Reclaiming Old Data: The Wasden Site Research Project

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Abstract: The Wasden site is a significant Paleoindian site in southeastern Idaho, USA. Excavated between 1961-1979, this large collapsed lava tube has preserved evidence of prehistoric people hunting mammoth and other extinct Pleistocene species dated c.11,000 B.P., and two separate bison kills involving at least 60 animals dated c.8000 B.P. This significant site has never been fully analyzed, nor a final report published. Individual papers and theses have been written but the data has never been integrated in a comprehensive, searchable electronic database. This paper presents an overview of our efforts to reclaim and recast archaeological data to allow research on an important forty year old site excavation. Our results will be available online and on CD-ROM, with applications in GIS, and ACCESS. The CD-ROM is scripted in Macromedia Director and contains all documentation, written reports and papers, artifact and site images.

Keywords: data reclamation; databases; GIS; multimedia

Data Defined

Archaeological excavations yield a wide range of information, encoded in variable constructions, measurement systems, and file formats. The problems for data compilers multiply as time between excavation, analysis, publication and compilation increases. This paper addresses our efforts to reclaim "old data" from an archaeological site first excavated almost forty years ago. At that time, all excavation records and subsequent analyses were preserved only as handwritten documents and scribbled notes. No standard excavation recording system was used. Two principle excavators worked on the site from 1963-1978. The usual labor force consisted of amateur volunteers and fieldschool students.

This is not a novel concern, as a glance at the literature on data management reveals (e.g., Andresen and Madsen 1996; Cheetham and Haigh 1992; Clubb and Lang 1996; Hadizlacos and Stoumbou 1995; Hansen 1993; Lamprell et al. 1995; Murray 1995; Stewart 1996). One important issue is the development of standards for data definition, maintenance and dissemination (e.g., Beargrie and Greenstein 1998; McCartney, Robertson and Cowgill 2000; RCHME 1993; Stewart 1995; Van Leusen et al. 1996; Wise and Miller 1997). Another is description of incomplete data in a standard relational database (e.g., Eiteljorg 2000).

Our practical difficulties are compounded by dealing with a significant archaeological site excavated and analyzed over two decades beginning some forty years ago. Our goal is data reclamation and then integration of this information in a standard database that will be archived. We have a number of specific concerns:

Need to archive archaeological data from a significant site
Development of a web site for online dissemination of information
Development of a comprehensive museum database that incorporates Wasden data in a regional database
Use of digital imaging for recording archaeological information and for enhancing future research

Wasden '60s-70s: Data Transformed

The Wasden site consists of a collapsed lava tube on the Snake River Plain, southeastern Idaho, which was occupied over the past eleven thousand years by prehistoric hunters (Figure 1). The lowest levels contain Folsom projectile points and mammoth, bison and camel bones. Just above, is a major concentration of bison bone representing several discrete entrapments, butchering and processing events that occurred about eight thousand years ago. Excavation at Wasden began in 1964 as an archaeological dig of the Upper Snake River Prehistoric Society and the Idaho Museum of Natural History. Three separate adjacent caves were explored: Owl Cave or Wasden (10BV30), Coyote Cave (10BV31) and Dry Cat Cave (10BV32). All three lie at an elevation of 5000' a.s.l. Work at the Wasden site from 1964 to 1974 proceeded solely on volunteer labor. From 1975-1978 work was conducted by Idaho State University archaeological field schools, funded by a National Science Foundation grant (SOC75-10340). The site deposits exceeded fifteen feet in depth, consisted largely of aeolian deposition, and were finely stratified. The site yielded a large

collection of microfaunal and macrofaunal remains, collected in three stratigraphic columns for identification and bagged by excavation level. The focus of research from 1975-1978 was to excavate deposits in the alcove on one side of the bisecting trench and define an association of fluted stone points and extinct Pleistocene elephant, camel and horse remains. The Wasden site was the first find of butchered elephant remains in a stratified rockshelter in the Northern Intermountain West, USA.

