of rib bone due to its attribute of flexibility which results in a springboard effect as the rib is drawn across leather that is conducive to producing a smooth, glossy surface that becomes water resistant (Soressi et. al. 2013). The specimens were not accessible for direct inspection although adequate images were obtained for examination. The location of the

specimens is not known though they may be housed in the C. T. Hurst Museum in Hurst Hall at Western Colorado University, Gunnison, CO.

Plate 13. DARG 266, bison rib fragment.

DARG 267, from site 5GN2477, the Mountaineer site, Block A, consists of a large bison tibia fragment abutting a bison second phalange (DARG 265) and situated against the back wall of a Folsom structure identified as a lithic workshop. A stone anvil and a chopper were also found within the structure. This specimen and the bison phalanx abutting it are considered technological flintknapping mallet tools verses food processing remains (Stiger 2019:42). Nearby splinters of bone may be post-depositional debris from the tibia. Sample CAMS105764, taken from the specimen produced a 14C date of 10,440 BP. The tibia was collected during excavations conducted by Dr. Mark Stiger of Western Colorado University, in Gunnison, CO during the 2003 field season. The specimen may be curated in the C. T. Hurst Museum in Hurst Hall at Western Colorado University, Gunnison, CO.

DARG 317, from 5GN1835, the Tenderfoot site, consists of a bison phalange recovered near a windbreak structure, The expansive Tenderfoot site is located at the western foot of Tenderfoot Mountain below the Mountaineer site, at an elevation of 7680 feet. A total of 60 radiocarbon dates indicate the site was occupied between 8000 BP and 3000BP. Cultural modification is not mentioned regarding the specimen and it was not available for direct inspection. It is however; directly associated with the site and may be indicative of use as a tool similar to the DARG 265, a phalange recovered from 5GN2477, or it may be waste material from butchering that was discarded. The specimen may be curated in the C. T. Hurst Museum in Hurst Hall at Western Colorado University, Gunnison, CO. but was not available for examination during the museum visit.

DARG 318, from 5GN1835, the Tenderfoot site, is a possible bison tibia recovered from a bone disposal area or toss zone. The Tenderfoot site is located at the western foot of Tenderfoot Mountain below the Mountaineer site, at an elevation of 7680 feet. A total of 60 radiocarbon dates indicate the site was occupied between 8000 BP and 3000 BP. This specimen, similar to DARG 267, a tibia found in a Folsom phase lithic workshop structure at 5GN2477, may also have been used as a tool or it may have been discarded as butchering waste material. The specimen may be curated in the C. T. Hurst Museum in Hurst Hall at Western Colorado University, Gunnison, CO. but was not available for examination during the museum visit.

DARG 310, a group of probable distal right bison humerus fragments (2003.20.5GN189.35) listed as FS-16, recovered from Haystack Cave (5GN189), OS/2W, Level 5. The specimen is reported to be unmodified. The site where the specimen was recovered is a somewhat tube shaped volcanic vent cave, located at an elevation of 8000 feet in Sapinero Mesa tuff which is impermeable to water thereby resulting in a dry shelter. The south-facing entrance to the cave is 10 meters high by 2.3 meters in diameter and the interior is 12 meters in depth tapering to a diameter of one meter at the back. The paleontological record of the cave dates from the present to 30,000 ago. Archaeological evidence of cultural exploitation at the site includes hundreds of tools and flakes (Euler and Stiger 1981) which primarily indicate Protohistoric use and Archaic occupations spanning the last 3000 to 5000 years. Some evidence of pre-Clovis occupation greater than 12,000 YBP, consisting of lithic debitage was found in association with the bones of extinct Late Pleistocene Epoch vertebrates (Emslie 1986). Unidentifiable bone fragments from two levels of the cave produced conventional radiocarbon dates of 10,204 BC +/- 1700 and 12,985 BC +/- 610 thereby confirming that the deposits include the Late Pleistocene and Early Holocene. Finally, a radiocarbon date of 17,670 was produced from bone recovered from the deepest strata excavated. Emslie (1986) states that "...evidence for human use of the site during deposition of the lower levels is uncertain." and that bone excavated from the lower levels is assumed to be due to natural occurrences. The specimen is curated at the Canyons of the Ancients Visitors Center and Museum in Dolores, Colorado.

DARG 268, a single bison second phalange (Plate 14) with a heavy mineral patina, was excavated from the Cement Creek Cave, approximately a 6 miles south of Crested Butte, Colorado, at one of the deeper, but unspecified, levels of the cave deposits. Excavated in 1998 and 2007 by Emslie and Meltzer (2019), the cave produced several thousand bone samples primarily from small mammals. Stratigraphic disturbance by rodents, modern spelunkers, and vandals has mixed most fossil assemblages except those found in levels 18 through 40 which are intact and undisturbed. The bones within these levels have produced dates from the present along with results pre-dating the Last Glacial Maximum and extending to 43,330 YBP. To date the cave has produced no archaeological evidence of human occupation or use. This determination was attributed to the relatively small opening and narrow winding corridors of the cave. As humans today regularly and easily enter the cave as a recreational spelunking activity it is proposed by the project that prehistoric humans very likely accessed the cave without difficulty and that this consideration should not be ruled out. Due to it's small size and limited interior space and headroom its use as a shelter would have been unlikely. Use of the cave as a storage shelter for tools, equipment or food may also have been a possibility. Emslie's and Meltzer (2019) also state that large mammals would not have been capable of accessing the cave entrance and this is considered a reasonable assumption. As the phalange is a relatively small bone as compared to other bison skeletal elements, it may have been transported into the cave by a moderate sized rodent such as a pack rat, by a raptor, or by humans. As the present location of the specimen cannot be confirmed it is not possible to examine it for cultural modification or use as a tool. An available photographic image suggests the severe degree of weathering would obscure any bone surface markings making it difficult to determine cultural alterations. It is likely curated at either Southern Methodist University or at

the University of North Carolina. A good image of the bone was available and inspection of the photograph indicates little potential for identifying and confirming cultural modification. Due to the unknown curation location, its limited potential to produced evidence of cultural modification, and the unavailability of persons involved in its recovery and collection, further efforts to access the specimen for examination was not pursued.

Plate 14. DARG 268, a bison second phalange at left and a modern comparative example at right.

DARG 269, DARG 270, and **DARG 271** consist of a likely *Bison latifrons* molar (DARG 269) and an associated set of two B. latifrons horn cores (DARG 270 and DARG 271). All specimens were found in 1929 by Mr. L. G. Coffin, the land owner, during construction of an irrigation ditch along the west side of a valley in the Little Cimarron drainage at an elevation at or above 8,000 feet. The precise location of the site is unknown but, as it is reported as being within a 12 mile radius of Cerro Summit which falls within the study area. The assemblage, possibly the first high elevation Ice Age bison discovery in western Colorado, was shown by Mr. Coffin to Harold J. Cook who published a brief report on the find in Science Magazine in 1930. Cook was quite confident that the specimens were attributable to B. latifrons and both Cook's and the landowners descriptions support this. When viewing curated B. Latifrons specimens at a later date, Mr. Coffin stated they were the same as those he had previously

found. Although Mr. Coffin collected the specimens none of them were acquired by Cook and it is assumed the landowner retained them. Their whereabouts are unknown at this time and without proper preservation it is unlikely these important specimens have survived. Although the exact date range of B. Latifrons is not confirmed it may have originated 500,000 to 200,000 years ago (Hoganson 2002) existing in North America until extinction 30,000 to 20,000 years ago (McDonald 1981). Recent research by Froese and associated researchers (2017) indicates bison arrived on the continent in two phases, the first occurring ~195,000 to 135,000 years ago and the second during the Late Pleistocene ~45,000 to 21,000 years ago.

DARG 272, is a 90% intact bison horn cap (Plate 15) found on the Quarter-Circle Circle Ranch private property located 11 miles southwest of Colorado State Highway 114 on Gunnison County Road 17GG at an elevation of approximately 9200 feet above sea level. The horn cap was located approximately 5 miles west of the ranch headquarters and was found eroding out of a collapsing unnamed drainage. An additional severely weathered horn cap tip fragment, DARG 273, was found in association with the specimen. Although there is no evidence of cultural modification the specimen provides evidence of bison presence along the northwestern Old Cochetopa Pass area and the Old Spanish Trail corridor, a region known to have supported Ute and prehistoric large game hunters. The specimen is located at the Quarter-Circle Circle Ranch.

Plate 15. DARG 272, bison horn cap, bottom. DARG 273, bison horn cap frag, top.

DARG 273, is a significantly weathered bison horn cap tip fragment (Plate 15) recovered from private property belonging to the Quarter-Circle Circle Ranch private property located 11 miles southwest of Colorado State highway 114 on Gunnison County Road 17GG at an elevation of approximately 9200 feet above sea level. The fragment was found eroding out of a collapsing unnamed drainage cut-bank located approximately 5 miles west of the ranch headquarters. DARG 272, a bison horn cap, was found near the specimen. Although there is no evidence of cultural modification the specimen provides evidence of the presence of bison within the northwestern Old Cochetopa Pass area and the Old Spanish Trail corridor, a region known to have supported Ute and prehistoric large game hunters. There is no evidence of cultural modification. The specimen is located at the Quarter Circle Circle Ranch.

DARG 274, is a bison cranium fragment (Plate 16) missing the lower nasals and maxilla and the mandible. The specimen is deteriorating and cracking along the frontal suture. It has no evidence of cultural modification. The specimen was found in the region of Old Cochetopa Pass, the original pass on the Old Spanish Trail, likely within the Old Spanish Trail corridor between an elevation of 9000 and 10,000 feet above sea level. Old Cochetopa Pass and the Old Spanish Trail corridor were used extensively by historic Ute and American hunters. Abundant evidence of prehistoric large game hunters in this area is well documented and includes large game drive stone structure sites. Although there is no cultural modification the location of the specimen supports the theory of bison migration via Cochetopa Pass and into the Gunnison Valley. It was recovered in the early 1900s by an unknown rancher and gifted to the informant. The specimen is presently on public display at Trader's Rendevous, a private enterprise, in Gunnison, CO.

Plate 16. DARG 274, a bison skull recovered within the Cochetopa Pass trail corridor.

DARG 275, is a bison horn cap tip fragment recovered by a United States Forest Service employee from the Old Cochetopa Pass area within the Old Spanish Trail corridor likely between an elevation of 9000 and 10,000 feet above sea level. There is no evidence of cultural modification. The original location of the specimen supports the presence of bison within the Cochetopa Pass trail corridor. This specimen, along with specimen DARG 264, is stored at the Grand Mesa Uncompahgre and Gunnison National Forests, Gunnison District Office, 216 N Colorado St, Gunnison, Colorado.

DARG 283 is a partial bison skull missing the mandible, the nasals, the right and left orbit, lacrimals, and buccal area, and most of the right horn core. The specimen is impacted with silty soils and poorly sorted sandstone clasts and unidentified pebbles. It presents with no cultural modification. It was reported to have been found in the 1970s in an unnamed drainage cutbank to the east of the Continental Divide and may possibly have been within the Old Spanish Trail corridor. The specimen is presently available upon request and by appointment with Trader's Rendevous personnel, for professional researchers, historians or university students.

A visit to the Gunnison Pioneer Museum produced four bison specimens two of which are confirmed as not originating in western Colorado and two others of unknown origin. As the museum display information cards do not clearly indicate that the specimens were not found in western Colorado they are briefly addressed here as a courtesy to future researchers. A single bison horn cap fragment tagged as number 48, and a bison cranial fragment with one attached horn core tagged as number 49, are both displayed in a case on the second floor of the main building. A document in the archives, located in a difficult to find file categorized as "Arrowheads", associates both specimens with the extensive Bernard Bench Indian Collection. Number 48 is described as: Large outer buffalo horn, near Riverton Wy, 10" 1.00. Number 49 is described as: Two smaller horns found at Sakajawea's Mandan village near Stanton, North Dakota 100. Neither specimen exhibits cultural modification.

Two taxidermied bison head mounts are displayed in the Western Memorabilia barn of the facility. There is no donation record or anecdotal information regarding their origin therefore, the possibility of origin within the study area, though unlikely, is not excluded. Cultural modification consists of modern preservation by taxidermy.

No bison faunal elements are curated at the Crested Butte Mountain Heritage Museum. The collection contains two post cards with images of the White Buffalo Ranch that was operational in the 1970s and 1980s. The few bison owned by this enterprise were confined in fenced pastures on the property and did not access other lands. Of note is a culturally modified bison skull (DARG 276) collected by a private individual in the Crested Butte area in 1899. It is presently curated in the Saguache County Historical Museum in Saguache, Colorado.

9.2 Hinsdale County

Late May of 2019 saw unprecedented Spring flooding that inundated parts of the town of Lake City in Hinsdale County. This event occurred secondary to a winter snow pack determined to be 300 percent above average. As the snow pack began to melt and soften, avalanche debris dams consisting of timber, wood, rock, snow and ice, occluded the historic structural dams on both Henson Creek and the Lake Fork of the Gunnison. Snow melt waters accumulated behind the debris which began to dislodge and breach the structural dams threatening to engulf Lake City and the surrounding area. On May 6, 2019 Governor Jared Polis declared a State of Emergency and the placement of 18,000 sandbags and mitigation of the avalanche debris began. Due to the anticipated threat of flooding on a disastrous scale, the Hinsdale County Museum made the decision to close the museum and move the collections to secure, waterproof containers located on high ground. Colorado archaeologists, historians, students, and many other volunteers assisted in packing, labeling and moving the museum’s artifacts and archives. Due to this situation it was not possible to explore the museum or the archives for bison remains. E-mail contact with the museum curator regarding the presence of bison remains in the collection resulted in his assurance that there were none. He agreed to review the archives when time allowed and contact the Project should he located any specimens. The museum location was visited on 8-29-2019 and several hundred sandbags were observed about the grounds surrounding the closed museum. To date, the museum remains

closed, the collection stored and secure, and no opening date has been announced. Due to the 2020 Covid 19 pandemic and resultant statewide restrictions, the museum was unable to reopen on Memorial Day 2020, as is its tradition. Therefore, the collections could not be investigated during the time allotted to the project. Bison remains and possible bison remains attributed to northern Hinsdale County were located late in the project time line resulting in out of sequence DARG numbers. These specimens were identified using a curation listing provided by Canyons of the Ancients Visitor Center and Museum in Dolores, Colorado. An abbreviated visit was made to this facility early in the project and no bison bone specimens were located in the public displays.

DARG 286 is a single unidentified large burnt bone (2002.3.5HN300.82) from a large mammal described as an elk or bison recovered from a multicomponent site (5HN300) known as the Argentum townsite near Burrows Park and White Cross Mountain. The specimen was located in Feature 9 test trench at Level 1. The site, situated at an elevation of 10,560 feet, contained both a historic mining townsite and a prehistoric open camp. The historic component of the site was occupied from at least 1872 through early 1900. Six or more burnt bone specimens, including the unidentified bone, were found near a historic feature and, according to the site form, are not excluded as originating from the prehistoric component. A possible prehistoric hearth feature is located on the southeastern periphery of the site boundary. A biface was located within the eastern aspect of the site near feature 4 and immediately east of the BLM parking area on the Cinnamon Pass Road. In addition, the discovery of an Ancestral Puebloan ceramic sherd may indicate a date of as early as AD 1000. Only five of these burnt bone specimens were placed together in a bag and submitted for curation to the Canyon of the Ancients Visitors Center and Museum in Dolores, Colorado. There is no information concerning submission of any specimen for radiometric testing.

DARG 287 through DARG 296 consists of ten culturally modified bones recovered from 5HN300, the Argentum townsite, P.D. 16.1, Feature 16 test trench, Level 1. The site is located on the Cinnamon Pass road near Burrows Park and White Cross Mountain. The group of specimens tagged as Bag 114 are identified as collection 2002.3.5HN300.85. They are described as follows: two large bison or elk bones (DARG 287, DARG 288), six bones of a very large mammal (DARG 289 through DARG 294), one bone of a very large mammal (DARG 295), one bone of a large mammal (DARG 296). The bones are described as charred with unidentified ones as being sawn. No further details concerning these specimens are included in the associated site forms. The site, situated at an elevation of 10,560 feet, contained both a historic mining townsite and a prehistoric open camp. The historic site was occupied from at least 1872 through early 1900. According to the site form, the specimens are not excluded as originating from the prehistoric component. A possible prehistoric hearth feature is located on the southeastern periphery of the site boundary. A biface was located within the eastern aspect of the site near feature 4 and immediately east of the BLM parking area on the Cinnamon Pass Road. In addition, the discovery of an Ancestral Puebloan ceramic sherd may indicate a date of as early as AD 1000. The collection is curated at the Canyon of the Ancients Visitors Center and Museum in Dolores, Colorado. As the site has a prehistoric component and it is possible some of the bones are bison, they are included in the project findings in the hopes

that the listing will enable future investigators to consider evaluation of the collection.

DARG 297 and DARG 298 consist of two unidentified bones, 2002.3.5HN302.10, described as bison or elk, collected from the Tellurium/White Cross mining camp site (5HN302) situated at an elevation of 10,780 feet. There is no further information regarding these specimens. The collection is curated at the Canyon of the Ancients Visitors Center and Museum in Dolores, Colorado.

DARG 299 through DARG 309 is a collection of 11 large mammal bones (2002.3.5HN302.11) described as bison or elk recovered from the Tellurium/White Cross mining camp site (5HN302) situated at an elevation of 10,780 feet, from P.D. 13.2, Feature 13 test trench, Level 2-cellar. A total of 65 bones of various species were collected from the site and 27 of these are described as being hand sawn however; these modified specimens are not individually identified. The collection is curated at the Canyon of the Ancients Visitors Center and Museum in Dolores, Colorado.

9.3 Mineral County

No bison specimens have yet been identified as originating in Mineral County, Colorado.

9.4 Saguache County

The northwestern segment of Saguache County is situated west of the Continental Divide and includes Old Cochetopa Pass (Plate 17) and a segment of the Old Spanish Trail. At 10,067 feet above sea level this high elevation, wide and easily accessible pass was referred to

Plate 17. “Buffalos in the Cochetopa Pass of the Rocky Mountains”, an 1862 Karl Wimer mural in the rotunda of the Old Federal Courthouse, St. Louis, MO.

by the Ute people as the “Pass of the Buffalo”(Pettit 2012) or the “Buffalo Gate” (Carvalho 2004) indicating that it was a route commonly used by bison. It is probable that ancient large game and bison trails evolved into the trails habitually used by prehistoric groups following and hunting the herds as they traversed up and over the pass while moving in and out of the Gunnison Basin. Extensive historic documentation notes evidence of both bison and Native peoples in this important region of western Colorado. Although located east of the Continental Divide and outside the parameters of the study area, the Saguache County Museum was included in the project in hopes that, by chance, their collection might contain bison faunal elements or information related to bison originating near the original Old Cochetopa Pass or other nearby areas of the western slope. The outcome of the gamble proved to be most rewarding.

DARG 276, consists of a bison skull (Plate 18) sans mandible and a segment of the occiput. The horn caps are intact and attached to the horn cores. The lower aspect of the nasals and the maxilla are missing secondary to old breakage. Most of the turbinates are absent. The interior cavities of the skull were packed with dry detritus consisting of high elevation vegetation including pine needles, moss, and aspen leaf fragments. The skull is in very good condition and surprisingly retains both horn caps indicating it is unlikely to be of great antiquity. Dried rodent scat and insect larval casings were also noted. Poorly sorted small granite fragments and fine grained dark brown silt was packed within the deeper interior crevasses and under the both horn caps. On the foreskull, painted in barn-red oil base enamel, in a rather pleasant and flowing script indicative of the era, is written the following: Buffalo Head found by Jack Welch near Crested Butte Colo 1899. Approximately 80% of the occiput has been sawn off using a coping or hack saw. The foramen magnum and surrounding bone also absent likely due to breakage from the intentional removal of the occiput. It is not possible to determine when this modification occurred, however; it is strongly suspected it was done by Mr. Jack Welch, the owner, in order to better facilitate hanging the specimen on a wall for display. Removal of the

Plate 18. DARG 276, Skull with historic pigment.

tuberosities of the occiput minimizes damage to wall surfaces and assures a bison skull, when hung for display using wire, remains stable, secure, and level to the eye of the viewer (Thunder Mountain Trading Company 1999). Heavy gauge wire wrapped around both horn cores and arranged at the back of the skull to form a crude hanger, was tenuously secured to a nail hammered into a beam at the peak of a museum display room ceiling. The skull had been hanging at this location since it was donated in 1959, the year the museum opened. As it was located approximately 10 feet high and out of the field of view, museum staff were unaware of its presence until it was seen by the writer. As the wire was abrading the bone at the base of the horn cores it was removed and stored with the specimen at the time the skull was professionally cleaned. Due to project results the museum now intends to install a dedicated, secure display showcasing the skull, a photo of Jack Welsh, and associated information, to be unveiled when the museum opens for the 2021 season. Cultural modification includes the painted script on the foreskull, the sawn occiput, and the wire previously wrapped about the specimen. The Jack Welch bison skull is curated at the Saguache County Museum where a dedicated display of the specimen and associated images is planned for completion and public display by the Spring of 2021.

DARG 277, is a severely weathered bison skull fragment consisting of the remnant of the foreskull both abbreviated horn cores (Plate 19). All bone structure below the top of the right orbit and below the left horn core is absent. The base of the left horn core has weathered away. Overall weathering stage is 5 (Behrensmeyer 1978). Rodent gnaw is visible at the tip of the right horn core and to the left and the right of the foramen magnum. The specimen appears to be a juvenile of 2 to 3 years of age as it is smaller than an adult and the frontal suture is not fused. The interior of the skull was densely packed with pine tree needle duff and other vegetal detritus, roots, insect egg casings, and poorly sorted sandy sediments. There is no discernable cultural modification. The specimen, referred to as the Bunker Buffalo Skull, is presently in process of being donated to the Saguache County Museum, was found in the early to mid 1900s by a private individual in a one mile radius that encompasses both the eastern and western aspect of the Continental Divide in the Sheep Mountain area near the Rainbow Trail having eroded out of a small drainage at an elevation of approximately 10,000 feet above sea level. The specimen is to be curated at the Saguache County Museum in the Spring of 2021 and incorporated into a display with DARG 276.

Plate 19. DARG 277, bison skull found near the Continental Divide.

As this skull and several other bison specimens were originally located within the vicinity of Old Cochetopa Pass and the Old Spanish Trail corridor, it is important to mention the Cochetopa Game Drive Quarry Site (5SH1714) located on the southern periphery of Cochetopa Park approximately two miles south of Cochetopa Pass road just off the South Pass road on a ridge (UTM 13 353175 x 4224830) where Cochetopa Dome is visible to the north-northwest. The site consists of a prehistoric chert quarry, a historic rock alignment, and a prehistoric large mammal game drive with surrounding game drive features of a few excavated pits and several rock cairns averaging one meter in diameter. The possibility of this drive being used for bison kills should be considered as a possible intended use of this and other game drives in the region.

9.5 San Juan County

No bison bone specimens specific to San Juan County were found during the project visit to the San Juan County Historical Society Mining Heritage Center. No archaeological or other professional reports referring to bison bone within San Juan County have yet been located.

9.6 San Miguel County

No bison bone specimens specific to San Miguel County were found during the project visit to the Telluride Historical Museum. Museum staff declined to permit viewing of the museum archives as they were confident no bison bone was curated at the facility. No archaeological, historical, or other professional reports referring to bison bone within San Miguel County have been located to date.

9.7 Ouray County

DARG 278, documented as bison bone (5-OR-69 2-A-3) is a small bison femur fragment missing the majority of the proximal end (Plate 22). The distal portion is absent due to mechanical or hand sawing that occurred during meat processing. The specimen was recovered by Centuries Research, Inc. in 1991 from the Dallas Townsite (5OR69) located just southwest of Ridgeway State Park at an elevation of 6,840 feet above sea level. It was identified by Dr. Danny Walker, of the University of Wyoming. The bone was located near the back of what is suspected to have been a butcher shop. As the bone is small it is determined to be from a very young animal. The specimen is curated at the Ouray County Historical Museum, Ouray, Colorado.

DARG 279, documented as bison bone (5-OR-69 3W1), is a small left bison metacarpal (Plate 20) missing the distal end due to mechanical or hand sawing resulting from modern butchering. The specimen was recovered by Centuries Research, Inc. in 1991 from the Dallas Townsite (5OR69) located just southwest of Ridgeway State Park at an elevation of 6,840 feet above sea level. The bone was located near the back of what is suspected to have been a butcher shop. It was identified by Dr. Danny Walker, of the University of Wyoming. As

the bone is small and missing the majority of structure and is likely from an adolescent animal. The specimen is curated at the Ouray County Historical Society Museum , Ouray, Colorado.

DARG 280, documented as bison bone (5-OR-69 3H1) is the proximal end of a bison left metacarpal (Plates 20 and 21). The entire distal aspect is missing due to mechanical or hand sawing that occurred during meat processing. The specimen was recovered by Centuries Research, Inc. in 1991 from the Dallas Townsite (5OR69) located just southwest of Ridgeway State Park at an elevation of 6,840 feet above sea level. The bone was located near the back of what is suspected to have been a butcher shop. The bone, identified by Dr. Danny Walker, of the University of Wyoming, is small, deteriorated, and missing the majority of structure and is determined to be from a very young animal. The specimen is curated at the Ouray County Historical Society Museum, Ouray, Colorado.

Plate 20. DARG 278, 279, and 280, the Dallas Townsite, 5OR69, collection.

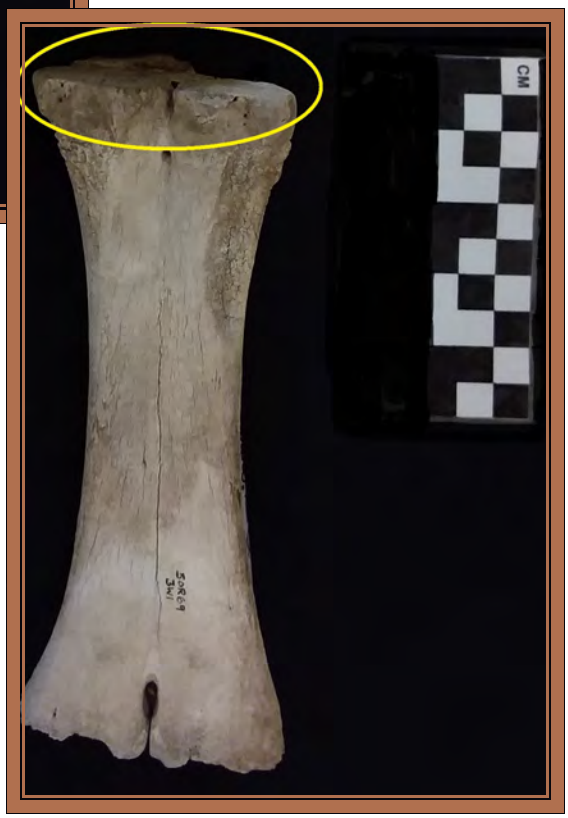

Plate 21. DARG 279, detail of sawn segment (yellow) of bison left metacarpal.

DARG 281, is a collection of and unknown number of bison bone fragments recovered by Centuries Research, Inc. in 1991 from the Dallas Townsite (5OR69) located just southwest of Ridgeway State Park at an elevation of 6,840 feet above sea level. As the assemblage could not be located in the museum storage area, it could not be examined and no further information is available. The specimens are curated at the Ouray County Historical Society Museum, Ouray, Colorado.

9.8 Pitkin County

DARG 284 is a partial bison skull (Plate 22) reported to have been recovered by an unknown party near the confluence of Park Creek and North Thompson Creek near County Road 117 in the extreme northwestern aspect of Pitkin County at an approximate elevation of 9000 feet above sea level. The significantly weathered specimen is displayed in a glass case with another bison skull recovered near Rifle, Colorado in May of 1997 by Bureau of Land Management surveyor Mike Miller. Both are displayed in the same case with a variety of bead necklaces, feathers, projectile points and other assorted Native American items. The specimen consists of the upper aspect of the cranium missing all below the apex of the nasals, the right eye orbit, the right horn core, and approximately half of the terminal aspect of the left horn core. The back of the skull is weathered away exposing the interior of the cranial cavity and upper aspect of the sinuses. Parallel to the base of the right horn core is an approximately 4mm wide and 5 cm long shallow groove which appears unnatural and somewhat suggestive of cultural modification resultant from tying cordage to the skull for the purpose of hanging for display or from abrasion related to dragging the skull. DARG 284 produced calibrated dates of A. D.1690-1730 (21.8%) and A. D. 1810-1920 (73.6%). The specimen is presently curated at the Silt Historical Museum in Silt, Colorado.

Plate 22. DARG 284, a partial bison skull recovered in Pitkin County.

Ziegler Reservoir Fossil Site, Pitkin County

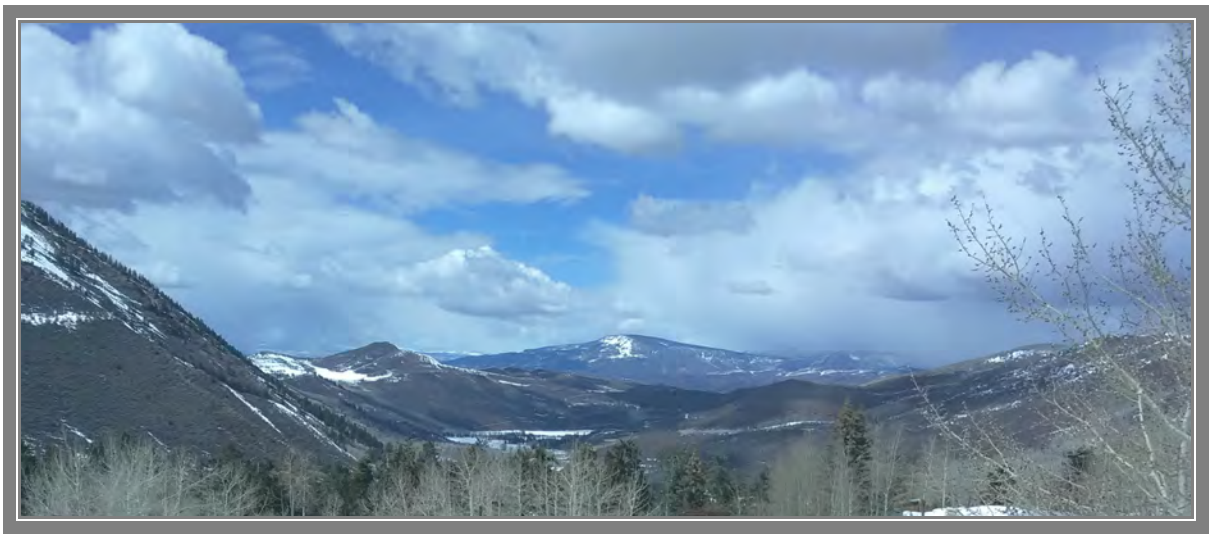

Plate 23. Ziegler Reservoir Fossil Site, just left of lower center.

The Ziegler Reservoir Fossil Site (ZRFS)(5PT1264) (Appendices H and I) is located approximately a mile west of Snowmass Village, Colorado in the basin of a high elevation enclosing glacial moraine (Plate 25). The site produced several thousand vertebrate, invertebrate, and floral specimens representing a Pleistocene ecosystem spanning a series of nearly continuous sedimentary sequences representing the end of Marine Oxygen Isotope (MIS) 6, all of MIS 5 and 4, and the beginning of MIS 3. To date ZRFS is the most complete high elevation MIS 5 terrestrial site known in North America. A total of 402 bison bones, primarily *Bison* latifrons, were excavated, processed, examined and collected. The specimens are housed at the Denver Museum of Nature and Science in Denver, Colorado and were graciously made available for direct examination by the facility staff. Bone collagen testing resulted in dates spanning a time period of ~140 ka to 55 ka . All specimens were viewed and photographed and ten of these were inspected in detail visually and using a 50X-500X 0.3MP handheld multi-USB digital microscopic.

Of interest were a number of parallel and curvilinear scratches and striations present on the surfaces of several of the specimens. It is probable that the marks are due to various hydraulic and sediment abrasion processes though it is noted that the marks do not occur over the entirety of the specimen surfaces as might be expected secondary to centuries of exposure to such natural processes. The origin of these marks is of interest and, though non-cultural modification is assumed and most likely the possibility of cultural modification should be addressed. A discussion of the ZRFS and the bison bone assemblage is contained in Appendix I of this report.

Region: Southwestern Colorado

It was determined to include five southwestern Colorado counties, Archuleta, Dolores, southern Hinsdale, La Plata, and Montezuma, in the body of the project in order to provide an all encompassing overview of the region and to investigate any relationship regarding the presence and exploitation of bison between west-central and southwestern Colorado. An unexpected increase in time available to the project provided an opportunity to seek out curated bison faunal elements from this region. A visit in early March of 2019 to the Animas Museum in Durango, Colorado and a tour of their exceptional curation facility revealed no bison faunal elements or references to bison. On the following day a tour of the Canyons of the Ancients Visitors Center and Museum in Dolores, Colorado also produced negative results after viewing of the public displays. Further investigations were not possible at that time as staff were unavailable. A later request to the museum resulted in the provision of a curation list specific to bison bone and possible bison bone collected from the above listed counties. The project was unable to visit the Pagosa Springs Historical Museum as, in response to the Covid-19 pandemic, they have closed until further notice. Although no museum staff could be contacted a member of the local history club stated she was not aware of any bison related displays or bones in the museum. All of the bison bone located by the project in southwestern Colorado are curated at the Canyons of the Ancients Visitors Center and Museum.

9.9 Archuleta County

DARG 285, a bison (or possibly wapiti) patella (2012.9.5AA83.121) recovered from Chimney Rock Pueblo (5AA83) subsurface Stratum 3, Level 1 in room 7, PD 46. The pueblo is a Chacoan outlier site consisting of multiple room blocks, two kivas, and a plaza. The somewhat rectangular masonry structure spans the periods of Pueblo I, II, and III and is situated at an elevation of 7600 feet. The patella is unmodified and is attributed to the Ancestral Pueblo. Of the 47 faunal remains located during excavation this was the only specimen determined to possibly be bison. It appears that no radiometric sample was taken from the specimen. The specimen is curated at the Canyons of the Ancients Visitors Center and Museum in Dolores, Colorado.

9.10 Dolores County

No bison specimens have yet been identified as originating from Dolores County. Several individuals with family history dating to the 1880s in Dolores County have referred to generational memory of an organized bison hunt in the Rico area circa 1886 or 1888. One individual recalls that this event was advertized in the Silverton newspaper. Unfortunately, the project has been unable to locate this article or other confirmation of the reported event.

9.11 Southern Hinsdale County

No bison specimens have yet been identified as originating in southern Hinsdale County. In his Many More Mountains, three volume set, volume I, Alan Nossaman (1981)

notes that the Ute people followed bison trace through the deep early Spring snows over the passes into the high mountain parks in Hinsdale County. The trail broken by the bison through the deep snow was the only way to access the high country passes early in the Spring season. Following bison trace broken through deep winter and Spring snows was also a common practice documented by fur trappers and mountain men of the 1820s to the 1850s fur trade era in the Rocky Mountains.

9.12 La Plata

DARG 320 (2003.47.5LP1915), is a single sawn long bone described as "1 Bison/cow-sized mammal..." recovered from the Cherry Creek Construction Camp site (5LP1915), a Rio Grande Southern Railroad construction camp situated at an elevation of 8360 feet and located eight miles southeast of the town of Mancos, Colorado. The bone was located near Feature 13 which, from the site form description, may have been a dump area. The camp was likely occupied in the Summer or Fall of 1890. The specimen is curated at the Canyons of the Ancients Visitors Center and Museum in Dolores, Colorado.

DARG 321 (2003.47.5LP1921.274) four unidentified, sawn possible bison bone fragments, and **DARG 322** (2003.47.5LP1921.278), five unidentified, sawn possible bison bone fragments. All are from the Hook Site (5LP1921), a railroad section house situated at an elevation of 8160 feet. The bones are described as "Bison/cow-sized mammal" bones culturally modified by sawing, a modern butchering technique. The bones were found in a refuse dump associated with the three features two of which were identified as a bunkhouse and a section house. The site dates from between 1892 and 1910. The specimens are curated at the Canyons of the Ancients Visitors Center and Museum in Dolores, Colorado.

9.13 Southern Mineral County

No bison specimens have yet been identified as originating in the southern aspect of Mineral County, Colorado.

9.14 Montezuma

DARG 314, is an unmodified bison terminal phalanx (1978.1.5MT4797) recovered from Cougar Cave site (5MT4797) situated at an elevation of 6900 feet and located on the south side of Dry Canyon 600 meters northeast of the Dolores River. The cave opens to the northwest and is 25 meters long and 2.1 meters deep with a small drip spring found within. An upright slab alignment, a green quartzite hammer stone, and a concentration of flakes were found along with the bison bone. No further information is available regarding the site or the bison phalanx. Its similarity to the phalanxes found at the Mountaineer and Tenderfoot sites in Gunnison County which may have been used as lithic manufacturing mallet tools and its location in a habitation area may indicate it was purposed or intended for use as a tool. When possible the specimen will be examined for impact indentations. The specimen is curated at the Canyons of the Ancients Visitors Center and Museum in Dolores, Colorado.

DARG 315, is a possible bison astralgus found in association with nine other artiodactyla bones (1978.28.5MT2149.25.6) that are not clearly defined as bison. The nine bones include a first phalanx, four carpals, a left calcaneous, a tarsal navicule-cuboid, and two patella. The astralgus is attributed to a small, immature bison and all the bones are described as unmodified. The specimen was recovered from the Escalante Ruin (5MT2149) a nine room pueblo with one kiva occupied during Pueblo cultural periods I, II, and III. The specimens are curated at the Canyons of the Ancients Visitors Center and Museum in Dolores, Colorado**.**

9.15 Southwestern Montrose County

DARG 319, consists of unidentified bison bone recovered from 5MN1068, the Zephyr site, a few miles east of Cerro Summit and immediately north of State Highway 50 at an elevation of 8040. The site, located very near the Gunnison county line and near DARG 269, DARG 270, and DARG 271, was excavated in the 1980s and contained a large 6 meter by five meter charcoal stain and a house structure. Radiocarbon dates spanned 7650 BP to 8,000 BP, and though there was concern they may have been coal contaminated, several large bifaces and two Paleoindian projectile point fragments were found in the site (Indeck and Kihm 1982). Archaic projectile points were also found on the site. A later test produced a date of 3965 BP which may indicate a later occupation or a more accurate date.

DARG 323, consists of bison long bone fragments (2012.18.5MN654.892) that may have been burned, recovered from what is likely House 1 at Cottonwood Pueblo; 5MN654. The site is situated at an elevation of 6462 feet and located approximately 10 miles east of Nucla, Colorado in the southwestern aspect of Montrose County. This extensively excavated and meticulously studied site dates to 1050 +/- 40 BP (cal A.D. 900-1030) and is included in a network of sites referred to as the Gateway Phase. The site is considered to be a settlement of immigrant Puebloan peoples who shared the immediate region with an indigenous local population identified as a Gateway Phase group (Greubel 2018). These two groups may have enjoyed a mutually supportive relationship within a core area where the Gateway Phase group engaged in hunting and foraging and the Puebloan immigrants focused on a more sedentary lifestyle of farming and production of trade items including ceramics. Within the Gateway Core Area specialized stone cist storage structures are found at sites attributed to the local indigenous groups, including the Jeff Lick Stone Circles site, 5MN3462. These and other nearby “way-station” type sites may suggest a system of the acquisition and progressive transfer of regional resources including meat, such as bison (Martin and Shelton 2015). There are indications that these and other surplus hunted and foraged products were temporarily stored and then successively transported from one way-station to another for eventual delivery and trade with the Puebloans at their settlements. The presence of bovine antisera in a storage structure at the Jeff Lick Stone Circles site, 5MN3462 (Martin and Shelton 2015), a probable way-station stockpiling location in the Gateway Core Area, and the bison long bone fragments at Cottonwood Pueblo certainly confirm that bison hunting was occurring within the region and that bison meat, in addition to being a primary or supplemental source of protein nourishment, may have been a valued trade item. Ceramic trade ware fragments have been found at Huscher Middle Fork Escalante sites, 5ME22100 and 5ME21948, (Harris, Greubel, and Hunt 2020) and

other sites further supporting the theory of trade activity between Puebloan and Gateway Core Area indigenous peoples. The majority of specimens are curated at the Canyons of the Ancients Visitors Center and Museum in Dolores, Colorado with several other specimens identified as bison bone curated in framed cases at the Rimrocker Historical Museum in Naturita, Colorado. Removal from the frames for inspection though permissible per the curator, was not possible as the display is situated high on a wall and, at the time, there was not a safe way to access them.

10.0 RESULTS

Phase II of the Western Colorado Bison Project produced a total of 470 bison faunal elements, 68 of which are included in the main body of the study. The remaining 402 bones compose the Ziegler Reservoir Fossil Site (5PT1264) bison bone assemblage addressed in Appendices H and I.

Of the 68 faunal elements evaluated for the main body of the study, 35 specimens were available for direct visual inspection. Twelve confirmed bison bone specimens, DARG 263, DARG 265, DARG 267, DARG 268, DARG 269, DARG 270, DARG 271, DARG 310, DARG 314, DARG 317, DARG 319, and DARG 323, were not available for study as they either had not been collected, were curated out of state, or the curation location could not be determined at this time. Research on all specimens included attempts to collect as much information as possible related to each specimen including its original and present location, previous data collection information, notes, reports, and published information, available radiometric data, and any other associated history related to the item. Available bones and horn elements were examined in an effort to confirm species, identify the presence or absence of cultural modification, or identify it as an ecofact, and to determine the degree of weathering. Details of these observations are found in Appendices A, B, C, D, E, F, and G. A total of 32 specimens, most described as probable or possible bison could not be examined and confirmed as bison as they are curated in facilities closed due to the 2020 Covid 19 pandemic. As much information as possible was obtained and included in the report and in Appendices A through G. Bone collagen samples for radiometric dating were taken from 10 specimens and eight other specimens had previous results obtained from bone or associated charcoal samples. A total of 18 radiometric dates were included in the report and all radiometric data noted in Appendix F has been entered into both the DARG Colorado Radiocarbon Database Project (http://dargnet.org/net/RCPublic/) and the recently created DARG Western Colorado Bison Study website (dargnet.org/net/bison/bison.html).

Of the 68 primary specimens included in the body of the report 10 (14.7 %), exhibited evidence of cultural modification (Appendix B), 10 (14.7 %) were defined as ecofacts (Appendix C), and 47 (69.1 %) had no evidence of cultural modification (Appendix D). One specimen, DARG 263, is intentionally duplicated in Appendix C and D. A significant number of specimens, 49 (72.0%), were recovered from an elevation at or greater than 8,000 feet above sea level in the Montaine to Alpine life zones.

