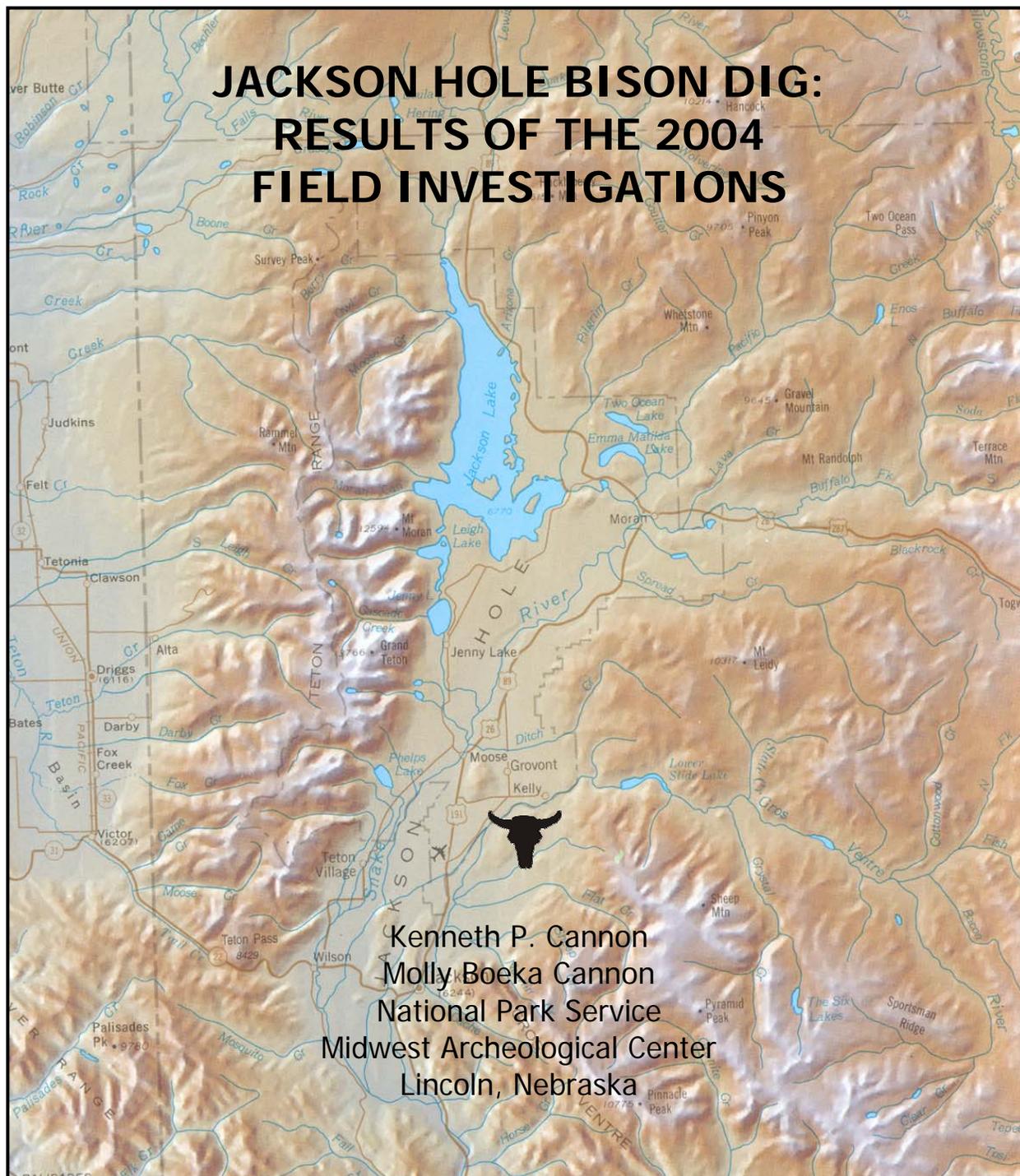


# JACKSON HOLE BISON DIG: RESULTS OF THE 2004 FIELD INVESTIGATIONS



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# **EARTHWATCH INSTITUTE FIELD REPORT**

## **JACKSON HOLE BISON DIG**

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## PART I

### Research Site:

The Goetz site (48TE455) is located on the National Elk Refuge in Jackson, Wyoming.

