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ARCHAEOLOGICAL INVESTIGATIONS AT SITE 45-DO-282, CHIEF JOSEPH DAM PROJECT, WASHINGTON

E.S. Lohse
with S.K. Campbell, S.N. Crozier, L. Hause,
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Site 45-DO-282 is on the south bank of the Columbia River (River Mile 556) near the Okanogan Highland - Columbia Plateau boundary in an Upper Sonoran life zone. The University of Washington excavated 186.1 m^3 of site volume in 1979 for the U.S. Army Corps of Engineers, Seattle District, as part of a mitigation program associated with adding 10 ft to the pool level behind Chief Joseph Dam. Systematic aligned random sampling with 1 x 1 x 0.2-m units of record in 1 x 2 or 2 x 2-m cells disclosed one historic and four prehistoric occupations on an alluvial fan built onto an early river terrace, interbedded with later overbank and aeolian sediments. There are no radiocarbon dates, but projectile points indicate the earliest occupation is early to mid-Kartar Phase. The second, more intensive occupation probably occurred 6,000 to 5,000 years ago. The third and fourth occupations in the late Kartar Phase took place about 5,000 to 4,000 years ago. Occupation character shows no change in 2,500 years; all occupations are lithic scatters with blade and microblade technology and chipping stations. Shelters, earth ovens, hearths, and bone concentrations are absent. Environmental stability is indicated by soil formation after 4,000 years ago. The historic occupation is an early 20th century homestead.

ARCHAEOLOGICAL INVESTIGATIONS AT SITE 45-DO-282, CHIEF JOSEPH DAM PROJECT, WASHINGTON

by

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with

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Principal Investigators

R.C. Dunnell 1978-1984
D.K. Grayson 1978-1981
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

ABSTRACT

Site 45-DO-282 is on the south bank of the Columbia River (River Mile 556) near the Okanogan Highland - Columbia Plateau boundary in an Upper Sonoran life zone. The University of Washington excavated 186.1 m^3 of site volume in 1979 for the U.S. Army Corps of Engineers, Seattle District, as part of a mitigation program associated with adding 10 ft to the pool level behind Chief Joseph Dam. Systematic aligned random sampling with 1 x 1 x 0.2-m units of record in 1 x 2 or 2 x 2-m cells disclosed one historic and four prehistoric occupations on an alluvial fan built onto an early river terrace, interbedded with later overbank and aeolian sediments. There are no radiocarbon dates, but projectile points indicate the earliest occupation is early to mid-Kartar Phase. The second, more intensive occupation probably occurred 6,000 to 5,000 years ago. The third and fourth occupations in the late Kartar Phase took place about 5,000 to 4,000 years ago. Occupation character shows no change in 2,500 years; all occupations are lithic scatters with blade and microblade technology and chipping stations. Shelters, earth ovens, hearths, and bone concentrations are absent. Environmental stability is indicated by soil formation after 4,000 years ago. The historic occupation is an early 20th century homestead.

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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 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, above 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 the OPA to review the 27 sites tested to date and identify those worthy of immediate investigation. A priority list of six sites was compiled. The Corps, in consultation with the Washington State Historic Preservation Officer and the Advisory Council on Historic Preservation, established an Interim Memorandum of Agreement under which full-scale excavations at those six sites could proceed. In August 1978, data recovery (Contract No. DACW67-78-C-0106) began at five of the six sites.

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

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

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

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

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. Dr. Manfred E.W. Jaehnig served as Project Supervisor during this stage of the work. Since the autumn of 1981, Dr. Jaehnig has served as 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.

Excavations at 45-DO-282 were carried out by a joint Western Washington University and University of Washington field school, under the direction of Garland Grabert. Site 45-DO-282 is located on land owned by Howard F. Brandt of Bridgeport, whom we thank for granting us permission to excavate.

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

Jerry V. Jermann, 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.

S. Neal Crozier did the initial data summary for the stratigraphic analysis; he also performed the chemical and mechanical sort analyses. The laboratory staff did the technological and functional artifact analysis. Janice Jaehnig did keypunching and John Chapman and Duncan Mitchell manipulated the computerized data.

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

Marc Hudson edited the text; Dawn Brislawn typed it, and coordinated production. Melodie Tune and Bob Radek drafted the final versions of the graphics except Figure 3-2, drafted by the senior author, and Figures 3-3 and 3-4, drafted by Bob Thomas. Larry Bullis photographed the artifacts and took the cover photograph. Production of the final camera-ready copy was accomplished by Natalie Cadoret, Charlotte Beck, and Karen Weed under the direction of Sarah Campbell.

1. INTRODUCTION

Site 45-DO-282 is on the left bank of the Columbia River about 125 m downstream from River Mile (RM) 556 in the NW1/4 of the NW1/4 of Section 29, T30N, R27E, Boot Mtn. Quadrangle (U.T.M. Zone 11, N. 5327650, E. 315900). Figure 1-1 shows the location of site 45-DO-282 in relation to the other salvaged sites in the Rufus Woods Lake project area. Lying within Box Canyon, the site is situated on the south side of a bend in the river, about 300 m downstream from an unnamed series of rapids and about .5 km upstream from Eagle Rapids. It lies on a broad, sloping terrace at an elevation of 289-295 m (947-968 ft) m.s.l. and about 40-50 m above the original level of the river (calculated from annual low water level, 1931). The river forms the northern site boundary, marked by a wide, shallow beach studded with large basalt erratics (Plate 1-1). On the south, the site is bounded by a steep talus slope which rises to another higher terrace.

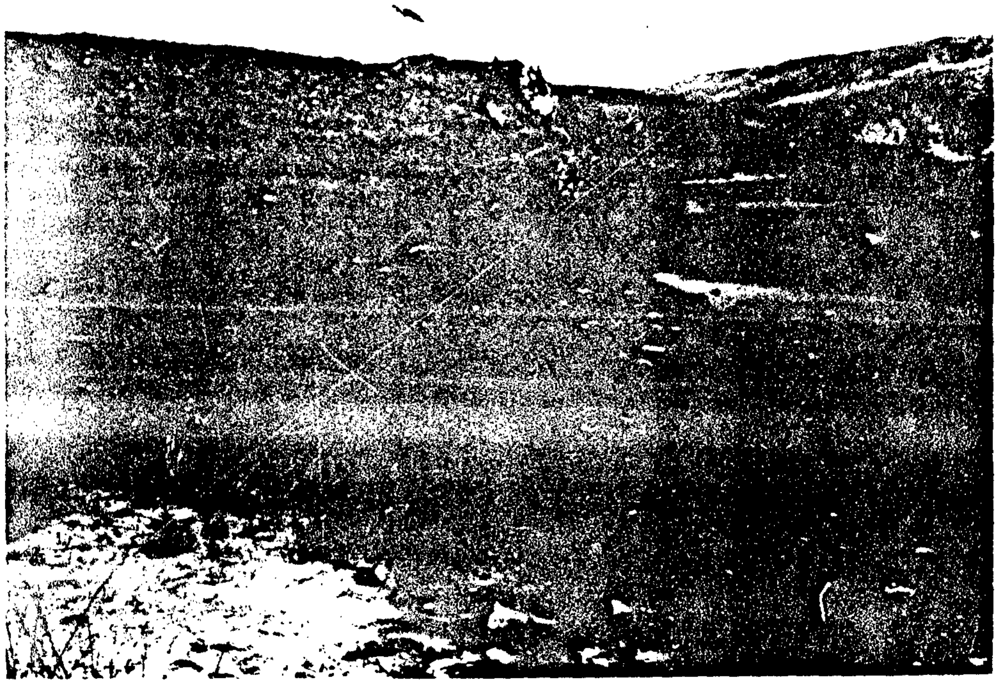


Plate 1-1. Downstream view showing area of beach collection, 45-DO-282. (View to west.)

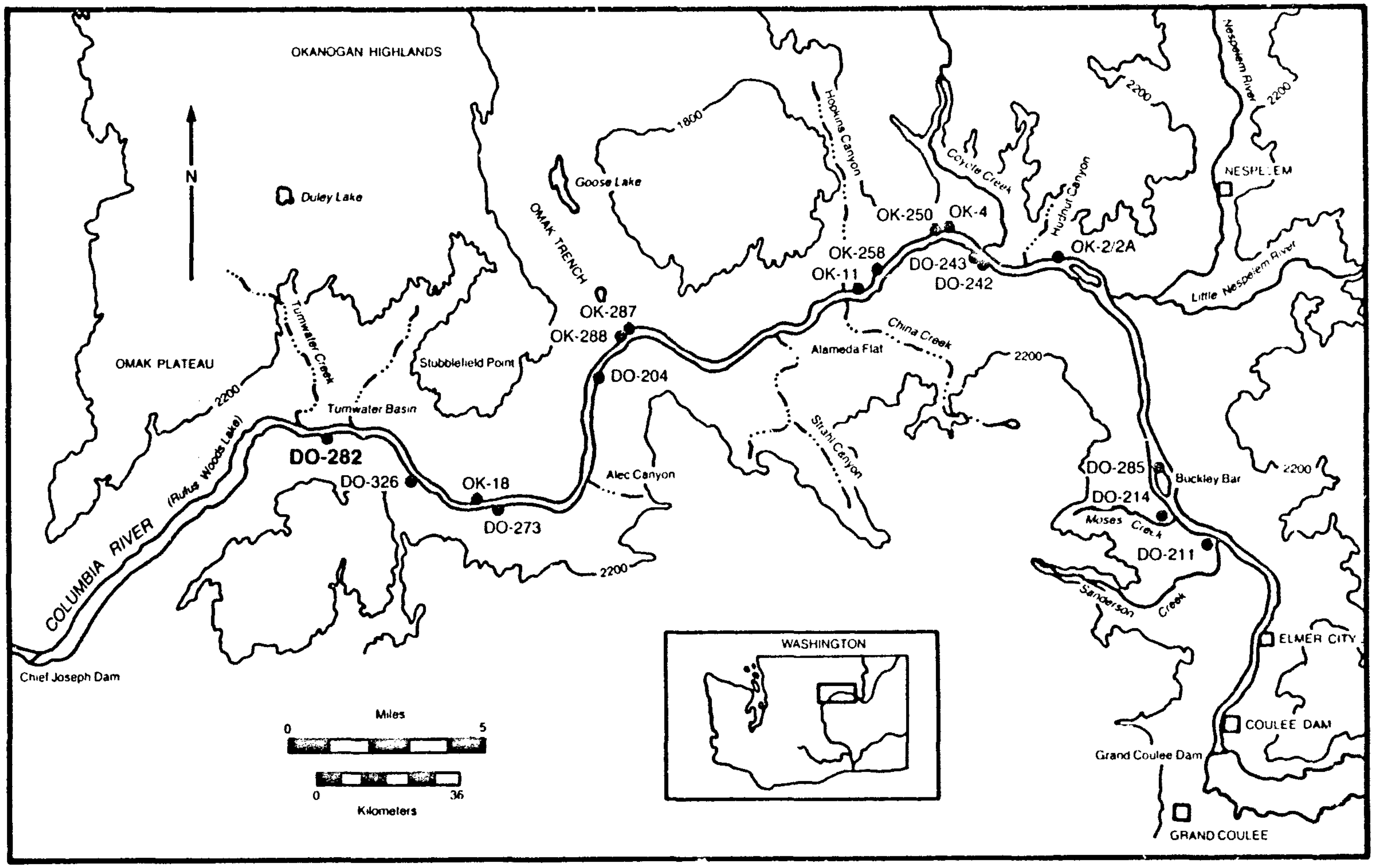


Figure 1-1. Map of project area showing location of 45-DO-282.

The site terrace rises gradually to the south, away from the river, with a gain in elevation across the site area of about 9 m (Figure 1-2). Two ephemeral stream channels, running roughly north-south, cut across the site area. An unimproved dirt road crosses the site from east to west, paralleling the river margin. An historic homestead was built in the approximate middle of the site area, with buildings and other structures concentrated near the westernmost stream channel. Apple trees are widely scattered over the site near channels of natural runoff. The entire terrace has been subject to numerous channel cutting episodes, during which heavy rain or snowmelt has sluiced down from the higher terrace into the river below. The attendant erosion, and deposition of sediments, coupled with historic Euroamerican activities, have greatly modified the character of cultural remains. A plowzone, about 20-30 cm in depth, was evident in excavation units. Deeper site deposits showed little or no clustering of artifacts or recognizable boundaries defining cultural features, suggesting that runoff has moved the cultural materials down slope toward the river. Thus, most of the site's artifact associations are probable products of secondary depositions.

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

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

All of these environments, from river bottom to mountain zones, may be found within an eight km radius centered on site 45-DO-282. The Tumwater and Achimin Basins across the river to the north represent moderately well-drained zones with a variety of associated plant communities on surrounding slopes and along stream channels. Small patches of pine forest grow along Tumwater Creek and atop highland areas to the north of the basin. On the south side of the river, numerous small lakes occur in the uplands. Several of these are drained by stream channels which empty into the Columbia and provide natural

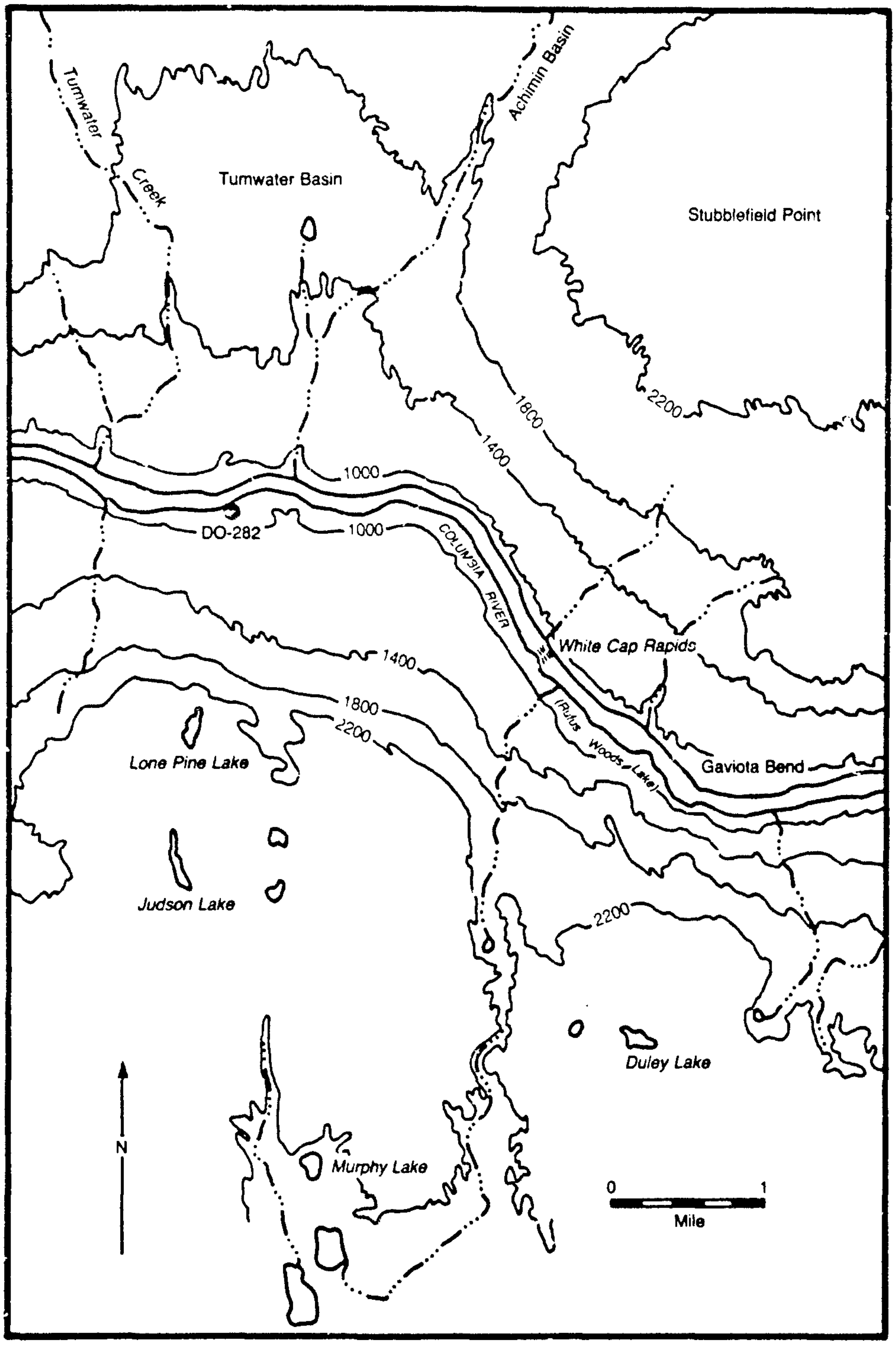


Figure 1-2. Map of site vicinity, 45-DO-282.

routes down to the river bottom. Goose Lake and the Omak Trench lie less than 20 km to the northeast, offering a variety of microenvironments, including riparian habitats along the lake shore. On both sides of the Omak Trench are high uplands with pine and fir forest. To the north is Omak Lake, and to the east, Whitmore Mountain, which rises to an elevation of over 1,050 m m.s.l.

A variety of large and small game was present. Deer and elk ranged widely between upland and river bottom vegetation zones. Smaller species had more restricted ranges tied to specific vegetation communities or water sources. Migratory waterfowl were plentiful along lake, river, and stream margins during the spring and fall migrations. The river offered salmon, suckers, and freshwater mussels, with salmon available during spring and fall runs.

The location of 45-DO-282 on the river, near dependable sources of fresh water, with easy access to upland environments, and near the historically recorded fishing site of Kalitsin, would have allowed systematic exploitation of a number of these floral and faunal resource zones. The occupants may have been drawn there by the seasonal abundance of salmon, or perhaps the pleasant aspect of the site--the river with its sandy beach, the nearby springs, the readily accessible riverine resources. The nearby rapids could certainly have been a major focus of activity during the salmon runs in the spring and fall. And the shoreline with its springs and streams would have attracted wildlife, particularly migratory waterfowl in the spring and fall and big game in the winter months.

INVESTIGATIONS AT 45-DO-282

Site 45-DO-282 was excavated during the summer 1979 field season, and was the subject of a combined University of Washington and Western Washington University field school under the direction of Dr. Garland F. Grabert. It was selected for excavation because survey and testing had disclosed a large scatter of debris over 90,000 m^2 in extent and two meters in depth. Further, the general site area had included numerous springs, ephemeral streams, and large rapids, factors that would seem to have been ideal for prehistoric occupation and exploitation of a variety of permanent and seasonal resources. Testing confirmed the potential of 45-DO-282: three separate cultural components, spanning a period as great as 7,000 years, were identified. The site was thus considered significant because of its great size, its physical setting favorable for occupation, and its indicated time depth.

The designation 45-DO-282 actually encompasses three prior site numbers: 45-DO-188, 45-DO-282, and 45-DO-187H. 45-DO-282 was chosen to designate the site because testing began there and was continued upstream until general site boundaries were established. Three separate areas were designated during excavation (Figure 1-3). They were defined on the basis of relative concentrations of cultural material, and do not correspond to prior site identifications. Area B includes the major portion of the site. Area A, encompassing site 45-DO-188, was near the beach, immediately upstream from historic site 45-DO-187H. Area C was inland, near the boulder terrace

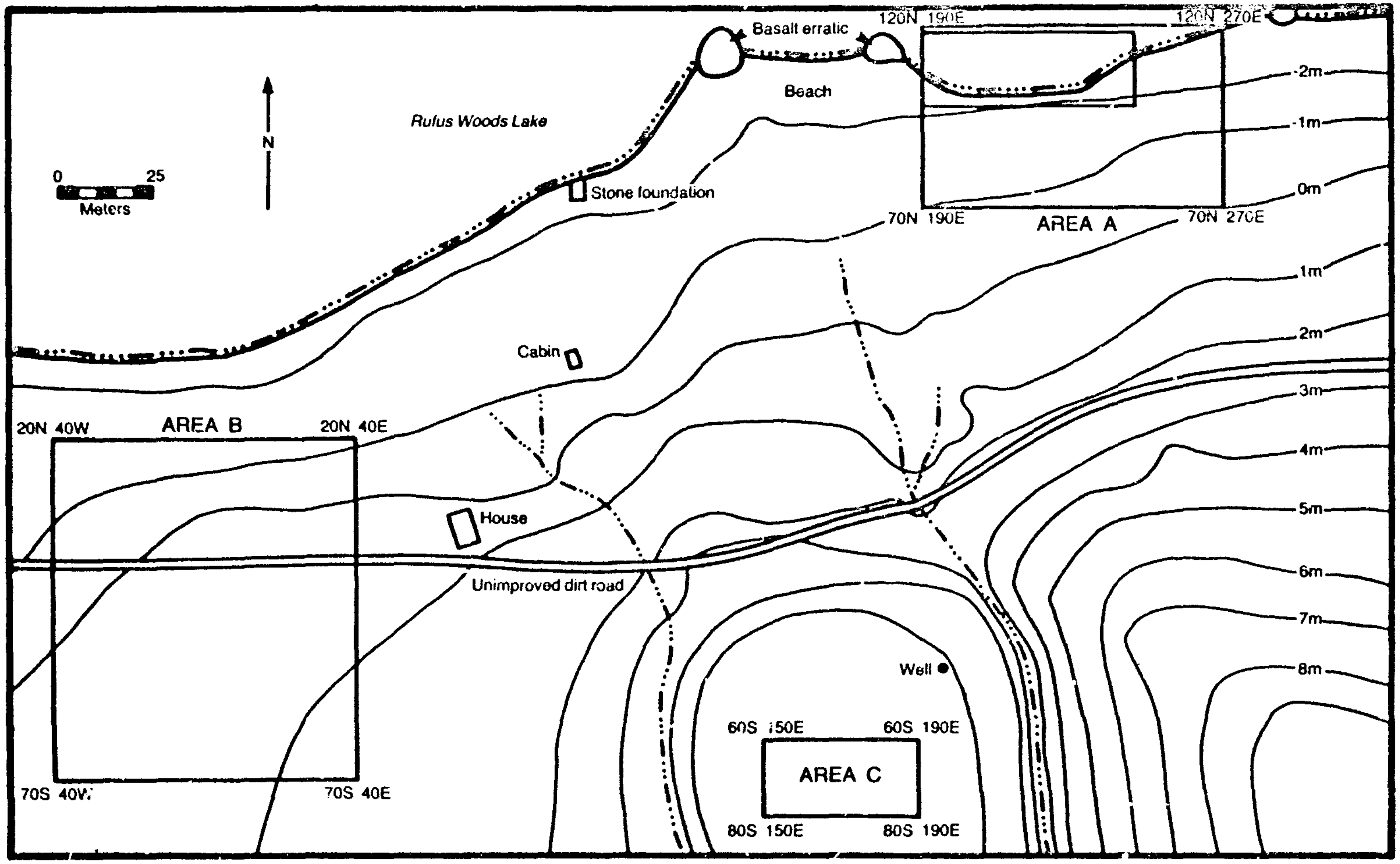


Figure 1-3. Topographic map showing location of excavation areas, 45-DO-282.

bordering the site on the south.

Excavation began 19 June 1979, and continued until 17 August 1979. A systematic sampling design was employed in all three areas. Eighteen sampling units were placed in Area A (Figure 1-4), 17 units in Area B, and five in Area C (Figure 1-5). A surface collection was also made on the beach, an intermittently inundated area just north of Area A (Figure 1-4). All 1 x 1-m units within the grid coordinates defining this collection were examined. Collection was confined to artifacts found on the surface. No excavation of soil matrix or screening was done.

Investigation was done by 26 field school students under the direction of three teaching assistants and the instructor. Excavation was done within either 1 x 2-m or 2 x 2-m grid squares. Matrix was removed in arbitrary 10 cm levels keyed to unit and site datums and screened through 1/8 in wire mesh. Stratigraphic profiles were created for units whenever these were deemed appropriate. A transit and alidade were used to record unit excavation levels and for mapping the general site area.

The sheer size of 45-DO-282 (over 40 hectares) dictated the approach to excavation. The paramount sampling concern was coverage of the defined area. The number of sampling units was limited to that which would be feasible to dig, given time requirements. Percentage of site area sampled was not fixed, since anything but a cursory examination was impossible. The strategy was to cover the area adequately, with the assumption that a systematic placement of units would reveal any significant patterning in the artifact assemblage. Another assumption made was that patterning in the archaeological record was not consistent, i.e. coincident with the systematic placement of sampling units, and as a corollary, that cultural features would be of sufficient size to be penetrated by 1 x 2-m or 2 x 2-m grid units laid out with a gap of not more than eight meters between them. These assumptions are even more crucial given the great size of the site, which precluded excavating outside of the original sample units. At best, excavation of 45-DO-282 was expected to produce a good characterization of the nature of cultural deposits, identifying variation in artifact assemblages and site function over time and space. It was meant to yield a good sampling of vertical deposits in the site and any differences in the structure of those deposits across the site area.

A total of 126 1 x 1-m excavation units were dug and another 1,120 1 x 1-m units were surface collected. Excavation units removed 183 m^3 of cultural deposit, and contained 15,170 stone artifacts, eight fire-modified rocks, 201 bone fragments, and seven pieces of shell. Surface collected units produced 1,394 stone artifacts, 90 fire-modified rocks, 32 bone fragments, and no pieces of shell. Altogether 921 tools were identified, and 13,662 pieces of debitage were sorted.

REPORT FORMAT

The following chapters survey the data recovered from 45-DO-282. Chapter 2 discusses the site's sedimentary stratigraphy and the assignment of artifacts to defined analytic zones. Chapter 3 is an analysis of the

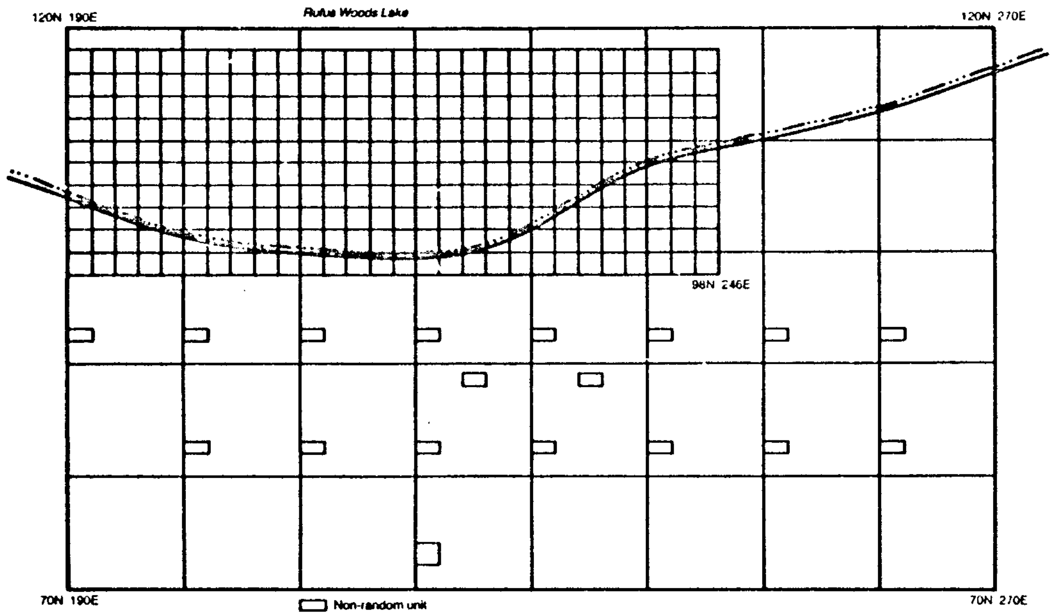
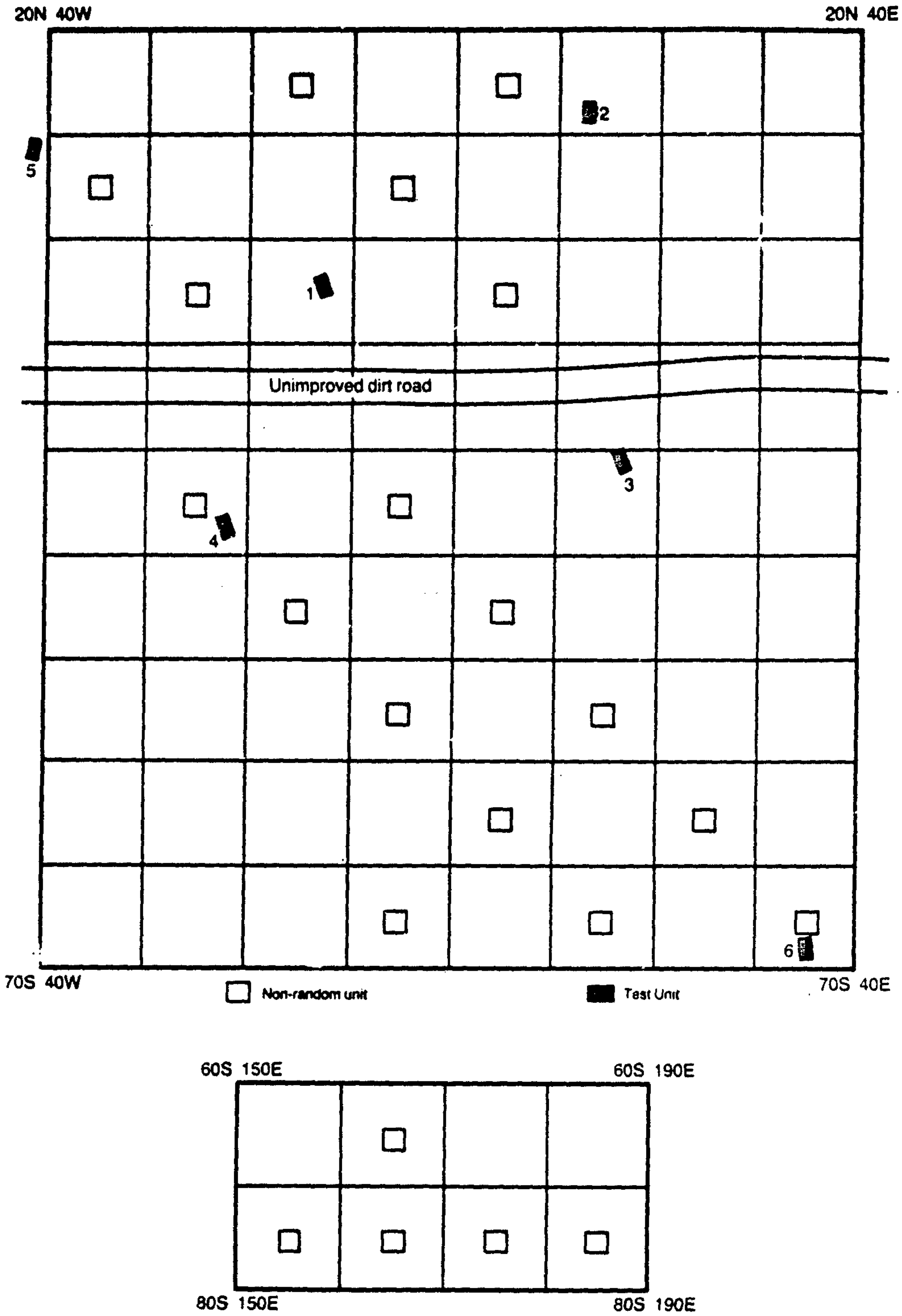


Figure 1-4. Units excavated and surface collected, Area A, 45-DO-282.

Figure 1-5. Units excavated, Areas B and C, 45-DO-282.



artifacts, characterizing technological, functional and stylistic aspects of the assemblage. Chapter 4 describes the results of faunal analysis. Chapter 5 describes cultural features identified at the site. Chapter 6 summarizes our findings and discusses both the chronology of site occupations and the nature of activities documented for site inhabitants. No botanical analysis was done for 45-DO-282, although soil samples are available for future analysis.

2. NATURAL AND CULTURAL STRATIGRAPHY

This chapter discusses the geologic setting of site 45-DO-282 with reference to local geologic history and describes the sedimentary history of the site itself in detail. Strata mapped during excavation are grouped into sitewide 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

Geologic formations in the vicinity of 45-DO-282 are shown in Figure 2-1. On either side of 45-DO-282 are outcrops of granite bedrock (Mzg). These are part of the exterior Colville batholith, the main body of which lies to the north. Not shown on the map is the later Miocene basalt formation. Part of the vast basalt flows forming the entire Columbia Plateau, this formation locally covers 250 sq km on the plateau north of the Columbia River Canyon. It outcrops also on the southern rim of the canyon, indicating a greater original extent. The basalt lag blocks on the site area, if indeed deposited by advancing Cordilleran ice, may be derived either from this local basalt formation, or from a source further away. Alternatively, the large pieces of basalt may not be erratics, but simply remnants of the local basalt formation lowered by gravity as the deposit was eroded from the canyon. This mechanism, hypothesized for basalt "havstacks" on upper terraces in the northern end of the reservoir (Hibbert 1984), probably is responsible for the basalt "erractics" at 45-DO-282.

Pleistocene events in the site vicinity include the deposition of proglacial gravels (Qpg) and the early Nespelem silt (Qne), followed by deposition of the till (Qt) as the ice advanced southward across the canyon and over the southern rim to the Waterville Plateau. On the north side of the canyon, Nespelem silt (Qn) overlies the till, but later Pleistocene deposits are missing on the south side of the canyon. The exposure of bedrock near the river level on the south side indicates that the till has been eroded away.

Since the Pleistocene, the river has been incising its channel into the glacial age deposits. The topography of the south side of the canyon suggests that the river migrated as far south as the 1,400 ft contour, cutting several small terraces as it moved deeper and northward. The site itself is located on a bench, or terrace, sloping gently from 1,000 ft down to the bank at 950 ft. Although no regional formation is mapped for this terrace, it was presumably cut by the Columbia River. Deposits of the Columbia River would be

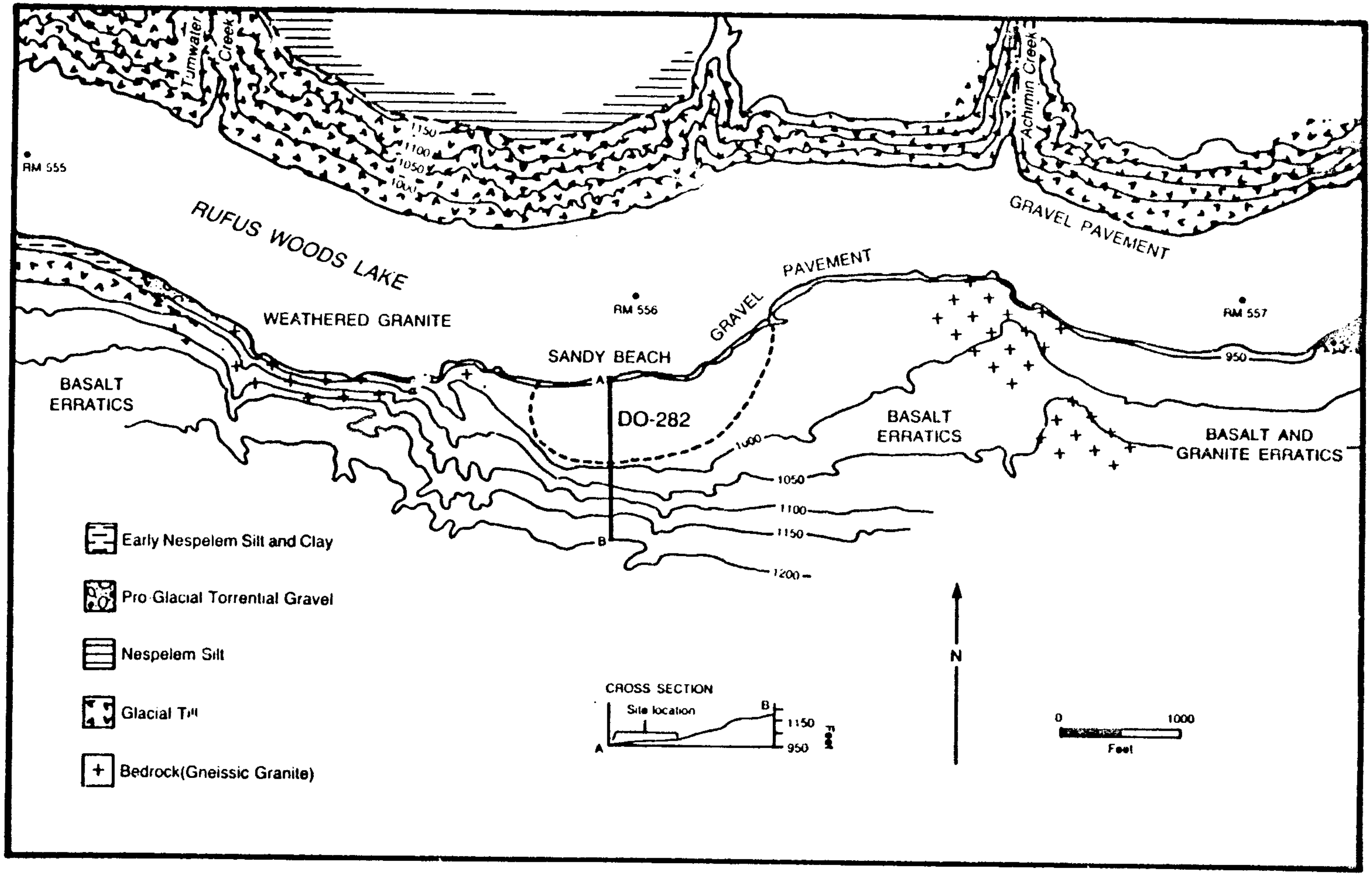


Figure 2-1. Geologic map of site vicinity, 45-DO-282.

expected to occur, overlying Pleistocene deposits such as the proglacial gravels (Qpg) which outcrop on the bank of the terrace to the east. The two granite outcrops at each end of the terrace would have affected the currents, and thus the deposition, in the site area.

