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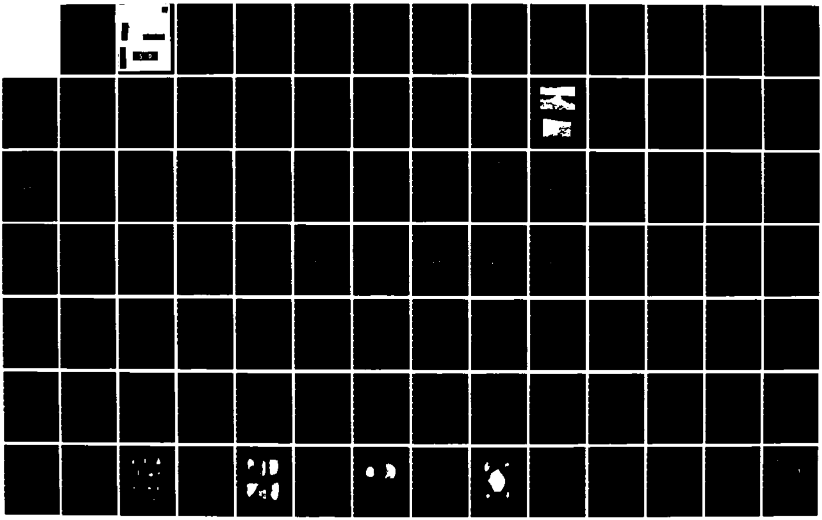

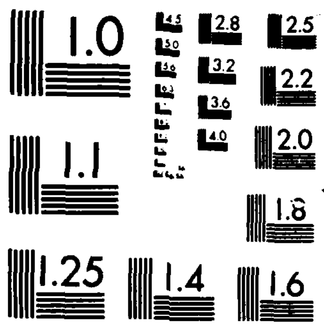

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BLOCK 20 (Continued)

Site 45-OK-18 is on the north bank of the Columbia River (River Mile 561), near the Okanogan Highland-Columbia Plateau boundary, in an Upper Sonoran life zone. The University of Washington excavated 166.13 m^3 of site volume in 1978 for the U.S. Army Corps of Engineers, Seattle District, as part of a mitigation program for a 10-ft pool raise at the Chief Joseph Dam Project. Systematic aligned random sampling with 1 x 1 x 0.1-m units of record in 1 x 2 or 2 x 2-m cells disclosed three prehistoric occupations on a terrace built from Columbia River gravels covered by overbank and aeolian sediments. The two carbon dates obtained, the Mt. St. Helens P and Yn series tephra recovered, and the several lanceolate, shouldered lanceolate and large side-notched projectile points suggest that the three occupations occurred between 4000 and 3000 B.P., which places them in the Hudnut Phase. The site appears to have been abandoned after that time. The second of the three occupations was the most intense. A cache of stone beads is associated with the second occupation. Lithic and bone concentrations indicate that the site served as a base camp for hunting and gathering. A single firepit was found.

ARCHAEOLOGICAL INVESTIGATIONS AT SITE 45-OK-18, CHIEF JOSEPH DAM PROJECT, WASHINGTON

by

Manfred E.W. Jaehnig

with

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Principal Investigators

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

Final report submitted to the U.S. Army Corps of Engineers, Seattle District, in partial fulfillment of the conditions and specifications of Contract No. DACW67-78-C-0106.

Office of Public Archaeology
Institute for Environmental Studies
University of Washington

1984

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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, including 45-OK-18, 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 projects (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.

ACKNOWLEDGEMENTS

This report is the result of the collaboration of many individuals and agencies. During the excavation and early reporting stages, Co-principal 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. I served as Project Supervisor during this stage of the work. Since the autumn of 1981, I have served as Co-principal 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.

45-OK-18 is located on property owned by Timm Brothers, Inc. of Okanogan. We would like to express our gratitude to Mr. Fred Timm and his family for their cooperation. The family welcomed project personnel working on their lands. They shared information about local history and conditions before Chief Joseph Dam was constructed and, equally important, furnished the crews water during a hot summer. The Timms continued to offer our excavation crews hospitality while they worked on other sites far from the field base camp.

As senior author of this report, I take responsibility for its contents. What I 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, Co-principal 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.

I would also like to thank all excavators and lab analysts, especially Bryn Thomas, site supervisor, Karen Whittlesey, lab supervisor, and Duncan Mitchell, data base manager. The report itself is an effort of many. I served as principal author and wrote Chapter 1 in consultation with Dr. Jermann, who designed the sampling plans for each project site. I also wrote Chapters 3 and 7 as well as coordinated and integrated the contributions of the other authors. Chapter 2 was written jointly by S. Neal Crozier, project stratigrapher, and Sarah K. Campbell, zone analyst. Stephanie Livingston and R. Lee Lyman analyzed the faunal assemblage and wrote Chapter 4. Nancy A. Stenholm, project archaeobotanist, wrote Chapter 5. Denise Varner did special work on features and Dorothy Sammons-Lohse, project features analyst, wrote Chapter 6. Linda Leeds edited the first draft of the text and Helen Mundy Hudson the final draft. Dawn Brislawn coordinated production for all draft versions. Karen Whittlesey and Marilyn Hawkes produced the site photographs; Larry Bullis photographed the artifacts and took the cover photograph. Melodie Tune and Bob Radek drafted the maps and figures. Production of the final camera-ready copy was accomplished by Charlotte Beck and Julie Tomita under the direction of Sarah Campbell.

Manfred E.W. Jaehnig

1. INTRODUCTION

Site 45-OK-18 is a small prehistoric site along Rufus Woods Lake, the reservoir behind Chief Joseph Dam on the Columbia River in north central Washington State (Figure 1-1). The site is 293 m (960 ft) above m.s.l. on the north, or Okanogan County, bank of the lake about 350 m downstream from River Mile (RM) 561 in the NE 1/4 SE 1/4 SE 1/4, Section 35, T30N, R27E Willamette Meridian; U.T.M. Zone 11, N.5,324,630, E.321,923.

The site is at the narrow upstream end of a terrace 1.2 km long and 0.2 km wide that forms the north shore of Gavlota Bend in the Columbia River (Figure 1-2). Before Chief Joseph Dam was built, there was an unnamed set of rapids approximately 1.5 km downstream and a second set 3.2 km upstream.

The terrace is bounded on the north by a relatively steep slope that leads to a second, higher terrace (Plate 1-1). A shallow, eroded channel runs from east to west between the site and this slope. On the east, the terrace is bounded by a draw formed by drainage of the higher terrace and an even higher basalt plateau approximately 1 km north of the site. To the south, a steep bank drops to the level of Rufus Woods Lake.

The site is on a relatively flat, gently rolling part of the terrace (Figure 1-3). Maximum elevation differences are less than 2 m but across most of the site the elevation varies by less than 1 m. A very low ridge runs from the northeast to the southwest corner. The present reservoir level is about 3 m below the terrace, but the former river level (January 1931) was approximately 25 m below. According to land owner Fred Timm, the bank down to the river was relatively steep and access may have been along the side of the draw that bounds the site on the east. Cultural remains cluster near a basalt erratic boulder that lies just off the bank south of the site. Immediately southwest of the site is a shallow, bowl-shaped area. West of this depression, the terrace continues for about 1 km.

Although this site has a southern exposure, the southern rim of the Columbia River Canyon (about 672 m above m.s.l.) lies within 1 km of the river (Plate 1-1) blocking the winter sun for all but a short time each day. In contrast, the site is exposed to intense sunlight during the summer.

The semiarid climate and the Columbia River have always influenced vegetation found in the site vicinity. Today, agricultural practices, especially grazing and irrigation, also influence vegetation. The plant association is that of Piper's Upper Sonoran Zone, (1906:36), Daubenmire's Artemesia tridentata-Agropyron association (1970:10-16), and Erickson's shrub-steppe habitat type (Erickson et al. 1977). The following plants grew on the site before excavation: big sagebrush (Artemesia tridentata) (abundant),

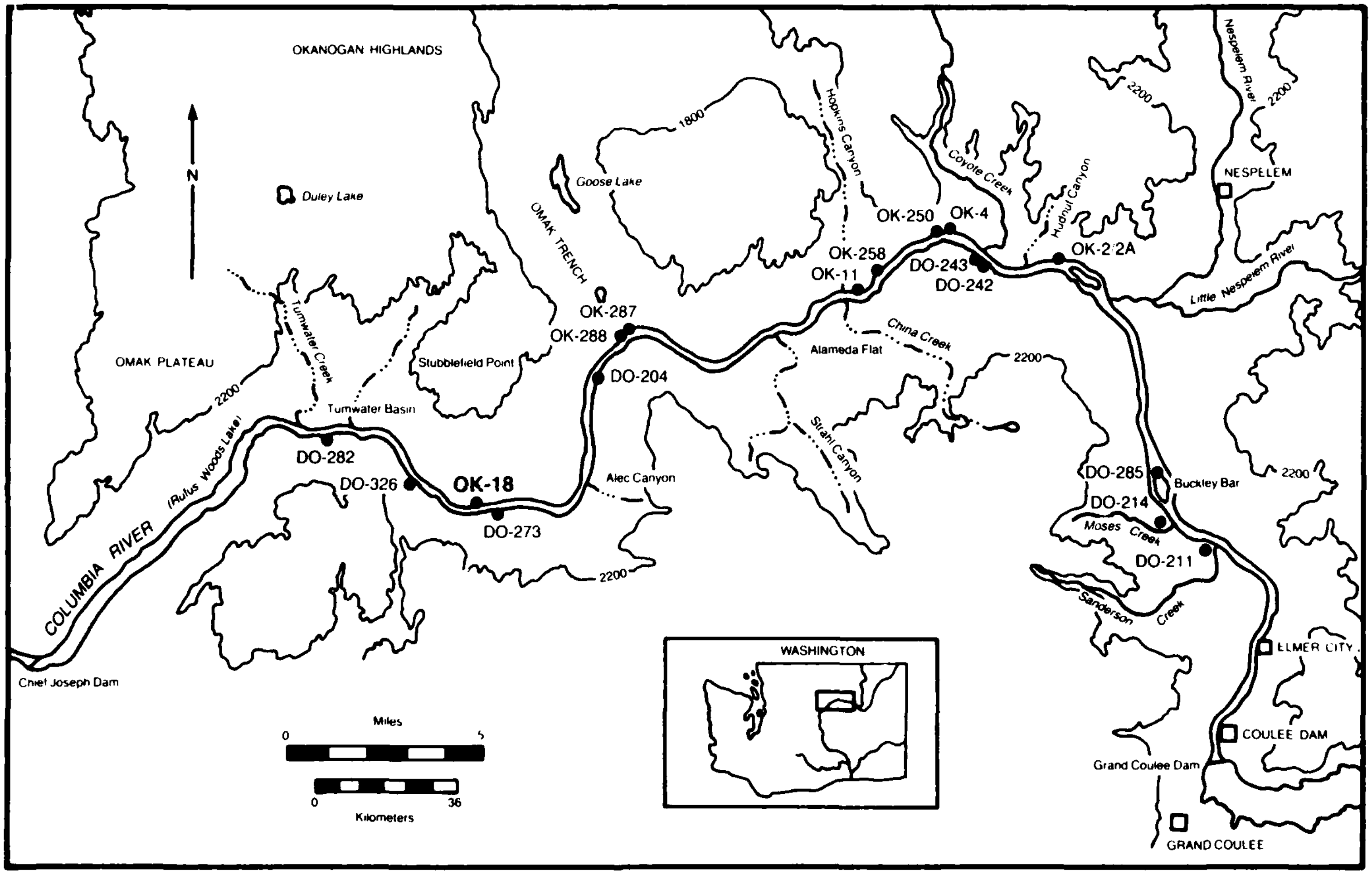


Figure 1-1. Map of project area showing location of 45-OK-18.

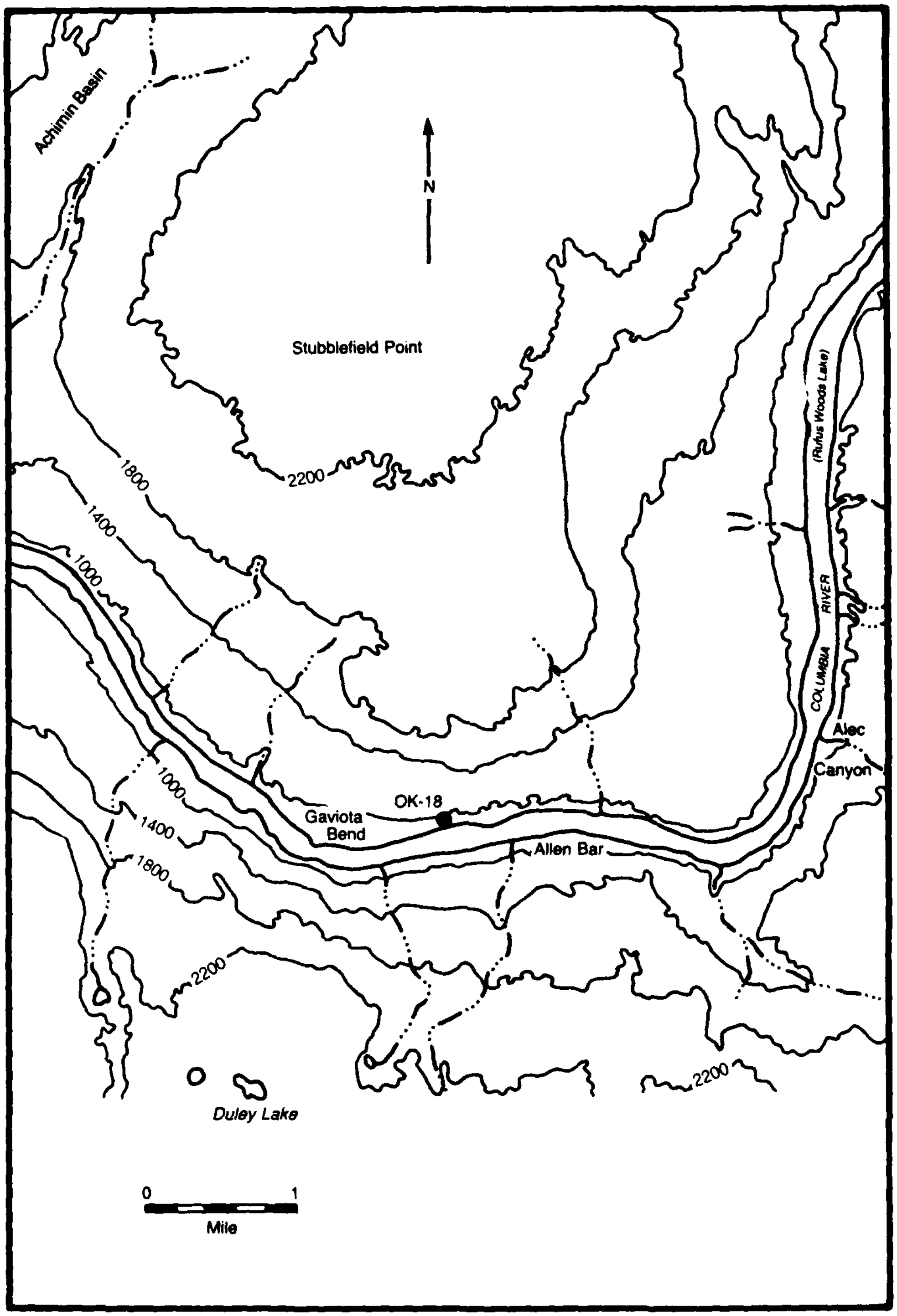


Figure 1-2. Map of site vicinity, 45-OK-18.

Plate 1-1. Two views of 45-OK-18 looking southwest.

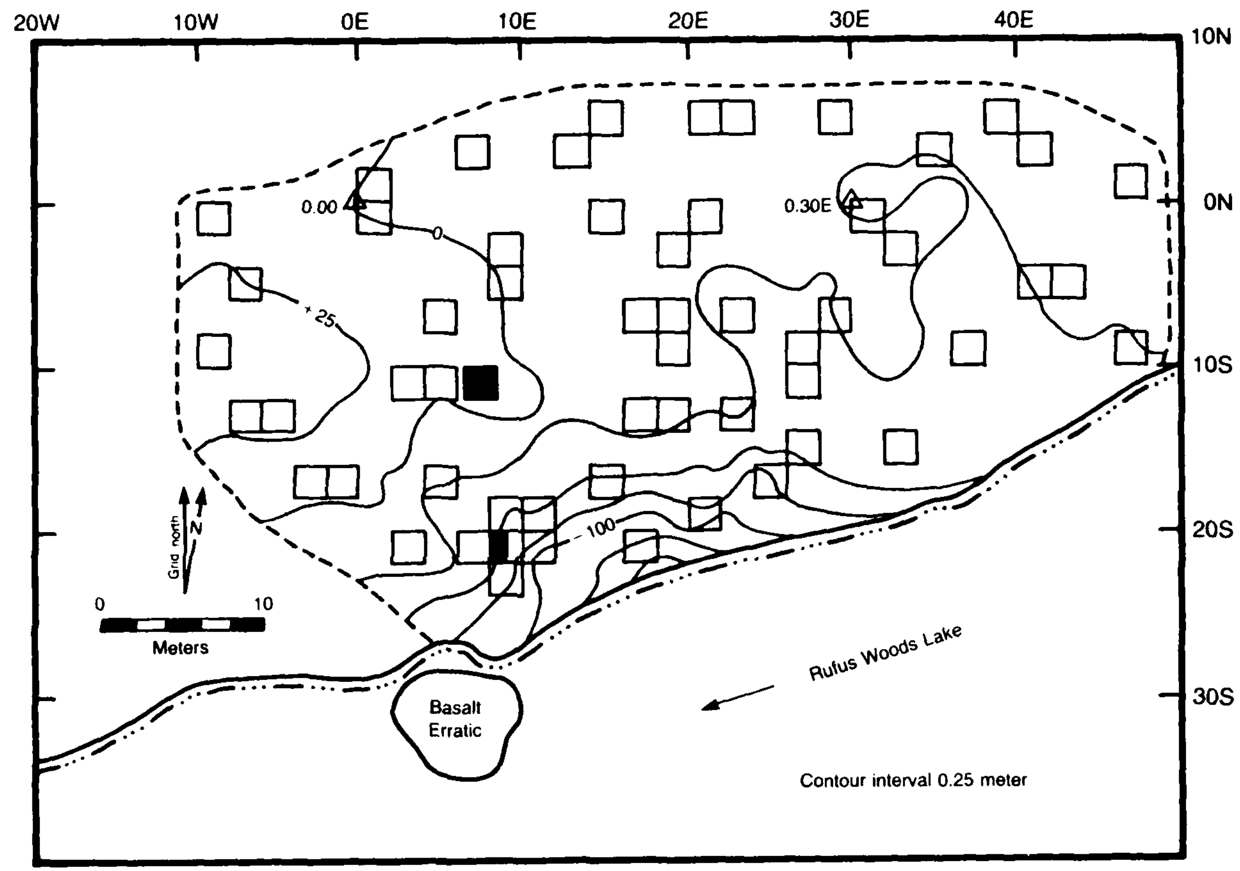


Figure 1-3. Topography of 45-OK-18.

cheatgrass (Bromus tectorum) (abundant), Russian thistle (Salsola kali) (abundant), grasses (Agropyron spicatum and others) (abundant), other thistles (Cirsium sp.) (somewhat abundant), tumble weed (Sisymbrium altissimum) (sparse), hawksbeard (Crespis sp.) (sparse), alfalfa (Medicago sativa) (sparse), and sunflower (Helianthus annuus) (sparse). (Relative abundance of the several plants is based on archaeological field workers' impressions not on statistical samples or actual counts.)

A number of these plants are not members of the true Artemisia tridentata-Agropyron climax community (Daubenmire 1970:10,16). All except alfalfa and sunflowers, however, are typical of the rather dry micro- and macro-environments of the area. The sunflowers tended to grow in moderately dry areas near water while alfalfa was restricted to the lower terrace where it was watered by overflow from irrigation water from the upper terrace. Tumbleweed, Russian thistle, and cheatgrass all indicate that the area has been disturbed (Daubenmire 1980:80-82). These three species and others found at the site are imports rather than part of the native plant community. As is apparent, such imports make up a major part of the present vegetation.

INVESTIGATIONS AT 45-OK-18

Site 45-OK-18 is one of the six sites originally recommended for excavation in 1978 when only 27 out of 79 sites had been tested. Like the remainder of this initial sample, 45-OK-18 promised to contribute to the broad variability required by project objectives. It was one of three sites chosen that had no apparent housepits, but testing revealed dense cultural deposits. The presence of microblades and a radiocarbon date of 3780±175 B.P. from a feature--the oldest from the project area at that time--indicated an older component. The site was liable to inundation after the pool raise. Furthermore, 45-OK-18 was one of few downstream sites in Okanogan County Ethnographic reports indicate that this part of the project area may have been a boundary between the Sanpoil-Nespelem tribes and the Southern Okanogan (Ray 1932; Spier 1938); it is also close to the"aKT'ti tqwEta'n" site, a Tukoratum band site name that translates "tules by the mouth of the creek" (Walters, in Spier 1938).

In 1977, two sampling units (one 1 x 2-m and one 2 m^2) were tested and excavated at 45-OK-18. The test units were placed directly north of the basalt erratic on the eroding river bank (Figure 1-4).

For full-scale excavation in 1978, a two-stage sampling design was used. First, a probabilistic sample of units was selected to provide unbiased data for characterization of site content and secondly, a purposive sample was designated to provide additional information about site structure in specific areas.

The probabilistic sampling scheme developed for 45-OK-18 encompassed the site area identified during the 1977 testing efforts. At that time, site boundaries were determined by excavating shovel holes approximately 0.5 m in diameter (Leeds et al. 1981). During excavation, however, units near the northern and eastern site boundary yielded enough artifacts to suggest that the site extended beyond the 1977 boundaries. Since artifact densities at the

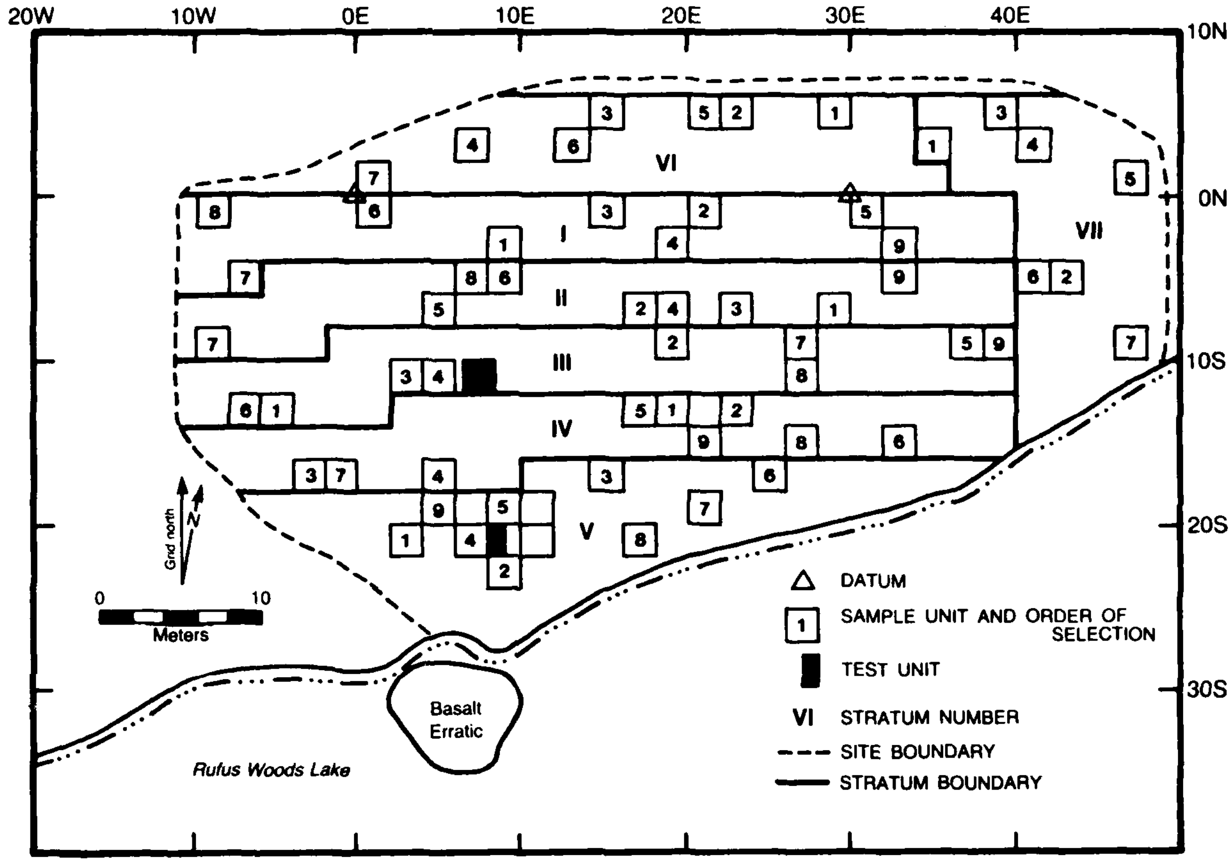


Figure 1-4. Stratified random sampling design, 45-OK-18.

site were low, we added probabilistic units (Strata VI and VII, Figure 1-4) in order to recover an artifact sample large enough to suggest site function.

Probabilistic sampling was conducted according to a stratified random sampling design. Sampling strata were developed by superimposing a 2-m^2 grid of 260 units on the original site area and numbering each unit serially from 1 to 260, beginning at the northwest corner (unit ON10W) and proceeding from west to east and north to south. Five sampling strata were created by dividing the 260 units into five sets of 52 units each (Figure 1-4).

45-OK-18 has no housepits and no other distinct features (such as surface concentrations or stone piles), so these strata were artifically created to assure even dispersion of sampling excavation units. Nine sample units were selected from each stratum. Numbers between 1 and 260 were read from a table of random numbers and the first nine units in each stratum whose numbers corresponded to those read from the table were chosen. Units in each stratum were excavated in order of selection. If all units so chosen had been excavated, they would have constituted a 17.3% areal sample of the site. In actuality, variable degrees of coverage were achieved within the five original sampling strata although at least seven units in each stratum were excavated.

When site boundaries were expanded, two additional sampling strata were added to the original five: Stratum 6 was added to the north and Stratum 7 to the east (Figure 1-4). Each new stratum included 52 2-m^2 units; random sample units were chosen from these as described above. Seven random units were excavated in each of the additional strata (Figure 1-5).

We found little evidence of human activity areas during excavation of the random sample units. During test excavation of the 1 x 2-m unit north of the basalt erratic, however, the scattered remains of a pit feature that included fire-modified rock (FMR) and charcoal had been identified. Accordingly, one 1 x 2-m and two 2-m^2 purposive units were placed immediately east of the 1977 test unit (Figure 1-5). Together with three random sample units abutting the test unit to the north, west, and south, they provided more exposure of the feature. The feature and its context will be discussed in Chapter 6.

Excavations at 45-OK-18 began on 1 August 1978 and continued until 10 November 1978. The crew of eight excavators and a site supervisor excavated 56 2 x 2-m units and one 1 x 2-m unit. Depths of excavation varied from 0.4 m to 1.4 m; a total volume of 166.1 m^3 was dug. Units excavated are shown in Figure 1-5. Field excavation methods used at the site are described in the project's plan of action (Jermann and Whittlesey 1978) and research design (Campbell 1984d).

The recovered assemblage includes 6,373 lithic artifacts, 3,061 bone fragments, 810 fire-modified rocks, 20 pieces of shell, and three cultural features. All material was recovered by dry-screening. Carbon samples yielded two radiocarbon dates indicating an age range of about 4000-3000 B.P.

REPORT ORGANIZATION

The following chapters describe and analyze data recovered from 45-OK-18. Chapter 2 discusses the site's sedimentary stratigraphy and the definition and dating of zones. Chapter 3 analyzes artifacts, Chapter 4 analyzes faunal

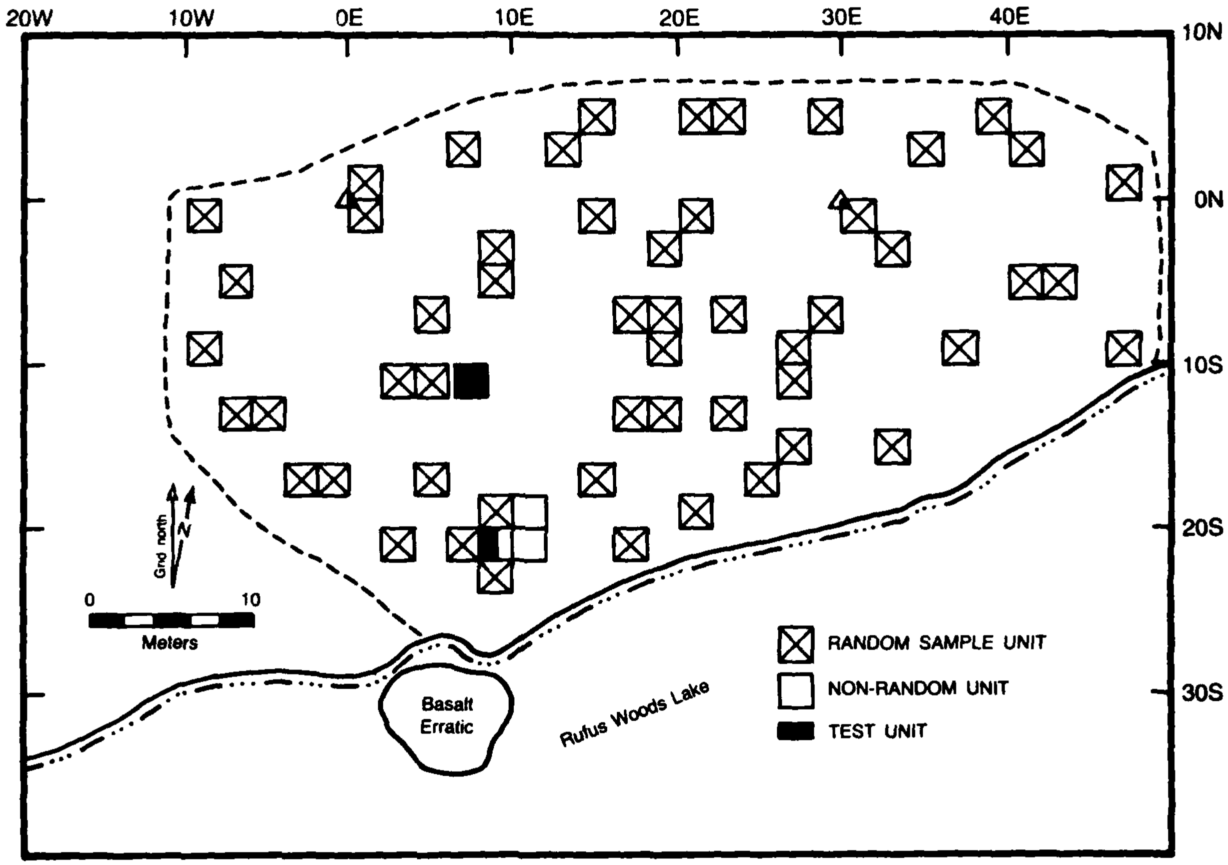


Figure 1-5. Units excavated, 45-OK-18.

remains, Chapter 5 analyzes botanical specimens, and Chapter 6 classifies features and describes their cultural contents. Chapter 7 synthesizes the analyses, including site chronology and a discussion of the possible uses prehistoric peoples made of the site.

2. STRATIGRAPHY AND CHRONOLOGY

This chapter discusses the geologic setting of site 45-OK-18 with reference to local geologic history and describes 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. The second half of the chapter discusses the cultural strata, or analytic zones, defined within this framework.

GEOLOGIC SETTING

The surface of the terrace upon which 45-OK-18 lies has been mapped as Columbia River gravels (Figure 2-1). In early postglacial times, the Columbia River cut this terrace into glaciolacustrine sediments. Several glacial period deposits --silt, recessional sand, recessional gravel, and glacial till--are exposed in the vicinity. In Rufus Woods Lake, below the mouth of the Nespelem, there is actually only one till deposit (Hibbert 1980:8-9), but between RM 563 and RM 560 where 45-OK-18 is located, the lower part of the till contains so few clasts that it has been called "Gaviota clay with pebbles" (Figure 2-1).

Across the river from the upstream end of Gaviota Bend lies Allen Bar, another terrace at roughly the same elevation (ca. 300 m above m.s.l.). This terrace is formed by till overlain by Columbia River gravels up to 4.6 m deep. The gravels, which include clasts up to almost 1 m long, occur in foreset beds that dip 15°-20° downstream; they have been interpreted as the consequence of a catastrophic flood other than the Missoula flood (Hibbert 1980:9). The Columbia River gravels of the 45-OK-18 terrace may have been deposited in a single rapid event which also deposited other Columbia River gravels.

PROCEDURES

Site 45-OK-18 was excavated and originally profiled in 1978 before the full-time pedology crew was formed. In order to make the stratigraphic analysis comparable to other project sites, 45-OK-18 was reopened and reprofiled by the stratigraphy crew in June 1980. They collected data from seven 2 x 2-m units and sampled three block columns (Figure 2-2).

During field investigations, the soil/sedimentology crew identified strata in profile walls by using soil color, texture, structure, and consistence. At 45-OK-18, 23 such strata were mapped and described in the

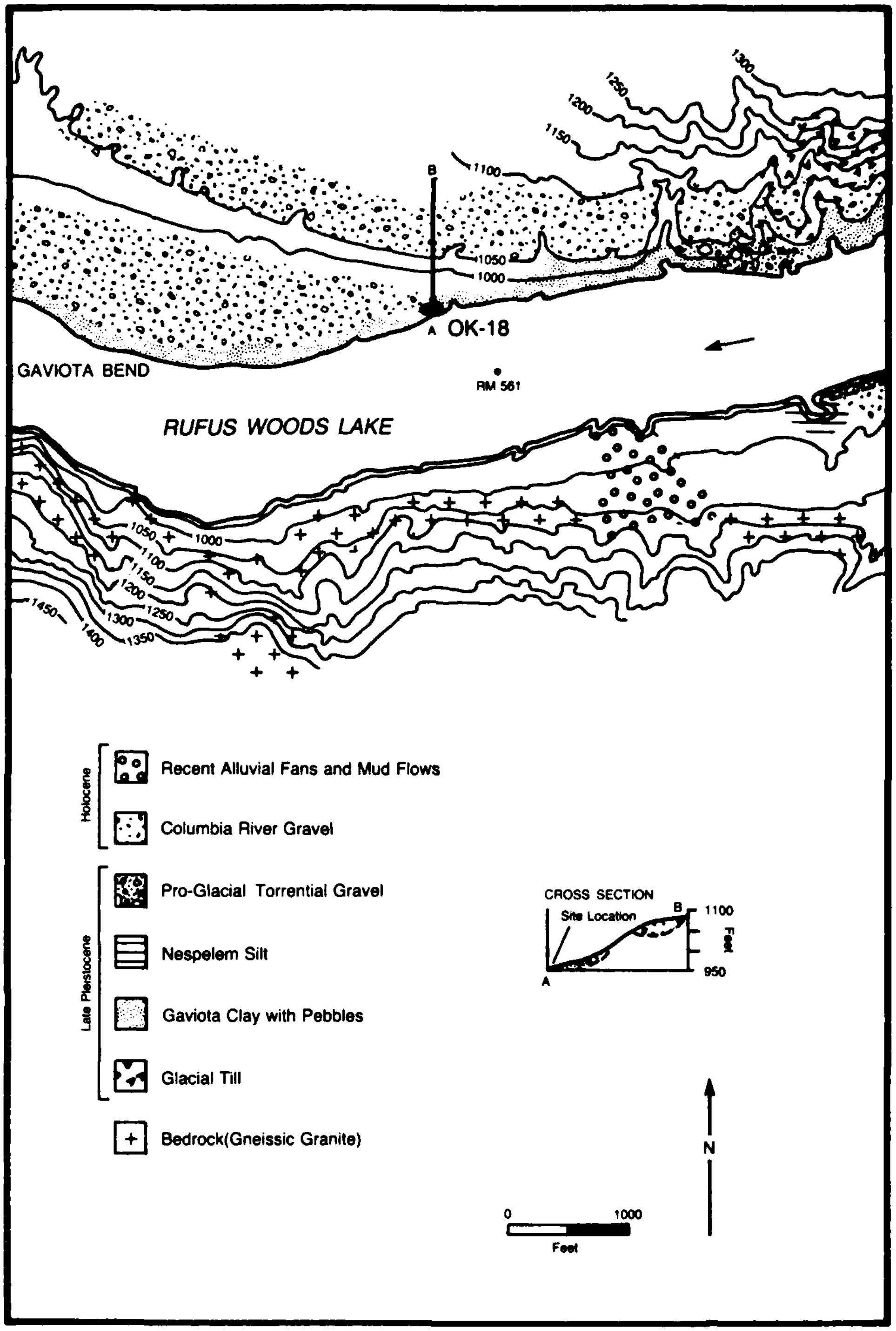


Figure 2-1. Geologic map of site vicinity, 45-OK-18.

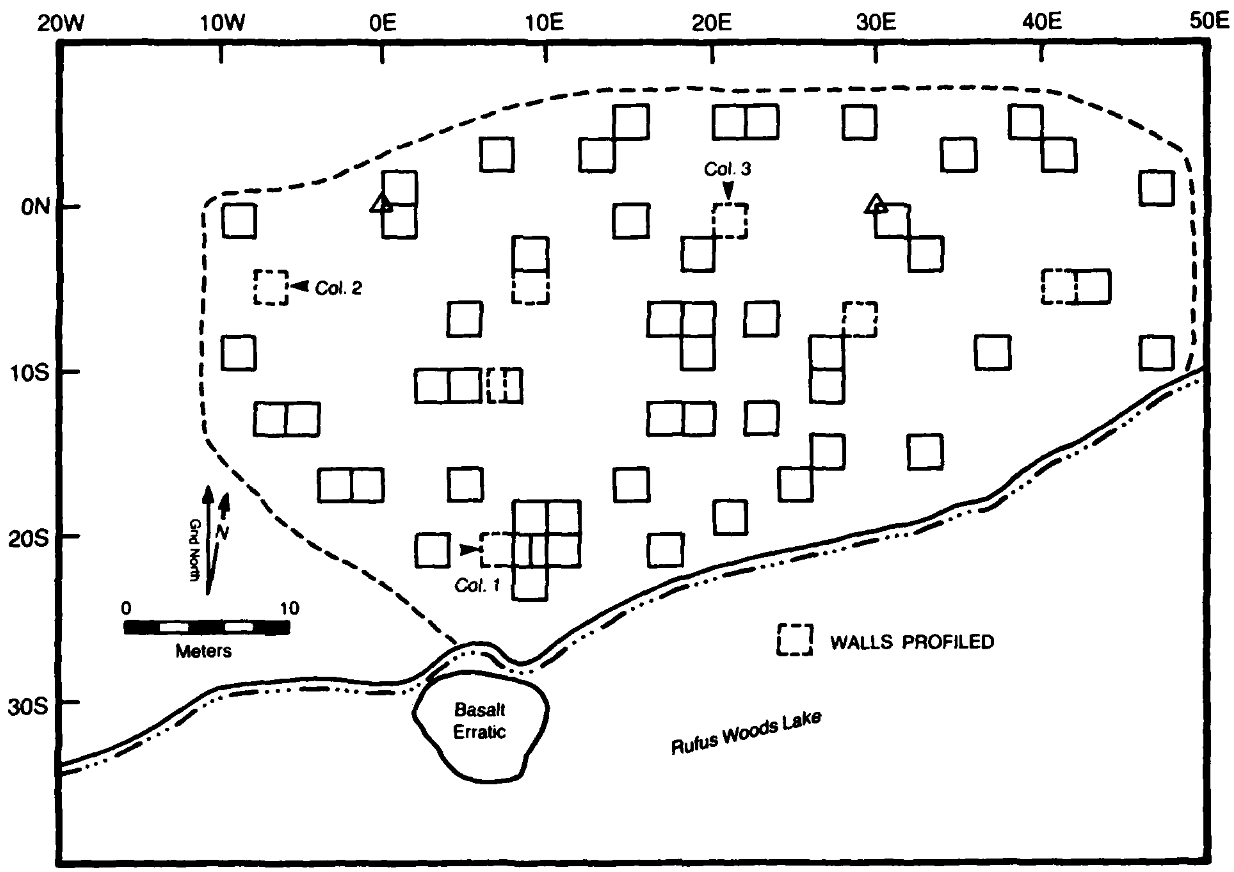


Figure 2-2. Location of profiled walls and column samples, 45-OK-18.

seven re-excavated units. Twenty-four soil samples from three columns were analyzed in the soil laboratory to determine percentages of sand-silt-clay particle sizes, grain rounding, pH, exchangeable calcium, soluble phosphate, and a number of other physical and chemical characteristics of lesser importance in the present discussion. Tephra samples from Column 1 were identified by Dr. Tom Davis of Mt. Holyoke College.

Because so few units were reprofiled, and because they were reopened to a depth of only 1 m, interpretation of the depositional history at 45-OK-18 is based on excavator's field notes, as well as field profile descriptions and laboratory analyses. In particular, the field notes contributed information on the horizontal extent of distinctive surfaces such as cobbles or lacustrine layers. They also record details of appearance not noted in the early profiles and information about the deepest areas of the site. The field notes compare easily to the later stratigraphic profiles because the deposits in 45-OK-18 are quite distinct. Major differences in color, texture, and compactness noted by the pedology crew were accurately and consistently noted by field personnel during the original excavation. The backfill noted on some profiles is from the 1978 backfilling of the site. It was ignored by the stratigraphic analysts who presumed that the base of the backfilling was the excavation surface.

The stratigraphic boundaries were used as temporal markers to aid in subdividing the cultural deposits for analysis. For the profiled units, the horizontal and vertical distribution of artifacts by quad and level was compared with the natural depositional sequence and feature boundaries. Those stratigraphic units containing a discrete cultural deposit were defined as analytic zones. The zones were extrapolated to adjacent units with the aid of field notes and other chronological information such as radiocarbon dates and projectile points. For a more detailed discussion of procedures used in defining analytic zones, see Campbell (1984d).

DEPOSITIONAL SEQUENCE

Based on field profiles, laboratory analyses, and excavator's notes, four site wide depositional units were defined at 45-OK-18 (Table 2-1). Representative profiles of east-west and north-south transects are illustrated in Figures 2-3 and 2-4.

DEPOSITIONAL UNIT I

The oldest depositional unit at the site, DU I is a layer of coarse material with a steeply sloping surface (Figure 2-5). It consists of cobbles, pebbles, and sand toward the north and east that grade into medium sized sand toward the south and west. This is probably the deposit mapped as Columbia River gravels in Figure 2-1. Both cobbles and sand are part of channel deposits left by the river as it migrated across the terrace during early postglacial times (Hibbert 1980:11).

Table 2-1. Summary of depositional units, 45-OK-18.