### Local Management Status of the Research Site:

United States Fish and Wildlife Service's National Elk Refuge

### Scientific names of primary species being studied:

*Bison bison*, *Cervus elaphus*

### Key Research Objectives:

#### Archeological research topics:

- ▼ What is the context of the bone bed uncovered in 1971?
- ▼ What was the method of bison procurement used by the prehistoric groups?
- ▼ What is the time depth of the site?
- ▼ Are there other deposits present at the site, or was this a single event?
- ▼ What was the role of bison in the aboriginal economy and what were the influences of humans on the bison populations?
- ▼ How does lithic acquisition and tool production compare to other sites in Jackson Hole? Has this pattern changed through time?
- ▼ Have there been changes in site function and mobility over the course of the Holocene?
- ▼ What impact do humans have on local ecosystems? How have bison reacted to past climate change?

#### Paleoenvironmental research topics:

- ▼ How long have bison resided in the Greater Yellowstone Ecosystem?
- ▼ What were the characteristics of the pre-contact bison populations?
- ▼ Holocene paleoecology of the eastern portion of Jackson Hole. Specifically, how does local paleoecology of the Goetz site relate to the model of vegetative change developed from the pollen record by Dr. Cathy Whitlock?
- ▼ What is the geomorphic history of the Goetz site in the context of regional climate change? How has the geomorphic history influenced human settlement?
- ▼ The role of other large mammals, such as elk and deer, in the precontact economy of Jackson Hole.
- ▼ What management decisions can be made to ensure viable populations of bison in light of our current understanding of future climate change?

**Date this report was completed:** 12 July 2005

### Data Collection and Results:

Our work at the Goetz site is still in the exploratory phase. We have continued to excavate in areas of the site where we believe deeply buried deposits are present. These areas of the site have produced evidence of significant occupational debris, including butchered bones of large mammals (e.g., bison and elk), fired rock cooking features, and stone tool production and maintenance. All excavated materials larger than approximately 2 cm were piece-plotted in three

dimensions prior to collection. All excavated sediments were water-screened through 1/16-inch mesh with all classes of cultural and natural materials being retained for further analysis.

Summary of results of excavations from 2002-2004 field investigations at the Goetz site (48TE455). Numbers are based upon preliminary analyses and cataloging and are expected to change following detailed laboratory analyses.

<b>Year of Fieldwork</b>	<b>Units Excavated</b>	<b>Total Excavated m<sup>3</sup></b>	<b>Number of Artifacts Excavated</b>	<b>Number of Artifacts Piece Plotted</b>	<b>Number of Surface Artifacts</b>
2002	9	7.4	2,501	512	693
2003	7	3.6	2,871	955	627
2004	5	2.6	995	830	13
<b>Totals</b>	<b>21</b>	<b>13.6</b>	<b>6,367</b>	<b>2297</b>	<b>1333</b>

In addition, surface artifacts were mapped and collected. The surface artifacts are almost exclusively confined to the northern portion of the site along the valley walls and represent primary stone tool production using locally available quartzite. All mapping was accomplished using a SOKKIA Total Station with data being downloaded into an SDR field notebook. Mapping data was then downloaded into a Microsoft Access 2002 database for further analysis. Maps were constructed in ArcGIS.

Number of piece plotted artifacts by material type.

<b>Year of Fieldwork</b>	<b>Number of Artifacts Piece Plotted</b>	<b>Bone</b>	<b>Quartzite</b>	<b>Chert</b>	<b>Obsidian</b>
2002	512		477	6	1
2003	955	113	433	8	12
2004	994	177	784	2	27
<b>Totals</b>	<b>2461</b>	<b>290</b>	<b>1694</b>	<b>16</b>	<b>40</b>

In addition to hand excavation, seven backhoe trenches were excavated for geomorphic exploration. Dr. Kenneth Pierce (US Geological Survey) and William Eckerle (Western GeoArch Research) conducted the geomorphic investigations. Trench 7, at the northern end of the site, provided the most compelling information. The trench produced over 2-meter record of Holocene and terminal Pleistocene deposits, including a buried paleosol in contact with late Pleistocene Pinedale-aged fluvial deposits. A bulk soil sample of the paleosol produced a mean residence age of  $8840 \pm 70$  yrs BP.