11.0 DISCUSSION

The goal of Phase II of the Western Colorado Bison Project was to locate bison faunal elements in west-central and southwestern Colorado to determine the degree to which these specimens evidence cultural modification and to collect and assimilate data in an effort to begin to develop an understanding of the relationship of humans to bison west of the Continental Divide. As locating and excavating sites was an unrealistic research method it was determined to explore the collections of western slope museums and research previous archaeological work in order to secure specimens for evaluation or to access previously accumulated data. Although an unknown number of specimens may have been overlooked due to constraints of time and opportunity, this strategy has proven most effective.

All twenty museums and facilities listed in the project were contacted and 19 were visited. All of the museums actively and enthusiastically participated in the project by generously permitting access to their collections and any bison faunal elements therein or by providing information to the best of their ability. Each facility kindly made available their curation files, archives, and any other available records. All available specimens located during the project were examined, photographed, and data collected. Bone collagen samples were obtained with permission of museum Board of Directors or curators. Additional contributors included two private land owners who had located specimens on their private farm and ranch properties. These individuals graciously provided, to the best of their knowledge, general location information, dates of collection, photographs and other pertinent information during one-on-one visits. None of the privately owned specimens proved to be archaeological artifacts.

Bison bone artifacts, non-modified bison faunal elements, or information related to bison was verified in the collections or archives of seven of the 20 museums. Those available bison bone specimens were directly examined for cultural modification and other data and all the museums possessing bison bone permitted the investigator to obtain bone collagen samples for radiometric dating. Bone collagen samples were also obtained from non-culturally modified bison bone and are presently stored at Dominquez Archaeological Research Group offices pending location of an appropriate curation facility hoped to be Colorado Mesa University's Forensics Investigation Research Station, where they may be made available to students and researchers in their comparative collection.

Additional information concerning unavailable specimens was obtained from reviews of formal archaeological reports, curation listings, photographs, various obscure publications, historic documents, military records, unpublished papers, other literature reviews, and personal communications. Comments, observations, and input offered by Ute Tribal Elders Clifford Duncan during a 2014 visit with DARG and the Grand Junction BLM to the Rader Wickiup site (5RB2624) and Alden Naranjo on June 12th, 2018 during the UTE STEM San Luis Valley field trip was gratefully accepted and taken into consideration during the investigations. All valid data was ultimately incorporated into the ever-evolving Western Colorado Bison Study database (dargnet.org/net/bison/bison.html). The interactive data base and query maps are designed to allow professional archaeologists and interested researchers to obtain information

as needed and to self-enter newly acquired information to the data base. These tools are available and accessible to professionals, students, and the interested public.

11.1 The Occurrence and Fluctuation of Bison in the Desert West (by James C. Miller and Holly Shelton; abbreviated from Berry et al. 2012)

The occurrence of bison on the Great Plains has received substantial documentation. Several scholars and writers suggest that bison roamed in abundance west of the Great Plains. Research conducted by Butler (1978) as well as Meaney and Van Vuren (1993) promotes a basic knowledge of the occurrence of bison west of the Great Plains.

Butler (1978) focuses on documenting a regional occurrence of bison west of the Great Plains. A consensus exists between many scholars and writers that bison were abundant from the Green River in southwestern Wyoming westward through the northeastern corner of Utah and the Snake River Plain into eastern Idaho (Butler 1978). "According to early travelers (Kingston 1932), there were thousands upon thousands of bison to be seen in the Upper Snake country, but only occasional skulls, 'strays,' and small 'bands' farther west (Butler 1978)." This historical account led Butler to postulate a westward boundary for bison. Other reports by early travelers recount bison in the northern portion of Nevada, eastern Oregon and eastern Washington. Meaney and Van Vuren (1993) undertook an extensive records search to document the former distribution of bison in western Colorado excluding the eastern Colorado plains due to previous substantial documentation of bison in that area. Their search of records from local museums and private collections yielded 102 specimens from 86 localities in 20 counties. Review of literature yielded an additional 47 localities in 18 counties. Meaney and Van Vuren conclude that bison were abundant in northwestern Colorado. The Front Range, South, Middle and North Parks of Colorado provided good forage and cover for bison. Conversely, bison are relatively rare in the southwest portion of the state, particularly the San Juan Mountains and the Uncompahgre Plateau. The rugged terrain of the San Juan Mountains is perhaps one reason for the lack of bison in this area. On the other hand, the Uncompaghre Plateau would have been prime habitat for bison and it is surprising that there are so few reports of bison remains there.

It has been a long held belief that the presence of bison in the Desert West was a phenomenon of the early Historic Period. This belief has been challenged by the inundation of data concerning the presence and absence of bison remains in archaeological contexts. It is now known that the presence of bison in the Desert West fluctuated throughout Prehistoric and Historic periods. Archaeological research conducted by Butler (1978), and Lubinski (1995), as well as, Thompson and Pastor (1995) stated that bison populations were highest during the Late Prehistoric period in the Desert West. The Medithermal climate from 500 BP to 1500 BP fluctuated somewhat but overall consisted of relatively stable cool and wet periods which likely contributed to the high bison populations of that time. Excavation due to construction also results in exposure of bison remains and, when the construction is monitored, they can be recovered previous to deterioration.

According to Robert Butler, discernable patterns for the occurrence of bison through time are only evident in the sagebrush grass regions of the Desert West. It appears that "bison were continually present in the Upper Snake country from before man first entered the region until well into the Historic period, but were apparently more abundant in the Late Prehistoric period" (Butler 1978). Butler's premise is based on data recovered from stratified rockshelters in the Birch Creek Valley of eastern Idaho. A distinctively different distribution is present in the Columbia Basin (Butler 1978). Data from 32 archaeological sites suggests that bison roamed the area up until 6,300 years ago and then populations significantly declined. This is in-part evidenced by the "3,000-year gap between the bison remains reported by Schroedl (1985:83) and those recovered from Layer 5e at the Weis Rockshelter at the extreme eastern margin of the Basin that dates from 6,300 years ago" (Butler 1978). Bison appeared to be most abundant from 3000-1500 years ago.

Archaeological investigations by Lubinski (1995) also reveal evidence for a fluctuating bison population. Lubinski dated 93 faunal assemblages from sites in southwest Wyoming ranging from Paleoindian to Protohistoric. Analysis of the faunal assemblages revealed that bison were present in 50% of the assemblages. Bison remains were most prevalent from the Middle Archaic through the Late Prehistoric. From about 5,000 to 8,000 years BP, bison remains essentially disappeared, constituting less than 1% of 955 identifiable species. Bison remains reappear in the archaeological record between 9,000-10,000 BP after a 1000 year hiatus.

Thompson and Pastor (1995) conducted a study similar to Lubinski's. Archaeological data was compiled through an intensive cultural resource management study of southwest Wyoming. Analysis of the data suggests that bison occurred sporadically during the Archaic and increased in frequency during the Late Prehistoric. Frequency was measured through the tabulation of identifiable bison remains in dated components, organized into 400-year increments, spanning the complete cultural chronology from Paleoindian to Late Prehistoric (Thompson and Pastor 1995:79, Table 8). Total frequency of bison remains recorded for sites in southwest Wyoming equals 19, which comprises 11.66% of the combined faunal assemblages. There are no identifiable bison remains in the study area dating to the Paleoindian period. The sporadic occurrence of bison in the Archaic is clearly illustrated by the distribution of only three bison throughout the Early Archaic, one bison in the Middle Archaic and three bison in the Late Archaic. In the Late Prehistoric, there is a marked increase in the frequency of bison. A total of 12 bison were identified at Late Prehistoric sites.

Butler, Lubinski, and Thompson and Pastor acknowledge that there are inherent problems with their data. Assuming that bison remains in archaeological sites correlates directly with bison population deserves careful consideration. It is possible that bison remains in archaeological sites may reflect encounter hunting instead of bison populations. Limited sample size, primarily due to the extremely fragmented nature of faunal assemblages in archaeological sites, plays a significant role in biasing data. Displacement of elements by carnivores and rodents and the inability to discern certain cultural specimens from non-cultural specimens, also causes complications with data interpretation.

Native American reliance on bison in the Desert West exhibits a sporadic quality when examined through time. On the other hand, the minimum number of bison manifest in the archaeological record remains relatively constant through time. A series of sites, with the exception of a few anomalies, in southwest Wyoming and Colorado are noted to reveal this evident pattern.

The Barnes site (48LN350) and the Wardell site (48SU301) warrant valid classification as an aberration in the archaeological record when compared to the plethora of sites containing the remains of only a few bison. The main difference for their anomalistic quality is rooted in site function. The Barnes site and the Wardell site are bison procurement sites; whereas, the majority of sites in southwest Wyoming and Colorado are short-term encampments. The Barnes site is a Late Prehistoric bison jump located along the Fontenelle Creek in southwest Wyoming (McKern 1995). Investigations in 1987, revealed eighteen individual bison. However, during the first investigation conducted in 1978, Professor Charles Love noted that bone, possibly representing four or five different bison, was collected by his informants. Unfortunately, the bone was not included in the analysis of the 1987 investigation. The Wardell site is a Late Prehistoric bison pound, butchering and processing area, and campsite located in the Green River Basin near Big Piney, Wyoming (Frison 1991). Bison were herded into a corral at the base of a steep scarp and slaughtered. There are nearly 5 five feet of stratified bone levels spanning a total of 500 years. Hundreds of bison are interred at the site. Excavations involving less than a quarter of the site revealed at least 150 bison. According to Frison (1991:225), "there is no way of knowing whether the corral was partly cleaned at various times or how much of the bone material was taken to the processing area, so the total count of animals killed [is] a guess."

The majority of the archeological sites in southwestern Colorado that contain bison remains are typically short-term encampments. Archaeological investigations by Carl E. Conner at sites 5ME5997 and 5ME6144 revealed a small sample of bison bone. A utilized bison scapula was found at site 5ME5997 a Late Prehistoric open camp that lies along the rim of Clark Wash in Glade Park in Mesa County. According to Conner (1998), the carbon date for the hearth feature associated with the bison scapula served as the first substantial date for the presence of bison on the Uncompahgre Plateau. Site 5ME6144, also on the rim of Clark Wash in Glade Park, is a Late Prehistoric rockshelter. Four identifiable fragments of bison bone were recovered from the site and additional bison bones were found in a packrat midden outside the rockshelter.

Buckles recovered bone in buried context during his work on the Uncompahgre uplift; however, the material was lost before analysis was complete, so it is uncertain if bison remains were included in the assemblage (1971:575-576). Archaeological investigations at the Taylor site (5LP696), located at the south end of Red Mesa near the Colorado-New Mexico state line, revealed a large artiodactyl rib and vertebra fragments that may represent bison (Firor 2001). Bison bone was also discovered on the Roan Plateau at site 5GF2416 (Conner 2008, personal communication). Grand River Institute of Grand Junction, recorded bison bone (distal portion of a left tibia) in the upper reaches of Willow Creek in Garfield County. The tibia has been

culturally modified. It exhibits green bone fractures, which indicate marrow extraction. The bone was then modified through flaking to produce a fleshing tool (Smith et al. 2008).

Reliable historical documentation of living bison in western Colorado is rare and often anecdotal. Several individuals did formally document the presence of bison the area including Simmons (2000) who notes that by 1850 bison were no longer found in lower elevations but that the Heap-Beale expedition of 1853 observed Utes hunting bison at Cochetopa Pass and that Mexicans still came to trade with the Utes for "buffalo" hides. In December of 1854 the Utes and Shoshones hunted bison together on the White River (Simmons 2000). Dr. W. H. Bergtold, of Denver, stated that in 1894 he found "abundant" bison bones in the area between Rifle Creek and the Bears Ears mountains near Craig.

Documentation of the last known living wild bison in western Colorado consists of Felger's (1909) inclusion of a personal communication from the owner of the Meeker Hotel in Meeker, Colorado, Mr. R. S. Ball, who shared his observation that the last known bison in the area was killed in 1884 by a group of Ute Indians at Cedar Springs approximately six miles west of Craig, Colorado.

11.2 Prehistory and History of Bison and Bison Hunting in West-central Colorado.

The evolutionary history of bison in North America is by no means clearly understood. Dates of the bison's first appearance in the Americas, time lines of biological divergence, routes of migration, episodes of species congruence, and extinction dates are all embedded with controversy. Research dedicated to clarifying these questions is ongoing and the pieces of the bison evolutionary puzzle are gradually coming together to create a picture of the complicated journey through time of this remarkable creature. The Bovidae Family, of which bison are a member, consists of 140 living and over 300 extinct species which may extend to approximately 17.7 million years ago to the common ancestor *Selenoprortax* vexillarius (Badgley et. al., 2008). *Bison* priscus was the first of the genus to migrate into the Americas. It is important to note that several additional chronologically oriented subspecies of *B.* priscus have been proposed by Castaños, Castaños, and Murelaga (2006) that include *B.* priscus gigas, *B.* priscus mediator, and *B.* priscus priscus. Over time, several species of bison, the majority now extinct, were present on the North, Central, and South American continents with B. latifrons, B. priscus, and B. antiquus, having been pursued and harvested by human predators.

Until recently it has been commonly accepted that the earliest bison in North America, *Bison* priscus, also referred to as steppe bison or steppe wisant, traversed the Bering Land Bridge from Siberia sometime between 300,000 and 130,000 years ago (Shapiro et al. 2004) gradually wending their way into western Canada, mid-continent America, and southward into what is now Mexico. New investigations using mitochondrial DNA from fossil bison bone has significantly refined the timing of this previously confusing mammalian invasion of the Americas. By evaluating the results from a combination of paleontological and paleogenomic testing and resultant evidence from the oldest known bison fossils in North America, including *a Bison* latifrons bone specimen from Ziegler Reservoir Site in Colorado, Dr. Duane Froese

and a team of researchers have developed an accurate time line defining the appearance of bison and aspects of their evolution in North America (Froese et.al. 2017).

Using bison fossil specimens collected from two well dated sites, a 130,000 year old Ch'ijee's Bluff *Bison* cf. priscus from the Old Crow area of the northern Yukon, Canada, the 120,000 year old Snowmass *Bison* latifrons from Ziegler Reservoir Site near Snowmass, Colorado, and 44 additional bison mitogenomes the team determined that there were two distinct episodes of bison moving out of Asia and invading and colonizing North America. The first of these invasions date to ~195,000 to 135,000 years ago and occur before morphological diversification of bison on the North American continent. During the Late Pleistocene the second invasion occurs and is dated to ~45,000 to 21,000 years ago. Therefore, the data reveals that bison made their first appearance in North America during a sea level low stand within marine isotope stage 6 (MIS 6) thereby refuting previous proposals of an earlier presence of bison on the continent. Bison rapidly colonized most of North America and, effectively surpassing the mega-mammalian grazers Equus and Mammuthus, established themselves as the dominate grazing mammal on the continent. Bison retained this status until their near extermination, induced by both EuroAmericans and Native Americans, left the species teetering on the brink of extinction by the late 1800s. A population of *Bison* priscus, which did not migrate southward from Beringia, appears to have spread eastward into the Northwest Territories of Canada and are dated to have existed as late as 11,800 B.P. (Zazula et al. 2009:2741), an indication that they may have been available as prey for human hunters.

The long-horned *Bison* latifrons was the largest of the ancient bison standing 2.4 meters at the withers. This remarkable example of Pleistocene megafauna weighed up to 1024 kilograms, and averaged a length of 4.75 meters. Its distinctive horns, the longest of any known bison species, are known to have an average horn core tip to tip span of 1.4 to 2.2 meters with the horn caps extending much farther (San Diego Zoo Global 2009). That *B*. latifrons evolved to become Bison antiquus (Meltzer 1999; Schultz and Hillerud 1977) is a theory challenged by Schultz and Hillerud (1977:112) who propose that a several "paleospecies" of bison filled various ecological niches resulting in multiple lineages of bison occurring in the Late Quaternary. As it relates to bison evolution in North America, the importance of the Ziegler Reservoir site *B*. latifrons specimens cannot be overemphasized. As *B.* latifrons is not found in the northern reaches of North America, Canada, or in Siberia, the presence of the Snowmass *B.* latifrons in an MIS 5 senso lato site, combined with additional evaluation of a collection of bison mitochondrial genomes, establishes a morphologically distinct bison species in continental North America that is of a younger age than the Old Crow *B*. priscus used in the Froese study (2017). This information indicates that *B*. latifrons evolved to become morphologically distinct in what is now defined as the continental United States (Froese et.al. 2017). By the late Wisconsin Glaciation, approximately 20,000 years ago, *Bison* latifrons was likely extinct.

Bison antiquus, possibly a direct ancestor of *Bison* bison, was common in mid-continent America by 18,000 years ago and may have disappeared from the faunal community as recently as 10,000 years ago. Averaging 2.2 meters in height, 4.6 meters in length, and with a tip to tip

horn core span of about 1 meter, *B.* Antiquus was approximately 20 percent larger than the modern *Bison* bison we are familiar with today. Paleoindian hunters of the Rocky Mountains and Plains left evidence of extensive hunting of *B.* antiquus as found in multiple archaeologically important kill sites such as the Finley Bison Kill site, a Cody Complex site in southwestern Wyoming, Hudson-Meng (Agenbroad 1978) where over 500 *B.* antiquus remains were found with in-situ Paleoindian projectile points and other stone tool artifacts.

Existing congruently for a time with *B.* antiquus, *Bison* occidentalis lived during the Late Pleistocene and through the mid-Holocene from approximately 11,000 years ago to 5,000 years ago, and was also hunted by Paleoindian peoples. Morphologically *B.* occidentalis was slightly smaller and more gracile than *B*. antiquus sporting thinner horns that pointed backwards instead of forwards. There is conflict among academics regarding the development of *B.* antiquus and *B.* occidentalis with Meagher (1986) and Frison (1998) stating each are a separate species and Wilson (1978) indicating they are both subspecies of *Bison* bison. Further study wil be required to resolve this issue. There is a possibility that, instead of becoming extinct, both *Bison* antiquus and *Bison* occidentalis, via phenotypic and morphologic adaptation to climatic change, evolved to become *Bison* bison (Martin 2018).

One of only eight ungulates to survive the last deglaciation in the Americas (McDonald 1981) *Bison* bison, alternately referred to as the American or Plains Bison, or colloquially as buffalo, is now the commonly accepted extant bison species on the North American continent. Standing an average of 1.67 meters to 1.86 meters for males and 1.52 m to 1.57 meters in females at the withers and with a head to tail base length of 3.6 meters to 3.8 meters in males to 2.13 meters to 3.18 meters in females, an adult male *B*. b. bison can weigh between 318 to 1179 kg with the heaviest known wild bull weighing 1270 kg (https://animaldiversity.org/). Their unusual conformation, massive head and forequarters tapering downward to a narrow rump, does not disable them from being fleet and agile reaching speeds up to 65 km/h (40 mph) and being fully capable of easily jumping a 6 foot fence or simply plowing through it. Over time this species of bison reproduced in great numbers and soon became the predominate large mammal species of the continent. They congregated in herds of such size that it is difficult to comprehend their magnitude as they migrated across the Great Plains in numbers estimated between 60 and 100 million individuals.

Though not always supported in the archaeological community, it is suggested that there were and are presently two subspecies of Plains bison these being *B. b.* athabascae, the wood bison and *B.b.* bison the plains bison. Though previously found in significant numbers throughout the high country and boreal forests of Alaska, northwestern and northeastern Canada, and the Yukon, the wood or mountain bison is described as larger than *B. b.* bison and possibly more aggressive and dangerous. *B. b.* bison, or the Plains bison, is described as slightly smaller with a rounded instead of a squareish hump, fleeter of foot, and with more stamina and endurance. Though not a universally accepted concept, the plains bison may be divided further into two ecotypes, *B. b.* montainae, a northern plains ecotype, and *B. b.* bison, and ecotype of the southern plains. It is suspected that the bison of the western rocky mountains and Colorado high country may have been a subspecies or race of *B*. b. bison. These, often

referred to as Mountain bison, are described as slightly smaller and more gracile than the Plains bison and are considered to have been more agile, aggressive, and elusive. Although he did not consider them a separate species, President Theodore Roosevelt, a remarkably experienced big game hunter, spoke of hunting this type of bison and made clear distinctions when discussing their attributes (Roosevelt 1893):

> " In the recesses of the Rocky Mountains, from Colorado northward through Alberta, and in the depths of the sub-arctic forest beyond the Saskatchewan, there have always been found small numbers of the bison, locally called the mountain buffalo and wood buffalo; often indeed the old hunters term these animals "bison," although they never speak of the plains animals save as they form a slight variety of what was formerly the ordinary plains bison, intergrading with it; on the whole they are darker in color, with longer, thicker hair, and in consequence with the appearance of being heavier-bodied and shorter-legged. They have been sometimes spoken of as forming a separate species; but, judging from my own limited experience, and from a comparison of the many hides I have seen, I think they are really the same animal, many individuals of the two so-called varieties being quite indistinguishable. In fact, the only moderate-sized herd of wild bison in existence to-day, the protected herd in the Yellowstone Park, is composed of animals intermediate in habits and coat between the mountain and plains varieties — as were all the herds of the Bighorn, Big Hole, Upper Madison, and Upper Yellowstone valleys.
>
> However, the habitat of these wood and mountain bison yielded them shelter from hunters in a way that the plains never could, and hence they have always been harder to kill in the one place than in the other; for precisely the same reasons that have held good with the elk, which have been completely exterminated from the plains, while still abundant in many of the forest fastnesses of the Rockies. Moreover, the bison's dull eyesight is no special harm in the woods, while it is peculiarly hurtful to the safety of any beast on the plains, where eyesight avails more than any other sense, the true game of the plains being the prong-buck, the most keen-sighted of American animals. On the other hand the bison's hearing, of little avail on the plains, is of much assistance in the woods; and its excellent nose helps equally in both places."

Confirmation of a scientific distinction between the Plains and Mountain bison has not yet been confirmed and the issue remains a point of conflict among those with an interest in the subject. That said, it is to be noted that, though a limited sampling, the majority of *B.* Bison skeletal remains examined in both Phase I and Phase II of the project are observed to be slightly smaller than those specimens common to the Plains. Although of interest to the project, data collection on skeletal element size which may contribute to discerning a possible differentiation of Mountain bison from Plains bison, it is not an aspect of the study and pursuit of this concern shall be left to future researchers.

The earliest evidence of bison in the west-central Colorado project area is from the recently excavated Ziegler Reservoir Fossil Site, commonly referred to as the Snowmastadon

Site. Located in Pitkin County, less than one mile west of Snowmass Village, Colorado, on the ridge of a glacial moraine between Brush Creek and Snowmass Creek, the reservoir was constructed in 1958 in a sediment filled basin meadow. The meadow had previously been a natural alpine lake formed by the lateral lobe of a glacier during Marine Oxygen Isotope Stage (MIS) 6. As the lake filled with sediment over time an astonishing variety of flora and fauna was preserved in the accumulating layers. The resultant biotic community is represented by species of mega and macro fauna including mammoth, mastodon, bison, ground sloth, bear, camel, horse, and canids. Macro and micro flora and a wide variety of reptiles, insects, and molluscs were also recovered from the site (Johnson and Miller 2012). Use of three well defined stratigraphic tie points within at the site enabled scientists to confidently establish a correlation between the lake center and the lake margins and thereby confidently assign date ranges. The dates for the site and the bison specimens span a period of ~140 ka to ~55 ka. A faunal element assemblage representing at least five *Bison latifrons* were excavated at the site (Mahan et. al. 2014). These were found in sediments dated to late MIS 6, all of MIS 5, MIS 4, and early MIS 3. Among the 402 bison specimens are included an almost complete *B*. latifrons cranium (DMNH EPV.60678) likely female, three partial crania that retained horn cores (DMNH EPV.66964, 66965, 66966), and a single relatively complete horn core (DMNH EPV.66967). The remaining post cranial specimens include long bones, jaws, jaw fragments, teeth, and various other bone fragments. Many of the postcranial elements could not be absolutely diagnosed as *Bison latifrons*. As most were found in geologic horizons where the confirmed *Bison latifrons* specimens were recovered they are likely to be attributed to the species.

Previous to the discovery of the Ziegler Reservoir Fossil Site only a few locations in west-central Colorado are noted to have produced Pleistocene and Early Holocene age bison remains. Harold J. Cook describes visiting a fossil deposit found in 1929 during construction of an irrigation ditch along the west side of a valley in the Little Cimarron drainage, approximately 12 miles from Cerro Summit, at an elevation of 8,000 feet. The assemblage, possibly the first high elevation Ice Age bison discovery in western Colorado, included a bison tooth that Cook examined and described as “a molar tooth of a very large fossil bison, of the size found in the immense *B. latifrons* and similar species.” (Cook 1930). Mr. L. G. Coffin, the rancher who owned the land where the fossils were discovered, reported also finding bison horns at the site. He described these as longer but less robust than the *B. latifrons* horns he had later seen in the Colorado Museum of Natural History. Unfortunately, none of these remarkable specimens were collected and it is reported that due to “rough handling” they were badly damaged.

A large Bison priscus (Steppe bison) skull, DARG 66, evaluated during Phase I of the WCBP (Shelton, Berry and Conner 2017) produced a late date of 11,700 YBP placing the specimen late in the Pleistocene but within parameters of the occurrence of Steppe bison known to have existed in prehistoric times. The frozen mummy of the Yukagir Bison, a well preserved, complete Steppe Bison (*Bison priscus*), was recovered in 2011 from the Chukchalakh Lake shore of the northern Yana-Indigirka Lowland of Eastern Siberia. An extensive necropsy, performed by scientists of the Yakutian Academy of Sciences in Siberia,

revealed the bison to be a male about four to four and a half years of age that had died of starvation. An accelerator mass spectrometry (AMS) radiocarbon date of approximately 9300 BP was obtained. The specimen represents the most complete mummy among known records of this extinct species (Serduk et al. 2014). Considering the Yukagir Bison date and the relatively late, yet valid date of DARG 66, it is quite possible that *Bison* priscus was hunted by the early Paleoindian peoples of western Colorado.

Late Paleoindian evidence of use of bison is represented at the Mountaineer Site (5GN2477) located near Gunnison, Colorado in the Upper Gunnison Basin. This remarkable site contains a Folsom pithouse identified and excavated under the supervision of Dr. Mark Stiger (2001, 2006, and personal communication 2019). Situated among small lithic flake tools, a drill, and a graver , a bison second phalange (DARG 265) abutting a bison tibia fragment (DARG 267) were both recovered within a Folsom pithouse determined to be a lithic workshop. It is unknown if the specimens are *B.* antiquus or another species. Bone sample number CAMS105764, collected from bone located at the base of an interior wall of the same structure, produced a 14C date of 10,440. Although the precise cultural use of the artifact is unknown it's location inside and against a wall of the Folsom structure indicates that Late Ice Age bison were likely being harvested by Folsom people and that the specimens may have been mallet tools used for lithic tool manufacture.

Archaic sites producing evidence of bison procurement are rare within the study area and include only the Marion site, 5GN1664, and possibly the Pioneer Point site, 5GN41, although this more likely to have been a Formative period hunting camp. Although very near but not located within the boundaries of the Project study area, the Roatcap Game Trai1 Site (5DT271), Component 1 is included here as it represents Protohistoric Ute bison hunting and butchering occurring in the late 1700s or early 1800s. In addition, the site is located in the corridor of the Kebler Pass route between the North Fork Valley and the UGB. This trail was traditionally used by the Ute peoples who inhabited the area until 1880 when they were forced to adjourn to the reservations of eastern Utah (Clifford Duncan personal communication 2012). The butchered bison bone found at the site strongly supports the suspicion that bison were traversing the corridor as they moved between the UGB and the lower elevations of the North Fork Valley. Elements recovered from Component 1 were tentatively radiocarbon and dendrochronologically dated between the late 1700s or very early 1800s falling within in the latter part of the Early Contact Phase (Baker 1988). Extensive excavations produced evidence of a historic Sabuagana Ute household with the remains of wooden shelter, a slab-lined hearth and several butchering areas containing processed elk, deer and bison bone indicative of large game hunting and processing activity. Baker (1991) describes the assemblage and ethnographic implications:

> "The faunal assemblage from Component 1 is particularly useful in allowing us to move into more detailed inquiry and evaluation of Sabuagana settlement analysis and social structure. As demonstrated by Rood (1987) over 45% of the deer elements and 75% of the elk elements consist of lower front quarter bones (radii, ulnae, humeri). This percentage is drawn from a population of 5 deer (3 mature and 2 yearling) and three elk (2 mature males and 1 mature

female). One bison is also represented by lower limb bones. Recovered body parts for both deer and elk indicate that lower front quarter, phalanges, some vertebra fragments, and skulls were the only items returned to or deposited at the site. Rood particularly notes the absence of hind quarters and believes it unlikely that these elements were left at the kill or were in some way removed from the site area. Rood and this writer concur that the faunal material strongly suggests a distribution of deer and elk body parts among Ute households. This view is strengthened by the relatively high number of individual kills represented and the consistency in the faunal elements found at the site."

The butchered portions of a carcass are often ranked according to preference (Hill 2007) and the Roatcap site provides some evidence of kinship distribution as the remnant bones of a less preferred portion, the front quarters, were present at the excavated household. The faunal assemblage, including the bison bone, evidences a consistent pattern of probable kinship-based meat distribution as described by Baker (1991):

"It is suggested that the pattern in the faunal assemblage of Component 1 reflects a consistent pattern in meat distributions among a group of associated Ute households. It is furthermore suggested, in keeping with Service's reference to the familistic statuses involved in meat sharing (1966:17) that the distributions was based on kinship and the relationship of this particular household within a Ute deme, which is a cluster of families that were "usually related through the matriline and resided matrilocally. Demes owned no property and in most cases, individual families, as the basic economic unit in Great Basin societies, occupied separate dwellings and were relatively autonomous. The demes were mobile exogomous year-round residence groups that were held together by their respect for the deme headsman whose status was usually derived from his hunting and from his skillful direction of the camp's movements (Callaway, Janetski, and Stewart 1986:353; Steward 1938:44; Shapiro 1986:628)."

The butchered bison bone elements recovered from 5DT271 provide important insight into the relative rarity of bison procurement as compared to elk and deer, and likelihood of the commonality of single bison kills in the mountainous regions verses the multiple bison kills so familiar to the plains of eastern Colorado. Baker (1991) states:

"The presence of lower extremities of one bison (a right calcaneum and a right proximal metacarpal) further supports the kinship distribution theory. The limited bison bone in the site indicates that this species was not commonly taken in the area when compared to deer and elk. In this regard, it may be suggested that on the rare occasion when one was taken, the distribution system finally carried a limited and less than choice portion to this household. This is as compared to what appears to have been a larger part in the more frequent sharing of deer and elk. This interpretation is based on the assumption that we

were able to recover most of the faunal remains from the component."

The Roatcap Site is an important link between the UGB and the lower Gunnison River Basin regions providing evidence and insight into not only Protohistoric bison procurement but of regional bison migration patterns.

Historical documentation from the 1600s through the late 1800s, found in diaries, letters, and military logs, relate eyewitness accounts of bison and the evidence of bison in west-central Colorado. Several of these documents refer to Native Ute bison hunters.

On July the twenty-ninth, 1776 the Catholic Franciscan Fathers Fray Silvestre Velez de Escalante and Fray Francisco Atanasio Dominguez, in company with a small group of Spaniards and New Mexicans set forth on a most difficult and extraordinary journey intended to trace a direct route from Santa Fe, New Mexico to Monterey, California. Using Native American guides, the Fathers followed both established trails and more obscure prehistoric routes as they made their way through western Colorado and into eastern Utah. Over the next five months Father Escalante kept a detailed journal in which he described their progress and experiences. Within this document are several notations he made concerning bison. Father Escalante's first allusion to bison, on 1 September 1776, occurs not within, but less than 20 miles northwest of the present study area on the periphery of the north aspect of Gunnison County. In describing the events of a meeting with a large group of Utes, Father Escalante notes:

> "...some jerked bison meat was bought from them, they being paid for it with white beads..." (Chavez; Warner 1976).

There is no indication of where the meat was procured though additional comments in the journal confirm the presence of bison approximately seven and three quarters of a mile north-northwest of Rangely, Colorado where Father Escalante, on 12 September 1776, records evidence of bison and a bison kill as follows:

> "A short distance from El Barranco we had seen a recent spoor of bison. We saw it again still fresher on the plain, and saw that it went in the direction we were taking. By now we had few provisions, in view of the long traveling we still had to do, because of what we had spent among the Sabuaganas and other Yutas. And so, a little before reaching the arroyo, two companions took off and followed the spoor mentioned. A little after midday one of them returned saying that they had found the bison. We dispatched others on the fleetest horses and , after chasing it for about three leagues, they killed it; then at seven thirty at night, they brought back a grand supply of meat (much more than what a big bull of the common variety has). And, in order to prepare the meat so as to keep the heat from spoiling it for us, ...we spent the 12th at this place, which we named El Arroyo del Ci′bolo..." (Chavez; Warner 1976).

On 14 September 1776, near the Green River in Utah they killed another, smaller bison and on 17 September of the same year Father Escalante makes reference to a group of Utes who had been on a bison hunt (Chavez; Warner 1976).

By the mid 1800s the expansive bison herds of the Great Plains were in decline. In west-central Colorado occasional reference to their presence is found in a select few documents indicating that the species was present in the study area near the Continental Divide and still being hunted. One of these, the Heap-Beale Expedition of 1853, documented by Gwinn H. Heap and published in 1854, provides interesting and revealing details in chapter III of the document related to bison near Cochetopa Pass, southeast of Gunnison, Colorado. In an explanation of the origin of the name the author states:

> "A stream issues from Coochatope Pass and joins the Sahwatch; it is called Coochumpah by the Utahs, and Rio de los Cibolos by the Mexicans: both names have the same signification-River of buffaloes. Coochatope signifies, in the Utah language, Buffalo gate, and the Mexicans have the same name or it, El Puerto de los Cibolos. The pass and creek are so called, from the large herds of these animals which entered the Sawatch and San Luis valleys through this pass, from the Three Parks and Upper Arkansas, before they were destroyed, or the direction of their migration changed, by constant warfare carried on against them by Indians and New Mexicans." (Heap 1854 p 38).

The words "...entered the San Luis valley through this pass..." indicates that bison were regularly moving in and out of the project area via the Cochetopa Pass corridor. The next two sentences of the same paragraph,

> "A few still remain in the mountains, and are described as very wild and savage." and "We saw a great number of elk-horns scattered through these valleys; and, from the comparatively fresh traces of buffaloes, it was evident that many had visited the pass quite recently." (Heap 1854 p. 38).

are most revealing as these eyewitness observations clearly indicate that, in 1853, bison still remained in the high country and valleys of the project area and were using Cochetopa Pass to migrate between the Gunnison Basin and the San Luis Valley.

Heap also notes that Mexican traders met with the Utes in order to trade for buffalo robes. In addition, he writes that near the forks of Cochetopa Creek, between five and eight miles from the Pass, numerous buffalo skulls were seen (Heap1854 p39). These notations suggest that more than just a few bison remained in the region and that they were still being hunted and processed by Native peoples for meat, hides, and trade.

Captain Randolph B. Marcy was ordered to lead a small company of soldiers from Camp Scott in Utah southward to Fort Massachusetts, New Mexico in the winter of 1858 to

procure and return supplies to Camp Scott. Arriving in the Gunnison valley area in early January, his beleaguered troops, starving and freezing but faithful to their Captain, struggled through the deep snows, the men crawling through drifts to break trail for the mules as the hard crust of the snow had cut their legs. Eventually the company became disoriented and it was at this point Captain Marcy noted:

> " There was not the slightest sign of a road, trail, or footmark to guide us. All was one vast, illimitable expanse of snow as far as the eye could penetrate...Not a living animal outside our own party was seen for many, many long days all was a dreary, desolate solitude...".

His observation of the lack of any type of game, including bison, suggests that the local herds had migrated to lower elevations or were simply sheltered, out of sight, in the hills and swales within the landscape.

In 1858 Colonel William Wing Loring led members of the Regiment of Mounted Riflemen, and other detachments north along Colorado's Front Range from Fort Union, New Mexico to Fort Bridger to provide reinforcements to General A. S. Johnston's Utah Expedition. His orders then directed he lead a command from Camp Floyd, Utah back to New Mexico. This entailed taking a more southerly route through western Colorado and accessing parts of the Old Spanish trail. The manuscript of his report was first published in 1946 in The Colorado Magazine with an introduction and notes by the renowned historian Leroy Hafen (1946). Of note, as it relates to this project, are references to bison in two separate areas in what is now Gunnison County at the mouth of Tomichi Creek a near the town of Gunnison and along Cochetopa Creek which Loring refers to as the "Coochatope."

> "Goochatope River, Aug. 29th...Soon came to the valley formed by Grand River running east, its fork from the north, and Goochatopa., its tributary from the south...Antelope, bear, and grouse also recent buffalo sins and numerous Indian trails seen."

According to Hafen, and substantiated by modern maps, this describes the valley where the mouth of Tomichi Creek opens near the town of Gunnison, Colorado. Loring's second comment regarding bison occurs on the same day approximately 14 miles east and is similar stating:

> "Abundance of antelope, deer, bear, grouse, duck, geese and sandhill cranes, & also recent buffalo signs. Numerous Indian trails seen. Same description applies to valleys throughout today's march."

By Loring's descriptions and his use of the word "recent" in referring to signs of bison, which reasonablely would include tracks, trails, and droppings, it is clear that bison were present in the region during the Fall of 1858 in large enough numbers to leave visible evidence. His meeting with a large band of Utes and his comments regarding obvious Indian trails

confirms these were in use and that the Native peoples would have been very aware of the presence of bison and likely exploiting this resource.

Of great interest to the project are several indications that bison persisted and may have been hunted in the study area after 1858 and possibly into the early 1900s. The first of these, although not within the Phase II study area is worth mention as it confirms bison hunting by Ute peoples on west of the Continental Divide. A report of Ute people hunting a bison near Craig, Colorado was formally documented by the well respected ornithologist Dr. W. H. Bergtold of Denver in his notes of a multi-party scientific expedition to Colorado's western slope in 1894 (Felger 1909). His interview with Mr. R. S. Ball, the owner of the Meeker Hotel in Meeker, Colorado, detailed his description of a group of Ute hunters in 1884 who, while mounted on horseback, hunted and killed a cow bison at Cedar Springs located six miles west of Craig, Colorado. To date this is the last known living wild bison in western Colorado and the only objective documentation known to this writer confirming Ute people actively hunted bison on the western slope of Colorado.

Mr. John "Jack" Welch, 1854 to 1929, known as "Buckskin Jack", of Saguache, Colorado, was a mountain man, government scout, and contract hunter and trapper who supplied large game meat for the military, railroad and the Monte Vista and Del Monte irrigation ditch construction crews near Saguache, Colorado (Saguache Crescent 1929) which in all probability included bison meat. In 1899, while hunting near Crested Butte, Colorado, he found and collected a large bison skull (DARG 276) upon which he painted, in red on the foreskull, the following: "Buffalo Head Found by Jack Welch Near Crested Butte 1899". Radiometric testing of bone collagen collected from the skull indicates this bison most likely died between 1800 and the 1870s, though the 1890s cannot be ruled out. It is certainly conceivable that the specimen remained subsurface and was not exposed until shortly before discovery by Mr. Welch.

In the Fall of 1947 Gunnison National Forest Administrative Assistant Ralph Mike Sweet discovered a bison horn cap in Taylor Park in the Upper Gunnison Basin. In a brief he submitted to he notes his suspicion that the specimen likely dates to the very early 1900s (determined by the Project as between 1909 and 1919) due to the good condition of the specimen and his knowledge of a Mr. Thomas Stevens, whom he describes as an "old-timer", having information relating to a small herd of bison in the area.

Edward Royal Warren (1910, 1927, 1942) , a well respected avocational mammaolgist wrote of finding bison skulls in 1904 in the forest at an elevation of 10,700 feet close to the Venango Mine near Irwin (Ruby Camp), Colorado, approximately 10 miles northwest of Crested Butte. Reports and even anecdotal information regarding late occurring bison in the Upper Gunnison Basin and the fact that the Ute held access rights up to 1880 in parts of this region encourages consideration of continued research to identify additional solid evidence of bison procurement by Ute peoples in the UGB.

11.3 Identification of Bison Remains

Brown and Gustafson (1979) was the primary resource used to identify bison bone specimens. All bison skulls are distinctive and not easily confused with cattle (*Bos* spp.). The most likely domestic cattle skull to be confused with bison is that of the American Brahman (*Bos* taurus indicus). These domestic cattle, known for their docility and tolerance to extreme heat, were initially imported in small numbers to the United States between 1849 and 1946 (Department of Animal and Food Sciences Oklahoma University 2000, accessed April 2019) and their presence on the western slope of Colorado during the early period of the regions cattle industry would have been unlikely. Many of the postcranial elements of bison (*Bison* spp.) and cattle are similar. Brown and Gustafson (1979) identify 11 elements that present with singular distinctions which are diagnostic of *Bison* spp. These include the axis, the 5th cervical vertebrae, the 3rd and 6th lumbar vertebrae, the proximal end of the humerus, the anterior view and proximal end of the ulna, the proximal end of the radius, the tuber coxae at the dorsal of the ilium, the distal end of the tibia and the posterior view of the metatarsal. The presence of these traits in their corresponding elements greatly aided in distinguishing and definitively identifying several of the specimens evaluated during the project. Those specimens determined likely to be bison or reported as possible bison are documented as: Possible Bison Bone. A few other specimens, though noted and described in reports, simply could not be located.

Although non-diagnostic immature bison bones are easily confused with the bones of domestic cattle, adult bison bones are typically much larger and more robust than those of cattle. The occurrence of domestic cattle bone on archaeological sites that might be confused with bison bone can be confined to a relatively brief time span. New Mexican legal documents and United States military logs refer to the Ute people acquiring livestock, including goats, sheep, and at times cattle, without authorization, from New Mexican settlers from the 1600s through the late 1800s. These Ute acquisitions sparked a great deal controversy and conflict between the Native people, New Mexican authorities, the military, and the settlers. The Natives believed they were entitled to the livestock however; New Mexicans viewed these losses as theft. The Heap-Beale Expedition reports seeing a Ute band on July 16, 1853 with a herd of goats on Savoya Creek just west of the Lake Fork of the Gunnison (Heap 1854). The first domestic cattle to officially arrive on the western slope o f Colorado were a herd of Texas longhorns driven from New Mexico, over Cochetopa Pass to the Los Piños Indian Agency cow camp in 1869. Therefore; it can safely be assumed that any Bos bone recovered from strata or features predating the presence of domestic cattle on the western slope from approximately the mid 1600s forward, are determined to be, by default, one of several species of bison.