Depositional Unit		Strata	Description
IV	Aeolian sediments with slopewash	100, 200, 300, 310	Brown (10YR5/3) loamy sand, very fine, well sorted, slightly compact, some organic debris. *Less compact, lighter in* color, less gravel, slightly coarser sand towards bottom - *gradual changes but noted as seperate* stratum (310-300) towards west. May be cultural staining towards base (300). Stratum 200 *uniform* thickness across site, stratum 300 thickest towards west, thinner to south and north, disappears to east. Intermittent organic mat at surface. Entire unit largely aeolian in origin, upper stratum (200) may be organic zone due to cattle pasturage and plowing.
III	Aeolian sediments with slopewash	400, 405, 410, 420, 421, 450	Pale brown (10YR6/3) sandy loam, well sorted, loose, soft. Gravel decreases, compaction increases, color lightens towards base (421). Cultural staining (405,420) and pits (450) occur toward base. *Pockets of tephra (410) may occur at upper* boundary. Thickest towards west, thinner to north, south and east.
IIb	Overbank sediments with stillwater deposits	460, 500, 510, 600, 625, 700, 710	Light *colored ashy, sandy loam.* Very pale brownish gray or brown (10YR - 6/2,6/3,7/2,7/3) loamy sand, sandy loam with *traces of subrounded gravel,* slightly compact, powdery at top (500,600) through light grey (10YR7/2) loam with light silt and clay. Tephra occurs throughout the sequence. Silt and clay increase towards base, as does compaction; color lightens. Freshwater snails associated. Pockets of tephra (625), pinkish white (7.5YR8/2) and sand (630) may occur, also one stain caused by percolation from above.
IIa	Overbank sediments with stillwater deposits	520, 740, 800	White to light grey (10YR8/1-7/1,2.5Y7/2), mottled, compact clay loam, very fine, well sorted, hard, may contain tephra.
I	Columbia River channel deposits	610, 630, 750	Fine sand to loamy sand, light gray (10YR7/2) with some gravels (strata 610,630) *grading downwards* to salt and pepper sand, medium, moderately well sorted, loose alluvium *with mica and magnetite (Stratum 750);* grading downwards and eastwards to a coarser sand and pebble layer to a cobble layer with cobbles up to 0.80 m in size.

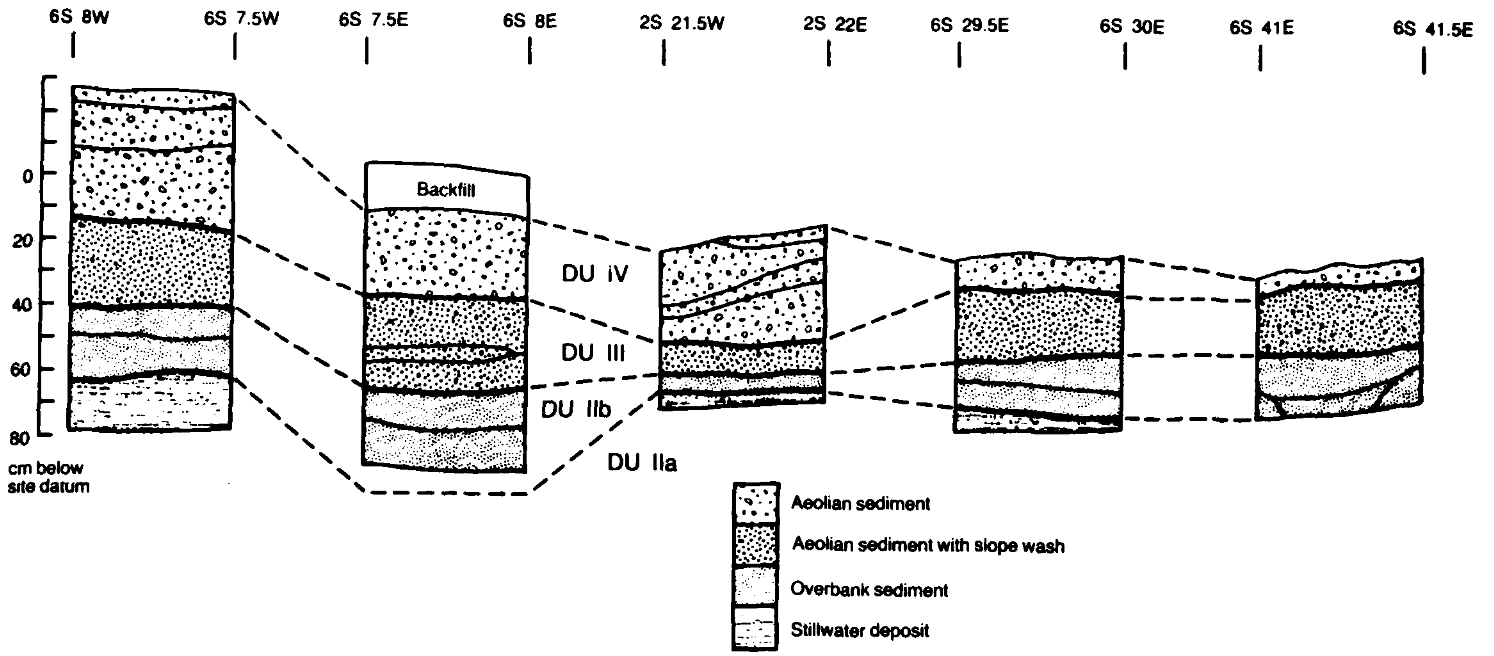


Figure 2-3. West to east stratigraphic transect, 45-OK-18.

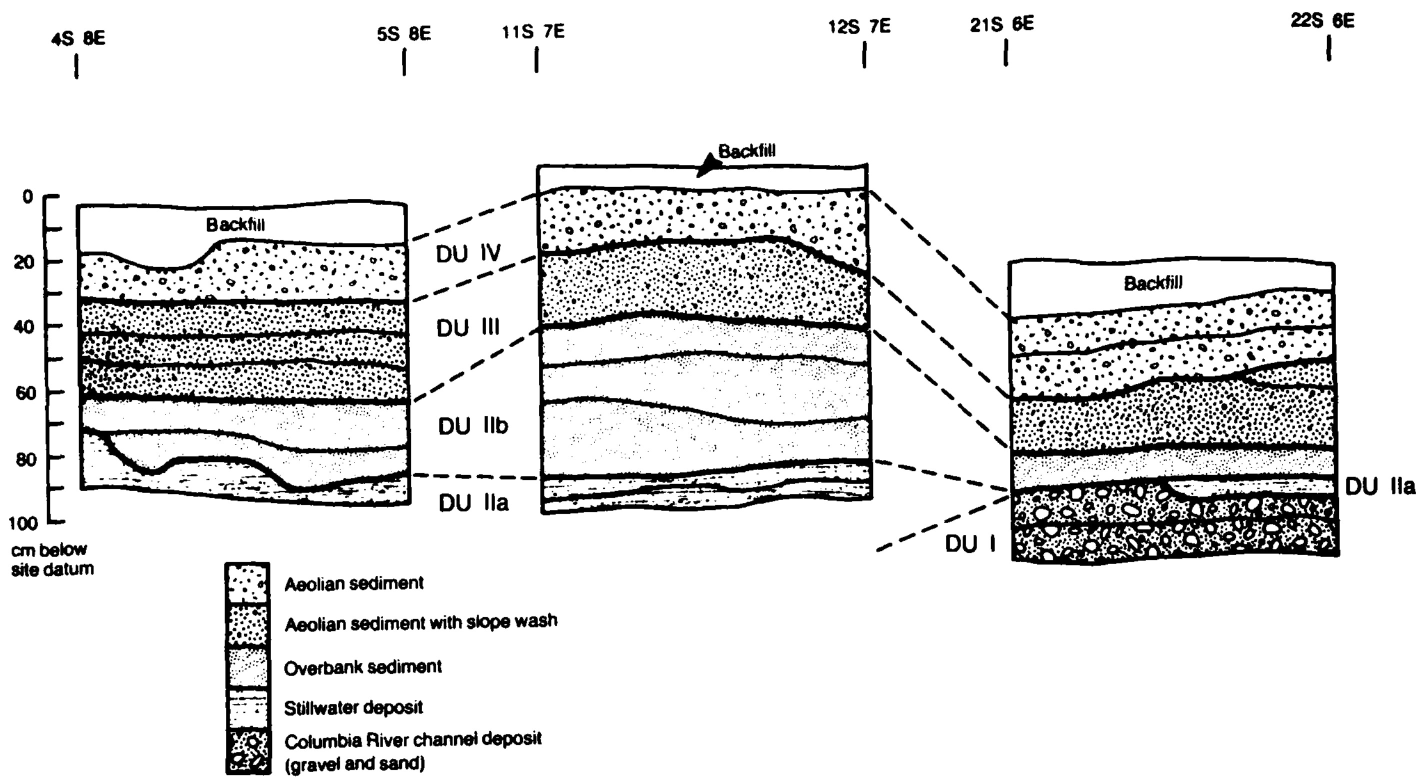


Figure 2-4. North to south stratigraphic transect, 45-OK-18.

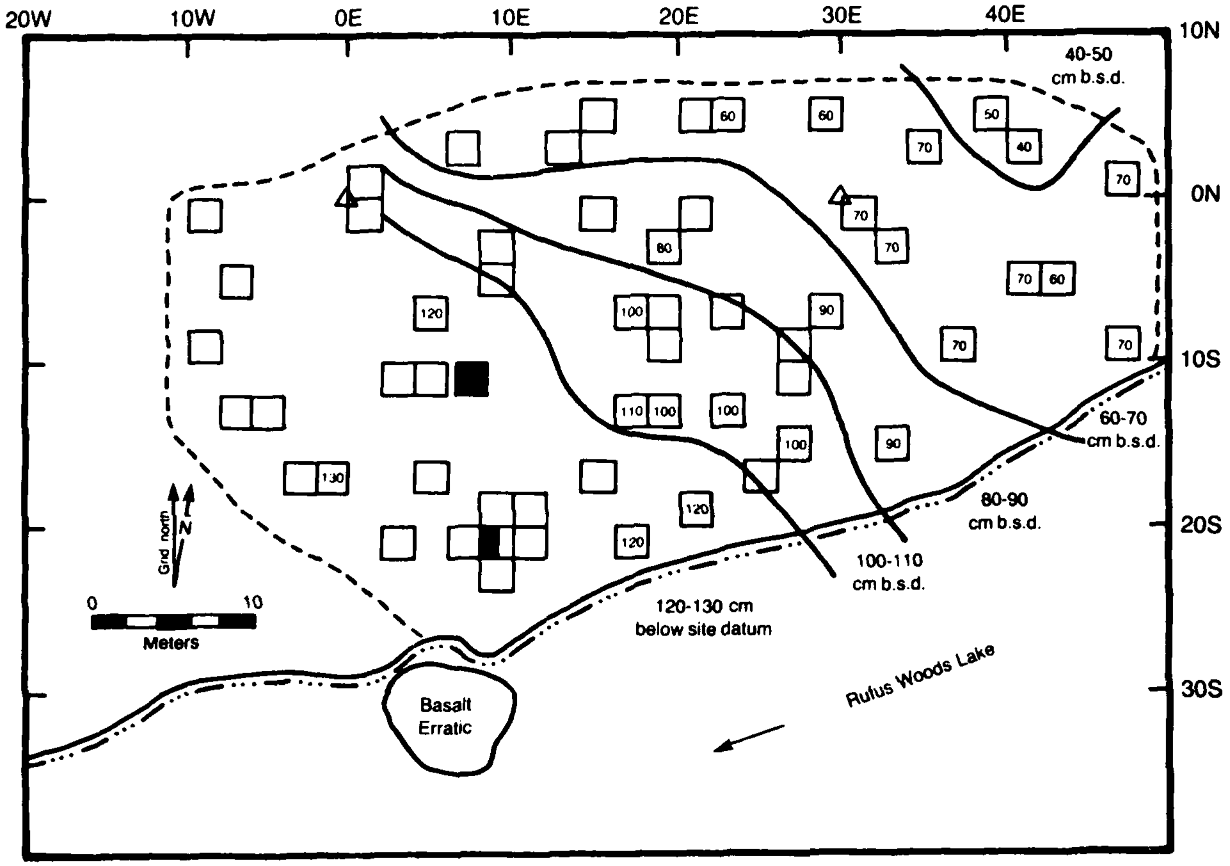


Figure 2-5. Topography of upper surface of cobbles and coarse sand (DU 1), 45-OK-18.

DEPOSITIONAL UNIT II

Overlying the coarse material of DUI is a series of fine materials, DUII. We have subdivided this unit because the lowest strata indicate a slightly different depositional mode from those above. However, both subunits include snail shells and volcanic ash (tephra) indicating that they are closely related. Both also differ substantially from the underlying and overlying depositional units. Bracketing radiocarbon dates and tephra dates indicate that the sediments were deposited between 3800 and 3400 B.P.

The lower part of DU II, designated DU IIa, is marked by a distinctive very compact clay or silt loam. It is very light in color (whitish or light grayish), although in some areas it grades into a darker greenish-gray. It is usually mottled, indicating alteration by ground water after deposition. The silt or clay loam occurs as a single thin layer, or laminated with thin bands of sand, or as intermittent nodules and lenses in a sandy matrix. The subunit includes fresh water snail shells found in many postglacial deposits on the Columbia Plateau (Jaehnig, personal communication). In unit 20S6E, (Figure 2-6) two sediment lenses approximately 60 cm long and 10 cm thick (Stratum 520) contain tephra which has been identified as St. Helens Series Yn tephra, dated to 3400 B.P. (Davis 1984).

The DU IIa deposit is found extensively across the site (Figure 2-7). Excavators noted it consistently in the southwestern part of the site. In the northeastern site area, from units 4N6E, 0N30E, and 8S36E to units 4N34E and 4S40E, this unit is situated within the upper limits of the cobble matrix of DU I (Figure 2-8, also compare Figures 2-5 and 2-7). However it is not present in the extreme northern and eastern units, north of 4N and east of grid line 42E (Figure 2-7).

The thickness and structure of DU IIa indicates that it was deposited by a body of ponded water that remained in place longer than the backwaters of a single flood would have. A seasonal flood would have deposited a thinner layer of slightly coarser material. A ponded body of water could have been formed during a temporary damming of the Columbia River by a landslide.

Above this distinct lacustrine marker bed, DU IIb is a series of fine-textured deposits, generally a silt loam, grading upwards into a sandy loam with pebbles. This subunit is thicker and more differentiated toward the west. In the west, a silty clay loam (Stratum 700) overlies the compact clay loam of DU IIa in turn overlain by separate strata of sand (Stratum 600) and sandy loam (Stratum 500). Amounts of silt and clay generally decrease toward the top of DU IIb. Tephra, St. Helens Series Yn, is present in varying amounts. It may be expressed as a single, pinkish white layer up to 10 cm thick at the top of DU IIb, in Strata 500 and 600 as pockets at stratigraphic boundaries, or it may be noticeable in the powdery texture of the sediments. Fresh water snail shells of the same species found in DU IIa occur in the upper subunit.

The prominent tephra layer at the top of DU IIb is a mixture of tephra and silty sand indicating it is redeposited. Stratum 520 in DU IIa may represent a primary wind blown tephra deposit.

STRATA DESCRIPTIONS

0	Backfill and disturbed sand.
200	Brown (10YR5/3) loamy sand, very fine, well sorted, slightly hard, compact. Predominately aeolian. Boundary: gradual.
300	Pale brown (10YR 6/3) sand, very fine, well sorted, soft. Boundary: gradual.
400	Pale brown (10YR 6/3) sand, fine, well sorted, soft, micaceous, cultural zone, structureless. Boundary: gradual.
410	Very pale brown (10YR 7/3) loamy sand, very fine, well sorted, slightly hard, ashy pockets. Boundary: clear. St. Helens Series P tephra.
450	Pale brown (10YR 6/3) loamy sand, slight cultural staining. Boundary: clear.
510	Light grey (10YR 7/2) sand, fine/very fine, well sorted, soft. Possibly alluvial. Boundary: clear.
520	White to light grey (10YR 8/1-7/1) clay loam, very fine, well sorted, hard. Boundary: clear. St. Helens Series Yn tephra.
610	Light grey (10YR 7/2) loamy sand, fine with trace of sub-rounded gravel, moderately well sorted, slightly hard. Boundary: clear.
630	Light grey (10YR 7/2) sand, very fine, well sorted, soft to slightly hard, less gravel and less compact than 610. Boundary: clear.
750	Salt/pepper sand, moderately well sorted, loose, structureless, with mica and magnetite. Alluvium.

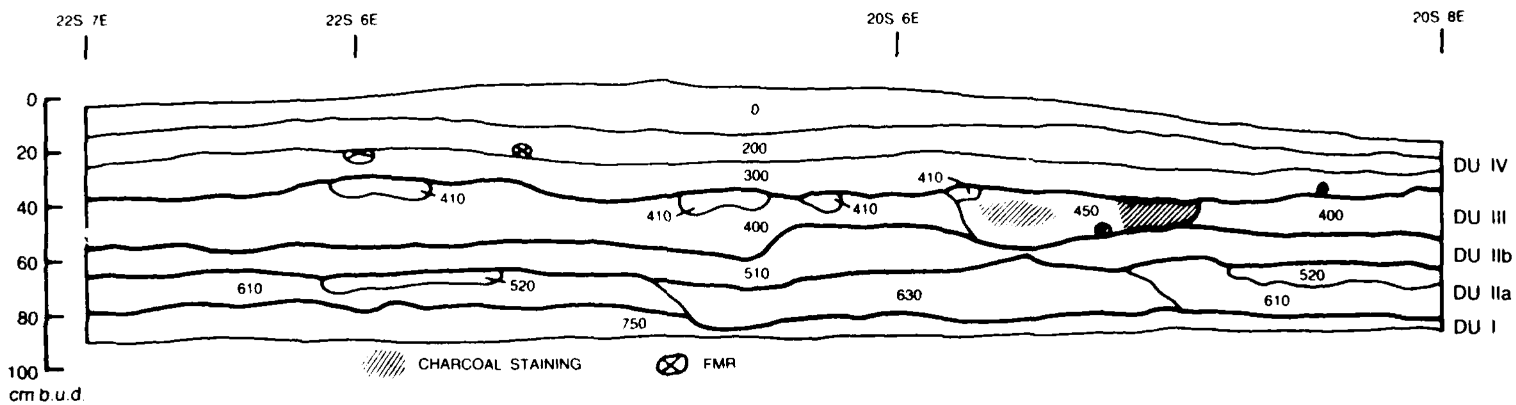


Figure 2-6. Detailed profile from 20S6E, 45-OK-18.

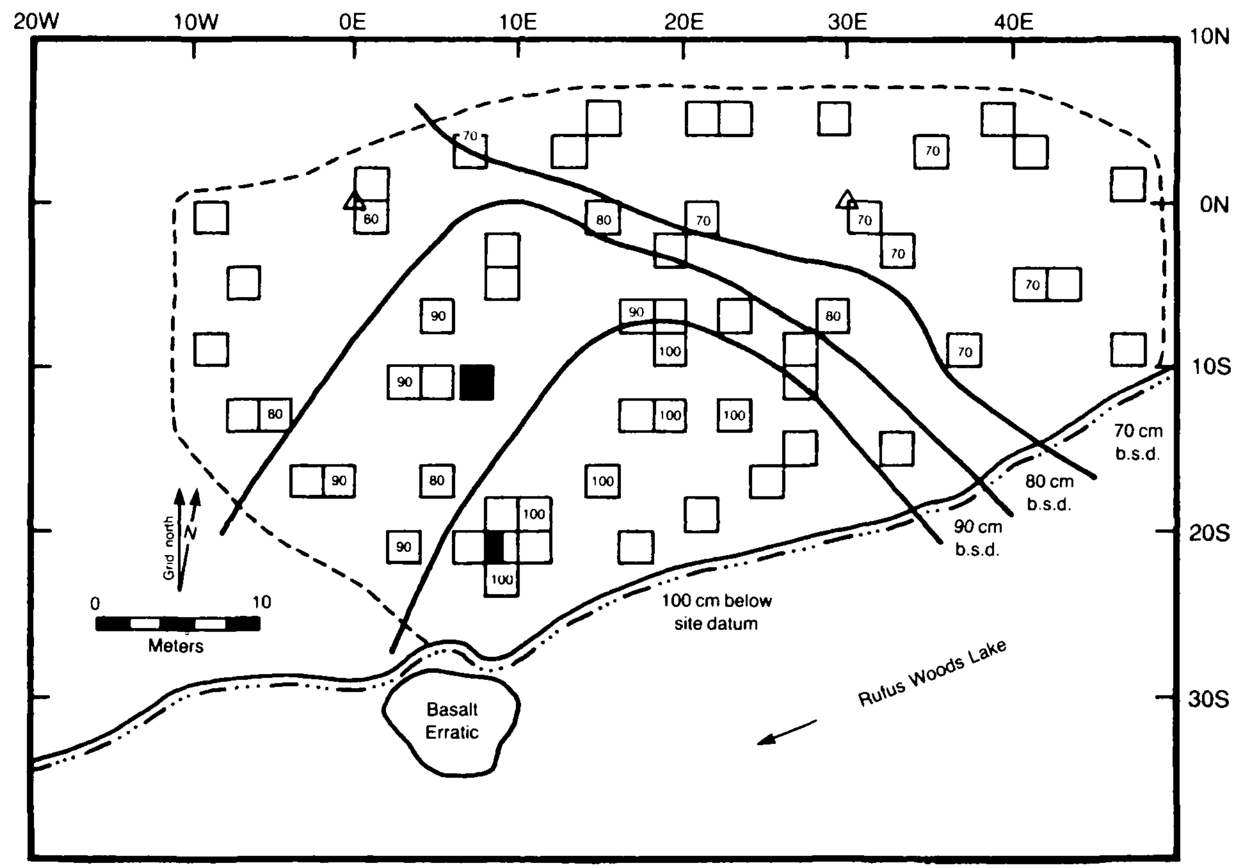


Figure 2-7. Topography of upper surface of compact silt (DU IIa), 45-OK-18. Number in unit indicates depth below surface at which tephra was encountered. Tephra was not encountered in blank units.

DEPOSITIONAL UNIT III

Two loamy sand deposits of mixed aeolian and alluvial origin lie above DU II. Designated DU III and DU IV, these layers form distinct physical units traceable across the site. The deeper of the two, DU III, is a soft, well sorted loamy sand with very fine sand. Areas of staining (Strata 405, 420, 510) indicate cultural modification, but there are areas without staining (Stratum 421) as well (Figure 2-8). Small pockets of tephra and sand (Stratum 410) occur between DU III and DU IV (Figure 2-6). This is St. Helens series P tephra, dated 2,500 B.P. (Davis 1984). Gravel inclusions in DU III decrease toward the south and west, indicating that they originated on the slopes above the site.

DEPOSITIONAL UNIT IV

The shallower unit, DU IV, is similar to DU III but harder and more compact, an indication that it apparently has been altered more after deposition. It is also darker, probably due to soil development. A slightly compact loamy sand, very fine and well sorted, becoming less silty and less compact toward the bottom (Stratum 200) comprises this unit. The deposit is thicker towards the west; in this area, the lower, less silty, and lighter colored part of the unit was distinguished as Stratum 300. Stratum 300 is probably part of Stratum 200, as it does not occur uniformly across the site, and the boundaries between it and Stratum 200 are gradual. A thin, discontinuous litter mat (Stratum 100) forms on the upper surface of this depositional unit.

PHYSICAL AND CHEMICAL ANALYSES OF COLUMN SAMPLES

Twenty-four samples from three columns and two additional samples taken near Column 1 were analyzed in the laboratory to obtain detailed descriptions of the physical and chemical properties of the samples. These analyses corroborate field observations and also help explain how cultural activities may have altered the deposits. Column sample data are summarized in Appendix A, Tables A-2 through A-4.

To a large extent, physical analyses simply corroborate field interpretation, and conclusions made about **in situ** cultural deposits. Laboratory tests verified that the DU IV and DU III samples are similar. Since both deposits are of mixed aeolian and alluvial origin and both contain cultural deposits, this was a predictable conclusion. Physically, they are characterized by darker color, greater angularity of grains, more charcoal, bone, and shell, and less tephra than the DU II and DU I samples. They have a higher percentage of sand relative to silt than the DU II samples. The grain angularity of these sediments confirms that they are relatively unweathered aeolian material from glacial deposits. The measurable presence of charcoal, bone, and shell are cultural additions. These sediments must postdate the tephra deposit since no tephra was found in them. With the exception of

STRATA DESCRIPTIONS

100 Brown (10YR 5/3) litter mat, disturbed, discontinuous.

200 Pale brown (10YR 6/3) loamy sand, fine with a few coarse grains, moderately well sorted, possibly aeolian, hard. Boundary: clear/gradual and wavy/smooth.

300 Grayish brown (10YR 5/2) loamy sand lens, very fine, well sorted, light, intermittent cultural staining, slightly hard. Boundary: clear and smooth/discontinuous.

310 Pale brown/brown (10YR 6/3-5/3) same matrix as 300, but no staining, soft. Boundary: gradual and smooth.

420 Brown (10YR 5/3) loamy sand/sandy loam, very fine, well sorted with a few small gravels, soft, moderate cultural staining. Boundary: gradual and smooth.

421 Very pale brown (10YR 7/3) same deposit as 420, but lacks cultural staining. Boundary: gradual and smooth.

600 Pale brown (10YR 6/3) sandy loam, very fine, well sorted with a few coarse grains, slightly hard. Boundary: gradual and smooth.

740 Pale brown (10YR 6/3) clay loam, very fine, well-sorted, very compact, may contain ash. Boundary unknown.

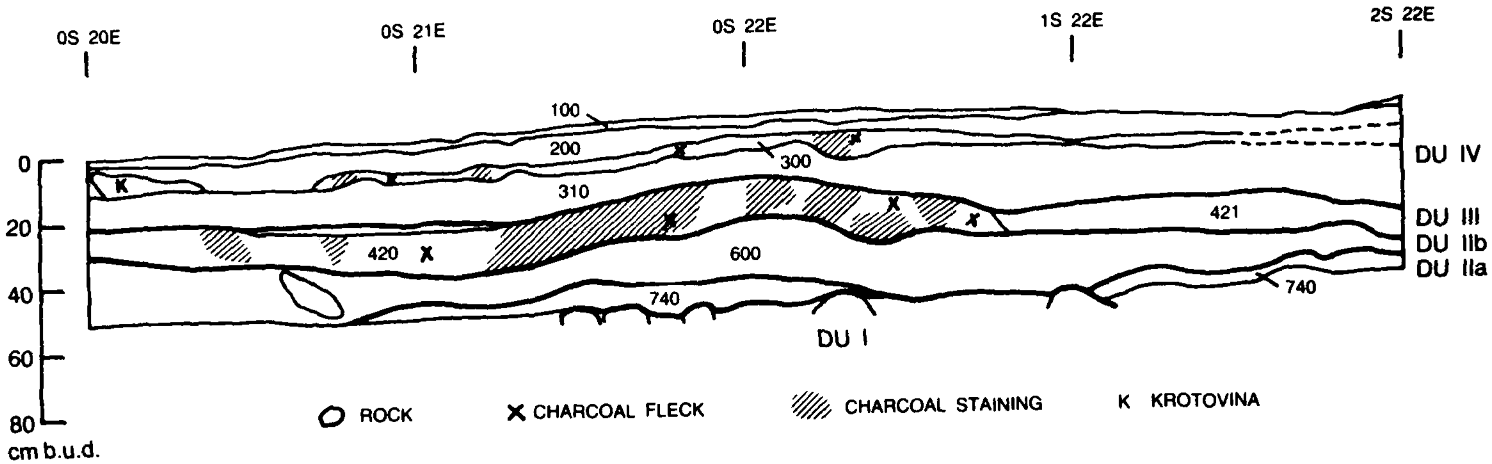


Figure 2-8. Detailed profile from 0S20E, 45-OK-18.

Column 3, DU II samples show the largest percentages of silt. Samples from DU I show large percentages of sand and those from Column 1 show more grain rounding. These characteristics are consistent with an alluvial origin. The extensive distribution of charcoal, bone, and organic material in Column 3 may indicate a greater amount of rodent activity in this area than in those sampled by the other columns.

Chemical properties also differ among the depositional units. Acidity generally decreases with depth. Although each column exhibits a slightly different pattern, soluble phosphate tends to have relatively stable, high values in DU III and DU IV, in contrast with DU I and DU II. The lowest exchangeable calcium values occur in DU III and DU IV, and coincide with those strata which have evidence of cultural alteration. Column 3 shows a more regular decrease in soluble phosphate and it has the highest pH values for all strata. These patterns may be related to the fact that the column also has the greatest amount of organic material. As mentioned above, rodent activity may have mixed sediments, and spread organic material, thereby affecting the chemical nature of the sediments.

In Column 1, two of the tephra samples show an interesting contrast. Sample 6 was taken from a compact clay loam lens 10 cm thick and 60 cm long. Tephra occurs throughout the site in this stratigraphic position. Sample 9, was taken from a lens 10 cm thick and 40 cm long. This is the largest of several small pockets on the border between DU III and DU IV, a place where tephra otherwise does not occur. The stratigraphers suggest that Sample 9 is a secondary deposit, possibly redeposited by rodents. However, analysis showed that the lenses are two different tephras--the lower, St. Helens Series Yn, and the upper, St. Helens Series P--in correct stratigraphic relationship.

CULTURAL ANALYTIC ZONES

Four analytic zones were assigned based on the location of cultural material within the depositional units. Separable peaks of cultural material occur in DU III and DU IV, and DU IIb, where the tephra is found. Excavation seldom proceeded beyond the upper surface of the lacustrine layer, but when it did extend into the sandy strata of DU II, occasional cultural materials were found. The four zones are generally sitewide although the deepest zone, Zone 4, does not occur in the eastern part of the site. Table 2-2 summarizes the stratigraphic definition, contents, and radiocarbon dates of each zone. Profiles from testing phase units also were zoned in order to associate radiocarbon dates and projectile points with the appropriate levels.

ZONE 4

Zone 4 includes all DU I sediments below the compact lacustrine layer. Since excavation sometimes stopped at the compact silt layer, these deposits were not always examined (Figure 2-9). Therefore, the sample from this zone is smaller than the others. The decision not to excavate these strata was made largely because of the high probability that the few cultural materials that were found had been displaced from other strata by rodents. However, it

Table 2-2. Analytic zones of 45-OK-18: stratigraphic definition, radiocarbon dates, and contents.

Zone	DU	Mode of Deposition	Dendrocorrected Radiocarbon Dates[1]	Excavated Volume (m^3)	Lithics	Bone		Shell[2]		FMR		Total # of Artifacts	Artifacts per m^3	# of Features
						#	wt(g)	#	wt(g)	#	wt(g)			
1	4	Aeolian		58.4	1,829	344	37	2	7	201	14,527	2,376	40.7	-
2	3	Aeolian and slope-wash	3383±394	59.0	3,525	1,949	198	13	80	597	63,530	6,084	103.1	3
3	2	Overbank and stillwater	3780±175	42.1	865	653	41	5	41	12	1,185	1,535	36.5	-
4	1	Columbia River Channel		7.8	54	115	11	-	2	-	-	169	21.7	-
Total				167.3	6,273	3,061	287	20	130	810	79,242	10,164	60.8	3

1 For more information, see Appendix A, Table A-1.
2 Shell count includes hinges only.

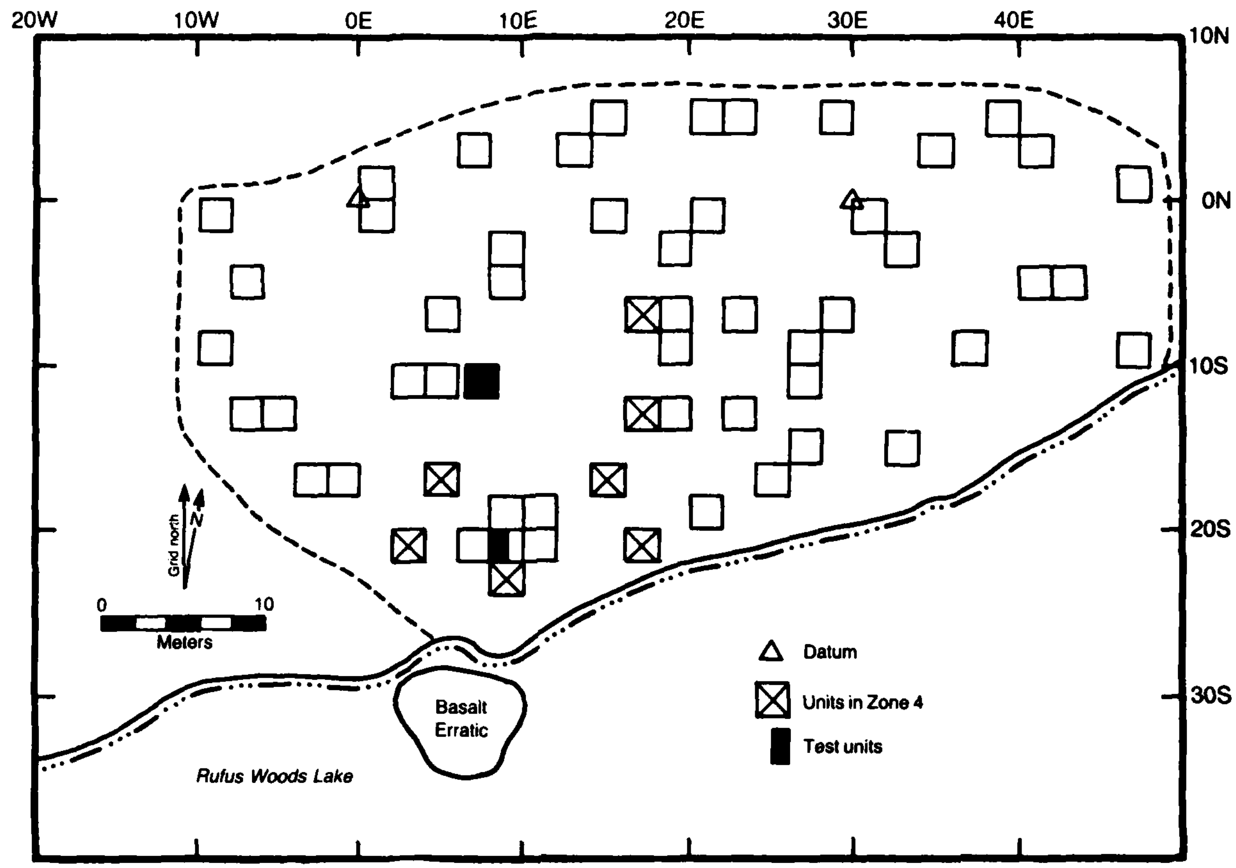


Figure 2-9. Occurrence of Zone 4, 45-OK-18. (Test units were not excavated into Zone 4.)

was designated as a separate zone since some material was found there. In contrast to the other three zones, Zone 4 contained bones but few lithics. No radiocarbon dates were obtained, but given overlying zone dates, it must pre-date 4000 B.P.

ZONE 3

Zone 3, which is comprised of a series of sandy loams grading downward to a compact silt and clay lacustrine deposit, is associated with DU II. This zone was not identified at the extreme northeastern margin of the site (Figure 2-10). Cultural materials are denser than those of Zone 4 but less dense than those of Zone 2 above. As in Zone 2, lithics comprise about 50% of the assemblage by number. This is consistent with the occurence of St. Helens Yn Series tephra, dated at 3,400 B.P., in the upper part of the zone. No features were observed. A radiocarbon date of 3780±175 B.P. was obtained from 10S8E in this zone during testing.

ZONE 2

Zone 2 corresponds to the lower loamy sand stratum, DU III, and was identified in all units at the site (Figure 2-11). This zone had the largest assemblage and is the only one with features. Its assemblage has a greater proportion of bone and a lower proportion of lithics (by number) than the assemblage of Zone 1. Zone 2 is clearly an **in situ** cultural occupation. A radiocarbon date of 3363±394 B.P. was obtained from unit 10S4E. The age of the zone is also bracketed by the overlying St. Helens Series P tephra (2,500 B.P.).

ZONE 1

Zone 1 is the deposit of cultural materials closest to the surface; it corresponds to DU IV, the uppermost stratum of loamy sand. Zone 1 can be identified across the entire site except in excavation unit 20S16E (Figure 2-12), a riverbank unit where the sediments apparently had been eroded before Chief Joseph Dam was built. Lithics predominate in this assemblage, constituting 75% of the materials recovered. While some fire-modified rock (FMR) was found, no features were associated with it. Plowing and pasturing apparently have altered the aeolian sediments considerably. The presence of historic artifacts in Zone 1 suggests that the cultural materials recovered from these sediments were disturbed by historic activities. No radiocarbon dates were obtained from Zone 1 and the cultural assemblage may date anywhere from about 3000 B.P. to historic times.

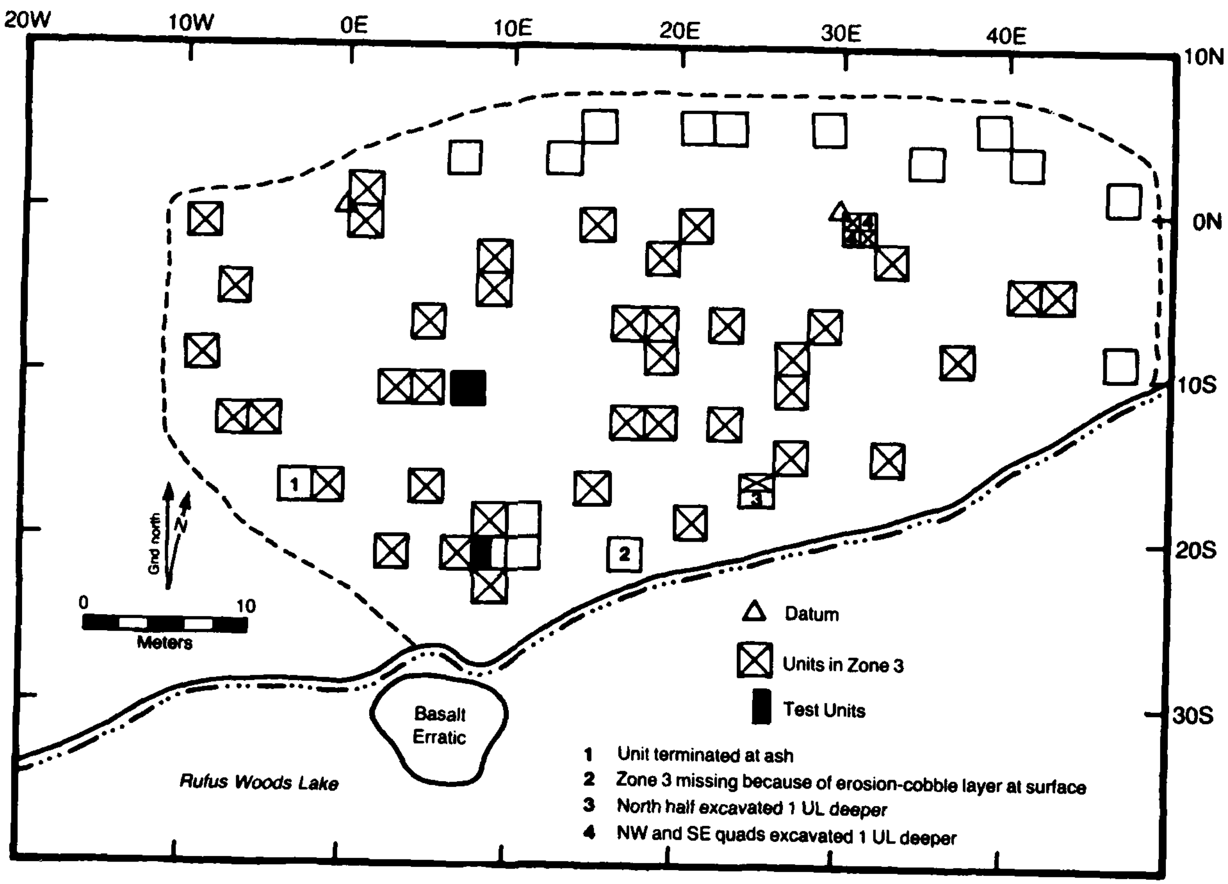


Figure 2-10. Occurrence of Zone 3, 45-Ok-18.

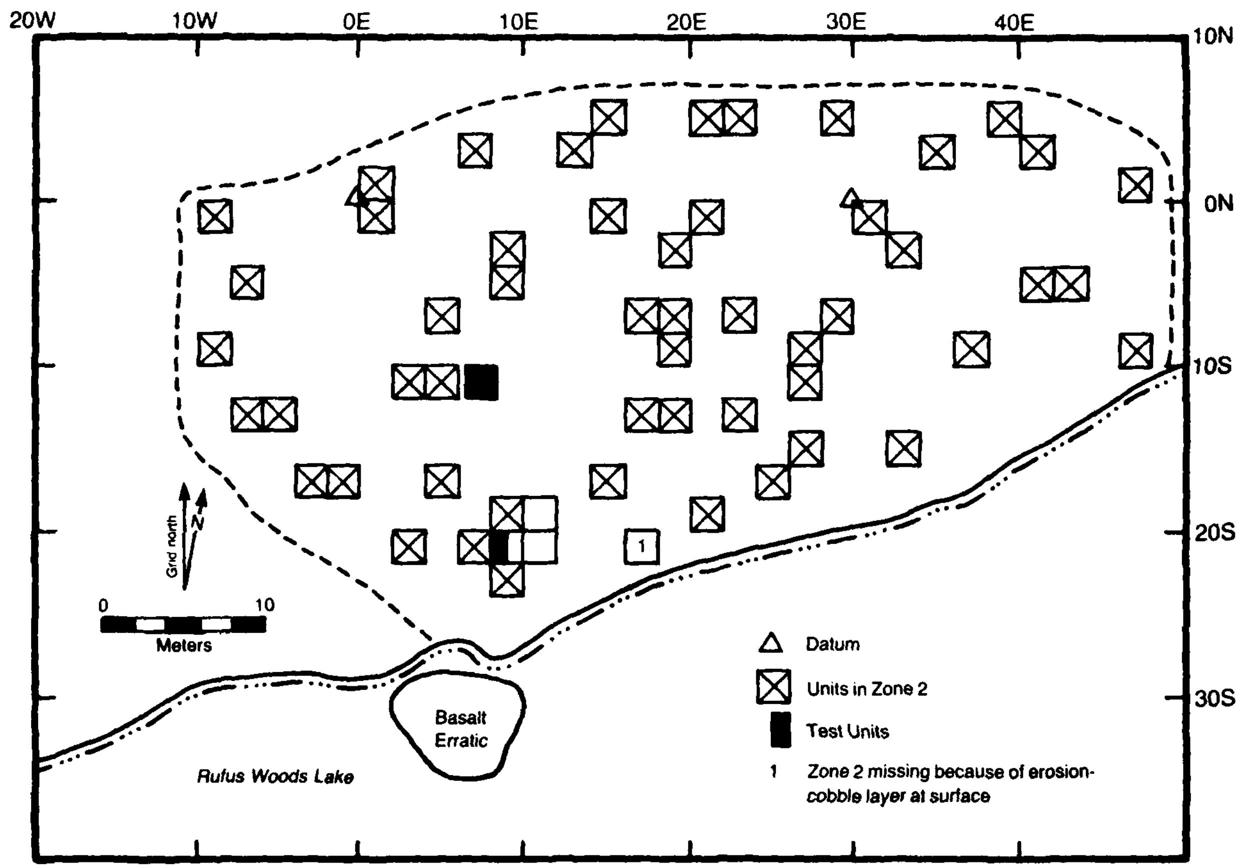


Figure 2-11. Occurrence of Zone 2, 45-OK-18.