Number of piece plotted artifacts by artifact type.

<b>Year</b>	<b>Number of Artifacts Piece Plotted</b>	<b>Flake</b>	<b>Core</b>	<b>Biface</b>	<b>Nodule</b>	<b>Retouch Flake</b>	<b>Ground Stone</b>	<b>Fired Rock</b>	<b>Charcoal</b>	<b>Proj. Point</b>
2002	512	290	17		28	2	2	87	6	
2003	955	251	6	7	6	2		203	8	2
2004	995	308		7	140			353	2	
<b>Totals</b>	<b>2462</b>	<b>849</b>	<b>23</b>	<b>14</b>	<b>174</b>	<b>4</b>	<b>2</b>	<b>643</b>	<b>16</b>	<b>2</b>

Dr. Steve Bozarth (University of Kansas) collected phytolith samples from the trench at 10-cm intervals. This record should provide us with a detailed understanding of local vegetation change that will be compared to the regional record developed by Dr. Cathy Whitlock. Other paleoenvironmental samples collected from the trench include soil samples for mechanical and chemical analysis and a 2-cm interval column for magnetic susceptibility analysis.

### **Significance/Benefits of Research**

- ▼ In contrast to other sites in Jackson Hole, the lithic assemblage is dominated by quartzite that was locally procured from redeposited glacial deposits. The technology is bifacial reduction and includes all stages of biface production.
- ▼ Although obsidian artifacts are limited at the Goetz site understanding the location of the geologic source of the obsidian adds greatly to questions concerning precontact land use patterns. The analysis of obsidian artifacts will continue as part of this research. Currently a small sample of artifacts has been analyzed by Dr. Richard Hughes of Geochemical Research Laboratory and indicates the use of local Jackson Hole and Yellowstone Plateau obsidian sources.
- ▼ Faunal species identified to date include bison, elk, black bear, bighorn sheep/deer, and various species of micromammals. A large amount of large mammal bone was recovered in 2004 during backhoe trenching. Much of the bone has been identified as elk and may represent the largest assemblage of elk in the region.
- ▼ Immunological analysis has also been conducted and positive results have been obtained for deer, bear, and rabbit antisera. The results of the immunological analysis can add to our knowledge of subsistence of precontact groups, as well as help in the interpretation of how stone tools functioned. The limited sample from the Goetz site is encouraging and suggests that immunological analysis is a viable research tool for understanding a number of issues at the Goetz site. Four additional samples from the 2004 field season are currently being analyzed and results are expected in July 2005.
- ▼ The 1971 bone bed is probably an isolated event that occurred 800 years ago and involved the hunting and butchering of four bison, at least two of which were males. Field notes and photographs from the 1971 excavations have not been located. Due to the lack of documentation from the 1971 excavations, the method of procurement still remains elusive, but may have involved some type of ambush.
- ▼ The occupational history of the site is probably co-extensive with the Holocene based upon the geologic context and projectile point styles. The geologic setting within a mid-Pleistocene valley capped with late Pleistocene and Holocene sediments suggests a much longer history is potentially present. We currently have four radiocarbon ages that date cultural deposits and landforms. These include  $800 \pm 40$  yrs BP from a bison metatarsal from the 1971 excavations;  $1,900 \pm 40$  yrs BP on a large mammal bone in association with fired rock feature F01-01;  $3,360 \pm 40$  yrs BP on a long bone fragment from a medium artiodactyl from level 9 in Unit 24; and a mean residence age for the paleosol identified in Trench 7 of  $8840 \pm 70$  yrs BP. Late Paleoindian and mid-Holocene projectile points have been recovered and provide some evidence of the cultural history of the site.
- ▼ The occupational history at the Goetz site is long and involves a wide range of activities that include, but are not limited to, possible plant processing based upon the presence of ground stone artifacts, the hunting and processing of large and small mammals, and biface production from locally occurring quartzites.
- ▼ The density of bison in Jackson Hole, and the Greater Yellowstone Ecosystem, is an ongoing research topic. The field investigations over the past three summers indicate that bison have been a component of the local faunal community for thousands of years, and

may have been more prevalent than previous researchers have suggested (cf. Wright 1984). This will be an ongoing topic of this field investigation.