At this time, the terrace lies along a two mile straight reach (RM 555-557) of the Columbia River. The rapids across from Box Canyon are undoubtedly caused by a bedrock obstruction in the channel, continuous with the bedrock exposed at the upstream end of the terrace. The rapids may have been a relatively stable feature over the last few thousand years.

PROCEDURES

The locations of profiled walls at Areas A, B, and C are shown in Figures 2-2 and 2-3. The stratigraphy crew profiled walls in 17 units in Areas A and B while the field school students profiled all of the units in Areas C and most of those in Area B. In analyzing and describing the stratigraphic units at the site, the stratigraphy crew profiles were given more weight than the student profiles. Consequently, the data for Areas A and B are considered more reliable. Areas B and C are grouped in Table 2-1, which summarizes the depositional history, not because they are necessarily similar, but because they are close together and there is little data available for Area C. Representative profiles from Areas A and B are shown in Figures 2-4 and 2-5.

DEPOSITIONAL HISTORY

The oldest deposit encountered in excavation at the site, DU I, is a layer of rounded river cobbles found underlying Stratum 400 in 74S174E. On the basis of comparison with other sites in the project area, these are undoubtedly part of a more extensive river channel deposit.

The overlying depositional unit, DU II, is the product of alluvial fan deposition. Two site wide strata, 400 and 300, were recognized, as well as a localized ash deposit, Stratum 250, which has been identified as Mt. St. Helens tephra, and might be St. Helens S-set tephra (ca. 13,000 B.P.) or Mt. St. Helens Yn tephra (ca. 3400 B.P.) (Davis 1984).

Stratum 400 was encountered in only a few excavation units, as most units terminated above it. Apart from the river cobbles, Stratum 400 has the coarsest matrix and the most gravel of all the deposits at the site. The gravel is decomposing granite, and is more frequent in Area B, which is topographically higher and further inland than Areas A and C. The distribution of the gravel is more consistent with deposition in an alluvial fan from bedrock weathering upslope than it is with bedrock weathering in situ.

The boundary between Stratum 400 and the overlying Stratum 300 is clear, and distinguished primarily by higher color values in Stratum 300. Particle size and gravel content decrease more gradually in Stratum 300, indicating that this is a conformable boundary. The sediments of this deposit vary more than those of the other deposits, with particle size decreasing toward the

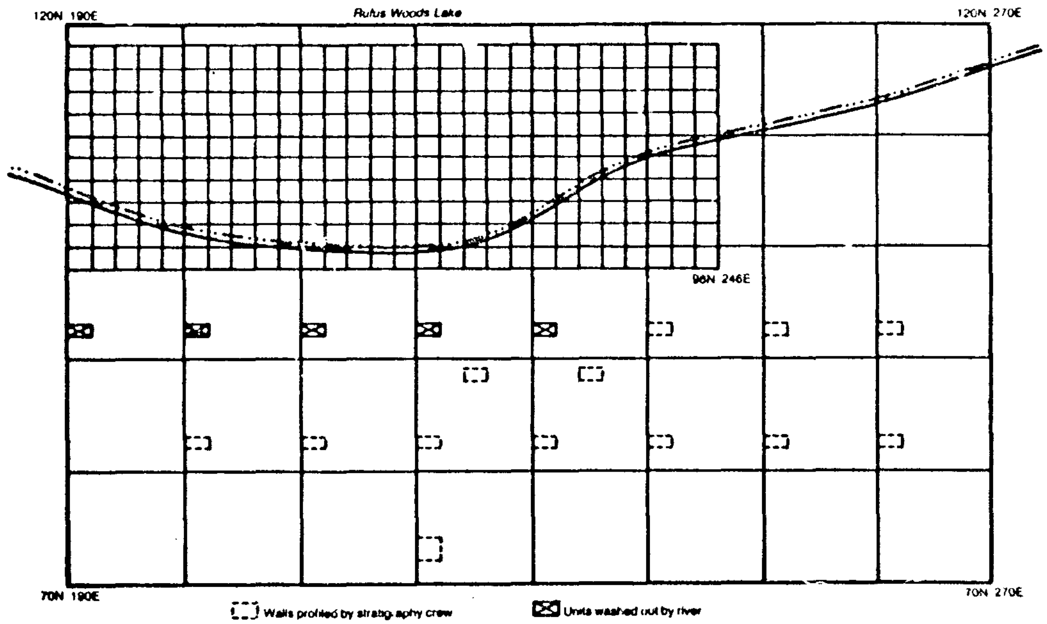


Figure 2-2. Location of profiled walls in Area A, 45-DO-282.

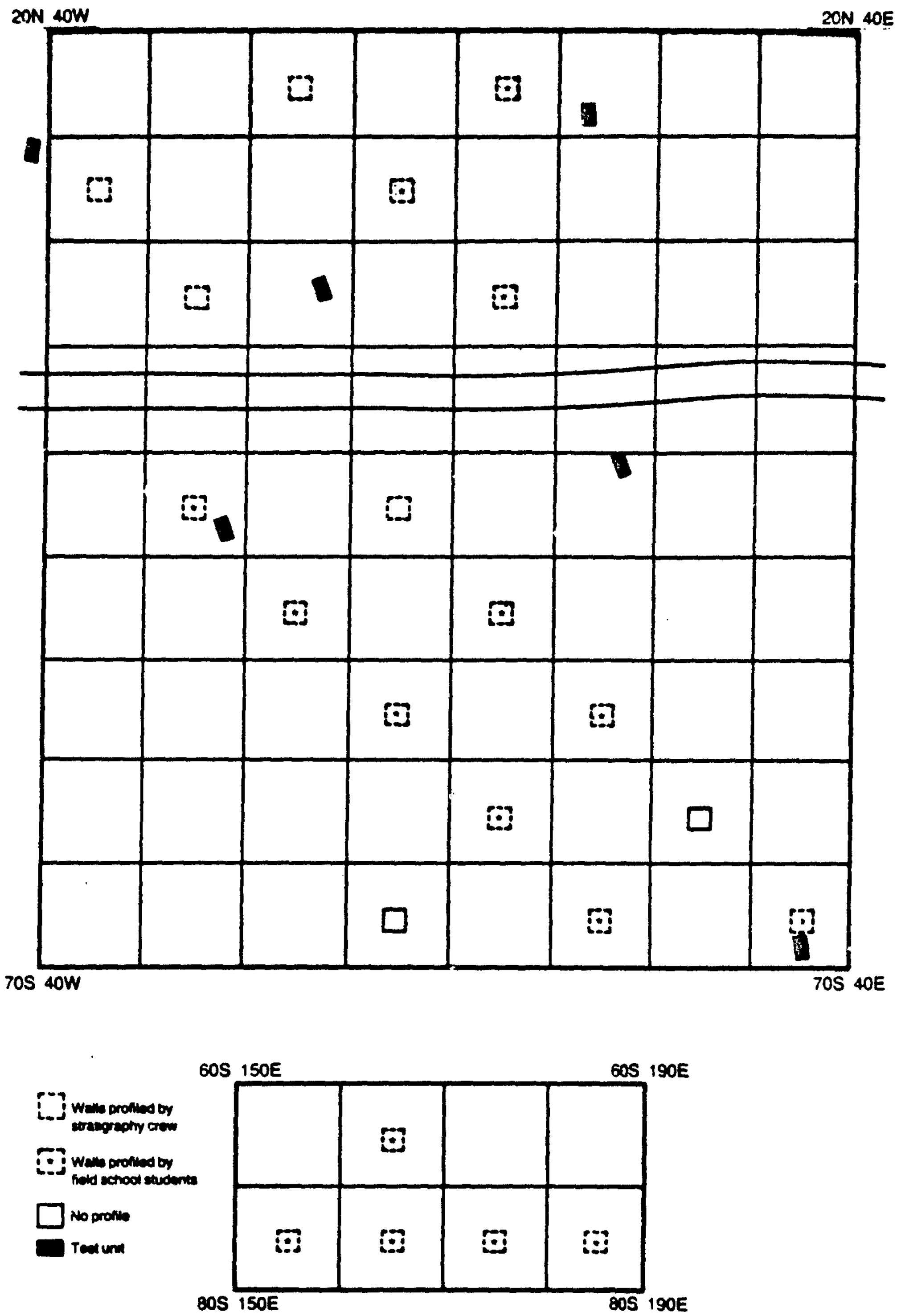
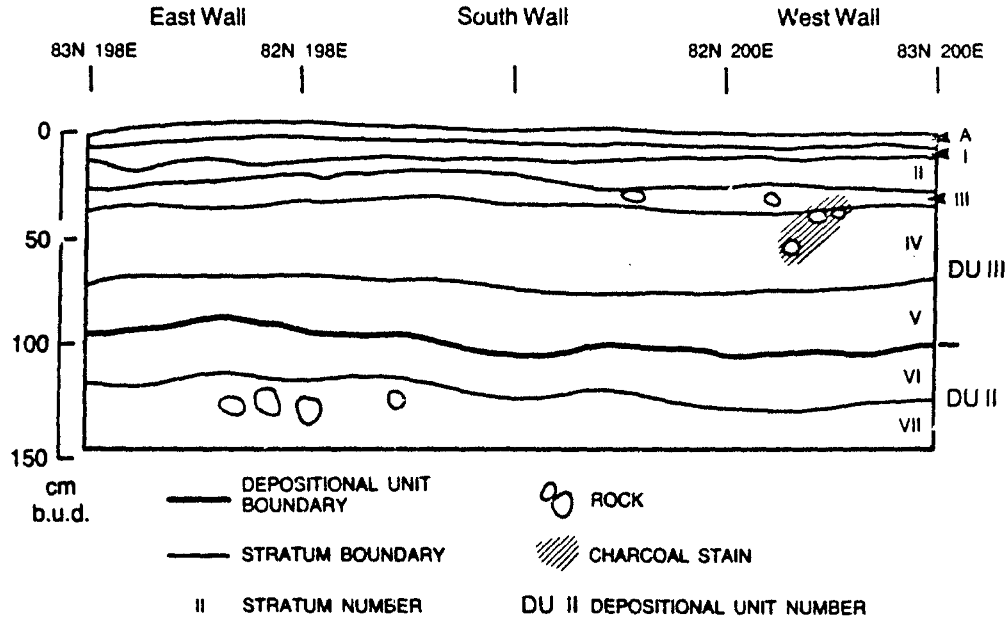


Figure 2-3. Location of profiled walls in Areas B and C, 45-DO-282.

Table 2-1. Summary of depositional units, 45-DO-282.

Depositional Unit	Sitewide Stratum	Physical Description
III overbank and aeolian deposition	50 overbank and aeolian sediments with littermat and B horizon	A: fine sand, moderately to poorly sorted, grayish brown (10YR5/2) with some darker colors, dark grayish brown to very dark grayish brown (10YR4/2-3/2), hard to soft, boundary clear.
		B and C: loamy sand to sandy loam, sand is fine to medium, poorly to moderately well sorted, brown to grayish brown (10YR5/3-5/2), soft to hard, boundary clear.
	100 overbank and aeolian deposits	A: sand to sandy loam, sand fine, moderately to moderately well sorted, light brownish grey to grayish brown (10YR6/2-5/2), soft, boundary gradual to clear.
		B and C: as above except less well sorted, pale brown to brown (10YR6/3-5/3).
	200 overbank deposits	A: sand to sandy loam, sand medium to fine, moderately to well sorted, light grey and pale brown (10YR7/2-6/3) to grayish brown and dark brown (10YR5/2 and 3/3), soft, boundary clear.
		B and C: sand to loamy sand, sand medium to fine, poorly to moderately sorted, light grey and pale brown to brown (10YR7/2,6/3-5/3), soft, boundary gradual.
II alluvial fan deposits	250 secondary ash deposit	A: clay loam with some fine gravel, 35% volcanic ash, compact when dry, soft when wet, light grey (10YR7/2), boundary clear, found only in 83N200E.
	300 fine alluvial fan deposits	A: variable textures from sand to clay loam but predominantly fine grained, moderately sorted, colors range from pale brown (10YR6/3) to dark grayish brown (10YR4/3), finer sediments are hard, coarser sediments soft, boundary clear, more gravel than Stratum 200.
		B and C: sand to sandy loam, sands medium to fine, poorly to moderately well sorted, wide color ranges with very pale and pale brown (10YR7/3-6/3), light brey (10YR7/2) and grayish brown (10YR5/2) dominant, loose to soft, clear boundary, more gravel than Stratum 200.
	400 coarse alluvial fan deposits	All: coarse to fine-grained sand with some decomposing granite gravel, poorly to moderately sorted, soft to hard, brown to dark grayish brown (10YR5/3-4/2), more gravel than Stratum 300.
I Columbia River gravels		B: rounded river cobbles underlying Stratum 400, encountered only in 745174E.



STRATA DESCRIPTIONS

A: Dark greyish brown (10YR4/2) loamy fine grained sand. Organic mat-roots, twigs, grasses. Soft consistence. Moderately sorted. Boundary: abrupt, wavy.

I: Greyish brown (10YR5/1-5/2) fine grained sandy loam. Hard consistence. Moderately sorted (high silt content). Boundary: abrupt, wavy.

II: Dark greyish brown (10YR4/2) sandy loam. Hard consistence. Moderately sorted. Boundary: abrupt, wavy (but disturbed). This is the A1 horizon.

III: Greyish grown (10YR5/2) fine grained sandy loam. Soft consistence. Moderately sorted. Contains possible ?eature. Boundary: clear, wavy. This is the A2 horizon.

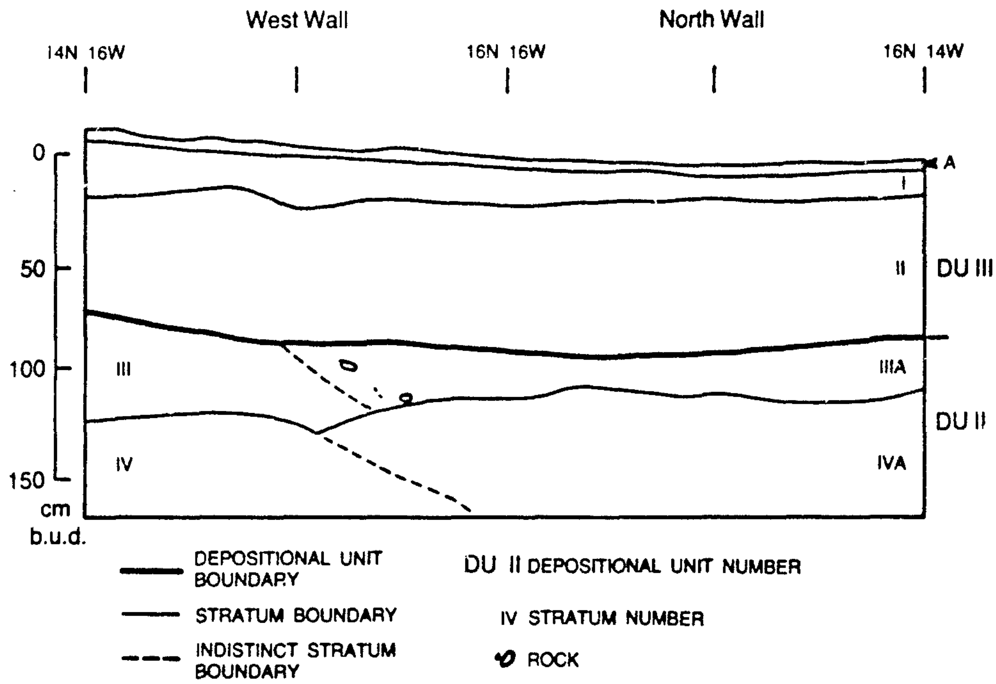
IV: Light brownish grey (10YR6/2) sandy loam. Soft consistence. Moderate to poorly sorted. Occasional fine gravel. Boundary: Clear to gradual, smooth. This iu the A3 horizon.

V: Greyish brown (10YR5/2) sandy loam. Soft consistance. Moderately to poorly sorted. Fairly abundant fine gravel. Boundary: clear, wavy.

VI: Light grey (10YR7/2) clwy loam. Fairly compact but soft consistence when dry. Occasional fine gravel. Moderately sorted. Boundary: clear, wavy.

VII: Pale brown (10YH6/3) sandy lcam to loamy sand. Coarser than any of the above strata. Soft consistence. Occasional fine gravel. Moderately sorted. Boundary: unknown.

Figure 2-4. Profile of 83N200E, Area A, 45-DO-282.



STRATA DESCRIPTIONS

A: Brown (10YR5/3) loamy sand. Organic litter mat- roots, grasses. Boundary: abrupt. wavy.

I: Brown (10YR5/3) loamy sand. Moderately sorted. Soft consistence. Slightly harder and darker in color than Level II. This is the A Horizon. Boundary: gradual, wavy.

II: Brown (10YR5/3) loamy sand. Contains some coarse sand, but is predominantly fine sand. Somewhat more friable in the upper half of the level. Same as Level I but lighter in color.

III: Yellowish brown (10YR5/4) loamy sand. Moist, slightly harder than Level II, more compact, different in color, and somewhat coarser grained. Boundary: clear to gradual, wavy.

IIIA: Brown to dark brown (10YR4/3 when wet) loamy sand. Same as Level III, but darker in color, slightly finer grained, and more compact. Boundary: clear, wavy.

IV: Brown (10YR5/3) fine and medium sand. Single grain to fine blocky structure. Moderately sorted. Very wet. Lighter in color than Level III. Boundary: gradual, irregular.

IVA: Brown (10YR5/3 to 4/3 when wet) sand. Similar to Level IV but darker in color and somewhat finer grained. Boundary: unknown.

Figure 2-5. Profile of 16N6W, Area B, 45-DO-282.

river. Stratum 300 appears to be a continuation, at a diminished energy level, of the alluvial processes at work in Stratum 400. It is also possible that there is some some overbank contribution, especially close to the river. The great variability in color in this stratum is due to variation in both texture and moistness of the sediments.

During laboratory analysis, Stratum VI from 83N200E (Figure 2-4) was found to contain 35% volcanic ash identified as Mt. St. Helens tephra by Davis (1984). On the basis of other characteristics, the stratum in which the ash occurred is part of sitewide Stratum 300, but because of its unique content it was labelled Stratum 250. Although Stratum 300 in the adjacent units has a similar matrix, ash was not noted. The isolated horizontal occurrence of the ash indicates that it is a secondary deposit. It therefore provides only a maximum date for the age of Stratum 300.

Above the alluvial fan deposits are a series of overbank deposits, DU III. Three sitewide strata, 200, 100, and 50, were recognized.

Stratum 200, inferred to be overbank deposition, is a more massive deposit with more uniform characteristics sitewide than Stratum 300. In Area A, Stratum 200 is coarser, sandier, better sorted, and looser than the underlying units, although similar in color, while in Area B, Stratum 200 is finer, loamier, harder, and more poorly sorted than the underlying unit. These contrasts indicate a change in the direction of deposition, which would be the case if overbank deposition was more prevalent than alluvial fan deposition. Despite the greater uniformity in texture, a wide range of colors were recorded for this stratum. This is due primarily to variations in the moisture of the sediments.

The sediments of Stratum 100 are yet more uniform, markedly finer, somewhat loamier, and somewhat more poorly sorted than Stratum 200. The textural differences may indicate a fining upwards in the overbank sequence, or an increase in aeolian contribution. In either case, the gradual boundary indicates that Stratum 100 overlies Stratum 200 conformably. The colors of the sediments in Area A are the same in value, but consistently grayer than those in Areas B and C, indicating a more reducing environment at Area A. It is possible, therefore, that the observed physical difference is more a function of soil development than a change in depositional regime. While soil formation is a postdepositional process, it is generally uniform relative to the topography, and may develop along textural lines. In the absence of a distinct boundary between Stratum 100 and 200, this soil horizon is probably an adequate time marker.

Stratum 50 is coarser, loamier, and more poorly sorted than Stratum 100. The litter mat and underlying B horizon are contained in this depositional unit. The sediments have been affected by soil forming processes and are dark grayish brown and darker colors. It is possible that the upper 15-25 cm of this unit are a plow zone but this was not corroborated by local informants. Although there are textural distinctions between Strata 100 and 200, the boundary between them, generally found at 75-100 cm below the surface, is gradual and recognized largely by color differences.

In summary, DU I represents the passage of the Columbia River channel across the bench. After the river withdrew, an alluvial fan began to aggrade, protected from fluvial erosion by the granite outcrop at the upstream end of the bench. DU II was the result. The fan aggradation rate diminished, and came into equilibrium with the local base level, and overbank deposition became dominant (Stratum 200). As the elevation of the overbank deposits relative to the river channel increased, the rate of deposition slowed, and aeolian deposition made a greater contribution (Stratum 100). The relative stability of the surface in Stratum 100 and 50 allowed soil development to begin.

ANALYTIC ZONES

The four sitewide stratigraphic units containing separate peaks of cultural material were defined as cultural analytic zones. Table 2-2 summarizes the stratigraphic definitions and cultural contents of each zone. Due to a lack of charcoal or other datable organic material, no radiocarbon dates were obtained for any of the deposits. A lack of patterning in artifact distribution, a lack of bounded cultural features, and a lack of lighter materials such as charcoal, bone, and shell suggests that they may be secondary or deflated deposits. However, the small assemblage of projectile point types (see stylistic analysis) indicates that there are discernible differences in the temporal distribution of the cultural deposits, and justify division of these strata into four analytic zones. Each zone is discussed individually below.

ZONE 4

The cultural materials from DU II (Strata 250, 300, 400) have been assigned to Zone 4. This is the smallest of all four assemblages, although it has the second largest excavated volume. The cultural assemblage includes lithic and bone scatters. No FMR (fire modified rock) or shell was recovered. Although cultural features were recorded, they are all unstructured features identified on the basis of content alone and defined within arbitrary unit levels within 2 x 2-m excavation units. The Zone 4 materials occur with the redeposited Mt. St. Helens ash deposit (Stratum 250). Stylistic evidence indicates this zone dates before 6000 B.P., which implies that the ash must be the S-set tephra (ca. 13,000 B.P.). Zone 4 was excavated in all but a few units in Areas B and C. These were terminated above DU I.

ZONE 3

Stratum 200 (DU III), containing the largest cultural assemblage of the four depositional units, is defined as cultural Analytic Zone 3. Like the other zones, the assemblage is dominated by lithics and only a very small percentage bone, shell, FMR and miscellaneous items. The feature assemblage is the largest of all the zones. Although features were recorded, they are all

Table 2-2. The analytic zones, 45-DO-282: their stratigraphic definition and contents.

Zone	DU	Stratum	Description	Lithic[1] number	Non-lithic[2] number	Bone # grams	Shell[3] # grams	FMR # grams	Total #	Miscellaneous/ Historic	# features	Volume (m^3)	Density (objects/m^3)
1	3	50	Overbank and aeolian	2,783	24	68 24	- -	- -	2,860	4	-	45.0	63.6
2	3	100	Upper overbank deposit	3,920	35	52 47	2 21	6 944	4,021	6	3	40.7	98.8
3	3	200	Lower overbank deposit	6,877	77	73 17	5 28	[illegible] 1,0[illegible]	7,037	3	8	53.1	132.5
4	2	250 300 400	Alluvial fan	1,610	36	7 <1	- 2	- -	1,655	2	2	47.3	35.0
25	-	-	Beach lag	1,394	13	32 145	- 5	90 32,687	1,527	8	-	1,120[4]	-

[1]Includes <1/4 in flakes.
[2]Includes bone artifacts, ochre, historic, and miscellaneous.
[3]Count is of hinges; weight is total shell weight.
[4]Area (m^2).

unstructured and defined on the basis of content alone. Cultural materials in this zone may be less disturbed or reworked than those in Zone 4 because of the dominance of overbank deposition. This zone was excavated in all units.

ZONE 2

Zone 2 corresponds to Stratum 100 (DU III). This zone has a larger and more diverse assemblage than that of Zone 1, even though it represents a slightly smaller excavated volume. The assemblage is dominated by lithics, but also includes FMR, bone, shell and cultural features. The features recorded were all unstructured and defined by content alone. The sediments are overbank and aeolian deposits resulting from processes which should not have disturbed the cultural materials. This zone was excavated in all units.

ZONE 1

Zone 1 includes the cultural materials recovered from Stratum 50 (DU III). The assemblage consists largely of lithics, with but a few bones. No features, shell or FMR were recovered. This zone was excavated in all units. A plow zone has reworked the upper 20-30 cm of deposit.

THE BEACH COLLECTION (ZONE 25)

The surface on which the beach lag collection occurred was labeled Zone 25. It is an erosional beach surface cross-cutting several of the deposits at the site. Although not comparable to the other zones in duration and formation processes, the zone yielded a large assemblage containing valuable information on artifact types and morphology.

3. ARTIFACT ANALYSES

Artifacts recovered from site 45-DO-282 have been subjected to three separate analyses. Technological analysis describes elements of prehistoric tool manufacture, detailing processes of lithic reduction. Functional analysis describes attributes of wear on tools and develops inferences concerning the use of tools at the site. Stylistic analysis describes morphological elements that have demonstrated temporal and regional significance and compares recovered artifacts with types defined outside of the project area.

Stone artifacts are treated in the most detail, with other materials entering the classification only when specified attributes are applicable. Analyses were intentionally biased towards lithics with the assumption that these artifact classes would be of the most value in comparisons with other researchers' work and in developing reconstructions of site activities. Artifacts of bone, shell, and other non-lithic materials, though included in the classifications wherever appropriate, are only described in detail selectively.

All artifact analyses take the form of paradigmatic classifications as defined by Dunnell (1971, 1979). In this system, dimensions are selected which can describe morphological variation in the collection. These dimensions may correspond to defined stages of tool manufacture, be characteristic of specific tool uses, or be indicative of limited periods of time depending on the purpose of the classification. Dimensions are divided into sets of attributes. In analysis each artifact is identified by a single attribute from each dimension. By cross-tabulating the dimensions, sets of comparable but mutually exclusive classes are formed. From study of these classes, inferences may be drawn concerning the nature of tool manufacture, use, and distribution in time and space.

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

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

Artifact analyses will be presented with reference to the five analytic zones outlined in Chapter 2. All four excavated zones correspond to the Kartar Phase (ca. 7000-4000 B.P.) defined for the Rufus Woods Lake project area. The beach collection (Zone 25), represents an eroded remnant surface, with diagnostic projectile point types that indicate a temporal range comparable to that documented for the four excavated zones. We include the beach collection in all the following descriptive tables since it is of comparable age, and can be used to assess the validity of patterns observed in the other four zonal assemblages. Because the site had neither activity surfaces nor bounded cultural features, the artifact assemblages within the zones cannot be divided further; consequently, the zones must serve as our finest units of analysis. Discussion of artifacts in association with the arbitrarily defined unit level features is reserved for Chapter 5. This chapter will also treat the spatial patterning in the artifact classes.

TECHNOLOGICAL ANALYSIS

Prior researchers have described general manufacturing sequences in the production of stone tools, and have thereby identified specific morphological elements associated with certain methods of production and particular steps in the reductive sequence (e.g., Crabtree 1972, 1967a,b; Flenniken and Garrison 1975; Muto 1971, 1976; Smith and Goodyear 1976; Speth 1972; Stafford 1977; Swanson 1975).

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

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

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

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

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

Technological analysis at 45-DO-282 utilized an abbreviated form termed LITHAN-X, which applied standard analytic procedures only to the NW quadrant of any excavated unit. Other quadrants within the unit received only partial analysis. Artifacts in the NW quadrant were identified according to all five dimensions. Artifacts recovered elsewhere in the square were only identified according to MATERIAL TYPE and OBJECT TYPE. Exceptions are field-catalogued objects and flakes smaller than 1/4 in. These were subjected to standard analysis, irrespective of provenience. This means that counts of material types and object types will be higher than those tabulated for condition, dorsal topography and treatment. Worn and manufactured objects and flakes smaller than 1/4 in are subjected to full analysis, and included in the above

Table 3-1. Technological dimensions, 45-DO-282.

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
- Bone/antler
- Ocher

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).

categories.

We will first examine the range of material types recovered, and then the types of objects present. By examining such technological dimensions as material, object type, type of manufacture, treatment, dorsal topography, and flake size, we will make inferences about the nature of lithic reduction at the site. These are admittedly crude indicators, but they should provide the data necessary to describe the sorts of stone tool production present at the site. When analyzed by distribution over analytic zones and in cultural features, these diagnostics will also allow us to make inferences about changes over time and the use of space in any defined period.

MATERIAL TYPES

Ninety-five percent of the worked stone recovered from site 45-DO-282 was either jasper (57%) or chalcedony (38%) (Table 3-2). No other material type exceeds 2% of any zonal assemblage nor 1% of the total assemblage. Distribution across zones is very even, except for a dramatic increase in jasper in Zone 25, the beach collection. This zone also produced slightly higher quantities of quartzite, fine-grained quartzite and basalt, and markedly lower quantites of chalcedony than found in the excavated zones.

Non-lithic materials were rare at this site (Table 3-3), consisting solely of ocher, three glass fragments, and two poorly preserved bone/antler tool fragments. Again, none of these exceeded 2% of any zonal assemblage and only ocher tallied 1% or above.

Table 3-3. Count of non-lithic material by zone, 45-DO-282.

Material	Zone					Total
	1	2	3	4	25	
Ocher	24	35	78	38	1	174
Column %	01	01	01	02	-	
Glass	1	1	1	-	-	3
Column %	-	-	-	-	-	
Bone/Antler	-	-	-	-	2	2
Column %	-	-	-	-	-	
TOTAL	25	36	79	38	3	179

OBJECT TYPES

Jasper and chalcedony conchoidal flakes are easily the most common object type in the collection, comprising 88% of the artifacts recovered (jasper, 52%; chalcedony, 36%) (Table 3-4). Other object types occur in the following order of descending frequency: chunks, of all material types (5%), conchoidal flakes of other than jasper and chalcedony (3%), formed objects (2%), microblades (1%), cores (.3%) and unmodified objects (.2%). Jasper and chalcedony are the most frequent minerals for all object types except the unmodified category, which includes hammerstones and pestles. Chalcedony is

Table 3-2. Count of lithic material by zone, 45-DO-282[1].

Material	Zone					Total
	1	2	3	4	25	
Jasper	349	518	819	165	1,111	2,962
Column %	50.5	50.3	47.7	47.3	81.2	
Chalcedony	315	473	830	171	158	1,947
Column %	45.6	46.0	48.4	49.0	11.5	
Petrified wood	3	2	13	0	8	26
Column %	0.4	0.2	0.8	0.0	0.6	
Obsidian	0	3	4	1	1	9
Column %	0.0	0.3	0.2	0.3	0.1	
Opal	8	3	6	3	0	20
Column %	1.2	0.3	0.3	0.9	0.0	
Quartzite	1	0	4	0	22	27
Column %	0.1	0.0	0.2	0.0	1.6	
Fine-grained quartzite	0	5	1	1	17	24
Column %	0.0	0.5	0.1	0.3	1.2	
Basalt	2	12	17	3	27	61
Column %	0.3	1.2	1.0	0.9	2.0	
Fine-grained basalt	5	5	5	2	2	19
Column %	1.7	0.5	0.3	0.6	0.1	
Silicized mudstone	0	0	2	0	2	4
Column %	0.0	0.0	0.1	0.0	0.1	
Argillite	6	5	11	3	4	29
Column %	0.9	0.5	0.6	0.9	0.3	
Granitic	0	0	3	0	7	10
Column %	0.0	0.0	0.2	0.0	0.5	
Sandstone	0	0	0	0	1	1
Column %	0.0	0.0	0.0	0.0	0.1	
Indeterminate	2	3	1	0	8	14
Column %	0.3	0.3	0.1	0.0	0.6	
TOTAL	691	1,029	1,716	349	1,368	5,153

[1] <1/4 in flakes deleted.

more prevalent than jasper in the microblades (chalcedony 69%; jasper 31%) and equals jasper in the cores (chalcedony 44%; jasper 44%). Jasper is the more common in conchoidal flakes, chunks and formed objects.

Table 3-4. Material by object type by zone, 45-OO-282.

Material by object type	Zone					Total
	1	2	3	4	25	
Conchoidal flake						
Jasper	321	478	768	151	844	2,660
Chalcedony	289	454	799	159	138	1,839
Basalt	7	13	19	5	8	52
Quartzite	1	5	5	1	15	27
Argillite	5	5	11	3	1	25
Petrified wood	3	2	13	0	5	23
Obsidian	-	3	4	1	-	8
Opal	6	2	6	2	-	16
Silicized mudstone	-	-	2	-	-	3
Microblade						
Jasper	4	3	4	2	4	17
Chalcedony	8	3	18	6	3	38
Chunk						
Jasper	16	31	43	10	83	183
Chalcedony	15	8	11	4	7	45
Basalt	-	-	2	-	-	2
Quartzite	-	-	-	-	4	4
Argillite	-	-	-	-	1	1
Petrified wood	-	-	-	-	1	1
Obsidian	-	-	-	-	1	1
Opal	1	1	-	-	-	2
Core						
Jasper	-	1	1	1	4	7
Chalcedony	1	1	2	1	2	7
Basalt	-	-	1	-	-	1
Argillite	-	-	-	-	-	1
Formed object						
Jasper	6	5	5	1	67	84
Chalcedony	1	7	-	1	7	16
Basalt	1	2	-	-	11	14
Quartzite	-	-	-	-	3	3
Argillite	1	-	-	-	1	2
Petrified wood	-	-	-	-	1	1
Opal	1	-	-	1	-	2
Silicized mudstone	-	-	-	-	1	1
Unmodified						
Jasper	-	-	-	-	1	1
Basalt	-	-	-	-	6	6
Quartzite	-	-	-	-	1	1
Granitic	-	-	1	-	3	4
TOTAL	687	1,024	1,713	349	1,329	5,092

Zonal distributions of object types are remarkably regular, with the percentage of object types very uniform across the four excavated zones and the Zone 25 beach collection. The only exception is the formed object category: in Zone 25 formed objects make up 7% of the total assemblage; in the other zones, this category makes up less than 1.5% of the zonal assemblage.

MANUFACTURE

Chipping accounts for 99% of the manufacture observed for objects in the collection (Table 3-5). However, only 4% of the total number of objects recovered show any manufacture beyond initial detachment from a core or blank, or resharpened tool. Chipped objects constitute no more than 3% of the objects in any zonal assemblage, with the exception of Zone 25, where the 10.2% tally reflects the higher number of formed objects recovered.

Table 3-5. Type of manufacture by zone, 45-DO-282[1].

Type	Zone 1	Zone 2	Zone 3	Zone 4	Zone 25	Total
None	671	1,009	1,698	344	1,227	4,949
Column %	97.1	98.1	99.0	98.6	89.7	
Chipping	20	20	18	5	139	202
Column %	2.9	1.9	1.0	1.4	10.2	
Indeterminate	-	-	-	-	2	2
Column %	-	-	-	-	0.1	
TOTAL	691	1,029	1,716	349	1,368	5,153

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

Heat treatment prior to manufacture appears to have been common, with 4-7% of each zonal assemblage listed as burned or dehydrated (Table 3-6). Jasper and chaldedony frequently exhibit burning (jasper 75%; chalcedony 23%) (Table 3-7). Two examples of opal and fine-grained basalt are also listed as burned. All four specimens listed as dehydrated are opal; however, this is probably the result of natural dehydration since opal tends to dehydrate when exposed.