The Wasden site overhang is roughly circular with a diameter of approximately 22 meters at the dripline. Before excavation, the southern portion was filled with sediments sloping down to the floor of the cave from the south. The northern portion of the cave created a sheltered area about 18 meters wide and 4-16 meters back from the dripline. Deposition consisted of fine laminae of wind-blown sediments and water-deposited sediments broken by periodic episodes of rockfall from frost-weathering of the laminar basalts constituting the walls and overhang. Stratigraphy is marked by the presence of strata indicative of clear climatic shifts and accompanying changes in basic geomorphological processes affecting the site. The master stratigraphic profile (Figure 2) shows major stratigraphic features of the site sequence within the overhang. A sequence of ice-wedge casts is bracketed by two radiocarbon dates of about 8160 B.P. and 7750 B.P. A redeposited layer of Mazama Ash is dated about 6600 B.P. The eastern half of the cave had been excavated down to heavy roof-fall resting on bedrock. That roof-fall slopes down from the front to the rear of the cave. The overlying loess becomes correspondingly deeper toward the rear of the cave as well (Butler 1969). The remains of elephant, bison and camel bone were recovered from roof-fall blocks on the floor at the rear of the alcove.

In the 1965 excavation the grid system was set up using two-meter excavation test units, with a North-South axis and an East-West axis. As such the grid system was labeled with a three character name, eastern side of the site carrying an "E" designation, western side of the site carrying a "W", followed by a number (x-axis) and a letter (y-axis). The E/W lines are still marked on the north ceiling of the alcove. The excavation concentrated in the eastern section of Owl Cave, and generally proceeded down in five centimeter arbitrary excavation levels. Recovered deposits were passed through 3/8" screen. The later, 1975-77 excavations proceeded within the same grid system but varied in thickness of levels removed and the screen used.

Butler (1971) published a number of articles describing the bison remains recovered from the general site deposits. Those on the modern site surface are *Bison bison*. Those from lower loess deposits are too fragmentary to identify to species and too infrequent to constitute a good sample. The bison bone bed dated about 8000 B.P., however, yielded the disarticulated remains of more than 60 individual bison. The morphology of skulls and horn cores ranged from modern *Bison bison* to *Bison antiquus*. Butler concluded that the bison population comprised yearlings and adults of both sexes. The cave deposits also produced plentiful microfaunal remains including rabbits (*Sylvilagus*) and pocket gophers (*Thomomys*). *Sylvilagus idahensis* thrives in sagebrush areas and numbers are highly correlated with shrub density. The Northern pocket gopher is more common along streams and feeds on roots and stems of grasses. Guilday's (1969) study indicated pronounced shifts in total numbers of small mammals over time. Mean numbers of individuals are higher before 6600 B.P. and lowest between 3500-5500 B.P., a period correlated with the Altithermal, and intervals of dry and warm climate. There was also a shift in the ratio of pocket gophers to pygmy rabbits about 6600 B.P. Prior to that time, pocket gophers wre more numerous than pygmy rabbits. These shifts indicate a shift from grass to sagebrush vegetation coincident with the climatic change to a warmer, drier climate post-5500 B.P.

The Wasden site is one of the most significant archaeological sites in the western United States. The cave shows evidence of Native American use from about eleven thousand years ago to the early historic period (Butler 1978, 1986; Lohse 1994). A major occupation is the large bison kill dated about 8000 B.P. It seems that the site was used by prehistoric hunters at this time to drive bison into the overhang where they were dispatched and butchered. Discrete activity events like this are rarely documented in the archaeological record and examination of these assemblages of bones and artifacts will offer dramatic insights into prehistoric lifeways. The lower, less well defined mammoth kill was the focus of an incomplete dissertation by Susanne Miller. Her final report, dated 1/29/80, described these prehistoric events as workshops of extensively broken and modified bones from mammoth, bison and camel. To date though these assemblages remain incompletely studied and reported on. A number of papers and posters were presented by Miller on selected aspects of the butchering assemblages but no comprehensive published summary is yet available. Manuscripts on site environmental reconstruction were completed but not published. The associated megafauna populations have been studied and characterized (Butler, Gildersleeve and Sommers 1971; Miller 1982, 1989).

These collections and associated documentation are housed at the Idaho Museum of Natural History. They have received little attention from researchers because they remained in storage without a comprehensive catalog. Our current work focuses on accurately compiling the original site record to create a detailed map of the 8000 year old bison bone bed in a GIS environment . This first required reorganization of the Wasden site collection. The majority of the artifacts and faunal specimens had been stored in hundreds of cardboard boxes in a number of locations within the museum (Figure 3). Miller's dissertation research and the specimens she worked with had been stored in locked cabinets in the Paleontology Division's storage area. Materials analyzed by Butler had been stored in cabinets in the Anthropology Division. We set up a project room in the Anthropology Division and all artifacts and faunal specimens were taken there to be arranged on steel shelving. Graduate and undergraduate students, enrolled in lab courses, spent a year extracting specimens from boxes, entering these in a master catalog, and organizing specimens on the shelving.