- ▼ Data processing of the geophysical survey is currently being undertaken, but initial results indicate anomalies are present around the spring. These anomalies have signatures that meet our criteria for precontact deposits and will be ground truthed through hand-excavation in future field seasons.

The recovery of a large assemblage of large mammal remains will allow to begin to address the evolution of the mammalian community over the course of the past 10,000 years. One of our main long-term research goals is the development of a model of mammalian community response to past periods of climate change. This information will then be applied to topics of wildland management within the context of future climate change. This research is based upon the following premises that herbivores, and particularly bison, are important members of the faunal community that can provide information about past vegetation communities, and in turn past climatic episodes:

- ▼ Herbivores, particularly bison (*Bison* sp.), are widespread worldwide and are a common component of fossil and subfossil assemblages.
- ▼ Bison were a major component of the Great Plains post-glacial ecosystem and a major prey species of native groups prior to European contact.
- ▼ Depending upon their particular dietary requirements, herbivore grazing will reflect the relative abundance of vegetation in a particular ecosystem. For example, bison are relatively unselective grazers due to their requirement of large volumes of forage. This requirement limits their ability to be selective. In contrast, antelope are highly selective herbivores, subsisting almost exclusively on sagebrush.
- ▼ Stable carbon isotope analysis is an effective tool in determining photosynthetic pathways. It has also been applied to the tissue of primary consumers in determining their diet. If bison (as well as other migratory animals) are moving through various ecosystems during their annual migrations, and if these environments have different food resources, it should be evident in the bison's diet, as expressed by stable carbon isotope signatures.
- ▼ As tissues develop, they incorporate carbon and the isotopic value of these tissues reflects the relative amounts of the ingested carbon. Bone, which is commonly preserved in fossil and subfossil contexts, is a likely candidate for analysis, but because bone is constantly in a state of growth and modification, the isotopic values reflect an aggregate or averaged record of the individual's diet over an extended period. Studies indicate that complete bone replacement occurs over a period of about 10 years.
- ▼ Teeth, in contrast to bone, preserve a detailed record of an individual's foraging history through the incremental growth of the tooth enamel. By sampling a tooth, particularly the third molar, a geochemical record reflecting the individual's foraging history can be extracted at the resolution of subannual.

## **Dissemination of Results**

### Professional Meetings:

Recent Investigations at The Goetz Site, Jackson Hole, Wyoming, by Kenneth P. Cannon and Molly Boeka Cannon, paper presented at the Wyoming Archaeological Society Annual Meeting, Jackson, Wyoming, April 2004.

Recent Investigations at The Goetz Site, Jackson Hole, Wyoming, by Kenneth P. Cannon and Molly Boeka Cannon, paper presented at the 62nd Annual Plains Anthropological Conference, Billings, Montana, October, 2004.

Recent Investigations at The Goetz Site, Jackson Hole, Wyoming, Kenneth P. Cannon and Molly Boeka Cannon, poster presented at the 7th Biennial Rocky Mountain Anthropological Conference, Park City, Utah, September 2005.

Public Outreach:

“Elk Refuge Yields Hints of Ancient Ways of Life,” by Richard Anderson. *Planet Jackson Hole*, 23 July 2004.

Public presentation “The Ongoing Research at the Goetz site, Teton County, Wyoming.” Jackson Hole Visitors Center, 12 July 2004.

*Exploring the Relevance of the Prehistoric Record to Contemporary Issues of Conservation Biology*. Presentation to the University of Nebraska-Lincoln Environmental Studies Seminar, 26 February 2004.

Relevant Publications:

R. Lee Lyman and Kenneth P. Cannon (editors), 2004, *Zooarchaeology and Conservation Biology*. University of Utah Press, Salt Lake City.

