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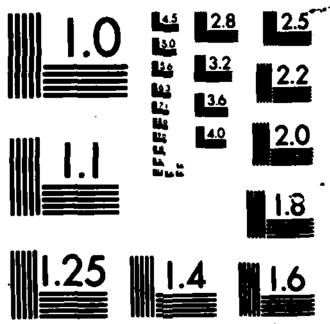

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Site 45-OO-326 is a rockshelter on the south bank of the Columbia River about 100 m upstream from River Mile 559. Vegetation is characteristic of the Upper Sonoran life zone. The University of Washington excavated 89 m^3 (12.5 %) of site volume in 1979 for the U.S. Army Corps of Engineers, Seattle District, as part of a mitigation program associated with adding 10 ft to the operating pool level behind Chief Joseph Dam. A systematic sample of 1 x 1-m units was laid out in the area outside of the rockshelter and an elongate block excavation was undertaken within the area of the basalt erratics. Four zones of cultural occupation were defined within a complex stratigraphic record about 1.5 m in depth. Radiocarbon dates and diagnostic projectile point types document at least 5,000 years of cultural activity spanning all three cultural phases defined for the Rufus Woods Lake project area. The rockshelter was maintained as a hunting base camp during the latter part of the Kartar Phase (ca. 5000-4000 B.P.). Numerous cache pits were formed during this period and at least two densely littered, darkly stained living surfaces were formed within the sheltering basalt erratics. A microblade industry is well documented for this period. Occupation during the subsequent Hudnut Phase (ca. 3000 B.P.) was much more infrequent, although identification of two cache pits indicates similar use of the rockshelter. There then appears to have been a hiatus in site use with a renewed occupation occurring ca. 1500-1200 B.P. The shelter was used sporadically as a short-term hunting camp throughout the Coyote Creek Phase and up into the ethnohistoric period (ca. 200-100 B.P.). Tool assemblages in the three cultural phases are basically similar, although distinctive; the economic focus throughout occupation appears to have been the hunting of deer, elk and mountain sheep.

ARCHAEOLOGICAL INVESTIGATIONS AT SITE 45-DO-326, CHIEF JOSEPH DAM PROJECT, WASHINGTON

by

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With

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M.E.W. Jaehnig 1981-1984
J.V.Jermann 1978-1981

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Office of Public Archaeology
Institute for Environmental Studies
University of Washington

1984

ABSTRACT

Site 45-DO-326 is a rockshelter on the south bank of the Columbia River about 100 m upstream from River Mile 559. Vegetation is characteristic of the Upper Sonoran life zone. The University of Washington excavated 89 m^3 (12.5 %) of site volume in 1979 for the U.S. Army Corps of Engineers, Seattle District, as part of a mitigation program associated with adding 10 ft to the operating pool level behind Chief Joseph Dam. A systematic sample of 1 x 1-m units was laid out in the area outside of the rockshelter and an elongate block excavation was undertaken within the area of the basalt erratics. Four zones of cultural occupation were defined within a complex stratigraphic record about 1.5 m in depth. Radiocarbon dates and diagnostic projectile point types document at least 5,000 years of cultural activity spanning all three cultural phases defined for the Rufus Woods Lake project area. The rockshelter was maintained as a hunting base camp during the latter part of the Kartar Phase (ca. 5000-4000 B.P.). Numerous cache pits were formed during this period and at least two densely littered, darkly stained living surfaces were formed within the sheltering basalt erratics. A microblade industry is well documented for this period. Occupation during the subsequent Hudnut Phase (ca. 3000 B.P.) was much more infrequent, although identification of two cache pits indicates similar use of the rockshelter. There then appears to have been a hiatus in site use with a renewed occupation occurring ca. 1500-1200 B.P. The shelter was used sporadically as a short-term hunting camp throughout the Coyote Creek Phase and up into the ethnohistoric period (ca. 200-100 B.P.). Tool assemblages in the three cultural phases are basically similar, although distinctive; the economic focus throughout occupation appears to have been the hunting of deer, elk and mountain sheep.

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ACKNOWLEDGEMENTS

This report is the result of the collaboration of many individuals and agencies. During the excavation and early reporting stages, Coprincipal Investigators were Drs. Robert C. Dunnell and Donald K. Grayson, both of the Department of Anthropology, University of Washington, and Dr. Jerry V. Jermann, Director of the Office of Public Archaeology, University of Washington. Dr. Manfred E.W. Jaehnig served as Project Supervisor during this stage of the work. Since the autumn of 1981, Dr. Jaehnig has served as Coprincipal Investigator with Dr. Dunnell.

Three Corps of Engineers staff members have made major contributions to the project. They are Dr. Steven F. Dice, Contracting Officer's Representative, and Corps archaeologists Lawr V. Salo and David A. Munsell. Both Mr. Munsell and Mr. Salo have worked to assure the success of the project from its initial organization through site selection, sampling, analysis, and report writing. Mr. Munsell provided guidance in the initial stages of the project and developed the strong ties with the Colville Confederated Tribes essential for the undertaking. Mr. Salo gave generously of his time to guide the project through data collection and analysis. In his review of each report, he exercises that rare skill, an ability to criticize constructively.

We have been fortunate in having the generous support and cooperation of the Colville Confederated Tribes throughout the entire length of project. The Tribes' Business Council and its History and Archaeology Office have been invaluable. We owe special thanks to Andy Joseph, former representative from the Nespelem District on the Business Council, and to Adeline Fredin, Tribal Historian and Director of the History and Archaeology Office. Mr. Joseph and the Business Council, and Mrs. Fredin, who acted as liaison between the Tribe and the project, did much to convince appropriate federal and state agencies of the necessity of the investigation. They helped secure land and services for the project's field facilities as well as helping establish a program which trained local people (including many tribal members) as field excavators and laboratory technicians. Beyond this, their hospitality has made our stay in the project area a most pleasant one. In return, conscious of how much gratitude we wish to convey in a few brief words, we extend our sincere thanks to all the members of the Colville Confederated Tribes who have supported our efforts, and to Mrs. Fredin and Mr. Joseph, in particular.

Site 45-DO-326 is located on land owned by the Bureau of Land Management. Before excavation began, the U.S. Army Corps of Engineers obtained a right of power withdrawal and permission to retrieve archeological data.

As authors of this report, we take responsibility for its contents. What we have written here is only the final stage of a collaborative process which is analogous to the integrated community of people whose physical traces we have studied. Some, by dint of hard labor and archaeological training, salvaged those traces from the earth; others processed and analyzed those traces; some manipulated the data and some wrote, edited and produced this report. Each is a member of the community essential to the life of the work we have done.

Jerry V. Jermann, Coprincipal Investigator during the field excavation and artifact analysis phase of the project, developed site excavation sampling designs that were used to select data from each site. The designs provided a uniform context for studying prehistoric subsistence-settlement patterns in the project area.

Bruce Freyburger directed site excavations. S. Neal Crozier did the initial data summary for the stratigraphic analysis; he also performed the chemical and mechanical sort analyses. The laboratory staff, under the direction of Karen Whittlesey and Kathy Lewin, did the technological and functional artifact analysis. Janice Jaehnig did keypunching and John Chapman and Duncan Mitchell manipulated the computerized data.

The writing of the report itself is an interdisciplinary effort. Ernest S. Lohse wrote Chapters 1, 3 and 6. As senior author, he also coordinated and integrated the contributions of the other authors. Neal Crozier, Sarah K. Campbell and Julia E. Hammett wrote Chapter 2. Stephanie Livingston analyzed the faunal assemblage and wrote Chapter 4. Dorothy Sammons-Lohse analyzed the cultural features and wrote Chapter 5.

Marc Hudson edited the text; Dawn Brislawn typed it, and coordinated production. Melodie Tune drafted the final versions of figures. Larry Bullis photographed the artifacts. Final production of camera-ready copies was accomplished by Natalie Cadoret, Charlotte Beck, and Karen Weed under the direction of Sarah Campbell.

PREFACE

The Chief Joseph Dam Cultural Resources Project (CJDCRP) has been sponsored by the Seattle District, U.S. Army Corps of Engineers (the Corps) in order to salvage and preserve the cultural resources imperiled by a 10 foot pool raise resulting from modifications to Chief Joseph Dam.

From Fall 1977 to Summer 1978, under contract to the Corps, the University of Washington, Office of Public Archaeology (OPA) undertook detailed reconnaissance and testing along the banks of Rufus Woods Lake in the Chief Joseph Dam project area (Contract No. DACW67-77-C-0099). The project area extends from Chief Joseph Dam at Columbia River Mile (RM) 545 upstream to RM 590, about seven miles below Grand Coulee Dam, and includes 2,015 hectares (4,979 acres) of land within the guide-taking lines for the expected pool raise. Twenty-nine cultural resource sites were identified during reconnaissance, bringing the total number of recorded prehistoric sites in the area to 279. Test excavations at 79 of these provided information about prehistoric cultural variability in this region upon which to base further resource management recommendations (Jermann et al. 1978; Leeds et al. 1981).

Only a short time was available for testing and mitigation before the planned pool raise. Therefore, in mid-December 1977, the Corps asked OPA to review the 27 sites tested to date and identify those worthy of immediate investigation. A priority list of six sites was compiled. The Corps, in consultation with the Washington State Historic Preservation Officer and the Advisory Council on Historic Preservation, established an Interim Memorandum of Agreement under which full-scale excavations at those six sites could proceed. In August 1978, data recovery (Contract No. DACW67-78-C-0106) began at five of the six sites.

Concurrently, data from the 1977 and 1978 testing, as well as those from previous testing efforts (Osborne et al. 1952; Lyman 1976), were synthesized into a management plan recommending ways to minimize loss of significant resources. This document calls for excavations at 34 prehistoric habitation sites, including the six already selected (Jermann et al. 1978). The final Memorandum of Agreement includes 20 of these. Data recovery began in May 1979 and continued until late August 1980.

Full-scale excavation could be undertaken at only a limited number of sites. The testing program data allowed identification of sites in good condition that were directly threatened with inundation or severe erosion by the projected pool raise. To aid in selecting a representative sample of prehistoric habitation sites for excavation, site "components" defined during testing were characterized according to (1) probable age, (2) probable type of occupation, (3) general site topography, and (4) geographic location along the river (Jermann et al. 1978:Table 18). Sites were selected to attain as wide a diversity as possible while keeping the total number of sites as low as possible.

The Project's investigations are documented in four report series. Reports describing archaeological reconnaissance and testing include (1) a management plan for cultural resources in the project area (Jermann et al. 1978), (2) a report of testing at 79 prehistoric habitation sites (Leeds et al. 1981), and (3) an inventory of data derived from testing. Series I of the mitigation reports includes (1) the project's research design (Campbell 1984d) and (2) a preliminary report (Jaehnig 1983b). Series II consists of 14 descriptive reports on prehistoric habitation sites excavated as part of the project (Campbell 1984b; Jaehnig 1983a, 1984a,b; Lohse 1984a-f; Miss 1984a-d), reports on prehistoric nonhabitation sites (Campbell 1984a) and burial relocation (Campbell 1984c), and a report on the survey and excavation of historic sites (Thomas et al. 1984). A summary of results is presented in Jaehnig and Campbell (1984).

This report is one of the Series II mitigation reports. Mitigation reports document the assumptions and contingencies under which data were collected, describe data collection and analysis, and organize and summarize data in a form useful to the widest possible archaeological audience.

1. INTRODUCTION

One of only three rockshelter sites in the Rufus Woods Reservoir, 45-DO - 326 was selected for investigation by the Chief Joseph Cultural Resources Project. Our analyses show that it was used for at least 5,000 years as a base camp for hunting deer, elk, and mountain sheep. Although there are differences between the Kartar, Hudnut, and Coyote Creek Phase components, the tool assemblages and faunal assemblages show remarkable similarity through time. Among the sites excavated by the project, it is a unique example of a hunting base camp.

SITE SETTING

Site 45-DO-326 is in Douglas County, Washington on the left bank of the Columbia River about 100 m upstream from River Mile (RM) 559 in the NE 1/4 of the NW 1/4 of the NW 1/4 of Section 34, T30N, R27E (U.T.M. Zone 11, 5326000m.N., 319100m.E.). It lies on a large, eroded river terrace studded with basalt erratics (Plate 1-1). Prior to dam construction, the terrace at elevation 268 m (879 ft) above mean sea level was at least 27 m above the normal river level, but now it is less than 2 m above the present average operating level of Rufus Woods Lake. The site is confined to a small area between three large basalt erractics. They incline toward each other so that the tops touch, while the bases remain apart, forming a sheltered passage with openings to the east and west (Plates 1-2 and 1-3).

The site is about 1.5 km downstream from the Gaviota Bend, just upstream from the White Cap Rapids, and less than 2.5 km upstream from Long Rapids, the location of an ethnohistoric fishing site known as Kalichen Rock. On the north bank of this stretch of the Columbia River, from the Gaviota Bend to Coyote Rapids, 6 m further downstream, were a number of ethnohistoric southern Okanogan villages. Archaeological survey and testing failed to identify any of these ethnohistoric sites, but did identify a number of archaeological sites on either side of the river within the pool taking guidelines. Salvaged sites in the vicinity of 45-DO-326 include 45-DO-282, a Kartar Phase (ca. 7000-4000 B.P.) activity site, about 2 km downstream, 45-DO-273, another Kartar Phase campsite, about 2 km upstream, and 45-OK-18, a Kartar Pase and Hudnut Phase (ca. 4000-2000 B.P.) campsite, about 2 km upstream and on the opposite side of the river. Figure 1-1 shows the location of 45-DO-326 in relation to other salvaged sites in the Rufus Woods Lake project area.

The basalt erratics sheltering 45-DO-326 are part of a series of erratics which occur on the left and right banks of this stretch of the Columbia River and along the river bottom, creating the several rapids. The river is flanked to the north by the steep bluffs of Stubblefield Point and, to the south, by the talus slopes of the Columbia Plateau. Small springs and ephemeral streams are common on the stepped terraces to either side of the river. One large, unnamed ephemeral stream near the site drains a small spring- and runoff-fed pothole lake on the Columbia Plateau to the south, and forms a natural route down from the high ground overlooking the river to the flat, sandy river margins (Figure 1-2). Small, brackish pothole lakes dot the top of the Columbia Plateau in this area. The largest, named lakes include Lone Pine Lake, Judson Lake, Duley Lake, and Murphy Lake, all within less than 5 km of the site. The nearest sources of perennial freshwater are the numerous nearby springs. The major nearby drainage basins are the Achimin and Tumwater Basins across the river to the north, which contain small, saline lakes and large ephemeral stream channels draining the Okanogan Highlands.

A sagebrush-grass association (Artemisia tridentata-Agropyron) (Daubenmire 1970), typical of the Upper Sonoran life zone (Piper 1906), dominates the vegetation in the site area. Scattered sagebrush and rabbitbrush (Chrysothamnus nauseosus), spring flowers, and a dense understory of grasses grow on the site (cf., Franklin and Dyrness 1973). Introduced elements include cheatgrass (Bromus tectorum), and thistles (Salsola kali and Cirsium sp.), among others. A more mesic association including rose (Rosa sp.), serviceberry (Amelanchier sp.), horsetail (Equisetum spp.), rushes (Equisetum hymale), tule (Scirpus acutus), and sedges (Carex spp.) is found in nearby drainages.

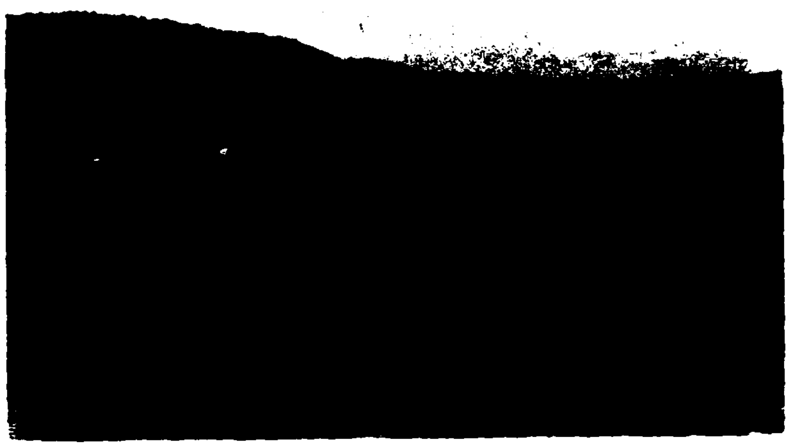


Plate 1-1. View of site 45-DO-326 from the river.

Plate 1-2. Overview of site 45-DO-326 showing entrance to rockshelter.

Plate 1-3. Site 45-DO-326, view from inside of rockshelter.

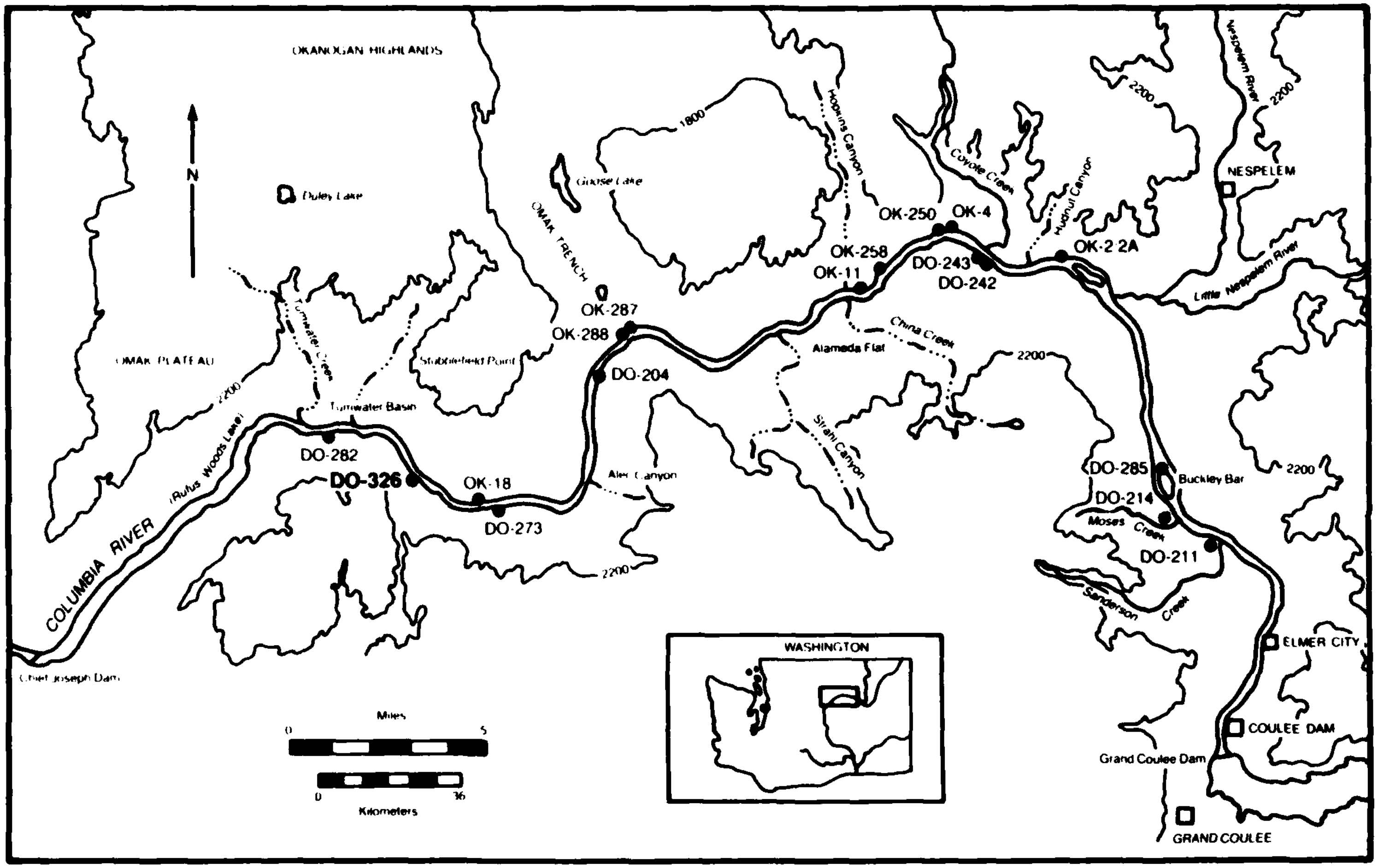


Figure 1-1. Map of project area showing the location of 45-DO-326.

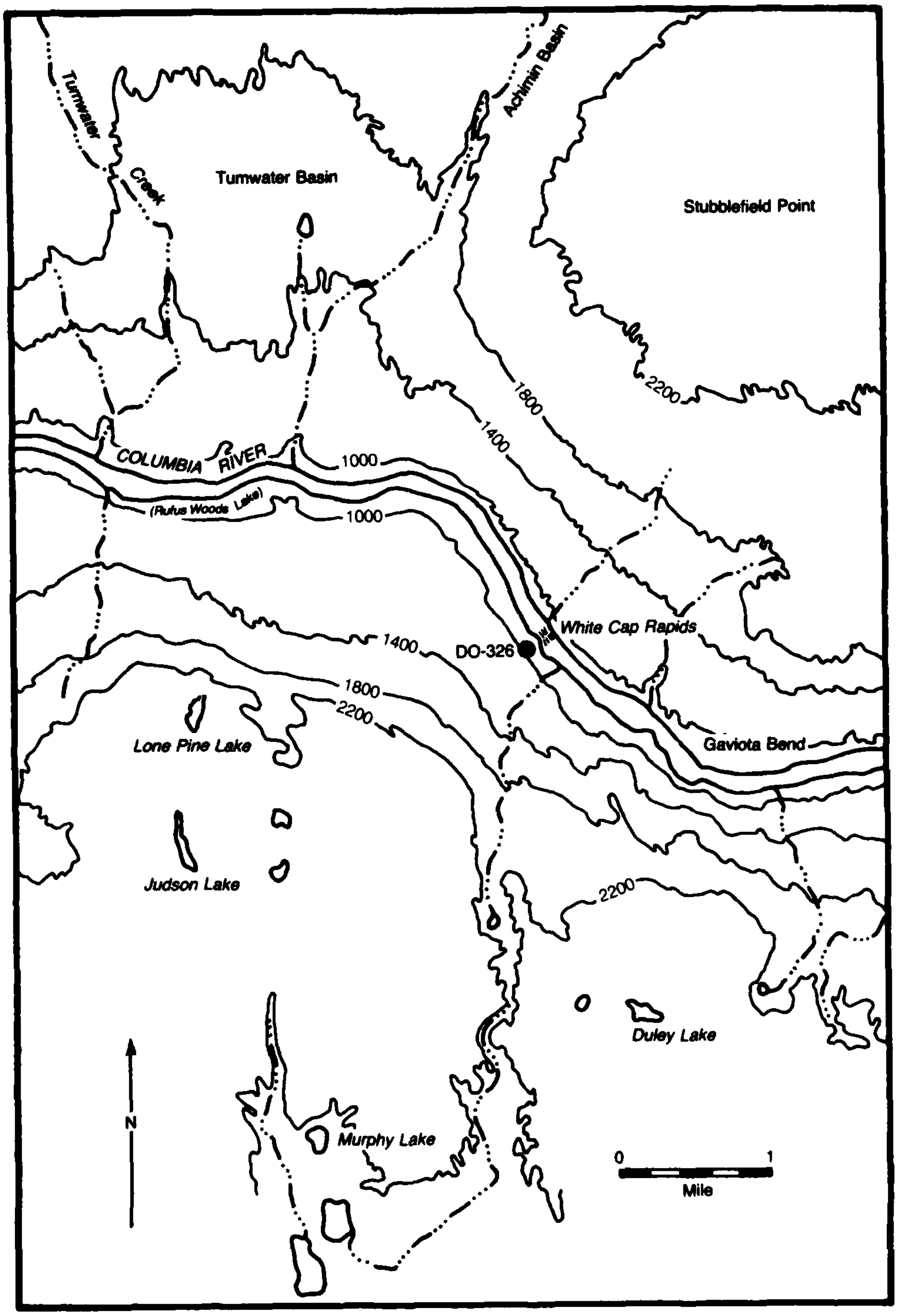


Figure 1-2. Site vicinity map, 45-DO-326.

On the upper terraces above the river, Artemisia rigida replaces big sagebrush in areas of thinner, rocky soils. Bitterbrush (Purshia tridentata) and isolated pines (Pinus ponderosa), with an understory of grasses, grow along the steep draws draining the slopes and terraces. To the south, scattered pines give way to sagebrush covered uplands dotted with small lakes and springs. To the north, across the river, mixed Douglas fir (Pseudotsuga menziesii) and pine are dominant in moister bottomlands and along streams, where they grow with broadleaf trees and shrubs. At the highest elevations, the fir forest gives way to pine forest, except on north-facing slopes and valley floors, where the dominant species is still Douglas fir with larch (Larix occidentalis), some spruce (Picea engelmannii) and an associated understory of woody shrubs. larch (Larix occidentalis) and an associated understory of snowberry.

The prehistoric occupants of 45-DO-326 could have exploited a wide variety of riverine and terrestrial habitats. Nearby was a range of plant species ethnographic societies of the area used in the manufacture of utilitarian items--rushes and bark for mats and baskets, for instance. Edible seeds and roots were available in abundance, as well as brush for fuel and construction. Driftwood from the river and the nearby stands of Ponderosa pine provided a a ready source of building material and fuel as well. Year-round, they could take small game such as beaver (Castor canadensis), hares (Lepus townsendii), and marmots (Marmota flaviventris), common residents of the general site area. In the winter, when mountain sheep and elk came down from the uplands to forage by the river, they could take larger game. Deer may have been present year-round. The river, of course, yielded an abundance of fish: four species of salmon--chinook (Oncorhynchus tschawytscha), coho (O. kisutch), chum (O. keta), and humpback (O. gorbushcha)--had runs from May through November; sturgeon (Acipenser transmontanus) made runs in August. Resident fish would have been available year-round. Waterfowl were present year-round, although during spring and fall migrations and during the breeding seasons in the late spring-early summer their numbers would have been at their peak.

INVESTIGATIONS AT 45-DO-326

Site 45-DO-326 was first designated as a site by the CJDCRP. The shelter formed by the unique erratic formation, apparently an ideal location for human occupation, had been noted by surveyors. However, no cultural materials were noted on the surface until 1978, when L. Salo and R. Daugherty noted river cobbles, necessarily transported there by people, among the basalt rockfall. Because no rockshelter sites were included among the sites selected for investigation at either the testing or salvage level, 45-DO-326 was added to the contract in 1979, for testing and salvage if warranted. Three 1 x 2-m units placed in the site showed that there were indeed buried cultural deposits, and salvage excavations commenced immediately.

EXCAVATION METHOD

Excavation at 45-DO-326 was carried out from 4 June 1979 until 11 July 1979, and again from 14 August 1979 until 6 November 1979. The field crew consisted of ten excavators, an assistant site director and a site director.

No random sampling plan was formulated. Instead, a systematic sample of 1 x 1-m units was laid out in the area outside of the basalt erratics to ascertain site extent, and an elongate block excavation was undertaken within the area of the three basalt erratics. Excavation removed 89 m^3 of site deposits within 17 1 x 1-m, ten 1 x 2-m, and seven 2 x 2-m excavation units, with an average excavation depth of 1.22 m. Figure 1-3 shows the distribution of excavation units across the site area.

Excavators designated units by their northwest corner grid points, and subdivided them into 1 x 1-m quadrants, each of which were kept separate. All excavation proceeded in arbitrary 10-cm levels, measured from the northwest corner of each 2 x 2-m unit. When excavators encountered some difference in matrix composition, they recorded this as a feature, profiled or mapped both the feature and the associated artifacts, and bagged the artifacts separately. Excavators used flat-nosed shovels to skim the earth until a cultural feature was identified; then they removed matrix with trowels. They sifted all material through one-eighth inch screens. Because of the large number of basalt fragments in some units, screened materials were brought to the lab for sorting. Excavation techniques are described in more detail in the project's research design (Cambell 1984d).

EXCAVATION RESULTS

Excavation at 45-DO-326 exposed 16 cultural features, comprising a series of large and small pits and a single well-defined occupation surface. An assemblage of 7,006 stone artifacts, 3,827 non-stone artifacts, 87,476 bone fragments, 11 pieces of shell, and 751 fire-modified rocks was recovered. These counts include 383 worn and/or manufactured tools. Seven radiocarbon dates document a temporal span of occupation from at least 3100-100 B.P. Recovered projectile point types indicate a longer range, spanning all three defined cultural phases for the Rufus Woods Lake project area (Kartar Phase, ca. 7000-4000 B.P., Hudnut Phase, ca. 4000-2000 B.P., Coyote Creek Phase, ca. 2000-200 B.P.) (Jaehnig and Lohse 1984). The four defined cultural zones appear distinct with regard to the distribution of projectile point types. However, not all of the radiocarbon dates are consistent with the ages suggested by the projectile points. We attribute this discrepancy to the complex nature of site deposits--the numerous defined and undefined pits, interbedded and truncated strata--and rodent disturbance. This is particularly true of the lowest radiocarbon samples, which were taken from carbonized wood in areas of rodent disturbance and heavy cultural activity, and probably date the upper zones rather than those from which they were taken.

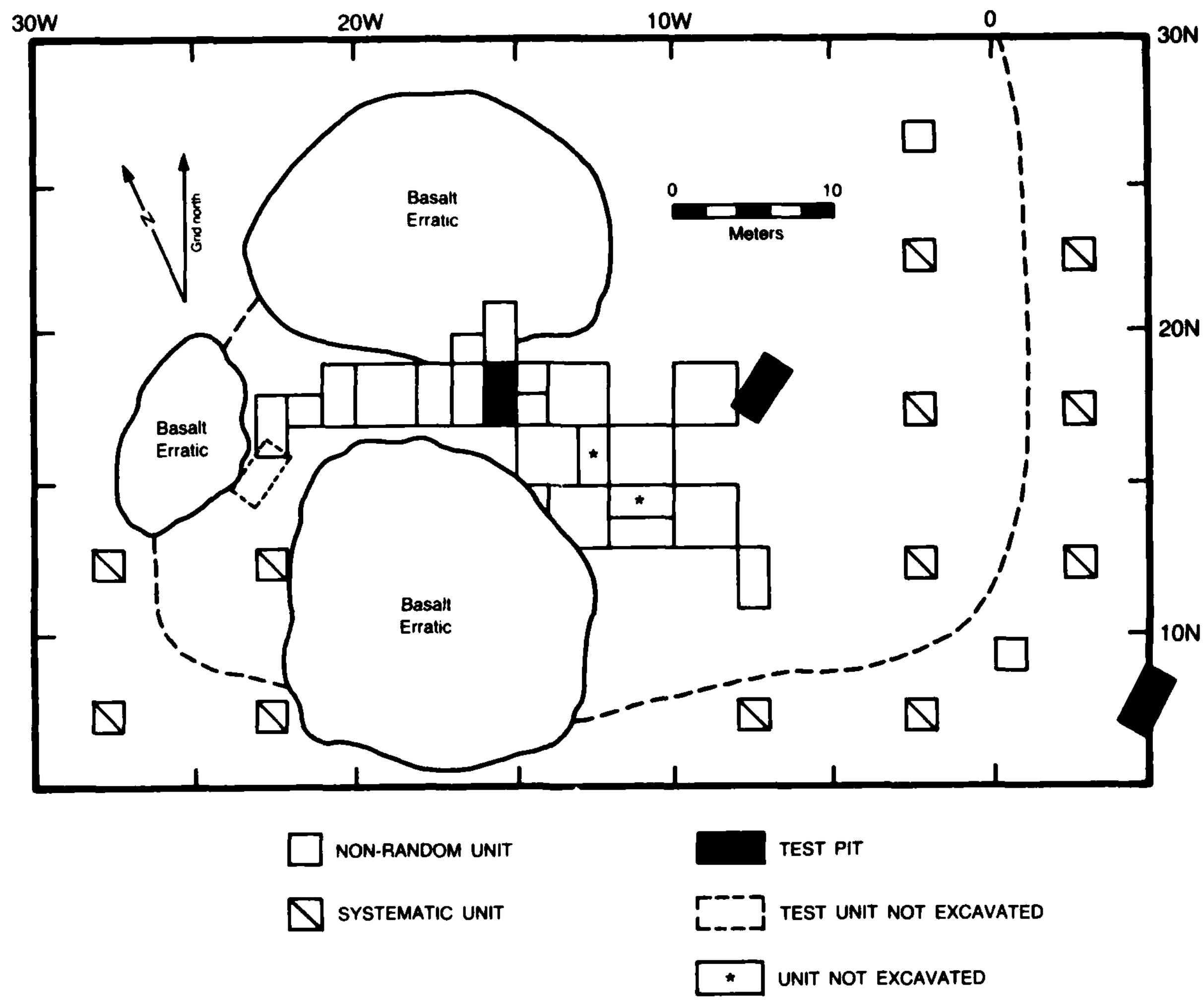


Figure 1-3. The distribution of excavation units, 45-DO-326. Dashed line circumscribes area with cultural materials. Primary datum is ONOW.

REPORT ORGANIZATION

The following chapters provide a guide to data from 45-DO-326. Chapter 2 discusses the site's sedimentary stratigraphy and the definition and dating of periods of cultural deposition termed zones. Chapters 3 and 4 summarize the results of artifactual and archaeofaunal analyses. In Chapter 5, features are classified and their cultural contents described. Chapter 6 includes a site chronology and a discussion of possible activities represented by the assemblages from each zone.

2. NATURAL AND CULTURAL STRATIGRAPHY

This section describes the geologic setting of site 45-DO-326 with reference to local geologic history and discusses the sedimentary history of the site itself in detail. Strata mapped during excavation are grouped into site-wide depositional units, which provide the basis for determining how deposition occurred and for correlating cultural materials among units.

GEOLOGIC SETTING

Site 45-DO-326 lie on the 950 ft terrace directly upstream from White Cap Rapids. On the Okanogan side of the river across from the site are massive deposits of glacial drift with undivided glacial and glacial fluvial sand, gravel and till. This deposit includes glacial outwash. The geologic and sedimentary formations surrounding the site on the Douglas County side consist of glacial drift and Mesozoic age granitics, including quartzite, quartz diorite and granodiorite to grid south. Along the river bank by the site lie Miocene volcanic rocks with basaltic flow material. The basalt is commonly columnar (Figure 2-1). The three basalt erratics which form the shelter rest on a substratum of massive, glacially-deposited basalt column fragments and rounded granitic boulders similar to those exposed on the point to the north. The land slopes from a high point on the ridge west of the shelter to a low point on the east.

Previous archaeological excavations of rockshelters on the Columbia Plateau have yielded well-defined cultural sequences (Fryxell and Daugherty 1963:13). The accumulation of debris on a sheltered floor protects materials as they are laid down, preserving them from erosion and virtually insuring superposition of cultural debris left by successive occupants. Stratigraphic records from archaeological excavations at more than 20 caves and rockshelters in the region reveal a common stratigraphic sequence, with modifications reflecting local conditions: (1) accumulation of rockfall from the cave or shelter ceiling; (2) deposition of aeolian sediment and; (3) build-up of organic debris (Fryxell and Daugherty 1963:13-14).

Fryxell and Daugherty (1963) interpret variation in the relative importance of these processes as a reflection of regional climatic conditions. Thus, coarse rock fall at the base of this sequence records a cool, moist environment accompanied by vigorous frost activity until about 8,000 years ago, which was followed by a period of relative aridity, lessened frost activity, and increased accumulation of organic debris.

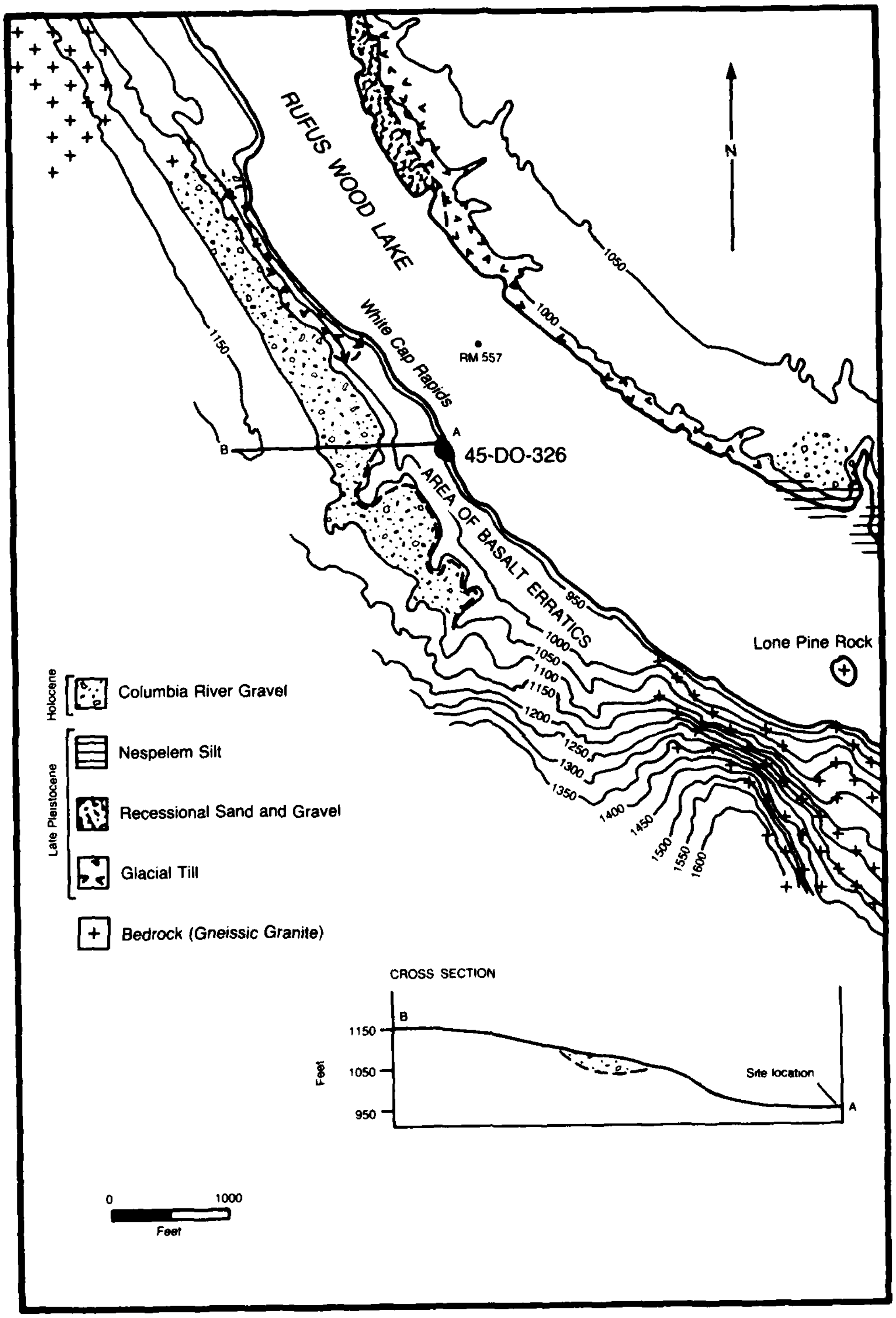


Figure 2-1. Geologic map of site vicinity, 45-DO-326.

The stratigraphic sequence at 45-DO-326 varies somewhat from the regional sequence described above. This may be due to intervening local factors, especially the open nature of the rockshelter and its occurence on an alluvial fan.

Unlike most sites excavated in the Rufus Woods reservoir area, rockshelter site 45-DO-326 exhibits a sedimentary profile not directly influenced by Columbia River alluvium. The earliest depositional episodes relate to an alluvial fan laid down by the small stream immediately to the southwest; fine to medium sands, along with at least two gravel/cobble mudflow-type layers, were deposited outside the shelter. After depositing the upper cobble layer (which slopes down towards the inside of the shelter), the stream changed its course and began to flow through the shelter, covering the basalt column fragments and boulders with a poorly sorted mixture of sands and gravels (identical to those found in the present stream) and gradually filling up what was left of the original depression. This depositional sequence is capped by an unidentified layer of redeposited tephra that can be traced from the coarse sands and gravels on the west (approximately 21W) into the fine, moderately well-sorted sands on the east (approximately 12W). This grading of the alluvial sediments from west to east is characteristic of the alluvium at the site. Scattered rockfall also is present as a minor constituent. Post-ash deposition inside was dominated by rockfall and aeolian activity, while that outside resulted from both slopewash and wind. The only deposits found on the western periphery are alluvial fan gravels and wind-blown loamy sands.

PROCEDURES

From June through November 1979, the stratigraphic crew profiled 146 linear meters of walls in 34 excavation units. Twenty-one sediment samples from two columns and 75 samples from strata not represented in the columns were collected. Chemical and mechanical analyses were completed on all column samples and ten of the other samples.

The methods, procedures and equipment used in stratigraphic profiling and sediment analysis for the Chief Joseph Dam project are described in detail in the research design (Campbell 1984). Excavation and stratigraphic procedures were somewhat modified as a result of the high amount of angular basaltic roof fall and the lack of light within the rockshelter. Gasoline lanterns solved the lighting problem; however, it remained difficult to define shelter-wide strata on walls containing up to 80% rocks. Small samples of matrix were collected and examined in the field in order to determine stratum continuity and/or depositional changes. As excavation units were opened, rocks along the walls of adjoining units loosened: wall collapse was a continual problem. One major collapse occurred along grid line 19N between 10W and 15W. These units walls were cut back where possible to facilitate profiling.

DEPOSITIONAL HISTORY

The site's natural depositional sequence can be viewed as four major stages with several sub-stages. These are designated as Depositional Units (DUs) and are illustrated in trench or transect form in Figures 2-2 and 2-3. Morphological descriptions of the depositional units are shown in Table 2-1. A profile within the rockshelter at grid 18 and 19N shows individual strata and their relationship to the DUs (Figure 2-4).

The site is composed of three distinct geological and cultural environments. The area denoted "inside" lies within the rockshelter (from approximately 12W to 22W); that called "outside" lies in front (east) of the erratics from 7W to 12W; and the area designated as the "periphery" comprises everything else.

DU I (Stratum: 150)

The earliest deposit is a stratum of massive, glacially deposited basalt columns and rounded granitic boulders. This underlying DU was uncovered in several units within the shelter and in the northeastern excavation units outside the shelter. Sand, gravel and pebbles from the overlying DU II filtered in between the rocks and covered the boulders throughout much of the site.

DU II (Stratum: 100)

This post-glacial deposit contains graded beds of alluvial fan sands and gravels within the rockshelter. Evidence of the earliest occupation of the shelter is found within this DU. Outside the shelter the fan debris is slightly coarser and mixed with more rapidly deposited mud flow material. The fan sediments are coarse sands and gravels near the western entrance, grading into finer sands toward the east, indicating deposition by a stream directly southwest of the site.

DU IIa (Stratum: 90)

Immediately overlying DU II in the central portion of the rockshelter is a discontinous stratum of unidentified redeposited tephra. The tephra was washed into the shelter from the west while the fan was still building.

DU III (Stratum: 85, 80, 75, 70)

The post-ash deposition inside the rockshelter consists of angular basalt rockfall and alluvial fan debris. The large size and amount of rocks dislodged from the shelter roof may have resulted from earth tremors as well as a frost-thaw cycle. Evidence of the second occupation of the shelter is found in this depositional unit.

Table 2-1. Morphological descriptions of combined strata, 45-DO-326.