11.4 Cultural Modification of Bison Bone

Creating and using stone, bone, and metal tools to intentionally butcher game in an intentionally selective and systematic manner is a behavior exclusive to humans. The act of butchering is a refined, purposeful, and progressive endeavor requiring specialized knowledge and skill that includes appropriate tool manufacture and use and an intimate understanding of the anatomy of the game animal being processed. Adherence to correct sequences of the

butchering process need not be strict but do help to assure the process is ultimately successful in that an optimal amount of the product, which may include any combination of meat, bone, connective tissue, offal, and hide is secured. Binford (1981:179) defines the act butchering an animal carcass as requiring the use of tools to dismember and fillet meat without only relying on the weakening and separating of articulated joints such as a carnivore must do. Binford (1981) goes on to catagorize processing techniques as either primary or secondary butchering processes which may or may not occur together. Primary processes occur at the kill site, and are commonly associated with dismemberment and disarticulation for ease of transport back to camp. Secondary processes occur at the site of consumption and this "filleting" technique involves a more precise and select removal of meat from bone. Each of these processes has different characteristic traits that affect and are recognizable on bone as a variety of scrape, cut, indent, and crush marks. Cut marks on points of articulation are likely associated with the primary processes of disarticulation and dismemberment while impact indentations may indicate bone breakage to access marrow. It is important to recognize that the intent of butchering quite often includes not only acquisition of meat but also of bone, teeth, tendon, connective tissue, hide and horns.

Specimens directly inspected during the project were evaluated for cultural modification with attributes being defined by this project as: possible butchering, butchering chop mark, spiral fracture, stone tool cut, use wear polish, impact indentation, craniectomy, abrasion striations, metal tool cut, saw cut, pigment, tool scrape/tool gouge, burned bison bone, bison bone manuport, bison bone tool, processed bison bone. In addition, specimens absent of cultural modification but evidencing cultural association, such as those faunal elements situated near-by or within a cultural site or exhibiting intentional rearrangement for ceremonial purposes, were defined as ecofacts. Attributes that defined a bison bone ecofact included bison bone manuports, bison bone found in association with a feature, bison bone found in association with another relevant artifact, bison bone skeletal elements commonly used as tools, and bison bone with other archaeological significance. Burning was considered cultural modification only when it was clearly deemed secondary to human activity such as bone having been cooked or discarded in the fire of a hearth or burned ceremonially. Small, bluish bone fragments were considered to have been processed primarily in order to extract bone grease and included boiled or otherwise cooked bone (Morin and Soulier 2017). Modification including carnivore and rodent gnaw marks, mammal claw scratches, root etching, burning, natural oxidation, and mineral staining is considered non-cultural. Evaluation of the available bison faunal elements was primarily performed at the various museums participating in the project and at the Dominquez Archaeological Research Group facility in Grand Junction, Colorado. When permissible, specimens were transported to, examined, and imaged using state of the art technology available at the Colorado Mesa University Forensics Investigation Research Station (FIRS). The FIRS comparative faunal collection was also employed to aide in identification of certain skeletal elements. Melissa Conner, PhD, director of FIRS, provided invaluable assistance, input, and support regarding the evaluation of various specimens. Data collected from the 27 remaining specimens which were not available for direct visual inspection was accessed from photographs, report content, and occasionally supplemented with input from the archaeologists who had recovered the bones.

Of the 89 specimens evaluated a total of 11.2% had evidence of cultural modification and 11.2% were deemed ecofacts. Although burned bone fragments were reported the specimens were not available for direct inspection and no exact specimen count was provided. The breakdown of cultural modification into the 10 culturally modified specimens and the overall sample of 89 specimens, respectively, is as follows:

Modification	10 culturally modified specimens	Overall sample
Butchering chop mark	10%	1.1%
Spiral fracture	20%	2.0%
Impact indentation	50%	6.0%
Craniectomy and	10%	1.1%
Saw cut	40%	4.0%,
Pigment	10%	1.1%
Tool scrape/tool gouge	20%	2.0%
Burned bison bone	undetermined	undetermined
Bison bone manuport	40%	4.0%,
Processed bison bone	30%	3.0%.

TABLE 1. Cultural Modification Identifier Frequencies

Butchering chop marks were visible on DARG 254, a left humerus. Spiral fracturing was noted on two specimens, DARG 254, a left humerus and DARG 260, a right humerus. No specimens produced clearly discernable evidence of stone tool cutting or use wear polish. Impact indentations were evident on five specimens, DARG 251, a skull, DARG 254, a left humerus, 255, a radius, DARG 260, a right humerus, and DARG 284 a skull. Metal tool cutting in the form of saw cuts, is confirmed on DARG 276, the Jack Welch bison skull and on the three historically butchered specimens from Dallas Townsite DARG 278, DARG 279, and DARG 280. Saw cuts are reported on a number of bison bones and possible bison bones found at the railroad work camp sites of Argentum, Tellurium, and White Cross. Unfortunately, these bones were not available for direct inspection and the modification cannot be analyzed or confirmed. Pigment is clearly present on DARG 276, the Jack Welch bison skull in the form of English script. One specimen, DARG 258, a right mandible, exhibited evidence of a stone tool scrape. Although 15 burned and unburned bison bone fragments, DARG 263, were reported from the Pioneer Point site, 5GN41, the exact number of burned bone is not specified. In addition, an unspecified number of burned bison and possible bison bone was reported at all three of the previously noted railroad work camp sites, the exact number of burned bison bone

specimens is undetermined as these specimens were not available for direct evaluation. Therefore, the data is not confidently measurable and not included in this tally.

The highest incidence of cultural modification consisted of impact indentation accounting for 50% of the total of sample size. It is distinguished from chop marks by a tendency of the impacted bone to present as somewhat concave with a smooth surface. Bone surfaces at the perimeter of an impact indentation. Indicators of impact include not only the indentations but spiral fracturing and, occasionally, dislodged angular bone fragments that leave angular or triangular openings at the surface. Hairline fractures that radiate away from the impact and slightly widen at the periphery of the impact may also be apparent. Craniectomy, a variation of impact processing for the purpose of brain matter extraction and/or ceremonial intent, was observed on 10% of the total sample and consisted of a single specimen. A craniectomy is distinguished from maul or other impact indentation by a somewhat irregular, generally circular orifice, usually located on the central foreskull, with conchoidal scalloping at the interior periphery. Hairline fractures are usually found radiating away from the periphery of the orifice or along the distal aspect of a scalloped area that did not fully fracture and dislodge upon impact. The craniectomy perforates the foreskull leaving a gaping hole of adequate dimensions for accessing brain matter. Associated bone flakes may or may not be present within the skull cavity. This style of modification is clearly apparent on the foreskull of DARG 251 with visible concave scalloping and impact fractures.

Bone breakage and subsequent spiral bone fracturing has commonly been considered indicative of human processing for the extraction of nutritious bone marrow; a common practice among humans. A total of 20% of the total sample exhibited spiral fracturing. Excepting reasonable confirmation, this type of fracture should not be referenced exclusively to human processing activity as it can also result from carnivore bone crushing activity (Binford 1981:58). Spiral fracturing is frequently indicative of marrow extraction a process well documented by Binford (1981) while observing Anaktuvuk women actively engaged in the skill.

Chop marks constituted 10% of the total specimen count. Chopping of bone tends to result in a flattening or compressed planing of the bone, an identifiable modification (Frison 1978: 306) caused by the use of a larger stone or bone tool used intended to disarticulate skeletal segments or break into marrow or cranial cavities. Expedient tools used for chopping may be manufactured from a large bone, such as a humerus or tibia obtained directly from the carcass (Frison 1978). Chop marks are most often located at the transverse process of vertebrae, the proximal end of ribs and the proximal and distal ends of long bones and may be evident at the periphery of a craniectomy.

Cultural modification is not confined only to the results of butchering. The application of pigment for ownership identification, religious, spiritual, or ritualistic purposes was and still is a common cultural practice among the bison hunting cultures of both the High Plains and the Great Plains. Although no specimens held evidence of pigment applied by prehistoric or historic or Native Americans, DARG 276, a bison cranium was discovered to have been

culturally modified by the use of red pigment in the form of a painted inscription applied in 1899 by one Jack Welch a mountain man who had settled in Saguache, Colorado and found the specimen in the Crested Butte area. To commemorate the unusual acquisition he painted, in bright red oil based paint "Buffalo Head Found by Jack Welch near Crested Butte Colo 1899". Aside from a bone in which a broken projectile point was intentionally inserted and glued as a hoax and the application of ambriolite preservative applied to several skulls identified in Phase I of the WCBP, this is the only bison bone skeletal element known to have been culturally modified by a EuroAmerican with the intent of decoration and communicating an interpretable message.

The paucity of stone tool and metal tool cut marks (excluding the saw cuts) on bison bone was unexpected as evidence of prehistoric and historic hunting in the study area is substantial. Cut marks made by stone tools are relatively easily identified as fine linear, parallel striations or deeper V-shaped grooves with steeply faceted sides. Finer cut marks, usually due to filleting of meat from the bone can be confirmed via microscopic evaluation and are either long, longitudinally oriented cuts or a concentrated series of short, parallel, oblique cuts that result from butchering to free the meat from the bone with the intent of wasting as little of the product as possible. The degree of weathering on the majority of the specimens was stage 3 to stage 5 thereby precluding clear interpretation of possible cut marks as the deteriorated condition of many of the bones would have obscured the faceted sides of deeper marks and obliterated any finer marks and striations. In addition, the unexpected small sample size minimized the opportunies present in a sample of greater numbers. Due to denial of permission or to their fragile state, a number of specimens could not be transported to the FIRS facility for high resolution examination. It is possible that some finer cut marks may have been visible through the use of the FIRS equipment. The scrape mark on DARG 258, located on the inner aspect of the mandible, is in the correct location for scrapes resulting from butchering to remove the tongue. A number of the scrape marks on DARG 260, a culturally modified right humerus, may be human induced but are too obscured by weathering to confirm such.

Although a high percentage of metal tool cut marks was not anticipated due to the relatively limited time period of metal tool availability, the project fully expected to identify some indication of metal tool use. Primarily confined to the Protohistoric and Historic periods (Martin 2016) the most concentrated use of metal trade goods occurred during the Fur Trade era between the early 1820s to the late 1870s (Hafen and Hafen 1993). Twitchell (1914) reported documentation recorded in the Spanish Archives of New Mexico detailing legal action taken against a number of Abiquiu´ residents in 1783 for engaging in unauthorized trade with the Ute people. That these trading activities would not have involved the exchange of metal tools is unlikely as metal trade goods and weapons such as metal arrowheads were a prime commodity deeply desired by all native peoples. Trade occurring with the Ute people this early and within a mere 260 miles of the center of the study area via the Old Spanish Trail would have extended the time period that metal tools were available compared to the more northern regions of western Colorado. This, combined with the presence of bison at least as late as the early 1850s, suggest that the evidence of metal tool use on bison bone within the study area was a reasonable assumption.

Historic saw cut marks resulting from skilled butchering activity are present on the bison bone in the Dallas Townsite assemblage, DARG 278, DARG 279, and DARG 280. Hand saw or mechanical saw cut marks are easily identifiable and the planar surface that results a firm diagnostic. A number of specimens reported as bison bone and possible bison bone will require further evaluation to confirm this type of cultural modification. The breakdown of ecofact identifiers into the 10 ecofact specimens and the overall sample of 89 specimens, respectively, is as follows:

Ecofact Identifier	10 ecofact specimens	Overall Sample
Manuport	90%	10%,
Specimen found in association with a feature	100%	10%
Specimen found in association with another artifact	60%	7.0%
Skeletal element potentially used as a tool	40%	4.0%
bison bone skeletal element of other archaeological significance	1%	1%

TABLE 2. Ecofact Identifier Frequencies

The most common ecofacts were both those that had been transported to an archaeological site by humans (manuport) and those found in association with a feature or other artifact of some relevance. These two identifiers appear to be related for obvious reasons. Disarticulated, select bison bone, while likely encased in flesh, would have been transported from a Native American kill site to a camp or habitation site for further processing and distribution. Waste bone would be discarded within or near these sites. Those bison bones found in association with other artifacts, such as DARG 265, and DARG 317, both phalanges, and DARG 267 and DARG 318 both tibias, are considered to also represent intentionally selected bones likely used as knapping mallets . DARG 265 and DARG 267 were found adjacent to one another within a lithic workshop structure near a stone anvil other stone tools at 5GN2477 while DARG 317 and DARG 318 were associated with the Tenderfoot site (5GN1835). The accumulation of and unknown number of bison rib fragments, DARG 266, at 5GN2477 should not necessarily be delegated to the categories of processed bone or waste material. As reported by Soressi et. al. (2013) archaeological investigations at two Paleolithic cave sites in France resulted in the discovery of several of the oldest rib bone tools proven to have been used by Neanderthals. Secondary to evaluation of the surface microstriations it was determined the rib bone tools were lissiors; smoothing tools used to bring leather to a high degree of flexibility and polish and to enhance moisture resistance. Use wear comparison was possible as lissiors continue to be used today by modern leather workers who prefer the rib bone for its springboard type flexibility that assures consistent pressure against leather. In 2020 Martisius et. al. employed the testing technique of zooarchaeology by mass spectrometry

(ZooMS), a non-destructive triboelectric capture of collagen peptides, to identify the species of the morphologically unidentifiable rib bone lissiors. The results indicated that auroch or bison bone was the preferred tool bone source and was being strategically selected over an abundance of available reindeer bone. A similar bison rib bone tool was recovered from the Harrell Site, a multicomponent site located at the confluence of the Brazos and Clear rivers in northern Texas and spanning a period from the Middle Archaic to Late Prehistoric. It is a somewhat shaped and beveled bison rib tool fragment (8-59-702) closely resembling a lissior. Close examination of the Mountaineer Site, 5GN2477, bison rib bones for microstriation and other evidence of use wear combined with ZooMS testing might reveal additional information regarding activities within the Folsom structure which may have included not only stone tool manufacture but leather working as well. Therefore, the bison bone fragment assemblage at 5GN2477 are identified as bison bone skeletal elements of other archaeological significance.

11.5 Hunting Techniques

As suggested in Phase I of the Western Colorado Bison Project many of the specimens evaluated during that assessment were likely representative of mountain bison (*B.b.b.* spp.) a subspecies of Plains bison (*B.b.* spp.). Overall, the specimens examined in Phase II are not all of robust dimensions but the sampling is too small to make a confident determination regarding the presence of mountain bison . Specimens from west-central and southwestern Colorado examined during Phase II of the project offer more species variety ranging from *Bison latifrons* to *Bison bison.* It is relatively certain that the bison present on Colorado's western slope did not gather in large herds but congregated in small groups of under 30 animals with many found in smaller family groups of less than five or often singly. The topography of the high country does not offer the open High or Great Plains habitat that supports large herds of Plains bison. Rather, it is consistent with the majority of the landscape of the western slope which is rugged, broken with multiple plateaus and mesas, canyons, ridges and arroyos, and hosting very few broad expanses of open land. The scattered high elevation parks, rugged mid-elevation hill country, and broken canyon country of the extreme west would have easily accommodated single animals or herds of no more than 5 to 30 individuals. The bison of western Colorado would, out of necessity, have had to have been more agile, alert, possibly more aggressive, and less dependent on large herd security than the Plains bison and would have been well adapted to negotiate the more confined terrain of west-central Colorado.

As noted in Phase I well documented Paleoindian and Late Prehistoric bison hunting methods (Kornfeld et al 2010:213-286) include such techniques as surround, impound, game drive, and bison jumps. Surround, impound, and jump hunting tactics may have been used within the study area and, although there is little sure evidence of such, the topography in the mid-elevation hill country definitely lends itself to the use of impound, surround, and especially game drive hunting techniques. Large animal game drives consisting of intentionally constructed stone blinds, constructed or natural stone walls, and strategically placed lines of cairns, designed for communal hunting events are somewhat of a rarity in the high elevations of Colorado's western slope when compared to the high country of eastern Colorado (Cassells 1995). Likely due to the lack of the long, broad, open and gently sloping ridge tops so common

in the mountains of eastern Colorado, individually constructed blinds used by small groups of hunters appear to be the norm in the majority of the San Juan mountain range high country (Southwell 1995) and the upper Gunnison Basin area. Large communal style game drive systems, though not the standard in the study area, are present. A total of 12 game drive systems near Monarch Pass are located along the Continental Divide at the Gunnison County and Chaffee County boundary lines. These stone structures consist of low rock walls, blinds, and possibly remnants of wooden sticks or posts incorporated into the stone walls at two to three meter intervals (Hutchinson 1990). These wooden stick or post features, known to have been used by native Arctic hunters (Speiss 1979), were incorporated into the low stone drive walls and intended to support flagging materials used to enhance the visual impact of the wall and startle and redirect game through the drive toward the kill zone. Tenderfoot Mountain, a high flat top mesa with severe drop-offs on all sides also boasts evidence of a game drive. A nearby sudden and precipitous drop-off to the south could have sufficed as a bison jump (2019 Stiger personal communication and tour of the site) however; investigations of the possible game drive and jump location have been limited and bison bone has yet to be identified along the drive or at the base of the precipice.

The adaptive hunting technique proposed by Shelton (Shelton, Berry and Conner 2017) in Phase I of the project, a flight zone pressure hunting tactic that exploits available topography, is offered in Phase II as it is applicable to the study area. Due to abundant availability of short, steep secondary and tertiary drainage topography (similar to that of northwest Colorado) located within the study area it is suggested that this hunting adaptation would have been a viable option for prehistoric and Historic Native hunters of the region. Shelton (Shelton, Berry and Conner 2017) propose that adaptations to Great Plains and High Plains hunting techniques would have been necessary to assure successful procurement of individual or small groups of bison in the rugged, convoluted, and often confined landscape of Colorado's western slope.

> "...these adaptations would have required the native hunters, whether mounted or not, to frequently engage in a modified hunting technique suited to the environment and the species. Hunting bison in the intricate and multitudinous canyons and drainages of northwest and west-central Colorado, as opposed to the open plains of the east, would have required a singular approach. As many of the culturally modified specimens originated at, in, or near the mouths of secondary and tertiary drainages, it is suggested that the following specific hunting technique was employed. Small groups of bison, or one or two animals could have been gently pressured, either by hunters on foot or horseback, to move up a drainage, preferably toward the mouth of a short, steep, tertiary drainage. Individuals strategically situated to the side and up drainage of the bison could then alarm the animals causing them to turn and move up into the selected tertiary drainage, as, from the perspective of the bison, it would appear to be a viable escape route. At this point the bison, restricted and slowed by the narrowness and severe steepness of the drainage and

> having no option but to return (downhill), would then be susceptible to ambush at the mouth of the drainage by the now congregated hunters. After a successful kill, primary and possibly secondary processing could then be undertaken. After abandonment of the processing site, alluvial deposition would have quickly buried and preserved the remains."

This adaptation would have been especially applicable to the rolling hill country to the south of Blue Mesa Reservoir, including the lands now inundated, as they are cut by numerous secondary and associated steep, short tertiary drainages that provide the needed topographic structure for flight zone pressure hunting and ambush. Future investigations at the mouths of likely tertiary drainages may provide adequate samples of butchered bison bone to support the theory.

During project visits to the Upper Gunnison Basin (UGB)area special attention was given to viewing and glassing the landscape in search of various topographical features which might suggest use as bison habitat or offer a human hunting advantage. Examination of the foothills on the northeast aspect of Tenderfoot Mountain revealed a drainage with a wide shallow mouth that opens northeast to a broad lowland park and riparian area well suited as bison range. The drainage is flanked by relatively steep hillsides which narrow and rise in elevation in a south-southwesterly direction sweeping upwards to a terminus at approximately 8000 feet on the east side of Tenderfoot Mountain. This topographical feature, rising 200 feet in elevation in a distance of 4000 feet, is ideal for maneuvering large game such as bison into a vulnerable situation as the last 1000 feet is suddenly steep and narrow. The wide mouth would allow for mildly stressing and gently pressuring bison gradually uphill and into the confines of the flanking hillsides. The hillsides, brush, rock and any man-made structure would have provided cover for hunt participants to pressure game further in the chosen direction. The higher, narrow aspect of the drainage would allow for hunters to ambush selected game in the narrow, steeper ascent where bison, forced to slow and struggle to manage the terrain, might also increase their vulnerability when attempting to turn and descend.

Another use of this topographical feature may have been to channel game upwards into the northeast segment of the Tenderfoot Mountain mesa top game drive. Alternatively, using a drainage on the northwest side of the mountain, game could have been channeled uphill in a southeasterly direction and possibly to the mesa top as the final ascent is less severe. In fact, due to this ease of access, a modern dirt road has been constructed on this route. On the flat surface of Tenderfoot mountain is located a probable Folsom large game drive feature, oriented somewhat east to west and bounded by deteriorated rock cairns, which may have been constructed to take advantage of this route. A steep drop off near the east end of the drive may be a bison jump, however; no bison bone evidence is known to have been located to date. The drop-off, the result of a geological slump, would require further geologic investigation to determine if it was present during the Folsom era. The lack of evidence of bison procurement at the drop-off is, in part, due to the lack of opportunity to thoroughly investigate the site. It should also be noted that large game may have, on occasion, ascended Tenderfoot Mountain naturally during the winter in order to access it's windswept surface which would have allowed

for grazing on exposed dry grasses, forbs, and shrubs not covered by the deep winter snows common to the region. In this case, any game, large or small, would have been a major attraction and the drive a significant asset to the intermittently residential/sedentary Folsom peoples overwintering atop the mesa. Archaeological survey of the entirety of both drainages, especially eroded cut banks, and further investigation of the probable game drive and possible bison jump is strongly advised as it may produce positive evidence of bison hunting.

Due to the absence of vast, open prairie lands and associated large bison nursing herds in west-central and southwestern Colorado, it is strongly suspected that encounter hunting verses logistically complex communal hunting events (greater than 50 persons), were the predominant hunting style. The topographic conditions of the study area, lacking for the most part the broad open expanses of so distinctive of Colorado's eastern plains, tend to discourage the use of logistically complex communal hunting events which employ tactics such as bison jumps or startle and chase tactics that involve large numbers of participants. This is not to say that communal hunting was not engaged in but, if engaged in, it was most probably performed on a smaller, abbreviated scale. In fact, stone game drive sites are not uncommon in the UGB and surrounding study area. Dr. Stiger lists a number of known large-game drive sites located reasonably near the Tenderfoot Site (5GN1835) including: Black Canyon, Curecanti Creek, Haystack I, Haystack II, Historic Iola Elkhorn Site, Cochetopa Game Drive Quarry (5SH1714), Kezar Basin, Old Agency, and DOW Beaver Creek.

The Cochetopa Game Drive Quarry (5SH1714), located in Cochetopa Park south of Cochetopa Dome, is of interest as two bison horn caps (DARG 272 and DARG 273) were found within five miles of the site which also falls within a bison migration corridor that accesses the UGB via Cochetopa Pass. It is reasonable to assume that game directed through this drive may well have included bison. Depending on how the terrain is incorporated into the design of the game drive system, the season and weather conditions under which it is used, and the desired number of animals to be taken, a drive or hunt event could be successfully accomplished with as few as two participants (Whittenburg 2017; personal experience 1998) or up to 25 individuals (Buchholtz1987) with the majority of participants and largest blinds located at the area of drive structure convergence; the most important feature of the drive system.

Situated along a known and well used game trail, wooden or stone feature hunting blinds, especially in timbered areas, are an effective technique known to have been used on the western slope (Conner et. al. 2016). Examples of these in Eagle County include 5ME3236 consisting of two hunting blinds constructed of juniper branches leaned against live juniper trees and 5ME3235, a game blind consisting of a large bent juniper branch and an adjacent brush wall. All three blinds overlook a small drainage still used as a game trail. Because of the nature of the game blind hunting strategy, one or two hunters secluded in a feature designed to obstruct the animal's field of view most often results in the procurement of a single animal as additional animals on the game trail tend to startle and run in response to the first kill. Blind sizes, whether associated with a game drive or a trail, are indicative of the number of hunting participants secluded therein. At the zone of intercept, be it a game drive or a trail, more

participants and a larger blind might be required to maximize the potential for procurement success (LaBelle 2012). As bison are large and unpredictable creatures, often posing a serious threat to hunter safety and requiring more than a single weapon assault, it is proposed that larger blinds at the intercept zone might indicate the need for multiple hunters engaged in co-ordinated, sequential tactics including a multiple weapon assault, in order to effectively procure even a single bison. That a trail blind would have been used to hunt bison, which do follow and often create game trails, is a reasonable consideration, no direct evidence of this has been identified in western Colorado.

Finally, when discussing the hunting techniques of any people, ancient or historic within the study area, an expansive viewshed from atop a high vantage point is a tactic mandatory for the effective observation of lowlands, drainages, and hillsides when sighting large game, including bison. This observation technique, commonly defined as glassing, would have been, and still is, an important hunting advantage. Positioning of observers from a vantage point also allows them to signal and provide direction to hunters located below and nearer game. In discussing glassing, which refers both to the use of binoculars or the naked eye, for big game hunting, specifically elk, Colorado Parks and Wildlife (Gindlesperger 2010) states:

> "An effective way to scout is by glassing the area from a distance, especially if you're above tree line. Set up in a spot that gives you a good vantage point, and watch likely areas for elk. In the mornings and evenings, elk will be feeding in or near openings. As the day progresses, look for elk along the edge of timber or other cover."

The ability to identify the type, number, location and movement of game across a landscape from a high vantage point, such as Tenderfoot Mountain and the many other high mesas and ridge tops within the study area, is a significant advantage. This enables a single hunter or an organized hunting group to coordinate and plan a procurement event in such a manner as to conserve energy while greatly improving the potential for a successful outcome. Bison, though large and frequently found in groups, have an uncanny ability to effectively seclude themselves in the undulating topography of hilly country, drainages, riparian areas, and forested mountain slopes. Dr. Larry Loendorf (2019) describes the Crow, Hidatsa and Sioux peoples perception of bison emerging from and receding into the landscape or the earth as so common and yet so profound that their spiritual rock art and boulder sculptures frequently depict this as a "bison emergence" effect. Considering this remarkable ability of bison to avoid detection by effectively melding into the landscape, it is clear that scouting from a high elevation is a hunting technique of no small consequence.

By the advent of the Historic period hunting practices began to change as the availability of horses, metal tools, firearms, the fur trade altered the longstanding native economy and hunting behavior of both plains and mountain peoples. Hunting of bison expanded to an unprecedented scale and the need for bison surrounds, impounds, jumps, and game drives was no longer necessary and these tactics were abandoned within a generation. Native tribes quickly adapted to the use of firearms for distance hunting and the use of the

horse for the chase. The romanticized belief that the Native American peoples always used every part of the game they killed and wasted nothing is a myth. Native Americans certainly knew how to use every iota of a carcass of any species of game procured but they were also capable of being as opportunistic as Euro-American hunters depending upon their circumstances and the economic demands of the time. Although not presented as a theory, but merely as an observation to be considered, W. H. Hutchinson (1972), a Colorado native, accomplished historian of the Fur Trade era, and respected critic of the concept of the ecological native, states:

> "If the Amerind was a truly dedicated ecologist, why did he so succumb to the artifacts offered him by the Europeans that he stripped his land of furs and pelts to get them?" "He did so because he was only human. The white man offered him material goods – iron, and woolens and gewgaws, and alcohol – which he could not resist. The riches, which is what they were, gave his life an expanded dimension which it had never known before. No power on earth could keep him from getting these things by raid or trade, once he had been exposed to them. To ask him to refrain from making his material life fuller and richer is to ask him far more than we have ever asked of ourselves."

The North American fur trade, beginning with European trade with natives in the 1500s, escalated to a fever pitch by the 1820s as Europe's demand for beaver fur and bison robes swelled and attracted greater numbers of Canadian and American entrepreneurs. From that time and continuing through about 1857, Native Americans, for a variety of reasons, set aside any previous values regarding resource conservation and wastefully exploited large numbers of bison (Isenberg 2000) primarily for fur trade purposes and frequently left the carcasses to the wolves as did the EuroAmerican hunter.

The reasoning behind such behavior includes not only the perception that the supply of bison was inexhaustible but the inability of a limited number of individuals to process a massive amount of product especially from a large kill. In addition native peoples and EuroAmericans alike, had preferences for select portions of meat including the hump, hump ribs, and the fatty tongue. Bison cows were preferred over bulls as the meat was more tender and the hides easier to work. Therefore; bulls killed in the excitement of the chase frequently had only the tongue harvested and the rest of the carcass abandoned. As the wild game and hunting territory began to dwindle Native Americans became increasingly dependent on French, English, Spanish and American trade goods. Soon furs and robes began to fall out of favor in Europe and the economy shifted to a focus on the need for bison meat to supplement railroad construction crews and military posts. Having little choice, Native peoples adapted accordingly, and engaged in the slaughter of large numbers of bison and other animals often taking only hump, rib meat, and tongues to trade for guns, ammunition, horses, and other desired trade articles. Thereby did they, in concert with the Americans, significantly contribute to the ultimate collapse of their bison hunting based economies. These events also impacted both native and American hunting practices on Colorado's western slope. The remaining

smaller, scattered bison groups and individuals, previously somewhat protected by the rugged landscape, would have been sought out as the Plains bison populations decreased. The resultant increase in intentional encounter hunting would have gradually reduced their numbers until they suffered the same fate as their cousins on the prairie and disappeared altogether.

11.6 Selected County Specific Observations

Gunnison County

The highest frequency of bison faunal elements identified and/or examined during Phase II of the project occur in Gunnison County with a total of 29 bison bone and horn cap specimens recovered from the Upper Gunnison Basin (UGB) and surrounding areas. The majority of the specimens were either noted or recovered from archaeological sites including open camps, activity areas, and habitation features. Eleven specimens curated at Western Colorado University in the C. T. Hurst Museum were available for evaluation. Two specimens from the Mountaineer site (5GN2477) and two from the Tenderfoot site (5GN1835) were, unfortunately, not available for evaluation. Four of the specimens, all without cultural modification, were recovered on private property, are privately owned and either on public display or available to the public and researchers upon request. Cultural modification, prehistoric and historic, occurred in five specimens. It is notable that 24 (82.7%) of the 29 specimens found in Gunnison County were located at elevations of or greater than 8,000 feet.

It is strongly surmised that a multitude of undiscovered bison remains are present at lower elevations, namely the large parks and drainage basins which have long been privatized as cattle ranches or inundated by reservoirs. This would including the expanse of Blue Mesa Reservoir which covers an area of 9,180 acres (Bureau of Reclamation accessed 2019) and had limited archaeological survey and excavation completed previous to inundation. These basins and the rolling hill country to the south of Blue Mesa Reservoir are easily visible from Colorado State Highway 149, on to the hamlet of Powderhorn, and continue until reaching the descent to Lake Fork Canyon somewhat north of the tourist town of Lake City, Colorado. All of this topography would have provided extensive native graze, easy access to water, and comfortably navigable terrain – an ideal habitat for bison. These factors may also have contributed to slightly larger herd size as compared to that of northwestern Colorado where the topography precluded the massive herds so common to the Great Plains limiting bison to smaller groups likely not larger than 15 individuals. High elevations of 8,000 feet and above in the UGB (and the San Juan Mountains) would also have necessitated bison to wander as individuals or congregate in small groups of about 15 or less due to the steep topography, smaller parks, and dense forested landscapes. The increase in elevation and resultant limitations of Montaine, Sub-alpine and Alpine Life Zones would increase competition for graze and browse on the limited surface area further limiting herd size.

The limited sample size of bison faunal elements recovered within the study area is also a result of the relatively small number of archaeological investigations undertaken within the hundreds of square miles of the study area. Future field work and excavation is likely to

produce additional specimens especially in the upper and lower Gunnison basin and the Old Spanish Trail corridor. The extent of the occurrence of culturally modified bone will prove most interesting. Continuous occupation of key landscapes by historic ranches, towns, cities, and other developments superimposed over what were ideal Native American hunting grounds, will continue to inhibit archaeological research excepting during those rare occasions when construction activity is professionally and scientifically monitored.

By far the most extensive work in which bison hunting of the Upper Gunnison Basin is addressed has been conducted by Dr. Mark Stiger. His multi-season excavations of the Mountaineer Site (5GN2477) have produced a bison second phalange (DARG 265) and a tibia fragment (DARG 267) recovered from the interior stone wall of a Folsom house structure. The structure is described as a lithic workshop due the presence of a fractured stone anvil and a large cobble tool situated near large mammal rib fragments-possibly bison-all located within the structure. The second phalange and possibly the tibia fragment were likely used as mallets for indirect percussion flaking; a flintknapping technique. Indirect percussion flaking is performed using two bone or antler mallets. The smaller mallet, commonly referred to as a punch, is held against the edge of the tool stone being worked while the larger mallet is used to strike the punch in order to indirectly remove a flake. The resultant greater indirect force results in precision removal of flakes in the manufacture of a variety of stone tools. A successful demonstration of this technique, using a modern bison phalange and bison tibia fragment was performed for the project by Master flintknapper Nicholas DiMambra of Grand Junction, Colorado on 3/18/2020. Bison bone was also recovered at the Tenderfoot Site (5GN1835) (Stiger 2001) from a bone disposal area and a windbreak structure. Seven additional sites in Gunnison County have produced bison bone associated with human activity. Game drives are also present in the UGB including a possible drive located atop Tenderfoot Mountain. Dr. Stiger's (1999) comments support the presence of bison in the UGB at different times in the past and at all elevations of western Colorado. He posits that due to the topography limiting herd size small scale bison kills may have been common regional adaptation as the large amount of meat from even a single animal would have had value to a primitive community. He encourages ongoing paleoecological research specific to the western slope mountain area as necessary to clarify the role of bison hunting in a subsistence culture.

Ute procurement of bison into the late 1850s in the mid and high elevations of the UGB is supported not only by documented historic observations of the presence of both Ute peoples and bison in the area but also by DARG 251, a partial bison cranium with cultural modification in the form of a frontal craniectomy. Hagie (1942) briefly described the find in Southwest Lore indicating he skull was found exposed on a steep hillside southeast of the Willow Creek Ranger Station in Taylor Park, Gunnison County, CO.

Over the past 11,000 years of human predation of bison, until the advent of European influence, the basic technique of butchering varied little among the peoples of the Plains and Rocky Mountains excepting the process of accessing the brain cavity. Kornfeld, Frison, and Larson (2010) indicate that effecting a craniectomy on the foreskull to access the cavity seems to be attributed to the Late Prehistoric period and occurred primarily on the Plains. As

hammering through the thick foreskull is much more difficult than breaking through the thinner bone of the maxilla or accessing the brain cavity via the foramen magnum, that a craniectomy may primarily have had a ritualistic intent verses accessing the brain tissue for practical purposes. The brain matter of bison, as with many mammals, was frequently used for tanning purposes (Dary 1975:90) and possibly as a supplemental nutritional source as well. Bison skulls with craniectomies are found at many sites throughout the Plains and the west with the Vore Site in Wyoming having a significant number of specimens. Several of these, which exhibit craniectomies, have been intentionally arranged in arcs further indicating a ritualistic purpose associated with foreskull breaching.

With their acquisition and mastery of the horse by 1640 (Hafen 1945), the Ute extended their range to include not only western Colorado but the eastern Great Plains as well. There they successfully hunted bison and interacted with a variety of Plains tribes who had long been engaged in a bison hunting culture. Adoption, by the Ute people, of many aspects of Plains cultural practices, including the practical or ritualistic imposition of a craniectomy on a bison skull, would be expected and is evidenced on several bison skulls recovered within traditional Ute territories on Colorado's western slope. As documented in Phase I of the Project (Shelton, Berry and Conner 2017) three bison skulls, DARG 38 from site 5GF2416 on Trapper Creek atop the Piceance Basin, DARG 135 from Rio Blanco County, and DARG 143 from a Piceance Basin drainage, all exhibit obvious craniectomies. Both DARG 38 and DARG 143 were determined by the Northern Ute Tribe to have spiritual value due to the presence of the craniectomies. Under supervision of Tribal Historic Preservation Officer Terry Knight, authorized representatives formally claimed and ceremonially repatriated both specimens to unknown locations under the Native American Graves Protection and Repatriation Act (NAGPRA 1990). The intent or previous action taken by the individual facilities regarding repatriation of bison skulls with craniectomies is unknown and as inquiry concerning such was not an aspect of the project the subject was not broached during museum visits.

As previously mentioned abundant evidence confirms the presence of bison and the likelihood of Ute exploitation by hunting well into the 1850s. Of greater interest regarding the late presence of bison are two intriguing documents which refer to the possibility of remnant bison surviving in the high parks of the UGB as late as the 1920s. The first reference is contained in a brief composed by Gunnison National Forest Administrative Assistant Ralph Mike Sweet on November 17, 1949 and filed at the United States Forest Service offices in Gunnison, Colorado. Mr. Sweet, with his companion, Pitkin County Ranger District Forest Ranger James Oluf Folkestad, found DARG 264, a bison horn cap in Taylor Park during a 1949 hunting trip. In a one page document composed by Mr. Sweet he describes the find and the location in detail and the surprisingly good condition of the horn cap which he believes indicated the bison died no more than "...about 30 years ago, or possibly 40 years ago...". This would tally to approximately 1909 or 1919. He then makes reference to anecdotal information regarding an unnamed party possessing bison horn caps and bison skulls from the same area. Throughout the document Mr. Sweet's tone suggests a commonly accepted awareness of a small bison herd in Taylor Park that eventually perished as a result of a severe winter. He concludes with reference regarding his intent to contact and inquire of a Mr. Thomas Stevens,

who he describes as an “old timer,” and whom he believed had living memory of a remnant bison herd occupying the Taylor Park area.

Two additional references to late occurring bison in the UGB are made by Edward Royal Warren, an exceptional amateur mammaolgist working in Colorado in the early 1900s. Warren produced 96 papers and books on mammalogy previous to his death in 1942. Dr. Mark Stiger, referring to an excerpt from an unspecified 1999 Annual Report he prepared indicates Warren (1910, 1927, 1942) wrote of seeing bison skulls in 1904 at an elevation of 10,700 feet close to the Venango Mine near Irwin (Ruby Camp), Colorado, 10 miles northwest of Crested Butte. Irwin, still inhabited at the time Warren visited , was laid out within the boundaries of the Ute reservation and maintained a Ute interpreter, Captain U. M. Curtis, in 1880 (Wolle 1947) as the Utes continued to frequent the area and were considered a potential threat. The pine forests surrounding Irwin were and still are inhabited by a wide variety of rodents and porcupines (*Erethizon* dorsatum). Porcupines especially eat horn sheds and bone, consuming them usually within a season. The presence of the bison skulls observed by Warren would easily suggest that the animals had died relatively recently as bone weathering secondary to the high precipitation climate of the forest, combined with destruction due to gnawing by rodents, especially porcupines, combine to indicate exposed bison bone would have been unlikely to survive greater than 15 to 20 years. That the skulls were older and may have eroded out of protective sediments must also to be considered though it should be noted that the forest duff and soils near the Venango Mine area was observed by the writer to be rocky and shallow (personal visit 2019) casually averaging surface to bedrock at 30cm to 50cm in depth with most of the surface consisting of duff and small woody debris that would not hinder a rodent or provide measurable protection from weathering due to moisture and microbe activity.

Considering weathering and rodent gnaw potential and calculating for a 20 year span from Warrens visit in 1904, and including Sweet’s estimations, bison may possibly have been in existence in the Crested Butte area from as late as 1884 to 1919. The presence of bison in the area would likely have been known by Ute tribal hunters long familiar with the region. As the area was located within previous Ute reservation boundaries and the Ute continued to frequent the area into at least 1880, presumably hunting as they moved through, an opportunity to obtain bison meat would have been a strong temptation for the Ute people. Therefore; a continued future search for documentation of or actual culturally modified bison bone, as defined by stone or metal tool marks and supported by radiometric testing, from the area is strongly encouraged. Hinsdale County.

Although no specimens were located in Hinsdale County it is strongly suspected that bison were present in the upper elevations surrounding the Lake Fork drainage. As discussed in the Gunnison County segment the rolling hill grasslands and intermittent shallow drainages found within this region of Hinsdale County would have provided a supportive environment for large mammalian grazers including bison. Previous to the overgrazing beginning in the late 1800s, a wide variety of native browse, grasses and forbs would have provided adequate sustenance for small bison herds. In addition, the topography, mimicking somewhat the Great Plains of eastern Colorado, offers viewsheds that would have enabled prehistoric and historic

hunters to pinpoint the location of these small bison herds or vulnerable individuals and strategically maneuver themselves to procure prey. Hunting tactics in this landscape may have differed from predation tactics used in the more rugged lowland country and that of the higher elevations in that use of topographic features as concealment would have minimized startling bison and improved chances of ambush previous to the animals taking flight.

Since the late 1800s the grasslands of Hinsdale County have been exploited for beef cattle production. It would be expected that bison bones, excepting the distinctive skulls, when found by ranchers and residents then and today, would have been disregarded as beef cattle bones and seldom given a second thought, much less collected. Personal interviews with ranchers and individuals with a generational knowledge of the area's history would be required to determine the extent of private curation of bison bone specimens. Unfortunately, the time required for this endeavor is not available to the project.

Alan Nossaman's (1981) comments concerning bison in Hinsdale County in his Many More Mountains three volume set, mentions the Ute using the trail broken through the snow by bison as the only way to access Hope Lake early in the Spring. Unfortunately there is no time line associated with this comment.

Saguache County

A visit to the Saguache County Museum resulted in one of the most unexpected and enjoyable outcomes of the project. Although only a portion of the northwest quarter of Saguache County is situated in the project area a decision was made to investigate in the hope that the facility would have information or possibly a specimen collected from the western slope.

Pre-visit calls to the facility staff resulted in an invitation to visit but assurance that they had no bison bones, skulls, or related information excepting a native American bison pipe bead breast-plate. During Phase one of the WCBP every museum contacted by phone had confidently assured the investigator that no bison faunal elements were present in their collections. Visits were made regardless and proved that all but one museum had multiple specimens that they were unaware of or had disregarded as unimportant. Therefore; secondary to learning from past experience, the investigator visited the Saguache County Museum and the results were astounding and delightful. Upon arrival at the facility it was again confirmed that the museum had no bison skulls or bones. During the tour, guided by two knowledgeable docents who have volunteered at the museum for over 20 years, the writer espied a rather large bison skull hanging from a high rafter of the central room. The surprised docents stated they had never seen it before though it was later revealed it had been placed there, as one of the first acquisitions of the museum, in 1959, the year the museum opened. A nine foot ladder was acquired from the facility handyman, and, Not without some degree of trepidation, climbed by the writer who was gently detached the heavy and dusty specimen from the wall and transferred it to a stable lower elevation surface for inspection. Upon the foreskull, painted in thick barn-red oil base enamel, and in a rather pleasant and flowing script indicative of the era, is written

the following: Buffalo Head found by Jack Welch near Crested Butte Colo 1899. The occiput of the skull had been sawn off so the skull would lie flat against a wall and heavy gauge wire was wrapped around the horn cores for use as a hanging wire. Needless to say this was the most unexpected type of cultural modification ever encountered during either phase of the Western Colorado Bison Project.