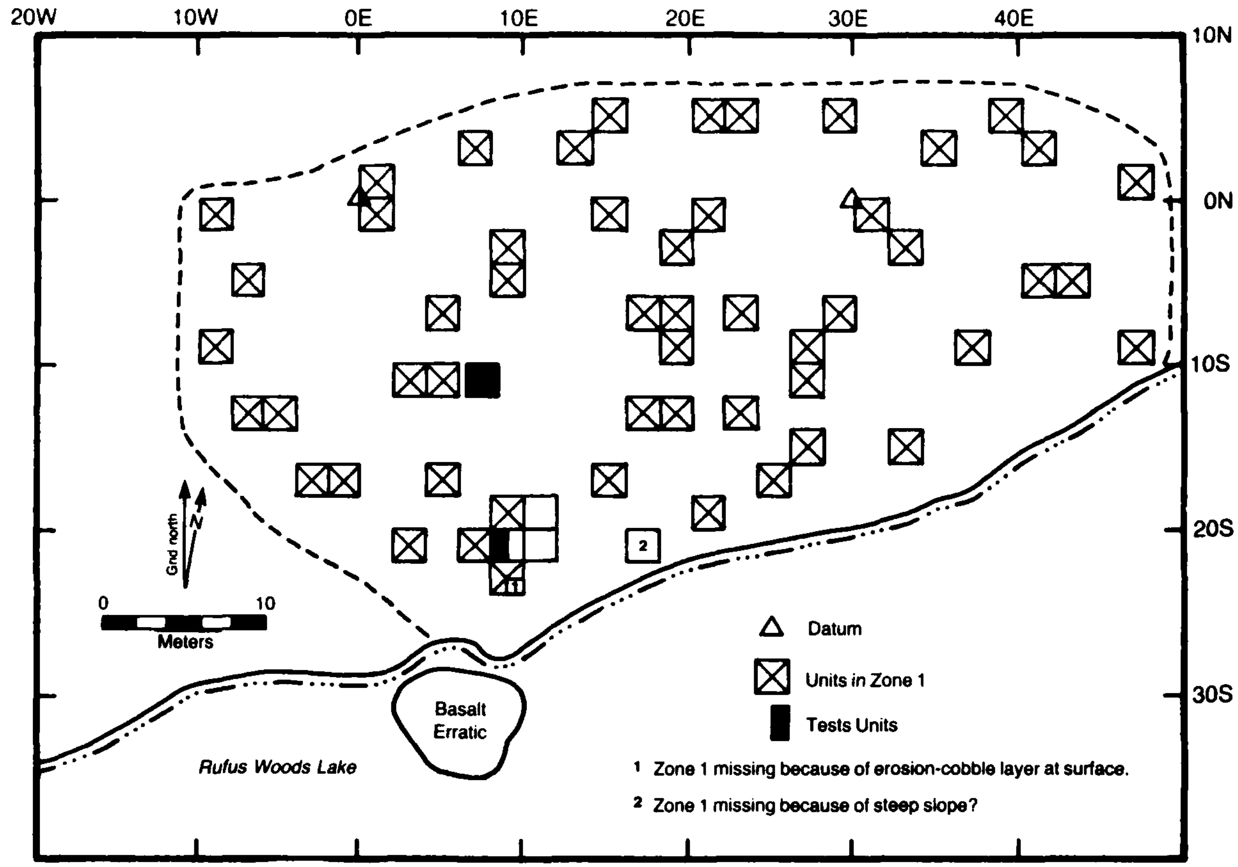


Figure 2-12. Occurrence of Zone 1, 45-OK-18.

3. ARTIFACT ANALYSES

This chapter presents data, discusses results, and suggests interpretations from analyses of artifacts recovered from 45-OK-18. The entire assemblage has been subjected to both technological and functional analysis. Technological analysis describes elements of manufacture, emphasizing raw materials and lithic reduction sequences. Functional analysis describes attributes of manufacture and wear used to infer how the tools were used. In addition, projectile points from the assemblage have been subjected to a stylistic analysis and classified according to form. The results of this analysis allow Rufus Woods Lake points to be compared with types established in other regions of the Columbia Plateau. Together, technological, functional, and stylistic analyses provide a basic description of artifacts collected at 45-OK-18 and highlight aspects of the collection of interest to researchers. The analyses are likewise a guide to the more complete data available in the project's computerized data base. Detailed descriptions of analytic procedures and their rationale are included in the project's research design (Campbell 1984d). All three analyses will be evaluated more fully in the synthesis report.

Analysis of artifact frequencies and stratigraphic data at 45-OK-18 identified four analytic zones (see Chapter 2). Data recovery yielded 10,264 artifacts, including 10,241 prehistoric and 21 historic artifacts (nails and staples). The artifact assemblage is divided into bone, shell, fire-modified rock (FMR), and lithics. Distribution of these categories by zone is shown in Table 2-2. Amounts of excavated matrix for the upper three zones are roughly equal, but excavation in Zone 4 was much more restricted. The table also shows the number of artifacts per cubic meter. Zone 2 yielded the highest artifact density by far, more than double that of Zones 1 and 3. The low density of artifacts in Zone 4 prompted an early end to investigation in this zone. Statistical manipulation of density data for the upper three zones indicates that density differences are not due to chance. Possible reasons for the varying densities are discussed in the final chapter of this report.

The three analyses in this chapter focus on lithic artifacts. Non-lithic artifacts have been classified only when specific descriptive elements apply. Because only three bone tools were found at 45-OK-18, a separate bone tool analysis was not done. Instead, the three objects are described and illustrated individually.

TECHNOLOGICAL ANALYSIS

Technological analysis of artifacts from this site involves five dimensions of classification: object type, material, condition, dorsal topography, and heat treatment (Table 3-1). The attributes of length, width, thickness, and weight supplement the five primary dimensions. Only object type material and dorsal topography are discussed in this section. The attributes of length, width, and thickness will be discussed. Other data can be found in project data base files.

All lithic objects except unmodified flakes and chunks were given formal type names during functional analysis. These names are based on traditionally accepted terms, not on functional analysis of manufacture and/or wear patterns (see Campbell 1984d for defining criteria). All data presented below, in this and the following sections, are sorted according to formal type designations.

Table 3-2 summarizes formal types by zone, providing basic background information for comparison with information about individual lithic industries. For easier reference and comparison, formal types are subdivided into groups: formed objects, worn and/or manufactured objects, miscellaneous objects, and debitage. Comparison of Table 3-2 with Table 2-2 shows that percentages of analyzed artifacts per zone differ. In Zone 1, 77.3% of the zone total shown in Table 3-A was analyzed; percentages for Zones 2, 3, and 4 are 58.3%, 56.9%, and 32.4%, respectively. The remainder of the materials in each zone consist of FMR, unmodified bone and shell, and other nonlithic objects.

Nine raw materials, plus bone and ochre, were identified during lithic analysis. Three of these--jasper, chalcedony, and petrified wood--are discussed jointly as "cryptocrystalline material" (CCS) because they occur naturally in the same, or very similar, situations, and fracture in the same manner. Basalt and fine-grained basalt are considered together for the same reason, while granite, bone, and ochre are grouped with the "indeterminates" because of their small numbers. Quartzite is divided into coarse-grained and fine-grained because the two types flake differently. Coarse-grained flakes into tablets while fine-grained does not. All quartzite referred to in this report is tabular.

Table 3-3 summarizes the distribution of material types by zone. Chi-square determinations between the three largest groups--CCS, quartzite, and the basalts--in Zones 1, 2, 3 shows that the difference in relative frequency in each zone is due to causes other than chance at the 0.995 level of confidence. By applying the same statistics to CCS and quartzite the same results at the same level of confidence are achieved. We have not subjected other materials to these tests because they occur in quantities too small for statistical analysis.

Table 3-4 shows CCS artifact types by zone. There are relatively few tabular knives and flakes in the CCS assemblage because CCS materials tend to fracture conchoidally and seldom produce tabular flakes. Cryptocrystalline objects apparently are easier to identify than those of other materials, resulting in relatively fewer indeterminate objects. Percentages of formed

Table 3-1. Technological dimensions.

DIMENSION I: OBJECT TYPE

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

DIMENSION II: RAW MATERIAL*

- Jasper
- Chalcedony
- Petrified Wood
- Obsidian
- Opal
- Quartzite
- Fine-grained quartzite
- Basalt
- Fine-grained basalt
- Silicized mudstone
- Argillite
- Granite
- Siltstone/mudstone
- Schist
- Graphite/molybdenite
- Bone/antler
- Ochre
- Shell
- Dentalium

DIMENSION III: CONDITION

- 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

- Definitely burned
- Dehydrated (heat treatment)

ATTRIBUTE I: WEIGHT

Recorded weight in grams

ATTRIBUTE II: LENGTH

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

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

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

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

Table 3-2. Formed object types by zone, 45-OK-18.

Formal Type		Zone 1	Zone 2	Zone 3	Zone 4	Total
Formed Object						
Projectile point		9	14	7	-	30
Projectile point base		3	4	1	-	8
Projectile point tip		6	10	2	-	18
Biface		13	14	7	1	35
Drill		1	2	-	-	3
Scraper		3	5	2		10
Tabular knife		15	30	2	-	47
Bead		37	79	11	-	127
Pointed bone object		1	-	-	-	1
Subtotal	N	88	158	32	1	279
	Col %	4.7	4.4	3.6	1.8	4.4
Worn/Manufactured Object						
Amorphously flaked object		1	-	-	-	1
Hammerstone		3	8	-	-	11
Large linear flake		-	1	1	-	2
Small linear flake		8	64	27	4	103
Indeterminate object		2	5	1	-	8
Formed bone object		-	1	-	-	1
Modified bone object		-	1	-	-	1
Unifacially retouched object		19	18	7	-	44
Bifacially retouched object		12	19	9		40
Utilized only object		59	116	25	1	201
Subtotal	N	104	233	70	5	412
	Col %	5.6	6.5	7.9	9.1	6.5
Miscellaneous						
Core		2	5	1	-	8
Resharpening flake		2	10	1	-	13
Ochre		1	3	-	-	4
Subtotal	N	5	18	2	-	25
	Col %	0.3	0.5	0.2	-	0.4
Debitage						
Conchoidal flake		1,380	2,746	684	43	4,853
Tabular flake		123	152	27	4	306
Chunk		162	267	67	2	498
Subtotal	N	1,665	3,165	778	49	5,657
	Col %	89.4	88.6	88.2	89.1	88.6
Total	N	1,862	3,574	882	55	6,373
	Col %	29.2	56.2	13.8	0.9	99.9

Table 3-3. Summary of materials, 45-OK-18.

Material Type		Zone 1	Zone 2	Zone 3	Zone 4	Total
Jasper, chalcedony, petrified wood	N	1,565	3,112	786	50	5,513
	Col %	84.0	87.0	89.2	90.0	86.5
Quartzite	N	146	192	32	4	374
	Col %	7.8	5.4	3.6	7.3	5.9
Fine-grained quartzite	N	17	15	8	-	40
	Col %	0.9	0.4	0.9	-	0.6
Basalt, Fine-grained basalt	N	90	176	34	-	300
	Col %	4.8	4.9	3.9	-	4.7
Obsidian	N	7	24	5	-	36
	Col %	0.4	0.7	0.6	-	0.6
Other	N	37	56	16	1	110
	Col %	2.0	1.6	1.8	1.8	1.7
Total	N	1,862	3,575	881	55	6,373
	Col %	99.9	100.0	100.0	100.0	100.0

objects, worn/manufactured objects, and detritus are surprisingly similar for each zone, even where small numbers of artifacts are involved, as in Zone 4. This homogeneity indicates a constancy through time in the site occupants' preference for certain formal types of cryptocrystalline objects.

Table 3-5 presents the metric attributes of cryptocrystalline conchoidal flakes by zone, so they may be compared with other industries. Flakes with maximum dimensions <1/4 in and broken flakes that could not be measured accurately are not included in this table. Average metric dimensions are similar among zones.

If we compare zone percentages of primary and secondary debitage (Table 3-6), including small flakes, we must conclude that little change through time took place at the site. We infer then that the cryptocrystalline industry remained relatively unchanged during the several occupations of 45-OK-18.

Table 3-7 shows the formal types of artifacts made of quartzite raw material. The formed object group includes only tabular knives. All tabular knives except one of CCS and two of indeterminate materials are made of quartzite. Since this material tends to fracture along straight, parallel planes, tabular flakes also occur in proportionally large numbers. The frequencies of retouched and utilized objects made from quartzite in relation to the total number of quartzite artifacts is surprisingly low. This low frequency of worn and/or manufactured objects indicates that quartzite was used mostly to make tabular knives at 45-OK-18.

Table 3-4. Cryptocrystalline Industry (jasper, chalcedony, and petrified wood), 45-OK-18.

Formal Type		Zone				Total	% of Formal Type[1]
		1	2	3	4		
Formed Object							
Projectile Point		7	10	5	-	22	73.3
Projectile Point Base		2	4	1	-	7	87.5
Projectile Point Tip		4	10	1	-	15	83.3
Biface		12	13	5	1	31	88.6
Drill		1	2	-	-	3	100
Scraper		2	5	2	-	9	90.0
Tabular Knife		1	-	-	-	1	2.1
Subtotal	N	29	44	14	1	88	31.5
	Col %	1.9	1.4	1.8	2.0	1.6	
Worn/Manufactured Object							
Amorphously Flaked Object		1	-	-	-	1	100
Large Linear Flake		-	1	-	-	1	50.0
Small Linear Flake		3	53	22	4	82	89.3
Indeterminate		2	3	-	-	5	62.5
Unifacially Retouched Object		19	18	6	-	43	97.7
Bifacially Retouched Object		11	16	9	-	36	90.0
Utilized Flake		57	112	24	1	194	96.5
Subtotal	N	98	208	61	5	372	90.3
	Col %	6.3	6.7	7.3	10.0	6.7	
Miscellaneous							
Core		1	5	1	-	7	87.5
Resharpening Blade		2	9	1	-	12	92.3
Debitage							
Conchoidal Flakes		1,280	2,539	645	42	4,556	93.9
Tabular Flakes		-	1	-	-	1	0.3
Chunks		155	256	64	2	477	95.8
Subtotal	N	1,435	2,846	709	44	5,034	89.0
	Col %	91.7	91.5	90.2	38.0	91.3	
Total		1,565	3,112	786	50	5,513	86.5

[1] See Table 3-2 for formal type total.

Table 3-5. Metric attributes of cryptocrystalline conchoidal flakes by zone, 45-OK-18.

Attribute (mm)	Statistic	Zone 1	Zone 2	Zone 3	Zone 4	Total[1]
Length	$\bar{x}$	9.0	9.4	9.3	8.9	9.24
	s.d.	3.7	4.1	3.6	3.3	3.9
	N	615	1,137	308	20	2,080
Width	$\bar{x}$	8.7	8.8	8.8	9.7	8.81
	s.d.	3.8	4.1	4.0	6.2	4.0
	N	615	1,135	308	20	2,078
Thickness	$\bar{x}$	1.96	2.03	1.93	1.93	2.00
	s.d.	1.12	1.25	1.13	2.01	1.21
	N	616	1,135	308	20	2,079

[1] Flakes less than 1/4-in deleted.

Table 3-6. Primary and secondary CCS debitage by zone, 45-OK-18.

Kind of Debitage		Zone 1	Zone 2	Zone 3	Zone 4	Total
Secondary:						
Flakes without	N	1,053	2,009	533	33	3,623
Cortex	Col %	73.4	70.6	75.2	75.0	42.1
Primary:						
Flakes with	N	171	297	75	2	545
Cortex and Chunks	Col %	11.9	10.7	10.6	4.5	10.8
Indeterminate	N	211	540	101	9	861
Flakes	Col %	14.7	19.0	14.2	20.5	17.1
Total		1,435	2,846	709	44	5,034
Debitage	N	193	504	93	10	800
< 1/4-in	Col %	13.4	17.7	13.1	22.7	15.9
Debitage	N	1,242	2,342	616	34	4,234
> 1/4-in	Col %	86.6	82.3	86.9	77.3	84.1
Total		1,435	2,846	709	44	5,034

Table 3-7. Quartzite Industry, 45-OK-18.[1]

Formal type		Zone 1	Zone 2	Zone 3	Zone 4	Total	% of Formal Type[2]
Formed Object							
Tabular Knife	N	13	29	2	-	44	93.6
	Col %	8.9	15.1	6.3		11.8	15.8%
Worn/Manufactured Object							
Hammerstone		1	-	-	-	1	9.1
Small Linear Flake		-	1	-	-	1	1.0
Indeterminate		-	1	-	-	1	12.5
Unifacially Retouched Object		-	-	1	-	1	2.3
Utilized Flake		-	2	-	-	2	1.0
Subtotal	N	98	208	61	5	372	90.3
	Col %	6.3	6.7	7.3	10.0	6.7	
Debitage							
Conchoidal Flakes		6	9	3	-	18	0.4
Tabular Flakes		123	150	26	4	303	99.1
Chunks		3	-	-	-	3	0.6
Subtotal	N	132	159	29	4	324	5.7
	Col %	90.4	82.8	90.6		86.6	
Total		146	192	32	4	374	5.9

[1] Fine-grained quartzite excluded.
[2] See row totals, Table 3-2 for formal type totals.

The metric attributes of quartzite objects shown in Figure 3-7 include measurements on both conchoidal and tabular flakes. Length and width, defined on the basis of striking platforms and bulbs of percussion, could not be taken on tabular flakes. Large differences in thickness occur only in Zones 3 and 4, where numbers of objects are small. We attribute this variation, then, to sample size differences.

Table 3-9 presents data about primary and secondary quartzite debitage. Frequencies of debitage types and sizes change relatively little except in Zone 4. We again attribute this to variations in sample size.

As shown in Table 3-10, few artifacts are made of fine-grained quartzite--only a small number of worn/manufactured objects and detritus. Each of these categories represents less than 1% of the analyzed assemblage. No formed tools, cores, or resharpening flakes are present. Tables 3-11 and 3-12 present metric and debitage data for fine-grained quartzite. These tables are offered only for comparative purposes since the numbers are so small.

Table 3-8. Metric attributes of quartzite conchoidal and tabular flakes by zone, 45-OK-18.[1]

Attribute (mm)	Statistic	Zone 1	Zone 2	Zone 3	Zone 4	Total
Length	$\bar{x}$	11.7	8.9	-	-	9.9
	s.d.	3.4	2.7	-	-	3.1
	N	4	7	-	-	11
Width	$\bar{x}$	11.2	9.3	-	-	10.0
	s.d.	4.5	1.4	-	-	2.9
	N	4	7	-	-	11
Thickness	$\bar{x}$	2.81	2.61	2.21	3.34	2.63
	s.d.	1.87	1.96	1.77	3.32	1.92
	N	136	177	29	4	346

[1] Flakes less than 1/4 inch deleted. Length and width taken on conchoidal flakes only.

Table 3-9. Primary and secondary quartzite debitage, 45-OK-18.

Kind of Debitage		Zone 1	Zone 2	Zone 3	Zone 4	Total
Secondary						
Flakes with cortex	N	98	111	23	3	235
	Col %	74.2	69.8	79.3	75.0	72.4
Primary:						
Flakes with	N	18	19	2	1	40
cortex and chunks	Col %	13.6	11.9	6.9	25.0	12.3
Indeterminate	N	16	29	4	-	49
flakes	Col %	12.1	18.2	13.8	-	15.1
Total		132	159	29	4	324
Debitage	N	4	11	1	-	16
< 1/4-in	Col %	3.0	6.9	3.4	-	4.9
Debitage	N	128	148	28	4	8
> 1/4-in	Col %	97.0	93.1	96.6	100.0	95.1
Total		132	159	29	4	324

Table 3-10. Fine-grained quartzite industry, 45-OK-18.

Formal Type		Zone				Total	% Formal Type[2]
		1	2	3	4		
Worn/Manufactured Object							
Hammerstone		1	-	-	-	1	9.1
Small Linear Flake		-	-	1	-	1	1.0
Utilized Only Object		1	-	-	-	1	0.5
Subtotal	N	2	-	1	-	3	0.7
	Col %	11.8	-	12.5	-	7.5	
Debitage							
Conchoidal Flakes		15	13	5	-	33	0.7
Tabular Flakes		-	-	1	-	1	0.3
Chunks		-	2	1	-	3	0.6
Subtotal	N	15	15	7	-	37	0.7
	Col %	88.2	100.0	87.5	-	92.5	
Total		17	15	8	0	40	0.6

[1] See row totals, Table 3-2.

Table 3-11. Metric attributes of fine-grained quartzite conchoidal flakes by zone, 45-OK-18.[1]

Attribute (mm)	Statistic	Zone				Total[1]
		1	2	3	4	
Length	$\bar{x}$	13.8	9.7	8.0		11.5
	s.d.	7.1	3.9	-		5.8
	N	9	8	2	-	19
Width	$\bar{x}$	14.8	12.5	10.0		13.5
	s.d.	6.4	6.7	-		6.3
	N	9	8	1	-	18
Thickness	$\bar{x}$	3.34	2.04	1.70		2.67
	s.d.	1.63	1.38	-		1.59
	N	9	8	1	-	18
Total		19	18	3	-	40

[1] Flakes less than 1/4-in deleted.

Table 3-12. Primary and secondary fine-grained quartzite debitage, 45-OK-18.

Kind of Debitage		Zone				Total
		1	2	3	4	
Secondary:						
Flakes without	N	13	7	4	-	24
cortex	Col %	86.6	46.7	57.1	-	64.9
Primary:						
Flakes with	N	2	4	1	-	7
Cortex and Chunks	Col %	13.3	26.7	14.3	-	18.9
Indeterminate	N	-	4	2	-	6
Flakes	Col %	-	26.7	28.6	-	16.2
Total		15	15	7	-	37
Debitage	N	-	1	1	-	2
< 1/4-in	Col %	-	6.7	14.3	-	5.4
Debitage	N	15	14	6	-	35
> 1/4-in	Col %	100.0	93.3	85.7	-	94.6
Total		15	15	7	-	37

Table 3-13 presents information on both basalt and fine-grained basalt artifacts. We have combined the two kinds of basalt because of their similar fracturing characteristics and the small size of each artifact group. However, these two materials may have had different sources. A basalt erratic is present at the site, but no fine-grained material was found near it. Of the basalt objects, 10.3% are basalt and 89.7% are fine-grained basalt.

Basalt projectile points constitute a large percentage of the total number of projectile points, but no drills, scrapers, and tabular knives are of basalt. The absence of drills from the basalt assemblage may be due to sample size, which is very small. Tabular knives are restricted primarily to the quartzite industry. No unifacially retouched objects and only a few utilized objects of basalt were found, and basalt debitage is slightly underrepresented in comparison to the lithic assemblage as a whole. Of the 127 beads at the site, 118 were recorded as basalt. Indentification of material on these small, ground artifacts was difficult and it is possible that many of the beads are actually made of a somewhat platy, fine grained metamorphic which is softer than basalt.

Table 3-14 presents the metric attributes of basalt conchoidal flakes, and Table 3-15 shows primary and secondary basalt detritus. In both cases, little variation occurs between zones, except where absolute numbers of objects are very small.

Table 3-13. Basalt industry (including fine-grained basalt), 45-OK-18.

Formal Type	Basalt Type[1]	Zone 1	Zone 2	Zone 3	Zone 4	Row Total	% of Formal Type[2]
Formed Objects							
Projectile Point	9	2	4	2	-	8	26.7
Projectile Point Base	8	1	-	-	-	1	12.5
Projectile Point Tip	9	2	-	1	-	3	16.7
Biface	9	-	1	2	-	3	8.6
Beads	9	37	72	9	-	118	92.9
Subtotal	N	42	72	14	-	133	477.0
	Col %	46.7	43.8	41.2	-	44.3	
Worn/maufactured objects							
Hammerstone	8	-	2	-	-	2	18.2
Large Linear Flake	9	-	-	1	-	1	50.0
Small Linear Flake	8	-	1	-	-	1	5.8
	9	-	3	2	-	5	
Bifacially Retouched	8	-	1	-	-	1	10.0
Objects	9	1	2	-	-	3	
Utilized Objects	8	-	1	-	-	1	1.0
	9	1	-	-	-	1	
Subtotal	N	2	10	3	-	15	
	Col %	2.2	5.7	8.8		3.6	
Miscellaneous							
Core	8	1	-	-	-	0.3	12.5
Debitage							
Conchoidal Flakes	8	6	13	2	-	21	3.0
	9	36	72	15	-	123	
Chunks	8	2	1	-	-	3	1.4
	9	1	3	-	-	4	
Subtotal	N	45	89	17	-	151	2.7
	Col %	50.0	50.6	50.0	-	50.3	
Total		90	176	34	-	300	4.7

[1] 8=Basalt; 9=F-G Basalt.
[2] See row totals Table 3-2 for formal type totals.

Table 3-14. Metric attributes of basalt conchoidal flakes by zone, 45-OK-18.[1]

Attribute (mm)	Statistic	Zone 1	Zone 2	Zone 3	Zone 4	Total
Length	$\bar{x}$	11.30	12.90	8.30		12.1
	s.d.	7.3	17.8	3.9		14.4
	N	23	43	6	-	72
Width	$\bar{x}$	13.80	12.50	10.00		12.74
	s.d.	10.3	13.1	5.2		11.7
	N	23	43	6	-	72
Thickness	$\bar{x}$	2.38	1.93	1.87		2.07
	s.d.	1.94	1.76	1.06		1.77
	N	23	43	6	-	72

[1] Flakes less than 1/4 inch deleted.

Table 3-15. Primary and secondary basalt debitage, 45-OK-18.

Kind of Debitage		Zone 1	Zone 2	Zone 3	Zone 4	Total
Secondary:						
Flakes without	N	39	71	14	-	124
Cortex	Col %	86.7	79.8	82.4	-	82.1
Primary:						
Flakes with	N	4	7	1	-	12
Cortex and Chunks	Col %	8.9	7.9	5.9	-	7.9
Indeterminate	N	2	11	2	-	15
Flakes	Col %	4.4	12.4	11.8	-	9.3
Total		45	89	17	-	151
Debitage	N	-	9	1	-	10
< 1/4-in	Col %	-	10.1	5.9	-	6.6
Debitage	N	45	80	16	-	141
> 1/4-in	Col %	100.0	89.9	94.1	-	93.4
Total		45	89	17	-	151

Data on obsidian artifacts are shown in Table 3-16. We present this material separately despite the small absolute numbers because obsidian does not occur naturally in the project area; the closest known source is in central Oregon. Table 3-16 shows that obsidian artifacts are restricted to a small number of formal types.

Table 3-16. Obsidian Industry, 45-OK-18.

Formal Type		Zone 1	Zone 2	Zone 3	Zone 4	Total	% of Formal Type[1]
Formed Object							
Biface	N	-	1	-	-	1	2.9
	Col %		4.2				
Worn Manufactured Object							
Small Linear Flake	N	-	1	-	-	1	1.0
	Col %		4.2				
Debitage							
Conchoidal Flakes	N	7	22	5	-	34	0.75
	Col %	100.0	91.7	100.0			
Total		7	24	5	-	36	0.65 of Analyzed assemblage

[1] See row totals, Table 3-2.

Table 3-17 presents metric attributes of obsidian objects. Conchoidal flakes of obsidian are relatively large compared to flakes of other materals. Primary and secondary debitage data in Table 3-18 show that neither primary flakes nor flakes less than 1/4 in in size were found. While we would expect to find no primary flakes the absence of very small flakes is unexpected. Once again, small sample size makes sampling error probable.

Table 3-17. Metric attributes of obsidian conchoidal flakes by zone, 45-OK-18.[1]

Attribute (mm)	Statistic	Zone 1	Zone 2	Zone 3	Zone 4	Total
Length	$\bar{x}$	7.70	10.30	6.00		9.40
	s.d.	2.10	5.30	-		4.70
	N	3	9	1	-	13
Width	$\bar{x}$	7.30	7.10	8.0		7.20
	s.d.	0.6	2.1	-		1.80
	N	3	9	1	-	13
Thickness	$\bar{x}$	1.20	1.44	0.60		1.32
	s.d.	0.40	0.75	-		0.69
	N	3	9	1	-	13

[1] Flakes less than 1/4 inch deleted.

Table 3-18. Primary and secondary obsidian debitage, 45-OK-18.

Kind of Debitage		Zone 1	Zone 2	Zone 3	Zone 4	Total
Secondary:						
Flakes without Cortex	N	5	22	5	-	32
	Col %	71.4	100.0	100.0	-	94.1
Indeterminate Flakes	N	2	-	-	-	2
	Col %	28.6	-	-	-	5.9
Total	N	7	22	5	-	34

[1]No flakes < 1/4 in. No primary debitage.

DISCUSSION

The relative frequency of basalt changes very little among the zones (Table 3-2). CCS objects decrease slightly in frequency from Zone 3 through Zone 1 while quartzite objects increase in frequency.

Table 3-19 summarizes the formal types of each lithic industry. CCS and basalt industries provided raw materials for the greatest number of formal types as well as the greatest number of formed objects. Quartzite was used exclusively for the manufacture of tabular knives. Change in the relative frequencies of CCS and quartzite through time, seems to represent an increased preference for quartzite tabular knives from Zone 3 through Zone 1. The percentage of CCS formed objects is rather low in comparison with the relative frequency of total CCS objects in the assemblage, as shown by the bottom row in Table 3-19.

Comparison of worn/manufactured objects other than formed objects shows that those of CCS are most numerous and diverse. Basalt, quartzite, and obsidian objects follow in absolute frequency and diversity. The figures for CCS seem high while those for quartzite seem low in relation to their relative frequencies in the total assemblage. This probably results from the many small, linear flakes and retouched and utilized objects in the CCS group, all of which require thinly and conchoidally fracturing raw materials. CCS materials have these characteristics while quartzite does not. Basalt is intermediate in fracturing characteristics.

The few cores recovered at 45-OK-18 suggest that raw materials brought to the site had been converted to blanks or preforms at quarry sites. Small chunks of raw material, except tabular quartzite, probably occurred naturally at the site and were converted into core tools. Coarse-grained quartzite is the exception. Core tools made from it are very hard to recognize because coarse-grained quartzite breaks into tablets naturally.

The relative frequency of debitage of each kind of raw material corresponds rather closely to the relative frequency of artifacts of each kind in the assemblage. This is not unexpected, since debitage (except in the basalt assemblage) makes up by far the largest percentage of each material.

Table 3-19. Summary of formal types by lithic industry, 45-OK-18.

Formal Type	Industry												Total	
	CCS		Quartzite		FGQ		Basalt		Obsidian		Other			
	N	Row %	N	Row %	N	Row %	N	Row %	N	Row %	N	Row %	N	Row %
Formed Objects														
Projectile point	22	73.3	-	-	-	-	8	26.7	-	-	-	-	30	100.0
Projectile point base	7	87.5	-	-	-	-	1	12.5	-	-	-	-	8	100.0
Projectile point tip	15	83.3	-	-	-	-	3	16.7	-	-	-	-	18	100.0
Biface	31	86.6	-	-	-	-	3	8.6	1	2.9	-	-	35	100.1
Drill	3	100.0	-	-	-	-	-	-	-	-	-	-	3	100.0
Scraper	9	90.0	-	-	-	-	-	-	-	-	1	10.0	10	100.0
Tabular knife	1	2.1	44	93.6	-	-	-	-	-	-	2	4.3	47	100.0
Bead	-	-	-	-	-	-	118	92.9	-	-	9	7.1	127	100.0
Subtotal	88	31.7	44	15.8	-	-	133	47.8	1	0.4	12	4.3	78	100.0
Worn/Manufactured Objects														
Amorphously flaked object	1	100.0	-	-	-	-	-	-	-	-	-	-	1	100.0
Hammerstone			1	9.1	1	9.1	2	18.2			7	63.6	11	100.0
Large Linear Flake	1	50.0	-	-	-	-	1	50.0	-	-	-	-	2	100.0
Small linear flake	92	89.3	1	1.0	1	1.0	6	5.8	1	1.0	1	1.9	103	100.0
Indeterminate object	5	62.5	1	12.5	-	-	-	-	-	-	2	25.0	8	100.0
Unifacially retouched object	43	97.7	1	2.3	-	-	-	-	-	-	-	-	44	100.0
Bifacially retouched object	36	90.0	-	-	-	-	4	10.0	-	-	-	-	40	100.0
Utilized only object	194	96.5	2	1.0	1	0.5	2	1.0			2	1.0	201	100.0
Subtotal	372	90.7	6	1.5	3	0.7	15	3.7	1	0.2	13	3.2	410	100.0
Miscellaneous														
Core	7	87.5	-	-	-	-	1	12.5	-	-	-	-	8	100.0
Resharpening flake	12	92.3	-	-	-	-	-	-	-	-	1	7.7	13	100.0
Subtotal	19	90.5	-	-	-	-	1	4.8	-	-	1	4.8	21	100.1
Debitage														
Conchoidal flake	4,556	93.9	18	0.4	33	0.7	144	3.0	34	0.7	68	1.4	4,853	100.0
Tabular flake	1	0.3	303	99.1	1	0.3					1	0.3	306	100.0
Chunk	477	95.8	3	0.6	3	0.6	7	1.4			8	1.6	498	100.0
Subtotal	5,034	89.0	324	5.7	37	0.7	151	2.7	34	0.6	77	1.4	5,657	100.0
Total	5,513	86.6	374	5.9	40	0.6	300	4.7	36	0.6	103	1.6	6,366	100.0

Table 3-20 summarizes metric attributes by lithic industry. Because of the great difference in number of specimens between industries, these comparisons are tenuous. At best, trends for comparison with data from other sites can only be suggested here. Obsidian and CCS flakes are very thin and relatively narrow in relation to length. Basalt flakes tend to be long and wide but also relatively thin. Both types of quartzite flakes are long, wide and thick. These metric attributes suggest that these are differences in formal types and functions among raw materials.

Table 3-20. Summary of metric attributes of debitage by lithic industry, 45-OK-18.

Attribute (mm)	Statistic	Cryptocrystalline	Quartzite	Fine-grained Quartzite	Basalt	Obsidian
Length	$\bar{x}$	9.2	9.9	11.5	12.1	9.4
	s.d.	3.9	3.1	5.8	14.4	4.7
	N	2,080	11	19	72	13
Width	$\bar{x}$	8.8	10.0	13.5	12.7	7.2
	s.d.	4.0	2.9	6.3	11.7	18
	N	2,078	11	18	72	13
Thickness	$\bar{x}$	2.00	2.63	2.67	2.07	1.32
	s.d.	1.21	1.92	1.59	1.77	0.69
	N	2,079	346	18	72	13

Table 3-21 summarizes debitage data by lithic industry. Again, small absolute numbers of objects in several of the categories introduce errors based on sample size, and only trends can be suggested. We assume that primary debitage results from the initial trimming of nodules of raw materials by prehistoric flintknappers, while secondary debitage results from the manufacture of preforms and blanks. Tertiary debitage is the end product of finishing blanks into formed objects. We consider flakes smaller than 1/4 in as a rough index of formed object production. By comparing the percentages of these three kinds of debitage we can make inferences about the flintknapping process at the site. The table shows that no initial trimming of obsidian nodules took place. Fine-grained quartzite nodules were trimmed more than the nodules of any other material. The low percentage of basalt primary decortation flakes may reflect our difficulty in recognizing basalt cortex since so many chunks of basalt are found near the basalt erratic at the site. The relatively high frequency of CCS primary debitage suggests that CCS raw material was available near the site, and that nodules were brought to the site and trimmed.

Percentage frequencies of tertiary debitage indicate that no quartzite objects were manufactured at the site while a relatively large number of CCS objects were produced. The low frequencies of the other raw materials suggest that tools may have been manufactured primarily near their source.

All materials except obsidian may have been procured from sources at or near the site. Quartzite and fine-grained quartzite occur as river cobbles along the beaches of the Columbia River. The erratic just south of the site may have been a source of the coarse-grained basalt, although we do not know if it is the right quality for flintknapping. Fine-grained basalt and regular basalt may be available in river gravels and in basalt outcrops on the south wall of the canyon across the river from the site. Cryptocrystalline silicates may also be available there.

Obsidian, then, is the only material that definitely had to be transported a long distance. (This is also probably true for petrified wood, which we did not look at separately in this report.) Table 3-21 reveals that primary reduction of this material did not take place at the site. Two of the obsidian flakes are so fragmented that we cannot determine the presence of cortex. The remaining 34 flakes are secondarily detached material. The absence of flakes <1/4 in suggests that formed objects of obsidian were not manufactured at 45-OK-18, although the smallness of the sample size must temper that conclusion. The presence of a few relatively large conchoidal flakes hints that an intermediate step of reduction may have taken place. No evidence of the resharpening of obsidian objects has been found.

Basalt secondary debitage has the second highest relative frequency, but the sample size is small, and percentages are not greatly different from those of other materials. Since only CCS debitage occurs in numbers sufficiently large enough so that the sample size is trustworthy, no comparisons between materials are possible. The data do indicate that the site occupants primarily reduced all materials except obsidian at the site and produced formed objects from them. Apparently, only CCS objects were resharpened.

FUNCTIONAL ANALYSIS

Functional analysis of artifacts involves two different groups of dimensions: those that describe entire objects and those that describe individual areas of wear on each object. Three dimensions apply to the first group: utilization and/or modification; type of manufacture (where applicable); and manufacture disposition (describing the extent of manufacture) (Table 3-22). Seven dimensions describe wear areas on objects: condition of wear (whether worn area on broken objects is complete or partial); the relationship of wear to manufacture; the kind of wear; the location of wear on an object; the shape of worn area; the orientation of wear; and, the edge angle of each wear area (Table 3-22). The following analysis describes the worn and/or modified objects from the upper three zones at 45-OK-18. Of the six modified objects from Zone 4, only one exhibits a wear area.

Tables 3-23 and 3-24 show relationships between presence of wear/manufacture and kind of manufacture for formed objects and all other worn and/or manufactured objects, respectively. For our analyses, we have limited the definition of manufacture to the production of an object for a specific function. Objects such as cores and linear flakes which are the result, but not the sought-after end product, of the lithic reduction sequence, are thus considered "manufactured." Two tabular knives that exhibit no manufacture are included in Table 3-23 because they were split off quartzite cobbles in such a way that they could be used without further shaping. Other than the two

Table 3-21. Summary of primary and secondary *debitage* by lithic industry, 45-OK-18.

Debitage	Industry												Total	
	CCS		Quartzite		F-G Quartz		Basalt		Obsidian		Other			
	N	Col %	N	Col %	N	Col %	N	Col %	N	Col %	N	Col %	N	Col %
Primary: Flakes with Cortex and Chunks	545	10.8	40	12.3	7	18.9	12	7.8	-	-	12	15.6	616	10.9
Secondary: Flakes without Cortex	3,628	72.1	235	72.5	24	64.9	124	82.1	32	94.1	50	64.9	4,093	72.4
Cortex Indeterminate	861	17.1	49	15.1	6	16.2	15	9.9	2	5.9	15	19.5	948	16.8
Total	5,034	100.0	324	99.9	37	100.0	151	99.9	34	100.0	77	100.0	5,657	100.1
Debitage < 1/4-in	800	15.9	16	4.9	2	5.4	10	6.6	-	-	2	2.6	830	14.7
Debitage > 1/4 in	4,234	84.1	308	95.1	35	94.6	141	93.4	34	100.0	75	97.4	4,827	85.3
Total	5,034	100.0	324	100.0	37	100.0	151	100.0	34	100.0	77	100.0	5,657	100.0

Table 3-22. Functional dimensions.

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

Table 3-23. Presence of wear/manufacture and kind of manufacture on formed objects, 45-OK-18.

Formal Type	Wear/ Manufacture[1]	Kind of Manufacture[2]												Total
		Zone									Total			
		1			2			3						
		1	2	9	1	2	9	1	2	9	1	2	9	
Projectile Point Base	3	-	4	-	-	8	-	-	5	-	-	17	-	17
	4	-	5	-	-	6	-	-	2	-	-	13	-	13
														30
Projectile Point Base	3	-	1	-	-	4	-	-	-	-	-	5	-	5
	4	-	2	-	-	-	-	-	1	-	-	3	-	3
														8
Projectile Point Tip	3	-	5	-	-	9	-	-	1	-	-	15	-	15
	4	-	1	-	-	1	-	-	1	-	-	3	-	3
														18
Biface	3	-	7	-	-	8	-	-	5	-	-	20	-	20
	4	-	6	-	-	6	-	-	2	-	-	14	-	14
														34
Drill	4	-	1	-	-	2	-	-	-	-	-	-	-	3
Scraper	4	-	3	-	-	4	-	-	2	-	-	9	-	9
	5	-	-	-	-	1	-	-	-	-	-	1	-	1
														10
Tabular Knife	2	-	1	-	-	1	-	-	-	-	-	2	-	2
	3	-	-	-	-	4	-	-	1	-	-	5	-	5
	4	-	14	-	-	25	-	-	1	-	-	40	-	40
														47
Bead	5	-	-	37	-	-	79	-	-	11	-	-	127	127
Pointed Bone Fragment	5	-	-	-	-	-	1	-	-	-	-	-	1	1
Total	2	1	-	-	1	-	-	-	-	-	2	-	-	2
	3	-	17	-	-	33	-	-	12	-	-	62	-	62
	4	-	32	-	-	44	-	-	9	-	-	85	-	85
	5	-	-	37	-	-	80	-	-	11	-	1	128	129
Total	N	1	49	37	1	77	80	-	21	11	2	148	128	278
	%	1.1	56.3	42.5	0.6	48.6	50.6	-	65.6	34.4	0.7	50.2	46.0	100.0

1 Presence of wear/manufacture
2. Wear only
3. Manufacture only
4. Wear and manufacture
5. Indeterminate utilized/manufactured

2 Kind of Manufacture
1. None
2. Chipping
9. Not applicable/indeterminate

Table 3-24. Presence of wear/manufacture and kind of manufacture, other than formed objects, 45-OK-18.

Formal Type	Wear/ Manufacture[1]	Kind of Manufacture[2]									Total			Total
		Zone												
		1			2			3						
		1	2	9	1	2	9	1	2	9	1	2	9	
Amorphously flaked object	1	1	-	-	-	-	-	-	-	-	1	-	-	1
Hammerstone	2	3	-	-	7	-	-	-	-	-	10	-	-	10
	5	-	-	-	-	-	1	-	-	-	-	-	1	12
Large linear flake	1	-	-	-	2	-	-	-	-	-	1	-	-	1
	2	-	-	-	1	-	-	1	-	-	1	-	-	1
														2
Small linear flake	1	8	-	-	61	-	-	26	-	-	95	-	-	95
	2	-	-	-	2	-	-	1	-	-	3	-	-	3
	6	-	-	-	-	-	1	-	-	-	-	-	1	1
														99
Core	1	2	-	-	4	-	-	-	-	-	6	-	-	6
	3	-	-	-	-	-	-	-	1	-	-	1	-	1
	4	-	-	-	-	1	-	-	-	-	-	1	-	1
														8
Resharpening flake	1	-	-	-	-	2	-	-	-	-	-	2	-	2
	3	-	-	-	-	7	-	-	1	-	-	8	-	8
	4	-	1	-	-	1	-	-	-	-	-	2	-	2
	5	-	-	1	-	-	-	-	-	-	-	-	1	1
														13
Formed bone object	5	-	-	-	-	-	1	-	-	-	-	-	1	1
Modified bone object	5	-	-	-	-	-	1	-	-	-	-	-	1	1
Indeterminate	1	-	-	-	-	-	-	-	-	1	-	-	1	1
	5	-	-	2	-	2	-	-	-	-	-	2	4	6
	6	-	-	-	-	-	1	-	-	-	-	-	1	1
														8
Unifacially retouched flake	3	-	4	-	-	6	-	-	1	-	1	11	-	11
	4	-	15	-	-	12	-	-	6	-	-	33	-	33
														44
Bifacially retouched flake	3	-	4	-	-	10	-	-	1	-	-	15	-	15
	4	-	15	-	-	12	-	-	8	-	-	25	-	25
														40
Utilization only	2	59	-	-	114	-	-	24	-	-	197	-	-	197
	4	-	-	-	-	3	-	-	-	-	-	3	-	3
														200
Total utilized/ modified	1	11	-	-	66	2	-	26	-	1	103	2	1	106
	2	62	-	-	123	-	-	26	-	-	211	-	-	211
	3	-	8	-	-	23	-	-	4	-	-	35	-	35
	4	-	24	-	-	26	-	-	14	-	-	64	-	64
	5	-	-	3	-	2	5	-	-	-	-	2	8	10
	6	-	-	-	-	-	2	-	-	-	-	-	2	2
Total	N	73	32	3	139	53	7	52	18	1	314	103	11	428
	%	67.8	29.8	2.3	75.9	21.3	2.8	73.2	25.4	1.4	73.4	24.1	2.6	100.0

[1] Presence of wear/manufacture
1. None
2. Wear only
3. Manufacture only
4. Wear and manufacture
5. Modified indeterminate.
6. Indeterminate.