DU[1]	Stratum	Color		Texture	Consistence	pH	Comments
		Moist	Dry				
V	50	Dark grayish brown (10YR 4/2)	Brown (10YR 5/3)	Sand to sandy loam	Loose (dry) Loose (moist)	4.8–6.0 (inside)	Inside only: includes aeolian sands and small diameter shelter rockfall. Boundary: clear; wavy.
IV a	55	Grayish brown (10YR 5/2)	Brown (10YR 5/3)	Sand to loamy sand	Loose (dry) Loose (dry)	7.8 (outside)	Outside only: includes surface litter layer, aeolian and minor slope wash. Boundary: clear to gradual; smooth.
IV	60	Dark grey (10YR 4/1)	Dark grayish brown (10YR 4/2)	Sandy loam	Loose (dry) Loose (moist)	5.8–6.0 (inside)	Inside only: similar to stratum 50 but includes upper occupation debris. Boundary: clear; wavy.
IIIa	65	Grayish brown (10YR 5/2)	Brown (10YR 5/3)	Sand to loamy sand	Loose (dry) Loose (moist)	7.8–8.8 (outside)	Outside only: alluvial fan, slope-wash and some aeolian. Poorly sorted. Boundary: gradual; smooth.
III	70	Dark grayish brown (10YR 4/2)	Grayish brown (10YR 5/2)	Sand to loamy sand	Loose (dry) Loose (moist)	6.0 (inside)	Inside border: start of rockfall at eastern boundary. Poorly sorted angular basalt in sand matrix. Boundary: gradual; wavy.
III	75	Grayish brown (10YR 5/2)	Grayish brown (10YR 5/2)	Sand loam	Loose (dry) Loose (moist)	6.3–6.5 (inside)	Inside only: basalt rockfall with cultural features associated with middle occupation. Boundary: clear to gradual; irregular.
III	80	Dark brown (10YR 3/3)	Dark brown (10YR 3/3)	Sandy loam	Loose (dry) Firm (moist)	5.5–6.8 (inside)	Inside only: rockfall with light to heavy carbon staining and charcoal assocciated with earliest occupation. Boundary: clear to abrupt; irregular.
III	85	Brown (10YR 5/3)	Brown (10YR 5/3)	Sandy loam	Loose (dry) Loose (moist)	6.0–6.5 (inside)	Inside only: similar to and underlies stratum 80. No discernable stratified occupation. Boundary: clear to abrupt; wavy.
IIa	90	Very pale brown (10YR 7/3)		Loam	Loose (dry) Firm (moist)	6.5 (inside)	Inside only: thin lens of redeposited tephra mixed with sand and some gravel. Boundary: clear; smooth.
II	100	Brown (10YR 5/3)	Pale brown (10YR 6/3)	Sand to Loamy sand	Loose (dry) Loose (moist)	6.7 (outside) 6.5 (inside)	Inside and outside: alluvial fan sand and slope wash/mud flow pebbles. Poorly sorted. Boundary: clear to abrupt; wavy.
I	150	Pale brown (10YR 6/3)		Sand	Loose (dry) Loose (moist)	Not tested	Inside and outside: sub-stratum of glacially deposited columnar basalt and rounded granitic cobbles in a sand matrix. Boundary: unknown.

[1] Depositional unit

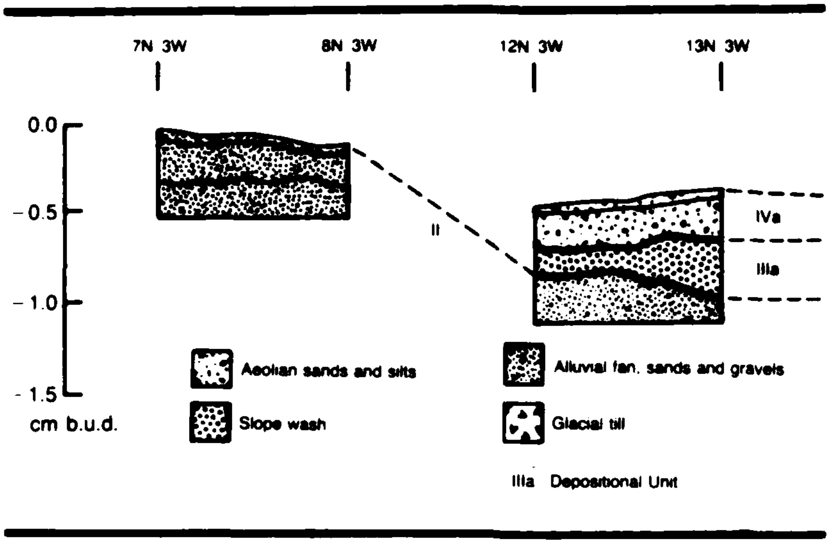


Figure 2-2. Transect at 3W line between 7N and 27N showing depositional

DU IIIa (Stratum: 65)

Contemporary with the rockfall within the shelter is a deposit of wind-modified sheet wash and slope wash material outside. This subunit is represented by poorly to moderately sorted sands, gravel and a few pebble-sized sediments.

DU IV (Stratum: 60-50)

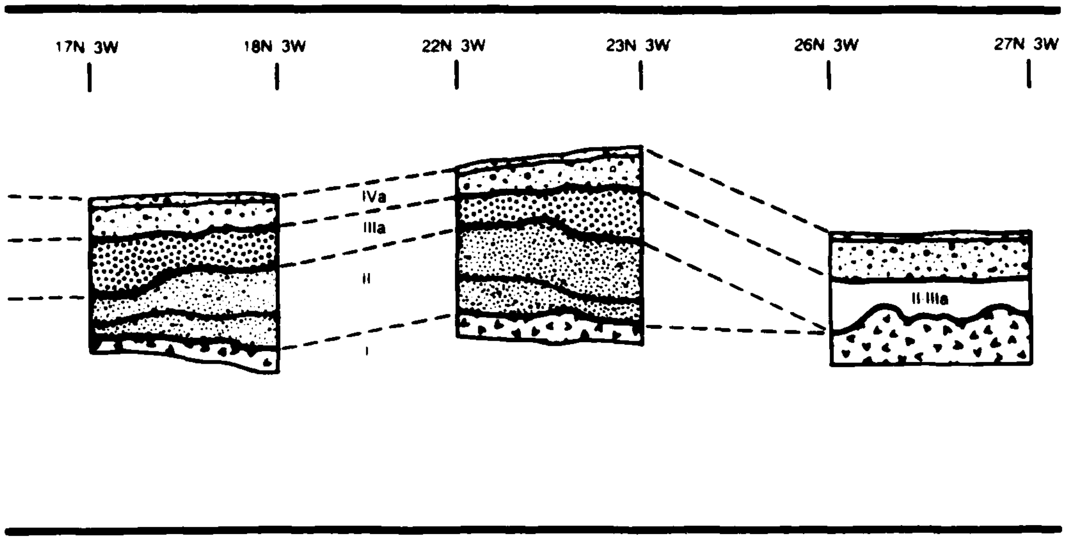
The most recent deposition within the rockshelter is a mixture of aeolian sands and silt and a decreasing amount of basalt rockfall. Although the debris from the roof is still considerable, the diameter of the rocks is smaller than those in DU III. Occupation debris dating to less than 350 years ago is contained in DU IV.

DU IVa (Stratum: 55)

Capping the outside area, and contemporaneous with DU IV, are aeolian sands and silt with a minor mixture of slope wash gravel. No occupation evidence was observed on the profile walls of this outside depositional unit.

INTERPRETATION OF PHYSICAL AND CHEMICAL ANALYSES

The 21 samples from Columns 1 and 2 (Figure 2-5) and 10 other soil samples were subjected to chemical and physical analyses as described in Campbell et al. (1984d). The results (Appendix A, Figures 1 and 2) provide information about postdepositional proccesses and cultural deposition which supplements the stratigraphic descriptions made in the field.



units, 45-DO-326.

The difference between pH values within the shelter and outside indicate two different micro-environments. Lower pH readings within the shelter are probably due to lightly acidic water accumulating as moisture on the rock ceiling, and dripping onto acidic organic material left by human occupants. The slightly higher phosphate levels in Column #2 are probably due to the cultural deposition of organic material. Sediment color changed abruptly at the dripline, being darker within the shelter; this is assumed to be due to the incorporation of organic material in the sediments within the shelter.

CULTURAL STRATIGRAPHY

To analyze a site's cultural deposits, we must identify a cultural correlate for the natural depositional unit. This may be done during excavation, when artifacts are removed in layers corresponding to perceptible differences in the matrix. Or it may be done later, after the excavation, by correlating artifact and feature distributions with natural strata. We used the second approach here. Because strata in the field were not easily distinguished, excavators employed arbitrary levels referenced to the grid unit and site datums. Frequency counts are tabulated by these 10 cm arbitrary levels and 1 x 1-m areal units of provenience. We determined zones by correlating artifact frequency distributions with defined cultural and natural features. Radiocarbon dates and diagnostic artifact types were used to check our determinations.

It must be kept in mind that the zone may encompass a large cut of complex site stratigraphy. It does not represent a single circumscribed occupation limited to one interval of time. Indeed, it usually represents numerous activities over a fairly long span of time. Zones sometimes can be viewed as cultural occupations or cultural components. For instance, if a

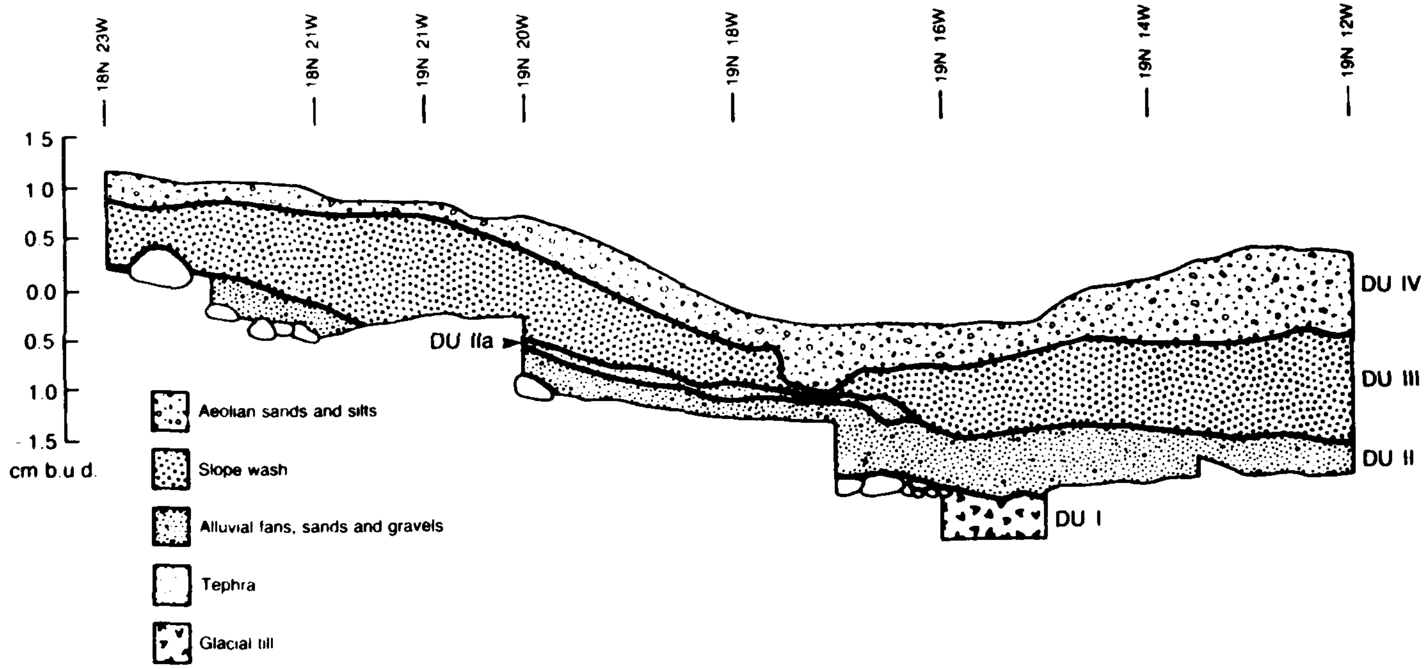


Figure 2-3. East/west trench through rockshelter showing depositional units.

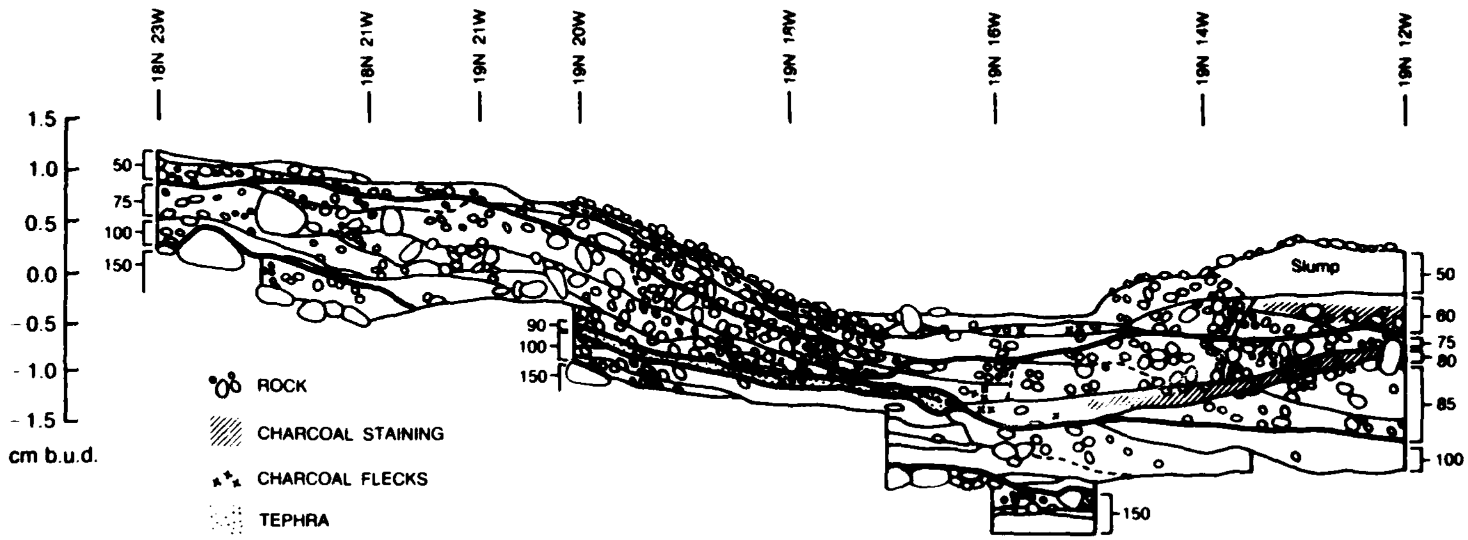


Figure 2-4. East/west trench through rockshelter showing site-wide strata and cultural modification. (less than 50% of rockfall is shown).

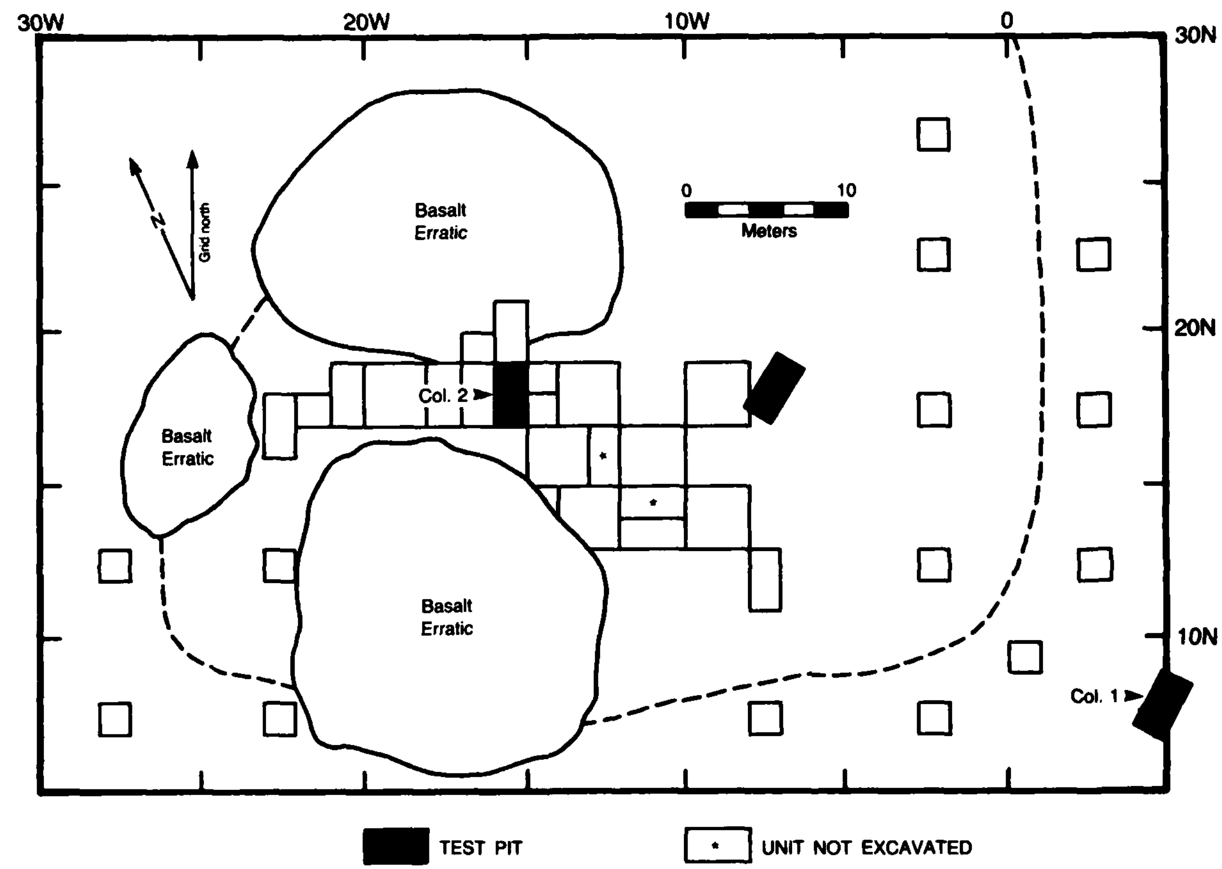


Figure 2-5. Location of column samples, 45-DO-326.

living surface is identified within a zone, it can be referred to as an occupation--a definable set of activities that may be isolated within a limited span of time. If cultural affiliation can be documented, a defined occupation or series of occupations within a zone or zones may be called a cultural component.

ANALYTIC ZONES

Four stratigraphic units containing separate peaks of cultural material were defined as cultural analytic zones. Radiocarbon dates and datable projectile points (see stylistic analysis) corroborate the temporal order of the stratigraphically defined zones. Table 2-2 indicates the stratigraphic definition of the zones, the contents, and associated radiocarbon dates. Each zone is discussed individually below.

Zone 4

The cultural materials from DU II, an alluvial fan deposit of sands and gravels with a redeposited ash layer, have been assigned to Zone 4. This deposit is not the oldest encountered in excavation, but the glacial boulder deposit, DU I, is barren of cultural material. Between the boulders is a sandy matrix containing some cultural materials; this also is part of DU II. Zone 4 has the largest excavated volume and the second largest assemblage of artifacts, which is dominated by bone and lithics, and includes shell, FMR and a large quantity of miscellaneous items. In contrast, this zone has the fewest field-identified cultural features. A radiocarbon date of 3129±95 B.P. (B-4819) from this zone is probably in error, given associated projectile point types which indicate occupation well before 4000 B.P. Zone 4 was excavated in all units of the site except 17N12W (all quads), which was terminated above DU II, and 27N3W, at the northern edge of the site where the alluvial fan deposit does not occur.

Zone 3

Strata 80 and 85 (DU III), characterized as aeolian sandy loams with dense rockfall and heavy carbon staining, are defined as Zone 3. This zone has the smallest excavated volume, yet yielded the largest of the four assemblages. Bone and lithics dominate the assemblage; only small numbers of shell, FMR, and miscellaneous items were recovered. The feature assemblage, which is the largest of the four assemblages. Bone and lithics dominate the assemblage; only small numbers of shell, FMR, and miscellaneous items were recovered. The feature assemblage, which is the largest of the zones, includes pits, a large occupation surface and the only field-identified hearth. A radiocarbon date of 3027±81 B.D. (B-4818) was obtained from this zone. Again, we suspect this date is too late given associated projectile point types. Zone 3 has a localized horizontal distribution in the eastern part of the shelter (Figure 2-1), corresponding to the distribution of Strata 80 and 85. It is lacking in 16N11W, which was not excavated to this depth.

Table 2-2. The analytic zones of 45-DO-326: stratigraphic definition, radiocarbon dates and contents.

Zone	DU	Stratum	Major Description	Radiocarbon Dates (Years B.P.)	Lithic artifacts #	Nonlithic artifacts #	Bone # grams	Shell # grams	FMR # grams	Historic #	Total	# Features	Volume (m^3)	Density Objects (m^3)
1	IV	50,55, 60	Aeolian sands and silts mixed with some rockfall *inside the rockshelter* and slopewash gravel outside	109±55 283±75	1,927	229	19,483 4,089	3 6	386 71,913	1	22,032	3	25.4	867.3
2	*III*	65,70, 75	*Aeolian sands with rockfall* inside the rockshelter and slopewash and alluvial materials outside	943±81 1,278±78 1,553±61	1,799	2,560	17,394 3,188	1 1	159 35,904	2	21,920	2	24.1	909.5
3	III	80,85	Aeolian sandy loam with heavy rockfall and heavy carbon staining	3,027±81	1,998	492	28,259 3,636	6 <1	193 27,478	1	30,950	9	12.5	2,476.0
4	II, I	90,100, 150	Alluvial fan deposits with mudflow and redeposited tephra lenses overlying glacially deposited boulders and erratics	3,129±85	1,282	546	22,340 3,307	1 1	13 3,855	-	24,193	2	30.6	790.6
Total N					7,006	3,287	87,476	11	751	4	99,095	16	92.6	5,043.4

Zone 2

Zone 2 corresponds to Strata 65, 70 and 75. These upper strata of DU III are similar to the lower DU III deposits described above except that they are not so heavily carbon-stained nor do they contain quite so much rockfall. This zone has a slightly smaller excavated volume than Zone 1, and a correspondingly smaller assemblage. The assemblage is dominated by bone, ocher and lithics but also includes FMR, shell, and other miscellaneous items. A firepit and another large pit make up the features of this zone.

Three radiocarbon dates, 843±81 B.P. (B-4814), 1278±82 B.P. (B-4816), and 1553±61 B.P. (B-4817) are from this zone. Two of the samples (B-4814 and B-4817) are of questionable origin. Sample B-4814 was recovered from the extreme northern end of the area under the shelter, from rodent-disturbed soils (Feature 43). Sample B-4817 was taken from a large root (Feature 38) that apparently burned where it had grown. We cannot determine if human activities are responsible for the burning; no cultural materials were associated with the root.

Zone 2 is absent from the periphery of the site, where DU III does not extend (Figure 2-1). It also is absent in 16N11W, which was not excavated deeply enough to encounter this deposit.

Zone 1

Zone 1 includes the cultural materials from DU IV (Strata 50, 55, and 60), which includes aeolian deposits with some slope wash debris and a surface litter mat, extending both within and without the shelter. The assemblage consists largely of bone and lithics, with but a small amount of shell, and miscellaneous items. While the FMR makes up only a small percentage of the zone's total assemblage, the amount is twice that of any other zone. Cultural features consist of dark soil stains and artifact concentrations. Two radiocarbon dates, 108±55 B.P. (B-4815) and 283±75 B.P. (B-4813), were obtained from this zone. This zone was not excavated in 21N16W, where the space below the overhanging basalt erratic is filled by older deposits.

SUMMARY

The geologic stratigraphy at 45-DO-326 is relatively straightforward; however, the reconstruction of cultural events is difficult, given the heavy rockfall that has obscured the relationship of cultural features, the repeated superimposition of the features themselves, and considerable rodent disturbance. The definition of analytic zones diminishes this problem somewhat by grouping large blocks of site deposit, and offers us some reasonable stratigraphic control. Although the zonal definitions do not clarify the relationship of cultural activities within their boundaries, they do provide a reliable basis for the comparison of artifact assemblages over time.

Geologic strata, cultural strata and features, associated radiocarbon dates and projectile point types indicate three major periods of occupation in the rockshelter. Initial occupation occurred in the postglacial alluvial fan and gravel deposits of DU II, just above the basal deposit of glacially dropped basalt columns and granitic boulders (DU I) and during or after the redeposition of tephra in the shelter (DU II). Projectile point types recovered from this zone indicate cultural activity during the mid- to later part of the Kartar Phase (ca. 5000-4000 B.P.). A pit and a small, charcoal-stained area evidence sporadic cultural activity. Aboriginal use of the shelter continued throughout the deposition of heavy rockfall (DU III). The earliest period dates to the Hudnut Phase (ca. 4000-2000 B.P.). This is the episode of heaviest use of the shelter, preserved in numerous large and small pits and a thick occupation surface. Sometime after ca. 2000 B.P., but still within the zone of heavy rockfall designated DU III, the intensity of site use diminished, with cultural features restricted to small firepits and the artifact assemblage showing much lower densities. This period of occupation is assigned to the Coyote Creek Phase (ca. 2000-200 B.P.), and extends up into the most recent zone of deposition at the site (DU IV), where rockfall lessens and geologic deposits consist primarily of aeolian sands and silt. Within 50 cm of the surface, Zone 1 records at least two light occupations with charcoal staining and a single poorly defined firepit. Radiocarbon dates place this latest period of site use sometime between 300-100 years ago.

The range of occupation for the rockshelter indicated by radiocarbon dates is considerably less than that indicated in the discussion above, where we have chosen to rely on recovered projectile point types. If we relied on the dates alone, we would infer occupation between about 3000-100 B.P. This is obviously far too recent for the earliest periods of occpation, as outlined above. We feel justified in ignoring the earliest date, given problems of sample provenience incurred because of the nature of the geologic deposit and the churning of site deposits when the pits in Zone 3 were dug. Since features or cultural strata were not removed by natural boundaries, we must evaluate the nature of the arbitrarily defined assemblages. Specifically, we reject the date of 3129±95 B.P. taken from several units in Zone 4. The more recent dates may be accurate; despite problems with their proveniences, they seem to match the stratigraphic distribution of projectile point types. Table A-1 lists the radiocarbon dates recovered and describes the provenience of the dates as well as the associated projectile point types. For a fuller discussion of the projectile point types recovered see the stylistic analysis section of Chapter 3.

We may conclude, then, that the rockshelter saw repeated use over some 5,000 years or more, extending from the mid- to late Kartar Phase, through the Hudnut Phase, and continuing on to the end of the Coyote Creek Phase. Over that period, the intensity of occupation appears to have varied, with greater or longer periods of use in those periods prior to ca. 2000 B.P. than in the subsequent period. For a complete discussion of the cultural features and associated artifact assemblages see Chapter 5, Feature Analysis. Site stratigraphy, although complex, appears to be well-defined at the level of analytic zones.

In the following analyses we may expect the clearest differences in the artifact assemblages to occur between those of Zones 1, 2, and 3, with those of Zones 3 and 4 perhaps quite similar in the distribution of diagnostics. Zone 4, the earliest stratigraphic unit, probably dates sometime prior to 4000 B.P., and is assigned to the Kartar Phase. Zone 3 is radiocarbon dated to ca. 3000 B.P. or the Hudnut Phase. Zones 2 and 1 date between ca. 1500-200 B.P. or the early and very late Coyote Creek Phase. The lower zones (4 and 3) evidence considerable mixing of cultural materials due to the construction of numerous deep pits in Zone 3 and their penetration in Zone 4 deposits.

3. ARTIFACT ANALYSES

Artifacts recovered from site 45-DO-326 have been subjected to three separate analyses. _Technological_ analysis describes elements of prehistoric tool manufacture, detailing processes of lithic reduction. _Functional_ analysis describes attributes of wear on tools and develops inferences concerning the use of tools at the site. _Stylistic_ analysis describes morphological elements that have demonstrated temporal and spatial significance and compares recovered artifacts with types defined outside of the project area.

The over 7,000 stone artifacts are treated in the most detail. Analyses were intentionally biased towards lithics with the assumption that these artifact classes would be of the most value in comparisons with other researchers' work and in developing reconstructions of site activities. The 15 artifacts of bone and one of shell are included in the classifications where appropriate, but not described in detail.

All artifact analyses take the form of paradigmatic classifications as defined by Dunnell (1971, 1979). In this system, commonly used descriptive terms take on specific meanings. Attributes are selected which can describe morphological variation in the collection. These attributes may correspond to defined stages of tool manufacture, be characteristic of specific tool uses, or indicative of limited periods of time, depending on the purpose of the classification. Attributes are combined into sets: those that describe morphological variation in the artifact assemblage without reference to cultural origin are called features, while those that represent cultural activity are called modes. During analysis each artifact is identified by the single feature or mode that characterizes it. By organizing the features and modes into larger organizations termed dimensions, and by cross-tabulating these, sets of comparable but mutually exclusive classes can be formed. From study of these classes, inferences may be drawn concerning the nature of tool manufacture, use, and distribution in time and space.

Our classificatory dimensions and constituent attributes are not always truly exhaustive and must be viewed as gross analytic categories designed to signal obvious morphological variation. Whenever possible, our defined attributes approximate characteristics identified in prior research as important technological, functional, or stylistic indicators. Further, it will be apparent that analytic levels within the paradigmatic classifications often preclude direct comparison with more traditional typological approaches. For example, in several instances these analyses will focus on the tool, and not on the artifacts, because an artifact may have more than one tool or use. These classes are then only related to more standard classifications by cross-correlation with more traditional artifact designations (e.g., biface, drill, or chopper). The following discussion, therefore, involves analysis both at the level of the tool and of the artifact.

In the following subsections we present the descriptive data generated from technological, functional, and stylistic analysis. The bulk of the data is summarized in tabular form by the four analytic zones, with text reserved for discussion and interpretation of major points. Brief explanations of dimensions and attributes used in each analysis are presented at the beginning of each subsection. Introductory tables list the attributes corresponding to each classificatory dimension. All data tables are confined to the appendix. Only interpretive illustrations are included within the text proper.

Because no major subzones have been identified, the discussion is confined entirely to the zonal assemblages. The feature provenience is provided for projectile points, but this detailed provenience information plays no role in the technologial, functional, or stylistic analyses. See Chapter 5 for information on artifacts found in features.

TECHNOLOGICAL ANALYSIS

Prior researchers have described general manufacturing sequences in the production of stone tools, and have thereby identified specific morphological elements associated with certain methods of production and particular steps in the reductive sequence (e.g., Crabtree 1972, 1976a,b; Flenniken and Garrison 1975; Muto 1971, 1976; Smith and Goodyear 1976; Speth 1972; Stafford 1977; Swanson 1975).

While the process of lithic reduction may vary greatly even within defined industries, an idealized trajectory of reduction, with certain fundamental steps, can be constructed. First, the knapper selects a nodule which will serve as a core for the production of flakes of suitable size and shape. The first flakes removed exhibit the weathered surface of the stone. Later flakes show little or no weathered surface, and may have flake scars from the initial flaking. All of these flakes may be removed with a hard hammer of stone, and this creates distinctive large flakes with pronounced bulbs of percussion, strong stress lines, and crushed striking platforms. Once flakes are of a suitable size, the knapper modifies them further with a soft hammer of antler or wood, producing smaller flakes with less pronounced bulbs of percussion, finer stress lines, and little or no crushing of the striking platforms. Later, after the artifact has been roughed out to the desired shape, the knapper may remove still smaller flakes with an antler tine to sharpen, finely shape, and maintain working edges on the tool.

This is, of course, an extreme simplification. Not only are there innumerable variations in the sequence of steps and tools used, there are also several related processes with distinctive steps and products. The above description characterizes a flake tool technology, wherein hammers of different materials are used to detach thin, lamellar flakes by direct percussion. There is a related blade industry, where hammers or punches are used to create long, narrow flakes with prismatic cross sections. This technique requires a more prepared core, and may involve indirect as well as direct percussion (cf., Leonhardy and Muto 1972; Muto 1976). In turn, these industries may be contrasted with the microblade industry which calls for the creation of small, carefully prepared wedge-shaped cores and use of fine fabricators for detachment of flakes. Very small, thin blades with one or more arrises are produced, which are in themselves finished tool forms requiring no further modification (cf., Sanger 1968, 1970). While clearly distinct, these three industries need not have been independent, as one could easily complement the others as part of a more comprehensive industry. That this is in fact the case is suggested by the presence of flake and blade industries in early assemblages on the Columbia Plateau (Leonhardy and Rice 1970; Leonhardy et al. 1971).

Artifact types are the best practical indicators of lithic industries (e.g., cores, blades and flakes, and tools made from blades or flakes). Core configuration is distinctive; flakes, blades, and microblades are also readily distinguished. Tools often evidence attributes of origin like arris remnants or striking platforms. Other characteristics, though quite recognizable, are less certain diagnostic indicators, and often blend into the general signposts of lithic reduction outlined above (e.g., detritus, flake size, presence or absence of cortex, etc.).

In technological analysis, we record attributes indicative of these steps in stone tool manufacture, and characteristic of these three reduction techniques.

Technological analysis makes use of seven dimensions: OBJECT TYPE, MATERIAL, CONDITION, DORSAL TOPOGRAPHY, TREATMENT, KIND OF MANUFACTURE, and MANUFACTURE DISPOSITION. These describe the kind and condition of artifacts and the materials from which they are made. Descriptive attributes of WEIGHT, LENGTH, WIDTH, and THICKNESS are also measured, and supplement the classificatory dimensions. Table 3-1 lists these dimensions and attributes.

To discuss the technological analysis at 45-DO-326 we must first review the analysis of the artifacts in the laboratory, a process that went on intermittently from June of 1979 until September of 1982. Over that period, eight different analysts were employed in the technological classification. Also over that time, the analysis was changed to facilitate completion of this phase of the project. Twenty excavation units were subjected to the normal technological analysis, entailing all descriptive attributes listed under technological dimensions in Table 3-1, as of November of 1979. When work resumed in October of 1982, the 15 remaining units were analyzed under an abbreviated scheme termed LITHAN AB-R, in which only those objects pulled for functional analysis were given the full technological analysis. Other object types were identified only to material type and dorsal topography. Dimensions of condition and treatment and all measurements were omitted. Figure 3-1 shows the distribution of units analyzed under the two frameworks.

In assessing the following description, it should also be noted that at 45-DO-326 intentionally modified basalt flakes could not easily be separated from the myriad frost-spalled natural flakes. Careful sorting in the laboratory reduced errors in this regard, but we may be sure less cultural basalt material is reported in these descriptive tables than was probably present in the site deposits.

Table 3-1. Technological dimensions, 45-DO-326.

DIMENSION I: OBJECT TYPE

- Conchoidal flake
- Chunk
- Core
- Linear flake
- Unmodified
- Tabular flake
- Formed object
- Weathered
- Indeterminate

DIMENSION II: RAW MATERIAL[1]

- Jasper
- Chalcedony
- Petrified Wood
- Obsidian
- Opal
- Quartzite
- Fine-grained quartzite
- Basalt
- Fine-grained basalt
- Silicized mudstone
- Argillite
- Granite
- Calcite
- Quartz
- Bone/antler
- Dentalium
- Ochre
- Indeterminate

DIMENSION III: CONDITION[2]

- Complete
- Proximal fragment
- Proximal flake
- Less than 1/4 inch
- Broken
- Indeterminate

DIMENSION IV: DORSAL TOPOGRAPHY

- None
- Partial cortex
- Complete cortex
- Indeterminate/not applicable

DIMENSION V: TREATMENT[2]

- Definitely burned
- Dehydrated (heat treatment)

ATTRIBUTE I: WEIGHT[2]

Recorded weight in grams

ATTRIBUTE II: LENGTH[2]

Flakes: length is measured between the point of impact and the distal end along the bulbar axis

Other: length is taken as the longest dimension

ATTRIBUTE III: WIDTH[2]

Flakes: width is measured at the widest point perpendicular to the bulbar axis

Other: width is taken as the maximum measurement along an axis perpendicular to the axis of length

ATTRIBUTE IV: THICKNESS[2]

Flakes: thickness is taken at the thickest point on the object, excluding the bulb of percussion and the striking platform

Other: thickness is taken as the measurement perpendicular to the width measurement along an axis perpendicular to the axis of length

1 Only those raw materials recorded from 45-DO-326 are listed here; a complete list is available in the Project's Research Design (Campbell 1984d).

2 These dimensions were omitted in Lithan AB-R.

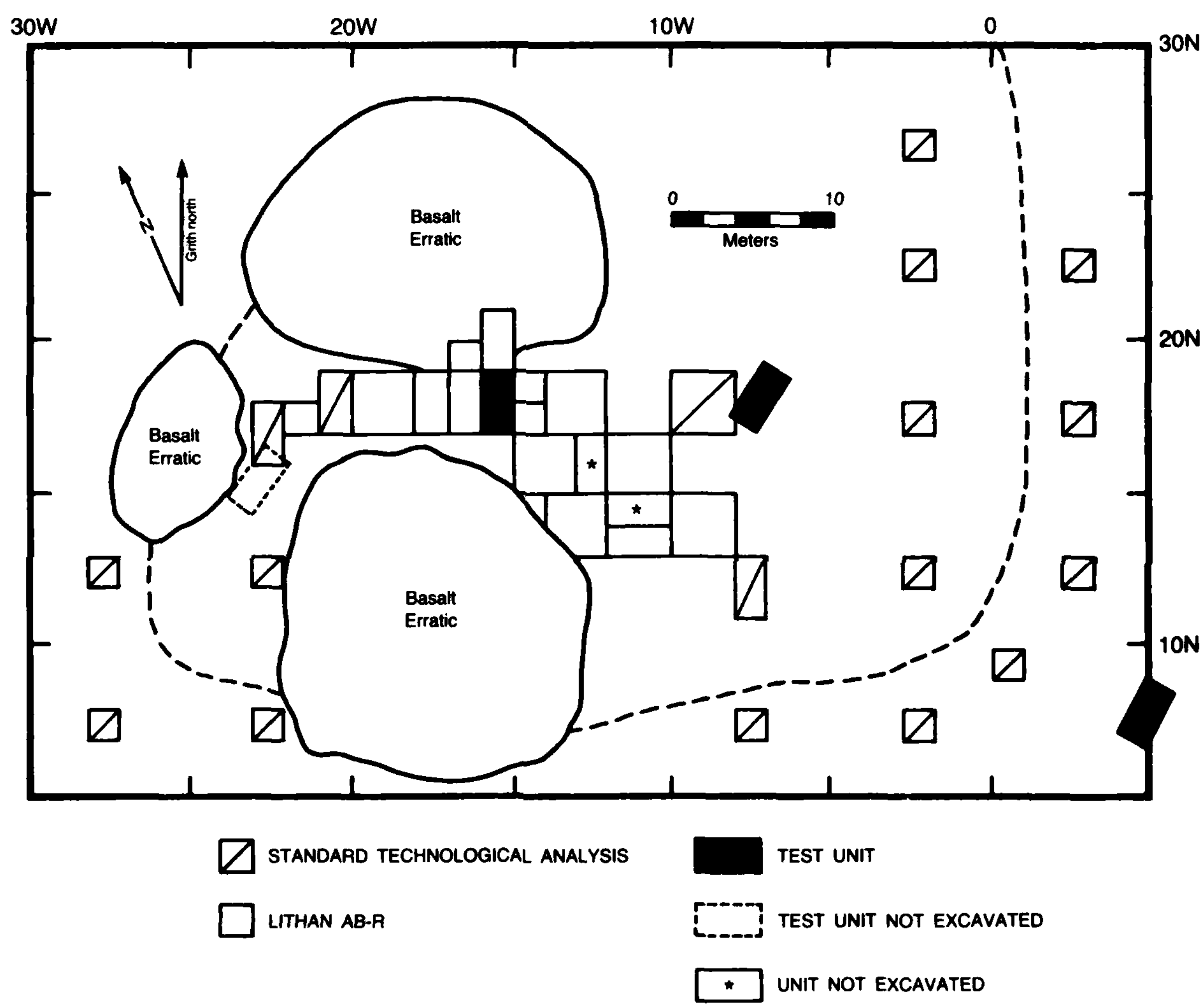


Figure 3-1. Excavation units analyzed under different technological classifications, 45-DO-326.

MATERIAL TYPES

Jasper and chalcedony are the most numerous material types at 45-DO-326 (jasper, 36.2%; chalcedony, 14.0%) (Table 3-2). No other material type exceeds 6.3% of the total, with most well below 1.0%. Distribution across zones is fairly regular, with the exception of a large number of ocher fragments in Zone 2 that reduces the percentages of jasper and chalcedony recovered markedly. If we drop non-lithic material types, we see that jasper comprises 55.8% and chalcedony 21.7%. Further, we note that although jasper is the dominant material in every zone, there is a slight proportionate increase in chalcedony relative to jasper in Zones 1 and 4, with the most marked increase in chalcedony in Zone 1.

The non-lithic materials are mostly pieces of ocher, which, although common in all zones, are most prevalent in Zone 2 where this material type constitutes 58.6% of the total. Bone and antler artifacts are rare, and only one dentalium shell was recovered from Zone 1.

OBJECT TYPES

Jasper and chalcedony conchoidal flakes are easily the most common object type in the collection, comprising 67.1% of the artifacts recovered (jasper, 47.3%; chalcedony, 19.8%) (Table 3-3). Other material types occur in the following descending order of frequency: conchoidal flakes of other than jasper and chalcedony (11.2%), chunks (6.7%), tabular flakes (9.5%), linear flakes (2.4%), formed objects (2.0%), unmodified objects (.3%), cores (0.1%) and a single blade. Jasper and chalcedony are the most frequent stones in all categories except tabular flakes, cores and unmodified objects. Tabular flakes are primarily quartzite (98.4%), with a few examples of silicized mudstone, schist and calcite. Microblades are commonly jasper (78.1%), with the rest chalcedony (20.7%), and a single example of basalt. Jasper and chalcedony also dominate the formed object category (jasper, 73.2%; chalcedony 14.8%), but other specimens include petrified wood (4.2%), basalt (2.8%), obsidian (21.1%) and isolated examples of quartzite, fine-grained quartzite, fine-grained basalt and indeterminate. Unmodified objects are granitic (50%), basalt (37.5%), quartzite (8.3%) and indeterminate (4.2%). Of the four cores recovered, two are jasper, one is quartzite, and the other is basalt. The single blade is chalcedony.

Zonal distribution of object types show some marked patterns (Table 3-4). Distribution of conchoidal flakes, the prevalent category, and chunks, is fairly regular across all four zones. Conchoidal flakes average about 68% of each zonal assemblage, chunks about 6%. Both microblades and tabular flakes are much more prevalent in the lower zones (4 and 3). The single blade was recovered from Zone 4 as well. Conversely, formed objects show marked increases in frequency in the upper two zones (2 and 1).

Table 3-2. Count of material types by zone, 45-DO-326.

Material	Zone				Total
	1	2	3	4	
Jasper	905	1,073	1,297	651	3,926
Col %	41.9	24.6	52.0	35.4	36.2
Chalcedony	628	356	264	274	1,522
Col %	29.1	8.2	10.6	14.9	14.0
Petrified wood	31	5	8	10	54
Col %	1.4	0.1	0.3	0.5	0.5
Obsidian	104	24	7	9	144
Col %	4.8	0.5	0.3	0.5	1.3
Opal	7	18	10	11	46
Col %	0.3	0.4	0.4	0.6	0.4
Quartzite	154	128	239	168	689
Col %	7.1	2.9	9.6	9.1	6.3
Fine-grained quartzite	3	4	5	3	15
Col %	0.1	0.1	0.2	0.2	0.1
Basalt	78	168	145	139	530
Col %	3.6	3.8	5.8	7.6	4.9
Fine-grained basalt	-	3	4	3	10
Col %	0.0	0.1	0.2	0.2	0.1
Silicized mudstone	6	8	6	9	29
Col %	0.3	0.2	0.2	0.5	0.3
Argillite	1	-	-	1	2
Col %	0.0	0.0	0.0	0.1	0.0
Granitic	2	5	4	4	15
Col %	0.1	0.1	0.2	0.2	0.1
Silt/Mudstone	-	1	-	-	1
Col %	0.0	0.0	0.0	0.0	0.0
Schist	6	2	4	1	13
Col %	0.3	0.0	0.2	0.1	0.1
Calcite	-	-	-	1	1
Col %	0.0	0.0	0.0	0.1	0.0
Quartz	5	9	6	9	29
Col %	0.2	0.2	0.2	0.5	0.3
Bone/Antler	10	3	3	2	18
Col %	0.5	0.1	0.1	0.1	0.2
Dentalium	1	-	-	-	1
Col %	0.0	0.0	0.0	0.0	0.0
Ochre	218	2,557	489	544	3,808
Col %	10.1	58.6	19.6	29.6	35.1
Indeterminate/misc	1	2	1	-	4
Col %	0.0	0.0	0.0	0.0	0.0
TOTAL	2,160	4,366	2,492	1,839	10,857

Table 3-3. Material by object type, 45-DO-326.