Situated below the skull on an ornate Victorian side table was found a framed black and white photographic image of Mr. Jack Welch (Plate 24). He is extravagantly mustachioed, sports long hair, and is mounted horseback in full mountain man regalia complete with sidearms and a rifle. An inscription below the image reads “Jack Welch Known among the Indians as “Buckskin Jack”.” A tag, typed in capital letters, and placed near the photo reads:

> 59-398-1 PHOTO OF JACK WELSH WHO WAS BORN IN GETTYSBURG, PA IN 1854 AND CAME TO COLORADO IN 1868. HE WAS TYPICAL OF THE MOUNTAIN MAN. PHOTO TAKEN IN INDIAN TERRITORY. GIFT: WALTER HAMMOND.

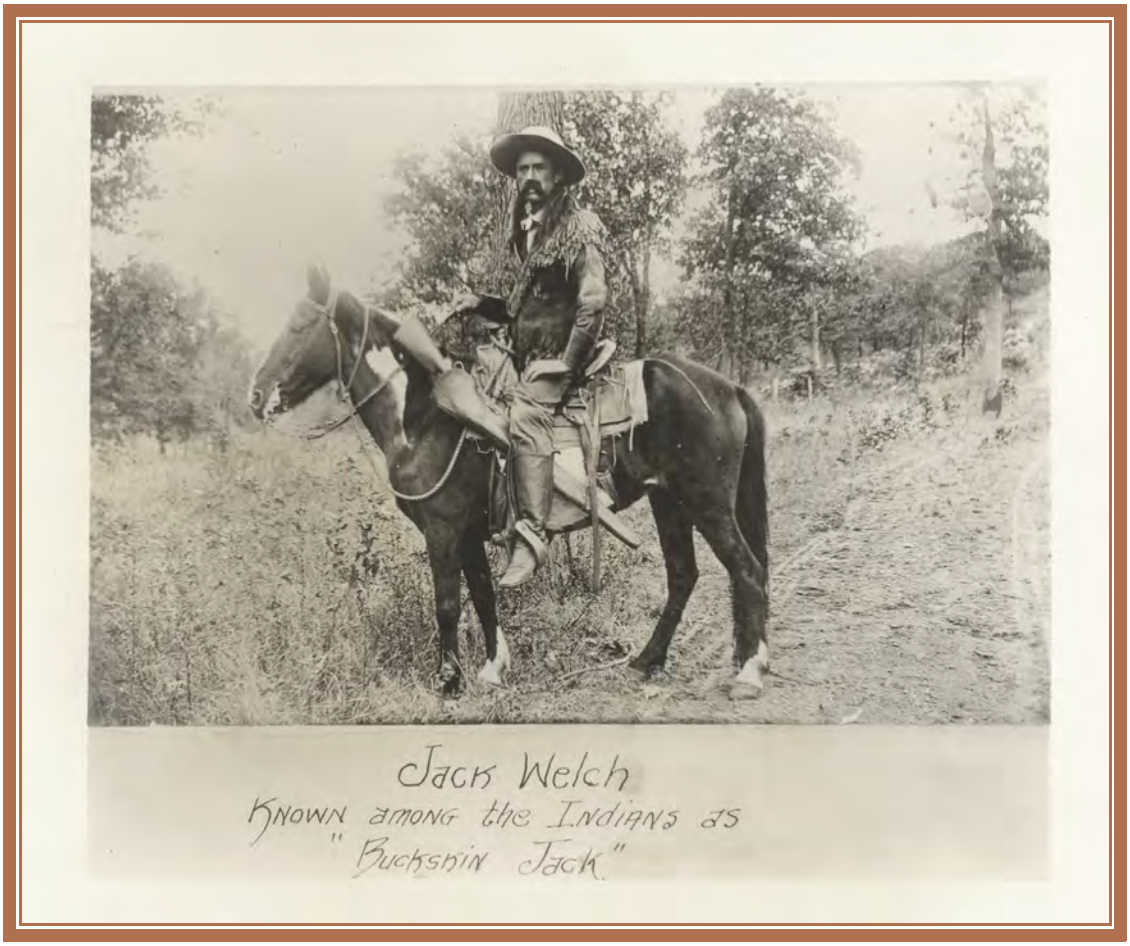

Plate 24. Mr. Jack Welch “Buckskin Jack”.

The misspelling of Welch as "Welsh" is recognized and it should be noted that this type of error was not uncommon in past decades. As the museum volunteers stated they had never inspected the back of the photo, permission was granted by the director and the photo was removed from the frame. Handwritten in pencil on the back of the image was the following:

> "Born 1854 - Gettysburg PA on his fathers farm Buckskin Jack came to Colo at 14, in 1868. Hunted with buffalo hunters He was a true mountain Man. Engaged in trapping & hunting Providing game for food of the work camps of Del Norte - Saguache, Cane - now known as Trincheria Ditch He died in Salida hosp buried in Saguache Photo given to Saguache C. Museum Gift of Donation. Walter L. Hammond This photo taken in the Indian Territory of Oklahoma(.)"

Diligent detective work by the Saguache County Museum volunteers as they perused the museum archives produced several references to Mr. Welch. These were recorded in the Saguache Crescent, the longest continuously published newspaper in the State of Colorado, and included a December 26, 1912 advertisement for his offer of sale for "A pile of heavy bobsleds..." and a September 19, 1901 comment "Jack Welch left Saguache Monday morning for (C)rested Butte.". This last indicates he was certainly familiar with Crested Butte and likely the surrounding country. He was a competent buffalo hunter in the 1870s and was later employed providing wild game meat for the military and railroad and irrigation construction workers (Saguache Crescent 1929). If his photograph is any indiction he appears to be more than capable of successfully fulfilling these roles. His obituary, noted in the same paper indicates he passed away after a brief illness at a hospital in Salida, Colorado on 8/11/1929. Burial records list his grave site as located at the Saguache County Cemetery. A visit to this cemetery confirmed the presence of a recently placed new granite headstone said by the Saguache Crescent editor as having been provided by his great niece. A small bouquet of flowers was placed by the project as a humble tribute to this remarkable Colorado pioneer.

Ouray County

A total of three bison bones (DARG 278, DARG 279, DARG 280) and an undetermined number of possible bison bone fragments (DARG 281) were identified in Ouray County. All specimens are curated at the Ouray County Museum and the three bones are displayed in a secure case. The specimens were recovered from the Dallas town site by Steven Baker of Centuries Research LTD during a survey of the site in 1991 and evaluated and identified by retired Assistant State Archaeologist Dr. Danny Walker, University of Wyoming. The town of Dallas was a temporary terminus of the Denver and Rio Grande Railroad and served the San Juan Mountain region's gold mining industry with a variety of services including blacksmiths, mercantile, boarding houses, hotels, butcher shops, and restaurants. The town, founded in 1880, incorporated in 1887 was virtually abandoned by 1891 due to the railroad having extended to Ridgeway, Colorado. The Dallas Townsite bison bone, found behind what was likely the back of the Dallas butcher shop, was butchered by modern means using a meat saw. This is indicated on each specimen by the level, flat cut surface with no undulation or stepping and repetitive, fine, parallel striations that are not set deep in the bone.

There is also a slight wave pattern above the terminal breakaway spur at the edge of the bone cut (Guilbeau 1989). The saw teeth marks average 2mm apart in keeping with the common meat saw. No false start kerf is evident on any of the specimens indicating that the butcher was in all probability, highly skilled and familiar with large game processing.

During the construction of the cross continental railroads bison meat was a common source of easily accessible and palatable protein for railroad construction crews and they were, along with military personnel stationed at various frontier forts, quite dependant upon it. (Hill 2014). Bison meat was easily accessible and as the animals were abundant they could be found, killed, and butchered practically on or very near construction sites. As the fresh killed meat did not have to be transported over long distances or time periods there was little concern regarding spoilage. It was simply hauled via wagon to a trailhead and then moved by rail directly to the work site (Hill 2014). The meat was then quickly consumed by the workers negating the need for complicated and time consuming processing techniques such as salting, pickling, or smoking.

American bison (*Bison* bison), considered incapable of domestication (Diamond 2003), are notoriously difficult to manage and are not easily herded to a destination point or confined in an enclosure such as livestock pens at a railhead. Bison, as do domestic cattle, perceive a human, mounted on horseback or afoot, as a predator exhibiting stalking behavior. Domestic cattle have a narrower flight zone than bison and tend to respond to gentle herding pressure with initial unease and then mild anxiety that results in a stimulus-response avoidance behavior of bunching and easing away from the perceived threat (Grandin 2019). Only when their flight zone perimeter is pressured do cattle shift from unease and mild anxiety to fear and flight. Even so they still tend to group together. Therefore, five to ten skilled cattlemen/women can safely move groups of 1000 or more cattle long distances with relative ease and guide them into an enclosure (Shelton 1971 personal experience). Bison have a lower stimulus-response tolerance level and a very broad flight zone boundary (Grandin personal communication 2018). They quickly respond with unease and anxiety at first sight of a perceived threat and exhibit fear indicating behaviors such as licking, blinking, and huddling.

As their degree of fear escalates they may begin to mill about, raise their tails, vocalize, and then run or stampede (Grandin undated). At the point of peak or plateau of escalation their time period for de-escalation to full recovery can be extensive. There are mid 1800s reports of bison stampeding across the prairie for days. Being somewhat unpredictable when pressured they may also opt to engage in aggressive or defensive behavior such as charging and goring. If confined they may break out of or jump over the enclosure, trample and gore each other, or ultimately succumb to tonic immobility and die. Due to these inherent behaviors economic cost of bringing bison to market as compared to cattle was not practical. According to Dr. Hill's (2014) calculations for the late 1800s movement of one ton of bison meat over one mile averaged a cost of 30 cents while driving live domestic cattle to a railhead totaled only two cents per ton per mile.

With the advent of the refrigerated railroad boxcar in 1851 dressed meats no longer had

to be preserved and shipped in barrels to minimize spoilage. By 1872 fresh meat of any type, butchered and processed on Colorado's eastern slope could be safely shipped in modernized refer (refrigerator) railcars as hanging quarters anywhere in the country including western Colorado. These hanging quarters were usually delivered to a local butcher for cutting into manageable portions and then delivered to hotels, restaurants, and boarding houses to be prepared and served to the public. Harry Cornwall (1969) in describing his experience returning to Colorado by rail in 1879, mentions the common availability of bison meat during meals at rail stops.

> "The time from New York to Denver was four days and three nights or vice versa. I went from New York on the Erie to Chicago, then to St. Louis and Kansas City and from there to Denver by the Kansas Pacific. There were then only two railroads across the plains, the Union Pacific from Omaha to Cheyenne and San Francisco being I think the only trans-continental route and the Kansas Pacific from Kansas City to Denver. The real thrills of the trip for a "tenderfoot" began when we reached the open plains in western Kansas. While there were no buffalo to be seen from the train, buffalo meat was a regular dish at the eating stations as there were still enormous herds in Indian Territory (now Oklahoma) and Texas."

While transporting bison meat by rail was possible, and was certainly done, it was not cost effective. Bison had to be butchered in the field and the meat transported to railheads because the animals could not be easily driven to or contained at livestock pens or transported live in railcars to slaughterhouses. Regardless of this fact, live bison were known to have been transported by railroad livestock cars to the town of De Beque in western Colorado in the early 1900s. Dave Knight, a Cherokee stockman who moved to Deer Park in Mesa County, Colorado in 1911 (Woodhouse 1998) purchased an unknown number of live bison and paid to have them transported by railcar to De Beque, Colorado (Galyean 1977). His intention was to breed them with cattle but they proved too unmanageable. Galyean (1977) knew Mr. Knight personally and clearly recalls the delivery of the bison. Considering this evidence of transport of bison to western Colorado, it is not inconceivable that bison meat, considered by many in the 19th century to be far superior to beef and somewhat of a delicacy, was transported by rail to urban and rural locations such as Hotel Colorado in Glenwood Springs or the little hamlet of Dallas. The use of bison meat by railroad workers at railroad towns and work camp sites such as Dallas in Ouray County and Tellurium and Argentum in Hinsdale County, may have occurred in western Colorado secondary to availability of the meat by rail or from procurement of an occasional remnant native bison.

Pitkin County

Aside from the Ziegler Reservoir Fossil Site collection the only bison bone specimen identified during this phase of the Project is DARG 284. This severely weathered partial skull is reported to have come from the extreme northwest aspect of Pitkin County near the confluence of Park Creek and North Thompson Creek. Several other bison bones have been

found relatively near this specimen including DARG 282, a bison skull recovered from Elk Creek in the Flat Tops Wilderness area of Garfield County, approximately 25 miles to the northwest of Park and Thompson Creeks. An exceptionally well preserved bison skull collected from Bison Site Cave (5GF2734) and curated at the Denver Museum of Nature and Science, was located less than 20 miles to the northeast.

During Phase I of the project seven bison specimens were identified to have originated in Garfield County relatively near the original location of DARG 284. These were located in similar topography and elevations. As there are no topographic barriers insurmountable to bison between Garfield and Pitkin County, it is reasonable to expect that movement of the species across the landscape and between these counties occurred with some regularity. It was fully anticipated that more than a single bison specimen originating in Pitkin County would be found and the paucity of specimens was curious. The remoteness and rugged topography of the area does pose barriers to humans, if not bison and historic and present day settlement of both the Flat Tops in Garfield County and the northwest corner of Pitkin County is sparse with many square miles of uninhabited land. Today the Flat Tops Wilderness Area boasts a myriad of roads, two-tracks, and trails and, due to ease of access, is heavily used for multi-seasonal recreation and hunting. Therefore, the opportunity for discovery of bison faunal elements is high as evidenced by the greater number of specimens recovered and reported from the area. The northwest corner of Pitkin County has few roads with limited access and the minimal use is likely an explanation for the scarcity of recovered or reported specimens. It should also be noted that many decades of domestic cattle ranching in both area have resulted in the presence of no small number of domestic Bos bones on and beneath forest surfaces. It is impossible to deduce how many bison bones have been overlooked under the assumption that they were cattle bones. It is hoped that future investigations, carried out with an awareness of the importance of closely evaluating bone for species identification and cultural modification and not disregarding large bone remains as domestic Bos, may aide in clarifying the presence or absence of bison and evidence of bison hunting in the northwest Pitkin County area.

12.0 RADIOMETRIC DATA

Organic remains, including bone and soft tissue, are excellent sources for radiocarbon testing for the purpose of determining the date of the death of an organism. Carbon-14 testing of bone collagen and the collagen in horn cap keratin was the primary technique selected for dating specimens sampled for this project. Radioactive carbon formation, carbon-14, is a result of high energy cosmic ray bombardment of nitrogen-14 that occurs at a constant ratio in the upper atmospheres of the Earth. The collision of a neutron with the nucleus of a N-14 isotope produces C-14. The process of plant photosynthesis incorporates the atmospheric carbon-12 and carbon-14 into the cellular structure of plants at a constant ratio whereupon it is transferred into the food chain and, ultimately, into all living organisms with mammals receiving it in the form of carbohydrates, proteins, and fats. Beginning at the point in time when an organism dies-for the purposes of this study the bison species-the level of carbon-14 begins to decline at a predictable rate with the half-life being approximately 5,730 years. By measuring the isotopic

levels in a sample and calculating the known levels of carbon-14 in living organisms using the half-life number, a back calculation can be used to determine the rate of radioactive decay in order to determine the date the sampled organism died. The resultant date can then be used to locate the existence of that organism on a comparative time line. Excepting forensic analysis of recently deceased human fingernail tissue (Hodkins 2009), this process rarely results in a precise date for archaeological specimens but does provide a reasonable range. The C-14 date ranges of selected bison bone samples tested during the project and those dates obtained from a variety of previously tested samples were assimilated to identify where in the western Colorado time line bison were present and when they were exploited by both prehistoric and historic peoples.

12.1 Overview of Radiometric Testing

A total of 18 radiometric dates were incorporated into Phase II of the Western Colorado Bison Study website data base (dargnet.org/net/bison/bison.html). These are detailed in Appendix F. After obtaining permission from the curation facility or individual, bone collagen samples were collected from eight bone specimens with two samples being collected from two horn cap specimens. All samples procured during the study were submitted to International Chemical Analysis, Incorporated 10585 SW 53rd Street, Sunrise, Florida, for radiometric testing. The remaining eight radiocarbon dates were gleaned from various reports and publications concerning bison bone, some not available for direct observation, that was either culturally modified, culturally associated, or considered an ecofact. Two of these dates resulted from charcoal tested at sites with associated bison bone, the Marion Site (5GN1664) and the Pioneer Point Site (5GN41). Excepting one date obtained from an unspecified Block A sample from the Mountaineer Site (5GN2477), the remaining three Mountaineer Site dates resulted from bone samples recovered from within Block A. Dates from the Tenderfoot Site (5GN1835) are the result of an assessment of 60 radiocarbon dates obtained from samples collected at the site.

The radiometric results from the 18 samples included in this study span a time period from 10,440 BP to AD 1960 with a probable and more realistic terminal date of AD 1890 and a possible, but unconfirmed, terminal date of AD 1910. Study results reveal an intermittent occurrence of bison in west central and southwestern Colorado from the Late Folsom Period to the late 1850s. Three culturally affected bison bone ecofacts fall within the Late Paleoindian period dated at 10,440 BP (DARG 265), 10,380 BP (DARG 266), and 10,295 (also DARG 266). All three specimens were located in and near a Folsom habitation excavated at the Mountaineer site (5GN2477), Block A. Results also suggest the presence of remnant bison, possibly as late as 1910, in the Upper Gunnison Basin.

Within the time line there are six gaps showing an absence of evidence of bison. These are as follows: 10,295 BP to 8000 BP (2295 years), 3000 BP to 2130 BP (870 years), 918 BP to 470 BP (448 years), 460 BP to AD 1670 (2130 years), AD 1690 to AD 1730 (60 years), and AD 1810 to AD 1860 (50 years).

It must be noted that the available samples were significantly limited due to several factors, these being the inability to obtain permission to test several culturally modified specimens, restrictions imposed by budget constraints, and a paucity of past archaeological focus and data collection related to the occurrence of bison and culturally modified bison bone. This last resulted in lack of or incomplete evaluation of possible or probable bison bone and in bone collagen rarely being collected and submitted for radiometric testing. Bone collagen sampling for radiometric testing was unexpectedly limited due to the inaccessibility of a number of bison specimens and to possible bison bone specimens which required direct evaluation. This unfortunate circumstance was due in part to four major complications; these being: 1) a lack of information confirming collection details regarding some specimens, 2) lack of identification of the curation facility in which some specimens were housed, and 3) closure of the Hinsdale County Museum due to a natural disaster-the Lake Fork of the Gunnison 2019 flood, and 4) mandatory closure of public museums and archives in southwestern Colorado due to the 2020 Covid 19 pandemic. Mandatory restrictions on business operations and limits on social interaction resulted in interruption of the ability of the investigator to visit facilities, access collections, and directly examine specimens and collect bone collagen samples.

12.2 Cultural Sequences and Associated Specimens

The chronological boundaries of cultural sequences can not realistically be bracketed by specifically set dates. Due to a variety of ever changing factors, including prehistoric and historic climate change, variable life zone elevations over time, the presence or absence of resources, and resultant human movement across regions, precise dates are blurred, often overlap, and can change significantly as new evidence and testing techniques are discovered. It is important to understand that the cultural sequence time lines presented in this study are to be considered flexible for they cover both a great expanse of territory, periods of climate change, and many life zones which fluctuate according to climate change. Although used in this report, in reality, linear visuals, though convenient, do not offer an altogether accurate view of events over time. A digital multi-dimensional image would better provide a more holistic interpretation of the reality of the human experience in West Central and southwestern Colorado and, though beyond the scope of this project, it is hoped the data contained herein will, at some point in the future, be translated into such a presentation.

Late Paleoindian Period through the Late Archaic Period

The Paleoindian Period exists within an ever changing time line as new discoveries push dates back ever farther into the past and into what is now deemed Pre-Clovis. In general the traditions of this period include Clovis, Goshen, Folsom and Plano with the Plano tradition subdivided into that of the Plains Tradition and the Foothills Mountain Tradition as defined by Frison (1992). The earliest bison specimens identified in this study; the Ziegler Reservoir Fossil Site (5PT1264) collection, the bison second phalange from Cement Creek Cave (DARG 268), and a probable distal right bison humerus listed as FS-16 along with a collection of distal humerus fragments, recovered from Haystack Cave (DARG 310), 5GN189, predate any known evidence of the presence of humans in North America (Figure 2). As the *Bison* latifrons molar

and two horn cores (DARG 269, DARG 270, and DARG 271) recovered in Gunnison County in 1929 were not collected and no samples were taken it is not possible to determine a date other than the accepted range of the species existence from 250,000 YBP to 20,000 YBP (San Diego Zoo Global 2009).

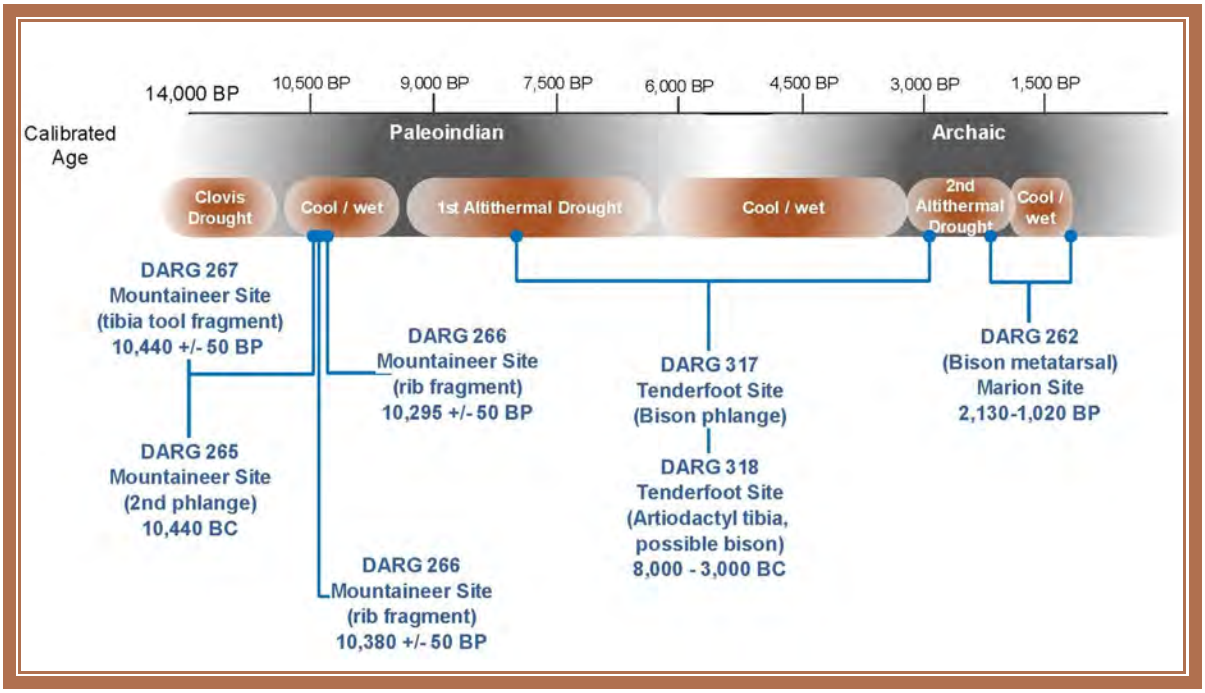

Figure 2. Timeline 1, periods, climate, calibrated ages, and associated specimens.

The earliest bison ecofacts identified during Phase II of the Project are DARG 265, a bison second phalange and DARG 267, a bison tibia fragment recovered from the Mountaineer Site (5GN2477) in Gunnison County. The site is located atop Tenderfoot Mountain, locally known as W Mountain, where, under the ongoing direct supervision of Dr. Mark Stiger of Western Colorado University's anthropology department, continues to produce a remarkable amount of unprecedented archaeological data. DARG 265 was found abutting DARG 267 which produced a 14C date of 10,440 BP (sample CAMS105764). These two specimens, directly associated with each other, produced test results that fall comfortably within the Late Paleoindian Era. As Stiger (personal communication 2019) suggests these were possibly Folsom Complex flintknapping tools as they were situated among at the interior back wall of a Folsom structure determined to be a lithic workshop. Both specimens suggest use as components of a flintknapping kit (Frison 1982) comprised of those technological tools used as mallets for direct or indirect flintknapping. A concentration of quartzite cobble fragments inside the structure showed evidence of percussion scarring suggestive of use as hammer stones. A fractured stone anvil, a large cobble tool, and a number of large mammal rib fragments (DARG 266), possibly bison, were all located within the structure. Bone collagen samples from these rib fragments produced dates of 14C 10,295 BP (CAM105765) with an individually tested seven centimeter long rib fragment producing a result of 14C 10,380 BP

(UCIAMS-11240). The identification of bison bone flintknapping tools in a Folsom era lithic workshop combined with bison rib fragments which may also have been used as lissior tools suggests a familiarity with the species to the degree that intentional selection of certain faunal elements was an established pattern.

An absence of bison bone is evident from 10,295 BP through 8000 BP. A segment of this gap, from 9500 BP to 8000 BP, falls within the First Altithermal Drought occurring from 9500 BP to 6300 BP (Miller 1992). The lack of bison bone ecofacts may be indicative of a progressive decrease in the availability of bison at this elevation due to protein stress as the nutritional quality of available C-3 grasses which thrive during cool/wet climates, decreased due to the warming temperatures. In their excellent study of the climatic warming effects on *Bison* bison via the use of DNA metabarcoding to show seasonal variation between two bison herds residing on separate ranges differing in mean annual temperature by 6° Celsius, Craine et. al. (2015) state:

> "Climatic warming has the potential to reduce the growth and reproduction of large mammalian terrestrial herbivores by not only reducing the nutritional quality of plant species, but also decreasing the relative abundance of nutritionally critical species. For North American plains bison (Bison bison), a keystone species in North American grasslands, climatic warming is likely to increase protein stress, reducing bison growth and reproduction."

In general, though nitrogen fixing eudicots typically have higher protein concentrations than the C-3 or C-4 grasses, bison, being strict grazers, prefer a diet of grasses and monocots verses browsing woody eudicots such as forbs, shrubs, and trees. Although less attractive to bison they do, to some degree, consume eudicots and the lower protein heat tolerant C-4 grasses (Craine et. al. 2015). It is unknown if a dependence on low protein vegetation imposed by the warming of the First Altithermal Drought climate would have motivated bison to migrate to higher elevations in order to access the greater availability of high protein graze but, given the option of roaming freely it is reasonable to assume bison would respond to warming climates by seeking higher elevations which support their preferred graze. They would however; very likely have sought the more readily available and dependable water resources of the high country. Additional bison population decreases may have resulted during this period as they and other large game competed for sustenance on the reduced land mass of the higher elevation life zones. Future exploration and research of the study area's higher elevations to discover or identify known culturally modified bison bone faunal elements is an activity that might produce evidence of Late PaleoIndian hunters following bison to higher elevations during episodes of drought.

The Early Archaic period, 6400 BP to 3500 BP (Reed and Metcalf 1999) is represented by DARG 317 and DARG 318, an unidentified bison phalange and a possible bison tibia, both recovered from the Tenderfoot Site (5GN1835). Radiometric dates from various samples associated with the site returned dates spanning 8000BP to 3000BP. At this time the broad date range and the lack of bone collagen testing of these specific bison bone artifacts negates a more

precise date. As with the bison bone artifacts recovered from the Mountaineer site, the phalange and tibia may be indicative of bison bone tool use or they may simply have been faunal waste material resultant from butchering. Unfortunately neither specimen was available for direct evaluation. From 6300 BP to 3500 BP a Middle Holocene cool/wet period would have contributed to a life zone supportive of a greater variety of cool temperature loving C3 grasses and monocots with a reduction in C4 grasses and woody, rough browse eudicots. This habitat, inviting to bison, would have attracted individuals and small herds back to the lower elevations of the UGB.

Occurring from 3500 BP to 2800 BP, the Second Altithermal or 700 years Drought, would have been a challenging period for bison survival at lower elevations due to previously discussed resultant nutritional stressors. This is reflected in an absence of bison bone artifacts from 3000 BP to 2130 BP. The Middle Archaic period, 3500 BP to AD 1000 (Reed and Metcalf 1999) includes only the bison bone found at the Marion Site, DARG 262, the radiometric dates are imprecise for they span a broad period from 2130 BP to 1230 BP and 1172 BP to 918 BP. As the following cool/wet period from 2800 BP through 1000 BP (Miller 1992 and 2012 in prep) would have been supportive of higher numbers of bison at both higher and lower elevations, there is a higher probability that the specimens were procured at some point between 2130 and 1000 BP.

A third drought from 1000 BP to 600 BP (Miller 1992 and 2012 in prep) marked the beginning of the Late Archaic period dated 1000 BP to AD 300 (Reed and Metcalf 1999) and shows a 448 year absence of bison from 918 BP to shortly after resolution of the drought at 600 BP. Bison bone (DARG 263) evidence reappears 130 years into a brief cool/wet period occurring from 600 BP to 150 BP at Pioneer Point, a site located on the east rim of the Black Canyon of the Gunnison, dated between 550 BP and 390 BP placing the more recent date just within the Formative Period of AD 400 to AD 1300 (Reed and Metcalf 1999).

Post Archaic, Formative, and Historic Pre-contact Periods

From 460 BP to AD 1670, a span of 2130 years that included the controversial Medieval Warm Period (MWP) of AD 900 to AD 1300, no dateable culturally modified bison bone specimens were located. The MWP is considered to have resulted from multiple influences including solar radiation fluctuations, altered oceanic air currents, and decreased volcanic activity which produced less than uniform degrees of warming, or a lack thereof, worldwide (Dean 1994). It's effect on the Colorado Plateau during the Post-Archaic Period, appears to have been measurable in that the rise and fall of the agrarian focused Ancestral Puebloan culture coincides with the MWP onset, peak, and decline. During the apex of the MWP increased summer and winter precipitation extended and supported growing seasons adequate to support large human populations in southwestern Colorado. Although corn based agriculture was, at this time, the predominant source of nutrition, hunting, gathering, and trade was ongoing and combined to supplement the prehistoric diet. Although no dated bone associated with this period was found during the project, evidence of bison procurement is noted in three locations in the study area which do fall within the Formative era. The first of

these, recovered from Couger Spring Cave; 5MT4797, is an undated possible bison astralgus, DARG 314, a bone often used as an expedient flesher due to it's natural shape (Shelton, Berry, and Conner 2017; Berry et. al. 2012). Collected from Escalante Ruin, 5MT2149, a nine room pueblo with one kiva occupied during Pueblo cultural periods I, II, and III, DARG 315, an unmodified bison astralgus, was found in association with nine other artiodactyla bones that were not specifically defined as bison. The nine bones included a first phalanx, four carpals, a left calcaneous, a tarsal navicule-cuboid, and two patella.

Just outside the study area perimeter, on the western and northern boundary near Nucla, Colorado in Montrose, County is situated Cottonwood Pueblo; 5MN654. A collection of possibly burned, bison long bone fragments, DARG 323, were recovered here. Although the Late Prehistoric structures at Cottonwood Pueblo, 5MN654, and the Jeff Lick Stone Circles site; 5MN3462, are both located in the Phase I study area just out of the Phase II boundaries, they both show evidence of bison procurement and large game exchange systems that may be applicable to other sites in southwestern Colorado. It is important to include recent findings presented by Rand Greubel (2018) concerning his insight regarding Gateway Phase large game exchange practices. This system, identified and refined by Greubel, appears to include acquisition and storage of processed large game stored with the intention of progressively conveying it from one site to another until reaching a final destination where the products might be exchanged for other desired resources. It is important to note that results from the protein residue samples collected from the Jeff Lick Stone Circles site indicated the presence of Antilocapridae and Bovidae with the most likely candidates being *Ovis canadensis*, *Antilocapra americana*, and *Bison bison*. Greubel (2018) states:

> The Jeff Lick Stone Circles site has recently yielded direct evidence of meat storage in the form of a positive protein residue result from a storage feature (Martin and Shelton 2015). Between the lower elevation sites and the Jeff Lick site, a number of structural sites extend up the flank of the Uncompahgre Plateau along tributaries of the San Miguel and Dolores rivers. Some of these sites, many of which are atop prominent ridges, were documented by Reed and Emslie (2008), who noted the possibility that they are inter-visible. This is an intriguing and potentially important possibility that requires further research. These sites may be part of a network of way stations-as suggested by Martin and Shelton (2015) for the Jeff Lick site-along a series of trails or travel corridors connecting the lower elevation population centers with the high country.

Greubel (2018) continues:

> From the Jeff Lick site, passing over the crest of the Uncompahgre Plateau into the Escalante Creek drainage system is relatively easy. It would appear that a Late Prehistoric network of sites once existed that extended from the largest Gateway phase habitations in the San Miguel basin and Paradox Valley, up to the crest of the Uncompahgre Plateau, and thence down into the lower Escalante

> Creek drainage. It might be posited that this travel corridor enabled an exchange network that moved resources back and forth between these areas and possibly to areas beyond.

And then concludes:

> "The results of the faunal analysis from the Weimer Ranch sites generally echo those from Paradox I (Kasper 1977), and suggest that Gateway groups relied on hunting to a greater degree than Puebloan groups to the south, but less than regional Archaic and Ute peoples (Greubel et al. 2006; Reed 2007). Based on artiodactyl indices, the occupants of the Weimer Ranch sites relied on hunting slightly more than most Fremont groups (Greubel et al. 2006). DARG's recent research at the Jeff Lick Stone Circles site on the Uncompahgre Plateau (Martin and Shelton 2015) confirms the suspicions of earlier researchers that the site functioned as a base for seasonal hunting forays, and provides crucial evidence of the existence of nodes within the settlement system largely devoted to big-game hunting."

Although Martin and Shelton (2015) initially minimized the probability of bison meat being stored in the Jeff Lick site storage cysts and opted for *Ovis canadensis* as the game most likely to have been procured at that elevation, Greubels findings combined with this projects determination that bison were not uncommon at high elevations, has prompted reconsideration. The possibility of bison procurement at both high and lower elevations is feasible and has been repeatedly confirmed by this project. That bison were present and being exploited by Prehistoric and Formative era peoples, including those within the Gateway Phase, not only through subsistence big game hunting but also as a resource managed in an organized exchange system, is certainly to be given serious consideration. Re-assessment of similar sites within the study area may reveal inter-visible sites with evidence of large game exchange frameworks akin to those found in the Gateway Phase area.

Testing results indicate a fluorescence of culturally modified bison bone and bison bone ecofacts occurring during the Little Ice Age (LIA) with a significant number of these specimens found at elevations above 8000 feet. The LIA encompasses a period from AD 1275 (Miller G. 2012) to AD 1850 and, in all probability, extended into the early 1900s (Miller 1992 and 2012 in prep) with gradual warming occurring from 1800 to 1900. This approximately 600 year climatic event was characterized by an abrupt onset, initiated by 50 year episode of active volcanism (Miller G. 2012) and multi-century period of cool but variably dry climate affecting the majority of the planet including the study area. Those affected by the impact of the LIA include the Formative and pre-contact peoples and the native, European, and American hunters of the Historic period. Many factors contribute to the evident increased availability of bison to hunters during this time including the extended period of cooler temperatures during the LIA and the associated environmental recovery.

The historic pre-contact time span in western Colorado is loosely bracketed between the late 1600s and the 1820s. The vague boundaries of this period are due to the variability in dates of exposure occurrence of Late Prehistoric Native Americans to European influence. It was not uncommon for native peoples throughout North America to obtain European tools, beads, metals, weapons, and livestock and convey such goods to peoples not yet having direct contact with Europeans (Martin 2016). The Spanish periodically traded goods with native tribes but more often were relieved of such, especially horses and other livestock, via unauthorized acquisition by native peoples. These acquired and purloined goods were then progressively exchanged eventually finding their way northward to those native peoples who had experienced no direct European contact. In west-central and southwestern Colorado this primarily occurred from south to north as the ever encroaching Spanish intruded further northward from new Mexico into western Colorado. During this period the Ute, Shoshone, Navajo, Apache, and other tribes quickly adapted to using firearms and blacksmithed metal projectile points for use in hunting and other activities. Martin (2016) has documented extensive evidence of native manufacture of metal tools and projectile points. No metal tool induced cultural modification, metal tool artifacts, or ordinance were found on or in association with the six specimens attributed to the historic pre-contact time span. Full range of calibration percentages of those radiometrically dated specimens lacking metal tool modification, but falling within the range of the historic pre-contact time span include DARG 264, DARG 276, DARG 277, DARG 282, DARG 283, and DARG 284 (Figure 3).

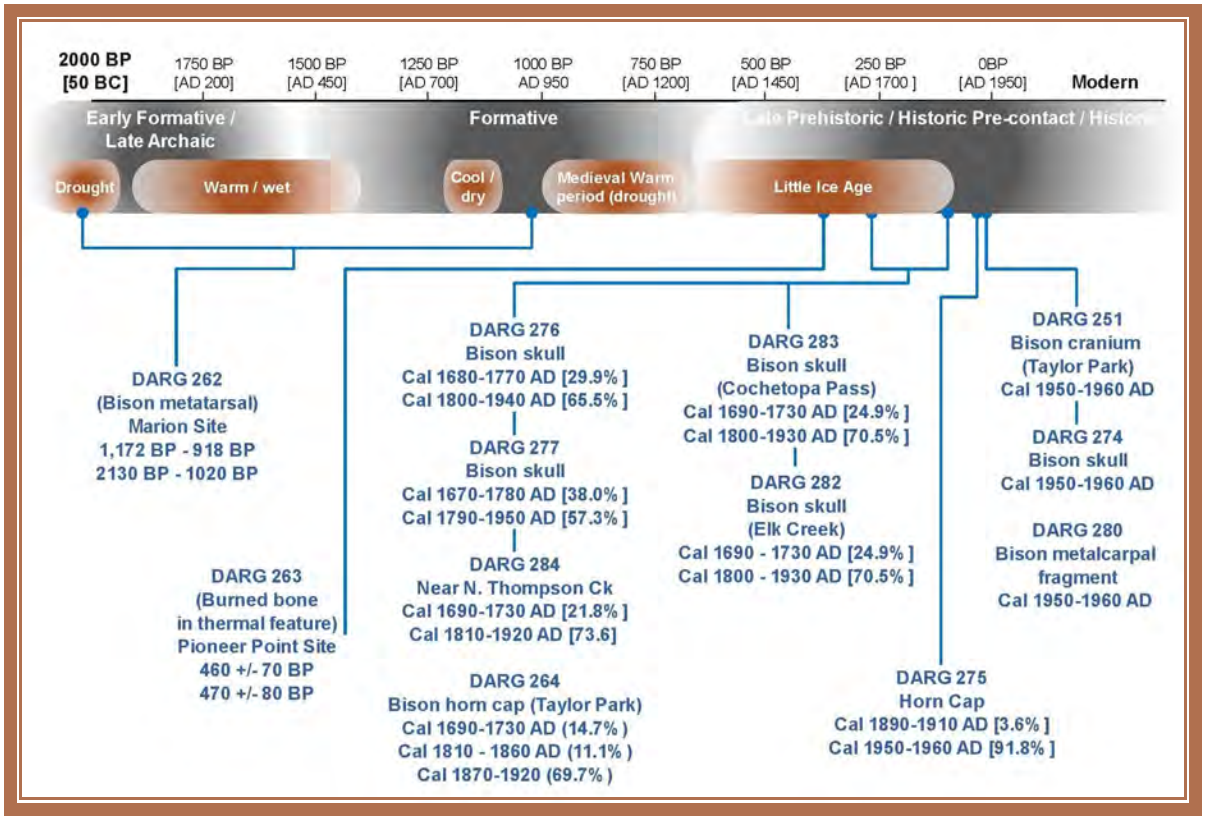

Figure 3. Timeline 2, periods, climate, calibrated ages, and associated specimens.

Historic Period

The Historic Period in Colorado coincides with the founding of the Spanish province of Santa Fé de Nuevo México in AD 1598 (Finch 1999) and extends into the late 1800s. Included in this period are all tested bison bone specimens occurring in the historic pre-contact time span and DARG 251, DARG 274, DARG 275, and DARG 280 (Figure 3). When viewed through the full range of calibration percentages the highest incidence of culturally modified bison bone occurs during the Formative and historic pre-contact time span with the highest concentration evident in the Historic period. Historical documentation, previously discussed in detail, confirms the presence of bison in the west-central region and primarily in the UGB and Cochetopa Pass areas. These areas were frequented by those peoples who had acquired the horse, particularly the Ute, who had opted for and excelled at a nomadic verses predominantly ambulatory hunter gatherer or agrarian lifestyle. Historical documentation and previous archaeological research along with the aforementioned tested specimens which originated on each slope of Cochetopa Pass, in the Gunnison Valley, in Taylor Park, near Crested Butte, with the bison bone noted by Baker (1991) in the northwest corridor of Kebler Pass and on to the North Fork Valley, begins to define, if vaguely, a probable bison migration route exploited by prehistoric and historic peoples alike. Euro American interaction with bison in the study area includes valid military journal documentation of their presence into the 1850s. Saw cut bison bone and possible bison bone found in the middens of 1880s and 1890s railroad construction camps suggest possible hunting of remnant individuals or small herds such as that in the Taylor Park basin alluded to by a Forest Ranger and calculated to have existed possibly as late as 1909. Butchering of bison killed near railheads or of bison carcasses imported by rail to supply railroad construction workers was also a historic practice that may have occurred in western Colorado.

The full range calibration percentages of the Jack Welch bison skull, DARG 276, found in 1899, initiate at AD 1680 and therefore, do not rule out a late date. Finally, it is now apparent that culturally modified bison bone dating into the very late 1800s and possibly into the early 1900s is not to be immediately disregarded. Efforts directed toward locating additional late bison bone specimens and historical documentation of such are worthy of pursuit.

In summary, DARG 265 and DARG 267, respectively a bison phalange and tibia fragment, and DARG 266, the separately dated rib fragments and likely bison 7 centimeter rib fragment, were all recovered from the Mountaineer site (5GN2477) and found in association with Folsom Complex projectile points, knapping tools, and within what is identified as a Folsom Complex lithic workshop structure. The ecofacts fall within the height of a cool and wet climactic period that would have been supportive of the high protein vegetation preferred by bison. This suggests the presence of a sustainable bison population readily available to Folsom hunters. The phalange and tibia appear to be intentionally selected as knapping tools indicating these Folsom peoples possessed and intimate understanding and knowledge of the use of bison by-products. The presence of bison bone rib fragments is cause for consideration of the possibility of their use as tools, including end stage hide finishing lissiors.