[2] Kind of Manufacture
1. None
2. Chipping
9. Not applicable/indeterminate

tabular knives mentioned above, all formed objects are either chipped or have indeterminate manufacture. Almost half the remaining tools have indeterminate wear and/or manufacture. The group, however, includes many beads so small that it cannot be determined whether they were worn or not. These beads were not produced by chipping. In Zones 1 and 2, about 50% of the formed tools are chipped, and most of the remainder are of indeterminate manufacture. If we disregard beads, only two artifacts, less than 1% of formed objects, fall into the indeterminate group. The variation from this percentage in Zone 3 probably is due to the small sample size. If we disregard beads, from 98% to 100% of all formed objects in each zone are chipped. These data indicate that very little change in manufacturing processes took place at the site through time.

Almost 25% of the formed objects are manufactured and have no wear, while almost 33% are both manufactured and worn. If we discount beads, the proportions of these groups increase to over 40% and almost 60%, respectively.

Table 3-24 presents the same data for modified objects other than formed objects. This table includes objects defined on the basis of wear (such as hammerstones and retouched and utilized objects) and those defined on the basis of form, such as linear flakes, cores, and resharpening flakes. Nearly 25% of the objects in Table 3-24 are classified as having neither wear nor manufacture. The large numbers of linear flakes and linear flake cores, which are defined by form, make up the bulk of nonworn, nonmanufactured items. Nearly 50% of the objects in the table exhibit wear only. Most of these are naturally occurring stones used without manufacture. They are referred to as utilized only objects. The remainder, about 3% of the total, are hammerstones and linear flakes. Less than 10% of the objects show manufacture only, and 15% show both wear and manufacture. Less than 3% are classified "indeterminate" with regard to presence or absence of wear/manufacture. Only about 27% of the objects show any manufacture beyond that by which they were formed. Almost all of these show chipping manufacture; the remainder are of indeterminate manufacture.

Relative frequencies of categories of manufacture are similar between Zones 2 and 3. The relative frequency of objects without manufacture in Zone 1, is higher than in the other zones; consequently, the relative frequency of manufacture by chipping is lower. We cannot attribute this difference to sample size, since the number of objects from Zone 1 is much higher than the number from Zone 3.

Tables 3-25 and 3-26 show numbers of wear areas on objects in each formal category. These are the focus of data presented below. Each wear area on an object is treated separately and regarded as a separate tool. A pointed biface, for example, might have wear on its point and on one or more of its edges. If this wear is continuous from the point along the edge, it is treated as one wear area. If, on the other hand, wear areas are separated by an unworn stretch of edge, they are treated as two different tools. If a bifacially retouched object has wear on only one face, the location will be listed as "unifacial edge". Conversely, a unifacially retouched object may exhibit wear on both manufactured and unmanufactured sides. This will be

Table 3-25. Comparisons of objects and wear patterns, formed tools, 45-OK-18.

Formal Types	N of Wear Areas	N of Objects	Ratio Wear Area/Object	N of Objects	Ratio Wear Area/Object	N of Objects	Ratio Wear Area/Object	Total Ratio of Wear Areas/Object
Projectile point	0	4	12/9=1.33	8	10/14=0.71	5	2/7=0.29	24/39=0.80
	1	1		2		2		
	2	2		4		-		
	3	1		-		-		
	4	1		-		-		
Projectile point base	0	-	2/3=0.67	4	0/4=0.0	-	1/1=1.0	3/8=0.38
	1	2		-		1		
Projectile point tip	0	5	2/6=0.33	8	2/10=0.20	1	1/2=0.50	5/18=0.28
	1	-		-		1		
	2	1		1		-		
Biface	0	-	8/13=0.62	8	8/14=0.57	5		18/34=0.53
	1	5		4		2	2/7=0.23	
	2	-		2		-		
	3	1		-		-		
Scraper	0	-	7/3=2.33	1	11/5=2.20	-	5/2=2.50	23/10=2.30
	1	-		-		-		
	2	2		2		1		
	3	1		1		1		
	4	-		1		-		
Tabular knife	0	-	13/15=1.20	4	32/30=1.07	1	3/2=1.50	53/47=1.13
	1	12		21		-		
	2	3		4		-		
	3	-		1		1		
Bead	0	37	0/37=0.0	79	0/79=0.0	11	0/11=0.0	0/127=0.0
Pointed bone fragment	1	-		1	1/1=1.0	-		1/1=1.0
Total of no wear areas per object	0	41		104		23		
	1	20		30		6		
	2	8		13		1		
	3	4		2		2		
	4	1		1		-		
Total wear areas and ratio		52	52/87=0.60	66	66/159=0.42	14	14/31=0.45	132/277=0.43
Ratio-bone and beads deleted			52/50=1.04		65/29=0.32		14/20=0.70	131/149=0.88

Table 3-26. Comparisons of objects and wear areas--modified objects other than formed objects, 45-OK-18.

Formal Types	N of Wear Areas	N of Objects	Ratio Wear Area/Object	N of Objects	Ratio Wear Area/Object	N of Objects	Ratio Wear Area/Object	Total Ratio of Wear Areas/Object
Amorphously flaked object	1	1	1/1=1.00	-		-		1/1=1.0
Hammerstone	1	1	8/3=2.67	3	14/8=1.75	-	22/11=2.0	
	2	-		4		-		
	3	1		1		-		
	4	1		-		-		
Large linear flake	0	-		1	0/1=0.00	-	1/1=1.00	1/2=0.50
	1	-		-		1		
Small linear flake	0	8	0/8=0.00	62	2/82=0.03	27	1/29=0.04	3/99=0.03
	1	-		2		1		
Core	0	2	0/2=0.00	4	1/5=0.20	1	0/1=0.00	1/8=0.13
Resharpening flake	0	1	1/2=0.50	5	8/8=1.00	1	0/1=0.00	81/11=0.73
	1	1		-		-		
	2	-		2		-		
	3	-		-				
	4	-		1				
Bifacially retouched flake	0	4	11/12=0.92	9	14/19=0.74	1	11/9=1.22	35/40=0.88
	1	6		7		6		
	2	1		2		1		
	3	1		1		1		
Utilized only	1	41	98/61=1.61	79	173/116=1.49	13	40/24=1.67	311/201=1.55
	2	9		25		8		
	3	6		6		1		
	4	4		4		2		
	5	1		2		1		
Bone, technologically modified only	0	-		1	0/1=0.00	-		0/1=0.00
Other formed bone object	0	-		1	0/1=0.00	-		0/1=0.00
Indeterminate	0	2	0/2=0.00	2	2/4=0.50	-	2/6=3.33	
	1	-		2		-		
Total N of wear areas per object	0	21		91		31		
	1	58		101		23		
	2	16		37		11		
	3	8		9		3		
	4	5		5		3		
	5	1		2		-		
Total wear areas and ratio	142		142/110=1.29	232	232/246=0.95	66	66/71=0.93	440/426=1.03
Ratio, bone deleted			142/110=1.29		232/242=0.94		66/71=0.93	440/424=1.04

shown as "bifacial edge" wear. Wear listed as "edge only" is on the very edge of the object; it does not extend up either side.

Table 3-25 shows this data for formed objects including beads and bone objects. Ratios represent the average number of wear areas per object for each type. Tabular knives have the largest average followed by scrapers and projectile points. The low number of wear areas on bifaces is of interest, as is the relatively low number on projectile points. As noted above, no wear areas were identified on beads. The bottom row of data in Table 3-25 shows that ratios vary between zones from a low of 0.7 in Zone 3 to a high of 1.04 in Zone 1 and indication that formed objects were used more intensively, or for more diverse purposes, during more recent occupations.

Table 3-26 presents the same data for worn and/or manufactured objects other than formed objects. The ratios clearly show a difference between formal types defined on the basis of wear areas, with average ratios of over 1.5; formal types are defined on the basis of form only, with ratios of 0.5 or less. Retouched objects and resharpening flakes have intermediate ratios.

In the following discussion wear characteristics of each formal type, information about kind of wear, shape of worn area, and edge angle has been modified slightly from that in the data base. In the dimension "shape of worn area," areas listed as "abruptly convex" and "slightly convex" have been combined under "convex." The same has been done for concave shapes. Areas of wear extending over a combination of convex, straight, and/or concave edges or surfaces are called "irregular." Edge angles have been combined into groups of 30° each to simplify what would otherwise be an unwieldy mass of data.

Each formal type is discussed below.

PROJECTILE POINTS

Wear data for projectile points and other formed objects are shown in Table 3-27. The table combines the formal types "projectile point," "base," and "tip." Kinds of wear on projectile points include smoothing, feathered chipping, hinged chipping, and combinations of these types of chipping with smoothing. These terms are defined in the glossary. Although sample size is quite small, several general observations can be made. Smoothing occurs with surprising frequency for objects used as the tips of projectiles. Projectile points are illustrated in the Stylistic Analysis section.

Both feathered and hinged chipping occur on projectile points. Hinged chipping without smoothing occurs in low relative frequency on projectile points. Even with smoothing, hinged chipping occurs less frequently than smoothing alone, feathered chipping alone, or feathered chipping with smoothing.

Location of wear data also shows some surprising results. Wear on edges of projectile points occurs almost four times as often as wear on tips, and 25% of the wear areas are located on unifacial edges. Generally, then, these objects exhibit greater variation in kinds of wear and locations of wear than one would predict for objects used only as projectile points. Fine, medium, and steep edge angles are present on projectile points. More than 75% of the wear areas on projectile points have medium angles. The low frequency of

Table 3-27. Kind of wear, location of wear, and grouped edge angle, formed objects, 45-OK-18.

	Zone						Total	
	1		2		3			
Formal Type and Wear Area Paradigm	N	χ^2	N	χ^2	N	χ^2	N	2
Projectile Points								
Kind of Wear:								
2. Smoothing	5	31.3	2	16.7	1	25.0	8	25.0
5. Feathered Chipping	5	31.3	1	8.3	1	25.0	7	21.9
7. Feathered Chipping and Smoothing	4	25.0	5	41.7	2	50.0	11	34.4
10. Hinged Chipping	-	-	1	8.3	-	-	1	3.1
12. Hinged Chipping and Smoothing	2	12.5	3	25.0	-	-	5	15.6
Location of Wear:								
1. Edge only	-	-	2	16.7	-	-	2	6.3
2. Unifacial Edge	4	25.0	2	16.7	2	50.0	8	25.0
3. Bifacial Edge	9	56.3	6	50.0	-	-	15	46.9
4. Point Only	2	12.5	1	8.3	1	25.0	4	12.5
6. Point and Biface Edge	-	-	1	8.3	-	-	1	3.1
7. Point and Both Edges	1	6.3	-		1	25.0	2	6.3
Grouped Edge Angles:[1]								
1. Fine	1	6.3	2	14.3	2	50.0	5	15.6
2. Median	13	81.3	10	85.7	2	50.0	25	78.1
3. Steep	2	12.5	-	-	-	-	2	6.3
Total	16		12		4		32	
Bifaces								
Kind of Wear:								
2. Smoothing	-	-	1	12.5	-	-	1	5.6
4. Polishing	1	12.5	-	-	-	-	1	5.6
5. Feather Chipping	4	50.0	3	37.5	-	-	7	38.9
7. Feather Chipping and Smoothing	-	-	2	25.0	-	-	2	11.1
10. Hinged Chipping	2	25.0	2	25.0	1	-	5	27.8
12. Hinged Chipping and Smoothing	1	12.5	-	-	-	-	1	5.6
13. Hinged Chipping and Crushing	-	-	-	-	1	50.0	1	5.6
Location of Wear:								
2. Unifacial Edge	4	50.0	3	37.5	-	-	7	38.9
3. Bifacial Edge	3	37.5	4	50.0	2	100.0	9	50.0
4. Point Only	1	12.5	-	-	-	-	1	5.6
6. Point and Bifacial Edge	-	-	1	12.5	-	-	1	5.6
Grouped Edge Angles:								
2. Medium	7	87.5	6	75.0	2	100.0	15	83.3
3. Steep	1	12.5	2	25.0	-	-	3	16.7
Total	8		8		2		18	
Drills								
Kind of Wear:								
5. Feathered Chipping	2		1		-		3	60.0
7. Feathered Chipping and Smoothing	1		-		-		1	20.0
12. Hinged Chipping and Smoothing	-		1		-		1	20.0
Location of Wear:								
2. Unifacial Edge	2		-		-		2	40.0
7. Point and Both Edges	1		2		-		3	60.0

Table 3-27. Cont'd.

Formal Type and Wear Area Paradigm	Zone 1 N	Zone 1 %[2]	Zone 2 N	Zone 2 %[2]	Zone 3 N	Zone 3 %[2]	Total N	Total %[2]
Grouped Edge Angle[1]:								
1. Fine	1		-		-		1	20.0
2. Medium	2		-		-		2	40.0
3. Steep	-		1		-		1	20.0
5. Indeterminate	-		1		-		1	20.0
Total	3		2		-		5	
Scrapers								
Kind of Wear:								
5. Feathered Chipping	-		3	27.3	-		3	13.0
7. Feathered Chipping and Smoothing	5	71.4	-		-		5	21.7
10. Hinged Chipping	2	28.6	3	27.3	3	60.0	8	34.8
12. Hinged Chipping and Smoothing	-		5	45.5	2	40.0	7	30.4
Location:								
2. Unifacial Edge	7	100.0	10	90.9	5	100.0	22	95.7
3. Bifacial Edge	-		1	9.1	-	-	1	4.3
Grouped Edge Angle:								
2. Medium	2	28.6	2	18.2	2	40.0	6	26.1
3. Steep	5	71.4	9	81.3	3	60.0	17	73.9
Total	7		11		5		23	
Tabular Knives								
Kind of Wear:								
2. Smoothing	17	94.4	30	93.8	3	100.0	50	94.3
12. Chipping	1	5.6	2	6.3	-	-	3	5.7
Location:								
1. Edge Only	17	94.4	29	90.6	3	100.0	49	92.5
3. Bifacial Edge	1	5.6	3	9.4	-	-	4	7.5
Grouped Edge Angle:								
1. Fine	11	61.1	9	28.1	-	-	20	37.7
2. Medium	7	38.9	21	65.6	3	100.0	31	58.5
3. Steep	-	-	2	6.3	-	-	2	3.8
Total N	18		32		3		53	

[1] Grouped Edge Angles
1. Fine = 1-30°
2. Medium = 31-60°
3. Steep = 61-90°
4. Very Steep = > 90°
5. Indeterminate

[2] Percentage within dimension.

steep edge angles and the somewhat higher frequency of fine edge angles are not particularly notable. These data are shown for comparison with data on wear areas from other formal types.

Wear analysis data on projectile points suggest that use of these objects as tips on projectiles either cannot be detected or that resulting wear cannot be separated from other kinds of wear. The first explanation is preferred because stone objects should show some evidence of having shattered upon impact with other objects. It is assumed that projectiles frequently hit bones of animals, or that they miss intended targets and hit the ground, trees, rocks or other hard objects. In these cases, damage would result.

A projectile must have enough force to penetrate the skin of an animal and its vital organs. The resulting impact would cause more than shatter marks on lithic projectile points. Indeed, many points apparently broke when striking prey, a tree or rocks. Table 3-28 presents data on breakage of all fractured projectile points from 45-OK-18. Breaks that have not been reworked are clean snaps without bulbs of percussion, ripple marks, platform impact shatters, or other indication that breaks are due to hammering. All breaks occur above hafting elements, suggesting that points were attached to shafts when they broke. Many breaks between lower and upper quarters of blades are at the thickest parts of blades. We have almost no evidence that the points broke either because of imperfections in raw materials or flawed manufacture. Therefore, the breaks are due to impact fracturing indicating use as projectiles.

Table 3-28 also shows that one third to more than one half of the points from each of the upper three zones are broken. The difference between zones is probably due to small sample size. Furthermore, only a few wear areas are on broken points, even though at least half of the blade still is present in 12 of the 15 cases. Two-thirds of the wear areas on broken points occur on projectile points with only broken tips. Tips, then, may have broken off while being used for something other than projectiles.

BIFACES

Bifaces are illustrated in Plate 3-1;a-c. Bifaces show the same wear patterns exhibited on projectile points as well as polishing and hinged chipping combined with crushing or pecking (Table 3-27). The relative frequency of hinged chipping on bifaces is high and feathered chipping is higher. Polishing and smoothing occur alone or in combination with the two types of chipping in about 25% of the cases. Hinged chipping alone and in combination with other kinds of wear occurs in almost 40% of the cases while feathered chipping comprises almost 50% of the total.

Most of the wear on the bifaces is located along the edges. Fifty percent of the wear is bifacial, but more than 33% is unifacial. According to its traditional form definition, "biface" is regarded as a cutting implement. Cutting produces wear on both sides. The high percentage of unifacial wear in this assemblage suggests scraping may have been done with bifaces. Biface points also showed used. Generally speaking, bifaces have fewer wear areas

Table 3-28. Projectile point breakage.

Zone	Master N	Morphological		Direction in Relation to Center Line		Remarks	N of Wear Areas	Zone Total			
		Type	Approximate Location	Front View	Side View			Wear Area[1]		Object[2]	
								N	%	N	%
1	334	12	Upper 1/3 of blade	Diagonal and perpendicular	Slightly diagonal	Stepped break	1				
	586	12	Lower 1/3 of blade	Perpendicular	Perpendicular	Heat spalled face	-	2	14.3 of 14	3	40.0 of 10
	611	13	Midpoint of blade	Slightly diagonal	Perpendicular		1				
	66	17	Barb only	Diagonal	Slightly diagonal		-				
2	67	7	Tip only	Perpendicular	Slightly diagonal		1				
	79	8	Midpoint of blade	Indeterminate	Indeterminate	Reworked	-				
	622	9	Upper 1/3 of blade	Perpendicular	Diagonal		-				
	33	11	Tip only	Indeterminate	Interminate	Reworked	-				
	110	11	Tip only	Slightly diagonal	Slightly diagonal		2				
	252	11	Upper 1/4 of blade	Perpendicular	Slightly diagonal		-				
	289	11	Lower 1/3 of blade	Perpendicular	Diagonal		-		30.0 of 10	9	52.9 of 17
	154	12	Upper 1/3 of blade	Diagonal	Diagonal	Stepped break	-				
	352	12	Lower 1/4 of blade	Interminate	Interminate						
3	598	10	Tip only	Diagonal	Perpendicular		1				
	207	12	Tip only	Perpendicular	Slightly diagonal -		-	1 of 3	33.3	2 of 3	33.3
Total								6	22.2 of 27	15	45.5 of 33

1 Percent is based on number of worn areas per zone of projectile point bases.
2 Percent is based on number of typed projectile points per zone (see Appendix 4-C).

than projectile points, even though there are more bifaces in the assemblage. Bifaces also exhibit more kinds of wear but fewer kinds of wear locations than projectile points.

Medium edge angles predominate on bifaces; there are some steep edge angles but no fine edge angles. The absence of fine edge angles is expected in view of the low number of wear areas.

DRILLS, SCRAPERS, TABULAR KNIVES

Drills are illustrated in Plate 3-1;d-e. The low absolute frequency of wear areas on these artifacts (Table 3-27) precludes comparisons. We may, however, discuss the one worn drill, recovered from Zone 1. The following information is taken from Appendix B, Table 6.

The drill has three wear areas. Two are unifacial; the first is on a convex edge with a medium angle and the second is on a concave edge with a medium angle. These wear areas are located on opposite edges of the object, even though the functional paradigm does not cover this situation. The third wear area covers the tip of the object and extends onto both edges. This wear area exhibits a fine edge angle. The pointed wear area shows feathered chipping and smoothing; the two edge wear areas show feathered chipping only.

Table 3-27 also presents information about wear areas on scrapers. All scrapers have worn areas with chipping, predominantly hinged chipping and hinged chipping with smoothing. Feathered chipping and feathered chipping with smoothing are present in about 33% of the cases. All worn areas occur on edges, and unifacial edge wear is present on 22 of the 23 scrapers. About 25% of the wear areas have medium edge angles; the rest have steep angles. Scrapers are illustrated in Plate 3-1;f-k.

Wear patterns on tabular knives (Table 3-27) are quite uniform consisting predominantly of smoothing; two of 23 artifacts show hinged chipping and smoothing wear. Almost all of the wear is restricted to edges alone, but four examples of wear extend beyond edges. Wear area edge angles are medium in more than 50% of the cases and fine in more than 33% of the cases. The remaining angles are steep. Two kinds of wear, smoothing and hinged chipping and smoothing, and two locations of wear, edge only and bifacial edge, occur in very high frequencies on tabular knives and in low frequencies on other objects. These data indicate that tabular knives were used for a different set of activities. Tabular knives are illustrated in Plate 3-2.

HAMMERSTONES

Table 3-29 summarizes wear area data for worn objects other than formed objects. Although wear areas are relatively infrequent on most formal types, wear areas on hammerstones are the exception (Plate 3-3;a-b). They are of sufficient number to merit discussion. Wear areas on hammerstones are the results of crushing and pecking. In most instances wear areas are located on the ends of hammerstones; several, however, occur on edges thinned by chipping before they were used. Edge angles on prepared edges are medium; those on unprepared ends are very steep, the only steep angles in the assemblage.

Table 3-29. *Kind of wear, location of wear, and grouped edge angle, other worn or modified objects, 45-OK-18.*

Formal Type and Wear Area Paradigm	Zone						Total	
	1		2		3			
	N	%	N	%	N	%	N	%
Amorphously Flaked Object								
Kind of Wear:								
Hinged Chipping	1	100.0	-	-	-	-	1	-
Location:								
Unifacial Edge	1	100.0	-	-	-	-	1	-
Grouped Angle:[1]								
Steep	1	100.0	-	-	-	-	1	-
Total	1		-		-		1	
Hammerstones								
Kind of Wear:								
ushing/Pecking	8	100.0	14	100.0	-	-	22	100.0
Location:								
Edge Only	-	-	3	23.4	-	-	3	23.6
End (Terminal Surface)	8	100.0	11	78.6	-	-	19	86.4
Grouped Angle:								
Medium	-	100.0	3	21.4	-	-	3	13.6
Very Steep	8	100.0	11	78.6	-	-	19	86.4
Total	8		14		-		22	
Linear Flakes (Blade and Microblade)								
Kind of Wear:								
Feather Chipping	-	-	2	66.6	-	-	2	50.0
Feather Chipping and Smoothing	-	-	1	33.3	1	-	2	50.0
Location:								
Uniface Edge	-	-	3	100.0	1	100.0	4	100.0
Grouped Angles:								
Fine	-	-	3	100.0	1	100.0	4	100.0
Total	-		3		1		4	
Indeterminate Formal Type								
Kind of Wear:								
Feather Chipping	-	-	1	50.0	-	-	1	50.0
Feather Chipping and Smoothing	-	-	1	50.0	-	-	1	50.0
Location:								
Unifacial Edge	-	-	1	50.0	-	-	1	50.0
Point and Both Edges	-	-	1	50.0	-	-	1	50.0
Grouped Angles								
Medium	-	-	2	100.0	-	-	2	100.0
Total	-		2		-		2	
Core								
Kind of Wear:								
Hinged Chipping and Smoothing	-	-	1	100.0	-	-	1	100.0
Location:								
Bifacial Edge	-	-	1	100.0	-	-	1	100.0
Grouped Angles								
Steep	-	-	1	100.0	-	-	1	100.0
Total	-		1		-		1	
Unifacially Retouched Objects								
Kind of Wear:								
Smoothing	-	-	1	5.6	-	-	1	1.9
Feathered chipping	8	34.8	5	27.8	7	53.8	20	37.0
Feathered chipping and smoothing	7	30.4	4	22.2	1	7.7	12	22.0
Hinged chipping	8	34.8	6	33.3	4	30.0	18	33.3
Hinged chipping and smoothing	-	-	2	11.1	1	7.7	3	5.6

[1]Grouped Edge Angles
1. Fine =1-30°
2. Medium =31-60°
3. Steep =61-90°
4. Very Steep = > 90°
5. Indeterminate

Table 3-29. Cont'd.

Formal Type and Wear Area Paradigm	Zone 1 N	Zone 1 %	Zone 2 N	Zone 2 %	Zone 3 N	Zone 3 %	Total N	Total %
Location:								
Unifacial edge	19	82.6	16	88.9	11	84.6	46	85.2
Bifacial edge	3	13.0	1	5.6	2	15.4	6	11.1
Point only	1	4.3	–	–	–	–	1	1.9
Point and both edges	–	–	1	5.6	–	–	1	1.9
Grouped Angle:[1]								
Fine	7	30.4	2	11.1	4	30.8	13	24.1
Medium	14	60.9	5	27.8	6	46.2	25	46.3
Steep	2	8.7	11	61.3	3	23.1	16	29.6
Total	23		18		13		54	
Bifacially Retouched Objects								
Kind of Wear:								
Smoothing	–	–	4	28.6	1	9.1	5	14.3
Feathered chipping	2	20.0	6	42.9	3	27.3	11	31.4
Feathered chipping and Abrasion/grinding	–	–	–	–'	1	9.1	1	2.9
Feathered chipping	2	20.0	–		1	9.1	3	8.6
Hinged chipping	5	50.0	3	21.4	2	18.2	10	28.6
Hinged chipping and smoothing	1	10.0	–		2	18.2	3	8.6
Hinged chipping and Crushing/pecking	–	–	1	7.1	1	9.1	2	5.7
Location:								
Edge only	–	–	3	21.4	–	–	3	8.6
Unifacial edge	4	40.0	7	50.0	6	54.5	17	48.6
Bifacial edge	5	50.0	4	28.6	4	36.4	13	37.1
Point only	–	–	–	–	1	9.1	1	2.9
Point only and both edge	1	10.0	–	–	–	–	1	2.9
Group Angles								
Fine	2	20.0	1	7.1	1	9.1	4	11.4
Medium	7	70.0	8	57.1	7	63.6	22	62.9
Steep	1	10.0	5	35.7	3	27.3	9	25.7
Total	10		14		1		35	
Utilized Only Objects								
Kind of Wear:								
Smoothing	–	–	5	2.8	–	–	5	1.6
Feathered chipping	69	76.7	137	76.5	31	77.5	237	76.7
Feathered chipping and smoothing	6	6.7	11	6.1	–	–	17	5.5
Hinged chipping	14	15.6	21	11.7	8	20.0	43	13.9
Hinged chipping and smoothing	1	1.1	4	2.2	–	–	5	1.6
Hinged chipping and crushing/pecking	–	–	1	0.6	1	2.5	2	0.6
Location:								
Edge only	–	–	2	1.1	–	–	2	0.6
Unifacial edge	82	91.1	156	87.2	37	92.5	275	89.0
Bifacial edge	4	4.4	12	6.7	3	7.5	19	6.1
Point only	–	–	4	2.2	–	–	4	1.3
Point only and unifacial edge	2	2.2	1	0.6	–	–	3	1.0
Point only and bifacial edge	–	–	1	0.6	–	–	1	0.3
Point only and both	2	2.2	3	1.7	–	–	5	1.6
Grouped Edge Angles:								
Fine	51	56.7	103	57.4	29	72.5	183	59.2
Medium	33	36.7	66	36.9	9	22.5	10.8	35.0
Steep	6	6.7	9	5.0	2	5.0	17	5.5

[1] Grouped Edge Angles
1. Fine =1-30°
2. Medium =31-60°
3. Steep =61-90°
4. Very Steep = > 90°
5. Indeterminate

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

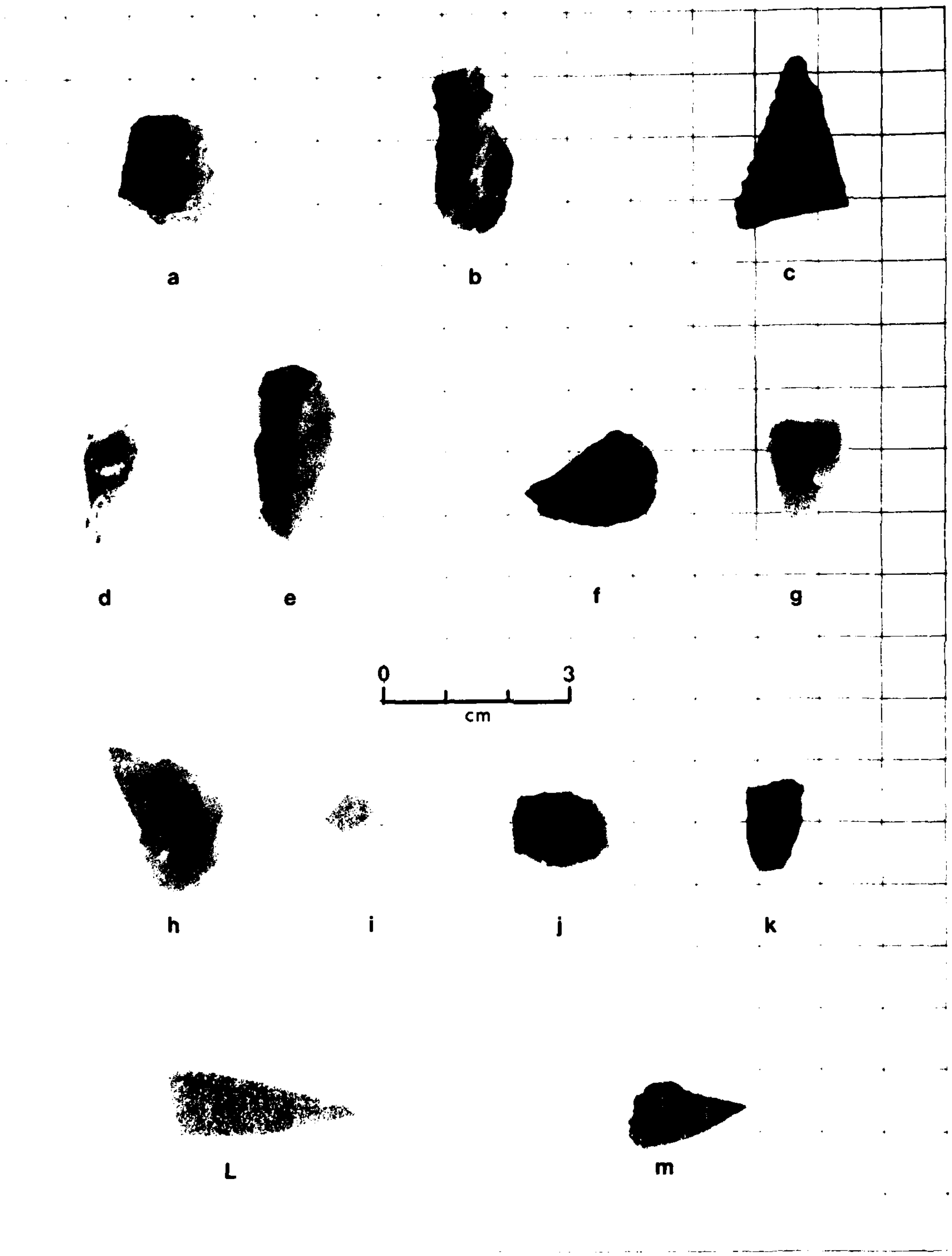
a.	b.	c.
732	218	547
Biface	Biface	Biface tip
22S9E/10	7S4E/10	14S27E/0
1	1	1
Jasper	Jasper	Jasper

d.	e.	f.	g.
197	637	257	203
Drill	Drill	Scraper	Scraper
4S43E/20	17S2W/30	7S28E/10	5S42E/20
2	1	1	2
Jasper	Chalcedony	Jasper	Jasper

h.	i.	j.	k.
138	300	705	249
Scraper	Scraper	Scraper	Scraper
5N38E/30	8S37E/20	21S2E/30	7N22E/50
2	2	1	3
Jasper	Chalcedony	Jasper	Jasper

l.	m.
643	398
Pointed bone fragment	Other formed bone object
17S4W/10	12S19E/40
1	2
Bone/antler	Bone/antler

Plate 3-1. Bifaces, drills, scrapers, and modified bone, 45-OK-18.


a
b
c
d
e
f
g
0
3
cm
h
i
j
k
L
m

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

a.	b.	c.
118	176	536
Tabular knife	Tabular knife	Tabular knife
4N40E/20	5S40E/20	14S26E/10
2	2	1
Fine-grained quartzite	Coarse-grained quartzite	Coarse-grained quartzite

d.	e.	f.
413	540	553
Tabular knife	Tabular knife	Tabular knife
13S22E/50	14S26E/30	14S27E/50
2	2	3
Coarse-grained quartzite	Sandstone	Coarse-grained quartzite

Plate 3-2. Tabular knives, 45-OK-18.


a
b
c
0
3
cm
d
e
f

WORN DEBITAGE

Table 3-29 presents wear area data for worn debitage, a category that includes conchoidal flakes, tabular flakes, and chunks that have been unifacially retouched, bifacially retouched, or utilized only. The three object types have been combined, but the three kinds of modifications are shown separately. More than 33% of the wear areas on unifacially retouched objects consist of feathered chipping; another 33% are hinged chipping. Feathered chipping and smoothing constitute slightly more than 20% while smoothing and hinged chipping with smoothing are less common. Most of the wear is on unifacial edges. This is not surprising on unifacially modified objects, but the presence of over 10% bifacial wear is notable. Pointed wear areas are also present in very low relative frequencies. Almost half of the wear areas are on edges of medium angle while the other half are on fine and steep edges.

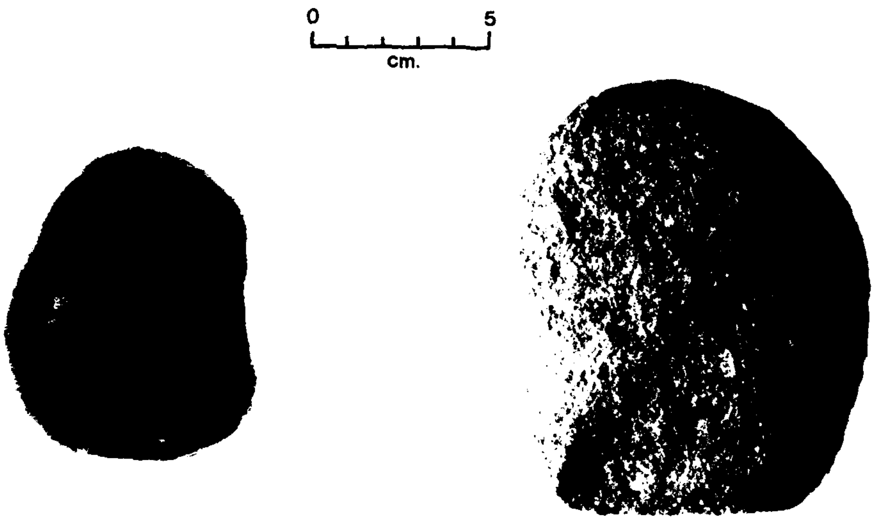
Wear on bifacially retouched objects is surprisingly variable. More than 50% of the wear areas consist of feathered chipping and hinged chipping. Nearly 33% show smoothing, feathered chipping with smoothing, and hinged chipping with smoothing. Smoothing alone is slightly more prevalent than either of the other two. Feathered chipping with abrasion and/or grinding and hinged chipping with crushing and/or pecking occur a few times. Although these objects are bifacially manufactured, almost half of their wear occurs on unifacial edges, while somewhat less than 35% occurs on bifacial edges. Edge-only and pointed wear areas make up the remainder. Bifacially retouched objects are illustrated in Plate 3-4;b-c.

Grouped edge angles include medium, steep, and fine angles. Almost 67% of the wear areas occur on edges with medium angles. Slightly more than 25% are on steep edges, and about 10% on fine edges.

Wear areas on objects that show no manufacture (Plate 3-4;a,g,h,) constitute more than half of the wear areas identified on objects from 45-OK-18. This large absolute frequency, however, is reflected neither in large numbers of kinds of wear nor in grouped edge angles. Only the number of wear locations is slightly larger than for any other formal type. More than 75% of the wear consists of feathered chipping alone. Other than that only hinged chipping exceeds 10% of the total. Smoothing, feathered chipping with smoothing, and hinged chipping occur in very low frequencies. Hinged chipping with crushing and/or pecking occurs on only two of more than 300 wear areas. Examples of utilized only objects are illustrated in Plate 3-4;a,d-g.

Wear is located primarily on the unifacial edges of debitage. Low frequencies of bifacial edge wear and very low frequencies of edge-only, point-only, and point with various edge wear also are present. Most edge angles are fine; slightly more than 33% are medium. A few steep angles and one indeterminate angle occur.

Another formal type without extensive wear is small linear flakes. Of the 105 recovered, only 4 (4%) have wear areas.



a.
58
Hammerstone
0S15E/50
2
Granite

b.
45
Hammerstone
11S2E/50
2
Granite

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

Plate 3-3. Hammerstones, 45-OK-18.

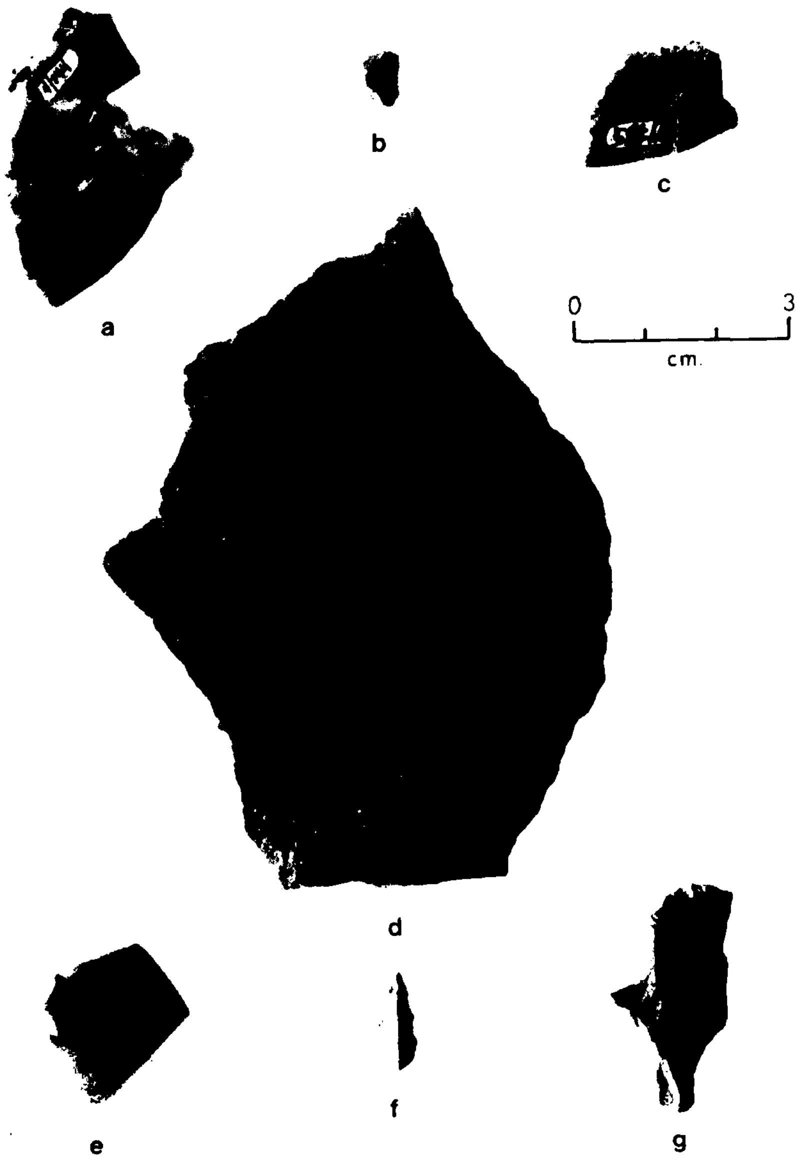
KEY: Master Number:
Tool:
Provenience/Level:
Zone:
Material:

a.	b.	c.
711	146	733
Utilized flake	Bifacially retouched flake	Bifacially retouched flake
20S6E/20	3S18E/10	22S8E/10
1	1	1
Jasper	Jasper	Chalcedony

d.
46
Utilized flake
11S3E/80
2
Basalt

e.	f.	g.
755	756	144
Utilized flake	Utilized flake	Utilized flake
2S19E/30	3S18E/60	2S19E/50
2	3	3
Jasper	Jasper	Jasper

Plate 3-4. Utilized and bifacially retouched flakes, 45-OK-18.


a
b
c
d
e
f
g
0
3
cm.

DISCUSSION

Although data indicate that all identifiable manufacture was done by chipping, the beads illustrated in Plate 3-5;m-aa were apparently ground, rather than chipped, at least in the last stage of manufacture. Site occupants may have manufactured beads by first producing a bead "blank," probably a flake modified by pecking and grinding until it was relatively small and flat. They then ground the blank down to the desired thickness and surface finish and then drilled a hole through the flat blank. Finally, they ground the edges down to the desired shape and roundness.

None of the drills found at the site shows sufficient wear to have been used to drill holes in beads even though the large number of beads found probably required a number of drills to make them, presuming that drills used on hard materials wear out quickly. Their absence suggests that the beads were not manufactured at the site. Of course, such drills may simply have escaped recovery.

So far we have considered the amount of use each formal type exhibits in terms of wear areas per object, but we may view these data from another perspective. Twenty-six of the 56 projectile points and point fragments have one or more wear areas, a relative frequency of 54%. On the other hand, 10 of 33 stylistically analysed projectile points, about 30%, are broken in a way that reveals they were used in hunting. Fourteen of 35 bifaces, or 60%, show wear. These frequencies suggest either that projectile points and bifaces were not manufactured for use exclusively at the site or that the activities for which these types were used left little wear. Very few bones were recovered at the site; the occupants appear to have manufactured and repaired hunting-associated implements at the site but they do not seem to have returned frequently with their game.

Only one of the eight cores (12.5%) exhibits wear. We assume that cores result from flake manufacture and were not meant to be used as tools. Any handy implement, however, might have been used casually if it was appropriately shaped.

About 90% of the scrapers and tabular knives have wear areas, thus suggesting that they were made to be used at the site. The few unused tools probably were lost before they could be used enough to leave indications, or abandoned during manufacture.

Seventy-five percent of the unifacially retouched objects and about 65% of the bifacially retouched objects show use. These frequencies are intermediate between those of tools apparently made for off-site use and those of scrapers and tabular knives likely manufactured in large quantities for general use at the site.