Material	Object type										Total
	Conchoidal flake	Linear flake	Blade	Tabular	Chunk	Core	Formed object	Weathered	Unmodified	Indeterminate/misc	
Jasper	3,313	132	-	-	328	2	104	1	-	34	3,914
Row %	84.6	3.4	0.0	0.0	8.4	0.1	2.7	0.0	0.0	0.9	
Col %	60.5	78.1	0.0	0.0	69.2	50.0	73.2	100.0	0.0	68.0	55.8
Total %	47.3	1.9	0.0	0.0	4.7	0.0	1.5	0.0	0.0	0.5	
Chalcedony	1,385	35	1	-	67	-	21	-	-	7	1,516
Row %	91.4	2.3	0.1	0.0	4.4	0.0	1.4	0.0	0.0	0.5	
Col %	25.3	20.7	100.0	0.0	14.1	0.0	14.8	0.0	0.0	14.0	21.6
Total %	19.8	0.5	0.0	0.0	1.0	0.0	0.3	0.0	0.0	0.1	
Petrified wood	38	-	-	1	7	-	6	-	-	2	54
Row %	70.4	0.0	0.0	1.9	13.0	0.0	11.1	0.0	0.0	3.7	
Col %	0.7	0.0	0.0	0.1	1.5	0.0	4.2	0.0	0.0	4.0	0.8
Total %	0.5	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0	
Obsidian	139	-	-	-	-	-	3	-	-	2	144
Row %	96.5	0.0	0.0	0.0	0.0	0.0	2.1	0.0	0.0	1.4	
Col %	2.5	0.0	0.0	0.0	0.0	0.0	2.1	0.0	0.0	4.0	2.1
Total %	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Opal	43	-	-	-	2	-	-	-	-	1	46
Row %	93.5	0.0	0.0	0.0	4.3	0.0	0.0	0.0	0.0	2.2	
Col %	0.8	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	2.0	0.7
Total %	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Quartzite	17	-	-	657	10	1	1	-	2	-	688
Row %	2.5	0.0	0.0	95.5	1.5	0.1	0.1	0.0	0.3	0.0	
Col %	0.3	0.0	0.0	98.4	2.1	25.0	0.7	0.0	8.3	0.0	9.8
Total %	0.2	0.0	0.0	9.4	0.1	0.0	0.0	0.0	0.0	0.0	
Fine-grained quartzite	8	-	-	-	6	-	1	-	-	-	15
Row %	53.3	0.0	0.0	0.0	40.0	0.0	6.7	0.0	0.0	0.0	
Col %	0.1	0.0	0.0	0.0	1.3	0.0	0.7	0.0	0.0	0.0	0.2
Total %	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	
Basalt	504	2	-	-	8	1	4	-	9	2	530
Row %	95.1	0.4	0.0	0.0	1.5	0.2	0.8	0.0	1.7	0.4	
Col %	9.2	1.2	0.0	0.0	1.7	25.0	2.8	0.0	37.5	4.0	7.6
Total %	7.2	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.1	0.0	
Fine-grained basalt	9	-	-	-	-	-	1	-	-	-	10
Row %	90.0	0.0	0.0	0.0	0.0	0.0	10.0	0.0	0.0	0.0	
Col %	0.2	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.1
Total %	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

Table 3-3. Cont'd.

Material	Object type										Total
	Conchoidal flake	Linear flake	Blade	Tabular	Chunk	Core	Formed object	Weathered	Unmodified	Indeterminate/misc	
Silicized mudstone	20	–	–	1	8	–	–	–	–	–	29
Row %	69.0	0.0	0.0	3.4	27.6	0.0	0.0	0.0	0.0	0.0	
Col %	0.4	0.0	0.0	0.1	1.7	0.0	0.0	0.0	0.0	0.0	0.4
Total %	0.3	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	
Argillite	1	–	–	–	–	–	–	–	–	–	1
Row %	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Col %	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total %	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Granitic	–	–	–	–	3	–	–	–	12	–	15
Row %	0.0	0.0	0.0	0.0	20.0	0.0	0.0	0.0	80.0	0.0	
Col %	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	50.0	0.0	0.2
Total %	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	
Silt/Mudstone	–	–	–	–	1	–	–	–	–	–	1
Row %	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	
Col %	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
Total %	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Schist	–	–	–	8	5	–	–	–	–	–	13
Row %	0.0	0.0	0.0	61.5	38.5	0.0	0.0	0.0	0.0	0.0	
Col %	0.0	0.0	0.0	1.2	1.1	0.0	0.0	0.0	0.0	0.0	0.2
Total %	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	
Calcite	–	–	–	1	–	–	–	–	–	–	1
Row %	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	
Col %	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total %	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Quartz	–	–	–	–	29	–	–	–	–	–	29
Row %	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	
Col %	0.0	0.0	0.0	0.0	6.1	0.0	0.0	0.0	0.0	0.0	0.4
Total %	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	
Indeterminate/misc	–	–	–	–	–	–	1	–	1	2	4
Row %	0.0	0.0	0.0	0.0	0.0	0.0	25.0	0.0	25.0	50.0	
Col %	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0	4.2	4.0	0.1
Total %	0.0	0.0	0.0	0.0	0.0	0.0.	0.0	0.0	0.0	0.0	
TOTAL	5,477	169	1	668	474	4	142	1	24	50	7,010
Row %	78.1	2.4	0.0	9.5	6.8	0.1	2.0	0.0	0.3	0.7	

Table 3-4. Distribution of object type[1] by material by analytic zone, 45-DO-326.

Object type by material	Zone 1	Zone 2	Zone 3	Zone 4	Total
Cryptocrystalline[2]					
Conchoidal flake	1,335	1,294	1,349	801	4,779
Col %	69.2	71.8	67.5	62.5	68.2
Microblade	18	26	75	48	167
Col %	0.9	1.4	3.7	3.7	2.4
Blade	-	-	-	1	1
Col%	0.0	0.0	0.0	0.1	0.0
Tabular flake	1	-	-	-	1
Col %	0.0	0.0	0.0	0.0	0.0
Chunk	132	80	125	67	404
Col %	6.8	4.4	6.2	5.2	5.8
Core	-	1	1	-	2
Col %	0.0	0.0	0.0	0.0	0.0
Formed object	52	38	25	16	131
Col %	3.0	2.1	1.2	1.2	1.9
Weathered	-	-	-	1	1
Col %	0.0	0.0	0.0	0.1	0.0
Indeterminate	30	8	3	3	44
Col %	1.5	0.4	0.1	0.2	0.6
Quartzite					
Conchoidal flake	1	3	5	8	17
Col %	0.0	0.2	0.2	0.8	0.2
Tabular flake	149	122	229	157	657
Col %	7.7	6.8	11.4	12.2	9.4
Chunk	3	3	1	1	8
Col %	0.1	0.2	0.0	0.1	0.1
Core %	-	-	1	-	1
Col %	0.0	0.0	0.0	0.0	0.0
Formed object	-	-	-	1	1
Col %	0.0	0.0	0.0	0.1	0.0
Unmodified	1	-	-	-	1
Col %	0.0	0.0	0.0	0.0	0.0
Fine-grained quartzite					
Conchoidal flake	1	3	2	1	8
Col %	0.0	0.2	0.1	0.1	0.1
Chunk	1	1	3	-	5
Col %	0.0	0.0	0.1	0.0	0.1
Formed object	1	-	-	-	1
Col %	0.0	0.0	0.0	0.0	0.0

1 <1/4 in flakes and non-lithics deleted

2 Jasper, chalcedony, petrified wood, and opal are included in cryptocrystalline.

Table 3-4. Cont'd.

Object type by material	Zone 1	Zone 2	Zone 3	Zone 4	Total
Basalt					
Conchoidal flake	70	161	145	137	513
Col %	3.6	8.9	7.2	10.7	7.3
Microblade	-	-	-	2	2
Col %	0.0	0.0	0.0	0.1	0.0
Chunk	1	2	3	2	8
Col %	0.0	0.1	0.1	0.1	0.1
Core	1	-	-	-	1
Col %	0.0	0.0	0.0	0.0	0.0
Formed object	1	3	-	1	5
Col %	0.0	0.2	0.0	0.1	0.1
Unmodified	5	4	-	-	9
Col %	0.2	0.2	0.0	0.0	0.1
Indeterminate	-	1	1	-	2
Col %	0.0	0.0	0.0	0.0	0.0
Granitic					
Chunk	-	-	1	2	3
Col %	0.0	0.0	0.0	0.1	0.0
Unmodified	2	5	3	2	12
Col %	0.1	0.3	0.1	0.1	0.2
Obsidian					
Conchoidal flake	99	24	7	9	139
Col %	5.1	1.3	0.3	0.7	2.0
Formed object	3	-	-	-	3
Col %	0.1	0.0	0.0	0.0	0.0
Indeterminate	2	-	-	-	2
Col %	0.0	0.0	0.0	0.0	0.0
Other lithic					
Conchoidal flake	6	6	4	5	21
Col %	0.3	0.3	0.2	0.4	0.3
Tabular flake	6	1	2	1	10
Col %	0.3	0.0	0.1	0.1	0.1
Chunk	6	13	10	14	43
Col %	0.3	0.7	0.5	1.1	0.6
Indeterminate lithic					
Formed object	-	-	1	-	1
Col %	0.0	0.0	0.0	0.0	0.0
Unmodified	-	1	-	-	1
Col %	0.0	0.0	0.0	0.0	0.0
Indeterminate	1	1	-	-	2
Col %	0.0	0.0	0.0	0.0	0.0
Total	1,928	1,801	1,999	1,282	7,010

MANUFACTURE

Chipping accounts for 99.5% of the manufacture observed for objects in this collection, with the single exception a pecked/ground pestle recovered from Zone 2 (Table 3-5). However, only 2.9% of the objects show any manufacture once they were removed from a core or blank. Chipped objects constitute no more than 4% of any zonal assemblage. The increase in chipped objects in Zones 2 and 1, of course, corresponds to the higher number of formed objects from these two zones.

Table 3-5. Count of type of manufacture by zone, 45-DO-326.

Type of manufacture	Zone 1	Zone 2	Zone 3	Zone 4	Total
None	1,850	1,742	1,959	1,251	6,802
Col %	96.0	96.7	98.0	97.6	97.0
Chipping	78	57	37	31	203
Col %	4.0	3.2	1.9	2.4	2.9
Pecking and grinding	–	1	–	–	1
Col %	0.0	0.1	0.0	0.0	0.0
Indeterminate	–	1	3	–	4
Col %	0.0	0.1	0.2	0.0	0.1
Total	1,928	1,801	1,999	1,282	7,010

[1]<1/4 in flakes and non-lithics deleted

Heat treatment prior to manufacture is poorly represented in the zonal assemblage (Table 3-6), although we have no way of assessing possible differences between those unit assemblages coded for heat treatment, which are mostly outside the rockshelter, and those not coded for heat treatment (LITHAN AB-R), which were primarily inside the rockshelter (Figure 1-1). It may well be that heat treatment was a more common practice than indicated in this table, since we would expect heat treatment-manufacture to have been more common within the rockshelter near firepits and in the lee of the large basalt erratics.

Certainly, both primary and secondary reduction were prevalent on the site (Table 3-7). Over 6% of the stones in all zones retain cortex remnants, indicative of primary reduction. The highest total is that observed for Zone 4, where 11.1% of the zonal assemblage have cortex. Those stones most commonly reduced from a core include quartzite (3.0% of total, 30.9% of quartzite recovered), basalt (3.8% of total, 50.4% of basalt recovered), jasper (0.2% of total, 0.3% of jasper recovered), chalcedony (0.01% of total, 0.06% of chalcedony recovered), fine-grained quartzite (0.1% of total, 53.3% of fine-grained quartzite recovered) (Table 3-8). Both the basalt and the quartzite were available in the nearby Columbia River gravels and were a handy stone for tools. The jasper and chalcedony must have been transported from some distance. The majority of object types with cortex are conchoidal flakes (52.4%) (Table 3-9). Tabular flakes with cortex are also common (37.4%), with the rest chunks (7.1%), formed objects (1.2%), unmodified objects (1.5%), and cores (0.4%). Only two of the recovered cores retain cortex.

Table 3-6. Count[1] of heat treatment by zone, 45-DO-326.

Treatment	Zone				Total
	1	2	3	4	
None	1,923	1,790	1,999	1,277	6,989
Col %	99.7	99.4	100.0	99.6	99.7
Burned	5	11	-	5	21
Col %	0.3	0.6	0.0	0.4	0.3
Total	1,928	1,801	1,999	1,282	7,010

[1]<1/4 in flakes and non-lithics deleted

Table 3-7. Count[1] of dorsal topography by zone, 45-DO-326.

Dorsal topography	Zone				Total
	1	2	3	4	
None	1,794	1,667	1,850	1,130	6,438
Col %	92.9	92.6	92.5	88.1	91.8
Partial and complete cortex	124	124	145	142	535
Col %	6.4	6.9	7.3	11.1	7.6
Indeterminate	13	10	4	10	37
Col %	0.7	0.6	0.2	0.8	0.5
Total	1,928	1,801	1,999	1,282	7,010

[1]<1/4 in flakes and non-lithics deleted

Secondary reduction and finishing/maintenance of stone tools on the site is poorly documented in terms of the measurement of flake size, with 99.7% of all conchoidal flakes listed as > 1/4 in (Table 3-10). Only 20 specimens, primarily jasper and chalcedony are < 1/4 in. As for heat treatment, flake size distribution may be badly skewed by the LITHAN AB-R analyis of unit assemblages within the rockshelter which did not take measurement. It seems quite likely that tool finishing and repair would have taken place most often within the shelter and near the firepit or other foci of everyday activity. Evidence for the smallesi flakes in the jasper and chalcedony categories is consistent with the greater proportion of formed objects in those stones.

Table 3-8. Dorsal topography by material[1] by zone, 45-DO-326.

Dorsal topography by material	Zone 1	Zone 2	Zone 3	Zone 4	Total
Jasper					
None	897	1,064	1,294	637	3,892
Partial cortex	6	4	1	3	14
Indeterminate	1	2	1	4	8
Total	904	1,070	1,296	644	3,914
Chalcedony					
None	626	353	264	270	1,513
Partial cortex	–	–	–	1	1
Indeterminate	–	1	–	1	2
Total	626	354	264	272	1,516
Petrified wood					
None	31	5	7	10	54
Total	31	5	7	10	54
Obsidian					
None	104	24	8	8	144
Total	104	24	8	8	144
Opal					
None	7	18	10	11	46
Total	7	18	10	11	46
Quartzite					
None	89	87	176	123	651
Partial cortex	64	41	63	44	212
Complete cortex	1	–	–	–	1
Total	154	128	239	167	688
Fine-grained quartzite					
None	1	2	2	2	7
Partial cortex	2	2	3	1	8
Total	3	4	5	3	15
Basalt					
None	31	96	75	58	260
Partial cortex	43	88	70	81	282
Complete cortex	2	3	–	–	5
Indeterminate	2	1	–	–	3
Total	78	188	145	139	530

[1] <1/4 in flakes and non-lithics deleted.

Table 3-8. Cont'd.

Dorsal topography by material	Zone 1	Zone 2	Zone 3	Zone 4	Total
Fine-grained basalt					
None	–	3	4	3	10
Total	–	3	4	3	10
Silicized mudstone					
None	4	7	6	2	19
Partial cortex	2	–	–	7	9
Indeterminate	–	1	–	–	1
Total	6	8	6	9	29
Argillite					
None	1	–	–	–	1
Total	1	–	–	–	1
Granitic					
None	–	–	–	1	1
Partial cortex	1	–	2	2	5
Complete cortex	1	5	2	1	9
Total	2	5	4	4	15
Schist					
None	–	–	1	1	2
Indeterminate	6	2	3	–	11
Total	6	2	4	1	13
Calcite					
Indeterminate	–	–	–	1	1
Total	–	–	–	1	1
Quartz					
None	–	8	2	3	13
Partial cortex	2	–	4	2	8
Indeterminate	1	1	–	4	8
Total	5	9	6	9	29
Indeterminate/misc					
None	–	–	1	–	1
Partial cortex	–	–	–	–	–
Complete cortex	–	1	–	–	1
Indeterminate	1	1	–	–	2
Total	1	2	1	–	4

Table 3-9. Object type[1] by dorsal topography, 45-DO-326.

Object type	Dorsal topography: None	Partial cortex	Complete cortex	Indeterminate	Total
Conchoidal flake	5,197	272	–	8	5,477
Row %	94.9	5.0	0.0	0.1	
Col %	80.7	52.4	0.0	21.6	78.1
Total %	74.1	3.9	0.0	0.1	
Microblade	169	–	–	–	169
Row %	100.0	0.0	0.0	0.0	
Col %	2.6	0.0	0.0	0.0	2.4
Total %	2.4	0.0	0.0	0.0	
Blade	1	–	–	–	1
Row %	100.0	0.0	0.0	0.0	
Col %	0.0	0.0	0.0	0.0	0.0
Total %	0.0	0.0	0.0	0.0	
Tabular	466	194	–	8	668
Row %	69.8	29.0	0.0	1.2	
Col %	7.2	37.4	0.0	21.6	9.5
Total %	6.6	2.8	0.0	0.1	
Chunk	423	37	–	14	474
Row %	89.2	7.8	0.0	3.0	
Col %	6.6	7.1	0.0	37.8	6.8
Total %	6.0	0.5	0.0	0.2	
Core	2	2	–	–	4
Row %	50.0	50.0	0.0	0.0	
Col %	0.0	0.4	0.0	0.0	0.1
Total %	0.0	0.0	0.0	0.0	
Formed object	135	6	–	1	142
Row %	95.1	4.2	0.0	0.7	
Col %	2.1	1.2	0.0	12.7	2.0
Total %	1.9	0.1	0.0	0.0	
Weathered	–	–	–	1	1
Row %	0.0	0.0	0.0	100.0	
Col %	0.0	0.0	0.0	2.7	0.0
Total %	0.0	0.0	0.0	0.0	
Unmodified	–	8	16	–	24
Row %	0.0	33.3	66.7	0.0	
Col %	0.0	1.5	100.0	0.0	0.3
Total %	0.0	0.1	0.2	0.0	
Indeterminate/misc	45	–	–	5	50
Row %	90.0	0.0	0.0	10.0	
Col %	0.7	0.0	0.0	13.5	0.7
Total %	0.6	0.0	0.0	0.1	
Total	6,438	519	16	37	7,010
Row %	91.8	7.4	0.2	0.5	

[1]<1/4 in flakes and non-lithics deleted

Table 3-10. Count of flake size by material[1] by zone, 45-DO-326.

Size (in) by material	Zone 1	Zone 2	Zone 3	Zone 4	Total
Jasper					
>1/4	904	1,070	1,296	644	3,914
<1/4	1	3	1	7	12
Chalcedony					
>1/4	626	354	264	272	1,516
<1/4	2	2	–	2	6
Petrified wood					
>1/4	31	5	8	10	54
Obsidian					
>1/4	104	24	7	9	144
Opal					
>1/4	7	18	10	11	46
Quartzite					
>1/4	154	128	239	167	688
<1/4	–	–	–	1	1
Fine-grained quartzite					
>1/4	3	4	5	3	15
Basalt					
>1/4	78	168	145	139	530
Fine-grained basalt					
>1/4	–	3	4	3	10
Silicized mudstone					
>1/4	6	8	6	9	29
Argillite					
>1/4	1	–	–	–	1
<1/4	–	–	–	1	1
Granitic					
>1/4	2	5	4	4	15
Silt/Mudstone					
>1/4	–	1	–	–	1
Schist					
>1/4	6	2	4	1	13
Calcite					
>1/4	–	–	–	1	1
Quartz					
>1/4	5	9	6	9	29
Indeterminate/misc					
>1/4	1	2	1	–	4
Total					
>1/4	1,928	1,801	1,999	1,282	7,010
<1/4	3	5	1	11	20

[1] Non-lithics deleted

Tables 3-11, 3-12 and 3-13 present a similar problem of interpretation--only those flakes from units that underwent full standard analysis, and those objects with wear and/or manufacture were measured. However, we can state that flake sizes are fairly consistent in cryptocrystalline and non-cryptocrystalline categories from zone to zone, and that measurements seem to increase from cryptocrystalline to non-cryptocrystalline stones and from stones with no cortex to those with cortex. The differences among materials in their suitability for secondary and primary reduction would lead us to expect this finding. However, samples are very small, and anything beyond this very general inference is unwarranted.

INDUSTRIES

There are at least three recognizable stone tool industries at 45-DO-326. The pervasive industry is a generalized flake tool technology, represented by cores, flakes, finished tools and a great amount of chipping detritus. Heat treatment is represented. From the frequency of objects with complete or partial cortex, we can conclude that primary reduction also was commonly practiced. Jasper and chalcedony often were transported to the site as weathered nodules. Basalt and quartzite cobbles from Columbia River gravels were utilized frequently as well. The number of conchoidal and tabular flakes present and the meager evidence of finishing flakes show considerable investment of effort, and the importance of this generalized reductive technique in the manufacture of most tool forms at the site (Table 3-14). We cannot describe actual steps in this reduction sequence nor the fundamental characteristics necessary to delineate the nature of reduction (e.g., hard hammer versus soft hammer percussors, the angle of flake detachment, core and platform preparation, etc.). We can state that the manufacture of lamellar flakes was the most common tool form production; that flake dimensions appear relatively consistent over time, either representing consistent knapping techniques and an idealized product or uniform core sizes; and that there is little apparent change over the period of site occupation in this basic reductive technique.

A Levallois-like blade industry may have been present in zone 4, given the recovery of a single large blade. It is quite comparable to those described by Leonhardy and Muto (1976). No cores were recovered, nor does this analysis recognize the characteristics of manufacture detailed by Muto (1976). We can merely say, then, that one blade is present, and that some core preparation and attendant blade production went on at the site. We cannot, however, assess its prevalence, nor its relationship to the more generalized flake tool technology.

The third tool industry is better described, if only because its products are numerous. This is a microblade industry, which entails the detachment of small, parallel-sided blades from carefully prepared, tiny wedge-shaped cores. Represented by two jasper cores, two core fragments of basalt and fine-grained quartzite, and 169 complete and fragmented microblades, it appears to have been a common form of stone tool production throughout the span of occupation at 45-DO-326. The category linear flake was used in the project analyses for

Table 3-11. Average length of conchoidally flaked material by zone, 45-DO-326.

Dorsal topography	Zone 1	Zone 2	Zone 3	Zone 4	Total
None					
Cryptocrystalline					
$\bar{x}$	10.8	10.5	10.4	11.6	10.7
s.d.	3.8	4.1	4.1	5.6	4.3
n	810	668	663	438	2,579
Non-cryptocrystalline					
$\bar{x}$	17.7	14.5	19.0	12.9	15.9
s.d.	8.9	7.7	7.0	4.0	7.4
n	28	82	68	47	225
Total					
$\bar{x}$	11.0	10.9	11.2	11.7	11.1
s.d.	4.3	4.8	5.1	5.5	4.9
n	838	750	731	485	2,804
Partial cortex					
Cryptocrystalline					
$\bar{x}$	0.0	0.0	0.0	34.7	34.7
s.d.	0.0	0.0	0.0	12.9	12.9
n	–	–	–	3	3
Non-cryptocrystalline					
$\bar{x}$	17.1	19.1	19.1	15.1	17.5
s.d.	9.2	14.7	10.3	5.6	10.5
n	29	64	67	82	242
Total					
$\bar{x}$	17.1	19.1	19.1	15.8	17.7
s.d.	9.2	14.7	10.3	6.9	10.6
n	29	64	67	85	245
Indeterminate					
Cryptocrystalline					
$\bar{x}$	16.0	27.0	0.0	18.5	21.4
s.d.	0.0	11.3	0.0	20.5	12.8
n	1	2	–	2	5
Non-cryptocrystalline					
$\bar{x}$	17.0	0.0	0.0	0.0	17.0
s.d.	0.0	0.0	0.0	0.0	0.0
n	1	–	–	–	1
Total					
$\bar{x}$	16.5	27.0	0.0	18.5	20.7
s.d.	0.7	11.3	0.0	20.5	11.6
n	2	2	–	2	6

[1]<1/4 in flakes, non-lithics and non-conchoidal flakes deleted.

Table 3-12. Average thickness of conchoidally flaked material[1] by zone, 45-DO-326.

Dorsal topography	Zone 1	Zone 2	Zone 3	Zone 4	Total
None					
Cryptocrystalline					
$\bar{x}$	27.3	21.7	57.6	26.6	27.6
s.d.	17.9	16.4	69.2	22.8	27.5
n	79	81	20	97	277
Non-cryptocrystalline					
$\bar{x}$	30.0	30.0	0.0	14.5	26.1
s.d.	17.2	0.0	0.0	6.4	15.0
n	5	1	-	2	8
Total					
$\bar{x}$	27.5	21.8	57.6	26.4	27.6
s.d.	17.8	16.3	69.2	22.7	27.2
n	84	82	20	99	285
Partial cortex					
Cryptocrystalline					
$\bar{x}$	0.0	0.0	0.0	70.0	70.0
s.d.	0.0	0.0	0.0	1.4	1.4
n	-	-	-	2	2
Non-cryptocrystalline					
$\bar{x}$	0.0	0.0	200.0	58.5	105.7
s.d.	0.0	0.0	0.0	47.4	88.3
n	-	-	1	2	3
Total					
$\bar{x}$	0.0	0.0	200.0	64.2	91.4
s.d.	0.0	0.0	0.0	28.2	65.4
n	-	-	1	4	5
Indeterminate					
Cryptocrystalline					
$\bar{x}$	71.0	52.0	0.0	47.0	53.8
s.d.	0.0	5.7	0.0	28.3	17.5
n	1	2	-	2	5
Non-cryptocrystalline					
$\bar{x}$	89.0	0.0	0.0	0.0	89.0
s.d.	4.2	0.0	0.0	0.0	4.2
n	2	-	-	-	2
Total					
$\bar{x}$	83.0	52.0	0.0	47.0	63.9
s.d.	10.8	5.7	0.0	28.3	22.4
n	3	2	-	2	7

[1] <1/4 in flakes, non-lithics and non-conchoidal flakes deleted.

Table 3-13. Average width of conchoidally flaked material[1] by zone, 45-DO-326.

Dorsal topography	Zone 1	Zone 2	Zone 3	Zone 4	Total
None					
Cryptocrystalline					
$\bar{x}$	13.2	12.7	19.9	14.5	14.1
s.d.	6.6	8.6	13.6	9.7	9.1
n	55	44	15	66	180
Non-cryptocrystalline					
$\bar{x}$	20.0	4.0	0.0	15.0	14.7
s.d.	15.6	0.0	0.0	0.0	11.7
n	2	1	-	1	4
Total					
$\bar{x}$	13.4	12.6	19.9	14.5	14.1
s.d.	6.9	8.6	13.6	9.7	9.2
n	57	45	15	67	184
Partial cortex					
Cryptocrystalline					
$\bar{x}$	0.0	0.0	0.0	38.0	38.0
s.d.	0.0	0.0	0.0	9.9	9.9
n	-	-	-	2	2
Non-cryptocrystalline					
$\bar{x}$	0.0	0.0	108.0	33.5	58.3
s.d.	0.0	0.0	0.0	24.7	46.4
n	-	-	1	2	3
Total					
$\bar{x}$	0.0	0.0	108.0	35.7	50.2
s.d.	0.0	0.0	0.0	15.6	35.0
n	-	-	1	4	5
Indeterminate					
Cryptocrystalline					
$\bar{x}$	20.0	19.5	0.0	24.5	21.6
s.d.	0.0	6.4	0.0	17.7	9.8
n	1	2	-	2	5
Non-cryptocrystalline					
$\bar{x}$	50.0	0.0	0.0	0.0	50.0
s.d.	0.0	0.0	0.0	0.0	0.0
n	1	-	-	-	1
Total					
$\bar{x}$	35.0	19.5	0.0	24.5	26.3
s.d.	21.2	6.4	0.0	17.7	14.5
n	2	2	-	2	6

[1] <1/4 in flakes, non-lithics and non-conchoidal flakes deleted.

Table 3-14. Material group by object type[1] by functional type by dorsal topography by zone, 45-DO-326.

Material group	Object type	Functional type	Dorsal topography	Zone 1	Zone 2	Zone 3	Zone 4	Total
Cryptocrystalline	Conchoidal flake	Biface	None	1	-	-	-	1
		Burin	None	1	-	-	-	1
		Drill	None	1	1	1	4	7
		Graver	None	1	1	1	1	4
			Partial cortex	-	-	-	1	1
		Resharpened flake	None	2	2	-	-	4
		Flake from a blade core	None	-	-	1	-	1
		Bifially retouched flake	None	5	7	-	3	15
		Unifacially retouched flake	None	2	2	2	3	9
		Utilization only	None	25	19	22	39	105
			Partial cortex	-	-	-	1	1
		None	None	1,295	1,257	1,322	746	4,620
			Partial cortex	1	3	-	1	5
			Indeterminate	1	2	-	2	5
	Microblade	Microblade	None	16	28	75	48	167
	Blade	Blade	None	-	-	-	1	1
	Tabular	None	None	1	-	-	-	1
	Chunk	Biface	None	1	-	-	-	1
		Amorphously flaked object	None	-	-	-	1	1
		Blade core	None	-	-	-	1	1
		Bifacially retouched flake	None	5	1	-	1	7
		Unifacially retouched flake	None	1	2	2	2	7
		Utilization only	None	7	3	3	1	14
		None	None	113	73	119	59	364
			Partial cortex	5	1	1	1	8
			Indeterminate	-	-	-	1	1
	Core	Core	None	-	-	1	-	1
		Blade core	None	-	1	-	-	1
	Formed object	Projectile point	None	15	6	4	5	30
		Projectile point base	None	3	3	7	2	15
		Projectile point tip	None	10	12	3	-	25
		Biface	None	19	15	7	5	46
			Indeterminate	-	-	1	-	1
		Burin	None	-	1	-	-	1
		Graver	None	1	-	-	1	2
		Scraper	None	1	-	-	1	2
		Bifacially retouched flake	None	2	1	1	1	5
		Unifacially						

Table 3-14. Cont'd.

Material group	Object type	Functional type	Dorsal topography	Zone 1	Zone 2	Zone 3	Zone 4	Total
Cryptocrystalline	Weathered	None	Indeterminate	–	–	–	1	1
	Indeterminate	Utilization only	None	–	–	1	2	3
		None	None	30	7	2	–	39
			Indeterminate	–	1	–	1	2
Quartzite	Conchoidal flake	Utilization only	Partial cortex	–	–	1	–	1
		None	None	1	1	3	5	10
			Partial cortex	–	2	1	3	6
	Tabular	Tabular knife	None	–	–	3	1	4
			Partial cortex	1	2	1	–	4
		None	None	88	86	168	117	459
			Partial cortex	60	34	57	39	190
	Chunk		None	–	–	2	–	2
			Partial cortex	3	3	1	1	8
	Core	Chopper	Partial cortex	–	–	1	–	1
	Formed object		Partial cortex	–	–	–	1	1
	Unmodified		Partial cortex	–	–	1	–	1
		None	Complete cortex	1	–	–	–	1
Fine-grained quartzite	Conchoidal flake		None	1	2	2	1	6
			Partial cortex	–	1	–	1	2
	Chunk		None	–	–	–	1	1
			Partial cortex	1	1	3	–	5
	Formed object	Tabular knife	Partial cortex	1	–	–	–	1
Basalt	Conchoidal flake	None	None	31	96	76	57	260
			Partial cortex	37	65	69	80	251
			Indeterminate	2	–	–	–	2
	Microblade	Microblade	None	–	–	–	2	2
	Chunk	Indeterminate	Partial cortex	–	–	1	–	1
		None	None	–	2	2	2	6
			Partial cortex	1	–	–	–	1
	Core	Core	Partial cortex	1	–	–	–	1
	Formed object	Projectile point	None	–	1	–	–	1
		Chopper	Partial cortex	–	1	–	1	2
		Pestle	Partial cortex	–	1	–	–	1
		Peripherally flaked cobble	Partial cortex	1	–	–	–	1
	Unmodified	Hammerstone	Partial cortex	1	1	–	–	2
			Complete cortex	1	1	–	–	2
		None	Partial cortex	2	–	–	–	2
			Complete cortex	1	2	–	–	3
	Indeterminate		None	–	–	1	–	1
			Indeterminate	–	1	–	–	1

Table 3-14. Cont'd.

Material group	Object type	Functional type	Dorsal topography	Zone 1	Zone 2	Zone 3	Zone 4	Total
Granitic	Chunk		None	–	–	–	1	1
			Partial cortex	–	–	1	1	2
	Unmodified	Hammerstone	Partial cortex	1	–	1	1	3
			Complete cortex	1	4	–	1	6
		Hopper mortar	Complete cortex	–	–	1	–	1
		Indeterminate	Complete cortex	–	1	–	–	1
		None	Complete cortex	–	–	1	–	1
Obsidian	Conchoidal flake	Bifacially retouched flake	None	1	–	–	–	1
		Utilization only	None	1	–	–	–	1
		None	None	97	24	7	9	137
	Formed object	Biface	None	3	–	–	–	3
	Indeterminate	*None*	None	2	–	–	–	2
Other lithic	Conchoidal flake	Utilization only	Partial cortex	–	–	–	2	2
			Indeterminate	–	1	–	–	1
		None	None	5	5	4	1	15
			Partial cortex	1	–	–	2	3
	Tabular	Utilization only	Indeterminate	1	–	–	–	1
		None	None	–	1	1	–	2
			Indeterminate	5	–	1	1	7
	Chunk	Indeterminate	Partial cortex	–	–	1	–	1
		None	None	–	9	4	5	18
			Partial cortex	3	–	3	5	11
			Indeterminate	3	4	2	4	13
Indeterminate lithic	Formed object	Bead	None	–	–	1	–	1
	Unmodified	Hammerstone	Complete cortex	–	1	–	–	1
	Indeterminate	None	*Indeterminate*	1	1	–	–	2
Total				1,828	1,801	1,899	1,282	7,010

[1] <1/4 in flakes and non-lithics deleted

flakes less than one cm wide and more than twice as long as they were wide in hopes of identifying microblades. As there is clear evidence of a microblade technology at this site, they have been called microblades rather than linear flakes.

The production of microblades requires quite different core preparation than that involved in the production of conchoidal flakes (Figure 3-2). Striking platforms must be broad and flat, with angular margins that approach a 90 degree or sub-90 degree angle to the striking platform. This results in a plane of detachment for blades that carries from the point of impact well down toward the ventral midline of the core. Blades may be detached by percussion or pressure flaking. The focused force will remove a long narrow flake that feathers out as the force carries across the core's lateral surface or terminates abruptly at some surface irregularity. This reductive process is more controlled and intricate than that required for the simple detachment of lamellar flakes. However, the two techniques may not be exclusive, since cores or chunks that are products of the one process can be readily adapted for use in the other.

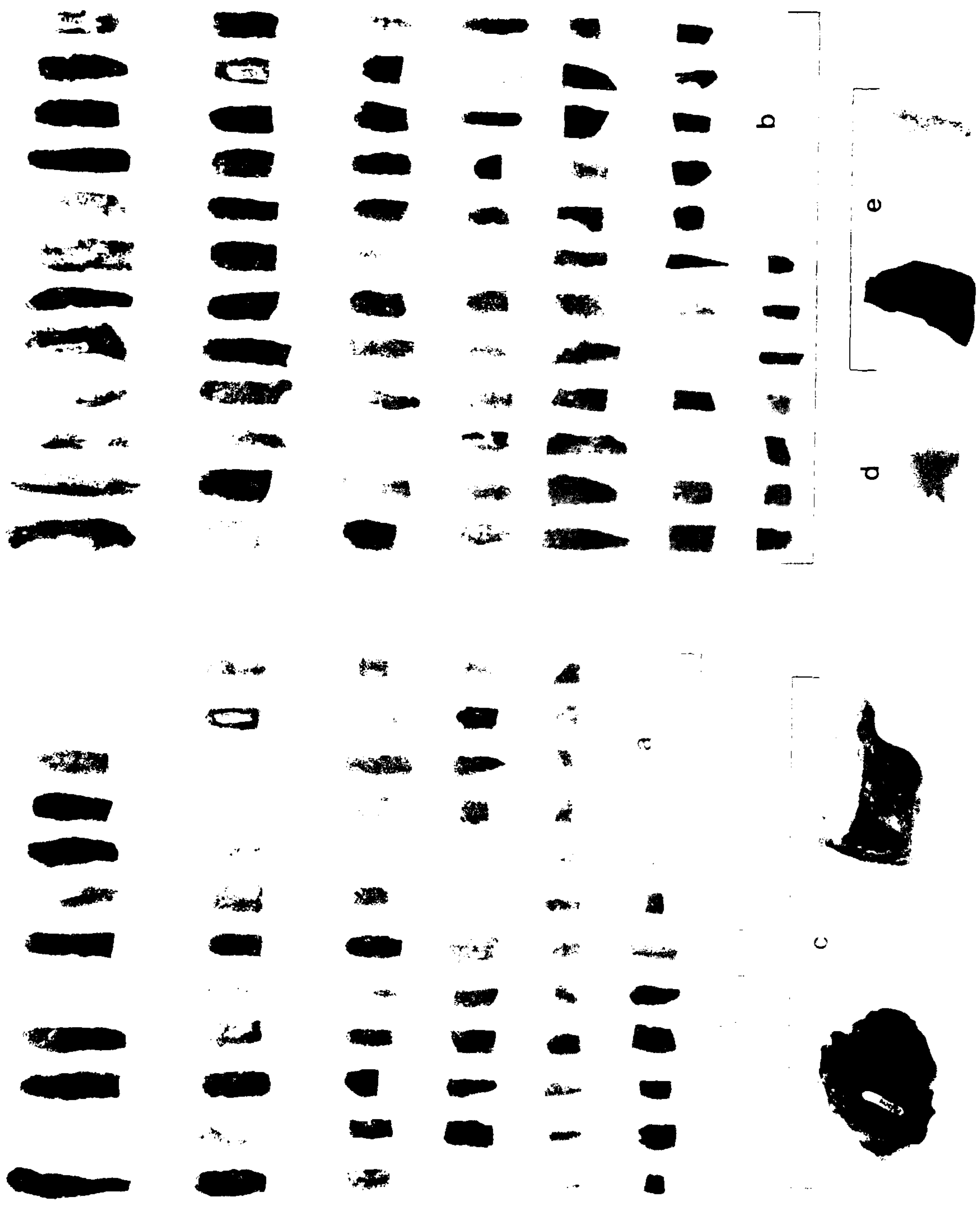
Microblade, blades, and microblade cores recovered from 45-DO-326 are illustrated in Plate 3-1. Table 3-15 lists measurements of all microblades classified as whole specimens, and contrasts these with measurements taken from distally snapped as well as complete microblades. Table 3-16 describes microblade attributes for the site assemblage as a whole. Most microblades have prismatic cross sections (two arrises on the dorsal surface) (N=102, 60.3%), although many have a triangular cross section (a single arris) (N=67, 39.6%). Only 16 specimens do not terminate in a lateral snap fracture. Sixty-five (38.5%) have been snapped across both the dorsal and proximal ends. The consistent location of these snaps makes it unlikely that they are the product of use, but rather they are the result of manufacture. The microblades with intact proximal ends consistently show characteristics defined for classic microblades (Figure 3-2): striking platform remnants, areas of battering/core preparation, strong bulbs of percussion, even, parallel lateral margins, one or more parallel arrises, and a feathered or laterally snapped distal end. Some crushing of the striking platforms and pronounced bulbs of percussion indicate blade removal by direct freehand percussion (cf. Kelly 1982). Remnant core edges on these blades document

Table 3-15. Range of microblade measurements, 45-DO-326.

Measurements	Length (mm)	Width (mm)	Thickness (mm)
Complete			
Range	11.0-31.0	4-9	1.0-2.0
$\bar{x}$	20.1	5.8	1.2
n=16			
Complete/distal snap fracture			
Range	11.0-31.0	3-9	1.0-2.0
$\bar{x}$	18.8	5.7	1.2
n=42			

Plate 3-1. Microblades, blades, and microblade cores, 45-DO-326.

a. microblades with triangular cross sections
b. microblades with prismatic cross sections
c. microblade cores
d. blade fragment
e. microblade core fragments


a
b
c
d
e

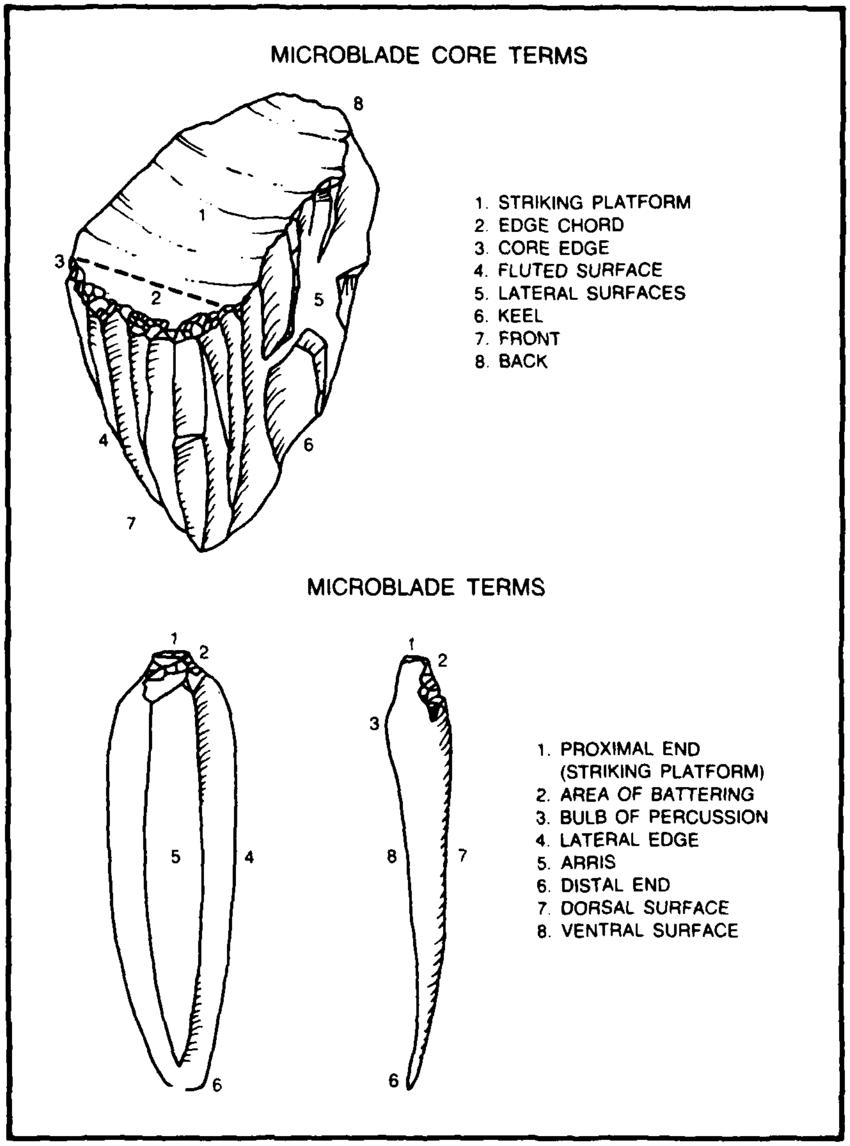


Figure 3-2. Microblade core and microblade terms (from Sanger 1968: Figure 2).

Table 3-16. Microblade attributes, 45-DO-326.