R. Lee Lyman and Kenneth P. Cannon, 2004, Applied Zooarchaeology, Because It Matters In *Zooarchaeology and Conservation Biology*, edited by R. Lee Lyman and Kenneth P. Cannon, pp. 1-24. University of Utah Press, Salt Lake City.

Kenneth P. Cannon and Molly Boeka Cannon, 2004, Zooarchaeology and Wildlife Management in the Greater Yellowstone Ecosystem, In *Zooarchaeology and Conservation Biology*, edited by R. Lee Lyman and Kenneth P. Cannon, pp. 45-60. University of Utah Press, Salt Lake City.

Kenneth P. Cannon, Dawn R. Bringelson, and Molly Boeka Cannon, 2004, Hunter-Gatherers in Jackson Hole, Wyoming: Testing Assumptions about Site Function, In *Hunters and Gatherers in Theory and Archaeology*, edited by George M. Crothers, pp. 103-124. Occasional Paper No. 31, Center for Archaeological Investigations, Southern Illinois University.

Website:

2003 Field Season:

[http://www.cr.nps.gov/mwac/field\\_seas\\_2003/earth2003/index.html](http://www.cr.nps.gov/mwac/field_seas_2003/earth2003/index.html)

2004 Field Season:

[http://www.cr.nps.gov/mwac/field\\_2004/earth/t1/index.htm](http://www.cr.nps.gov/mwac/field_2004/earth/t1/index.htm)

Late Holocene bison ecology:

[http://www.cr.nps.gov/mwac/bison\\_ecology/index.htm](http://www.cr.nps.gov/mwac/bison_ecology/index.htm)

[http://www.cr.nps.gov/mwac/publications/misc\\_pdf/cannon.htm](http://www.cr.nps.gov/mwac/publications/misc_pdf/cannon.htm)

## **PART II**

### **Volunteer Tasks and Accomplishments**

Earthwatch volunteers were involved in all segments of the project. This included the hand-excavation of deposits and the recording of the recovered data. Earthwatch volunteers also participated in a pedestrian survey of the site and the location, mapping, and collection of the identified specimens. Laboratory assignments included the washing, labeling, rebagging of artifacts, and the entering of data into a field catalog. This year we changed our collection strategy in order to enhance the recovery of paleoenvironmental specimens by retaining all excavated sediments and water-screening the sediments 1/16-inch screen.

The Earthwatch volunteers graciously and enthusiastically supplied much of the labor involved in our project, and because of these efforts, we now have a substantial amount of data concerning the prehistoric environment and occupation of the Goetz site. In 2004, the Earthwatch volunteers, representing five countries and 11 states, contributed 1812 hours. We also had the assistance of US Fish and Wildlife Service regional archeologist Rhoda Lewis for two days; two days of labor by Sal Rodriguez of the Jackson Hole Chapter of the Wyoming Archeological Society; 40 hours by Blaise Whitman; 88 hours by Hanna Richards, and 104.5 hours of laboratory assistance by University of Nebraska anthropology student Greg Horner. A total of 2076.5 hours were contributed to the investigation of the Goetz site in 2004-5.

### **Project Development**

In addition to hand-excavation techniques, we applied the technology of geophysical survey in attempting to detect the presence of buried cultural deposits and more efficiently direct our subsurface investigations. Geophysics has many applications and uses many different technologies that range from measuring the earth's magnetic field to measuring the resistance of buried deposits to an electric current. At the Goetz site we used an instrument called a Fluxgate gradiometer. The Fluxgate is an instrument that measures deviations in the earth's magnetic field. These data can then be plotted to produce an image of magnetic anomalies found beneath the surface. These anomalies have positive and negative values that are compared to known values of archeological significance, such as fired rock (hearth) features and other ground disturbances. If one of these anomalies is identified and fits within our criteria for precontact deposits we "ground truth" the deposit through hand excavation.

We have also implemented a GIS (geographic information system) for the Goetz site. To date our application has been limited to map generation, a slope analysis for surface collected artifacts to investigate possible slope movement of artifacts. We plan on using the analytical capabilities of the GIS for understanding both the natural depositional history of the site through three-dimensional mapping and attribute queries. Though three-dimensional mapping has been, and continues, to be an excellent data management tool for the cultural materials at the Goetz site.