The dates assigned to DARG 317 and DARG 318, the phalange and tibia fragment from the Tenderfoot site (5GN1835), were not obtained from the bison bone specimens but are the result of an average of samples taken during work at the Tenderfoot site. The date range encompasses a broad span from the very end of the PaleoIndian period to the beginning of the Middle Archaic. The specimens may be tools associated with a knapping kit or debris from other cultural activity. As the climate ranges from the middle of the First Altithermal Drought through the Middle Holocene cool/wet period and into the Second Altithermal drought, and the radiometric date span is so broad, it is difficult to determine the possible population density of bison other than to say that there were likely fewer available for exploitation during each drought and assuredly greater availability in the Middle Holocene.

Considering the broad date range from all charcoal testing results at the Marion site (5GN1664) it appears the associated bison bone (DARG 262) at the site could have occurred during the Middle Archaic during a cool/wet period. The bison may have been procured midway through this cool/wet period or during and through to the end of the Third Altithermal Drought in the very early Late Archaic. Examination and testing of the bones would aide significantly in determining if the bison was harvested and clarifying a date. As the radiometric dates overlap in the cool/wet period, a climate time when bison would be more prevalent at this elevation, there is a higher probability that the animal was harvested between 2130 BP and 1000 BP.

Dated or bison bone with associated dates identified within the Formative Period includes bison bone artifacts and ecofacts located in southwest Colorado sites and prehistoric pueblo ruins. Evidence of an exchange system based on inter-visible sites that included large game has been identified just north of the western project area boundary may be applicable to sites within the study area. Beginning midway in the Little Ice Age there is evidence of a sudden and moderately sustained increase in bison procurement extending into the 1800s. Considering the advantages resultant for both humans and bison during this time of climate stability this surge of hunting activity is not unexpected. The frequency of bison bone recovered at high elevations, 8000 feet or greater and most often occurring during the Little Ice Age, throughout the UGB and southwest Colorado is intriguing. At this time it is unknown if bison were accessing and grazing high elevations seasonally or migrating through the high country and going over established mountain passes, such as Cochetopa Pass and Kebler Pass, to access lower, more extensive landscapes. Hunting could certainly have consisted of encounter episodes however; organized cooperative endeavors using game drives did exist throughout the region and may have been used to exploit bison in addition to other large game.

Previously described in detail, historic documentation supports the later dates of several specimens including DARG 275, DARG 276, DARG 277, DARG 282, DARG 283, DARG 284 all of which fall within the Historic Pre-contact or Historic period (Figure 3). It is apparent from the historic documentation that the bison population was declining and residual small groups or individual animals may have been isolating in the relative safety of the higher elevation refugiums such as Taylor Park and numerous other smaller parks surrounding the Crested Butte area. The Ute, intimately familiar with the territory and adept at avoiding

American intruders (Martin 2016), were still accessing the area at least until 1878. They would have been the most likely peoples to have successfully sought out and unobtrusively hunted these remnant herds. The bison bone and possible bison bone specimens located at historic railroad work camps, along with anecdotal references to the presence of bison as late as 1909, poses many intriguing and unanswered questions. Although bison meat was frequently transported by rail to work camps and military installations evidence of this activity within the study area has not been found. Live bison were transported at least as far as De Beque, Colorado. This then raises the question as to the possibility of remnant bison being hunted at high elevations by Americans to supply the railroad work camps. It would be expected that such unusual, and in all probability lively, hunts would be expected to have been publically noted, but, to date, no historic news articles, railroad documents, journals, or letters referring to such have been found.

Several specimens produced unrealistic dates of 1950to 1960. Although all specimens were handled and processed with the greatest care in order to avoid contamination, previous handling and storage may have resulted in unknown contaminates affecting the bone. DARG 251, found in 1942 by Dr. S. E. Hagie in Taylor Park north of Gunnison, has a frontal craniectomy that would be attributed, at the latest, to the Ute people who were confirmed in the region in the 1850s and may have still been hunting the area as late as the early 1870s. Bison were certainly not present in the area in the 1950s there is no evidence of historic private bison herds in Taylor Park. DARG 274 may have incurred carbon contamination secondary to exposure to motor vehicle exhaust fumes due to its having, for many years, been on public display in a building located within 10 to 15 feet of a major highway. DARG 280 was recovered from the Dallas Townsite a railroad rail-head that was abandoned in 1891 Therefore the specimen, unless introduced at a later date, would not antedate that decade. Though these dates are unfortunate the specimens still provide information useful to the project.

13.0 CONCLUSIONS

The Western Colorado Bison Project Phase II investigations into the occurrence of bison and culturally modified bison faunal elements specific to both the initial and the expanded study area produced expected, unanticipated, and at times, confusing results. Due to enthusiastic cooperation from all museums involved in the project, a total of 470 bison bone elements from 13 west-central and southwestern Colorado counties were included in the project. Of this number, 68 specimens were included in the primary report with the 402 Ziegler Reservoir Fossil Site (5PT1264) specimens being addressed separately and 41 specimens being observed directly and analyzed for cultural and non-cultural modification. Excepting the Ziegler Reservoir Fossil Site bison bone assemblage, the project produced a significantly lower number of bison faunal elements than was initially anticipated. The occurrence of cultural modification was also less than expected. Several critical specimens, namely, those associated with the Mountaineer Site and the Tenderfoot Site not available to the project for direct evaluation, may yet produce valuable data related to cultural modification or absolute confirmation of use as tools. A total of 27 possible bison bone specimens collected and curated

in southwestern Colorado could not be directly inspected or confirmed as bison bone due to the 2020 Covid 19 pandemic restrictions that disallowed access.

As approximately 75% of the study area land mass is at an elevation of 8000 feet or greater, the major percentage of large mammals such as bison would logically be expected to occur at these elevations. As it is apparent that a minimum of a third of the topography within these Life Zones are of such severe grades as to be inaccessible and unattractive to bison, it was initially anticipated that the majority of bison faunal specimens would originate below 8000 feet. Therefore, the high frequency of bison bone, a total of 72% found at elevations of or greater than 8000 feet, was a striking and unexpected outcome of the study. Of the 29 specimens found in Gunnison County, (42.64% of the project total) 24 (82.7%) of these were originally collected from elevations between 8000 and 10,000 feet. These remains, recovered from refugiums such as the small parks secluded between and protected by high mountain peaks and accessible by passes, are contributing to ongoing evidence (Cannon 2007) of bison comfortably existing at high elevations in the mountains of western Colorado. Project data, combined with the Ziegler Reservoir Fossil Site assemblage and that of Phase I of the Western Colorado Bison Project indicates that the bison of the western slope of Colorado often favored and thrived in high, cool and wetter elevations, as opposed to the drier, warmer, and more spacious lower elevation sage and grassland environments.

In their studies Butler (1978), and Meaney and Van Vuren (1993) confirm the occurrence of bison west of the Great Plains and their record searches provide adequate information to conclude that bison were present in extreme northwestern Colorado. Due to a paucity of available literature concerning bison and bison hunting in the west-central and southwest sections of western Colorado it is difficult to accurately determine the consistency or fluctuation of bison populations over time. There is a possibility that a lingering Paleoclimate in the UGB may have provided generations of bison in the region a more consistent and hospitable habitat as compared to the western and southern aspects of the study area which were more susceptible to periods of drought and warm, dry conditions. The bison population in the plains-like topography of the southern UGB and northern Hinsdale counties appears to have been relatively sustainable over time, possibly due to larger breeding populations of small nursing herds. The relocation of bison to higher, cooler and wetter elevations would not have precluded procurement although the resultant decrease in bison population may account for the time line data gaps identified in the study. Though bison populations fluctuated in response to climate they were intermittently available in sustainable populations and contributed to the ongoing large mammal hunting based economies of the region from the late PaleoIndian period through early to mid-Historic times.

Considering all radiometric testing results from the selected culturally modified specimens six active hunting periods are evident. These represent the Late Paleoindian Folsom Complex, the Archaic, the Post-Archaic and Formative Periods, the historic pre-contact time span, and the Historic Period. These episodes of bison procurement are interspersed with four data gaps absent of culturally modified bison bone indicating either an absence or reduction of bison populations or reduced bison procurement activity. There are no data gaps after AD 1690.

Of significance are bison bone ecofacts recovered from the Mountaineer and Tenderfoot sites which indicate both Folsom and Early Archaic peoples were actively hunting bison between 10,440 BP, and 10,295 BP and between 8000 BP and 3,000 BP. The presence of culturally modified and of bison bone ecofacts in the Middle Archaic and briefly in the Late Archaic indicates that the skills for effective bison procurement were intact and that bison were a valued nutritional supplement.

DARG 265 and DARG 267, respectively a bison phalange and tibia fragment, and DARG 266, the separately dated rib fragments and likely bison 7 centimeter rib fragment, were all recovered from the Mountaineer site (5GN2477) and found in association with Folsom Complex projectile points, knapping tools, and within what is identified as a Folsom Complex lithic workshop structure. The ecofacts fall within the height of a cool and wet climactic period that would have been supportive of the high protein vegetation preferred by bison. This suggests the presence of a sustainable bison population readily available to Folsom hunters. The phalange and tibia appear to be intentionally selected as knapping tools indicating these Folsom peoples possessed an intimate understanding and knowledge of the use of bison by-products. The presence of bison bone rib fragments is cause for consideration of the possibility of their use as tools, including end stage hide finishing lissiors.

The dates assigned to DARG 317 and DARG 318, the phalange and tibia fragment from the Tenderfoot site (5GN1835), were not obtained from the bison bone specimens but are the result of an average of samples taken during work at the Tenderfoot site. The date range encompasses a broad span from the very end of the PaleoIndian period to the beginning of the Middle Archaic. The specimens may be tools associated with a knapping kit or debris from other cultural activity. As the climate ranges from the middle of the First Altithermal Drought through the Middle Holocene cool/wet period and into the Second Altithermal drought, and the radiometric date span is so broad, it is difficult to determine the possible population density of bison other than to say that there were likely fewer available for exploitation during each drought and assuredly greater availability in the Middle Holocene.

Considering the broad date range from all charcoal testing results at the Marion site (5GN1664) it appears the associated bison bone (DARG 262) at the site could have occurred during the Middle Archaic during a cool/wet period. The bison may have been procured midway through this cool/wet period or during and through to the end of the Third Altithermal Drought in the very early Late Archaic. Examination and testing of the bones would aide significantly in determining if the bison was harvested and clarifying a date. As the radiometric dates overlap in the cool/wet period, a climate time when bison would be more prevalent at this elevation, there is a higher probability that the animal was harvested between 2130 BP and 1000 BP.

Dated bison bone or bison bone with associated dates occurring within the Formative Period primarily includes those bison bone artifacts and ecofacts located in southwest Colorado sites and prehistoric pueblo ruins. Evidence of an exchange system based on inter-visible sites that included large game has been identified just north of the western project area boundary

may be applicable to other sites within the study area. Beginning midway in the Little Ice Age there is evidence of a sudden and moderately sustained increase in bison procurement extending into the 1800s. Considering the advantages resultant for both humans and bison during this time of climate stability this surge of hunting activity is not unexpected.

Evidence of bison bone recovered at high elevations of 8000 feet or greater most often occurs during the Little Ice Age throughout the UGB and southwest Colorado. At this time it appears bison were seasonally accessing and grazing at high elevations and traversing established high mountain passes, such as Cochetopa Pass and Kebler Pass, to access lower elevation grasslands. Hunting tactics would certainly have consisted of encounter episodes however; organized cooperative endeavors using game drives did exist throughout the region and may have been used to exploit bison in addition to other large game at high elevations.

Those specimens with late dates including DARG 275, DARG 276, DARG 277, DARG 282, DARG 283, DARG 284 all fall within the Historic Pre-contact or Historic period. It is apparent from the historic documentation that the bison population was declining and residual small groups or individual animals may have been isolating in the relative safety of the higher elevations such as Taylor Park and the smaller parks near Crested Butte. The Ute, intimately familiar with the territory and adept at avoiding American intruders (Martin 2016), were still accessing the area at least until 1878. They would have been the most likely peoples to have successfully sought out and unobtrusively hunted these remnant herds. The bison bone and possible bison bone specimens located at historic railroad work camps, along with anecdotal references to the presence of bison as late as 1909, poses many intriguing and unanswered questions. Although bison meat was frequently transported by rail to work camps and military installations documentation or evidence of this activity within the study area has not been found. Live bison were transported at least as far as De Beque, Colorado. This then raises the question as to the possibility of remnant bison being hunted at high elevations by Americans to supply the railroad work camps. It would be expected that such unusual, and in all probability lively, hunts would be expected to have been publically noted, but, to date, no historic news articles, railroad documents, journals, or letters referring to such have been found.

Several specimens produced unrealistic dates of 1950 to 1960. Although all specimens were handled and processed with the greatest care in order to avoid contamination, previous handling and storage may have resulted in unknown contaminates affecting the bone. DARG 251, found in 1942 by Dr. S. E. Hagie in Taylor Park north of Gunnison, has a frontal craniectomy that would be attributed, at the latest, to the Ute people whose presence is confirmed in the region in the 1850s and may have still been hunting the area as late as the early 1870s. Bison were certainly not present in the area in the 1950s and there is no evidence of historic private bison herds in Taylor Park. The only known modern private bison herd was contained in secure, fenced pastures near Crested Butte in the late 1970s and were not permitted to free range. Consequently, the occurrence of modern bison skeletal remains located in the study area is highly unlikely. DARG 274 may have incurred carbon contamination secondary to exposure to motor vehicle exhaust fumes due to its having, for many years, been on public display in a building located within 10 to 15 feet of a major highway. DARG 280 was

recovered from the Dallas Townsite a railroad rail-head that was abandoned in 1891 Therefore the specimen, unless introduced at a later date, would not antedate that decade. Though these dates are unfortunate the specimens still provide information useful to the project. DARG 265 and DARG 267, respectively a bison phalange and tibia fragment, and DARG 266, the separately dated rib fragments and likely bison 7 centimeter rib fragment, were all recovered from the Mountaineer site (5GN2477) and found in association with Folsom Complex projectile points, knapping tools, and within what is identified as a Folsom Complex lithic workshop structure. The ecofacts fall within the height of a cool/wet climactic period that would have been supportive of the high protein vegetation preferred by bison. This suggests the presence of a sustainable bison population readily available to Folsom hunters. The phalange and tibia appear to be intentionally selected as knapping tools indicating these Folsom peoples possessed and intimate understanding and knowledge of the use of bison by-products. The presence of bison bone rib fragments is cause for consideration of the possibility of their use as tools, including end stage hide finishing lissiors.

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Dated or bison bone with associated dates identified within the Formative Period includes bison bone artifacts and ecofacts located in southwest Colorado sites and prehistoric pueblo ruins. Evidence of an exchange system based on inter-visible sites that included large game has been identified just north of the western project area boundary may be applicable to sites within the study area. Beginning midway in the Little Ice Age there is evidence of a sudden and moderately sustained increase in bison procurement extending into the 1800s. Considering the advantages resultant for both humans and bison during this time of climate stability this surge of hunting activity is not unexpected. The frequency of bison bone

recovered at high elevations, 8000 feet or greater and most often occurring during the Little Ice Age, throughout the UGB and southwest Colorado is intriguing. At this time it is unknown if bison were accessing and grazing high elevations seasonally or migrating through the high country and going over established mountain passes, such as Cochetopa Pass and Kebler Pass, to access lower, more extensive landscapes. Hunting could certainly have consisted of encounter episodes however; organized cooperative endeavors using game drives did exist throughout the region and may have been used to exploit bison in addition to other large game.

Previously described in detail, historic documentation supports several specimens with late dates including DARG 275, DARG 276, DARG 277, DARG 282, DARG 283, DARG 284 all falling within the Historic Pre-contact or Historic period. Sparse but dependable documentation, beginning with the 1776 journal of the intrepid explorers Fathers Dominquez and Escalante and progressing through the 1858 military logs of the Loring detachment, confirmed that bison were present and being hunted by Native, Spanish, and Euro-Americans alike. It is apparent from the historic documentation that the bison population was declining and residual small groups or individual animals may have been isolating in the relative safety of the higher elevations such as Taylor Park and the smaller parks near Crested Butte.

The Ute, intimately familiar with the territory and adept at avoiding American intruders (Martin 2016), were still accessing the area at least until 1878. They would have been the most likely peoples to have successfully sought out and unobtrusively hunted these remnant herds. The bison bone and possible bison bone specimens located at historic railroad work camps, along with anecdotal references to the presence of bison as late as 1909, pose many intriguing and unanswered questions. Although bison meat was frequently transported by rail to work camps and military installations evidence of this activity within the study area has not been found. Live bison were transported at least as far as De Beque, Colorado. This then raises the question as to the possibility of remnant bison being hunted at high elevations by Americans to supply the railroad work camps. It would be expected that such unusual, and in all probability lively, hunts would be expected to have been publically noted, but, to date, no historic news articles, railroad documents, journals, or letters referring to such have been found.

The data deficits of the project are acknowledged. Considering the extent of the study area and the long history of archaeological investigations in the region the sampling is relatively small. A number of the radiometric dates are based, not on bison bone collagen, but upon charcoal recovered from sites with associated bison bone, unspecified bison bone samples, or bison bone ecofacts. Precise dating was seldom possible as the majority of the full range of calibration percentages represented broad time periods. Four samples, though carefully handled, are assumed to have unknown contamination which produced dates later than 1940; obviously invalid results. Due to these deficits, solid conclusions regarding the relationship between carrying capacity of prehistoric bison populations and aboriginal bison procurement within the study area not possible. The limited sampling available within the study area impairs the ability of the project to confidently ascertain the variability of bison populations over time, the extent and frequency of procurement, and the most common butchering practice and use of byproducts. Although the degree of prehistoric and historic peoples dependence is unknown, it

is evident that bison hunting and the use of bison bone was an intermittent but ongoing aspect of Native American lifeways in west-central and southwestern Colorado.

Curated within the antique display cases, dusty back rooms, and dark basements of west-central and southwestern Colorado's large regional, university, and local county museums rest a multitude of scientifically neglected cultural resources. Among the collections of projectile points, broken pottery, and basket fragments are a surprising number of bison bones, bison skulls, and related information. Some of these were collected during formal archaeological surveys or excavations yet many others were found by ranchers, farmers and hunters who donated their finds in the hope that these rare specimens would add some small contribution to history and maybe even to science. More often than not, and primarily due to their large size and awkward shapes, these rare faunal elements are relegated to a high shelf or displayed in a showcase behind a plethora of "Indian" artifacts, fossils, furs, and other miscellany. The ongoing study of culturally modified bison bone in continues to produce unexpected and fascinating results. As discovered during Phase II the Western Colorado Bison Project data obtained from those bison faunal elements with evidence of cultural modification and those deemed ecofacts combines to add to the ever evolving story of human occupation of Colorado's western slope. The increasing accumulation of scientific data continues to enhance and magnify the present understanding of the interrelationship of bison with the Native American and Euro-American peoples of west-central and southwestern Colorado while also raising new and intriguing questions worthy of future investigation.

In order to develop an accurate scientific perspective of the interrelationship of bison and the native occupants of western Colorado it is crucial that further investigation for evidence of human interaction with bison in the western slope be undertaken. Data collection tools and techniques developed by DARG specifically for this project were provided to those museums who desired such and included printed and digital preservation processes and data collection tools related to newly acquired or presently curated bone artifacts. All facilities visited indicated a clear understanding of the NAGPRA regulations. The intent or previous action taken by the individual facilities regarding repatriation of bison skulls with craniectomies is unknown and, though strongly encouraged, was not a subject pursued in depth by the project. Information regarding the Colorado Radiocarbon Database Project (dargnet.org/net/RCPublic/RCGraph.html) and the Western Colorado Bison Study website database (dargnet.org/net/bison/bison.html) was made available to each facility for professional use. These interactive sites will enable researchers to enter newly acquired data regarding known and recently discovered bison faunal elements and their associated attributes, photos, location information, and any radiometric dating information. Data submitted by participating researchers will continue to clarify and define bison population concentrations, their movement on the landscape, and the responding procurement patterns and processing techniques specific to the native people of the region. The ongoing addition of newly acquired bison faunal element data by other researchers will contribute to the evolution of a viable and credible research tool; accessible not only to professional archaeological and historic communities, but to all those with an interest in the subject of bison hunting in western Colorado.

This project is but an initial assessment intended to produce an embryonic data set to be supplemented and enhanced by ongoing research. It is sincerely hoped that future studies and submission of data into the Western Colorado Bison Study website will aide in providing an increasingly accurate interpretation of bison procurement in the region. Information acquired from the recent endeavors of the Western Colorado Bison Project and the resultant database will continue to be incorporated into the on-going public and professional outreach programs developed by Dominquez Archaeological Research Group in concert with the History Colorado State Historical Fund. Professional papers, public lectures, interactive public school programs, and remote digital public presentations in the form of ZOOM events have and will continue to be offered to all those requesting such. In addition bison related content directed toward the lay public has been made available on the recently upgraded DARG website (dargnet.org) and on the Dominquez Archaeological Group DARG FaceBook page.

Finally, and possibly of greatest and lasting importance, is the impact the results of the study may have for the First Peoples of west-central and southwestern Colorado. These include the Southern and Ute Mountain Ute, the eastern Shoshone, the Navajo, the Jicarilla Apache, and other tribes known to have lived and or hunted west of the Continental Divide in what is now western Colorado. The great American bison, known respectively by these western Colorado First Peoples as cooch, bozheena, ayani, and a-yan-de, plays an integral role in their history, spiritual lives, and overall culture. Traditional native and especially Ute oral histories refer frequently to the bison (Smith 1974). Ancestral stories of bison hunts, and the bison's practical and spiritual relationship with man, animals, and supernatural beings, are a sacred legacy embedded in Native identity. Although there is a respectable amount of literature related to the Ute presence in western Colorado, very little is documented regarding actual episodes of Ute bison hunting within the west-central and southwestern regions. Clifford Duncan, Elder of the Northern Ute Tribe, shared many stories of bison and, prior to his passing, asked this writer to "learn all you can about the buffalo" and to then "come and teach it to the kids; tell them so they'll know". "Too much is forgotten and there aren't too many of us left." (personal communication, Clifford Duncan, 2012). Alden Naranjo, respected Elder of the Southern Ute tribe verbally expressed his support of the project and encouraged discussing and sharing of appropriate information with tribal elders and youth. It is the sincere hope of the Dominquez Archaeological Research Group that the efforts and results of the Western Colorado Bison Project will substantially contribute to the process of respectfully honoring the requests of these esteemed elders.

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2008 Director of Dominquez Archaeological Research Group, Grand Junction, CO.

Decker, George
2012 Western Colorado Cattleman and avocational archaeologist. Cedaredge, CO.

Diaz, Bladimir
2017 Director, International Chemical Analysis, Inc., Miami.

Duncan, Clifford

2012-2014 Northern Ute Tribal Historian working with the Northern Ute Cultural Rights and Protection Office. Multiple one-on-one personal and professional interactions between 2012 through 2014.

Grandin, M. Temple

2018 Doctorate in animal and agricultural sciences. Colorado State University faculty member. Personal communication Rifle, Colorado AG EXPO February 1, 2018 and additional ongoing telephone communications through to the present.

Stiger, Mark

2019 Personal communication during a tour of the Mountaineer Site.

APPENDIX A: Comments and Weathering Stages

Western Colorado Bison Project. Appendix A: COMMENTS AND WEATHERING STAGES							
County	**Curated**	**DARG #**	**Site # or Name**	**Accession #**	**Element**	**Weathering stage***	**Comments**
Archuleta	Canyon of the Ancients Visitors Center and Museum	**DARG 285**	5AA83	2012.9.5AA83.121	Probable bison patella	Unknown	A probable bison (or possibly wapiti) patella (2012.9.5AA83.121) recovered from Chimney Rock Pueblo (5AA83) subsurface Stratum 3, Level 1 in room 7, PD 46. There is no reported cultural modification.
Gunnison	C T Hurst Museum, Western Colorado University	**DARG 251**	Hagie site	1410	Cranium	1, 2,3	A bison cranium sans the lower maxilla, lower nasals, and the lower turbinates. Cultural modification on the frontal consists of a somewhat circular craniotomy offset left of center. Scalloped impact indentations that protrude into the skull cavity surround the periphery. Crescent shaped impact fractures are apparent on the upper right and upper left sides of the orifice. The craniotomy extends into the brain cavity. The specimen was recovered in 1942 from a steep hillside southeast of the Willow Creek Ranger station in Taylor Park, Gunnison County, CO. It is curated at the C. T. Hurst Museum at Western Colorado University in Gunnison, CO.
Gunnison	C T Hurst Museum, Western Colorado University	**DARG 252**	Olmstead Site	None	Atlas	3, 4	A bison atlas missing approximately 70% of the right transverse process and approximately 10% of the left transverse process. The vertebral and transverse foramen are impregnated with small poorly sorted sandstone fragments and soils high in calcite with visible sulfites indicative of lower altitude alluvial soils. Organic detritus is present but does not include conifer needles. Specimen recovered on 21 May 1998 by Mr. Tom McGinnes from the Olmstead Site. To date no further information concerning this site has been found. It was initially located in the wall of an arroyo in immediate association with multiple bison horn core fragments. There is no cultural modification. The specimen is curated in the C. T. Hurst Museum at Western Colorado University in Gunnison, CO.
Gunnison	C T Hurst Museum, Western Colorado University	**DARG 253**	Olmstead Site	None	Horn core fragments	5	80 fragments of a bison horn core recovered from the wall of an arroyo at the Olmstead site by Tom McGinnes on 21 May 1998. Specimens found in immediate association with a bison atlas. The fragments range in size from 8 centimeters in length by 2.5 centimeters wide to multiple minuscule fragments measuring less than .01 cm. There is no cultural modification. The specimens are curated in the C. T. Hurst Museum at Western Colorado University in Gunnison, CO.

County	Curated	DARG #	Site # or Name	Accession #	Element	Weathering stage*	Comments
Gunnison	C T Hurst Museum, Western Colorado University	**DARG 254**	Gold Creek site	Unknown	Left Humerus	1, 2	A bison left humerus fragment excavated during construction of an irrigation ditch near Parlin, Colorado and north of Ohio City, Colorado. The specimen has a spiral fracture of the diaphysis possibly indicative of cultural modification for removal of bone marrow (Binford 1981). The distal aspect of the epiphesium shows two possible chop marks and 2 possible impact indentations. Unfortunately the bone in this area is so severely weathered it prohibits confirmation of such. Compact silt with calcite and sparse sulfites is present in the interior and orifices of the specimen. The specimen was found in association with a bison left radius fragment, a right maxilla fragment, and a single bison premolar. It is curated in the C. T. Hurst Museum at Western Colorado University in Gunnison, CO.
Gunnison	C T Hurst Museum, Western Colorado University	**DARG 255**	Gold Creek site	None	Left Radius	1, 2	A bison left radius fragment excavated during construction of an irrigation ditch near Parlin, Colorado and north of Ohio City, Colorado. The specimen was found in association with a bison left humerus fragment with possible cultural modification, a bison maxilla fragment, and a single bison premolar. Situated on the fractured diaphysis is a sharp 3 centimeter wide and 5 centimeter long V-shaped, internally faceted fracture that tapers to an apex oriented toward the epiphesium. It is similar to fractures occurring from intentional impact and may be indicative of cultural modification. The specimen is curated in the C. T. Hurst Museum at Western Colorado University in Gunnison, CO.
Gunnison	C T Hurst Museum, Western Colorado University	**DARG 256**	Gold Creek site	Unknown	Right maxilla fragment	2, 3	A right maxilla fragment consisting of one erupted molar and one un-erupted molar excavated during construction of an irrigation ditch near Parlin, Colorado and north of Ohio City, Colorado. There is no culturalo modification. It was found in association with a bison left humerus fragment with possible cultural modification, and a single bison premolar. The specimen is curated in the C. T. Hurst Museum as part of a comparative collection at Western Colorado University in Gunnison, CO.

County	Curated	DARG #	Site # or Name	Accession #	Element	Weathering stage*	Comments
Gunnison	C T Hurst Museum, Western Colorado University	**DARG 257**	Gold Creek site	None	Premolar	3, 4	A single unremarkable bison premolar missing the root. It was found in association with a bison left humerus, a bison left radius fragment, a right mandible fragment excavated during construction of an irrigation ditch near Parlin, Colorado and north of Ohio City, Colorado. There is no cultural modification and the specimen is curated in the C. T. Hurst Museum at Western Colorado University in Gunnison, CO.
Gunnison	C T Hurst Museum, Western Colorado University	**DARG 258**	McLain site	Unknown	Right Mandible	1, 2	A right side bison mandible missing all structure forwards of the M3 molars including all the premolars. The specimen was recovered 20 May 1998 from the McLain Site. The official report is closed per request of the property owner. A 1.3 centimeter long by 1.0 millimeter wide curvilinear scrape mark is located below the M3 molars on the lower buccal aspect of the mandible. Cultural modification in the form of a scrape relate to butchering to remove the tongue is possible. A claw or other unknown scratch mark should also be considered. Of interest is a 3.0 centimeter somewhat square broken chert fragment which was found near the specimen and is curated with it. No notes were included regarding the chert fragment. The specimen was found in association with a collection of unidentified bone (DARG 259), and a bison right humerus (DARG 260). The specimen is curated in the C. T. Hurst Museum at Western Colorado University in Gunnison, CO.
Gunnison	C T Hurst Museum, Western Colorado University	**DARG 259**	McLain site	Unknown	Bone fragments, unidentified	5	A collection of unidentified bone fragments found in close association with a bison right mandible (DARG 258) and a bison right humerus (DARG 260) recovered from an exposure in a ditch in peat soil on 20 May 1998 from the McLain site. There is no evidence of cultural modification on any of the bone fragments. They are curated in the C. T. Hurst Museum at Western Colorado University in Gunnison, CO.

County	Curated	DARG #	Site # or Name	Accession #	Element	Weathering stage*	Comments
Gunnison	C T Hurst Museum, Western Colorado University	**DARG 260**	McLain site	Unknown	Humerus	2, 3	A robust bison right humerus recovered from the McLain site, found 10 to 13 centimeters below the surface atop a black peat layer in Grid A, on 20 May 1998. The proximal end and most of the lateral tuberosity are missing. There are three groups of distinct gouge or scratch marks and a single gouge or scratch mark on the head of the humerus. All the gouge or scratch marks are approximately 1.0 millimeter in width. Due to the mark groupings, the curvilinear parallel arrangement, and the bulb of initiation on several of the marks, it is possible they are large predator claw marks. The lateral tuberosity is fractured and though the remnant edges are scalloped the degree of weathering prohibits confirmation of cultural modification. A primary impact point on a diamond shaped area of missing bone is evident approximately 8.0 centimeters below the head of the humerus. There are impact indentations around the primary impact point as exhibited by fine fractures that arc inward toward the orifice. Resultant breakage fractures emanate from that point creating a spiral fracture. The evidence indicates the bone may have been impacted by the apex of a stone tool. This specimen is tentatively considered to exhibit cultural modification in the form of impact and spiral fracturing. The specimen was identified at and is curated in the C. T. Hurst Museum at Western Colorado University in Gunnison, CO.
Gunnison	C T Hurst Museum, Western Colorado University	**DARG 261**	McLain site	Unknown	Unidentified bone fragment	5	A small bone fragment from the McLain Site curated in the same bag with DARG 260, a bison humerus. There is no evidence of cultural modification. It was identified at and is curated in the C. T. Hurst Museum at Western Colorado University in Gunnison, CO.
Gunnison	Unknown	**DARG 262**	5GN1664 Marion Site	5GN1664.21	Metatarsal	Unknown	A bison metatarsal was located at the Marion Site, in Feature 21, hearth B in one of three prehistoric components of the site. Radiometric testing of charcoal from hearth B resulted in a date range of 1172BP to 918BP however; the confidence level regarding this date is noted as low. The four radiocarbon dates obtained from charcoal located in the various hearth features produced a date range of 2130BP to 1020BP. At this time the location of the specimens is unknown.

County	Curated	DARG #	Site # or Name	Accession #	Element	Weathering stage*	Comments
Gunnison	Midwest Archaeological Center, Lincoln, Nebraska.	**DARG 263**	5GN41 Pioneer Point Site	Unknown	15 bison bone fragments	5	15 burned and unburned bison bone fragments found at the Pioneer Point site were found in association with rim and body ceramic fragments that are likely Uncompahgre Brown ware, quartzite flakes, charcoal, a single side-notched projectile point, and bifacial and unifacial stone tools ecovered in and around a hearth. Midwest Archaeological Center mitigated the site by complete excavation in 1981. The specimens are curated at the Midwest Archaeological Center, Lincoln, Nebraska.
Gunnison	Grand Mesa Uncompahgre and Gunnison National Forests, Gunnison District Office	**DARG 264**	Folkestad site	None	Horn cap fragment	3	A bison horn cap fragment recovered in 1949 by Forest Ranger James Oluf Folkestad and Gunnison National Forest Administrative Assistant Ralph Mike Sweet from Texas Creek in Taylor Park, Colorado. Of note is the altitude, 9,187 feet, at which the specimen was located. There is no evidence of cultural modification.
Gunnison	Possibly at the C T Hurst Museum, Western Colorado University	**DARG 265**	5GN2477 Mountaineer site	Unknown	Second phalange	1	A bison second phalange recovered from the Mountaineer site, Block A, near Gunnison, Colorado. It was found abutting a large bison tibia fragment and situated at the back wall of the interior a Folsom lithic workshop structure located atop the western aspect of Tenderfoot Mountain on the Mountaineer Site. The bison tibia that abutted the specimen produced a 14C date of 10,440 BP. Both specimens are considered technological flintknapping mallet tools The specimen is curated in the C. T. Hurst Museum in Hurst Hall at Western Colorado University, Gunnison, CO.
Gunnison	Possibly at the C T Hurst Museum, Western Colorado University	**DARG 266**	5GN2477 Mountaineer site	Unknown	Bone fragments	5	An unknown number of large mammal rib fragments (possibly bison) recovered from within a Folosm lithic workshop structure, Block A at the Mountaineer Site. These and a 7 centimeter long rib fragment submitted for AMS testing produced a dates of 14C 10,295 +/-50 BP and 10,380 +/- 50 BP respectively. The specimens are curated in the C. T. Hurst Museum at Hurst Hall at Western Colorado University, Gunnison, CO.

County	Curated	DARG #	Site # or Name	Accession #	Element	Weathering stage*	Comments
Gunnison	C T Hurst Museum, Western Colorado University	**DARG 267**	5GN2477 Mountaineer site	Unknown	Tibia fragment	Unknown	A large bison tibia fragment situated among small lithic flake tools, a drill, and a graver in Block A of the Mountaineer site. The specimen abutted a bison phalanx with the entirety located at the rear wall of a Folosm lithic workshop. This specimen and the bison phalanx abutting it are considered technological flintknapping mallet tools. The tibia was collected during excavations conducted by Dr. Mark Stiger of Western Colorado University, in Gunnison, CO during the 2003 field season. A bone collagen sample submitted for AMS testing produced a calibrated date of 10,440 +/-50 BP. The specimen is housed at the C. T. Hurst Museum in Hurst Hall at Western Colorado University, Gunnison, CO.
Gunnison	Southern Methodist University or at the University of North Carolina	**DARG 268**	Cement Creek Cave site	Unknown	Second phalange	Unknown	A single bison second phalange recovered from the Cement Creek Cave, south of Crested Butte, Colorado. Curation location is at Southern Methodist University or at the University of North Carolina.
Gunnison	Not curated	**DARG 269**	Coffin site	None	molar	Unknown	A Bison latifrons molar found in association with two B. latifrons horn cores. All specimens were found in 1929 by Mr. L. G. Coffin, the land owner, during construction of an irrigation ditch along the west side of a valley in the Little Cimarron drainage within a 12 mile radius of Cerro Summit at an elevation of 8,000 feet. Harold J. Cook published a report on the find in Science magazine in 1930. The specimen was not collected.
Gunnison	Not curated	**DARG 270**	Coffin site	None	Bison latifrons horn core fragment	Unknown	A Bison latifrons horn core found in association with a likely B. latifrons molar and a B. latifrons horn core. The specimen was found in 1929 by Mr. L. G. Coffin, the land owner, during construction of an irrigation ditch along the west side of a valley in the Little Cimarron drainage within a 12 mile radius of Cerro Summit at an elevation of 8,000 feet. Harold J. Cook published a report on the find in Science magazine in 1930. The specimen was not collected.

County	Curated	DARG #	Site # or Name	Accession #	Element	Weathering stage*	Comments
Gunnison	Not curated	**DARG 271**	Coffin site	None	Bison latifrons horn core fragment	Unknown	A Bison latifrons horn core found in association with a likely B. latifrons molar and a B. latifrons horn core. The specimen was found in 1929 by Mr. L. G. Coffin, the land owner, during construction of an irrigation ditch along the west side of a valley in the Little Cimarron drainage within a 12 mile radius of Cerro Summit at an elevation of 8,000 feet. Harold J. Cook published a report on the find in Science magazine in 1930. The specimen was not collected.
Gunnison	Circle Quarter Circle Ranch	**DARG 272**	Quarter Circle Circle site		Horn cap fragment	4	A single, dessicated bison horn cap fragment found on private ranch land to the west of Colorado State Highway 114 near Gunnison County Road 17GG approximately 20 miles NW of Cochetopa Pass.
Gunnison	Circle Quarter Circle Ranch	**DARG 273**	Quarter Circle Circle site		Horn cap fragment	4	A single, dessicated bison horn cap fragment found on private ranch land to the west of Colorado State Highway 114 near Gunnison County Road 17GG approximately 20 miles NW of Cochetopa Pass.
Gunnison	Trader's Rendevous	**DARG 274**	Trader site	None	Cranium	3, 4	A bison cranium likely found in the region of Old Cochetopa Pass, likely within the Old Spanish Trail corridor in the early 1900s on private ranch land. There is no cultural modification. The specimen is on public display at Trader's Rendevous, a private enterprise, in Gunnison, CO.
Gunnison	Grand Mesa Uncompahgre and Gunnison National Forests Gunnison District Office	**DARG 275**	Horn cap site	None	Horn cap fragment	4	A bison horn cap tip fragment recovered by a United States Forest Service employee from the Old Cochetopa Pass area within the Old Spanish Trail corridor. Ther is no cultural modification. The specimen is stored at the Grand Mesa Uncompahgre and Gunnison National Forests Gunnison District Officein Gunnison, Colorado.
Gunnison	Traders Rendevous	**DARG 283**	Ryans (Casey) site	NA	Partial skull	4	A partial bison cranium recovered from an unknown drainage east of the Old Cochetopa Pass area but possibly within the Old Spanish Trail corridor. It presents with no cultural modification. The specimen is presently only available upon request and by appointment with Trader's Rendevous personnel for interested parties.

County	Curated	DARG #	Site # or Name	Accession #	Element	Weathering stage*	Comments
Gunnison	Haystack Cave	**DARG 310**	5GN189 Haystack Cave	2003.20.5GN189.35 (FS-16)	Distal right bison humerus (probable)	Unknown	A probable distal right bison humerus listed as FS-16, a collection of distal humerus fragments, recovered from Haystack Cave, 5GN189, OS/2W, Level 5. The specimen is reported to be unmodified. The site has evidence of Protohistoric and Archaic use spanning the last 3000 to 5000 years and evidence of pre-Clovis occupation greater than 12,000 ybp.
Gunnison	C T Hurst Museum, Western Colorado University	**DARG 317**	5GN1835, Tenderfoot site.	Unknown	Phalange	Unknown	A bison phalange recovered near a windbreak structure at the Tenderfoot site. Its possible use as a flintknapping mallet tool must be considered and the specimen, when available, should be evaluated for evidence of such use. A total of 60 radiocarbon dates indicate the site was occupied between 8000 BP and 3000BP.
Gunnison	C T Hurst Museum, Western Colorado University	**DARG 318**	5GN1835, Tenderfoot site.	Unknown	Artiodactyl tibia, possibly bison	Unknown	An artiodactyl tibia, possibly bison, recovered from a bone disposal area or toss zone in the Tenderfoot site near Gunnison, Colorado. A total of 60 radiocarbon dates indicate the site was occupied between 8000 BP and 3000 BP.
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 286**	5HN300	2002.3.5HN300.82	Large burnt possible bison bone	NA	A single unidentified large burnt bone from a large mammal described as an elk or bison recovered from a multicomponent site known as the Argentum townsite near Burrows Park and White Cross Mountain.
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 287**	5HN300	2002.3.5HN300.85.	1 large bone, bison or elk	Unknown	One of a collection of ten bones collected from the Argentum townsite and curated together in Bag 12. As the site has a prehistoric component and it is possible some of the bones are bison, they are included in the project findings in the hopes that the listing will enable future investigators to consider evaluation of the collection.
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 288**	5HN300	2002.3.5HN300.85.	1 large bone, bison or elk	Unknown	One of a collection of ten bones collected from the Argentum townsite and curated together in Bag 12. As the site has a prehistoric component and it is possible some of the bones are bison, they are included in the project findings in the hopes that the listing will enable future investigators to consider evaluation of the collection.

County	Curated	DARG #	Site # or Name	Accession #	Element	Weathering stage*	Comments
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 289**	5HN300	2002.3.5HN300.85.	A large mammal bone	Unknown	One of a collection of ten bones collected from the Argentum townsite and curated together in Bag 12. As the site has a prehistoric component and it is possible some of the bones are bison, they are included in the project findings in the hopes that the listing will enable future investigators to consider evaluation of the collection.
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 290**	5HN300	2002.3.5HN300.85.	A large mammal bone	Unknown	One of a collection of ten bones collected from the Argentum townsite and curated together in Bag 12. As the site has a prehistoric component and it is possible some of the bones are bison, they are included in the project findings in the hopes that the listing will enable future investigators to consider evaluation of the collection.
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 291**	5HN300	2002.3.5HN300.85.	A large mammal bone	Unknown	One of a collection of ten bones collected from the Argentum townsite and curated together in Bag 12. As the site has a prehistoric component and it is possible some of the bones are bison, they are included in the project findings in the hopes that the listing will enable future investigators to consider evaluation of the collection.
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 292**	5HN300	2002.3.5HN300.85.	A large mammal bone	Unknown	One of a collection of ten bones collected from the Argentum townsite and curated together in Bag 12. As the site has a prehistoric component and it is possible some of the bones are bison, they are included in the project findings in the hopes that the listing will enable future investigators to consider evaluation of the collection.
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 293**	5HN300	2002.3.5HN300.85.	A large mammal bone	Unknown	One of a collection of ten bones collected from the Argentum townsite and curated together in Bag 12. As the site has a prehistoric component and it is possible some of the bones are bison, they are included in the project findings in the hopes that the listing will enable future investigators to consider evaluation of the collection.
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 294**	5HN300	2002.3.5HN300.85.	A large mammal bone	Unknown	One of a collection of ten bones collected from the Argentum townsite and curated together in Bag 12. As the site has a prehistoric component and it is possible some of the bones are bison, they are included in the project findings in the hopes that the listing will enable future investigators to consider evaluation of the collection.