Attendant paper documentation, including excavation records, analysis notes, correspondence, manuscripts, and

published articles were gathered together in the Wasden project room and placed in lockable fire files. These were initially gathred from files in the Southeastern Archaeological Repository, Anthropology Division, but as work proceeded, documents were also recovered from Miller and from the amateur members of the original excavation crews. Documentation held and catalogued by the Museum was primarily that produced by the work of and the Idaho State University archaeology fieldschool crews.

No standard excavation record keeping system had been developed over the two decades of Wasden site excavation, and notes consisted mostly excavators' field notebooks, artifact and specimen cards, and maps and profiles drawn in the field. No comprehensive inventory had been made and our students carefully combed published papers and manuscripts to cross-reference field notes and analysis records. Problems encountered were myriad and included redundant specimen numbers, redundant or contradictory provenience notations, conflicting field and lab records, and missing level or excavation square notebooks. The most complete documentation was that supplied for the published work of Butler on the 8000 year old bison bone bed and that developed by Miller for her research on the 11,000 year old mammoth level. We quickly learned that other aspects of the site were equally interesting and important. We also learned that some important parts of the documentation record were missing or suspect.

Reclamation Strategy

Reclaiming the Wasden site data is a significant addition to our knowledge of regional prehistory. It adds to our understanding of Paleoindian and Early Archaic hunting societies on the North American continent in general. Several points are paramount in reclaiming this site record.

Our current IMNH database design could not simply be imposed on the Wasden collection (cf. Lohse 1996; Lohse and Sammons 1998, 1999). In many cases, information was missing or recorded on disparate scales of measurement. Bringing the Wasden collection into an electronic format facilitates further analysis of this important site. Analysis of the well defined bison kill levels supplies a compelling case study emphasizing the value of using digital imaging in database construction, analysis, interpretation and information sharing (Anderson 2001). Publication of the analysis of the entire Wasden site assemblage will deliver information on a very significant paleoindian site that has yet to be published in any detail yet it is listed in summaries of Idaho prehistory and in introductory textbooks on North American prehistory. Putting selected elements of this project online will lead to significant collaborative efforts by regional and national experts interested in Paleoindian and Early Archaic hunting cultures.

Reclamation Methodology

The Wasden paper database, consisting of 4 artifact catalogs and 4 faunal catalogs were converted into a Microsoft Access relational database format (Figure 4). The new digital version can be queried, and can be placed into statistical software. This digital database was then inventoried against the actual collection of specimens to look for glaring errors, such as errors in classification. It was also inventoried to check for missing artifacts. The resulting inventories list particular classes of artifacts, and partially record associations with cultural and natural features. The database does not include small faunal remains, which were apparently never catalogued though these number in the thousands.

Data reclamation is a time and money consuming process. The Wasden catalogs were placed into two tables in the master Wasden database, which also includes tables that are set for particular analyses, such as Funcan (Functional) and Techan (Technological) for future stone tool analysis (Lohse 1993:33-64, 1996; Lohse and Sammons 1998). The current artifact database consists of twenty fields for over 1600 records. The faunal database consists of ten fields for 8000 records, reflecting almost exclusively the large faunal remains. The old specimen catalogs were entered into our Microsoft Access 2000 tables. Data entry was done by students and took over two hundred hours. The data were then proofed for accuracy. The edited database was placed into SPSS by converting the Access database into a dBase file, which required an additional twenty hours to put into a useable format by converting fields from a string to a numeric format. Only some of the fields were in a standard format, which would have enabled a software solution for conversion. Fields, such as grid square, feature, and layer, were in a standard form. Problems were encountered when these variables were given as ranges, reflecting the inaccuracy of the collection methods. Some of the fields, such as the explanation of skeletal element in the faunal database, required hand entry of code numbers that would allow for nonparametric correlation testing and basic exploration statistics to be performed on the Wasden material. The skeletal elements were grouped into fifty different classes based on how they were originally coded in the specimen catalogs. In total, close to three hundred hours were needed simply to put the older Wasden material into a useable format. This does not count the hours required to create the original paper databases. Nor do these hours reflect additional statistical analysis, entry into GIS ArcView, the basic stone tool analysis, any formal analysis of bone, or a complete inventory of the Wasden material.