### **Educational Opportunities**

Over the course of the past four years, we have had the opportunity to involve high school and college students in our research. Three of these students have pursued careers in archaeology, and a fourth is enrolled in environmental studies in college. We have also had the opportunity this past winter to involve, University of Nebraska anthropology student Greg Horner in our research.

In addition to lectures at professional conferences concerning our research, I was invited to be a guest lecturer for the University of Nebraska's Environmental Studies Seminar during the winter of 2004. A major focus of our research has been to try and illustrate the value of the long-term record archaeology can provide in addressing important issues of conservation biology and public land management.

Some of the data, particularly the large mammal remains, will be incorporated into my dissertation research. Molly has incorporated the spatial data into her PhD course work by developing animated maps and exploration of three-dimensional mapping applications to the piece-plotted archeological data.

### **Partnerships**

The following organizations have contributed either through direct donations of equipment or funds, or through logistical support:

National Park Service's Midwest Archeological Center (logistical support)

US Fish and Wildlife Service (monetary and logistical support)

Patagonia, Inc. (gear)

Teton County Historic Preservation Board (monetary support)

Jackson Hole Chapter of the Wyoming Archeological Society (monetary support)

Each of these organizations supported our research because they believed the research was relevant to their various missions.

### **Acknowledgements**

A number of individuals and institutions have provided their time, energy, and support to the archeological investigations at the Goetz Site. I would like to specifically thank the following supporters:

#### **Earthwatch Team 1**

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Colleen Cummins

Rick Deschler

Barbara Gray

Yvan Kobusinski

Elizabeth Roland

Betty Storey

Hugh Williams

Jeanneine Witt

#### **Earthwatch Team 2**

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Tim Bolger

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Holly DiSalvo

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Alejandro Rodriguez

Matt Young

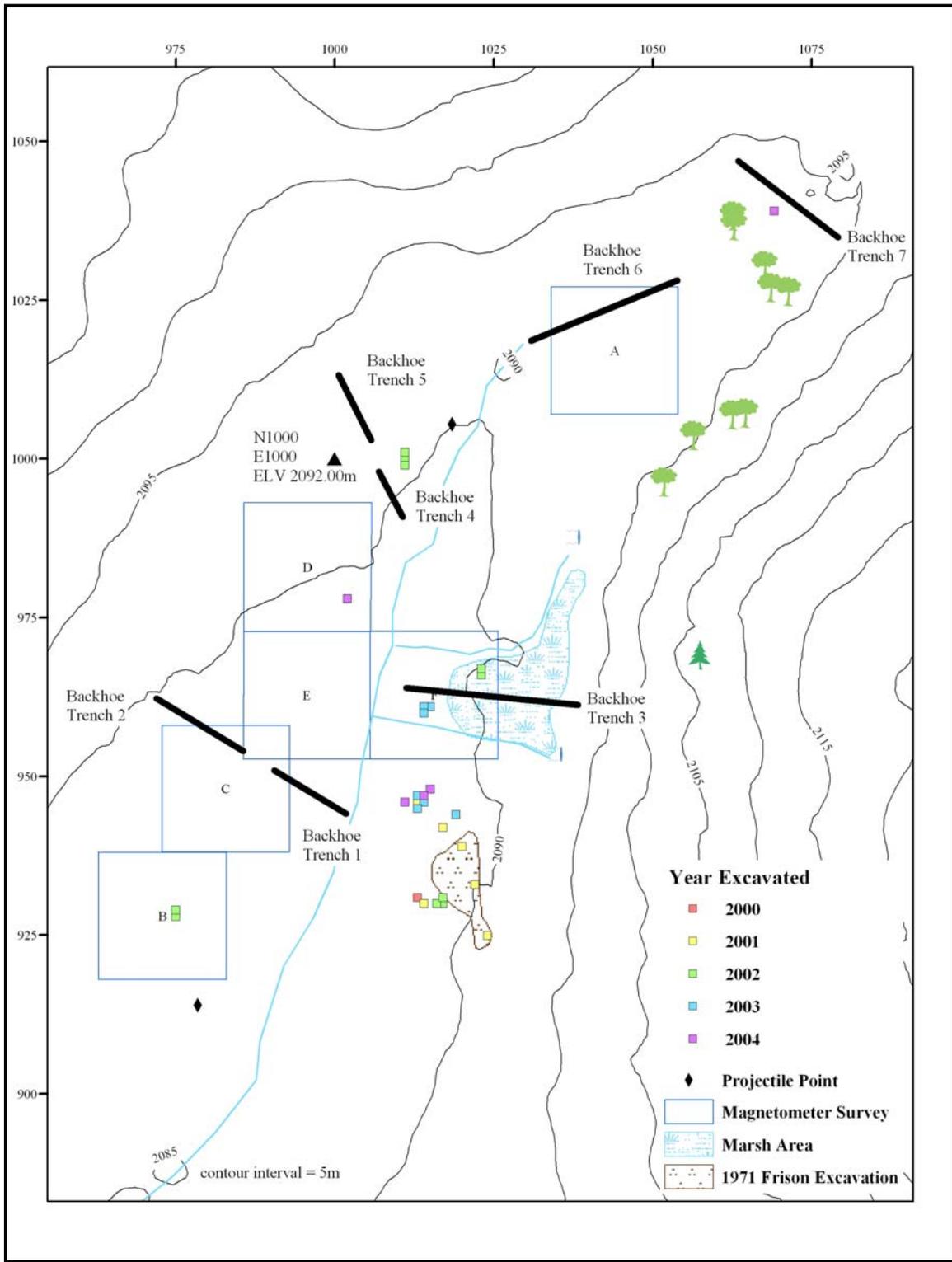
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Site map illustrating location of 2000-2004 investigations.  
 Distribution of surface collected artifacts is not shown.