Table 3-6. Count of treatment by zone, 45-DO-282[1].

Treatment	Zone 1	Zone 2	Zone 3	Zone 4	Zone 25	Total
None	648	976	1,643	323	1,314	4,904
Column %	93.8	94.8	95.7	92.6	96.1	
Burned	40	53	72	26	54	245
Column %	5.8	5.2	4.2	7.4	3.9	
Dehydrated	3	-	1	-	-	4
Column %	0.4	-	0.1	-	-	
TOTAL	691	1,029	1,716	349	1,368	5,153

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

Table 3-7. Heat treatment by material by zone, 45-DO-282[1].

Treatment by material	Zone 1	Zone 2	Zone 3	Zone 4	Zone 25	Total
Jasper						
None	321	478	787	147	1,087	2,778
Burned	28	42	52	18	44	184
Total	348	518	818	165	1,111	2,963
Chalcedony						
None	304	463	811	164	148	1,890
Burned	11	10	19	7	10	57
Total	315	473	830	171	158	1,847
Petrified wood						
None	3	2	13	-	8	26
Total	2	2	13	-	8	26
Obsidian						
None	-	3	4	1	1	9
Total	2	2	13	-	8	26
Opal						
None	4	3	5	2	-	14
Burned	1	-	-	1	-	2
Dehydrated	3	-	1	-	-	4
Total	8	3	6	3	-	20
Quartzite						
None	1	-	4	-	22	27
Total	1	1	4	-	22	27
Fine-grained quartzite						
None	-	5	1	1	17	24
Total	-	5	1	1	17	24
Basalt						
None	2	12	17	3	27	61
Total	2	12	17	3	27	61
Fine-grained basalt						
None	5	4	4	2	2	17
Burned	-	1	1	-	-	2
Total	5	5	5	2	2	19
Silicized mudstone						
None	-	-	2	-	2	4
Total	-	-	2	-	2	4
Argillite						
None	6	5	11	3	4	29
Total	6	5	11	3	4	29
Granitic						
None	-	-	3	-	7	10
Total	-	-	3	-	7	10
Sandstone						
None	-	-	-	-	1	1
Total	-	-	-	-	1	1
Indeterminate						
None	2	3	1	-	8	14
Total	2	3	1	-	8	14

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

Primary reduction of all material types occurred on the site, with 4-8% of all object types recovered per zone having either partial or complete cortex (Table 3-8). Of the stones with cortex, 62.6% are jasper and 17.8% are chalcedony (Table 3-9). The remainder are primarily locally available quartzite and basalt. The majority of object types with cortex are cryptocrystalline concholdal flakes (73%) (Table 3-10). Cryptocrystalline chunks comprise 5.7% and non-cryptocrystalline formed objects make up another 5%. Other categories never exceed 3%. Only five of the sixteen recovered cores show any cortex remnants, and four of these five are cryptocrystalline stones.

Table 3-8. Count of dorsal topography by zone, 45-00-282[1].

Dorsal topography	Zone					Total
	1	2	3	4	25	
None	633 91.9	877 94.9	1,598 93.2	321 92.0	1,291 94.4	4,823
Partial cortex	53 7.7	46 4.5	[illegible] 6.8	28 8.0	48 3.5	291
Complete cortex	- 0.0	1 0.1	1 0.1	- 0.0	4 0.3	6
Indeterminate	3 0.4	5 0.5	- 0.0	- 0.0	25 1.8	33
TOTAL	691	1,029	1,716	349	1,368	5,153

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

Secondary reduction and finishing/maintenance of stone tools on the site is documented in Table 3-11, which lists conchodial flakes by size. Most (88%) of the concholdal flakes are larger than 1/4 in, 12% are less than 1/4 in, and only .04% are less than 1/8 in. Of the less than 1/4 in and 1/8 in flakes, 34% are jasper, 65% are chalcedony, with the rest, opal, obsidian and various other noncryptocrystalline stones. This closely replicates the pattern observed in the distribution of material types and object types.

Weight, length, thickness and weight measurements taken on concholdal flakes reflect the use of cryptocrystalline stones for most tool forms, as well as providing insights into the reduction process used. For example, Table 3-12, which lists average weights by material types for the five analytic zones, underscores the differential use of CCS and non-CCS stones. CCS--predominantly jasper and chalcedony--is consistently present in the lowest average weights, and shows very low standard deviations, reflecting the use of these stones for the widest variety of small tools and, perhaps, either very little variation in the size of cores or the kinds of tools made. It will be seen that the quartzite and basalt specimens recovered are much larger, indicating very different use patterns for CCS and non-CCS stones. We also observe much larger CCS flakes of more variable size in the beach collection (Zone 25), accompanied by smaller basalt flakes of less variable size. This may indicate some difference in the natu of reduction between that area and those zones still in stratigraphic context, although the possibility of size sorting by wave action must also be taken into account. These patterns in flake size are also represented in Tables 3-13, 3-14, and 3-15. In them, we see a marked consistency in the size of CCS flakes relative to the presence or absence of cortex in all zones except Zone 25, where the flakes are larger and more variable in size. It is also apparent that CCS and non-CCS flakes are generally comparable in length and width, except again, in Zone 25, where both CCS and non-CCS flakes show marked increases in size.

Table 3-9. Amount of cortex by material by zone, 45-DO-282[1].

Material debitage	Zone 1	Zone 2	Zone 3	Zone 4	Zone 25	Total
Jasper						
None	309	485	728	142	1,095	2,759
Part cortex	38	32	91	23	2	186
Indeterminate	-	1	-	-	14	15
Total	347	518	819	165	1,111	2,960
Chalcedony						
None	302	459	811	166	155	1,893
Part cortex	13	13	19	5	1	51
Complete cortex	-	1	-	-	1	2
Indeterminate	-	-	-	-	1	1
Total	315	473	830	171	158	1,947
Petrified wood						
None	3	2	13	-	8	26
Total	3	2	13	171	8	26
Obsidian						
None	-	3	4	1	1	9
Total	-	3	4	1	1	9
Opal						
None	7	3	6	3	-	19
Part cortex	1	-	-	-	-	1
Total	8	3	6	3	-	20
Quartzite						
None	1	-	4	-	6	11
Part cortex	-	-	-	-	15	15
Indeterminate	-	-	-	-	1	1
Total	1	-	4	-	22	27
Fine-grained quartzite						
None	-	5	1	1	14	21
Part cortex	-	-	-	-	3	3
Total	-	5	1	1	17	24
Basalt						
None	1	11	12	3	6	33
Part cortex	1	1	5	-	18	25
Complete cortex	-	-	-	-	2	2
Indeterminate	-	-	-	-	1	1
Total	2	12	17	3	27	61
Fine-grained basalt						
None	5	4	5	2	2	18
Indeterminate	-	1	-	-	-	1
Total	5	5	5	2	2	19
Silicized mudstone						
None	-	-	2	-	1	3
Part cortex	-	-	-	-	1	1
Total	-	-	2	-	2	4
Argillite						
None	6	5	11	3	1	26
Part cortex	-	-	-	-	2	2
Indeterminate	-	-	-	-	1	1
Total	6	5	11	3	4	29
Granitic						
None	-	-	1	-	-	1
Part cortex	-	-	1	-	6	7
Complete cortex	-	-	1	-	1	2
Total	-	-	3	-	7	10
Sandstone						
Indeterminate	-	-	-	-	1	1
Total	-	-	-	-	1	1
Indeterminate						
None	1	-	1	-	2	4
Indeterminate	1	3	-	-	6	10
Total	2	3	1	-	8	14

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

Table 3-10. Cortex on cryptocrystalline and other material by object type and zone, 45-DO-262[1].

Object type by cortex by material	Zone 1	Zone 2	Zone 3	Zone 4	Zone 25	Total
Conchoidal flakes						
No cortex						
Cryptocrystalline	572	896	1,488	286	1,081	4,323
Other	12	23	35	9	24	103
Partial cortex						
Cryptocrystalline	47	41	100	27	-	215
Other	1	-	4	-	1	6
Complete cortex						
Cryptocrystalline	-	1	-	-	-	1
Microblades						
No cortex						
Cryptocrystalline	12	5	22	8	6	53
Partial cortex						
Cryptocrystalline	-	1	-	-	-	1
Complete cortex						
Cryptocrystalline	-	-	-	-	1	1
Tabular flakes						
No cortex						
Cryptocrystalline	-	-	-	-	1	1
Other	-	-	-	-	4	4
Partial cortex						
Other	-	-	-	-	10	10
Chunks						
No cortex						
Cryptocrystalline	27	38	46	14	83	208
Other	-	-	1	-	2	3
Partial cortex						
Cryptocrystalline	5	2	8	-	2	17
Other	-	-	1	-	4	5
Cores						
No cortex						
Cryptocrystalline	1	1	2	1	5	10
Other	-	-	1	-	-	1
Partial cortex						
Cryptocrystalline	-	1	1	1	1	4
Other	-	-	-	-	1	1
Formed objects						
No cortex						
Cryptocrystalline	8	12	4	3	74	101
Other	1	2	-	-	-	3
Partial cortex						
Cryptocrystalline	-	-	1	-	-	1
Other	-	-	-	-	15	15
Unmodified						
No cortex						
Cryptocrystalline	-	-	-	-	1	1
Partial cortex						
Other	-	-	-	-	7	7
Complete cortex						
Other	-	-	1	-	3	4

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

Table 3-11. Count of flake size by material and zone, 45-DO-282.

Material	Size (in)	Zone 1	Zone 2	Zone 3	Zone 4	Zone 25	Total
Jasper	>1/4	1,263	1,709	2,809	637	1,111	7,529
	<1/4	82	142	341	82	28	675
	<1/8	-	-	-	-	1	1
Chalcedony	>1/4	1,136	1,616	2,881	639	158	6,410
	<1/4	199	306	633	136	4	1,278
	<1/8	-	7	-	-	-	7
Petrified wood	<1/4	7	6	28	3	8	52
Obsidian	>1/4	7	14	7	6	1	35
	<1/4	1	2	2	1	-	6
Opal	>1/4	12	7	9	6	-	34
	<1/4	1	-	1	-	-	2
Quartzite	>1/4	3	1	6	1	22	33
	<1/4	-	-	-	-	1	1
Fine-grained quartzite	>1/4	2	10	8	3	17	40
	<1/4	1	1	2	-	-	4
Basalt	>1/4	15	29	66	13	27	150
Fine-grained basalt	>1/4	8	7	13	4	2	34
	<1/4	-	-	2	1	-	3
Silicized mudstone	>1/4	-	1	5	2	2	10
Argillite	>1/4	13	13	28	11	4	69
	<1/4	-	1	1	1	-	3
Granitic	>1/4	-	2	5	1	7	15
Sandstone	>1/4	-	-	-	-	1	1
Silt/mudstone	>1/4	1	-	-	1	-	2
Mica	>1/4	12	46	49	62	-	169
Total	>1/4	2,479	3,481	5,894	1,389	1,360	14,583
	<1/4	284	452	982	221	33	1,972
	<1/8	-	7	-	-	1	8

Table 3-12. Average weight (in 0.1 g) of conchoidally flaked material by zone, 45-DO-282[1].

Material	Zone					Total
	1	2	3	4	25	
Cryptocrystalline						
$\bar{x}$	3.3	3.2	3.5	4.5	16.4	4.5
s.d.	8.0	9.0	11.9	16.3	30.1	14.2
n	2,273	3,146	5,400	1,198	1,087	13,103
Quartzite						
$\bar{x}$	3.7	94.0	47.8	7.0	115.5	48.5
s.d.	3.8	-	93.5	-	153.4	83.9
n	3	1	5	1	2	12
Fine-grained quartzite						
$\bar{x}$	1.0	1.1	17.0	1.0	25.0	13.2
s.d.	-	0.8	31.3	-	25.8	23.3
n	2	10	8	3	13	36
Basalt						
$\bar{x}$	34.8	104.7	190.8	76.8	68.9	130.1
s.d.	83.1	382.5	555.4	261.0	107.3	433.8
n	21	30	67	15	8	141
Granitic						
$\bar{x}$	-	273.0	39.5	-	-	117.3
s.d.	-	-	48.8	-	-	138.2
n	-	1	2	-	-	3
Obsidian						
$\bar{x}$	1.7	1.2	1.0	2.0	-	1.4
s.d.	1.9	0.8	-	2.5	-	1.4
n	7	13	7	6	-	33
Other lithics						
$\bar{x}$	2.5	4.8	32.8	4.5	9.5	17.0
s.d.	1.9	7.9	124.5	10.5	2.1	83.7
n	12	13	32	13	2	72
Indeterminate lithics						
$\bar{x}$	3.5	-	7.0	-	36.0	17.2
s.d.	3.5	-	-	-	14.1	18.7
n	2	-	1	-	2	5
Total						
$\bar{x}$	3.5	4.2	8.0	5.4	17.1	8.0
s.d.	12.1	33.0	65.9	33.1	32.0	48.8
n	2,320	3,213	5,522	1,236	1,114	13,405

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

Table 3-13. Average length (in mm) of conchoidally flaked material by zone, 45-DO-282[1].

Material	Zone 1	Zone 2	Zone 3	Zone 4	Zone 25	Total
No cortex						
Cryptocrystalline						
$\bar{x}$	10.4	10.8	11.0	11.2	18.8	11.9
s.d.	4.4	6.2	5.7	5.1	11.0	7.1
n	305	472	814	143	270	2,004
Other						
$\bar{x}$	10.7	10.7	12.7	11.2	23.1	13.6
s.d.	3.9	5.3	8.0	3.6	11.4	8.5
n	9	16	28	5	11	69
Total						
$\bar{x}$	10.4	10.8	11.0	11.2	18.9	12.0
s.d.	4.3	6.2	5.8	5.0	11.1	7.2
n	314	488	842	148	281	2,073
Partial cortex						
Cryptocrystalline						
$\bar{x}$	15.6	14.8	16.4	21.7	-	16.7
s.d.	7.6	9.2	9.6	15.2	-	10.2
n	21	17	56	15	-	109
Other						
$\bar{x}$	14.0	-	65.0	-	17.0	45.2
s.d.	-	-	74.8	-	-	59.3
n	1	-	3	-	1	5
Total						
$\bar{x}$	15.5	14.8	18.8	21.7	17.0	18.0
s.d.	7.4	9.2	19.9	15.2	-	16.1
n	22	17	59	15	1	114
Cortex						
Cryptocrystalline						
$\bar{x}$	-	15.0	-	-	-	15.0
s.d.	-	-	-	-	-	-
n	-	1	-	-	-	1
Total						
$\bar{x}$	-	15.0	-	-	-	15.0
s.d.	-	-	-	-	-	-
n	-	1	-	-	-	1

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

Table 3-14. Average width (in mm) of conchoidally flaked material by zone, 45-DC-282[1].

Material	Zone 1	Zone 2	Zone 3	Zone 4	Zone 25	Total
No cortex						
Cryptocrystalline						
$\bar{x}$	10.8	10.4	10.2	10.8	16.9	11.3
s.d.	5.2	5.4	5.1	5.0	8.4	6.2
n	274	433	754	133	265	1,859
Other						
$\bar{x}$	8.8	12.1	15.0	13.0	31.9	15.1
s.d.	3.5	8.1	10.8	6.4	18.6	11.7
n	9	16	25	4	7	61
Total						
$\bar{x}$	10.7	10.5	10.4	10.9	17.3	11.5
s.d.	5.2	5.4	5.4	5.1	9.1	6.5
n	283	449	779	137	272	1,920
Partial cortex						
Cryptocrystalline						
$\bar{x}$	15.1	15.2	15.0	18.6	-	15.5
s.d.	7.9	8.2	9.4	7.8	-	8.7
n	21	16	49	12	-	98
Other						
$\bar{x}$	16.0	-	19.3	-	25.0	19.8
s.d.	-	-	4.9	-	-	4.8
n	1	-	3	-	1	5
Total						
$\bar{x}$	15.1	15.2	15.2	18.6	25.0	15.7
s.d.	7.7	8.2	9.2	7.8	-	8.5
n	22	16	52	12	1	103
Cortex						
Cryptocrystalline						
$\bar{x}$	-	29.0	-	-	-	29.0
s.d.	-	-	-	-	-	-
n	-	1	-	-	-	1
Total						
$\bar{x}$	-	29.0	-	-	-	29.0
s.d.	-	-	-	-	-	-
n	-	1	-	-	-	1

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

Table 3-15. Average thickness (in 0.1 mm) of conchoidally flaked material by zone, 45-DO-282[1].

Material	Zone 11	Zone 12	Zone 13	Zone 14	Zone 25	Total
No Cortex						
Cryptocrystalline						
x̄	20.3	18.9	17.9	18.3	38.5	23.0
s.d.	13.5	12.6	11.7	10.4	25.2	18.0
n	416	662	1,142	203	783	3,206
Other						
x̄	17.3	24.0	30.8	28.0	55.6	32.8
s.d.	7.7	17.5	33.2	20.3	32.8	29.6
n	12	20	32	6	20	90
Total						
x̄	20.2	19.1	18.2	18.6	37.0	23.3
s.d.	13.4	12.8	12.9	10.8	25.5	18.5
n	428	682	1,174	209	803	3,296
Partial Cortex						
Cryptocrystalline						
x̄	32.9	27.6	35.9	42.0	-	34.5
s.d.	20.5	13.7	23.9	19.5	-	21.3
n	35	31	75	22	-	163
Other						
x̄	30.0	-	86.0	-	41.0	69.2
s.d.	-	-	81.4	-	-	68.3
n	1	-	4	-	1	6
Total						
x̄	32.9	27.6	38.4	42.0	41.0	35.7
s.d.	20.2	13.7	30.3	19.5	-	24.8
n	36	31	79	22	1	169
Cortex						
Cryptocrystalline						
x̄	-	30.0	-	-	-	30.0
s.d.	-	-	-	-	-	-
n	-	1	-	-	-	1
Total						
x̄	-	30.0	-	-	-	30.0
s.d.	-	-	-	-	-	-
n	-	1	-	-	-	1

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

INDUSTRIES

There are at least three recognizable stone tool industries at 45-DO-282. All three primarily utilized jasper and chalcedony transported to the site as nodules, cores or blanks. The pervasive industry is a generalized flake tool technology, represented by cores, flakes, finished tools and a vast amount of chipping detritus. Heat treatment appears to have been common. From the frequency of objects with complete or partial cortex, we can conclude that primary reduction also was commonly practiced, indicating that jasper and chalcedony often were transported to the site as weathered nodules. The number of tools present and the numerous fine finishing flakes show considerable investment of effort, and the importance of this generalized reductive technique in the manufacture of most tool forms at the site (Table 3-16). We cannot describe actual steps in this reduction sequence nor the fundamental characteristics necessary to delineate the nature of reduction (e.g., hard hammer versus soft hammer percussors, the angle of flake detachment, core and platform preparation, etc.). We can state, however, that the lamellar flake was the most common tool form produced; that flake dimensions are remarkably consistent over time, either representing consistent knapping techniques and an idealized product or uniform core sizes; and that, over the period of site occupation, this basic reductive technique apparently did not change.

A second tool industry is also in evidence--a Levallois-like method of blade production comparable to that described by Leonhardy and Muto (1972) and Muto (1976). Evidence consists solely of large blades and tools made on blades. No cores were recovered, nor does this analysis recognize the characteristics of manufacture detailed by Muto (1976). We may assume that some core preparation and attendant blade production went on at the site, but we cannot assess its prevalence, nor its relationship to the more generalized flake tool technology. The two large blades recovered appear to be what Muto (1976) has termed corner-removed blades. Evidence preserved in projectile point configuration suggests that these and so-called "A-blades" were commonly used in tool manufacture.

The third tool industry is better described, if only because its products are numerous. This is a microblade industry, which entails the detachment of small, parallel-sided blades from carefully prepared, tiny wedge-shaped cores. Represented by 13 cryptocrystalline cores and 173 microblades, its appears to have been a common form of stone tool production throughout the span of occupation at 45-DO-282. Plate 3-1 shows microblade cores recovered from 45-DO-282; Plate 3-2 shows the microblades themselves.

Morphological attributes and descriptive terminology for microblades and cores are illustrated in Figure 3-1. The production of microblades requires quite different core preparation than that involved in the production of conchoidal flakes. Striking platforms must be broad and flat, with angular margins that approach a 90 degree or sub-90 degree angle to the striking platform. This results in a plane of detachment for blades that carries from the point of impact well down toward the ventral midline of the core. Blades may be detached by percussion or pressure flaking. The focused force will remove a long narrow flake that feathers out as the force carries across the core's lateral surface or terminates abruptly at some surface irregularity. This reductive process is more controlled and intricate than that required for the simple detachment of lamellar flakes. However, the two techniques may not be exclusive, since cores or chunks that are products of the one process can be readily adapted for use in the other.

Table 3-17 describes microblades and microblades cores. Table 3-18 lists measurements of microblades. Table 3-19 describes microblade attributes by analytic zone. Most microblades have prismatic cross sections (two arrises on the dorsal surface) although many have a triangular cross section (a single arris). Only 41 specimens do not terminate in a snap fracture. A few have been snapped across both the dorsal and proximal ends. Except for these few

Table 3-16. Material by object type[1], functional type, dorsal topography, and zone, 45-DO-282.

Material	Object type	Functional type	Dorsal topography	Zone 1	Zone 2	Zone 3	Zone 4	Zone 25	Total
Cryptocrystalline	Conchoidal flake	Projectile point tip	None	-	1	-	-	-	1
		Biface	None	1	1	3	1	1	7
		Burin	None	1	2	1	2	-	6
		Drill	None	-	1	2	1	3	7
			Indeterminate	-	1	-	-	-	1
		Graver	None	-	1	2	-	-	3
		Scraper	None	1	-	2	1	4	8
		Burin spall	None	-	1	2	-	-	3
		Core	None	-	1	1	-	-	2
			Partial cortex	-	-	1	-	-	1
		Resharpening flake	None	7	1	3	2	5	18
		Fragment from a blade core	None	1	-	-	-	-	1
		Bifacially retouched flake	None	6	2	8	2	2	20
			Partial cortex	-	1	-	-	-	1
		Unifacially retouched flake	None	6	9	12	3	8	38
			Partial cortex	-	-	1	-	-	1
			Indeterminate	-	-	-	1	-	1
		Utilization only	None	64	79	128	39	144	464
			Partial cortex	8	2	6	4	-	20
			Indeterminate	1	1	1	-	-	3
		Indeterminate	None	1	-	-	-	-	1
		None	None	574	906	1,669	286	916	4351
			Partial cortex	41	42	116	26	-	225
			Complete cortex	-	1	1	-	-	2
			Indeterminate	1,533	2,029	3,439	830	8	7,900
	Microblade	Microblade	None	29	30	73	24	6	162
			Partial cortex	-	1	-	-	-	1
			Complete cortex	-	-	-	-	1	1
		None	Indeterminate	10	15	35	10	-	70

Table 3-16. Cont'd.

Material	Object type	Functional type	Dorsal topography	Zone					Total
				1	2	3	4	25	
Cryptocrystalline	Chunk	Biface	None	2	1	3	–	2	8
			Indeterminate	–	1	–	–	–	1
		Scraper	None	–	1	–	–	–	1
		Core	None	1	–	–	–	1	2
			Partial cortex	–	–	1	–	1	2
		Bifacially retouched flake	None	1	3	–	1	1	6
		Unifacially retouched flake	None	3	2	1	–	4	10
		Utilization only	None	1	–	5	1	4	11
			Indeterminate	–	–	–	–	2	2
		None	None	23	38	48	13	70	160
			Partial cortex	5	2	10	–	1	18
			Indeterminate	44	63	69	24	5	225
	Core	Biface	None	–	–	1	–	3	4
			Partial cortex	–	–	–	–	1	1
		Drill	None	–	–	–	1	–	1
		Core	None	4	1	1	–	1	7
			Partial cortex	–	1	2	1	–	4
			Indeterminate	–	–	–	1	–	1
		Unifacially retouched flake	None	–	–	1	–	1	2
		Utilization only	None	1	–	–	–	–	1
		None	Indeterminate	1	2	2	–	–	5
	Formed object	Projectile point	None	–	1	1	1	6	9
		Projectile point base	None	–	1	1	1	2	5
		Projectile point tip	None	2	3	2	1	7	15
		Biface	None	4	12	14	4	34	68
		Chopper	Partial cortex	–	–	1	–	–	1
		Scraper	None	2	3	5	–	10	20
		Core	None	–	–	1	–	–	1
		Resharpening flake	None	1	1	–	–	–	2
		Bifacially retouched flake	None	4	8	8	1	6	27
			Partial cortex	1	–	–	–	–	1
			Indeterminate	–	–	–	–	1	1
		Unifacially retouched flake	None	–	2	–	1	8	11
		Utilization only	None	1	–	–	1	1	3
		None	None	–	–	–	1	–	1
			Indeterminate	–	1	–	–	–	1

Table 3-16. Cont'd.

Material	Object type	Functional type	Dorsal topography	Zone 1	Zone 2	Zone 3	Zone 4	Zone 25	Total
Cryptocrystalline	Weathered	Indeterminate	Indeterminate	-	-	1	-	1	2
		None	Indeterminate	2	-	-	-	-	2
	Unmodified	Hammerstone	Partial cortex	-	-	1	-	-	1
		Microblade	None	2	-	2	-	1	5
	Indeterminate	Resharpening flake	None	1	-	-	-	-	1
		Utilization only	None	-	-	-	-	6	6
Quartzite	Conchoidal flake	Tabular knife	None	-	-	-	-	1	1
		None	None	1	-	4	-	1	6
			Indeterminate	2	1	1	1	-	5
	Tabular	Tabular knife	None	-	-	-	-	3	3
			Partial cortex	-	-	-	-	1	1
		None	None	-	-	-	-	1	1
			Partial cortex	-	-	-	-	9	9
	Chunk		Partial cortex	-	-	-	-	1	1
	Formed object	Chopper	Partial cortex	-	-	-	-	3	3
	Weathered	None	Indeterminate	-	-	-	-	1	1
	Unmodified	Chopper	Partial cortex	-	-	-	-	1	1
		Hammerstone	Complete cortex	-	-	1	-	-	1
Fine-grained quartzite	Conchoidal flake	Unifacially retouched flake	None	-	-	-	-	2	2
		Utilization only	None	-	-	-	-	1	1
		None	None	-	5	1	1	9	16
			Partial cortex	-	-	-	-	1	1
			Indeterminate	2	5	7	2	-	16
	Chunk		None	-	-	-	-	2	2
			Partial cortex	-	-	-	-	1	1
	Indeterminate	Chopper	Partial cortex	-	-	-	-	1	1
Basalt	Conchoidal flake		Partial cortex	-	-	1	-	-	1
		Unifacially retouched flake	None	1	-	-	-	-	1
			Partial cortex	-	-	1	-	-	1
		Utilization only	None	-	1	-	-	-	1
		None	None	5	14	22	6	8	55
			Partial cortex	2	1	5	-	-	8
			Indeterminate	13	14	38	9	-	74
	Microblade	Microblade	None	1	-	-	-	-	1
		None	Indeterminate	-	-	-	-	-	
	Chunk	Core	None	-	1	-	-	-	1
		None	None	-	-	1	-	-	1
			Partial cortex	-	-	1	-	-	1
	Core		Partial cortex	-	-	1	-	-	1

Table 3-16. Cont'd.

Material	Object type	Functional type	Dorsal topography	Zone 1	Zone 2	Zone 3	Zone 4	Zone 25	Total
Basalt	Formed object	Biface	None	-	1	-	-	-	1
			Partial cortex	-	-	1	-	-	1
		Chopper	Partial cortex	-	-	2	-	10	12
			Indeterminate	-	-	1	-	1	2
		Hammerstone	Indeterminate	-	-	1	-	-	1
		Resharpening flake	None	1	-	-	-	-	1
		bifacially retouched flake	None	-	1	-	-	-	1
	Weathered	None	Indeterminate	-	1	-	-	-	1
	Unmodified	Chopper	Partial cortex	-	-	-	-	3	3
		Pestle	Complete cortex	-	1	-	-	-	1
		Hammerstone	Part cortex	-	-	-	-	1	1
			Complete cortex	-	-	1	1	2	4
		Utilization only	Indeterminate	-	-	2	-	-	2
	Indeterminate	Chopper	Partial cortex	-	-	-	-	4	4
		Utilization only	Partial cortex	-	1	-	-	-	1
		None	Indeterminate	-	-	1	-	-	1
Granitic	Conchoidal flake		None	-	-	1	-	-	1
			Partial cortex	-	-	1	-	-	1
			Indeterminate	-	1	-	-	-	1
	Chunk		Partial cortex	-	-	-	-	1	1
	Formed object	Chopper	Partial cortex	-	-	-	-	1	1
	Unmodified	Pestle	Complete cortex	-	1	-	-	-	1
		Hammerstone	Partial cortex	-	-	-	-	2	2
			Complete cortex	-	-	3	1	1	5
	Indeterminate		Partial cortex	-	-	-	-	1	1
		Indeterminate	Partial cortex	-	-	-	-	1	1
Obsidian	Conchoidal flake	Utilization only	None	-	-	-	1	-	1
		None	None	-	3	4	1	-	8
			Indeterminate	7	10	3	4	-	24
	Microblade	Microblade	None	-	1	-	-	-	1
	Chunk	None	None	-	-	-	-	1	1
Other lithics	Conchoidal flake	Utilization only	None	-	-	1	-	-	1
		None	None	5	5	13	3	2	28
			Indeterminate	7	8	18	10	-	43
	Chunk		Partial cortex	-	-	-	-	1	1
			Indeterminate	13	47	50	63	-	173
	Core	Core	Partial cortex	-	-	-	-	1	1
	Formed object	Projectile point	Indeterminate	-	-	-	-	2	2
		Biface	None	1	-	-	-	-	1
		Chopper	Partial cortex	-	-	-	-	1	1

Table 3-16. Cont'd.

Material	Object type	Functional type	Dorsal topography	Zone					Total
				1	2	3	4	25	
Indeterminate lithics	Conchoidal flake	Indeterminate	Indeterminate	1	-	-	-	-	1
		None	None	1	-	1	-	2	4
	Chunk		Indeterminate	-	1	1	-	-	2
	Indeterminate	Utilization only	Indeterminate	-	1	-	-	-	1
		None	Indeterminate	1	3	-	2	6	12
Total				2,482	3,466	5,896	1,391	1,368	14,603

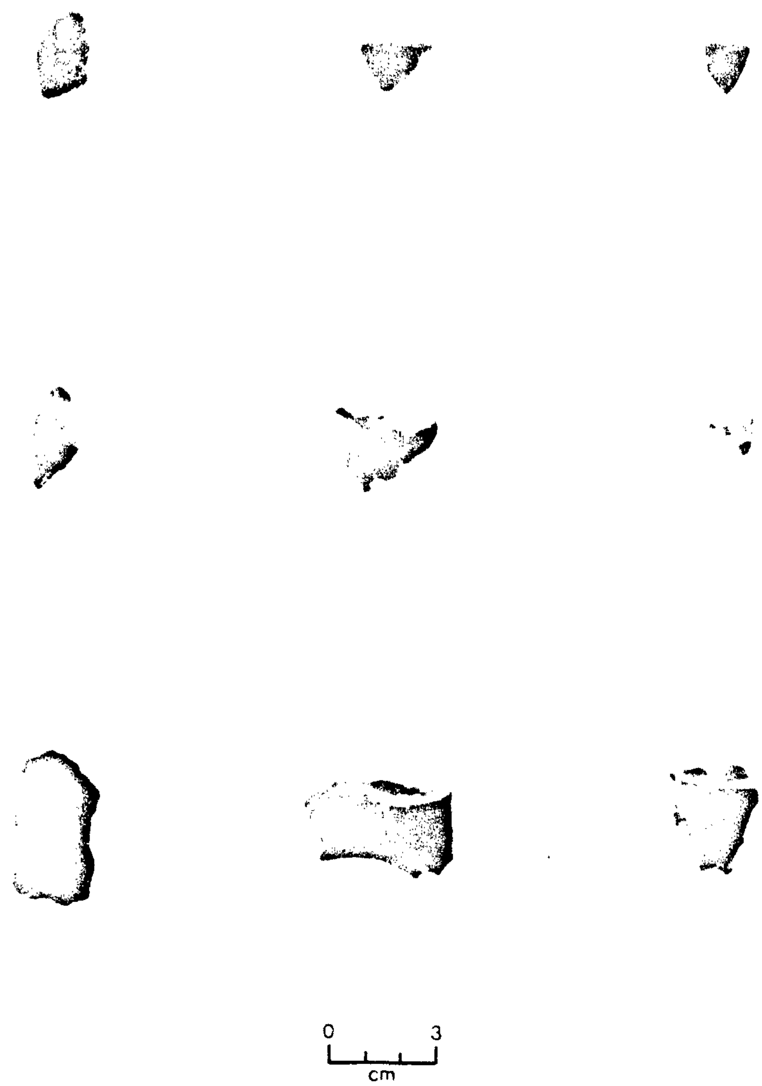
[1]<1/4 in flakes and non-lithics deleted.

Top Side Side

a.
416
Unifacially
retouched flake
83N241E/80
1
Chalcedony

b.
1152
Core
Surface
-
Chalcedony

c.
-
Core
Beach
25
Jasper



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

Plate 3-1. Microblade cores, 45-DO-282.

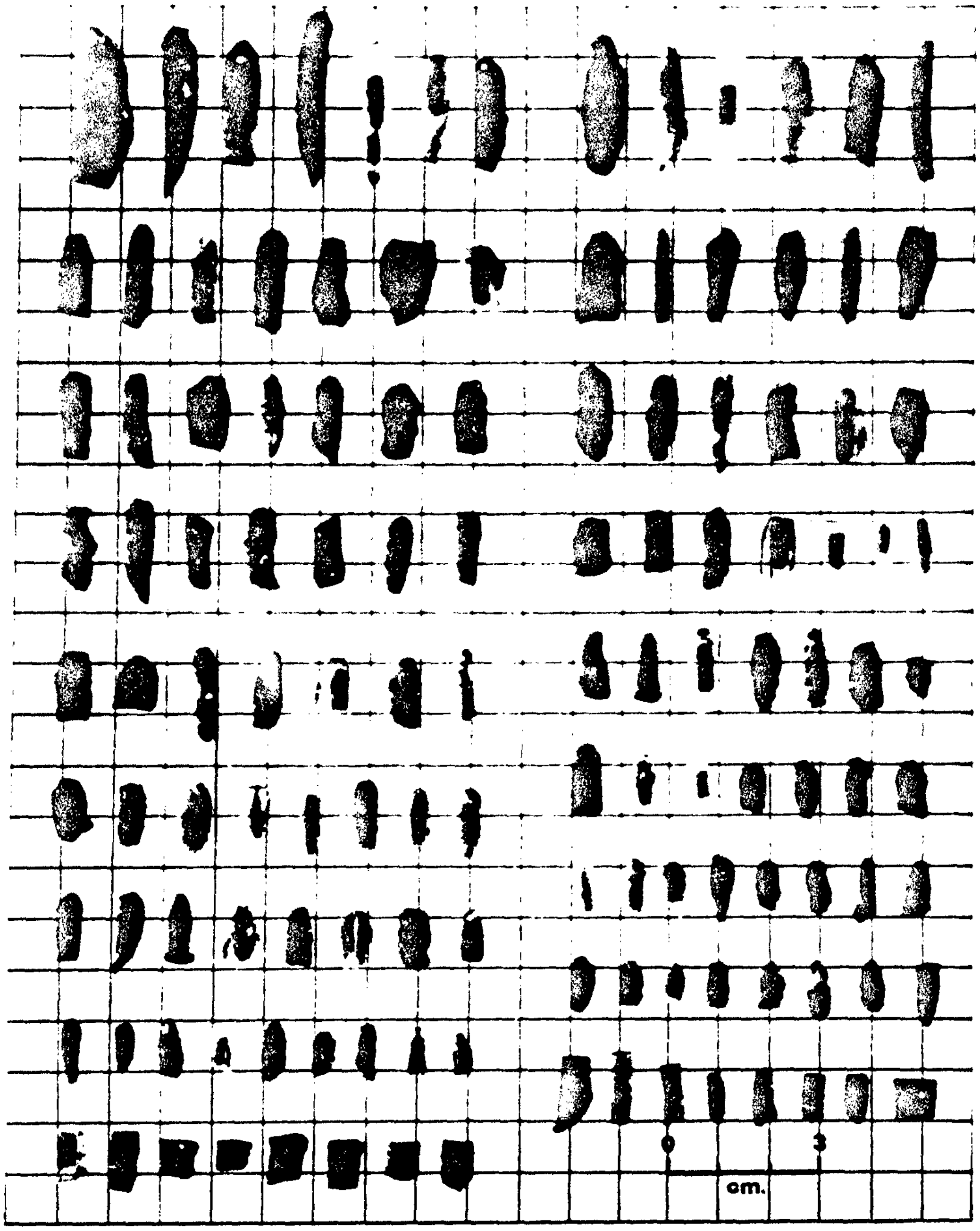


Plate 3-2. Microblades, 45-DO-282. Microblades with triangular cross sections on left, microblades with non-triangular cross sections on right.