Prismatic cross section	
Distal end snap fracture	41
Proximal end snap fracture	11
Distal/proximal end snap fracture	39
Complete	11
Triangular cross section	
Distal end snap fracture	32
Proximal end snap fracture	4
Distal/proximal end snap fracture	26
Complete	5
Total	169

routine core preparation described by Sanger (1968, 1970) as a definitive characteristic.

The two complete microblade cores (M#104 and 323) and the two core fragments (M#31 and 103) are described in Tables 3-17 and 3-18. As shown, all have core edge angles that are well below 90 degrees. The two complete specimens have only four flutes each. The two fragments have even fewer flutes, but given the small remnant surface, the close spacing of the flutes, and their fine, even arrises, we may infer that the original cores were more intensively utilized than the two complete specimens recovered. Also, it seems likely that both core remnants were intentionally detached from the parent cores. Both have a thick platform remnant and retain a part of the ventral heel, indicative of a blow intended to create a fresh working edge. Three of the four cores show heavy edge grinding as part of routine core preparation. Specimen #104 shows irregular flutes, most of which terminate in abrupt step fractures. It seems likely that it was preserved as a complete core because it proved unsuitable for consistent blade production. Specimen #323, however, shows fine regular flutes taken off of the front end and may simply have been abandoned once a sufficient number of blades had been removed.

Table 3-17. Attributes of microblade cores, 45-DO-326.

Specimen #	Zone	Material	Platform length (mm)	Platform width (mm)	Core Height (mm)	Core edge angle (degrees)
31	2	Basalt	—	—	—	81
103	3	Fine-grained quartzite	—	—	—	60
104	3	Jasper	33.0	26.0	22.0	68
323	4	Jasper	39.0	14.0	24.0	71
$\bar{x}$			36.0	20.0	23.0	70

Table 3-18. Attributes of flutes on microblade cores, 45-DO-326.

Specimen #	Number of flutes	Mean width of flutes (mm)	Mean length of flutes (mm)	Striking directions
31	2	5.0	24.0	1
103	3	5.0	19.3	1
104	4	6.0	16.75	2
323	4	4.2	20.0	1
Range		4.0-7.0	12.0-24.0	1-2
x̄		5.0	20.0	1.2

Flute measurements match very closely those listed for recovered microblades, with an average length of 20.0 mm and an average width of 5.0 mm. The consistency between measurements of microblade width, length, and thickness and core heights, flute length, and width demonstrate remarkable uniformity in this reductive technique. Knappers clearly were holding to an accepted standard and turning out blades with very little variation in size, except that dictated by core configuration and dimensions. However, it is also clear that cores were used intensively and that blades of differing shapes, lengths, widths, and thicknesses were removed from the same cores with little concern for a strict formal standard. One core from 45-DO-326 (Specimen #103) shows at least two striking directions--one is below the prepared platform edge, the other across the platform surface from the edge. Several microblade cores from nearby 45-DO-282 (Lohse 1983d) also show multiple striking platforms, documenting routine core rotation rather than use restricted to the more carefully prepared frontal edge as characterized by Sanger (1968, 1970), and thus production of blades of variable form if not of markedly variable size. It would seem, therefore, that the consistency observed in microblade sizes is a function of core selection and manufacture, as well as percussor size, rather than the result of a strict ideal of proper flake form. Size appears a concern, particularly width, but form appears to have been gauged within broad limits. In sum, it would seem that production of small blades of about the same width and thickness was more important than the overall form of the blade.

Dimensions recorded for both microblade cores and microblades in this collection are very similar to those recorded by Sanger (1968, 1970) and Munsell (1968) for microblades on the Columbia Plateau and by Taylor (1962) for microblades in the American Arctic. Blade widths average 5.7 mm; lengths average 18.8 mm. This consistency in blade size across the Northwest and into the Arctic has led Sanger (1968, 1970) to postulate a "Plateau Microblade Tradition" and to speculate that there are direct historical ties to microblade traditions to the north.

While this microblade industry occurred in the context of a more generalized flake tool industry which was also associated with a Levallois-like blade tool industry, and all three were based on the reduction of jasper and chalcedony, it required more careful, controlled techniques of tool production. All three industries at 45-DO-326 are distinct, but as shown by their association here and elsewhere on the Columbia Plateau, they were complementary facets of the same general stone tool technology.

TEMPORAL AND SPATIAL DISTRIBUTION

Stone tool manufacture, primarily as part of a generalized flake tool industry utilizing imported cryptocrystalline stones, was relatively consistent over the projected 5,000-4,000 year span of activity at 45-DO-326. Microblade production was an important supplement to this more pervasive industry. The recovery of a single large blade fragment may indicate a Levallois-like technique as well, but this is purely conjecture. We do note some temporal changes in the proportion of specific diagnostics in the artifact assemblage--microblades and tabular flakes are much more frequent in Zones 4 and 3; the only blade was recovered from Zone 4; formed objects are more frequent in the uppermost zones (2 and 1); the highest proportion of stones with cortex occur in Zone 4. Consistent elements include the dominance of jasper and chalcedony in all four zones, and the use of locally available basalt and quartzite throughout the span of occupation. Also, conchoidal flakes are the most numerous artifact class irrespective of analytic zone, and seem to have been the consistently preferred tool form, supplemented by the production of tabular flakes and microblades.

FUNCTIONAL ANALYSIS

Functional analysis examines the physical characteristics of artifacts in order to identify patterns of wear diagnostic of specific tool uses. Past research has pointed out the possibility of interpreting tool use by examining edge damage and general attrition of working surfaces (e.g., Hayden 1979; Stafford and Stafford 1979; Keeley 1974, 1978; Odell 1977; Crabtree 1973; Wilmsen 1968, 1970; Frison 1968; Semenov 1964). Wear patterns have been shown to reveal both the manner of tool use and the nature of the materials worked.

All artifacts were examined with a 10X hand-lens (cf. Hayden 1979; Stafford and Stafford 1979). During analysis, each artifact was classified as to tool shape, wear or surface damage, and edge angle. Making use of established correlations between specific wear patterns on certain materials and types of tool use, we can hypothesize the intended and actual use of collected tools. Most distinctions will be based on hardness--on the nature of edge attrition given softer and harder working mediums.

Eight classificatory dimensions are used to describe functional attributes: UTILIZATION-MODIFICATION, CONDITION OF WEAR, WEAR/MANUFACTURE RELATIONSHIP, KIND OF WEAR, LOCATION OF WEAR, SHAPE OF WORN AREA, ORIENTATION OF WEAR, and EDGE ANGLE. The first dimensions describes objects, the next six describe tools on objects, and the last describes variation within object/tool types through measurement of the working edges. Table 3-19 outlines these dimensions and constituent attributes.

Table 3-19. Functional dimensions, 45-DO-326.

DIMENSION I: UTILIZATION/MODIFICATION

None
Wear only
Manufacture only
Manufacture and wear
Modified/indeterminate
Indeterminate

DIMENSION II: TYPE OF MANUFACTURE

None
Chipping
Pecking
Grinding
Chipping and pecking
Chipping and grinding
Pecking and grinding
Chipping, pecking, grinding
Indeterminate/not applicable

DIMENSION III: MANUFACTURE DISPOSITION

None
Partial
Total
Indeterminate/not applicable

DIMENSION IV: WEAR CONDITION

None
Complete
Fragment

DIMENSION V: WEAR/MANUFACTURE RELATIONSHIP

None
Independent
Overlapping - total
Overlapping - partial
Independent - opposite
Indeterminate/not applicable

DIMENSION VI: KIND OF WEAR

Abrasion/grinding
Smoothing
Crushing/pecking
Polishing

DIMENSION VI: Continued

Feathered chipping
Feathered chipping/abrasion
Feathered chipping/smoothing
Feathered chipping/crushing
Feathered chipping/polishing
Hinged chipping
Hinged chipping/abrasion
Hinged chipping/smoothing
Hinged chipping/crushing
Hinged chipping/polishing
None

DIMENSION VII: LOCATION OF WEAR

Edge only
Unifacial edge
Bifacial edge
Point only
Point and unifacial edge
Point and bifacial edge
Point and any combination
Surface
Terminal surface
None

DIMENSION VIII: SHAPE OF WORN AREA

Not applicable
Convex
Concave
Straight
Point
Notch
Slightly convex
Slightly concave
Irregular

DIMENSION IX: ORIENTATION OF WEAR

Not applicable
Parallel
Oblique
Perpendicular
Diffuse
Indeterminate

DIMENSION X: OBJECT EDGE ANGLE

Actual edge angle

Description will initially focus on functional object types. Object-specific dimensions will be used to introduce the occurrences of wear on functional object types. Tool-specific dimensions will outline the relationship of wear to manufacture and explicate the kinds of wear observed. Analysis will therefore proceed from the object to examination of tools on the object. Summary tables will deal with tools and the attributes of wear and manufacture which characterize them, rather than with simple descriptions of traditional formal-functional categories.

As in the preceding section on Technological Analysis, all discussion will focus on the distribution of functional types and tool types within the four defined analytic zones.

FUNCTIONAL OBJECT TYPES

A total of 530 stone tools were recovered from site 45-DO-326 (Table 3-20). These include a broad range of functional forms, encompassing light piercing and cutting tools, cruder, thicker cutting and scraping tools, and heavy chopping and pounding implements. Microblades (31.9%, N=169) and simple utilized flakes (24.3%, N=129) are by far the most frequent tool forms. Other frequent tool forms include projectile points (13.4%, N=71), bifaces (9.8%, N=52) and bifacially and unifacially retouched flakes (9.0%, N=48). Small finished tool forms such as gravers, burins and drills comprise only 3% of the assemblage (N=16). Large chopping or pounding implements such as choppers, hammerstones and pestles constitute another 3.8% (N=20). All other tool forms together make up less than 5% of the entire assemblage, and include tabular knives, flaked cobbles, two cores and a hopper mortar base. Examples of most of the object types are illustrated in Plates 3-2, 3-3, and 3-4. Table 3-21 lists these functional types by occurrence of wear and wear/manufacture by analytic zone. As listed, 33.4% (N=177) show wear only, 10.9% (N=58) show a combination of wear and manufacture, 27.5% (N=146) have manufacture only, and the rest have either no manufacture or are classified as modified/indeterminate (28.2%, N=149). Of those functional types showing no manufacture, microblades (97.2%, N=143) are by far the most frequent. Together, these tool forms indicate a broad range of potential functions, but suggest a site economy geared primarily to hunting, butchering and processing of game and routine maintenance of that tool kit.

Nonlithic artifacts make up but a small proportion of the total assemblage. Because the functional analysis was designed to apply primarily to lithics, the nonlithic artifacts are summarized briefly here but are not discussed in the following sections. Decorative items of nonlithic materials include a bone bead and a dentalium bead. There are only two formed utilitarian objects. The item classified as a squared/rounded end shaft is a parallel-sided bone shaft with an oval cross section and blunt, slightly rounded ends. The fragmentary point could have resulted from the breakage of a variety of tools. The remaining categories of bone are not formed tools but display some evidence of modification, although it cannot necessarily be determined if the modification is due to manufacture, butchering, or wear. Technologically modified bone includes three elk antler beam sections (Plate

KEY

Master Number:
Morphological Type:
Tool:
Provenience/Level:
Material:

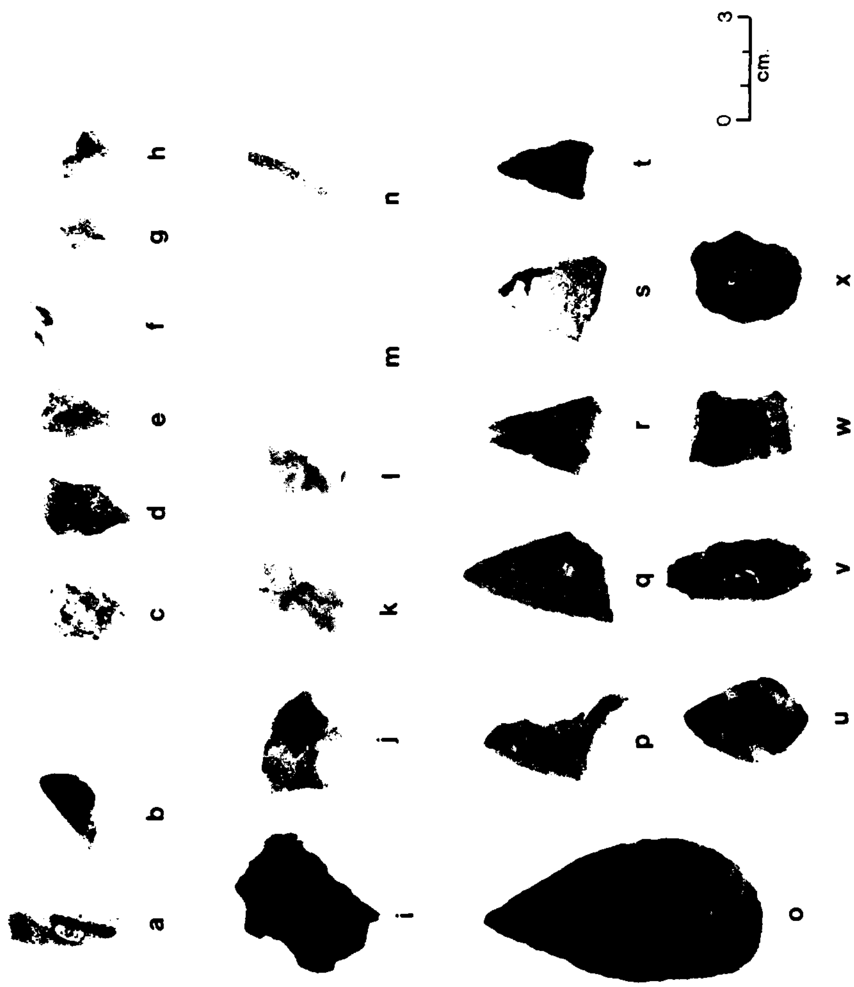
a.	b.	c.	d.	e.	f.	g.	h.
53	481	635	671	163	500	83	331
Scraper	Scraper	Drill	Drill	Drill	Drill	Drill	Drill
13N8S/20	19N16W/30	16N/15W/100	15N13W/180	19N14W/130	19N16W/40	20N16W/60	19N15W/20
1	1	1	1	4	1	2	1
Jasper	Jasper	Jasper	Jasper	Jasper	Chalcedony	Chalcedony	Jasper

i.	j.	k.	l.	m.	n.
106	167	125	162	615	114
Graver	Graver	Graver	Graver	Graver	Burin
14N12W/140	19N13W/90	19N19W/60	19N14W/130	17N14W/40	19N20W/50
4	3	1	4	1	2
Jasper	Jasper	Petrified Wood	Petrified Wood	Jasper	Jasper

o.	p.	q.	r.	s.	t.
425	37	568	316	79	661
Biface	Biface	Biface	Biface	Biface	Biface
18N15W/100	19N21W/30	19N18W/40	18N17W/FE44/30	10N16W/50	15N13W/30
3	1	2	2	2	1
Jasper	Jasper	Jasper	Jasper	Jasper	Jasper

u.	v.	w.	x.
230	615	182	194
Biface	Biface	Biface	Biface
18N13W/20	17N14W/40	19N13W/150	18N14W/30
2	1	4	1
Jasper	Jasper	Jasper	Jasper

Plate 3-2. Scrapers, drills, gravers, burin, and bifaces, 45-DO-326.


a
b
c
d
e
f
g
h
i
j
k
l
m
n
o
p
q
r
s
t
u
v
w
x
0
3
cm.

KEY

Master Number:
Morphological Type:
Tool:
Provenience/Level:
Zone:
Material:

a.	b.	c.
428	424	244
Chopper	Chopper	Chopper
18N15W/FE50/100	18N15WFE50/100	18N13W/140
3	3	4
Coarse-grained quartzite	Coarse-grained quartzite	Coarse-grained quartzite

d.

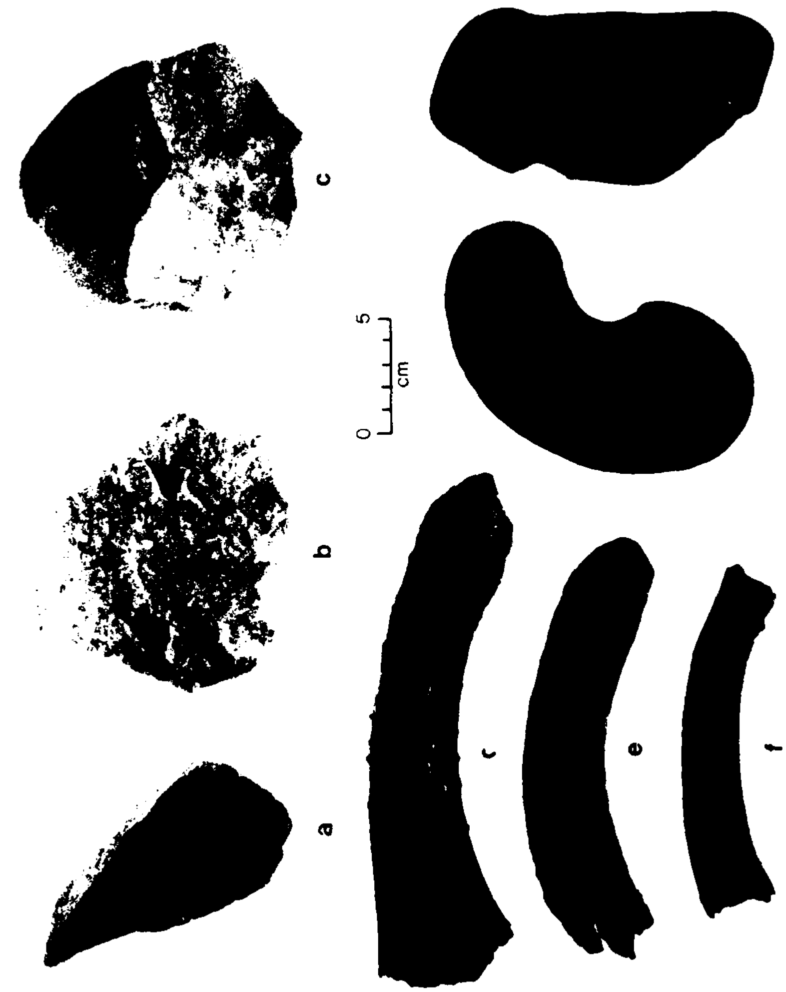
555
Technologically modified antler
20N17W/FE72/30
1
Antler

e.

554
Technologically modified antler
20N17W/FE72/30
1
Antler

f.	g.	h.
556	231	2
Technologically modified antler	Indeterminate	Net sinker
20N17W/FE72/30	18N13W/30	Surface
1	2	-
Antler	Granite	Basalt

Plate 3-3. Choppers, modified antler, indeterminate object, and net sinker, 45-DO-326.



c.
115
Hammerstone
19N20W/60
2
Basalt

d.
212
Hammerstone
18N14W/120
4
Granite

a.
118
Pestle
19N20W/FE41/100
2
Basalt

b.
676
Hammerstone
14N13W/100
2
Granite

KEY
Master Number:
Tool:
Provenience/Level:
Zone:
Material:

Plate 3-4. Pestles and hammerstones, 45-DO-326.

Table 3-20. Count[1] of functional types by zone, 45-DO-326.

Functional type	Zone 1	Zone 2	Zone 3	Zone 4	Total
Projectile point	15	7	4	5	31
Projectile point base	3	3	7	2	15
Projectile point tip	10	12	3	-	25
Biface	24	16	8	5	52
Burin	1	1	-	-	2
Chopper	-	1	2	2	5
Drill	1	1	1	4	7
Graver	2	1	1	3	7
Pestle	-	1	-	-	1
Peripherally flaked cobble	1	-	-	-	1
Scraper	1	-	-	1	2
Tabular knife	2	2	4	1	9
Bead	-	-	1	-	1
Amorphously flaked object	-	-	-	1	1
Hammerstone	4	7	1	2	14
Hopper mortar	-	-	1	-	1
Blade	-	-	-	1	1
Microblade	18	26	75	50	169
Core	1	-	1	-	2
Resharpenening flake	2	2	-	-	4
Flakes off blade core	-	-	1	-	1
Blade core	-	1	-	1	2
Bifacially retouched flake	13	9	1	5	28
Unifacially retouched flake	4	4	6	6	20
Utilization only	34	23	27	45	129
Indeterminate	-	1	2	-	3
Total lithics	136	117	146	134	533
Nonlithics					
Bone bead	1	-	-	-	1
Squared/rounded end shaft	-	-	1	-	1
Pointed bone fragment	-	-	-	1	1
Indeterminate bone	-	1	-	1	2
Technologically modified only bone	1	-	-	-	1
Flaked long bone	2	1	1	1	5
Dentalium	1	-	-	-	1
Total nonlithics	8	2	3	3	16

[1] <1/4 in flakes deleted.

Table 3-21. Functional types[1] and attributes of wear and manufacture by zone, 45-DO-326.

Functional type	UM[2]	TM[3]	Zone 1	Zone 2	Zone 3	Zone 4
Projectile point	3	2	15	6	3	4
	4	2	-	1	1	1
Projectile point base	3	2	3	3	7	2
Projectile point tip	3	2	9	12	2	-
	4	2	1	-	1	-
Biface	3	2	22	13	8	5
	4	2	2	2	2	-
Burin	4	2	1	1	-	-
Chopper	3	2	-	-	1	2
	4	2	-	1	1	-
Drill	2	1	-	1	-	3
	4	2	1	-	1	1
Graver	2	1	1	1	-	1
	4	2	1	-	1	2
Pestle	4	7	-	1	-	-
Peripherally flaked cobble	3	2	1	-	-	-
Scraper	3	2	-	-	-	1
	4	2	1	-	-	-
Tabular knife	3	2	-	-	2	-
	4	2	2	2	2	1
Bead	5	9	-	-	1	-
Amorphously flaked object	3	2	-	-	-	1
Hammerstone	2	1	4	7	1	2
Hopper mortar	2	1	-	-	1	-
Blade	2	1	-	-	-	1
Microblade	1	1	16	20	63	44
	2	1	2	6	12	6
Core	1	1	1	-	1	-
Resharpened flake	3	2	1	2	-	-
Flakes off blade core	1	1	-	-	1	-
Blade core	1	1	-	1	-	1
Bifacially retouched flake	3	2	10	7	1	2
	4	2	3	2	-	3
Unifacially retouched flake	3	2	-	-	-	2
	4	2	4	4	6	4
Utilization only	2	1	34	22	27	45
	3	2	-	1	-	-
Indeterminate	5	9	-	1	2	-
Total			136	117	148	134

[1]Non-lithic materials deleted

[2]Utilization/Modification
1. None
2. Wear only
3. Manufacture only
4. Manufacture and wear
5. Modified/indeterminate
6. Indeterminate

[3]Type of manufacture
1. None
2. Chipping
3. Pecking
4. Grinding
5. Chipping and pecking
6. Chipping and grinding
7. Pecking and grinding
8. Chipping, pecking, grinding
9. Not applicable/indeterminate

3-3,d-f) with extensive chopping marks. The cut marks have wide flat faces and are steep angled; they appear to have been made with a metal axe rather than with a stone tool. Flaked long bones may have single or multiple flake scars on the margins. In some cases the flake scars may be due to fracturing of the long bone shafts with a rock, in other cases they may be due to wear from use of the bottom edge as a tool.

WEAR PATTERNS

Many of the 530 stone tool forms exhibit more than one instance of wear or more than one tool (17.4%, N=92) (Table 3-22). The highest wear area-object ratios were observed on drills, gravers and scrapers. Ratios for hammerstones, unifacially retouched flakes, utilized flakes and tabular knives are only slightly lower. Bifacially retouched flakes, resharpening flakes, microblades, bifaces and projectile points have the lowest ratios among the remaining classes with reasonable samples. Tool forms with the largest range of defined wear areas include utilized flakes, unifacially retouched flakes, bifaces, drills and gravers, with from 0-6 isolable tools. Among those forms with the narrowest range are choppers, burins, bifacially retouched flakes and resharpening flakes, with 0-2 wear areas present. We conclude that although simple utilized flakes were the most frequent tool form with wear, and were intensively used, other tool forms such as drills, gravers, scrapers and hammerstones saw equally intensive use and reuse. We may also conclude that tool forms may not be safely categorized under a single functional label as they have multiple uses and variable potential functions.

Figure 3-3 illustrates the relationship of wear types to defined functional types; Table 3-23 describes them more fully. Most obvious is the rough correspondence between functional types with implicitly associated uses and wear types indicative of those kinds of uses. Choppers and hammerstones are characterized by heavy crushing wear on edges and surfaces indicative of work in hard materials, either bone or stone. Smaller flaked tool forms are characterized by feathered and hinged chipping wear on unifacial and bifacial edges and points. If we make finer distinctions, however, we discover discrepancies between implied and actual tool uses. For instance, projectile points show smoothing, feathered chipping and crushing wear on edges, reflecting use as general purpose cutting and scraping tool forms. Scrapers show predominantly hinged chipping wear on unifacial and bifacial edges indicative of heavy cutting or scraping uses. If these tools had, in fact, been commonly used to scrape hides or other soft materials, they would have exhibited a prevalence of smoothing or light, feathered chipping wear. Drills and gravers, tool forms believed to have been used to perforate or incise relatively hard material like bone, do exhibit the expected heavy hinged chipping wear on points, but are characterized as well by feathered and hinged chipping wear on unifacial and bifacial edges. We conclude, then, that tool forms were used for purposes not necessarily defined by obvious morphological attributes of form or by attached functional labels.

Table 3-22. Functional type and wear area:object ratio by zone, 45-DO-326.

Functional type	Number of worn areas	Zone 1 Frequency	Zone 1 Ratio	Zone 2 Frequency	Zone 2 Ratio	Zone 3 Frequency	Zone 3 Ratio	Zone 4 Frequency	Zone 4 Ratio	Total Frequency	Total Ratio
Utilized flake	0	-	46/34	1	30/23	-	43/27	-	73/45	1	192/129
	1	24	=1.35	15	=1.30	15	=1.59	28	=1.62	82	=1.49
	2	9		6		8		7		30	
	3	-		1		4		9		14	
	4	1		-		-		1		2	
Unifacially retouched flake	0	-	7/4	-	11/4	-	8/6	2	8/6	2	34/20
	1	3	=1.75	1	=2.75	4	=1.33	3	=1.33	11	=1.70
	2	-		1		2		-		3	
	4	1		2		-		-		3	
	5	-		-		-		1		1	
Bifacially retouched flake	0	10	4/13	7	3/9	1	0/1	2	3/5	20	3/28
	1	2	=.31	1	=.33	-	=0.0	3	=.60	6	=.11
	2	1		1		-		-		2	
Resharpened flake	0	1	1/2	2	0/2	-		-		3	1/4
	1	1	=.50	-	=0.0	-		-		1	=.25
Microblade	0	16	3/18	20	8/26	63	16/75	44	8/50	143	36/169
	1	1	=.17	2	=.35	8	=.12	6	=.12	17	=.21
	2	1		3		4		-		8	
	3	-		1		-		-		1	
Blade	2	-		-		-		1	2/1 =2.00	1	2/1 =2.00
Tabular knife	0	-	4/2	-	3/2	2	1/4	-	2/1	2	11/9
	1	1	=2.00	1	=1.50	2	=.25	-	=.200	4	=1.22
	2	-		1		-		1		2	
	3	1		-		-		-		1	
Biface	0	22	4/24	13	2/15	6	6/8	5	0/5	46	12/52
	1	1	=.17	2	=.13	-	=.75	-	=0.0	3	=.23
	2	-		-		1		-		1	
	3	1		-		-		-		1	
	4	-		-		1		-		1	
Scraper	0	-	5/1	-		-		1	0/1	1	5/2
	5	1	=5.00	-		-		-	=0.0	1	=2.50
Burin	1	1	1/1 =1.00	1	1/1 =1.00	-		-		2	1/2 =.50

Table 3-22. Cont'd.

Functional type	Number of wear areas	Zone 1 Frequency	Zone 1 Ratio	Zone 2 Frequency	Zone 2 Ratio	Zone 3 Frequency	Zone 3 Ratio	Zone 4 Frequency	Zone 4 Ratio	Total Frequency	Total Ratio
Drill	1	1	1/1 =1.00	1	1/1 =1.00	-	4/1 =4.00	1	14/4 =3.50	3	20/7 =2.86
	2	-		-		-		1		1	
	4	-		-		1		-		1	
	5	-		-		-		1		1	
	6	-		-		-		1		1	
Graver	1	1	6/2 =3.00	-	2/1 =2.00	-	2/1 =2.00	-	9/3 =3.00	1	18/7 =2.57
	2	-		1		1		2		4	
	5	1		-		-		1		2	
Projectile point*	0	27	2/28 =.07	21	1/22 =.04	12	2/14 =.14	6	1/7 =. 14	66	6/71 =.08
	1	-		1		2		1		4	
	2	1		-		-		-		1	
Chopper	0	-		-	1/1 =1.00	1	1/2 =.50	2	0/2 =0.0	3	2/5 =.40
	1	-		1		1		-		2	
Peripherally flaked cobble	0	1	0/1 =0.0	-		-		-		1	0/1 =0.0
Amorphously flaked object	0	-		-		-		1	0/1 =0.0	1	0/1 =0.0
Core	0	1	0/1 =0.0	-		1	0/1 =0.0	-		2	0/2 =0.0
Blade core	0	-		-		1	0/1 =0.0	1	0/1 =0.0	2	0/2 =0.0
Hammerstone	1	2	6/4 =1.50	2	15/7 =2.14	-	2/1 =2.00	1	3/1 =3.00	5	26/14 =1.86
	2	2		2		1		1		6	
	3	-		3		-		-		3	
Pestle	1	-		1	1/1 =1.00	-		-		1	1/1 =1.00
Hopper mortar base	1	-		-		1	1/1 =1.00	-		1	1/1 =1.00
Total		136		115		143		134		528	

* The category of projectile point includes complete points, point bases, and point tips.

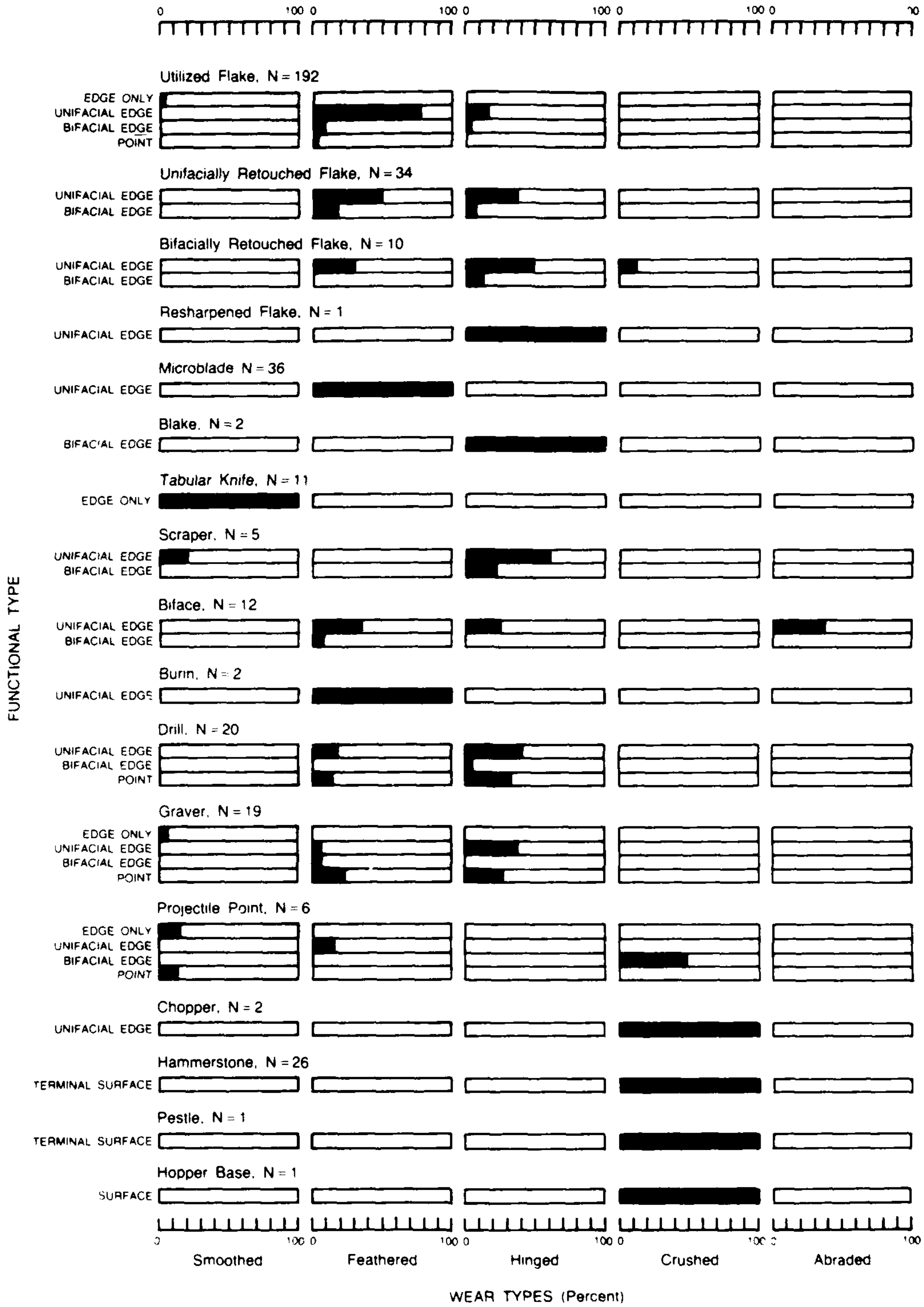


Figure 3-3. The relationship of wear types to functional types, 45-DO-326.

Table 3-23. The distribution of tool types by analytic zone, 45-DO-326.

Tool types	Zone								Total	
	1		2		3		4			
	Freq[1]	T%[2]/A%[3]	Freq	T%/A%	Freq	T%/A%	Freq	T%/A%	Freq	T%/A%
Utilized flake										
Smoothing - edge only	1	2.2/1.1	-		-		-		1	.5/.3
Feathered chipping - unifacial edge	35	76.1/38.9	22	73.3/26.8	32	74.4/36.8	54	74.0/44.6	143	74.5/37.6
Feathered chipping - bifacial edge	3	6.5/3.3	2	6.7/2.4	6	13.9/6.9	4	5.5/3.3	15	7.8/3.9
Feathered chipping - point	1	2.2/1.1	-		-		-		1	.5/.3
Hinged chipping - unifacialedge	6	13.0/6.7	6	20.0/7.3	5	11.6/5.7	14	19.2/11.6	31	16.1/8.1
Hinged chipping - bifacial edge	-		-		-		1	1.4/.8	1	.5/.3
Unifacially retouched flake										
Feathered chipping - unifacial edge	3	42.8/3.3	7	63.6/8.5	1	12.5/1.1	4	50.0/3.3	15	44.1/3.9
Feathered chipping - bifacial edge	1	14.3/1.1	-		2	25.0/2.3	1	12.5/.8	4	11.8/1.0
Hinged chipping - unifacial edge	3	42.8/3.3	4	36.4/4.9	4	50.0/4.6	2	25.0/1.6	13	38.2/3.4
Hinged chipping - bifacial edge	-		-		1	12.5/1.1	1	12.5/.8	2	5.9/.5
Bifacially retouched flake										
Crushing - unifacial edge	-		1	33.3/.12	-		-		1	10.0/.3
Feathered chipping - unifacial edge	1	25.0/1.1	1	33.3/1.2	-		1	33.3/.8	3	30.0/.8
Hinged chipping - unifacial edge	2	50.0/2.2	1	33.3/1.2	-		2	66.7/1.6	5	50.0/1.3
Hinged chipping - bifacial edge	1	25.0/1.1	-		-		-		1	10.0/.3
Resharpened flake										
Hinged chipping - unifacial edge	1	100.0/1.1	-		-		-		1	100.0/.3
Linear flake										
Feathered chipping - unifacial edge	3	100.0/3.3	11	100.0/13.4	16	100.0/18.4	6	100.0/4.9	36	100.0/9.5
Blade										
Feathered chipping - unifacial edge	-		-		-		2	100.0/1.6	2	100.0/.5
Tabular knife										
Smoothing - edge only	4	100.0/4.4	3	100.0/3.6	2	100.0/2.3	2	100.0/1.6	11	100.0/2.9
Scraper										
Smoothing - unifacial edge	1	20.0/1.1	-		-		-		1	20.0/.3
Hinged chipping - unifacial edge	3	60.0/3.3	-		-		-		3	60.0/.8
Hinged chipping - bifacial edge	1	20.0/1.1	-		-		-		1	20.0/.3
Biface										
Abrasion - edge only	-		-		4	66.7/4.6	-		4	33.3/1.0
Feathered chipping - unifacial edge	1	25.0/1.1	1	50.0/1.2	2	33.3/2.3	-		4	33.3/1.0
Feathered chipping - bifacial edge	1	25.0/1.1	-		-		-		1	8.3/.3
Hinged chipping - unifacial edge	2	50.0/2.2	1	50.0/1.2	-		-		3	25.0/.8

Table 3-23. Cont'd.

Tool types	Zone 1 Freq	Zone 1 T%/A%	Zone 2 Freq	Zone 2 T%/A%	Zone 3 Freq	Zone 3 T%/A%	Zone 4 Freq	Zone 4 T%/A%	Total Freq	Total T%/A%
Burin										
Feathered chipping - unifacial edge	1	100.0/1.1	1	100.0/1.2	-		-		2	100.0/.5
Drill										
Feathered chipping - unifacial edge	-		-		-		3	21.4/2.5	3	15.0/.8
Feathered chipping - point	-		-		-		2	14.3/1.6	2	10.0/.5
Hinged chipping - unifacial edge	-		-		2	50.0/2.3	6	42.8/4.9	8	40.0/2.1
Hinged chipping - bifacial edge	-		-		1	25.0/1.1	-		1	5.0/.3
Hinged chipping - point	1	100.0/1.1	1	100.0/1.2	1	25.0/1.1	3	21.4/2.5	6	30.0/1.6
Graver										
Smoothing - edge only	1	16.7/1.1	-		-		-		1	5.3/.3
Feathered chipping - unifacial edge	-		-		-		1	11.1/.8	1	5.3/.3
Feathered chipping - bifacial edge	-		-		-		1	11.1/.8	1	5.3/.3
Feathered chipping - point	1	16.7/1.1	2	100.0/2.4	-		1	11.1/.8	4	21.0/1.0
Hinged chipping - unifacial edge	2	33.3/2.2	-		1	50.0/1.1	4	44.4/3.3	7	36.8/1.8
Hinged chipping - point	2	33.3/2.2	-		1	50.0/1.1	2	22.2/1.6	5	26.3/1.3
Projectile point										
Smoothing - edge only	-		-		1	50.0/1.1	-		1	16.7/.3
Smoothing - point	-		-		1	50.0/1.1	-		1	16.7/.3
Crushing - bifacial edge	2	100.0/2.2	-		-		1	100.0/.8	3	50.0/.8
Feathered chipping - unifacial edge	-		1	100.0/1.2	-		-		1	16.7/.3
Chopper										
Crushing - unifacial edge	-		1	100.0/1.2	1	100.0/1.1	-		2	100.0/.5
Hammerstone										
Crushing - terminal surface	6	100.0/6.7	15	100.0/18.3	2	100.0/2.3	3	100.0/2.5	26	100.0/6.8
Pestle										
Crushing - terminal surface	-		1	100.0/1.2	-		-		1	100.0/.3
Hopper mortar										
Crushing - surface	-		-		1	100.0/1.1	-		1	100.0/.3
Total	90		82		87		121		380	

1 count of tools with specified wear attributes
2 percentage of specified functional type assemblage
3 percentage of the zonal assemblage

Table 3-24 ranks functional types by the proportion of specimens within a functional type with a certain kind of wear and by the percentage of specimens within that functional type with that type of wear for the entire tool assemblage. A close correspondence in the order of the two rankings may suggest prehistoric selection for a specific tool form. A lack of correspondence may imply that use indicated by the type of wear did not require a specialized tool form.

Definitive characteristics are largely those noted in previous tables. Smoothing wear on edges only is characteristic of tabular knives. Smoothing wear on unifacial and bifacial edges is only found on scrapers. Smoothing on points only occurs only on projectile points. Feathered chipping on unifacial and bifacial edges is most frequent on microblades, blades, burins and utilized flakes. Feathered chipping on points is most characteristic of gravers and drills. Hinged chipping on unifacial and bifacial edges is most frequent on resharpening flakes, but is also characteristic of scrapers, bifacially retouched flakes, drills, unifacially retouched flakes, gravers, bifaces and utilized flakes. Hinged chipping on points only is found only on drills and gravers. Crushing on unifacial and bifacial edges is found most often on choppers, but also on projectile points and bifacially retouched flakes. Crushing on surfaces and terminal surfaces, of course, characterizes hammerstones, pestles and the hopper mortar base. When we examine the ranking of functional types by type of wear for the entire assemblage, we find a varied lack of correspondence in most wear categories. Those rankings which are congruent include tabular knives in smoothing on edges only, scrapers in smoothing on unifacial and bifacial edges, projectile points in smoothing on points only, gravers and drills in feathered chipping on points only, drills and gravers in hinged chipping on points only, projectile points and choppers in crushing and unifacial and bifacial edges, and hammerstones, pestles and hopper mortar bases in crushing wear on surfaces and terminal surfaces. Wear types on unifacial and bifacial edges show marked variation in the proportional ranking, generally characterized by the dominance of simple utilized flakes. In general, it seems that utilized flakes, the most frequent tool form in the collection, were also the favored multipurpose tool, used for a wide range of purposes not limited to sharp unifacial or bifacial edges, but also points, and spanning the smoothing, feathered chipping and hinged chipping wear classes. In summary, it would seem that rigid selection of a particular tool form was largely confined to the creation of points and thus, functional types such as gravers, drills and projectile points. Edged tools, unifacial or bifacial, seem to have had more varied uses, commensurate with a more generalized tool form. The dubious association of tabular knives and smoothing wear on edges only does not seem to be a matter of tool design since these tool forms are among the crudest and least manufactured; rather, it probably represents use of a convenient stone with a tabular fracture plane for a certain job or very restricted range of jobs. Whatever the actual range of uses of these function types, examination of associated wear types clearly documents use of most edged tool forms for a wide variety of tasks, not necessarily predictable from traditional functional labels. While there is a tendency for obvious (i.e., specialized) tool forms, particularly those with

Table 3-24. Ranking of functional types by wear type, 45-DO-326.

Wear type	Functional type ranking % of assemblage within wear type		Functional type ranking % of total assemblage	
Smoothing				
Edge only	Tabular knife	100.0	Tabular knife	2.9
	Projectile point	16.7	Projectile point	.3
	Graver	5.3	Graver	.3
	Utilized flake	.5	Utilized flake	.3
Unifacial/ bifacial edge	Scraper	20.0	Scraper	.3
Point	Projectile point	16.7	Projectile point	.3
Feathered				
Unifacial/ bifacial edge	Linear flake	100.0	Utilized flake	41.5
	Blade	100.0	Linear flake	9.5
	Burin	100.0	Unifacially retouched flake	4.9
	Utilized flake	82.3	Biface	1.3
	Unifacially retouched flake	55.9	Bifacially retouched flake	.8
	Biface	41.6	Drill	.8
	Bifacially retouched flake	30.0	Graver	.6
	Projectile point	16.7	Blade	.5
	Drill	15.0	Burin	.5
	Graver	10.6	Projectile point	.3
Point	Graver	21.0	Graver	1.0
	Drill	10.0	Drill	.5
	Utilized flake	.5	Utilized flake	.3
Hinged				
Unifacial/ bifacial edge	Resharpened flake	100.0	Utilized flake	8.4
	Scraper	80.0	Unifacially retouched flake	3.9
	Bifacially retouched flake	60.0	Drill	2.4
	Drill	45.0	Graver	1.8
	Unifacially retouched flake	44.1	Bifacially retouched flake	1.6
	Graver	36.8	Scraper	1.1
	Biface	25.0	Biface	.8
	Utilized flake	16.6	Resharpened flake	.3
Point	Drill	30.0	Drill	1.6
	Graver	26.3	Graver	1.3
Crushing				
Unifacial/ bifacial edge	Chopper	100.0	Projectile point	.8
	Projectile point	50.0	Chopper	.5
	Bifacially retouched flake	10.0	Bifacially retouched flake	.3
Terminal surface	Hammerstone	100.0	Hammerstone	6.8
	Pestle	100.0	Pestle	.3
Surface	Hopper mortar base	100.0	Hopper mortar base	.3
Abrasion				
Edge only	Biface	33.3	Biface	1.0

points, to have been used in a manner suggested by the functional label, tools were used for a number of different jobs and not restricted to a single job. We have noted that the simple utilized flake was adapted to the widest range of tasks. Less obvious examples include projectile points, used for cutting and scraping as well as perforating, and scrapers, with hinged chipping wear more indicative of heavy cutting than scraping of soft hides.