In this assemblage, resharpening flakes, that is, flakes detached from previously finished tools may have originated from a few resharpened projectile points. Wear patterns on the flakes would seem to bear this out. Unifacial wear patterns are not unusual on site projectile points. Such wear patterns would result if the flakes were detached after the objects were used.

Change in the ratios between the number of wear areas on objects indicate more intensive use in recent occupations. The apparent exception is between Zone 3 and Zone 2. Even though the number of objects increases dramatically in Zone 2, the ratio increase from Zone 3 is slight. This suggests that either the intensity or duration of occupation increased significantly between the two zones. This increase is greater than from Zone 3 to Zone 2 if bones and beads are discounted.

The increase in wear areas per object from Zone 2 to Zone 1 indicates that either raw material sources were less accessible over time or the occupants became more efficient in exploitation and manufacturing techniques. Neither explanation can be chosen on the basis of data from a single site of short-term occupation. This problem will be addressed in the project's synthesis report.

Table 3-30 compares wear area data from modified debitage with data from formed and worn objects. Kinds of wear found on debitage reflect the full range of wear, excluding crushing and/or pecking, found on other objects. This suggests that debitage was used for all activities except hammering.

Feathered chipping is the most prevalent kind of wear on debitage. This may show that most debitage was used to process materials intermediate in hardness (such as hides or soft wood) rather than on the softer or harder materials. Most formed objects were used on softer materials, like meat, and most worn objects were used on harder materials, like wood.

Locations of wear areas suggest that scraping was a primary use for debitage, although we have not used the formed object data to make this interpretation. Scrapers occur in very low numbers and, therefore, do not show up in the summary data. Rather, we have compared the debitage with direct observation of the scrapers.

Comparison of grouped angles of debitage and other objects shows that a larger amount of fine-angled wear is present on debitage than medium-angle wear. Furthermore, this high frequency is not reflected in data of individual formal types in sufficient quantity to allow comparison. We have suggested above that debitage was used to scrape moderately hard materials. Grouped angle data, however, indicate that debitage scrapers, because of their sharp, fine edges, served different functions than formed scrapers which have steep, large-angled edges.

BONE ARTIFACTS

The three modified bone objects from 45-OK-18 referred to in the above discussion may be distinguished as pointed bone object, a formed bone object, and a modified bone object.

The pointed bone object consists of two fragments which together make an assymmetrical point, 44 mm long, 11 mm wide, and 3 mm thick (only the tip fragment is shown in Plate 3-1;l). One side of the point is 17 mm long and the other is 25 mm long. Its edges are smoothed and its tip is polished. Long, fine striations parallel to the edges mark the sides of the object and extend part way onto the long side of the pointed end. Examination with a 10X hand lens shows very fine striations along the short side of the point. These

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

	Master Number	Tool	Provenience/Level	Zone	Material
a.	323	Microblade core fragment	8S46E/0	1	Jasper
b.	30	Microblade	4N6E/30	1	Chalcedony
c.	567	Microblade	14S32E/10	1	Jasper
d.	87	Microblade core fragment	0N0E/60	2	Jasper
e.	77	Microblade	1S1E/70	2	Chalcedony
f.	125	Microblade	5N14E/30	2	Jasper
g.	725	Microblade	20S11E/40	2	Jasper
h.	723	Microblade	20S9E/20	2	Jasper
i.	607	Microblade	16S4E/50	3	Jasper
j.	32	Microblade	4N7E/60	3	Jasper
k.	233	Microblade	6S18E/60	3	Fine-grained basalt
l.	741	Microblade	23S8E/40	2	Basalt
m.	417	Bead	12S8W/30	1	Fine-grained basalt
n.	418	Bead	12S8W/30	1	Fine-grained basalt
o.	419	Bead	12S8W/40	1	Fine-grained basalt
p.	420	Bead	12S8W/40	1	Fine-grained basalt
q.	421	Bead	12S8W/40	1	Fine-grained basalt
r.	431	Bead	12S8W/50	2	Fine-grained basalt
s.	422	Bead	12S8W/40	1	Fine-grained basalt
t.	423	Bead	12S8W/40	1	Fine-grained basalt
u.	424	Bead	12S8W/40	1	Fine-grained basalt
v.	425	Bead	12S8W/40	1	Fine-grained basalt
w.	426	Bead	12S8W/40	1	Fine-grained basalt
x.	427	Bead	12S8W/40	1	Fine-grained basalt
y.	428	Bead	12S8W/40	1	Fine-grained basalt
z.	429	Bead	12S8W/40	1	Fine-grained basalt
aa.	430	Bead	12S8W/40	1	Fine-grained basalt

Plate 3-5. Beads, microblades, and microblade core fragments, 45-OK-18.

striations are not quite perpendicular to the object's surface. The form and the wear pattern indicate that the object may be part of an awl.

The formed bone object (Plate 3-1;m) is irregularly triangular in shape. It is 19 mm long from base to apex, 11 mm wide at the base, and 2 mm thick. The shape and all metric dimensions except thickness are due to breakage, rather than function or style. Three almost regular, parallel incised lines traverse the width of the object. The base is broken along a fourth incised line. Spacing between lines is 5 mm, 3 mm, and 4 mm in sequence from the bottom up. Finer, more irregular, and more closely spaced incisions have been made between the deeper and wider lines. Some of these incisions are perpendicular to the deeper ones, while others are slightly diagonal. The fragment looks like one of the small, cord-marked pottery sherds so prevalent in eastern North American sites. No function is assigned to this object.

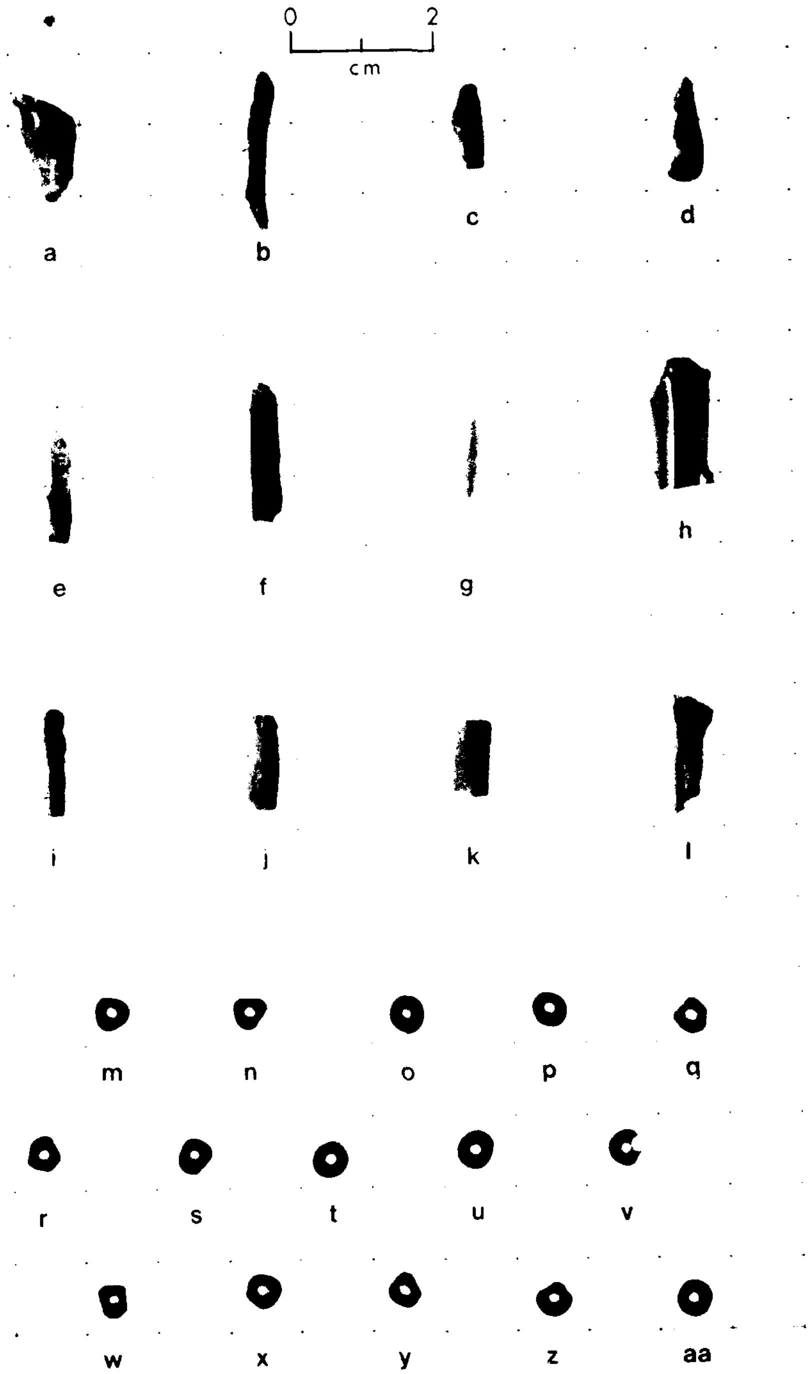
The modified bone object is a longbone fragment from a deer-sized animal. It is 67 mm long, 17 mm wide, and 6 mm wide. A long, shallow, incised line runs along the splinter's length, at the bottom of the naturally occuring longitudinal groove. Finer incised lines run parallel to the long line, while several shorter incised lines are located long the sides of the groove. These lines may have been placed to split the long bone along the groove. If so, the attempt was abandoned.

The bone tool assemblage is too small to add much to an understanding of activities carried out at the site. At best, we can suggest that an awl was used, perhaps to manufacture or mend something made of hide.

STYLISTIC ANALYSIS

The purpose of the stylistic analysis of projectile points is to identify morphological characteristics which are sensitive to temporal and spatial cultural variation. By correlating sensitive stylistic types with radiocarbon dates, we can develop a local chronology and sequence of human occupation which can be compared with sequences developed in other regions of the Plateau.

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 points from the Rufus Woods Lake project area and as a means to measure the distribution of formal attributes as well as point styles. The **historical classification** correlates these projectile points with recognized types with discrete temporal distributions. Together, these analyses allow us to (1) assess formal and temporal variation in our collection witout 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.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AD-A163 424 ARCHAEOLOGICAL INVESTIGATIONS AT SITE 45-OK-18 CHIEF JOSEPH DAM PROJECT WASHINGTON(U) WASHINGTON UNIV SEATTLE OFFICE OF PUBLIC ARCHAEOLOGY 2/2

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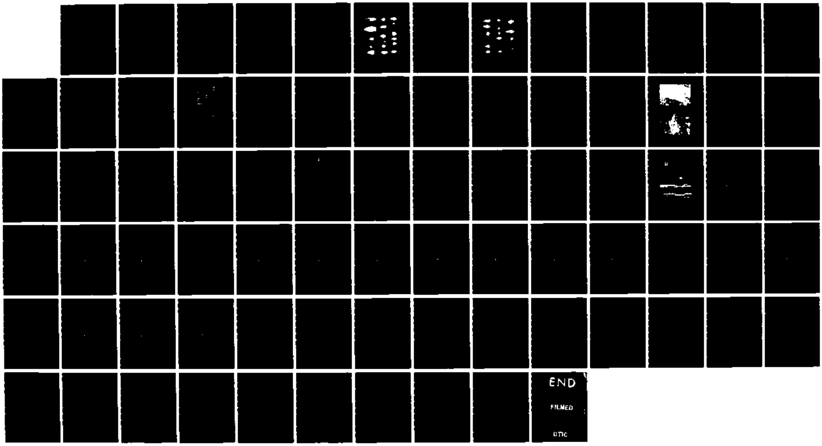

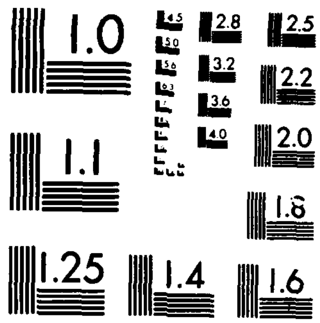

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MORPHOLOGICAL CLASSIFICATION

Eleven dimensions have been established for this stylistic analysis: blade-stem juncture, outline, stem edge orientation, basal edge shape, blade edge shape, cross section, serration, edge grinding, basal edge thinning, and flake scar pattern (Table 3-31). The first four of these define 18 separate morphological types identified at the Chief Joseph Project (Figure 3-1). The other seven describe objects more fully and identify variants within the type categories. The classification system is described fully in the project summary report (Lohse 1984g).

The 33 classifiable points fall into 13 types; these have a minimum representation of one member and a maximum of seven (Table 3-32). The small numbers preclude statistically valid comparisons with projectile point types established for other regions on the Columbia Plateau. The points are illustrated in Plates 3-6 and 3-7 and the digitized outlines are shown in Appendix B, Figure B-1.

Projectile points from 45-OK-18 are shown in Plates 3-6 and 3-7. Points in Zone 3 include one large, side-notched specimen (Type 3, Plate 3-6;d). Small, shouldered, triangular points with straight or expanding stems (Type 10, Plate 3-6;p-q) and large, squared, triangular, contracting stemmed points (Type 11, Plate 3-7,a-g) occur in both Zone 3 and Zone 2. Points of several types are found exclusively in Zone 2: one lanceolate point (Type 5, Plate 3-6;e); one large, shouldered, triangular contracting stemmed point (Type 7, Plate 3-6;j); two small, shouldered, triangular, contracting stemmed points (Type 8, Plate 3-6;k-l); and three large, shouldered, triangular points with straight or expanding stems (Type 9, Plate 3-6;m-o). Large triangular specimens (Type 1, Plate 3-6;a-b); shouldered lanceolate points (Type 6, Plate 3-6;f-i); and large, square, triangular, points with straight or expanding stems (Type 13, Plate 3-7;n-o) occur in both Zone 2 and Zone 1. Points of two types are found only in Zone 1: those of Type 2, a small triangular variety (Plate 3-6;c); and, those of Type 17, a large, barbed, triangular variety with a non-contracting stem (Plate 3-7;p). Small, squared, triangular, points with straight to expanding stems (Type 12, Plate 3-7;h-m) are found in all three zones. No points were found in Zone 4.

HISTORIC CLASSIFICATION

Our projectile points were assigned to historic types by comparison to a metrically derived type collection. Line and angle measurements based on outlines were used because they made it possible to use published illustrations of projectile points. The outlines of both our projectile points and the type specimens were digitized using the landmarks shown in Figure 3-2. Other measurements such as weight and thickness were taken on our projectile points, but problems of cost and efficiency precluded getting these measurements from specimens from other study areas. 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).

Table 3-31. 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

Table 3-32. Individual projectile point data, 45-OK-18.

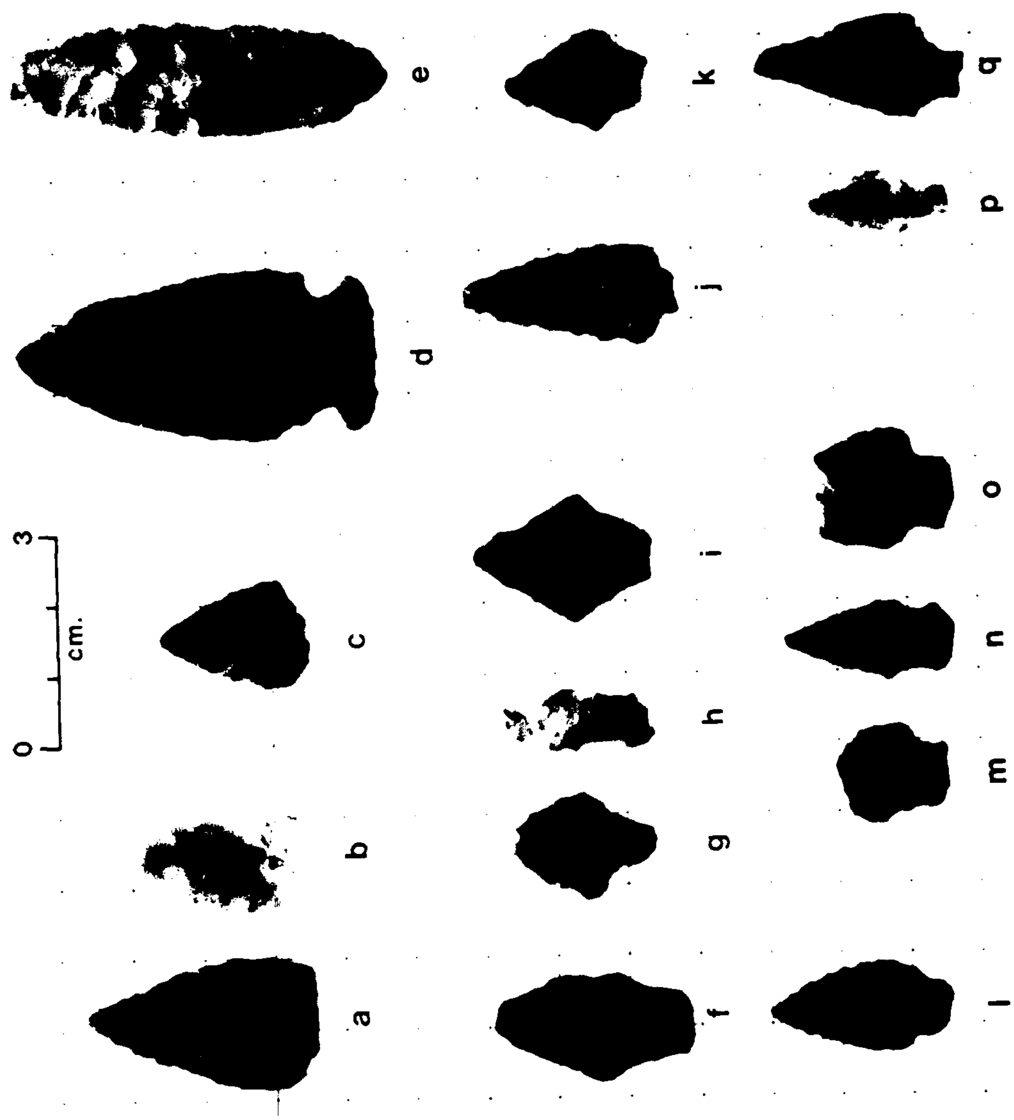
Morphological Type	Historic Type	Description	Class	Metric Attributes (mm) Length	Width	Thickness	Material	Master N	Remarks	Zone
1	62	Large, triangular	NNN2221NNB	32.8	18.5	5.5	Jasper	121		1
1	51		NNN2211NNB	33.4	16.6	5.1	Chalcedony	675		2
2	51	Small, triangular	NNN2221NNN	20.8	15.4	3.8	Jasper	402		1
3	41	Large, side-notched	11NN1221NNN	50.5	24.3	7.4	Jasper	185		3
5	28	Lanceolate	N2NN2221111	58.7	16.6	7.7	Jasper	678		2
6	61	Shouldered lanceolate	222NN221121	28.1	18.1	8.0	Fine grained basalt	308		1
6	52		222NN221121	21.8	15.7	5.2	Jasper	825		1
6	51		228NN221131	24.7	8.8	6.1	Jasper	848		1
6	31		222NN121121	252.0	16.0	4.2	Basalt	172		2
7	52	Large, shouldered, triangular, contracting stem	21228121NNN	30.8[1]	14.2	5.3	Jasper	87	Extreme tip snapped	2
8	52	Small, shouldered, triangular, contracting stem	21228121NNN	20.6	14.2	3.7	Fine-grained basalt	283		2
8	51		21221221NN2	25.8	12.4	4.8	Jasper	286		2
9	51	Large, shouldered, Non-contracting	21111121NNN	18.3[1]	14.8	4.4	Fine-grained basalt	78	Reworked	2
9	63		21311121NN2	24.1	11.3	5.8	Jasper	178		2
9	51		21311121NNN	±35.0[2]	17.5	6.0	Jasper	622	Broken blade	2
10	63	Small, shouldered, triangular	21321221NNN	23.6	10.5	3.1	Chalcedony	251		2
10	52	Non-contracting stem	21121221NNN	28.8[1]	14.1	4.6	Fine-grained basalt	508	Extreme tip snapped off	3
52	11	Large, squared, triangular, contracting stem	31211121NN2	23.8[1]	17.4	4.8	Jasper	33	Extreme tip	2
53	11		31212121NNN	36.6	15.6	5.7	Jasper	110		
52	11		31212121NNN	±40.0[2]	17.8	5.4	Jasper	282	Broken blade	2
62	11		31211821NNN	±40.0[2]	18.8	7.2	Jasper	288	Broken blade	2
53	11		31212121NNN	31.8	16.1	4.2	Fn-Gr. Basalt	580		3
53	11		31212121NN2	42.8	14.8	5.4	Jasper	581		3
52	11		31212121NNN	31.6	17.4	8.5	Jasper	587		3
53	12	Small, squared, triangular, contracting Stem	31228111NNN	±35.0[2]	16.2	3.5[1]	Jasper	334	Broken blade	1
53	12		31222111NNN	±40.0[2]	14.8	2.8	Jasper	586	Broken blade heat spalled	1
52	12		31221222NNN	28.0	14.2	3.6	Jasper	847		1
52	12		31221121NNN	±35.0[2]	13.3	4.8	Jasper	154	Broken blade	
64	12		31222121NNN	±16.7[2]	16.2	5.1	Jasper	352		
53	12		31224111NNN	±28.0[2]	12.7	4.8	Jasper	207	Tip broken off	
61	13	Large, squared, Non-contracting stem	31311821NNN	±80.0[2]	14.4	5.7	Basalt	861	Broken blade	1
52	13		31111121NNN	41.6	16.0	8.2	Jasper	595		2
72	17	Large, barbed, non-contracting stem	41311121NN2	30.6	±25.0[2]	5.5	Jasper	66	One barb broken	1

[1] Measurements are actual, even if broken or reworked
[2] Estimated measurements on broken projectile point

KEY:
Master number:
Morphological type:
Historic type:
Provenience/Level:
Zone:
Material:

	Master number	Morphological type	Historic type	Provenience/Level	Zone	Material
a.	121	1	Quilomene bar corner notched	8N45E/10	1	Jasper
b.	675	1	Rabbit Island A	18S9E/30	2	Chalcedony
c.	482	2	Rabbit Island A	12S8W/40	1	Jasper
d.	155	3	Cold Springs side notched	4S9E/70	3	Jasper
e.	678	5	Cascade C	18S9E/40	2	Jasper
f.	308	6	Rabbit Island A	8S37E/10	1	Fine-grained basalt
g.	625	6	Rabbit Island B	16S25E/20	1	Jasper
h.	646	6	Rabbit Island A	17S4W/20	1	Jasper
i.	172	6	Rabbit Island A	4S41E/30	2	Fine-grained basalt
j.	87	7	Rabbit Island B	1S20E/30	2	Jasper
k.	263	8	Rabbit Island B	7S28E/10	2	Fine-grained basalt
l.	286	8	Rabbit Island A	8S27E/20	2	Jasper
m.	79	8	Rabbit Island A	0S20E/30	2	Fine-grained basalt
n.	178	9	Columbia corner notched B	5S40E/30	2	Jasper
o.	622	9	Rabbit Island A	16S24E/30	2	Jasper
p.	251	10	Columbia corner notched B	6S22E/30	2	Chalcedony
q.	598	10	Rabbit Island B	15S32E/60	3	Fine-grained basalt

Plate 3-6. Projectile points (1), 45-OK-18.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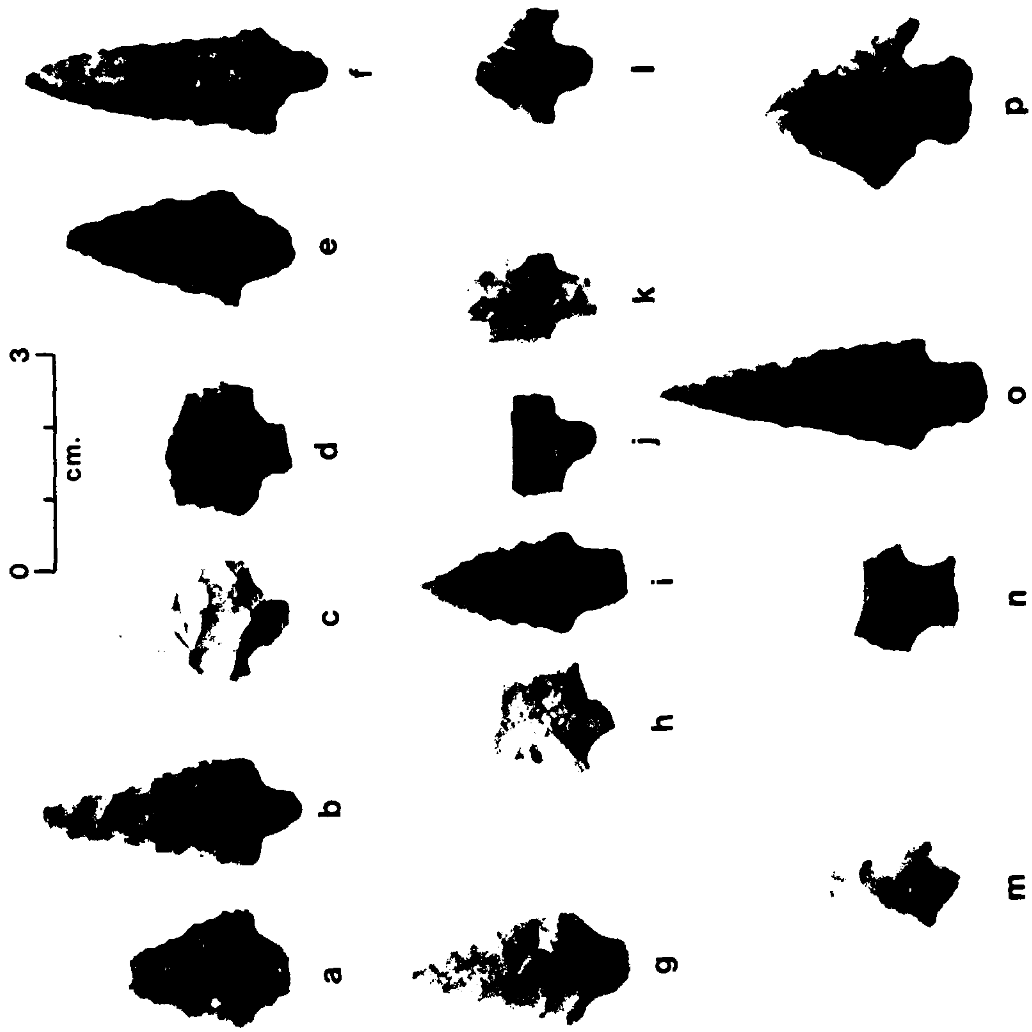
	Master number	Morphological type	Historic type	Provenience/Level	Zone	Material
a.	33	11	Rabbit Island B	4N34E/30	2	Jasper
b.	110	11	Rabbit Island C	3N13E/30	2	Jasper
c.	252	11	Rabbit Island B	6S28E/20	2	Jasper
d.	268	11	Rabbit Island B	8S18E/30	2	Jasper
e.	580	11	Rabbit Island C	14S32E/50	3	Fine-grained basalt
f.	581	11	Rabbit Island C	14S32E/60	3	Jasper
g.	597	11	Rabbit Island B	15S32E/50	3	Jasper
h.	334	12	Rabbit Island C	8S47E/10	1	Jasper
i.	647	12	Rabbit Island B	17S4W/20	1	Jasper
j.	566	12	Rabbit Island C	14S32E/10	1	Jasper
k.	154	12	Rabbit Island B	4S9E/50	2	Jasper
l.	352	12	Wallula rectangular stemmed	11S4E/40	2	Jasper
m.	207	12	Rabbit Island C	5S42E/40	3	Jasper
n.	661	13	Columbia corner notched A	16S15E/20	1	Basalt
o.	595	13	Rabbit Island B	15S32E/30	2	Jasper
p.	66	17	Quilomene Bar basal notched B	0N0E/30	1	Jasper

Plate 3-7. Projectile points (2), 45-OK-18.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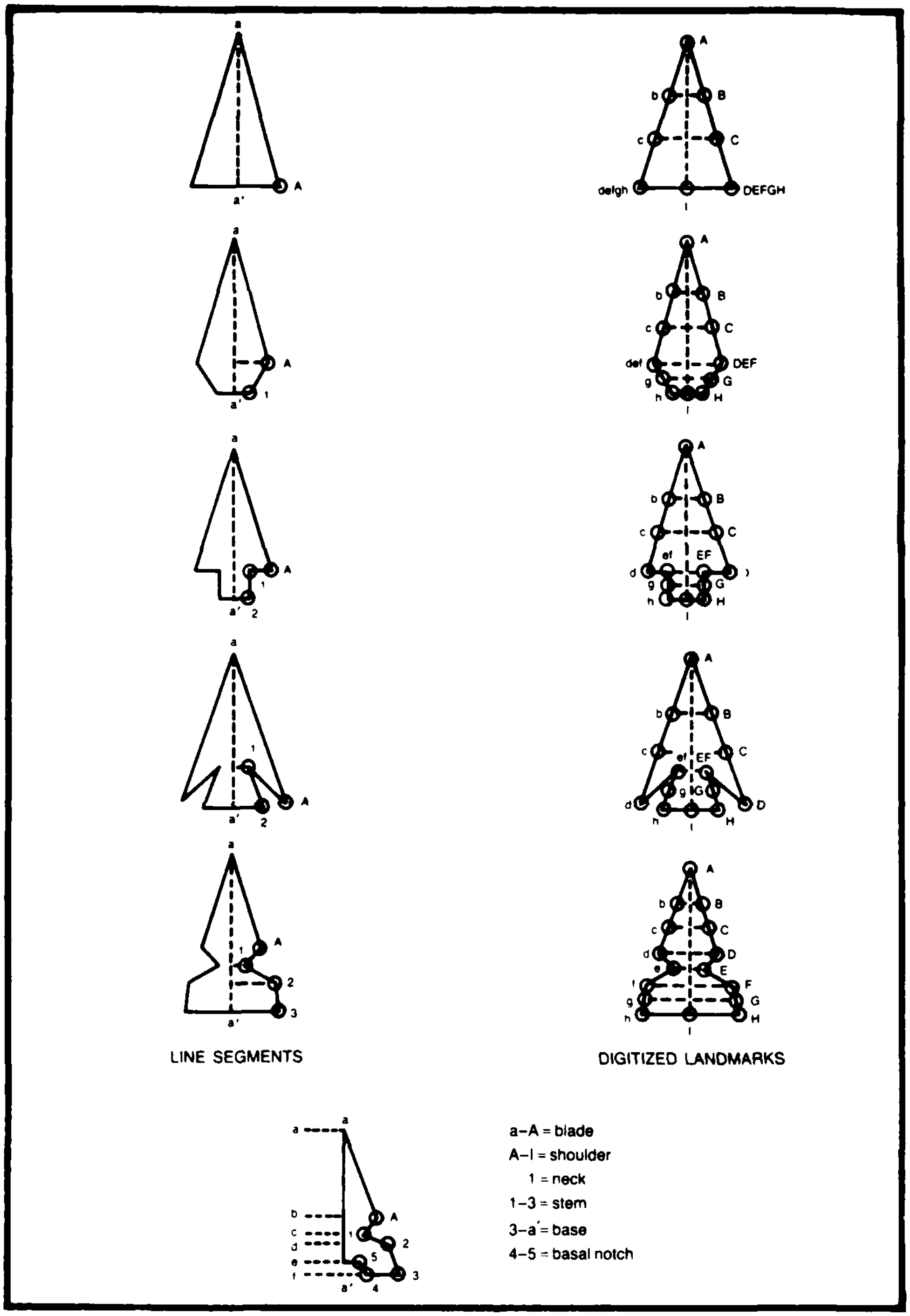

Figure 3-2. Definition of projectile point outline.

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 3-3. Historical projectile point types.

We assembled a type collection of over 1,200 projectile points from the Columbia Plateau comprising 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 into six formal type series (Figure 3-3). We consistently applied distinctions based on the original type definitions, modified, where appropriate, by subsequent research. We defined type variants, usually suggested by prior researchers, that 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. They 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.

Ten of the 23 historic projectile point types were found at 45-OK-18 (Table 3-32). See Plates 3-6 and 3-7 and Appendix B, Figure B-1 for illustrations. These point types are briefly discussed below, detailing possible correlates with types defined by other researchers.

TYPE 23. Cascade C. (N=2, Plate 3-6;e)

Elongate, often delicate lanceolate forms, with regular, symmetrical outlines, these specimens correspond to the classic Cascade Type first defined by Butler (1962). They closely resemble illustrations assembled by Butler (1962), Rice (1965), Rice (1969, 1972), Leonhardy (1970), and Leonhardy and Rice (1970).

TYPE 41. Cold Springs Side-notched. (N=1, Plate 3-6;d)

Two specimens are identified as Cold Springs Side-notched, large side-notched forms with a lanceolate outline and variable cross section. These indicate a late Cascade subphase affiliation, sometime after the 7000 B.P. date given the Mt. Mazama eruption, and characteristic of the so-called "Cold Springs Horizon" (Butler 1962, 1965). This type as presently defined, is a large, variable class of related forms. Illustrated examples (Rice 1969, 1972; Leonhardy 1970; Butler 1962; Rice 1965; Nelson 1969; Leonhardy and Rice 1970) include a variety of forms with triangular to lanceolate outlines, collateral to variable flaking, and well-defined side notches and squared basal margins to slight lateral indentations and rounded basal margins. On the Columbia Plateau, this type is seen to date in the period 7000-5000 B.P., yet in the northern Great Basin and Idaho, a similar form, the Bitterroot Side-notched is documented to date from prior to 7000 B.P. up to at least 2000 B.P. (cf., Butler 1962, 1978; Swanson 1962). Infrequent in our project area and in excavations along the middle and upper Columbia, it is impossible to assess accurately the temporal duration of these forms, beyond stating that they are considered characteristic of the late Cascade subphase.

TYPE 51. Nespelem Bar or Rabbit Island A. (N=9, Plate 3-6;b,c,f,h,i,l,m,o)

A frequent type in the Rufus Woods Lake project area, this variant of Rabbit Island Stemmed, like the Mahkin Shouldered Lanceolate discussed above, is not well documented on the Columbia Plateau as a whole. Isolated examples are fairly common, however, and are usually classified as variants of the Rabbit Island Stemmed Type (e.g., Nelson 1969; Swanson 1962; Greengo 1982). These specimens are thick, squat triangular forms with slight to well-defined sloping shoulders, and contracting, rounded stems. Comparable specimens are illustrated by Rice (1969, 1972), Nelson (1969), Greengo (1982), and Chance and Chance (1982).

TYPE 52. Rabbit Island B. (N=11, Plate 3-6;g,j,k,q; Plate 3-7;a,c,d,g,i,k,o)

Recovered specimens are large, thick triangular forms with squared shoulders and contracting stems. All have variable flaking patterns. This type is characteristic of the Frenchman Springs Phase defined by Nelson (1969) and Swanson (1962). Infrequent in collections on the lower Columbia River, where they are occasionally found in Tucannon Phase assemblages with Columbia corner-notched forms, this type is considered characteristic of the period from about 4000-2000 B.P. Comparable specimens are illustrated by Nelson (1969), Swanson (1962), Rice (1969, 1972), and Greengo (1982).

TYPE 53. Rabbit Island C. (N=7, Plate 3-7b,e,f,h,j,m)

All specimens are small, often delicate, triangular forms with markedly contracting stems. This variant of the Rabbit Island Stemmed Type appears characteristic of the latter part of the Frenchman Springs Phase, dating from about 3000-2000 B.P. (Nelson 1969; Lohse n.d.). Nelson (1969), Swanson (1962), and Greengo (1982) show comparable specimens.

TYPE 61. Columbia Corner-notched A. (N=1, Plate 3-7n)

Specimens assigned to this type show variable haft treatment, with straight to expanding stems, on large, slightly barbed triangular forms. They have a generally crude appearance, with slightly irregular outlines, and variable flaking patterns. Best defined by Leonhardy and Rice (1970), this type is seen to mark the Tucannon Phase (ca. 5000-2500), although similar forms continue to appear well into the later Harder Phase (ca. 2500-800 B.P.). Comparable specimens are presented in Rice (1969, 1972), Leonhardy (1970), Nelson (1969), and Greengo (1982).

TYPE 62. Quilomene Bar Corner-notched. (N=1, Plate 3-6;a)

The single example is a large triangular form with slightly barbed shoulders and straight to slightly expanding stem. Flaking is variable, and the lateral margins of the blade exhibit deep notches about midway down the sides. Defined by Nelson (1969), this type is part of a larger Quilomene Bar series which includes various basal-notched varieties, and is thought to date sometime after 2500 B.P., with similar forms occurring well into the late Cayuse Phase (ca. 2000-0 B.P.). Comparable specimens are illustrated by Nelson (1969) and Greengo (1982).

TYPE 63. Columbia Corner-notched B. (N=2, Plate 3-6;n,p)

Small triangular points with slightly barbed shoulders and generally expanding stems, these specimens are smaller variants of Columbia Corner-notched A. Leonhardy and Rice (1970) illustrate similar examples as characteristic of the Tucannon and Harder Phases. Comparable specimens are also illustrated by Leonhardy (1970), Nelson (1969) and Greengo (1982).

TYPE 64. Wallula Rectangular-stemmed. (N=1, Plate 3-7;l)

The type, as defined by Shiner (1961), has small, narrow triangular blades, straight to slightly barbed shoulders, and essentially straight, elongate stems. specimens are comparable to forms illustrated by Shiner (1961), Nelson (1969), and Greengo (1982), and dated to the Cayuse Phase (ca. 2000-0 B.P.). Nelson (1969) and Shiner (1961) suggest that this type is related to the Columbia Stemmed series, and may in fact, represent a form transitional between that type and the earlier Columbia Corner-notched or Quilomene Bar Corner-notched varieties.

TYPE 72. Quilomene Bar Basal-notched B. (N=1, Plate 3-7;p)

A single specimen has been classified as a Quilomene Bar Basal Notched B. A squat, triangular point of jasper, it has deep basal notches forming a thin barbed shoulder and an expanding stem.

The distribution of historic projectile point types by zone are given in Table 3-33. Figure 3-4 compares the two radiocarbon dates from 45-OK-18 with the cultural periods developed previously for the Rufus Woods Lake project area and the cultural phases defined more recently for the same area. Both dates fall into the earlier part of the Hudnut Phase (4000-2000 B.P.) Zone 3, yielding the earlier date, is slightly older than Zone 2, as is expected. However, the date from Zone 2 has a very large standard deviation, and there is only a 67% chance that this date falls into the early half of the Hudnut Phase. When three standard deviations are considered, the dated sample may fall anywhere from 4500 to almost 2000 B.P. This time span includes the late

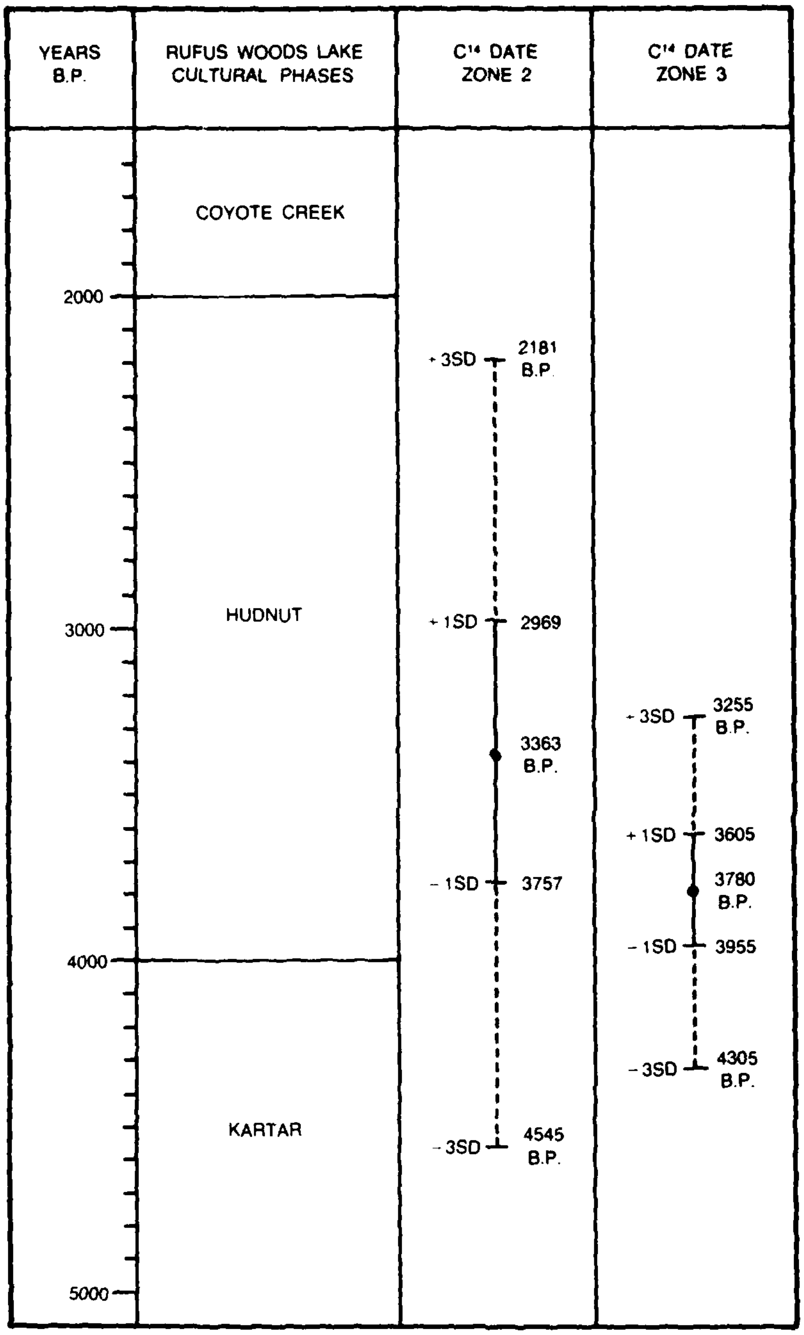

Figure 3-4. Cultural zones at 45-OK-18 in relationship to Rufus Woods Lake cultural phases and cultural sequences of nearby study areas adapted from Nelson (1969), Grabert (1968), and Chance and Chance (1977, 1979, 1982).

Kartar Phase and almost all of the Hudnut Phase. Examination of the historic projectile point types provides a more accurate temporal placement of the zones.

Table 3-33. Frequency of historic projectile point types by zone.

Zone		Historic Projectile Point Types*										Total
		23	41	51	52	53	61	62	63	64	72	
1	N	-	-	3	2	2	1	1	-	-	1	10
	Row %	-	-	30	20	20	10	10	-	-	10	
2	N	1	-	5	7	1	-	-	2	1	-	17
	Row %	6	-	29	41	6	-	-	12	6	-	
3	N	1	1	-	2	3	-	-	-	-	-	7
	Row %	14	14	-	29	43	-	-	-	-	-	
Beach	N	-	-	1	-	1	-	-	-	-	-	2
	Row %	-	-	50	-	50	-	-	-	-	-	
Total		2	1	9	11	7	1	1	2	1	1	36

* 23 = Cascade C
41 = Cold Spring Side-notched
51 = Rabbit Island A
52 = Rabbit Island B
53 = Rabbit Island C
61 = Columbia Corner-notched A
62 = Quilomene Bar Corner-notched
63 = Columbia Corner-notched B
64 = Wallula Rectangular-stemmed
72 = Quilomene Bar Basal-notched B

Type 23, the Cascade C points, and Type 41, the Cold Springs Side-notched projectile points, usually date to the early Hudnut Phase (Figures 3-5 and 3-6). Zone 3 includes one specimen of each type, for a combined relative frequency of 28%. Zone 2 includes only one point for a relative frequency of six percent. Types 51 and 52, the Rabbit Island A and B points, respectively; Type 61, the Columbia Corner-notched projectile points; and Type 63, the Columbia Corner-notched B points, all date to the whole of the Hudnut Phase. Projectile points assigned to these types comprise 29% of Zone 3 points, 82% of Zone 2 points, and 60% of Zone 1 points. Type 53, the Rabbit Island C points, Type 62, the Quilomene Bar Corner-notched points, and Type 72, the Quilomene Bar Basal-notched B points are considered to be late Hudnut Phase point types that also last through much of the Coyote Creek Phase. Zone 3 includes 43%, Zone 2 includes 6%, and Zone 1 includes 40% of these three point types. The remaining Type 64, Wallula Rectangular-stemmed points, post-dates the Hudnut and is usually assigned to the Coyote Creek Phase. One specimen of Type 64, is from Zone 2 at the site, making up 6% of the total points recovered from this zone.