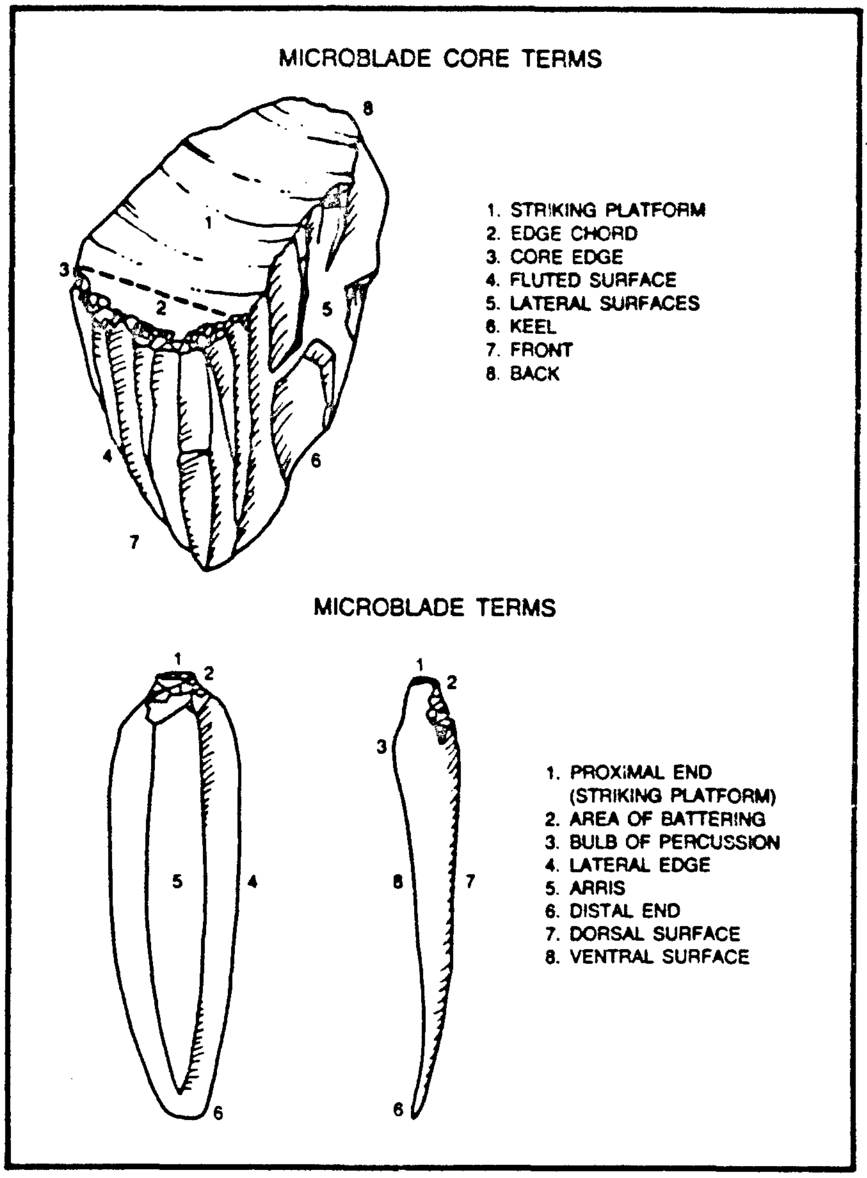


Figure 3-1. Microblade core and microblade terms (from Sanger 1986:95, Figure 2).

Table 3-17. Attributes of microblade cores, 45-DO-282.

Master number	Zone	Material	Platform length (mm)	Platform width (mm)	Core height (mm)	Core edge angle (degrees)	Number of flutes	Mean width of flutes (mm)	Mean length of flutes (mm)	Number of striking directions
11/1160	25	Jasper	42	22	25	97	8	3.7	12.2	2
11/1152	25	Chalcedony	28	15	17	63	7	5.3	12.6	1
11/314	25	Chalcedony	22	12	15	79	8	6.2	12.4	1
11/115	25	Jasper	26	13	28	67,61	6	7.0	17.0	1
11/651	1	Jasper	10	8	17	79	5	3.2	14.5	1
11/1055	2	Chalcedony	17	9	10	54	5	3.7	8.7	1
11/900	2	Chaldecony	27	20	30	114,64	12	6.3	17.7	3
11/851	3	Chalcedony	20	11	9	73	12	3.6	9.0	1
11/416	3	Chalcedony	29	13	24	62	4	8.6	23.0	1
11/906	3	Chaldedony	27	22	24	63,73,80	12	6.6	15.0	3
11/791	3	Chalcedony	20	17	23	76	7	5.5	13.0	2
11/964	3	Chalcedony	17	10	24	77	5	7.6	22.5	1
1/475	3	Chalcedony	30	26	28	76	10	7.5	14.5	1
Range			10-42	6-26	9-30	54-114	4-12	1-12	5-28	1-3
Mean			24.1	15.1	21.0	74	7.8	5.4	13.7	-
Standard deviation			7.9	5.9	6.7	14.4	2.9	2.3	4.7	-

specimens that exhibit both proximal and distal fractures, it is virtually impossible to classify breakage as intentional, or as an accidental product of manufacture. Many of the core flutes terminate abruptly in hinged fractures, and one may conclude that a large number of microblades with either end snapped off are simply products of manufacture.

Table 3-18. Microblade measurements, 45-DO-282.

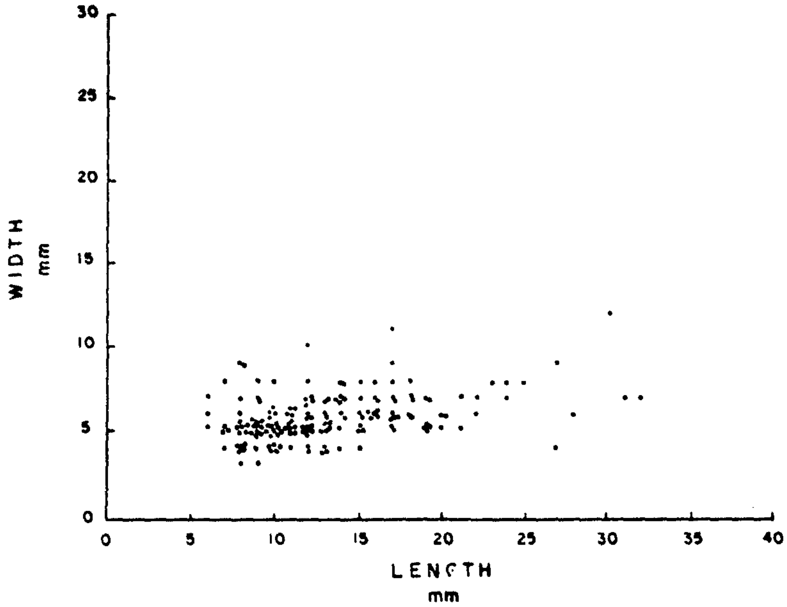
Measurements	All microblades N=173			Complete microblades N=41		
	Length (mm)	Width (mm)	Thickness (mm)	Length (mm)	Width (mm)	Thickness (mm)
Range	6-34	3-12	0.5-2.0	9-34	4-9	0.5-2.0
Mean	13.2	5.8	1.1	16.2	6.1	1.1
S.D.	5.1	1.5	0.4	6.2	1.2	0.4

Table 3-19. Microblade attributes by zone, 45-DO-282.

Attributes	Zone					Total
	1	2	3	4	25	
Prismatic cross section	17	22	41	13	7	100
Distal end snap	8	10	22	7	3	50
Proximal end snap	2	3	5	1	-	11
Distal-proximal end snap	3	4	5	2	3	17
Complete	4	5	9	3	1	22
Triangular cross section	13	12	35	9	4	73
Distal end snap	6	4	17	4	2	33
Proximal end snap	3	2	3	2	-	10
Distal-proximal end snap	1	2	7	1	-	11
Complete	3	4	8	2	2	19
Total	30	34	76	22	11	173

As shown in Table 3-17, the sizes and platform edge angles of cores are very consistent, regardless of associated analytic zone. Measurements of flutes or blade scars are also fairly consistent. This consistency is further demonstrated if one compares Tables 3-18 and 3-19. Mean lengths and widths of blades and blade scars are very close, indicating a fairly well controlled industry. One may infer with some confidence that knappers were attempting to produce blades of uniform proportions.

Figure 3-2 depicts the consistency observed in microblade dimensions. The upper graph shows the relationship of width and length; width shows a very narrow distribution (4-6 mm), regardless of length. The bottom graph depicts the lengths of specimens as a frequency distribution. Length, it will be noted, shows much greater variability than width. The control of width would seem to have been a cultural variable, related to selection of punch or percussor size and sense of ideal microblade size. Length, on the other hand, seemed to depend on the size and quality of the nodules being used as cores.



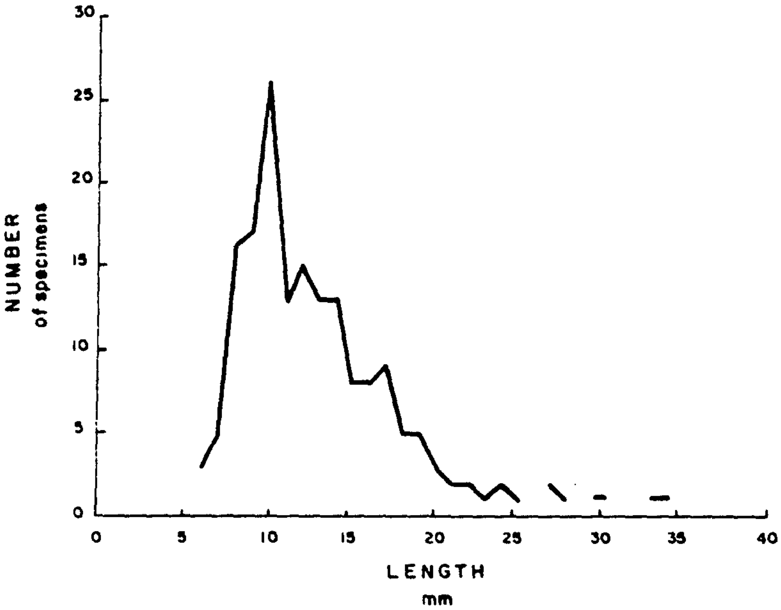


Figure 3-2. Length-width relationship of microblades, 45-DO-282.

Dimensions recorded for both microblade cores and microblades in this collection are very similar to those recorded by Sanger (1968, 1970) and Munsell (1968) for microblades on the Columbia Plateau and by Taylor (1962) for microblades in the American Arctic. Blade widths average 5.8 mm; lengths average 13.2 mm. This consistency in blade size across the Northwest and into the Arctic has led Sanger (1968, 1970) to postulate a "Plateau Microblade Tradition" and to speculate that there are direct historical ties to microblade traditions to the north.

While this microblade industry occurred in the context of a more generalized flake tool industry which was also associated with a Levallois-like blade tool industry, and all three industries were based on the reduction of jasper and chalcedony, it required more careful, controlled techniques of tool production. All three industries at 45-DO-282 are distinct, but, as shown by their association here and elsewhere on the Columbia Plateau, they were complementary facets of the same general stone tool technology.

TEMPORAL AND SPATIAL DISTRIBUTION

Stone tool manufacture, primarily as part of a generalized flake tool industry utilizing imported cryptocrystalline stones, was remarkably consistent over the span of occupation at 45-DO-282.

Together, the three stone tool industries mark the 45-DO-282 artifact assemblage as Cascade-like, probably dating to the latter part of the defined Cascade Phase (cf., Leonhardy and Rice 1970; Bense 1972). The presence of Levallois-like blades, with a generalized flake tool industry, and a microblade industry are characteristic of these early assemblages (Leonhardy and Muto 1972; Muto 1976; Sanger 1968, 1970; Munsell 1968). The closest correlate is probably the assemblage recovered from the Ryegrass Coulee Site (Munsell 1968), where radiocarbon assay and diagnostic artifact types supply a probable time frame of ca. 6500-3500 B.P. or the late Cascade Phase. To the north, the earliest dated site with microblades is the Drynotch Slide (ca. 7500 B.P.) (Sanger 1968). Microblades and microblade cores recovered from 45-DO-282 appear representative of the defined "Plateau Microblade Tradition."

The technological analysis presented in this report is too cursory to describe adequately the full range of variation in these separate manufacturing techniques, or to delineate fully the relationship between the three. We can safely state that they are present, but we cannot adequately describe them nor place them in proper regional perspective, without a much more detailed, careful analysis of the materials and the varied hallmarks of reductive strategy present in the collection.

FUNCTIONAL ANALYSIS

Functional analysis examines the physical characteristics of artifacts in order to identify patterns of wear diagnostic of specific tool uses. Past research has pointed out the possibility of interpreting tool use by examining edge damage and general attrition of working surfaces (e.g., Hayden 1979; Stafford and Stafford 1979; Keeley 1978, 1974; Odell 1977; Crabtree 1973;

Wilmsen 1968, 1970; Frison 1968; Semenov 1964). Wear patterns have been shown to reveal both the manner of tool use and the nature of the materials worked.

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

The surfaces of many of the lithics from 45-DO-282 had a thin deposit of an unidentified substance, which tended to be concentrated on the edges. Attempts were made to remove this substance with a variety of acids, bases, other solvents, and ultrasound, but to no avail. The deposit may have obscured light chipping wear in approximately 10% of the cases.

Eight classificatory dimensions are used to describe functional attributes: UTILIZATION-MODIFICATION, CONDITION OF WEAR, WEAR/MANUFACTURE RELATIONSHIP, KIND OF WEAR, LOCATION OF WEAR, SHAPE OF WORN AREA, ORIENTATION OF WEAR, and EDGE ANGLE. The first dimensions describes objects, the next six describe tools on objects, and the last describes variation within object/tool types through measurement of the working edges. Table 3-20 outlines these dimensions and constituent attributes.

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

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

FUNCTIONAL OBJECT TYPES

A total of 1,110 stone tools was recovered from site 45-DO-282. These include a broad range of functional forms: light piercing and cutting tools, cruder, thicker cutting and scraping tools, and heavy chopping and pounding implements. Chipping was the only type of manufacture recorded (Table 3-21). Simple utilized flakes are by far the most frequent tool form (48%, N=539). Other tools showing wear only include burins, choppers, drills, gravers, pestles, scrapers, hammers, microblades and cores (4%, N=49). Tools with manufacture only comprise 14% of the assemblage (N=156); they include projectile points, bifaces, choppers, scrapers, resharpened flakes, bifacially retouched flakes and unifacially retouched flakes. Tools with wear and manufacture constitute another 16% (N=174); they include projectile points, bifaces, choppers, drills, gravers, scrapers, tabular knives, hammers, cores, resharpened flakes, bifacially retouched flakes and unifacially retouched

Table 3-20. Functional dimensions. 45-DO-282.

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 3-21. Utilization/modification and type of manufacture of formed lithic objects by zone, 45-DO-282.

Object type	Utilization/ modification[1]	Type of manufacture[2]	Zone 1	Zone 2	Zone 3	Zone 4	Zone 25
Projectile point	3	2	-	1	-	1	4
	4	2	-	-	1	-	4
Projectile point base	3	2	-	1	1	1	2
Projectile point tip	3	2	1	2	2	1	3
	4	2	1	2	-	-	4
Biface	3	2	4	10	15	4	25
	4	2	4	6	7	1	16
Burin	2	1	1	2	1	2	-
Chopper	2	1	-	-	1	-	-
	3	2	-	-	4	-	15
	4	2	-	-	-	-	10
Drill	2	1	-	1	2	-	2
	4	2	-	1	-	2	1
Graver	2	1	-	1	1	-	-
	4	2	-	-	1	-	-
Pestle	2	1	-	2	-	-	-
Scraper	2	1	-	-	2	1	2
	3	2	-	-	1	-	1
	4	2	3	4	4	-	11
Tabular knife	4	2	-	-	-	-	5
Hammerstone	2	1	-	-	7	2	5
	4	2	-	-	-	-	2
Burin Spall	1	1	-	1	2	-	-
Microblade	1	1	30	31	73	24	6
	2	1	2	1	2	-	2
Core	1	1	4	3	7	2	3
	2	1	-	1	-	-	1
	4	2	1	-	-	-	-
Resharpening flake	2	1	4	-	-	-	1
	3	2	3	-	2	1	1
	4	2	3	2	1	1	3
Flakes off blade core	1	1	1	-	-	-	-
Bifacially retouched flake	3	2	5	9	8	4	4
	4	2	7	6	8	-	6
Unifacially retouched flake	3	2	4	1	6	1	8
	4	2	6	12	10	4	13
Utilized flake	2	1	104	85	145	46	159
	4	2	-	-	-	-	1
Indeterminate	5	9	2	-	1	-	2
Total			176	152	272	85	217

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

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

flakes. Together, these tool forms and associated attributes of wear and manufacture show a broad range of functions and an emphasis on tool production and tool maintenance at the site. Plates 3-3 through 3-5 illustrate flake cores and bifaces; projectile points and drills, burins, blades, and gravers. Plate 3-6 illustrates large cobble tools, and two pestles are shown in Plate 3-7.

WEAR PATTERNS

Many of the 1,110 stone objects exhibit more than one instance of wear or more than one tool (25%, N=276) (Table 3-22). The highest wear area-object ratios were observed on scrapers, gravers, drills and hammerstones. Ratios for tabular knives, unifacially retouched flakes, pestles, and utilized flakes are only slightly lower. Cores, choppers, burins, resharpened flakes, and microblades have the lowest ratios. Object forms with the largest range of defined wear areas include scrapers, unifacially retouched flakes, and simple utilized flakes, with from 0-7 isolable tools. Those forms with the narrowest range are cores, choppers, burins, tabular knives, and resharpened flakes, with 0-2 wear areas present. We conclude that although simple utilized flakes were the most frequent form, and were intensively used, other object types such as scrapers, gravers, drills, and hammerstones saw more consistent use and reuse. We may also conclude that any given object may not be accurately categorized under a single functional label, as it may have multiple uses and variable potential functions.

Most tools in this collection are some combination of feathered and hinged chipping wear on a unifacial edge (79%, N=920) (Table 3-23). Other wear is predominantly smoothing on edges only and unifacial and bifacial edges (6%, N=65) or crushing of a surface (2%, N=28). Any sort of wear on points is relatively uncommon, as is crushing of unifacial or bifacial edges. In general, it seems that heavy chopping or pounding activities are represented, but do not account for a large proportion of tool types recovered, These indicate intensive cutting and scraping activities in soft, pliable materials like hides, meat, or, perhaps, plant or woody materials.

Figure 3-3 illustrates the relationship of wear types to defined functional object types. Most obvious is the rough correspondence between functional types with implicitly assumed uses and wear types indicative of those kinds of uses. Choppers and hammerstones are characterized by heavy crushing wear on edges and surfaces, indicative of work on hard materials, either bone or stone. Smaller flaked tool forms are characterized by feathered and hinged chipping wear on unifacial and bifacial edges and points. If we make finer distinctions, however, we discover discrepancies between implied and actual tool uses. For instance, projectile points show smoothing, feathered chipping and crushing wear on edges, reflecting use as general purpose cutting and scraping tools. Scrapers show predominantly hinged chipping wear on unifacial and bifacial edges, indicative of heavy cutting or scraping uses. If these tools had, in fact, been commonly used to scrape hides or other soft materials, they would have exhibited smoothing or light, feathered chipping wear. Drills and gravers, tool forms believed to have been

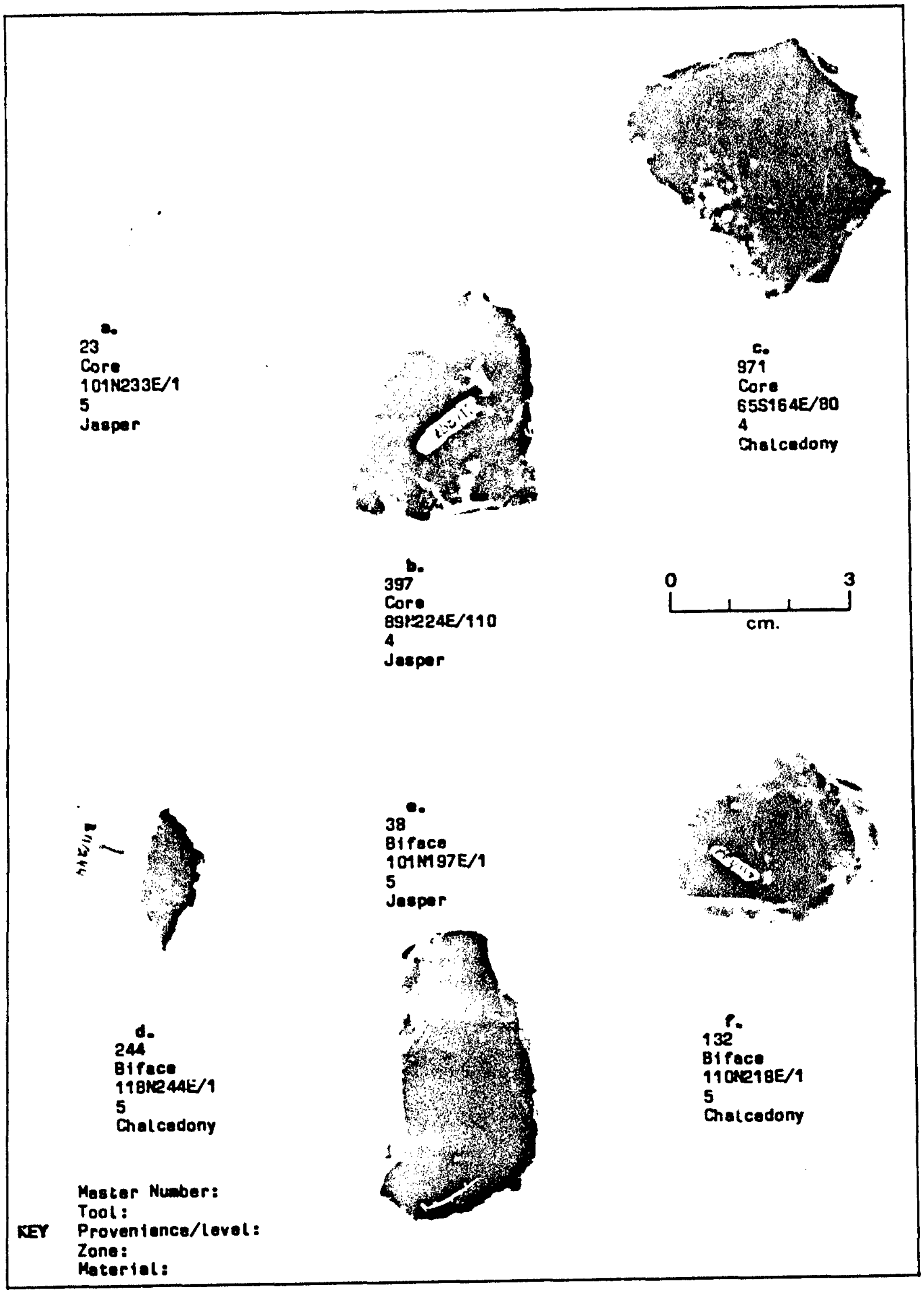


Plate 3-3. Flake cores and bifaces, 45-DO-282.

KEY

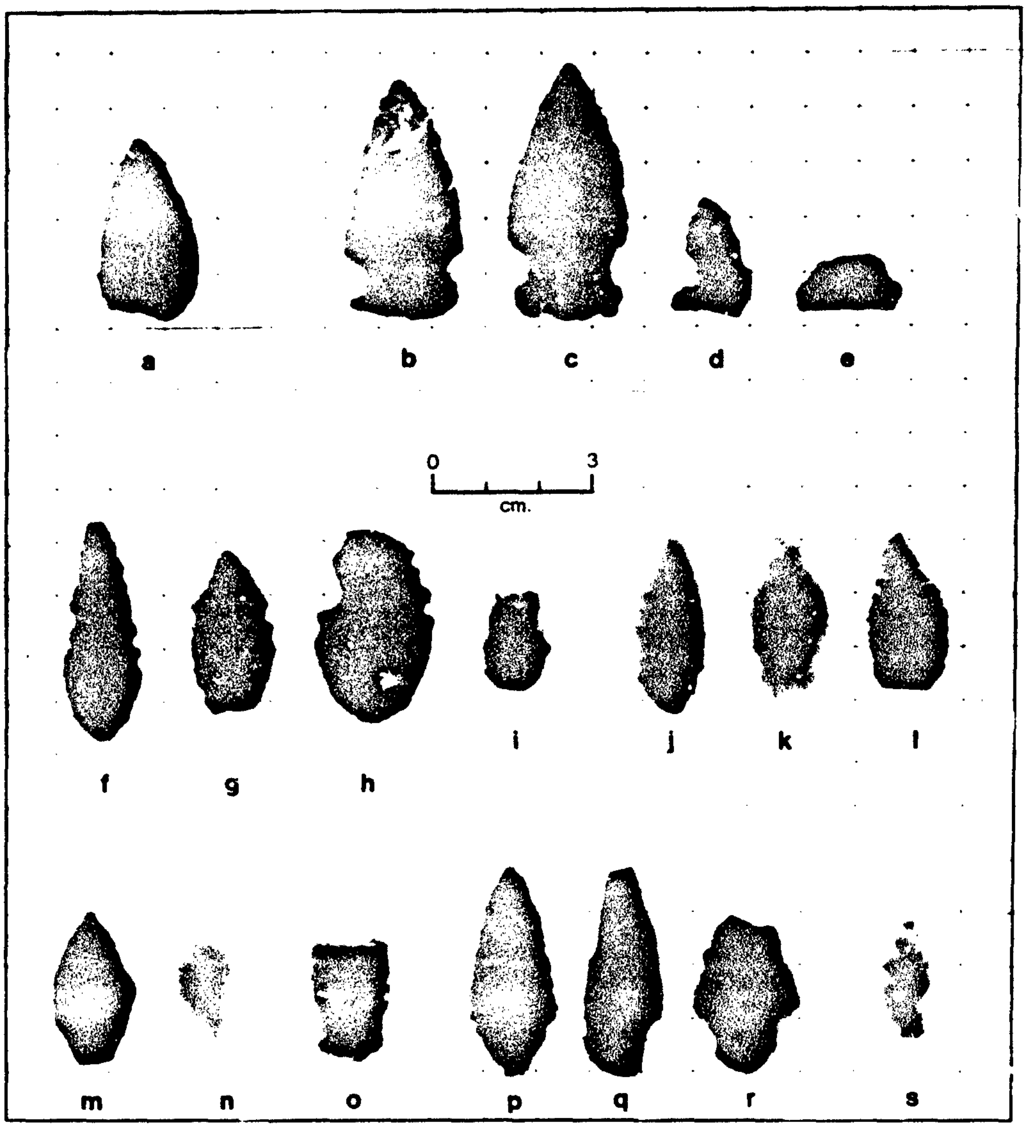
Master number:
Morphological type:
Historical type:
Provenience/level:
Zone:
Material:

a.	b.	c.	d.	e.
57	471	89	301	1048
Type 2	Type 3	Type 3	Type 3	Type 3
Unassigned	Cold Springs	Cold Springs	Cold Springs	Cold Springs
103N231E/1	83N200E/110	105N233E/1	122N230E/1	75S174E/110
5	4	5	5	4
Jasper	Opal	Argillite	Jasper	Jasper

f.	g.	h.	i.	j.	k.	l.
106	850	884	1121	216	258	522
Type 5	Type 5	Type 5	Type 5	Type 5	Type 5	Type 5
Wndust A	Cascade A	Cascade A	Cascade A	Cascade A	Cascade A	Mahkin Shouldered
105N86E/1	84S34E/Fe13/110	84S35E/Fe13/110	54S25E/Fe14/100	115N245E/0-40	117N232E/1	5N5W/70
5	3	3	3	-	5	2
Jasper	Jasper	Jasper	Chalcedony	Jasper	Chalcedony	Jasper

m.	n.	o.	p.	q.	r.	s.
239	116	277	-	208	1154	305
Type 6	Type 6	Type 6	Type 7	Type 7	Type 7	Type 10
Mahkin Shouldered	Mahkin Shouldered	Mahkin Shouldered	-	Nespelem Bar	Nespelem Bar	Columbia 8
115N216E/1	108N243E/1	119N239E/1	Surface	116N245E/0-40	Surface	122N197E/10
5	5	5	5	-	-	5
Jasper	Jasper	Jasper	-	Jasper	Jasper	Chalcedony

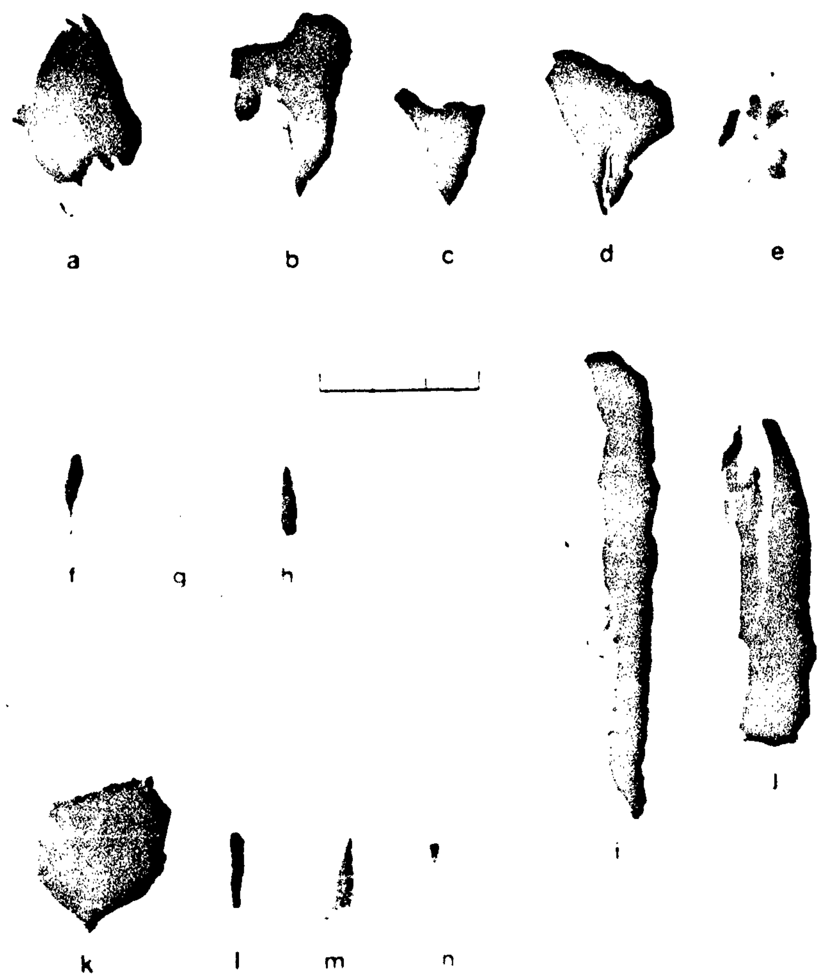
Plate 3-4. Projectile points, 45-DO-282.

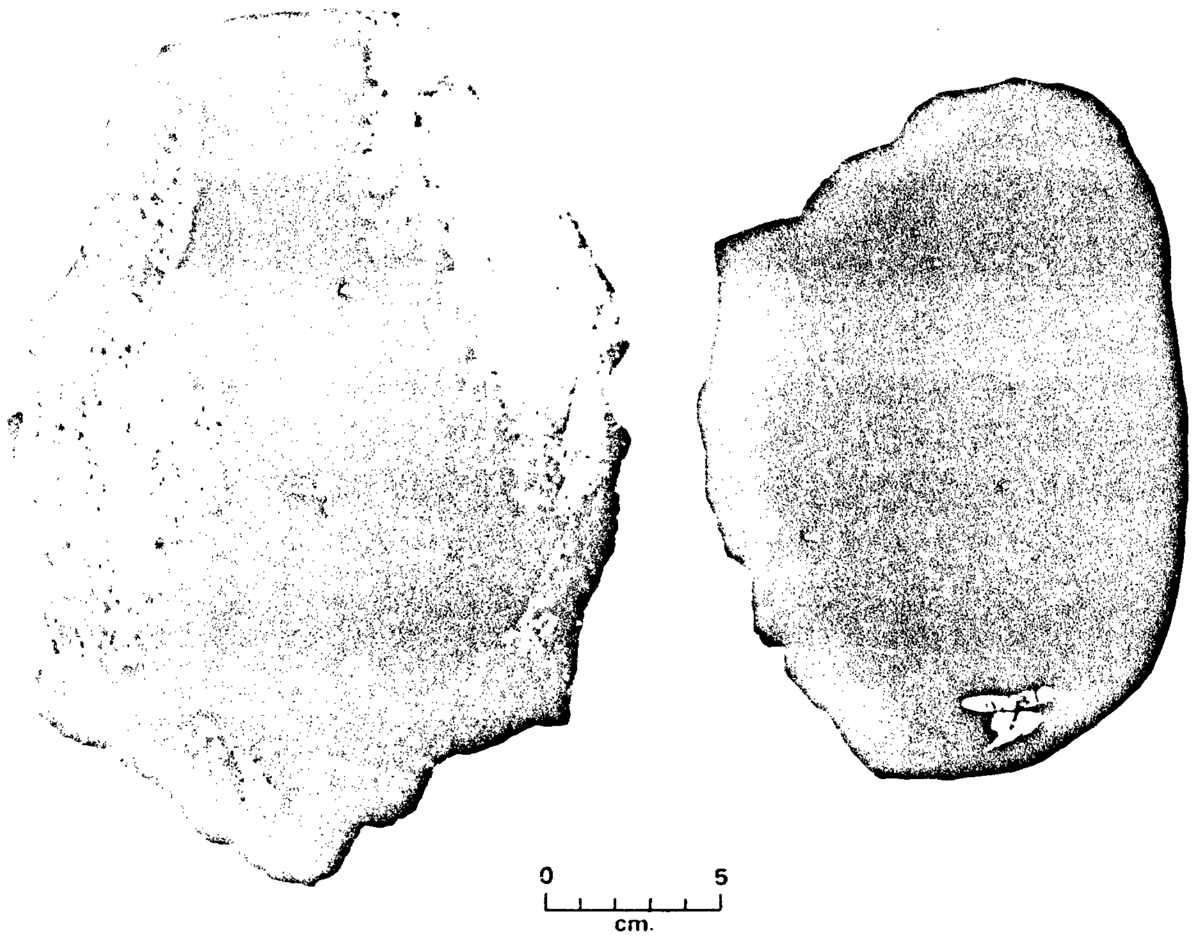


KEY
Master number:
Tool:
Provenience:
Zone:
Material:

	Master number	Tool	Provenience	Zone	Material
a.	953	Drill	64S165E/20	2	Chalcedony
b.	805	Drill	54S5E/70	3	Chalcedony
c.	49	Utilized flake	103N232E/1	5	Jasper
d.	103	Drill	106N213E/1	5	Jasper
e.	25	Drill	102N230E/1	5	Jasper
f.	477	Burin	74N221E/0	1	Chalcedony
g.	954	Burin	64S165E/20	2	Chalcedony
h.	431	Burin	83N231E/30	2	Chalcedony
i.	1141	Blade	108N200E/1	5	Jasper
j.	DL 38	Blade	13N46W/Beach collection	-	Jasper
k.	926	Graver	64S14E/100	3	Chalcedony
l.	744	Burin	45S6W/Fe7/90	3	Jasper
m.	708	Graver	34S15W/90	3	Jasper
n.	219	Chunk	115N245E/0-40	-	Chalcedony

Plate 3-5. Drills, burins, blades, and gravers, 45-DO-282.


a
b
c
d
e
f
g
h
i
j
k
l
m
n

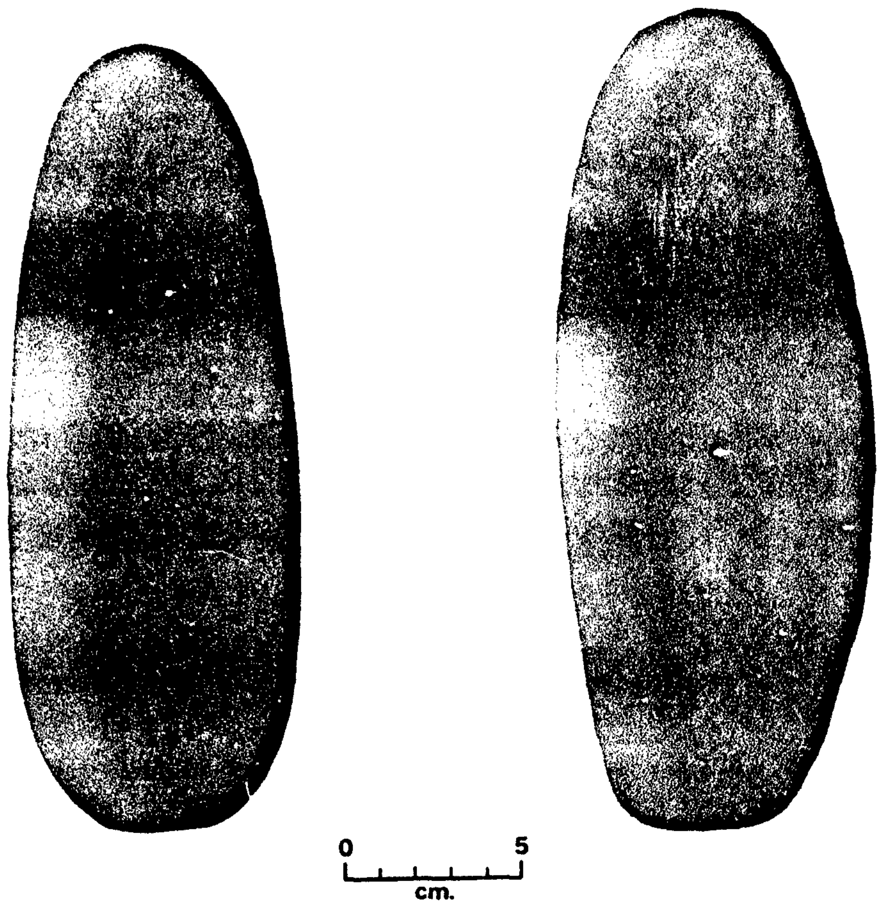


a.
145
Chopper
109N199E/1
5
Basalt

b.
81
Core
105N241E/1
5
Argillite

KEY
Master number:
Tool:
Provenience/level:
Zone:
Material:

Plate 3-6. Large cobble tools, 45-DO-282.



a.
654
Pestle
25S5W/Fe6/40
2
Basalt

b.
653
Pestle
25S5W/Fe6/40
2
Granite

KEY
Master number:
Tool:
Provenience/level:
Zone:
Material:

Plate 3-7. Pestles, 45-DO-282.