The many practical problems ranged from large to small. Even when the data are in a consistent format, there are errors, from excavation, cataloging, analysis and simple changes in handling and storage over several decades. Things are coded incorrectly. There are errors in data transfer within the original paper catalogs, and then again in the transfer from paper to digital format. We found redundant data to be helpful, as when a grid unit highlight the error even if the analysts cannot with assurance reconstruct the provenience. Without a standard system for excavation, there were inconsistencies in the way that people recorded the data in the field and in the lab. Variables recorded in the paper database as depth, BMD, and BOD, are different depth measurements taken from different site datums. Excavators did not measure from a standard corner in the excavation

unit, and this has compounded our problems in putting the master stratigraphic profiles together.

Data Production

Transfer of the paper record to a standard electronic format is essential for effective manipulation of the Wasden site collection.

Entry into a GIS Environment

A GIS, by definition, is the linking of descriptive database information to visual representation, normally a map or a digital image, as in the case of raster GIS data. As such there are several ways to bring such information into a useable GIS. For the Wasden project we brought information into the GIS database using three different approaches.

The first approach was to construct a GIS of the grid system used in the Wasden excavation using ArcInfo. The information was coded using Microsoft Wordpad and appropriate ArcInfo syntax to create a text document. The Wordpad text document was then brought into ArcInfo and using the generate command a GIS layer was developed. The database created when the GIS layer was generated was then amended to bring additional information to the database, such as the grid unit designation.

The second approach used in reclamation of the Wasden data was using the constructed Microsoft Access database saved as a dbase file with a .dbf extension. ArcView uses dbase as its relational database core and is only able to bring in files with the .dbf extension. The file was then used to generate a database within ArcView. The database in ArcView was then used to create a point theme, representing the artifact distribution within the Wasden site. This event theme was then saved as an ArcView file.

The final approach was digitizing the maps using a Numonics Grid Master digitizing pad and ArcView GIS to reproduce the paper maps that were created during the original excavations at Wasden. These paper maps had been stored rolled, which necessitated that they be flattened. These original documents were copied, and the copies used for the digitizing. The original documents were thereby protected from possible damage. The photocopying introduces some level of error, but this error level, roughly 1%, was considered to be acceptable. In fact the error level, with most of the maps at a scale of 1:10, fell within the acceptable level for the program to register the map. ArcView accepts a registration error of .004 in the unit of measurement. The database was then amended to include additional information about the polygons that were created representing rock fall and faunal material (Figure 5).

ArcView lends itself to the presentation of complex data, by displaying it in a visual format. The presentation of the Wasden data has been accomplished in several ways. Using the Layout module in ArcView allows themes to be manipulated for hardcopy presentation and export in a variety of digital formats, i.e. .jpg, .tif, etc. This allows a variety of options for the display of GIS data. For the Wasden project themes and complete views were exported for use in an online environment. The Wasden site is one of the first archaeological sites in the western United States to be online in a useable GIS format as part of the "Digital Atlas of Idaho."

Imaging Analysis

Recording and analysis of the artifacts and specimens from the Wasden site is enabled by use of sophisticated digital imaging hardware and software. CCTV cameras attached to binocular microscopes with fiber optic illumination allows generation of high quality, high magnification digital images. Digital data is manipulated through ImagePro Plus software allowing analysis of pixel patterns, exact quantification of those patterns, entry into standard relational databases, and easy statistical manipulation. Artifacts from the Wasden site show clear evidence of Paleoindian hunting and butchering patterns (Figures 6, 7). Perhaps more importantly, storage of the live, information rich digital images and links to databases holding numerical information to the level of a single pixel, ensures accurate dissemination of information.