The low absolute frequencies of projectile points from all zones make conclusions based on relative frequencies hazardous because of sampling error. However, higher frequencies of early projectile points are from Zone 3, and the radiocarbon date of approximately 3800 B.P. is probably accurate. Zone 2 yielded one Coyote Creek projectile point, but its presence is probably due to bioturbation, discussed elsewhere in this report. Other projectile point freqencies indicate a late early to middle Hudnut Phase placement for this zone. Perhaps the site was visited repeatedly by small groups in long, drawn out intervals, during this time period. Zone 1 probably represents two components, including a late Hudnut and a Coyote Creek Component, as suggested by the presence of Types 62 and 72 in this zone, and Type 64 in Zone 2 that probably also originated in Zone 1.

SMALL LINEAR FLAKES (MICROBLADES)

The category small linear flake was established to identify possible microblades. Analysis indicates that most of these flakes at 45-OK-18 are, indeed, microblades as defined by previous researchers Borden (1950), Browman and Munsell (1969), and Sanger (1969, 1970). We will not discuss their chronological significance, however, until small linear flakes from all sites in the project area can be considered.

Thirteen of the 103 small linear flakes have dimensions that exclude them from further consideration as microblades. Of the remaining 90, 63% have trapezoidal cross sections, that is, two arrises (see Plate 3-1;b,e,f, for examples). The remainder have one arris (see Plate 3-1;i,j, for examples). Although 45-OK-18 yielded no microblade cores, two of the objects listed under "Other," may have been struck from microblade cores. These are relatively thick, short conchoidal flakes that have three flake scars each. These scars are long and narrow, and the arrises are parallel-sided.

Several researchers, including those listed above, have discussed microblade industries on the Columbia Plateau. Sanger (1968:95, 1970:106) suggests that microblade cores provide the best evidence of the industry. Where cores are absent, an assemblage of parallel-sided flakes in which more than 25% of the specimens have a trapezodial cross section (evidence of successive flake removal) may be considered evidence of a blade technology. According to these criteria there is, indeed, a microblade technology at 45-OK-18.

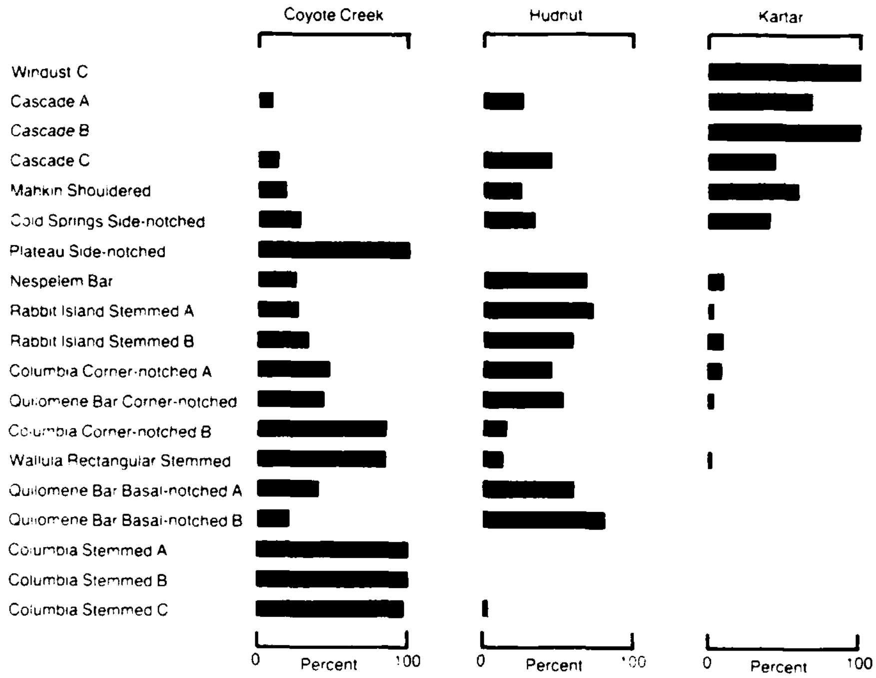

Figure 3-5. Proportions of historic projectile point types across all phases.

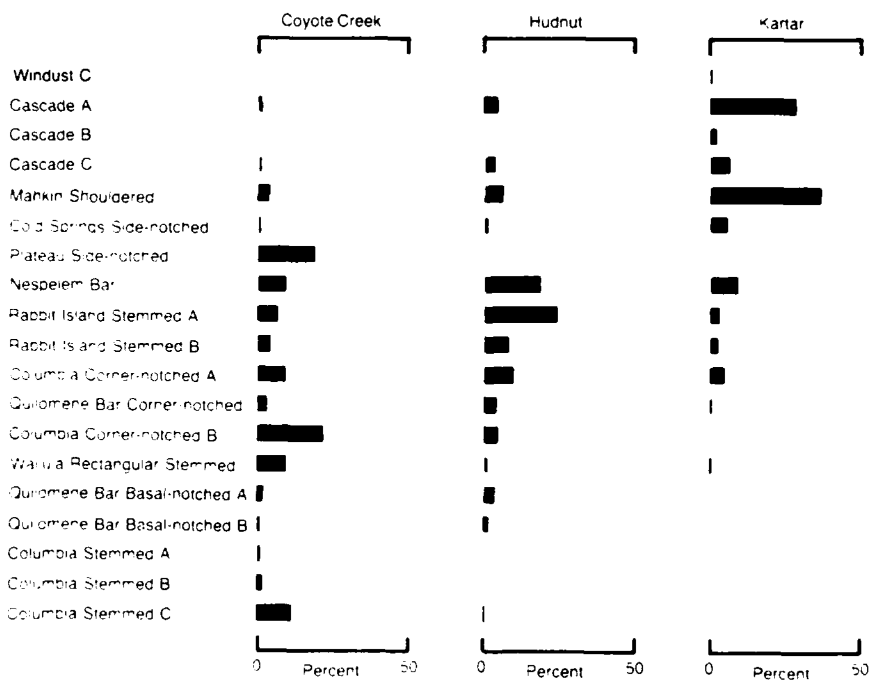

Figure 3-6. Proportions of historic projectile point types within phase.

4. FAUNAL ANALYSIS

Faunal remains from archaeological sites provide a source of data on the history 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-OK-18, and summarizes the implications of the assemblage for understanding the archaeology of the site.

FAUNAL ASSEMBLAGE

The faunal assemblage from 45-OK-18 consists of 3,061 bone fragments weighing 257 g. Of these, only 72, slightly more than 2% of the sample, are identifiable. The relatively small proportion of identifiable fragments attests to the highly fragmented nature of the bones. The identified specimens include 32 (44%) mammalian, 38 (53%) reptilian, and two (3%) fish elements. Taxonomic composition and distribution of vertebrate remains are shown in Table 4-1. Twenty fragments of river mussel, weighing 130 g, were recovered. The shells from this site have not been classified to taxon. Shell analyzed during the testing phase of this project showed that shell in the project area is predominantly Margaritifera falcata with a very minor component of Gonidea angulata.

The following summary lists the elements identified for each taxon and criteria used to identify them, where applicable, and discusses past and present distribution and cultural significance. A summary of elements representing each taxon is provided in Appendix C.

SPECIES LIST

MAMMALS (NISP=32)

Marmota flaviventris (yellow-bellied marmot) -- 3 elements.

Marmots are common residents of talus slopes. They estivate from late June and may pass directly into hibernation in August. They do not come out again until some time in February or March (Dalquest 1948; Ingles 1965). Ethnographically, marmots were exploited as a small game resource, but there is no evidence, such as butchering marks or burning, to indicate that the marmot bones in these zones were deposited by cultural agents.

Table 4-1. Taxonomic composition and distribution of vertebrate remains, 45-OK-18.

Taxa	Zone 1		Zone 2		Zone 3		Zone 4		Site Total	
	NISP[1]	MNI[2]	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI
MAMMALIA (NISP=32)										
Sciuridae										
Marmota flaviventris	1	1	1	1	1	1	-	-	3	1
Geomyidae										
Thomomys talpoides	-	-	9	2	4	2	1	1	14	2
Heteromyidae										
Perognathus parvus	1	1	5	1	1	1	1	1	8	3
Cricetidae										
Peromyscus maniculatus	-	-	1	1	-	-	-	-	1	1
Microtus	-	-	2	1	-	-	-	-	2	1
Lagurus curtatus	-	-	3	2	-	-	-	-	3	2
Deer-Sized	-	-	1	1	-	-	-	-	1	-
REPTILIA (NISP=38)										
Chelydridae										
Chrysemys picta	-	-	13	1	1	1	-	-	14	1
Colubridae	-	-	24	1	-	-	-	-	24	1
PISCES (NISP=2)										
Salmonidae										
Oncorhynchus sp.	-	-	-	-	2	1	-	-	2	1
Total	2		59		9		2		72	

1 Number of Identified Specimens.
2 Minimum Number of Individuals.

Thomomys talpoides (northern pocket gopher) -- 14 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) -- 8 elements.

Perognathus parvus is the only heteromyid rodent in the project area. These mice are common residents of sagebrush areas. P. parvus is most likely present as a result of natural agents of deposition.

Peromyscus maniculatus (deer mouse) -- 1 element.

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

Microtus spp. (meadow mouse) -- 2 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) -- 3 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.

Deer-Sized (deer, sheep, antelope) -- 1 element.

Fragmentary elements of deer, sheep, and antelope frequently are missing the landmarks that distinguish the three taxa. Such elements have been grouped under the label "deer size."

ᶜPTILIA (NISP=38)

Chrysemys picta (painted turtle) -- 14 elements.

Chrysemys picta is the only turtle currently living in the project area. Clemmys marmorata (western painted turtle) has been reported in the eastern part of Washington in the ethnographic literature, but there is no way to ascertain if taxonomic identification is accurate. C. marmorata now occur only on the west side of the Cascades and in the southern part of the state. On the basis of present distributions all turtle remains have been tentatively assigned to C. picta. The turtle shell in this assemblage is too fragmentary to determine whether it is carapace or plastron.

Family Colubridae (colubrid snakes) -- 24 elements.

There are at least four snakes living in the project area that may be represented by these vertebrae: Coluber constrictor (western yellow-bellied racer), Pituopis melanoleucus (gopher snake), Thamnophis sirtalis (valley garter snake) and T. elegans (wandering garter snake). The 24 vertebrae were found together and probably belong to the same individual.

PISCES (NISP=2)

Family Salmonidae -- 2 elements.

These vertebrae could belong to any one of at least eight species of salmonid fish known in the project area. Any fish vertebrae with parallel-sided, fenestrated centra were assigned to this family.

DISCUSSION

All identified taxa occur in the site area at present, and tend to be the most common taxa recovered from archaeological sites in the project area. None of the identified fragments exhibit evidence of alteration from which inferences of cultural use could be drawn. However, use of vertebrate resources by ethnographically known groups living in or near the project area suggest that the marmots, artiodactyls, turtles and fish may have been deposited in this site as a result of human use. The remaining taxa are common residents of the site area, and remains of these taxa tend to be common even in noncultural sediments.

If the marmots and turtles were deposited as a result of human activities they may be used as indicators of season of site occupation. Both taxa are seasonally active. Marmots estivate from June to August and hibernate from August to March (Dalquest 1948; Ingles 1965). Consequently, if marmots were taken while active, they indicate that the site was occupied during the spring months in Zones 1, 2, and 3. Turtles hibernate from October until March or April (Stebbins 1966; Ernst and Barbour 1972). They are available between April and October, indicating that the site was occupied during the spring and/or summer in Zones 2 and 3.

The estimated spring and/or summer occupations during the formation of Zones 1, 2, and 3 represent a minimum estimate of season of site occupation for these zones. As is the case for all seasons in Zone 4, we have no means of assessing, for Zones 1, 2, and 3, whether or not the site was occupied during seasons for which there are no seasonally sensitive taxa. A site may be used during a given season and leave no seasonal indicators, especially in faunal samples as small as this. Further, seasonality inferences require making the assumption that the faunal remains were deposited during the inferred season as the result of human activity and the assumption that there has been no change in the seasonal behavior of the taxa involved (Monks 1981). For these reasons, the season(s) of site occupation inferred from the faunal assemblage must be considered as one estimate, to be compared with botanical and/or sedimentological estimates when available. The extremely small size of this sample precludes drawing any further inferences regarding subsistence or environments.

5. BOTANICAL ANALYSIS

Botanical studies, sometimes termed paleoethnobotany, concern analysis of vegetable materials found in archaeological matrices (Dimbleby 1967; Renfrew 1973; Dennel 1976; Ford 1979). Archaeobotanical materials can provide information about the resource base of the peoples who inhabited a site. With lithic and faunal materials, they help us interpret features and larger-scale activity areas. The presence and condition of certain kinds of seeds can suggest seasonality of site use.

At 45-OK-18, 23 flotation samples were taken from 1,350 g of sediment. Six carbon samples collected for radiocarbon dating also were examined. Flotation procedures are described in detail in the project's research design (Campbell 1984d). Because collection procedures at this site differed from those used at other project sites, however, procedures used to float the sediment samples differed as well.

Flotation samples were taken from each unit level of two test units (10S7E, levels 20-100; 20S8E, levels 30-80) and one unit (10S8E, levels 20-90) excavated during full-scale data recovery. Because of their small size (average weight ca. 59 g), all of these samples were sugar floated, and standard subsamples were not drawn. Only one sample contained any carbon in the light fraction. Quantities presented in the following tables represent all archaeological carbon from each sample, including the heavy fraction of the sugar flotation sample. The weight of archaeological carbon from all flotation samples is 0.34 g, producing a carbon:noncarbon ratio of 0.03%, a figure comparable to those from sites for which water flotation only was used.

The following sections describe the botanical assemblage from 45-OK-18 by taxa and briefly discuss the subassemblage of each zone.

BOTANICAL ASSEMBLAGE

Table 5-1 shows the carbon ratios from flotation samples by depth, zone and age in radiocarbon years. Table 5-2 summarizes the botanical assemblage from both flotation samples. Carbon samples are discussed in the text. The assemblage of flotation and radiocarbon material is presented below arranged alphabetically by family. Possible uses are suggested from information supplied in the ethnobotanical and ethnographic literature. Seasonality data are included where pertinent.

Table 5-1. Percentage of archaeological carbon in flotation samples (N=23), 45-OK-18.

Zone	Carbon:Noncarbon Ratio	Approximate Depth
1	0.02%	
		-0.5m-
2	0.03% 3363±394 (B-2521)	
		-1.0m-
3	0.01% 3780±175 (TX-3052)	

Table 5-2. Botanical assemblage by analytic zone, weight, and number of occurrences (N=23), 45-OK-18.

Identified Material	Zone 1 wt(g)	Zone 1 N	Zone 2 wt(g)	Zone 2 N	Zone 3 wt(g)	Zone 3 N	Total wt(g)	Total N
Conifer (34%)								
Pine	<.01	2	.04	3	-	-	.04	5
Douglas Fir	-	-	<.01	2	-	-	<.01	2
Larch	-	-	<.01	1	.01	2	.01	3
Pinaceae	<.01	1	.04	3	-	-	.04	4
Bark	-	-	<.01	1	-	-	<.01	1
Other conifer	<.01	2	.01	4	<.01	3	.02	9
Hardwood (52%)								
Sage	-	-	.10	8	.01	2	.11	10
Bitterbrush	<.01	1	.02	5	.01	1	.03	7
Rabbitbrush	-	-	.01	1	-	-	.01	1
Hackberry	<.01	1	-	-	-	-	<.01	1
Serviceberry	-	-	<.01	1	-	-	<.01	1
Rosaceae	<.01	3	.01	5	-	-	.01	8
Other hardwood	-	-	.01	1	<.01	3	.02	4
Edible plants (2%)								
Cherry pits	-	-	.01	2	-	-	.01	2
Other tissue (12%)								
Seeds	<.01	1	<.01	1	-	-	<.01	2
Grass	<.01	2	<.01	1	-	-	<.01	3
Stem/leaf	<.01	2	<.01	3	<.01	1	.01	6
Other	<.01	3	.01	7	<.01	2	.03	12
Total	.03	17	.27	47	.04	14	.34	78

APIACEAE (Umbelliferae, Parsley or Celery Family)

Lomatium Raf. (desert parsley, biscuitroot)

Lomatium root tissue was taken from a carbon sample from 10S8E, level 60. The lomatium tissue is delicate and weighs very little compared to wood. At 12% by weight, lomatium tissue is an exceptionally large percentage of the total.

Although species cannot be assigned on the basis of root tissue fragments alone, this specimen probably is from a species with large storage roots. Two of those in the project's comparative collection have large roots--Lomatium dissectum (chocolate tip) and L. macrocarpum (Nutt.) Coult. & Rose (desert parsley). Only the latter is edible. Lomatium was collected in late June and early July to be eaten fresh, boiled, dried, or pit cooked with lily bulbs and bitterroot (Turner et al. 1980:68-69). An example of Lomatium macrocarpum is shown in Plate 5-1.

ASTERACEAE (Compositae, Daisy Family)

Artemisia tridentata Nutt. (sagebrush, big sagebrush)

Sage is the most common hardwood found in samples at the site and it continues to grow there. Sage was found in 10 of 23 flotation samples and two of six carbon samples, 41% of all samples examined. Sage also accounts for 32% of all flotation sample material by weight. It is found associated with conifer and bitterbrush in all zones. Nearly all of the sage examined is stem wood; one leaf was found.

Because sage wood tends to exfoliate between annual rings and between rays, it probably was used primarily for fuel, rather than for manufacturing artifacts. Rolled into a bundle, sage bark has been used as a slow match (Ray 1932:43). Branch tips and leaves have been used as a fumigant, a disinfectant, a deodorizer, and an insect repellent (Turner 1979:179); green parts of the plant had medicinal uses (Turner et al. 1980:79).

Chrysothamnus nauseosus (Pall.) Britt. (rabbitbrush)

Rabbitbrush stem wood was found in Flotation Sample 4. Rabbitbrush is a small, slender shrub found among sage and bitterbrush on terraces and hillsides near the river; it presently grows at the site. Although nearly identical to sage in woody structure, its stems do not grow large enough to constitute a good fuel for cook fires. It has been used as a hide-smoking material in this area (Ray 1932:217; Turner 1979:185-186); in the American Southwest, buds and flowering material were used to make a dye (Vestal 1952:49-50).

Plate 5-1. Lomatium macrocarpum, Douglas County harvest site. Root partially exposed, total weight of 28 g. Distance from round surface to top of root is 14 cm. Note low, inconspicuous leaves.

Plate 5-2. Prunus virginiana, chokecherry. Nespelem River. Bush height, 3 m.

PINACEAE (Pine Family)

Pine family members are found in nine flotation samples and three carbon samples, 41% of all samples examined. Genera represented include Pinus, pine; Pseudotsuga, Douglas fir; and Larix, larch. Charcoal of these and other genera are designated Pinaceae when pieces are too small to identify further. Because the smallness of the samples meant we examined every fragment, this category is quite large at the site.

Yellow Pine

Most of the pine is ponderosa (Pinus ponderosa Dougl. ex D. Don). In addition, one of the flotation samples probably contains lodgepole pine (P. contorta Dougl. ex Loud.). Since the two pines do not differ appreciably in microscopic structure, and since we are speaking about only 0.01 g of material, the term "yellow pine" is used for both species. Young lodgepole pines are particularly suited for construction, and they tend to prefer slightly moister environs than ponderosa. Both, however, are good building material and good fuel.

Pseudotsuga menziesii (Mirb.) Franco (Douglas fir)

Douglas fir currently grows among ponderosa pine above the floodplain. Occasional individuals can be seen close to the water upstream in protected spots on the Douglas County side of the river, and samples can be picked from driftwood on both sides of the Columbia. Fir charcoal from the site comes from two flotation samples and three carbon samples.

Fir burns well. The ethnographic record notes also that fir was the preferred wood for harpoons because long straight warp- and water-resistant shafts could be made of it (Post and Commons 1938:55-56).

Larix occidentalis Nutt. (Western larch, tamarack)

Larch was found in three flotation samples. The nearest present source of trees is in moist and shaded environments above 540 m in the Condon-Harrison-Coyote Creek drainage area along Kartar road. The wood does not seem to have been valued highly as a construction material among the Okanogans, although it was used as fuel and the gum was eaten (Ray 1932:105).

Other Conifer

Approximately 0.02 g of conifer charcoal is distributed among nine flotation samples from Zones 1, 2, and 3. In general the fragments are too small to enable us to classify them according to family.

POACEAE (Gramineae, Grass Family)

Small quantities of small-stemmed grass were found in three flotation samples. Two samples are a solid-culmed grass that probably belongs to the genus Sporobolus, dropseed grass. The third cannot be identified, although it is about the same slenderness and overall size (about 30-70 cm tall) of dropseed grass.

Sporobolus seeds are free-threshing, making the grain edible without prolonged processing. Since they are only about 1-2 mm long, however, the grains seem very small for intensive gathering, nor is this genus listed in regional ethnobotanies. Since grass is fairly common in flotation samples at 45-OK-18 and other sites, it probably is a general part of camp refuse and had a variety of purposes. Grass, such as pine grass (Calamagrostis), which is similar to dropseed in habitat, culm diameter, and height, reportedly was gathered for packing material, for layering surrounding food bundles in steam pits, and for use as moccasin linings (Turner et al. 1980:53). Sporobolus could fill these purposes as well.

ROSACEAE (Rose Family)

Amelanchier alnifolia Nutt. (serviceberry, saskatoon)

Serviceberry wood was found in a flotation sample from occupational debris from 10S8E, UL 50 and in one carbon sample from 2N6E in the same unit level. In the carbon sample it was found with Douglas fir charcoal. No fruiting material was observed.

Serviceberry wood is hard and durable, suited for digging sticks, arrow shafts, seed beater frames, cooking sticks, and the like (Ray 1932:98; Post and Commons 1938:53,58,60).

Crataegus L. (hawthorn, thornberry, haw.)

Hawthorn wood was found in a carbon sample from an occupation layer in 10S8E. The particular carbon sample includes a variety of other species such as lomatium tissue, herbaceous stem tissue, and Douglas fir, sage, and hackberry wood. Hawthorn wood contributed 44% of the carbon total.

Two species of hawthorn currently grow near the site (C. columbiana, and C. douglasii), but we cannot distinguish between them. Turner states that the wood of black hawthorn was used occasionally for digging sticks, mauls, wedges and clubs, and the thorns for piercing (1979:234; Turner et al. 1980:125).

Prunus L. (wild cherry)

Two cherry pit fragments were found in fotation samples from occupational debris in 10S7E and 10S8E (UL 40 and 70, respectively). The pits were identified on the basis of cross section morphology and the presence of a suture. They may be either bitter cherry (_P. emarginata_ [Dougl.] Walpers) or chokecherry (_P. virginiana_ L.). The former, however, is not common on the floodplain and has not been observed thus far in the project area.

According to Post (1938:101), chokecherry fruits were gathered in mid-August and often were treated like serviceberries, dried on mats and stored whole. Alternately, they could be pounded along with salmon by-products such as heads, tails, or eggs. Ray notes that chokecherries were used fresh, and that unseeded, mashed fruits were mixed with pulverized, dried salmon and stored (1932:101). Turner reports similar treatment except that she does not mention seed removal (Turner et al. 1980:127-128).

Large numbers of whole pits might suggest fresh fruits eaten out of hand during the fall. Pit fragments, however, could result either from preparation for storage or from consumption during the winter. A wild cherry bush is shown in Plate 5-2. The fruits are barely turning color during the first week in August when this was photgraphed. In the last two years, chokecherries ripened in mid-August on the Nespelem River. Prime harvestability in the area above the falls was on or about August 26 in 1981.

Purshia tridentata (Pursh) D.C. (bitterbrush, greasewood)

Bitterbrush charcoal appears in 31% of the samples, seven flotation samples and two carbon samples. The wood of bitterbrush apparently was not utilized for tools or other items; the Southern Okanogan reportedly used it to give a hot fire, particularly in the initial stages of making an earth oven (Turner et al. 1980:128).

Two portions of carbonized seed coat believed to be bitterbrush were found. Bitterbrush seeds ripen in the last half of June. Since bitterbrush now grows on and near the site, these seeds could have been introduced naturally.

Other Rosaceae

Eight samples contained wood fragments too small to identify further. Most of these appear to be samples of rose family woods already noted, such as hawthorn, serviceberry and bitterbrush.

ULMACEAE (Elm Family)

Celtis douglasii Planch. (hackberry)

Hackberry wood was found in one carbon sample and one flotation sample. Hackberry shrubs and trees dot the local area, and are numerous at the base of rock and talus accumulations along with rose, mock orange, and serviceberry bushes. The small (6-8 mm) fruits are edible, although the pulp is thin and the "seed" (a bony nutlet) large.

Although the wood is not mentioned in regional ethnobotanies, it is used now for the same commercial purposes as elm and white ash (Panshin and de Zeeuw 1980:578) since it is hard and durable.

SUMMARY BY ZONE

The botanical assemblage from 45-OK-18 is summarized below by zone. Zones are discussed in reverse numerical order, oldest first.

ZONE 3

Six flotation samples and one carbon sample were derived from Zone 3. The carbon sample consists of 0.7 g of bitterbrush charcoal. The flotation samples contain little material--traces of conifer, larch, and unidentified hardwood.

ZONE 2

Diverse botanical remains come from Zone 2. The zone contains 78% by weight of all remains from flotation samples. The 12 samples contributed 0.27 g of materials from 779 g of soil, providing a carbon:noncarbon ratio of 0.03%. Since only three excavation units were sampled and two are adjacent, the most southern unit will be discussed first and the adjacent units together.

Excavation unit 20S8E has flotation samples from unit levels 40, 50, and 60, as well as one carbon sample from level 40. The carbon sample consists of branch material from Douglas fir. The three flotation samples, with a combined field weight of 154 g, yielded over 0.02 g of material (combined carbon:noncarbon ratio of 0.01%). Half of this amount is larch charcoal. In addition, there is a trace (<0.01 g) of pine and shrubby, rosaceous wood. A sage twig, not completely carbonized, probably is not archaeological. Immature ant bodies were noted in one of the samples, suggesting the presence of an ant nest in the unit. No nonwoody material was taken from the flotation samples.

The remaining nine flotation samples and one carbon sample are from unit levels 40-70 in adjacent units 10S7E and 10S8E. More than 0.23 g of material was taken from 625 g of soil from these units for a combined ratio of 0.04% carbon, a very high yield. The amount and diversity of the botanical materials from these samples indicate an occupation layer. This can be pinpointed more exactly using carbon ratios. For instance, the carbon:noncabon ratio at UL 40 of both units is 0.01%. The ratio rises to 0.05% in UL 50 and peaks in UL 60 at 0.1% before dropping to 0.02% in UL 70.

Flotation materials from Zone 2 are shown below in Table 5-3 (see also Table 5-2). Conifer wood from this zone consists of a high percentage of yellow pine (P. ponderosa and/or P. contorta), a trace of fir, a trace of larch, and a few fragments of conifer bark. All the Douglas fir charcoal is from the late wood portion of the annual ring. Well over half of the conifer wood (0.05 g) cannot be identified to genus. About 45% of it, however, is from the Pinaceae family, and about 10% is probably from families other than Pinaceae.

Table 5-3. Results of flotation, Analytic Zone 2, by weight, percentage, and number of occurences (N=12), 45-OK-18.

Type of Material	Weight (g)	%	Count	%
Conifer	0.09	33.3	14	28.6
Hardwood	0.15	55.6	21	42.9
Edibles	0.01	3.7	2	4.1
Other	0.02	7.4	12	24.5
Total	0.27	100.0	49	100.1

In the hardwood group, sage stands out as the most important wood (0.1 g). It is found in 66% of the flotation samples, the highest amount of any wood in the zone. Bitterbrush is second, (0.02 g) occurring in 42% of the flotation samples. The remaining hardwoods consist of rabbitbrush (0.01 g) and a trace of serviceberry. Each appears once. About one fifth of the hardwood charcoal cannot be identified to genus. Half of its belongs to the rose family, and the other half remains unknown.

Edible tissue from the flotation samples consists of cherry pits; one sample is from level 40 in 10S7E and another from level 70 in 10S8E. Lomatium tissue was found in a carbon sample taken from between the cherry samples (10S8E, UL 60). A section of seed coat, probably from bitterbrush, comes from UL 50. The three species are ripe at different times: cherry in late August, bitterbrush seeds in late July, and lomatium roots from early June until early July. The root cells are in excellent condition, which would not be the case had they been mashed into cakes. On a few pieces portions of the last inner layer of epidermal tissue are present, suggesting that the roots had been peeled before they were charred. We cannot tell from this evidence whether the roots were consumed at harvest time or later.

Other tissues from Zone 2 include grass and epidermal tissue from the occupation layer. The epidermal tissue suggests assorted camp refuse.

Three remaining carbon samples from Zone 2 consist of 0.6 g of Douglas fir from 20S2E, 0.5 g of bitterbrush from 12S17E, and a small sample of fir and serviceberry from 3N6E.

ZONE 1

Zone 1 is represented by five flotation samples and one carbon sample. The carbon sample consists of about 3 g of carbonized and partially carbonized sage from 4S42E. This sample may be modern, derived from a contemporary burned bush or root, as the excavator believed.

The flotation samples yielded a total of 0.03 g of archaeological carbon for a zone average of 0.02% (carbon:noncarbon ratio). Among the plants present are pine, bitterbrush, hackberry, grass, herbaceous twig ends, and portions of a probable bitterbrush seed coat. Finally, there are three examples of a diffuse, porous wood belonging to the rose family.

6. FEATURES

Only three cultural features were recorded at 45-OK-18 and all were found in Zone 2. Two are discrete associations of artifacts; the other is a pit filled with charcoal.

Feature 2 (12S6W) consists of a quartzite knife, two basalt flakes, and a utilized flake that were piled on top of one another (Figure 6-1). A cryptocrystalline retouched flake was nearby but in no clear association. No living surface, staining, or other cultural materials were noted. It is, of course, possible that this feature results from a natural sifting of artifacts through the loose sand deposits. If it is a cache or a deliberate pile of objects, there is no pattern in the type of objects gathered to suggest a specific use. Even though the function of Feature 2 is unclear, we believe that it was formed deliberately.

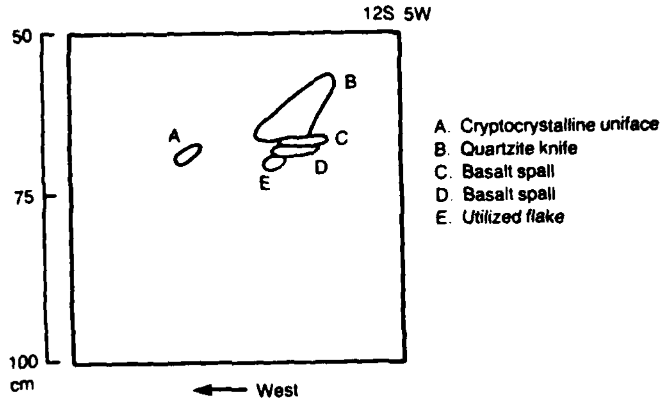

Figure 6-1. Profile of Feature 2, Zone 2, 45-OK-18.

Another aggregation of artifacts, Feature 3, occurs in 8S18E. Three hammerstones, two fire-modified rocks, and some unmodified granite and basalt rocks lay close together in a 1 x 1 x .2-m area (Figure 6-2). One hammerstone lay on top of another. This feature is part of a general increase in artifact density, especially of FMR, exhibited in these levels. It resembles Feature 2 in that its function is obscure, yet is apparently a deliberate grouping of objects. Feature 3 differs from Feature 2 in the classes of artifacts it contains.

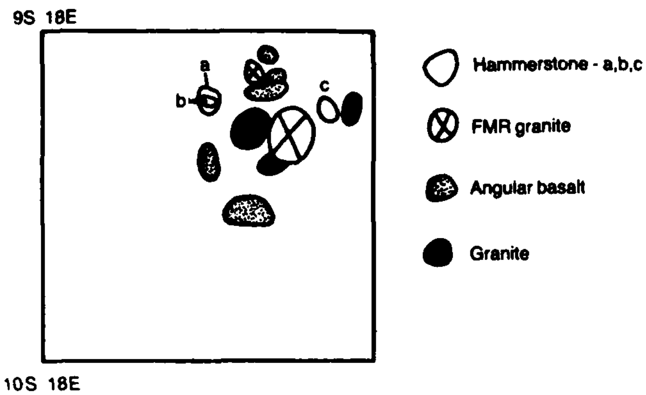

Figure 6-2. Plan view of Feature 3, Zone 2, 45-OK-18.

Feature 4 is firepit which either was not constructed with rocks or from which all FMR have been removed. It is a basin-shaped area of charcoal and charcoal staining (Figure 6-3) approximately 50 cm in diameter. Only the eastern half of the feature was intact. No artifacts were recovered from the pit. A carbon sample from it combined with four other small samples from the same unit level (10S4E, Level 60), yielded a date of 3363±364.

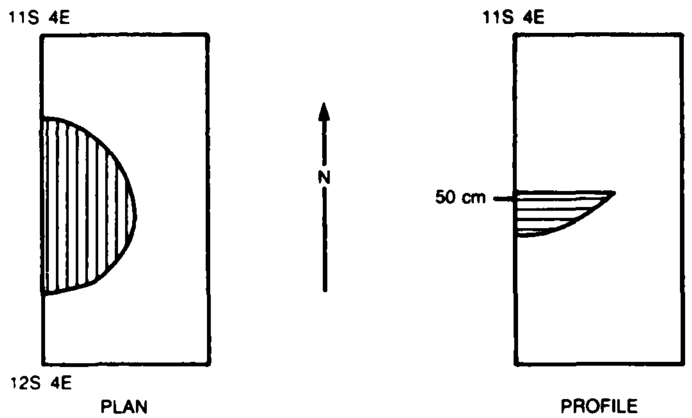

Figure 6-3. Plan and profile of Feature 4, Zone 2 45-OK-18.

The three features at 45-OK-18 are more informative when one considers what they are _not_ rather than what they are. They are not structured, bounded features, associated with compact living surfaces. Nor are they dense concentrations of debris deep pits lined with FMR. They are few in number, suggesting either that evidence of more intensive occupation has eroded away at 45-OK-18 or that man's use of the site was short-lived and resulted in little modification of the site surface.

7. SYNTHESIS AND INTERPRETATION

This chapter presents a short discussion of all analyses of data from 45-OK-18. Most of the information cited here is summarized from previous chapters on stratigraphy and chronology, artifacts, features, and archaeofaunal analysis. New data are presented on artifact distributions.

GEOCHRONOLOGY

Site 45-OK-18 covers a relatively small area and its deposits are shallow. Stratigraphic information was not collected until a year after the site's excavation and so is limited. We have, however, supplemented stratigraphic analysis with excavators' observations. The resulting geochronology is both simple and straightforward.

The earliest cultural zone, Zone 4, is in or on DU I. This unit is composed of Columbia River gravels deposited in early postglacial times (see Chapter 2). The presence of many contracting-stemmed projectile points in Zone 4 indicates that cultural materials are not much older than those of the dated Zone 3 above. Since traces of Mazama ash (ca. 6700 B.P.), seen above Columbia River gravels in profiles of other terraces are absent here, more than 3,500 years seem to have transpired between the deposition of the gravels and deposition of the sediments of DU II. This leads us to conclude that the Zone 4 occupation probably took place sometime after DU I was deposited, and that some of its cultural material sifted down into the upper 10 cm of the DU I gravels.

Zone 3 is in overbank deposits of DU II that lie on the Columbia River gravels. These deposits are due to periodic, perhaps annual, flooding of the site. Such flooding may have occurred either because the river bed was higher then than it is now or because floods were particularly severe at that time. It is also possible that repeated hill slippage downstream dammed the river and impounded waters that built up slackwater deposits at the site. The first explanation is the least likely because the 6,000 year interval from the end of the Pleistocene (DU I) to the initial occupation (DU II) was long enough for the river to have cut down almost to its present channel. On the basis of a radiocarbon date from cultural inclusions in DU II, we believe the overbank deposits are about 3,800 years old.

Zone 2 is in DU III, an aeolian deposit with some slope wash, dated to about 3400 B.P. By this time, regular site flooding had ended and overbank deposition along with it. DU III has a greater density of cultural material than any of the other depositional units at the site. This may be because site build-up was slower during the deposition of Zone 3, or because larger groups of people visited the site. People may have also visited the site more often than at other times.

Zone 1 is in DU IV, an aeolian deposit with some slope wash that is harder and more compact than deposits in DU III. We attribute this hardness and compactness to postdepositional influences, primarily weathering. This indicates that these layers were laid down more slowly than underlying deposits. This deposit postdates 3400 B.P., but judging from the presence of shouldered lanceolate projectile points, probably not by more than a few hundred years.

Radiocarbon dates and projectile point assemblages indicate that the depositional sequence from DU II through DU III probably occurred from about 4,000 to about 3,000 years ago. This suggests that the surface was stabilized for much of the time the project area was occupied. There is nothing on the surface to indicate that additional deposition and deflation have taken place since the last prehistoric occupation, but farming on and near the site may have destroyed such evidence.

Reasons why the site was abandoned must remain a matter of speculation. On the evidence gathered, however, we can offer a reasonable scenario. Corps of Engineers aerial photographs taken in 1930 show a long, low terrace below the site approximately between one and 50 ft above ordinary high water (Salo, personal communication 1982). This terrace is now inundated by Rufus Woods Lake. We suspect that the Columbia River had cut down deeply enough into the canyon to expose this terrace about 3,500 years ago, a date coinciding with the abandonment of 45-OK-18. We assume that the prehistoric occupants of the area resettled on the lower terrace because it provided easier access to the water. Any occupation records contained on the lower terrace are now far below the lowest operating level of the Chief Joseph Dam reservoir, making further speculation about the occupation sequence of the last 2,500 years fruitless.

CULTURAL CHRONOLOGY

Radiocarbon dates place 45-OK-18 within the project's Hudnut Phase. The high relative freqency of Rabbit Island projectile points (they make up 75% of all typed points from the site) supports this phase assignment. The early date from Zone 3 and the presence of Cascade C and Cold Springs Side-notched projectile points indicate that this zone dates to the early part of the Hudnut Phase. Zone 2 occupation followed Zone 1 and probably occurred infrequently from the late part of the early to the middle Hudnut Phase. This interpretation is based on one radiocarbon determination and a total of 17 projectile points, comprising 47% of the site's classified points. Zone 1 appears to be a mixed component that includes both late Hudnut Phase and Coyote Creek Phase materials.

SEASONALITY

The quantity of cultural remains, particularly the relatively small number of artifacts and even smaller number of features in comparison with other sites in the project area, suggest that the site was occupied very sporadically. Table 7-1 presents data on seasonality of occupation.

Table 7-1. Indications of seasonality by zone, 45-OK-18.

Zone	Botanical			Faunal	
	Roots	Berries	Bitterbrush Seeds	Marmots	Fishes (Salmonids)
1			Last half of June	February-late June	
2	Late June-early July	Mid-late August	Last half of June	February-late June	
3		Mid-late August		February-late June	June-September

The presence of marmot bones and burned bitterbrush seeds in Zone 1 suggests that the site was occupied during the last half of June. It is unlikely that the marmot bones were incorporated into the deposits naturally. The site is not on a talus slope, the marmot's usual habitat, and the bones were recovered as part of an assemblage that includes lithic artifacts, a few features, and many other bone fragments. Several of the bone fragments show definite cultural modification (see Chapter 4) making it more than likely that marmot bones are on the site because people put them there. The seeds probably came from bitterbrush used for fuel, since bitterbrush berries are not used for food (see Chapter 6).

Zone 2 yielded four indicators of seasonality: roots, berries, bitterbrush seeds, and marmot bones. The presence of marmot bones shows that occupation could have taken place between February and late June. The lomatium root and bitterbrush seeds narrows this to late June, possibly early July. The presence of chokecherry pits indicates that the site probably was occupied during berry gathering times in mid-August as well.

Zone 3 also may have been occupied in June and August. The faunal indicators point to a June occupation, while chokecherry pits again imply an August occupation. Zone 4 yielded no seasonality indicators. In general, then, the site appears to have been occcupied primarily during the summer.

FAUNAL AND BOTANICAL REMAINS

Identified faunal remains include marmot, rats and mice, turtle, snake, fish, and deer-sized antiodactyls (Chapter 4). The rats, mice, and the single snake probably are present because of natural processes. We judge, however, that the turtle and deer-sized bones, like the marmot bones, are part of the cultural assemblage.

Despite the relative paucity of identified bones deposited at the site by people, some hunting and fishing probably took place. Fish, marmot, and perhaps turtle were procured during the deposition of Zone 3; marmot, turtle, and at least one deer-sized animal during that of Zone 2; and marmot during that of Zone 1. Numerous other bones too fragmentary to identify have been counted and weighed (Table 7-2). The number of fragments per gram of bone decreases from Zone 3 through Zone 1. Zone 4 is disregarded because of the very small sample size. Plowing in Zone 1 did not fragment the bone appreciably, nor does it appear that trampling greatly disturbed the site matrix of Zone 2. We attribute this decrease in the average weight of the bone fragments to a change in the manner in which the bones were utilized or, possibly, to the use of different sized animals identified in the assemblage.

Table 7-2. Comparison of bone counts and weights between zones, 45-OK-18.

Zone	# Bone Fragments	Bone Weight (g)	Ratio of #/g
1	344	37	9.3
2	1,926	178	10.8
3	653	41	15.9
4	115	11	10.5
Total	3,038	267	11.4

Among the botanical remains that may have served as food or tools are lomatium root, chokecherry, hawthorn wood, and serviceberry wood. We may infer from them that vegetable resources were gathered, at least during occupations of Zones 3 and 2, while wood may have been gathered and processed for tools during the occupations of Zones 2 and 1.

ARTIFACT DISTRIBUTIONS

Before we summarize lithic, bone and feature data and identify activity areas based on distributional data, it is of interest to examine the evidence of post-depositional vertical and horizontal movement provided by bead distribution in two adjoining excavation units.