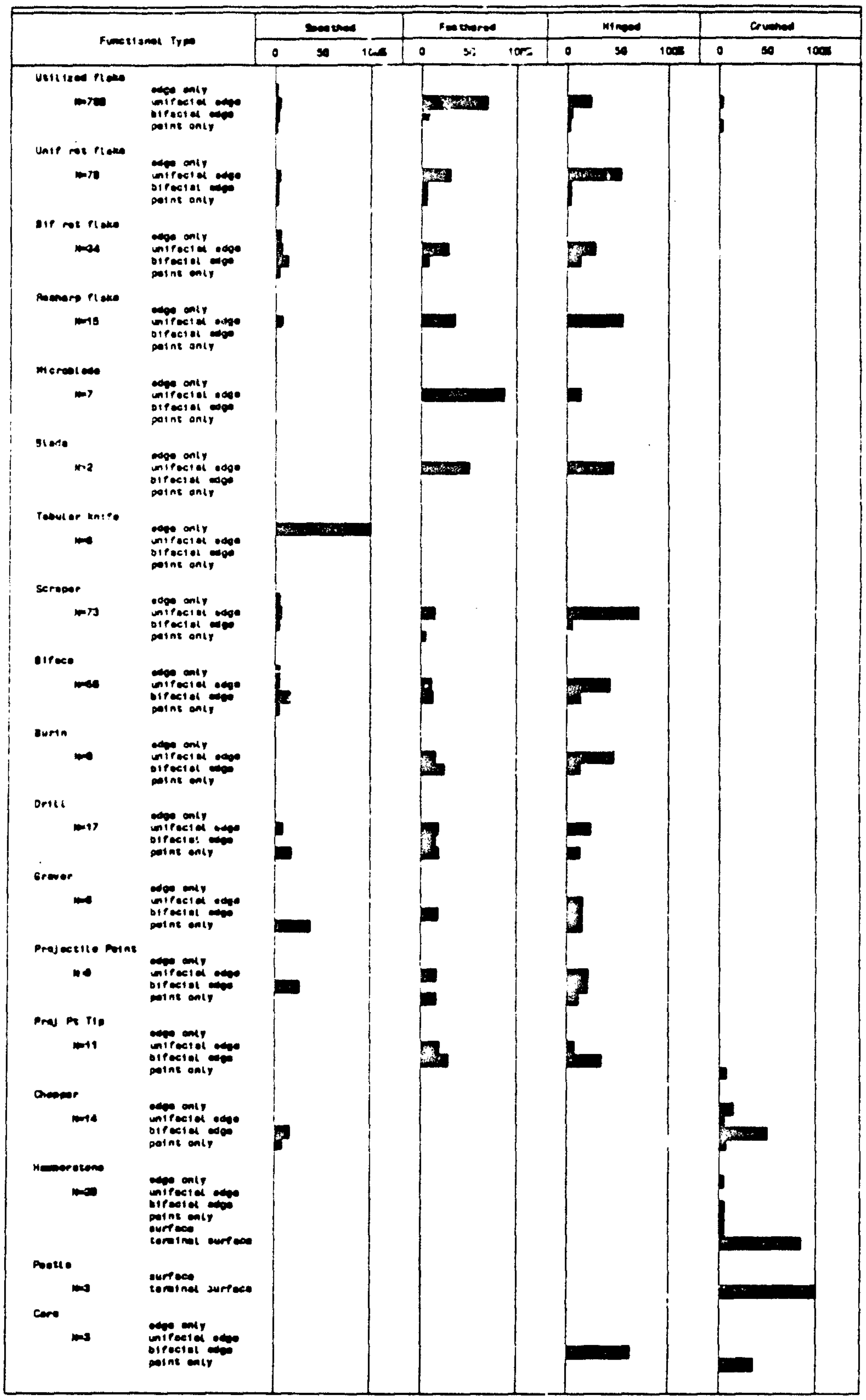
Table 3-22. Functional object type and wear area/object ratio by zone, 45-DO-282.

Functional types	Number of wear areas	Zone										Total	
		1		2		3		4		25			
		Frequency	Ratio	Frequency	Ratio	Frequency	Ratio	Frequency	Ratio	Frequency	Ratio	Frequency	Ratio
Utilized flakes	1	81	136/104	62	120/85	93	227/145	35	62/46	108	241/160	379	786/540
	2	17	=1.31	16	=1.41	31	=1.56	8	=1.35	34	=1.51	106	=1.45
	3	3		4		14		2		11		34	
	4	3		2		5		-		4		14	
	5	-		-		2		1		2		5	
	6	-		1		-		-		1		2	
Unifacially retouched flake	0	4	12/10	1	22/13	6	19/16	1	15/5	8	30/21	20	98/65
	1	4	=1.20	7	=1.69	7	=1.19	1	=3.00	7	=1.43	26	=1.51
	2	2		2		3		-		4		11	
	3	-		2		-		2		1		5	
	4	-		1		-		-		1		2	
	7	-		-		-		1		-		1	
Bifacially retouched flake	0	5	13/12	9	15/15	8	20/16	4	0/4	4	12/10	30	64/57
	1	6	=1.08	6	=1.00	6	=1.25	-	=0	5	=1.20	23	=1.12
	2	1		-		-		-		-		1	
	3	-		-		2		-		1		3	
Resharpening flake	0	-	0/0	-	0/2	2	1/3	1	1/2	1	4/5	4	8/12
	1	-		2	=0	1	=0.33	1	=0.50	4	=0.80	8	=0.67
Microblade	0	28	2/30	31	2/32	72	1/73	24	0/24	5	2/7	160	7/166
	1	2	=0.07	-	=0.06	1	=0.014	-	=0	2	=0.28	5	=0.04
	2	-		1		-		-		-		1	
Blade	0	2	0/2	-		-		-		-		2	0/2
			=0										=0
Tabular knife	1	-		-		-		-		1	9/5	1	9/5
	2	-		-		-		-		4	=1.80	4	=1.80
Biface	0	4	6/8	10	18/16	15	25/22	4	1/5	25	58/41	58	116/92
	1	2	=0.75	4	=1.12	4	=1.14	1	=0.20	4	=1.41	15	=1.26
	2	2		2		3		-		9		16	
	3	-		-		-		-		2		2	
	5	-		-		-		-		1		1	
Scraper	0	-	8/3	-	8/4	1	26/8		2/1	1	38/14	2	82/30
	1	1	=2.67	1	=2.00	3	=3.25		=2.00	4	=2.71	9	=2.73
	2	-		2		-		1		2		5	
	3	1		1		-		-		4		6	
	4	1		-		1		-		1		3	
	5	-		-		1		-		-		1	
	6	-		-		1		-		1		2	
	7	-		-		1		-		1		2	
Burin	1	1	1/1	-	4/2	1	1/1	2	1/2	-	0/0	4	4/6
	2	-	=1.00	2	=2.00	-	=1.00	-	=0.50	-		2	=0.67

Table 3-22. Cont'd.

Functional types	Number of wear areas	Zone 1 Frequency	Zone 1 Ratio	Zone 2 Frequency	Zone 2 Ratio	Zone 3 Frequency	Zone 3 Ratio	Zone 4 Frequency	Zone 4 Ratio	Zone 25 Frequency	Zone 25 Ratio	Total Frequency	Total Ratio
Burin spall	0	-			0/1 =0	-		-		-		1	0/1 =0
Drill	1	-		1	5/2	1	4/2	2	1/2	1	6/3	5	16/9
	2	-		-	=2.50	-	=2.00	-	=0.50	1	=2.00	1	=1.78
	3	-		-		1		-		1		2	
	4	-		1		-		-		-		1	
Graver	1	-		1	0/1	1	4/2	-		-		2	6/3
	4				=0	1	=2.00					1	=2.00
Projectile point	0	1	1/2		3/6	3	1/4	3	0/3	9	24/17	20	40/22
	1	1	=0.50		=0.50	1	=0.25	-	=0	2	=1.41	5	=1.85
	2	-		1		-		-		5		6	
	3	-		-		-		-		1		1	
Chopper	0	-		-		4	2/5	-		15	12/25	19	14/30
	1	-		-		-	=0.40	-		6	=0.48	8	=0.47
	2	-		-		1		-		2		3	
Hammerstone	1	-		-		4	12/7	1	4/2	3	12/7	8	28/16
	2	-		-		2	=1.71	-	=2.00	3	=1.71	5	=1.75
	3	-		-		-		1		1		2	
	4	-		-		1		-		-		1	
Pestle	1	-		1	3/2	-		-		-		1	3/2
	2	-		1	=1.50	-		-		-		1	=1.50
Core	0	4	1/5	3	1/4	7	0/7	2	0/2	3	1/4	19	3/22
	1	1	=0.20	1	=.025	-	=0	-	=0	1	=0.25	3	=0.14
Indeterminate	0	2	0/2 =0	-		1	0/1 =0	-		2	0/2 =0	5	0/5 =0

Figure 3-3. Type and location of wear by functional object type, 45-DO-282.



used to perforate or incise relatively hard material like bone, do exhibit the expected heavy hinged chipping wear on points, but are characterized as well by feathered and hinged chipping wear on unifacial and bifacial edges. Some of the attrition recorded as wear may not be due to direct use, but to preparation for hafting, or to resharpening. Nonetheless, it appears that tool forms were used for purposes not necessarily defined by obvious morphological attributes of form nor by attached functional labels.

Table 3-23. Type and location of wear by zone, 45-DO-282.

Kind of wear	Location of wear	Zone					Total
		1	2	3	4	5	
Smoothing	Edge only	1	2	-	-	10	13
	Unifacial edge	5	9	10	1	2	27
	Bifacial edge	1	3	7	1	13	25
	Point only	1	2	3	1	3	10
Crushing	Edge only	-	-	1	-	2	3
	Unifacial edge	-	-	-	-	1	1
	Bifacial edge	-	-	2	-	6	8
	Point only	-	1	-	-	4	5
	Surface	-	3	11	4	10	28
Feathered chipping	Unifacial edge	105	85	162	75	18[illegible]	[illegible]88
	Bifacial edge	11	8	18	1	28	66
	Point only	-	3	1	-	3	7
Hinged chipping	Unifacial edge	50	58	79	21	124	332
	Bifacial edge	4	9	13	4	12	42
	Point only	-	1	2	-	3	6
TOTAL		178	184	308	88	402	1,161

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

Definitive characteristics are largely those noted in previous tables. Smoothing wear on edges only is characteristic of tabular knives. Smoothing wear on unifacial and bifacial edges is most common on projectile points, bifacially retouched flakes, choppers and bifaces. Smoothing on points only typifies gravers, and, to a much lesser extent, drills. Feathered chipping on unifacial and bifacial edges is most frequent on microblades, and utilized flakes. Feathered chipping on points is most frequent on microblades and utilized flakes. Hinged chipping on unifacial and bifacial edges is frequent on all flaked functional types except choppers. Hinged chipping on points only is most characteristic of gravers, drills and projectile points. Crushing on edges only and unifacial and bifacial edges is found most often on choppers. Crushing on points is not frequent in any functional type category, but comprises the highest percentage in cores. Crushing on surfaces and terminal surfaces, of course, characterizes hammerstones and pestles.

Table 3-24. Ranking of functional tool types by wear type, 45-DO-282.

Wear type	Functional type ranking % of assemblage within wear type		Functional type ranking % of total assemblage	
Smoothing				
Edge only	Tabular knife	100.0	Tabular knife	.8
	Bifacially retouched flake	2.9	Bifacially retouched flake	.1
	Biface	1.7	Biface	.1
	Scraper	1.4	Scraper	.1
	Utilized flake	.1	Utilized flake	.1
Unifacial/ bifacial edge	Projectile point	22.2	Utilized flake	1.9
	Bifacially retouched flake	17.7	Biface	.7
	Chopper	14.3	Bifacially retouched flake	.5
	Biface	13.8	Scraper	.4
	Scraper	6.8	Unifacially retouched flake	.3
	Resharpened flake	6.7	Projectile point	.2
	Drill	5.9	Chopper	.2
	Unifacially retouched flake	5.1	Resharpened flake	.1
	Utilized flake	2.9	Drill	.1
Point only	Graver	33.3	Graver	.2
	Drill	11.8	Drill	.2
	Chopper	7.1	Utilized flake	.2
	Bifacially retouched flake	2.9	Chopper	.1
	Biface	1.7	Bifacially retouched flake	.1
	Unifacially retouched flake	1.3	Biface	.1
	Utilized flake	.2	Unifacially retouched flake	.1
Feathered chipping				
Unifacial/ Bifacial edge	Microblade	85.7	Utilized flake	49.0
	Utilized flake	72.4	Unifacially retouched flake	2.2
	Blade	50.0	Biface	1.1
	Projectile point tip	45.5	Bifacially retouched flake	1.0
	Burin	37.5	Scraper	.8
	Resharpened flake	33.3	Microblade	.5
	Bifacially retouched flake	32.4	Projectile point tip	.4
	Unifacially retouched flake	32.1	Resharpened flake	.4
	Drill	29.4	Drill	.4
	Biface	22.4	Burin	.3
	Graver	16.7	Blade	.1
	Scraper	12.3	Graver	.1
	Projectile point	11.1	Projectile point	.1
Point only	Drill	17.6	Drill	.2
	Projectile point	11.1	Unifacially retouched flake	.2
	Unifacially retouched flake	2.6	Projectile point	.1
	Scraper	1.4	Scraper	.1

Table 3-24. Cont'd.

Wear type	Functional type ranking % of assemblage within wear type		Functional type ranking % of total assemblage	
Hinged chipping				
Unifacial/ Bifacial edge	Scraper	78.1	Utilized flake	16.3
	Core	66.7	Biface	3.0
	Burin	62.5	Bifacially retouched flake	1.3
	Resharpened flake	60.8	Resharpened flake	.8
	Biface	60.3	Burin	.4
	Unifacially retouched flake	57.7	Projectile point tip	.4
	Blade	50.0	Projectile point	.4
	Projectile point tip	45.4	Drill	.3
	Projectile point	44.4	Scraper	.2
	Bifacially retouched flake	44.1	Core	.2
	Graver	33.4	Graver	.2
	Utilized flake	24.1	Unifacially retouched flake	.1
	Drill	23.5	Blade	.1
	Microblade	14.3	Microblade	.1
Point only	Graver	16.1	Drill	.2
	Drill	11.8	Graver	.1
	Projectile point	11.1	Projectile point	.1
	Unifacially retouched flake	1.3	Unifacially retouched flake	.1
	Utilized flake	.1	Utilized flake	.1
Crushing				
Edge only	Chopper	14.3	Chopper	.2
	Hammerstone	3.6	Hammerstone	.1
Unifacial/ bifacial edge	Chopper	57.1	Chopper	.7
	Hammerstone	3.6	Hammerstone	.1
	Utilized flake	.1	Utilized flake	.1
Point only	Core	33.3	Core	.1
	Projectile point tip	9.0	Projectile point tip	.1
	Chopper	7.1	Chopper	.1
	Hammerstone	3.6	Hammerstone	.1
	Utilized flake	.1	Utilized flake	.1
Surface	Hammerstone	3.6	Hammerstone	.1
Terminal surface	Pestle	100.0	Hammerstone	2.1
	Hammerstone	85.7	Pestle	.2

Table 3-25. Distribution of functional types by zone, 45-DO-282.

Functional type	Zone									
	1		2		3		4		25	
	N	%	N	%	N	%	N	%	N	%
Flake tools										
Utilized only	104	58.7	85	45.9	145	46.6	46	46.9	160	50.1
Unifacially retouched	10	5.6	13	7.0	16	5.2	5	5.1	21	6.6
Bifacially retouched	12	6.5	15	8.1	16	5.2	4	4.1	10	3.1
Resharpened	-	-	2	1.1	3	1.0	2	2.0	5	1.6
Microblade	30	16.9	32	17.3	73	23.5	24	24.5	7	2.2
Blade	2	1.1	-	-	-	-	-	-	-	-
Tabular knife	-	-	-	-	-	-	-	-	5	1.6
Subtotal	158	89.3	147	79.4	253	87.6	81	82.6	208	65.2
Formed tools										
Biface	8	4.5	16	8.6	22	7.1	5	5.1	41	12.8
Scraper	3	1.7	4	2.2	8	2.6	1	1.0	14	4.4
Burin	1	0.6	3	1.6	1	0.3	2	2.0	-	-
Drill	-	-	2	1.1	2	0.6	2	2.0	3	0.9
Graver	-	-	1	0.5	2	0.6	-	-	-	-
Projectile point	2	1.1	6	3.2	4	1.3	3	3.1	17	5.3
Chopper	-	-	-	-	5	1.6	-	-	25	7.8
Core	5	2.8	4	2.2	7	2.2	2	2.0	4	1.2
Subtotal	19	10.7	36	19.4	51	16.4	15	15.3	104	32.6
Unformed-pecked										
Hammerstone	-	-	-	-	7	2.2	2	2.0	7	2.2
Pestle	-	-	2	1.1	-	-	-	-	-	-
Subtotal	-	-	2	1.1	7	2.2	2	2.0	7	2.2
TOTAL	177		185		318		98		319	

Functional types and associated wear patterns indicate that hunting and attendant on-site butchering and processing of game were probably the primary economic activities at site 45-DO-282. Lacking definable cultural features and having only a sparse faunal collection, we must base this inference on our functional analysis. On the other hand, site activity may have been focused on the production of stone tools, and hunting was undertaken only to provide very short-term subsistence. Yet another possibility, not unrelated to a focus on hunting, is the use of on-site produced tool forms to manufacture and maintain non-lithic items of the tool kit. Utilized and retouched or resharpened flakes, as well as scrapers, bifaces and a wide variety of other formed tools, may have been used to manufacture wooden or bone implements--shafts for spears or atlatls, points for the projectile shafts, handles for knives and scrapers, etc. Weighing all the evidence--a lack of bone in the site deposits, no identified firepits or living surfaces, and incontrovertible evidence of tool production and tool maintenance, with tool types commonly associated with hunting--we conclude that 45-DO-282 was the scene of very short-term camps where tools were made preparatory to hunting, but where little butchering or processing was done. The massive erosion of the site area nearest the Columbia River adds uncertainty to this conclusion, of course. In addition to the tool forms discussed above, the beach collection also held evidence of firepits, river mussel collection, and fragmented food bone, all of which indicate a prehistoric site economy more in line with the postulated emphasis on hunting and butchering, as well as supplementing the meager evidence for consumption of other resources. It seems plausible that tools were made and used upslope from the area of camping and everyday living

When we examine the ranking of functional types by type of wear for the entire assemblage, we find a varied lack of correspondence in most wear categories. Those rankings which are congruent include tabular knives in smoothing on edges only, gravers and drills in smoothing on points only, drills in teathered chipping on points only, drills in feathered chipping on points only, drills and gravers in hinged chipping on points only, and choppers, hammerstones and pestles in all types of crushing wear except crushing on points only. Wear types on unifacial and bifacial edges show marked variation in the proportional ranking, generally characterized by the dominance of simple utilized flakes in most categories. It seems that utilized flakes, the most frequent tool form in the collection, were also the favored multipurpose tool, used for a wide range of purposes not limited to sharp unifacial or bifacial edges, but also points, and spanning all four major wear classes from smoothing to crushing. In general, it would seem that rigid selection of a particular tool form was largely confined to the manufacture of points and thus, functional types such as gravers, drills and projectile points. Edged tools, unifacial or bifacial, seem to have had more varied uses, commensurate with a more generalized tool form. The dubious association of tabular knives and smoothing wear on edges only does not seem to be a matter of tool design since these tool forms are among the crudest and least manufactured; rather, it probably represents use of a convenient stone with a tabular fracture plane for a certain job or very restricted range of jobs. Whatever the actual range of uses of these function types, examination of associated wear types clearly documents use of most edged tool forms for a wide variety of tasks, not necessarily predictable from traditional functional labels. While there is a tendency for obvious (i.e., specialized) tool forms, particularly those with points, to have been used in a manner suggested by the functional label, it is clear that tools were used for a number of different jobs and not restricted to a single job. We have noted that the simple utilized flake was adapted to the widest range of tasks. Less obvious examples include projectile points, used for cutting and scraping as well as perforating, and scrapers, with hinged chipping wear more indicative of heavy cutting than scraping of soft hides.

SUGGESTED USE

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

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

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

All of the formed tool types recovered show feathered and hinged chipping wear. Those with the least manufacture (e.g., simple utilized flakes and linear flakes) show the highest occurrence of feathered chipping wear. More complex tool forms or those that show resharpening or retouch (e.g., scrapers, bifaces, burins, projectile points, resharpened and retouched flakes) have proportionately higher frequencies of hinged chipping wear. Drills are an exception--feathered chipping wear slightly exceeds hinged chipping wear. The seeming correlation between feathered chipping wear and hinged chipping wear and relatively unmodified and carefully shaped or maintained tools respectively, leads us to suspect that the wear types may be largely a function of the intensity or duration of use in comparable activities.

EDGE ANGLE DISTRIBUTIONS

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

Edge angle distributions generally support inferences drawn from consideration of attributes of wear. Simple utilized flakes show a distribution skewed toward an acute edge angle in the range 16-31 degrees, reflecting selection for a sharp cutting edge and little concern for durability. Retouched and resharpened flakes show a more regular distribution, with a peak in a less acute edge angle range (46-66 degrees), which is also repeated in the distribution drawn for other functional types. These distributions indicate a paramount concern with strength of the working edge or point, and, thus, greater application of force and durability. When these three functional type classes are grouped into two major groups of wear only and wear and manufacture, this fundamental pattern shows even more clearly. Tools with wear and manufacture show a more normal distribution centered in a broad range from 46-65 degrees. Certainly, there is considerable overlap between the two distributions, particularly in the wear only distribution where there are two small peaks in the range 36-45 degrees and 50-55 degrees; but the different characteristics of these edge angle distributions reflect care in selection of a sharp edge for jobs of the moment and creation of less acute edge angles for formed tools for which design and durability were salient concerns.

ECONOMIC PATTERNS

The overwhelming majority of stone tools recovered from 45-DO-282 document cutting, piercing, scraping, and chopping uses in soft to hard elastic materials, characteristics commonly associated with hunting-butchering-processing of game (97%, N=1,127). Many of the tool forms could have been used for other economic pursuits, notably the processing of plant parts or woods, but the character of the assemblage seems to argue for hunting. Feathered and hinged chipping wear, often associated with smoothing, and primarily on unifacial and bifacial edges of simple flake tools, bifaces,

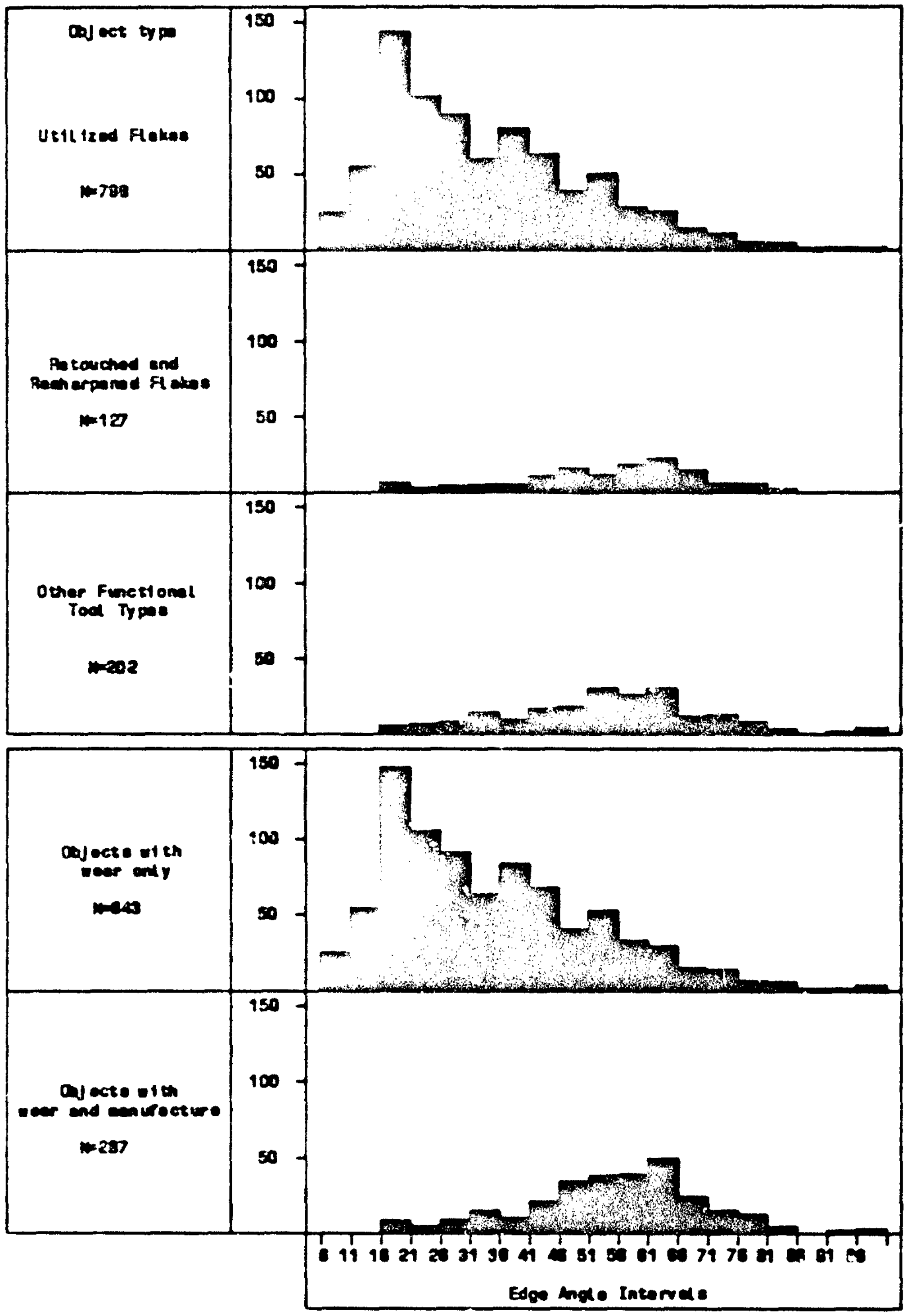


Figure 3-4. Edge angle distribution of functional tool types, 45-DO-282.

burins, drills, and projectile points, indicate tool use on soft and hard materials or consistent reuse and heavier use of some functional types. Smoothing on the edges of tabular knives and the recovery of a large number of scrapers may indicate an emphasis on hide processing. However, it is equally likely that these forms may have been used to manufacture non-lithic elements of the tool kit; for instance, to shape and smooth wood or bone foreshafts and handles. Heavy crushing wear on the unifacial edges of choppers and surfaces of the numerous hammerstones may evidence considerable attention to marrow extraction and bone tool manufacture, or the working of small wood parts. Other heavy tools include 28 hammerstones, which may be further evidence of the importance of bone reduction or the emphasis on lithic reduction. Recovery of two pestles clearly documents the processing of plant parts at the site as well.

TEMPORAL AND SPATIAL PATTERNS

Differences in artifact distribution among zones are more a matter of the presence or absence of particular functional types than significant changes in intensity of tool use or wear patterning (Table 3-25). Differences among excavated zones, in particular, seem insignificant. The most marked contrast occurs between the excavated zones (Zones 1 through 4) and the beach collection (Zone 25). For example, Zone 25 yielded a much lower proportion of simple flake tools and a correspondingly higher proportion of formed tools than the excavated zones. Tabular knives were only recovered from the beach collection, and bifaces, scrapers and projectile points comprised a much higher proportion of that zonal assemblage than in the excavated zonal assemblages.

We performed a chi-square test for two or more independent samples on the distribution of functional types (using the collapsed categories of Table 2-25) across all five defined zones. and for the distribution of tool types (kind of wear by location of wear) across excavated zones and the beach collection. In both instances the derived chi-square value easily exceeded the critical values at the .05 level of significance. We conclude that the distribution of functional object types and tool types does vary significantly among the defined analytic zones and between the excavated zones and beach collection, and that the beach collection represents a different set of activities. As the beach collection is comparable in age to the other zones, this may indicate activity patterning on the site, with a marked difference in site use between an area closer to the river and one further upslope. However, the beach collection is not comparable to the assemblages from the buried zones, either in duration or in recovery techniques. It is possible that proportions of specific artifact types within Zone 25 are inflated simply because it is a remnant surface onto which artifacts from the other zones settled. The presence of tabular knives in the beach collection and their absence in the other zones is the most striking difference.

activities, which was located nearer the river, and that the rising waters of Rufus Woods Lake have all but obliterated evidence of this site activity.

All evidence points to a very con 'stent pattern of site use over the postulated 3,000 year span of occupati , from ca. 7000-4000 B.P. This period, defined as the Kartar Phase in the Rufus Woods Lake project area, saw use of 45-DO-282 as very short-term camps, perhaps not even overnight stops, associated with tool production and tool kit maintenance. We have some very inconclusive evidence that the part of the site nearest the river (preserved as the Zone 25 beach collection) may have seen more intensive and prolonged use, but still confined to camps.

STYLISTIC ANALYSIS

Projectile points are the only class of artifacts from site 45-DO-282 that permit the researcher to make assessment of temporal period and/or cultural affiliation. They supply us with a reasonable temporal scale when we compare stylistic attributes of specimens in this collection with those considered diagnostic of defined projectile point types, either within this project area or on the Columbia Plateau as a whole. At 45-DO-282 this is particularly important, since we do not have radiocarbon dates or distinctive, dated geologic deposits.

PROJECTILE POINT CLASSIFICATION

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

Eleven classificatory dimensions have been defined for morphological classification: BLADE/STEM JUNCTURE, OUTLINE, STEM EDGE ORIENTATION, SIZE, BASAL EDGE SHAPE, BLADE EDGE SHAPE, CROSS SECTION, SERRATION, EDGE GRINDING, BASAL EDGE THINNING, and FLAKE SCAR PATTERN (Table 3-26). Of these, the first four (DI-DIV) define eighteen morphological types (Figure 3-5). The other seven serve to describe these types more fully, and permit the identification of variants within the types.

Table 3-26. Dimensions of morphological projectile point classification.

DIMENSION I: BLADE-STEM JUNCTURE

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

DIMENSION II: OUTLINE

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

DIMENSION III: STEM EDGE ORIENTATION

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

DIMENSION IV: SIZE

N. Not applicable
1. Large
2. Small

DIMENSION V: BASAL EDGE SHAPE

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

DIMENSION VI: BLADE EDGE SHAPE

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

DIMENSION VII: CROSS SECTION

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

DIMENSION VIII: SERRATION

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

DIMENSION IX: EDGE GRINDING

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

DIMENSION X: BASAL EDGE THINNING

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

DIMENSION XI: FLAKE SCAR PATTERN

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

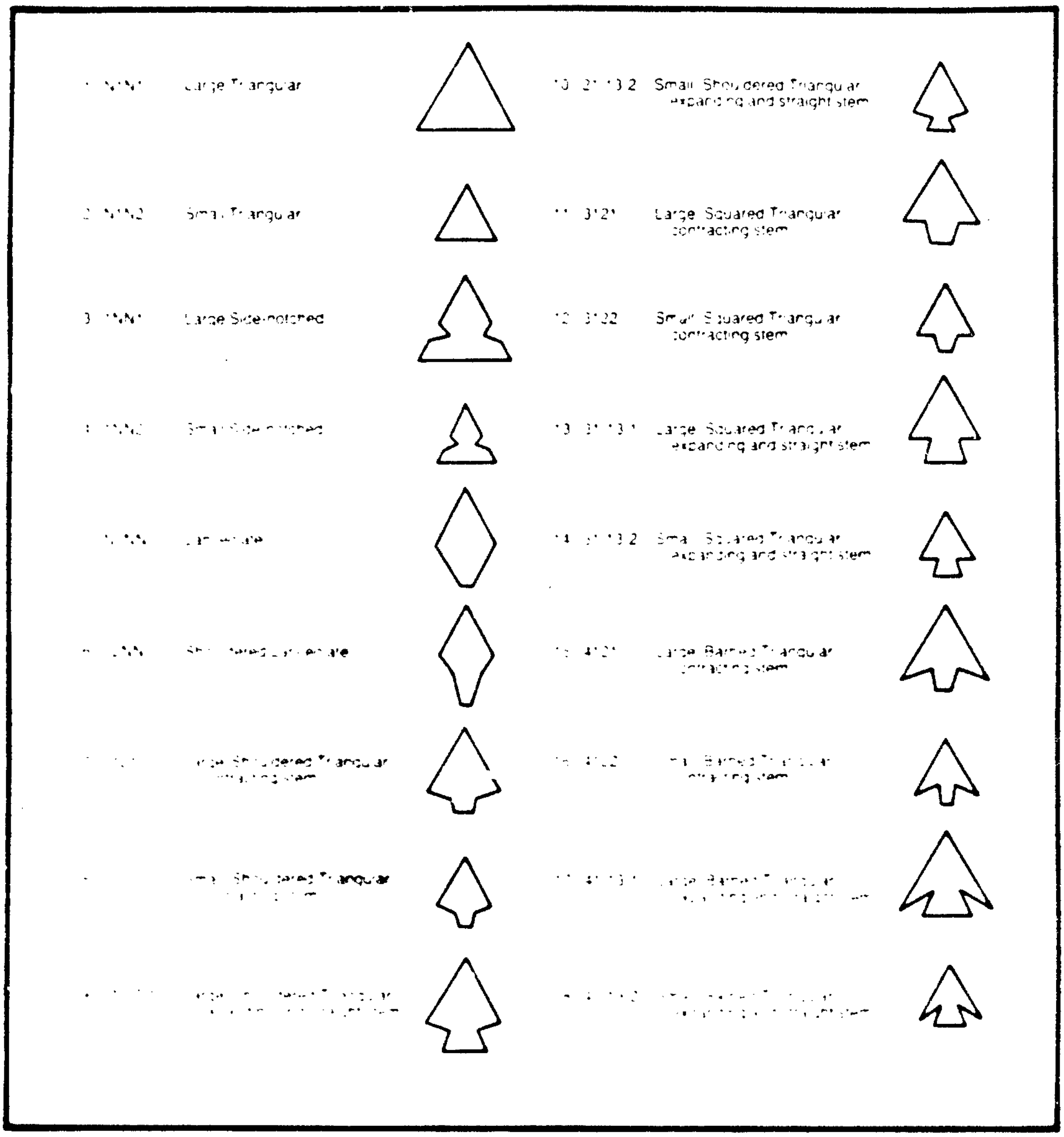


Figure 3-5. Morphological projectile point types.