SUGGESTED USE

Feathered chipping and feathered chipping-smoothing most likely represents light cutting operations on comparatively soft materials--hide, meat, tendon or soft plant parts. Hinged chipping and hinged chipping-smoothing indicate heavier, deeper cutting actions in which the tool comes into contact with bone, gristle or other hard but elastic material. Smoothing by itself may be more material dependent, with similar wear patterns produced by quite different uses. For example, smoothing along a unifacial or bifacial edge on a cryptocrystalline tool likely evidences light cutting or scraping use on a soft, elastic material. However, smoothing wear on an edge only on a quartzite tool, with its denser, less brittle and less sharp mass, may indicate cutting on hard, dense material which simply wears down the edge. Our cursory analysis does not permit us to investigate smoothing wear more thoroughly (i.e., does the smoothing wear obliterate flake scars or other landmarks along the working edge, or does it obliterate the manufacture altogether, or are there striae within the smoothing wear? etc.). Crushing wear, either in combination with pecking or hinged or feathered chipping, indicates heavy tool use and repeated contact with hard surfaces like bone and/or stone working supports.

In general, then, we have four primary tool types described by attributes of wear: smoothing on edges and points, feathered chipping on edges and points, hinged chipping on edges and points, and crushing of edges and surfaces. Combinations thereof indicate variable functions, variable intensity of use, or persistent reuse of tool forms. It is difficult to assess tool use within these broad attribute categories, as a look at the tabular knife will demonstrate. Characterized by smoothing wear on edges only, tabular knives are ubiquitous. Because the smoothing wear does not extend onto any adjoining planar surface, we speculate that use was essentially vertical--the tabular knife was held upright in the hand and used to cut, or saw through elastic material of some hardness, and perhaps came into contact with a stone working base. Certainly, the attrition of the edge, which obliterates flaking irregularities or other landmarks of manufacture, is not the result of cutting or scraping of soft, elastic material such as hide or meat, unless the hides or meat were worked over a solid, hard base which, rubbing against the knife, dulled the working edge over extended periods of use. Whatever their actual use, their wear patterns distinguish them from other flake tool forms on which smoothing consistently occurs on unifacial and bifacial edges and points indicative of cutting, scraping and perforating uses, usually on relatively soft, tractable materials.

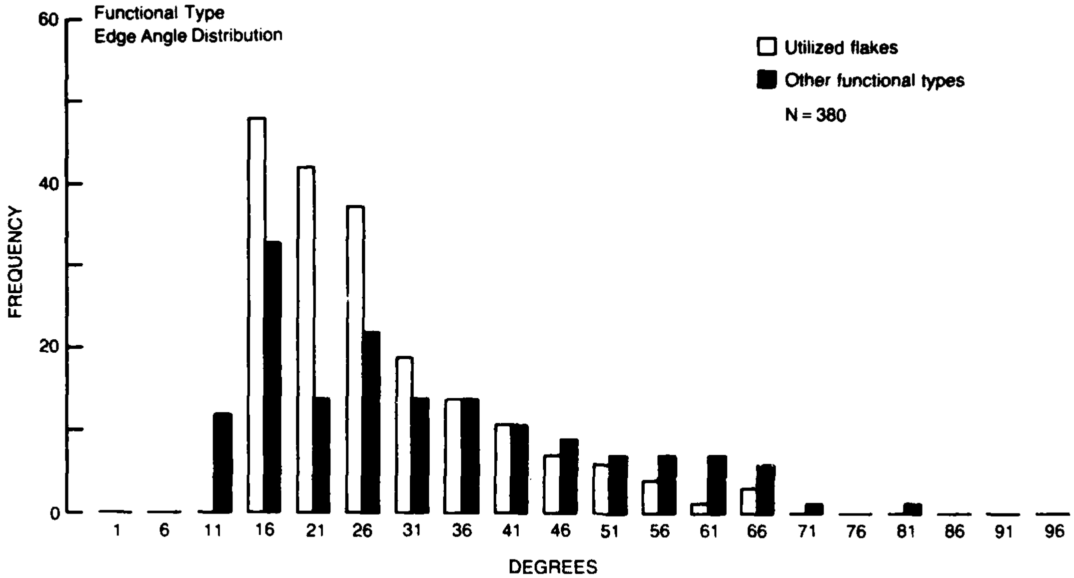
Another example of the difficulty of assessing tool function lies in the simple distinction between feathered and hinged chipping wear as distinct tool types. This distinction is the least pronounced of the four defined wear types--similar tool forms characteristically have both kinds of wear, although one or the other tends to predominate. We may explain this distinction on the basis of both cutting activity and worked medium--feathered chipping is produced by light cutting on relatively soft materials while hinged chipping reflects heavier, deeper cutting in which the tool comes into contact with harder, but still elastic materials. Or we may suggest that the distinction rests on the intensity and/or duration of use of the tool form. Finally, we may submit that that the difference, unless clearly correlated with distinctive tool forms, is inconsequential: both wear types indicate general butchering activity; any distinctions result from random use of like tool forms for light or heavy cutting, or variation in intensity or duration of use.

All of the flaked tool types recovered, except tabular knives, show feathered and hinged chipping wear. Those with the least manufacture (e.g., simple utilized flakes and microblades) show the highest occurrence of feathered chipping wear. More complex tool forms or those that show resharpening or retouch (e.g., scrapers, bifaces, resharpening and retouched flakes) have proportionately higher frequencies of hinged chipping wear. The seeming correlation between feathered chipping wear and hinged chipping wear and relatively unmodified and carefully shaped or maintained tools respectively, leads us to suspect that the two wear types may be largely a function of the intensity or duration of use in comparable activities.

EDGE ANGLE DISTRIBUTIONS

Measurement of edge angles within these general functional classes gives us another, complementary method of evaluating the function of different tool forms and differences in the activities represented within the defined zones. Figure 3-4 illustrates edge angle distributions for functional types with two divisions: utilized flakes and all other flaked tool forms. It also presents edge angle distributions by the two largest possible classes: objects with wear only and objects with wear and manufacture. Edge angle distributions of functional types within these classes have been listed in tabular form in Table B-1 to facilitate comparison since many of these artifacts are present in numbers too low for meaningful histograms to be drawn.

Edge angle distributions generally support inferences drawn from consideration of attributes of wear. Simple utilized flakes show a distribution skewed toward an acute edge angle in the range 16-31 degrees, reflecting selection for a sharp cutting edge and little concern for durability. The edge angle distribution for all other functional types shows a bimodal distribution: the highest peak is in the 16-20 degree range and represents primarily microblades; the second, lower peak occurs in the 26-30 degree range and includes manufactured tool types, predominantly drills, gravers, unifacially and bifacially retouched flakes. This distribution roughly parallels that presented for utilized flakes but shows lower



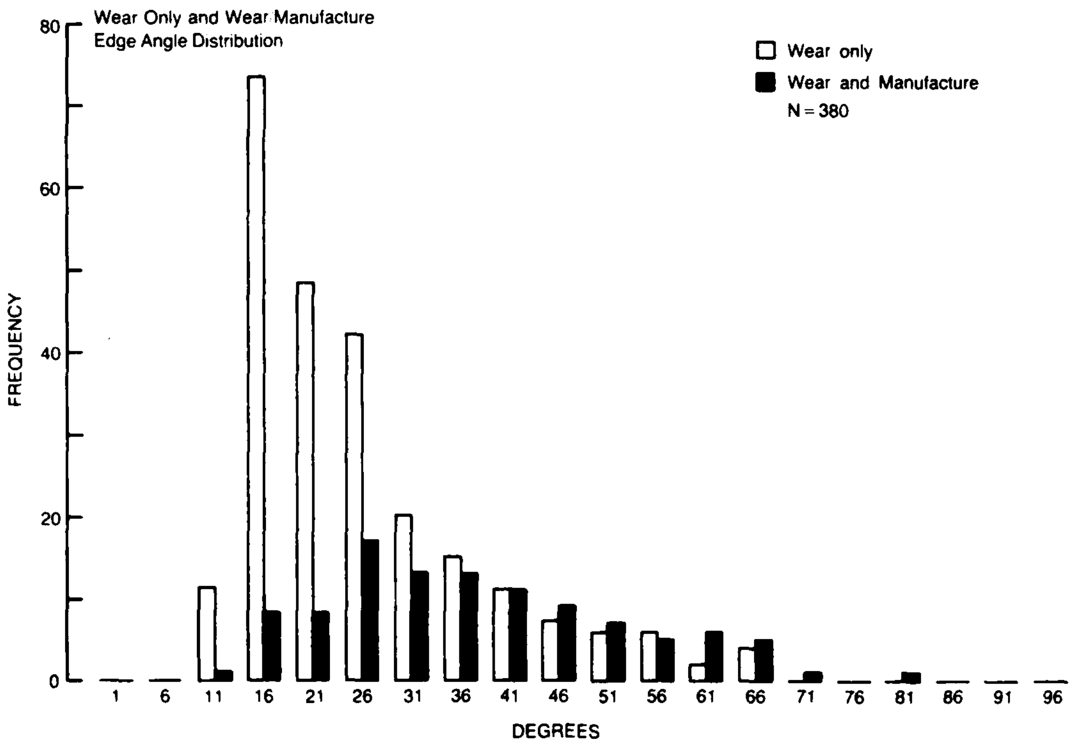


Figure 3-4. Edge angle distributions for functional types and for classes of wear only and wear/manufacture, 45-DO-326.

frequencies in the more acute edge angle ranges. When these three functional type classes are grouped into two major groups of wear only and wear and manufacture, this fundamental pattern shows even more clearly. Tools with wear only have a distribution markedly skewed toward an acute edge angle in the range 16-30 degrees. Tools with wear and manufacture show a more normal distribution centered in a broad range from 26-45 degrees. Certainly, there is considerable overlap between the two distributions but the different characteristics of these edge angle distributions reflect care in selection of a sharp edge for jobs of the moment and creation of less acute edge angles for formed tools for which design and durability were salient concerns.

ECONOMIC PATTERNS

The overwhelming majority of stone tools recovered from 45-DO-326 document cutting, piercing, scraping and chopping uses in soft to hard elastic materials, characteristics commonly associated with hunting-butchering-processing of game (97%, N=1,127). Many of the tool forms could have been used for other economic pursuits, notably the processing of plant parts or woods, but the character of the assemblage seems to argue for hunting. Feathered and hinged chipping wear, often associated with smoothing, and primarily on unifacial and bifacial edges of simple flake tools, bifaces, burins, drills and projectile points, indicates tool use on soft and hard materials or consistent reuse and heavier use of some functional types. Smoothing on the edges of tabular knives, and the recovery of a large number of scrapers, may indicate an emphasis on hide processing. However, it is equally likely that these forms may have been used to separate the meat of a carcass from bone, to reduce bone or to manufacture non-lithic elements of the tool kit; for instance, to shape and smooth wood or bone foreshafts and handles. Heavy crushing wear on the unifacial edges of choppers and surfaces of the numerous hammerstones may evidence considerable attention to marrow extraction and bone tool manufacture, or the working of small wood parts. The hammerstones, of course, were probably an integral part of stone tool production. Recovery of the single pestle and the hopper mortar base suggests the processing of plant parts at the site as well.

TEMPORAL AND SPATIAL PATTERNS

Differences in artifact distribution among analytic zones at 45-DO-326 are more a matter of the presence or absence of particular functional types or the relative proportions of types within the zonal assemblages than any fundamental changes in the use or intensity of use of specific tool types. For example, projectile points, bifaces, burins, hammerstones, resharpening flakes, bifacially retouched flakes and pestles are either much more frequent or only recovered in Zones 2 and 1. Conversely, choppers, drills, hopper mortar bases, blades, microblades and microblade cores are either more frequent or were only recovered from Zones 4 and 3. Other functional types such as tabular knives, unifacially retouched flakes and utilized only flakes are fairly evenly distributed through all four defined zones. Thus, although about the same range of potential functions are found throughout the span of occupation at the site, there may well have been either different specialized activities during the separate periods of occupation or else some variation in the use of tool forms for comparable tasks.

The character of all four zonal assemblages indicates an emphasis on hunting-butchering-processing and the maintenance of that tool kit. A pestle from Zone 2 and a hopper mortar base from Zone 3 also suggest plant processing, although it could also have been used for pulverizing meat. It may well be that microblades were a more common element of the tool kit prior to ca. 2000 B.P., perhaps in part replacing the use of bifaces, resharpening and bifacially retouched flakes, all of which seem to be more prevalent in the later periods. The higher numbers of these tool forms in the earlier periods might also be a consequence of longer stays during that time, judging from the construction of numerous pits and formation of at least one well-defined living surface (see Chapter 5). Whatever the cause for the disparity in the tool assemblages between Zones 4 and 3 and Zones 2 and 1, we do know that about the same range of animals were being taken and consumed at the site over time (see Chapter 4). It seems most likely that the presence, absence, or relative frequency of certain tool forms resulted from the specific kind and duration of site activity in each period; however, since the four zones span all three cultural phases defined for the Rufus Woods Lake project area, we certainly cannot rule out culturally distinct tool kits and the preferential use of specific tool forms to perform similar activities in different periods of occupation.

STYLISTIC ANALYSIS

Projectile points are the only artifacts from site 45-DO-326 used for assessment of temporal period and/or cultural affiliation. They supply us with a reasonable temporal scale when we carefully compare stylistic attributes of specimens in this collection with those considered diagnostic of defined projectile point types, either within this project area or on the Columbia Plateau as a whole.

PROJECTILE POINT TYPES

Two separate but conceptually related analyses are used to classify projectile points. A morphological classification is used to define descriptive types that do not directly correspond to recognized historical types. This is intended as an independent check on the temporal distribution of projectile point forms in the Rufus Woods Lake project area and as a means to measure the distribution of formal attributes as well as point styles. An historical classification correlates these projectile points with recognized types with discrete temporal distributions. A multivariate statistical program which compares line and angle measurements taken along the outlines of the points is used to classify the specimens. Together, these analyses allow us to (1) assess formal and temporal variation in our collection without first imposing prior typological constructs, (2) correlate specimens recovered from our study area with those found elsewhere on the Columbia Plateau in a consistent, verifiable manner, (3) develop a typology that incorporates both qualitative and quantitative scales of measurement, and (4) examine the temporal significance of specific formal attributes as well as aggregates viewed as ideal types.

Eleven classificatory dimensions have been defined for morphological classification: BLADE/STEM JUNCTURE, OUTLINE, STEM EDGE ORIENTATION, SIZE, BASAL EDGE SHAPE, BLADE EDGE SHAPE, CROSS SECTION, SERRATION, EDGE GRINDING, BASAL EDGE THINNING, and FLAKE SCAR PATTERN. Of these, the first four (D_1-D4) define 18 morphological types. The other seven serve to describe these types more fully, and permit the identification of variants within the types. Table 3-25 outlines these dimensions and associated attributes.

By defining the margins of projectile points, we are able to place them within one of the 18 morphological types. This is done by drawing straight lines from nodes where the outline of the specimen changes direction. Figure 3-5 illustrates the technique. For a corner-notched triangular point, the blade is defined as line segment $\overline{a\ A}$. The shoulder is line segment $\overline{A\ 1}$. The neck is node 1. The stem is line segment $\overline{1\ 2}$. The base is line segment $\overline{2\ a'}$. Terms applied and the number of line segments drawn vary given the two basic subdivisions of form. Lanceolates are generally defined by four or fewer line segments ($\overline{aA12}$). Stemmed triangular forms are defined by five or fewer line segments ($\overline{aA123}$). Side-notched triangular forms are defined by five or more line segments ($\overline{aA12345}$). Table 3-26 lists the 18 morphological types with descriptions, classification codes and line segment definitions.

Cross-tabulation of classificatory dimensions D5-D11 supplies detailed descriptions of the 18 morphological types and allows us to assess the temporal distribution of formal attributes as well as that of point styles. We might subdivide any or all of the types in terms of their basal edge shape, serration, or flaking pattern. We can also assess the chronological significance of concave bases, serrated margins, or regular collateral flaking pattern independent of associated morphological type. Further, we can use this information to establish variants in the basic historical types.

We have defined historical types on the basis of line and angle measurements in order to have a consistent classification method which utilizes published illustrations of projectile points. Other measurements such as weight and thickness were taken on projectile points in our collection, but problems of cost and efficiency precluded handling of specimens from other study areas. These measurements can be included in analyses of our points, and, hence, for definition of types and type variants that will correlate with acknowledged types, but they are not part of the initial typological exercise. Justification for this decision is found in prior research emphasizing the outline of projectile points as the basis of classification (Benfer 1967; Ahler 1970; Gunn and Prewitt 1975; Holmer 1978).

Our desire for a statistically derived classification prompted selection of a multivariate statistical method termed discriminant analysis (Nie et al. 1975). In this analysis, individual specimens are sorted into selected groups on the basis of mathematical equations derived from analysis of cases with known memberships. First, we assembled representative specimens for each

Table 3-25. Dimensions of morphological projectile point classification.

DIMENSION I: BLADE-STEM JUNCTURE

N. Not separate
1. Side-notched
2. Shouldered
3. Squared
4. Barbed
9. Indeterminate

DIMENSION II: OUTLINE

N. Not applicable
1. Triangular
2. Lanceolate
9. Indeterminate

DIMENSION III: STEM EDGE ORIENTATION

N. Not applicable
1. Straight
2. Contracting
3. Expanding
9. Indeterminate

DIMENSION IV: SIZE

N. Not applicable
1. Large
2. Small

DIMENSION V: BASAL EDGE SHAPE

N. Not applicable
1. Straight
2. Convex
3. Concave
4. Point
5. 1 or 2 and notched
9. Indeterminate

DIMENSION VI: BLADE EDGE SHAPE

N. Not applicable
1. Straight
2. Excurvate
3. Incurvate
4. Reworked
9. Indeterminate

DIMENSION VII: CROSS SECTION

N. Not applicable
1. Planoconvex
2. Biconvex
3. Diamond
4. Trapezoidal
9. Indeterminate

DIMENSION VIII: SERRATION

N. Not applicable
1. Not serrated
2. Serrated
9. Indeterminate

DIMENSION IX: EDGE GRINDING

N. Not applicable
1. Not ground
2. Blade edge
3. Stem edge
9. Indeterminate

DIMENSION X: BASAL EDGE THINNING

N. Not applicable
1. Not thinned
2. Short flake scars
3. Long flake scars
9. Indeterminate

DIMENSION XI: FLAKE SCAR PATTERN

N. Not applicable
1. Variable
2. Uniform
3. Mixed
4. Collateral
5. Transverse
6. Other
9. Indeterminate

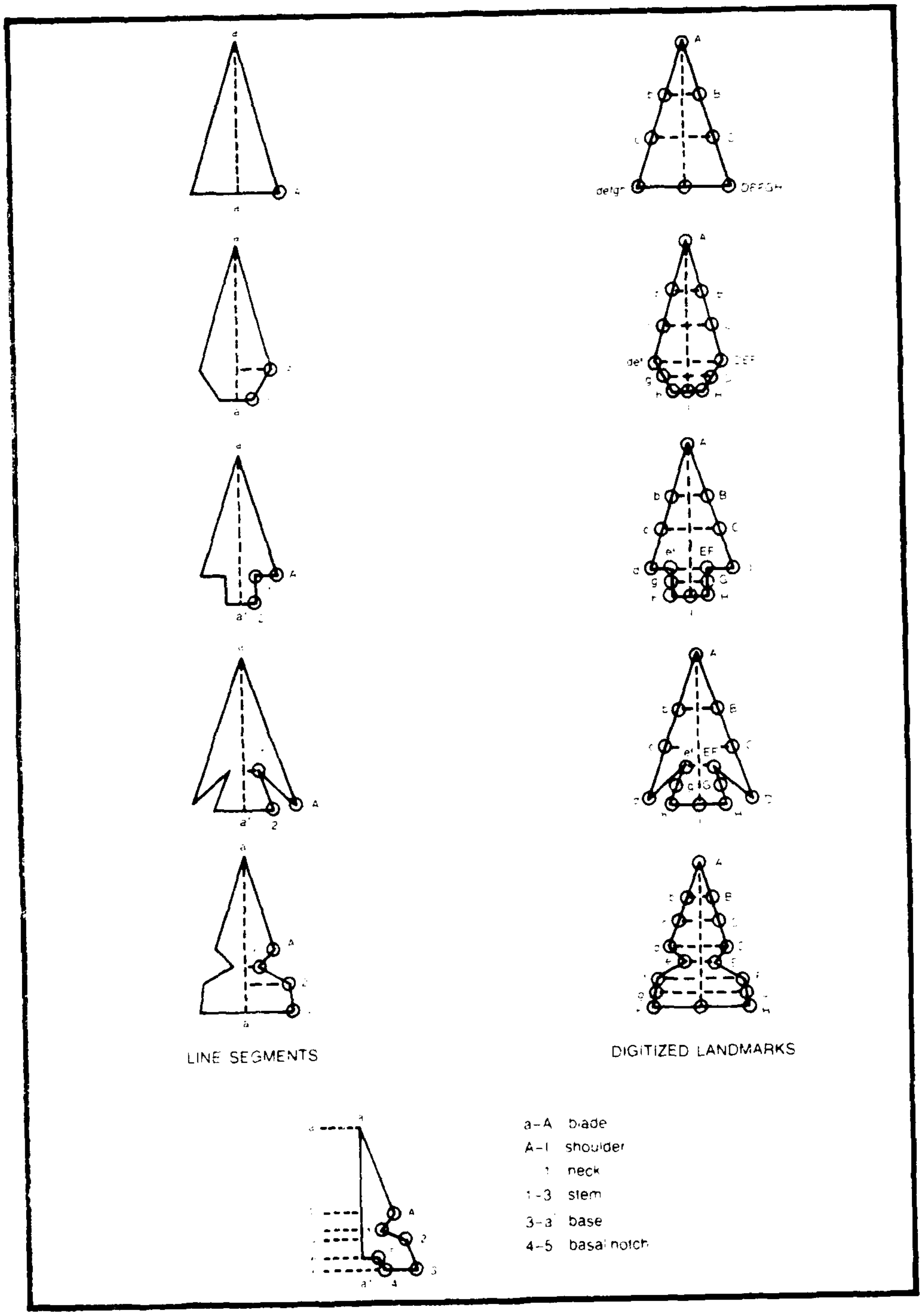


Figure 3-5. Definition of projectile point outlines.

Table 3-26. Morphological classes of projectile points: descriptive name, classification code, and line segment definition.

Type	Description	Classification	Definition
1	Large Triangular	N 1 N 1	$\overline{aA}$
2	Small Triangular	N 1 N 2	$\overline{aA}$
3	Large Side-notched	1 N N 1	$\overline{aA123}$, $\overline{aA1234}$, $\overline{aA12345}$
4	Small Side-notched	1 N N 2	$\overline{aA123}$, $\overline{aA1234}$, $\overline{aA12345}$
5	Lanceolate	N 2 N N	$\overline{aA}$
6	Shouldered Lanceolate	2 2 N N	$\overline{aA}$, $\overline{aA1}$, $\overline{aA12}$
7	Large, Shouldered Triangular, contracting stem	2 1 2 1	$\overline{aA}$, $\overline{aA1}$
8	Small, Shouldered Triangular, contracting stem	2 1 2 2	$\overline{aA}$, $\overline{aA1}$
9	Large, Shouldered Triangular, non-contracting stem	2 1 (13) 1	$\overline{aA12}$, $\overline{aA123}$
10	Small, Shouldered Triangular, non-contracting stem	2 1 (13) 2	$\overline{aA12}$, $\overline{aA123}$
11	Large, Squared Triangular, contracting stem	3 1 2 1	$\overline{aA1}$
12	Small, Squared Triangular, contracting stem	3 1 2 2	$\overline{aA1}$
13	Large, Squared Triangular, non-contracting stem	3 1 (13) 1	$\overline{aA12}$, $\overline{aA123}$
14	Small, Squared Triangular, non-contracting stem	3 1 (13) 2	$\overline{aA12}$, $\overline{aA123}$
15	Large, Barbed Triangular, contracting stem	4 1 2 1	$\overline{aA1}$
16	Small, Barbed Triangular, contracting stem	4 1 2 2	$\overline{aA1}$
17	Large, Barbed Triangular, non-contracting stem	4 1 (13) 1	$\overline{aA12}$, $\overline{aA123}$
18	Small, Barbed Triangular, non-contracting stem	4 1 (13) 2	$\overline{aA12}$, $\overline{aA123}$

acknowledged historical type, and tested group autonomy through analysis of specified discriminating variables. Then, we used derived equations called discriminant functions to assign specimens in our collection to the statistically defined projectile point types. All cases are given a probability of group membership, calculated as the distance a given case score is away from a group score. Discriminating variables--those providing the most separation between groups--are ranked and serve as type definitions. The outcome is a statistically defensible projectile point typology based on traditional, intuitively derived classifications. The resulting classification is consistent, and produces mathematically defined ranges of variability. It enables the researcher to quickly categorize a large collection, and it offers a sound, rational basis for definition of new types as well as an explicit definition of accepted types. We can thereby correlate the Rufus Woods Lake projectile point sequence with other chronologies in both a quantitative and qualitative manner. For a detailed discussion of procedures and assumptions involved in discriminant analysis see Johnson (1978) and Klecka (1980).

We assembled a type collection for the Columbia Plateau of over 1,200 specimens that constituted originally defined type examples, labelled specimens of recognized types, or type variants that were reasonably well-dated. By critically reviewing the archaeological literature, we identified 23 historical types which we arranged in six formal type series (Figure 3-6). We consistently applied distinctions based on the original type definitions, modified, where appropriate, by subsequent research. We routinely defined type variants, usually suggested by prior researchers, which segregate specimens according to diagnostic patterns in morphology. Historical types identified here represent a synthesis of projectile point types and cultural reconstructions postulated by researchers in different areas of the Columbia Plateau, and were not taken from any single typology or chronological sequence (e.g., Butler 1961, 1962; Nelson 1969; Leonhardy and Rice 1970). Names are usually those applied by the first researcher to define a specific type. We developed variant labels by using the accepted type name followed by a letter denoting diagnostic variation. For a complete discussion of procedures followed see Lohse (1984g).

Projectile points from 45-DO-326 are listed in Table 3-27 and illustrated in Plate 3-5. Table 3-28 lists classified projectile point fragments. Digitized projectile point outlines are shown in Appendix B, Figure B-1.

A total of 47 projectile points at 45-DO-326 were assigned to defined historical projectile point types based on line and angle measurements. Another six fragmented specimens were hand assigned to historical types. Forty-one other blade fragments, detached stems and broken bases were described within the morphological classification. Each assigned type is briefly described below.

Cascade A (Type 21) N=4

Four specimens were assigned to Cascade A. Three are elongate, teardrop forms, without edge grinding or serrated margins. The fourth, Specimen #59, is more symmetrical, with well-defined serrations along both lateral

AD-A163 460 ARCHAEOLOGICAL INVESTIGATIONS AT SITE 45-DO-326 CHIEF JOSEPH DAM PROJECT WASHINGTON(U) WASHINGTON UNIV SEATTLE OFFICE OF PUBLIC ARCHAEOLOGY E S LOHSE ET AL. 1984 DACW67-78-C-0106 2/2

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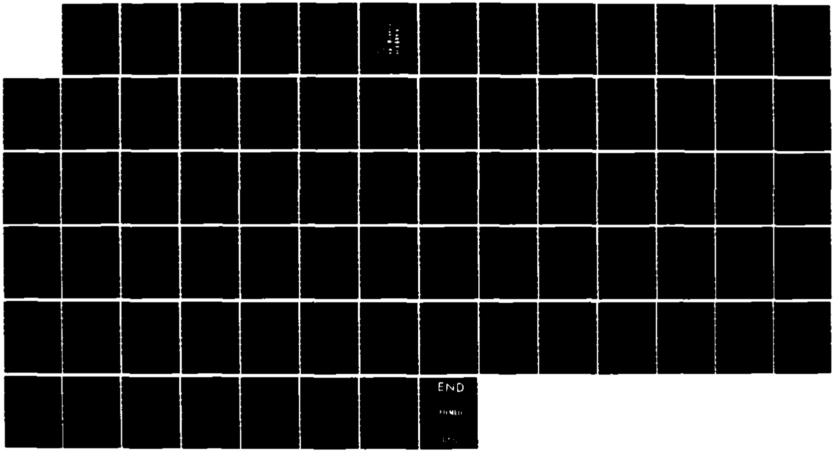
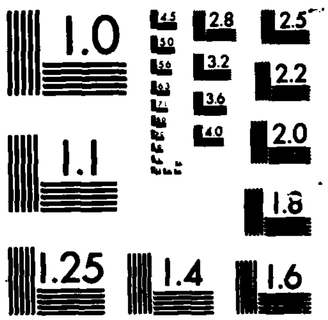




MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

HISTORICAL TYPE CLASSIFICATION

DIVISION	LANCEOLATE		TRIANGULAR			
SERIES	SIMPLE	SHOULDERED	SIDE-NOTCHED	CORNER-REMOVED	CORNER-NOTCHED	BASAL-NOTCHED
TYPE	11 LARGE LANCEOLATE	12 LIND COULEE	41 COLD SPRINGS	51 NESPELEM BAR	61 COLUMBIA A Corner-notched	71 QUILOMENE A Basal-notched
	15 WINDUST C Contracting base	13 WINDUST A	42 PLATEAU Side-notched	52 RABBIT ISLAND A	62 QUILOMENE Corner-notched	72 QUILOMENE B Basal-notched
	21 CASCADE A	14 WINDUST B		53 RABBIT ISLAND B	63 COLUMBIA B Corner-notched	73 COLUMBIA STEM A
	22 CASCADE B	31 MAHKIN SHOULDERED			64 WALLULA Rectangular stemmed	74 COLUMBIA STEM B
	23 CASCADE C					75 COLUMBIA STEM C

Types are numbered consecutively within formal series: a two-digit code indicates the approximate temporal sequence of defined series and types.

Type names are those most commonly applied: Mahkin Shouldered and Nespelem Bar are types defined for the Rufus Woods Lake project area.

Figure 3-6. Defined historical projectile point types.

Table 3-27. Projectile point types, 45-DO-326.

Master #	Historical Type[1]	Morphological Classification[2]	Zone	Feature	Association
50	21	22NN2221131	2	—	—
606	21	N2NN2121121	2	—	—
249	21	N2NN2241133	4	—	—
438	22	N2NN1211111	3	—	—
374	31	22NN3239121	3	50	Living surface B
213	31	22NN2949121	4	—	—
449	31	22NN2221121	4	66	Living surface A
366	41	1NN15929NN9	3	50	Living surface B
581	41	1NN11929NN9	3	—	—
327	42	1NN23121NN1	1	—	—
400	42	1NN23221NN3	1	—	—
454	42	1NN23929NN1	1[3]	—	—
529	42	1NN23221NN1	1[3]	—	—
567	42	1NN21929NN1	1	—	—
600	42	1NN23121NN1	1	—	—
601	42	1NN23121NN1	1	—	—
602	42	1NN25121NN1	1	—	—
358	42	1NN22121NN1	2	—	—
497	51	21222112NN1	1[3]	—	—
154	51	21112929NN1	3	50	Living surface B
205	51	22NN2221121	3	—	—
609	51	21212221NN1	3	—	—
186	51	31211921NN1	4	—	—
472	52	31211141NN3	1	—	—
144	61	21322121NN1	3	—	—
52	61	31312921NN1	4	—	—
270	62	1NN12929NN9	1	—	—
185	62	31314211NN1	4	—	—
272	63	31321121NN1	1	—	—
274[4]	63	31321112NN3	1	—	—
274	63	31[illegible]2192NN9	1	—	—
399	63	31322111N1N	1	—	—
474	63	41321321NN1	1[3]	—	—
475	63	31322141NN1	1[3]	—	—
531	63	41329121NN1	1[3]	—	—
92	63	41322221NN1	2	—	—
139	63	31321311NN3	2	—	—
359	63	1NN21121NN1	2	—	—
685	63	31325111NN1	2	—	—
48	64	41221141NN1	1[3]	—	—
339	64	41122322NN1	1	—	—
407	64	41329229NN1	1	—	—
473	64	41321221NN3	1[3]	—	—
684	64	41321211NN3	beach	—	—
505	73	41321121NN3	2[3]	—	—
68	74	41322121NN3	1	—	—
305	74	41222321NN1	2	44	Firepit 2 fill

[1]See Figure 3-6 for type names.
[2]See Table 3-27 for definitions.
[3]From testing unit not incorporated in previous technological and functional analyses.
[4]Two points were erroneously given the same master number.

Table 3-28. Projectile point fragments, 45-DO-326.

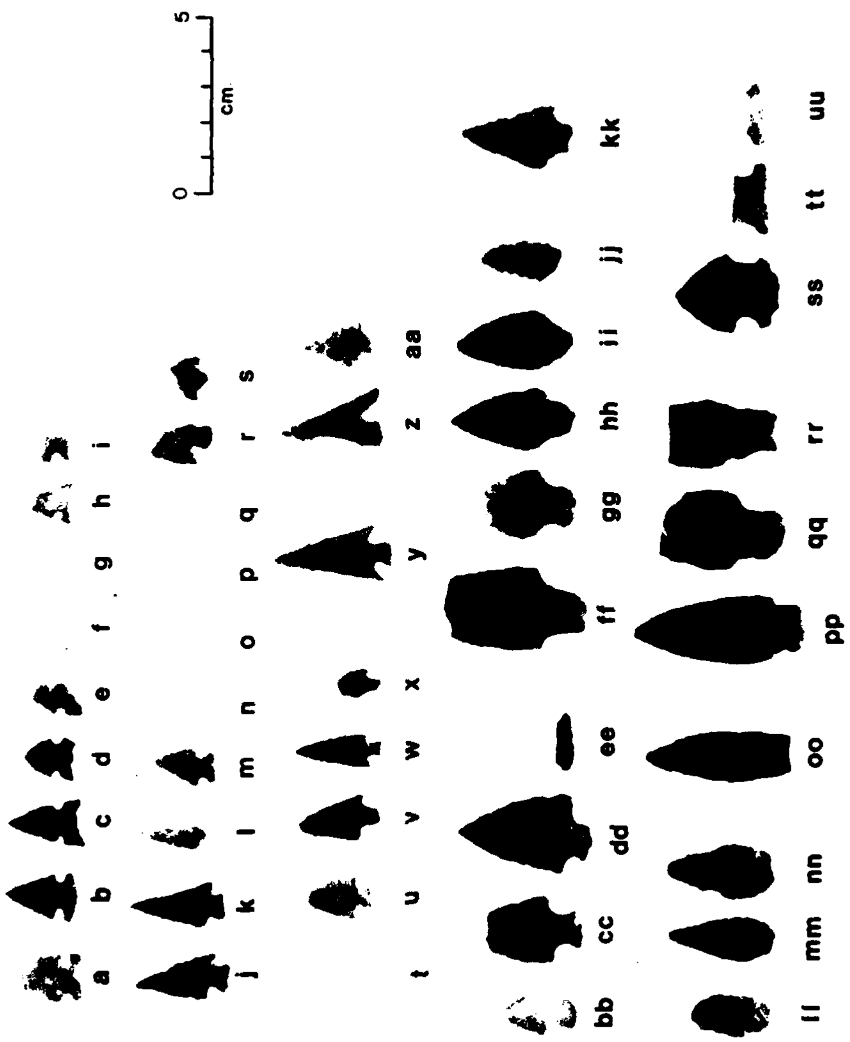
Master #	Historical Type[1]	Morphological Classification[2]	Zone	Feature	Association
Unclassified					
861	81	N1N23211NN1	1	—	—
81	81	N1N21121NN1	2	—	—
568	81	N1N11221NN1	2	—	—
78	81	N1N11211NN1	2	—	—
182	—	21121131NN1	1	—	—
273	—	N2N14231124	1	—	—
605	41	1NN12221NN3	1	—	—
230	—	N2NN2241121	2	—	—
425	—	N2NN2241123	3	—	—
620	51	22222911121	3	50	Living surface B
645	—	N2NN2241121	4	—	—
638	—	21312341NN1	4	—	—
Blade fragments					
291	—	31929121NN2	1	—	—
264	—	31929321NN1	1	—	—
257	—	41929121NN1	1	—	—
59	21	N2NN9222984	1	—	—
348	—	41929321NN3	1	—	—
350	—	41N21221NN1	1	—	—
550	42	1NN21929NN9	1	13	Stratum 50
479	—	N1N29221NN2	1[3]	—	—
476	63	31321929NN9	1[3]	—	—
470	—	41929321NN1	1[3]	—	—
471	—	41929121NN1	1[3]	—	—
535	72	41919221NN2	1[3]	—	—
498	—	21922229NN1	1[3]	—	—
195	—	41929221NN1	2	—	—
542	—	29122929NN9	3[3]	—	—
417	—	29122929NN9	3	50	Living surface B
9	61	41919121NN3	3	—	—
597	61	49312929NN9	4	—	—
Detached stems					
513	—	99393999999	1[3]	—	—
74	—	99393999999	1	—	—
534	—	99191999999	1[3]	—	—
356	—	99392999999	1	72	Stratum 50
526	—	99393999999	1[3]	—	—
404	—	99393999999	1	—	—
675	—	99391999999	1	—	—
504	—	99392999999	1[3]	—	—
313	—	99392999999	2	44	Firepit 2 fill
309	—	99392999999	2	44	Firepit 2 fill
283	—	99392999999	2	51	Pit 9 fill
431	—	99292999999	3	50	Living surface B
430	—	99292999999	3	50	Living surface B
371	—	99393999999	3	50	Living surface B
Broken bases					
269	—	99191999129	1	—	—
6	—	99291999129	1	—	—
67	—	99291999129	2	—	—

[1]See Figure 3-6 for type names.
[2]See Table 3-27 for definitions.
[3]From testing unit not incorporated in previous technological and functional analyses.

KEY
Master Number:
Morphological Type:
Tool:
Provenience/Level:
Material:

	Master Number	Morphological Type	Tool	Provenience	Level	Material
a.	406	Plateau Side-notched		18N15W/20	1	Chalcedony
b.	368	Plateau Side-notched		18N15W/40	2	Jasper
c.	327	Plateau Side-notched		18N15W/20	1	Jasper
d.	568	Plateau Side-notched		18N16W/20	1	Jasper
e.	602	Plateau Side-notched		17N15W/30	1	Jasper
f.	464	Plateau Side-notched		18N16W/FE86/20	1	Chalcedony
g.	505	Plateau Side-notched		17N15W/20	1	Chalcedony
h.	601	Plateau Side-notched		17N15W/30	1	Chalcedony
i.	327	Plateau Side-notched		18N15W/20	1	Chalcedony
j.	665	Columbia Corner-notched B		20N16W/30	2	Jasper
k.	130	Columbia Corner-notched B		18N15W/120	2	Jasper
l.	274	Columbia Corner-notched B		18N17W/30	1	Jasper
m.	272	Columbia Corner-notched B		18N17W/20	1	Petrified Wood
n.	367	Columbia Corner-notched B		18N16W/10	1	Jasper
o.	474	Columbia Corner-notched B		18N16W/FE86/30	1	Chalcedony
p.	380	Columbia Corner-notched B		18N15W/20	1	Chalcedony
q.	475	Columbia Corner-notched B		18N15W/30	1	Opal
r.	82	Columbia Corner-notched B		20N16W/100	2	Jasper
s.	501	Columbia Corner-notched B		18N15W/20	1	Jasper
t.	604	Wallula Rectangular Stemmed		Beach	-	Jasper
u.	330	Wallula Rectangular Stemmed		18N15W/30	1	Jasper
v.	40	Wallula Rectangular Stemmed		18N7W/20	2	Jasper
w.	473	Wallula Rectangular Stemmed		18N16W/30	1	Jasper
x.	487	Wallula Rectangular Stemmed		18N15W/30	1	Chalcedony
y.	506	Columbia Stemmed A		18N16W/30	2	Jasper
z.	68	Columbia Stemmed B		20N16W/20	1	Jasper
aa.	365	Columbia Stemmed B		18N17W/FE44/20	2	Petrified Wood
bb.	144	Columbia Corner-notched A		18N14W/80	3	Jasper
cc.	82	Columbia Corner-notched A		18N23W/80	4	Jasper
dd.	185	Quilomene Bar Corner-notched		18N13W/100	4	Jasper
ee.	278	Quilomene Bar Corner-notched		18N17W/20	1	Jasper
ff.	108	Nespelem Bar		18N13W/160	1	Jasper
gg.	154	Nespelem Bar		18N14W/FE50/100	3	Jasper
hh.	206	Nespelem Bar		18N14W/100	3	Jasper
ii.	680	Nespelem Bar		17N15W/100	3	Jasper
jj.	487	Nespelem Bar		18N16W/40	1	Jasper
kk.	472	Rabbit Island Stemmed A		18N16W/30	1	Chalcedony
ll.	248	Cascade A		18N13W/180	4	Jasper
mm.	665	Cascade A		17N15W/60	2	Fine-grained basalt
nn.	50	Cascade A		18N7W/70	2	Jasper
oo.	438	Cascade B		18N15W/120	3	Jasper
pp.	448	Mahkin Shouldered		18N15W/FE86/100	4	Jasper
qq.	213	Mahkin Shouldered		18N14W/120	4	Jasper
rr.	374	Mahkin Shouldered		18N15W/FE86/150	3	Jasper
ss.	566	Cold Springs Side-notched		17N15W/40	1	Jasper
tt.	308	Cold Springs Side-notched		18N15W/80	3	Jasper
uu.	501	Cold Springs Side-notched		18N15W/FE85,87/80	3	Jasper

Plate 3-5. Projectile points from 45-DO-326.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cm
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a b c d e f g h i
j k l m n o p q r s
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ll mm nn oo pp qq rr ss tt uu

blade margins. Flaking scar patterns on all four specimens are classified as variable or mixed. All were made on flakes. Specimen #50 has two deep lateral notches about midway up the long axis. Cascade A points are characteristic of the Kartar Phase (ca. 7000-4000 B.P.) in the Rufus Woods Lake project area.

Cascade B (Type 22) N=1

This is a thin, well-made, slender specimen on a long, flat flake. The flaking pattern is variable, and only the dorsal surface has been completely reduced. The lateral basal margin and base, which contains a remnant of a striking platform, show considerable smoothing of flake arrises indicative of hafting. Cascade B forms are uncommon in the project area, but have been found in contexts dated to the mid- to late Kartar Phase.

Mahkin Shouldered (Type 31) N=3

All three specimens were made on large, thick flakes. Haft elements are straight to slightly expanding. Shoulders are well-defined. Flaking patterns are variable, although on Specimen #449 flaking on the distal part of one surface is oblique collateral. A markedly diamond shaped cross section on Specimen #374 may indicate manufacture on a blade. All three specimens have pronounced smoothing wear across shoulders and lateral haft margins from hafting. Similar Mahkin Shouldered points date from the mid- to late Kartar Phase or ca. 5000-4000 B.P.