Online Presentation of Reclaimed Data

The Digital Atlas of Idaho is a GIS based interactive production housed on the Idaho Museum of Natural History server, and links web sites of the Idaho Geological Survey and the Idaho State University College of Education. The Digital Atlas was funded by a multi-year award of the Idaho State Board of Education Technology Inventive Grant, and is a cooperative venture with principal investigators from Idaho State University, Boise State University and the University of Idaho. Data sets dealing with anthropology, archaeology, geography, history, surface and subsurface geology, seismic activity, hydrology, and vertebrate and insect ecology are linked using ArcView GIS and Visual Basic Map Objects Graphical User Interface (GUI).

Future Work

The databases are intended to compile information about southern Idaho for distribution to Idaho's Universities and the Idaho Virtual Campus, as well as elementary and secondary schools. Teaching modules are being created for elementary and secondary educators.

Archaeological data is currently being added to the Digital Atlas. Specifically the digital atlas archaeology section has data layers with links to survey and excavation data and provides digital images of diagnostic specimens and sites online. Part of the Digital Atlas contains links to the Anthropology Collections database at the Idaho Museum of Natural History, with thumbnail images of those collections housed at the Idaho Museum of Natural History. These images and the database itself are placed online as they become available. The Digital Atlas archaeology sections include regional overviews and culture history sections. The Atlas, because it provides information for multiple levels of users, becomes an introduction to archaeology and Idaho

prehistory for elementary and secondary students, it gives elementary and secondary educators teaching material, and it also becomes an accessible repository of information for all interested in Idaho Archaeology and Idaho prehistory.

The Wasden project has become a template of how to place, or not to place information online. The strategy employed has been to divide the presentation of sites into relatively easy to produce modules. These modules are self-contained autonomous pieces. Being self-contained, these pieces are interactive with the entire online presentation when placed into the web site structure. This allows the web page to flow easily while pieces are added, and allows the web site a completed look although it is under continuous construction.

For example with the Wasden site the original work focused on and ultimately published on two occupations, one from roughly 8,000 BP and the other from roughly 11,000 BP, within the site. These two occupations are the natural beginning point to create the online Wasden site. After the data reclamation and GIS construction discussed earlier, a textual overview, or narrative for the site was constructed. Artifact record shots were taken and the constructed GIS maps were brought in as JPEGs as well as placed in ArcView format for download. ArcExplorer is available for download, allowing even those without access to standard GIS software to view some of the GIS mapping.

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Figures

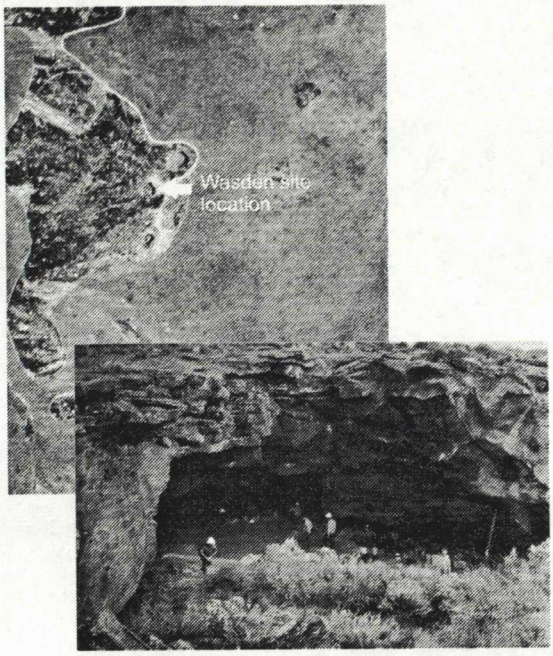
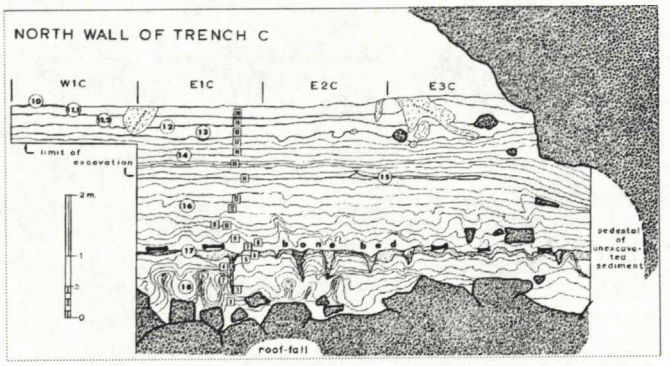


Figure 1. Views of the Wasden site: Above, aerial view showing Owl Cave (arrow indicator), Coyote Cave to north and Dry Cat Cave to the south (USDA Photograph; Butler 1968: Fig 4); Below, view of the site from the west before excavation began in 1965 (Butler 1968: Fig. 5).