County	Curated	DARG #	Site # or Name	Accession #	Element	Weathering stage*	Comments
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 295**	5HN300	2002.3.5HN300.85.	A very large mammal bone	Unknown	One of a collection of ten bones collected from the Argentum townsite and curated together in Bag 12. As the site has a prehistoric component and it is possible some of the bones are bison, they are included in the project findings in the hopes that the listing will enable future investigators to consider evaluation of the collection.
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 296**	5HN300	2002.3.5HN300.85	A very large mammal bone	Unknown	One of a collection of ten bones collected from the Argentum townsite and curated together in Bag 12. As the site has a prehistoric component and it is possible some of the bones are bison, they are included in the project findings in the hopes that the listing will enable future investigators to consider evaluation of the collection.
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 297**	5HN302	2002.3.5HN302.10	Unidentified bison or elk bone, one of two.	Unknown	One of two unidentified bones, curated together and described as bison or elk, collected from the Tellurium/White Cross mining camp site.
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 298**	5HN302	2002.3.5HN302.10	Unidentified bison or elk bone, one of two.	Unknown	One of two unidentified bones, curated together and described as bison or elk, collected from the Tellurium/White Cross mining camp site.
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 299**	5HN302	2002.3.5HN302.11	Unidentified bison or elk bone, one of eleven.	Unknown	One of a collection of 11 large mammal bones described as bison or elk recovered from the Tellurium/White Cross mining camp site
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 300**	5HN302	2002.3.5HN302.11	Unidentified bison or elk bone, one of eleven.	Unknown	One of a collection of 11 large mammal bones described as bison or elk recovered from the Tellurium/White Cross mining camp site.

County	Curated	DARG #	Site # or Name	Accession #	Element	Weathering stage*	Comments
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 301**	5HN302	2002.3.5HN302.11	Unidentified bison or elk bone, one of eleven.	Unknown	One of a collection of 11 large mammal bones described as bison or elk recovered from the Tellurium/White Cross mining camp site.
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 302**	5HN302	2002.3.5HN302.11	Unidentified bison or elk bone, one of eleven.	Unknown	One of a collection of 11 large mammal bones described as bison or elk recovered from the Tellurium/White Cross mining camp site.
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 303**	5HN302	2002.3.5HN302.11	Unidentified bison or elk bone, one of eleven.	Unknown	One of a collection of 11 large mammal bones described as bison or elk recovered from the Tellurium/White Cross mining camp site.
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 304**	5HN302	2002.3.5HN302.11	Unidentified bison or elk bone, one of eleven.	Unknown	One of a collection of 11 large mammal bones described as bison or elk recovered from the Tellurium/White Cross mining camp site.
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 305**	5HN302	2002.3.5HN302.11	Unidentified bison or elk bone, one of eleven.	Unknown	One of a collection of 11 large mammal bones described as bison or elk recovered from the Tellurium/White Cross mining camp site.
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 306**	5HN302	2002.3.5HN302.11	Unidentified bison or elk bone, one of eleven.	Unknown	One of a collection of 11 large mammal bones described as bison or elk recovered from the Tellurium/White Cross mining camp site.
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 307**	5HN302	2002.3.5HN302.11	Unidentified bison or elk bone, one of eleven.	Unknown	One of a collection of 11 large mammal bones described as bison or elk recovered from the Tellurium/White Cross mining camp site.
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 308**	5HN302	2002.3.5HN302.11	Unidentified bison or elk bone, one of eleven.	Unknown	One of a collection of 11 large mammal bones described as bison or elk recovered from the Tellurium/White Cross mining camp site.

County	Curated	DARG #	Site # or Name	Accession #	Element	Weathering stage*	Comments
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 309**	5HN302	2002.3.5HN302.11	Unidentified bison or elk bone, one of eleven.	Unknown	One of a collection of 11 large mammal bones described as bison or elk recovered from the Tellurium/White Cross mining camp site.
La Plata	Canyon of the Ancients Visitors Center and Museum	**DARG 320**	5LP1915	2003.47.5LP1915	Possible bison sawn long bone	Unknown	A single sawn long bone described as "1 Bison/cow-sized mammal..." recovered from the Cherry Creek Construction Camp site (5LP1915), a Rio Grande Southern Railroad construction camp located eight miles southeast of the town of Mancos, Colorado.
La Plata	Canyon of the Ancients Visitors Center and Museum	**DARG 321**	5LP1921	2003.47.5LP1921.274	Four possible bison bone fragments	Unknown	Four unidentified, sawn possible bison bone fragments all curated with DARG 322. All are from the Hook Site, a high altitude railroad section house.
La Plata	Canyon of the Ancients Visitors Center and Museum	**DARG 322**	5LP1921	2003.47.5LP1921.278	Five possible bison bone fragments	Unknown	Five unidentified, sawn possible bison bone fragments all curated with DARG 321. All are from the Hook Site, a high altitude railroad section house.
Montezuma	Canyon of the Ancients Visitors Center and Museum	**DARG 314**	5MT4797	1978.1.5MT4797	Bison terminal phalanx	Unknown	An unmodified bison terminal phalanx recovered from Cougar Springs Cave site situated at an altitude of 6900 feet and located on the south side of Dry Canyon 600 meters northeast of the Dolores River.
Montezuma	Canyon of the Ancients Visitors Center and Museum	**DARG 315**	5MT2149	1978.28.5MT2149.25.6	Possible bison astralgus	Unknown	A possible bison astralgus found in association with nine other bones. The nine bones include a first phalanx, four carpals, a left calcaneous, a tarsal navicule-cuboid, and two patella. The astralgus is attributed to a small, immature bison and all bones are described as unmodified. The specimen was recovered from the Escalante Ruin, a nine room pueblo with one kiva occupied during Pueblo cultural periods I, II, and III.
Montrose	Canyon of the Ancients Visitors Center and Museum	**DARG 323**	5MN654	2012.18.5MN654.892	Bison long bone fragments	Unknown	Bison long bone fragments that may have been burned, recovered from what is likely House 1 at Cottonwood Pueblo. The site is situated at an altitude of 6462 feet and located approximately 10 miles east of Nucla, Colorado in the southwestern aspect of Montrose County.

County	Curated	DARG #	Site # or Name	Accession #	Element	Weathering stage*	Comments
Montrose	Unknown	**DARG 319**	5MN1068, Zephyr site.	Unknown	Unidentified bison bone	Unknown	Unidentified bison bone recovered from the Zephyr (Zepher) site, a few miles east of Cerro Summit. Charcoal collected from thermal features produced radiocarbon dates which spanned 7650 BP to 8,000 BP.
Saguache	Saguache County Museum	**DARG 276**	Jack Welch site	None	Bison skull	2, 3, 4	A bison cranium recovered from the Crested Butte area in 1899. Cultural modification includes an inscription on the foreskull in heavy red paint stating "Buffalo Head Found by Jack Welch near Crested Butte Colo 1899". Associated with the bison skull is a 4"X5" photograph of Jack Welch mounted horseback and in mountain man attire, armed with a rifle and other period accoutrements. The photo bears the following inscription: "Jack Welch Known among the Indians as "Buckskin Jack"." On the back of the image, scripted in pencil, is a brief life history of the gentleman. Additional associated documentation is noted in the body of the report.
Saguache	Saguache County Museum	**DARG 277**	Bunker Site		Partial Cranium	4, 5	A partial bison cranium missing all of the left horn core excepting the base and all below the left horn core. The convex curve of the right horn core is eroded away and all below the upper aspect of the right orbit is missing. The specimen was recovered by hunters in the early 1960s from the Sheep Mountain area near the Rainbow Trail at the Continental Divide. The specimen is in process of being accepted on loan to the Saguache County Museum.
Ouray	Ouray County Historical Museum	**DARG 278**	5OR69	5-OR-69 2-A-3	Possible bison femur fragment	2	A possible bison femur fragment missing significant portions of the proximal end. The distal portion is absent due to mechanical or hand sawing that occured during meat processing. The specimen was recovered by Centuries Research, Inc. in 1991 from the Dallas Townsite located just southwest of Ridgeway State Park. The bone was located near the back of what is suspected to have been a butcher shop. The artifact is curated at the Ouray County Historical Museum, Ouray, Colorado.

County	Curated	DARG #	Site # or Name	Accession #	Element	Weathering stage*	Comments
Ouray	Ouray County Historical Society Museum	**DARG 279**	5OR69	5-OR-69 3W1	Possible left bison metacarpal fragment	2	A small possible left bison metacarpal missing the distal end due to mechanical or hand sawing resulting from modern butchering. The specimen was recovered by Centuries Research, Inc. in 1991 from the Dallas Townsite located just southwest of Ridgeway State Park. The bone was located near the back of what is suspected to have been a butcher shop. The specimen is curated at the Ouray County Historical Society Museum , Ouray, Colorado.
Ouray	Ouray County Historical Society Museum	**DARG 280**	5OR69	5-OR-69 3H1	Possible left bison metacarpal fragment poximal end	2	Proximal end of a possible left metacarpal. The entire distal aspect is missing due to mechanical or hand sawing that occured during meat processing. The specimen was recovered by Centuries Research, Inc. in 1991 from the Dallas Townsite located just southwest of Ridgeway State Park. The bone was located near the back of what is suspected to have been a butcher shop. The specimenis curated at the Ouray County Historical Society Museum, Ouray, Colorado.
Ouray	Ouray County Historical Society Museum	**DARG 281**	5OR69	Unknown	Unknown number of bison bone fragments	Unknown	An unknown number of possible bison bone fragments recovered by Centuries Research, Inc. in 1991 from the Dallas townsite (5OR69) southwest of Ridgeway State Park. The specimens are curated at the Ouray County Historical Society Museum, Ouray, Colorado.
Pitkin	Denver Museum of Nature and Science	**NA**	NA	NA	402 Ice Age bison bone fossils	variable	A collection of 402 Ice Age bison bone fossils collected from the Zeigler Reservoir Fossil Site near Snowmass, Colorado (Appendix F). There is no confirmed cultural modification however; several specimens present with unusual parallel striations and grooves that warrant further evalualtion and consideration of radiometric testing of the specific specimens. The collection is curated at the Denver Museum of Nature and Science in Denver, Colorado.

County	Curated	DARG #	Site # or Name	Accession #	Element	Weathering stage*	Comments
Pitkin	Silt Historical Museum	**DARG 284**	Park Creek site	None	Bison skull	4	A partial bison skull reported to have been recovered by an unknown party near a drainage in the general area of Park Creek or North Thompson Creek in northwest Pitkin County. The significantly weathered specimen consists of the upper aspect of the cranium missing all below the apex of the nasals, the right eye orbit, the right horn core, and approximately half of the terminal aspect of the left horn core. The back of the skull is weathered away exposing the interior of the cranial cavity and upper aspect of the sinuses. Parallel to the base of the right horn core is an approximately 4mm wide and 5 cm long shallow groove which appears unnatural and somewhat suggestive of cultural modification resultant from tying cordage to the skull for the purpose of hanging for display or from abrasion of unknown purpose. The specimen is presently curated at the Silt Historical Museum in Silt, Colorado.

***Weathering stages as catagorized by Behrensmeyer, A. K. 1978, Taphonomic and Ecologic Information from Bone Weathering**

0-No cracking or flaking on bone surface

1-Longitudinal and/or mosaic cracking present on bone surface

2-Longitudinal cracks, exfoliation of bone surface

3-Fibrous texture, extensive exfoliation, weathering penetrates 1-1.5 mm into bone

4-Coarsely fibrous texture, splinters of bone loose on the surface, open cracks

5-Bone crumbling in situ, large splinters of bone

APPENDIX B: Culturally Modified Elements

Western Colorado Bison Project. Appendix B: CULTURALLY MODIFIFIED ELEMENTS							
County	**Curated**	**DARG #**	**Site #**	**Accession #**	**Element**	**Cultural Modi-fication**	**Comments**
Gunnison	C T Hurst Museum, Western Colorado University	**DARG 251**	Hagie site	1410	Cranium	6, 7	A bison cranium sans the lower maxilla, lower nasals, and the lower turbinates. Cultural modification on the frontal consists of a somewhat circular craniotomy offset left of center. Scalloped impact indentations that protrude into the skull cavity surround the periphery. Crescent shaped impact fractures are apparent on the upper right and upper left sides of the orifice. The craniotomy extends into the brain cavity. The specimen was recovered in 1942 from a steep hillside southeast of the Willow Creek Ranger station in Taylor Park, Gunnison County, CO. It is curated at the C. T. Hurst Museum at Western Colorado University in Gunnison, CO.
Gunnison	C T Hurst Museum, Western Colorado University	**DARG 254**	Unknown	Parlin/Gold Crk	Left Humerus	2, 3, 6	A bison left humerus fragment excavated during construction of an irrigation ditch near Parlin, Colorado in the Gold Creek drainage north-northeast of Ohio City, Colorado. The specimen has a spiral fracture of the diaphysis possibly indicative of cultural modification for removal of bone marrow (Binford 1981). The distal aspect of the epiphesium shows two possible chop marks and 2 possible impact indentations. Unfortunately the bone in this area is so severely weathered it prohibits confirmation of such. Compact silt with calcite and sparse sulfites is present in the interior and orifices of the specimen. The specimen was found in association with a bison left radius fragment, a right maxilla fragment, and a single bison premolar. It is curated in the C. T. Hurst Museum at Western Colorado University in Gunnison, CO.

County	Curated	DARG #	Site #	Accession #	Element	Cultural Modi-fication	Comments
Gunnison	C T Hurst Museum, Western Colorado University	**DARG 255**	Unknown	Parlin/Gold Crk	Left Radius	6	A bison left radius fragment excavated during construction of an irrigation ditch near Parlin, Colorado in the Gold Creek drainage north-northeast of Ohio City, Colorado. The specimen was found in association with a bison left humerus fragment with possible cultural modification, a bison maxilla fragment, and a single bison premolar. Situated on the fractured diaphysis is a sharp 3 centimeter wide and 5 centimeter long V-shaped, internally faceted fracture that tapers to an apex oriented toward the epiphesium. It is similar to fractures occurring from intentional impact and may be indicative of cultural modification. It is curated in the C. T. Hurst Museum at Western Colorado University in Gunnison, CO.
Gunnison	C T Hurst Museum, Western Colorado University	**DARG 258**	McLain site	McLain Site	Right Mandible	12	A right side bison mandible missing all structure forwards of the M3 molars including all the premolars. The specimen was recovered 20 May 1998 from the McLain Site. The official report is closed per request of the property owner. A 1.3 centimeter long by 1.0 millimeter wide curvilinear scrape mark is located below the M3 molars on the lower buccal aspect of the mandible. Cultural modification in the form of a scrape related to buturing to remove the tongue is possible. A claw or other unknown scratch mark should also be considered. Of interest is a 3.0 centimeter somewhat square broken chert fragment which was found near the specimen and is curated with it. No notes were included regarding the chert fragment. The specimen was found in association with a collection of unidentified bone (DARG 259), and a bison right humerus (DARG 260). Cultural modification though possible, cannot be solidly confirmed. TIt is curated in the C. T. Hurst Museum at Western Colorado University in Gunnison, CO.

County	Curated	DARG #	Site #	Accession #	Element	Cultural Modi-fication	Comments
Gunnison	C T Hurst Museum, Western Colorado University	**DARG 260**	McLain site	Unknown	Humerus	3, 6, 12,	A robust bison right humerus recovered from the McLain site, found 10 to 13 centimeters below the surface atop a black peat layer in Grid A, on 20 May 1998. The proximal end and most of the lateral tuberosity are missing. There are three groups of distinct gouge or scratch marks and a single gouge or scratch mark on the head of the humerus. All the gouge or scratch marks are approximately 1.0 millimeter in width. Due to the mark groupings, the curvilinear parallel arrangement, and the bulb of initiation on several of the marks, it is possible they are large predator claw marks. The lateral tuberosity is fractured and though the remnant edges are scalloped the degree of weathering prohibits confirmation of cultural modification. A primary impact point on a diamond shaped area of missing bone is evident approximately 8.0 centimeters below the head of the humerus. There are impact indentations around the primary impact point as exhibited by fine fractures that arc inward toward the orifice. Resultant breakage fractures emanate from that point creating a spiral fracture. The evidence indicates the bone may have been impacted by the apex of a stone tool. This specimen is tentatively considered to exhibit cultural modification in the form of impact and spiral fracturing. The specimen was identified at and is curated in the C. T. Hurst Museum at Western Colorado University in Gunnison, CO.

County	Curated	DARG #	Site #	Accession #	Element	Cultural Modi-fication	Comments
Saguache	Saguache County Museum	**DARG 276**	None	Jack Welch Skull	Bison skull	10, 11, 14	A bison cranium recovered from the Crested Butte area in 1899. Cultural modification includes an inscription on the foreskull in heavy red paint stating "Buffalo Head Found by Jack Welch near Crested Butte Colo 1899". Associated with the bison skull is a 4"X5" photograph of Jack Welch mounted horseback and in mountain man attire, armed with a rifle and other period accoutrements. The photo bears the following inscription: "Jack Welch Known among the Indians as "Buckskin Jack"." On the back of the image, scripted in pencil, is a brief life history of the gentleman. Additional associated documentation is noted in the body of the report.
Ouray	Ouray County Historical Museum	**DARG 278**	5OR69	5-OR-69 2-A-3	Possible bison femur fragment	10, 14, 16	A possible bison femur fragment missing significant portions of the proximal end. The distal portion is absent due to mechanical or hand sawing that occured during meat processing. The specimen was recovered by Centuries Research, Inc. in 1991 from the Dallas Townsite located just southwest of Ridgeway State Park. The bone was located near the back of what is suspected to have been a butcher shop. The artifact is curated at the Ouray County Historical Museum, Ouray, Colorado.
Ouray	Ouray County Historical Society Museum	**DARG 279**	5OR69	5-OR-69 3W1	Possible left bison metacarpal fragment	10, 14, 16	A small possible left bison metacarpal missing the distal end due to mechanical or hand sawing resulting from modern butchering. The specimen was recovered by Centuries Research, Inc. in 1991 from the Dallas Townsite located just southwest of Ridgeway State Park. The bone was located near the back of what is suspected to have been a butcher shop. The specimen is curated at the Ouray County Historical Society Museum , Ouray, Colorado.

County	Curated	DARG #	Site #	Accession #	Element	Cultural Modi-fication	Comments
Ouray	Ouray County Historical Society Museum	**DARG 280**	5OR69	5-OR-69 3H1	Possible left bison metacarpal fragment poximal end	10, 14, 16	Proximal end of a possible left metacarpal. The entire distal aspect is missing due to mechanical or hand sawing that occured during meat processing. The specimen was recovered by Centuries Research, Inc. in 1991 from the Dallas Townsite located just southwest of Ridgeway State Park. The bone was located near the back of what is suspected to have been a butcher shop. The specimenis curated at the Ouray County Historical Society Museum, Ouray, Colorado.
Pitkin	Silt Historical Museum	**DARG 284**	None	Pitkin Skull	Bison skull	6	A partial bison skull reported to have been recovered by an unknown party near a drainage in the general area of Park Creek or North Thompson Creek in northwest Pitkin County. The significantly weathered specimen consists of the upper aspect of the cranium missing all below the apex of the nasals, the right eye orbit, the right horn core, and approximately half of the terminal aspect of the left horn core. The back of the skull is weathered away exposing the interior of the cranial cavity and upper aspect of the sinuses. Parallel to the base of the right horn core is an approximately 4mm wide and 5 cm long shallow groove which appears unnatural and somewhat suggestive of cultural modification resultant from tying cordage to the skull for the purpose of hanging for display or from abrasion of unknown purpose. The specimen is presently curated at the Silt Historical Museum in Silt, Colorado.

Cultural Modification Key
***(R)-Repatriated**

1-Possible butchering
2-Butchering chop mark
3-Spiral fracture
4-Stone tool cutting
5-Use wear polish
6-Impact indentation
7-Craniectomy
8-Abraision striations
9-Metal tool cutting
10-Saw cut
11-Pigment
12-Tool scrape/gouge
13-Burned
14-Manuport
15-Tool
16-Processed

APPENDIX C: Bison Bone Ecofacts

Western Colorado Bison Project. Appendix C: ECOFACTS							
County	**Curated**	**DARG #**	**Site #**	**Accession #**	**Element**	**Cultural Influence**	**Comments**
Archuleta	Canyon of the Ancients Visitors Center and Museum	**DARG 285**	5AA83 Chimney Rock Pueblo	2012.9.5AA83.121	bison (or possibly wapiti) patella	16, 17	A bison (or possibly wapiti) patella (2012.9.5AA83.121) recovered from Chimney Rock Pueblo (5AA83) subsurface Stratum 3, Level 1 in room 7, PD 46. The single specimen was likely transported into the structure by humans.
Gunnison	Unknown	**DARG 262**	5GN1664 Marion Site	Unknown	Metatarsal	16, 17	A bison metatarsal was located at the Marion Site, in Feature 21, hearth B in one of three prehistoric components of the site. Radiometric testing of charcoal from hearth B resulted in a date range of 1172BP to 918BP however; the confidence level regarding this date is noted as low. The four radiocarbon dates obtained from charcoal located in the various hearth features produced a date range of 2130BP to 1020BP. At this time the location of the specimens is unknown.
Gunnison	Midwest Archaeo-logical Center, Lincoln, Nebraska.	**DARG 263**	5GN41 Pioner Point site.	Unknown	15 bison bone fragments	16, 17, 18,	15 burned and unburned bison bone fragments found at the Pioneer Point site were found in association with rim and body ceramic fragments that are likely Uncompahgre Brown ware, quartzite flakes, charcoal, a single side-notched projectile point, and bifacial and unifacial stone tools recovered in and around a hearth. Midwest Archaeological Center mitigated the site by complete excavation in 1981. The specimens are curated at the Midwest Archaeological Center, Lincoln, Nebraska.
Gunnison	C T Hurst Museum, Western Colorado University	**DARG 265**	5GN2477 Mountaine er site.	Unknown	Second phalange	16, 17, 18, 19	A bison second phalange recovered from site 5GN2477, the Mountaineer site, Block A, near Gunnison, Colorado. It was found abutting a large bison tibia fragment and situated at the back wall of the interior a Folsom lithic workshop structure located atop the western aspect of Tenderfoot Mountain on the Mountaineer Site. The bison tibia that abutted the specimen produced a 14C date of 10,440 BP. Both specimens are considered technological tools likely used as flintknapping mallets. The specimen is curated in the C. T. Hurst Museum in Hurst Hall at Western Colorado University, Gunnison, CO.

County	Curated	DARG #	Site #	Accession #	Element	Cultural Influence	Comments
Gunnison	C T Hurst Museum, Western Colorado University	**DARG 266**	5GN2477 Mountaineer site.	Unknown	Bone fragments	16, 17	An unknown number of large mammal rib fragments (suspected bison) recovered from within a Folosm lithic workshop structure at the Mountaineer Site. These and a 7 centimeter long rib fragment submitted for AMS testing produced a dates of 14C 10,295 BP and 10,380 BP respectively. The specimens are curated in the C. T. Hurst Museum at Hurst Hall at Western Colorado University, Gunnison, CO.
Gunnison	C T Hurst Museum, Western Colorado University	**DARG 267**	5GN2477 Mountaineer site.	Tibia fragment	Tibia fragment	16, 17, 18, 19	A large bison tibia fragment situated among small lithic flake tools, a drill, and a graver in Block A. The specimen abutted a bison phalanx with the entirety located at the rear wall of a Folosm lithic workshop. This specimen and the bison phalanx abutting it are considered technological flintknapping mallet tools. The tibia was collected during excavations conducted by Dr. Mark Stiger of Western Colorado University, in Gunnison, CO during the 2003 field season. A bone collagen sample submitted for AMS testing produced a calibrated date of 10,440 +/-50 BP. The specimen is housed at the C. T. Hurst Museum in Hurst Hall at Western Colorado University, Gunnison, CO.
Gunnison	C T Hurst Museum, Western Colorado University	**DARG 317**	5GN1835, Tenderfoot site.	Unknown	Phalange	16, 17, 18, 19	A bison phalange recovered near a windbreak structure at the Tenderfoot site. It is possibley a technological flintknapping mallet tool. A total of 60 radiocarbon dates indicate the site was occupied between 8000 BP and 3000BP.
Gunnison	C T Hurst Museum, Western Colorado University	**DARG 318**	5GN1835, Tenderfoot site.	Unknown	Artiodactyl tibia, possibly bison	16, 17, 18, 19	An artiodactyl tibia, possibly bison, recovered from a bone disposal area or toss zone in the Tenderfoot site near Gunnison, Colorado. A total of 60 radiocarbon dates indicate the site was occupied between 8000 BP and 3000 BP.

County	Curated	DARG #	Site #	Accession #	Element	Cultural Influence	Comments
Montrose	Unknown	**DARG 319**	5MN1068, Zephyr site.	Unknown	Unidentified bison bone	17, 18	Unidentified bison bone recovered from the Zephyr site, a few miles east of Cerro Summit. Found in association with a prehistoric house structure and several large bifaces and two Paleoindian projectile point fragments and an unknown number of Archaic projectile points. Charcoal fom thermal features produced radiocarbon dates which spanned 7650 BP to 8,000 BP.
Montrose	Canyon of the Ancients Visitors Center and Museum	**DARG 323**	5MN654	2012.18.5MN654.892	Bison long bone fragments	16, 17	Bison long bone fragments that may have been burned, recovered from what is likely House 1 at Cottonwood Pueblo. The site is situated at an altitude of 6462 feet and located approximately 10 miles east of Nucla, Colorado in the southwestern aspect of Montrose County.

Cultural Influence Key

***(R)-Repatriated**

16-Manuport

17-Found in association with a feature

18-Found in association with another artifact

19-Skeletal element commonly used as a tool

20-Other archaeological significance

APPENDIX D: Non-culturally Modified Elements

Western Colorado Bison Project. Appendix D: NON-CULTURALLY MODIFIED ELEMENTS							
County	**Curated**	**DARG #**	**Site #**	**Accession #**	**Element**	**Modi-fication**	**Comments**
Gunnison	C T Hurst Museum, Western Colorado University	**DARG 252**	Olmstead Site	None	Atlas	23	A bison atlas missing approximately 70% of the right transverse process and approximately 10% of the left transverse process. The vertebral and transverse foramen are impregnated with small poorly sorted sandstone fragments and soils high in calcite with visible sulfites indicative of lower altitude alluvial soils. Organic detritus is present but does not include conifer needles. Specimen recovered on 21 May 1998 by Mr. Tom McGinnes from the Olmstead Site. To date no further information concerning this site has been found. It was initially located in the wall of an arroyo in immediate association with multiple bison horn core fragments. There is no cultural modification. The specimen is curated in the C. T. Hurst Museum at Western Colorado University in Gunnison, CO.
Gunnison	C T Hurst Museum, Western Colorado University	**DARG 253**	Olmstead Site	None	Horn core fragments	23	80 fragments of a bison horn core recovered from the wall of an arroyo at the Olmstead site by Tom McGinnes on 21 May 1998. Specimens found in immediate association with a bison atlas. The fragments range in size from 8 centimeters in length by 2.5 centimeters wide to multiple minuscule fragments measuring less than .01 cm. There is no cultural modification. The specimens are curated in the C. T. Hurst Museum at Western Colorado University in Gunnison, CO.
Gunnison	C T Hurst Museum, Western Colorado University	**DARG 256**	Gold Creek Site	Unknown	Right maxilla fragment	23	A right maxilla fragment consisting of one erupted molar and one un-erupted molar excavated during construction of an irrigation ditch near Parlin, Colorado in the Gold Creek drainage north-northeast of Ohio City, Colorado. There is no cultural modification. It was found in association with a bison left humerus fragment with possible cultural modification, and a single bison premolar. The specimen is curated in the C. T. Hurst Museum as part of a comparative collection at Western Colorado University in Gunnison, CO.

County	Curated	DARG #	Site #	Accession #	Element	Modi-fication	Comments
Gunnison	C T Hurst Museum, Western Colorado University	**DARG 257**	Gold Creek Site	None	Premolar	23	A single unremarkable bison premolar missing the root. It was found in association with a bison left humerus, a bison left radius fragment, a right mandible fragment excavated during construction of an irrigation ditch near Parlin, Colorado in the Gold Creek drainage north-northeast of Ohio City, Colorado. There is no cultural modification and the specimen is curated in the C. T. Hurst Museum at Western Colorado University in Gunnison, CO.
Gunnison	C T Hurst Museum, Western Colorado University	**DARG 259**	McLain site	McLain Site	Bone fragments, Unident.	5	A collection of Unident. bone fragments (likely bison) found in close association with a bison right mandible (DARG 258) and a bison right humerus (DARG 260) recovered from an exposure in a ditch in peat soil on 20 May 1998 from the McLain site. There is no evidence of cultural modification on any of the bone fragments. They are curated in the C. T. Hurst Museum at Western Colorado University in Gunnison, CO.
Gunnison	C T Hurst Museum, Western Colorado University	**DARG 261**	McLain site	Mclain Site	Unident. bone fragment	23	A small bone fragment from the McLain Site curated in the same bag with DARG 260, a bison humerus. There is no evidence of cultural modification. It was identified at and is curated in the C. T. Hurst Museum at Western Colorado University in Gunnison, CO.
Gunnison	Unknown	**DARG 262**	5GN1664	5GN1664.21	Metatarsal	Unknown	A bison metatarsal was located at the Marion Site, in Feature 21, hearth B in one of three prehistoric components of the site. Radiometric testing of charcoal from hearth B resulted in a date range of 1172BP to 918BP however; the confidence level regarding this date is noted as low. The four radiocarbon dates obtained from charcoal located in the various hearth features produced a date range of 2130BP to 1020BP. At this time the location of the specimens is unknown.

County	Curated	DARG #	Site #	Accession #	Element	Modi-fication	Comments
Gunnison	Midwest Archaeo-logical Center, Lincoln, Nebraska.	**DARG 263**	5GN41	Pioneer Point Site	15 bison bone fragments	Unknown	15 burned and unburned bison bone fragments found at the Pioneer Point site were found in association with rim and body ceramic fragments that are likely Uncompahgre Brown ware, quartzite flakes, charcoal, a single side-notched projectile point, and bifacial and unifacial stone tools ecovered in and around a hearth. Midwest Archaeological Center mitigated the site by complete excavation in 1981. The specimens are curated at the Midwest Archaeological Center, Lincoln, Nebraska.
Gunnison	Grand Mesa Uncompah gre and Gunnison National Forests, Gunnison District Office	**DARG 264**	Folkestad site	None	Horn cap fragment	23	A bison horn cap fragment recovered in 1949 by Forest Ranger James Oluf Folkestad and Gunnison National Forest Administrative Assistant Ralph Mike Sweet from Texas Creek in Taylor Park, Colorado. Of note is the altitude, 9,187 feet, at which the specimen was located. There is no evidence of cultural modification.
Gunnison	Southern Methodist University or at the University of North Carolina	**DARG 268**	Cement Creek Cave Site	Unknown	Second phalange	Unknown	A single bison second phalange recovered from the Cement Creek Cave, south of Crested Butte, Colorado. No cultural modification is reported. Curation location is at Southern Methodist University or at the University of North Carolina.

County	Curated	DARG #	Site #	Accession #	Element	Modi-fication	Comments
Gunnison	Not curated	**DARG 269**	Coffin Site	None	molar	Unknown	A likely Bison latifrons molar found in association with two B. latifrons horn cores. All specimens were found in 1929 by Mr. L. G. Coffin, the land owner, during construction of an irrigation ditch along the west side of a valley in the Little Cimarron drainage within a 12 mile radius of Cerro Summit at an elevation of 8,000 feet. Harold J. Cook published a report on the find in Science magazine in 1930. The specimen was not collected.
Gunnison	Not curated	**DARG 270**	Coffin Site	None	Bison latifrons horn core fragment	Unknown	A Bison latifrons horn core found in association with a likely B. latifrons molar and a B. latifrons horn core. The specimen was found in 1929 by Mr. L. G. Coffin, the land owner, during construction of an irrigation ditch along the west side of a valley in the Little Cimarron drainage within a 12 mile radius of Cerro Summit at an elevation of 8,000 feet. Harold J. Cook published a report on the find in Science magazine in 1930. The specimen was not collected.
Gunnison	Not curated	**DARG 271**	Coffin Site	None	Bison latifrons horn core fragment	Unknown	A Bison latifrons horn core found in association with a likely B. latifrons molar and a B. latifrons horn core. The specimen was found in 1929 by Mr. L. G. Coffin, the land owner, during construction of an irrigation ditch along the west side of a valley in the Little Cimarron drainage within a 12 mile radius of Cerro Summit at an elevation of 8,000 feet. Harold J. Cook published a report on the find in Science magazine in 1930. The specimen was not collected.
Gunnison	Circle Quarter Circle Ranch	**DARG 272**	Quarter Circle Circle site		Horn cap fragment	23	A single, dessicated bison horn cap fragment found on private ranch land to the west of Colorado State Highway 114 near Gunnison County Road 17GG approximately 20 miles NW of Cochetopa Pass.
Gunnison	Circle Quarter Circle Ranch	**DARG 273**	Quarter Circle Circle site		Horn cap fragment	23	A single, dessicated bison horn cap fragment found on private ranch land to the west of Colorado State Highway 114 near Gunnison County Road 17GG approximately 20 miles NW of Cochetopa Pass.

County	Curated	DARG #	Site #	Accession #	Element	Modi-fication	Comments
Gunnison	Trader's Rendevous	**DARG 274**	Trader Site	None	Cranium	18, 19, 23	A bison cranium likely found in the region of Old Cochetopa Pass, likely within the Old Spanish Trail corridor in the early to mid 1900s on private ranch land. There is no cultural modification. The specimen is on public display at Trader's Rendevous, a private enterprise, in Gunnison, CO.
Gunnison	Grand Mesa Uncompah gre and Gunnison National Forests Gunnison District Office	**DARG 275**	Horn Cap Site	None	Horn cap fragment	23	A bison horn cap tip fragment recovered by a United States Forest Service employee from the Old Cochetopa Pass area within the Old Spanish Trail corridor. Ther is no cultural modification. The specimen is stored at the Grand Mesa Uncompahgre and Gunnison National Forests Gunnison District Officein Gunnison, Colorado.
Gunnison	Traders Rendevous	**DARG 283**	Ryans (Casey) site	None	Partial skull	23	A partial bison cranium recovered from an unknown drainage east of the Old Cochetopa Pass area but possibly within the Old Spanish Trail corridor. It presents with no cultural modification. The specimen is presently only available upon request and by appointment with Trader's Rendevous personnel.
Gunnison	Haystack Cave	**DARG 310**	5GN189	2003.20.5G N189.35 (FS-16)	Distal right bison humerus (probable)	Unknown	A probable distal right bison humerus listed as FS-16, a collection of distal humerus fragments, recovered from Haystack Cave, 5GN189, OS/2W, Level 5. The specimen is reported to be unmodified. The site has evidence of Protohistoric and Archaic use spanning the last 3000 to 5000 years and evidence of pre-Clovis occupation greater than 12,000 ybp.

County	Curated	DARG #	Site #	Accession #	Element	Modi-fication	Comments
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 287**	5HN300	2002.3.5HN 300.85.	1 large bone, bison or elk	Unknown	One of a collection of ten bones collected from the Argentum townsite and curated together in Bag 12. As the site has a prehistoric component and it is possible some of the bones are bison, they are included in the project findings in the hopes that the listing will enable future investigators to consider evaluation of the collection.
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 288**	5HN300	2002.3.5HN 300.85.	1 large bone, bison or elk	Unknown	One of a collection of ten bones collected from the Argentum townsite and curated together in Bag 12. As the site has a prehistoric component and it is possible some of the bones are bison, they are included in the project findings in the hopes that the listing will enable future investigators to consider evaluation of the collection.
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 289**	5HN300	2002.3.5HN 300.85.	A large mammal bone	Unknown	One of a collection of ten bones collected from the Argentum townsite and curated together in Bag 12. As the site has a prehistoric component and it is possible some of the bones are bison, they are included in the project findings in the hopes that the listing will enable future investigators to consider evaluation of the collection.
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 290**	5HN300	2002.3.5HN 300.85.	A large mammal bone	Unknown	One of a collection of ten bones collected from the Argentum townsite and curated together in Bag 12. As the site has a prehistoric component and it is possible some of the bones are bison, they are included in the project findings in the hopes that the listing will enable future investigators to consider evaluation of the collection.
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DAR 291**	5HN300	2002.3.5HN 300.85.	A large mammal bone	Unknown	One of a collection of ten bones collected from the Argentum townsite and curated together in Bag 12. As the site has a prehistoric component and it is possible some of the bones are bison, they are included in the project findings in the hopes that the listing will enable future investigators to consider evaluation of the collection.

County	Curated	DARG #	Site #	Accession #	Element	Modi-fication	Comments
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 292**	5HN300	2002.3.5HN 300.85.	A large mammal bone	Unknown	One of a collection of ten bones collected from the Argentum townsite and curated together in Bag 12. As the site has a prehistoric component and it is possible some of the bones are bison, they are included in the project findings in the hopes that the listing will enable future investigators to consider evaluation of the collection.
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 293**	5HN300	2002.3.5HN 300.85.	A large mammal bone	Unknown	One of a collection of ten bones collected from the Argentum townsite and curated together in Bag 12. As the site has a prehistoric component and it is possible some of the bones are bison, they are included in the project findings in the hopes that the listing will enable future investigators to consider evaluation of the collection.
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 294**	5HN300	2002.3.5HN 300.85.	A large mammal bone	Unknown	One of a collection of ten bones collected from the Argentum townsite and curated together in Bag 12. As the site has a prehistoric component and it is possible some of the bones are bison, they are included in the project findings in the hopes that the listing will enable future investigators to consider evaluation of the collection.
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 295**	5HN300	2002.3.5HN 300.85.	A very large mammal bone	Unknown	One of a collection of ten bones collected from the Argentum townsite and curated together in Bag 12. As the site has a prehistoric component and it is possible some of the bones are bison, they are included in the project findings in the hopes that the listing will enable future investigators to consider evaluation of the collection.
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 296**	5HN300	2002.3.5HN 300.85.	A very large mammal bone	Unknown	One of a collection of ten bones collected from the Argentum townsite and curated together in Bag 12. As the site has a prehistoric component and it is possible some of the bones are bison, they are included in the project findings in the hopes that the listing will enable future investigators to consider evaluation of the collection.

County	Curated	DARG #	Site #	Accession #	Element	Modi-fication	Comments
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 297**	5HN302	2002.3.5HN 302.10	Unident. bison or elk bone, one of two.	Unknown	One of two Unident. bones, curated together and described as bison or elk, collected from the Tellurium/White Cross mining camp site.
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 298**	5HN302	2002.3.5HN 302.10	Unident. bison or elk bone, one of two.	Unknown	One of two Unident. bones, curated together and described as bison or elk, collected from the Tellurium/White Cross mining camp site.
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 299**	5HN302	2002.3.5HN 302.11	Unident. bison or elk bone, one of eleven.	Unknown	One of a collection of 11 large mammal bones described as bison or elk recovered from the Tellurium/White Cross mining camp site
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 300**	5HN302	2002.3.5HN 302.11	Unident. bison or elk bone, one of eleven.	Unknown	One of a collection of 11 large mammal bones described as bison or elk recovered from the Tellurium/White Cross mining camp site.
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 301**	5HN302	2002.3.5HN 302.11	Unident. bison or elk bone, one of eleven.	Unknown	One of a collection of 11 large mammal bones described as bison or elk recovered from the Tellurium/White Cross mining camp site.

County	Curated	DARG #	Site #	Accession #	Element	Modi-fication	Comments
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 302**	5HN302	2002.3.5HN 302.11	Unident. bison or elk bone, one of eleven.	Unknown	One of a collection of 11 large mammal bones described as bison or elk recovered from the Tellurium/White Cross mining camp site.
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 303**	5HN302	2002.3.5HN 302.11	Unident. bison or elk bone, one of eleven.	Unknown	One of a collection of 11 large mammal bones described as bison or elk recovered from the Tellurium/White Cross mining camp site.
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 304**	5HN302	2002.3.5HN 302.11	Unident. bison or elk bone, one of eleven.	Unknown	One of a collection of 11 large mammal bones described as bison or elk recovered from the Tellurium/White Cross mining camp site.
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 305**	5HN302	2002.3.5HN 302.11	Unident. bison or elk bone, one of eleven.	Unknown	One of a collection of 11 large mammal bones described as bison or elk recovered from the Tellurium/White Cross mining camp site.
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 306**	5HN302	2002.3.5HN 302.11	Unident. bison or elk bone, one of eleven.	Unknown	One of a collection of 11 large mammal bones described as bison or elk recovered from the Tellurium/White Cross mining camp site.

County	Curated	DARG #	Site #	Accession #	Element	Modi-fication	Comments
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 307**	5HN302	2002.3.5HN 302.11	Unident. bison or elk bone, one of eleven.	Unknown	One of a collection of 11 large mammal bones described as bison or elk recovered from the Tellurium/White Cross mining camp site.
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 308**	5HN302	2002.3.5HN 302.11	Unident. bison or elk bone, one of eleven.	Unknown	One of a collection of 11 large mammal bones described as bison or elk recovered from the Tellurium/White Cross mining camp site.
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 309**	5HN302	2002.3.5HN 302.11	Unident. bison or elk bone, one of eleven.	Unknown	One of a collection of 11 large mammal bones described as bison or elk recovered from the Tellurium/White Cross mining camp site.
Montezuma	Canyon of the Ancients Visitors Center and Museum	**DARG 314**	5MT4797	1978.1.5MT 4797	Bison terminal phalanx	Unknown	An unmodified bison terminal phalanx recovered from Cougar Springs Cave site situated at an altitude of 6900 feet and located on the south side of Dry Canyon 600 meters northeast of the Dolores River.

County	Curated	DARG #	Site #	Accession #	Element	Modi-fication	Comments
Montezuma	Canyon of the Ancients Visitors Center and Museum	**DARG 315**	5MT2149	1978.28.5MT2149.25.6	Possible bison astralgus	Unknown	A possible bison astralgus found in association with nine other artiodactyla bones that are not clearly defined as bison. The nine bones include a first phalanx, four carpals, a left calcaneous, a tarsal navicule-cuboid, and two patella. The astralgus is attributed to a small, immature bison and all the bones are described as unmodified. The specimen was recovered from the Escalante Ruin, a nine room pueblo with one kiva occupied during Pueblo cultural periods I, II, and III.
Montrose	Unknown	**DARG 319**	5MN1068, Zephyr site.	Unknown	Unident. bison bone	Unknown	Unident. bison bone recovered from the Zephyr site, a few miles east of Cerro Summit. Charcoal fom thermal features produced radiocarbon dates which spanned 7650 BP to 8,000 BP.
Saguache	Saguache County Museum	**DARG 277**	Bunker Site		Partial Cranium	18, 19, 23, 24	A partial bison cranium missing all of the left horn core excepting the base and all below the left horn core. The convex curve of the right horn core is eroded away and all below the upper aspect of the right orbit is missing. The specimen was recovered by hunters in the early 1960s from the Sheep Mountain area near the Rainbow Trail at the Continental Divide. There are some modern scratches likely due to poor storage and handling. The specimen is in process of being accepted on loan to the Saguache County Museum.
Ouray	Ouray County Historical Society Museum	**DARG 281**	5OR69	Unknown	Unknown number of bison bone fragments	Unknown	An unknown number of bison bone fragments recovered by Centuries Research, Inc. in 1991 from the Dallas townsite (5OR69) southwest of Ridgeway State Park. The specimens are curated at the Ouray County Historical Society Museum, Ouray, Colorado.