A total of 112 beads was found in the eight 1 x 1-m quadrants of 12S8W and 12S6W from level 10 through level 110. The beads are so similar in size and appearance they seem to be a set. We assume they were originally deposited in one cultural zone, and probably at one location within it. Their recovered distribution, therefore, is due to factors other than the cultural activity that originally caused their deposition at the site. The vertical and horizontal distributions are shown in Figure 7-1, a stylized representation of the unit levels along grid line 12S and grid line 13S. The statistical mean and standard deviation were computed. The 19 beads in level 60 of unit 12S8W lie outside of three standard deviations. Because of this large deviation from the mean, it is assumed this is the original locus of deposition. Given this assumption, we can postulate that at least all beads within one standard deviation of the mean have been moved to other locations, a displacement we attribute to the animal burrowing activity noted by the excavators. Such disturbances explain the dislocation of small numbers of artifacts, especially those that are small in size. As the effects of these disturbances, are limited we still assume that larger concentrations of artifacts reflect prehistoric activity areas.

The following discussion describes the distributions of artifact groups by zone. Field observations indicate that FMR are displaced less often than other artifacts, probably because they are relatively large. Bones, on the other hand, seem to be disturbed more often than other artifacts, perhaps because rodents gnaw on them and move them. The degree of disturbance of lithics lies between these two extremes. Disturbance of shell seems to depend on number of shells in any one location; large concentrations of shell are much less scattered than small concentrations.

ZONE 3

Figure 7-2 presents distribution of detritus in Zone 3. All materials occur in moderately dense, discrete concentrations. The test pit at 10S7E yielded enough charcoal for a radiocarbon date. This charcoal may be the remains of a fireplace located near the concentrations of shell, bone, lithics, and FMR seen in the west-central part of the site. The lithic concentration in the southeastern site area is separate from the other activity area.

Figure 7-3 presents the total distribution of worn/manufactured objects. Concentrations coincide with the southeastern lithic concentration, an area where lithic implements may have been manufactured. In contrast, food may have been processed and eaten in the central site area. The location of the two tabular knives shown in Figure 7-4 partly overlap the southeastern lithic concentration and may indicate that implement manufacturing went on there.

Figure 7-5 shows the distribution of small linear flakes. Small numbers coincide with concentrations of other objects, but moderately dense concentrations occur north and south of the presumed firepit. These two areas and the other concentrations in the west-central site area form an offset circle around the test unit that contains the charcoal.

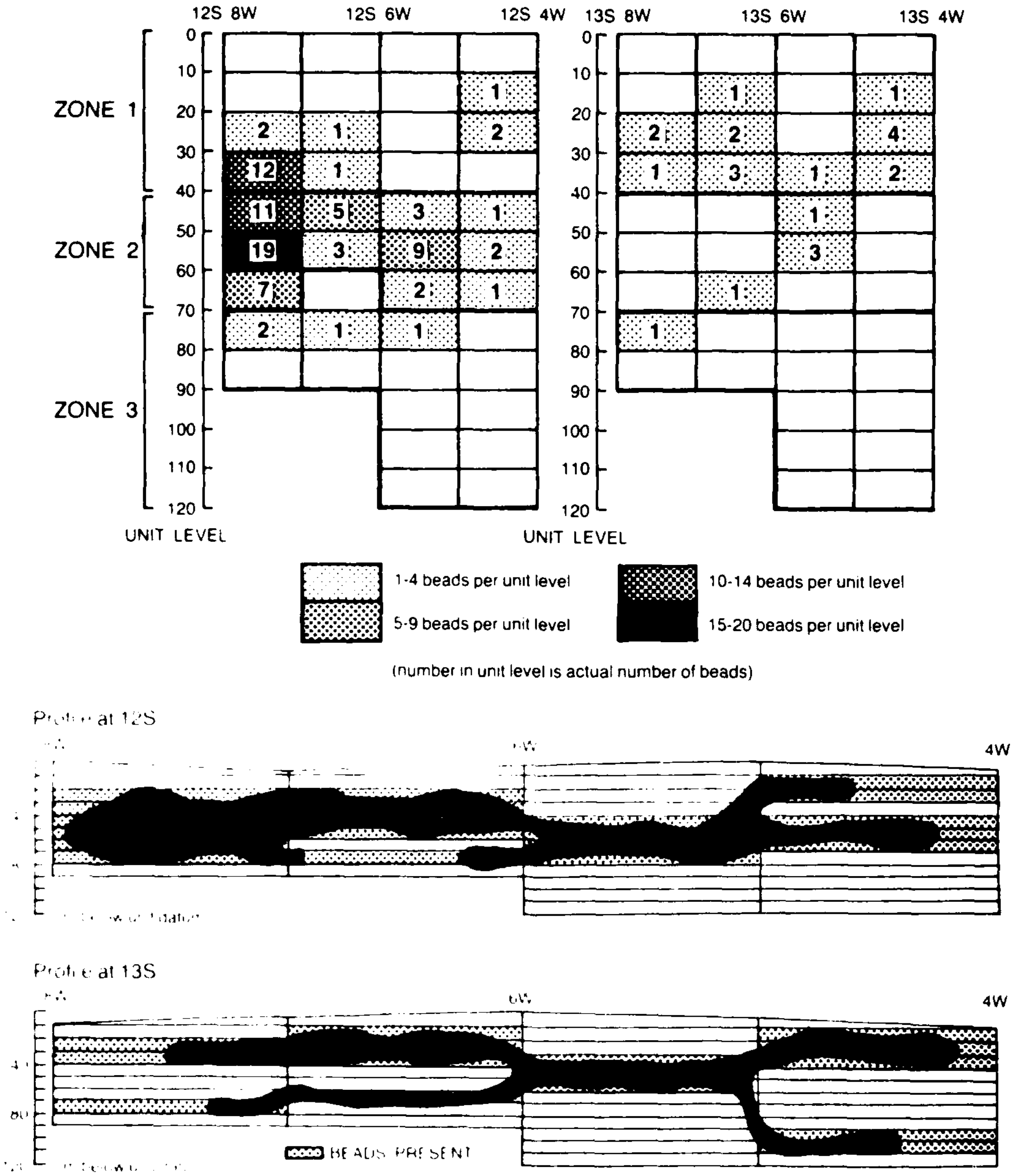

Figure 7-1. Distribution of beads in excavation units 12S8W and 12S6W, 45-OK-18. Upper figure shows idealized reconstruction of rodent burrow.

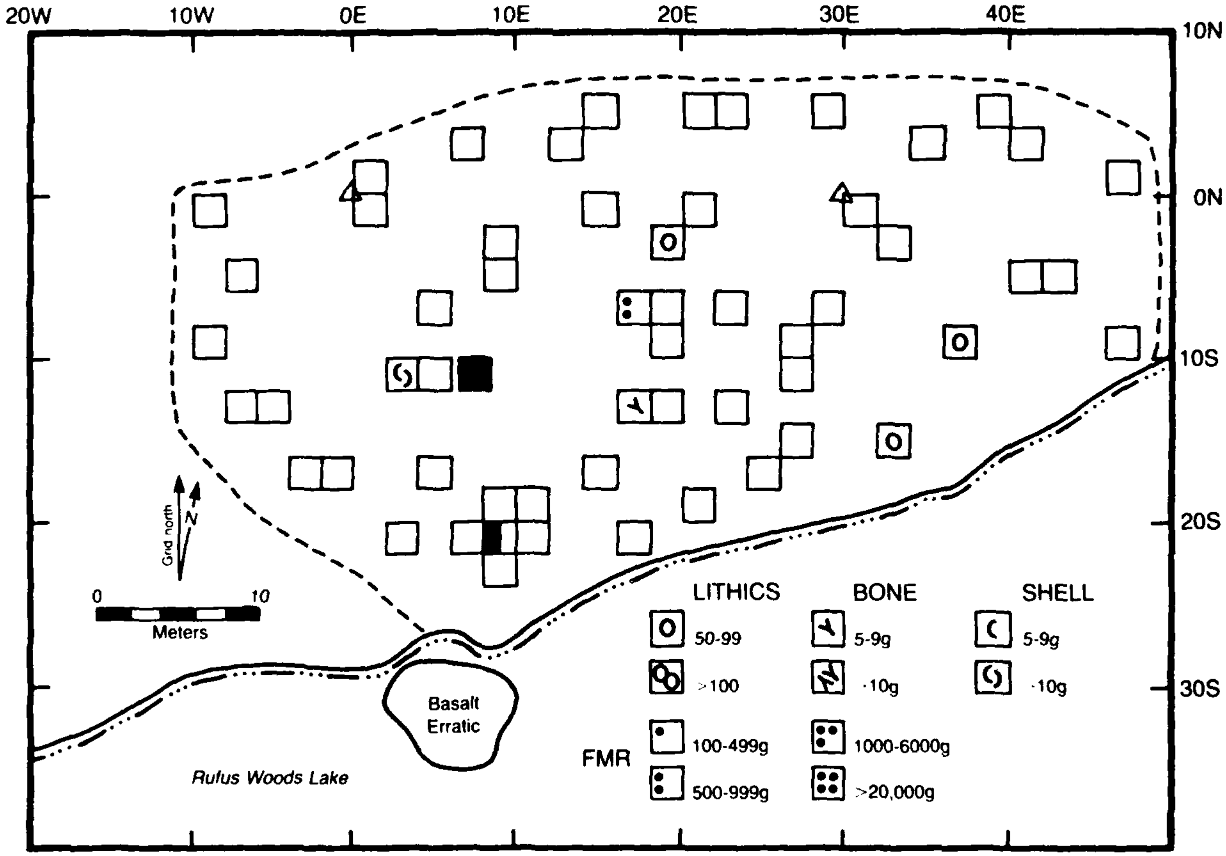

Figure 7-2. Distribution of lithics, bone, shell, and FMR, Zone 3, 45-OK-18. Quantities are count (lithics) or weight per 2 x 2-m unit.

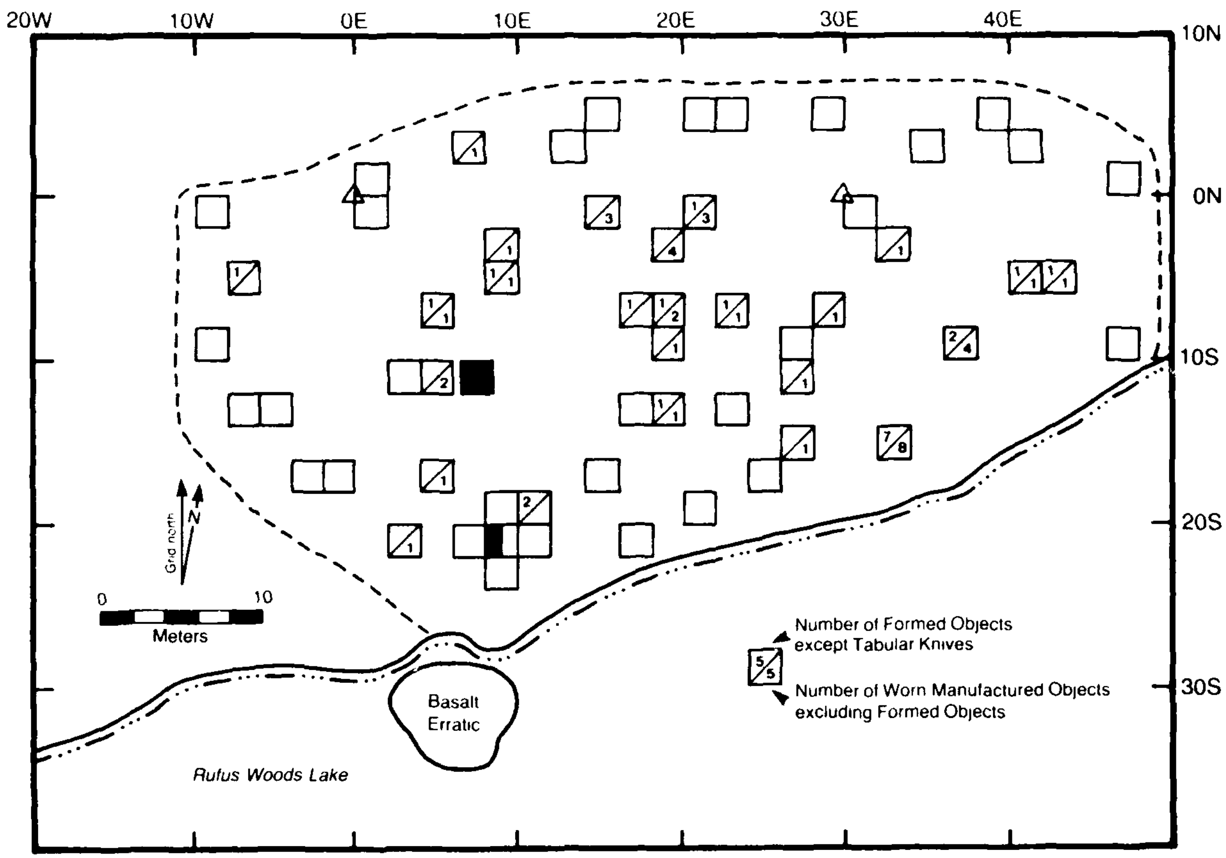

Figure 7-3. Distribution of worn and manufactured objects (except tabular knives), Zone 3, 45-OK-18.

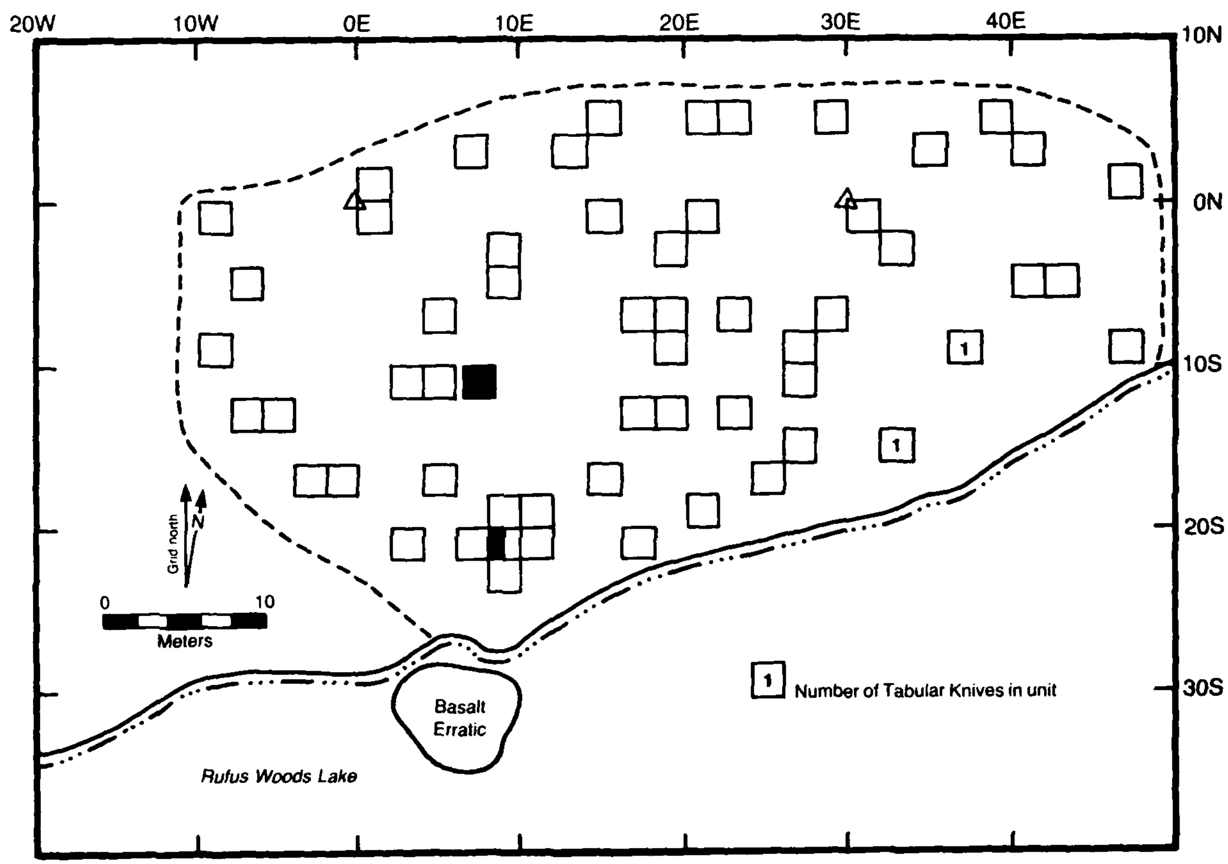

Figure 7-4. Distribution of tabular knives, Zone 3, 45-OK-18.

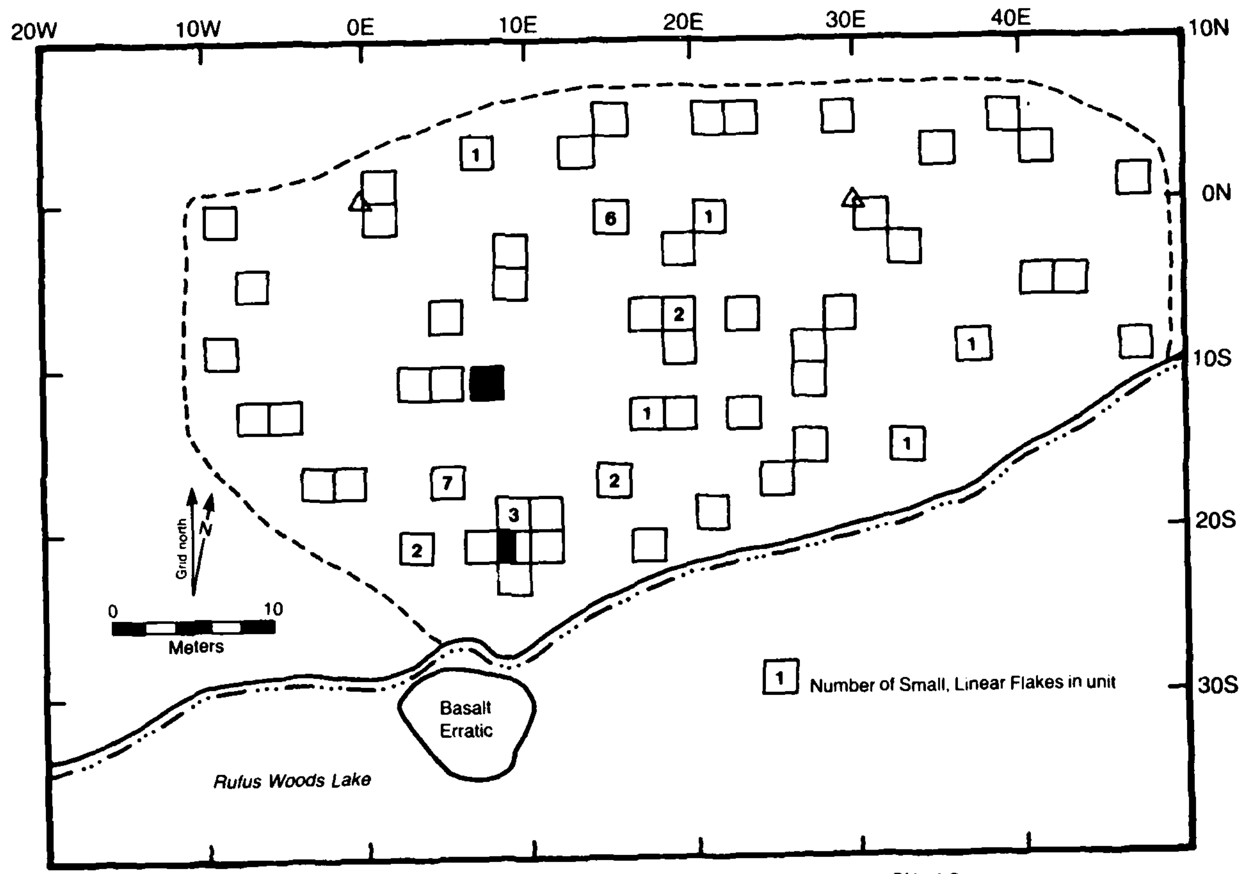

Figure 7-5. Distribution of small linear flakes, Zone 3, 45-OK-18.

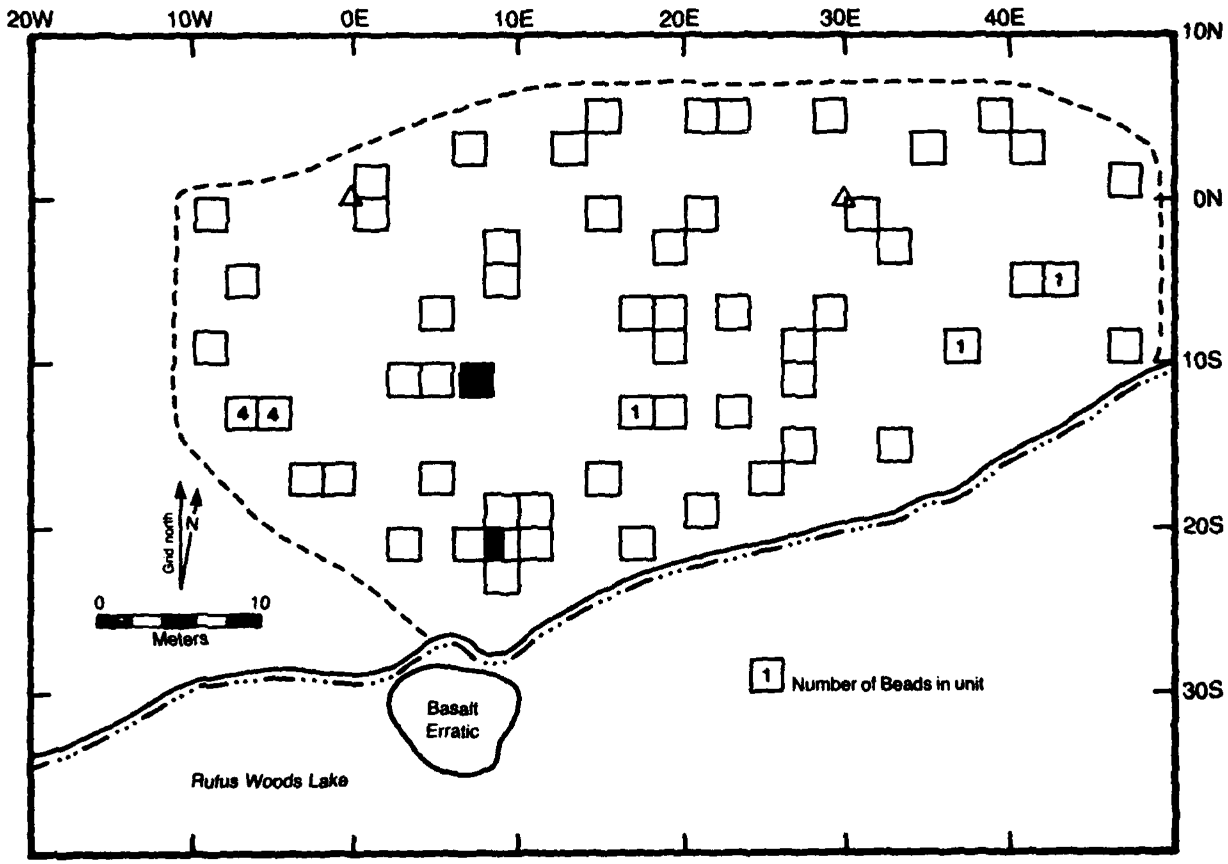

Figure 7-6. Distribution of beads, Zone 3, 45-OK-18.

Bead distributions are shown in Figure 7-6. While a few beads occur near other concentrations, most lie in units on the western margin of the site. If, as we have argued, these eight beads were redeposited from Zone 2, they and the small linear flakes do not represent Zone 3 activities.

Zone 3 data suggest two possible associated activity areas, a food preparation area centered around a hearth, and an implement manufacturing area. Yielding a date of approximately 3800 B.P., the hearth includes a lithic concentration, indicating that people may have manufactured implements there as well as processed and eaten food.

ZONE 2

Judging from the detritus distribution shown in Figures 7-7, 7-8, and 7-9, Zone 2 is more complex than Zone 3: detritus concentrations, overlapping in a complex and sometimes confusing manner, cover much more of the site. Indeed, concentrations of all materials are more dense in this zone which has the site's only features. The location of features is shown in Figure 7-7.

Feature 3 is a dense lithic concentration which includes three hammerstones that may have been used for lithic manufacture and several unmodified granite and basalt cobbles, possible hammerstones. Although located in an area with few lithics, Feature 2 does lie near dense concentrations of FMR and bone. This feature includes a utilized flake, two basalt spalls, and a tabular knife that may have been used to process food. Feature 4 is a fire pit located in a unit with large numbers of FMR and moderate concentrations of lithics and bone. The adjoining unit contains large numbers of bones and FMR. East of thr feature, a test square yielded botanical materials indicating that plant foods were processed in this area. Charcoal from this feature yielded a radiocarbon date of approximately 3400 B.P.

Figure 7-10 shows the distribution of worn/manufactured objects in Zone 2 other than tabular knives. Large numbers occur east of Feature 4 in areas of high lithic concentrations. Intermediate numbers of formed objects also are found east of the firepit and around it. This distribution suggests that implements were manufactured in the east-central and eastern site area and that some were used in the food processing area around Feature 4.

Figure 7-11 presents tabular knife distributions. Although these partially overlap lithic manufacuring areas, larger numbers of knives occur outside of lithic concentrations. Tabular knives are not directly associated with Feature 4.

Table 7-12 shows the distribution of small linear flakes in Zone 2. One of two units with large numbers of these objects also contains an intermediate concentration of lithics; the other contains an intermediate concentration of bone. Moderate numbers of small linear flakes appear independent of both other implements and of the activity area around Feature 4.

Figure 7-13 presents distributions of beads from Zone 2. Aside from several beads from the southern and eastern site areas, all beads are concentrated in two western units. Beads do not overlap any other materials except in unit 12S6W, where some FMR occur.

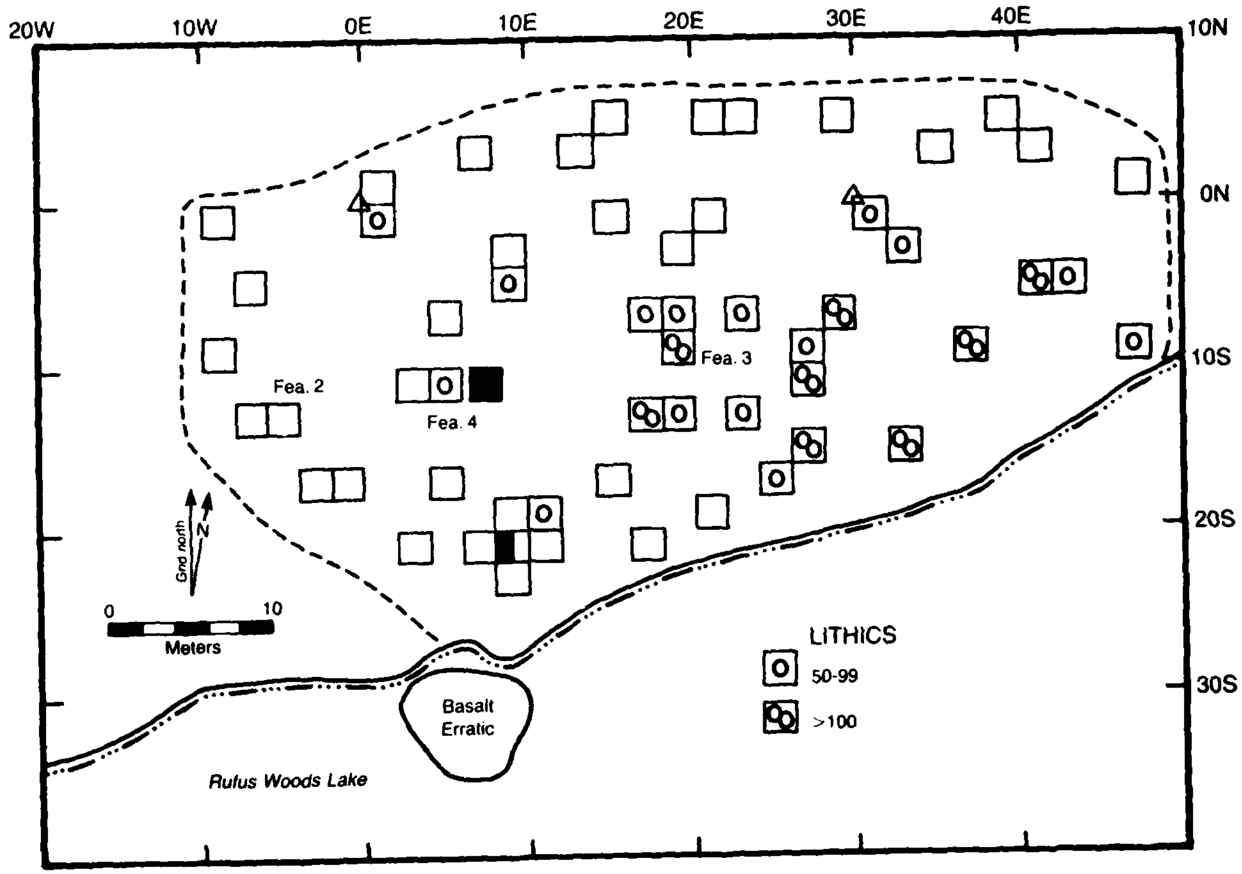

Figure 7-7. Distribution of lithics (count), Zone 2, 45-OK-18.

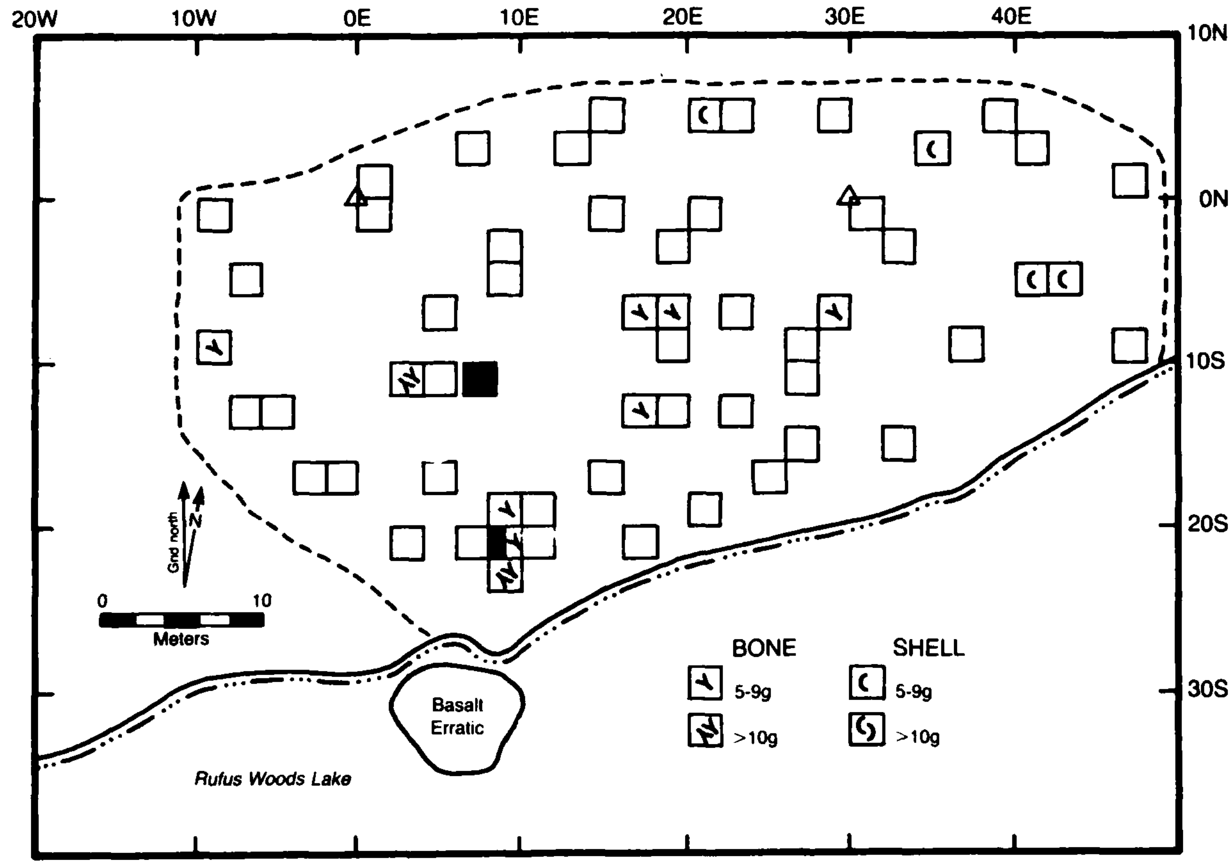

Figure 7-8. Distribution of bone and shell (weight), Zone 2, 45-OK-18.

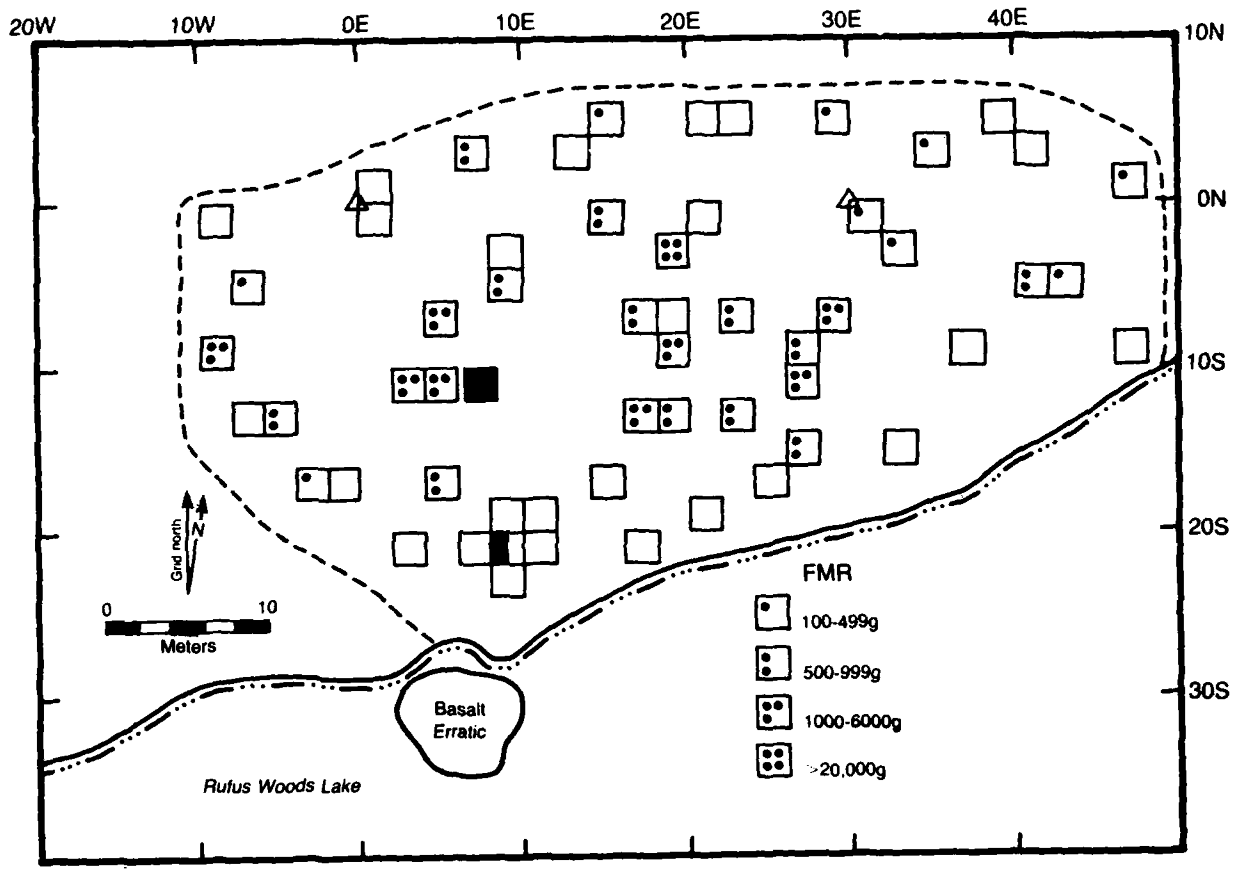

Figure 7-9. Distribution of fire-modified rock (FMR) by weight, Zone 2, 45-OK-18.

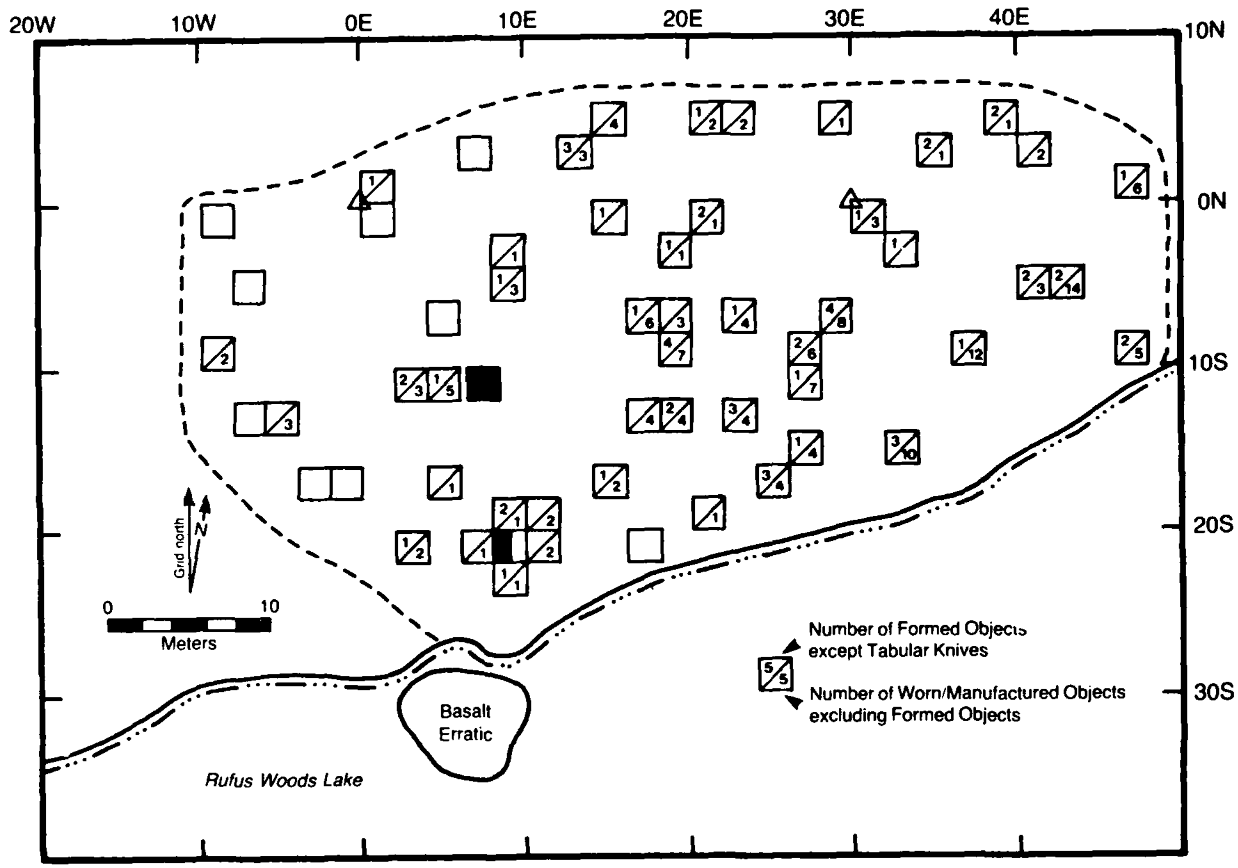

Figure 7-10. Distribution of worn and manufactured objects (except tabular knives), Zone 2, 45-OK-18.

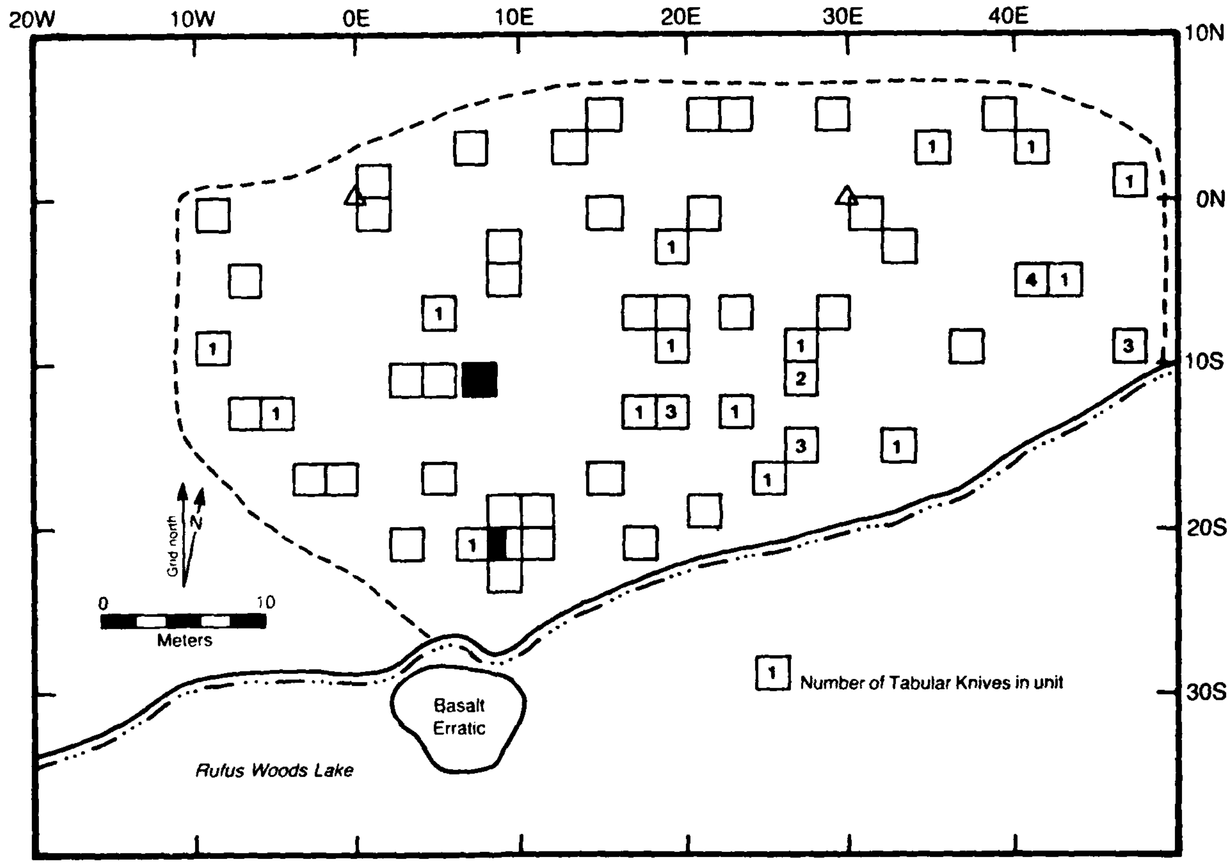

Figure 7-11. Distribution of tabular knives, Zone 2, 45-OK-18.