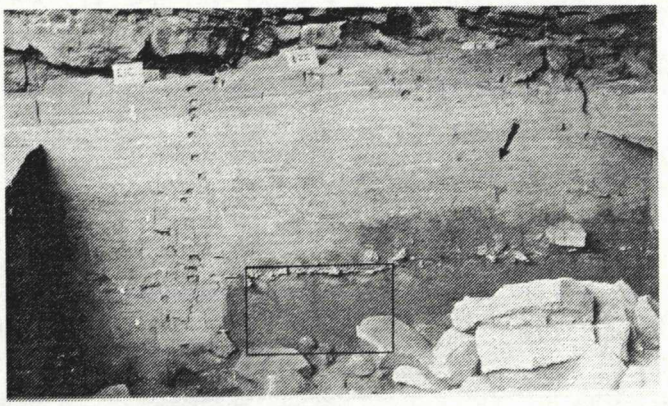


Figure 2. Wasden site stratigraphy. Top, stratigraphic drawing of north wall of Trench C. Numbers indicate strata recognized in the field. Distortion of strata lines below Layer 14 represent cryoturbation of bedding planes. Ice-wedge casts are shown below Layer17. Note the prominent bone bed indicated as Layer 17. Butler (1971:Fig.7). Bottom, photograph of north wall of Trench C. Arrow points to identified Mazama Ash Layer 17. Box shows ice-wedge casts below the bison bone bed radiocarbon date about 8100 B.P. Butler (1968:Fig.8a).

Figure 3. Sorting Wasden site specimens in the project room before data entry and authentication.

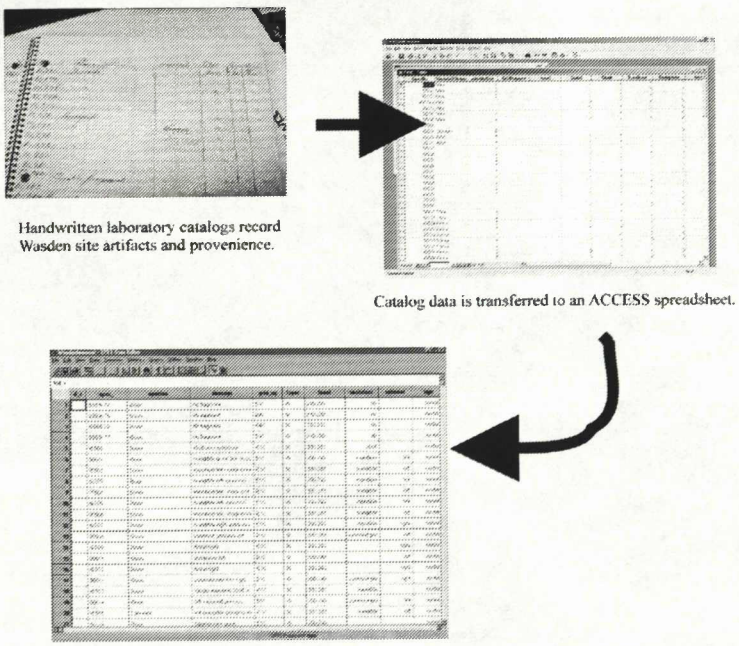


Figure 4. Data Records and Data Entry: Variable formats.

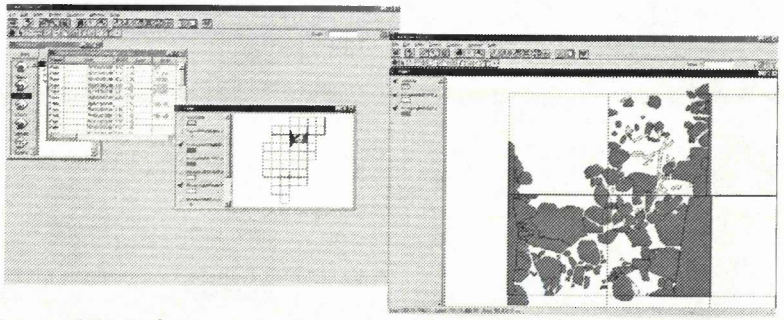


Figure 5. Data representation in GIS. Left, Screen capture of ArcView GIS 3.2 database screen: Attributes of Layer 16 database.dbf; right, Screen capture of plan map in ArcView GIS 3.2 of level 647-657 b.s.d, Unite E4E-E5E, E4F-E5F, Owl Cave