Cold Springs Side-notched (Type 41) N=3

Two of the three specimens are detached hafting elements, broken through the neck or across the shoulders. The other, Specimen #605, is a variant of the classic Cold Springs Side-notched type, with very low, open notches, sharply contracting lateral basal corners rather than the vertical basal margins observed on Specimens #366 and #581, and markedly excurvate basal margins. Similar forms were found at 45-DO-285 (cf. Miss 1983c). Cold Springs Side-notched points have been recovered throughout the Kartar Phase, although they are not numerous in the project area.

Plateau Side-notched (Type 42) N=10

These points are small, delicate side-notched triangular forms with narrow lateral notches, and excurvate, straight, and slightly concave to notched basal margins. Form varies from slender to squat. Flaking patterns are variable, except in Specimen #400, where the pattern is classified as mixed. Similar points span a range from ca. 1000-200 B.P. or the mid- to very late Coyote Creek Phase.

Nespelem Bar (Type 51) N=6

Specimens classified as Nespelem Bar show a broad range of formal variation, a characteristic of this type as defined for the Rufus Woods Lake project area (Lohse 1984g). Specimen #186 is a heavy, thick example made on a large flake. Though triangular, its outline is very similar to the recovered Mahkin Shouldered specimens, and similar forms have been found in contexts radiocarbon dated to the Kartar Phase. Specimens #154, #205 and #609 are more typical examples of the Nespelem Bar type, and have sloping shoulders and long, straight to contracting stems. All were made on thick, broad flakes. Similar forms have a temporal range of ca. 5000-3000 B.P. or late Kartar Phase to early to mid- Hudnut Phase. Specimen #497 is yet another variant, with serrated margins, a markedly planoconvex cross section, and crudely thinned basal margin. It tends to occur in the early Hudnut Phase between ca. 4000-3000 B.P. in the project area. Flaking patterns on all five specimens are variable, with reduction of both the dorsal and ventral surface quite crude.

Rabbit Island A (Type 52) N=1

This is a characteristic Rabbit Island Stemmed point with straight to incurvate lateral margins, straight shoulders, and slightly contracting stem. The flaking pattern is classified as mixed. It was made on a thick, squat flake. The crazed surface and glossy texture of the chalcedony indicates heat treatment prior to manufacture. This form dates to the early and middle Hudnut Phase in the project area.

Columbia Corner-notched A (Type 61) N=4

Three of the four specimens are large corner-notched points with downward projecting shoulders. The two examples with intact stems show expanding lateral basal margins. Flaking patterns are variable. Specimens #9 and #52 exhibit lateral breaks, hinged fractures and lips near the distal tip indicative of impact fractures. The fourth specimen (M#144) is smaller than the other three, with slight corner notches, less well-defined shoulders, an expanding stem, and excurvate lateral basal margins. All four specimens were made on thick flakes. Columbia Corner-notched A points date to Hudnut Phase and Coyote Creek Phase in the project area.

Quilomene Bar Corner-notched (Type 62) N=2

The intact specimen (M#185) has a long, broad blade with excurvate margins, slightly downward projecting shoulders, and relatively delicate, expanding stem. The flaking pattern is variable and the margins show extensive hinged chipping or retouch. A large potlid on the ventral surface, partially reduced, attests to heat treament prior to manufacture. The other specimen (M#270) is a stem fragment, broken through the lower part of the neck. Classified as Quilomene Bar Corner-notched because of its overall configuration and size, it is also similar to the base on Specimen #605 from Zone 1, which was classified as a Cold Springs Side-notched type. Distinguished from the related Columbia Corner-notched A type largely because of their greater size and breadth, the Quilomene Bar Corner-notched points date to about the same temporal period or the Hudnut Phase and later Coyote Creek Phase.

Columbia Corner-notched B (Type 63) N=12

These specimens range from elongate forms with well-defined, downward projecting shoulders and expanding stems to squat forms with slight barbs and delicate expanding stems or slight shoulders and short, markedly expanding stems. As such, they resemble variants of the smaller Columbia Stemmed series and Plateau Side-notched forms with very low side notches, as well as the larger Columbia Corner-notched A types. In the Rufus Woods Lake project are, these Columbia Corner-notched B varieties are

almost entirely confined to the period after ca. 2000 B.P. or the Coyote Creek Phase.

Wallula Rectangular Stemmed (Type 64) N=5

This type has an elongate triangular outline with a long, straight delicate stem, and short, generally fine bars. All five points are characteristic examples, lacking serrated margins and long bars, and are indicative of the mid- to late Coyote Creek Phase. One specimen from the beach is included.

Columbia Stemmed A (Type 73) N=1

This specimen is a thin, elongate form with straight lateral blade margins, long, downward projecting barbs, and a narrow, strongly expanding stem with a straight basal margin. Flaking is mixed but tending toward fine collateral. This type is confined to the middle to late Coyote Creek Phase in the project area.

Columbia Stemmed B (Type 74) N=2

Specimen #68 is a classic late Columbia Stemmed variant with straight lateral blade margins and thick, contracting barbs that extend down to the straight basal margin. Flaking is mixed but exhibits fine parallel flake scars running from the lateral blade margins toward the midline of the point. Specimen #305 is shorter, with a long, thin tip and slightly incurvate lateral blade margins. The stem has been snapped off about midway through the neck. The flaking pattern is variable. This type dates to the latter part of the Coyote Creek Phase.

Unclassified Specimens N=12

Specimens designated as Type 81 are large and small triangular forms, which are perhaps finished projectile points, but more likely are preforms, which have not been notched to create hafting elements. Other specimens are badly fragmented forms, without the proximal end or basal margin, and not measurable by our discriminant analysis. Specimen #605 was unavailable during the discriminant run, and was hand assigned as a Type 41 above. Forms include a shouldered lanceolate (M#620), probably a Mahkin Shouldered type, from Zone 13, several lanceolate forms from Zones 2, 3, and 4, and large and small shouldered triangular forms with straight, contracting, and expanding stems from Zones 1, 3, and 4.

Blade Fragments N=18

Five of these specimens were hand assigned to historical types as listed. The rest are shouldered, square shouldered, and barbed triangular points without stems or do not have completed stems. All but one (M#535) are small, and probably represent Columbia Corner-notched B and Columbia Stemmed variants dating to the mid- to late Coyote Creek Phase.

Detac ied Stems N=14

The majority of detached stems have expanding lateral margins and probably represent small triangular corner- and basal-notched projectile points such as Columbia Corner-notched B and Columbia Stemmed varieties. Exceptions are the straight sided stem from Zone 11, which may be a Wallula Rectangular-stemmed, and two contracting stems from Zone 13 (living surface B) that are probably Nespelem Bar varieties. The Columbia Corner-notched B, Columbia Stemmed, and Wallula Rectangular Stemmed types would indicate occupations during the Coyote Creek Phase, while the probable Nespelem Bar stem forms indicate a late Kartar Phase or Hudnut Phase affiliation.

Broken Bases N=3

All three recovered bases are finely made, thinned lanceolate forms suggestive of Cascade or Mahkin Shouldered variants. None show edge grinding. All were made on flakes. If they represent Cascade and/or Mahkin Shouldered points, they date to the mid- to late Kartar Phase.

STRATIGRAPHIC DISTRIBUTION

The stratigraphic distribution of projectile points at 45-DO-326 is shown in Table 3-29. For comparison, the distribution of historic types by phase at all sites is shown in Figures 3-7 and 3-8. Zone 4, with an associated radiocarbon date of ca. 3100 B.P., appears to date at least 1,000-2,000 years

Table 29. Stratigraphic distribution of projectile points, 45-DO-326.

Type		Zone 1	Zone 2	Zone 3	Zone 4	Total
Plateau Side-notched (42)	N %	9 32.1	1 11.1	-	-	10
Columbia Stemmed A (73)	N %	-	1 10.0	-	-	1
Columbia Stemmed B (74)	N %	1 3.6	1 11.1	-	-	2
Columbia Corner-notched B (63)	N %	8 28.6	4 44.4	-	-	12
Wallula Rectangular Stemmed (64)	N %	4 14.3	-	-	-	4
Quilomene Bar Basal-notched B (72)	N %	1 3.6	-	-	-	1
Quilomene Bar Corner-notched (62)	N %	1 3.6	-	-	1 14.3	2
Columbia Corner-notched A (61)	N %	-	-	2 20.0	2 28.6	4
Rabbit Island A (52)	N %	1 3.6	-	-	-	1
Nespelem Bar (51)	N %	1 3.6	-	4 40.0	1 14.3	6
Mahkin Shouldered (31)	N %	-	-	1 10.0	2 28.6	3
Cold Springs Side-notched (41)	N %	1 3.6	-	2 20.0	-	3
Cascade B (22)	N %	-	-	1 10.0	-	1
Cascade A (21)	N %	1 3.6	2 22.2	-	1 14.3	4
Total	N	28	9	10	7	54

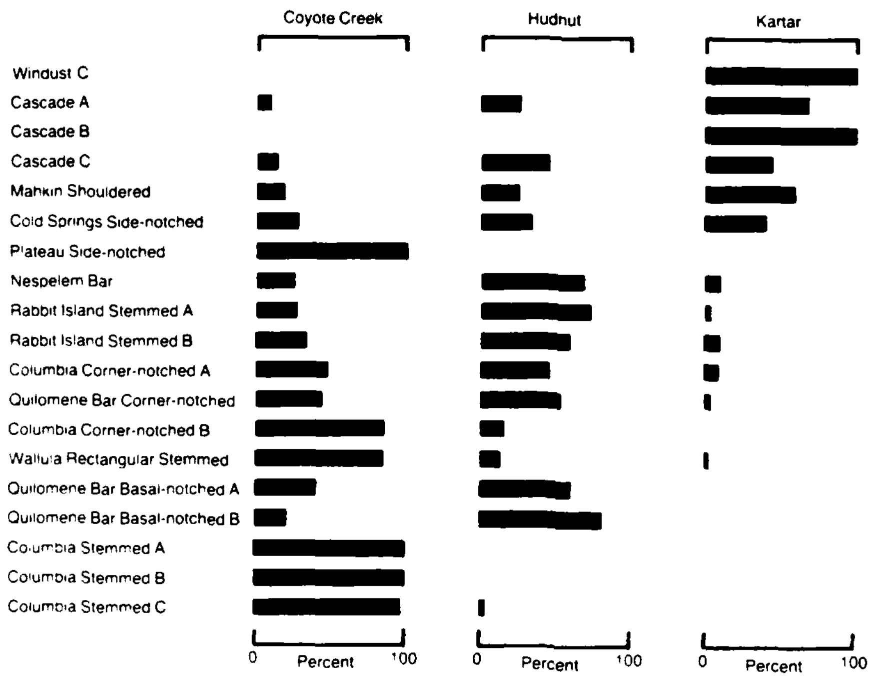

Figure 3-7. Proportions of historic projectile point types across all phases.

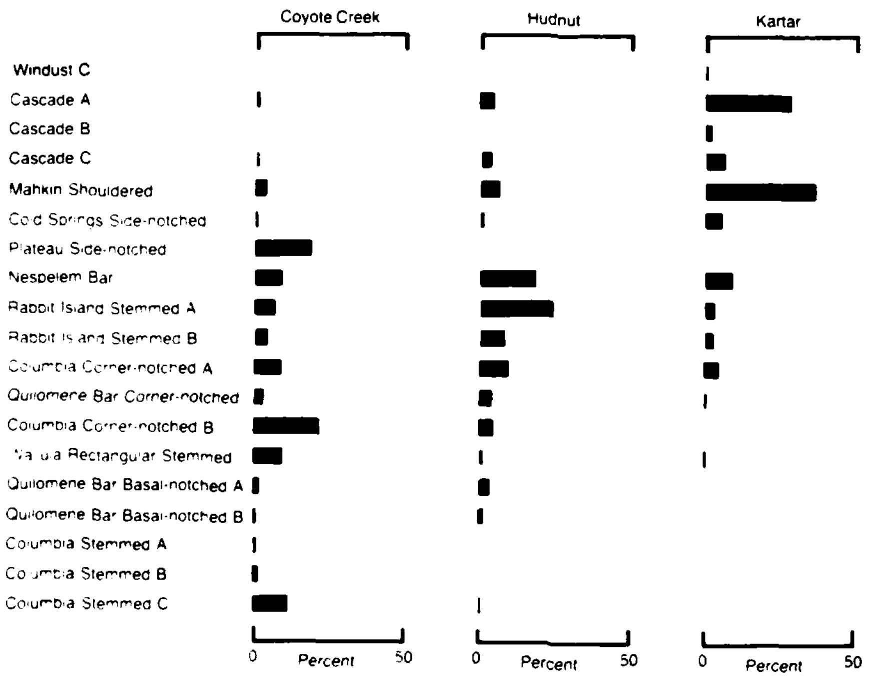

Figure 3-8. Proportions of historic projectile point types within phase.

earlier than that, given the presence of early Mahkin Shouldered points in that zone and Cold Springs Side-notched, Cascade A, Cascade B, Mahkin Shouldered and Nespelem Bar types in the overlying Zone 3. A radiocarbon date of ca. 3000 B.P. for Zone 3 may be accurate since that zone contains Columbia Corner-notched A points as well as the earlier types. However, the presence of these Kartar Phase projectile point types in Zone 3 overlying the Mahkin Shouldered points in Zone 4 indicates considerable disturbance of the earliest occupation levels. The construction of numerous pits in Zone 3, which extended down into Zone 4, probably redeposited earlier diagnostics in that later zone. An equally valid inference, of course, is that Zone 3 as defined encompasses both a Kartar Phase occupation and the later Hudnut Phase occupation. This is possible since Living Surface B, a thick charcoal-stained lense of cultural material, might be either a late Kartar Phase or early Hudnut Phase activity surface, given Nespelem Bar and Mahkin Shouldered projectile points, as well as a number of contracting and expanding stem fragments (cf., Lohse 1983e). The point of origin of the numerous pits in relation to Living Surface B is not clear, and it is likely that pit construction occurred in two temporally distinct occupations in Zone 3 that the zone designation unintentionally mixed. Equally likely is that the radiocarbon date of ca. 3000 B.P. as well as the radiocarbon date of ca. 3100 B.P. are valid assays for the later cultural occupation in Zone 3. The temporal separation of Zones 3 and 2 is quite obvious, and seems to indicate a possible hiatus of about 1,500-1,000 years given the earliest C14 date for Zone 2 of 1500 B.P., and a lack of any Hudnut Phase point types in that zone. Zone 1 appears distinct from Zone 2 as well, given radiocarbon dates spanning a period from ca. 800-200 B.P. and a relatively discrete distribution of small Plateau Side-notched projectile points. That occupation in the two zones occurred throughout the Coyote Creek Phase and over a relatively short time is indicated by the distribution of characteristic point types such as Columbia Stemmed varieties and Columbia Corner-notched B, and the short span of ca. 400 years between the latest radiocarbon date in Zone 2 and the earliest in Zone 1. The distribution of Cascade A points through the upper three zones is probably the result of site disturbance and/or curation.

In summary, use of the 45-DO-326 rockshelter spans all three cultural phases, probably beginning ca. 5000 B.P., if not earlier, and continuing on up into the early historic period at ca. 200 B.P., with a significant hiatus between the Hudnut Phase and Coyote Creek Phase at ca. 2500-1500 B.P. Intense site disturbance, both through cultural constructions, and natural processes, including rodent action and heavy rockfall, make reconstruction difficult. There is little doubt, however, that the radiocarbon date of ca. 3100 B.P. is far too late for the earliest zone of occupation, and that this date and the date of ca. 3000 B.P. probably record poorly defined Hudnut Phase occupation in the upper part of Zone 3, which overlie a late Kartar Phase occupation. The hiatus at ca. 2000 B.P. seems to document a significant shift in site use, as will be discussed in Chapter 6.

4. FAUNAL ANALYSIS

Zoological remains from archaeological sites provide a unique source of data on the ecology and historic biogeography of animal species living in the area, and on utilization of faunal resources by human occupants. This chapter describes the faunal assemblage recovered from 45-DO-326, and summarizes the implications of the assemblage for understanding the archaeology of the site.

FAUNAL ASSEMBLAGE

The faunal distribution of vertebrate and invertebrate faunal remains is summarized by zone in Table 2-C. The vertebrate assemblage consists of 87,476 specimens weighing 14,219 gms. Only 1,325 (approximately 1.5%) of the elements were identifiable. Of the identified elements 1,068 (81%) are mammalian, 161 (12%) are reptilian, eight (less than 1%) are amphibian, and 88 (7%) are fish. Taxonomic composition and distribution of the vertebrate remains for the site as a whole and by zone are shown in Table 4-1. The invertebrate assemblage consists of 11 shell fragments weighing eight g. The shells have not been analyzed.

The following summary presents criteria used to identify elements where appropriate, and comments concerning the past and present distribution and cultural significance of the taxa represented. A summary of the elements representing each taxon is provided in Appendix C.

SPECIES LIST

MAMMALS (NISP=1,068)

Lepus cf. *townsendii* (white-tailed hare) -- 1 element.

Two species of *Lepus* presently inhabit the project area, *L. townsendii* (white-tailed hare) and *L. californicus* (black-tailed hare). A third species, *L. americanus* (snowshoe hare), inhabits regions adjacent to the project area. These elements could not be assigned to species on the basis of morphological features. *L. californicus* is thought to have immigrated from the Great Basin during the early part of the twentieth century (Couch 1927; Dalquest 1948). *L. americanus* is largely nocturnal and secretive, and inhabits wooded areas. Consequently, these specimens have been tentatively assigned to *L. cf. townsendii*.

Table 4-1. Taxonomic composition and distribution of vertebrate remains from 45-DO-326.

Taxa	Zone 1 NISP[1]	Zone 1 MNI[2]	Zone 2 NISP	Zone 2 MNI	Zone 3 NISP	Zone 3 MNI	Zone 4 NISP	Zone 4 MNI	Site Total NISP	Site Total MNI
MAMMALIA (NISP=1,068)										
Leporidae			1	-					1	-
Lepus cf. townsendii			1	1					1	1
Sylvilagus nuttallii	5	1	4	1			1	1	10	2
Sciuridae										
Marmota flaviventris	13	1	42	2	49	3	107	2	211	6
Spermophilus spp.	6	1	1	1	2	1	1	1	10	1
Geomyidae										
Thomomys talpoides	8	3	17	3	6	2	63	8	95	12
Heteromyidae										
Perognathus parvus	5	2	7	2			1	1	13	5
Cricetidae	3	-	10	-	7	-	7	-	27	-
Peromyscus maniculatus	1	1	2	1	3	2	3	2	9	5
Neotoma cinerea			1	1	2	1	1	1	4	2
Microtus spp.	1	1	1	1	1	1	1	1	4	2
Lagurus curtatus	8	4	3	2	4	2	3	2	18	8
Canidae										
Canis spp.	1	1	1	1			4	1	6	1
Mustelidae										
Taxidea taxus	2	1	2	1			53	1	57	2
Cervidae	4	-	13	-	2	-	2	-	21	-
Cervus elaphus	1	1	4	1			2	1	7	1
Odocoileus sp.	83	2	23	1	5	1	29	1	120	2
Bovidae	36	-	28	-	24	-	35	-	123	-
Antilocapra americana	2	1			1	1			3	1
Ovis canadensis	15	1	37	2	6	1	14	1	72	2
Deer-Sized	89	-	86	-	28	-	35	-	238	-
Elk-Sized	5	-	2	-	2	-	2	-	11	-
REPTILIA (NISP=161)										
Colubridae	4	-	6	-	25	-	126	-	161	-
AMPHIBIA (NISP=8)										
Ranidae/Bufonidae							8	-	8	-
PISCES (NISP=89)										
Salmonidae	6	-	2	-	10	-	63	-	81	-
Oncorhynchus tshawytscha							4	-	4	-
Cyprinidae	2	-	1	-					3	-
TOTAL	281		295		177		565		1,318	

[1]NISP = Number of Identified Specimens.
[2]MNI = Minimum Number of Individuals.

Sylvilagus cf. *nuttallii* (Nuttall cottontail) -- 10 elements.

Three species of rabbits may be present in the site area. *Sylvilagus nuttallii* and *S. idahoensis* are both native to eastern Washington. *S. floridanus* was introduced in the early 20th century (Dalquest 1941). Of the two native species, *S. nuttallii* is larger and more abundant. This specimen was identified as *S. nuttallii* because of its size. *S. nuttallii* is a common resident of rocky, sagebrush habitats in the project area. Both rabbits and hares were sought by ethnographic tribes (Post, in Spier 1938:24) for furs and food (Ray 1933:87).

Marmota flaviventris (yellow-bellied marmot) -- 212 elements.

All marmot remains have been tentatively assigned to the species *M. flaviventris* on the basis of present distribution. This species is the only marmot now living in the project area, and is a common resident of talus slopes. Marmots were exploited as a small game resource by ethnographic inhabitants of eastern Washington (Ray 1932; Post, in Spier 1938). Their presence in this faunal assemblage may indicate prehistoric exploitation.

Spermophilus spp. (ground squirrels) -- 10 elements.

Three species of ground squirrels are currently found in eastern Washington: *Spermophilus columbianus*, *S. washingtoni*, and *S. townsendii*. *S. columbianus* is larger than the other two and prefers more mesic habitats. *S. washingtoni* and *S. townsendii* are smaller and prefer sagebrush and grass zones to the south and east of the project area (Dalquest 1948:268; Ingles 1965:169). These elements could not be assigned to species. Ground squirrels have been reported as a food resource in the ethnographic literature (Ray 1932:82).

Thomomys talpoides (northern pocket gopher) -- 95 elements.

Thomomys talpoides is the only geomyid rodent in the project area. Because pocket gophers are extremely fossorial and there is very little evidence that they were utilized prehistorically or ethnographically, their presence in this assemblage may be considered fortuitous.

Perognathus parvus (Great Basin pocket mouse) -- 13 elements.

Perognathus parvus is the only heteromyid rodent known in the project area. Like the pocket gophers, *P. parvus* is most likely present as a result of natural agents of deposition.

Peromyscus maniculatus (deer mouse) -- 9 elements.

Deer mice are residents of all habitat types in the project area. There is no evidence that deer mice were ever utilized.

Neotoma cinerea (bushy-tailed woodrat) -- 2 elements.

Woodrats live in a variety of habitats in eastern Washington (Ingles 1965). Woodrats were not considered desirable food by ethnographic inhabitants of the project area (Ray 1932:90).

Microtus spp. (meadow mouse) -- 4 elements.

Three species of Microtus occur in the site area: M. montanus, M. pennsylvanicus and M. longicaudus. All three species inhabit marshy areas or live near streams. M. montanus can also be found in more xeric areas. None of the elements in this assemblage could be assigned to species. There is no evidence that microtine mice were culturally deposited.

Lagurus curtatus (sagebrush vole) -- 19 elements.

Sagebrush voles inhabit dry sagebrush areas with little grass (Maser and Storm 1970:142). Only cranial material of this species is distinguishable from Microtus sp. The occlusal surface of M^3 (Maser and Storm 1970) and the location of the mandibular foramen (Grayson 1982) are distinctive.

Canis spp. (dog, coyote, wolf) -- 6 elements.

Both Canis latrans (coyote) and C. familiaris (domestic dog) are common in the project area today. C. latrans is an indigenous species, and C. familiaris has great antiquity in the northwest (Lawrence 1968). C. lupus (wolf) is also known to have been a local resident in the past, but has been locally extinct since about 1920 (Ingles 1965). Dogs were used ethnographically for hunting deer, but were not eaten except in emergencies (Post 1938). Coyotes, however, were considered good food (Ray 1932:90).

Taxidea taxus (badger) -- 57 element.

The badger is a powerful burrower and is found thoughout eastern Washington, though not in large numbers (Ingles 1965). Badgers were trapped regularly by the Sanpoil and Nespelem (Ray 1932:85).

Cervus elaphus (elk) -- 11 elements.

Elk are rare in the extant local fauna of the project area. The closest population is in the Cascade Mountains to the west (Ingles 1965). Elk bones occur in low frequencies in many archaeological sites in eastern

Washington, however, indicating that elk once occupied a more extensive range than at present and/or that people were traveling some distance to hunt them.

Odocoileus spp. (deer) -- 120 elements.

Two species of deer may be represented in this assemblage, Odocoileus hemionus and O. virginianus. Deer are thought to have represented a major food resource to the prehistoric inhabitants of eastern Washington (Gustafson 1972), as they did for the ethnographic cultures (Post, in Spier 1938; Ray 1932).

Antilocapra americana (pronghorn antelope) -- 3 elements.

Although antelope are only present today in Washington as an introduced species (Ingles 1965), antelope remains are common in both historic and prehistoric archaeological sites, especially in the arid part of the Columbia Basin (Gustafson 1972; Osborne 1953). There are ethnographic records of hunting practices associated with antelope procurement (Ray 1932; Post, in Spier 1938).

Ovis canadensis (mountain sheep) -- 72 elements.

Mountain sheep occur in archaeological sites in eastern Washington with some regularity. The presence of this species is somewhat difficult to interpret, however, because references to it in the ethnographic literature are scarce. Moreover, when competition with man and domestic stock for range became severe during historic times, the habitat preference of this species appears to have changed (Manville, in Monson and Sumner 1980). Mountain sheep are known ethnographically to have been exploited both for meat and as a source of bone for tools (Spinden 1908).

REPTILIA (NISP=161)

Colubridae (Colubrid snakes) -- 161 elements.

Snake vertebrae were identified to family on the basis of size. There are at least four species of snakes living in the project area that may be represented by these vertebrae: Coluber constrictor (western yellow-bellied racer), Pituophis melanoleucus (gopher snake), Thamnophis sirtalis (valley garter snake), and T. elegans (wandering garter snake). Most snake elements appear to be intrusive.

AMPHIBIANS (NISP=8)

Ranidae/Bufonidae (frogs and toads) -- 8 elements.

Both frogs and toads inhabit the project area (Stebbins 1966). Inadequate comparative material precluded assigning these elements to the correct family. Like those of the snakes, these elements appear to be intrusive.

PISCES (NISP=89)

Salmonidae (salmon, trout, and whitefish) -- 82 elements.

These vertebrae could belong to any of at least eight species of salmonid fish known in the project area. All fish vertebrae with parallel-sided fenestrated centra were assigned to this family. Salmonid fish represented a major food resource for ethnographic tribes (Ray 1932; Post, in Spier 1938; Craig and Hacker 1940). The high incidence of burned and broken vertebrae in this assemblage indicates salmonid fish were utilized at this site.

Oncorhynchus _tshawytscha_ (Coho salmon) -- 4 elements.

Four otoliths allowed identification of the species in this assemblage.

Cyprinidae (carp and minnows) -- 3 elements

Inadequate comparative collections precluded more specific identification of fish vertebrae. Assignment of nonsalmonid fish vertebrae to family was made on the basis of size. At least seven species of cyprinid fish occur in the project area. Some ethnographic groups exploited these fish (Post, in Spier 1938). These fish remains are probably present as a result of human activity.

DISCUSSION

The usefulness of faunal remains in helping to unravel the sequence of events recorded in an archaeological deposit is directly related to our ability to recognize the agents responsible for depositing the bones in the site. Distinguishing faunal remains deposited as the result of activities of people from remains present as a result of natural depositional processes is a problem that has recently become a major focus of research (Behrensmeyer and Hill 1980; Binford 1981; Brian 1981; Thomas 1971). Major advances have been made in identifying possible sources of faunal materials as well as potential errors in interpretation that may occur due to failure to identify the agents responsible for accumulating bone assemblages.

Regularly acknowledged sources of bone accumulations include the subsistence activities of people, hunting and scavenging activities of nonhuman carnivores, transport by natural agents such as water, and the life cycle of individuals living on the site. In open sites, concentrations of bones associated with evidence of the presence of people are routinely attributed to their activities. The underlying assumption is that there is no necessary reason for people and other agents of accumulation to deposit their respective assemblages in the same place. In sheltered sites, the assumption that people and other bone accumulating agents will generally not use the same locations, and leave behind assemblages of faunal remains, is not valid. While it is reasonable to assume that at least some of the bones from sheltered sites were deposited by the same agents as the other archaeological remains, other agents of bone deposition known to use sheltered sites include raptors, predatory and scavenging carnivores, and rockdwelling rodents. These agents, as well as the activities of people, may be responsible for some portion of the faunal assemblage recovered from 45-DO-326.

Interpretation of the archaeological significance of the faunal assemblage from 45-DO-326 relies heavily on determining how the bones of each taxon became incorporated into the archaeological deposits. Where possible, we have sought to determine the agent of deposition for the bones identified. For this site, like other sites in the project area, agents of deposition are suggested on the basis of ethnographic analogy, the natural history of the taxon, evidence of butchering and/or burning, and the distribution and association of elements. This evidence is provided in the accounts of the species above and the discussion of subsistence below.

SUBSISTENCE

A total of 90 elements from this site exhibit evidence of butchering marks or burning that may indicate people deposited them. These elements are distributed across at least eight taxa as shown in Table 4-2. Four of the elements are artifacts and are discussed in Chapter 3.

Burned elements occur in all zones. The nonartiodactyl taxa (sciurids, lagomorphs, cricetids, mustelids and canids) are included in the butchering analysis solely on the basis of burned bone; none show evidence of breakage or cut marks indicating use. The frequencies of burned elements among these taxa are extremely low, making interpretation difficult. It should not be inferred that all elements of the taxa listed in Table 4-2 were deposited by cultural agents on the basis of the burned elements recorded. Fifty-two of the 53 badger (Taxidea taxus) elements from Zone 4 represent a single, relatively complete, badger recovered from unit 19N9W in the levels between 140 and 170 cm (Feature 36). There is no indication that human activity deposited this individual. The single burned badger element from Zone 4 was recovered from unit 17N23W in the 70 cm level; spatial distribution suggests that it came from a second badger. Similar caution must be exercised in inferring use of the remaining taxa for which burned elements are recorded.

Most burned and butchered elements are from small artiodactyls (deer, sheep and antelope). The majority of these elements could not be assigned to species because the extremely fragmented remains often lack diagnostic features. When considered collectively, there are butchered or burned elements from all parts of the small artiodactyl skeleton. The densest

Table 4-2. Butchered and burned elements, 45-DO-326.

Element	Zone 1				Zone 2		Zone 3			Zone 4
	Flaked	Flaked and Striated	Artifact	Burned	Flaked	Burned	Flaked	Artifact	Burned	Burned
Sylvilagus nuttallii										
humerus				2						
Spermophilus spp.										
maxilla									1	
Cricetidae										
mandible						1				
Taxidea taxus										
humerus										1
Canis spp.										
astragalus				1						
Odocoileus spp.										
mandible	1									
molariform										1
metapodial										1
first phalanx					1					1
Cervus elaphus										
antler			1							
Cervidae										
antler			2					1		1
Bovid										
incisor									1	
Deer-sized										
skull				1						
mandible				1						1
axis vertebra										1
thoracic vertebra									1	
lumbar vertebra				1						
rib									2	
costal cartilage									1	
scapula				1						
humerus					1		1			
carpal				2						1
metacarpal					3					
femur	1			1			1			
tibia	2				1					
metatarsal					2		1			
metapodial	5	1		2	3	6	1		3	
first phalanx				2		2			3	3
second phalanx				1						1
dew claw						1				1
sesamoid				2		2				1
Elk-sized										
vertebra				1						
metapodial	1						1			
Colubridae										
vertebra						1			1	
Salmonidae									1	

elements, such as metapodials, are present in the greatest numbers, as we would expect, since they would preserve better. The range of elements suggests that the entire carcass was brought to the site.

Butchering marks recorded include flakes and striae. When green bones are struck with a blunt instrument a crescentic, conchoidal flake scar is frequently left on the broken edge of the bone at the point of impact (Binford 1981). Flake scars may be expected to occur when bone is broken after the surrounding muscle tissue has been removed, as in the process of marrow extraction. Striae are cut marks produced when a sharp edged implement is drawn across green bone. Striae may be expected to occur during skinning, filleting, or disarticulation (Binford 1981). In this assemblage, butchering marks occur only on artiodactyl elements.

SEASONALITY

If we assume that the faunal remains were deposited by the activities of people during the season(s) when taxa are naturally available, the season of site occupation may be inferred from the presence of seasonally active taxa and the age at death of taxa with a known season of birth. Four such taxa are represented in the 45-DO-326 assemblage: Marmota flaviventris, Spermophilus spp., Ovis canadensis, and Oncorhynchus tshawytscha. Table 4-3 shows the distribution of these four taxa across four zones and the indicated season of site occupation.

Both marmots (Marmota flaviventris) and ground squirrels (Spermophilus spp.) are active during the late winter/early spring months. They estivate during the summer and may go directly into hibernation for the winter or may be active for a short period again in the fall. The time of their greatest availability is between February and June, but this may vary slightly according to the local climatic conditions and the species (Dalquest 1948; Ingles 1965). Both marmot and ground squirrel elements were recovered from all four zones.

Age of death could only be determined for a single individual, an 11 month old mountain sheep (Ovis canadensis) from Zone 2. This was established using criteria described by Deming (1952). Sheep usually give birth during May or June (Ingles 1965), indicating this individual probably died in April or May.

The four Chinook (Oncorhynchus tshawytscha) otoliths and the high relative abundance of salmonid elements in Zone 4 may represent exploitation of salmon runs or spawning. Chinook salmon migrate upstream from the Pacific Ocean in late May and early June, and again in August and September. They spawn from July to September (Wydoski and Whitney 1979:59).

SUMMARY

Small artiodactyls appear to have been the primary mammalian resource of people using this site. Other mammalian taxa that may have been exploited include rabbits and hares, marmots and ground squirrels, canids, badgers, and elk. Salmonid fish may also have represented a major resource, at least for

Table 4-3. Seasonal indicators from the faunal assemblage, 45-DO-326.

Zone	Taxon Element	Season of Death											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
1	*Marmota flaviventris*				NISP=14								
	Spermophilus spp.				NISP=6								
2	*Marmota flaviventris*				NISP=42								
	Spermophilus spp.				NISP=1								
	Ovis canadensis				NISP=11								
3	*Marmota flaviventris*				NISP=48								
	Spermohpilus spp.				NISP=2								
4	*Marmota flaviventris*				NISP=107								
	Spermophilus spp.				NISP=1								
	Oncorhynchus tshawytscha							NISP=4					

the occupants of Zone 4. Salmonid elements occur in highest relative abundance in Zone 4, artiodactyls in Zones 1 and 2.

Late winter/early spring use of this site may be inferred from the mammalian taxa if we assume cultural activity is responsible for introducing the faunal remains into the site. In view of the sheltered nature of the site, we suggest that such an assumption be made with caution. The fish remains may also suggest a fall/winter occupation.

Most of the geomyid, heteromyid, cricetid and mustelid remains are probably present in this site naturally. Because sheltered sites such as this provide attractive habitations for animals as well as people, and because such sites are usually good preservation environments, a diverse small mammal fauna is to expected. Extensive disturbance of the site by the burrowing activities of these taxa, especially the gophers, precludes drawing environmental inferences from these taxa.

5. FEATURES ANALYSIS

The cultural features at 45-DO-326 occur in all four analytic zones. Basically three types of features occur: large pits, firepits, and occupation surfaces. All of the features were recorded within the rock shelter. None occurred in either the "outside" or periphery areas.

Practical problems arose in the field during excavation. The combined effects of rodent disturbance and heavy accumulations of roof fall often made it difficult to recognize pit features in horizontal view. The profiles indicate that some of the field-assigned pit features should be discarded: no soil changes were noted in profiles or the pits are shown to be rodent runs. Even more striking is the number of pits and possible pits recorded by stratigraphic crews which were not seen by excavators (for example, Figure 5-3 below). Also, although feature numbers were assigned as consistently as possible, occasionally a single pit might be given different numbers in different units, or a feature which seemed to be a single entity during excavation and given one feature number was shown in profile to be two overlapping pits. Illustrations in this chapter demonstrate the complex stratigraphy of the site and the ubiquitous rockfall which concealed pit features. We report only pits or surface features recognized by excavators and confirmed by stratigraphic profiles. They should be viewed as a biased sample of a number of other pit features which were not recorded by excavators.

Tables 5-1, 5-2 and 5-3 offer the basic descriptive information for the features at 45-DO-326. Dimensions, provenience and an estimate of excavated volume are given in Table 5-1, which also lists material contents. Specific functional types recovered are listed in Table 5-A and, for Surface B and Firepit 2, in Table 5-2. Identified faunal species are shown in Table 5-3.

A final caveat is necessary. Pits 3, 4 and 5 all occur in Testing Unit 19N16W. Following standard project procedure, material from test units was not tabulated or encoded with material from the rest of the site, and therefore is not reflected in the material counts given in the tables. Recording procedures, the designation of features, etc. were different in testing than in later excavations and the results from the two are not comparable. In any case, none of the material from Pits 3, 4 or 5 from 19N16W is reported in the tables; the figures represent approximately half of each pit.

Table 5-1. Dimensions, provenience, and material recovered from features, 45-DO-326.

Feature #	Feature type	Dimensions (cm)	Total Depth	Provenience	Debitage	Formed Objects		Bone		FMR		Estimated Volume (m)	Tool Types
						Lithic	Bone	#	g	#	g		
Zone 1													
73	Stratum 60	1 x 1 x .1m		20N17W	14	1	0	126	42	9	2,290	.100	Hammerstone
14	Stain	.7 x .4 x .2		21N16W	5	0	1	96	35	0	0	.056	Flaked long bone
13, 15, 34 72	Stratum 50	discontiguous		18-20N 15-18W	10	1	3	324	220	16	3,615	.425	Point base, modified elk antler fragments
12	Firepit 3	80 x 50 cm.	15	19N10W	4	1	0	0	0	0	0	.250	Microblade
Zone 2													
51	Pit 9	1.3 m diameter	60	18-20N 16-17W	64	4	0	537	55	5	1,430	.578	Microblades (3), point base
44	Firepit 2	86 x 86		18N16-17W	59	11	1	2,306	277	29	4,400	.108	see Table
Zone 3													
50, 29, 45	Surface B	2 x 3-4 m	15	17-19N 12-16W	662	41	0	10,271	1,329	92	12,057	.992	see table
28 ,27	Firepit 1	35 x 60 cm	15	20N16W	6	1	0	107	14	0	0	.062	Biface
58	Pit 2	1.3 m diameter	60	19-20N17W	7	1	0	65	6	1	125	.338	Unifacially retouched flake
59, 62	Pit 3	1.2 m diameter	75	18-19W 16-17W	38	2	0	378	23	0	0	.345	Microblades (2)
74, 39	Pit 4	1 m (?) diameter	60	19N15-16W	11	1	0	170	25	3	340	.295	Unifacially retouched flake
71	Pit 5	1.3 m diameter	50	18-19N 15-16W	46	1	0	643	83	2	322	.250	Microblade
17	Pit 6	1 m+ diameter	30	15N13W	9	0	0	30	7	0	0	.250	None
16	Pit 7	1.3 m diameter	30-50	15-16N14W	23	4	0	149	17	2	130	.400	Microblades (2), utilized flake, tabular knife
69	Pit 8	1.3 m diameter	75	15-16N14W	17	2	0	184	23	2	322	.500	Microblade, unifacially retouched flake
Zone 4													
8, 60	Pit 1	1 m diameter	40	18N20-21W	6	1	0	0	0	0	0	.542	Utilized flake
85	Surface	70 x 70	6	19N18W	2	0	0	1	0	0	0	.065	-

Table 5-2. Identified tool types from Surface B and Firepit 2, 45-DO-326.

Surface B, Zone 3	Firepit 2, Zone 2
Point base (7)	Point base (2)
Bead*	
Biface (2)	Biface (2)
Chopper (2)	
Microblade (19)	
	Projectile point
Point tip	Point tip (3)
Unifacially retouched flake	
Utilized flake (5)	Utilized flake (3)
	Flaked long bone

* bead of undetermined material

ZONE 4

Zone 4 contains two features, both toward the west side of the shelter (Figure 5-1). Pit 1 (Features 60, 8) is a large, deep, but poorly defined pit in 18N20-21W (shown in profile in Figure 5-2). About one meter in diameter and 40 cm deep, Pit 1 contained practically no artifacts (Table 5-1), although its fill was carbon-stained and yielded a few chunks of charcoal.

Surface A (Feature 65) is a small area of intense charcoal staining which underlies an unfeatured pit in 19N18W. It also underlies the stratum of redeposited tephra (Stratum 90) discussed in Chapter 2 (Figure 5-3). This surface overlies a thick gravel stratum (Stratum 100) and is a primary cultural deposit. Very little material occurs within this feature.

ZONE 3

This zone contains several pits and a thick occupation surface or stratum (Figure 5-4), suggesting that cultural activity at this site was at its most intense during this period.

Surface B (Features 50, 1) yielded more material than any other cultural feature at 45-DO-326. It was recorded in a roughly 2 x 3-m area east of a concentration of pits (Figure 5-4) and is the same as Stratum 80. The intense charcoal staining which marks this feature had very abrupt edges and occupied a shallow depression, the west and south sides of which had been excavated aboriginally. Several localized concentrations of charcoal or staining within this surface include a remnant firepit (Feature 29), decayed organic stain (Feature 45), and several rodent burrows. There is evidence that the natural boundaries of the depression had been culturally enhanced, but not evidence that a superstructure had been erected over the depression.

A firepit (Features 26, 27) in 20N16W may also be part of this surface. Heavily disturbed by rodent activity, this firepit was 35 x 60 x 15 cm, and contained over one hundred very small bone fragments, lithic debitage and a biface.

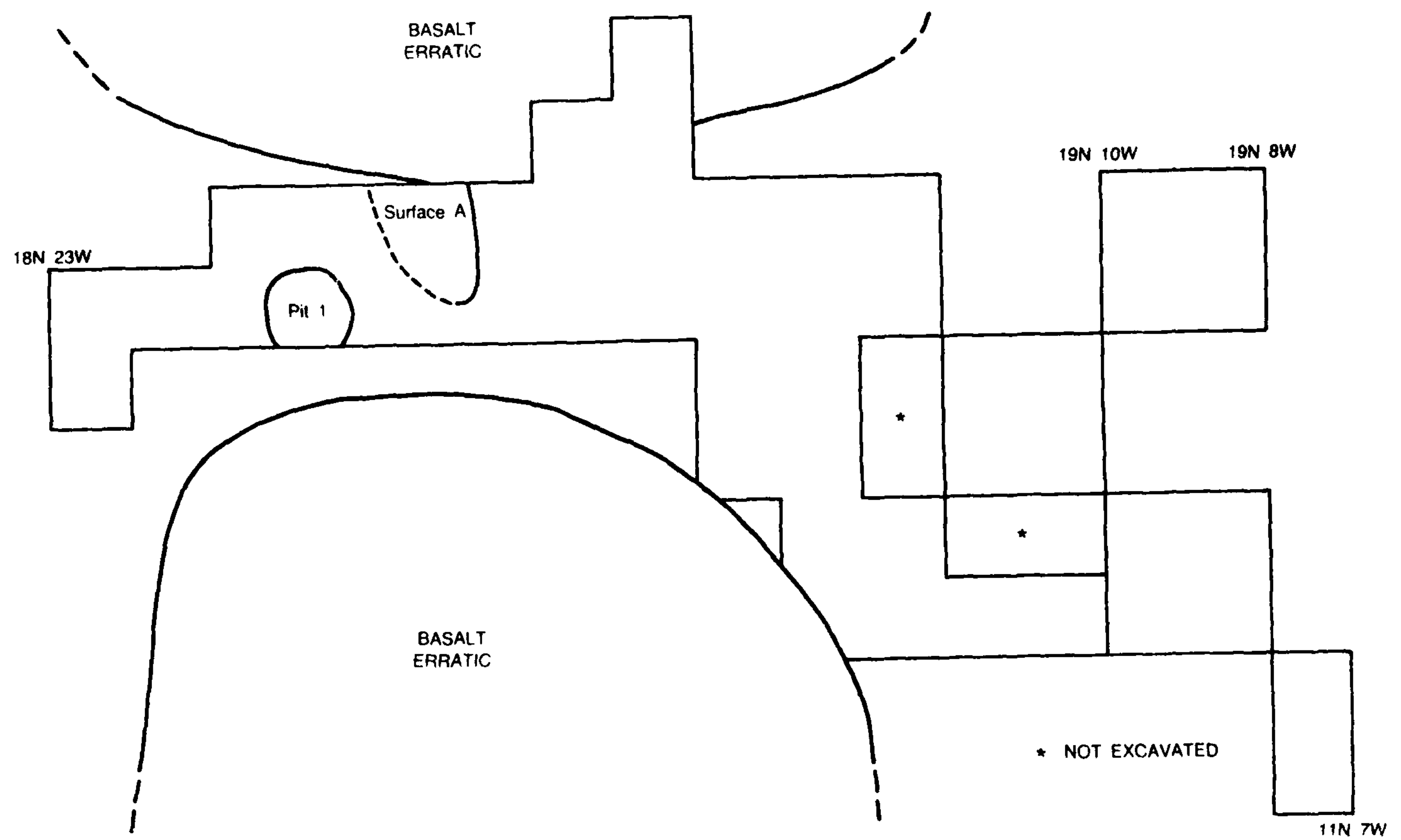

Figure 5-1. Plan map of the features of Zone 4, 45-DO-326.