Non-cultural Modification
17-Carnivore gnaw marks
18-Rodent gnaw marks
19-Root etching
20-Mammal scratch marks
21-Oxidation due to non-cultural burning
22-Mineral staining
23-Grooves and Scratches of unknown origin

APPENDIX E: Unconfirmed Bison Bone

Western Colorado Bison Project. Appendix E: UNCONFIRMED BISON BONE							
County	**Curated**	**DARG #**	**Site #**	**Accession #**	**Element**	**Cultural Influence**	**Comments**
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 286**	5HN300	2002.3.5HN300.82	Large unspecified, burnt possible bison bone	13, 17	A single Unident. large burnt bone from a large mammal described as an elk or bison recovered from a multicomponent site known as the Argentum townsite near Burrows Park and White Cross Mountain.
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 287**	5HN300	2002.3.5HN300.85.	1 large bone, bison or elk	16, 17	One of a collection of ten bones collected from the Argentum townsite and curated together in Bag 12. As the site has a prehistoric component and it is possible some of the bones are bison, they are included in the project findings in the hopes that the listing will enable future investigators to consider evaluation of the collection.
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 288**	5HN300	2002.3.5HN300.85.	1 large bone, bison or elk	16, 17	One of a collection of ten bones collected from the Argentum townsite and curated together in Bag 12. As the site has a prehistoric component and it is possible some of the bones are bison, they are included in the project findings in the hopes that the listing will enable future investigators to consider evaluation of the collection.
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 289**	5HN300	2002.3.5HN300.85.	A large mammal bone	16, 17	One of a collection of ten bones collected from the Argentum townsite and curated together in Bag 12. As the site has a prehistoric component and it is possible some of the bones are bison, they are included in the project findings in the hopes that the listing will enable future investigators to consider evaluation of the collection.
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 290**	5HN300	2002.3.5HN300.85.	A large mammal bone	16, 17	One of a collection of ten bones collected from the Argentum townsite and curated together in Bag 12. As the site has a prehistoric component and it is possible some of the bones are bison, they are included in the project findings in the hopes that the listing will enable future investigators to consider evaluation of the collection.

County	Curated	DARG #	Site #	Accession #	Element	Cultural Influence	Comments
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 291**	5HN300	2002.3.5HN300.85.	A large mammal bone	16, 17	One of a collection of ten bones collected from the Argentum townsite and curated together in Bag 12. As the site has a prehistoric component and it is possible some of the bones are bison, they are included in the project findings in the hopes that the listing will enable future investigators to consider evaluation of the collection.
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 292**	5HN300	2002.3.5HN300.85.	A large mammal bone	16, 17	One of a collection of ten bones collected from the Argentum townsite and curated together in Bag 12. As the site has a prehistoric component and it is possible some of the bones are bison, they are included in the project findings in the hopes that the listing will enable future investigators to consider evaluation of the collection.
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 293**	5HN300	2002.3.5HN300.85.	A large mammal bone	16, 17	One of a collection of ten bones collected from the Argentum townsite and curated together in Bag 12. As the site has a prehistoric component and it is possible some of the bones are bison, they are included in the project findings in the hopes that the listing will enable future investigators to consider evaluation of the collection.
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 294**	5HN300	2002.3.5HN300.85.	A large mammal bone	16, 17	One of a collection of ten bones collected from the Argentum townsite and curated together in Bag 12. As the site has a prehistoric component and it is possible some of the bones are bison, they are included in the project findings in the hopes that the listing will enable future investigators to consider evaluation of the collection.
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 295**	5HN300	2002.3.5HN300.85.	A very large mammal bone	16, 17	One of a collection of ten bones collected from the Argentum townsite and curated together in Bag 12. As the site has a prehistoric component and it is possible some of the bones are bison, they are included in the project findings in the hopes that the listing will enable future investigators to consider evaluation of the collection.

County	Curated	DARG #	Site #	Accession #	Element	Cultural Influence	Comments
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 296**	5HN300	2002.3.5HN300.85.	A very large mammal bone	16, 17	One of a collection of ten bones collected from the Argentum townsite and curated together in Bag 12. As the site has a prehistoric component and it is possible some of the bones are bison, they are included in the project findings in the hopes that the listing will enable future investigators to consider evaluation of the collection.
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 297**	5HN302	2002.3.5HN302.10	Unident. bison or elk bone, one of two.	16, 17	One of two Unident. bones, curated together and described as bison or elk, collected from the Tellurium/White Cross mining camp site.
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 298**	5HN302	2002.3.5HN302.10	Unident. bison or elk bone, one of two.	16, 17	One of two Unident. bones, curated together and described as bison or elk, collected from the Tellurium/White Cross mining camp site.
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 299**	5HN302	2002.3.5HN302.11	Unident. bison or elk bone, one of eleven.	16, 17	One of a collection of 11 large mammal bones described as bison or elk recovered from the Tellurium/White Cross mining camp site
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 300**	5HN302	2002.3.5HN302.11	Unident. bison or elk bone, one of eleven.	16, 17	One of a collection of 11 large mammal bones described as bison or elk recovered from the Tellurium/White Cross mining camp site.
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 301**	5HN302	2002.3.5HN302.11	Unident. bison or elk bone, one of eleven.	16, 17	One of a collection of 11 large mammal bones described as bison or elk recovered from the Tellurium/White Cross mining camp site.

County	Curated	DARG #	Site #	Accession #	Element	Cultural Influence	Comments
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 302**	5HN302	2002.3.5HN302.11	Unident. bison or elk bone, one of eleven.	16, 17	One of a collection of 11 large mammal bones described as bison or elk recovered from the Tellurium/White Cross mining camp site.
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 303**	5HN302	2002.3.5HN302.11	Unident. bison or elk bone, one of eleven.	16, 17	One of a collection of 11 large mammal bones described as bison or elk recovered from the Tellurium/White Cross mining camp site.
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 304**	5HN302	2002.3.5HN302.11	Unident. bison or elk bone, one of eleven.	16, 17	One of a collection of 11 large mammal bones described as bison or elk recovered from the Tellurium/White Cross mining camp site.
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 305**	5HN302	2002.3.5HN302.11	Unident. bison or elk bone, one of eleven.	16, 17	One of a collection of 11 large mammal bones described as bison or elk recovered from the Tellurium/White Cross mining camp site.
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 306**	5HN302	2002.3.5HN302.11	Unident. bison or elk bone, one of eleven.	16, 17	One of a collection of 11 large mammal bones described as bison or elk recovered from the Tellurium/White Cross mining camp site.
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 307**	5HN302	2002.3.5HN302.11	Unident. bison or elk bone, one of eleven.	16, 17	One of a collection of 11 large mammal bones described as bison or elk recovered from the Tellurium/White Cross mining camp site.

County	Curated	DARG #	Site #	Accession #	Element	Cultural Influence	Comments
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 308**	5HN302	2002.3.5HN302.11	Unident. bison or elk bone, one of eleven.	16, 17	One of a collection of 11 large mammal bones described as bison or elk recovered from the Tellurium/White Cross mining camp site.
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 309**	5HN302	2002.3.5HN302.11	Unident. bison or elk bone, one of eleven.	16, 17	One of a collection of 11 large mammal bones described as bison or elk recovered from the Tellurium/White Cross mining camp site.
La Plata	Canyon of the Ancients Visitors Center and Museum	**DARG 320**	5LP1915	2003.47.5LP1915	Possible bison sawn long bone	10, 16, 17	A single sawn long bone described as "1 Bison/cow-sized mammal..." recovered from the Cherry Creek Construction Camp site (5LP1915), a Rio Grande Southern Railroad construction camp located eight miles southeast of the town of Mancos, Colorado.
La Plata	Canyon of the Ancients Visitors Center and Museum	**DARG 321**	5LP1921	2003.47.5LP1921.274	Four possible bison bone fragments	10, 16, 17	Four Unident., sawn possible bison bone fragments all curated with DARG 322. All are from the Hook Site, a high altitude railroad section house.
La Plata	Canyon of the Ancients Visitors Center and Museum	**DARG 322**	5LP1921	2003.47.5LP1921.278	Five possible bison bone fragments	10, 16, 17	Five Unident., sawn possible bison bone fragments all curated with DARG 321. All are from the Hook Site, a high altitude railroad section house.

Cultural Influence Key
***(R)-Repatriated**
10-Sawn
13-Burned
16-Manuport
17-Found in association with a feature
18-Found in association with another artifact
19-Skeletal element commonly used as a tool
20-Other archaeological significance

APPENDIX F: Radiometric Data

Western Colorado Bison Project. Appendix F: RADIOMETRIC DATA							
County	**Testing Facility ID**	**DARG #**	**Site # or Name**	**FS # or Accession #**	**Element**	**Conventional Age**	**Calibrated Age**
Garfield	20B/0359 ICA	**DARG 282**	Schultz	None	Bison skull (Elk Creek, near DARG 284)	80+/-30 BP	Cal 1690-1730 AD (24.9%) Cal 1800-1930 AD (70.5%)
Gunnison	20B/0352 ICA	**DARG 251**	NA	Hurst Catalog number 4410	Bison cranium (Taylor Park)	1.01833+/-0.00259	Cal 1950-1960 AD
Gunnison	Unk	**DARG 262**	5GN1664	5GN1664.21	Bison metatarsal (Marion site associated hearth charcoal)	Not noted	1172BP to 918BP 2130BP to 1020BP
Gunnison	Unk	**DARG 263**	5GN41	Not noted	15 burned/unburned bison bone fragments (Pioneer Point hearth feature charcoal)	Not noted	460+/-70 BP 470+/-80 BP
Gunnison	20B/0353 ICA	**DARG 264**	None	None	Bison horn cap (Taylor Park)	10+/-30 BP	Cal 1690-1730 AD (14.7%) Cal 1810-1860 AD (11.1%) Cal 1870-1920 AD (69.7%)
Gunnison	CAMS105764	**DARG 265**	5GN2477	Not noted	Bison second phalange. Mountaineer site tibia (DARG 267) bone sample.	Not noted	10,440 BP
Gunnison	CAM105765 and UCIAMS-11240	**DARG 266**	5GN2477	5GN2477	Likely bison bone rib fragments (Mountaineer site, Block A processing area)	Not noted	10,295+/-50 BP
Gunnison	CAM105765 and UCIAMS-11240	**DARG 266**	5GN2477	5GN2477	Likely bison bone 7 centimeter long rib fragment (Mountaineer site, Block A processing area)	Not noted	10,380+/-50 BP

County	Testing Facility ID	DARG #	Site # or Name	FS # or Accession #	Element	Conventional Age	Calibrated Age
Gunnison	Unk	**DARG 317**	5GN1835	Not noted	Bison phalange (Tenderfoot site-60 radiocarbon dates)	Not noted	8000 BP-3000 BP
Gunnison	Unk	**DARG 318**	5GN1835	Not noted	Artiodactyl tibia, possibly bison (Tenderfoot site-60 radiocarbon dates)	Not noted	8000 BP-3000 BP
Gunnison	20B/0354 ICA	**DARG 274**	NA	NA	Skull-Trader's Rendevous (Cochetopa Pass, OST Corridor)	1.01165+/-0.00306	Cal 1950-1960 AD
Gunnison	20B/0355 ICA	**DARG 275**			Horn cap USFS (Cochetope Pass, OST Corridor)	1.00231+/-0.00304	Cal 1890-1910 AD (3.6%) Cal 1950-1960 AD (91.8%)
Gunnison	20B/0363 ICA	**DARG 283**			Bison skull Skull-Trader's Rendevous (Cochetopa Pass, OST Corridor)	80+/-30 BP	Cal 1690-1730 AD (24.9%) Cal 1800-1930 AD (70.5%)
Ouray	20B/0358 ICA	**DARG 280**	5OR69	5-OR- 69 3H1	Bison metacarpal fragment poximal end (Dallas Townsite)	1.00644+/-0.00303	Cal 1950-1960 AD
Pitkin	20B/0361 ICA	**DARG 284**	NA	NA	Near North Thompson Creek (Silt Museum)	50+/-30 BP	Cal 1690-1730 AD (21.8%) Cal 1810-1920 AD (73.6)
Saguache	20B/0356 ICA	**DARG 276**	NA		Bison Skull (Jack Welch found in Crested Butte area, Gunnison County. (Curated at Saguache Cty Museum, Saguache, CO)	110+/-30 BP	Cal 1680-1770 AD (29.9%) Cal 1800-1940 AD (65.5%)
Saguache	20B/0357 ICA	**DARG 277**	NA	NA	Bison skull (Cont. Divide, Sheep Mtn.)	130+/-30 BP	Cal 1670-1780 AD (38.0%) Cal 1790-1950 AD (57.3%)

APPENDIX G: Universal Transverse Mercator (UTM) Locations
(Privileged Data - Available OAHP copy only)

Western Colorado Bison Project. Appendix G: Universal Transverse Mercator (UTM) Locations

County	Curated	DARG #	Site # or Name	Accession #	Element	Zone	Easting	Northing	Zone	Easting	Northing
Archuleta	Canyon of the Ancients Visitors Center and Museum	**DARG 285**	5AA83	2012.9.5AA83 .121	bison (or possibly wapiti) patella, Chimney Rock Pueblo	13	295302	4118645			
Gunnison	C T Hurst Museum, Western Colorado University	**DARG 251**	Hagie site	1410	Cranium, likely between the inidicated UTMs in an unnamed drainage south-southeast of the Willow Creek Ranger Station in Taylor Park, Gunnison County.	13	366981	4296867	13	366790	4295921
Gunnison	C T Hurst Museum, Western Colorado University	**DARG 252**	Olmstead site	None	Atlas, Olmstead site, Gunnison County, location unkown.	13					
Gunnison	C T Hurst Museum, Western Colorado University	**DARG 253**	Olmstead site	None	>80 Horn core fragments, Olmstead site, Gunnison County, location unkown.	13					
Gunnison	C T Hurst Museum, Western Colorado University	**DARG 254**	Gold Creek site	Unknown	Left Humerus, likely found in an approximately 1.5 mile span in the farmed valley area of the Gold Creek drainage NNE of Ohio City, NE of Parlin, Gunnison County	13	359716	4270453	13	360080	4272572

County	Curated	DARG #	Site # or Name	Accession #	Element	Zone	Easting	Northing	Zone	Easting	Northing
Gunnison	C T Hurst Museum, Western Colorado University	**DARG 255**	Gold Creek site	None	Left radius, likely found in an approximately 1.5 mile span in the farmed valley area of the Gold Creek drainage NNE of Ohio City, NE of Parlin, Gunnison County	13	359716	4270753	13	360080	4272572
Gunnison	C T Hurst Museum, Western Colorado University	**DARG 256**	Gold Creek site	Unknown	Right maxilla fragment, likely found in an approximately 1.5 mile span in the farmed valley area of the Gold Creek drainage north-northeast of Ohio City, Colorado	13	359716	4270753	13	360080	4272572
Gunnison	C T Hurst Museum, Western Colorado University	**DARG 257**	Gold Creek site	None	Pre-molar, likely found in an approximately 1.5 mile span in the farmed valley area of the Gold Creek drainage NNE of Ohio City, NE of Parlin, Gunnison County	13	359716	4270753	13	360080	4272572
Gunnison	C T Hurst Museum, Western Colorado University	**DARG 258**	McLain site	Unknown	Right Mandible, McLain Site.	13	356089	4267249			

County	Curated	DARG #	Site # or Name	Accession #	Element	Zone	Easting	Northing	Zone	Easting	Northing
Gunnison	C T Hurst Museum, Western Colorado University	**DARG 259**	McLain site	Unknown	Bone fragments, unidentified, McLain Site.	13	356089	4267249			
Gunnison	C T Hurst Museum, Western Colorado University	**DARG 260**	McLain site	Unknown	Right humerus, McLain Site.	13	356089	4267249			
Gunnison	C T Hurst Museum, Western Colorado University	**DARG 261**	McLain site	Unknown	One small bone fragment packaged with DARG 260, McLain Site.	13	356089	4267249			
Gunnison	Unknown	**DARG 262**	5GN1664	5GN1664.21	Metatarsal, Marion Site, Lk. Fork of the Gunnison N of Gateview, S of Sapinero, Gunnison County	13	304160	4250610			
Gunnison	Midwest Archaeo-logical Center, Lincoln, Nebraska.	**DARG 263**	5GN41	Unknown	15 burned and unburned bison bone fragments, Pioneer Point, Gunnison County	13	289200	4258750			

County	Curated	DARG #	Site # or Name	Accession #	Element	Zone	Easting	Northing	Zone	Easting	Northing
Gunnison	Grand Mesa Uncompahgre and Gunnison National Forests, Gunnison District Office	**DARG 264**	Folkestad site	Unknown	Horn cap fragment, Taylor Park between the noted UTMs within a corridor south of Texas Creek.	13	365054	4300894	13	367116	4301193
Gunnison	C T Hurst Museum, Western Colorado University	DARG 265	5GN2477	Unknown	Bison second phalange tool, Mountaineer Site, Gunnison County	13	333823	4265350			
Gunnison	C T Hurst Museum, Western Colorado University	**DARG 266**	5GN2477	Unknown	Bone fragments, Mountaineer Site	13	333823	4265350			
Gunnison	C T Hurst Museum, Western Colorado University	**DARG 267**	5GN2477	Unknown	Tibia tool fragment, Mountaineer Site, Gunnison County	13	333823	4265350			

County	Curated	DARG #	Site # or Name	Accession #	Element	Zone	Easting	Northing	Zone	Easting	Northing
Gunnison	Southern Methodist University or at the University of North Carolina	**DARG 268**	Cement Creek Cave site	Unknown	Second phalange, Cement Creek Cave, Gunnison County	13	338004	4299022			
Gunnison	Not curated	**DARG 269**	Coffin site	None	Bison latifrons molar, Little Cimarron drainage, Cerro Summit, Montrose/Gunnison County, within a 12 mile radius of the listed UTM.	13	269503	4258523			
Gunnison	Not curated	**DARG 270**	Coffin site	None	Bison latifrons horn core fragment, Little Cimarron drainage, Cerro Summit, Montrose/Gunnison County, within a 12 mile radius of the listed UTM.	13	269503	4258523			
Gunnison	Not curated	DARG 271	Coffin site	None	Bison latifrons horn core fragment, Little Cimarron drainage, Cerro Summit, Montrose/Gunnison County, within a 12 mile radius of the listed UTM.	13	269503	4258523			

County	Curated	DARG #	Site # or Name	Accession #	Element	Zone	Easting	Northing	Zone	Easting	Northing
Gunnison	Circle Quarter Circle Ranch	**DARG 272**	Quarter Circle Circle site	None	Horn cap fragment, Quarter Circle Circle Ranch, Gunnison County	13	349649	4224099			
Gunnison	Circle Quarter Circle Ranch	**DARG 273**	Quarter Circle Circle site	None	Horn cap fragment, Quarter Circle Circle Ranch, Gunnison County	13	349649	4224099			
Gunnison	Trader's Rendevous	**DARG 274**	Trader site	None	Partial bison cranium, Old Cochetopa Pass trail corridor, Gunnison/Saguache County within a 10 mile radius of the indicated UTM.	13	359623	4225076			
Gunnison	Grand Mesa Uncompahgre and Gunnison National Forests Gunnison District Office	**DARG 275**	Horn cap site	Unknown	Bison horn cap fragment, Old Cochetopa Pass trail corridor, Gunnison/Saguache County within a 10 mile radius of the indicated UTM.	13	359623	4225076			
Gunnison	Traders Rendevous	**DARG 283**	Ryans (Casey) site	None	Bison partial cranium, East side of Old Cochetopa Pass possibly in the OST corridor, Gunnison/Saguache County estimated to be within a 10 mile radius of the listed UTM.	13	359623	4225076			

County	Curated	DARG #	Site # or Name	Accession #	Element	Zone	Easting	Northing	Zone	Easting	Northing
Gunnison	Haystack Cave	**DARG 310**	5GN189	2003.20.5GN189.35 (FS-16)	Distal right bison humerus, Haystack Cave, Gunnison County	13	311150	4260400			
Gunnison	C T Hurst Museum, Western Colorado University	**DARG 317**	5GN1835, Tenderfoot site.	Unknown	Bison phalange, Tenderfoot site, Gunnison County	13	331445	4264537			
Gunnison	C T Hurst Museum, Western Colorado University	**DARG 318**	5GN1835, Tenderfoot site.	Unknown	Tibia	13	331445	4264537			
Gunnison	Unknown	**DARG 319**	5MN1068, Zephyr (Zepher) site.	Unknown	Unidentified bison bone	13	271664	4257991			
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 286**	5HN300	2002.3.5HN300.82	Large unspecified, burnt possible bison bone, Argentum townsite, Hinsdale County	13	283040	4202200			
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 287**	5HN300	2002.3.5HN300.85.1 large bone, bison or elk	1 Large bone, bison or elk, Argentum townsite, Hinsdale County	13	283040	4202200			

County	Curated	DARG #	Site # or Name	Accession #	Element	Zone	Easting	Northing	Zone	Easting	Northing
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 288**	5HN300	2002.3.5HN300.85.	1 large bone, bison or elk, Argentum townsite, Hinsdale County	13	283040	4202200			
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 289**	5HN300	2002.3.5HN300.85.	A large mammal bone, Argentum townsite, Hinsdale County	13	283040	4202200			
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 290**	5HN300	2002.3.5HN300.85.	A large mammal bone, Argentum townsite, Hinsdale County	13	283040	4202200			
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 291**	5HN300	2002.3.5HN300.85.	A large mammal bone, Argentum townsite, Hinsdale County	13	283040	4202200			
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 292**	5HN300	2002.3.5HN300.85.	A large mammal bone, Argentum townsite, Hinsdale County	13	283040	4202200			
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 293**	5HN300	2002.3.5HN300.85.	A large mammal bone, Argentum townsite, Hinsdale County	13	283040	4202200			

County	Curated	DARG #	Site # or Name	Accession #	Element	Zone	Easting	Northing	Zone	Easting	Northing
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 294**	5HN300	2002.3.5HN300.85.	A large mammal bone, Argentum townsite, Hinsdale County	13	283040	4202200			
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 295**	5HN300	2002.3.5HN300.85.	A very large mammal bone, Argentum townsite, Hinsdale County	13	283040	4202200			
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 296**	5HN300	2002.3.5HN300.85.	A very large mammal bone, Argentum townsite, Hinsdale County	13	283040	4202200			
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 297**	5HN302	2002.3.5HN302.10	Unidentified bison or elk bone, one of two, Tellurium/White Cross mining camp site, Hinsdale County	13	280758	4202510			
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 298**	5HN302	2002.3.5HN302.10	Unidentified bison or elk bone, one of two, Tellurium/White Cross mining camp site, Hinsdale County	13	280758	4202510			
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 299**	5HN302	2002.3.5HN302.11 Unidentified bison or elk bone, one of eleven.	Unidentified bison or elk bone, one of eleven, Tellurium/White Cross mining camp site, Hinsdale County	13	280758	4202510			

County	Curated	DARG #	Site # or Name	Accession #	Element	Zone	Easting	Northing	Zone	Easting	Northing
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 300**	5HN302	2002.3.5HN302.11	Unidentified bison or elk bone, one of eleven, Tellurium/White Cross mining camp site, Hinsdale County	13	280758	4202510			
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 301**	5HN302	2002.3.5HN302.11	Unidentified bison or elk bone, one of eleven, Tellurium/White Cross mining camp site, Hinsdale County	13	280758	4202510			
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 302**	5HN302	2002.3.5HN302.11	Unidentified bison or elk bone, one of eleven, Tellurium/White Cross mining camp site, Hinsdale County	13	280758	4202510			
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 303**	5HN302	2002.3.5HN302.11	Unidentified bison or elk bone, one of eleven, Tellurium/White Cross mining camp site, Hinsdale County	13	280758	4202510			
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 304**	5HN302	2002.3.5HN302.11	Unidentified bison or elk bone, one of eleven, Tellurium/White Cross mining camp site, Hinsdale County	13	280758	4202510			
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 305**	5HN302	2002.3.5HN302.11	Unidentified bison or elk bone, one of eleven, Tellurium/White Cross mining camp site, Hinsdale County	13	280758	4202510			

County	Curated	DARG #	Site # or Name	Accession #	Element	Zone	Easting	Northing	Zone	Easting	Northing
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 306**	5HN302	2002.3.5HN302.11	Unidentified bison or elk bone, one of eleven, Tellurium/White Cross mining camp site, Hinsdale County	13	280758	4202510			
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 307**	5HN302	2002.3.5HN302.11	Unidentified bison or elk bone, one of eleven, Tellurium/White Cross mining camp site, Hinsdale County	13	280758	4202510			
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 308**	5HN302	2002.3.5HN302.11	Unidentified bison or elk bone, one of eleven, Tellurium/White Cross mining camp site, Hinsdale County	13	280758	4202510			
Hinsdale	Canyon of the Ancients Visitors Center and Museum	**DARG 309**	5HN302	2002.3.5HN302.11	Unidentified bison or elk bone, one of eleven, Tellurium/White Cross mining camp site, Hinsdale County	13	280758	4202510			
La Plata	Canyon of the Ancients Visitors Center and Museum	**DARG 320**	5LP1915	2003.47.5LP1915	Possible bison sawn long bone, Cherry Creek Construction Camp site, La Plata County	12	754190	4135850			
La Plata	Canyon of the Ancients Visitors Center and Museum	**DARG 321**	5LP1921	2003.47.5LP1921.274	Four possible bison bone fragments, Hook Site, La Plata County	12	748470	4137690			

County	Curated	DARG #	Site # or Name	Accession #	Element	Zone	Easting	Northing	Zone	Easting	Northing
La Plata	Canyon of the Ancients Visitors Center and Museum	**DARG 322**	5LP1921	2003.47.5LP 1921.278	Five possible bison bone fragments, Hook Site, La Plata County	12	748470	4137690			
Montezuma	Canyon of the Ancients Visitors Center and Museum	**DARG 314**	5MT4797	1978.1.5MT 4797	Bison terminal phalanx, Cougar Springs Cave.	12	716020	4161690			
Montzuma	Canyon of the Ancients Visitors Center and Museum	**DARG 315**	5MT2149	1978.28.5M T2149.25.6	Escalante Ruin, Possible bison astralgus	12	717023	4150716			
Montrose	Canyon of the Ancients Visitors Center and Museum	**DARG 323**	5MN654	2012.18.5M N654.892	Cottonwood Pueblo, bison long bone fragments	12	731494	4239352			
Saguache	Saguache County Museum	**DARG 276**	Jack Welch site		Bison skull, (Jack Welch) Crested Butte area within a 15 mile radius of the indicated UTM.	13	327712	4304191			
Saguache	Saguache County Museum	**DARG 277**	Bunker site		Partial cranium, Continental Divide near Sheep Mountain/Rainbow Trail.	13	392981	4243297			

County	Curated	DARG #	Site # or Name	Accession #	Element	Zone	Easting	Northing	Zone	Easting	Northing
Ouray	Ouray County Historical Museum	**DARG 278**	5OR69	5-OR-69 2-A-3	Possible bison femur fragment, Dallas Townsite	13	259435	4230256			
Ouray	Ouray County Historical Society Museum	**DARG 279**	5OR69	5-OR-69 3W1	Possible left bison metacarpal fragment, Dallas Townsite	13	259435	4230256			
Ouray	Ouray County Historical Society Museum	**DARG 280**	5OR69	5-OR-69 3H1	Possible left bison metalcarpal fragment poximal end, Dallas Townsite	13	259435	4230256			
Ouray	Ouray County Historical Society Museum	**DARG 281**	5OR69	None	Unknown number of bison bone fragments, Dallas Townsite	13	259435	4230256			
Pitkin	Denver Museum of Nature and Science	**Appendix F**	5PT1264	See Appendix F	444 Ice Age bison bone fossils, majority Bison latifrons	13	330372	4341651			
Pitkin	Silt Historical Museum	**DARG 284**	Park Creek site		Partial bison skull, Park Creek or North Thompson Creek, Pitkin County. Within a 1/2 mile radius of the noted UTM.	13	292476	4356909			

***Weathering stages as catagorized by Behrensmeyer, A. K. 1978, Taphonomic and Ecologic Information from Bone Weathering**
0-No cracking or flaking on bone surface
1-Longitudinal and/or mosaic cracking present on bone surface
2-Longitudinal cracks, exfoliation of bone surface
3-Fibrous texture, extensive exfoliation, weathering penetrates 1-1.5 mm into bone
4-Coarsely fibrous texture, splinters of bone loose on the surface, open cracks
5-Bone crumbling in situ, large splinters of bone

APPENDIX H: Ziegler Reservoir Fossil Site (5PT1264) Bison Bone Specimen List
(Priveleged Data - Available OAHP copy only)

Western Colorado Bison Project Phase II. Appendix H: Zeigler Reservoir Fossil Site (5PT1264) Bison Bone Specimens					
Internal Record Number	**Catalog Number**	**Collection**	**Other Numbers**	**Taxon: Bison latifrons; Bison; Bovidae; Artiodactyla; Mammalia; Vertebrata; Chordata; Animalia**	**Anatomical Element**
565852	EPV.60679	Vertebrate Paleontology		Bison latifrons	skull
565851	EPV.60678	Vertebrate Paleontology	21.7	Bison latifrons	skull
567250	EPV.60679.023	Vertebrate Paleontology	25.23	Bison latifrons	rib
567240	EPV.60679.013	Vertebrate Paleontology	25.13	Bison latifrons	rib
567243	EPV.60679.016	Vertebrate Paleontology	25.16	Bison latifrons	vertebra
567284	EPV.60679.057	Vertebrate Paleontology	25.57	Bison latifrons	phalange
567247	EPV.60679.020	Vertebrate Paleontology	25.20	Bison latifrons	patella
567285	EPV.60679.058	Vertebrate Paleontology	25.58	Bison latifrons	phalange
567254	EPV.60679.027	Vertebrate Paleontology	25.27	Bison latifrons	phalanges
567259	EPV.60679.032	Vertebrate Paleontology	25.32	Bison latifrons	tarsal
567276	EPV.60679.049	Vertebrate Paleontology	25.49	Bison latifrons	phalange
567257	EPV.60679.030	Vertebrate Paleontology	25.30	Bison latifrons	phalanges
567258	EPV.60679.031	Vertebrate Paleontology	25.31	Bison latifrons	
567228	EPV.60679.001	Vertebrate Paleontology	25.1	Bison latifrons	bone fragment
567229	EPV.60679.002	Vertebrate Paleontology	25.2	Bison latifrons	bone fragment
567230	EPV.60679.003	Vertebrate Paleontology	25.3	Bison latifrons	bone fragment
567231	EPV.60679.004	Vertebrate Paleontology	25.4	Bison latifrons	bone fragment
567232	EPV.60679.005	Vertebrate Paleontology	25.5	Bison latifrons	bone fragment

567233	EPV.60679.006	Vertebrate Paleontology	25.6	Bison latifrons	bone fragment
567234	EPV.60679.007	Vertebrate Paleontology	25.7	Bison latifrons	radius
567235	EPV.60679.008	Vertebrate Paleontology	25.8	Bison latifrons	vertebra
567236	EPV.60679.009	Vertebrate Paleontology	25.9	Bison latifrons	scapula
567237	EPV.60679.010	Vertebrate Paleontology	25.10	Bison latifrons	vertebra
567238	EPV.60679.011	Vertebrate Paleontology	25.11	Bison latifrons	innominate
567239	EPV.60679.012	Vertebrate Paleontology	25.12	Bison latifrons	rib
567241	EPV.60679.014	Vertebrate Paleontology	25.14	Bison latifrons	innominate
567242	EPV.60679.015	Vertebrate Paleontology	25.15	Bison latifrons	rib
567244	EPV.60679.017	Vertebrate Paleontology	25.17	Bison latifrons	vertebra
567245	EPV.60679.018	Vertebrate Paleontology	25.18	Bison latifrons	rib
567246	EPV.60679.019	Vertebrate Paleontology	25.19	Bison latifrons	rib
567248	EPV.60679.021	Vertebrate Paleontology	25.21	Bison latifrons	vertebra
567249	EPV.60679.022	Vertebrate Paleontology	25.22	Bison latifrons	rib
567251	EPV.60679.024	Vertebrate Paleontology	25.24	Bison latifrons	rib
567252	EPV.60679.025	Vertebrate Paleontology	25.25	Bison latifrons	vertebra
567253	EPV.60679.026	Vertebrate Paleontology	25.26	Bison latifrons	rib
567255	EPV.60679.028	Vertebrate Paleontology	25.28	Bison latifrons	metatarsal
567256	EPV.60679.029	Vertebrate Paleontology	25.29	Bison latifrons	vertebra
567260	EPV.60679.033	Vertebrate Paleontology	25.33	Bison latifrons	podial
567261	EPV.60679.034	Vertebrate Paleontology	25.34	Bison latifrons	bone
567262	EPV.60679.035	Vertebrate Paleontology	25.35	Bison latifrons	tarsal
567263	EPV.60679.036	Vertebrate Paleontology	25.36	Bison latifrons	astragalus

567265	EPV.60679.038	Vertebrate Paleontology	25.38	Bison latifrons	phalange
567266	EPV.60679.039	Vertebrate Paleontology	25.39	Bison latifrons	phalanges
567267	EPV.60679.040	Vertebrate Paleontology	25.40	Bison latifrons	humerus
567268	EPV.60679.041	Vertebrate Paleontology	25.41	Bison latifrons	femur
567269	EPV.60679.042	Vertebrate Paleontology	25.42	Bison latifrons	femur
567270	EPV.60679.043	Vertebrate Paleontology	25.43	Bison latifrons	tibia
567271	EPV.60679.044	Vertebrate Paleontology	25.44	Bison latifrons	rib
567272	EPV.60679.045	Vertebrate Paleontology	25.45	Bison latifrons	vertebra
567273	EPV.60679.046	Vertebrate Paleontology	25.46	Bison latifrons	rib
567274	EPV.60679.047	Vertebrate Paleontology	25.47	Bison latifrons	rib
567275	EPV.60679.048	Vertebrate Paleontology	25.48	Bison latifrons	phalange
567277	EPV.60679.050	Vertebrate Paleontology	25.50	Bison latifrons	metatarsal
567278	EPV.60679.051	Vertebrate Paleontology	25.51	Bison latifrons	tibia
567279	EPV.60679.052	Vertebrate Paleontology	25.52	Bison latifrons	bone fragments
567280	EPV.60679.053	Vertebrate Paleontology	25.53	Bison latifrons	rib
567281	EPV.60679.054	Vertebrate Paleontology	25.54	Bison latifrons	astragalus
567283	EPV.60679.056	Vertebrate Paleontology	25.56	Bison latifrons	tarsal
567286	EPV.60679.059	Vertebrate Paleontology	25.59	Bison latifrons	bone fragments
567287	EPV.60679.060	Vertebrate Paleontology	25.60	Bison latifrons	phalange
567288	EPV.60679.061	Vertebrate Paleontology	25.61	Bison latifrons	phalange
567289	EPV.60679.062	Vertebrate Paleontology	25.62	Bison latifrons	sesamoid
567290	EPV.60679.063	Vertebrate Paleontology	25.63	Bison latifrons	malleolus
567291	EPV.60679.064	Vertebrate Paleontology	25.64	Bison latifrons	rib

567264	EPV.60679.037	Vertebrate Paleontology	25.37	Bison latifrons	calcaneum
567282	EPV.60679.055	Vertebrate Paleontology	25.55	Bison latifrons	calcaneum
667284	EPV.120399	Vertebrate Paleontology	56.606	Bison latifrons	molar
558025	EPV.66964	Vertebrate Paleontology	33.024	Bison latifrons	part skull horncore
558026	EPV.66965	Vertebrate Paleontology	59.036	Bison latifrons	part skull_x000D_ horncore
558027	EPV.66966	Vertebrate Paleontology	56.294	Bison latifrons	part skull horncore
558028	EPV.66967	Vertebrate Paleontology	13.009	Bison latifrons	part skull_x000D_ horncore
558029	EPV.66968	Vertebrate Paleontology	48.536	Bison latifrons	part skull_x000D_ horncore
563546	EPV.67500	Vertebrate Paleontology	42.023_x000D_ 59.014_x000D_ 59.013	Bison latifrons	mandible
563547	EPV.67501	Vertebrate Paleontology	68.006	Bison latifrons	mandible
563548	EPV.67502	Vertebrate Paleontology	54.252	Bison latifrons	mandible
563549	EPV.67503	Vertebrate Paleontology	65.016	Bison latifrons	mandible
563550	EPV.67504	Vertebrate Paleontology	54.177_x000D_ 54.283	Bison latifrons	mandible
563551	EPV.67505	Vertebrate Paleontology	59.168_x000D_ 59.173_x000D_ 42.125	Bison latifrons	mandible
563552	EPV.67506	Vertebrate Paleontology	56.577	Bison latifrons	tooth
563553	EPV.67507	Vertebrate Paleontology	34.082	Bison latifrons	tooth
563554	EPV.67508	Vertebrate Paleontology	59.184	Bison latifrons	tooth
563555	EPV.67509	Vertebrate Paleontology	59.014	Bison latifrons	tooth
563556	EPV.67511	Vertebrate Paleontology	50.001	Bison latifrons	mandible
563557	EPV.67512	Vertebrate Paleontology	58.394	Bison latifrons	tooth

563558	EPV.67513	Vertebrate Paleontology	56.322	Bison latifrons	maxilla
563559	EPV.67514	Vertebrate Paleontology	34.008	Bison latifrons	maxilla
563560	EPV.67515	Vertebrate Paleontology	42.099	Bison latifrons	mandible
563561	EPV.67516	Vertebrate Paleontology	39.010	Bison latifrons	tooth
563562	EPV.67517	Vertebrate Paleontology	60.022	Bison latifrons	tooth
563563	EPV.67518	Vertebrate Paleontology	59.123	Bison latifrons	maxilla
563564	EPV.67519	Vertebrate Paleontology	59.005	Bison latifrons	maxilla
563565	EPV.67520	Vertebrate Paleontology	63.069	Bison latifrons	tooth
563566	EPV.67521	Vertebrate Paleontology	45.003	Bison latifrons	tooth
563567	EPV.67522	Vertebrate Paleontology	58.446	Bison latifrons	tooth
563568	EPV.67523	Vertebrate Paleontology	70.033	Bison latifrons	tooth
563569	EPV.67524	Vertebrate Paleontology	59.020	Bison latifrons	tooth
563570	EPV.67525	Vertebrate Paleontology	58.036	Bison latifrons	tooth
563571	EPV.67526	Vertebrate Paleontology	66.534	Bison latifrons	tooth
563572	EPV.67527	Vertebrate Paleontology	44.225	Bison latifrons	tooth
563573	EPV.67528	Vertebrate Paleontology	59.143	Bison latifrons	tooth
563574	EPV.67529	Vertebrate Paleontology	14.008	Bison latifrons	metatarsal
563575	EPV.67530	Vertebrate Paleontology	34.422	Bison latifrons	metatarsal
563576	EPV.67531	Vertebrate Paleontology	42.024	Bison latifrons	metatarsal
563577	EPV.67532	Vertebrate Paleontology	63.123	Bison latifrons	metatarsal
563578	EPV.67533	Vertebrate Paleontology	34.435	Bison latifrons	metacarpal
563579	EPV.67534	Vertebrate Paleontology	100.038	Bison latifrons	metatarsal
563580	EPV.67535	Vertebrate Paleontology	42.102	Bison latifrons	mandible
563581	EPV.67536	Vertebrate Paleontology	77.005	Bison latifrons	metacarpal

563582	EPV.67537	Vertebrate Paleontology	56.075	Bison latifrons	metatarsal
563583	EPV.67538	Vertebrate Paleontology	64.225	Bison latifrons	radius
563584	EPV.67539	Vertebrate Paleontology	56.083	Bison latifrons	tibia
563585	EPV.67540	Vertebrate Paleontology	30.071	Bison latifrons	patella
563586	EPV.67541	Vertebrate Paleontology	42.122	Bison latifrons	patella
563587	EPV.67542	Vertebrate Paleontology	14.009	Bison latifrons	tibia
563588	EPV.67543	Vertebrate Paleontology	54.258	Bison latifrons	metacarpal
563589	EPV.67544	Vertebrate Paleontology	48.108	Bison latifrons	femur
563590	EPV.67545	Vertebrate Paleontology	23.097	Bison latifrons	tibia
563591	EPV.67546	Vertebrate Paleontology	58.061	Bison latifrons	tibia
563592	EPV.67547	Vertebrate Paleontology	100.033	Bison latifrons	metatarsal
563593	EPV.67548	Vertebrate Paleontology	36.002	Bison latifrons	radius
563594	EPV.67549	Vertebrate Paleontology	68.043	Bison latifrons	femur
562991	EPV.67600	Vertebrate Paleontology	34.015	Bison latifrons	femur
562992	EPV.67601	Vertebrate Paleontology	34.429	Bison latifrons	femur
562993	EPV.67602	Vertebrate Paleontology	59.104	Bison latifrons	tibia
562994	EPV.67603	Vertebrate Paleontology	69.308	Bison latifrons	tibia
562995	EPV.67604	Vertebrate Paleontology	56.388	Bison latifrons	femur
562996	EPV.67605	Vertebrate Paleontology	56.283	Bison latifrons	femur
562997	EPV.67606	Vertebrate Paleontology	34.105	Bison latifrons	radius
562998	EPV.67607	Vertebrate Paleontology	33.091	Bison latifrons	radius
562999	EPV.67608	Vertebrate Paleontology	64.223	Bison latifrons	humerus
563000	EPV.67609	Vertebrate Paleontology	59.015	Bison latifrons	humerus