By defining the margins of projectile points, we are able to place them within one of the eighteen morphological types. This is done by drawing straight lines from nodes where the outline of the specimen changes direction. Figure 3-6 illustrates the technique. For a corner-notched triangular point, the blade is defined as line segment a A. The shoulder is line segment A 1. The neck is node 1. The stem is line segment 1 2. The base is line segment 2-a'. Terms applied and the number of line segments drawn vary given the two basic subdivisions of form. Lanceolates are generally defined by four or less line segments (aA12a'). Stemmed triangular forms are defined by five or less line segments (aA123a'). Side-notched triangular forms are defined by five or more line segments (aA12345a'). Table 3-27 lists the eighteen morphological types with descriptions, classification codes, and line segment definitions.

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

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

Our desire for a statistically derived classification prompted selection of a multivariate statistical method termed discriminant analysis (Nie et al. 1975). In this analysis, individual specimens are sorted into selected groups on the basis of mathematical equations derived from analysis of cases with known memberships. First, we assembled representative specimens for each acknowledged historical type, and tested group autonomy through analysis of specified discriminating variables. Then, we used derived equations called discriminant functions to assign specimens in our collection to the statistically defined projectile point types. All cases are given a probability of group membership, calculated as the distance a given case score is away from a group score. Discriminating variables--those providing the most separation between groups--are ranked and serve as type definitions. The outcome is a statistically defensible projectile point typology based on traditional, intuitively derived classifications. The resulting classification is consistent, and produces mathematically defined ranges of variability. It enables the researcher to quickly categorize a large collection, and it offers a sound, rational basis for definition of new types

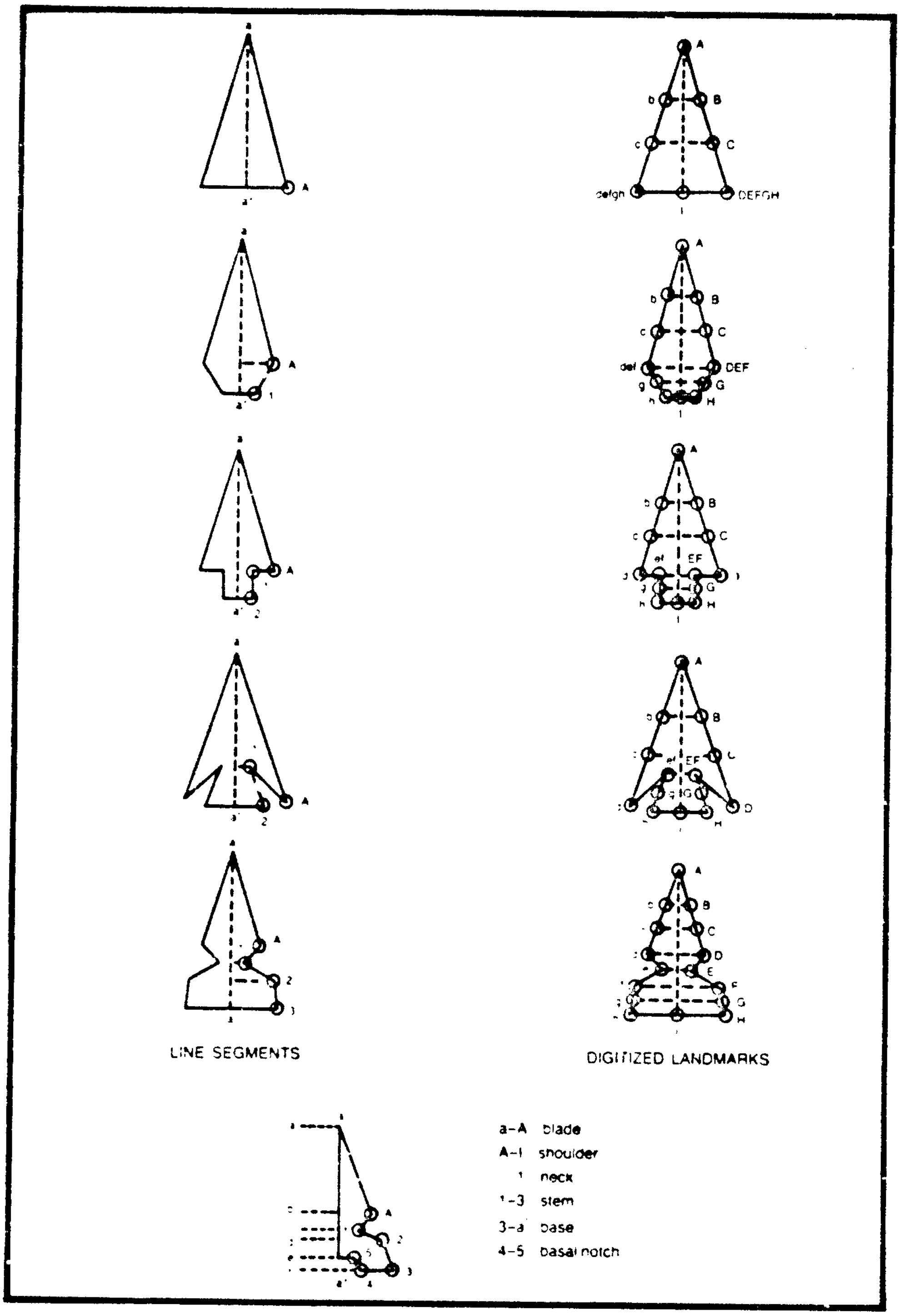


Figure 3-6. Definition of projectile point outline.

Table 3-27. Line segment definition of morphological projectile point types.

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

as well as an explicit definition of accepted types. We can thereby correlate the Rufus Woods Lake projectile point sequence with other chronologies in both a quantitative and qualitative manner. For a detailed discussion of procedures and assumptions involved in discriminant analysis see Johnson (1978) and Klecka (1980).

We assembled a type collection for the Columbia Plateau of over 1,200 specimens that constituted originally defined type examples, labelled specimens of recognized types, or type variants that were reasonably well-dated. By critically reviewing the archaeological literature, we identified 23 historical types which we arranged in six formal type series (Figure 3-7). We consistently applied distinctions based on the original type definitions, modified, where appropriate, by subsequent research. We routinely defined type variants, usually suggested by prior researchers, which segregate specimens according to diagnostic patterns in morphology. Historical types identified here represent a synthesis of projectile point types and cultural reconstructions postulated by researchers in different areas of the Columbia Plateau, and were not taken from any single typology or chronological sequence (e.g., Butler 1961, 1962; Nelson 1969; Leonhardy and Rice 1970). Names are usually those applied by the first researcher to define a specific type. We developed variant labels by using the accepted type name followed by a letter denoting diagnostic variation. For a complete discussion of procedures followed see Lohse (1984g).

THE PROJECTILE POINT ASSEMBLAGE

Examples of six different historical types were recovered from 45-DO-282 (Table 3-28). Descriptions of individual specimens follow in an outline form xspecifying physical characteristics and correlations with established projectile point types. Listings of authors and comparable illustrated specimens are not exhaustive, but are meant to alert the reader to artifact assemblages recovered from nearby study areas. Three measurements are given for each specimen: length, taken along a perpendicular axis bisecting the blade and haft; width, taken along a horizontal axis passing across the broadest part of the blade or blade-haft juncture; and thickness, taken through the blade-haft juncture. Specimens are illustrated in Plate 3-3 and digitized outlines are shown in Appendix B, Figure B-1.

CASCADE A (21) N=6

Provenience:	Material:	Measurement:
Zone 3	Jasper	-/1.5/.6 cm
Zone 3	Jasper	-/2.3/.7 cm
Zone 3	Jasper	-/1.4/.7 cm
Zone 1	Jasper	3.6/1.5/.5 cm
Zone 25	Jasper	-/1.5/.5 cm
Zone 25	Chalcedony	3.6/1.5/.4 cm

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 CUILOMENE 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 3-7. Historical projectile point type classification.

Comment: All specimens, with possible exception of the two from Zone 25, appear to have been made on large blades. Initial reduction seems to have entailed percussion flaking, followed by pressure flaking, to define and sharpen the edges. All specimens have been basally thinned, either through removal of series of small short flakes from the margin all around the convex base or by removal of large long flakes from the lateral margins only. All show uniform collateral flaking extending in from the lateral margins to the midlines of the points, which in at least two examples is the arris of a large blade.

Comparable Specimens: Collier et al. 1942: Plate I,j-m. Cressman 1960: Figure 41a,A,B. Butler 1962: Figure 9tt. Swanson 1962: Figure 36g. Leonhardy 1968: Figure 7h-q. Nelson 1969: Figure 42l,n; Figure 43k,l. Leonhardy and Rice 1970: Figure 3b; Figure 4a-d. Chance and Chance 1982: Figure 165d,g,j; Figure 166a,d; Figure 169b,c; Figure 170k; Figure 175a,d; Figure 180d.

Table 3-28. Classification of projectile points and projectile point fragments, 45-DO-282.

Historical type	Morphological classification	Zone	Feature	Association
Mahkin Shouldered	N1N22221NN1	25	—	—
Cold Springs Side-notched	1NN15221NN1	25	—	—
Cold Springs Side-notched	1NN13111NN1	25	—	—
Cold Springs Side-notched	1NN12121NN1	4	—	—
Col. Springs Side-notched	1NN11929NN9	4	—	—
Mahk.n Shouldered	N2NN9221124	25	—	—
Cascade A	N2NN2211123	25	—	—
Cascade C	N2NN2132123	1	—	—
Cascade A	N2NN2211122	1	—	Surface find
Cascade A	N2NN9222193	3	13	Cobble surface
Cascade A	N2NN2222124	3	13	Cobble surface
Cascade A	N2NN2132124	3	14	Cobble surface
Mahkin Shouldered	22NN1211122	25	—	—
Mahkin Shouldered	22NN1211122	25	—	—
Mahkin Shouldered	22NN2221123	25	—	—
Nespelem Bar	21212111NN1	1	—	Surface find
Nespelem Bar	21219121NN1	25	—	—
Nespelem Bar	21212122NN3	25	—	—
Columbia B corner-notched	21321221NN3	25	—	—
Blade fragments				
—	99919921993	25	—	—
—	92919231994	25	—	—
—	99999921994	2	—	—
—	92919221983	3	—	—
Stem fragments				
—	99315929NN9	2	—	—
—	99292929NN9	2	—	—
—	99291929NN9	2	—	—
—	99211929N33	3	—	—
Base fragments				
—	99212939123	25	—	—
—	99222929129	2	—	—
—	99221929129	2	—	—
—	99212929129	3	11	Cobble surface
—	19391929NN9	4	—	—

CASCADE C. N=1

Provenience:	Material:	Measurement:
Zone 1	Jasper	4.1/1.5/.6 cm

Comment: This specimen is a classic Cascade type projectile point as defined by Butler (1962) and redefined by Nelson (1969). It has a very regular lanceolate shape, with the widest part of the blade in the lower one-third of the outline. The base has been carefully thinned, but the mid-part of the specimen retains the thick, diamond-shaped cross section held to be characteristic of manufacture on a blade. Lateral margin serrations are large, and extend up from about the blade haft juncture to the distal point. Flaking is collateral, with flake scars of irregular width but uniform carry to the midline.

Comparable Specimen: Leonhardy and Rice 1970: Figure 4.

MAHKIN SHOULDERED LANCEOLATE (31) N=4

Provenience:	Material:	Measurement:
Zone 25	Jasper	3.0/1.5/.5 cm
Zone 25	Jasper	-/1.6/.7 cm
Zone 25	Chalcedony	4.4/2.0/.4 cm
Zone 25	Basalt	2.9/1.5/.5 cm

Comment: These four specimens, although shouldered lanceolate forms, are quite distinct, both in style and manufacture; this is very characteristic of the broad range of forms defined as Mahkin shouldered (Lohse 1984g). The basalt specimen is a squat, leaf-shaped form, roughed out by percussion flaking on a broad, thick flake. The striking platform and bulb of percussion are still evident at the proximal end. The chalcedony specimen is an elongate leaf-shaped form, roughed out by pressure flaking on a long, thin blade. No striking platform or bulb of percussion is visible. Only the margins have been reduced, leaving a well-defined arris along the midline of the point. One jasper specimen leaf-shaped with the thick, diamond-shaped cross section indicative of manufacture on a secondary flake. Both have been reduced uniformly on the dorsal and ventral surfaces. Flaking patterns on the four specimens are quite variable, ranging from irregular, with reduction of only one surface, to fine, even collateral flaking, and reduction of both surfaces.

This type has been referred to as "points with slight shoulders and rudimentary stems" (Nelson 1969:113) and as shouldered or stemmed leaf-shaped points (Swanson 1962). It is considered to be a form transitional from lanceolate to stemmed or triangular, spanning a long period from about 6500-2000 B.P.

Comparable Specimens: Cressman 1960: Figure 41a,C,D,E. Swanson 1962: Figure 20m,n. Leonhardy 1968: Figure 7f,g. Nelson 1969: Figure 37a-d. Leonhardy and Rice 1970: Figure 14e. Chance and Chance 1982: Figure 163a; Figure 164b,c,g-i; Figure 167e; Figure 169b.

COLD SPRINGS SIDE-NOTCHED (41) N=4

Provenience:	Material:	Measurement:
Zone 25	Basalt	4.7/2.2/.5 cm
Zone 25	Jasper	-/-/- cm
Zone 4	Opal	4.4/2.2/.9 cm
Zone 4	Jasper	-/-/.5 cm

Comment: The basalt specimen is a long, elegant form with excurvate sides made on a large, thin primary flake. The side notches are broad and shallow. The basal margin is lightly notched on either side of the midline. The dorsal surface has been uniformly reduced, but the flat ventral surface shows reduction only along the lateral margins. The opal specimen is bulkier and less finely finished, made on a large, thick primary flake. A large potlid on the ventral surface attests to heat treatment prior to reduction, although inclusions in the stone still resulted in an irregular flaking pattern and rough appearance. Both jasper specimens are large side-notched basal fragments on thick flakes. Flaking on both appears to have been regular.

The basally notched specimen is unusual in collections from Rufus Woods Lake, and has no real correlate in assemblages recorded for nearby study areas.

Comparable Specimens: Bryan 1955: Plate 11. Shiner 1961: Plate 356, 46b. Fryxell and Daugherty 1962: 46b. Nelson 1969: Figure 37p-q. Leonhardy and Rice 1970: Figure 4e,f.

NESPELEM BAR (51) N=3

Provenience:	Material:	Measurement:
Zone 1	Jasper	-/2.0/.8 cm
Zone 25	Jasper	-/-/.5 cm
Zone 25	Chalcedony	4.1/1.7/.4 cm

Comment: The chalcedony specimen is a finely flaked, serrated form made on a large, thin flake or blade. The dorsal surface has been uniformly reduced. The ventral surface has been flaked only along the lateral margins. Interestingly, the bulb of percussion appears to lie at the distal tip of the point. The jasper specimen from Zone 25 is an elongate, triangular form made on a thick flake or blade. Initial reduction appears to have been by percussion flaking. Later modification of the edge was by pressure flaking. A snap running the length of the projectile point, paralleling the midline, most probably occurred during manufacture. The jasper specimen from Zone 1 was crudely roughed out by percussion flaking. A lateral break through the blade below the tip probably occurred during manufacture.

The jasper specimen from Zone 25 appears to have been used as a cutting tool after a break terminated the manufacturing process. Heavy edge attrition on the intact lateral margin suggests its use as a backed knife, with the flat break employed as a convenient point of leverage.

Comparable Specimens: Swanson 1962: Figure 20m. Nelson 1969: Figure 37b; Figure 41t,u. Chance and Chance 1982: Figure 158q; Figure 164i; Figure 172g; Figure 174c.

COLUMBIA CORNER-NOTCHED B (63) N=1

Provenience:	Material:	Measurement:
Zone 25	Chalcedony	2.5/1.2/.5 cm

Comment: This specimen is a small triangular form made on a short, thick flake. The flaking pattern is mixed but tends toward collateral. The stem is expanding and the lateral margins mildly excurvate.

Comparable Specimens: Nelson 1969: Figure 41pp-rr. Leonnardy and Rice 1970: Figure 7f-i. Chance and Chance 1982: Figure 158g; Figure 164d.

UNNAMED TRIANGULAR PROJECTILE POINT (81) N=1

Zone 25	Jasper	3.3/1.8/.4 cm

Comment: Similar specimens often are called blanks or preforms; however, attrition of the edges may indicate that this form is a functional tool rather than an unfinished projectile point.

Authors refer to these forms as small triangular projectile points with the caveat that they may or may not be confined to that functional category (e.g., Collier et al. 1942; Nelson 1969).

Comparable Specimens: Nelson 1969: Figure 44r. Chance and Chance 1982: Figure 150, i.

DETACHED BLADES N=4

Provenience:	Material:	Measurement:
Zone 2	Jasper	-/1.8/.8 cm
Zone 2	Jasper	-/1.4/.7 cm
Zone 25	Jasper	-/1.6/.6 cm
Zone 25	Jasper	-/-/.7 cm

Comment: All four specimens represent lanceolate projectile point blade-tip fragments. Three have diamond shaped cross sections, the other, a thick biconvex cross section. The two specimens from Zone 25 show mixed flaking patterns, tending toward collateral. The two specimens from stratified contexts, Zones 2 and 3, have uniform collateral flaking patterns.

These four specimens are lanceolate forms, and, given associated projectile point types, are most probably Cascade or shouldered lanceolate types dating from about 6500 to 3500 B.P.

Comparable Specimens: None. Illustrated examples of lanceolate and shouldered lanceolate forms cited previously are appropriate.

DETACHED STEMS N=4

Provenience:	Material:	Measurement:
Zone 2	Jasper	-/1.4/.5 cm
Zone 2	Jasper	1.1/1.5/.5 cm
Zone 3	Jasper	-/1.4/.7 cm
Zone 2	Jasper	-/1.5/.5 cm

Comments: All four specimens are classified as stems because of the presence of a blade-haft juncture or overall configuration. All have been roughly flaked, either by percussion or pressure techniques. One specimen from Zone 2 has a slight basal notch at the approximate midline of the stem. All probably represent completed projectile points broken during use.

The specimen from Zone 3 may represent a lanceolate form since it lacks a definable blade-haft juncture; however, it is included here as a stem because its lateral margins flare out, perhaps indicative of a blade-haft juncture immediately above the lateral snap.

All four detached stems are considered representative of sloping and square-shouldered triangular types. Their large size probably indicates earlier forms diagnostic of a period from about 5000-3000 B.P. (cf., Nelson 1969). The notched stem specimen from Zone 2 may represent a "Quilomene Bar Base-notched" type (Nelson 1969: Figure 38, l-p), which dates in this project area from about 3000-500 B.P. (Lohse 1984g).

Comparable Specimen: None. Illustrated examples of large, sloping and square-shouldered triangular projectile points are appropriate (cf., Nelson 1969).

DETACHED BASES N=5

Provenience:	Material:	Measurement:
Zone 4	Chalcedony	-/-/.3 cm
Zone 3	Jasper	-/-/.4 cm
Zone 2	Jasper	-/-/.4 cm
Zone 2	Argillite	-/-/.2 cm
Zone 25	Jasper	-/-/.5 cm

Comment: These specimens are classified as detached bases because they lack a definable blade-haft juncture. All have been reduced through pressure flaking. The jasper specimen from Zone 25 exhibits a long narrow flake or flute extending up from its basal margin through the lateral snap. The jasper specimen from Zone 2 has a large impact fracture on one surface, attesting to breakage after manufacture.

The chalcedony specimen from Zone 4 may represent a side-notched type or expanding stem type, given the constriction of its lateral basal margin. Since Zone 4 produced Cold Springs Side-notched projectile points, it is likely that this base represents a large side-notched form. The other four specimens are most likely lanceolate forms.

Comparable Specimens: None. Illustrated examples of broken lanceolate forms in Nelson (1969) and Chance and Chance (1982) are probable correlates.

Zone 4, the oldest at the site, yielded two Cold Springs Side-notched points and a fragment possibly of the same type. These points are not numerous in the project area, but when found in dated context, occur before ca. 5000 B.P. (cf. Jaehnig 1984a; Lohse 1984f). That points from this zone are limited to Cold Springs Side-notched, without Mahkin Shouldered or Nespelem Bar projectile points, firmly places this early occupation sometime prior to ca. 5000 B.P.

Zone 3 contained only Cascade A points, which is consistent with the later stratigraphic position of the zone, as these points are generally found in slightly later contexts. Zone 2 had no diagnostic point types.

Zone 1 contained Cascade A, Cascade C, and Nespelem Bar points. Again, this association is consistent with a younger stratigraphic position, although the Nespelem Bar point is a surface find and not necessarily a temporal indicator for this zone. It is evident, however, given the occurrence of Cascade A and C point types, that the uppermost zone must be late Kartar Phase and not early Hudnut Phase, and thus dates prior to 4000 B.P. and probably not earlier than 5000 B.P.

Zone 25, the beach collection, contains point types found in other zones--Cold Springs Side-notched, Mahkin Shouldered, Cascade A, Nespelem Bar--as well as a Columbia Corner-notched B.

Projectile point data, therefore, indicate that all buried deposits at the site are assignable to the Kartar phase (ca. 7000-4000 B.P.) defined for the project area. Not only the classified points but the fragments support this temporal assignment: in all zones, blade, stem, and base fragments are characteristic of simple lanceolate and shouldered lanceolate or large shuldered and side-notched triangular projectile point forms. The vertical distribution of point types in the site suggests a rough temporal sequence of occupation in which Zone 4 corresponds to the early part of the Kartar phase (ca. 7000-6000 B.P.), Zone 3 is intermediate, and Zones 1 and 2 date to the mid- to latter part of the Kartar phase (ca. 5000-4000 B.P.). The beach collection spans the entire time period represented by the buried components, and a Columbia Corner-notched point is evidence of a possible occupation in the Hudnut Phase.

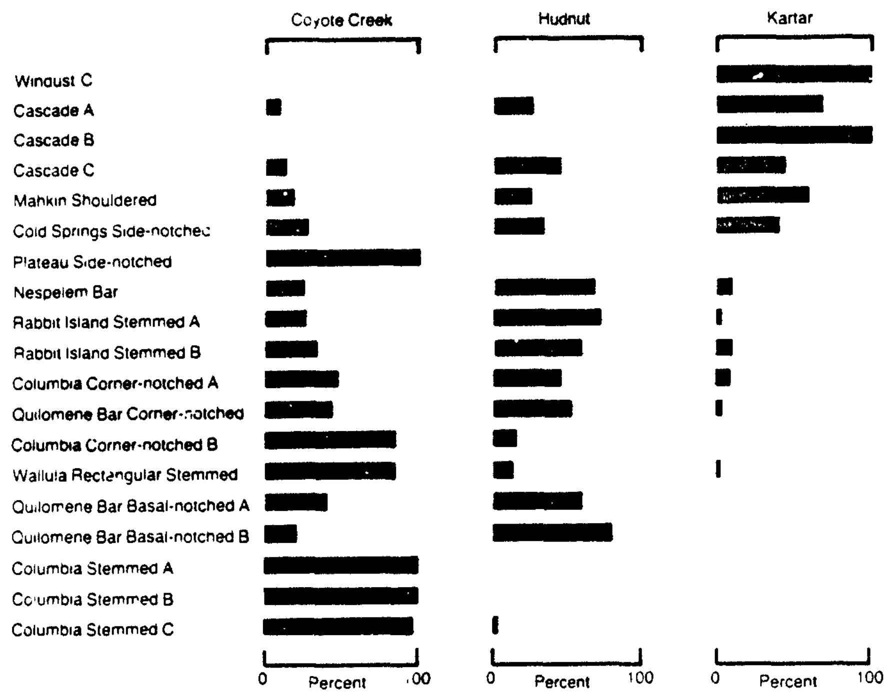


Figure 3-8. Projectile point type distribution across cultural phases.

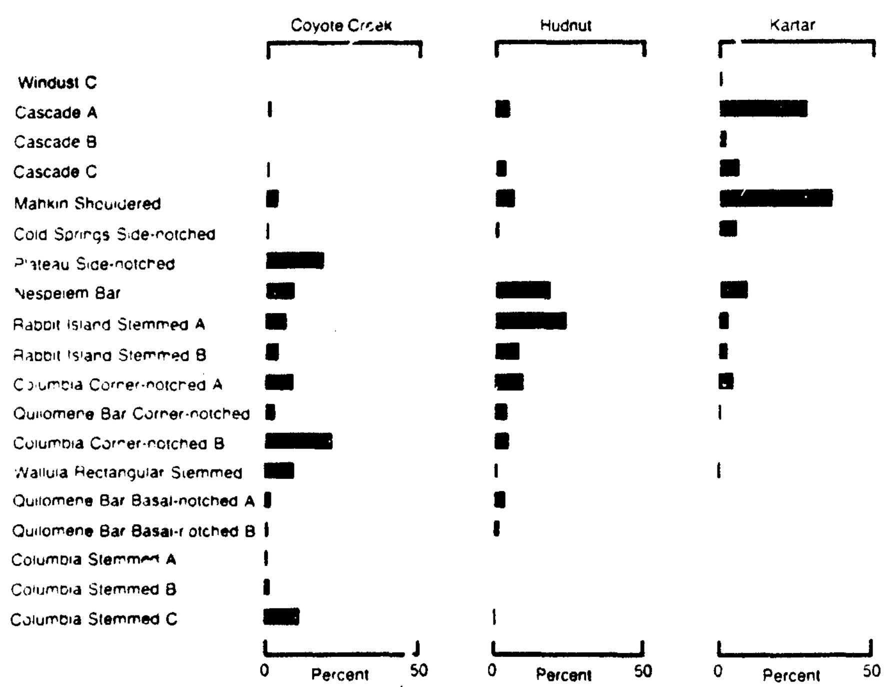


Figure 3-9. Projectile point type distribution within cultural phases.

4. FAUNAL ANALYSIS

Zoological remains from archaeological sites provide a unique source of data on the ecology and historic biogeography of animal species living in the site area, and on utilization of faunal resources by human occupants of the site. This chapter describes the faunal assemblage recovered from 45-DO-282, and summarizes the implications of the assemblage for understanding the archaeology of the site.

FAUNAL ASSEMBLAGE

The distribution of invertebrate faunal remains is summarized by zone in Table 2-2. The counts and weights of bone given in Table 2-2 do not represent the entire amount of bone examined by the faunal analysts. They were obtained during laboratory processing, after "noneconomic" bone had been removed. Both categories of bone were included in the faunal analysis but additional weights and counts were not taken. As the majority of the identified specimens from 45-DO-282 are rodents originally included in the noneconomic bone category, the counts of identified bone (Table 4-1) are higher than the total bone counts reported in Table 2-2. Of the 496 identified elements 459 (92%) are mammalian, one (<1%) is amphibian, 22 (4%) are reptilian, and 14 (3%) are fish. Taxonomic composition and distribution of the vertebrate remains for the site as a whole and by zone are shown in Table 4-1. The invertebrate assemblage consists of seven shells weighing 56 g. The shells have not been identified.

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

SPECIES LIST

MAMMALS (NISP=459)

Sylvilagus cf. *nuttallii* (Nuttall's cottontail) -- 9 elements.

Sylvilagus nuttallii is an abundant resident of rocky sagebrush areas in the project area. Cottontails were exploited ethnographically for fur and meat (Post 1938; Ray 1932).

Table 4-1. Taxonomic composition and distribution of vertebrate remains, 45-DO-282.

Taxa	Site Total		Zone									
			1		2		3		4		25	
	NISP[1]	MNI[2]	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI
MAMMALIA (NISP=460)												
Leporidae												
<u>Sylvilagus nuttallii</u>	10	1	2	1	1	1	-	-	-	-		
Sciuridae												
<u>Marmota flaviventris</u>	9	1	-	-	2	1	2	1	-	-	5	1
Geomyidae												
<u>Thomomys talpoides</u>	327	-	15	4	40	6	104	16	150	18	18	4
Heteromyidae												
<u>Perognathus parvus</u>	55	-	7	2	34	8	9	4	5	2	-	-
Cricetidae	28	-	4	-	10	-	8	-	3	-	1	-
<u>Lagurus curtatus</u>	12	6	6	3	2	2	2	2	1	1	1	1
<u>Microtus</u> sp.	1	1	-	-	-	-	1	1	-	-	-	-
<u>Peromyscus maniculatus</u>	3	1	-	-	-	-	1	1	2	1	-	-
<u>Neotoma cinerea</u>	2	1	-	-	1	1	1	1	-	-	-	-
Mustelidae	1	-	-	-	-	-	-	-	-	-	1	-
<u>Taxidea taxus</u>	1	1	-	-	-	-	-	-	-	-	1	1
Canidae												
<u>Canis</u> sp.	2	2	-	-	-	-	-	-	-	-	2	2
Cervidae	5	-	-	-	-	-	-	-	-	-	5	-
<u>Odocoileus</u> sp.	4	1	2	1	1	1	-	-	-	-	1	1
Deer-Sized	1	-	1	-	-	-	-	-	-	-	-	-
Elk-Sized	1	-	-	-	-	-	-	-	-	-	1	-
AMPHIBIA (NISP=1)												
Ranidae/Bufonidae	1	1	-	-	-	-	-	-	1	1	-	-
REPTILIA (NISP=22)												
Chelydridae												
<u>Chrysemys picta</u>	22	1	1	1	2	1	18	1	-	-	1	1
PISCES (NISP=14)												
Salmonidae	14	-	1	-	2	-	8	-	3	-	-	-
TOTAL	497		45		98		154		166		37	

1. Number of identified specimens.
2. Minimum number of individuals.

Marmota flaviventris (yellow-bellied marmot) -- 9 elements.

All marmot remains have been tentatively assigned to the species *M. flaviventris* on the basis of present distribution. This species is the only marmot now living in the project area, and is a common resident of talus slopes. *M. monax* has been recorded in extreme northeastern Washington and *M. calagata* occurs in the Cascades to the west of the project area (Ingles 1965; Dalquest 1948). The three species are indistinguishable on the basis of osteological morphology, and the size ranges of the three overlap extensively. Marmots were exploited as a small game resource by ethnographic inhabitants of eastern Washington (Ray 1932; Post 1938). Their presence in this faunal assemblage may indicate prehistoric exploitation. Potential changes in distribution or cultural transport of animals preclude dismissing the possible occurrence of one or both of the more montane species in this assemblage.

Thomomys talpoides (northern pocket gopher) -- 327 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) -- 55 elements.

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

Cricetidae (New World rats and mice) -- 26 elements.

Lagurus curtatus (sagebrush vole) -- 12 elements.

Lagurus curtatus generally inhabits dry sagebrush habitat which is sparsely grassed (Maser and Storm 1970:142). Only cranial material of this genus is readily distinguished from *Microtus* on osteological bases. The occlusal surface of the M^3 of *Lagurus* has a distinctive morphology (Maser and Storm 1970), and the location of the mandibular foramen is quite different for the two genera (Grayson 1984). *L. curtatus* is probably present in this assemblage as a result of natural processes.

Microtus sp. (meadow mouse) -- 1 element.

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 recovered could be assigned to species. There is no evidence that this genus is present because of cultural process.

Peromyscus maniculatus (deer mouse) -- 3 elements.

Peromyscus maniculatus is a resident of all habitat types in the project area.

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

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

Mustelidae (weasels, minks and allies) -- 1 element.

Taxidea taxus (badger) -- 1 elements.

Taxidea taxus is a powerful burrower and is found throughout eastern Washington, though not in large numbers. Badgers were regularly trapped by the Sanpoil and Nespelem (Ray 1932:85).

Canis sp. (wolf, coyotes and dogs) -- 2 elements.

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

Cervidae (deer, elk) -- 5 elements.

Odocoileus spp. -- 4 elements.

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

Elk-Sized (elk, cow and bison) -- 1 element.

The elements identified as *Odocoileus* sp. may represent one or both of the two species of deer known in the project area (*O. hemionus* and *O. virginianus*). The metapodial fragment identified as deer-sized lacked features that may be used to distinguish deer, sheep and antelope. It could represent any one of these three taxa. None of the non-artifactual cervid elements displayed evidence of human use such as butchering marks or burning.

AMPHIBIA (NISP=459)

Ranidae/Bufonidae (frogs, toads) -- 1 element.

Both frogs and toads inhabit the project area (Stebbins 1966). Inadequate comparative material precluded assigning these elements to family.

REPTILIA (NISP=22)

Chrysemys picta (painted turtle) -- 22 elements.

C. picta is the only turtle currently living in the project area. Clemmys marmorata (western pond 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 distribution, all turtle remains have been assigned tentatively to C. picta. The turtle shell in this assemblage is too fragmentary to determine whether it is carapace or plastron.

PISCES (NISP=14)

Salmonidae (salmon, trout, whitefish) -- 14 elements.

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

DISCUSSION

The vertebrate taxa identified from 45-DO-282 are representative of the fauna expected in the project area. All taxa identified currently live in the project area. The assemblage is dominated by rodents, undoubtedly reflecting a natural accumulation of bones in this site. Most elements appear recent and intrusive, consequently, shifting abundances across zones probably reflect more about differences in burrowing behavior among species than environmental or cultural conditions in the past. The relative abundance of Thomomys talpoides increases with depth as the abundances of Perognathus parvus and Lagurus curtatus decrease. Because T. talpoides generally prefers more mesic conditions than either P. parvus or L. curtatus, greater abundances of T. talpoides in deeper deposits might indicate more mesic conditions in the past. However, T. talpodies can burrow to 1.5 m (Szuter 1983:3), while P. parvus and

L. curtatus make burrows that are from 10-45 cm deep (Ingles 1965:291; see Szuter 1982). The uniform, recent appearance of most rodent elements in this assemblage supports the suggestion that shifting relative abundances of rodent taxa in this site are a function of differential burrowing ability among different species of rodents taxa.

Only nine identified elements appear to have been burned: one fragment of turtle shell from Zone 1, two salmonid vertebrae from Zone 3, and five antler fragments from Zone 25. The antler artifacts are discussed in Chapter 3. No evidence of butchering was observed on any of the identified elements. The small number of elements that may have been culturally deposited preclude making inferences from the fauna about subsistence or faunal utilization at this site.

5. FEATURES ANALYSIS

Twelve of the thirteen cultural features recorded at 45-DO-282 are arbitrary excavation levels which were designated in their entirety as features because they contained concentrations of basalt, and occasionally granite, rocks in association with high counts of lithic artifacts and debitage. The thirteenth cultural feature consists of two pestles, one of basalt and one of granite, which were found together.

The rock concentration features found in Zones 2, 3, and 4 represent use of natural basalt cobble concentrations for stone tool manufacture and repair. However, there is considerable variety of distribution of basalt among the features. Feature 4, a tight cluster of a few rocks (Plate 5-1), is a firepit. Feature 7 (Plate 5-3) is an amorphous scatter of basalt which contained a chipping station. Feature 5 (93N260E, Level 120) contained no cultural material, and is evidence of the natural occurrence of these scatters (Plate 5-2). Although the cultural materials appear to be primary deposits, the source and depositional history of the basalt is unclear. The basalt, which is largely angular, may have been transported from the outcrops to the south during the formation of the alluvial fan. In no case are the concentrations very dense; in some units (which were not featured), less than six basalt rocks were recorded.