Overview of Goetz site looking south.



**Area of  
main  
investigations**

## FIELD METHODS

**Water-screening of all sediments.  
Data entry of all recovered artifacts.  
Picking of water-screened sediments.**



# GEOMORPHIC INVESTIGATIONS

Dr. Kenneth Pierce, USGS

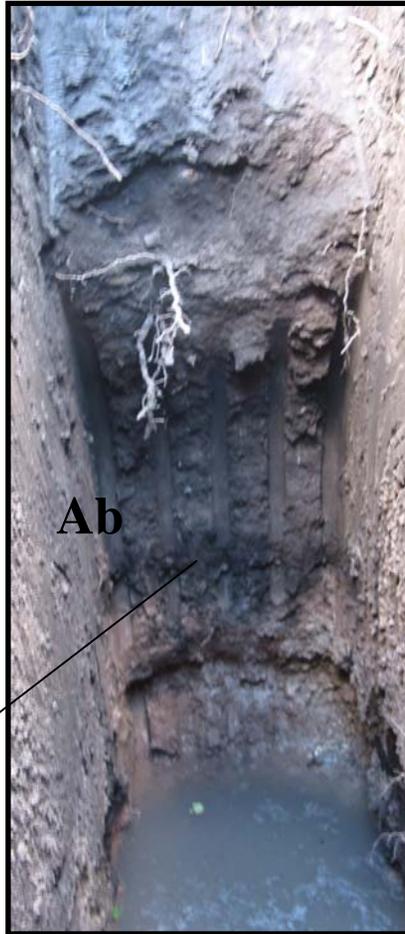
William Eckerle, Western GeoArch Research



A1

A2

C



**TRENCH 7**

- Over 2-m record of Holocene.
- Ab overlying Pleistocene-age Pinedale deposits.
- Mean residence age of  $8840 \pm 70$  BP obtained from bulk soil sample.



## **TRENCH 7 PALEOENVIRONMENTAL INVESTIGATIONS**

- **Phytolith sample collected by Dr. Steve Bozarth (University of Kansas) at 10-cm interval.**
- **Soil samples for chemical and mechanical analyses were also collected at 10-cm interval.**
- **Soil samples for magnetic susceptibility investigations collected at 2-cm interval.**
- **Analyses are currently being conducted.**