563001	EPV.67610	Vertebrate Paleontology	54.261_x000D_54.288	Bison latifrons	radius
563002	EPV.67611	Vertebrate Paleontology	54.2	Bison latifrons	radius
563003	EPV.67612	Vertebrate Paleontology	54.239	Bison latifrons	humerus
563004	EPV.67613	Vertebrate Paleontology	59.133	Bison latifrons	humerus
563005	EPV.67614	Vertebrate Paleontology	64.207	Bison latifrons	humerus
563006	EPV.67615	Vertebrate Paleontology	68.021	Bison latifrons	humerus
563007	EPV.67616	Vertebrate Paleontology	48.031	Bison latifrons	humerus
563008	EPV.67617	Vertebrate Paleontology	82.065	Bison latifrons	humerus
563009	EPV.67618	Vertebrate Paleontology	53.002	Bison latifrons	humerus
563010	EPV.67619	Vertebrate Paleontology	47.028	Bison latifrons	vertebrae
563011	EPV.67620	Vertebrate Paleontology	66.546	Bison latifrons	vertebra
563012	EPV.67621	Vertebrate Paleontology	42.009	Bison latifrons	vertebra
563013	EPV.67622	Vertebrate Paleontology	56.071	Bison latifrons	vertebra
563014	EPV.67623	Vertebrate Paleontology	44.086	Bison latifrons	vertebra
563015	EPV.67624	Vertebrate Paleontology	54.113	Bison latifrons	vertebra
563016	EPV.67625	Vertebrate Paleontology	59.04	Bison latifrons	vertebra
563017	EPV.67626	Vertebrate Paleontology	64.294	Bison latifrons	vertebra
563018	EPV.67627	Vertebrate Paleontology	56.362	Bison latifrons	vertebra
563019	EPV.67628	Vertebrate Paleontology	42.068	Bison latifrons	vertebra
563020	EPV.67629	Vertebrate Paleontology	54.175	Bison latifrons	vertebra
563021	EPV.67630	Vertebrate Paleontology	58.398	Bison latifrons	vertebra
563022	EPV.67631	Vertebrate Paleontology	80.014	Bison latifrons	vertebra
563023	EPV.67632	Vertebrate Paleontology	48.045	Bison latifrons	vertebra

563024	EPV.67633	Vertebrate Paleontology	58.371	Bison latifrons	vertebra
563025	EPV.67634	Vertebrate Paleontology	34.431	Bison latifrons	vertebra
563026	EPV.67635	Vertebrate Paleontology	69.149	Bison latifrons	vertebra
563027	EPV.67636	Vertebrate Paleontology	81.037	Bison latifrons	vertebra
563028	EPV.67637	Vertebrate Paleontology	58.001	Bison latifrons	vertebra
563029	EPV.67638	Vertebrate Paleontology	69.029	Bison latifrons	vertebra
563030	EPV.67639	Vertebrate Paleontology	74.007	Bison latifrons	rib
563031	EPV.67640	Vertebrate Paleontology	59.031	Bison latifrons	axis
563032	EPV.67641	Vertebrate Paleontology	69.192	Bison latifrons	vertebra
563033	EPV.67642	Vertebrate Paleontology	54.201	Bison latifrons	vertebra
563034	EPV.67643	Vertebrate Paleontology	54.166	Bison latifrons	vertebra
563035	EPV.67644	Vertebrate Paleontology	59.001	Bison latifrons	vertebra
563036	EPV.67645	Vertebrate Paleontology	59.19	Bison latifrons	atlas
563037	EPV.67646	Vertebrate Paleontology	54.221	Bison latifrons	axis
563038	EPV.67647	Vertebrate Paleontology	71.137	Bison latifrons	vertebra
563039	EPV.67648	Vertebrate Paleontology	69.195	Bison latifrons	vertebra
563040	EPV.67649	Vertebrate Paleontology	58.096	Bison latifrons	
562905	EPV.67950	Vertebrate Paleontology	59.165	Bison latifrons	vertebra
562906	EPV.67951	Vertebrate Paleontology	71.042	Bison latifrons	vertebra
562907	EPV.67952	Vertebrate Paleontology	58.399	Bison latifrons	vertebra
562908	EPV.67953	Vertebrate Paleontology	34.016	Bison latifrons	vertebra
562909	EPV.67954	Vertebrate Paleontology	33.028	Bison latifrons	vertebra
562654	EPV.69450	Vertebrate Paleontology	59.023	Bison latifrons	vertebra
562655	EPV.69451	Vertebrate Paleontology		Bison latifrons	metatarsal

562656	EPV.69452	Vertebrate Paleontology	42.016	Bison latifrons	vertebra
562657	EPV.69453	Vertebrate Paleontology	80.005	Bison latifrons	vertebra
562658	EPV.69454	Vertebrate Paleontology	58.126	Bison latifrons	vertebra
562659	EPV.69455	Vertebrate Paleontology	81.053	Bison latifrons	vertebra
562660	EPV.69456	Vertebrate Paleontology	59.134	Bison latifrons	vertebra
562661	EPV.69457	Vertebrate Paleontology	64.293	Bison latifrons	vertebra
562662	EPV.69458	Vertebrate Paleontology	5.011	Bison latifrons	vertebra
562663	EPV.69459	Vertebrate Paleontology	56.219	Bison latifrons	vertebra
562664	EPV.69460	Vertebrate Paleontology	60.087	Bison latifrons	vertebra
562665	EPV.69461	Vertebrate Paleontology	54.109	Bison latifrons	vertebra
562666	EPV.69462	Vertebrate Paleontology	42.020	Bison latifrons	vertebra
562667	EPV.69463	Vertebrate Paleontology	59.026	Bison latifrons	vertebra
562668	EPV.69464	Vertebrate Paleontology	59.114	Bison latifrons	vertebra
562669	EPV.69465	Vertebrate Paleontology	56.081	Bison latifrons	vertebra
562670	EPV.69466	Vertebrate Paleontology	44.005	Bison latifrons	vertebra
562671	EPV.69467	Vertebrate Paleontology	42.012	Bison latifrons	vertebra
562672	EPV.69468	Vertebrate Paleontology	80.016	Bison latifrons	vertebra
562673	EPV.69469	Vertebrate Paleontology	44.032	Bison latifrons	vertebra
562674	EPV.69470	Vertebrate Paleontology	34.010	Bison latifrons	vertebra
562675	EPV.69471	Vertebrate Paleontology	23.005	Bison latifrons	vertebra
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562677	EPV.69473	Vertebrate Paleontology	54.091	Bison latifrons	vertebra
562678	EPV.69474	Vertebrate Paleontology	42.121	Bison latifrons	vertebra
562679	EPV.69475	Vertebrate Paleontology	41.001	Bison latifrons	vertebra

562680	EPV.69476	Vertebrate Paleontology	65.014	Bison latifrons	vertebra
562681	EPV.69477	Vertebrate Paleontology	42.011	Bison latifrons	vertebra
562682	EPV.69478	Vertebrate Paleontology	34.171	Bison latifrons	vertebra
562683	EPV.69479	Vertebrate Paleontology	54.023	Bison latifrons	vertebra
562684	EPV.69480	Vertebrate Paleontology	59.025	Bison latifrons	vertebra
562685	EPV.69481	Vertebrate Paleontology	56.188	Bison latifrons	vertebra
562686	EPV.69482	Vertebrate Paleontology	65.018	Bison latifrons	vertebra
562687	EPV.69483	Vertebrate Paleontology	54.181	Bison latifrons	vertebra
562688	EPV.69484	Vertebrate Paleontology	54.253	Bison latifrons	vertebra
562689	EPV.69485	Vertebrate Paleontology	44.263	Bison latifrons	vertebra
562690	EPV.69486	Vertebrate Paleontology	34.074	Bison latifrons	vertebra
562691	EPV.69487	Vertebrate Paleontology	58.358	Bison latifrons	vertebra
562692	EPV.69488	Vertebrate Paleontology	54.116	Bison latifrons	vertebra
562693	EPV.69489	Vertebrate Paleontology	54.289	Bison latifrons	vertebra
562694	EPV.69490	Vertebrate Paleontology	59.183	Bison latifrons	rib
562695	EPV.69491	Vertebrate Paleontology	58.196	Bison latifrons	rib
562696	EPV.69492	Vertebrate Paleontology	58.130	Bison latifrons	rib
562697	EPV.69493	Vertebrate Paleontology	54.284	Bison latifrons	rib
562698	EPV.69494	Vertebrate Paleontology	77.107	Bison latifrons	rib
562699	EPV.69495	Vertebrate Paleontology	63.043	Bison latifrons	rib
562700	EPV.69496	Vertebrate Paleontology	44.143	Bison latifrons	rib
562701	EPV.69497	Vertebrate Paleontology	59.018	Bison latifrons	rib
562702	EPV.69498	Vertebrate Paleontology	59.107	Bison latifrons	rib

562703	EPV.69499	Vertebrate Paleontology	65.015_x000D_58.357	Bison latifrons	rib
561910	EPV.69800	Vertebrate Paleontology	58.485	Bison latifrons	rib
561911	EPV.69801	Vertebrate Paleontology	58.007	Bison latifrons	rib
561912	EPV.69802	Vertebrate Paleontology	59.121	Bison latifrons	rib
561913	EPV.69803	Vertebrate Paleontology	59.169	Bison latifrons	rib
561914	EPV.69804	Vertebrate Paleontology	42.025	Bison latifrons	rib
561915	EPV.69805	Vertebrate Paleontology	54.188	Bison latifrons	rib
561916	EPV.69806	Vertebrate Paleontology	14.010	Bison latifrons	rib
561917	EPV.69807	Vertebrate Paleontology	42.033	Bison latifrons	rib
561918	EPV.69808	Vertebrate Paleontology	34.017	Bison latifrons	rib
561919	EPV.69809	Vertebrate Paleontology	48.046	Bison latifrons	rib
561920	EPV.69810	Vertebrate Paleontology	56.022	Bison latifrons	rib
561921	EPV.69811	Vertebrate Paleontology	34.175	Bison latifrons	rib
561922	EPV.69812	Vertebrate Paleontology	34.107	Bison latifrons	rib
561923	EPV.69813	Vertebrate Paleontology	23.034	Bison latifrons	rib
561924	EPV.69814	Vertebrate Paleontology	54.218	Bison latifrons	rib
561925	EPV.69815	Vertebrate Paleontology	54.259	Bison latifrons	rib
561926	EPV.69816	Vertebrate Paleontology	56.098	Bison latifrons	rib
561927	EPV.69817	Vertebrate Paleontology	44.065	Bison latifrons	rib
561928	EPV.69818	Vertebrate Paleontology	54.286	Bison latifrons	rib
561929	EPV.69819	Vertebrate Paleontology	54.115	Bison latifrons	rib
561930	EPV.69820	Vertebrate Paleontology	54.214	Bison latifrons	rib
561931	EPV.69821	Vertebrate Paleontology	54.275	Bison latifrons	rib

561932	EPV.69822	Vertebrate Paleontology	54.043	Bison latifrons	rib
561933	EPV.69823	Vertebrate Paleontology	34.167	Bison latifrons	rib
561934	EPV.69824	Vertebrate Paleontology	59.178	Bison latifrons	rib
561935	EPV.69825	Vertebrate Paleontology	23.057	Bison latifrons	rib
561936	EPV.69826	Vertebrate Paleontology	56.536	Bison latifrons	rib
561937	EPV.69827	Vertebrate Paleontology	58.042	Bison latifrons	rib
561938	EPV.69828	Vertebrate Paleontology	33.237	Bison latifrons	rib
561939	EPV.69829	Vertebrate Paleontology	59.175	Bison latifrons	rib
561940	EPV.69830	Vertebrate Paleontology	34.403	Bison latifrons	rib
561941	EPV.69831	Vertebrate Paleontology	59.148	Bison latifrons	rib
561942	EPV.69832	Vertebrate Paleontology	58.103	Bison latifrons	rib
561943	EPV.69833	Vertebrate Paleontology	54.285	Bison latifrons	rib
561944	EPV.69834	Vertebrate Paleontology	56.626	Bison latifrons	rib
561945	EPV.69835	Vertebrate Paleontology	44.128	Bison latifrons	rib
561946	EPV.69836	Vertebrate Paleontology	62.011	Bison latifrons	rib
561947	EPV.69837	Vertebrate Paleontology	58.053	Bison latifrons	rib
561948	EPV.69838	Vertebrate Paleontology	56.251	Bison latifrons	rib
561949	EPV.69839	Vertebrate Paleontology	64.256	Bison latifrons	rib
561950	EPV.69840	Vertebrate Paleontology	82.227	Bison latifrons	rib
561951	EPV.69841	Vertebrate Paleontology	59.191	Bison latifrons	rib
561952	EPV.69842	Vertebrate Paleontology	60.021	Bison latifrons	rib
561953	EPV.69843	Vertebrate Paleontology	66.596	Bison latifrons	rib
561954	EPV.69844	Vertebrate Paleontology	45.083	Bison latifrons	rib
561955	EPV.69845	Vertebrate Paleontology	74.006	Bison latifrons	rib

561956	EPV.69846	Vertebrate Paleontology	56.337	Bison latifrons	rib
561957	EPV.69847	Vertebrate Paleontology	77.101	Bison latifrons	rib
561958	EPV.69848	Vertebrate Paleontology	56.513	Bison latifrons	rib
561959	EPV.69849	Vertebrate Paleontology	56.128	Bison latifrons	rib
561726	EPV.69950	Vertebrate Paleontology	59.131	Bison latifrons	rib
561727	EPV.69951	Vertebrate Paleontology	23.082	Bison latifrons	rib
561728	EPV.69952	Vertebrate Paleontology	56.129	Bison latifrons	rib
561729	EPV.69953	Vertebrate Paleontology	2.027	Bison latifrons	rib
561730	EPV.69954	Vertebrate Paleontology	23.087	Bison latifrons	rib
561731	EPV.69955	Vertebrate Paleontology	42.002	Bison latifrons	rib
561732	EPV.69956	Vertebrate Paleontology	59.001	Bison latifrons	rib
561733	EPV.69957	Vertebrate Paleontology	34.169	Bison latifrons	rib
561734	EPV.69958	Vertebrate Paleontology	23.X	Bison latifrons	rib
561735	EPV.69959	Vertebrate Paleontology	56.072	Bison latifrons	rib
561736	EPV.69960	Vertebrate Paleontology	44.040	Bison latifrons	rib
561737	EPV.69961	Vertebrate Paleontology	59.003	Bison latifrons	rib
561738	EPV.69962	Vertebrate Paleontology	69.113	Bison latifrons	rib
561739	EPV.69963	Vertebrate Paleontology	68.006	Bison latifrons	rib
561740	EPV.69964	Vertebrate Paleontology	56.130	Bison latifrons	rib
561741	EPV.69965	Vertebrate Paleontology	59.161	Bison latifrons	rib
561742	EPV.69966	Vertebrate Paleontology	59.115	Bison latifrons	rib
561743	EPV.69967	Vertebrate Paleontology	59.019	Bison latifrons	rib
561744	EPV.69968	Vertebrate Paleontology	23.093	Bison latifrons	rib
561745	EPV.69969	Vertebrate Paleontology	44.009	Bison latifrons	rib

561746	EPV.69970	Vertebrate Paleontology	58.368	Bison latifrons	rib
561747	EPV.69971	Vertebrate Paleontology	12.002	Bison latifrons	rib
561748	EPV.69972	Vertebrate Paleontology	59.124	Bison latifrons	rib
561749	EPV.69973	Vertebrate Paleontology	56.232	Bison latifrons	rib
561750	EPV.69974	Vertebrate Paleontology	42.015	Bison latifrons	rib
561751	EPV.69975	Vertebrate Paleontology	44.097	Bison latifrons	rib
561752	EPV.69976	Vertebrate Paleontology	42.071	Bison latifrons	rib
561753	EPV.69977	Vertebrate Paleontology	59.021	Bison latifrons	rib
561754	EPV.69978	Vertebrate Paleontology	34.432	Bison latifrons	rib
561755	EPV.69979	Vertebrate Paleontology	56.575	Bison latifrons	rib
561756	EPV.69980	Vertebrate Paleontology	59.032	Bison latifrons	rib
561757	EPV.69981	Vertebrate Paleontology	69.060	Bison latifrons	rib
561758	EPV.69982	Vertebrate Paleontology	56.141	Bison latifrons	rib
561759	EPV.69983	Vertebrate Paleontology	54.008	Bison latifrons	rib
561760	EPV.69984	Vertebrate Paleontology	23.D	Bison latifrons	rib
561761	EPV.69985	Vertebrate Paleontology	59.125	Bison latifrons	calcaneum
561762	EPV.69986	Vertebrate Paleontology	84.035	Bison latifrons	astragalus
561763	EPV.69987	Vertebrate Paleontology	42.132	Bison latifrons	tarsal
561764	EPV.69988	Vertebrate Paleontology	34.402	Bison latifrons	tarsal
561765	EPV.69989	Vertebrate Paleontology	56.218	Bison latifrons	astragalus
561766	EPV.69990	Vertebrate Paleontology	12.002	Bison latifrons	phalange
561767	EPV.69991	Vertebrate Paleontology	56.279	Bison latifrons	phalange
561768	EPV.69992	Vertebrate Paleontology	59.017	Bison latifrons	phalange
561769	EPV.69993	Vertebrate Paleontology	42.057	Bison latifrons	phalange

561770	EPV.69994	Vertebrate Paleontology	65.011	Bison latifrons	phalange
561771	EPV.69995	Vertebrate Paleontology	65.020	Bison latifrons	phalange
561772	EPV.69996	Vertebrate Paleontology	70.001	Bison latifrons	phalange
561773	EPV.69997	Vertebrate Paleontology	59.193	Bison latifrons	phalange
561774	EPV.69998	Vertebrate Paleontology	64.054	Bison latifrons	carpal
561775	EPV.69999	Vertebrate Paleontology	69.302	Bison latifrons	phalange
560811	EPV.71171	Vertebrate Paleontology	48.142	Bison latifrons	pelvis
560812	EPV.71172	Vertebrate Paleontology	59.111	Bison latifrons	innominate
560813	EPV.71173	Vertebrate Paleontology	56.052	Bison latifrons	pelvis
560814	EPV.71174	Vertebrate Paleontology	59.192	Bison latifrons	innominate
560815	EPV.71175	Vertebrate Paleontology	59.157	Bison latifrons	innominate
560816	EPV.71176	Vertebrate Paleontology	23.094	Bison latifrons	innominate
560817	EPV.71177	Vertebrate Paleontology	48.607	Bison latifrons	innominate
560818	EPV.71178	Vertebrate Paleontology	59.167	Bison latifrons	innominate
560819	EPV.71179	Vertebrate Paleontology	59.029	Bison latifrons	part skull
560820	EPV.71180	Vertebrate Paleontology	54.205	Bison latifrons	sacrum
560821	EPV.71181	Vertebrate Paleontology	23-P	Bison latifrons	innominate
560822	EPV.71182	Vertebrate Paleontology	59.102	Bison latifrons	sacrum
560823	EPV.71183	Vertebrate Paleontology	45.088	Bison latifrons	scapula
560824	EPV.71184	Vertebrate Paleontology	36.001	Bison latifrons	scapula
560825	EPV.71185	Vertebrate Paleontology	37.001	Bison latifrons	scapula
560826	EPV.71186	Vertebrate Paleontology	42.005	Bison latifrons	sacrum
560827	EPV.71187	Vertebrate Paleontology	34.063	Bison latifrons	rib
560828	EPV.71188	Vertebrate Paleontology	64.010	Bison latifrons	pelvis

560829	EPV.71189	Vertebrate Paleontology	56.175	Bison latifrons	rib
560830	EPV.71190	Vertebrate Paleontology	69.025	Bison latifrons	bone
560831	EPV.71191	Vertebrate Paleontology	42.036	Bison latifrons	scapula
560832	EPV.71192	Vertebrate Paleontology	57.006	Bison latifrons	skull fragment
560833	EPV.71193	Vertebrate Paleontology	66.556	Bison latifrons	skull fragment
560834	EPV.71194	Vertebrate Paleontology	42.050	Bison latifrons	bone
560835	EPV.71195	Vertebrate Paleontology	69.139	Bison latifrons	skull fragment
560836	EPV.71196	Vertebrate Paleontology	59.008	Bison latifrons	skull fragment
560837	EPV.71197	Vertebrate Paleontology	58.002	Bison latifrons	skull fragment
560838	EPV.71198	Vertebrate Paleontology	58.162	Bison latifrons	skull fragments
560839	EPV.71199	Vertebrate Paleontology	59.033	Bison latifrons	skull fragments
564264	EPV.73000	Vertebrate Paleontology	45.103	Bison latifrons	nasal
564265	EPV.73001	Vertebrate Paleontology	59.035	Bison latifrons	zygomatic arch
564266	EPV.73002	Vertebrate Paleontology	59.152	Bison latifrons	skull fragments
564267	EPV.73003	Vertebrate Paleontology	58.161	Bison latifrons	skull fragments
564268	EPV.73004	Vertebrate Paleontology	56.552	Bison latifrons	skull fragment
564269	EPV.73005	Vertebrate Paleontology	60.106	Bison latifrons	skull fragments
564270	EPV.73006	Vertebrate Paleontology	48.556	Bison latifrons	nasal
564271	EPV.73007	Vertebrate Paleontology	56.233	Bison latifrons	nasal
564272	EPV.73008	Vertebrate Paleontology	48.573	Bison latifrons	mandible
564273	EPV.73009	Vertebrate Paleontology	54.271	Bison latifrons	skull fragment
564274	EPV.73010	Vertebrate Paleontology	71.074	Bison latifrons	skull fragment
564275	EPV.73011	Vertebrate Paleontology	65.022	Bison latifrons	mandible
564276	EPV.73012	Vertebrate Paleontology	59.137	Bison latifrons	horn

564277	EPV.73013	Vertebrate Paleontology	59.036	Bison latifrons	skull fragments
564278	EPV.73014	Vertebrate Paleontology	56.591	Bison latifrons	bone fragment
564279	EPV.73015	Vertebrate Paleontology	23.054	Bison latifrons	bone fragment
564280	EPV.73016	Vertebrate Paleontology	54.229	Bison latifrons	atlas
564281	EPV.73017	Vertebrate Paleontology	69.018	Bison latifrons	skull
564282	EPV.73018	Vertebrate Paleontology	44.226	Bison latifrons	bone fragment
564283	EPV.73019	Vertebrate Paleontology	59.039_x000D_42.048	Bison latifrons	nasal
564284	EPV.73020	Vertebrate Paleontology	70.021	Bison latifrons	vertebra
564285	EPV.73021	Vertebrate Paleontology	34.174	Bison latifrons	tibia
564286	EPV.73022	Vertebrate Paleontology	58.098	Bison latifrons	sacrum
564287	EPV.73023	Vertebrate Paleontology	33.105	Bison latifrons	skull fragment
564288	EPV.73024	Vertebrate Paleontology	33.024	Bison latifrons	horn
564289	EPV.73025	Vertebrate Paleontology	56.571	Bison latifrons	horn
564290	EPV.73026	Vertebrate Paleontology	48.536_x000D_48.566	Bison latifrons	horn
564291	EPV.73027	Vertebrate Paleontology	56.229	Bison latifrons	horn
564292	EPV.73028	Vertebrate Paleontology	33.024	Bison latifrons	horn

APPENDIX I: Ziegler Reservoir Fossil Site (5PT1264) Discussion

Addendum I
Ziegler Reservoir Fossil Site Discussion

Plate 1. Ziegler Reservoir, Colorado

The earliest evidence of bison in the west-central Colorado project area is attributed to the Ziegler Reservoir Fossil Site (ZRFS), 5PT1264, (Plate 1). Commonly referred to as the Snowmastadon Site, it is located in Pitkin County, Colorado less than one mile west of Snowmass Village between Brush Creek and Snowmass Creek in the west-central region of the study area. The ancient lake, formed by the lateral lobe of a glacier approximately 130,000 ybp during Marine Oxygen Isotope Stage (MIS) 6, is situated in the basin of an enclosing glacial moraine. It was alternately inundated with glacial run-off and filled with sediments that ultimately covered and preserved a veritable gold mine of Ice Age fossils. Long after the extinction of the Pleistocene fauna, approximately 20,000 years ago, the later glacial rivers of ice which crept along the surrounding moraines did not affect the lake or disrupt the sediments and fossils therein. The result was a series of exceptionally preserved dateable strata from which over 35,500 fossil bones were recovered. The paleo-biotic community is represented by an astonishing variety of flora and fauna. A broad diversity of mega and macro fauna including mastodon, mammoth, bison, ground sloth, bear, camel, horse, and canids were preserved in the sediments. Macro and micro flora and a wide variety of reptiles, insects, and molluscs were also recovered from the site (Johnson and Miller 2012).

In 1958 Doug Ziegler, a local cattle rancher, constructed a five acre reservoir in the basin which was later transferred to the Snowmass Water & Sanitation District (SWSD). On October 14, 2010, SWSD bulldozer operator Jesse Steele while engaged in construction to expand the reservoir (which had been drained for the purpose) exposed several large rib bones, vertebra, and a mammoth tusk (. Officials from SWSD quickly contacted the Denver Museum of Nature and History (DMNH) and a contingency of scientists and United States Geological Survey (USGS) representatives soon arrived to inspect the site. The discovery was immediately identified as

significant and what ensued was a remarkable cooperative effort between SWSD personnel, the USGS, DMNH scientists, and many volunteers who initiated and engaged in a rapid paleontological salvage excavation over a brief period of only 18 days in the Fall of 2010 and 51 days in the Summer of 2011 (Plate 2). Upon completion of the effort the reservoir was again inundated. Excavation of the site produced several thousand vertebrate, invertebrate, and floral specimens from the sediments of the ancient alpine lake. Among the 50 species recovered from the site were 35 *Mammut* americanum (American mastodon), four *Mammuthus* columbi (Columbian mammoth), five Bison latifrons (Giant long horned bison), a number of unidentified bison species, a Megalonyx jeffersonii (Jefferson's ground sloth), a camel, and a multitude of smaller mammals, reptiles, amphibians, fish, molluscs, and insects. Upon completion of work it became clear that the Ziegler Reservoir Fossil Site was one of the most remarkable and important Pleistocene fossil sites ever discovered.

Plate 2. ZRFS excavation near spillway Summer of 2011.

The occurrence of such a large number of *M.* americanum and the presence of *M.* columbi in the same location is unprecedented in American paleontology and at 2700 meters above sea level ZRFS is the most complete high elevation MIS 5 terrestrial site known in North America. The ecosystems of high elevation sites such as ZRFS were extremely sensitive to climate change and therefore, remnant paleoecology has the potential to reveal important information regarding how the environment responded over time to paleoclimatic changes. As the ZRFS strata was minimally disrupted by natural or human induced impact, evidence of its response to past climate fluctuations are well preserved in the stratigraphic sediments and paleoecologic specimens that lie therein. Information resulting from ZRFS research is presently being applied to modern climate variability studies.

The sequential sediments of the ZRFS and the fossil specimens they encased represent a Pleistocene ecosystem spanning a period form 140,000 to 55,000 years ago (Johnson and Miller 2012) and include the end of Marine Oxygen Isotope (MIS) 6, all of MIS 5 and MIS 4, and the beginning of MIS 3. The site was excavated to glacial till with the oldest sediments dating to

~140,000 ybp, a time of extensive glaciation. As described by Sertich et al. (2014) using three well defined stratigraphic tie points within the site scientists were enabled to confidently establish a correlation between the lake center and the lake margins thereby confidently assigning date ranges. Fossil assemblages from the site occur in two well defined categories. The first is the Lake-Margin group dated at ~140,000 ybp through ~100,000 ybp, and was a warm climate falling within the Last Interglacial Period and spanning all of MIS 5. During this period open-lake and woodland taxa were present. The majority of mastodons, *B.* latifrons and other megafauna which thrived in this type of environment occur during this period. No fossils were evident in the sedimentary sequences between ~100,000 to 87,000 ybp as it was a severely cold period. The second category is the Lake-Center group dating from ~87,000 ybp to 77,000 ybp and consisting of an open wetland hosting cooler climate taxa. The landscape was dominated by grasslands and M. columbi, bison sp., and many other fauna returned to the ecosystem. By 55,000 ybp another glacial episode began and the fossil record at the site is significantly reduced.

A total of 402 bison bones (Addendum H) were excavated, processed, examined and collected by the ZRFS team between 2010 and 2011. All specimens are housed at the Denver Museum of Nature and History in Denver, Colorado and were graciously made available by the facility staff for direct examination by the project. All specimens were viewed and photographed with the majority situated on curation storage trays and not handled. Ten specimens were selected for hands on evaluation. These were removed from storage under supervision and examined visually and with the use of a 10X magnifying glass and a 50X-500X 0.3MP handheld multi-USB digital microscopic.

A faunal element assemblage representing at least five *Bison* latifrons were excavated at the site (Mahan et. al. 2014). The assemblage includes an almost complete *B*. latifrons cranium (DMNH EPV.60678) likely female (Plate 3), three partial crania that retained horn cores (DMNH EPV.66964, 66965, 66966), and a single relatively complete horn core (DMNH EPV.66967).

Plate 3. DMNH EPV.60678, *B*. latifrons cranium

A number of the postcranial elements could not be absolutely diagnosed as *Bison latifrons*. These post cranial specimens included long bones, jaws, jaw fragments, teeth, and various other bone fragments. Although these can not be firmly identified as *B.* latifrons, all were located in horizons dated at MIS 6-5c indicating that their origin as *B.* latifrons is a reasonable conclusion. Individual and articulated remains of unidentified bison species were recovered from the Lake-Center horizons and may represent species other than *B.* latifrons.

Of interest were a number of specimens exhibiting parallel and curvilinear scratches and striations on the external surfaces. Three of these are selected for discussion.

The first of these is DMNH EPV 69480, a nearly complete *Bison* latifrons thoracic vertebra (Plate 4) that presents with multiple scratch marks and striations. The marks are present on the bone surface near the base of the spinus process on the right side. Detailed examination reveled that a number of the finer marks are crosshatched while those closer to the base of the spinous process are parallel and deeper (Plate 5). They do not appear to be the result of rodent gnaw.

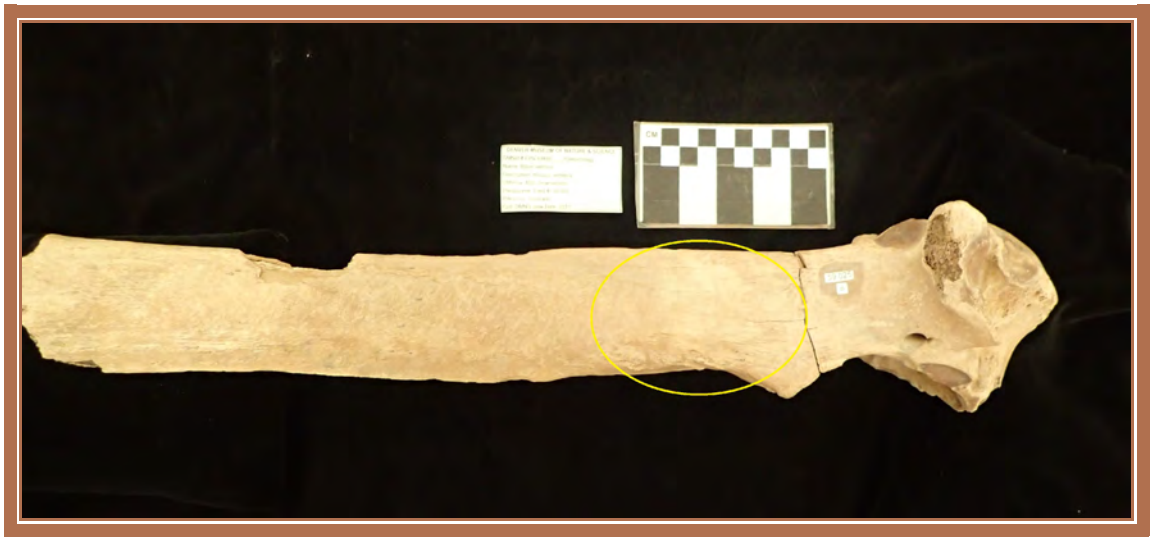

Plate 4. DMNH EPV 69480, Bison Latifrons thoracic vertebra showing area with striations and other marks encircled in yellow.

Low angle light used to create shadow clearly shows fine parallel marks and the crosshatching. The marks are covered with the same patina as the rest of the bone and do not appear to be caused by recent mechanical insult. The marks may be claw marks or simply due to abrasion from clasts and small stones or debris of the Ziegler Reservoir Fossil Site strata that in which the specimen moved and shifted over time. The fracture seam is not considered to be associated with the marks. It is observed that the marks do not occur over the entirety of the specimen surface as might be expected secondary to centuries of exposure to natural geologic processes.

Plate 5. DMNH EPV 69480, detail of marks.

A bison mandible (Plate 5), DMNH EPV 67504, has a large number of marks on buccal and lingual sides of the specimen. The majority of the marks appear to be obvious impact, scrape, and abrasion marks resulting from post mortem damage due to long term exposure to and movement within the sediments of the Ziegler Reservoir Fossil site. Several linear marks are visible across the surfaces and are possibly predator and scavenger marks (Plate 6). Among the many marks are several short parallel incise type marks on various surfaces of the bone. There cause is undetermined. The obvious fracture seam is not associated with the marks.

Plate 5. DMNH EPV 67504, a B. latifrons mandible with various marks.

Plate 6. DMNH EPV 67504, detail of marks on lingual aspect of bison mandible.

DMNH EPV 67609, is a humerus fragment (Plate 7) with a spiral fracture and various scrape, abrasion, and scratch marks. The cause of the spiral fracture is unknown and may have been induced by a predator or scavenger or it may be the result of pressure from a geological source. Spiral fractures are by no means specific to intentional human impact breakage. The surfaces of the fracture have a patina similar to the rest of the bone and do not appear to be modern. The marks are determined to be natural and though several do resemble stone tool cut marks, this is most unlikely.

Plate 7. DMNH EPV 67609, a humerus fragment with spiral fracture and various surficial marks.

A number of short, fine, linear marks present on the surface of the specimen are not congruent with rodent incisor marks but may be claw scratch marks. Close inspection shows that many of the marks are curvilinear and are likely the result predator or scavenger scraping at bone. The marks are multidirectional, of varied depth and width, and do not follow a set pattern.

Plate 8. DMNH EPV 67609, a with various bone surface marks.

The majority of the origin of the marks on all of the evaluated specimens, including the three discussed here, is suspected to be due to natural causes. Though a number of the marks resemble incised stone tool cut marks and are located on bone surface areas commonly subject to butchering evidence, non-cultural modification is assumed as the *Bison* latifrons bones were recovered from strata dated to MIS 5, a time period exempt of human occupation in North America. Though the marks are determined to be secondary to predator or scavenger activity that occurred shortly after death or a result of various natural hydraulic and geodynamic abrasion processes or both, further professional examination of some of the parallel incised type marks using a forensic microscope should confirm their natural origin or it might reveal unexpected results.

REFERENCES

Johnson, Kirk and Ian Miller

2012 *Digging Snowmastodon: Discovering an Ice Age World in the Colorado Rockies.* Denver, Colo.; Aspen, Colo.: Denver Museum of Nature & Science; People's Press.

Sertich, Joseph J. W., Richard K. Stucky, H. Gregory McDonald, Cody Newton, Daniel C. Fisher, Eric Scott, John R. Dembosky, Carol Lucking, Brianna K. McHorse, Edward B. Davis

2014 *High-elevation Late Pleistocene (MIS 6-5) Vertebrate Faunas from the Ziegler Reservoir Fossil Site, Snowmass Village, Colorado.* Quaternary Research, Volume 82, Issue 3, November 20, pp. 504-517.

APPENDIX J: Osteological Element Care for Museums

OSTEOLOGICAL ELEMENT PRESERVATION
A Basic Guide to Acquiring Information, Handling, Cleaning, Storing, and Displaying Osteological Specimens for Museum Curators and Staff.

In order to safely preserve archaeological objects in a museum it is important to manage and store items in manner that will not harm the artifact. The National Park Service Museum Management Program (https://www.nps.gov/museum/publications/handbook.html) Part I: Museum Collections (https://www.nps.gov/museum/publications/mhi/mhi.pdf), Appendix I (https://www.nps.gov/museum/publications/mhi/appendi.pdf) contains excellent information related to the management and safe storage of artifacts curated in museums.

Osteological (bone) specimens of a variety of animals are frequently found in museum collections. These specimens are valuable and useful for many reasons. When properly displayed they are intriguing to the public, sparking many questions and offering museum staff an opportunity to interact with and educate the museum visitor. They are powerful visual and tactile teaching aides for school children and the public enabling participants to see and sometimes touch rare specimens that are otherwise inaccessible. For the researcher and graduate student osteological specimens are indispensable in providing data and information specific to their area of study.

It is critically important that osteological specimens be cleaned, displayed and stored properly in order to assure that there is no damage to the bone or to any possible scientific evidence on or in the bone. The following steps will help your facility to effectively preserve both newly acquired and presently curated osteological specimens.

When humans hunt and butcher prey animals such as bison, bighorn sheep, pronghorn, and other game animals, they often leave marks on the bones. These marks are referred to as cultural modification and may consist of embedded objects including projectile points or bullets, gouges, indentations, holes, and cuts and scratches made by stone or metal tools. The information from the included Osteological (bone) Specimen Donor Questionnaire along with any cultural modification on the bone provides important information to researchers, historians, and students about how prehistoric and historic people used the animal and of how the animal lived and moved across the landscape.

Animal bones are often found and donated to museums by private individuals who feel the specimen holds some importance and should be cared for professionally. It is critical that all possible information related to the donated specimen be obtained from the person donating the item. This information helps researchers date a specimen and correctly associate it with the prehistoric or historic people who may have hunted the animal. The attached form will help your facility obtain critical information from donors.

The majority of bone that is donated does not have fresh or dried tissue on it and the included instructions for Handling, Cleaning, Storing, and Displaying Osteological Specimens apply to bone in this state.

Osteological (bone) Specimen Donor Questionnaire

FACILITY:_____

SPECIMEN: _____ CURATION NO.: _____
DONOR: _____ DATE: _____

Critical Questions to ask the Donor	**Response**
Where did you (or whoever) find it? *Have the donor mark on a map, as close as possible, where the specimen was found. Circling a general area is ok.*	Describe location: Please, attach the map (or a copy) to this form.
Was it on the surface? *Was it near a river, a creek, a canyon mouth, an arroyo, on a mesa, or in a creek bed or river-bed, or dry drainage?*	Describe:
Do you have a picture of the area where it was found? (*Request a copy of the picture.*)	Please, attach a copy of the picture to this form.
Was it eroding out of the soil? *If so, how deep was it? Did you have to dig it out? How hard was the soil it was in? What color was the soil it was in?*	Describe:
When was it found? *The date, the year or even the decade is helpful.*	Date:
Were there any other bones near it? Do you remember what they looked like? *Can you describe them? Long bones, short bones, ribs, vertebra, teeth?*	Describe:
Did you clean it with anything? If so what and how.	Describe:

Handling, Cleaning, Storing, and Displaying Osteological Specimens

While cleaning and handling a specimen it is important to not gouge or mark the surface of the bone as this could result in obscuring important evidence of cultural modification.

Steps for Safe Handling

Before touching the specimen:

1. Visually inspect the container it is in.
    a. If the container is stable-not deteriorating, collapsing, crumbling, or damp-temporarily leave the specimen in it.
    b. If the container is not stable place it on a safe surface where it will not be disturbed until it is safe to transfer the specimen to a stable container such as an acid free box, a clean cardboard box, or a clean surface.

2. Look for flash drives, documents, notes, photos, or papers in the container that might provide information about the specimen.
    a. remove these and place them in a file with a label that associates them with the specimen
    b. store the file in the facility filing system

3. Visually examine the specimen moving it as little as possible. Look for:
    a. damaged, broken pieces
    b. items that are not part of the specimen
    c. any foreign or embedded objects

4. Avoid removing embedded objects such as arrowheads, bullets, or other bone. If an embedded object is present in the bone:
    a. photograph the specimen with the embedded object in place and put the photo in the file associated with the specimen
    b. note the type of embedded object and the time and date in the file.
    c. note any witnesses in the file
    d. Contact an archaeologist or other specialist (see Interpretation and Analysis) to examine the specimen before you proceed. Holly Shelton of Dominquez Archaeological Research Group is available to inspect specimens. The contact numbers are: 970-589-6450 or 970-245-7868 .

5. Carefully remove loose soil and debris. It is helpful to save a cupful of the soil in a paper bag as it may provide information related to the specimen. With a permanent marker, label the paper bag with:
    a. the date
    b. a brief description of the specimen
    c. the identification number the museum has assigned to the specimen
    d. the name of the person who collected the soil
    e. store the soil in a cool, dry location

6. When the specimen is in a safe place and all loose rocks, pebbles, soil and debris have been removed visually inspect it again looking for and noting details such as cut marks or

embedded objects.

7. If there are no embedded objects you may begin the cleaning process as follows:

Steps for Cleaning

First, if wet or damp, allow the specimen to dry. Then:

- Using split bamboo pieces or bamboo skewers or chopsticks, soft brushes, gently pick and brush away dry loose and compacted soils and sediment from bone surfaces and crevasses.

- When cleaning with any of the above, the strokes should followed the “texture” or “grain” of the bone to prevent degradation or abrasion of the surface layers.

- When as much dry sediment as possible has been picked or brushed from the remains, the bone may then be cleaned using tap water in a basin and soft brushes.

    - Tap water is preferable to distilled or deionized water as the alkaline pH that will not adversely affect the integrity of the bone. Distilled or deionized water has a pH of about 6.5, which is the most destructive pH for bone due to resultant absorption of carbon dioxide from the atmosphere.

- A dental water-pic may used along with the thin pieces of split bamboo when working close to the bone surface to prevent damage to the bone.

- A spray bottle can be used to wet the bone and remove sediment in deep recesses.

- Do not saturate or immerse the specimen in water as this may result in flaking of the bone surface and deformation of the bone as it dries.

- A final rinse may be done with a spray bottle.

- Blot the bone dry with paper toweling and let it air dry in an approximately 72° F environment.

Steps for Storing and Displaying

- Store the bone in an acid free container or display in a secure, enclosed case on an acid free surface. Do not apply any preservative or substance to the surface of the bone.

- Avoid hanging specimens from a wall, decorating them with beads, or other artifacts, and placing them where visitors can touch or handle them.

- Label the specimen accurately.

- Contact and archaeologist or other specialist to examine the specimen.

Interpretation and Analysis

Interpretation of an artifact consists of carefully evaluating the specimen to assure correct identification and determination of other features of importance that might provide additional information.

If indicated, detailed analysis using scientific techniques may be employed by an archaeologist to glean additional information from the bone. Types of analysis include, but are not limited to evaluation of cultural modification, radiometric dating, DNA testing, and weathering stages.

Professionals who are available to examine osteological specimens donated or presently curated in a museum include:

- The Office of Archaeology & Historic Preservation and State Historical Fund, 1200 Broadway, Denver, CO, 80203 Phone: 303-447-8679.

- Holly Shelton (970-589-6450) sonny.shelton44@aol.com
- Dominquez Archaeological Research Group P.O. Box 3543, Grand Junction, CO 81502 Phone: 970-245-7868 Fax: 970-245-6317 Email: info@dargnet.org

APPENDIX K: General Distribution Map; and,
Maps with specific locations and optional satellite backgrounds are included as part of a database on:
dargnet.org/net/bison/bison.html