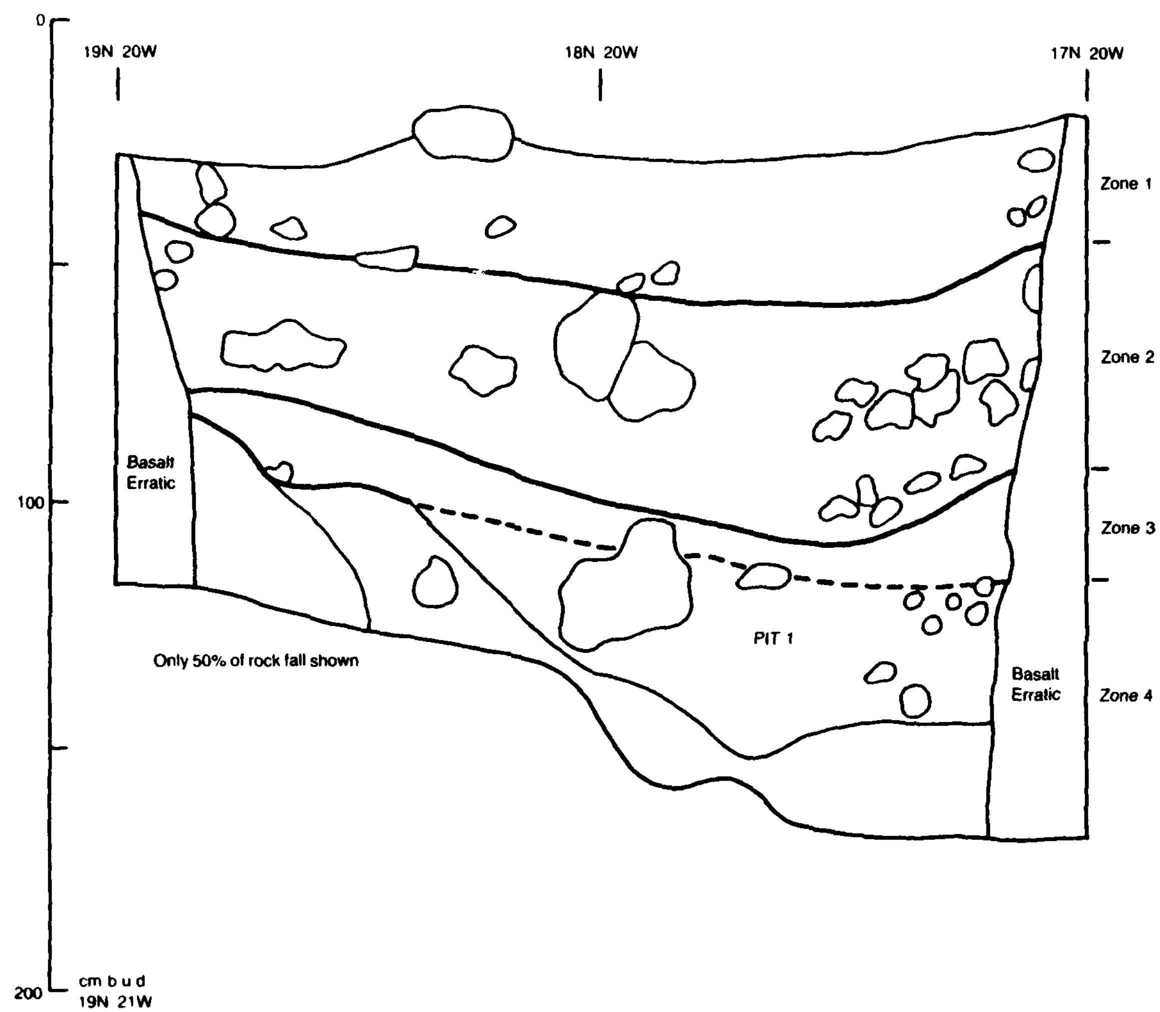

Figure 5-2. Profile of 20W line, showing Pit 1, Zone 4, 45-DO-326.

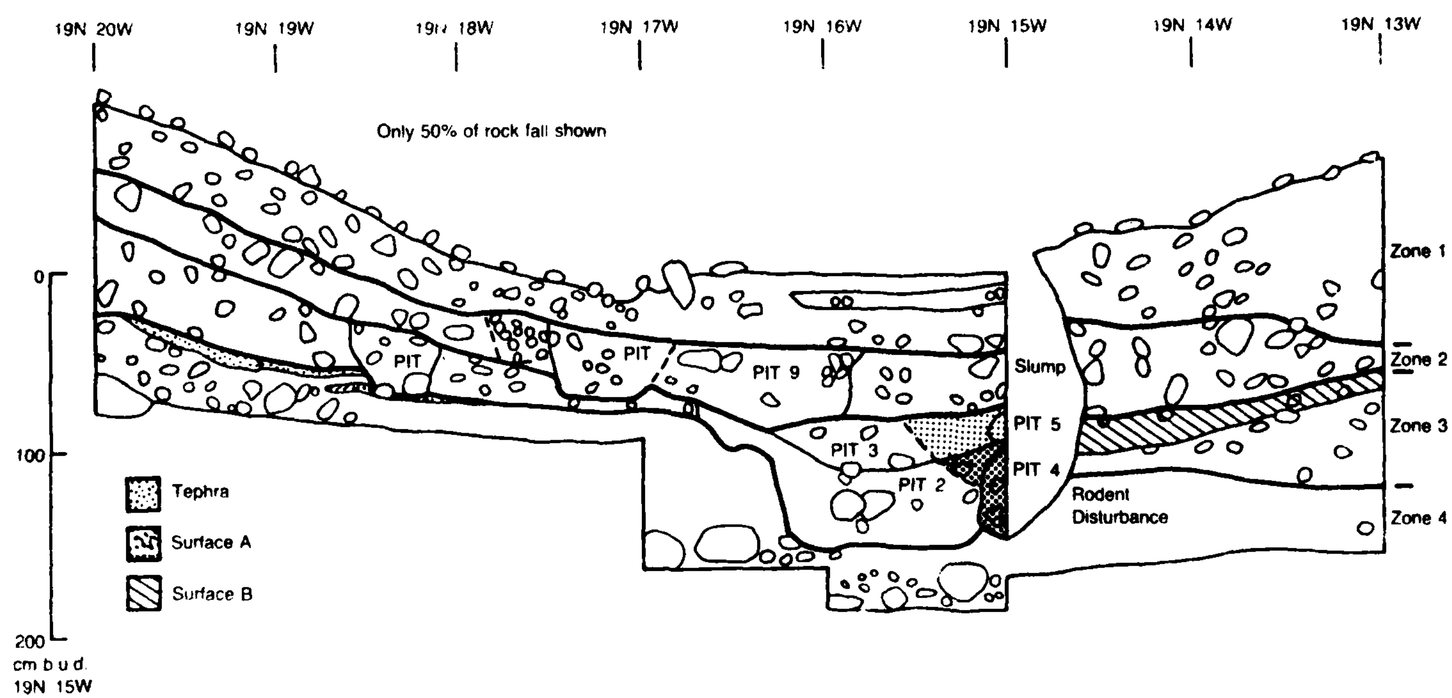

Figure 5-3. Profile of 19N line, 45-DO-326. Note the complex stratigraphy caused by the succession of pits. At least three other pits were not featured.

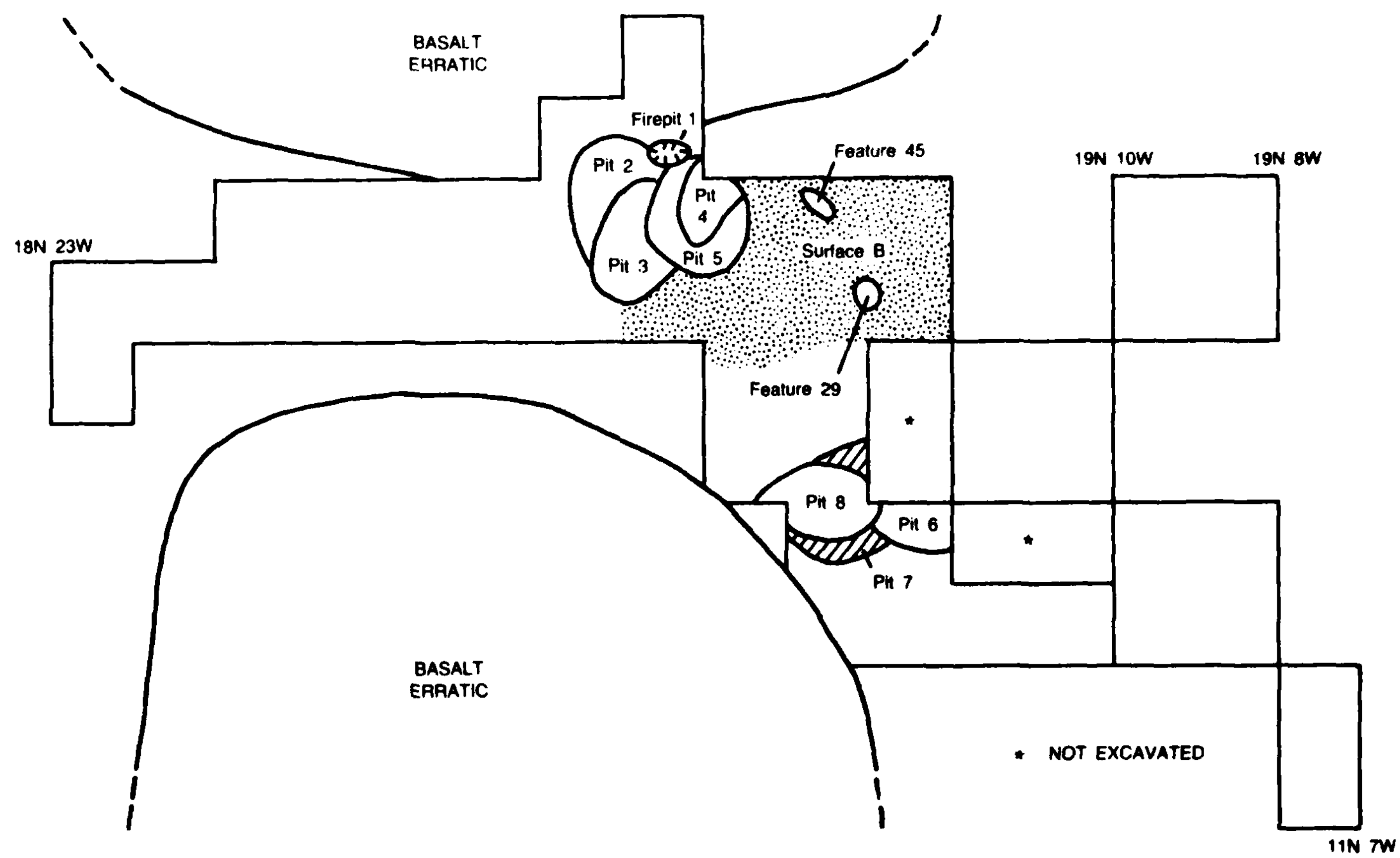

Figure 5-4. Plan map of features in Zone 3, 45-DO-326.

Table 5-3. Identified faunal species (NISP) by feature, 45-DO-326.

Feature	Deer	Deer-size	Elk	Mountain sheep	Sheep/antelope	Cervidae, unknown	Salmon	Marmot	Deer mouse	Sagebrush vole	Meadow mouse	Cricetidae (mouse/vole), unknown	Ground squirrel	Pocket gopher	Colubridae (snake), unknown
Zone 1															
Stratum 60	–	2	–	–	–	–	–	–	–	–	–	–	–	–	–
Stain	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Stratum 50	4[1]	12[1]	4[2]	–	1	–	–	–	–	1	–	1	1	–	–
Firepit 3	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–
Zone 2															
Pit 9	1	1	1	–	6	–	–	–	–	–	–	–	–	–	–
Firepit 2	–	1	–	–	–	–	–	–	–	–	–	–	–	–	1
Zone 3															
Surface B	2	15	–	3	–	1	1	1	1	–	2	–	1	1	5
Firepit 1	–	3	–	–	–	–	–	–	–	–	–	–	–	1	–
Pit 4	1	–	–	–	–	–	1	–	–	–	–	–	–	–	–
Pit 5	–	–	–	–	1	–	–	–	–	–	–	–	–	–	1
Pit 6	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Pit 7	–	–	–	–	–	–	2	–	–	–	–	–	–	–	1
Pit 8	–	1	–	–	–	–	–	–	–	–	–	–	–	–	1
Zone 4															
No identified fauna from features in Zone 4.															

[1] All of the deer bone and eight of the deer size bone are from the large bone scatter within Stratum 50 (F34).

[2] A cluster of modified antler fragments (F72) within Stratum 50.

The firepit is just north of a 2 x 2-m area in which four pits, all overlapping, were found. The oldest of the four pits is Pit 2 (Feature 58), most of which had been destroyed by Pits 3 and 9 (Zone 2). Although its surface of origin is obscured (Figure 5-5; see also Figure 5-3), Pit 2 appears to have been about 60 cm deep and 1.3 m or more across. Probably less than one-quarter of the pit had not been destroyed by other pit remains (volume ca the upper fill was marked by darker soil and less gravel than the fill in the pits above it, and by red ocher.

Pit 3 (Features 59, 62) is a deep, straight- to bell-sided pit which truncates Pit 2 (Figures 5-3 and 5-5). It seems very clearly to originate within Surface B; Pit 2 may also originate within the lower portions of Surface B. Approximately 75 cm deep and 120 cm across, Pit 3, like Pit 2, had a layer of charcoal staining at its base.

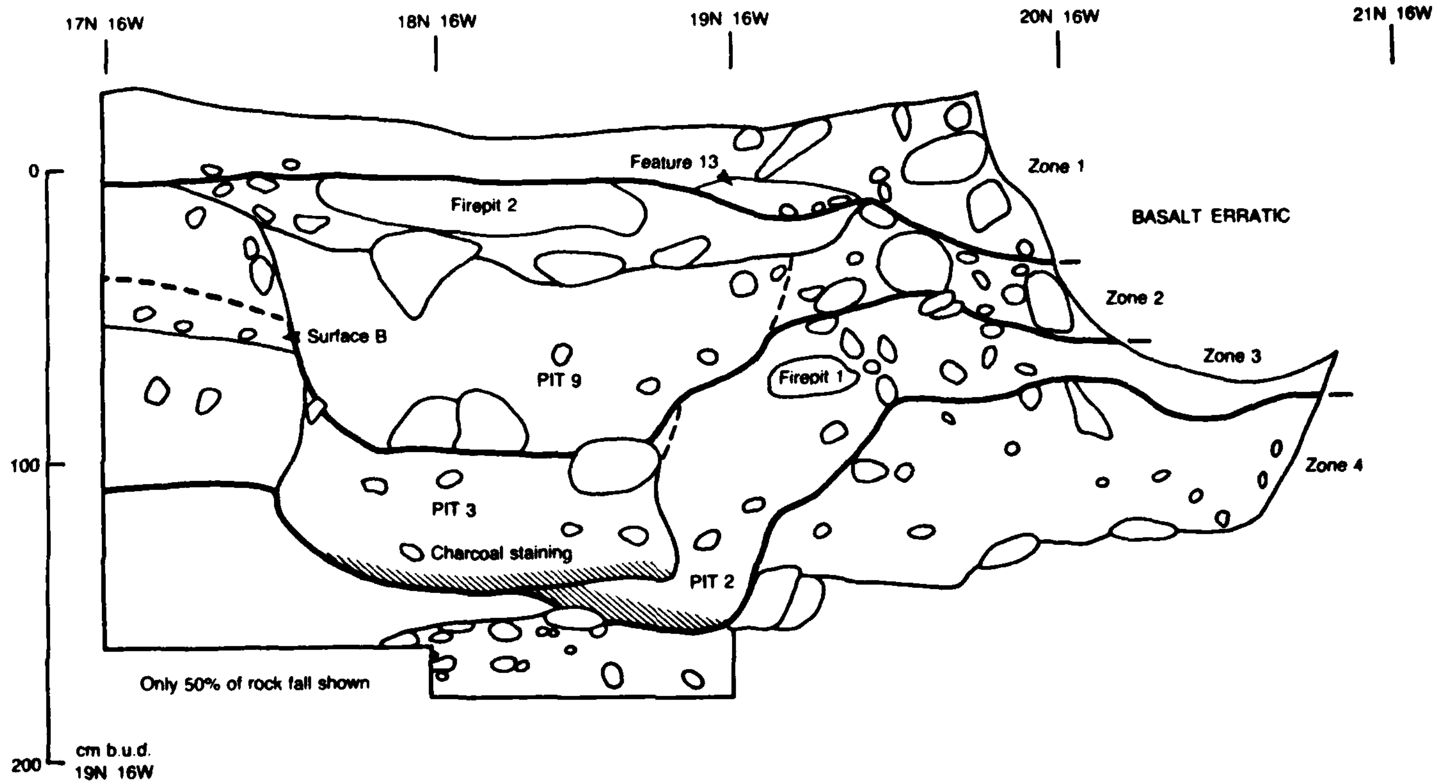

Figure 5-5. Profile of 16W line, 45-DO-326. Note the dissimilarities between this profile and that in Figure 3-6, just one meter to the east.

Pit 4 (Feature 74, 39) is a smaller pit, just east of Pits 2 and 3. It is less than one meter in diameter at the bottom; its upper reaches have been destroyed by Pit 5 (Figure 5-6). The remaining portion is about 60 cm deep and irregular in shape. A few FMR occurred in this pit and, among the identified bone, a single salmon vertebrae. It seems to originate at the bottom of Stratum 80.

Pit 5 (Feature 71) cuts through Pit 4 and the eastern edge of Pit 3, and may originate at the top of Stratum 80. (This stratigraphic relationship does not show well in Figure 5-3 because the wall slumped away before the profile was drawn.) Profiles (Figure 5-6) show a basin-shaped pit about 50 cm deep; but the boundary between Pit 4 and Pit 5 was indistinct. The presence of several hundred bone fragments, only two of which were identified, is unique to this pit.

Three overlapping pits can be seen along the 15N line (Figure 5-7). These are Pit 6 (Feature 17), Pit 7 (Feature 16), and Pit 8 (Feature 69). Pit 6 is a basin-shaped feature, more than a meter across but only 30 cm deep. Its western edge is truncated by Pits 7 and 8. Pit 7 has nearly been totally destroyed by Pit 8, but was originally about 130-140 cm across and 30-50 cm deep. Pit 8, which originated above Pit 7, is also about 120-130 cm across, but is much deeper (about 75 cm) and is more bowl-shaped in profile.

Thus, in Zone 3, we have evidence of many episodes of occupation in the form of several, large, overlapping pits, and a thick use surface. The function of the pits is not clear. There is little charcoal and very few FMR in any of them. In some, many of the bone fragments were burnt. If these burnt bones were charred within these pits, then the other evidence of firing (charcoal, FMR, oxidized soil) must have been cleaned out of the pits, perhaps deposited on Surface B, and the small bone fragments and other debris then tossed back into the pits. Whatever the purpose of the pits, however, it was an activity that was carried out several times at the site, often at the same location. The pits probably represent a single type of activity because they are nearly identical in dimensions and construction.

ZONE 2

Two features are recorded in Zone 2 (Figure 5-8). Pit 9 (Feature 51) originates at the top of Stratum 75, the earliest of the Zone 2 deposits, and is the last of the large pits recorded at the site (Figures 5-3 and 5-5). Large (130 cm diameter) and deep (60 cm), Pit 9 is similar to the features of Zone 3, in form and contents. This similarity suggests a short time lapse between the two zones, a supposition reinforced by the inclusion of the strata of Zones 2 and 3 into a single depositional unit (DU III).

A possible firepit in Zone 2 has been radiocarbon dated to 1278±82 B.P. This is a 15-cm thick "pocket" of charcoal, FMR, burnt sand, and debris (Figure 5-5), including several stone tools. The more than 2,300 bone fragments have a mean weight of .12 g (Table 5-1), which is small compared to similar features at other sites in the project area. The occurrence of several projectile fragments along with the many bone fragments suggest the use of the site as a hunting camp at this time. This firepit originates very

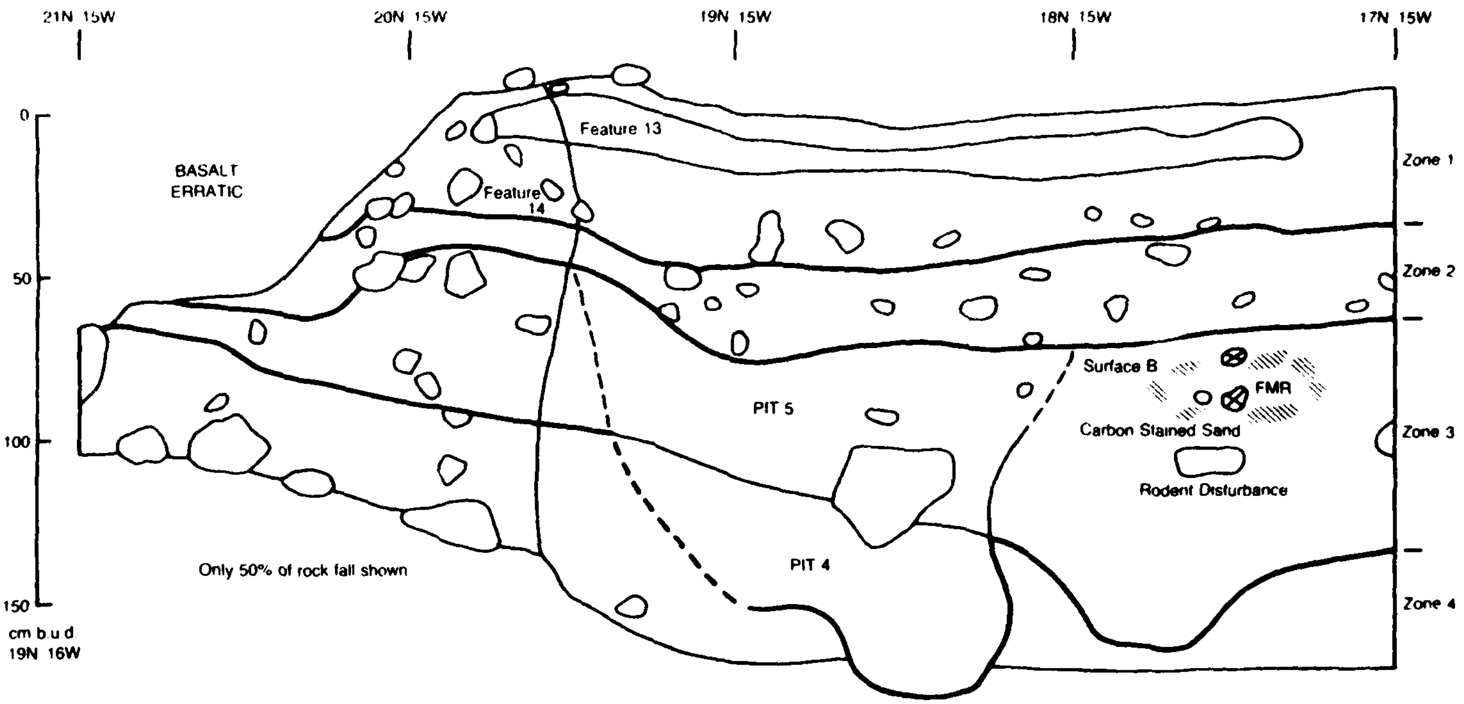

Figure 5-6. Profile of 15W line, 45-DO-326. Pits 4 and 5, which were easily distinguished during excavation, are not quite as distinct in profile.

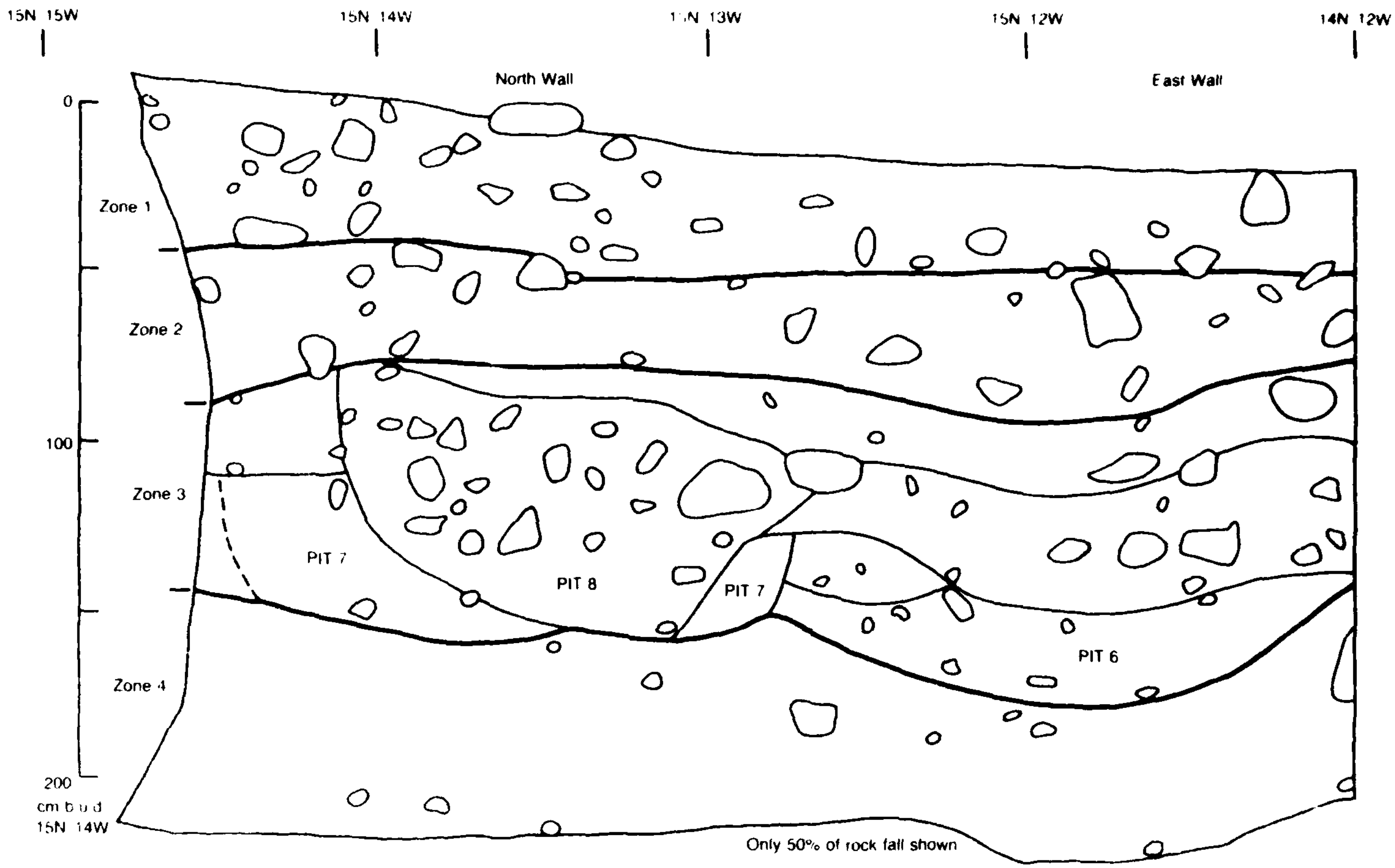

Figure 5-7. Profile of Pit 6, Pit 7, and Pit 8, Zone 3, 45-DO-326.

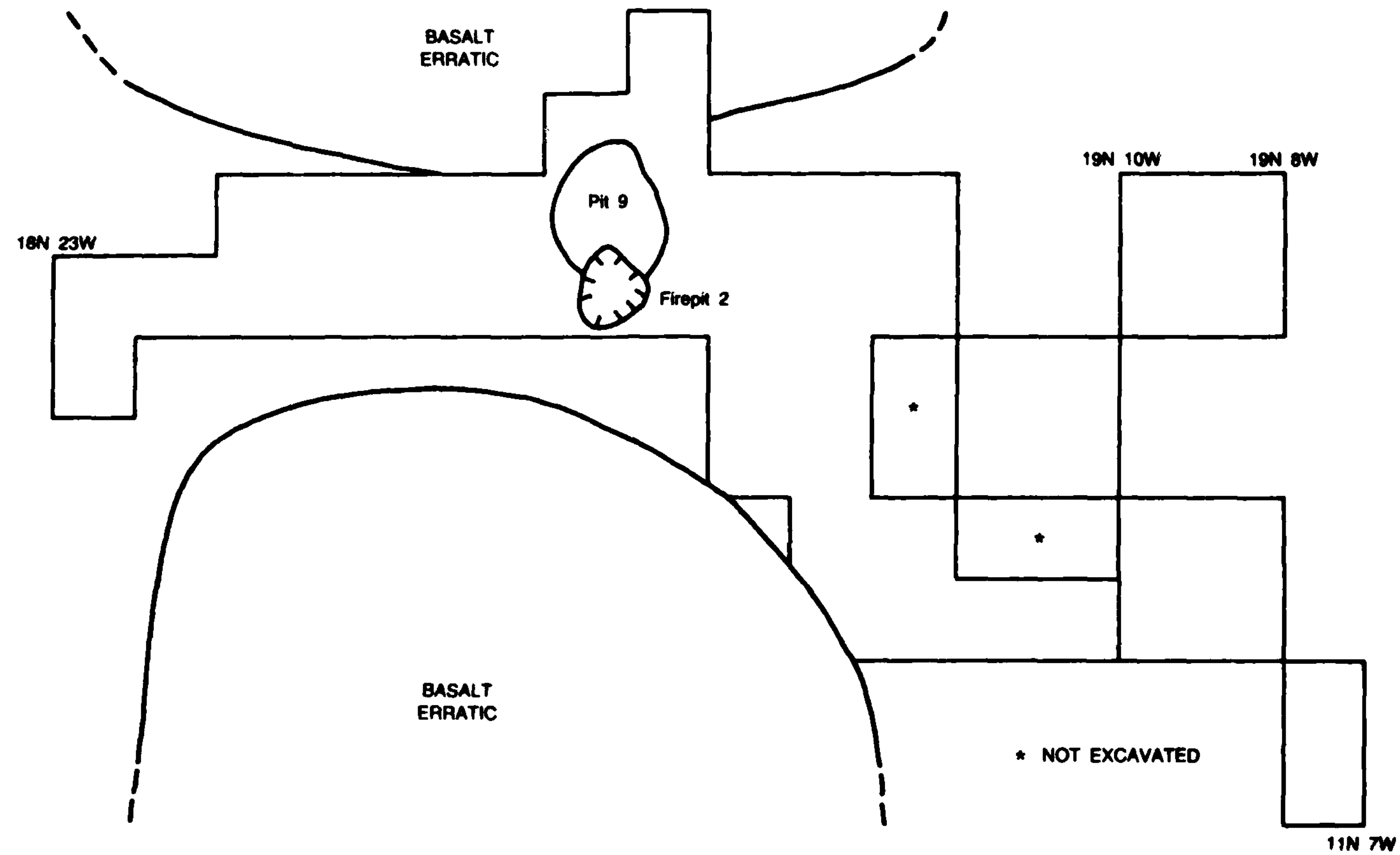

Figure 5-8. Plan map of the features in Zone 2, 45-DO-326.

near the boundary between DU III and DU IV, and thus may be much younger than the other feature of this zone.

ZONE 1

Two light occupations within Zone 1 are signaled by the superposition of two different strata within DU IV. The first (Feature 73) was featured only in one unit (20N17W) (Figure 5-9), but apparently is found elsewhere in the site as Stratum 60. It is essentially a natural deposit containing cultural material; this featured portion represents less than 3% of the whole stratum. A localized heavy stain of charcoal in 20N16W (Feature 14) is a part of this occupation. Nearly 100 bone fragments (Table 5-1) were recovered from the 70 x 40 x 10-cm area associated with the stain. A radiocarbon date of 108±55 B.P. was obtained from the same level but outside the feature boundary. This and a date of 283±75 B.P. from a circular concentration of basalt spalls in 19N9W (Feature 12) confirms the very recent deposition of Zone 1. The latter is a seldom used firepit (Figure 5-10): the basalt shows little sign of fire-modification but the presence of charcoal and the circular depression indicate this function.

The uppermost stratum in the shelter is Stratum 50. Certain portions of this stratum in which charcoal staining was more intense received feature numbers (Feature 13, Feature 15). Their horizontal extent is shown in Figure 5-9. In addition, within this stratum was recorded a scatter of large deer bone (mean weight of 3.4 g) and a cluster of four pieces of elk antler (Feature 72), three of which show the scars of detaching. Although many small bone fragments occurred within the large bone scatter, only the large pieces were collected as part of the feature; this explains the extremely large mean weight figure. However, even given this bias, the scatter is still the only notable concentration of large pieces of bone at the site. It appears that, during Zone 1, the shelter was used sporadically by hunting parties for butchering and some cooking.

SUMMARY

There are striking differences in the distribution of kinds of features among the zones at 45-DO-326; Zone 2 seems to mark a shift in the activities occurring at the site. Prior to 4000 B.P. (judging from projectile point types--see Chapter 3), the site was used many times, perhaps by hunting parties. Several large pits--usually well over a meter in diameter and 50-80 cm deep--were dug; other pits were excavated in the same area. The result is a complex stratigraphy of imposed pits. Nine of these pits received feature designations and are discussed in the text, although others are recorded in profiles. Bone is the major constituent of these pits and of the thick occupation surface with which they are associated; however, due to its highly fragmented condition, very little of the bone could be identified.

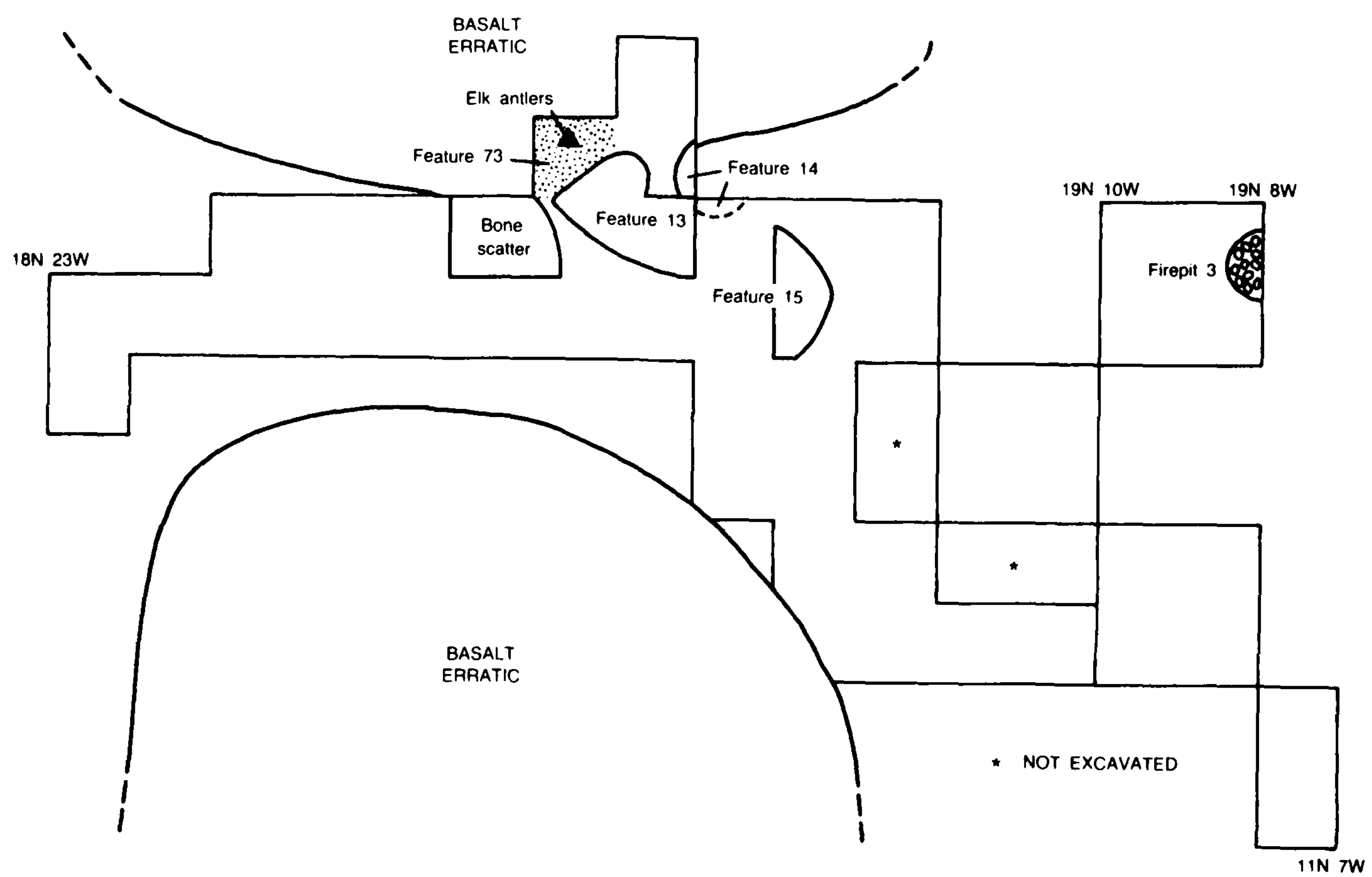

Figure 5-9. Plan map of features in Zone 1, 45-DO-326.

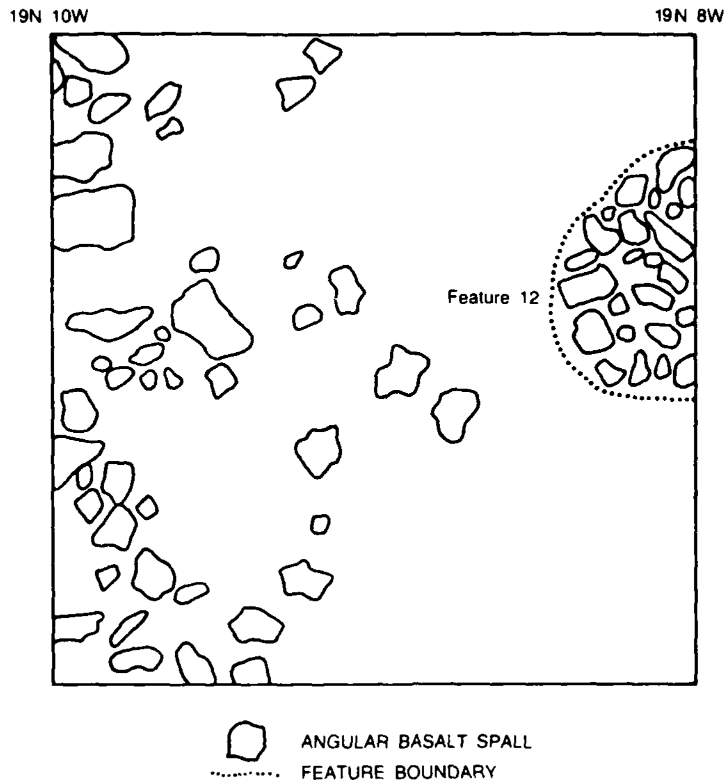

Figure 5-10. Plan map of Firepit 3, Zone 1, 45-DO-326.

After about 1500 B.P., the site seems to have been visited by small groups who constructed firepits but did not extensively modify the site surface. The scatter of large bone within Stratum 50 suggests at least one episode of butchering.

6. SYNTHESIS

Site 45-DO-326 was a frequently used hunting campsite throughout at least the last 5,000 years. The earliest and most intensive activity occurred during the Kartar Phase, probably from ca. 5000-4000 B.P., but perhaps much earlier. Use of the rockshelter as a short-term hunting camp continued into the early and middle Hudnut Phase (ca. 4000-3000 B.P.), although visits may have been less frequent and certainly seem to have been of shorter duration or involved far fewer individuals. Radiocarbon dates suggest a hiatus of ca. 1,500-1,000 years before the rockshelter was used again, in the Coyote Creek Phase. Of these latest occupations, one is dated between ca. 1600-800 B.P. and the other from ca. 300-100 B.P.

Over this long span of time, the duration of the camps or the size of the task groups changed, but the use of the site and the animal species taken are very consistent. In all zones, the emphasis was on the hunting of large ungulates, entailing some butchering-processing in the rockshelter. A biased distribution of faunal elements and a relative lack of coarse butchering tools such as choppers or large bifaces may indicate rough butchering of the carcasses near the kill site. Firepits and macerated bone scrap, as well as numerous small cutting tools evidence consumption of meat and, at least, overnight use of the rockshelter. Considerable lithic debitage and a range of tool forms indicate hunting tool kits were manufactured and maintained at the site, and imply longer stays. This is particulary true of Zone 3, where the bone scraps and debitage are associated with numerous deep pits constructed in the spall-filled rockshelter deposits and where a thick, heavily stained living surface was defined.

ZONE 4

The earliest use of the rockshelter occurred in a generalized alluvial fan deposit of varying grades, and lenses of sand and gravel (DU II). At the lowest levels, this sandy strata overlies large basalt columns and rounded granitic boulders deposited by glacial outwash (DU I). The source of this alluvial deposit appears to have been the present ephemeral stream channel directly southwest of the site. Clumps of an unidentified, redeposited tephra were recorded in the upper portion of the strata in the central part of the rockshelter. Artifacts were found throughout this depositional unit, but increase in frequency toward the top. The excavated volume for this zone was the largest at the site, and produced the second largest artifact assemblage.

Two cultural features were defined in the uppermost portion of this zone: a large pit and a darkly stained, charcoal flecked living surface covered by the redeposited tephra. A radiocarbon date of 3129±95 B.P., collected from bits of charcoal scattered throughout a 10-cm level in a 2 x 2-m unit near the top of this zone, in an area of considerable disturbance, has been rejected as too late for this early occupation, and more likely, it dates Living Surface B in Zone 3 above. The charcoal probably was deposited when the numerous large pits from Zone 3 were dug into Zone 4. A Mahkin Shouldered projectile point taken from Surface A, associated with two other Mahkin Shouldered points found nearby, and below other early diagnostic forms in the lower part of the overlying Zone 3, indicates that a more reasonable date for initial use of the site is probably ca. 5000 B.P., if not slightly earlier. A single large blade fragment associated with microblade cores and microblades also indicates occupation in the Kartar Phase (ca. 7000-4000 B.P.) defined for the Rufus Woods Lake project area.

The recovery of choppers, utilized and retouched flakes, heavily worn microblades, bifaces, drills, gravers and projectile points, associated with mountain sheep faunal elements, deer-sized bone fragments, marmot elements, and salmonid remains, indicate a site economy geared to hunting and occasional fishing. The construction of at least one pit and formation of a thick, well-defined living surface evidence stays of some duration and/or frequent recurrent visits during this period. An occupation of greater intensity than casual overnight camps may also be reflected in the large amount of lithic debitage and other evidence of tool manufacture and repair.