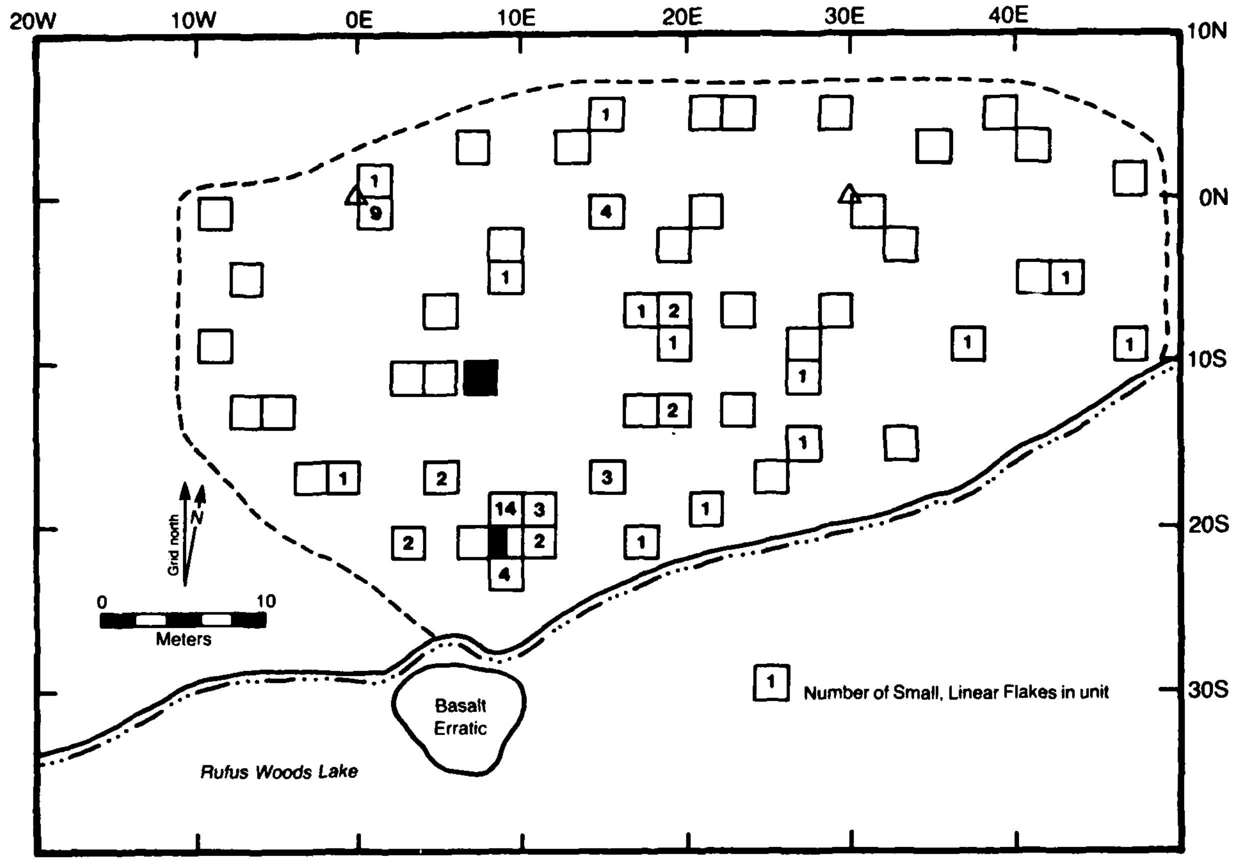

Figure 7-12. Distribution of small linear flakes, Zone 2, 45-OK-18.

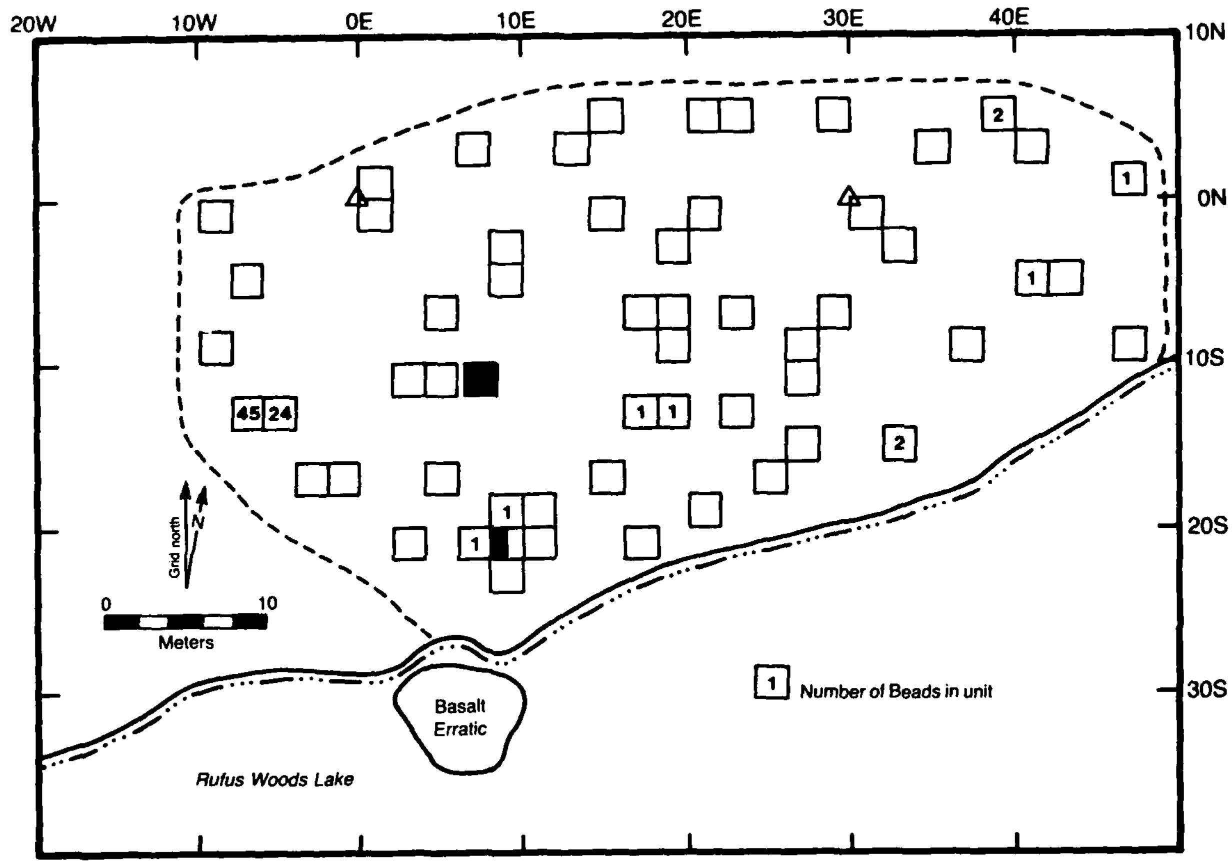

Figure 7-13. Distribution of beads, Zone 2, 45-OK-18.

Zone 2 presents a picture of overlapping concentrations. The activities of Zone 2 are similar to those of Zone 3. The differences between the two zones appear to have resulted either from more intense site use by a larger group of people or from more frequent visits by fewer people during the time period represented by Zone 2. We assume that frequent visits by fewer people would tend to blur artifact distributions. Spatial separation of bone and shell concentrations and distinct appearances of worn/manufactured objects, tabular knifes, linear flakes, and bead distributions indicate a restricted number of visits by a larger group of people than visited the site during the Zone 3 occupation.

It should be noted, however, that these recognized "concentrations," leading to the above conclusions, result from a visual inspection of the data rather than from its statistical manipulation. In addition, breaks in the frequency distribution of data may be due to sampling of nonadjoining units rather than actual spatial arrangements. Frequency breaks also do appear between adjoining units leading us to conclude that the sampling strategy probably achieved a general, if discontinuous, coverage of the site.

ZONE 1

Distributions of detritus in Zone 1 are presented in Figures 7-14 and 7-15. This zone of has fewer artifacts and so is less complex than Zone 2. There are large numbers of FMR located in the central and western site areas and large numbers of lithics in the central and eastern site areas. The two distributions overlap in the center of the site. Some bones are found in the southwestern area, where they are associated with FMR. Features and charcoal concentrations are absent from Zone 1.

Three separate areas of worn/manufactured objects occur along the southern margins of the site in this zone (Figure 7-16), partially overlapping with lithic concentrations and high counts of FMR. Both units with intermediate numbers of bone are associated with one of the areas containing worn/manufactured objects.

Concentrations of tabular knives (Figure 7-17) are associated with lithic concentrations. The area where a few knives were found in the southwestern part of the site is located between bone concentrations. Low numbers of small linear flakes (Figure 7-18) are scattered over the site in this zone. As in Zone 2, beads (Figure 7-19) occurred only in the two western units, probably because of site matrix disturbances (see above).

Zone 1, then, seems to have been a lithic manufacturing station. It also contains some evidence of food processing. The data suggest, then, that the site was visited infrequently by small groups of people during this time.

DISCUSSION

In general the artifact distributions suggest that different kinds of activities were carried out in separate areas. This indicates that occupations may have been more permanent than overnight camps, which would probably result in small, generalized activity areas.

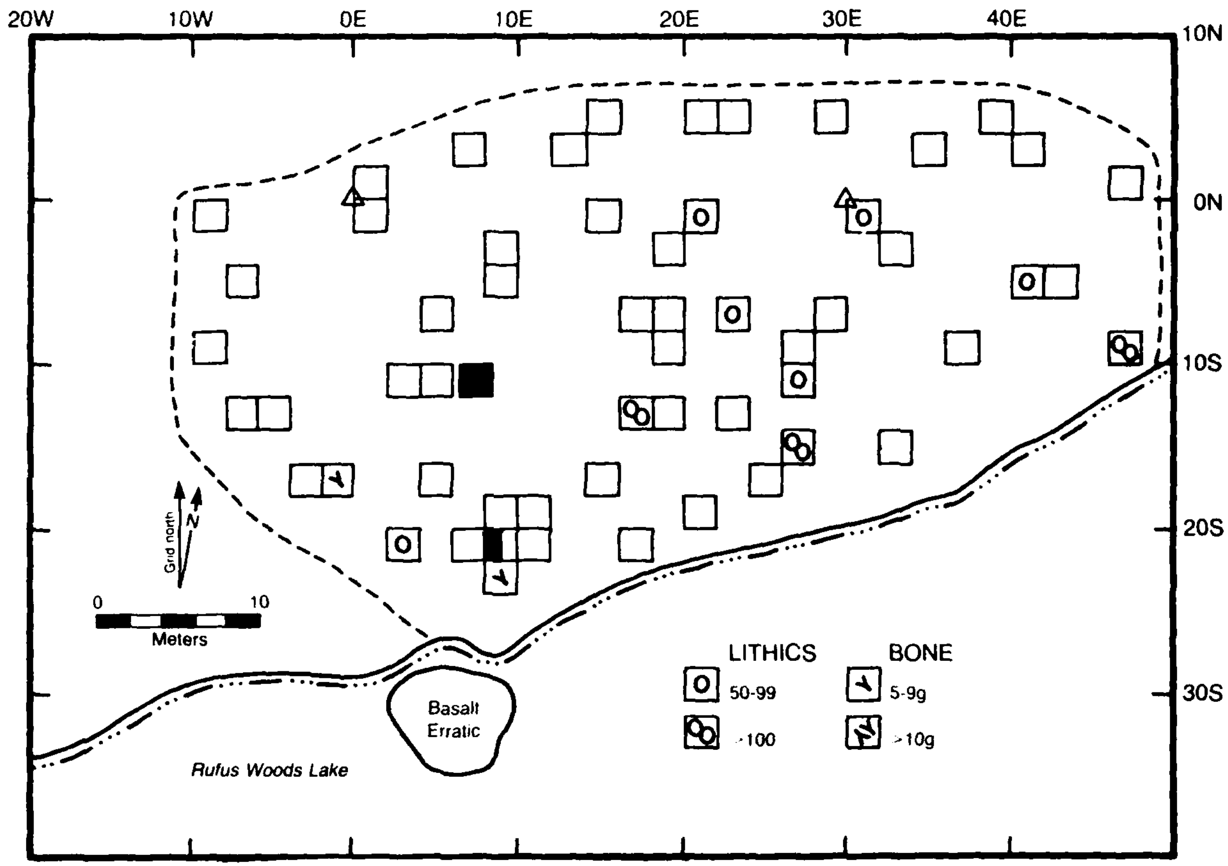

Figure 7-14. Distribution of lithics (count) and bone (weight), Zone 1, 45-OK-18.

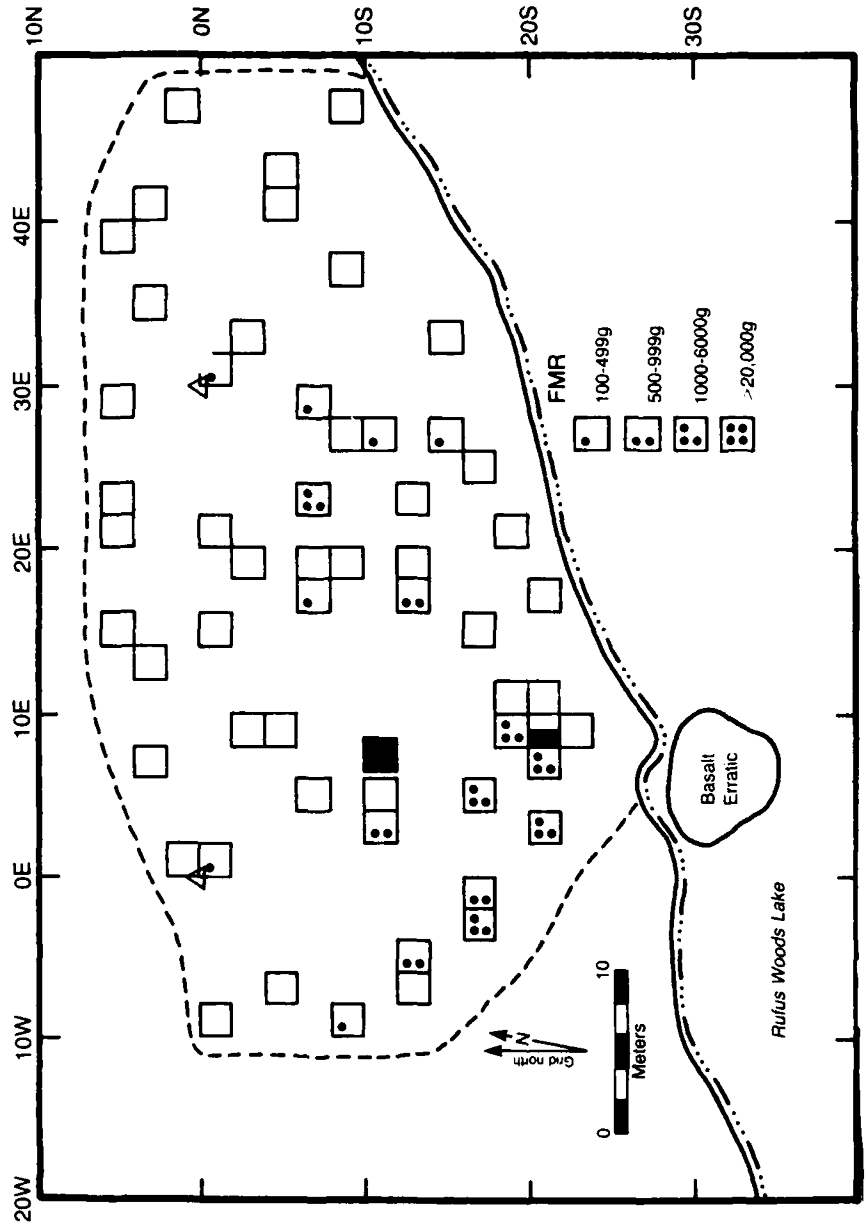

Figure 7-15. Distribution of fire-modified rock (FMR) by weight, Zone 1, 45-OK-18.

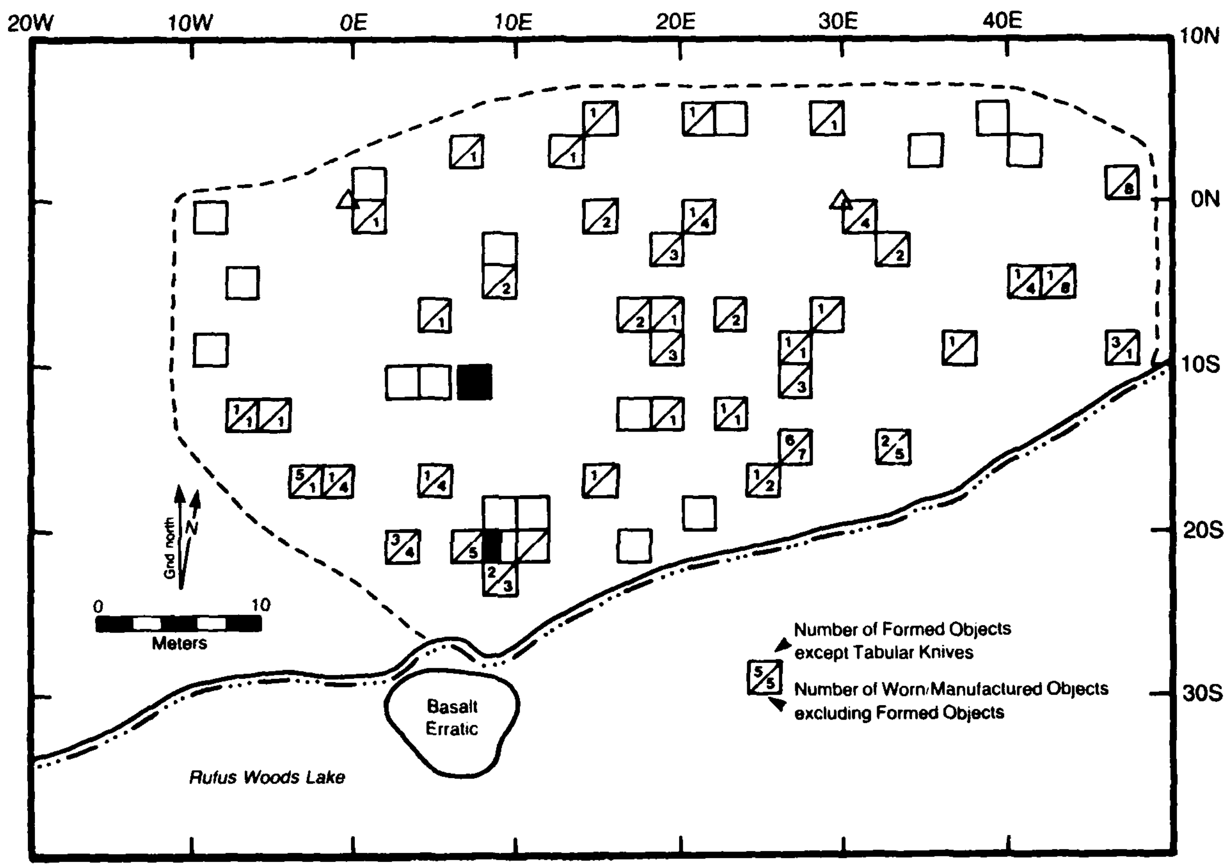

Figure 7-16. Distribution of worn and manufactured objects (except tabular knives), Zone 1, 45-OK-18.

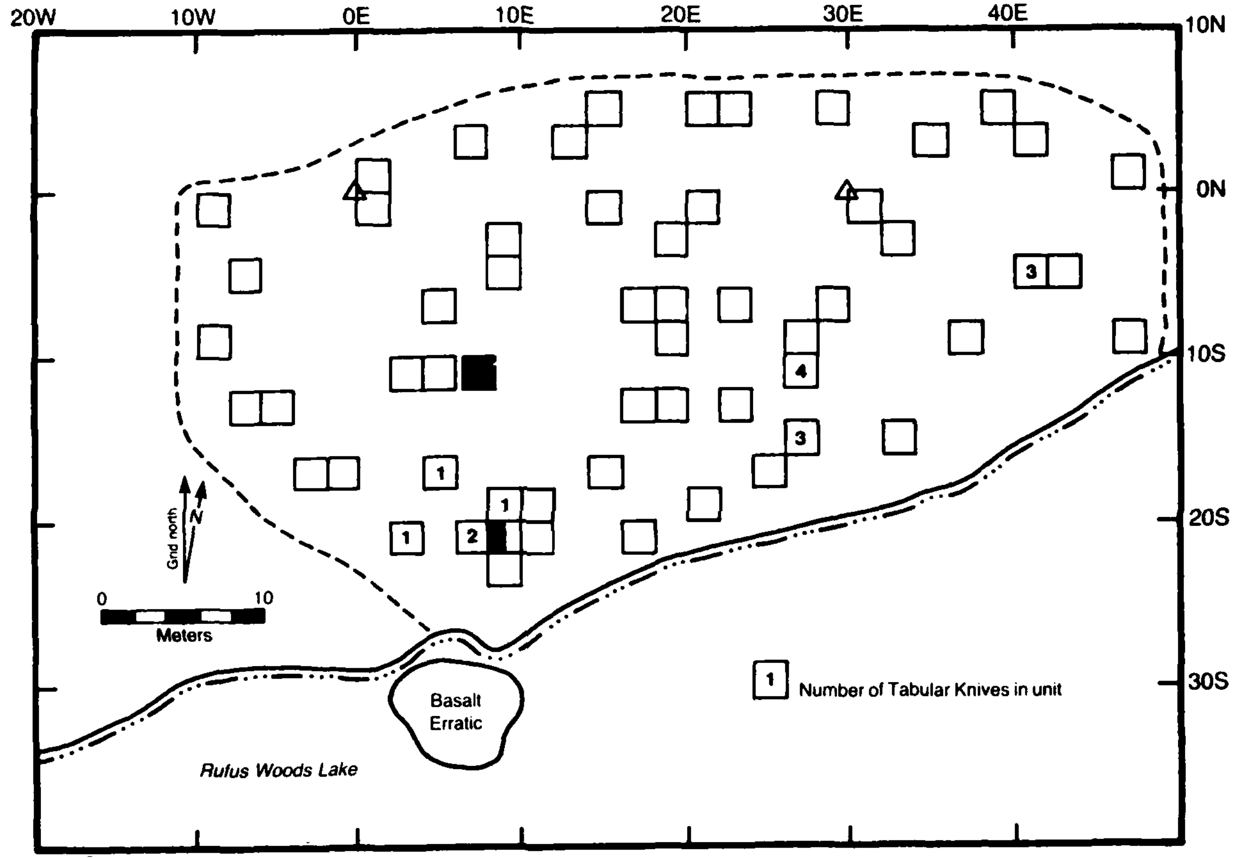

Figure 7-17. Distribution of tabular knives, Zone 1, 45-OK-18.

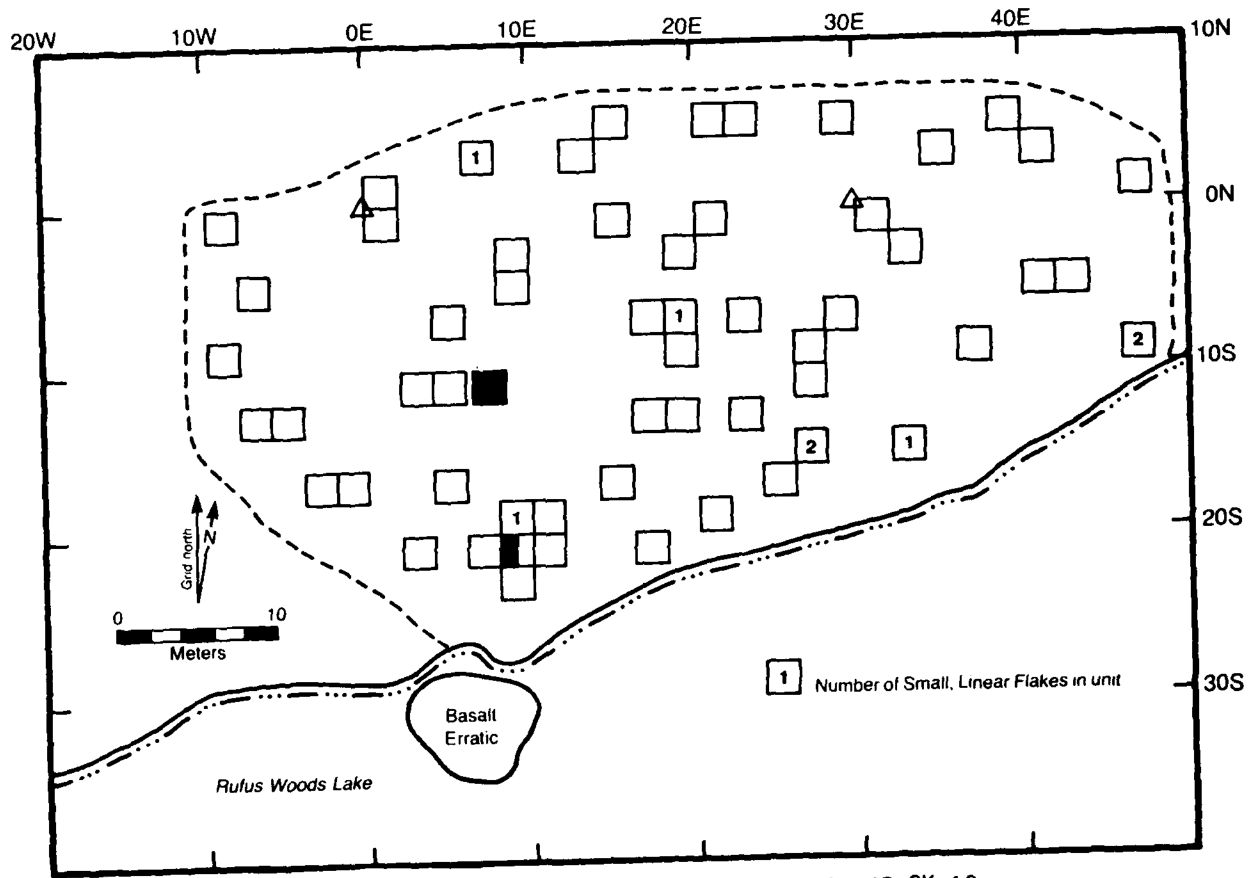

Figure 7-18. Distribution of small linear flakes, Zone 1, 45-OK-18.

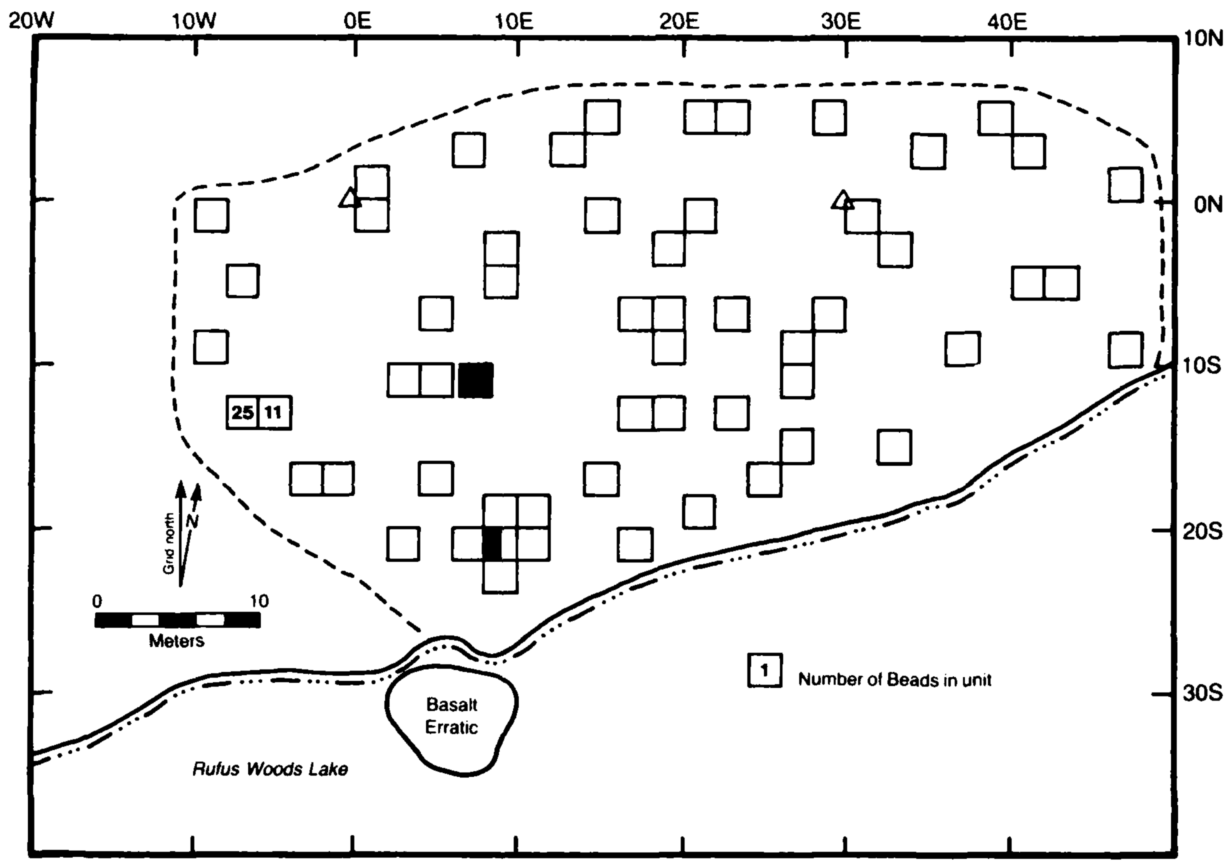

Figure 7-19. Distribution of beads, Zone 1, 45-OK-18.

Our data shows that tabular knives in all three zones tend to be associated with lithic manufacturing and food processing areas. More than lithic material may have been worked on in the manufacturing areas, however. As suggested in the functional analysis section, the tabular knives might have been used to scrape hides or to scrape wood for handles of hafted stone tools and other wood implements. Their association with food processing areas suggests that they might have been used as cooking tools as well. In any event, given the large numbers of wear areas per object, tabular knives were used frequently.

Small linear flakes at 45-OK-18 are associated most often with food processing areas. With their sharp edges, they may have been used for cutting meat; such use would result in little, if any, wear. We hope that additional data from other project area sites will cast some light on their use.

The distribution of beads is functionally distinct from the other artifacts. We believe that only in Zone 2, are the beads in situ. If we compare Figures 7-7, 7-8, and 7-9 with Figure 7-13, it is apparent that the large numbers of beads (45 and 25 in units 12S8W and 12S6W, respectively) are located at some distance from other artifact concentrations. Dense deposits of lithics, bone, and shell, and large numbers of FMR all suggest tool manufacture, food preparation, eating and other life maintenance activities. Since the beads are physically separate, we conclude they were probably associated with some other activity. Beads are probably ornamental and their manufacture and use might be expected to take place away from other activity areas.

SUMMARY

During a thousand year span from about 4000 to 3000 B.P., small groups visited site 45-OK-18 infrequently. If there were earlier occupations the evidence was obliterated by erosion before sedimentation above DU 1 began.

We have very little data from Zone 4 and the initial occupation of the site. Zone 3 data suggests that a small group of people visited the site a few times at the most. During the Zone 2 occupation, a larger group of people apparently stayed at the site. During the time Zone 1 was occupied, a small group may have camped there a few times. Our evidence suggests these were all early and late summer occupations.

The occupants used the site as a base for hunting, fishing, and gathering; they processed food at the site and manufactured implements, making use of raw lithic materials brought in from elsewhere. They probably procured other raw materials, such as wood, at the site or nearby. Judging from the kinds of wear on them, implements such as hammerstones, scrapers, drills, retouched flakes, and tabular knives may have been used to manufacture artifacts of wood. Other tools used to procure and process food, including projectile points, bifaces and small linear flakes, are also present.

We can only speculate as to why occupation of the site ended after about 3000 B.P. Perhaps some environmental change, such as the formation of the lower terrace made the site less hospitable than it had been.

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APPENDIX A:

RADIOCARBON DATE SAMPLES AND RESULTS OF SOIL ANALYSES, 45-OK-18

Table A-1. Radiocarbon date samples, 45-OK-18.

Lab Sample #[1]	Zone	DU	Stratum	Unit	Level	Feature #	Material/gms	Radiocarbon Age (Years B.P.) T1/2=5730	Dendrocorrected Age (Years B.P.)[2]
B-2521	2	3	-	11S4E 10S4E 10S5E 11S5E	60 60 60 60	4 4	Charcoal/1.6	3090±390	3363±394
	Four samples were combined; Feature 4 is a small, basin-shaped firepit in Zone 2.								
TX-3052	3	2	-	10S8E	70A	-	Charcoal/3.4	3512±170	3780±175
	Test unit. A flotation sample from unit level 70 taken near this radiocarbon sample contained sage (*Artimesia* sp.), bitterbrush (*Purshia tridentata*) and conifer wood. The sample also contained chokecherry fragments (*Prunus* sp.).								

1 TX samples were dated by University of Texas-Austin, Radiocarbon Laboratory.
B samples were dated by Beta Analytic, Inc.
2 Dendrocorrected according to Damon et al. (1974).

Table A-2. Results of physical and chemical soil analyses, Column 1, 45-OK-18.

Sample No.	cm Below Surface	Physical Analyses: Munsell Color (dry)	Particle Size: Sand/Silt/Clay (%)	Constituents: Charcoal (%)	Tephr (%)	Bone (%)	Shell (%)	Organic Matter (%)	Minerals (%)	Chemical Analyses: pH	Organic Matter (%)	Exchangeable Calcium (ppm)	Soluble Phosphate (ppm)
1	5-122	10YR(5/3)	57/35/ 8	Trace	Trace	1	Trace	3	95+	8.65	-	2975	67.8
2	15-24	10YR(5/3)	60/32/ 8	Trace	-	Trace	Trace	2	97+	8.50	-	3010	67.8
3	26-36	10YR(6/3)	57/35/ 8	Trace	Trace	Trace	-	1	98+	8.55	-	3010	67.2
4	36-50	10YR(6/3)	57/33/10	-	1	-	-	4	95	8.85	-	2975	67.2
5	53-60	10YR(6/2)	50/40/10	-	10	-	-	5	85	9.00	-	3115	42.0
6	63-70	10YR(7/3)	47/43/10	-	8	-	-	1	91	9.10	-	3010	53.8
7	72-82	10YR(7/2)	47/43/10	-	8	-	-	Trace	91+	9.30	-	3255	54.6
8	85-92	1oYR(7/1-7/2)	57/33/10	-	10	-	-	Trace	89+	9.55	-	3395	46.2

Table A-3. Results of physical and chemical soil analyses, Column 2, 45-OK-18.

Sample No.	cm Below Surface	Physical Analyses: Munsell Color (dry)	Particle Size: Sand/Silt/Clay (%)	Constituents: Charcoal (%)	Tephra (%)	Bone (%)	Shell (%)	Organic Matter (%)	Minerals (%)	Chemical Analyses: pH	Organic Matter (%)	Exchangeable Calcium (ppm)	Soluble Phosphate (ppm)
1	15-22	10YR(5/3)	68/22/10	Trace	-	-	-	7	92+	8.70	-	2093	61.6
2	25-32	10YR(6/3)	65/23/12	Trace	-	-	Trace	3	96+	8.80	-	1050	65.1
3	35-43	10YR(6/3)	53/25/22	2	-	Trace	2	2	95+	8.90	-	2604	66.5
4	43-52	10YR(6/3)	68/12/20	2	-	Trace	2	2	95+	9.00	-	1435	65.1
5	56-64	10YR(7/2)	73/15/12	1	5	Trace	Trace	2	91+	9.80	-	4529	19.6
6	67-71	10YR(8/1-7/1)	60/13/27	Trace	10	-	Trace	1	88+	9.60	-	2709	4.9
7	73-79	10YR(7/2)	65/ 8/27	-	3	-	-	-	97	9.80	-	3234	1.4
8	82-92	Salt/pepper	78/10/12	-	1	-	-	-	99	9.80	-	4410	18.9
9	33-37	10YR(7/3)	53/22/25	-	10	-	-	2	87+	8.80	-	2443	67.2
10	37-47	10YR(6/3)	68/ 7/25	1	-	Trace	Trace	1	97+	9.30	-	1771	60.9

Table A-4. Results of physical and chemical soil analyses, Column 3, 45-OK-18.

Sample No.	cm Below Surface	Physical Analyses								Chemical Analyses			
		Munsell Color (dry)	Particle Size	Constituents									
			Sand/Silt/Clay (%)	Charcoal (%)	Tephra (%)	Bone (%)	Shell (%)	Organic Matter (%)	Minerals (%)	pH	Organic Matter (%)	Exchangeable Calcium (ppm)	Solible Phosphate (ppm)
1	2- 8	10YR(6/3)	40/47/13	3	-	Trace	-	5	91+	9.95	Trace	3325	72.8
2	10-14	10YR(5/2)	42/50/ 8	2	-	Trace	-	4	93+	10.20	Trace	2870	63.0
3	15-22	10YR(6/3-5/3)	40/47/13	1	Trace	10	-	3	95+	10.15	Trace	3115	59.5
4	24-34	10YR(5/3)	35/55/10	Trace	1	Trace	-	3	96+	9.80	Trace	2975	49.0
5	36-47	10YR(6/3)	37/53/10	Trace	Trace	Trace	Trace	12	87+	9.40	Trace	3010	42.7
6	50-58	10YR(6/3)	42/48/10	Trace	-	Trace	-	3	96+	9.20	Trace	3255	40.6

APPENDIX B:

ARTIFACT ASSEMBLAGE, 45-OK-18

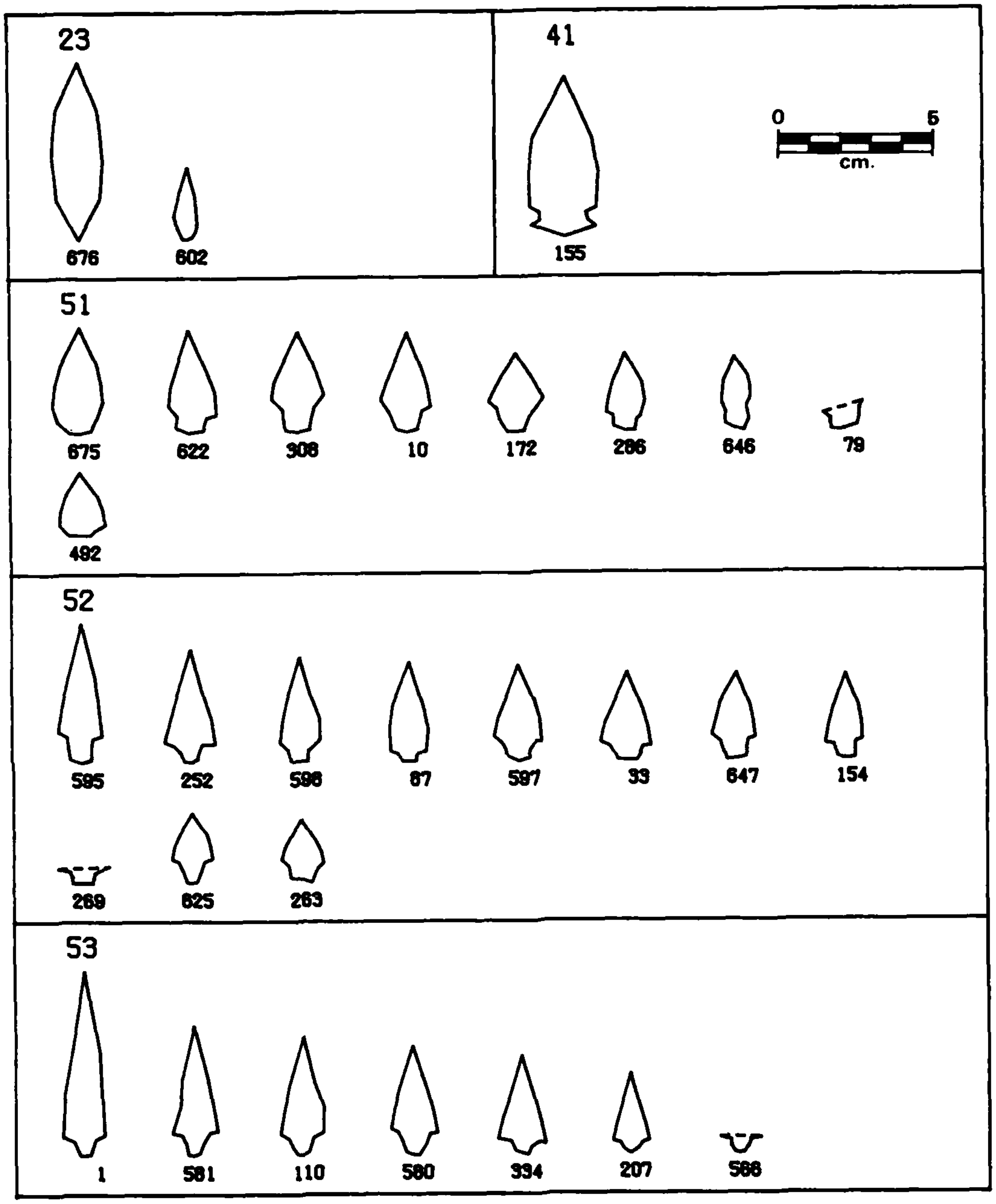

Figure B-1. Projectile point outlines from digitized measurements, 45-OK-18. Upper number is the historic type (see Figure 3-3 for key). Lower number is master number.

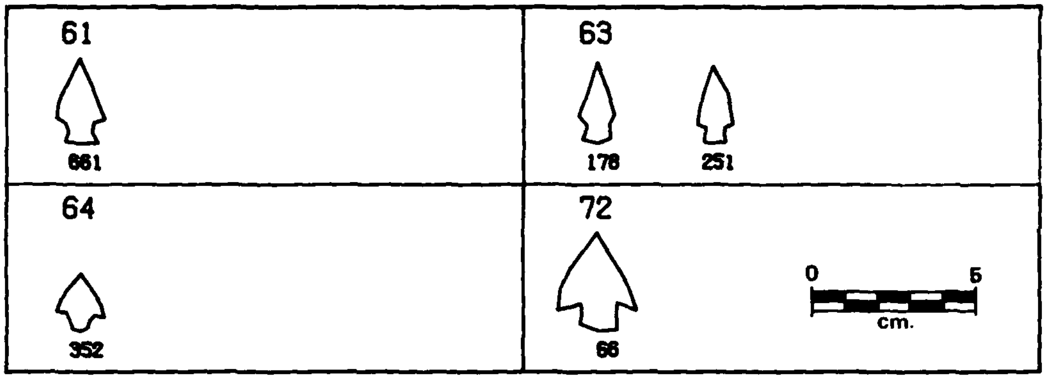

Figure B-1. Cont'd.

APPENDIX C

FAUNAL ASSEMBLAGE, 45-OK-18

Family Sciuridae

Marmota flaviventris

Zone 1: 1 tibia fragment

Zone 2: 1 femur fragment.

Zone 3: 1 molar.

Family Geomyidae

Thomomys talpoides

Zone 2: 1 femur fragment, 2 humeri, 2 mandible fragments, 1 skull, 2 skull fragments, 1 tibia.

Zone 3: 2 mandibles, 1 mandible fragment, 1 skull.

Zone 4: 1 humerus.

Family Heteromyidae

Perognathus parvus

Zone 1: 1 mandible.

Zone 2: 1 mandible, 2 mandible fragments, 1 femur, 1 tibia.

Zone 3: 1 mandible.

Zone 4: 1 skull fragment.

Family Cricetidae

Peromyscus maniculatus

Zone 2: 1 mandible.

Microtus sp.

Zone 2: 1 mandible, 1 maxilla fragment.

Lagurus curtatus

Zone 2: 3 mandibles.

Family Bovidae/Cervidae

Deer-sized

Zone 2: 1 atlas fragment.

Family Chelydridae

Chrysemys picta

Zone 2: 13 shell fragments.

Zone 3: 1 shell fragment.

Family Colubridae

Zone 2: 24 vertebrae.

Family Salmonidae

Zone 3: 2 vertebrae fragments.

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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