The thirteen cultural features are described briefly below by analytic zone. They occur in three of the fire zones. No cultural features or basalt concentrations were found in Zone 1 and Features were not recorded in the beach collection (Zone 25). Figures 5-1 and 5-2 show the distribution of features in each area of the site. Table 5-1 lists the provenience of the features, while Table 5-2 shows the lithics associated with each. The material types of the lithic objects are shown in Table 5-3. There is no separate table for bone or shell; aside from three salmon vertebrae (one in Feature 11, two in Feature 13), fish teeth (in Feature 11), and two pieces of shell (in Feature 12), only rodent bone was recovered from the feature levels.

ZONE 4

Features 3 and 4 in Area A are assigned to Zone 4, the lowest at the site. Zone 4 encompasses the strata of DU II, primarily coarse, gravel-bearing strata which are part of the alluvial fan. Feature 3 is a scatter of basalt, granite and river cobbles near the present-day beach. Cultural material is limited compared to the features of Zone 3; the feature designation is based primarily on the occurrence of basalt. Feature 4 is probably a firepit: even though the associated basalt rocks shows no signs of

Plate 5-1. Feature 4, Zone 4, Area A, 45-DO-282.

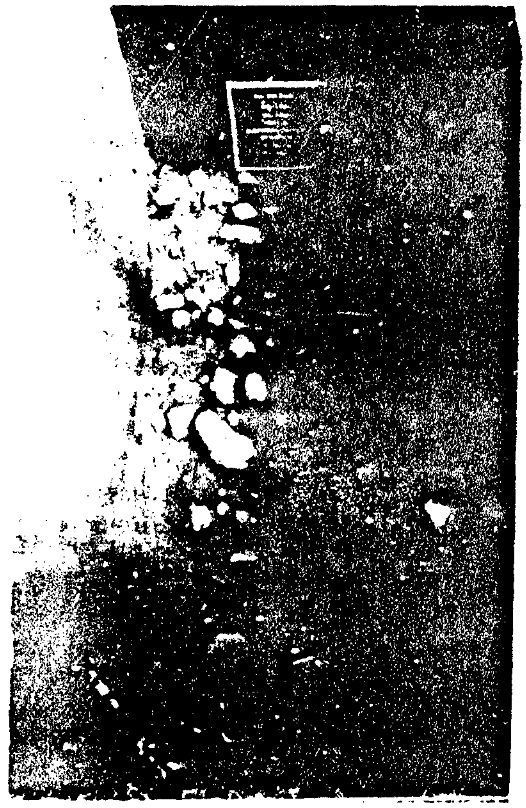


Plate 5-2. Feature 5 (noncultural), Zone 4, Area A, 45-DO-282.

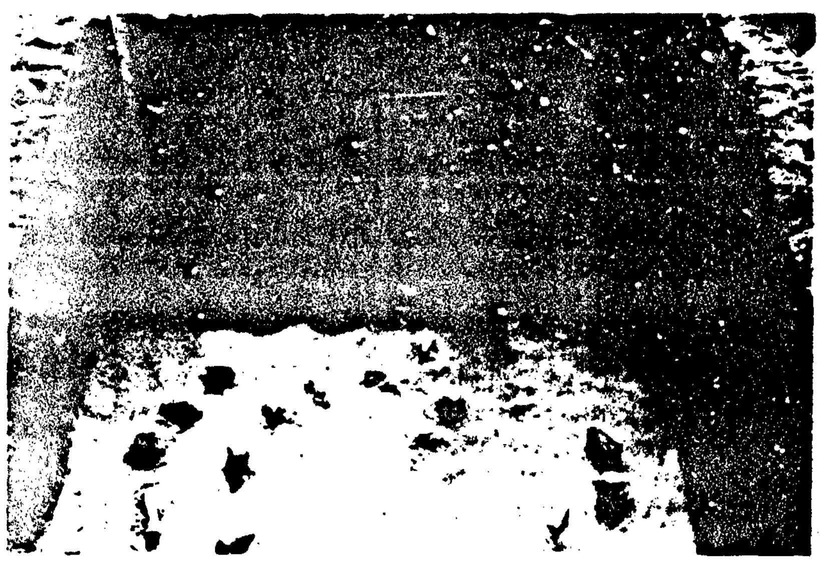


Plate 5-3. Feature 7, Zone 3, Area B, 45-DO-282.

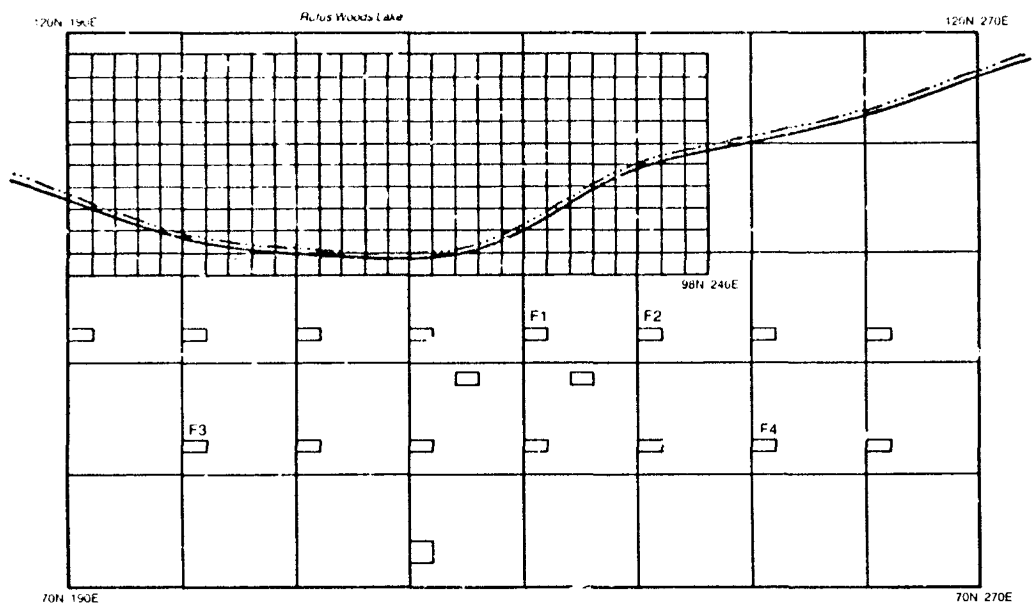


Figure 5-1. Location of features in Area A, 45-DO-282.

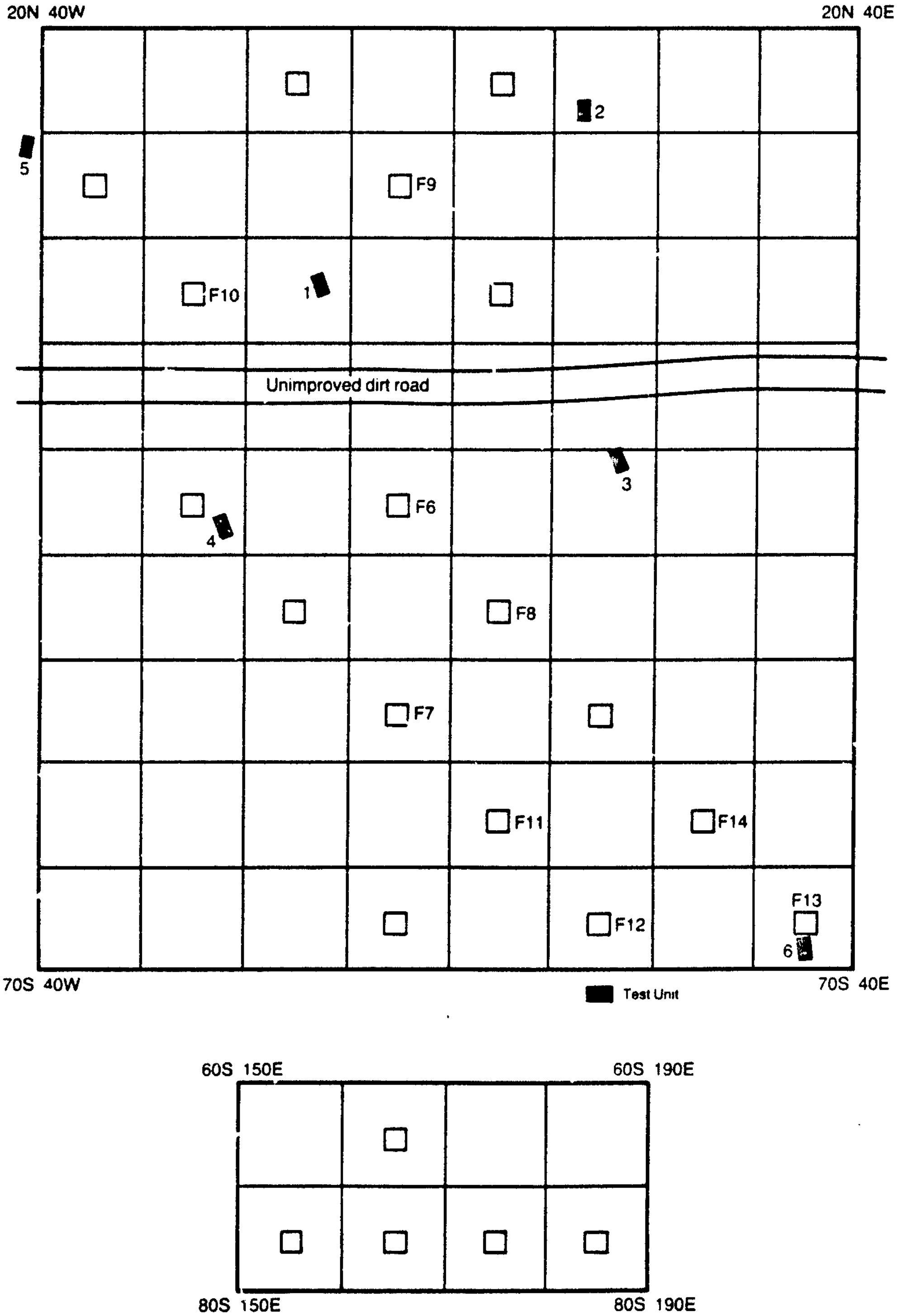


Figure 5-2. Location of features in Areas B and C, 45-DO-282.

Table 5-1. Provenience of features, 45-DO-282.

Area	Zone	Feature	Provenience	Unit size	Level
A	3	1	93N230E	1x2	70-100
		2	93N240E	1x2	80
	4	3	83N200E	1x2	130-140
		4	83N250E	1x2	110-150
B	2	6	25S5W	1x1	40
		9	6N6W	2x2	40-60
		10	4S26W	2x2	50
	3	7	44S6W	2x2	60-90
		8	34S4E	2x2	80
		11	54S4E	2x2	80-100
		12	64S14E	2x2	100-110
		13	64S34E	2x2	100
		14	54S24E	2x2	100-110
			54S24E	1x1	120

Table 5-2. Provenience of artifacts by feature, 45-DO-282.

Artifact type	Feature													Total
	1	2	3	4	6	7	8	9	10	11	12	13	14	
Biface	-	-	-	-	-	2	-	2	-	1	-	1	3	9
Projectile point	-	-	-	-	-	-	-	-	-	-	-	1	-	1
Point fragment	-	-	-	-	-	-	-	-	-	-	-	-	1	1
Scraper	-	-	-	-	-	-	1	1	-	-	-	-	-	2
Graver	-	-	-	-	-	-	-	-	-	-	1	-	-	1
Core	-	-	-	-	-	-	-	1	-	2	1	1	-	5
Blade	-	-	-	-	-	-	-	-	-	1	-	-	-	1
Microblade	-	-	-	-	-	7	-	3	-	6	2	2	2	22
Burin	-	-	-	-	-	1	-	-	-	-	-	-	-	1
Unifacially retouched flake	-	-	-	-	-	1	-	1	-	2	-	1	1	6
Bifacially retouched flake	1	-	-	-	-	1	-	1	-	1	-	-	-	4
Utilized flake	-	-	1	1	-	7	2	7	1	18	3	-	8	48
Chopper	-	-	-	-	-	-	-	-	-	-	-	-	2	2
Hammerstone	-	-	-	-	-	1	-	-	-	1	-	-	-	2
Pestle	-	-	-	-	2	-	-	-	-	-	-	-	-	2
Debitage	27	11	26	4	-	652	87	185	33	677	286	200	374	2,562
TOTAL	28	11	27	5	2	672	90	[illegible]	34	709	293	206	3[illegible]1	2,669

Table 5-3. Lithic artifacts and debitage by material type, 45-DO-282.

Material	Feature													Total
	1	2	3	4	6	7	8	9	10	11	12	13	14	
Jasper	11	1	14	3	–	384	53	115	14	420	123	89	202	1,430
Chalcedony	13	9	12	2	–	282	36	81	17	277	168	107	185	1,189
Petrified wood	–	–	–	–	–	–	–	1	–	–	–	1	–	2
Obsidian	–	–	–	–	–	–	–	–	1	2	1	1	–	5
Opal	1	–	1	–	–	–	–	–	–	–	–	–	–	2
Fine-grained quartzite	–	–	–	–	–	–	–	2	–	–	–	–	–	2
Basalt	3	–	–	–	1	6	1	–	–	10	–	8	3	32
Fine-grained basalt	–	–	–	–	–	–	–	1	–	–	1	–	1	3
Argillite	–	1	–	–	–	–	–	–	1	1	–	–	–	3
Granite	–	–	–	–	1	–	–	–	–	–	–	–	–	1
TOTAL	28	11	27	5	2	672	90	201	34	709	293	206	391	2,669

fire-modification, they are tightly clustered and contain a few pieces of charcoal and charcoal flecks. Very little material occurred with the firepit.

ZONE 3

Zone 3 contains eight cultural features; again, all eight occur with basalt rock/river cobble scatters. Features 1 and 2, in Area A, may be secondary cultural deposits; river cobbles, basalt erratic fragments and spalls, and a matrix of silty sand may indicate erosional activity in this area of the site. Material counts for Features 1 and 2 are very low compared to Zone 3 features in Area B (an average of 7 artifacts per unit level in Feature 1 versus, e.g., 224 per unit level in Feature 7).

Features 7, 8, 11, 12, 13 and 14 all occur in the south half of Area B (Figure 5-2). Each is marked by a dense scatter of rounded and angular basalt, and river cobbles. Ocher and some charcoal occurs through the feature levels, indicating that some of the featured levels may have contained firepits. A large number of tools and associated debitage in these features suggests they result from primary cultural activity on a basalt-strewn surface. The overbank deposits which characterize this zone have apparently caused minimal disturbance of the features in Area B.

Stone tool manufacture is indicated in the field notes by a "pile of flakes" of the same material (44S5W, Level 70, Feature 7), and a possible "knapper's station" in Feature 11 (Level 100). As Table 5-4 shows, twenty percent of the analyzed lithics from Feature 11 have partial cortex. This is very high compared to the number of specimens with partial cortex in other features. The features from Zone 3, Area B, offer the best possibility for the study of lithic technology as they appear to represent manufacturing activity on a single surface.

ZONE 2

Three features are recorded in Zone 2; all are in Area B. Feature 6 is a content feature consisting of two pestles (illustrated in Plate 3-6). The basalt pestle is 21 cm long and 6.5 cm thick; it has smooth sides and is battered on one end. The granite pestle, 22 x 7.5 cm, has smooth sides and both ends battered. The two pestles were not associated with basalt rock concentrations.

Features 9 and 10 are basalt strata exposed in two excavation units in the north half of Area B. They were vertically separated from the basalt concentrations in the south half by 20-30 cm in which no basalt features occurred. Feature 9 was defined after excavation because of its similarity with Features 7 and 8 (Zone 3, Area B). Feature 10 consists of two distinct layers of basalt (43-45 cm b.u.d., and 50-55 cm b.u.d.) in a sandy silt matrix. This is the only case of directly observable superposition of basalt features at 45-DO-282. From the number of artifacts recovered, especially the large number of tools in Feature 9, we believe these features to be primary cultural deposits.

Table 5-4. Dorsal typography of lithic materials by feature, 45-DO-282[1].

Feature	Material	No cortex	Partial cortex	Full cortex	Unknown[2]
1	Jasper	6	-	-	5
	Chalcedony	5	1	-	6
	Opal	1	-	-	-
	Basalt	1	2	-	-
2	Jasper	1	-	-	-
	Chalcedony	5	-	-	4
	Argillite	1	-	-	-
3	Jasper	6	-	-	3
	Chalcedony	5	-	-	7
	Opal	1	-	-	-
4	Jasper	-	-	-	2
	Chalcedony	-	-	-	2
7	Jasper	81	3	-	164
	Chalcedony	88	-	-	133
	Basalt	1	-	-	5
8	Jasper	10	4	-	22
	Chalcedony	14	-	-	22
	Basalt	-	-	-	1
9	Jasper	23	2	-	88
	Chalcedony	13	1	-	37
	Petrified wood	-	-	-	1
	Obsidian	-	-	-	1
	Fine-grained quartzite	-	-	-	2
	Fine-grained basalt	1	-	-	-
10	Jasper	2	-	-	12
	Chalcedony	2	-	-	14
	Obsidian	-	-	-	2
	Argillite	-	-	-	1
11	Jasper	64	33	-	118
	Chalcedony	78	3	-	89
	Obsidian	1	-	-	-
	Basalt	4	-	-	2
	Argillite	1	-	-	-
12	Jasper	24	1	-	75
	Chalcedony	28	2	-	65
	Fine-grained basalt	-	-	-	1
	Obsidian	-	-	-	1
13	Jasper	18	-	-	70
	Chalcedony	30	-	-	78
	Basalt	2	1	-	5
	Petrified wood	-	-	-	1
14	Jasper	66	3	-	86
	Chalcedony	58	-	-	74
	Fine-grained basalt	1	-	-	-

[1] < 1/4 in flakes excluded.

[2] Only a sample of the lithic material from 45-DO-282 received full technological analysis. Therefore, for much of this material, the dorsal topography is "unknown".

CONCLUSIONS

The features at 45-DO-282 supplement our knowledge of the well-documented stone tool production activities at the site, but do not give any indication of other types of activities. The reasons for the co-occurrence of rock and artifacts documented by these features are unclear, especially since, in some instances, basalt scatters occurred without cultural material (e.g., Feature 5) and cultural material occurred without rock scatters (e.g., Feature 6). Since lithic chipping stations have been identified in at least two features, we might speculate that the basalt strata also contained raw material, perhaps jasper nodules, needed for stone tool production. Alternatively, the basalt itself may have been used in firepits in some stages of that production. Given the tenuous evidence for both possibilities, either may be correct.

It is important to remember that these features were arbitrarily bounded by excavation units. Distinct horizontal boundaries occurred in only a few cases (eg. Feature 4). These features are probably but small portions of larger activity areas on deflated basalt-strewn surfaces.

6. SYNTHESIS

45-DO-282 was a frequently used short-term activity site throughout much of the 3,000 year span of the defined Kartar Phase (ca. 7000-4000 B.P.) A large collection of knapping debris and stone tools indicate that a primary activity over that period was the reduction of imported jasper and chalcedony into a broad range of hunting-butchering-processing tool forms. Other site activities are preserved in the recovery of two stone pestles, indicative of some limited plant processing, and a very meager assemblage of ungulate bone, documenting the hunting of deer and elk. We base our dating of site deposits solely on the distribution of diagnostic projectile point types. The earliest occupation is marked by Cold Springs Side-notched points; later occupations by Cascade and Mahkin Shouldered points; and the final occupation by two Cascade varieties, Mahkin Shouldered and Nespelem Bar points. This succession of point styles in the Rufus Woods Lake project area characterizes the early to late Kartar Phase, and the association of typical Cascade projectile points with Mahkin Shouldered and Nespelem Bar points in the latest cultural level definitely places the end of site use prior to 4000 B.P., at the end of the Kartar Phase, and before the Hudnut Phase.

Excavation did not reveal any definable activity surfaces, nor any intact, bounded cultural features. Therefore, we have considered artifactual relationships primarily at the level of analytic zone. These stratigraphic divisions roughly match the identified geologic units of deposition, and appear to be temporally reliable, since diagnostic artifact distributions and associations of artifacts within the zones seem to retain integrity. Erosion in the active depositional environment of the alluvial fan led to deflation of surfaces, removing lighter artifacts such as bone and charcoal, if not actually redepositing heavier lithics. However, clusters of artifacts associated with exposed cobble surfaces within the zones do represent associations which we can assume to be in primary context. The lack of patterning in these areas suggests that cultural deposits are the result of frequent, short-term activities over time, and not the result of a few long-term occupations associated with the establishment of a base camp or living site. It is doubtful that 45-DO-282 ever represented anything more than a recurrent stopover, where hunting parties or task groups refurbished tool kits and cooked meals in preparation for the next day's travel.

Site 45-DO-282 is located on an extensive alluvial fan. The lowest cultural stratum lies on a coarse matrix of decomposing granite laid down either from bedrock weathering _in situ_ or as alluvium from bedrock weathering upslope. During these initial occupations, this alluvial wash appears to have been deposited by slowly moving water. At the same time that the western portion of the site was being covered by slope wash from the bedrock behind the site, that part of the site nearer the river was receiving overbank deposition. Although the energy level for these geologic processes may have been relatively low, the earliest cultural deposits exhibit marked erosional disturbance (Zones 4 and 3). The uppermost deposits (Zones 2 and 1) are largely aeolian, and greater stability of the surface is indicated by the formation of A and B soil horizons. These uppermost zones were, however, subject to other forms of disturbance, such as seasonal flooding and historic plowing. Indeed, some site activity is best preserved in the beach collection, which constitutes secondary cultural associations on a broad erosional surface. As a consequence of repeated disturbances of site deposits over time, few primary artifact associations have been preserved, although the varying rates of alluvial deposition did provide marked temporal boundaries for constituent artifact assemblages.

Thirteen cultural features were defined during excavation of this site. All but one are arbitrary excavation levels identified as concentrations of basalt and granite cobbles in association with high counts of lithic artifacts and debris. The single exception is a content feature consisting of the two pestles. Artifacts in direct association with these cobble lenses appear to be primary cultural associations since the assemblages do contain a high proportion of formed tools and high densities of associated worn objects and debris. The cobbles may have acted as buffers to erosion, sealing the artifacts in loose association. The cobble surfaces themselves appear to be natural accumulations, although one may be the eroded remains of a fire hearth.

ZONE 4

The two features in Zone 4 are concentrations of basalt and granite river cobbles defined in excavation units near the present beach. Associated artifact counts were not high compared to distributions elsewhere in the zone; and, as a whole, Zone 4 produced the lowest artifact totals at the site. Functional object types consisted principally of utilized flakes and linear flakes, although a broad range of functional tool types were also present. The bulk of the assemblage consisted of a debitage of primary and secondary flakes. The recovery of four Cold Springs Side-notched projectile points, without any other diagnostic point types, suggests this zone dates to the early to mid-Kartar Phase (pre-6000 B.P.).

ZONE 3

The six cultural features defined in Zone 3 together constitute a single basalt and granite cobble layer which contained a high proportion of formed tools and the highest density of artifacts in this zone. Among the tools associated with this layer were bifaces, microblades, retouched and utilized flakes, and choppers. Here as well excavators uncovered a "knapper's station" and a "pile of flakes." These two features (Feature 7 and Feature 11) produced 53% of the debitage and functional object types recovered from the cobble layer. Their association seems to indicate a primary cultural context preserved within the cobbles. Two lithic industries are in evidence: a generalized flake tool industry based upon the production of lamellar flakes from roughly prepared cores and a microblade industry, in which small blades were removed from delicate, carefully prepared wedge-shaped cores. Two Cascade A projectile points were recovered from this lens in direct association with two microblades. Their occurrence in Zone 3, above the Cold Springs Side-notched points recovered from Zo... 4, place these activities in the mid- to late part of the Kartar Phase, perhaps 6000-5000 B.P.

ZONE 2

Zone 2 contained two features within a cobble stratum much like those identified in Zones 3 and 4, and a single content feature of two pestles. This cobble layer did not yield high counts of artifacts, though it did contain a variety of functional object types and utilized flakes. The pestles were found in an isolated context, with no other associated artifacts. Among the projectile points recovered from Zone 2 were several stem fragments probably of shouldered lanceolate forms, and several basal fragments of unstemmed lanceolate forms. These probably correspond to Mahkin Shouldered and Cascade A projectile point types, and indicate a date in the latter part of the Kartar Phase (ca. 5000-4000 B.P.)

ZONE 1

Zone 1, the upper portion of the site deposit, contained no recognizable cultural features. Artifact counts were comparable to those of Zone 2, although no core was recovered from this zone (the only one that lacked a core). In general, historic activites--especially plowing--had greatly disturbed this layer. Recovered projectile points include Cascade A, Cascade C, Mahkin Shouldered, and Nespelem Bar, which in association, indicate activities in the late Kartar Phase (ca. 5000-4000 B.P.).

THE BEACH COLLECTION (ZONE 25)

The dense artifact scatter located just north of Area A betw... two large basalt erratics was thought to represent an <u>in situ</u> occupation s... face only recently exposed by wave action. The area was surface collected within 1 x 1-m grid units. Artifact densities were higher than in any other area of the site, but analysis revealed no apparent patterning in artifact locations. The lack of patterning and the occurrence of projectile point types characteristic of the entire Kartar Phase (ca. 7000-4000 B.P.), and a single point characteristic of the Coyote Creek Phase (ca. 2000-200 B.P.), indicate that this area is an eroded remnant surface comparable in age to all four excavated zones. Artifact counts were compared with those from excavated site deposits, since proportions of object and tool types could reveal site activities not represented in the zones further away from the river. The collection was found to include important additions to the total artifact inventory, such as tabular knives, projectile points, bifaces, scrapers and fire-modified rocks. The collection adds to our knowledge of site activities: hunting and butchering were done at the site, perhaps more frequently nearer the river margin; firepits were present suggesting short-term camps; and shellfish fragments (not collected) evidence use of the nearby river mussel beds for food. We conclude that a major portion of the site was nearer the river, and here many of the everyday living activities may have taken place. This segment of the prehistoric record, however, was eroded away by the rising water of Rufus Woods Lake.

DISCUSSION

The distributions of artifact types and the nature of artifact associations appear remarkably uniform across the four excavated zones. The manufacture of stone tools, usually from jasper and chalcedony, is the prevalent activity. These represent a range of tool forms from simple utilized flakes to carefully finished projectile points and drills, and range in size from microblades to large, blocky cobble choppers. Wear patterns on tool forms are also comparable in all zones, and indicate considerable tool use on the site as well as manufacture. Most wear is consonant with use on soft, pliable materials such as hides, meat, or woody plant parts. All site occupations appear to have occurred during the Kartar Phase (ca. 7000-4000 B.P.), with diagnostic projectile point types indicative of that entire span of time. The only indication of later occupation is the recovery of the single Columbia Corner-notched B projectile point from the beach.

Technological analysis of the artifact collection reveals a multi-faceted, complex reductive strategy focused on the production of a wide range of tool forms primarily from cryptocrystalline stones. At least three industries are present: a generalized flake tool technology, in which lamellar flakes were removed from unprepared and/or prepared cores; a Levallois-like blade industry based on the removal of large blades by percussion from carefully prepared cores; and a microblade industry, in which tiny blades were removed from carefully prepared, small wedge-shaped cores. All three industries are in evidence in the earliest levels of the site and continue on into the latest site occupation.

The occurrence of the generalized flake tool industry coupled with a blade tool industry in the Kartar Phase (ca. 7000-4000 B.P.) in this project area has correlates in sites 45-DO-273 (Jaehnig 1984a) and 45-OK-11 (Lohse 1984f). The two are generally considered complementary facets of stone tool technology during the Cascade Phase (8000-4000 B.P.) on the Columbia Plateau (cf. Leonhardy and Rice 1970; Rice 1972; Bense 1972). Their occurrence at 45-DO-282 in cultural contexts dated at ca. 7000-4000 B.P. is, therefore, not surprising, but two points are worthy of note. First, the overwhelming evidence indicates a far greater emphasis on the generalized flake tool technology. The only evidence for blade production is two large, Levallois-like blades, and a number of projectile points and other tool forms that appear to have been made on blades. No blade cores were recovered, nor were any hallmarks ot blade core preparation identified (cf. Muto 1976). All non-microblade cores are flake cores, most showing little or no preparation, and, in fact, many had been used as choppers or hammers before they were exhausted. The great majority of tool forms were made on conchoidal flakes. Second, a microblade industry is also associated with the generalized flake tool and blade industries. While we lack radiocarbon assays at 45-DO-282, diagnostic projectile points clearly document the microblade industry at ca. 7000-4000 B.P. Thus the assemblage from 45-DO-282 documents the regular use of three industries to produce flake tools, blake tools, and microblade tools during the period from 7000 to 4000 B.P. in the northern Columbia Plateau. This is coeval with the radiocarbon-dated assemblage from Ryegrass Coulee (Munsell 1968), and slightly later than the earliest dated occurrence of microblades on the Canadian Plateau, Drynoch Slide at ca. 7500 B.P. (Sanger 1968, 1970).

The microblade technology at 45-DO-282 in so early a period, may well represent a variant of the defined microblade industry characteristic of the northern Columbia Pateau. By Sangers' (1968, 1970) criteria, the linear flakes recovered from this site are microblades. However, after Sanger examined these blades he declared that they are distinct from those characterized within the "Plateau Microblade Tradition" (Sanger, personal communication 1982). For Sanger, who focuses primarily on identification of a cultural tradition and the tracing of cultural relationships, formal characteristics determine an artifact's designation as a microblade. However, the microblades taken from this site consistently exhibit the required morphological (length, width, parallelism) and technological (core preparation, successive blade removal) characteristics. Well over 50% of the microblade specimens are non-triangular in cross section, exhibiting two or more arrises. The associated cores range from an ideal type specimen collected from the Zone 25 beach collection to several problematic examples recovered in excavated contexts, which, although wedge-shaped with a pronounced keel, exhibit less uniform blade scars.

Although these microblades and microblade cores may not fall readily within the idealized types considered characteristic of the Plateau Microblade Tradition, they are undoubtedly products of that specialized technique or a closely related technique. Small linear flakes or microblades have been recovered in Cascade Phase contexts elsewhere on the Columbia Plateau (cf. Butler 1961; Dumond 1962; Leonhardy and Rice 1970; Bense 1972), but without the characteristic microblade cores and in much smaller numbers than those recovered from 45-DO-282. An important characteristic of this industry, which may distinguish it from the more uniform Plateau Microblade Tradition, is the presence of multiple striking platforms on the microblade cores, a characteristic which is rare in most microblade collections on the Columbia Plateau (Sanger 1970). This might account for the lack of uniformity in the cores and the more variable blade morphology. Thus, while they may not represent ideal specimens, they nevertheless must be considered microblades, and might be considered a variant of the idealized reduction sequence, a variant which is unusually well-represented in this site and in others in the Rufus Woods Lake project area.

Flake and blade tool forms show comparable patterns of wear--usually feathered and hinged chipping confined to a unifacial edge--, which indicates tool use on soft, pliable, and hard to elastic materials such as hides, meat and bone. The range of tool types recovered includes a preponderance of simple utilized flakes, a number of resharpened and retouched flakes, scrapers, bifaces, and a small assortment of burins, gravers, and drills, as well as numerous hammerstones and choppers. Although the use of the site was oriented toward stone tool manufacture, hunting, butchering, and attendant processing of game were also significant activities. Instances of multiple wear areas on single tool forms, and heavy attrition of working edges often entailing overlapping but distinct patterns of wear, as well as the high number of tools recovered, indicate intense activity. We cannot specify the size of prehistoric task groups, nor the duration and frequency of their visits, but we can speculate that activity was probably very short-term. We base this inference on the lack of recognizable patterning in the artifact assemblage and absence of bounded activity surfaces or cultural features. Thus, the high number of tools and loose artifact associations are likely the product of many visits over the indicated 3,000 years of site use.

Economic activity probably focused on hunting of large and small game; although the faunal assemblage is sparse, identified ungulate bone evidences the taking of deer and elk. Shellfish fragments in the beach collection attest to use of nearby shellfish beds as well. The only evidence for plant collection is the two pestles recovered in direct association in Zone 2. The cultural remains are probably the product of recurrent campsites or stopovers, most likely involving small task groups, where jasper and chalcedony nodules or blanks collected elsewhere were routinely reduced into tools, and where meals of game, shellfish, and seeds or roots were processed and consumed. The virtual lack of firepits might indicate little overnight camping; however, the disturbance of cultural deposits throughout the site may have removed evidence of fires.

Interpretation of the nature of site activities and the organization of these across the site surface is difficult given active erosion of the site surface throughout much of the span of site occupation. It seems that the site deposits were repeatedly scoured by slope wash from the bedrock formations behind the site, and ephemeral stream channels which swept across the coarse, sandy surface deposits. Rodents have also disturbed the site, but this cannot account for the lack of patterning exhibited by the site deposits. It may be that most of the cultural deposits are secondary accumulations of material, and that only in those areas of distinct cobble layers, perhaps remnant natural surfaces, are cultural remains preserved in something like a primary context. If this is true, it is especially important that a form of site stratigraphy is intact--the stratigraphic-temporal distribution of diagnostic artifact types and occasional loose associations of artifacts within the defined depositional units and analytic zones. Association appears to be sound at a gross level: cultural context is preserved within the broad boundaries of the analytic zones. However, more detailed interpretations are difficult. A lack of distinct patterning in artifacts, and, thus, of definable cultural features, largely precludes assessments of group size or duration of activity. The lack of bone or other faunal remains means we cannot determine seasonality or the intensity of use of specific resources.

In terms of the cultural record of the Rufus Woods Lake project area, and perhaps for that of the northern Columbia Plateau as a whole, this site's importance lies in its large and varied artifact assemblage. This assemblage is indicative of at least three distinct processes of stone tool manufacture: a generalized flake tool technology, a Levallois-like blade technology, and a microblade technology. All three industries were evidently complementary facets of a single stone tool technology.

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APPENDIX A

RESULTS OF SOIL ANALYSES, 45-DO-282

Table A-1. Results of physical and chemical soil analysis, Column 1, 45-DO-282.

Sample No.	cm Below Surface	Munsell Color (dry)	Physical Analyses: Particle Size: Sand/Silt/Clay (%)	Physical Analyses: Constituents: Charcoal (%)	Ash (%)	Bone (%)	Shell (%)	Organic Matter (%)	Minerals (%)	Chemical Analyses: pH	Organic Matter (%)	Exchangeable Calcium (ppm)	Phosphate (ppm)
1	0-5	10YR(4/2)	72/23/5	trace	-	trace	-	7	92+	8.15	1.5	3820	79.1
2	6-10	10YR(5/1)-10YR(5/2)	70/25/5	trace	-	-	-	2	97+	8.65	1.2	4060	80.5
3	14-24	10YR(4/2)	72/23/5	trace	-	-	-	trace	99+	8.43	trace	3605	74.9
4a	27-33	10YR(5/2)	70/27/3	trace	-	-	-	trace	99+	8.25	trace	3710	60.9
5	37-47	10YR(6/2)	72/25/3	trace	-	-	-	trace	99+	8.10	trace	3890	63.0
6	47-58	10YR(6/2)	77/20/3	trace	-	-	-	trace	99+	8.05	trace	3920	57.4
7	58-68	10YR(6/2)	77/18/5	trace	-	-	-	1	98+	7.70	-	3820	58.7
8	74-84	10YR(5/2)	75/20/5	trace	-	-	-	trace	99+	7.55	trace	3395	57.4
9	84-94	10YR(5/2)	72/20/8	-	-	-	-	trace	99+	7.75	-	3395	49.7
10	94-100	10YR(5/2)	70/25/5	-	-	-	-	trace	99+	7.80	trace	3500	44.1
11	103-113	10YR(7/2)	60/30/10	-	35[1]	trace	trace	trace	64+	7.70	trace	4270	-
12	113-123	10YR(7/2)	67/23/10	-	20[1]	-	-	trace	78+	7.60	-	4270	-
13	130-140	10YR(6/3)	85/10/5	-	3	-	-	trace	96+	7.75	-	4375	39.2
14	140-148	10YR(6/3)	87/10/3	-	-	-	-	trace	99+	7.80	-	4375	63.0

[1] Mazama

Table A-2. Results of physical and chemical soil analysis, Column 2, 45-DO-282.