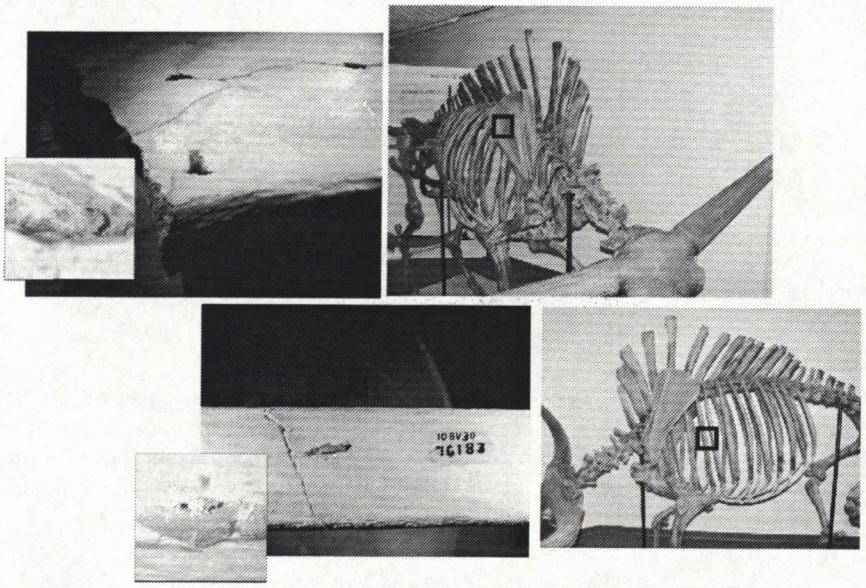


Figure 6. Date Interpretation: Forensic evidence of projectile angle of penetration using Bison scapula and rib recovered from units E3C and E1B at the Wasden site in the Layer 16 "Bison Bed".

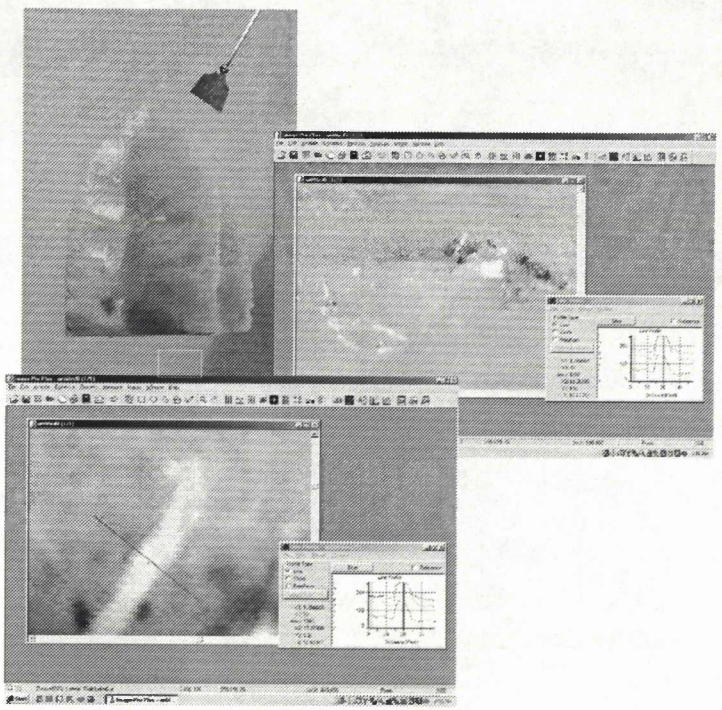


Figure 7. Image Analysis: Microscopic examination of a Folsom point fragment recovered from unit E6G at 6.34m b.u.d., Wasden site, in the Layer 18 "Mammoth Layer". Upper left, record shot with scale; Center right, magnified view of sinew fragment at 60X; Center left, magnified view of the same sinew Fragment at 200X. Graphs display measurements of spectral values that are downloaded to standard relational databases.