ZONE 3

The second period of occupation began sometime in the late Kartar Phase, most probably between ca. 5000-4000 B.P., and continued into the Hudnut Phase, to at least 3000 B.P. During this time, geologic deposition consisted principally of aeolian sandy loams and an increased density of angular basalt rockfall (DU III, Strat 85,80). The extensive spalling of the basalt would seem to indicate accelerating frost-rockfall activity at ca. 4000-2000 B.P., corresponding to an increasingly cooler, moister environment. This marks the end of a long period of relative aridity from ca. 8000-4000 B.P., which is manifest in less aeolian deposition and the gradual accumulation of organic debris (cf., Fryxell and Daugherty 1963). At this time, the rockshelter was the scene of much more intensive cultural activity, characterized by repeated episodes of pit construction and formation of a second, darkly stained, charcoal flecked living surface in a shallow, partially excavated depression. The numerous pits crosscut and, in conjunction with the dense rockfall, produce a very complex stratigraphic record. As a result, the seven defined pits must be viewed as an absolute minimum, representing only those that were clearly visible in the field. A radiocarbon date of 3027±81 B.P. was obtained from the upper portion of this zone, above the Surface B living accumulation and most of the pits, and probably dates a poorly defined Hudnut Phase occupation also indicated by recovery of two Columbia Corner-notched A projectile points. A Cold Springs Side-notched point, a Mahkin Shouldered point, a large Nespelem Bar point, and four probable Nespelem Bar point fragments clearly indicate a late Kartar Phase (ca. 5000-4000 B.P.) date for the living surface, and, by extension, perhaps the majority of the pits.

The artifact inventory for Zone 3 is comparable to that recorded for the lower Zone 4, but with a relative increase in the proportion of microblades, and the addition of a hopper mortar base and flake core. This zone has the highest artifact density at the site coupled with the lowest excavated volume. Two excavation units in the central part of the rockshelter (19N16W, 18N16W) cutting through the middle of the densest accumulation of cultural features, including Surface B, were designated test units and not included in the technological and functional analyses. Further, assemblages from nearby units covering the main part of the rockshelter received an abbreviated form of technological analysis in which flakes and other objects, unless considered functional types, were not measured or typed except for material and dorsal topography. As a result, we cannot assess characteristics of the tool manufacturing process necessary to reconstruct some types of activities in the densest zone of occupation at the rockshelter. We can only infer from the amount of debitage and the density of functional types that stone tool manufacture and repair was a common activity, no doubt related to maintenance of a hunting tool kit and the related tasks of butchering and processing. Pits characteristically contain dense accumulations of unidentified bone fragments--the majority would seem to be macerated large mammal long bones. Identified elements from Surface B include deer and deer-sized bone, mountain sheep, marmot, squirrel, and a variety of gopher, mice and snake elements. Salmonids are also represented. This 2 x 4 x .15-m surface is littered with a dense accumulation of bone fragments (10,271), debitage (662), tools (41) and fire-modified rock (92). The tool assemblage includes projectile points and fragments, utilized and retouched flakes, bifaces, choppers and microblades. A nearby firepit (Firepit 1), which may be part of this living surface B, contained over one hundred, small charred bone fragments and a comparable range of functional types.

Surface B, Firepit 2, and the numerous pits dating to the late Kartar Phase represent multiple episodes of site use, although all are characterized by artifacts of hunting tool kits and heavy concentrations of butchered, highly fragmented bone. As in the lower Zone 4, mountain sheep and deer were probably the emphasized large game, supplemented by small game such as marmot and squirrel--the various mice, gopher, and snake fragments may not be culturally deposited, for the site deposits are marked by intense rodent disturbance. Fishing is also represented by salmonid vertebrae, but these are far less frequent than in the underlying Zone 4. The Hudnut Phase occupation over the next 1,000 or so years in the upper part of Zone 3 was much more sporadic, although pits were still constructed. Since this assemblage was not defined separately, we cannot accurately assess differences in the constituent tool kits of the Hudnut Phase and the Kartar Phase. However, the tools from Pits 9 and 5, which probably date to this later period, have comparable forms and associated faunal remains, so we may infer that site economy was similar although site use was probably far less frequent.

ZONE 2

Zone 2 corresponds to geologic Strata 65, 70 and 75, which constitute the upper part of DU III. These deposits contain a slightly lower density of rockfall than the lower Strata 80 and 85, and exhibit far less carbon staining, suggestive of less intense cultural activity than recorded for Zone 3. Radiocarbon dates place occupation between ca. 1500-800 B.P. or the defined Coyote Creek Phase. However, Pit 9, which was placed within Zone 2, appears to be associated with the pit building episodes identified in Zone 3, and is probably better dated to the mid- to late Hudnut Phase. Stratigraphically, Pit 9 lies less than 20 cm below Firepit 2, which produced a radiocarbon date of 1282±82 B.P., and this proximity, plus the lack of any significant accumulation between Zones 2 and 3, indicates a hiatus of perhaps 1,000 years between the two periods of cultural activity. Artifact distributions are continuous, but given the complex nature of the site deposits, the heavy rockfall and the characteristic rodent disturbance, it is quite likely that a considerable period of time of little or no cultural activity could go unrecorded in the stratigraphic record. Projectile point types strongly indicate that Zone 2 dates to the Coyote Creek Phase, although two Cascade A type points from this zone indicate some disturbance of site deposits.

The sole identified cultural feature is the radiocarbon dated firepit. Other dates were derived from a carbonized root (1553±61 B.P.) and charcoal flecks taken from a sandy stratum with intense rodent disturbance. Although there is a possibility of contamination both dates fit the stratigraphic sequence. The firepit contained a Columbia Stemmed B projectile point, and two small expanding stem fragments, very much in line with the radiocarbon assay of ca. 1200 B.P. Other associated artifacts include projectile point types, utilized flakes, bifaces and a flaked long bone fragment.

The tool assemblage from Zone 2 is comparable to that recorded for Zones 3 and 4, with high proportions of utilized, retouched, and resharpened flakes, projectile points and microblades. Differences include a lack of microblade cores, a lower proportion of microblades, a relative lack of choppers, and a marked increase in bifaces and hammerstones. The only pestle recovered from the site was also taken from this zone. In general, tool types reflect a continued emphasis on hunting of large game, but with the replacement or enhancement of certain elements of the tool kit--utilized retouched and resharpened flakes appear to have been more common relative to microblades, and bifaces and projectile points were more numerous. About the same range of faunal remains was recovered from Zone 2 as in Zones 3 and 4: mountain sheep or antelope, deer, elk, marmot, a variety of rodents, and some salmonid vertebrae. This data, together with the characteristic hunting tool kit, seems to indicate a site economy in the Coyote Creek Phase basically similar to those of the earlier Hudnut and Kartar Phases. We do, however, note a difference of some magnitude in the size or duration of stay of the task groups in Zone 2, since there are neither pits nor densely littered, charcoal-stained living surfaces in this zone. Site activities were probably of shorter duration in the Coyote Creek Phase than in the previous periods, although we cannot rule out the possibility that a lack of cultural features and lower artifact densities may reflect a basic change in the size of the task groups visiting the site.

ZONE 1

Zone 1 continues the basic pattern of site use documented in Zone 2, with lower artifact densities and fewer cultural features compared to Zones 3 and 4. The uppermost stratum of cultural activity at the rockshelter, Zone 1 has associated radiocarbon dates of 283±75 B.P. and 108±55 B.P. A possible hiatus of activity occurs in the mid- to late Coyote Creek Phase or from ca. 800-200 B.P. The lack of cultural features and discernible stratigraphy over this period, however, makes any inference concerning the temporal extent of site occupation suspect; we will consider both Zones 2 and 1 evidence of continued use of the site over the approximate 1,500 year span of the Coyote Creek Phase.

Zone 1 includes cultural materials from DU IV, the uppermost geologic unit in the rockshelter, which consists of a mixture of aeolian sands, silt and the covering litter mat. This stratum is characterized by a gradually decreasing amount of rockfall, indicative of less frost action than in the underlying depositional unit (DU III). The excavated volume of this zone is comparable to that of Zones 2 and 4, yet the count of fire-modified rock is twice as great as that recovered from any other zone. This must reflect considerable cultural activity, so it is surprising that the only cultural features defined are darkly stained strata (Stratum 60, Stratum 50) and a small firepit (Firepit 3). Sparse artifact concentrations were mentioned in the field notes, but these have not been plotted as features, and we cannot assess patterning that may be preserved in this zone.

Recovered projectile point types include Plateau Side-notched varieties, Columbia Corner-notched B, Wallula Rectangular-stemmed, and a Columbia Stemmed B, all of which are characteristic of the Coyote Creek Phase as a whole. Several examples of earlier diagnostics are also present, but we can attribute these to curation by later site inhabitants or to the widespread disturbance of the site deposits. Elk antler fragments from Stratum B are particularly interesting--they appear to have been cut with a metal axe and therefore confirm the possibility of late occupations in the early ethnohistoric period. The small Plateau Side-notched points would tend to corroborate this as well; however, the lack of European artifacts in clear aboriginal context makes this inference uncertain.

The tool assemblage is very similar to that recovered from Zone 2, with a high proportion of utilized, retouched and resharpened flakes, and projectile points. The most striking change is the fourfold increase in the number of projectile points and diagnostic point fragments. Microblades were recovered, but in very low numbers, and without cores, so we might infer that their presence here is the result of site disturbance. Faunal remains again include deer, elk, sheep/antelope, marmot and various small rodents, indicating a continued emphasis on hunting-butchering-processing at the rockshelter. A lack of cultural features and defined patterning in the stratigraphic record would seem to reflect sporadic site use, probably involving small task groups and short-term camps or stopovers.

DISCUSSION

The cultural sequence preserved in the 45-DO-326 rockshelter records use of the site for at least the last 5,000 years as a hunting camp, where game was butchered, processed, and consumed, and where hunting tool kits were manufactured and repaired. Although this general economic focus appears to have remained consistent throughout the span of occupation, changes do occur in the kind and duration of site activity over that long period. The earliest use of the rockshelter probably occurred in the latter part of the Kartar Phase (ca. 5000-4000 B.P.), when the site was apparently used as a short-term hunting base camp. Pits were constructed and heavily stained living surface formed in Zone 4. Even more intensive, and perhaps, more prolonged use of the rockshelter as a base camp occurred in Zone 3, somewhat later in time, but still within the latter part of the Kartar Phase. During this period, numerous large pits were dug, and another larger, more densely littered and stained living surface, with at least one firepit, was formed. Hunting was again the principal activity, but the density of the debris and the number of intersecting cultural features clearly document more frequent use and/or stays of longer duration. Later in Zone 3, around ca. 3000 B.P. (Hudnut Phase), site use apparently diminished. The artifact assemblage and faunal remains are comparable to those from the earlier Kartar Phase assemblages, but the lack of definable cultural features probably reflects more short-term hunting camps or brief stopovers. There is certainly no indication that the rockshelter was a focus of activity, or that it continued to serve as a maintained base camp. We then have a hiatus of perhaps 1,500-1,000 years in the radiocarbon dates, and a return to use of the rockshelter in the early part of the Coyote Creek Phase by at least ca. 1200 B.P. Use of the site during this time, in Zone 2, and in the subsequent Zone 1, which dates to ca. 200-100 B.P., appears to have been more sporadic than in the earlier Kartar Phase. Tool assemblages and recovered faunal remains still reflect use of the rockshelter as a hunting camp, but there is no indication that stays were longer than brief, overnight camps. The high density of fire-modified rock in Zone 1 would seem to indicate that in this period, at least, visits to the rockshelter were frequent if not sustained.

Differences in the character of the artifact assemblages from the three defined cultural phases are not marked, but there are some salient characteristics. The Kartar Phase assemblages have much higher proportions of microblades, and the only microblade cores. They also contain the only recovered blade fragment. Tool assemblages during this period have a higher incidence of heavy chopping tools, which may indicate more preliminary butchering within the rockshelter than in the subsequent Coyote Creek Phase. Conversely, the two Coyote Creek assemblages have proportionately far more projectile points, and higher relative numbers of bifaces and hammerstones.

In the use of specific tool forms, however, there is no apparent difference between the Kartar Phase and the Coyote Creek Phase. Similar tools, regardless of the associated analytic zone, show about the same kinds of wear representing the same range of uses, and the same or roughly comparable ranges of intensity of use. This would seem to reflect the consistency we have observed in the economic focus at the site over time.

The microblades are quite interesting in that they show heavy feathered chipping wear, characteristically on both lateral margins. Further, on many examples, attrition along the edge has removed the blade margin almost to the midline, often in the form of a crescent outline reminiscent of a tiny spokeshave. The heavy wear noted on these tool forms is not characteristic of other microblade collections in the project area (cf., Lohse 1984d), and may partially corroborate the postulate that microblades were heavily used during the Kartar Phase and less emphasized later in time in favor of small bifaces or projectile points.

Tool production in general shows little, if any, change over time. At least three identified industries occur: a flake tool technology which principally made use of imported cryptocrystalline stones, but also locally available quartzite and basalt; a microblade technology concentrated on the reduction of jasper and chalcedony; and the barest evidence of a Levallois-like blade technology, preserved in a single chalcedony blade fragment from Zone 4. In all zones, the generalized flake tool industry supplied most of the tool forms. Both primary and secondary reduction were common within the rockshelter. The presence of thousands of fine, < 1/4 in conchoidal flakes attests to continual tool manufacture and repair.

All lines of evidence point to use of the rockshelter as a hunting base camp, a very short-term hunting camp, and as a frequent stopover site for small task groups. The presence of marmot remains in all four zones probably reflect activities in the spring and summer months. The recovered salmon vertebrae also indicate activity during the summer or fall salmon runs. Larger game animals could have been taken year-round, but acquisition of the mountain sheep and elk, in particular, would have been easiest in the late fall and winter months when heavy snows might have forced these animals down to lower elevations. Occupation is thus most firmly indicated for the spring and summer months, but use of the rockshelter might have been year-round. It could have provided welcome shade in the summer, and protection from wind and snow in the winter. In such weather, a fire in the lee of the overshadowing basalt erratics might serve to warm a small group of hunters who used the respite to refurbish tool kits, cook meals, and process game for transport back to the site of the winter settlement. Certainly, the spall littered floor of the rockshelter was not an inviting spot for lengthy stays, nor is it likely that a household group would camp here for any length of time given sheltered, sandy places nearer the river and close to sources of fresh water. It is likely that the rockshelter was a convenient landmark and a frequent stopping place. It also seems to have served as a maintained, frequently visited base camp, judging from the formation of several densely littered, stained living surfaces and numerous episodes of pit construction. The use of the pits is problematic, but they could have served as storage pits for caching of supplies during extended foraging activities.

45-DO-326 was excavated to supply information about a type of site infrequent in the project area. It certainly has supplied data we would not have otherwise obtained. The heavy frost-spalling noted for the period from ca. 4000-2000 B.P. corroborates information gleaned by Fryxell and Daugherty (1963) from other rockshelter sites in the region that suggested a shift from arid, warm conditions prior to ca. 4000 B.P. to cooler and wetter conditions thereafter. The presence of possible storage pits in the Kartar Phase and probable use of the rockshelter as a maintained hunting camp during that same period offers valuable insight into what appears to be a logistical system organized quite like that described for historic aboriginal groups in the area. Recovery of a large collection of microblades and microblade cores and core fragments in good stratigraphic contexts dating to the Kartar Phase bears out the description of comparable industries at 45-DO-282 (Lohse 1984d) just downstream and at 45-OK-18 (Jaehnig 1984b) just upstream. Finally, the consistent economic focus at this site, spanning some 5,000 years and all three cultural phases, provides evidence of stability in at least one aspect of the local cultural adaptive system.

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APPENDIX A

RADIOCARBON DATE SAMPLES AND RESULTS OF SOIL ANALYSES, 45-DO-326

Table A-1. Radiocarbon date samples, 45-DO-326.

Lab Sample #[1]	Zone	DU	Stratum	Unit	Level	Feature #	Material/gms	Radiocarbon Age (years B.P.) T1/2=5730	Dendrocorrected[2] Age (Years B.P.)
B-4813	1	IV	60	19N9W	40	12	Charcoal/5	275± 75	283± 75
	Wood charcoal from Firepit 3.								
B-4814	2	III	75	21N16W	110	43	Charcoal/5	845± 75	843± 71
	Wood charcoal from a stratum of fine sand exhibiting extensive rodent disturbance.								
B-4815	1	IV	60	20N16W	40	-	Charcoal/10	105± 55	108+ 55
	Wood charcoal collected throughout 10-cm unit level matrix. A type 74 (Columbia Stemmed B) found in level 20.								
B-4816	2	III	75	18N17W	30	44	Charcoal/10	1300± 65	1278± 82
	Wood charcoal collected from Firepit 2, rootlets adhering to the sample. Type 63 (Columbia Corner-notched B) points found in levels 40, 50,and 100, and a type 73 (Columbia Stemmed A) in level 50.								
B-4817	2	III	75	19N20W	110	38	Charcoal/10	1570± 55	1553± 61
	Carbonized hardwood root that extended down through at least one meter of site deposit. A type 63 (Columbia Corner-notched B) point in level 120.								
B-4818	2	II	100	19N14W (all quads)	140	-	Charcoal/8	2897± 90	3129± 95
	Wood charcoal collected throughout 10-cm unit level. Underlies Surface B (Feature 45).								

[1]Samples were dated by Beta Analysis, Coral Gables, Florida.
[2]These dates have been converted to a half-life of 5730 years and dendrocorrected according to Damon et al. (1974).

Table A-2. Results of physical and chemical soil analyses, Column 1, Test Pit 4, 45-DO-326.

Sample No.	cm Below Surface	Physical Analyses									Chemical Analyses			
		Munsell Color (dry)	Particle Size	Constituents						Grain Rounding[1]	pH	Organic Matter (%)	Exchangeable Calcium (ppm)	Phosphate (ppm)
			Sand/Silt/Clay (%)	Charcoal (%)	Ash (%)	Bone (%)	Shell (%)	Organic Matter (%)	Minerals (%)					
1	0- 5	10YR(4/2)	91/ 9/ 0	-	-	-	-	6	94	1-2	7.90	6.25	2860	67.0
2	5-15	10YR(4/3)	88/12/ 0	-	-	-	-	2	98	2-4	8.80	2.00	3080	47.0
3	20-30	10YR(5/3)	86/14/ 0	-	-	-	-	1	99	2-4	8.90	1.00	3010	58.0
4	40-50	10YR(3/3-3/4)	88/12/ 0	-	-	-	-	-	100	2-4	8.50	-	2730	58.0
5	60-70	10YR(4/4)	97/ 3/ 0	-	-	-	-	-	100	2-4	8.90	-	1470	63.0

[1] 1=angular, 2=sub-angular, 3=rounded, 4=sub-rounded.

Table A-3. Results of physical and chemical soil analyses, Column 2, 45-DO-326.

Sample No.	cm Below Surface	Physical Analyses									Chemical Analyses			
		Munsell Color (dry)	Particle Size	Constituents						Grain Rounding[1]	pH	Organic Matter (%)	Exchangeable Calcium (ppm)	Phosphate (ppm)
			Sand/Silt/Clay (%)	Charcoal (%)	Ash (%)	Bone (%)	Shell (%)	Organic Matter (%)	Minerals (%)					
1	5-12	10YR(4/2-5/2)	70/27/ 3	13	-	-	-	5	82	1-2	4.90	6.90	3073	73.5
2	13-20	10YR(4/2)	72/23/ 5	13	-	-	Trace	Trace	82+	2-4	6.10	1.25	3073	73.5
3	23-35	10YR(4/1)	77/20/ 3	25	3	3	Trace	2	66+	2-4	6.00	Trace	3010	75.6
4	38-47	10YR(4/2)	77/23/ 0	25	Trace	3	Trace	Trace	71+	2-4	5.90	Trace	3010	70.7
5	50-60	10YR(5/2)	75/25/ 0	17	-	3	-	Trace	78+	1-2	6.00	Trace	2767	70.7
6	60-70	10YR(5/2)	77/20/ 3	15	-	2	1	-	81+	1-4	6.20	Trace	2380	70.0
7	70-80	10YR(5/2)	75/25/ 0	13	-	3	1	-	83	1-4	6.30	Trace	2762	70.0
8	80-90	10YR(5/2)	77/23/ 0	10	-	2	Trace	-	87+	1-4	6.30	Trace	2800	70.0
9	105-115	10YR(3/3)	80/17/ 3	3	-	1	Trace	-	95+	2-4	5.70	Trace	1645	66.5
10	115-125	10YR(3/3)	82/18/ 0	3	-	1	Trace	-	95+	2-4	5.50	-	2380	70.0
11	125-135	10YR(3/3)	80/20/ 0	5	-	1	Trace	-	93+	2-4	5.40	Trace	1540	68.6
12	135-145	10YR(3/3)	77/23/ 0	15	-	1	Trace	-	83+	2-3	5.40	Trace	2800	68.6
13	147-157	2.5Y(4/4)	77/23/ 0	1	-	Trace	-	-	98+	1-2	5.70	-	-	63.7
14	160-172	5Y(5/3)	85/12/ 3	Trace	-	Trace	-	-	99+	1-2	5.90	-	-	63.7
15	175-184	2.5Y(4/4)	70/27/ 3	-	-	-	-	-	100	1-2	5.90	-	756	60.9
16	185-190	2.5Y(4/2)	92/ 5/ 3	-	-	-	-	-	100	1-2	6.20	-	-	54.6

[1] 1=angular, 2=sub-angular, 3=rounded, 4=sub-rounded.

APPENDIX B

ARTIFACT ASSEMBLAGE, 45-DO-326

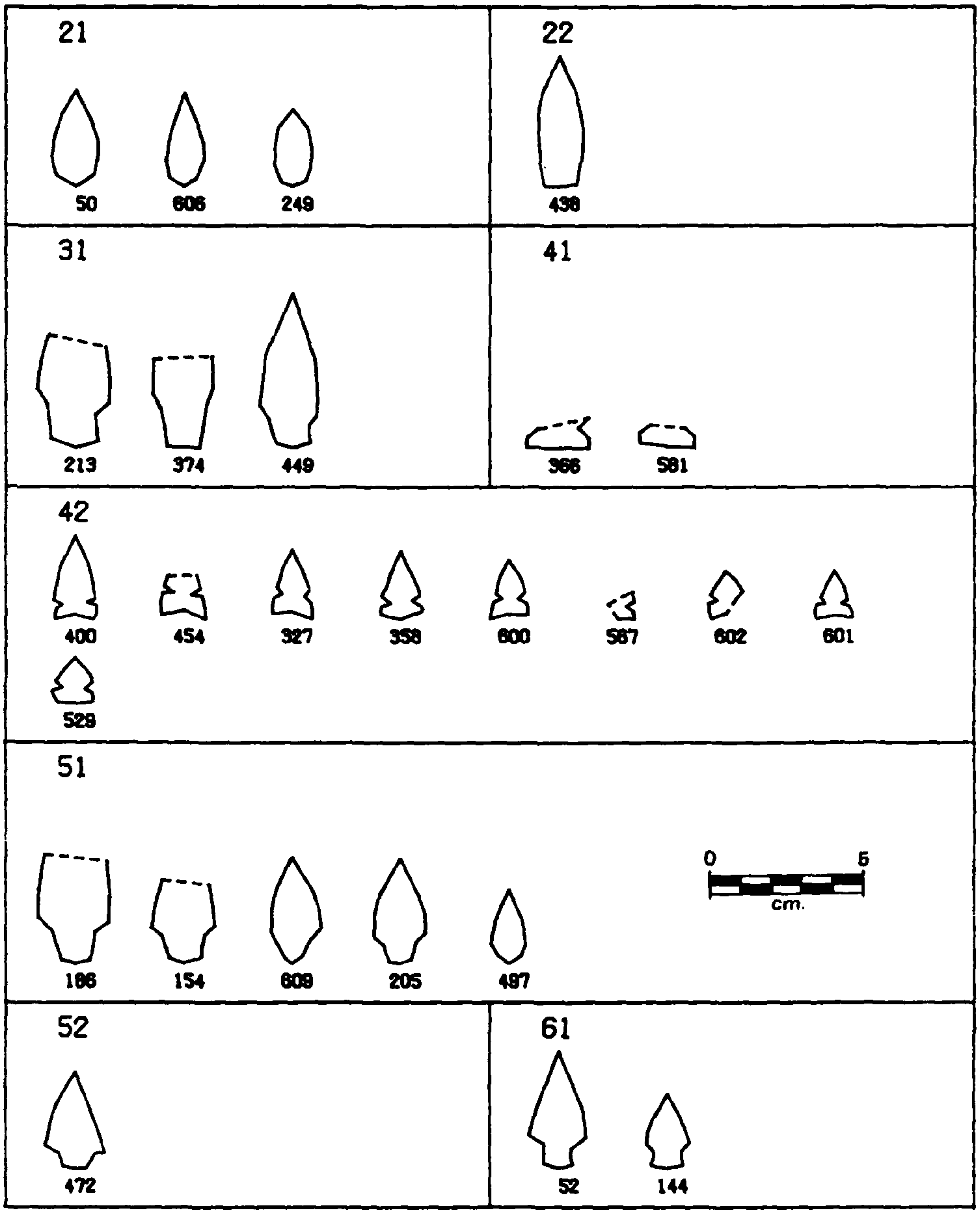

Figure B-1. Projectile point outlines from digitized measurements, 45-DO-326. Upper number is the historic type (see Figure 3-6 for key). Lower number is master number.

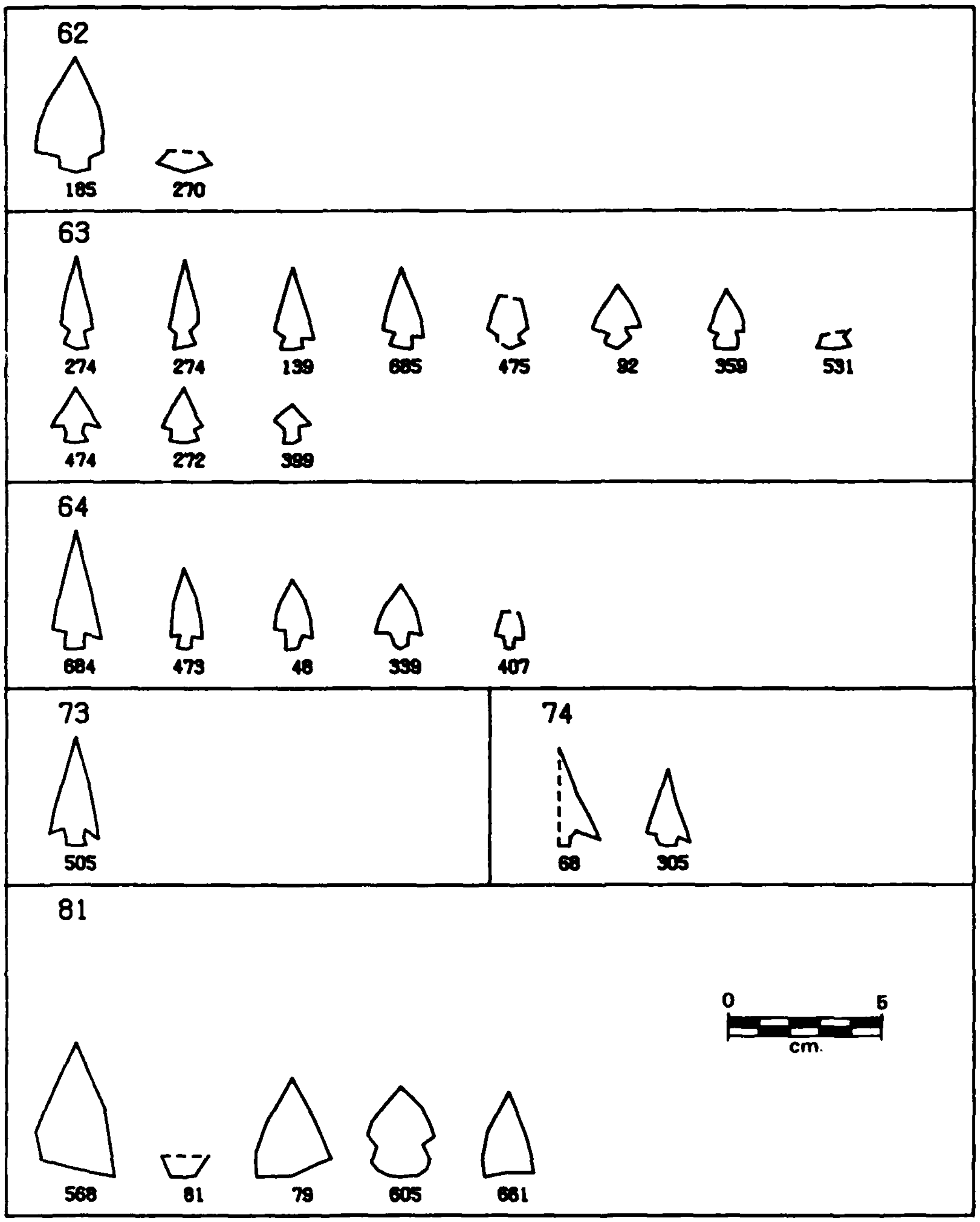

Figure B-1. Cont'd.

Table B-1. Functional type[1] by object edge angle by zone, 45-DO-326.

Functional type by zone	Edge angle (degrees)														Surface	Misc	Total
	11-15	16-20	21-25	26-30	31-35	36-40	41-45	46-50	51-55	56-60	61-65	66-70	71-75	81-85			
Projectile point																	
2	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
3	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1
4	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1
Total	-	1	-	-	1	-	1	-	-	-	-	-	-	-	-	-	3
Projectile point tip																	
1	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	2
3	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	1
Total	-	-	-	-	-	1	-	-	1	1	-	-	-	-	-	-	3
Biface																	
1	-	-	-	1	2	1	-	-	-	-	-	-	-	-	-	-	4
2	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	2
3	-	-	-	-	-	1	2	1	-	1	1	-	-	-	-	-	6
Total	-	-	-	2	3	2	2	1	-	1	1	-	-	-	-	-	12
Burin																	
1	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1
2	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1
Total	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	2
Chopper																	
2	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1
3	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	1
Total	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	2
Drill																	
1	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	1
2	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	1
3	-	-	-	-	2	-	-	-	-	-	-	-	-	1	-	1	4
4	-	2	2	4	1	1	1	-	-	2	-	1	-	-	-	-	14
Total	-	2	2	4	3	2	1	-	-	2	-	2	-	1	-	1	20
Graver																	
1	-	-	-	1	-	-	-	2	2	-	-	1	-	-	-	-	6
2	-	-	-	1	-	-	-	-	-	-	1	-	-	-	-	-	2
3	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	2
4	-	2	-	2	-	1	-	-	1	-	1	1	-	-	-	1	9
Total	-	2	-	4	-	1	-	2	4	-	2	2	-	-	-	1	19
Pestle																	
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1
Total	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1
Scraper																	
1	-	-	-	-	-	-	2	3	-	-	-	-	-	-	-	-	5
Total	-	-	-	-	-	-	2	3	-	-	-	-	-	-	-	-	5
Tabular knife																	
1	-	-	-	-	-	-	-	1	1	-	-	1	1	-	-	-	4
2	-	-	-	-	-	2	1	-	-	-	-	-	-	-	-	-	3
3	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	2
4	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	2
Total	-	-	-	-	-	4	2	2	1	-	-	1	[illegible]	-	-	-	11

Table B-1. Cont'd.

Functional type by zone	Edge angle (degrees)														Surface	Misc	Total
	11-15	16-20	21-25	26-30	31-35	36-40	41-45	46-50	51-55	56-60	61-65	66-70	71-75	81-85			
Hammerstone																	
1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6	-	6
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	15	-	15
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	2
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	3
Total	-	-	-	-	-	-	-	-	-	-	-	-	-	-	26	-	26
Hopper mortar																	
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1
Total	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1
Blade																	
4	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
Total	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
Linear flake																	
1	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
2	4	4	2	1	-	-	-	-	-	-	-	-	-	-	-	-	11
3	4	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16
4	1	2	2	-	1	-	-	-	-	-	-	-	-	-	-	-	6
Total	11	19	4	1	1	-	-	-	-	-	-	-	-	-	-	-	36
Resharpened flake																	
1	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1
Total	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1
Bifacially retouched flake																	
1	-	-	-	2	-	1	-	-	1	-	-	-	-	-	-	-	4
2	-	1	-	1	-	-	1	-	-	-	-	-	-	-	-	-	3
4	-	-	-	-	-	1	2	-	-	-	-	-	-	-	-	-	3
Total	-	1	-	3	-	2	3	-	1	-	-	-	-	-	-	-	10
Unifacially retouched flake																	
1	-	1	3	1	1	-	-	-	-	-	1	-	-	-	-	-	7
2	1	2	-	3	3	-	-	-	-	1	1	-	-	-	-	-	11
3	-	-	1	2	1	1	-	1	-	1	1	-	-	-	-	-	8
4	-	3	4	-	-	1	-	-	-	-	-	-	-	-	-	-	8
Total	1	6	8	6	5	2	-	1	-	2	3	-	-	-	-	-	34
Utilization only																	
1	-	11	8	8	5	6	2	2	3	1	-	-	-	-	-	-	46
2	-	8	8	6	4	1	-	1	-	-	-	2	-	-	-	-	30
3	-	9	12	6	2	2	6	1	3	2	-	-	-	-	-	-	43
4	-	20	14	17	8	5	3	3	-	1	1	1	-	-	-	-	73
Total	-	48	42	37	19	14	11	7	6	4	1	3	-	-	-	-	192
Total	12	81	56	59	33	28	22	16	13	11	8	9	1	1	28	2	380

† Non-lithic materials deleted

APPENDIX C

FAUNAL ASSEMBLAGE, 45-DO-326

Family Leporidae

Zone 2: 1 radius fragment.

Lepus sp.

Zone 2: 1 femur fragment.

Sylvilagus nuttallii

Zone 1: 2 humerus fragments, 2 tibia fragments, 1 astragalus.

Zone 2: 1 ulna fragment, 1 innominate, 1 innominate fragment, 1 femur fragment.

Zone 4: 1 innominate fragment.

Family Sciuridae

Marmota flaviventris

Zone 1: 1 mandible, 1 mandible fragment, 1 incisor, 3 molars, 1 cervical vertebra, 1 humerus fragment, 1 radius fragment, 1 ilium fragment, 1 astragalus, 1 calcaneus, 1 phalanx.

Zone 2: 5 skull fragments, 1 mandible fragment, 7 incisor fragments, 10 molars, 1 lumbar vertebra, 1 caudal vertebra, 1 vertebra fragment, 1 ulna fragment, 2 radius fragments, 5 innominate fragments, 2 astragali, 2 calcanea, 4 phalanges.

Zone 3: 10 skull fragments, 1 mandible, 4 incisor fragments, 4 molars, 1 axis vertebra, 3 cervical vertebrae, 5 thoracic vertebrae, 2 lumbar vertebrae, 1 scapula, 1 humerus, 1 humerus fragment, 1 ulna, 2 radii, 2 innominate fragments, 2 femur fragments, 1 tibia, 1 astragalus, 3 calcanea, 2 calcaneus fragments, 1 metapodial, 1 phalanx fragment.

Zone 4: 12 skull fragments, 9 mandible fragments, 12 incisor fragments, 35 molars, 1 atlas vertebra, 2 cervical vertebra, 1 thoracic vertebra, 1 humerus fragment, 1 radius, 1 radius fragment, 2 ulna fragments, 1 innominate fragment, 3 femur fragments, 1 astragalus, 1 calcaneus, 8 metapodials, 4 metapodial fragments, 12 phalanges.

Spermophilus spp.

Zone 1: 1 skull fragment, 1 ulna fragment, 1 innominate fragment, 2 femur fragments, 1 calcaneus fragment.

Zone 2: 1 skull fragment.

Zone 3: 1 skull fragment, 1 dentary fragment.

Zone 4: 1 tibia fragment.

Family Geomyidae

Thomomys talpoides

Zone 1: 4 mandible fragments, 2 humeri, 1 humerus fragment, 2 femora.

Zone 2: 1 skull, 1 skull fragment, 2 mandibles, 4 mandible fragments, 1 axis vertebra, 1 lumbar vertebra, 3 humerus fragments, 1 femur fragment, 1 tibia, 1 tibia fragment, 1 calcaneus.

Zone 3: 3 skull fragments, 1 mandible fragment, 2 humerus fragments.

Zone 4: 13 skull fragments, 7 mandibles, 13 mandible fragments, 4 incisors, 1 atlas, 2 axis, 1 scapula, 3 humeri, 3 humerus fragments, 1 ulna, 1 ulna fragment, 1 innominate, 1 innominate fragment, 3 femur, 1 femur fragment, 3 tibias, 5 tibia fragments.

Family Heteromyidae

Perognathus parvus

Zone 1: 2 skull fragments, 3 mandibles.

Zone 2: 2 skull fragments, 2 mandibles, 1 mandible fragment, 1 innominate fragment, 1 femur fragment.

Zone 4: 1 mandible fragment.

Family Cricetidae

Zone 1: 3 mandible fragments.

Zone 2: 1 skull, 2 skull fragments, 5 mandible fragments, 1 humerus fragment, 1 innominate fragment.

Zone 3: 1 skull fragment, 4 mandible fragments, 1 humerus, 1 femur.

Zone 4: 3 mandible fragments, 2 innominates, 2 tibia fragments.

Peromyscus maniculatus

Zone 1: 1 mandible.

Zone 2: 1 skull fragment, 1 mandible.

Zone 3: 3 mandibles.

Zone 4: 1 mandible, 2 mandible fragments.

Neotoma cinerea

Zone 2: 1 femur fragment.

Zone 3: 1 humerus, 1 humerus fragment.

Microtus spp.

Zone 1: 1 mandible fragment.

Zone 2: 1 skull fragment.

Zone 3: 1 mandible fragment.

Zone 4: 1 skull fragment.

Lagurus curtatus

Zone 1: 1 skull fragment, 7 mandibles.

Zone 2: 1 mandible, 2 mandible fragments.

Zone 3: 2 mandibles, 2 mandible fragments.

Zone 4: 3 mandibles.

Family Canidae

Canis spp.

Zone 1: 1 astragalus

Zone 2: 1 ulna fragment.

Zone 4: 1 premolar, 3 phalanges.

Family Mustelidae

Taxidea taxus

Zone 1: 1 mandible fragment, 1 radius fragment.

Zone 2: 1 axis vertebra fragment, 1 phalanx.

Zone 4: 5 skull fragments, 2 mandible fragments, 2 canines, 3 premolars, 1 molar, 1 axis vertebra, 1 cervical vertebra fragment, 3 thoracic vertebrae, 1 thoracic vertebra fragment, 2 lumbar vertebra, 2 caudal vertebrae, 14 rib fragments, 3 humerus fragments, 1 ulna fragment, 3 innominate fragments, 1 astragalus, 4 metapodials, 4 phalanges.

Family Ceridae

Zone 1: 4 antler fragments.

Zone 2: 13 antler fragments.

Zone 3: 2 antler fragments.

Zone 4: 2 antler fragments.

Cervus elaphus

Zone 1: 1 antler fragment.

Zone 2: 4 molar fragments.

Zone 4: 2 molar fragments.

Odocoileus spp.

Zone 1: 2 mandible fragments, 2 incisors, 5 premolars, 2 molars, 48 molar fragments, 2 metapodial fragments, 1 ulna fragment, 1 tibia fragment.

Zone 2: 1 skull fragment, 2 incisors, 4 premolars, 2 molars, 13 molar fragments, 1 phalanx fragment.

Zone 3: 5 molar fragments.

Zone 4: 1 incisor, 24 molar fragments, 2 metapodial fragments, 1 phalanx fragment, 1 dewclaw fragment.

Family Bovidae

Zone 1: 1 incisor fragment, 35 molar fragments.

Zone 2: 3 incisor fragments, 25 molar fragments.

Zone 3: 2 incisor fragments, 22 molar fragments.

Zone 4: 1 incisor fragment, 34 molar fragments.

Antilocapra americana

Zone 1: 1 premolar, 1 molar fragment.

Zone 3: 1 premolar.

Ovis canadensis

Zone 1: 1 mandible fragment, 1 premolar, 12 molar fragments, 1 metapodial fragment.

Zone 2: 2 skull fragments, 2 mandibles, 2 mandible fragments, 1 incisor, 1 incisor fragment, 15 premolars, 10 molars, 3 molar fragments, 1 phalanx fragment.

Zone 3: 1 incisor fragment, 2 premolars, 3 molar fragments.

Zone 4: 11 molar fragments, 2 tarsals, 1 phalanx fragment.

Deer-Sized

Zone 1: 3 skull fragments, 4 mandible fragments, 1 hyoid, 1 cervical vertebra fragment, 1 lumbar vertebra, 3 lumbar vertebra fragment, 1 vertebra fragment, 8 rib fragments, 1 scapula fragment, 4 humerus fragments, 3 radius fragments, 4 carpals, 2 metacarpal fragments, 3 femur fragments, 6 tibia fragments, 9 metatarsal fragments, 25 metatarsal fragments, **STEPHANIE - SHOULD ONE OF THE PREVIOUS BE SOMETHING ELSE?,** 7 phalanx fragments, 3 sesamoids.

Zone 2: 11 skull fragments, 1 atlas vertebra fragment, 1 axis vertebra fragment, 2 cervical vertebra, 1 thoracic vertebra fragment, 14 rib fragments, 2 humerus fragments, 3 radius fragments, 1 carpal, 5 metacarpal fragments, 4 femur fragments, 6 tibia fragments, 1 astragalus, 1 tarsal, 6 metatarsal fragments, 17 metapodial fragments, 7 phalanx fragments, 1 dewclaw fragment, 2 sesamoids.

Zone 3: 2 skull fragments, 1 thoracic vertebra fragment, 6 rib fragments, 1 costal cartilage fragment, 1 humerus fragment, 1 carpal, 1 femur fragment, 3 metatarsal fragments, 5 metapodial fragments, 7 phalanx fragments.

Zone 4: 4 skull fragments, 1 mandible fragment, 2 axis vertebra fragments, 3 humerus fragments, 1 radius fragment, 1 ulna fragment, 1 carpal, 1 tarsal, 1 metatarsal fragment, 4 metapodial fragments, 12 phalanx fragments, 2 dewclaw fragments, 2 sesamoids.

Elk-Sized

Zone 1: 3 vertebra fragments, 1 carpal, 1 metapodial fragment.

Zone 2: 1 vertebra fragment, 1 molar fragment.

Zone 3: 1 metapodial fragment, 1 phalanx fragment.

Zone 4: 1 femur fragment, 1 vertebra fragment.

Family Colubridae

Zone 1: 4 vertebrae.

Zone 2: 6 vertebrae.

Zone 3: 25 vertebrae.

Zone 4: 126 vertebrae.

Family Ranidae/Bufonidae

Zone 4: 3 humerus fragments, 3 innominate fragments, 1 femur, 1 astragalus.

Family Cyprinidae

Zone 1: 2 vertebrae.

Zone 2: 1 vertebra.

Family Salmonidae

Zone 1: 3 vertebrae, 3 vertebra fragments.

Zone 2: 1 vertebra, 1 vertebra fragment.

Zone 3: 1 vertebra, 9 vertebra fragments.

Zone 4: 3 vertebrae, 60 vertebra fragments.

Oncorhynchus tshawytscha

Zone 4: 4 otoliths.

APPENDIX D:

DESCRIPTION OF CONTENTS OF UNCIRCULATED APPENDICES

Detailed data from two different analyses are available in the form of hard copies of computer files with accompanying coding keys.

Functional analysis data include provenience (site, analytic zone, excavation unit and level, and feature number and level (if applicable); object master number; abbreviated functional object type; and coding that describes each tool on a given object. Data normally are displayed in alphanumeric order by site, analytic zone, functional object type, and master number. Different formats nay be available upon request depending upon research focus.

Faunal analysis data include provenience (site, analytic zone, excavation unit and level, feature number, and level (if applicable); taxonomy (family, *genus, species*); *skeletal element*; portion; side; sex; burning/butchering code; quantity; and age. Data normally are displayed in alphanumeric order by site, analytic zone, provenience, taxonomy, etc.

To obtain copies of the uncirculated appendices contact U.S. Army Corps of Engineers, Seattle District, Post Office Box C-3755, Seattle, Washington, 98124. Copies also are being sent to regional archives and libraries.

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