Sample No.	cm Below Surface	Munsell Color (dry)	Physical Analyses: Particle Size: Sand/Silt/Clay (%)	Physical Analyses: Constituents: Charcoal (%)	Ash[1] (%)	Bone (%)	Shell (%)	Organic Matter (%)	Minerals (%)	Chemical Analyses: pH	Organic Matter (%)	Exchangeable Calcium (ppm)	Phosphate (ppm)
1	+3-0	10YR[5/3]	87/10/3	trace	-	-	-	1	98+	NA[2]	NA	1750	74.2
2	4-14	10YR[4/2]	82/15/3	trace	-	-	-	1	98+	NA	NA	945	74.2
3	19-29	10YR[5/2]	82/13/5	trace	trace	-	-	1	98+	NA	NA	2730	81.2
4	29-39	10YR[5/2]	80/15/5	-	trace	-	-	trace	95+	NA	NA	2875	77.0
5	45-55	10YR[6/2]	80/20/-	-	-	-	-	trace	99+	NA	NA	3045	78.3
6	55-65	10YR[6/2]	82/15/3	trrce	-	-	-	trace	99+	NA	NA	3185	68.6
7	65-72	10YR[6/2]	82/15/3	-	-	trace	-	trace	99+	NA	NA	3080	67.9
8	79-89	10YR[6/2]	85/12/3	-	-	-	-	trace	99+	NA	NA	3080	68.6
9	89-99	10YR[6/2]	85/12/3	-	-	-	-	trace	99+	NA	NA	3080	68.6
10	99-109	10YR[6/2]	85/12/3	-	-	trace	-	trace	99+	NA	NA	3060	73.5
11	109-119	10YR[6/2]	85/12/3		-	-	-	trace	99+	NA	NA	3010	72.1
12	119-129	10YR[6/2]	80/15/5	-	-	trace	-	trace	99+	NA	NA	2800	74.2
13	133-143	10YR[6/2]	85/12/3	trace	-	-	trace	trace	99+	NA	NA	3010	72.1
14	143-153	10YR[6/2]	85/12/3	-	-	-	-	trace	99+	NA	NA	3115	70.0
15	159-169	salt/pepper	85/12/3	-	-	trace	trace	trace	99+	NA	NA	3185	66.5
16	169-179	salt/pepper	87/13/-	-	-	trace	trace	trace	99+	NA	NA	3185	57.4
17	179-189	salt/pepper	90/10/-	-	-	-	-	trace	99+	NA	NA	3185	63.0
18	189-199	salt/pepper	82/18/-	-	trace	-	-	trace	99+	NA	NA	2835	66.5

[1]Possibly Mazama ash.
[2]Not measured.

Table A-3. Results of physical and chemical soil analysis, Column 3, 45-DO-282.

Sample No.	cm Below Surface	Munsell[1] Color (dry)	Physical Analyses: Particle Size: Sand/Silt/Clay (%)	Constituents: Charcoal (%)	Ash (%)	Bone (%)	Shell (%)	Organic Matter (%)	Minerals (%)	Chemical Analyses: pH	Organic Matter (%)	Exchangeable Calcium (ppm)	Phosphate (ppm)
1	0-10	NA[3]	80/17/3	trace	-	trace	-	1	98+	7.40	trace	2660	77.0
2	10-20	NA	75/20/5	trace	-	-	-	1	98+	7.40	trace	2380	77.0
3	28-38	NA	70/27/3	trace	-	-	-	trace	99+	7.70	-	2380	79.1
4	38-48	NA	70/27/3	-	trace	-	-	-	99+	7.65	trace	2520	79.1
5	50-60	NA	80/17/3	trace	-	trace	-	trace	99+	8.00	trace	3255	79.1
6	60-70	NA	70/25/5	trace	-	trace	trace	trace	99+	7.75	trace	3220	79.1
7	70-80	NA	72/25/3	-	-	trace	trace	trace	99+	7.70	trace	3255	79.1
8	87-97	NA	72/25/3	-	-	-	-	trace	99+	7.90	trace	3150	77.7
9	102-112	NA	77/18/5	trace	-	-	-	trace	99+	8.10	-	3255	77.7
10	120-130	NA	87/10/3	-	trace[2]	-	-	trace	99+	8.05	-	2380	77.0
11	130-140	NA	90/7/3	-	trace[2]	-	-	-	99+	8.15	-	1855	74.2

[1] Not measured.
[2] Possibly Mazama ash.
[3] Not measured.

Table A-4. Results of physical and chemical soil analysis, Column 4, 45-DO-282.

Sample No.	cm Below Surface	Munsell Color (dry)	Physical Analyses: Particle Size: Sand/Silt/Clay (%)	Constituents: Charcoal (%)	Ash (%)	Bone (%)	Shell (%)	Organic Matter (%)	Minerals (%)	Chemical Analyses: pH	Organic Matter (%)	Exchangeable Calcium (ppm)	Phosphate (ppm)
1	+13-+10	10YR(4/3)	87/10/3	trace	-	trace	-	4	85+	5.20	1.3	126	68.6
2	+7-+3	10YR(5/2)	85/12/3	-	-	-	-	2	98	6.50	trace	126	68.5
3	1-11	10YR(6/3)	80/20/-	trace	trace	trace	-	trace	99+	6.80	-	245	72.1
4	11-21	10YR(6/3)	82/18/-	trace	-	-	trace	trace	99+	6.95	-	-	72.1
5	21-27	10YR(6/3)	77/20/3	trace	-	-	-	trace	99+	6.65	-	490	72.1
6	32-42	10YR(5/2)	82/15/3	trace	trace[1]	-	-	trace	99+	6.85	-	294	74.9
7	42-52	10YR(5/2)	80/17/3	trace	-	-	-	trace	99+	6.90	-	567	74.2
8	57-67	10YR(5/3)	80/20/-	-	-	trace	-	trace	99+	6.95	-	294	73.5
9	75-85	10YR(5/2)	80/20/-	-	trace[1]	-	-	trace	99+	7.00	-	518	74.9
10	91-93	10YR(5/2)	77/23/-	-	trace[1]	-	-	trace	99+	6.30	-	1330	74.9
11	101-111	10YR(5/2)	60/35/5	trace	trace[1]	-	-	trace	99+	6.65	-	1750	77.0
12	111-116	10YR(5/2)	65/32/3	-	trace[1]	-	-	trace	99+	6.70	-	1925	77.7
13	121-128	10YR(5/2)	77/20/3	-	trace[1]	-	-	trace	99+	6.90	-	1750	79.8
14	134-144	10YR(5/2)	80/15/5	-	trace[1]	-	-	-	59+	7.20	-	2450	79.1
15	151-160	10YR(5/2)	90/7/3	-	-	-	-	-	100	7.30	-	756	77.7

[1] Possibly Mazama ash.

Table A-5. Results of physical and chemical soil analysis,Column 5,45-DO-282.

Sample No.	cm Below Surface	Munsell Color (dry)	Physical Analyses							Chemical Analyses			
			Particle Size	Constituents									
			Sand/Silt/Clay (%)	Charcoal (%)	Ash (%)	Bone (%)	Shell (%)	Organic Matter (%)	Minerals (%)	pH	Organic Matter (%)	Exchangeable Calcium (ppm)	Phosphate (ppm)
1	+10-0	10YR(3/2)	75/20/5	trace	trace	-	-	2	97+	6.80	trace	1750	78.4
2	2-8	10YR(4/3)	65/30/5	trace	-	trace	-	3	96+	7.00	trace	2380	78.4
3	10-20	10YR(3/3)	65/32/3	trace	trace	trace	-	2	97+	7.10	trace	2730	77.0
4	20-40	10YR(3/3)	65/30/5	trace	-	trace	-	1	98+	7.40	trace	2415	80.5
5	28-38	10YR(4/2)	65/32/3	-	-	trace	-	trace	99+	7.50	-	2520	79.1
6	43-53	10YR(5/3)	65/32/3	-	-	trace	trace	trace	99+	7.65	trace	2870	80.5
7	53-63	10YR(5/3)	67/28/5	-	-	trace	-	trace	99+	7.85	-	2695	79.1
8	63-73	10YR(5/3)	67/30/3	-	-	1	trace	trace	98+	7.70	trace	2800	79.1
9	73-83	10YR(5/3)	72/25/3	trace	-	trace	trace	trace	99+	8.00	trace	3080	81.9
10	83-89	10YR(5/3)	67/28/5	trace	-	trace	trace	trace	99+	7.90	trace	3045	78.4
11	95-105	10YR(5/2)	75/20/5	-	-	trace	trace	trace	69+	8.00	-	3185	80.5
12	112-122	10YR(7/1)	77/20/3	-	-	trace	-	trace	99+	8.25	-	3150	76.3
13	122-130	10YR(7/1)	77/20/3	-	-	-	-	trace	99+	8.30	-	2905	77.0

APPENDIX B

ARTIFACT ASSEMBLAGE, 45-DO-282

Table B-1. Object edge angle by artifact type and zone, 45-DO-282[1].

Functional type by zone	Edge angle (degrees) 6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45	46-50	51-55	56-60	61-65	66-70	71-75	76-80	81-85	86-90	91-95	>95	Surface	Misc.	Total
Projectile point																						
3	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1
25	-	-	-	-	1	-	1	2	1	0	1	2	-	-	-	-	-	-	-	-	-	8
Projectile point tip																						
1	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1
2	-	-	-	1	-	1	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	3
25	-	-	-	-	-	-	-	1	-	3	2	1	-	-	-	-	-	-	-	-	-	7
Biface																						
1	-	-	-	-	-	1	-	3	1	-	1	-	-	-	-	-	-	-	-	-	-	6
2	-	-	-	-	-	2	-	-	1	1	-	2	-	1	1	-	-	-	-	-	-	8
3	-	-	-	-	-	-	-	1	1	-	3	1	3	-	-	1	-	-	-	-	-	10
4	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1
25	-	-	-	-	2	5	-	1	4	7	7	5	1	1	-	-	-	-	-	-	-	33
Burin																						
1	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
2	-	-	2	-	-	-	-	-	-	-	-	1	-	-	1	-	-	-	-	-	-	4
3	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
4	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-	-	-	2
Chopper																						
3	-	-	-	-	-	-	-	1	-	-	-	-	1	-	-	-	-	-	-	-	-	2
25	-	-	-	-	-	-	-	1	1	1	1	4	-	3	-	1	-	-	-	-	-	12
Drill																						
2	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	1	-	2	5
3	-	-	-	1	1	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1	4
4	-	-	-	-	-	-	-	-	-	1	-	-	-	-	1	-	-	-	-	-	-	2
25	-	-	1	1	-	-	-	-	-	3	-	-	-	-	1	-	-	-	-	-	-	6
Graver																						
2	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1
3	-	-	-	-	-	-	-	2	1	2	-	-	-	-	-	-	-	-	-	-	-	5
Pestle																						
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	3
Scraper																						
1	-	-	-	1	-	-	-	-	-	1	-	1	-	2	3	-	-	-	-	-	-	8
2	-	-	-	-	-	-	1	-	1	2	-	2	1	1	-	-	-	-	-	-	-	8
3	-	-	-	1	1	2	1	3	1	1	3	2	2	-	-	-	-	-	1	-	-	18
4	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
25	-	-	2	-	2	2	2	-	2	6	7	6	2	3	1	-	-	1	1	-	-	37
Tabular knife																						
25	-	-	-	-	-	1	1	1	-	2	-	3	1	-	-	-	-	-	-	-	-	9
Hammerstone																						
3	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	11	-	12
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	4
25	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1	10	-	12
Blade																						
3	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
Microblade																						
1	-	1	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	2
2	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
3	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
25	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
Core																						
1	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1
2	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1
25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1

Table B-1. Cont'd.

Functional type by zone	6 10	11 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 80	81 85	86 90	91 95	>95	Surface	Misc.	Total
	Edge angle (degrees)																					
Resharpening flake																						
1	-	-	-	-	-	-	-	-	1	2	-	3	-	1	-	-	-	-	-	-	-	7
2	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	2
3	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	1
4	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1
25	-	-	-	-	-	-	-	-	-	-	3	1	-	-	-	-	-	-	-	-	-	4
Bifacially retouched flake																						
1	-	-	-	-	-	1	2	1	2	-	2	-	-	-	-	-	-	-	-	-	-	8
2	-	-	-	-	-	-	-	-	2	2	-	1	-	-	1	-	-	-	-	-	-	6
3	-	-	3	-	-	-	2	-	4	2	1	-	-	-	-	-	-	-	-	-	-	12
25	-	-	-	1	-	-	-	1	-	-	2	1	2	1	-	-	-	-	-	-	-	8
Unifacially retouched flake																						
1	-	-	1	-	-	-	-	-	1	-	4	-	1	-	1	-	-	-	-	-	-	8
2	-	-	1	1	1	1	-	2	2	3	4	1	2	1	1	1	-	-	-	-	-	21
3	-	-	-	-	1	1	-	2	1	-	2	2	3	-	1	-	-	-	-	-	-	13
4	-	-	2	1	1	1	1	3	1	-	-	-	1	-	1	-	-	-	-	-	-	14
25	-	-	-	-	1	1	-	1	3	2	2	8	2	1	-	1	-	-	-	-	-	22
Utilization only																						
1	6	12	21	20	20	8	14	3	11	3	6	2	5	1	-	-	-	1	-	-	-	136
2	1	3	24	19	10	17	9	8	3	12	9	3	2	2	-	1	-	-	-	-	-	120
3	8	15	40	25	32	13	27	18	3	12	8	8	5	2	1	1	1	-	-	-	-	227
4	1	7	9	3	6	7	5	7	3	3	2	4	-	1	4	-	-	-	-	-	-	62
25	8	18	41	33	19	18	24	25	18	19	4	8	2	5	1	3	-	-	-	-	-	241
Subtotals																						
1	6	13	22	21	20	8	17	13	18	8	11	8	8	4	4	-	-	1	-	-	-	178
2	1	4	28	21	11	21	12	9	10	21	13	10	8	6	4	2	-	-	1	3	2	184
3	8	15	51	29	35	17	31	26	12	17	17	14	15	3	2	2	1	-	1	11	1	309
4	1	7	11	5	9	8	6	10	5	4	2	7	1	2	6	1	-	-	-	4	-	88
25	8	18	44	36	27	25	28	33	28	43	28	38	11	14	3	5	-	1	3	10	-	402
TOTALS	25	54	158	111	101	79	84	80	74	91	72	78	38	28	19	10	1	2	5	28	3	1,181

[1] Non-lithic materials deleted.

Table B-2. Distribution of tool types by zone, 45-DO-282.

Object type Kind of wear	Location of wear	Zone 1 Freq[1]	Zone 1 T%/A%[2]	Zone 2 Freq	Zone 2 T%/A%	Zone 3 Freq	Zone 3 T%/A%	Zone 4 Freq	Zone 4 T%/A%	Zone 25 Freq	Zone 25 T%/A%	Total Freq	Total T%/A%
Utilized flake		N=136		N=120		N=227		N=62		N=241		N=786	
Smoothing	Edge only	-	-	1	0.8/0.5	-	-	-	-	-	-	1	0.1/0.1
	Unifacial edge	3	2.2/1.7	5	4.2/2.7	6	2.6/1.9	-		1	0.4/0.2	15	1.9/1.3
	Bifacial edge	-	-	-		4	1.8/1.3	-		3	1.2/0.7	7	1.0/0.6
	Point only	-	-	-		1	0.4/0.3	-		1	0.4/0.2	2	0.2/0.2
Crushing	Unifacial edge	1	0.7/0.6	-		-		-		-	-	1	0.1/0.1
	Point only	-	-	-		-		-		1	0.4/0.2	1	0.1/0.1
Feathered chipping	Unifacial edge	83	88.3/52.2	75	62.5/40.8	155	68.3/50.2	44	71.0/50.0	155	64.3/38.5	522	68.4/45.0
	Bifacial edge	7	5.1/3.9	5	4.2/2.7	13	5.7/4.2	1	1.6/1.1	21	8.7/5.2	47	6.0/4.0
Hinged chipping	Unifacial edge	31	22.8/17.4	29	24.2/15.8	44	19.4/14.2	14	22.6/15.9	54	22.4/13.4	172	21.9/14.8
	Bifacial edge	1	0.7/0.6	5	4.2/2.7	4	1.8/1.3	3	4.8/3.4	4	1.6/1.0	17	2.2/1.5
	Point only	-		-	-	-		-		1	0.4/0.2	1	0.1/0.1
Unifacially retouched flake		N=8		N=21		N=13		N=14		N=22		N=78	
Smoothing	Unifacial edge	-	-	1	4.8/0.5	2	15.4/0.6	-	-	-	-	3	3.8/0.2
	Bifacial edge	-	-	-		1	8.0/0.3	-	-	-	-	1	1.3/0.1
	Point only	-	-	-		-		-		1	4.5/0.2	1	1.3/0.1
Feathered chipping	Unifacial edge	1	12.5/0.6	6	28.6/3.3	1	8.0/0.3	10	71.4/11.4	5	22.7/1.2	23	29.5/2.0
	Bifacial edge	-	-	-		1	8.0/0.3	-	-	1	4.5/0.2	2	2.6/0.2
	Point only	-	-	2	9.5/10.9	-		-		-	-	2	2.6/0.2
Hinged chipping	Unifacial edge	7	87.5/3.9	11	52.4/6.0	8	61.5/2.6	4	28.6/4.5	14	63.6/3.5	44	56.4/3.8
	Bifacial edge	-		1	4.8/0.5	-	-	-		-	-	1	1.3/0.1
	Point only	-	-	-		-	-	-		1	4.5/0.2	1	1.3/0.1
Bifacially retouched flake		N=8		N=6		N=12		N=0		N=8		N=34	
Smoothing	Edge only	-	-	1	16.7/0.5	-	-	-		-		1	2.9/0.1
	Unifacial edge	-	-	1	16.7/0.5	1	8.3/0.3	-	-	-	-	2	5.9/0.2
	Bifacial edge	1	12.5/0.8	1	16.7/0.5	-	-	-	-	2	25.0/0.5	4	11.8/0.3
	Point only	1	12.5/0.8	-	-	-	-	-	-	-	-	1	2.9 0.1
Feathered chipping	Unifacial edge	4	50.0/2.2	-	-	3	25.0/1.0	-	-	2	25.0/0.5	9	26.5/0.8
	Bifacial edge	-	-	-	-	2	16.7/0.6	-	-	-	-	2	5.9/0.2
Hinged chipping	Unifacial edge	-	-	3	50.0/1.6	3	25.0/1.0	-		4	50.0/1.0	10	29.4/0.9
	Bifacial edge	2	25.0/1.1	-		3	25.0/1.0	-		-	-	5	14.7/0.4
Resharpened flake		N=7		N=2		N=1		N=1		N=4		N=15	
Smoothing	Unifacial edge	-	-	1	50.0/0.5	-	-			-	-	1	6.7/0.1
Feathered chipping	Unifacial edge	4	57.1/2.2	-	-	-	-	1	100.0/1.1	-	-	5	33.3/0.4
Hinged chipping	Unifacial edge	3	42.8/1.7	1	50.0/0.5	1	100.0/0.3	-	-	4	100.0/1.0	9	60.0/0.8
Microblade		N=2		N=2		N=1		N=0		N=2		N=7	
Feathered chipping	Unifacial edge	2	100.0/1.1	2	100.0/1.1	-	-	-	-	2	100.0/0.5	6	87.5/0.5
Hinged chipping	Unifacial edge	-	-	-		1	100.0/0.3	-	-	-	-	1	14.3/0.1

Table B-2. Cont'd.

Object type / Kind of wear	Location of wear	Zone 1 Freq	Zone 1 T%/A%	Zone 2 Freq	Zone 2 T%/A%	Zone 3 Freq	Zone 3 T%/A%	Zone 4 Freq	Zone 4 T%/A%	Zone 25 Freq	Zone 25 T%/A%	Total Freq	Total T%/A%
Blade		N=0		N=0		N=2		N=0		N=0		N=2	
Feathered chipping	Unifacial edge	-	-	-	-	1	50.0/0.3	-	-	-	-	1	50.0/0.1
Hinged chipping	Unifacial edge	-	-	-	-	1	50.0/0.3	-	-	-	-	1	50.0/0.1
Tabular knife		N=0		N=0		N=0		N=0		N=8		N=8	
Smoothing	Edge only	-	-	-	-	-	-	-	-	8	100.0/2.2	8	100.0/0.8
Scraper		N=8		N=8		N=18		N=2		N=37		N=73	
Smoothing	Edge only	-	-	-	-	-	-	-	-	1	2.7/0.2	1	1.4/0.1
	Unifacial edge	1	12.5/0.3	-	-	1	5.5/0.3	-	-	1	2.7/0.2	3	4.1/0.2
	Bifacial edge	-	-	2	25.0/1.1	-	-	-	-	-	-	2	2.7/0.2
Feathered chipping	Unifacial edge	-	-	1	12.5/0.5	-	-	-	-	8	21.6/2.0	9	12.3/0.8
	Point only	-	-	-	-	-	-	-	-	1	2.7/0.2	1	1.4/0.1
Hinged chipping	Unifacial edge	7	87.5/3.8	4	50.0/2.2	16	88.8/5.2	1	50.0/1.1	26	70.3/6.5	54	74.0/4.6
	Bifacial edge	-	-	1	12.5/0.5	1	5.5/0.3	1	50.0/1.1	-	-	3	4.1/0.2
Biface		N=6		N=8		N=10		N=1		N=33		N=58	
Smoothing	Edge only	1	16.7/0.8	-	-	-	-	-	-	-	-	1	1.7/0.1
	Unifacial edge	-	-	1	12.5/0.5	-	-	-	-	-	-	1	1.7/0.1
	Bifacial edge	-	-	-	-	2	20.0/0.8	1	100.0/1.1	4	12.1/1.0	7	12.1/0.6
	Point only	-	-	1	12.5/0.5	-	-	-	-	-	-	1	1.7/0.1
Feathered chipping	Unifacial edge	1	16.7/0.8	-	-	-	-	-	-	5	15.1/1.2	6	10.3/0.5
	Bifacial edge	3	50.0/1.7	-	-	-	-	-	-	4	12.1/1.0	7	12.1/0.6
Hinged chipping	Unifacial edge	1	16.7/0.8	6	75.0/3.3	4	40.0/1.3	-	-	16	48.5/4.0	27	46.6/2.3
	Bifacial edge	-	-	-	-	4	40.0/1.3	-	-	4	12.1/1.0	8	13.8/0.7
Burin		N=1		N=4		N=1		N=2		N=0		N=8	
Feathered chipping	Unifacial edge	-	-	-	-	1	100.0/0.3	-	-	-	-	1	12.5/0.1
	Bifacial edge	1	100.0/0.8	1	25.0/0.5	-	-	-	-	-	-	2	25.0/0.2
Hinged chipping	Unifacial edge	-	-	2	50.0/1.1	-	-	2	100.0/2.3	-	-	4	50.0/0.3
	Bifacial edge	-	-	1	25.0/0.5	-	-	-	-	-	-	1	12.5/0.1
Drill		N=0		N=5		N=4		N=2		N=6		N=17	
Smoothing	Unifacial edge	-	-	-	-	-	-	1	50.0/1.1	-	-	1	5.9/0.1
	Point only	-	-	-	-	1	25.0/0.3	1	50.0/1.1	-	-	2	11.8/0.2
Feathered chipping	Unifacial edge	-	-	1	20.0/0.5	1	25.0/0.3	-	-	1	16.7/0.2	3	17.6/0.2
	Bifacial edge	-	-	1	20.0/0.5	1	25.0/0.3	-	-	-	-	2	11.8/0.2
	Point only	-	-	1	20.0/0.5	-	-	-	-	2	33.3/0.5	3	17.6/0.2
Hinged chipping	Unifacial edge	-	-	1	20.0/0.5	-	-	-	-	3	50.0/0.7	4	23.5/0.3
	Point only	-	-	1	20.0/0.5	1	25.0/0.3	-	-	-	-	2	11.8/0.2
Graver		N=0		N=1		N=5		N=0		N=0		N=6	
Smoothing	Point only	-	-	1	100.0/0.5	1	20.0/0.3	-	-	-	-	2	33.3/0.2
Feathered chipping	Bifacial edge	-	-	-	-	1	20.0/0.3	-	-	-	-	1	16.7/0.1
Hinged chipping	Unifacial edge	-	-	-	-	1	20.0/0.3	-	-	-	-	1	16.7/0.1
	Bifacial edge	-	-	-	-	1	20.0/0.3	-	-	-	-	1	16.7/0.1
	Point only	-	-	-	-	1	20.0/0.3	-	-	-	-	1	16.7/0.1

Table B-2. Cont'd.

Object type Kind of wear	Location of wear	Zone										Total	
		1		2		3		4		25			
		Freq	T%/A%	Freq	T%/A%	Freq	T%/A%	Freq	T%/A%	Freq	T%/A%	Freq	T%/A%
Projectile point		N=0		N=0		N=1		N=0		N=8		N=9	
Smoothing	Bifacial edge	-	-	-	-	-	-	-	-	2	25.0/0.5	2	22.2/0.2
Feathered chipping	Unifacial edge	-	-	-	-	-	-	-	-	1	12.5/0.2	1	11.1/0.1
	Point only	-	-	-	-	1	100.0/0.3	-	-	-	-	1	11.1/0.1
Hinged chipping	Unifacial edge	-	-	-	-	-	-	-	-	2	25.0/0.5	2	22.2/0.2
	Bifacial edge	-	-	-	-	-	-	-	-	2	25.0/0.5	2	22.2/0.2
	Point only	-	-	-	-	-	-	-	-	1	12.5/0.2	1	11.1/0.1
Projectile point tip		N=1		N=3		N=0		N=0		N=7		N=11	
Crushing	Point only	-	-	1	33.3/0.5	-	-	-	-	-	-	1	9.0/0.1
Feathered chipping	Unifacial edge	-	-	-	-	-	-	-	-	2	28.6/0.5	2	18.2/0.2
	Bifacial edge	-	-	1	33.3/0.5	-	-	-	-	2	28.6/0.5	3	27.3/0.2
Hinged chipping	Unifacial edge	-	-	-	-	-	-	-	-	1	14.3/0.2	1	9.0/0.1
	Bifacial edge	1	100.0/0.6	1	33.3/0.5	-	-	-	-	2	28.6/0.5	4	36.4/0.3
Chopper		N=0		N=0		N=2		N=0		N=12		N=14	
Smoothing	Bifacial edge	-	-	-	-	-	-	-	-	2	16.7/0.5	2	14.3/0.2
	Point only	-	-	-	-	-	-	-	-	1	8.3/0.2	1	7.1/0.1
Crushing	Edge only	-	-	-	-	-	-	-	-	2	16.7/0.5	2	14.3/0.2
	Unifacial edge	-	-	-	-	-	-	-	-	1	8.3/0.2	1	7.1/0.1
	Bifacial edge	-	-	-	-	2	100.0/0.6	-	-	5	41.7/1.2	7	50.0/0.6
	Point only	-	-	-	-	-	-	-	-	1	8.3/0.2	1	7.1/0.1
Hammerstone		N=0		N=0		N=12		N=4		N=12		N=28	
Crushing	Edge only	-	-	-	-	1	8.3/0.3	-	-	-	-	1	3.6/0.1
	Bifacial edge	-	-	-	-	-	-	-	-	1	8.3/0.2	1	3.6/0.1
	Point only	-	-	-	-	-	-	-	-	1	8.3/0.2	1	3.6/0.1
	Surface	-	-	-	-	-	-	-	-	1	8.3/0.2	1	3.6/0.1
	Terminal surface	-	-	-	-	11	91.7/3.6	4	100.0/4.5	9	75.0/2.2	24	85.7/2.1
Pestle		N=0		N=3		N=0		N=0		N=0		N=3	
Crushing	Terminal surface	-	-	3	100.0/1.6	-	-	-	-	-	-	3	100.0/0.2
Core		N=1		N=1		N=0		N=0		N=1		N=3	
Crushing	Point only	-	-	-	-	-	-	-	-	1	100.0/0.2	1	33.3/0.1
Hinged chipping	Unifacial edge	1	100.0/0.6	1	100.0/0.5	-	-	-	-	-	-	2	66.7/0.2
TOTAL		178		184		309		88		402		1,161	

[1]Freq - Count of tools with specified wear attributes.
[2]%T - Percentage of specified functional type assemblage.
%A - Percentage of the zonal assemblage.

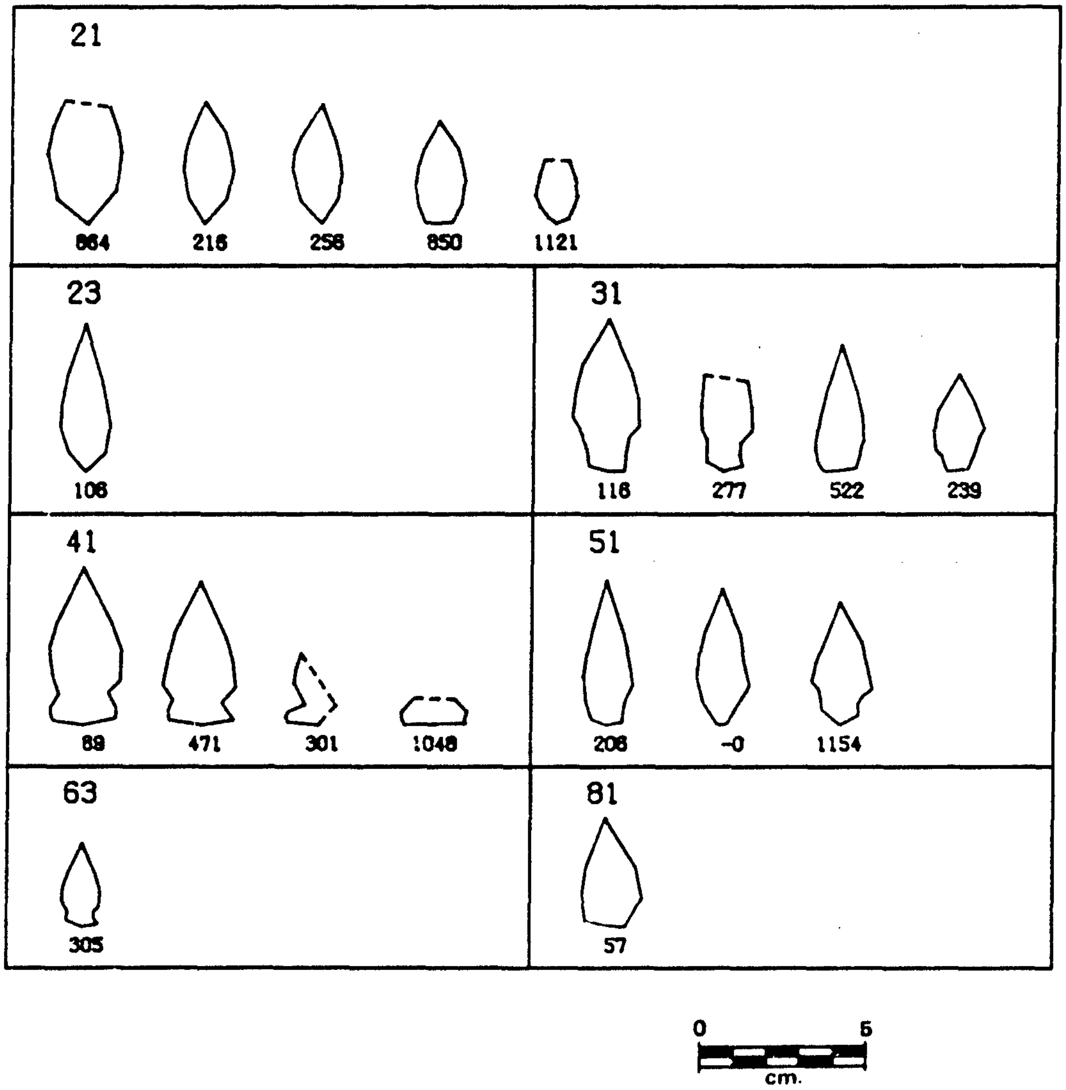

Figure B-1. Projectile point outlines from digitized measurements, 45-DO-282. Upper number is the historic type (see Figure 3-7 for key). Lower number is master number.

APPENDIX C

FAUNAL ASSEMBLAGE, 45-DO-282

Family Laporidae

Sylvilacus of *nuttallii*

Zone 1: 2 metapodials, 5 phalanges, 1 tibia fragment.

Zone 2: 1 calcaneus.

Family Sciuridae

Marmota flaviventris

Zone 2: 1 ulna fragment, 1 calcaneus.

Zone 3: 1 molar, 1 incisor fragment.

Zone 25: 1 mandible, 1 mandible fragment, 1 humerus fragment, 1 radius fragment, 1 ulna fragment.

Family Geomyidae

Thomomys talpoides

Zone 1: 2 mandibles, 3 mandible fragments, 1 humerus fragment, 2 innominate fragments, 4 maxilla fragments, 1 skull fragment, 1 scapula, 1 tibia.

Zone 2: 2 skulls, 7 skull fragments 6 mandibles, 7 mandible fragments, 4 scapulae, 2 humeri, 3 humerus fragments, 1 ulna fragment, 1 pelvis, 1 innominate, 1 saccrum, 2 femurs, 2 femur fragments, 1 tibia.

Zone 3: 4 skulls, 11 skull fragments, 15 mandibles, 21 mandible fragments, 9 humeri, 3 humerus fragments, 3 ulnas, 1 ulna fragment, 2 radius, 7 scapulae, 7 innominates, 2 innominate fragments, 2 pelvis, 9 femurs, 5 femur fragments, 2 tibias, 1 tibia fragment.

Zone 4: 7 skulls, 18 skull fragments, 4 incisors, 25 mandibles, 20 mandible fragments, 9 scapulae, 14 humeri, 5 humerus fragments, 7 ulnas, 2 ulna fragments, 5 radii, 5 innominate fragments, 1 calcaneus, 9 femurs, 5 femur fragments, 1 pelvis, 11 tibias, 2 tibia fragments.

Zone 25: 2 skulls, 7 skull fragment, 4 mandibles, 1 mandible fragment, 1 humerus, 1 humerus fragment, 1 radius, 1 tibia.

Family Heteromyidae

Perognathus parvus

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

Zone 2: 2 skulls, 5 skull fragments, 11 mandibles, 2 mandible fragments, 4 femurs, 1 pelvis, 5 innominates, 2 tibias, 1 tibia fragment, 1 scapula.

Zone 3: 1 mandible, 6 mandible fragments, 1 skull fragment, 1 femur.

Zone 4: 2 mandibles, 1 mandible fragment, 2 innominate fragments.

Family Cricetaidae

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

Zone 2: 4 mandible fragments, 3 skull fragments, 1 femur, 1 scapula, 1 ulna fragment.

Zone 3: 4 mandible fragments, 2 skull fragments, 1 humerus fragment, 1 tibia fragment.

Zone 4: 1 skull fragment, 1 innominate, 1 ulna fragment.

Zone 25: 1 mandible fragment.

Lagurus curtatus

Zone 1: 4 mandibles, 1 mandible fragment, 1 skull fragment.

Zone 2: 2 mandibles.

Zone 3: 2 mandibles.

Zone 4: 1 mandible fragment.

Zone 25: 1 mandible.

Microtus sp.

Zone 3: 1 mandible fragment.

Peromyscus maniculatus

Zone 3: 1 femur.

Zone 4: 1 mandible, 1 mandible fragment.

Neotoma cinerea

Zone 2: 1 molar.

Zone 3: 1 molar.

Family Mustelidae

Zone 25: 1 metapodial.

Taxidea taxus

Zone 25: 1 humerus fragment.

Family Canidae

Canis sp.

Zone 25: 1 mandible with teeth, 1 molar.

Family Cervidae

Zone 25: 5 antler fragments.

Odocoileus sp.

Zone 1: 2 premolars.

Zone 2: 1 metatarsal fragment.

Zone 25: 1 molar.

Family Cervidae/Bovidae

Deer-Sized

Zone 1: 1 metapodial fragment.

Elk Size

Zone 25: 1 cervical vertebrae fragment.

Family Ranidae/Bufonidae

Zone 4: 1 radioulna

Family Chelydridae

Chrysemys picta

Zone 1: 1 shell fragment.

Zone 2: 2 shell fragments.

Zone 3: 18 shell fragments.

Zone 25: 1 shell fragment.

Family Salmonidae

Zone 1: 1 vertebra.

Zone 2: 1 vertebra, 1 vertebra fragment.

Zone 3: 4 vertebrae, 4 vertebra fragments.

Zone 4: 3 vertebrae.

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 may 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.